Manual of TEMPOROMANDIBULAR DISORDERS

Edward F. Wright

THIRD EDITION

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Manual of Temporomandibular Disorders

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Preface

While I was teaching temporomandibular disorder (TMD) to postgraduate residents, they often complained that they needed a concise, clinically relevant, evidence-based TMD book. Specifically, they wanted a book (1) written on the level for the average dentist or dental student, (2) focused on evidence-based diagnosis and multidisciplinary treatment for the majority of TMD patients, (3) that included guidelines on how to rule out disorders that mimic TMD and identify medical contributing factors for which patients may need to be referred, and (4) that detailed how to identify patients with complex TMD who are beyond the scope of most dentists.

The thrust of this book is to satisfy their desires. As such, it is the clinical implementation of my assimilated evidence-based TMD knowledge and experience. The book attempts to simplify the complexities of TMD for ease of clinical understanding and application, in addition to integrating the scientific literature, clinical trials, and clinical experiences into an effective strategy. To the degree possible, it provides a systematic guide on how to most effectively diagnose and treat the various types of TMD patients. The book directs how the information obtained from the patient interview and clinical exam can be used to select the most cost-effective, evidence-based therapies that have the greatest potential to provide long-term symptom relief.

TMD "specialists" must not only consider the musculoskeletal factors but also the psychosocial and neurophysiology issues related to management of the TMD patient. Since most readers of this text are not training to be TMD "specialists," the most easily understandable mechanisms that correlate to the recommended treatment approaches have been chosen. Occasionally, when simplified mechanisms will not sufficiently explain the phenomenon, psychosocial and CNS involvement are discussed. Similarly, since this is not a comprehensive textbook on TMD, it periodically warns that certain characteristics are suggestive of an uncommon disorder beyond the book's scope and recommends the practitioner consider referring the patient.

To speed the reader's synthesis of this material, questions that students frequently ask are placed at the beginning of the applicable chapters, and important concepts are highlighted throughout the book. Important terms are in bold, with many listed in the glossary.

Recognizing that the general dentist is the primary provider for most TMD patients, I sincerely hope this book will be a reference that significantly facilitates your TMD evaluations and therapies.

Edward F. Wright

Manual of Temporomandibular Disorders

Third Edition

Introduction

The cardinal signs and symptoms for temporomandibular disorder (TMD) are pain in the masseter muscle, temporomandibular joint (TMJ), and/or temporalis muscle regions; mouth-opening limitation; and TMJ sounds. TMD pain is by far the most common reason patients seek treatment.[1,2]

FOCAL POINT

The cardinal signs and symptoms for TMD are pain in the masseter muscle, TMJ, and/or temporalis muscle regions; mouth-opening limitation; and TMJ sounds.

TMD is the second most common musculoskeletal pain, with low back pain being the first. It is most often reported in individuals between the ages of 20 and 40. Approximately 33% of the population has at least one TMD symptom, and 3.6–7% of the population has TMD with sufficient severity to cause patients to seek treatment.[2–5]

FOCAL POINT

TMD is an extremely common disorder that is most often reported in individuals between the ages of 20 and 40. Approximately 33% of the population has at least one TMD symptom, and 3.6–7% has TMD with sufficient severity that treatment is desired.

TMD symptoms generally fluctuate over time and correlate significantly with masticatory muscle tension, tooth clenching, grinding, and other **oral parafunctional habits**. TMD symptoms are also significantly correlated with an increase in psychosocial factors, for example, worry, stress, irritation, frustration, and depression.[6–8] Furthermore, TMD patients with poor psychosocial adaptation have significantly greater symptom improvement when the dentist's TMD therapy is combined with cognitive-behavioral intervention.[2,9]

QUICK CONSULT

Observing TMD Symptom Correlations

TMD symptoms generally fluctuate over time and correlate significantly with masticatory muscle tension, tooth clenching, grinding, and other oral parafunctional habits. TMD symptoms are also significantly correlated with an increase in psychosocial factors, for example, worry, stress, irritation, frustration, and depression.

TMD can cause other symptoms that are beyond the masticatory musculoskeletal system, for example, tooth pain, nonotologic otalgia (ear pain that is not caused by the ear), dizziness, tinnitus, and neck pain. TMD can contribute to migraine and tension headaches, muscle pain in the region, and many other pain complaints.[10]

Women request treatment more often than do men, providing a female–male patient ratio

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between 3:1 and 9:1.[2] Additionally, TMD symptoms are less likely to resolve for women than for men.[6,7] Many hypotheses attempt to account for the gender difference, but the underlying reason remains unclear.[11]

QUICK CONSULT

Comparing the Response of Men and Women

TMD symptoms are less likely to resolve for women than for men.

Knowledge about TMD has grown throughout the ages. In general, treatment philosophies have moved from a mechanistic dental approach to a biopsychosocial medical model with the integration of neuroscience literature. This is comparable to the treatment philosophies of other joint and muscle conditions in the body.[3,12,13]

Beneficial occlusal appliance therapy and TMJ disc-recapturing surgery were reported as early as the 1800s.[12,14] The understanding of the importance to harmonize the occlusion for the health of the masticatory muscles and TMJs developed as the skills to reconstruct natural teeth advanced. As enthusiasm grew for obtaining optimum health, comfort, and function, the popularity of equilibrating the natural dentition also developed.[12,15]

In the 1930s, Dr. James Costen, an otolaryngologist, brought TMD into the awareness of physicians and dentists, and readers may still find TMD occasionally referred to as **Costen's syndrome**. Dr. Costen reported that TMD pain and secondary otologic symptoms could be reduced with alterations of the occlusion.[16]

Since TMD is a multifactorial disorder (having many etiologic factors), many therapies have a positive impact on any one patient's symptoms. Throughout much of the 1900s, many beneficial therapies were independently identified. Physicians, physical therapists, chiropractors, massage therapists, and others treating the muscles and/or cervical region reported positive responses in treating TMD symptoms. Psychologists working with relaxation, stress management, cognitive-behavioral therapy, and other psychological aspects reported beneficial effects with their therapies. Orthodontists, prosthodontists, and general dentists working with the occlusion also observed the positive impact that occlusal changes provided for TMD symptoms.

FOCAL POINT

Since TMD is a multifactorial disorder (having many etiologic factors), many therapies have a positive impact on any one patient's symptoms.

Surgeons reported positive benefits from many different TMJ surgical approaches. Many forms of occlusal appliance were tried and advocated, from which studies reveal there is similar efficacy for different appliance forms. Medications as well as self-management strategies used for other muscles and joints in the body were also shown to improve TMD symptoms. During this observational period, TMD therapies were primarily based on testimonials and clinical opinions, according to a practitioner's favorite causation hypothesis rather than scientific studies.[12]

Different philosophies appeared, with enthusiastic nonsurgeons "recapturing" discs through occlusal appliances, whereas surgeons repositioned the discs or replaced discs with autoplastic materials. The eventual breakdown of the autoplastic materials led to heartbreaking sequelae that caused many to step back from their narrowly focused treatment regimens and recognize the multifactorial nature of TMD and the

importance of conservative noninvasive evidence-based therapies.[12]

Over the last 50 years, much was learned about basic pain mechanisms and the shared neuron pool of the trigeminal spinal nucleus, other cranial nerves, and cervical nerves. This provided a better understanding of the influence that regional and widespread pain may have on TMD, the similarities between chronic TMD pain and other chronic pain disorders, and the need for chronic pain management from a psychosocial and behavioral standpoint.[8,17]

Today, a large number of potentially reversible conservative therapies are available for our TMD patients. By using the information obtained from the recommended patient interview and clinical exam, practitioners can select cost-effective, evidence-based therapies that have the greatest potential to provide long-term symptom relief. The treatment selected often reduces a patient's **contributing factors** and facilitates the patient's natural healing capacity. This management is consistent with treatment of other orthopedic and rheumatologic disorders.[2,3,10,13]

QUICK CONSULT

Selecting TMD Therapies

Today, a large number of potentially reversible conservative therapies are available for our TMD patients.

FOCAL POINT

By using the information obtained from the patient interview and clinical exam, practitioners can select cost-effective, evidence-based therapies that have the greatest potential to provide long-term symptom relief for patients. The treatment selected often reduces a patient's contributing factors and facilitates the patient's natural healing capacity.

We do not fully understand TMD and the mechanisms causing or sustaining it. Practitioners should bear in mind that not all TMD therapies are equally effective, and no one treatment has been shown to be best for all TMD patients. Most TMD patients can be managed successfully with reversible, conservative, noninvasive therapies by general practitioners, without using expensive, high-tech treatments.[4,18–20]

Most TMD patients who receive therapy obtain significant symptom relief, whereas patients who do not receive treatment have minimal symptom change.[21]

TMD therapy is generally recommended for patients who have significant temporal headaches, preauricular pain, jaw pain, TMJ catching or locking, loud TMJ noises, restricted opening, difficulty eating due to TMD, or nonotologic otalgia due to TMD.

To help your hygienists better identify patients in your practice who need your help, a recommended "Referral Criteria for Hygienists" is provided in Appendix 1.

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Part I

Initial Evaluation

Temporomandibular disorder (TMD) generally involves many structures with varying degrees of intensity. During the initial evaluation, the involved structures need to be identified and the degree for which each contributes to the patient's symptoms need to be categorized. Additionally, the contributing factors and symptom patterns help to identify which therapies will be the most beneficial for each patient.[1]

Hence, the goals of the initial examination are to identify a patient's primary diagnosis; secondary, tertiary, and so on, diagnoses; contributing factors; and symptom patterns.

FOCAL POINT

The goals of the initial examination are to identify a patient's primary diagnosis; secondary, tertiary, and so on, diagnoses; contributing factors; and symptom patterns.

The **primary diagnosis** is the diagnosis for the disorder most responsible for a patient's chief complaint. This diagnosis can be of TMD origin (e.g., myalgia, TMJ arthralgia, or temporomandibular joint [TMJ] disc displacement without reduction with limited opening) or from a different source (e.g., pulpal pathosis, sinusitis, or cervicogenic headache).[2]

FOCAL POINT

The primary diagnosis is the diagnosis for the disorder most responsible for a patient's chief complaint.

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Secondary diagnosis, **tertiary diagnosis**, and so on, are other TMD diagnoses that generally contribute to the TMD symptoms. Typically, the primary diagnosis will be of TMD origin (e.g., myalgia), and the secondary and tertiary diagnoses will be other TMD diagnoses (e.g., TMJ arthralgia and TMJ disc displacement with reduction) that contribute to a patient's chief complaint. When a non-TMD (e.g., fibromyalgia) contributes to a TMD primary diagnosis, the non-TMD disorder is designated as a contributing factor to the TMD diagnosis and not as secondary or tertiary diagnosis.[2]

FOCAL POINT

Secondary, tertiary, and so on, diagnoses are additional TMD diagnoses that contribute to the TMD symptoms.

During the initial exam, we also attempt to identify the **perpetuating contributing factors**. These are elements that perpetuate the disorder (not allowing it to resolve), for example, nighttime parafunctional habits, gum chewing, daytime clenching, stress, or neck pain.[1–3] Additionally, we attempt to identify the **symptom patterns** that include the period of the day in which the symptoms occur or are most intense (e.g., worse upon awaking) and the location pattern (e.g., begins in the neck and then moves to the jaw).

FOCAL POINT

Perpetuating contributing factors are elements that are not allowing the disorder to resolve, for example, nighttime parafunctional habits, gum chewing, daytime clenching, stress, or poor posture.

Symptom patterns include the period of the day in which the symptoms occur or are most intense (e.g., worse upon awaking) and the location pattern (e.g., begins in the neck and then moves to the jaw).

The following non-TMD examples may help you better understand how these terms are used. A patient complains to her physician about wrist pain. Through palpation of her wrist area, her physician determines the primary cause for her pain is the tenderness within the wrist joint (its diagnosis would be the primary diagnosis). Her physician also finds the muscles around the wrist are painful but less tender than the wrist joint (the muscle diagnosis would be the secondary diagnosis). The physician

also knows the patient has a systemic arthritic condition, which he suspects makes her more susceptible to developing the wrist pain (a contributing factor).

By asking questions, the physician finds that this pain only occurs upon awakening and lasts half an hour; this suggests nocturnal wrist activity is the major contributing factor. Her physician may decide the best initial therapy is to prescribe her a wrist splint to wear at night to ensure the wrist stays in a neutral position during sleep.

In a second example, the patient has the identical diagnoses and systemic arthritic condition, but has a different symptom pattern. In this example, the wrist pain consistently begins approximately half an hour after she starts using the computer and continues as long as she uses the computer, suggesting computer use is the major contributing factor for her wrist pain.

To treat the wrist pain, her physician decides the best initial approach is to (1) refer her to a therapist to teach her about computer keyboard and mouse ergonomics, and (2) prescribe her a nonsteroidal anti-inflammatory drug (NSAID) short term, to provide her with temporary relief until her wrist responds to the computer keyboard and mouse ergonomic instructions. In both situations, the physician decides to not escalate therapy for the systemic arthritic condition because he believes the local therapies will resolve the pain complaint.

In spite of having the identical diagnoses and systemic contributor, the preferred therapy changed with different contributing factors.

The initial TMD evaluation involves interviewing the patient about his or her symptoms, potential contributing factors, and potential non-TMD. The interview most influences the patient's final treatment approach and generally brings to light concerns that the practitioner will need to evaluate during the clinical examination.

The clinical examination will help to confirm or rule out the structures involved in the patient's complaints and other suspected disorders that may contribute to these complaints. Imaging may be appropriate, but, in my experience, it rarely changes the treatment approach derived from the patient interview and examination.

In the late 1980s when I was in the U.S. Air Force, an experience demonstrated that patients with TMD symptoms needed a more thorough evaluation for potential non-TMD than what most dentists provided. A

physician asked if I knew that one of the dentists who worked for me had diagnosed someone with TMD when the patient actually had meningitis. After reviewing the patient's dental record, I found she had been referred by the emergency room physician for possible TMD. The patient told the dentist she had been previously diagnosed with TMD, had an occlusal appliance, and believed she was having a relapse of this disorder. The dentist palpated her masticatory muscles and TMJs and found the muscles were tight and tender to palpation. The dentist confirmed for the patient that she had TMD, gave her TMD self-management instructions, and told her she should see her civilian dentist to have her appliance adjusted (as she was not an active-duty military patient). At the time, it appeared to me the dentist performed an appropriate evaluation and drew a fitting conclusion.

The emergency room record was then reviewed to obtain a better perspective of what had transpired. It was documented that the patient also told the emergency room physician that she had previously been diagnosed with TMD, had an occlusal appliance, and believed she was having a relapse of this disorder. The physician found she had firm masticatory and cervical muscles and a fever, and referred her to the dentist for a TMD evaluation and to a neurologist. When the patient saw the neurologist, he did a spinal tap and found she had meningitis.

This disheartening experience inspired me to research everything I could concerning disorders that mimic TMD. Lists were made of how their symptoms differed from TMD and a fairly brief list of questions was finally formulated that dentists can use to warn themselves that a patient may have a non-TMD condition that is mimicking TMD.[4] This questionnaire has been used ever since and modified as new information became available.[5,6] This questionnaire is certainly not foolproof, but it is the best I can formulate to alert me of potential non-TMD disorders, contributing factors, and symptom patterns.

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Chapter 1

Patient Interview

FAQs

Q: What should be done if a patient reports having a temporomandibular joint (TMJ) Teflon-Proplast implant, Silastic implant, or TMJ prostheses?
A: A specific protocol has been recommended for TMJ Teflon-Proplast and Silastic implants and joint prostheses.[1] Follow-up for these is beyond the scope of this book. If the practitioner is unsure of the implant or prosthesis type and management, it is recommended the practitioner refer the patient to, or work in conjunction with, someone who has greater expertise in this area.

Q: What are the different situations in which you recommend I refer a patient to someone who has greater expertise in this area?
A: Table 1.4 provides a list of histories and symptoms that would be identified during the patient interview, for which most general dentists would refer a patient to a practitioner with greater expertise. Table 3.4 provides additional characteristics that would be identified during the clinical exam, for which most general dentists would refer a patient to a practitioner with greater expertise.

Q: What is secondary gain and how common is it among temporomandibular disorder (TMD) patients?
A: Secondary gain is a situation in which the patient is rewarded for having TMD; for example, the patient receives disability payments or is excused from undesirable chores or work. Clinically, this is not commonly observed among TMD patients, but, if it is present, the patient may not relate improvement from any therapy.

Q: What should be done when a patient appears to have a tooth causing or contributing to the TMD symptoms?
A: The symptoms that suggest a tooth is causing or contributing to the TMD symptoms are provided in Items 9 and 10 of this chapter, and a recommended approach to determine whether the tooth is causing or contributing to a patient's TMD symptoms is provided in "Intraoral Examination" in Chapter 3.

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A recommended "Initial Patient Questionnaire" is provided (Appendix 2) and may be reproduced or printed from the enclosed CD for your patients to complete. The questionnaire is designed to efficiently use the time spent interviewing patients. The practitioner's customary medical history form should be used in conjunction with this questionnaire.

QUICK CONSULT

Collecting Symptom History

The "Initial Patient Questionnaire" is designed to efficiently use the time spent interviewing patients and should be used in conjunction with the practitioner's customary medical history form.

The practitioner may desire to add an additional page to obtain medical and dental insurance information and the name and address of the individual who recommended that the patient come to your office, in addition to the name and address of the patient's physician and dentist. It is comforting to a referring provider to receive a letter acknowledging that the referral was appropriate and providing your findings and recommended treatment. This also tends to encourage the referring provider to recommend your office the next time a patient with a similar complaint needs treatment. A copy of this letter is often sent to the patient's physician and dentist (if not the referring doctor); a release statement is included in the "Initial Patient Questionnaire" for this purpose.

The questionnaire appears to keep patients from elaborating in nonproductive discussions or becoming irritated by the number of questions asked, and prevents the practitioner from forgetting to ask relevant information. Clinical experience suggests a patient's responses are not always accurate, and the examiner needs to review the answers with the patient. For better patient recall, it appears best if the patient arrives 15 minutes prior to the appointment and completes the questionnaire just prior to the appointment. During the patient interview, the practitioner usually needs to ask the patient to elaborate on some of the answers.

QUICK CONSULT

Confirming Patient Responses

Clinical experience suggests a patient's responses are not always accurate, and the examiner needs to review the answers with the patient.

TECHNICAL TIP

Assisting Patient Recall

For better patient recall, it appears best if the patient arrives 15 minutes prior to the appointment and completes the questionnaire just prior to the appointment.

Chapter 2, "Review of the 'Initial Patient Questionnaire,'" presents the key points for each of the questions and is designed to help a practitioner quickly evaluate a patient's responses. Many of the questions are self-explanatory, but additional discussion for some of the questions, as well as supplementary information, is provided as follows:

Item 1 (On the diagram below, please shade the areas of your pain:) provides a quick overview of the patient's pain locations. From the patient's shaded areas, I observe whether the patient's pain appears to be from (1) the masseter muscle or temporomandibular joint (TMJ) (the most common temporomandibular disorder [TMD] pain locations); (2) the posterior neck region and locations where neck pain commonly causes referred pain (e.g., periorbital, forehead, and

temporalis regions[2,3]); (3) the anterior neck region, in which I will attempt to identify whether this is due to a local problem or referred pain (6% of patients with cardiac ischemia only have craniofacial pain, and the anterior neck region is the most common location for referred ischemia pain to appear among these patients[4]); or (4) other types of pain patterns (e.g., sinus pain).

Items 4 and 5 (What makes it feel worse? and What makes it feel better?) provide insight as to whether the patient's symptoms are due to TMD. One study found that 99% of TMD patients reported their pain was modified by movement, function, parafunctional activity, and/or rest. Intuitively, one would expect movement, function, and parafunctional activity to worsen TMD pain, while rest would improve TMD pain. This is a very powerful way to try to identify patients whose pain is and is not due to TMD. Contrarily, 9% related at least one aspect of their pain was improved by a specific movement; for example, occasionally TMD patients tell me that chewing gum, popping the TMJ, and so on, improve their TMD pain.[5]

Item 6 (What treatments have you received?), with additional inquiries, gives an indication of which treatments were previously beneficial for the patient. For example, if the patient found that an occlusal appliance (which the patient no longer has) resolved the symptoms, then fabricating another appliance should be very beneficial. Reinforce to the patient that using the treatments (e.g., application of heat) he or she previously found beneficial can again be beneficial. If the patient has previously received the therapies the practitioner traditionally provides but without satisfactory benefit, the practitioner may desire to refer the patient to someone with greater expertise in this area.

TMJ implants composed of Teflon-Proplast and Silastic have a history of fragmenting, causing a foreign-body response that results in progressive degeneration of the condyle and glenoid fossa. A specific protocol has been recommended for these implants and joint prostheses.[1] Follow-up for these is beyond the scope of this book. If a practitioner is unsure of the implant or prosthesis type and management, it is recommended the practitioner refer the patient to, or work in conjunction with, someone who has greater expertise in this area.

Item 7 (When is your pain the worst?) will often help identify the time when significant contributing factors are present. Patients with nighttime parafunctional habits usually have an increase in pain when they first awake, whereas patients with daytime parafunctional habits have an increase in pain during the day or evening. The examiner may be able to elicit more specific periods, for example, during or after driving, or when using the computer.

FOCAL POINT

Patients with nighttime parafunctional habits usually have an increase in pain when they first awake, whereas patients with daytime parafunctional habits have an increase in pain during the day or evening.

QUICK CONSULT

Observing for Significant Contributing Factors

When discussing a patient's symptom pattern, an examiner may be able to elicit specific periods when significant contributing factors are present, for example, during or after driving, or when using the computer.

Item 8 (What does the pain keep you from doing?) gives the practitioner a sense for how much the pain is affecting the patient's life. This may correlate with how motivated the

patient will be to participate in therapy and the level of therapy the patient may be interested in receiving. Occasionally, this answer is out of proportion with other features of the examination; for example, the patient is unable to work, but has only minimal palpation tenderness. Additional questions may reveal the patient continues to participate in other activities, such as yelling at basketball games. This inconsistency may suggest that other factors are involved, commonly referred to as **secondary gain**.[6]

Item 9 (Is your pain . . .) helps identify some possible conditions for a patient's pain. Patients most commonly characterize TMD pain as having an ache, pressure, or dull pain quality. If throbbing is one of the components, generally, the patient's disorder falls within one or more of the following three situations:

First, some patients report their pain is an ache, pressure, or of dull quality and, when it worsens, its quality may change to throbbing. The patient may have nausea, photophobia, and/or phonophobia associated with the throbbing pain. For these patients, clinically it appears that, if the ache, pressure, or dull pain can be satisfactorily reduced, this can prevent the pain sequence from escalating to the throbbing level.

QUICK CONSULT

Reducing Throbbing Pain

Clinically, it appears that if a patient relates the ache, pressure, or dull pain worsens to throbbing and can be satisfactorily reduced, this prevents the pain from escalating to the throbbing level.

In a second situation, the patient does not report that an ache, pressure, or dull pain progresses into throbbing pain. The source of the two types of pain may be from different sources, and the throbbing pain may not respond to TMD therapy. In this situation, the practitioner may desire to perform an occlusal appliance therapy trial and, if it is not effective, consider a referral to the patient's physician or neurologist for a probable migraine. Studies suggest some migraines respond to TMD therapy, but characteristics for identifying which migraines respond are not well established.[7]

For other patients, the throbbing pain may be **referred pain** from an oral problem (most commonly a tooth). Sometimes the perceived painful **site** (e.g., masseter muscle and/or TMJ) appears as the **source** to the patient, whereas the actual source (e.g., a tooth) has minimal symptoms. This is similar to how a patient suffering from a heart attack may perceive pain only in the left arm, whereas the pain's source is the heart. Treatment for the pain must be directed toward the source, not the site where it is felt.

QUICK CONSULT

Observing for Throbbing Pain Sources

Throbbing pain may be referred pain from an acute pulpalgia.

Innervations from tooth pulps and the masticatory musculoskeletal system appear to travel along similar pathways, so pain from one can sensitize common areas within the CNS, causing the pain to be perceived as from the other. There are also more nerves that enter the CNS than there are neurons to transfer the information to higher CNS centers, requiring pain input to converge from multiple sources (Figure 1.1). This may also cause pain from one source to be perceived as from the other. Additionally, muscles often respond to pain in the region by tightening, increasing the TMJ loading, causing pain in the masticatory muscles as well as the TMJ. Clinically, this sequence of events may

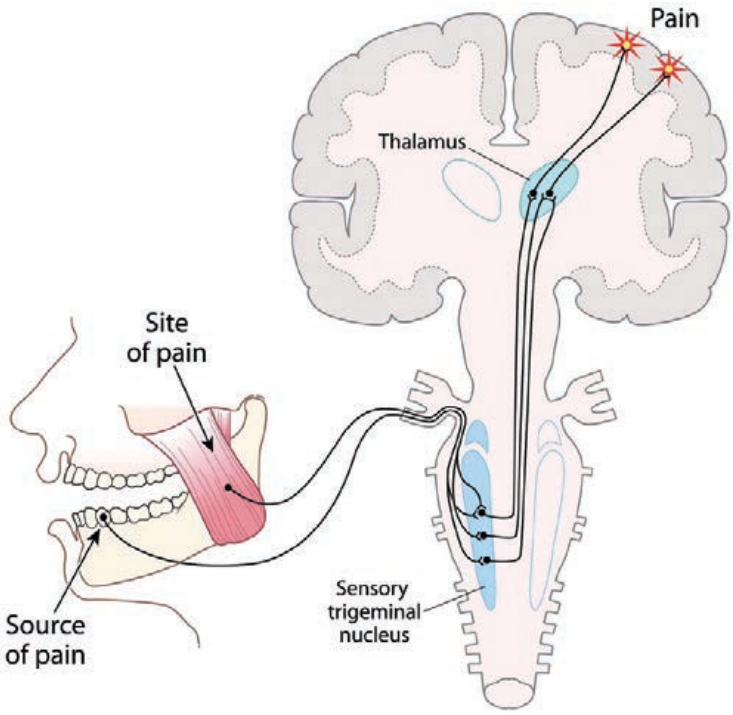

Figure 1.1. A depiction of central convergence enabling tooth pulp pain to be perceived as masseter muscle pain.

manifest as a masticatory muscle or the TMJ being perceived as the source of the odontogenic pain, and upon palpating the tender structure identified as the pain's site, the patient relates this reproduced or intensified pain as the chief complaint.

A study of patients suspected of having TMD by their dentists, but whose TMD pain upon additional examination was found primarily to be referred odontogenic pain, reported that (1) none of the periapical radiographs revealed apical pathosis, and (2) patients related that palpating the perceived painful site often reproduced their pain.[8]

The study found three helpful characteristics for identifying patients who have a tooth causing or contributing to their TMD symptoms: (1) the pain wakes the patient at night, (2) the pain increases when the patient lies down, and (3) the pain increases when the patient drinks hot or cold liquids, these are provided in Table 1.1. These patients also had a throbbing pain quality, which can also be due to TMD. Evaluating and treating referred odontogenic pain are discussed further in Item 10 and in "Intraoral Examination" in Chapter 3. A case scenario of a patient with this disorder is presented in "Case 1" in Part V.

Table 1.1. Symptoms suggesting the patients may have a tooth causing or contributing to his or her TMD symptoms.

- The TMD pain wakes the patient at night.
- The TMD pain increases when the patient lies down.
- The TMD pain increases when the patient drinks hot or cold liquids.

Burning is infrequently reported by TMD patients, whereas most neuropathic pains in the masticatory system include a burning

quality.[9,10] Clinical experience has shown that if burning is combined with the typical TMD pain qualities (ache, pressure, or dull pain), usually the burning correspondingly resolves with the ache, pressure, or dull pain from TMD therapy. If burning is the patient's most prominent pain quality or did not resolve from initial TMD therapy, the practitioner may desire to refer the patient to someone with greater expertise in this area to evaluate the patient for neuropathic pain. A method for identifying these practitioners is provided in "Practitioners with TMD Expertise and Fellowship Programs" in Appendix 13.

In addition to those already discussed, many other pain qualities are possible, for example, an electrical or stinging sensation. Knowledge of a patient's pain qualities will help a practitioner determine whether treatment for TMD has a high probability of benefiting the patient or whether this treatment may delay the evaluation for another, more probable, disorder.

Item 10 attempts to identify whether the practitioner should be suspicious that odontogenic pain, neck pain, or sinus congestion may be contributing to the patient's complaint. Clinical experience has shown that TMD pain rarely wakes patients up at night, but odontogenic pain and neck pain commonly wake patients up at night.[11] The patient may not be aware that the neck is the source and may only perceive pain at a different referred pain location. Identifying referred pain from the neck is discussed further in "TMD Palpations" in Chapter 3.

QUICK CONSULT

Observing for Sinus Congestion Contribution

Patients with sinus congestion tend to find an aggravation when they change their head position, that is, lie down or bend forward.

Historically, patients with odontalgia tend to report their pain wakes them at night, increases when they lie down, and/or increases when they drink hot or cold liquids. If a patient responds positively to one or more of these questions or has throbbing pain, this should raise a suspicion that a tooth may be causing or contributing to the TMD symptoms.[8]

QUICK CONSULT

Observing for Odontalgia Contribution

Historically, patients with odontalgia tend to report their pain wakes them at night, increases when they lie down, and/or increases when they drink hot or cold liquids.

Sometimes patients incorrectly answer "Yes" to the question "Does your pain increase when you drink hot or cold liquids?" When these patients elaborate, it becomes apparent that cold only causes tooth discomfort rather than aggravating their facial pain. Clinical experience has shown that thermal sensitivity of the teeth is common among TMD patients.

When the practitioner suspects that a tooth may be causing or contributing to the TMD symptoms, further evaluation is indicated. A recommended evaluation approach and treatment considerations are provided in "Intraoral Examination" in Chapter 3.

Patients with sinus congestion tend to find an aggravation when they change their head position, that is, lie down or bend forward. If the patient responds positively to either of these questions, it is recommended that the practitioner further inquire as to whether sinus congestion appears to contribute to the pain; for example, whether the patient finds decongestants or antibiotics help relieve the pain. If the patient is unaware of the impact from these and the practitioner suspects sinus congestion involvement, the practitioner may

Table 1.2. Medications to temporarily reduce sinus pain.

Category	Medication	Instructions
Oral decongestant	60 mg pseudoephedrine HCl	1 tab q 4–6 hours
Nasal spray decongestant	0.05% oxymetazoline HCl	2 sprays in each nostril q 12 hours
Antibiotic	500 mg amoxicillin/clavulanate	1 tab t.i.d. for 10 days

desire to determine the degree the sinus congestion is contributing to the TMD symptoms. He or she may do this by providing a trial with an oral decongestant, nasal spray decongestant, and/or antibiotic (e.g., Sudafed [pseudoephedrine HCl] 60 mg, 1 tab q 4–6 hours; Afrin [oxymetazoline HCl] 0.05%, two sprays in each nostril q 12 hours; and/or Augmentin [amoxicillin/clavulanate] 500 mg, 1 tab t.i.d. for 10 days [all have generic formulations]), listed in Table 1.2. If the sinus congestion is of recent onset and within a week of the patient having a cold, the sinus disorder is probably due to a virus and antibiotics may not be beneficial.[12]

If the sinus congestion is a chronic disorder, it is recommended the patient be referred to the patient's physician for evaluation and long-term management of the sinus problem. Eliciting pain from palpating over the sinuses can rule in the probability of sinus involvement, but not eliciting pain upon palpation cannot rule out sinus involvement.[9] A case scenario of a patient with chronic sinusitis is presented in "Case 3" in Part V.

Items 11, 12, and 13 attempt to quantify the pain, requiring the patient to delineate its intensity, frequency, and duration. The first two questions introduce patients to rating their pain intensity from 0 to 10 and give the practitioner a sense of the patient's pain history. This numerical rating system is the most effective manner we have at this time for rating pain intensity.[13] A concise and commonly used terminology for frequency is "constant" (always present), "daily" (occurs every day, but not constantly), "weekly" (occurs every week, but not daily), and so on. Duration may be momentary, the average number of seconds to hours, or constant. The pain may vary greatly and can be difficult to quantify accurately. For brevity, it is often clinically satisfactory to just document the average intensity and frequency in the patient's record, but in some situations, the practitioner may want to include the extremes and/or durations.

Item 14 attempts to identify unusual symptoms, which may be suggestive of other disorders that could mimic or coexist with TMD. For example, a progressively increasing open bite of the anterior teeth may be from the TMJ losing its vertical height, generally due to severe TMJ osteoarthritis.[14] As the condylar height collapses, the most posterior ipsilateral (affected side) tooth becomes the first tooth to contact, acts as a fulcrum, and progressively creates an open bite for the remaining dentition. The open bite generally begins on the contralateral (nonaffected side) anterior teeth and progressively spreads bilaterally until the only tooth that contacts is the most posterior ipsilateral tooth. This disorder and its treatment are complicated and beyond the scope of this book. Practitioners observing this complaint may desire to refer the patient to someone with greater expertise in this area.

It is not uncommon for a patient to relate autonomic changes, which are induced by central sensitization produced by the pain. These can include the face becoming red, puffy, or having thermal changes near the area of the pain; the eye becoming bloodshot or

Table 1.3. Recommendations for chronic headaches patients.

With headache diagnoses of tension-type, migraine without aura, migraine with aura, or combinations of these headaches	
Presentation	Therapy
If the patient has significant TMD pain that is worthy of receiving TMD therapy,	Provide TMD therapy and the patient may obtain significant headache improvement from this treatment.
If the patient has significant neck pain that is worthy of receiving neck therapy,	Refer patient for neck therapy and the patient may obtain significant headache improvement from this treatment.
If patient's headaches cannot be adequately controlled with medications by physicians and the patient has masticatory or neck tenderness,	Provide TMD therapy or refer patient for neck therapy, starting with the more tender area. The patient may obtain significant headache improvement from one or both of these treatments.

tearing; and/or the nose running or becoming congested. These autonomic changes occur when the pain is aggravated and should resolve when it lessens or resolves.[15] They are sometimes reproduced when the practitioner aggravates the pain during the palpation evaluation.

Headache is another symptom patients write for this item. If the patient relates this is a new severe headache, there are many serious disorders that can cause this symptom, and the patient needs to see a physician to evaluate the patient for these potential causes.

This book recommends treatment for TMD and cervical pain. There is an interrelationship between TMD pain, cervical pain, and chronic headaches, and many therapies used to treat TMD and cervical pain are also used to treat chronic headaches.[16,17]

I recommend you treat the patient's TMD pain and refer for cervical pain, as the symptoms warrant, as outlined in this book, and inform the patient that there is potential it may also benefit the chronic headache. If the patient does not obtain satisfactory headache benefit, I recommend the patient be referred to a neurologist for pharmaceutical management.

Treatment of TMD and the cervical region has been shown to be beneficial for tension type, migraine without aura, and migraine with aura headaches. The degree of headache improvement is quite varied among these studies, and no clinical characteristics have been identified for which patients are more likely to obtain headache improvement from TMD or cervical therapies.[7,18]

My recommendations for chronic headache patients are provided in Table 1.3.

Items 15, 16, and 17 provide a rapid tool to screen for a non-TMD that may be the cause of the pain or negatively impact it.[19,20] The practitioner can skip each question the patient answers with a "No" but needs to inquire further and consider the comments in a "Review of the 'Initial Patient Questionnaire'" (Chapter 2) for each question with a "Yes" answer.

Two disorders that are moderately prevalent among TMD patients often negatively influence TMD symptoms and treatment, and the practitioner must be very observant to identify them. The first is **cervical pain**; one study found that 51% of TMD patients had cervical pain.[21] Cervical pain may not only directly affect the masticatory system and its

ability to respond to therapy, but it may also cause referred pain to the masticatory structures, which can add to a patient's TMD symptoms or be the sole cause of the TMD symptoms.[2,3,20]

QUICK CONSULT

Observing Cervical Pain and Fibromyalgia Effects on TMD Therapy

Cervical pain and fibromyalgia often negatively influence TMD symptoms and treatment response.

Recommended cervical palpation techniques to identify referred pain from the cervical region to the head and face are provided in "TMD Palpations" in Chapter 3. The scope of clinical practice for TMD has been determined to include the diagnosis and treatment of disorders affecting the entire head and neck. This is consistent with the historical precedent in dentistry and within the scope of current dental practice.[22]

The other disorder that practitioners must be very astute in identifying is **fibromyalgia**. It is characterized by widespread body pain, multiple tender points over the body, poor sleep, stiffness, and generalized fatigue. Only about 4% of the general population has fibromyalgia, whereas 18–23% of TMD patients have it.[20,23]

It has been shown that TMD patients with fibromyalgia, widespread body pain, or neck pain do not respond as well to TMD therapies as do those without these comorbid disorders.[24–26] Therefore, it is important to identify patients with these disorders and inform them about the potential negative impact this may have on their treatment. If it appears a patient is not receiving adequate therapy for the coexisting disorder, it is recommended the patient discuss treatment alternatives with his or her medical provider or be referred to someone who specializes in the area. Rheumatologists generally specialize in fibromyalgia and widespread body pain disorders.

It is recommended that patients suspected of having fibromyalgia be referred to a physician for definitive diagnosis and management. There have been instances in which patients diagnosed with fibromyalgia by rheumatologists have had their fibromyalgia advance to other disorders, such as multiple sclerosis.[27]

Items 18, 19, and 20 ask about TMJ noise and the inability to open or close the mouth. The latter can be of muscle or TMJ origin. A "TMJ Disc–Condyle Complex Disorders" diagram is provided as Appendix 3 and may be reproduced or printed from the enclosed CD for your patients. It is helpful for explaining the cause of their TMJ noise and/or inability to open or close.

QUICK CONSULT

Explaining Mechanical Disorder

A "TMJ Disc–Condyle Complex Disorders" diagram is provided as Appendix 3 and is helpful for explaining the cause of a patient's TMJ noise and/or inability to open or close.

The diagram is broken into four sections, with the top left section providing a view of the skull with the zygomatic arch cut so the entire temporalis muscle can be visualized. This enables the provider to demonstrate how the temporalis muscle functions and how clenching or other oral habits can overuse this muscle, thereby causing pain similar to that caused by overuse of any muscle in the body. The zygomatic arch can be drawn in and the masseter muscle drawn over the ramus, and a similar discussion about muscle-overuse pain can be provided. The lateral pterygoid muscle can also be drawn to explain the symptoms

and treatment for lateral pterygoid spasm (explained in Chapter 9, "Lateral Pterygoid Spasm"). The articular eminence is also displayed so that condylar subluxation (the condyle catches in front of the eminence) or luxation (the condyle locks in front of the eminence) and its treatment may be demonstrated. Conservative therapies for these disorders are provided in Chapter 11.

To orient the patient for the next section of the diagrams, point to the ear on the skull and then to the ear in the top right section. This drawing provides an avenue to explain the "normal" disc–condyle alignment. If the patient has a TMJ click or pop, the most probable situation is that the elastic ligament (the retrodiscal tissue, in addition to its attachment complex) is stretched and the disc–condyle alignment looks like the top drawing in the bottom left section in which the disc is displaced. As the condyle translates forward (e.g., during opening), it moves into the center (intermediate zone) of the disc (the reduced position), and, as the individual closes, the condyle retrudes off the disc. This is commonly referred to as **TMJ disc displacement with reduction**, which is the terminology that is used in this book.

This section can visually explain the opening and/or closing click. Sometimes patients are also informed about how the tension in the closure muscles (temporalis, masseter, and medial pterygoid) brace the condyle in a superior position, which may promote a greater mechanical interference between the condyle and disc.[28] Clinically, patients report this effect by their TMJ click, catch, or lock occurring more frequently or with greater intensity when they are stressed, while eating, or after clenching their teeth.

For patients experiencing limited translation due to the disc blocking their normal opening (**TMJ disc displacement without reduction with limited opening**), the bottom right diagram can help visually explain the mechanical problem and treatment. This is discussed in Chapter 5, "TMD Diagnostic Categories," and in Chapter 10, "Intermittent and Continuous forms of TMJ Disc Displacement without Reduction with Limited Opening."

Many patients report the presence or history of TMJ noises (Item 18), since TMJ clicking or popping is very prevalent among the TMD and general populations.[29,30] These noises may occur with opening and/or closing, can fluctuate in intensity, and occur sporadically. If a patient has a TMJ click or pop that the practitioner can feel, the most likely diagnosis is TMJ disc displacement with reduction.[2,31,32] If the joint noise is crepitus, then the most likely diagnosis is **degenerative joint disease**; see Chapter 5 for an explanation of this terminology.[32] A more accurate assessment of the disc–condyle alignment can be obtained by magnetic resonance imaging (MRI) of the TMJ, but the findings rarely change the treatment approach, and MRI is rarely indicated at the initial TMD evaluation.[33] For more information on TMJ imaging, see Chapter 4, "Imaging."

QUICK CONSULT

Requesting MRIs

MRI findings rarely change the treatment approach, and MRI is rarely indicated at the initial TMD evaluation.

The inability to open wide (Item 19) is generally due to either a TMJ disorder (e.g., disc displacement without reduction with limited opening) or a muscle disorder. Discussing the onset and its history is often beneficial and may aid in determining the cause. If this limitation is intermittent, patients with a disc displacement with reduction with intermittent locking are usually aware that the TMJ is blocked at the opening where the TMJ normally clicks or

pops. Typically, they suddenly have a restricted opening, which just as abruptly releases, allowing them to obtain their normal opening once again. The TMJ locking disorder may be continuous, but often has a history of being intermittent. Conversely, an intermittent muscle disorder generally develops and resolves slowly for each episode.

FOCAL POINT

If a TMJ disc intermittently blocks a patient from opening wide, the patient is usually aware that the TMJ is blocked at the opening where the TMJ normally clicks or pops, it suddenly occurs, and just as abruptly releases; conversely, an intermittent muscle disorder generally develops and resolves slowly for each episode.

If a patient has a restricted opening, the practitioner may be able to determine its origin by stretching the mouth wider. This is usually done by placing the index finger over the incisal edges of the mandibular incisors and the thumb over the incisal edges of the maxillary incisors and pressing the teeth apart by moving the fingers in a scissor-type motion (Figure 1.2). The patient will usually feel tightness or pain at the location of the restriction, and the patient is asked to point to this source. From clinical experience, not all patients accurately point to the stretched discomfort location, and it is necessary to palpate the TMJ and musculature to reproduce the stretched discomfort in order to accurately identify its origin.

TECHNICAL TIP

Determining Origin of a Patient's Restricted Opening

The practitioner may be able to determine a patient's restricted opening origin by stretching the mouth wider and determining the location of the created discomfort.

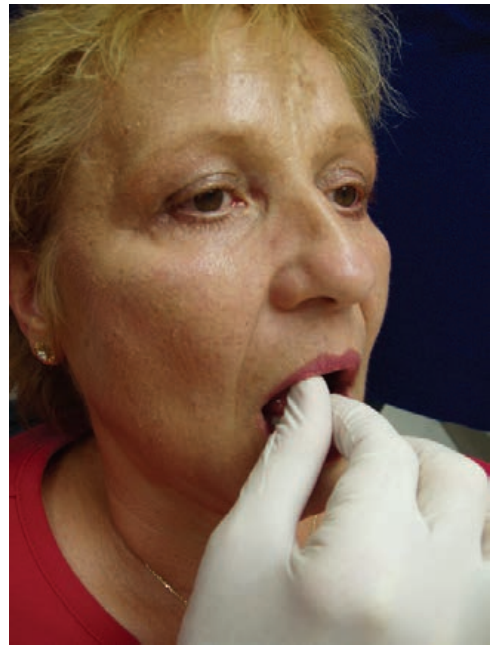

Figure 1.2. Stretching a restricted opening to determine the origin of the restriction.

It should be kept in mind that there are other potential, though less common, causes for patients having a restricted opening. Generally, these patients complain only about a restricted opening, not pain.[6] Some examples of these are TMJ ankylosis, contracture, and coronoid hyperplasia. These disorders are beyond the scope of this book, and if the practitioner suspects the patient may have one of them, he or she may desire to refer the patient to someone with greater expertise in this area.

Patients may report episodes of being unable to close their mouth (Item 20). From clinical experience, there are several common causes for a positive response to this question. If the patient reports the TMJ catches or locks at an opening of 45 mm or wider, the condyle has the potential of being in front of the eminence (TMJ subluxation or luxation). Among patients with this complaint, multiple disc–condyle relations have been observed,

and investigators have postulated that the catching or locking is due to (1) the articular eminence obstructing the posterior movement of the disc–condyle unit, (2) the disc obstructing the posterior movement of the condyle, or (3) a combination of the two.[34] Traditional TMD therapies have been shown to improve this condition.[35] Conservative treatments for TMJ subluxation and luxation are provided in Chapter 11."

If the patient's TMJ catches or locks during closure in a range of approximately 10–35 mm, the articular eminence should not be involved, and it would most probably be only the disc that is obstructing the posterior movement of the condyle. There is no consistent disc–condyle relationship for this interference, but it is speculated the most common scenario is that the patient has a TMJ disc displacement with reduction. The interference occurs during closure when the condyle is in the reduced position and the condyle has difficulty moving or is temporarily unable to move below the posterior band of the disc; this is the typical location of the closing click. This closing catch or lock occurs similarly to the way in which an opening click's mechanical interference worsens to become an opening catch or lock. The bottom left diagram of the "TMJ Disc–Condyle Complex Disorders" handout (Appendix 3) may help to visually explain this mechanical interference to patients. From clinical experience, this problem resolves with traditional conservative TMD therapies.

A third common cause of patients reporting an inability to close is a **lateral pterygoid spasm**. In this situation, the inferior lateral pterygoid muscle is in constant involuntary contraction at a partially shortened position. This is similar to the calf muscle cramp that has awakened many of us in the middle of the night. Upon awaking, the individual notes the calf pain and calf cramp in which he or she has difficulty and increased pain when attempting to move the foot up or down. A patient with a lateral pterygoid spasm similarly has difficulty and increased pain when attempting to translate the condyle forward or retrude the jaw so the teeth fit into maximum intercuspation. The patient usually complains of the inability to put the ipsilateral posterior teeth together without excruciating pain, the teeth are usually separated by a fraction of a millimeter to a few millimeters, and the first tooth contact is in the area of the contralateral canine (if the patient has normal tooth alignment).[36] Since the patient has difficulty translating forward, he or she usually also has a marked limited opening. A diagnostic test and treatments are provided in Chapter 9, "Lateral Pterygoid Spasm."

Items 21 through 27 ask about potential contributing factors to a patient's TMD. Some contributing factors are not asked about in this questionnaire, but will become apparent when the provider or staff member reviews the "TMD Self-Management Therapies" handout with the patient (e.g., gum chewing, caffeine consumption, or stomach sleeping). This handout is provided as Appendix 4.

Poor sleep may constitute the inability to fall asleep, stay asleep, or awake feeling rested (Item 21). Poor sleep has been shown to correlate with increased muscle pain and can be a predictor of patients who will respond poorly to TMD therapy.[37–39] A good system to use to evaluate poor-sleep severity is to ask the patient to rate his or her sleep quality between 0 and 10. Intuitively, when most of us do not get adequate sleep, we tend to feel more aches and pain, be more irritable, and so on. The effects of inadequate sleep tend to contribute to a TMD patient's symptoms on both a physical and psychosocial basis.[38] From clinical experience, when a patient relates that poor sleep is primarily due to TMD pain, it has been observed that, when the TMD pain resolves, generally, the sleep problem also resolves. To ensure a patient's needs and

desires are met, when other causes of poor sleep are involved, the provider may ask the patient to discuss this with his or her physician, refer the patient for relaxation therapy, or refer the patient to someone who specializes in sleep disorders. If the patient has poor sleep and awakes with morning TMD pain, the practitioner may desire to prescribe amitriptyline or nortriptyline; see "Tricyclic Antidepressants" in Chapter 17 for additional information.

It is important that the practitioner identify whether sleep apnea may be the cause for the patient awaking feeling tired. Patients with sleep apnea may also awake with a headache that can be similar to a headache from heavy nocturnal parafunctional activities. Patients with sleep apnea generally relate that they snore loudly at night, occasionally awake gasping for air, are drowsy throughout the day, and easily fall asleep during the day. The provider may ask the patient to discuss this with his or her physician and may request a sleep study to determine the cause for the poor sleep.[39]

Patients may relate they do not sleep well due to posttraumatic stress disorder (PTSD), in which they may awake with nightmares where they reexperience the traumatic event. PTSD is strongly linked with TMD symptoms,[40] and if these patients have not received pharmaceutical and psychological therapies to help control this disorder, they should be referred for these services. Some PTSD patients who are "maximally pharmaceutically managed" and receiving psychological therapy still awake from their PTSD nightmares with all of the muscles in their body intensely contracted. My clinical experience with these PTSD patients is that a maxillary acrylic stabilization appliance helps reduce the amount of masticatory pain they awake with from these nightmares. If they do not receive sufficient benefit from this, they may find an opposing mandibular soft thermoplastic stabilization appliance, as described in "Soft Thermoplastic Stabilization Appliance" in Chapter 12, provides additional benefit.[41]

Patients with fibromyalgia may also relate that they do not sleep well. These patients have widespread body muscle pain and fibromyalgia is discussed earlier under Items 15, 16, and 17.

Occasionally, patients relate their TMD symptoms awake them from their sleep. Clinical experience suggests that pain of this severity is generally not due to TMD, but most commonly due to tooth pulp or cervical pain being referred to the masticatory musculoskeletal system.

FOCAL POINT

> Poor sleep has been shown to correlate with an increase in muscle pain and can be a predictor of patients who will respond poorly to TMD therapy.

The usual portion of the day in which a patient feels most overwhelmed, tense, aggravated, or frustrated (Item 22) is an indicator as to the impact these feelings may have on the TMD symptoms. Patients with TMD tend to hold more tension in their jaws, clench their teeth, or engage in other nonfunctional activities during these times,[42,43] and some may be aware of these habits. Some patients may hold their teeth together throughout the day and squeeze them during these times, whereas others may swear they never touch their teeth, but after observing for these habits will later find they clench or tighten their masticatory muscles during such times. It is a challenge to help patients understand their unconscious daytime habits that are contributing to their TMD symptoms. Some dentists train a psychologist or staff member to help patients recognize and break their daytime contributing habits. A

diary in which patients hourly record their TMD symptoms and tension levels often helps patients learn about these associations and thereby provides the motivation to change their tension levels.

Psychosocial stress may also increase the nocturnal parafunctional activity. In one study,[44] subjects wore devices to bed that recorded the nocturnal EMG activity, and subjects were able to correlate higher nocturnal EMG activity with stressful life events (Figure 1.3 and Figure 1.4).

TECHNICAL TIP

Reducing Tension Levels

A diary in which patients hourly record their TMD symptoms and tension levels often helps patients learn about these associations and thereby provides the motivation to change their tension levels and habits.

Clinically, it has been observed that TMD patients often deny having stress because they relate the term "stress" to more significant events than they have in their lives. Terms that patients seem to acknowledge having that tend to be associated with these habits are "tension," "aggravations," "frustrations," "concerns," "busyness," "overwhelmed," "more of life's stuff," or "more of life's situations."

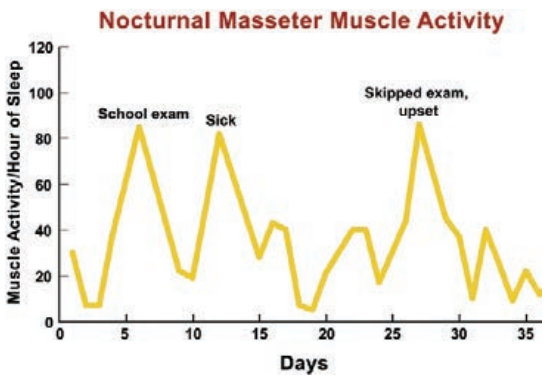

Figure 1.3. Correlation of increased nocturnal masseter muscle activity with stressful life events.[44]

Figure 1.4. Correlation of increased and decreased nocturnal masseter muscle activity with more and less stressful life events, respectively.[44]

Once patients recognize they have one of these feelings, it is recommended their preferred term be used in future discussions. Discuss the likelihood that this psychosocial contributor is associated with their pain because patients tend to hold more tension in their jaw muscles (also neck and shoulders if they also have pain or tenderness in these areas) during such times.

There are two approaches patients can use to reduce the symptoms related to these psychosocial contributors. They can learn to reduce the psychosocial contributors (using coping strategies, stress management, etc.) and/or become very aware of their propensity to tighten their muscles during such times and break this habit. A combination is generally used when patients are referred to a psychologist for treatment of this problem.

Sometimes, a patient's concerns are overwhelming, and the patient desires to discuss them with a trained professional and learn coping skills. Two examples of referrals to a psychologist are provided in Appendix 11.

Patients with depression have been shown to not respond to TMD therapy as well as most other TMD patients,[45] and the portion of the day in which a patient usually feels depressed (Item 23) is an indicator as to the

impact this may have on the patient's TMD symptoms. For providers to obtain a better feel for its significance, patients can be asked to rate their depression or other psychosocial contributor on a 0–10 scale. Clinical experience suggests that patients who are depressed and not open to discussing or receiving treatment for their depression minimize their answer with "seldom" or "never." For patients who mark "always" or "half the time," it is recommended the practitioner discuss the patient's depression and referral options, that is, primary medical provider (to discuss treatment options), psychologist (primarily treats through discussions), and/or psychiatrist (a physician who primarily treats with medications). Based on clinical experience, when a patient relates the depression is primarily due to TMD pain, the depression generally resolves when the TMD pain resolves.

FOCAL POINT

Depression negatively influences TMD symptoms.

Suicide is one of the three leading causes of death for individuals aged 15–34 years, and adolescents and adults who suffer from chronic pain are at increased risk for suicide ideation and attempts.[46,47] If a patient relates he or she has thoughts of hurting himself or herself, or committing suicide (Item 24), you must determine lethality. Ask the patient whether he or she has a plan, a time selected, and the means selected of carrying this out (pills, gun, etc.). If the answer is "Yes" to any of these, the patient must immediately be evaluated by someone trained in psychosocial suicide assessment to determine whether suicide is imminent, that is, a clinical social worker, psychologist, psychiatrist, your local hospital's suicide prevention team, the authority received by calling 911, or the police department's emergency psychiatric evaluation team. Do not allow the patient to leave without an escort (i.e., a staff member, responsible family member, police, or hospital personnel sent to your office) unless he or she has been cleared by an appropriate person. Clearly document your findings, actions, and follow up on your referral. Your local suicide prevention hotline can provide information about resources available in your community, and you can obtain more information from the American Foundation for Suicide Prevention (AFSP; www.afsp.org).

A considerable amount of time spent singing or playing a musical instrument (Item 25) may also significantly contribute to a patient's TMD symptoms. The impact will vary with the instruments and the amount of time spent in the activity. It has been speculated that wind instruments, some string instruments (violin and viola), and singing have the greatest potential for contributing to TMD symptoms.[48] A patient's symptom time pattern should give an indication of the impact singing or playing the musical instrument has on the symptoms. Sometimes, these activities are the patient's sole source of income, so the patient will have to weigh the cost and benefit of limiting or changing the intensity of these activities.

Studies that inquired numerous times throughout the day as to whether subjects were engaged in a nonfunctional tooth contact activity found TMD subjects have their teeth in contact significantly more often than non-TMD subjects.[43,49] It is common for many individuals to allow their opposing teeth to contact, but it appears when this behavior is excessive that it may be a significant contributor to TMD symptoms (Figure 1.5).[43] It is recommended patients never hold their teeth together except momentarily when swallowing (Item 26). This question nicely leads into discussing the patient's daytime

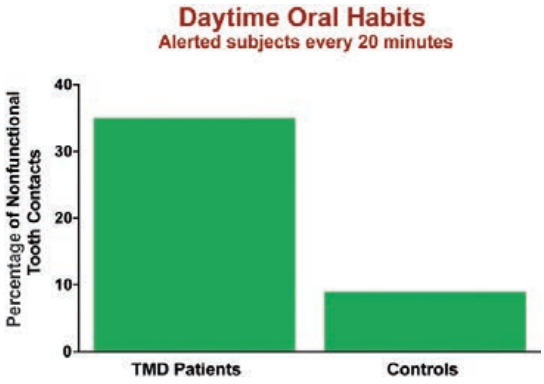

Figure 1.5. Alerted TMD patients and healthy control subjects every 20 minutes from 8 a.m. to 10 p.m. and found TMD patients were significantly more often engaged in a nonfunctional tooth contact activity.[43]

habits and the importance of breaking them. The following analogy is used, demonstrating with my arm, to help the patient understand the impact holding the teeth together may have on his or her pain.

Whenever my fingertips touch the palm of my hand, the muscles in my forearm must flex. If one were to hold this, the muscles would eventually tire and start to hurt. If this were a recurring habit, as the day becomes busy, frustrating, or irritating, the individual would most likely unconsciously squeeze his or her fingertips into the palm, overuse these muscles even more, and develop forearm pain. If the individual were to go to a physician and complain about the forearm pain, he or she would wonder why this muscle is so tender and painful compared with the other muscles in my body. The physician would need to realize this localized pain was caused by that habit and would conclude the best way to treat this muscle disorder is for the individual to break the habit.

If the patient does not have a widespread body disorder (e.g., fibromyalgia), I touch his or her biceps and forearm while I say, "Your biceps and forearm are not tender, so there must be something you are doing to overuse your jaw muscles. If your jaw muscles were relaxed, your jaw would drop away from your upper teeth, just as we allow our arms to hang loose and drop (at the same time I allow my arms to go limp and drop). Your jaw should be hanging loose all day with your lips just lightly touching (unless the patient is a mouth breather)."

If patients are aware of clenching, grinding, or any other oral habit (Items 27 and 28), they should be informed of how these negatively affect their TMD symptoms. Sometimes, breaking these habits and using the "TMD Self-Management Therapies" handout (Appendix 4) will satisfactorily decrease a patient's TMD symptoms.

Item 31 helps a practitioner determine whether a patient might have giant cell arteritis (temporal arteritis).[50,51] Giant cell arteritis may mimic mild TMD symptoms, has been misdiagnosed as TMD, and may cause blindness within a relatively short time if not treated.[52] As many as 20–60% of inadequately treated or untreated patients lose their vision.[51]

QUICK CONSULT

Observing for Giant Cell Arteritis

Giant cell arteritis may mimic mild TMD symptoms, has been misdiagnosed as TMD, and may cause blindness within a relatively short time if not treated.

Giant cell arteritis is almost exclusively found in individuals over the age of 50. It causes a reduction in the blood flow to the structures of the head and neck (including the masticatory muscles and eyes). The decreased masticatory muscle blood flow causes the muscles to tire easily, producing a tired, cramped feeling that resolves within 1–2 minutes after use. Some TMD patients without giant cell arteritis may report similar

symptoms, and these questions will help to differentiate the two disorders.[50]

"Yes" to the first two questions suggests jaw claudication, but a patient with mild TMD symptoms may respond positively to both questions. Consider giant cell arteritis when a patient relates unexplainable scalp tenderness, unexplainable or unintentional weight loss, significant morning stiffness lasting longer than a half hour, and visual symptoms or visual loss.[50]

A fever (previously asked about in the questionnaire) is also more prevalent among people who have giant cell arteritis.[50] If the fever is not due to a dental condition and has not been evaluated by a physician, it is recommended that the patient be referred for an evaluation. Another sign of giant cell arteritis is an abnormal temporal artery, which is evaluated by comparing the left and right temporal arteries. Relative to the other side, an abnormal vessel would be more visible, have no pulse, or have palpable nodes.

The onset of the disease is frequently abrupt and may be bilateral. A frequent complaint is a new headache and scalp pain that cause the patients to sit up in a chair all night, and local inflammation and tenderness in the head or neck area.[51,53] In a review of 390 reported cases, 59% complained of headache, and 31% complained of jaw pain or claudication (tiredness upon use).[52]

If a patient has had symptoms suggestive of giant cell arteritis for over a year, it is highly unlikely that he or she has giant cell arteritis. If you suspect a patient may have giant cell arteritis, it is recommended that (1) if the patient has any visual changes, he or she be seen by an ophthalmologist, rheumatologist, or emergency room that day and (2) if the patient does not have any visual changes, he or she be seen by an ophthalmologist, rheumatologist, or emergency room within a week.[54] It is better to err with an unnecessary referral than allow this disorder to go undiagnosed. Other potential causes for similar symptoms might be an intracranial hemorrhage, meningitis, encephalitis, and so on.

Table 1.4. Patient histories or symptoms for which most general dentists would refer to a practitioner with greater expertise.

- The patient previously received the therapies you traditionally provide, and the patient did not obtain satisfactory improvement.
- The patient received a TMJ Teflon-Proplast implant, Silastic implant, or TMJ prostheses, and you are unsure of the implant type or management.
- The patient has burning or electrical as the primarily quality of the pain complaint.
- The patient has a progressively increasing anterior open bite, thought to be from the TMJ(s) loosing vertical height due to severe TMJ osteoarthritis.

Note: A method for identifying practitioners with greater expertise is provided in Appendix 13, "Practitioners with TMD Expertise and Fellowship Programs."

Summary

It is extremely important to schedule enough time to listen to the patient's history and symptoms; listening to patients enhances patient compliance and patient satisfaction with the treatment, decreases the likelihood of a malpractice suit, and is one of the greatest tools at the provider's disposal.[55,56]

Table 1.4 provides a list of histories and symptoms for which most general dentists would refer a patient with TMD-like symptoms to a practitioner with greater expertise.

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Chapter 2

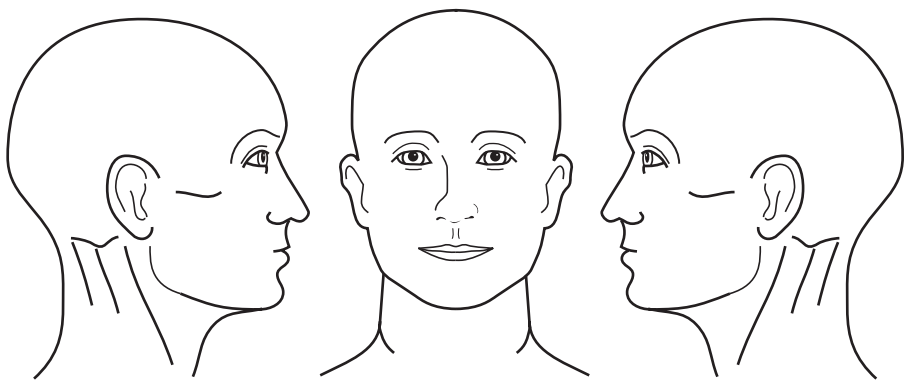
Review of the "Initial Patient Questionnaire"

The book's Appendix 2 is a recommended initial patient questionnaire that may be reproduced or printed from the enclosed CD for your patients to complete prior to your initial visit. This should greatly decrease the time you spend obtaining the patient's history, symptoms, and other relevant information that will influence how you will treat this patient.

To enhance your ability to use the answers your patients supply, this chapter provides a discussion as to the reason each question is asked and the ramifications of the various answers. During your initial interview, you will probably need to ask the patient to elaborate on some of the answers. I recommend you use this questionnaire in conjunction with your customary medical history form.

1. On the diagram below, please shade the areas of your pain:

This forces the patient to think where the pain is located.



Manual of Temporomandibular Disorders, Third Edition. Edward F. Wright.

2. When did your pain/problem begin?

This indicates the chronicity of the disorder. If it is of recent onset, the first occurrence, and mild to moderate pain, you may want to only prescribe TMD self-management therapy and ibuprofen, and observe to see if it resolves.

3. What seemed to cause it to start?

This answer may indicate a major contributing factor that can be changed.

4. What makes it feel worse?

Intuitively, these should be activities that traditionally aggravate TMD, that is, eating, clenching, and stress. This list can help you motivate the patient to change these activities. Observe for activities that should not worsen TMD and suggest the patient may have a disorder other than TMD, for example, symptoms worse when bear down for a bowel movement.

5. What makes it feel better?

Reinforce the use of these activities. Also, look for activities that suggest the patient may have a disorder other than TMD, for example, better when taking antibiotics.

6. What treatments have you received?

Were these treatments beneficial? These indicate the level of care the patient will need. Did patient receive a TMJ implant that should be followed?

7. When is your pain the worst?
When first wake up ___ Later in the day ___ No daily pattern ___ Other ___

Helps identify the significance of nighttime and/or daytime contributing factors and gives a guide to therapy considerations (see “Integrating Conservative Therapies” in Chapter 19).

8. What does the pain keep you from doing?

Reflects how much it affects the patient and may correlate with how motivated the patient will be to participate in therapy and the level of therapy the patient may be interested in receiving.

9. Is your pain (check as many as apply):
Ache ___ Pressure ___ Dull ___ Sharp ___ Throbbing ___
Burning ___ Other ___

"Ache," "pressure," or "dull" are the usual qualities of TMD pain. Sharp usually occurs intermittently and is often associated with the TMJ or lateral pterygoid muscle. Throbbing pain occurs in one or more of the following three situations:

a. Ache, pressure, or dull is the primary pain quality, and when the pain worsens, it changes to throbbing pain. If treatment of the ache, pressure, or dull can adequately keep it from escalating into the throbbing pain, the throbbing pain will be eliminated.
b. The patient does not report that the ache, pressure, or dull pain progresses into throbbing pain. This pain may be due to a source outside of the dentist's realm of treatment. The practitioner may desire to perform a trial with occlusal appliance therapy and if it is not effective, consider a referral to the patient's physician or neurologist for the probable migraine. Studies suggest some migraines respond to TMD therapy.
c. Referred tooth pain; items suggestive of this are asked in item 10.

If burning is in the background of ache, pressure, or dull pain, the burning generally resolves as the TMD improves. If burning is the primary pain quality within the masticatory system, this suggests it may be neuropathic pain.

10. Does your pain:
Wake you up at night? Yes ___ No ___

TMD rarely awakes patients from their sleep, but cervical pain and referred tooth pain will commonly awake patients.

Increase when you lie down? Yes ___ No ___

Could be related not only to how the mandible is positioned on a pillow, but also sinus congestion or referred tooth pain.

Increase when you bend forward? Yes ___ No ___

Could be related not only to gravity's pull on the mandible, but also to sinus congestion or referred pain from a tooth.

Increase when you drink hot or cold beverages? Yes ___ No___

TMD pain does not often increase when hot or cold beverages are drunk. What tooth or area does it touch that elicits this response? This response could be due to referred tooth pain. See "Intraoral Examination" in Chapter 3 for more information on referred tooth pain.

11. Please circle the number below to indicate your *present* pain level.
(No pain) 0 - 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 -10 (The worst pain imaginable)

12. Please circle your *average* pain level during the past 6 months.
(No pain) 0 - 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 -9 - 10 (The worst pain imaginable)

13. Is your pain always present? Yes ___ No ___ How often do you have it?

14. Please describe any other symptoms that you associate with your problem.

Look for anything that does not make sense (may be suggestive of non-TMD), for example, blacking out and decrease in visual field.

A progressively increasing open bite of the anterior teeth is suggestive of severe osteoarthritis causing the condyle to lose its vertical height, and is beyond the scope of this book. A posterior open bite or midline shift could be suggestive of many disorders; see "Intraoral Examination" in Chapter 3 for more information.

Items #15–17 evaluate for non-TMD. Talk to the patient about any "Yes" answer and consider the comments noted after the items.

15. Have you had any of the following:
Head or neck surgery? Yes ___ No ___

Is patient's complaint a surgical complication or recurrence from this?

Whiplash or trauma to your head or neck? Yes ___ No ___

Is patient's TMD related to this event? If so, was patient adequately evaluated? Does the patient have a neck disorder contributing to the TMD?

Shingles on your head or neck? Yes ___ No ___

Does the patient have postherpetic neuralgia?

16. Do you have any of the following:
A fever? Yes ___ No ___

TMD does not cause an elevated temperature. Does patient have another disorder that may be causing this, for example, meningitis, dental or sinus infection? Consider referring patient to physician if this has not been evaluated.

Nasal congestion or stuffiness? Yes ___ No ___

Is sinus pain the cause for the complaint or contributing to the TMD pain?

Movement difficulties of your facial muscles, eyes, mouth, or tongue? Yes ___ No ___

Does the patient have a neurological disorder?
Patients often report difficulty moving their more painful structures.

Numbness or tingling? Yes ___ No ___

Is it something more than TMD causing this neurological deficit? Patients often report small areas of numbness or tingling with a temporal and spatial relationship to their TMD complaint, which correlates with their TMD pain and resolves with TMD therapy. Observe to ensure it resolves.

Problems with your teeth? Yes ___ No ___

Does the patient have a tooth problem causing or contributing to the TMD?

Swelling over your jaw joint or in your mouth or throat? Yes ___ No ___

Evaluate the swelling; it may be causing or contributing to the TMD pain. TMD patients often report swelling over their painful TMJ or masticatory muscles (see Chapter 1 and item 14), but this swelling is difficult to visually discern (often only 1–2 mm). If it is in a different location or is more significant, further evaluation is needed.

A certain spot that triggers your pain? Yes ___ No ___

Does the patient have trigeminal neuralgia or some other localized problem? If the patient only has TMD, this spot is often the source of the primary diagnosis.

Recurrent swelling or tenderness of joints other than in your jaw joint?
Yes ___ No ___

Does the patient have arthritis or some other systemic disorder contributing to the TMD?

Morning stiffness in your body, other than with your jaw?
Yes ___ No ___

This can be of muscle and/or joint origin, may be related to a systemic disorder, and may contribute to the TMD. Keep in mind patients with widespread body pain do not respond as well to TMD therapy.

Muscle tenderness in your body (other than in your head or neck) for more than 50% of the time? Yes ___ No ___

Does the patient have fibromyalgia, myofascial pain with referral, or a systemic disorder?

17. Is your problem worse in any of the following:
When swallowing or turning your head? Yes ___ No ___

Consider: cervical pain, Eagle's syndrome, glossopharyngeal neuralgia, subacute thyroiditis, and so on.

After reading or straining your eyes? Yes ___ No ___

The patient may need a new eyeglass prescription or reading glasses, may have a cervical disorder that is exacerbated by poor posture during the activity, or may clench during this activity.

18. Do your jaw joints make noise? Yes ___ No ___ If yes, which: Right ___ Left ___

If yes, the patient most likely has a disc displacement.

19. Have you ever been unable to open your mouth wide?
Yes ___ No ___ If yes, please explain:

Could be due to a TMJ disorder (e.g., disc displacement without reduction with limited opening) or a muscle disorder. If present, practitioner may need to stretch patient's mouth beyond the restriction to determine location of restriction; see "Additional Evaluations" in Chapter 3 for more information.

20. Have you ever been unable to close your mouth? Yes ___ No ___
If yes, please explain:

If it occurred at an opening over 45 mm, the condyle was probably in front of the eminence, and the eminence and/or disc was interfering with the condyle's posterior movement.

If it occurred at an opening 10–35 mm, the patient probably has a disc displacement with reduction and the condyle was unable to move under the posterior band of the disc and return onto the retrodiscal tissue.

If it occurred at an opening less than 5 mm, it was probably a lateral pterygoid spasm.

21. Do you sleep well at night? Yes ___ No ___ Please explain:

Patients should wake up feeling rested. TMD patients who do not sleep well are less likely to obtain TMD symptom improvement from TMD therapy. Individuals with fibromyalgia, posttraumatic stress disorder (PTSD), and sleep apnea (see item 21 in Chapter 1) often report they do not sleep well. You may want to consider asking the patient to discuss this with his or her physician, or referring the patient for relaxation therapy or to someone who specializes in sleep disorders. If the patient also wakes up with morning TMD pain, you may want to prescribe amitriptyline or nortriptyline.

22. How often are you overwhelmed, tense, aggravated, or frustrated during a usual day?
Always ___ Half the time ___ Seldom ___ Never ___

If always or half the time is checked, consider referring patient for stress management to learn coping skills. Patients tend to hold more tension in their jaws or clench their teeth during these times.

23. How often do you feel depressed during a usual day?
Always ___ Half the time ___ Seldom ___ Never ___

If always or half of the time is checked, consider referring patient for an evaluation. I let patients choose whether they prefer to see a psychologist (treat through talking with patients), psychiatrist (a physician who primarily treats through medications that provide temporary relief), or both.

24. Do you have thoughts of hurting yourself or committing suicide? Yes ___ No ___

If yes, determine lethality by asking the patient whether he or she has a plan, a time selected, and the selected means of carrying this out (pills, gun, etc.). If the answer is yes to any of these, the patient must immediately be evaluated by someone trained in this area. A good option is to telephone your local hospital's suicide prevention team and discuss whether immediate referral is necessary. If it is, the patient must be escorted (i.e., by a staff member, responsible family member, or a staff member sent by the hospital). Document your findings, actions, and follow up on your referral.

25. Do you play a musical instrument and/or sing more than 5 hours in a typical week?
Yes ___ No ___

This often contributes to the patient's TMD symptoms.

26. What percent of the day are your teeth touching? ____%

As patients hold their teeth together, there is a tendency to unconsciously squeeze as life becomes busy, intense, and so on. Encourage patients to keep their jaw muscles relaxed; when these muscles are relaxed, their teeth will be apart.

27. Are you aware of clenching or grinding your teeth: When sleeping? ___ While driving? ___ When using a computer? ___ Other times? ___ Not aware? ___

The patient has minimal control over nighttime parafunctional habits, but otherwise, encourage the patient to stop clenching or grinding at checked times and become aware of other times he or she may be doing this.

28. Are you aware of oral habits such as: Chewing your cheeks? ___ Chewing objects? ___ Biting your nails or cuticles? ___ Tapping your teeth together? ___ Thrusting your jaw? ___ Other habits? ___ Not aware? ___

Encourage the patient to break checked oral habits.

29. What treatment do you think is needed for your problem?

Recommend you discuss the patient's treatment expectations.

30. Is there anything else you think we should know about your problem?

31. If your age is 50 or older, please circle the correct response:
Does your pain occur only when you eat? Yes ___ No ___
Are you pain free when you open wide? Yes ___ No ___
Do you have unexplainable scalp tenderness? Yes ___ No ___
Are you experiencing unexplainable or unintentional weight loss? Yes ___ No ___
Do you have significant morning stiffness lasting more than a half hour? Yes __ No __
Do you have visual symptoms or a visual loss? Yes ___ No ___

These features are more prevalent among individuals who have **giant cell arteritis** (temporal arteritis). Giant cell arteritis is almost exclusively found in people over the age of 50. It causes a reduction in the blood flow to the structures of the head and neck. The decreased masticatory muscle blood flow causes the muscles to tire easily, producing a tired, cramped feeling that resolves within 1–2 minutes after use. This symptom is also observed among some TMD patients without giant cell arteritis, and these questions are to help differentiate the cause. If the patient has had this symptom for over a year, it is highly unlikely that he or she has giant cell arteritis. Giant cell arteritis is an important disorder not to miss because it may progress to cause blindness.

A "Yes" response to the first two questions is suggestive of jaw claudication, but a TMD patient with mild TMD symptoms may positively respond to both questions. Consider giant cell arteritis when the patient relates unexplainable scalp tenderness, unexplainable or unintentional weight loss, significant morning stiffness lasting more than a half hour, and visual symptoms or visual loss.

A fever (previously asked in the questionnaire) is also more prevalent among individuals who have giant cell arteritis. If this is not due to a dental condition and has not been evaluated by a physician, I recommend he or she be referred for an evaluation. Another sign of giant cell arteritis is an abnormal temporal artery. This is evaluated by comparing the left and right temporal arteries. Relative to the other side, an abnormal vessel will be more visible, have no pulse, or have palpable nodes.

If you suspect a patient may have giant cell arteritis, it is recommended that (1) if patient has any visual changes, he or she should be seen by an ophthalmologist, rheumatologist, or emergency room that day and (2) if patient does not have any visual changes, he or she should be seen by an ophthalmologist, rheumatologist, or emergency room within a week. It is better to err with an unnecessary referral than allow this disorder to go undiagnosed.

Chapter 3

Clinical Examination

FAQs

Q: Which should be performed first: measurement of the range of motion or palpation?
A: The range of motion should be measured prior to palpating because palpation often aggravates the masticatory muscles and/or temporomandibular joints (TMJs), which may cause a decrease in a patient's range of motion.

Q: What is the minimum of normal range of motion?
A: Minimum of normal is 40 mm opening (including the overlap), 7 mm right and left lateral, and 6 mm protrusive movements.

Q: Can a dentist write prescriptions or refer a patient for neck pain?
A: Cervical treatment and referrals are within a dentist's scope of clinical practice for temporomandibular disorder (TMD).

Q: If odontogenic pain is suspected of contributing to a patient's TMD pain, what are the clinical observations that may aid in locating the offending tooth?
A: Anterior teeth (canine to canine) have been observed referring odontogenic pain bilaterally, whereas the premolars and molars have been observed referring pain only to the ipsilateral side, but there may also be minimal TMD symptoms on the contralateral side.

Substantial information should have been obtained from the patient interview suggesting whether the patient has TMD, other disorders that could contribute to TMD (e.g., odontalgia, sinusitis, neck pain, or cervicogenic headaches), many TMD contributing factors, and the symptom location and time patterns. Consequently, prior to performing the clinical examination, the practitioner should have strong suspicions as to which structures are concerns and need further evaluation.

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QUICK CONSULT

Obtaining Suspicions of Structures That Are a Concern

From the patient interview, the practitioner should have strong suspicions as to which structures are concerns and need further evaluation.

QUICK CONSULT

Verifying Potential Sources

A potential source can be verified by observing whether aggravating a structure causes the pain to be reproduced (if not present) or exacerbated (if present), or whether anesthetically blocking or alleviating the structure by other means decreases the pain.

The primary purpose of the clinical examination is to gather additional information to help confirm or rule out structures involved in a patient's complaints and other suspected disorders that may contribute to these complaints. A potential source can be verified by observing whether aggravating (e.g., palpation, cold to a tooth) a structure causes the pain to be reproduced (if not present) or exacerbated (if present), or whether anesthetically blocking or alleviating the structure by other means decreases the pain.[1]

Typically, palpation is used to aggravate the masticatory muscles and the temporomandibular joints (TMJs). Generally, more than one structure is the source of a temporomandibular disorder (TMD) patient's pain. Some practitioners grade the palpation tenderness between 0 and 3 for more definitive documentation and to help categorize a structure's contribution.

Some of the procedures used to anesthetically block or alleviate potential pain sources are (1) a trigger-point anesthetic injection for an individual myofascial trigger point, (2) an anesthetic infiltration or block for a tooth, and (3) a trial of antibiotics and decongestants (see Table 1.2) for the suspected contribution of sinus congestion. Obviously, one limiting factor for the anesthetic test is that the pain must be present when the test is performed.

Sometimes, structures are both aggravated and injected with anesthetic. For example, a patient with a frontal sinus headache that can be exacerbated by palpating a cervical trigger point (due to referred pain) may desire to have an anesthetic injection of the trigger point to determine the amount the trigger point is contributing to the sinus pain.

Range of Motion

The patient's range of motion should be measured prior to palpating, because palpation often aggravates the masticatory muscles and/or TMJs, which may cause a decrease in the range of motion. Recording the range of motion enables the practitioner to determine whether the patient has a significant decrease (suggestive of certain disorders) and to follow an objective measure for improvement. (An increase in a restricted range of motion suggests improvement.) Many range-of-motion measures can be performed, for example, assisted, unassisted, without pain, and despite pain.

The opening measurement routinely obtained is the distance (in millimeters) between the incisal edge of the maxillary central incisors and the incisal edge of the mandibular central incisors when I request of the patient, "Open as wide as you can" (Figure 3.1). Since practitioners may follow a patient's opening measures from appointment to appointment, it is important that practitioners try to be consistent in how the patient is asked to open. Therefore, the phrase

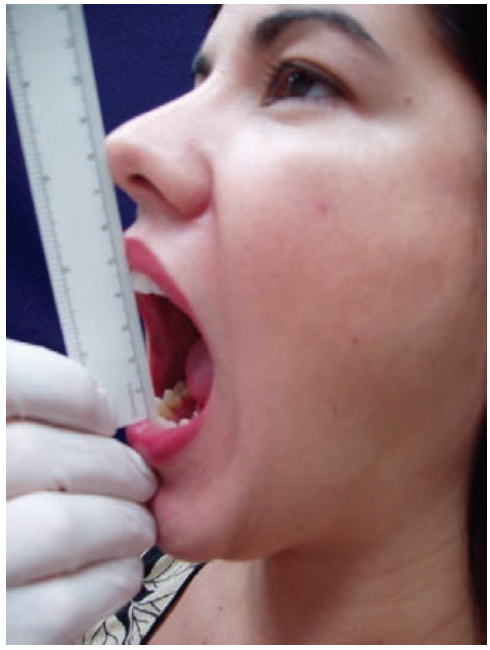

Figure 3.1. Measuring the opening incisal edge to incisal edge.

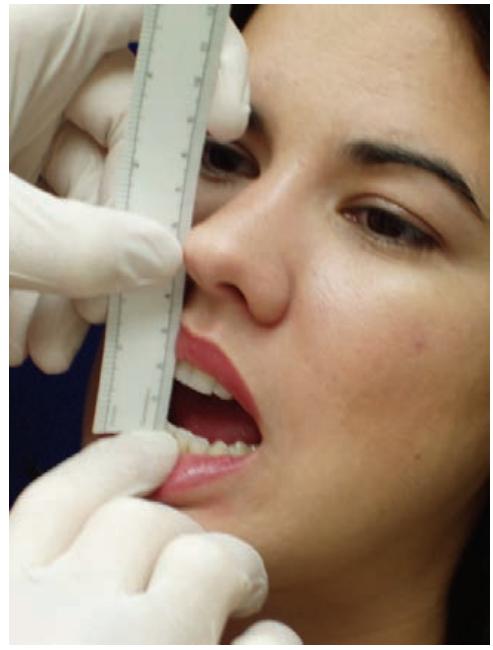

Figure 3.2. Measuring the vertical overlap of the central incisors.

and intonation should be consistent at every appointment.

TECHNICAL TIP

Opening Consistency

Since a patient's opening may be followed from appointment to appointment, practitioners should try to be consistent in how the patient is asked to open.

The true distance a patient opens includes the vertical overlap of the central incisors. This can easily be determined by asking the patient to close into maximum intercuspation (MI), placing a fingernail on the facial surface of the mandibular central incisor against the maxillary central incisor's incisal edge, asking the patient to open, and measuring the distance from the mandibular central incisor's incisal edge to the fingernail (Figure 3.2). Only the vertical overlap is routinely documented at the initial appointment, and the incisal-to-incisal openings are followed at future appointments. Measuring and adding the overlap at each appointment adds potential for error, and it rarely changes throughout treatment.

If a patient's mouth opening is significantly restricted, the practitioner may be able to determine the restriction's origin by stretching the mouth wider, usually by placing the index finger over the incisal edges of the mandibular incisors and the thumb over the incisal edges of the maxillary incisors and pressing the teeth apart by moving the fingers in a scissor-type motion (Figure 1.2). The patient will usually feel tightness or pain at the location of the restriction. Clinical experience has shown that not all patients accurately point to the stretched discomfort location, and it is necessary to palpate the TMJ and musculature to reproduce the discomfort to identify its origin.

TECHNICAL TIP

Determining Origin of Patient's Restricted Opening

If a patient's mouth opening is significantly restricted, the practitioner may be able to determine the restriction's origin by stretching the mouth wider.

A patient who has a significantly limited opening is told about the practitioner's need to look down the patient's throat. Place the head of a mouth mirror against the posterior portion of the tongue, press down on the mirror, and ask the patient to say "Ah" and open as wide as possible. Occasionally, a patient who could open only 21 mm may now open 45 mm. There are many potential reasons the patient did not previously open as wide, and these need to be discussed to the practitioner's satisfaction.

Lateral movements can be measured by asking the patient to close into MI and placing a ruler over the maxillary central incisors with the mandibular central incisors' facial embrasure lined with one of the prominent ruler marks (e.g., the 30-mm mark). The patient is asked to move his or her mandible as far as possible to one side while the practitioner observes the distance the embrasure has moved on the ruler; then, the patient is asked to move the mandible in the other direction (Figure 3.3). In general, people do not consciously move their mandible laterally, so some have difficulty when asked to do so. This can usually be resolved by the practitioner demonstrating these movements and asking the patient to practice them in a hand mirror.

TECHNICAL TIP

Enabling a Patient to Make Excursive Movements

If a patient has trouble making lateral or protrusive movements, asking him or her to practice these by looking into a hand mirror is usually beneficial.

The protrusive movement can be obtained by asking the patient to close in MI and measuring the anterior overjet. The patient is then asked to slide the lower jaw as far forward as possible while the practitioner measures the distance the mandibular incisors are in front of the maxillary incisors and adding the two numbers together (Figure 3.4).

As the patient makes these movements, the practitioner observes for the translation of each condyle. If it is suspected that translation is restricted on one or both condyles, it is recommended he or she feel the condyles for their translations. This is performed by placing the palmar surface of the index or middle finger over the condyle and asking the patient to open, close, and move the mandible in right lateral, left lateral, and protrusive.

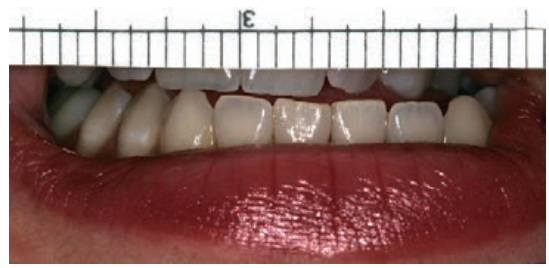

Figure 3.3. Measuring lateral movement.

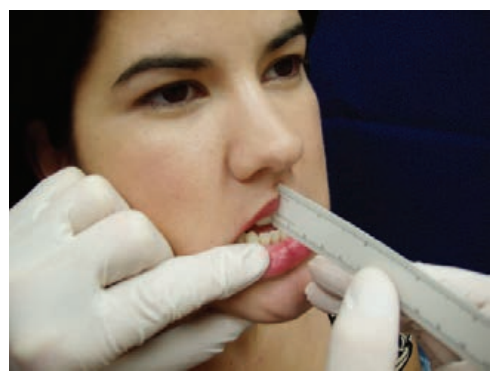

Figure 3.4. Measuring the distance the mandibular incisors are in front of the maxillary incisors.

TECHNICAL TIP

Observing Restricted TMJ Translation

If the practitioner suspects a patient's condylar translation is restricted, it is recommended the practitioner feel the condyles for their translations.

Slight to moderate restriction in the range of motion is commonly observed among TMD patients. However, range of motion varies with a patient's stature, and the degree of restriction is not always related to severity of TMD symptoms. Minimum of normal is 40 mm opening (including the overlap), 7 mm right and left lateral, and 6 mm protrusive movements.[2–4]

TMJ Noise

TMJ clicks and pops are very prevalent among TMD patients as well as in the general population.[5,6] **Crepitus** is a grating or crackling noise similar to the sound that is created when one walks over wet sand on the beach or wet snow. These noises may occur with opening and/or closing, fluctuate in intensity, and occur sporadically.[6,7] It is common for patients to report having a history of TMJ noise but be unable to reproduce it during the examination.[7]

Practitioners vary in the degree to which they try to verify the TMJ noise. Some palpate for the noise by placing the finger's palmar surface over the TMJ as the patient opens, closes, and moves through lateral and protrusive excursions. Others use a stethoscope to listen for the noise during these movements. The bell-shaped portion of the stethoscope should be used because when the flat portion of the stethoscope is used, a hair or whisker stub under the flat portion often sounds remarkably similar to TMJ crepitus. Some practitioners use even more sensitive equipment (e.g., Doppler) in an attempt to verify the TMJ noise.

Sometimes the patient and the practitioner have trouble distinguishing which TMJ is generating the click or pop because the vibration can travel through the mandible and be perceived in the contralateral TMJ. This can usually be differentiated by having the patient start in MI and move the mandible lateral to one side several times and then lateral to the other side several times. The click or pop is generated during the translation phase, and whichever condyle was translating when the noise was generated is the source.

Clicking and popping are most commonly related to a disc displacement with reduction,[8,9] while crepitus is most commonly related to roughness on the articular surface(s), which could be secondary to degenerative joint disease (Figure 3.5).[2] Crepitus is sometimes subcategorized as either coarse or fine crepitus, based upon how pronounced the noise is. For additional information on these diagnoses, see "TMJ Disorders" in Chapter 5.

TMJ noise rarely changes my treatment approach, so spending extensive time or using specialized equipment to verify the noise is unwarranted. In general, TMJ noise is no more of a concern than is noise in any other

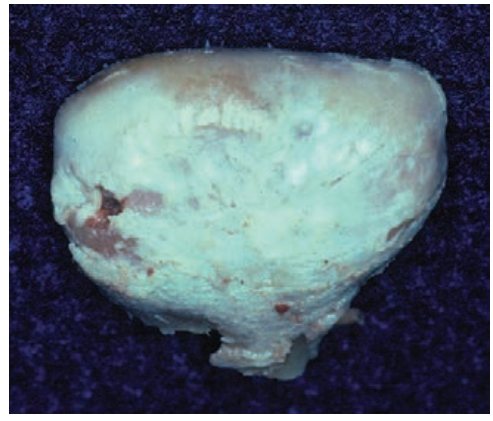

Figure 3.5. Roughness on the condylar surface with a portion of the articular fibrous connective tissue removed to expose the osseous surface.

joint in the body, and asymptomatic TMJ noise does not need to be treated.[2,10] If the noise is associated with catching or intermittent locking, I am concerned this may progress to a continuous lock,[4,11] so I recommend TMD therapy that would most effectively eliminate this; see the "Intermittent Disorder" in Chapter 10. A case scenario of a patient with only TMJ noise is presented in "Case 11" in Part V.

QUICK CONSULT

Understanding TMJ Noise Significance

In general, TMJ noise is no more of a concern than is noise in any other joint in the body, and TMJ noise alone does not need to be treated.

TMJ noise generally decreases with TMD therapy but is less responsive to therapy than are most TMD symptoms.[12] It tends to fluctuate over time and correlates with jaw fatigue, tooth clenching, and tooth grinding.[13] The percentage of patients observing improvement varies from study to study along with the procedures used to measure the noise. If a patient were to ask for the probability that his or her noise would decrease, as a general conservative guide I would inform the patient that from stabilization appliance therapy, approximately a third of patients report significant noise reduction or elimination, a third report minor improvement, and a third report no improvement.[11] There are no established predictors to suggest a specific individual's results.

TMD Palpations

The masticatory and cervical muscles and TMJs are generally palpated with the fingertip or palmar surface of the index or middle finger. If applicable, the forces placed on the head are balanced by simultaneously palpating both sides or stabilizing the head by placing the palm of the nonpalpating hand on the contralateral side. It is recommended the practitioner face the patient during the palpation rather than stand behind the patient. In this position the practitioner can observe the patient's eyes and facial expressions, for the eyes generally start to open wider or start to close as tenderness is generated. The muscles and TMJs are palpated with the muscles relaxed, and healthy muscles do not hurt when palpated.[11]

The muscle and TMJ palpations attempt to aggravate these structures sufficiently so that if they are contributing to the pain, the palpation will reproduce (if the pain is not present) or exacerbate (if the pain is present) it. The extent to which the practitioner must palpate varies with the ease of reproducing the patient's symptoms; for example, a patient with exquisite tenderness generally relates light touch reproduces the pain, whereas a muscular man who has not had the pain for a couple of weeks may need forceful palpation to reproduce his pain.

It is recommended using 2–3 lb for extraoral muscles and 1 lb on the TMJ and intraoral muscles,[8] but more force may be necessary to generate a patient's chief complaint. It is the author's teaching experience that most practitioners are initially reluctant to use sufficient force to reproduce the TMD symptoms. Conversely, excessive force causes unnecessary palpation and postexamination pain.

TECHNICAL TIP

Palpating Force

A way to gauge how much is 1 or 2–3 lb is to recall how heavy a package with this amount of ground beef would be, and apply the force it would take to hold his package against the palpated structure.

QUICK CONSULT

Palpating Force

It is the author's teaching experience that most practitioners are initially reluctant to use sufficient force to reproduce the TMD symptoms. Conversely, excessive force causes unnecessary palpation and postexamination pain.

Palpation may generate pain within or beyond the structure and/or generate referred pain to a distant location. A variety of palpation techniques provides varying degrees of aggravation to the structure. The degree of aggravation in addition to the sensitivity of the structure governs which of these responses occur. In general, three palpation techniques are used to provide different aggravation intensities: (1) nonspecific palpation in a predetermined location; (2) palpation of a trigger point or nodule of spot tenderness within the muscle (these are localized, firm, hyperirritable nodules that feel like firm knots within the muscle and are more tender than the surrounding muscle); and (3) firm, sustained palpation of these tender nodules.

It is recommended a tiered palpation approach be used. Initially palpate the anterior region of the temporalis muscles, TMJs, and masseter muscles bilaterally in predetermined locations,[14] and attempt to generate referred pain from the carotid artery, thyroid, and the muscles just below the occipital protuberance.

Start by palpating the anterior region of the temporalis muscle, TMJs, and masseter muscle; begin with light pressure and slowly increase the force until the patient's eyes or facial expressions convey that the patient is experiencing discomfort or reach the recommended force. Clinical experience has shown the eyes and face express discomfort prior to patients verbally responding to the discomfort. As the practitioner palpates, the patient is asked whether the palpation is causing discomfort and whether this is his or her pain complaint.

TECHNICAL TIP

Reducing Palpation Discomfort

It is recommended the practitioner face the patient during the palpation, so he or she can better observe the patient's eyes and facial expressions; these generally express discomfort prior to patients verbally responding to the discomfort.

After palpating these structures, rule out other specific disorders by palpating the carotid arteries, the thyroid, and the suboccipital protuberance area of the splenius capitis and trapezius muscles.[15] Additional specific guidance regarding the palpation of this first tier, as well as supplementary information, is provided in the following, and a synopsis is provided in Table 3.1.

The temporalis muscle is often segmented into the anterior, middle, and posterior regions. The muscle fiber direction and the direction the fibers move the mandible vary with each region segment. All three regions may be tender to palpation, have tender nodules, and be a source of the pain. Bilaterally palpate the **anterior region of the temporalis muscle** approximately 1.5 in. behind the eye canthus and 0.5 in. above the zygomatic arch (Figure 3.6).

If the anterior region of the temporalis or any other muscle is tender to palpation, the most probable diagnosis is myalgia. From a clinically practical viewpoint, if the muscle is tender to palpation and no other muscle diagnosis in Chapter 5 ("TMD Diagnostic Categories") better describes the patient's condition, it is recommended the muscle tenderness be diagnosed as myalgia. If the muscle causes referred pain, it is recommended the muscle tenderness be diagnosed as myofascial pain with referral.

Table 3.1. Recommended initial palpations.

Anterior region of the temporalis muscle	Bilaterally palpate approximately 1.5 inches behind the eye canthus and 0.5 inch above the zygomatic arch (Figure 3.6).
TMJ	Three areas of the TMJ need to be palpated bilaterally, and any one of these can be tender without tenderness of the others. A common mistake is not having the patient open sufficiently to adequately palpate the TMJ. (1) Ask the patient to open approximately 20 mm and palpate the condyle's lateral pole. (2) Ask the patient to open as wide as possible and palpate the depth of the depression behind the condyle with the fingertip. (3) With the finger in the depression, pull forward to load the posterior aspect of the condyle (Figure 3.7).
Masseter muscle	Bilaterally palpate the center of the masseter muscle (Figure 3.8). If unsure of the muscle's extent, ask the patient to clench, and its extent can easily be felt.
Carotid artery	Bilaterally palpate the carotid arteries on both sides of the thyroid cartilage (Figure 3.9). This rules out carotidynia as a contributor for patients who relate this palpation does not reproduce their pain complaint.
Thyroid	Initially touch the suprasternal notch and then bilaterally palpate approximately 1 inch superior and 1 inch lateral to the notch (Figure 3.10). This rules out thyroiditis as a contributor for patients in whom this palpation does not reproduce their pain complaint.
Splenius capitis muscle	This muscle is located in the depression just posterior to the sternocleidomastoid muscle along the base of the skull. Find the firm nodules within this muscle along the skull base. Palpate approximately 1 inch below the skull so these nodules are compressed up against the skull base. Press to patient tolerance and hold for approximately 5 seconds, attempting to generate referred pain. The head is stabilized during palpation by placing the palm of the other hand above the forehead (Figure 3.12).
Trapezius muscle	Find the firm nodules within this muscle along the base of the skull. Palpate approximately 1 inch below the skull so these nodules are compressed up against the skull base. Press to patient tolerance and hold for approximately 5 seconds, attempting to generate referred pain. The head is stabilized by placing the palm of the other hand above the forehead (Figure 3.13).

Masticatory muscle is the most common source of TMD pain, so myalgia or myofascial pain with referral are the most common diagnoses for TMD pain.

FOCAL POINT

> Muscle palpation tenderness generally provides a clinical diagnosis of myalgia or myofascial pain with referral, unless another muscle diagnosis in Chapter 5 ("TMD Diagnostic Categories") better describes the patient's condition.

Clinically it has been observed that the **TMJ** needs to be palpated in three locations. Tenderness in one of these locations is not necessarily associated with tenderness in another. Palpate the first location by asking the patient to open approximately 20 mm and palpating the condyle's lateral pole. Then ask the patient to open as wide as possible while you palpate the depth of the depression behind the condyle (over the retrodiscal tissue) with your fingertip. Finally, with the finger in the depression and the mouth open wide, pull

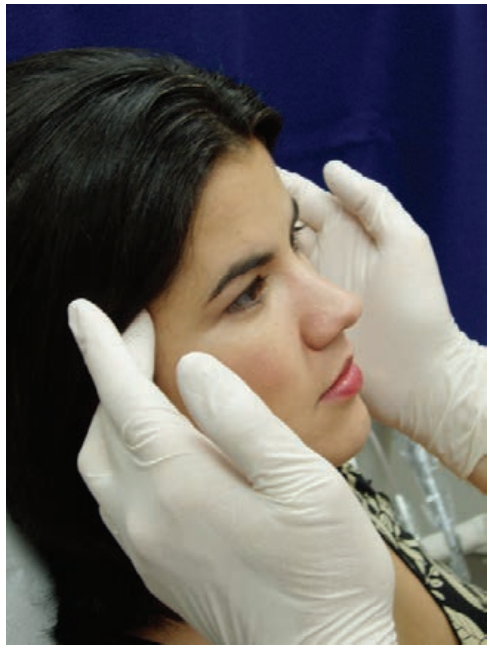

Figure 3.6. Palpation of the anterior region of the temporalis muscle.

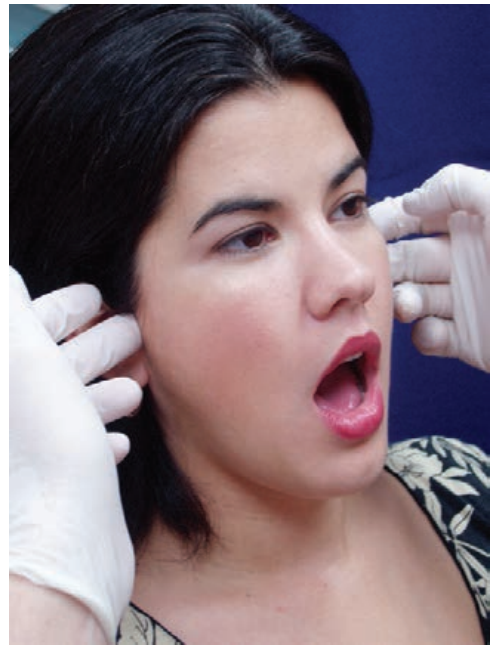

Figure 3.7. Palpation of the TMJ.

forward to load the posterior aspect of the condyle (Figure 3.7).

The clinical diagnosis for tenderness of the TMJ is TMJ arthralgia; except in the rare situation when the TMJ also has clinical characteristics of inflammation or infection (e.g., edema, erythema, and/or increased temperature), then the clinical diagnosis is TMJ arthritis. Clinical training experience has shown that most practitioners do not adequately palpate the TMJ, and the most common mistake is that the patient's mouth is not open wide enough. TMJ arthralgia is the second most common diagnosis for TMD pain.[16]

FOCAL POINT

TMJ palpation tenderness generally provides a clinical diagnosis of TMJ arthralgia.

The **masseter muscle** is composed of a superficial portion and a deep portion. Bilaterally palpating the center of the masseter

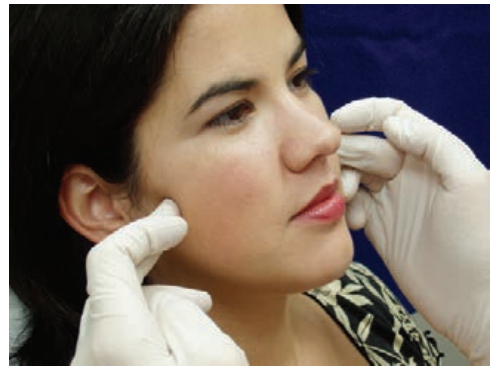

Figure 3.8. Palpation of masseter muscle.

muscle will simultaneously aggravate both sections of the muscle (Figure 3.8). If the practitioner is unsure of the muscle's center, it can easily be delineated by asking the patient to clench his or her teeth while the practitioner palpates the extent of the muscle. If the muscle is tender to palpation and no other muscle diagnosis in Chapter 5 ("TMD Diagnostic Categories") better describes the patient's condition, it is recommended the

Figure 3.9. Palpation of the carotid arteries.

Figure 3.10. Palpation of the thyroid.

muscle tenderness be diagnosed as myalgia, and if it causes referred pain, then it is recommended it be diagnosed as myofascial pain with referral.

The **carotid arteries** are palpated on both sides of the thyroid cartilage to determine whether aggravating these structures reproduces a patient's pain (Figure 3.9). This area is tender for most individuals, so prior to this palpation, it is recommended that the practitioner has palpated this structure on himself or herself to determine the force that would not cause undue discomfort. The patient may relate the palpation generates discomfort, but this is different from his or her pain complaint. If this palpation brings on the patient's pain complaint, it suggests carotidynia is causing or contributing to the pain, and a referral should be made to the patient's physician.

Bilaterally palpate the **thyroid**. If unsure of its location, first touch the suprasternal notch to establish the landmarks and then bilaterally palpate the thyroid at approximately 1 in. superior and 1 in. lateral to the notch (Figure 3.10). If this palpation reproduces the pain, this suggests thyroiditis is causing or contributing to the pain, and a referral should be made to the patient's physician.

It is important to attempt to generate referred pain from the **splenius capitis** (located in the depression just posterior to the sternocleidomastoid muscle along the base of the skull) and **trapezius muscles** because referred cervicogenic pain is relatively prevalent among TMD patients.[15] A study of 230 TMD patients found palpation of the splenius capitis and trapezius muscles generated referred pain to the temporalis muscle region in 18 and 31 patients, respectively. This study observed that palpating these muscles just below the occipital protuberance was one of the most common sources for generating referred pain to the forehead, periorbital, vertex, temple, occipital, postauricular, and ear.[17]

QUICK CONSULT

Identifying Referred Pain from the Neck

Referred pain from the neck is relatively prevalent among TMD patients. Palpating the neck muscles just below the occipital protuberance most commonly generates referred pain to the forehead, periorbital, vertex, temple, occipital, postauricular, and ear.

TMD pain commonly occurs in the temporalis and/or masseter muscle region, and I have observed some dentists automatically diagnosing patients with pain in this location as having TMD. It is not uncommon to observe patients with pain in this location having mild to moderate temporalis and/or masseter muscle palpation tenderness, and then when their suboccipital muscles are palpated, their eyes "light up" with the temporalis or masseter muscle pain complaint. As explained in Chapter 1, central sensitization and convergence are the primary mechanisms behind referred pain and can cause neck pain to appear as typical TMD pain (Figure 3.11). If these patients were treated with traditional TMD therapies, there is a low probability that they would obtain satisfactory symptom relief. This is one of the reasons I evaluate every TMD patient for referred cervical pain.

FOCAL POINT

The neck can be the source for referred pain to the temporalis or masseter muscle region, which is the most common location for TMD pain.

Prior to attempting to generate referred pain from either the splenius capitis or trapezius muscles, palpate the muscle to find the most tender nodules within the muscle along the skull base. Then press the fingertip approximately 1 in. below the skull, up against

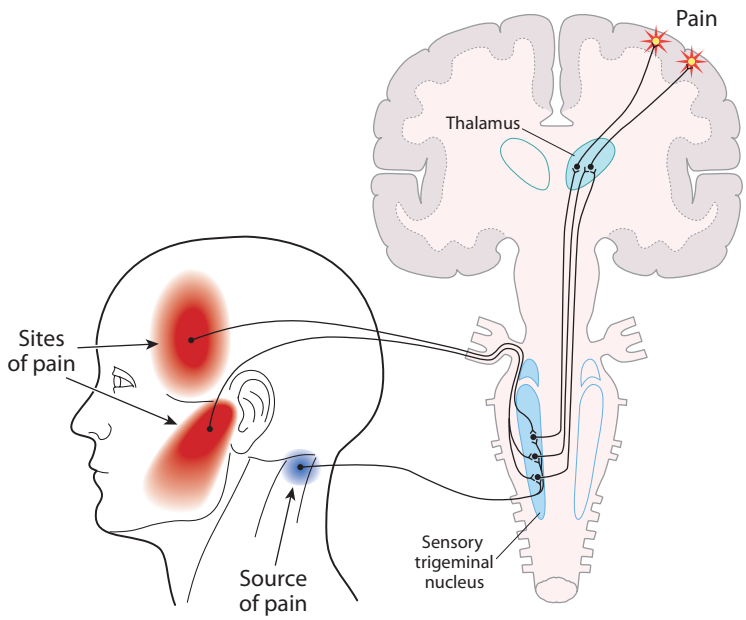

Figure 3.11. A depiction of central convergence enabling cervical pain to be perceived as temporalis and masseter muscle pain.

the skull base, so each nodule is compressed between the fingertip and skull base. Press to patient tolerance (a considerable amount of force may be needed) and hold for approximately 5 seconds. The head is stabilized during the palpation by placing the palm of the other hand over the forehead. See Figure 3.12 for palpation of the splenius capitis muscle and Figure 3.13 for the trapezius muscle. As these muscles are palpated, ask the patient whether pain is being felt in any location other than the palpation site.

The forehead and periorbital (in, behind, or around the eyes) areas are very common sites to which these muscles refer pain. It is believed that practitioners who have not previously palpated these muscles in this manner will be surprised by the frequency with which referred pain is generated from the cervical region. A case scenario of a patient with chronic forehead pain referred from the neck is presented in "Case 4" in Part V.

Figure 3.12. Palpation of the splenius capitis muscle.

Figure 3.13. Palpation of the trapezius muscle.

Clinically it has been observed that the vast majority of TMD patients have their pain reproduced by employing only these initial recommended palpations. If a patient's pain was reproduced by palpating these sites, it is felt that additional masticatory muscle palpation would only cause more discomfort and have little likelihood of changing the diagnoses and treatment plan. Stopping the palpation evaluation for these patients is justified because (1) the initial recommended palpations have demonstrated the pain is from masticatory structures, (2) most conservative TMD therapies treat all the masticatory structures, (3) a muscle and joint contribution comparison can be made with the information obtained, and (4) other structures that commonly refer to the masticatory system or whose source is important to rule out are part of the initial recommended palpations.

If the initial palpations were not able to reproduce the patient's pain, more extensive palpation is needed. A good technique for more intensely palpating muscles involves finding and loading the trigger points or nodules of spot tenderness within the muscle. These nodules feel like firm knots within the muscle and are more tender than the surrounding muscle.

Once found, apply pressure to each nodule. This will generate more intense pain within that muscle, generate pain that may go beyond the structure, and will sometimes refer pain to distant locations. If such a nodule cannot be found, then firmly palpate any tender areas within the muscle. The TMJ can be similarly aggravated more intensely by palpating its tender locations more vigorously.

If this second tier did not reproduce the patient's pain and the practitioner believes this location is the source of the pain, a more intense palpation can be employed, which is typically used when attempting to generate referred pain. This is accomplished by first identifying the tender nodules within the muscle or locations within the TMJ, applying sustained pressure to these sites up to patient tolerance, and holding it for at least 5 seconds or until the anticipated pain is elicited. This generates greater local pain that may go beyond the structure and/or referred pain to distant locations. To determine where referred pain is being generated to a distant location, ask the patient whether pain is being felt at a location other than where the practitioner is pressing. Each nodule within a muscle may refer pain to a different location; therefore, this palpation technique may need to be repeated for each tender nodule.

The choice of whether to more intensely palpate in the same location or attempt to reproduce the patient's pain from a different location varies with the practitioner's suspicions and clinical experience. For practitioners who have not yet developed this clinical experience, Figure 3.14 provides maps of palpation locations that have been shown to generate referred pain to the labeled anatomical areas of the head and face.[17]

The strategy for locating the pain source that is generally applied is to first consider the pain is due to pathology where the patient feels the pain. So if a patient complains of pain in the maxillary first molar, try to identify the pathology (e.g., with radiograph) and/or reproduce the pain at that location (e.g., applying cold to the tooth). If there is no pathology that is causing the patient's pain at that location, then consider a regional source, by evaluating adjacent teeth, opposing teeth, inquiring about recent sinus congestion, and so on. Once a regional source for the pain has been ruled out, consider that the pain may be referred from a different location.

For this example of maxillary first molar pain, Figure 3.14 identifies that the most common source for referred pain to the "maxillary dentition" is the superior portion of the masseter muscle. Use the above-mentioned technique to determine whether palpating tender nodules within the superior portion of the masseter muscle reproduces the tooth pain. If palpating this location does not generate the desired referred pain, it is recommended the practitioner palpate more intensely as previously described or try one of the less common sources. The pain can also be due to a combination of these sources. For additional information about tooth pain not due to local pathology, see "Intraoral Examination" in this chapter.

Techniques for palpating sources not part of the initial palpations are described later and summarized in Table 3.2. The practitioner may find the maps of palpation pain distribution in Figure 3.15 helpful for identifying to which locations each structure has been shown to refer pain.

The temporalis muscle can visually be divided into its three segments. The **middle region of the temporalis muscle** is palpated bilaterally in its central portion, approximately 2 in. above the TMJs (Figure 3.16). The **posterior region of the temporalis muscle** is similarly palpated bilaterally in its central portion, above and behind the ears (Figure 3.17). If the predetermined location did not reproduce the patient's pain and the practitioner suspects the patient's pain may be from these structures, the practitioner should find and load the tender nodules with momentary or sustained pressure to increase the pain intensities and probability of generating referred pain.

The digastric muscle has an anterior and posterior belly with an intermediate tendon that slides through a fibrous sling attached to

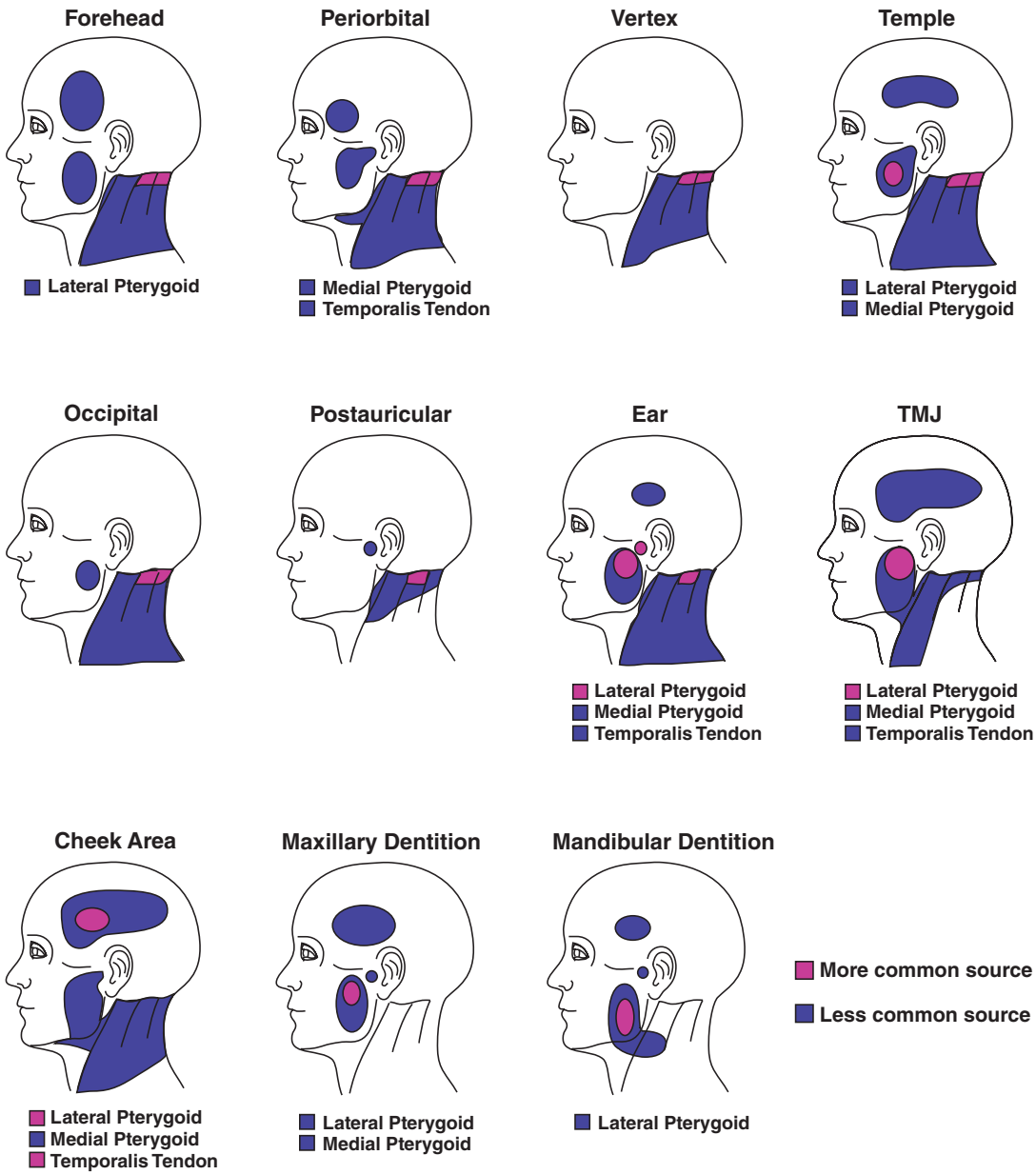

Figure 3.14. Map of palpation locations that can generate referred pain to the labeled anatomic areas. The superficial sites that caused referred pain to the labeled regions of the head are highlighted on the drawing and the intraoral palpation locations are listed below the drawing.

the hyoid bone. These are primarily opening muscles, and clinically I cannot delineate these muscles from the surrounding tissue. When the patient swallows, these muscles contract and they can sometimes be delineated in this fashion.[18] The **anterior digastric muscle** attaches lingual to the chin and runs near the midline to the hyoid sling. Based on the anatomical knowledge, palpate the location that the anterior digastric muscle transverses

Table 3.2. Additional palpations.

Middle temporalis muscle	The temporalis muscle can visually be divided into its three segments. Bilaterally palpate the central portion of the middle temporalis, approximately 2 in above the TMJs (Figure 3.16). Referred pain may be generated by locating and applying sustained pressure to the tender nodules within this segment.
Posterior temporalis muscle	Bilaterally palpate the central portion of the posterior temporalis, above and behind the ears (Figure 3.17). Referred pain may also be generated by locating and applying sustained pressure to the tender nodules within this segment.
Anterior digastric muscle	The anterior digastric muscle runs from the lingual surface of the chin, near the midline to the hyoid bone. I cannot delineate this muscle from the surrounding tissue, but palpate superiorly the area this muscle transverses (Figure 3.18). If tenderness is observed, rule out an oral disorder causing this tenderness. If tenderness is not due to an oral disorder, referred pain may be generated by applying sustained pressure to the tender area.
Posterior digastric muscle	The posterior digastric muscle runs from the hyoid sling medial to the sternocleidomastoid muscle and attaches medial to the mastoid process. Place a fingertip posterior to the angle of the mandible and medial to the sternocleidomastoid muscle and apply the palpation force posteriorly (Figure 3.19). If tenderness is observed, referred pain may be generated by applying sustained pressure.
Sternocleidomastoid muscle	Bilaterally palpate the sternocleidomastoid muscles by squeezing each between the thumb and index finger. If tender, holding for 5 seconds may generate referred pain. Clinically, the more superior portions of the muscle are more likely to generate referred pain to the head and face (Figure 3.20).
Additional muscle cervical palpation	Place the palm of the nondominant hand over the patient's forehead and the four fingertips of the dominant hand just below the occipital protuberance. Press in several millimeters and slowly slide fingertips down the neck muscles, feeling for tender nodules (Figure 3.21). To each tender nodule, apply firm, steady pressure up to patient tolerance for 5 seconds, inquiring about discomfort referred to another area (Figure 3.22). Similar to the sternocleidomastoid muscle, clinically the superior region tends to refer to the head and face, whereas the inferior region tends to refer into the upper back and shoulders.
Lateral pterygoid area	Slide the fifth digit along the lateral side of the maxillary alveolar ridge to the most posterior region of the vestibule (the location for the posterior superior alveolar injection). Palpate by pressing in a superior, medial, and posterior direction (Figure 3.23). If tenderness is observed, referred pain may be generated by applying heavier sustained pressure.
Medial pterygoid muscle	Slide the index finger a little posterior to the traditional insertion site for an inferior alveolar injection, until you feel muscle, and press laterally. If the patient gags, the finger is too posterior (Figure 3.24). If tenderness is observed, referred pain may be generated by applying heavier sustained pressure.
Temporalis muscle tendon	Slide the index finger superiorly along the anteromedial border of the ramus; as the finger approaches the superior extent, palpate the temporalis muscle's tendon overlaying the coronoid process (Figure 3.25). If tenderness is observed, referred pain may be generated by applying heavier sustained pressure.
Stylomandibular ligament	Palpate with a blunt instrument or fingertip medial to the posterior border of the mandible and 10–15 mm above the angle of the mandible in an anteromedial direction (Figure 3.26). If tenderness is observed, referred pain may be generated by applying heavier sustained pressure.

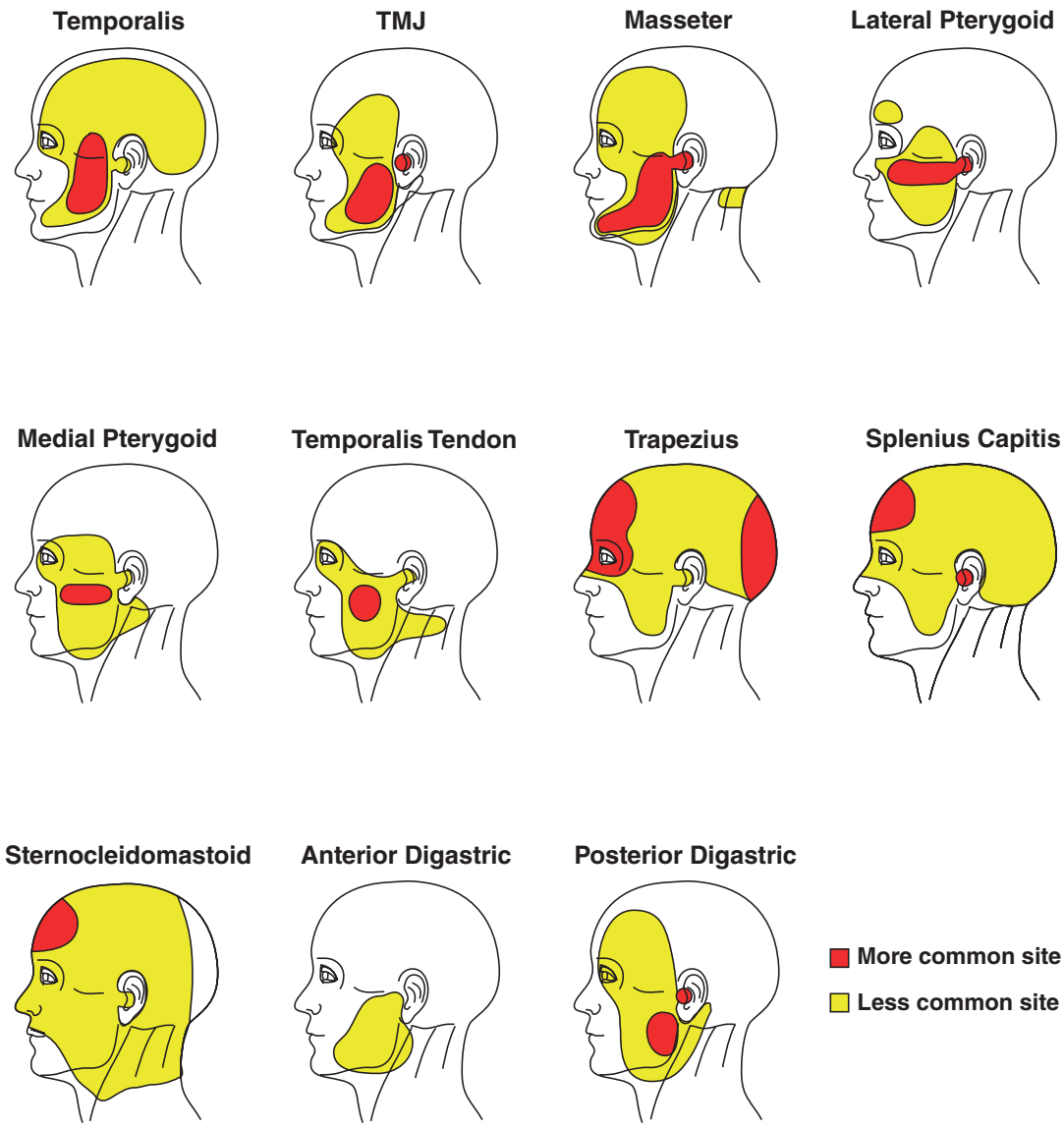

Figure 3.15. Map of palpation pain distribution generated by the labeled areas.

and observe for tenderness (Figure 3.18). If there is tenderness in this region, the practitioner should consider and rule out an oral disorder to ensure lymphadenopathy is not the cause of this tenderness.

The **posterior digastric muscle** runs from the hyoid sling, medial of the sternocleidomastoid muscle, and attaches medial to the mastoid process. Palpate this muscle by placing a fingertip posterior to the angle of the mandible and medial to the anterior border of the sternocleidomastoid muscle and press posteriorly (Figure 3.19). If tenderness is observed, referred pain may be generated by applying heavier sustained pressure. The posterior digastric muscle is an opening muscle and clinical experience has shown that the posterior digastric muscle may

Figure 3.16. Palpation of the central portion of the middle region of the temporalis muscle.

Figure 3.17. Palpation of the central portion of the posterior region of the temporalis muscle.

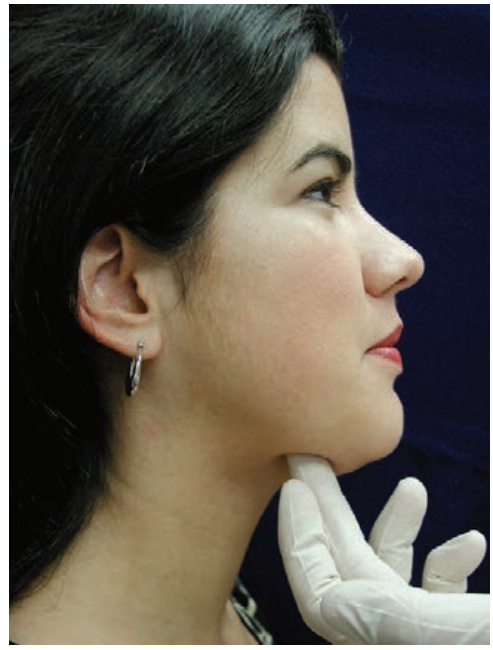

Figure 3.18. Palpation of the anterior digastric muscle.

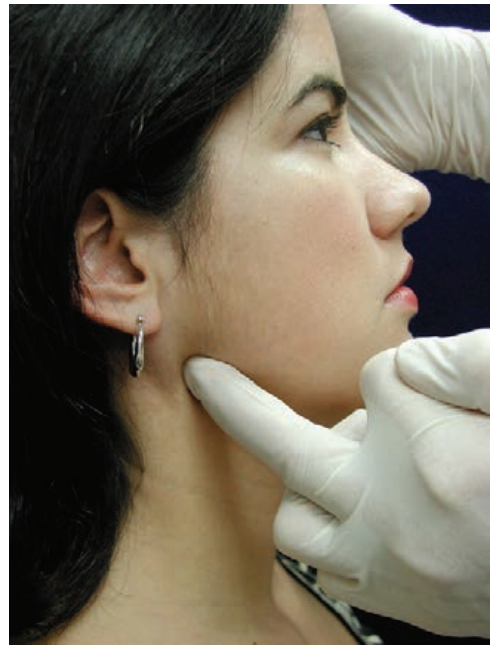

Figure 3.19. Palpation of the posterior digastric muscle.

be very tender when a patient has recently developed a restricted opening (e.g., TMJ disc displacement without reduction with limited opening). In this situation, the posterior digastric muscle is most likely painful from the patient's repeated forcible attempts to open wider.

Referred pain to the temple, masseter, ear, and TMJ areas can be generated by the **sternocleidomastoid muscle**, although the splenius capitis and trapezius muscles more commonly refer pain to these sites.[17] Clinical experience has shown that the more superior region of the sternocleidomastoid muscle is more likely to generate referred pain to the head and face. Bilaterally palpate the sternocleidomastoid muscles by simultaneously squeezing each between the thumb and index finger along the length of the muscle (Figure 3.20). If it is suspected that a patient's pain may be from these structures, any tender region should be held and squeezed for 5 seconds in an attempt to generate referred pain.

The suboccipital protuberance area should have been assessed during the initial palpations, but the **additional cervical muscle palpation** can appraise the remainder of the neck muscles. The cervical musculature has several layers of muscles overlapping each other that are nearly impossible to differentiate. It is common for the most superficial muscle to indicate the region (e.g., trapezius muscle), although the designated problem may actually be located in one of the deeper muscles.

Tender nodules within the remainder of the neck can be identified and palpated. Begin by placing the palm of the nondominant hand over the patient's forehead and the four fingertips of the dominant hand just below the occipital protuberance. Press in several millimeters and slowly slide your fingertips down the neck muscles, feeling for tender nodules (Figure 3.21). For each tender nodule, apply firm, steady pressure up to patient tolerance for 5 seconds, inquiring about

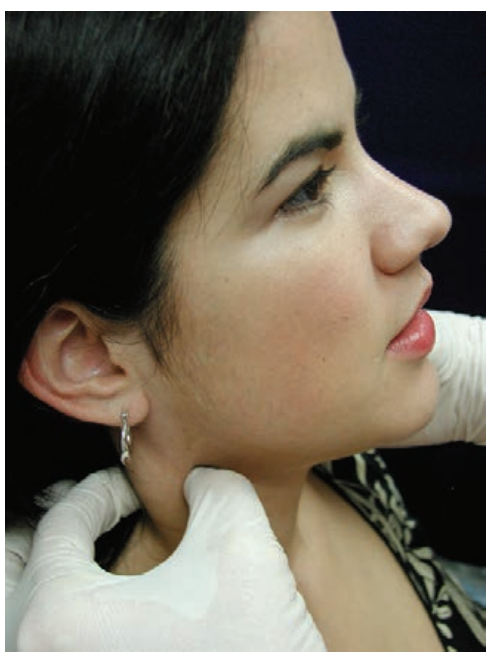

Figure 3.20. Palpation of the sternocleidomastoid muscle.

Figure 3.21. Palpation of additional cervical muscles.

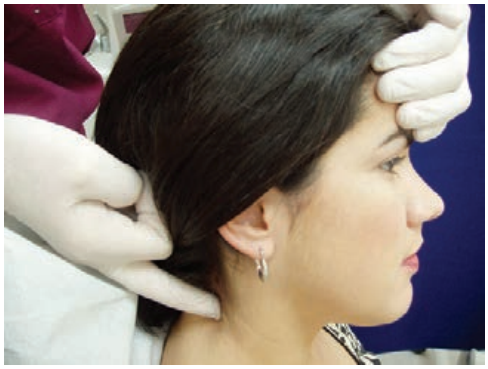

Figure 3.22. Firm, steady pressure applied to tender nodule identified in cervical musculature.

discomfort referred to another area (Figure 3.22). Continue this process throughout the cervical region, as each of the tender nodules may refer pain to a different location. Clinically, the superior region tends to refer pain to the head and face, whereas the inferior region tends to refer pain into the upper back and shoulders.

When I was lecturing in the U.S. Air Force, it was common to be asked to evaluate their TMD patients who were not responding to their TMD therapies. One of these patients who had unilateral TMD symptoms localized to the masseter muscle region had received several years of TMD therapy, but the symptoms had not improved. During my initial recommended palpations and more intense palpation of the masseter muscle, the patient's pain could not be reproduced. While performing these additional cervical palpations, several tender nodules within the neck muscles were found that referred pain to distant locations, but only one of these nodules reproduced the patient's masseter muscle pain complaint. This experience confirmed the necessity to find and test each tender nodule. My evaluation suggested that the patient's masseter muscle region pain would respond best from the therapy directed to the neck.

QUICK CONSULT

Directing Therapy at the Source

If the patient's TMD pain is primarily from the neck, therapy primarily needs to be directed to the neck.

Even though cervical muscle palpation reproduces a patient's pain, the source of the neck muscle tenderness may actually be a disorder within the spinal column. Spinal column disorders tend to cause the muscles in the region to tighten and become painful; this is the reason the chiropractor is able to adjust the vertebrae and relieve muscle pain. Similarly painful muscles tend to cause a malalignment of the vertebrae, which may be the reason the chiropractor's treatment may not be long term. Dental practitioners can attempt to palpate the spinal column, but it is preferred to refer the patient to an individual who specializes in treating the cervical region and let the specialist determine the diagnoses, contributing factors, and treatment.

The **lateral** (external) **pterygoid muscle** cannot be directly felt or palpated, but pressure applied to the lateral pterygoid area appears to put pressure on structures that transmit the load to the lateral pterygoid muscle. Clinical experience has shown that when the symptoms (e.g., the patient cannot close the posterior teeth together because of a lateral pterygoid spasm) suggest the lateral pterygoid muscle should be relatively tender, the palpation of this area has shown corresponding tenderness. Functional tests for the lateral pterygoid muscle have not been found to be as reliable as palpating this area.

To palpate the lateral pterygoid area, slide the fifth digit along the lateral side of the maxillary alveolar ridge to the most posterior region of the vestibule (the location for the posterior superior alveolar injection). Palpate by pressing in a superior, medial, and posterior direction (Figure 3.23). If tenderness

Figure 3.23. Palpation of the lateral pterygoid area.

is observed, referred pain may be generated by applying heavier sustained pressure. Palpation of the lateral pterygoid area is generally tender for most TMD patients and is also the most likely masticatory palpation to be tender for non-TMD patients.[19]

A practitioner whose fingernails are not well trimmed will more than likely get a painful response. When asked, sometimes the patient will respond, "The pain was due to your fingernail digging into my gum." As an alternative, some practitioners use the head of a mouth mirror to palpate this area.

Room to palpate this area is limited, so the right or left fifth digit, which will flex to curve along the alveolar ridge, is used. Occasionally, the patient is asked to move the mandible to the ipsilateral side to provide more room. If the practitioner finds space is still tight, the head of a mouth mirror can be used to palpate this area.

When teaching this palpation to residents, the fifth digit is placed on a skull in the area of the palpation. The skull is turned to view it from the bottom, visualize the lateral pterygoid muscle traversing from the lateral pterygoid plate to the fovea on the condyle

Figure 3.24. Palpation of the medial pterygoid muscle.

neck's anteromedial surface, and a discussion is held regarding the relative closeness of this palpation to the muscle. An MRI study supports that this palpation technique applies pressure against the lateral pterygoid muscle.[20]

The **medial** (internal) **pterygoid muscle** is similar to the masseter muscle but traverses medial to the ramus and therefore has very limited access. A small area of the medial pterygoid muscle can be palpated intraorally (a little posterior to the traditional insertion site for an inferior alveolar nerve block), and the extreme inferior portion can be palpated extraorally. Clinical experience has shown that the extraoral palpation is not as reliable as the intraoral palpation.

Intraorally, to palpate the medial pterygoid muscle, slide the index finger a little posterior to the traditional insertion site for an inferior alveolar nerve block, to where muscle is felt, and press laterally (Figure 3.24). If the patient gags, the finger is too posterior. Extraorally, the medial pterygoid muscle is palpated by

sliding the index finger medial to the inferior border of the ramus, pressing superior until resistance is met, and then pulling lateral to load the medial pterygoid muscle. If tenderness is observed in the medial pterygoid muscle, and the patient's pain is suspected to be from this structure, heavier sustained pressure will generate more intense and possibly referred pain.

The temporalis muscle inserts into the mandible on the medial and anterior surfaces of the **coronoid process**. Tenderness of the **temporalis muscle tendon** is evaluated by this palpation. Palpate this structure by sliding the index finger superiorly along the anteromedial border of the ramus; as the finger approaches the superior extent, palpate the temporalis muscle's tendon overlying the coronoid process (Figure 3.25). If tenderness is observed, and the pain is suspected to be from this structure, heavier sustained pressure will generate more intense and possibly referred pain.

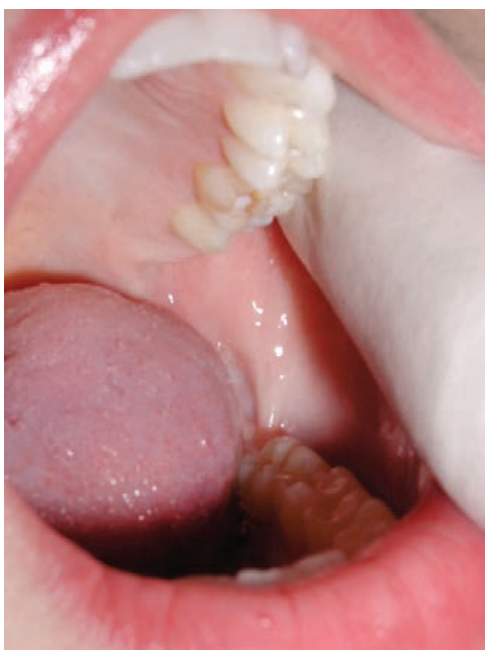

Figure 3.25. Palpation of the temporalis muscle tendon.

Figure 3.26. Palpation of the stylomandibular ligament.

Tenderness of this structure suggests tendonitis, and clinically it correspondingly improves, with the other masticatory structures, from conservative TMD therapy. If the pain is limited to this area and is recalcitrant to TMD therapy, the practitioner may desire to prescribe an oral anti-inflammatory medication or inject an anti-inflammatory medication into the tendon.[21]

Occasionally, patients report the pain source is located medial to the ramus and 10–15 mm anterior and superior to the angle of mandible. Tendonitis of the **stylomandibular ligament** has been reported as a source of pain in this location, in addition to causing referred pain to other areas. The diagnosis of this disorder has been designated **Ernest syndrome**.[22]

Palpate this structure with a blunt instrument or fingertip medial to the posterior border of the mandible and 10–15 mm above the angle of the mandible anteromedially (Figure 3.26). Clinical experience has shown it

correspondingly improves, with the other masticatory structures, from conservative TMD therapy. If the pain is limited to this area and is recalcitrant to therapy, the practitioner may desire to prescribe an oral administration and/or injection of anti-inflammatory medication.[11]

Referred pain frequently causes confusion for both the practitioner and the patient. There is the potential that the nonreproduced portion of the pain may be referred from a distant location. Referred pain is commonly seen with a heart attack; the site of the pain may be in the left arm or shoulder, while the pain's source is the heart. Treatment for the pain must be directed toward the source, not the site where it is felt.

To demonstrate the clinical relevance of determining a referred pain's source, assume that a patient with ear pain, whose physician has ruled out ear pathology, was referred to the dentist because the physician suspected the ear pain was due to TMD. During the TMD evaluation, the practitioner will need to determine the source of the ear pain. It is recommended the practitioner palpate the locations mapped in Figure 3.14 under "Ear." If the splenius capitis muscle was found to be the only area that could generate referred pain to the ear, this would suggest that therapy for the neck would have the highest probability of resolving the patient's ear pain. If palpating the masticatory muscles and/or the TMJ generated referred pain to the ear, but the ear pain could not be reproduced by palpating the cervical muscles, then TMD therapy would have the highest probability of resolving the ear pain.

If both the cervical and masticatory regions could generate referred pain to the ear, this would suggest that ear pain may be perceived when the patient aggravates either of these regions (e.g., cervical aggravation through poor posture or masticatory aggravation through oral habits). Therapy recommendations are a clinical judgment based on factors such as (1) understanding that TMD and cervical pain can negatively influence each other and treatment for one may benefit the other; (2) knowledge of the patient's symptom patterns (e.g., whether the masticatory or cervical region becomes painful first and then the pain moves to the other location); (3) knowledge of whether the masticatory or cervical region more readily reproduces the pain and is more tender to palpation; (4) efficacious experiences of the practitioner and patient for TMD and cervical treatments; and (5) understanding that many TMD patients report improvement of cervical symptoms following occlusal appliance therapy. Discussing this information with the patient, the practitioner may elect to institute TMD therapy first, cervical therapy first, or both together. Observational studies report that combining therapies enhances the potential for success.[23,24]

Cervical treatment and referrals are within a dentist's scope of clinical practice for TMD.[25] Many therapies have been shown to be beneficial in treating cervical pain, and the practitioner's clinical experience generally dictates the approach the practitioner uses, for example, prescription of the practitioner's preferred medication, instruction on cervical exercises, referral to a physician, or referral to a physical therapist. It is recommended that the chosen treatment give patients the ability to control their cervical pain on their own and not require them to continually return to a provider to maintain relief.

When evaluating patients for TMD or TMD-like pain, sometimes the palpations will not reproduce it. The practitioner needs to balance the discomfort created by the palpations and the probability of identifying the pain source through these palpations. If unable to reproduce the pain through these palpations, at some point the practitioner will need to proceed to the structures or tests

described in "Intraoral Examination" and "Additional Evaluations" in this chapter.

Intraoral Examination

The responses to the "Initial Patient Questionnaire" should alert a practitioner that an oral disorder may be causing or contributing to a patient's TMD-like symptoms, but the questionnaire is not infallible. If intraoral palpations were necessary, it is assumed these were previously performed. It is imperative that dentists observe for dental disorders contributing to pain, because nondentists treating patients for TMD generally assume that, if the patient has been evaluated by a dentist for TMD, a dental disorder would have been identified.

It is recommended the practitioner begins the intraoral exam by performing a general oral screening. The entire oral cavity should be visually appraised for pathology, for example, swelling and deflection of the soft palate. Ask the patient to say "Ah," place the head of a mouth mirror against the posterior portion of the tongue, press down on the mirror, and observe the pharynx and whether the soft palate uniformly raises bilaterally. A nasopharyngeal carcinoma may present as TMD (e.g., limited opening, masticatory muscle pain, and tenderness to masticatory muscle palpation), but the most common difference one would observe is asymmetry (ipsilateral paralysis) of the soft palate.[26]

Occlusal Changes

The responses to the "Initial Patient Questionnaire" generally inform the practitioner of other specific intraoral areas that need to be evaluated, for example, a developing anterior open bite, developing anterior midline shift, and/or developing posterior open bite. When evaluating perceived occlusal changes, I check all occluding teeth by placing shim stock along the occlusal surface, asking the patient to close on the shim stock and try to hold it with the opposing teeth (Figure 3.27). I then record which maxillary teeth are able to hold the shim stock; I might later use this information to determine whether the occlusal change is improving or worsening.

Figure 3.27. Patient holding shim stock between tooth 4 and its opposing tooth. This technique is used to determine which maxillary teeth have sufficiently close contacts enabling shim stock to be held.

A progressively increasing anterior open bite, if not due to local factors, is suggestive of severe osteoarthritis causing the condyle to lose its vertical height. As the condyle loses its height, the mandible tends to rock around the most posterior ipsilateral tooth contact and the anterior open bite progressively increases. Eventually, the most posterior ipsilateral tooth will be the only tooth that occludes. This disorder can occur bilaterally and the open bite may be symmetrical. This is a difficult condition to manage and is beyond the scope of this book, and practitioners observing this complaint may desire to refer the patient to someone with greater expertise in this area.[27] A method for identifying these practitioners is provided in "Practitioners with TMD Expertise and Fellowship Programs" in Appendix 13.

A posterior open bite or midline shift could be suggestive of many disorders[28–30] in which something is pushing or pulling the condyle

anterior. As the condyle is pushed or pulled, it translates anterior along the downward slope of the articular eminence, causing the posterior portion of the mandible to move inferior, and hence a posterior open bite occurs. If this disorder tends to be intermittent and associated with the patient's TMD pain, it is likely due to TMJ inflammation within the retrodiscal tissue pushing the condyle anterior and/or the lateral pterygoid muscle pulling the condyle anterior. The appropriate TMD therapy is likely to resolve the posterior open bite or midline shift complaint. Since there are many other potential causes for this complaint, the practitioner must ensure this disorder resolves or the practitioner may desire to refer the patient to someone with greater expertise in this area.

If posterior open bite or midline shift is a slow progressive disorder, it is probably not due to TMJ inflammation within the retrodiscal tissue or the lateral pterygoid muscle, and the practitioner may desire to immediately refer the patient to someone with greater expertise in this area.[31]

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Developing Posterior Open Bite or Midline Shift

If the posterior open bite or midline shift is intermittent and associated with the patient's TMD pain, appropriate TMD therapy is likely to resolve it.

TMD Pain Caused by a Tooth

The nervous system shares the neurological circuitry for deep pain (produced by musculoskeletal, neural, vascular, and visceral structures) among many structures. This enables pain from oral disorders to be perceived in the masticatory muscles and/or TMJs.[17,32]

A practitioner who is not aware of a patient's dental caries and periodontal disease status may desire to make dental radiographs to evaluate these in addition to clinically evaluating the teeth for cavities and periodontal disease. By far, the most common oral disorder that I see misdiagnosed as TMD is referred odontogenic pain. Bear in mind that a patient may have odontogenic pain even though the teeth are caries and restoration free and the periodontal health is within normal limits. Patients might have odontogenic pain from a tooth with a history of trauma or incomplete fracture.[33] Patients with an incomplete tooth fracture generally report a sharp lancinating pain upon biting or releasing tough or crunchy foods (e.g., bacon, crust of bread).

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Observing for an Odontalgia Contribution

By far, the most common oral disorder that I see misdiagnosed as TMD is referred odontogenic pain.

A dental disorder may not only contribute to a patient's TMD pain, but may also alter the patient's treatment plan, for any restorations that are placed after the occlusal appliance is fabricated may require the practitioner to alter the appliance. If a patient is diagnosed with TMD, awakes with significant TMD symptoms, and needs restorations, the practitioner may choose to use one of the following techniques, provided in Table 3.3.

1. Restore the teeth on the arch that needs the least treatment, fabricate an appliance for this arch, and adjust the appliance's occlusal surface as the opposing restorations are placed.
2. Provide a temporary appliance (e.g., soft appliance), adjust the appliance's occlusal

Table 3.3. Stabilization appliance alternatives for TMD patients who need multiple restorations.

- Can restore the teeth on the arch that needs the least treatment, fabricate an appliance for this arch, and adjust the appliance's occlusal surface as the opposing restorations are placed.
- Can provide a temporary appliance (e.g., soft appliance), adjust the appliance's occlusal surface as the opposing restorations are placed, fabricate the final appliance for the restored arch, and adjust the appliance's occlusal surface as the opposing restorations are placed.
- Can pharmaceutically manage the patient's TMD symptom until a temporary or the final stabilization appliance can be provided (e.g., cyclobenzaprine [Flexeril] 5 mg, 1–2 tabs h.s.; nortriptyline 10 mg, 1–5 tabs 0–3 hrs prior to bed, m. dict.; or amitriptyline 10 mg, 1–5 tabs 1–6 hrs prior to bed, m. dict.).

surface as the opposing restorations are placed, fabricate the final appliance for the restored arch, and adjust the appliance's occlusal surface as the opposing restorations are placed.

3. Pharmaceutically manage the patient's TMD symptom until a temporary or the final stabilization appliance can be provided (e.g., cyclobenzaprine (Flexeril) 5 mg, 1–2 tabs h.s.: nortriptyline 10 mg, 1–5 tabs 0–3 hours prior to bed, m. dict.; or amitriptyline 10 mg, 1–5 tabs 1–6 hours prior to bed, m. dict.). One study found patients obtained equivalent TMD symptom benefit from 10 mg of amitriptyline and a stabilization appliance (Figure 17.1).[34] Additionally, techniques to prevent TMD aggravation from dental treatment are provided in "Preventing Aggravation from Dental Treatment" in Chapter 8.

If odontogenic pain is suspected to be contributing to the pain (as represented in Figure 1.1), the dentist will need to search for the offending tooth. A few clinical observations may aid in locating the offending tooth. Anterior teeth (canine to canine) have been observed referring odontogenic pain bilaterally, whereas the premolars and molars have been observed referring pain to the ipsilateral side.[35]

Bilateral pain does not exclude the possibility that the patient may have odontogenic pain from a posterior tooth. It is common to observe a patient with odontogenic pain whose complaint is bilateral ache, pressure, and/or dull pain in addition to unilateral throbbing pain. The offending tooth is subsequently identified as a posterior tooth on the throbbing side, and the bilateral ache, pressure, and/or dull pain is due to coexisting TMD.[36] A case scenario of a patient with this situation is presented in "Case 1" in Part V.

If a patient reports the pain increases when drinking hot or cold liquids, ask which tooth the liquid touches to cause the increase. The answer should indicate a quadrant to evaluate initially for a dental source. It is common for patients with symptomatic muscles to report that their pain increases when the muscles get chilled, so it is not surprising that some TMD patients report that their pain increases when the cold liquid touches the medial pterygoid muscle rather than a tooth. In this situation, an odontogenic contributor is usually not present.

FOCAL POINT

If a patient reports that pain increases when drinking hot or cold liquids, this should lead the practitioner to suspect a tooth may be contributing to the pain.

The offending tooth should be identified through percussion and thermal tests (hot or cold, depending on which stimulus reproduces the pain). In a study of referred odontogenic

pain, all patients diagnosed with odontogenic pain contributing to their complaint had tenderness to percussion of the offending tooth.[36] Some patients with a positive thermal test relate it caused only lingering pain within the tooth (hyperresponsive reaction), and others relate it referred pain to the location of their chief complaint, whereas still others relate the test reproduced the sequential pain pattern they described during the interview.

If the thermal test is positive, a ligamentary injection to the suspected tooth will help determine the impact the hyperresponsive tooth may be having on the pain. When performing the thermal and anesthetic tests, it has been helpful for the patient to grade the pain intensity on a 0–10 scale, where 0 is no pain and 10 is the worst pain imaginable.

If the ligamentary injection dramatically reduces or eliminates the pain, odontogenic pain is apparently contributing significantly to the complaint. The ligamentary injection, rather than the traditional dental anesthetic injection, is recommended for the anesthetic test. A maxillary infiltration or inferior alveolar nerve block may cause symptom reduction due to the anesthetic's direct effect on the lateral pterygoid or medial pterygoid muscle.

FOCAL POINT

If the ligamentary injection dramatically reduces or eliminates a patient's pain, odontogenic pain is apparently contributing significantly to the complaint.

It is important for practitioners to realize that a ligamentary injection does not anesthetize only the tooth injected. It provides intraosseous distribution of the anesthetic, which may cause pulpal anesthesia of as many as two teeth on each side of the injected tooth.[37] Therefore, prior to administering the injection, it is imperative to identify the offending tooth by percussion and thermal testing. Careful diagnostic testing must also be used to rule out adjacent teeth as possible contributors.

Recommended criteria for classifying a tooth as an odontogenic contributor to a patient's TMD pain are (if both are positive) (1) the thermal test caused lingering tooth pain or generated the TMD pain, and (2) the ligamentary injection dramatically reduced or eliminated the TMD pain.[36]

Once the offending tooth is identified, the practitioner must determine whether the odontogenic pain is due to a reversible or a nonreversible disorder. Examples of nonreversible conditions include deep caries or restorations for which endodontic therapy is indicated, an incomplete tooth fracture with pulpal involvement, and a combined periodontal-endodontic condition. Offending teeth with nonreversible conditions should receive the traditional dental treatments for the disorder, generally involving endodontic therapy or extraction.

Clinical experience has shown that a reversible pulpitis in an offending tooth is often caused by a patient continually aggravating this tooth with an opposing tooth. This could be from a habit of rubbing or bumping the opposing teeth together, a high restoration causing the tooth to be the first or only closure contact, and so on.

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Observing Teeth with Reversible Pulpitis

Clinical experience has shown when a TMD patient's pain is primarily from a reversible pulpitis, the pulpitis is often caused by the patient continually aggravating the tooth with an opposing tooth.

For patients whose offending tooth pain is believed to be a reversible pulpitis caused by a habit, there are generally three choices of therapy: (1) Ask the patient to observe and break the rubbing or bumping habit. Some patients are unwilling or unable to do so, or it could be a nocturnal habit outside of the

patient's ability to change. (2) Adjust the occlusion; for example, remove the excursive contact on a posterior tooth. (3) Fabricate an occlusal appliance, which will interpose the opposing teeth so the habit cannot be performed.

Once the odontogenic pain is resolved, a significant reduction or elimination of the TMD symptoms should be observed.[35,36] If a patient is interested in pursuing treatment of the residual TMD symptoms, the symptoms have probably substantially changed, requiring the practitioner to reevaluate the remaining TMD symptoms and contributing factors.

Tooth Pain without Local Pathology

It is common for both dental and TMD patients to have a combination of dental and TMD-type pains.[11,38] Patients generally focus their complaint on the aspect they believe is their pain source, but the two may be interrelated.

Patients with primary dental pain should first be evaluated to identify whether the source is dental pathology, for example, caries, periodontal disease, or incomplete tooth fracture. If these pathological conditions are ruled out as the source of the pain, other causes for dental pain should be considered, for example, nasal mucosal pain secondary to sinusitis,[39] periodontal ligament inflammation secondary to parafunctional activity,[39–41] reversible pulpitis secondary to parafunctional activity,[11,41,42] or pain referred from the masticatory muscles or TMJs.[17,41]

The degree nasal mucosal pain is contributing to the tooth (usually maxillary) pain can be tested by a trial of oral decongestant, nasal spray decongestant, and/or antibiotic (e.g., Sudafed [pseudoephedrine HCl] 60 mg, 1 tab q 4–6 hours; Afrin [oxymetazoline HCl] 0.05%, 2 sprays in each nostril q 12 hours; and/or Augmentin [amoxicillin/clavulanate] 500 mg, 1 tab t.i.d. for 10 days [all have generic formulations]); see Table 1.2.

Once local pathology and nasal mucosal pain have been ruled out, multiple teeth with percussion tenderness, multiple teeth with pain, and tooth pain that moves between various teeth are speculated to be a result of significant parafunctional habits.[43] This is especially true when it involves opposing arches or is bilateral. The pain source can be periodontal ligament inflammation, reversible pulpitis, referred pain from the masticatory structures, or any combination of these. Since the primary contributing factor to each of these is the same (significant parafunctional habits), traditional TMD therapy will reduce this contributing factor, and it is generally not necessary to determine the percentage each is contributing to the symptoms.

FOCAL POINT

One of the goals in TMD therapy is to decrease the parafunctional activity and its effects on the masticatory system. Therefore, many of the therapies used in treating TMD may also be beneficial for patients with dental pain caused by significant parafunctional habits.

The periodontal ligament inflammation can be verified by applying an apical or lateral load to the tooth, for example, by percussing the tooth with the end of a mouth-mirror handle. It is common for TMD patients to have multiple teeth tender to percussion, and about one-third of my TMD patients have generalized percussion tenderness of their teeth.

It is common for many of my TMD patients to complain of thermal sensitivity of their teeth.[42] This is probably due to a reversible pulpitis secondary to significant parafunctional habits and can generally be verified by blowing cold air on these teeth.

The referred pain from the masticatory structures can be verified by palpating the

masticatory structures and observing whether this reproduces the patient's tooth pain. The referred pain is often not only limited to the tooth, but also causes pain to be perceived in the gingiva and alveolar process, even in edentulous areas.

The nervous system shares the neurological circuitry between pulpal pain and musculoskeletal pain. Similar to how central sensitization and central convergence can cause tooth pulpal pain to be perceived as masticatory musculoskeletal pain (Figure 1.1), masticatory musculoskeletal pain can be perceived as tooth pulpal pain (Figure 3.28).

In Figure 3.14, the map for maxillary dentition has areas of the temporalis muscle, TMJ, and masseter muscle marked on the head, in addition to the lateral pterygoid area and medial pterygoid muscle annotated below. (These are intraoral muscles that could not be drawn on the head.) The masseter muscle is the location marked with the color designated as the more common source, so intensely palpating the designated area of the masseter muscle is most likely to generate referred pain to the maxillary dentition. This also helps the patient to realize the source of the pain is not from the tooth but from the masseter muscle.

Patients with these symptoms may not find practitioners who understand this concept and able to demonstrate the true source of the pain. Occasionally, these patients are able to convince their dentists to treat their tooth pain with endodontic therapy, which does not provide improvement, and for various reasons the pain may then be perceived as from another tooth (Figure 3.29). It is estimated that each year, more than 680,000 teeth receive root canals when the pain was due to another cause.[44]

Another way to demonstrate this is to anesthetize the tooth with a ligamentary

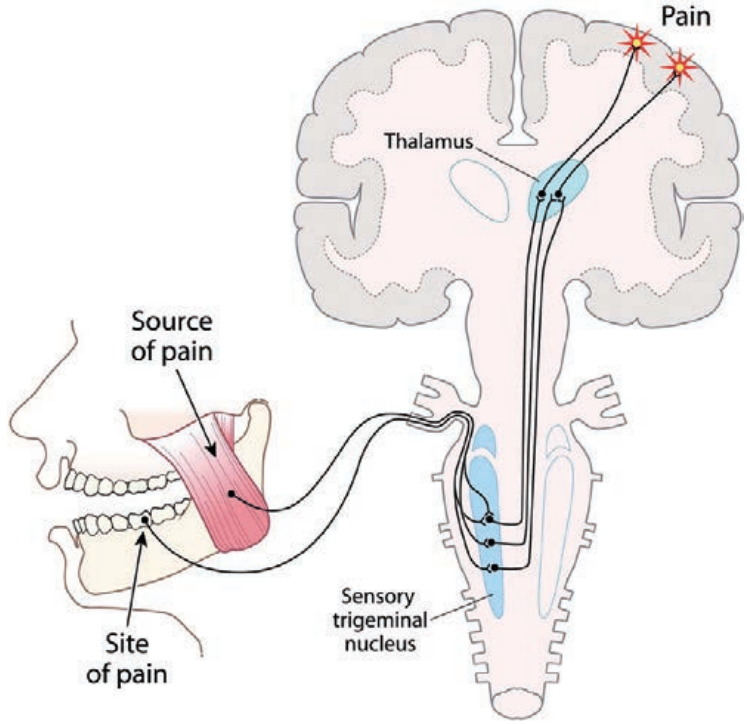

Figure 3.28. A depiction of central convergence enabling masseter muscle pain to be perceived as tooth pulp pain.

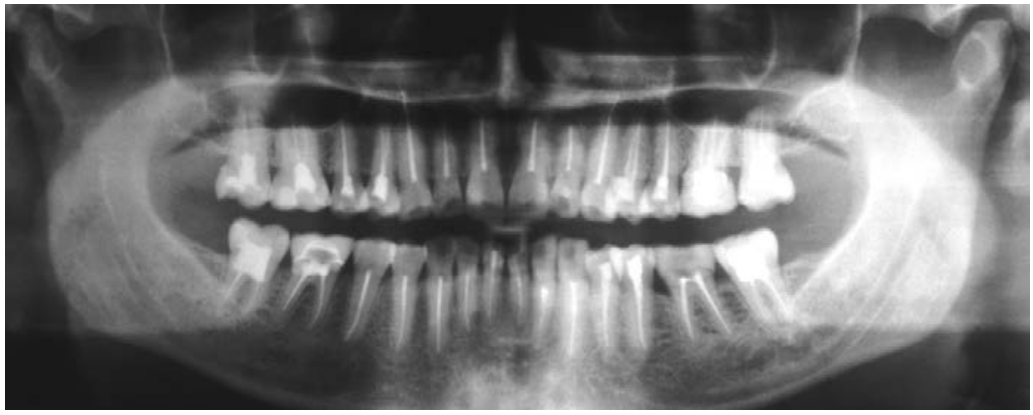

Figure 3.29. Radiograph of a TMD patient who perceived her TMD pain to be of pulpal origin and convinced dentists to treat her pain with endodontic therapy.

injection and show the patient that the tooth is numb, but the pain is still present. Conversely, if you anesthetize a tooth to treat it for a pain, be sure the anesthesia eliminated the pain prior to treating the tooth.[1]

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Treating a Tooth without Dental Pathology

If a patient complains of tooth pain and no dental pathology is identified, be cautious about proceeding with a root canal or extraction to appease the patient; the pain may be due to referred masticatory muscle or TMJ pain.

Additional Evaluations

During the patient interview, the practitioner may have developed suspicions for disorders that have not yet been evaluated and may not be within the practitioner's ability to evaluate. Sometimes the practitioner may prefer to refer patients directly to their physician for this, whereas at other times the practitioner may wish to obtain additional information to support or rule out the suspected disorder.

If one wishes to evaluate for sinus congestion, bear in mind that sinus congestion cannot be ruled out by lack of tenderness from palpating the maxillary and frontal sinuses. Even though a patient may have sinus congestion contributing to his or her pain, the maxillary and frontal sinuses are not always tender to palpation, and the problem could be from a sinus that is not able to be palpated, for example, the ethmoid sinus. Therefore, the practitioner may desire to test the patient's response from a trial of oral decongestant, nasal spray decongestant, and/or antibiotic (see Table 1.2). If the sinus congestion is of recent onset and within a week of the patient having a cold, the sinus disorder is probably due to a virus and antibiotics may not be beneficial.[45] If the sinus congestion is a chronic disorder, it is recommended the patient be referred to the patient's physician for evaluation and management of the sinus problem. As mentioned earlier, an increase in pain with bending forward may predict sinus congestion involvement.

Occasionally, the information gathered during the patient interview suggests the patient has TMD, but palpating the masticatory and cervical muscles and TMJs (as described previously) cannot reproduce the pain. A less specific test can be used to aggravate the masticatory system in order to

demonstrate that the pain is probably of masticatory origin. This involves asking the patient to put his or her teeth into MI and squeeze them together hard. The patient is asked to continue squeezing until the first sign that the pain is starting or until 1 minute elapses. This technique aggravates the masticatory system (including the dentition), so the practitioner needs to be sure the dentition is not the pain's source.

On rare occasions, the interview suggests the patient has TMD, and all other traditional causes for the pain are ruled out to the degree possible, but none of the aforementioned techniques can reproduce the pain. This generally occurs with a patient who only occasionally has the complaint. The patient is informed that a TMD origin for the pain could not be verified, but the signs, symptoms, aggravating activities, and alleviating activities are traditionally observed with TMD. The patient is offered a trial occlusal appliance to determine whether it might have a beneficial effect. If the practitioner observes that a trial appliance does not have a beneficial effect, it is recommended the patient be referred to someone with greater expertise in this area or to the patient's physician for evaluation for atypical causes of the pain.

The literature is filled with case reports of patients with TMD symptoms who actually had a brain tumor, eye disease, throat cancer, and so on. This may be a comorbid condition in which appliance therapy might reduce the TMD symptoms satisfactorily so the comorbid disease becomes recognizable. It could also be that the TMD therapies are not beneficial because the primary source for the pain was missed, and the practitioner may desire to refer the patient to someone with greater expertise in this area. Throughout TMD therapy, it is imperative to continually monitor the symptoms because the primary disorder may resolve and a secondary problem (e.g., cervical pain) may become the primary disorder.

Table 3.4. Patient characteristics for which most general dentists would refer to a practitioner with greater expertise.

- The patient received a TMJ Teflon-Proplast implant, Silastic implant, or TMJ prostheses and you are unsure of the implant type or management.
- The patient has "burning" or "electrical" as the primarily quality of the pain complaint.
- The patient's pain complaint source could not be identified.
- The patient has a significantly restricted opening, in which there is no pain when you forcibly attempt to open the mouth wider.
- The patient has a progressively increasing anterior open bite, thought to be from the TMJ(s) losing vertical height.
- The patient has a progressively increasing posterior open bite or mandibular midline shift, neither of which responds to your TMD therapies.
- The patient has previously received the therapies you traditionally provide and did not obtain satisfactory improvement.
- The patient did not obtain satisfactory improvement from your TMD therapies.

A method for identifying practitioners with greater expertise is provided in Appendix 13, under "Practitioners with TMD Expertise and Fellowship Programs."

Table 3.4 provides patient characteristics for which most general dentists would refer a patient to a practitioner with greater expertise. I generally recommend referring to a Diplomate of the American Board of Orofacial Pain (ABOP). The names and locations of these individuals are listed on the ABOP web site (www.abop.net/ and select "Diplomate Directory"). A TMD or orofacial pain fellowship program would be another location one could find practitioners with clinical TMD expertise. These programs are listed at www.aaop.org/ and select "Education and Research" followed by "Orofacial Pain Programs."

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Monitoring Symptoms throughout Therapy

Throughout TMD therapy, it is imperative that the practitioner continually monitor the patient's symptoms because the primary disorder may resolve and a secondary problem (e.g., cervical pain) may become the primary disorder.

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Chapter 4

Imaging

There is a wide choice of imaging procedures that can be used for patients with temporomandibular disorder (TMD), and they vary considerably in cost, availability, and quality of information that can be obtained. This chapter provides an overview of these procedures, followed by imaging recommendations.

The osseous portion of the temporomandibular joint (TMJ) is often assessed with plain radiographs, panoramic radiograph, axially corrected sagittal tomography, computed tomography (CT), and cone beam computed tomography (CBCT). It is relatively common for TMD patients to have some radiographic osseous changes and the prevalence of these increase as the patient ages.[1,2] These osseous changes are most prevalent in the condyle and generally begin on the condyle's lateral pole and slowly progresses medially.[1,3]

Parafunctional habits (clenching, bruxing, etc.) are the primary attributes responsible for most TMD patients' radiographic osseous changes. These habits overload the TMJ, thereby causing the breakdown of the synovial fluid, which then progresses to painful TMJ arthralgia. The synovial fluid provides nutrition to the TMJ surface tissues, and this degraded synovial fluid is not able to maintain the health of these tissues, leading to the slow progressive osseous changes observed from imaging.[4–7] As the TMJ loading sufficiently decreases, the new synovial fluid produced within the TMJ slowly replaces the degraded synovial fluid, and the arthralgia resolves. The TMJ surface tissues then return to a healthy state, and the demineralization correspondingly stops.[8] Certain systemic conditions (e.g., rheumatoid arthritis) make individuals more susceptible to this sequence of events.[7]

As has also been observed with other joints in the body, TMJ radiographic findings do not correlate well the patient's symptoms,[9–11] which could partially be caused by radiographic images not being able to differentiate between these degenerative changes and normal adaptive remodeling.[12]

Clinically, TMJ arthralgia can be identified by tenderness of the TMJ upon palpation. Similar to how it may take 2 weeks for an irreversible pulpitis to show radiographic changes,[13] radiographic evidence of osseous breakdown from TMJ arthralgia is similarly delayed and may be delayed by as much as 6

Manual of Temporomandibular Disorders, Third Edition. Edward F. Wright.

months.[14–16] Hence, a TMD patient's most current status is generally best determined by the patient's current signs and symptoms and not by the radiographic findings. Similarly, TMD therapy needs to be directed toward the patient's symptoms and not toward the radiographic findings.[5]

This has lead to the recommendations that the TMD evaluation be primarily based upon history and clinical evaluation, and TMJ imaging only being performed if there is a reasonable expectation that the additional information will influence a patient's treatment approach.[11,14,17–19]

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Stopping Radiographic Osseous Changes

It is relatively common for TMD patients to have radiographic osseous changes, which are generally in response to TMJ arthralgia from TMJ overload, that is, parafunctional habits. As a patient's TMJ arthralgia resolves, the demineralization correspondingly stops.

FOCAL POINT

Radiographic changes may lag behind the clinical symptoms by as much as 6 months.

TMJ arthralgia similarly causes deleterious effects on the soft tissue, and it impairs TMJ biomechanics and disc movement.[4] The soft-tissue portion of the TMJ is generally assessed with a magnetic resonance imaging (MRI), and this imaging is generally performed to observe the disc position when the mouth is closed and maximally opened. The disc can also be observed with the computed tomography (CT) imaging, but the disc currently cannot be seen with cone beam computed tomography (CBCT).[20]

Plain Radiographs

Several plain radiographic projections can image the osseous portion of the TMJ. However, these images have such significant distortion and superimposition from other structures that they can be used only to screen for gross degenerative changes and to evaluate condylar translation. The significant distortion also makes it impossible to determine the condyle's position in the glenoid fossa.

The transcranial projection can be made with the standard dental X-ray unit using a positioning device that is often available from the manufacturer. The image projected by this procedure enables the lateral pole to be evaluated for early osseous changes.

Panoramic Radiograph

The panoramic radiograph provides a screening image of the TMJs, maxilla, mandible, maxillary sinuses, teeth, and periodontium. It can identify fractures (including a subcondylar fracture) and screen for gross degenerative changes of the TMJ and gross pathological changes of the maxilla and mandible. Identifying an old nonreduced condylar or subcondylar fracture is not suggestive that the fracture was missed by a previous provider, that the patient received poor treatment, or that it is the primary factor contributing to the patient's TMD. Open reduction may not have been indicated, and nonreduced condylar or subcondylar fractures rarely cause a problem for the patient.[21]

As the TMJ is imaged, the X-ray beam travels from the posterior-inferior direction, causing the condyle's lateral pole to be superimposed within the head of the condyle, so early condylar demineralization cannot be viewed.[22] Similarly, the articular eminence is obstructed by the superimposition on the panoramic radiograph. Superimposition of the

glenoid fossa over the condyle can be minimized by asking the patient to open maximally during imaging, but this prevents most of the mandible from being imaged.

Some panoramic machines allow two to four projections of the TMJ to be imaged on one film, which may enable condylar mobility to be visualized. The X-ray beam for these images generally travels along the pathway of the panoramic image, projecting the condyle's lateral pole within the head of the condyle.[16]

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Viewing Panoramic Radiographs

The view of the condyle's lateral pole (generally the first area to show degenerative changes) is superimposed within the head of the condyle and not visible on the panoramic radiograph.

It is common to view a well-circumscribed radiolucent area on the anterior aspect of the condyle in a panoramic radiograph (Figure 4.1). These condylar pseudocysts are formed primarily by the cupping of the condyle's lateral pterygoid muscle fovea, and one survey found them in 18% of panoramic radiographs from children.[23]

The panoramic radiograph is probably the most commonly used screening image for TMD patients. This image does not provide information to determine early degenerative condylar changes or the condyle's position in the glenoid fossa, but it is able to rule out many of the other disorders that may cause or contribute to TMD symptoms.

Axially Corrected Sagittal Tomography

These radiographs are true lateral projections of the condyle without superimposition that enable practitioners to view osseous changes of the articular surface. Images with the mouth closed and maximally opened are routinely made, enabling practitioners to view the range the condyles translate. Through frontal images, the lateral and medial poles can be assessed. Condylar position has been shown not to be able to predict disc position reliably.[24]

Figure 4.1. Condylar pseudocysts, formed primarily by the cupping of the condyle's lateral pterygoid muscle fovea, are common on panoramic radiographs.

Cost and inconvenience (tomography is rarely available in a dental office) are the primary disadvantages of these radiographs.

Computed Tomography

This technology uses X-ray to obtain sectional images of the TMJ and the region. These images are capable of identifying both hard-tissue and soft-tissue abnormalities, and pathology in the head and neck and are primarily used for viewing TMJ ankylosis, neoplastic conditions, and anomalies. They are also used to fabricate a three-dimensional stereolithic model that enables the surgeon to better comprehend the disorder he or she will be treating and enables the laboratory to fabricate a custom TMJ prosthesis.

To separate this category from the next category of CT imaging, this category is referred to as "medical" CT, because these CT machines are large, expensive machines, primarily used for evaluating other parts of the body, and generally only found in hospitals and large medical imaging centers.

Cone Beam Computed Tomography

This is a relatively new technology providing higher resolution TMJ images (better than "medical" CT images) using low radiation (equivalent to a full mouth periapical series) on a comparatively small, inexpensive unit.[25,26] CBCT provides the best view for evaluating the integrity of the hard tissues and for evaluating osseous change within the TMJ; at the present time it cannot view the disc.[20,25] Software programs are able to provide a three-dimensional view of the TMJ, with the capability of rotating the image to observe any surface. This imaging provides the best view for evaluating the TMJ's hard tissues. CBCT units may be found in most dental schools, radiographic imaging centers, and some dental implant and TMD specialty offices.

Magnetic Resonance Imaging

MRI uses a magnetic field and radiofrequency impulses instead of radiation to produce its image. For TMD patients, it is primarily used to identify the disc position, usually viewed in both closed and maximal open positions. When the disc position identified by MRI is compared with those positions found surgically and through autopsy specimens, there is about a 90–95% agreement.[27]

Practitioners should bear in mind that the identification of a displaced disc does not suggest this is the source of the TMD symptoms because up to 35% of individuals who do not have TMD symptoms have a disc displacement, based upon MRI findings.[14] Also, muscle is the primary source of pain for the majority of TMD patients.[28]

In addition to disc position, the MRI also provides information about joint fluid, bone marrow changes, and bone structure at the various sections made of the TMJ. An MRI is contraindicated for patients who have a pacemaker, intracranial vascular clips, or metal particles in the eye or in other vital structures.[29]

This imaging procedure is the gold standard for identifying the disc position.[20] Cost and inconvenience are the primary disadvantages of obtaining this image.

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Viewing MRIs

When the disc position identified by an MRI is compared with those positions found surgically and through autopsy specimens, there is about a 90–95% agreement.

Arthrography

To obtain an arthrogram, radiopaque contrast medium must be injected into the TMJ. By observing the space outlines as the patient translates the condyle and observing for leakage of the contrast medium, the disc position, existence of a perforation, and sometimes disc condition can be identified. The procedure may be followed by a therapeutic TMJ lavage, which often provides symptom improvement and may change some of the identified information.

Generally, the time a practitioner would want to evaluate a disc is when the patient has significantly painful TMJ arthralgia. Injecting contrast medium into the TMJ at this time is extremely painful, so with the wide availability of MRI, TMJ arthrography is rarely performed.

High-Resolution Ultrasound

The TMJ's hard and soft tissues can be imaged by high-resolution ultrasound. This procedure is able to detect condylar defects on the anterior and lateral aspects, but has difficulty detecting defects on the medial aspect due to the limited space between the articular eminence and the condyle. This has led to errors such as osteophytes (bony projections) being misdiagnosed as loose calcified bodies within the joint space. The soft-tissue imaging is also plagued with unsatisfactory results, for example, poor accuracy in identifying the disc position compared with the MRI.[30,31]

High-resolution ultrasound is a noninvasive, inexpensive, and easily accessible technology for imaging the TMJ. Unfortunately, the limited space between the articular eminence and the condyle, and the potential for viewing medial portion of the condyle are problems that even more advance ultrasound technologies will probably not be able to overcome.

Imaging Strategies

As with other joints in the body, there are few, if any, correlations between symptoms and radiographic findings; imaging of individuals with significant pain may have normal findings, while imaging of asymptomatic individuals may have abnormalities.[9,11]

The patient interview and examination provide the most important information for establishing the TMD clinical diagnoses, contributing factors, and treatment plan.[17] Tumors within the TMJ are rarely the cause for TMD, and imaging to detect intraosseous lesions in asymptomatic individuals is neither cost-effective nor biologically advisable.[14,32]

FOCAL POINT

> The patient interview and examination provide the most important information for establishing the TMD clinical diagnoses, contributing factors, and treatment plan.

It is recommended that practitioners image only if there is a reasonable expectation that the additional information will influence a patient's treatment approach.[11,17,18] Such selective imaging is advisable, and overimaging will hamper a practitioner's ability to provide cost-effective care. Other than imaging for suspected odontogenic pathology, imaging has rarely changed my treatment approach.

Table 4.1 provides a list of recommended imaging for the desired purposes.

FOCAL POINT

> It is recommended that practitioners image only if there is a reasonable expectation that the additional information will influence a patient's treatment approach.

QUICK CONSULT

Prescribing Imaging

Other than imaging for suspected odontogenic pathology, imaging has rarely changed my treatment approach.

Imaging Recommendations

The literature-supported imaging indications that have been found useful are as follows:

1. If the practitioner is not aware of the patient's dental caries and periodontal disease status, the practitioner may desire to make dental radiographs to ensure these disorders are not causing or contributing to the patient's TMD symptoms.
2. A practitioner who suspects, based on the patient interview and clinical examination, that a patient may have pathology should not hesitate to make a screening radiograph, such as a transcranial or panoramic radiograph. Use common sense; for example, a patient with facial pain and swelling after the extraction of a mandibular tooth may have a fractured mandible.

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Prescribing for a Screening Radiograph

A practitioner who suspects, based on the patient interview and clinical examination, that a patient may have pathology should not hesitate to make a screening radiograph, such as a transcranial or panoramic radiograph.

3. If the primary cause for the patient's pain complaint is due to the TMJ, make a screening radiograph, for example, a transcranial or panoramic radiograph. If the TMJ complaint is only noise that does not need treatment, a screening radiograph is not needed.[11]

Table 4.1. Recommendations for imaging.

Purpose	Recommended image
To screen the TMJ or masticatory region	Transcranial or panoramic radiograph
To evaluate the TMJ's osseous structures	Cone beam computed tomography (CBCT) or axially corrected sagittal tomography
To evaluate the disc position or soft tissues	Magnetic resonance imaging (MRI)

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When the TMJ Is the Primary Cause for the Patient's Complaint

If the primary cause for the patient's complaint is due to the TMJ, make a screening radiograph; unless the complaint is only noise, then no imaging is necessary.

4. If the patient's TMD symptoms began with or greatly worsened from trauma, make a panoramic radiograph to rule out a fracture causing or contributing to the patient's pain. If the patient was not appropriately evaluated for a fracture following the trauma, and the practitioner suspects the patient may have a fracture in a bone that would not be revealed by the panoramic radiograph, then appropriate radiographs would be indicated.

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Observing for Trauma History

If the patient's TMD symptoms began or greatly worsened with trauma, make a panoramic radiograph to rule out a fracture causing or contributing to the patient's pain.

5. If the patient has pain and is taking (or has taken for a period of time) a bisphosphonate (i.e., Boniva, Fosamax, Actonel, or Zometa), make a panoramic radiograph to rule out osseous pathology as the cause for the pain.[33]
6. If the patient relates a developing or progressively increasing open bite of the anterior teeth, the patient may have such severe TMJ osteoarthritis or condylysis that is causing the condyle to lose its vertical height. If the patient has such severe osteoarthritis, it should be visible in a screening radiograph, such as a panoramic radiograph.[22] A CBCT would provide a better view of the degenerative changes and the practitioner may desire a baseline CBCT in order to better follow changes in the condyle's status throughout treatment. This disorder and its treatment are complicated and are beyond the scope of this book. Practitioners observing this complaint may desire to refer the patient to someone with greater expertise in this area. A method for identifying these practitioners is provided in "Practitioners with TMD Expertise and Fellowship Programs" in Appendix 13.
7. If the patient has a progressively increasing posterior open bite, midline deviation, or observable preauricular swelling, the patient may have a neoplastic growth within the TMJ, and the practitioner may desire a screening radiograph. Neoplasia arising within the restricted space of the TMJ might cause the condyle to move inferior or anterior-inferior, thereby causing a progressively increasing posterior open bite and/or midline deviation. A neoplasm on or near the TMJ's lateral surface may clinically manifest as a progressively increasing observable preauricular swelling.

   A posterior open bite or a change in the midline alignment are fairly frequently observed among TMD patients. The occlusal change is typically caused by a disorder such as a lateral pterygoid spasm or TMJ arthralgia. These patients will have pain (which may occur only when the patient attempts to occlude into maximum intercuspation), and the occlusal change fluctuates with the disorder's severity. A test to evaluate these is provided in Chapter 9.

   TMD patients frequently relate a history of swelling over the region of their pain (e.g., preauricular swelling). The swelling caused by TMD is a minor indistinct elevation (usually only noticeable by the patient) that fluctuates with the disorder's severity.

   If the practitioner suspects the patient may have a growth within the TMJ or these changes do not respond to initial therapy, it is recommended someone with expertise in this area evaluate the disorder.
8. TMJ implants composed of Teflon-Proplast and Silastic have a history of fragmenting, causing a foreign-body response that results in progressive degeneration of the condyle and glenoid fossa. A specific imaging and management protocol has been recommended for these implants and joint prostheses, which is beyond the scope of this book.[12] If the practitioner is unsure of the implant type or management, it is recommended the practitioner refers the patient to, or work in conjunction with, someone who has greater expertise in this area.
9. If the patient does not respond to TMD therapy as anticipated, make a panoramic radiograph to screen for other possible pathologies. Additional suggestions are provided in "TMD Refractory to Initial Therapy" in Chapter 19.

QUICK CONSULT

Observing Poor Therapy Response

If the patient does not respond to TMD therapy as anticipated, make a panoramic radiograph to screen for other possible pathologies.

10. If the patient is being referred for a TMJ surgical evaluation, the surgeon will probably request imaging. Let the surgeon prescribe the desired imaging. Clinical experience has shown that, out of mere curiosity, some practitioners like to request the imaging they anticipate the surgeon will want. It is recommended the practitioner not try to anticipate and prescribe the imaging, because there are many variables that will dictate the surgeon's imaging decision, that is, patient's insurance coverage, convenience to an imaging center. Practitioners requesting images merely out of curiosity will probably cost the patient unnecessary loss of money and time.
11. Occasionally, a third-party payer requests that an MRI or other imaging be prescribed to document the status of the TMJ or for medicolegal reasons.

This long list of indications may leave the reader assuming most TMD patients will need imaging. But muscle pain is the most common primary source for TMD patients' complaints, so the majority of TMD patients will not need imaging. The parameters of care of the American Academy of Oral and Maxillofacial Radiology for TMD muscle disorders relates that therapy can be provided and allow the patient's response to treatment determine whether imaging is indicated.[28,34] The TMD diagnoses and treatment plan is primarily determined through the patient history and clinical exam; imaging should be reserved for the minority of patients in which it has a reasonable expectation of influencing the patient's treatment approach.[11,17,18]

If the practitioner desires to use imaging to screen all TMD patients, then plain (e.g., transcranial) or panoramic radiographs would be the most cost-effective form of imaging.

FOCAL POINT

If the practitioner desires to use imaging to screen all TMD patients, then plain (e.g., transcranial) or panoramic radiographs would be the imaging of choice.

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Chapter 5

TMD Diagnostic Categories

FAQ

Q: Why do people who have a displaced disc often do well even though their condyle continues to articulate on the retrodiscal tissue?
A: In the healthy temporomandibular joint (TMJ), the repeated loading of the retrodiscal tissue causes adaptive changes within this tissue, making it comparable to the disc, and this is sometimes called a pseudodisc.

Many temporomandibular disorder (TMD) patients concurrently have muscle and TMJ pain in addition to TMJ noise. Each of these findings represents a different TMD diagnosis; therefore, multiple TMD diagnoses are very common for TMD patients.[1] To make the list of diagnoses meaningful, they are ranked in the order of their contribution of the patient's complaint(s), as primary, secondary, tertiary, and so on.

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Ranking TMD Diagnoses

Since multiple temporomandibular disorder (TMD) diagnoses are very common for TMD patients, they are ranked as primary, secondary, tertiary, and so on.

The **primary TMD diagnosis** is the diagnosis for the masticatory disorder most responsible for a patient's chief complaint. For example, if a patient's chief complaint is pain, the diagnosis for the masticatory structure that reproduces the pain is the primary TMD diagnosis. When multiple masticatory structures reproduce the pain, the structure that most readily reproduces it probably has the greatest impact on the pain, and its diagnosis would be the primary TMD diagnosis. The diagnoses for the other masticatory areas that reproduce the pain, followed by diagnoses involving tender masticatory structures that do not reproduce the pain, are the **secondary TMD diagnosis, tertiary TMD diagnosis**, and so on.

Manual of Temporomandibular Disorders, Third Edition. Edward F. Wright.

When a patient has more than one complaint, these are also ranked; for example, pain is the primary complaint, catching within the temporomandibular joint (TMJ) is secondary, and TMJ noise is tertiary. This complaint list is used to prioritize the diagnoses further. Ordering the diagnoses in this manner may sound complicated, but once practitioners have had a little practice formulating this list, it becomes simple and is very helpful in formulating the treatment recommendations. When the structure of a pain complaint is outside of the masticatory region (e.g., cervical pain), it is generally contributing to the TMD patient's masticatory muscle tightness, and is considered to be a contributing factor for the TMD pain.

Similar to many areas of medicine, TMD is plagued by inconsistent diagnostic categories and criteria. In an attempt to improve the TMD diagnostic terminology, a validation study followed by several NIH sponsored international consensus workshops provided us with an internationally accepted validated diagnostic criteria.[2] These diagnostic categories and criteria are part of the American Academy of Orofacial Pain (AAOP) guidelines,[1] provided later, and used throughout this book. I expect this diagnostic terminology to become universally accepted and used worldwide in all future communications.

The diagnostic categories are primarily separated into **TMJ disorders** and **masticatory muscle disorders**, but they also have two small categories for **headache disorders** and **associated structures** (Table 5.1). The recommended diagnostic criteria provide **clinical diagnoses** based on information that can be obtained from a patient's history and clinical examination. They are not meant to be rigid criteria but only provide guidance, and clinical judgment should be relied on for the final decision.

TMJ Disorders

Among the general population, TMJ noise is fairly common, but most individuals with TMJ noise do not seek treatment. Patients most commonly seek TMD therapy for pain, and arthralgia is the most common cause for TMJ pain.

Joint Pain

Parafunctional habits (clenching, bruxing, etc.) are the primary elements responsible for TMJ pain. These habits overload the TMJ, thereby causing the breakdown of the synovial fluid, which progresses to TMJ pain. The synovial fluid provides nutrition to the TMJ surface tissues, so the degraded synovial fluid is not able to maintain the health of these tissues, not able to provide the nutrition needed for normal adaptive changes, and impairs the normal biomechanics and disc movements.[3–5] Certain systemic conditions (e.g., rheumatoid arthritis) make individuals more susceptible to this sequence of events.[6]

Reducing the parafunctional habits reduces the TMJ overloading. Additionally, a stabilization appliance (discussed in Chapter 12, "Stabilization Appliance") has been shown to unload the TMJ when worn during the clenching activities.[4,7] With satisfactory control of the TMJ overloading, the normal production of healthy synovial fluid will slowly displace the degraded synovial fluid, any needed adaptive remodeling will then occur, and the TMJ will slowly return to a healthy joint. The areas of bone that were lost during this destructive phase do not reform, but healthy surface tissues once again cover them, so that further osseous degradation does not occur.[3,4,8]

Arthralgia

Arthralgia is diagnosed when the TMJ is tender to palpation at one or more of the three palpation locations described under

Table 5.1 TMD Diagnostic Categories and Diagnoses

TMJ Disorders
- I. Joint pain
  - A. Arthralgia
  - B. Arthritis
- II. Joint disorders
  - A. Disc–condyle complex disorders
    - 1. Disc displacement with reduction
    - 2. Disc displacement with reduction with intermittent locking
    - 3. Disc displacement without reduction with limited opening
    - 4. Disc displacement without reduction without limited opening
  - B. Other hypomobility disorders
    - 1. Adhesions/adherence
    - 2. Ankylosis
      - a. Fibrous ankylosis
      - b. Osseous ankylosis
  - C. Hypermobility disorders
    - 1. Subluxation
    - 2. Luxation
- III. Joint diseases
  - A. Degenerative joint disease
    - 1. Osteoarthrosis
    - 2. Osteoarthritis
  - B. Condylysis
  - C. Osteochondritis dissecans
  - D. Osteonecrosis
  - E. Systemic arthritides (e.g., rheumatoid arthritis)
  - F. Neoplasm
  - G. Synovial chondromatosis
- IV. Fractures
- V. Congenital/developmental disorders
  - A. Aplasia
  - B. Hypoplasia
  - C. Hyperplasia

Masticatory muscle disorders
- I. Muscle pain limited to the orofacial region
  - A. Myalgia
    - 1. Local myalgia
    - 2. Myofascial pain with spreading
    - 3. Myofascial pain with referral
  - B. Tendonitis
  - C. Myositis
  - D. Spasm
- II. Contracture
- III. Hypertrophy
- IV. Neoplasm
- V. Movement disorders
  - A. Orofacial dyskinesia
  - B. Oromandibular dystonia
- VI. Masticatory muscle pain attributed to systemic/central disorders
  - A. Fibromyalgia
  - B. Centrally mediated myalgia

Headache disorders
- I. Headache attributed to TMD

Associated structures
- I. Coronoid hyperplasia

"Palpation" in Chapter 3. This disorder may be localized to the TMJ or be due to a systemic condition also affecting other joints of the body. Arthralgia is the second most common diagnosis for TMD pain (myalgia is the most common diagnosis for TMD pain).

Arthritis

Arthritis is diagnosed when the TMJ is tender to palpation (as with arthralgia), but the TMJ also has clinical characteristics of inflammation or infection, for example, edema, erythema, and/or increased temperature.

Joint Disorders

Disc–Condyle Complex Disorders

Disc–condyle complex disorders are the most common of the TMJ disorders among the general population.[1] Autopsy, clinical, and imaging studies reveal that approximately 30% of asymptomatic volunteers have a displaced disc.[9] Since displaced discs are so prevalent among the general population (as well as the TMD population), they may be considered a physiological accommodation without clinical significance for many individuals.

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Evaluating Significance of Disc–Condyle Complex Disorders

Since displaced discs are so prevalent among the general population (as well as the TMD population), they may be considered a physiological accommodation without clinical significance for many individuals.

To help explain the disc–condyle complex disorders, a "TMJ Disc–Condyle Complex Disorders" diagram is provided as Appendix 3. The diagram is broken into four sections, in which the top left section provides an overview and the top right section portrays the "normal" disc–condyle alignment.

For a disc to displace, the retrodiscal tissue (elastic ligament, in addition to its attachment complex) and the collateral ligaments must stretch, allowing the disc to move anteriorly, as the disc–condyle alignment depicts in the top drawing in the bottom left section.[9] Reports of the disc being posteriorly displaced are rare.[10]

Once the disc is displaced, the portion of the retrodiscal tissue located where the disc used to be is subjected to repeated loading by the condyle. In a healthy TMJ, the repeated loading on this portion of the retrodiscal tissue causes adaptive changes, thereby providing most of the physical characteristics of the disc. This is analogous to what happens to our hands when we increase our physical activity, which causes adaptive changes of the skin to develop calluses. This modified retrodiscal tissue functions well as the disc, withstands TMJ loading somewhat comparable to the disc, and has been referred to as a **pseudodisc**.[4,11]

There is no known anatomical mechanism for an anteriorly displaced disc to retract back to its normal disc–condyle relationship; once these ligaments are stretched, they do not shorten or tighten in order for this to occur. This was substantiated clinically by one study that followed individuals with a disc displacement with reduction for 2 years and found that no individual's disc–condyle alignment returned to "normal".[12]

People commonly relate that their TMJ clicking comes and goes; for example, it occurs when the individual eats or is stressed and does not occur when relaxed. It is postulated that the TMJ anatomy (e.g., disc displacement with reduction) does not change, but clinically it appears the TMJ noise may vary with the degree of sustained joint loading.

Similarly, some dentists will attempt to "recapture the disc," in which they generally use an anterior repositioning appliance (discussed in Chapter 13, "Anterior Positioning Appliance"), maintain the "normal" disc–condyle alignment for a period of time, and then slowly retrude the condyle to where the teeth occlude into MI. Unfortunately, the disc's posterior and collateral ligaments are stretched and the disc generally resumes its old displaced position.[13]

Disc Displacement with Reduction

Disc displacement with reduction is diagnosed when the patient has a history of a

click or pop and the practitioner can feel it as the patient moves the mandible.[1] The top drawing in the bottom left section of the "TMJ Disc–Condyle Complex Disorders" diagram depicts a displaced disc. As the individual opens his or her mouth, the condyle translates forward and moves onto the intermediate zone of the disc (called the **reduced position**, shown in the bottom drawing of the bottom left section), which may cause an opening click or pop. As the mouth continues to open, the condyle continues to translate forward with the disc and remains in the disc's intermediate zone.

As the individual closes, the condyle **retrudes** and moves back under the posterior band onto the retrodiscal tissue, which may cause a closing click or pop. As the mouth continues to close, the condyle remains on the retrodiscal tissue. If both opening and closing noises are present, the opening click or pop occurs at a wider opening than the closing click or pop.

As I teach this disc displacement with reduction concept to dentists, many dentists have trouble with the term "reduction." One of its definitions is returning to its normal position, as (1) following a bone fracture in which the bone fragments are **reduced** back to their normal position, or (2) following a condylar luxation in which the dentist **reduces** the condyle back into the glenoid fossa. In the disc displacement with reduction, the disc–condyle alignment returns to its normal alignment during opening, once the condyle moves under the posterior band and onto the disc's intermediate zone.

Sometimes the patient and practitioner cannot determine which TMJ is generating the click or pop, since the vibration can travel through the mandible and be perceived in the contralateral TMJ. The TMJ that is generating the noise can usually be determined by having the patient start in maximum intercuspation and move laterally to the one side several times and then laterally to the other side several times. The click or pop is generated during the translation phase, and whichever condyle is translating when the noise is generated is generally the source of the noise.

TECHNICAL TIP

Determining Origin of a Patient's TMJ Noise

If the practitioner cannot determine which TMJ is generating the click or pop, the TMJ can usually be identified by asking the patient to start in maximum intercuspation and move laterally to one side several times and then laterally to the other side several times. The click or pop is generated during the translation phase, and whichever condyle is translating when the noise is generated is generally the source of the noise.

A more accurate assessment as to whether a patient has a disc displacement with reduction can be obtained by a TMJ magnetic resonance imaging (MRI) at maximal intercuspation and opening positions, but the findings rarely change the practitioner's treatment approach, and MRI is rarely indicated to confirm this diagnosis.[14] Spending extensive time or using specialized equipment to verify the noise is also not warranted.

Disc displacement with reduction generally does not progress to disc displacement without reduction unless the patient has pain or intermittent locking.[13,15] If the noise is the only complaint and is not an embarrassment or problem for the patient, then it is recommended the practitioner provide no therapy beyond education.[1,11] The "TMJ Disc–Condyle Complex Disorders" diagram is used to explain the cause for the noise, and the patient may be informed that TMJ noise is common and thought of similarly as noises in other joints of the body.

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Understanding Variability of Disc Displacement with Reduction

Some patients without any TMJ noise have a disc displacement with reduction.

If a patient wanted treatment to reduce this TMJ noise, the only treatment I would consider providing is a stabilization appliance worn at night. Its effect of TMD therapy on TMJ noise is variable, and there are no established predictors to suggest which patients will receive noise improvement. As a general conservative guide, it is estimated that approximately one-third of patients provided a stabilization appliance will report significant noise improvement or elimination, one-third will report minor noise improvement, and one-third will report no noise improvement.[11,16] A case scenario of a patient with a disc displacement with reduction is presented in "Case 11" in Part V.

Disc Displacement with Reduction with Intermittent Locking

Disc displacement with reduction with intermittent locking is diagnosed when the patient has a disc displacement with reduction and reports that occasionally the TMJ structure that normally causes the click blocks the condyle's movement, not allowing the mouth to obtain its normal opening. This lock suddenly occurs, may last for seconds to days, and then suddenly releases. It is discussed in Chapter 10, and techniques are provided that the patient can use to try to unlock his or her TMJ when this occurs (Table 10.1).

If a click is associated with catching or intermittent locking, out of fear, this may progress to a continuous lock (disc displacement without reduction with limited opening); traditional TMD therapies should be provided to eliminate the catch or intermittent lock and reduce the potential of it progressing to a continuous lock.[11,13]

A case scenario's patient with a disc displacement with reduction with intermittent locking is discussed in "Case 11" in Part V and presented in "Case 13" in Part V.

A disc displacement with reduction generally does not progress to a disc displacement without reduction with limited opening unless the patient has TMJ pain or intermittent locking.[13,15]

QUICK CONSULT

Understanding the Progression of a Disc Displacement with Reduction

A disc displacement with reduction generally does not progress to a disc displacement without reduction with limited opening unless the patient has TMJ pain or intermittent locking.

Disc Displacement without Reduction with Limited Opening

Disc displacement without reduction with limited opening (also known as **closed lock**) may be diagnosed when a patient has a suddenly occurring continuous marked limited opening. The minimum of a normal opening is 40 mm, so a limited opening would be less than 40 mm. Patients with this disorder are often aware that the TMJ structure that normally caused the click now blocks them from obtaining their normal opening. Many of these patients report a history of their TMJ catching at that location or intermittently having had this problem (lasting seconds to days), which suddenly released and allowed them to regain their normal opening.[17]

This disorder is demonstrated in the bottom right section of the "TMJ Disc–

Condyle Complex Disorders" diagram. As the mouth opens, the condyle first rotates then attempts to translate forward, but the condyle cannot slide under the disc's posterior band to reduce onto the intermediate zone of the disc. The translation is limited by the disc, and typically, the patient is initially able to open only between 20 and 30 mm.

In theory, as the patient attempts to open wider, the ipsilateral condylar translation is restricted by the disc while the contralateral condyle translates beyond that point, causing the anterior portion of the mandible to deviate to the side with the disorder. So the practitioner can generally observe, during the range-of-motion evaluation, that there is also a marked limitation to the contralateral side. Clinically, these findings are not always observed, because patients tend to guard against moving their mandible into painful positions, and the contralateral side may also have pain limiting a patient's movements.

The limited ipsilateral condylar translation can also be felt by placing a finger over the lateral pole of both condyles and asking the patient to open wide and move the mandible to each side. During these movements, it is easy to feel the limited ipsilateral condylar translation in comparison with the contralateral condylar translation.

A marked limited opening can also be caused by a muscle disorder, but a limited opening from a muscle disorder would generally exhibit a gradual onset (hours to days). One may also differentiate the origin of the restriction for a patient with a marked limited opening by stretching the mouth beyond a comfortable opening, as described in "Range of Motion" in Chapter 3 and shown in Figure 1.2.

Patients with a lateral pterygoid spasm often present with similarities to the disc displacement without reduction with limited opening disorder. These patients similarly have an immediate onset of a limited opening in which the ipsilateral condyle is restricted in its ability to translate, but with the lateral pterygoid spasm disorder, it is due to the lateral pterygoid muscle not being able to contract rather than the condylar translation being blocked by the disc. One of the ways to differentiate these is that patients with a disc displacement without reduction with limited opening can generally put their teeth into maximum intercuspation without pain, whereas patients with a lateral pterygoid spasm usually relate that they cannot close or have significant pain when closing into maximum intercuspation. Additional information on diagnosing and treating the lateral pterygoid spasm is provided in Chapter 9, "Lateral Pterygoid Spasm."

QUICK CONSULT

Observing Lateral Pterygoid Spasm Presentation

Patients with a lateral pterygoid spasm often present with similarities to the disc displacement without reduction disorder with limited opening.

If the sudden limited opening is due to external trauma, this limited opening may be from a muscle injury, TMJ arthralgia, fractured condyle, or other causes in addition to a disc displacement without reduction with limited opening. Recommended treatments for disc displacements without reduction with limited opening are provided in Chapter 10. Case scenarios of patients with different treatment strategies for this disorder are presented in "Case 14" and "Case 15" in Part V.

Disc Displacement without Reduction without Limited Opening

Disc displacement without reduction without limited opening is diagnosed when a

patient has a history of sudden-onset limited opening that gradually increased to 40 mm or greater. This history suggests the patient had a disc displacement without reduction with limited opening, over time the retrodiscal tissue stretched, enabling the disc to move forward, allowing the condyle to translate further, and permitting the patient to open wider.

QUICK CONSULT

Diagnosing Disc Displacement without Reduction without Limited Opening

This disorder is diagnosed when a patient has a history of sudden-onset limited opening that gradually increased to 40 mm or greater.

The mechanism for this transition is activated every time the individual attempts to open beyond the restriction. This causes the condyle to push against the posterior side of the disc, which puts a stretching force on the retrodiscal tissue. Repeatedly bumping the disc in this manner will often sufficiently stretch the retrodiscal tissue over time, allowing the disc to move forward so that the normal translation and opening are eventually regained. Many individuals can move through this transition without treatment (some with minimal discomfort), but others cannot. This transition may occur immediately, take a few days, months, or even take many years.[12] Patients who seek treatment are generally those whose opening is not progressively increasing and generally benefit from an exercise that puts a stretching force on the retrodiscal tissue (discussed in Chapter 10).

Other Hypomobility Disorders

Other disorders in which the TMJ does not allow the mandible to move to the normal range of motion are generally due to a restriction of the condyle's ability to translate, but they may also be due to a restriction of the condyle's ability to rotate. As discussed in the "Disc Displacement without Reduction with Limited Opening" section earlier, the condyle with limited translation can be identified by observing the anterior portion of the mandible deviating to the ipsilateral side, observing the limited movement to the contralateral side, and feeling for the limited translation while palpating the lateral pole of both condyles as the patient moves the mandible.

These disorders can be differentiated from a muscle causing the hypomobility by stretching the mouth open wider (as shown in Figure 1.2) and asking the patient to identify the location of the tightness, pulling, or pain (the location of the structure causing the restriction).

Adhesions/Adherence

Adhesions are fibrous bands of connective tissue that can form between the articulating surfaces of the condyle or mandibular fossa, the disc, or surrounding tissues. They most commonly form from bleeding within the TMJ following trauma.[11]

An adherence is the temporary sticking of the articular surfaces, which can occur between the condyle and disc or the disc and mandibular fossa. This most commonly occurs following prolonged static loading of the TMJ's surfaces.[11]

Ankylosis

Ankylosis is the firm restriction of the condyle due to fibrous bands or osseous union within the TMJ and is generally not associated with pain. It is most commonly the result of trauma to the mandible and/or TMJ. The involved condyle may not be able to translate and may have limited rotation, causing the patient to have a very limited opening, but

this will vary with the type and extent of the ankylosis.[18,19]

Conservative TMD therapy is not beneficial for this disorder, and arthroscopic or open joint surgery will be needed to release the TMJ complex. The decision to treat is dependent upon the degree of dysfunction and how well the condition is tolerated.[11]

QUICK CONSULT

Understanding TMJ Ankylosis

Ankylosis is the firm restriction of the TMJ due to fibrous bands or osseous union within the TMJ and is generally not associated with pain.

Fibrous Ankylosis

Fibrous ankylosis is generally associated with fibrotic tissue between the articulating surfaces of the condyle or mandibular fossa, the disc, or surrounding tissues.[11]

Osseous Ankylosis

Osseous ankylosis is generally due to bone formation between the condyle and fossa, and the patient has a more restricted opening than with fibrous ankylosis.[11]

Hypermobility Disorders

This category comprises two disorders in which the condyle is caught in front of the articular eminence. It may be due to the articular eminence obstructing the posterior movement of the disc–condyle unit, the disc obstructing the posterior movement of the condyle, or a combination of the two.[20,21] Conservative treatments for these disorders are discussed in Chapter 11, "TMJ Subluxation and Luxation."

Subluxation

Subluxation is diagnosed when a patient relates a history of momentary inability to close the mouth from a maximal open position, in which the patient had to perform a specific maneuver to close the mouth.

Luxation

Luxation (also known as **open lock**) is diagnosed when a patient presents with or relates a history of being unable to close his or her mouth from maximum opening and requires or required a practitioner to release it. Most dentists, who have been in practice for a while, have seen patients with this disorder following a dental procedure that required the patients to be open wide.

Joint Diseases

Degenerative Joint Disease

This category comprises two disorders in which there is deterioration of the articular tissues and osseous changes in the condyle and articular eminence. It is diagnosed when the practitioner detects crepitus or the patient hears crunching, grinding, or grating noises during the examination. If a CT image is made, then a subchondral cyst, erosion, generalized sclerosis, or osteophyte must be observed; condylar flattening and cortical sclerosis could be due to a normal TMJ variation or remodeling. A systemic disorder may cause or contribute to this deterioration.[1]

Degenerative joint disease may cause a malocclusion. If it is bilateral, it generally begins with an anterior open bite that progresses to single bilateral contacts with the most posterior teeth. If it is unilateral, it generally begins in the contralateral canine region that progresses to a single contact with the most posterior ipsilateral teeth.

When the malocclusion is involved, the treatment is complicated and is beyond the scope of this book. A practitioner observing this complaint may desire to refer the patient

to someone with greater expertise in this area. A method for identifying these practitioners is provided in Appendix 13, "Practitioners with TMD Expertise and Fellowship Programs."

QUICK CONSULT

Patients Observing a Progressively Increasing Anterior Open Bite

This may be due to degenerative joint disease. The bilateral form generally begins with an anterior open bite that progresses to single bilateral contacts with the most posterior teeth, and the unilateral form generally begins in the contralateral canine region that progresses to a single contact with the most posterior ipsilateral teeth.

Osteoarthrosis

Osteoarthrosis is diagnosed if a patient meets the above degenerative joint disease criteria and the TMJ is not tender to palpation.

Osteoarthritis

Osteoarthritis is diagnosed if a patient meets the above degenerative joint disease criteria and the TMJ is tender to palpation at one or more of the three palpation locations described under "Palpation" in Chapter 3.

Condylysis

Condylysis is a rare idiopathic osseous degeneration that causes the condyle to become progressively smaller. It primarily occurs in adolescent females and may cause similar progressive occlusal changes as discussed under degenerative joint disease.

Osteochondritis Dissecans

Osteochondritis dissecans is a disorder in which there are fragments of articular cartilage and bone that freely move within the synovial fluid. It generally occurs in the knee and elbow but has been reported in the TMJ. Little is known about the signs and symptoms of this disorder.[1]

Osteonecrosis

Osteonecrosis is a painful disorder that occurs when the blood supply to the bone is disrupted. It most often affects the hip, but does occur in the femur, humerus, and knee. It has been reported in the mandibular condyle, but its cause, clinical significance, and need for treatment are unknown.[1]

Systemic Arthritides

Systemic arthritides (e.g., rheumatoid arthritis) may cause TMJ tenderness, pain, and structural changes, as it can with other joints in the body. The systemic disorder may go through acute flare-up and remission phases, and should be treated by a physician. The masticatory component may benefit by reducing the TMJ loading through traditional TMD therapies. Condylar osseous degeneration from systemic arthritides may cause severe occlusal changes.

TECHNICAL TIP

Working with Physicians

Systemic arthritides should be treated by a physician, while the masticatory component may benefit by reducing the TMJ loading through traditional TMD therapies.

Neoplasm

Neoplasm is a malignant or benign disease process that results in the formation and growth of any new and abnormal tissue.

Reports of TMD symptoms caused by a neoplasm are very rare.[1]

Synovial Chondromatosis

Synovial chondromatosis is the rare condition in which cartilaginous remnants from the synovial tissue may become pedunculated or loose bodies within the synovial fluid. It may not cause any signs or symptoms, but can cause an ipsilateral posterior open bite, restricted opening, pain, and/or swelling. The current treatment of choice is open TMJ surgery to remove these nodules.[1,22]

Fractures

TMJ fracture may first be noticed on a routine panoramic radiograph taken for a non-TMD purpose. The patient may not have any signs or symptoms associated with the fracture or be aware of the fracture. Subcondylar fractures are the most common, and the condyle may even be dislocated out of the glenoid fossa. Most patients with condylar fractures do well with only conservative therapy, but a higher risk for occlusal changes is associated with bilateral fractures and the condyle being dislocated out of the fossa.[23]

Congenital/Developmental Disorders

Aplasia

Aplasia is the failure of the condyle to develop and incomplete development of the articular fossa and eminence. It most commonly is associated with congenital anomalies, occurs unilateral, causes facial asymmetries, and may cause a malocclusion.[1]

Hypoplasia

Hypoplasia is the underdevelopment of the mandible or cranial bones, is often secondary to trauma during adolescence, and may result in asymmetric growth of the mandible (Figure 5.1).[1,24]

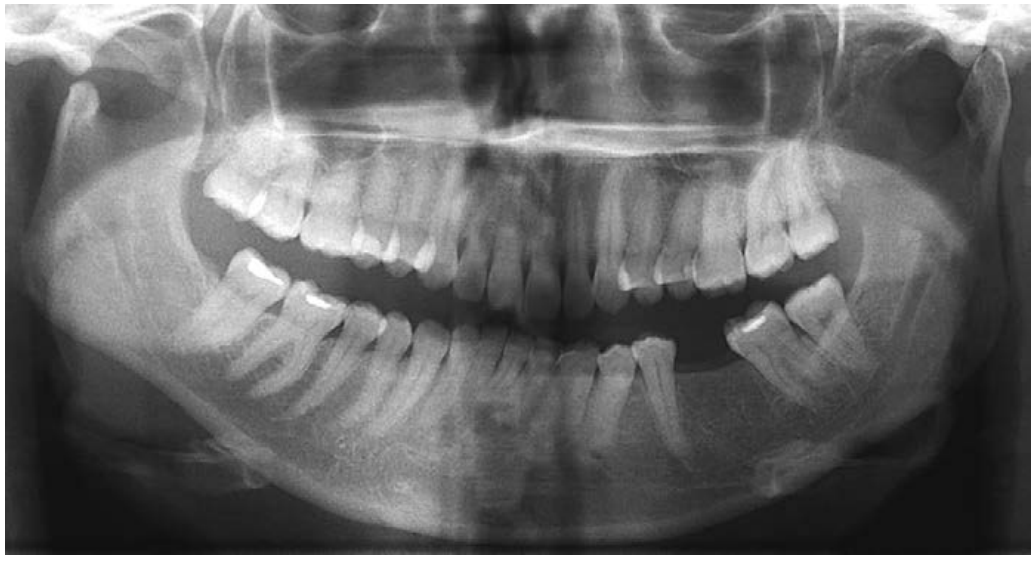

Figure 5.1. Panoramic radiograph showing hypoplasia of the right TMJ. Compare the images of the right and left TMJs and notice that the right condyle and articular eminence are smaller.

Hyperplasia
Hyperplasia is the overdevelopment of the mandible or cranial bones. It can occur unilaterally or bilaterally and normally occurs during adolescence, leading to facial asymmetry, mandibular deviation, and a malocclusion.[1,25]

Masticatory Muscle Disorders

Masticatory muscle pain is the most common reason TMD patients seek treatment, and myalgia is the most common TMD diagnosis given to TMD patients. Many mechanisms can produce, or make individuals more susceptible to, muscle pain, for example, muscle overuse, muscle ischemia, sympathetic and fusimotor reflexes, psychological states.[1] This is not a central issue for this book, so for ease of the readers, it is assumed that most muscle pain is due to muscle overuse and the many other potential contributing factors that are presented.

Muscle Pain Limited to the Orofacial Region

Myalgia
Myalgia is diagnosed when the patient's muscle pain is aggravated by mandibular movement, function, or parafunction, and it can be reproduced by palpating the painful muscle. There are three subtypes of myalgia: local myalgia, myofascial pain with spreading, and myofascial pain with referral.

Local Myalgia
Local myalgia is diagnosed when the disorder meets the criteria for myalgia, and the pain and palpation tenderness is limited to a small area of the muscle.

Myofascial Pain with Spreading
Myofascial pain with spreading is diagnosed when the disorder meets the criteria for myalgia and the palpation can cause the pain to spread to other parts of that muscle.

Myofascial Pain with Referral
Myofascial pain with referral is diagnosed when the disorder meets the criteria for myalgia and the palpation can cause referred pain to other areas beyond the muscle, for example, tooth, ear, eye.

Myalgia is the most common muscle diagnosis given to TMD patients. It is rarely important to differentiate between local myalgia and myofascial pain with spreading, but when a patient's pain is due to referred pain from a muscle, it should be diagnosed as myofascial pain with referral. Hence, in this book, I generally designate myalgia diagnoses as either myalgia or myofascial pain with referral.

Tendonitis
Tendonitis is diagnosed when the patient's pain is aggravated by mandibular movement, function, or parafunction, and it can be reproduced by palpating the painful tendon. For most masticatory muscles, it is nearly impossible to know whether the muscle or tendon is being palpated. About the only masticatory muscle tendon that can be palpated separately from the muscle is the temporalis muscle tendon, which can be palpated intraorally, as described in Table 3.2 and demonstrated in Figure 3.25.

Myositis
Myositis is diagnosed when the muscle meets the criteria for myalgia and has clinical characteristics of infection (e.g., edema, erythema, and/or increased temperature) or

inflammation. The history generally shows the onset of symptoms is directly related to an infection or trauma to the muscle, or it can occur chronically from an autoimmune disease.

If an infection is the etiology of the myositis, then treatment must involve identifying and resolving the infection, and antibiotic therapy may be advisable. If trauma is the etiology of the myositis, the myositis should be treated with nonsteroidal anti-inflammatory drugs (NSAIDs), limiting the use of the masticatory muscles (e.g., soft diet or avoiding oral habits), and possibly applying ice over the affected area for the first 48 hours after the trauma.

Spasm

Spasm is diagnosed when the muscle meets the criteria for myalgia, the muscle causes a limited range of motion, and the pain and limited range of motion had an immediate onset. This disorder has awaken many of us in the middle of the night with a spasm in our calf muscle. In this situation, the calf muscle is in a painful constant contraction in its midrange position, and there is increased pain when we attempt to move the foot up or down.

A spasm can occur in any masticatory muscle, but it alarms patients (and unaware practitioners) the most when it occurs in the inferior lateral pterygoid muscle. Similar to the calf muscle spasm, the individual with a lateral pterygoid spasm has the inferior lateral pterygoid muscle in a painful constant contraction in its midrange position, and there is increased pain when the individual attempts to translate the condyle forward or retrude the mandible so the teeth fit into maximum intercuspation.

The patient usually complains of the inability to put the ipsilateral posterior teeth together without excruciating pain (the teeth are usually separated by a fraction of a millimeter to a few millimeters), and the first tooth contact is in the area of the contralateral canine (if the patient has normal tooth alignment). Since the patient also has difficulty translating the condyle forward, he or she also usually has a marked limited opening. The immediate onset and the ability to reduce the pain by stretching the lateral pterygoid muscle help confirm this diagnosis rather than other diagnoses which can cause a similar posterior open bite. Diagnosis and treatments for the lateral pterygoid spasm are provided in Chapter 9, "Lateral Pterygoid Spasm."

TECHNICAL TIP

Lateral Pterygoid Spasm

This disorder causes the patient to not be able to put the ipsilateral posterior teeth together without excruciating pain and to have a limited opening. It has an immediate onset and can be confirmed by the pain being reduced from stretching the lateral pterygoid muscle.

Lateral and medial pterygoid spasms are the only spasms I can recall treating, but a spasm could occur in any muscle. The etiology of the medial pterygoid spasm is generally multiple inferior alveolar injections, and the patient returns to their dentist with pain localized to the medial pterygoid muscle and a restricted opening a few days following these injections.[26] Diagnosis and treatments for the medial pterygoid spasm are provided in "Medial Pterygoid Muscle Pain" in Chapter 8.

Contracture

Contracture is a painless disorder in which fibrosis of tendons, ligaments, and/or muscle

fibers do not allow the muscle to stretch to its full length. It is usually due to radiation therapy, trauma, or infection.

When this condition involves a closure muscle (e.g., masseter), it limits a patient's ability to open wide, and forcibly attempting to stretch the muscle beyond its firm limitation elicits pain. The most effective conservative method for attempting to regain a closure muscle's range of motion appears to be with the Dynasplint Trismus System (www.dynasplint.com). It has been shown to be effective for patients with limited opening from radiation therapy for head/neck cancer and stroke.[27] Clinically, I have observed limited improvement by patients using tongue depressors to forcibly stretch a muscle with contracture beyond its firm limitation, as demonstrated in Figure 8.2.

Hypertrophy

Hypertrophy is the enlargement of one or more masticatory muscle. This is usually due to chronic overuse or holding tension in the muscle(s). This is commonly observed as a painless disorder in muscular men who have significant tooth attrition from heavy parafunctional activity.

Neoplasm

Neoplasm is a malignant or benign disease process that results in the formation and growth of any new and abnormal tissue. Reports of TMD symptoms caused by a neoplasm are very rare.[1]

Movement Disorders

This category lists two disorders that cause involuntary contraction of muscles which move the face, lips, tongue, and/or mandible. Management of these disorders is beyond the scope of this book, and they are generally treated by a neurologist.

Orofacial Dyskinesia

Orofacial dyskinesia is the involuntary movement of the face, lips, tongue, and/or mandible. These contractions may temporarily reduce or stop when the mouth or face receives sensory stimulation. This disorder is more common among patients who are older, are taking neuroleptic medications, have a brain injury, have a psychiatric disorder, or have a neurologic disorder.[1]

Oromandibular Dystonia

Oromandibular dystonia is the involuntary sustained contraction of muscles of the face, lips, tongue, and/or mandible, which commonly disappears during sleep. This sustained contraction generally causes pain in the involved muscles. This disorder is commonly caused by a neurologic disorder, brain injury, or medications.[1]

Masticatory Muscle Pain Attributed to Systemic/Central Disorders

Fibromyalgia

Fibromyalgia is a widespread muscle pain disorder that can contribute to a TMD patient's myalgia, and patients with this disorder do not respond as well to TMD therapy. This disorder is discussed in Chapter 1, "Patient Interview," and a case scenario of a patient with this disorder is presented in "Case 10" in Part V. Rheumatologists generally have specialized training in fibromyalgia.

Centrally Mediated Myalgia

Centrally mediated myalgia may occur when there is prolonged continuous muscle pain. In this disorder, the central nervous system maintains the muscle in a state of constant pain and tenderness through the downregulation of peripheral neurogenic inflammation. This diagnosis may be considered when the muscle pain is prolonged and continuous, is a regional dull ache at rest, meets the definition for myalgia, the muscle has a sensory dysfunction (e.g., allodynia), has muscular atrophy, and causes a limited opening. The disorder is difficult to delineate from myalgia and may occur in combination with it.[1,11]

This disorder does not generally resolve as quickly as myalgia. Since neurogenic inflammation releases inflammatory substances into the muscle, it is recommended the patient be prescribed an NSAID (e.g., 800 mg ibuprofen, t.i.d.) in addition to the other therapies recommended for myalgia.[11]

Headache Disorders

Headache Attributed to TMD

Headache attributed to TMD is a headache located in the temple with a temporal relation to the patient's TMD pain. It worsens with function or parafunctional activities, and it can be reproduced by palpating the temporalis muscle or by its movement.

Associated Structures

Coronoid Hyperplasia

Coronoid hyperplasia is the enlargement of the coronoid process to the extent that it causes an individual to have a limited opening.

As the condyle translates, the coronoid process also travels forward. If something (e.g., trauma) caused the coronoid process to enlarge, there may no longer be room for the coronoid process to avoid the zygomatic process as the patient opens. A patient with this disorder would have a history of a progressively decreasing opening, a clinical finding of a limited opening, and an image finding of an elongated coronoid process that approximates the posterior aspect of the zygomatic process during maximum opening.[1,28]

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Chapter 6

Contributing Factors

FAQ

Q: Does smoking contribute to temporomandibular disorder (TMD)? If so, should I try to motivate my TMD patients to quit?

A: Studies suggest that smokers have worse TMD symptoms than nonsmokers.[1,2] I speculate smoking contributes to TMD symptoms through oral movements and lessening the body's ability to heal itself. I try to provide patients with the least costly (time, money, and effort) therapies that enable them to obtain satisfactory relief. It generally takes a great deal of effort for smokers to quit. I believe all smokers know smoking is harmful, and they currently do not possess the desire or willpower to stop. I present patients with other therapies that are much less difficult to implement and generally enable patients to obtain satisfactory relief.

Temporomandibular disorder (TMD) contributing factors are the elements that directly or indirectly contribute to the TMD symptoms, impacting both muscle and temporomandibular joint (TMJ) pain. They can be subcategorized into predisposing, initiating, and perpetuating contributing factors.[3–5] The **predisposing contributing factors** are the elements that make an individual more susceptible to developing TMD, for example, fingernail biting, clenching, and biting on objects. The individual who is very predisposed to developing TMD may be the one who develops TMD from a slight occlusal change, for example, from the placement of a pit and fissure sealant.

FOCAL POINT

Predisposing contributing factors are the elements that make an individual more susceptible to developing TMD, for example, fingernail biting, clenching, and biting on objects. An individual who is very predisposed to developing TMD may be the one who develops TMD from a slight occlusal change, for example, from the placement of a pit and fissure sealant.

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The **initiating contributing factor** is the event that caused the TMD symptoms to occur, for example, trauma to the jaw or the placement of a crown. A total of 230 sequential TMD patients were asked what they perceived as the cause of their TMD symptoms, and it was found that most (61%) did not associate the onset of their symptoms with any particular occurrence. Seven percent related it to dental treatment (orthodontic and other dental procedures) (see Table 6.1).

Some individuals who have developed TMD from dental treatment may have received treatments for which the average individual would not have had any problem, but these individuals may have been very predisposed to developing TMD. With the relatively high percentage of patients associating their TMD symptoms with dental treatment, it would be prudent for dentists to inquire about TMD symptoms and perform a cursory TMD evaluation prior to performing dental treatment, for example, during the periodic dental examination. A cursory TMD evaluation can be done by measuring the patient's opening and checking for tenderness in the temporalis and masseter muscles, TMJs, and lateral pterygoid areas, as described in "TMD Palpations" in Chapter 3 (Table 3.1 and Table 3.2).

Table 6.1. Events that patients related to TMD onset (n = 230).

61%	No reason
17%	Stress or stressful situation
4%	Orthodontic treatment
4%	Trauma
3%	Other dental procedures
3%	Motor vehicle accident
7%	Other events

QUICK CONSULT

Varying Patient Response

Some individuals who have developed TMD from dental treatment may have received treatments for which the average individual would not have had any problem, but these individuals may have been very predisposed to developing TMD.

The **perpetuating contributing factors** are the elements that directly or indirectly aggravate the masticatory system and prevent the TMD symptoms from resolving. It is important to attempt to identify these factors and determine the degree they are contributing to a patient's symptoms. Initially recommend the patient change the contributors that are the easiest to change and that should provide the greatest impact on the symptoms.

FOCAL POINT

Perpetuating contributing factors are the elements that directly or indirectly aggravate the masticatory system and prevent TMD symptoms from resolving.

Attempt to change the perpetuating contributing factors that are the easiest to change and that should provide the greatest impact on the patient's symptoms.

This is similar as to what we do in other areas of dentistry. For instance, common contributing factors in periodontal disease are calculus and poor oral hygiene. If we adequately control these contributing factors in mild to moderate periodontal disease, the body will generally heal itself and the periodontal disease will resolve.

The daily variation in symptoms will often give an indication of when these factors are occurring. For example, a situation in which a patient awakes with the TMD symptoms that rapidly resolve would suggest the primary perpetuating contributing factors are occurring

at night. It is recommended that the factors that should first be considered for changing are sleeping position (if the patient sleeps on his or her stomach) and nocturnal parafunctional habits.

QUICK CONSULT

Observing for Variation in Daily Symptoms

The daily variation in symptoms will often give an indication of when the perpetuating contributing factors are occurring.

Conversely, if the patient awakes symptom free with the symptoms occurring later in the day, this would suggest the primary perpetuating contributing factors are transpiring during the day and are under the patient's conscious control. This is generally due to excessive muscle activity in the form of holding excessive muscle tension in the masticatory muscles and/or excessive parafunctional habits, as depicted in Figure 1.5.[6,7]

At the initial evaluation, patients are rarely aware of excessive muscle tension or their daytime parafunctional habits and the frequency with which they perform them. For example, some patients relate they lightly rest their teeth together throughout the day but are unaware that they squeeze the teeth together when they are busy, frustrated, or concentrating on other activities, for example, using a computer or driving.

Clinically, some residual effect of the TMD contributing factors appears to carry over to the other portions of the day. Additionally, daytime stress may contribute to the nocturnal parafunctional activity; see Figure 1.3 and Figure 1.4.

Some TMD patients awake with symptoms and have symptoms throughout the day. This symptom pattern suggests these patients have daytime and nocturnal contributing factors. They may have daily severity patterns suggesting either the daytime and nocturnal contributing factors are more prominent, but generally both need to be addressed. The contributing factors are widely diverse and unique to each patient. For ease of comprehending the broad continuum of contributing factors, they can be thought about in biological, behavioral, emotional, cognitive, social, and environmental categories.[8]

QUICK CONSULT

Observing Treatment Effect on Daily Pattern

Clinically, some residual effects of TMD contributing factors appear to carry over to the other portions of the day.

Biological contributing factors are the elements that mechanically or biologically contribute to TMD. They can include neck pain, poor posture, malocclusion, insomnia, and systemic diseases (e.g., fibromyalgia or rheumatoid arthritis).[4] Behavioral contributing factors are habits a patient frequently performs that negatively impact TMD, for example, holding excessive tension in the masticatory muscles, clenching, fingernail biting, lip biting, stomach sleeping, or telephone cradling. Biological and behavioral contributing factors tend to influence the TMD symptoms directly, whereas emotional, cognitive, and social factors tend to convey their influence indirectly.[9]

QUICK CONSULT

Observing Contributing Factor Influence

Biological and behavioral contributing factors tend to influence the TMD symptoms directly, whereas emotional, cognitive, and social factors tend to convey their influence indirectly.

Emotional contributing factors are prolonged negative emotions such as depression, worry, anxiety, and anger. Cognitive factors are harmful thought processes or low cognitive skills, for example, negative self-statements or poor reasoning skills, making it difficult for the patient to work with the self-management or other instructions. Social contributing factors are related to interactions with others that can contribute to patients' TMD symptoms or their poor response to therapy, for example, coworker difficulties, lack of social support, or secondary gain.[4,8,9]

Environmental contributing factors can have a direct effect (e.g., a food additive directly causing a migraine headache) or an indirect effect (e.g., seasonal affective disorder causing depression and thereby contributing to TMD symptoms). These factors are usually quite difficult to identify and therefore are infrequently explored among TMD patients.[8]

Generally, TMD therapies are not directed toward physically or biochemically changing the TMD diagnosis (e.g., myalgia) but are directed at changing the contributing factors. With the reduction in the intensity and frequency of the perpetuating contributing factors, the body heals itself. This is similar to a patient who has mild generalized periodontal disease. A practitioner would not surgically intervene to change this condition, but would try to determine the factors that have caused this disease to develop, for example, not properly brushing or flossing, smoking, or poor nutrition. Once these factors have been identified, the practitioner would educate and motivate the patient to make sufficient behavioral changes to enable the body to reverse the disease. The practitioner would follow the patient's case to ensure adequate behavioral changes have been made to resolve the disease.

FOCAL POINT

With the reduction in the intensity and frequency of the perpetuating contributing factors, the body heals itself.

Identifying the TMD contributing factors, in addition to educating and motivating the patient to change the TMD contributing factors, is one of the most challenging aspects of treating TMD patients. Begin by using the daily symptom pattern as a guide. When one is having difficulty identifying the daytime contributing factors, a technique that has been helpful is asking the patient to hourly track the pain and other events that are occurring in the patient's life. This has often helped patients to identify events associated with the pain. The patient next needs to identify the perpetuating contributing factors that are occurring at that time, for example, clenching and holding tension in the masticatory muscles. Finally, the patient will need to break these habits so the masticatory system can heal. The patient may require assistance from someone trained in teaching patients to relax and/or break habits.

For example, a TMD patient who also had moderately severe hip pain was being evaluated as to whether the disorder was benign or malignant. Using the diary, the patient found a direct association between her hip and TMD symptoms. Upon discussing this, the patient thought that when her hip pain increased in severity, she tightened her masticatory muscles in response to the pain and started worrying about her hip disorder. She chose to use her hip pain as a cue to alert herself consciously to keep her jaw muscles relaxed. With this and other conservative therapies, she obtained satisfactory relief of her TMD pain.

QUICK CONSULT

Challenging Segments of Therapy

Identifying the TMD contributing factors, in addition to educating and motivating the patient to change them, is one of the most challenging aspects of treating TMD patients.

TECHNICAL TIP

Identifying Contributing Factors through a Diary

When one is having difficulty identifying the contributing factors, a technique that can be helpful is asking the patient to hourly track the pain and other events that are occurring in the patient's life.

A 64-year-old lady who had recently developed daytime TMD symptoms several days a week also found the diary helpful. At the initial appointment, when asked about new stresses, irritations, frustrations, or concerns in her life, she stated that she has a superb life, she doesn't work, all of her children have left home, and she and her husband have a wonderful relationship. After using the diary, she found her pain was related to thoughts regarding her 90-year-old father who lives alone (about an hour's drive from her home) and is becoming forgetful. She related that in the previous week, he left his house for several hours with the flame burning on his stove. She also periodically receives telephone calls from her siblings reminding her that she lives the closest to him, it is her responsibility to watch over him and, if anything went wrong, she would receive the blame. It was speculated that when she had concerned thoughts about her father, she tended to tighten her masticatory muscles sufficiently to manifest her TMD symptoms. She worked with a psychologist who taught her coping strategies and how to deal better with her siblings, in addition to my instructions on breaking her masticatory muscle-tightening habits, and her symptoms resolved after a few weeks.

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Part II

Common Acute TMD Conditions and Treatments

Most new temporomandibular disorder (TMD) patients report having chronic rather than acute TMD symptoms; they have had the pain at least several months, and the pain intensity generally fluctuates over time. When considering medications for a patient with chronic symptoms, generally assume they will be used for the long term. Therefore, avoid prescribing muscle relaxants and primarily use tricyclic antidepressants, nonsteroidal anti-inflammatory drugs (NSAIDs) on an as-needed basis, and/or topical medications.

It is believed that the best treatment for patients with chronic TMD symptoms is for them to change their parafunctional habits in addition to other perpetuating contributing factors, for example, not coping well with life's stresses, anxiety, and depression. Clinical experience has demonstrated there is a tendency for patients with chronic symptoms who are prescribed muscle relaxants to rely on these medications for pain relief rather than working to change their contributing factors.

An acute TMD condition can be the recent onset of TMD symptoms or an acute flare-up of a chronic condition. For these patients, I am much more likely to prescribe short-term use of a muscle relaxant and/or anti-inflammatory medications. A few patients, who occasionally (every 1 or 2 years) develop mild TMD symptoms related to temporary stressful events,

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prefer to use only TMD self-management therapy and medication. It is recommended that these cases be followed to ensure the symptoms adequately resolve and the patients do not need additional TMD therapy.

FOCAL POINT

An acute TMD condition can be the recent onset of TMD symptoms or an acute flare-up of a chronic condition.

Chapter 7

TMD Secondary to Trauma

FAQ

Q: What would you do if a patient who developed temporomandibular disorder (TMD) from trauma was provided your initial recommended therapy and returned requesting stronger medications?

A: If the patient returns requesting stronger medications after having been provided the initial recommended therapy, there is probably some other pathology involved, for example, pulpalgia from an incomplete tooth fracture.

TMD can occur from trauma to the masticatory system whose intensity or duration exceeds the adaptive capacity of this system. It can occur in three forms: (1) direct trauma (macrotrauma), for example, blow to jaw; (2) indirect trauma (nonimpact jolt to the jaw), for example, occurring in conjunction with cervical whiplash; and (3) microtrauma, for example, chronic parafunctional habits.[1]

QUICK CONSULT

Understanding Trauma

Trauma to the masticatory system can occur in three forms: (1) direct trauma (macrotrauma), (2) indirect trauma (nonimpact jolt to the jaw), and (3) microtrauma.

Direct and indirect trauma have identifiable events a patient normally reports as the initiating cause of the temporomandibular disorder (TMD) symptoms. Microtrauma generally reflects unconscious habits, which may predispose an individual to develop TMD from direct or indirect trauma and make it more difficult to resolve the manifested symptoms. This chapter focuses on direct and indirect trauma, and uses the term "trauma" to encompass both forms.

QUICK CONSULT

Understanding Trauma

This chapter focuses on direct and indirect trauma, and uses the term "trauma" to encompass both forms.

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Trauma can cause muscle pain, temporomandibular joint (TMJ) pain, and intracapsular changes. It can stretch ligaments supporting the TMJ's smooth mechanical movements, causing or predisposing an individual to develop one of the disc displacements or a subluxation or luxation. It can create irregularities in the smooth condyle, fossa, or disc surfaces, thereby causing roughness or catching during TMJ movements. Additionally, trauma can precipitate bleeding within the TMJ, leading to adhesion formation.[2]

If the TMJ is injured in a child or adolescent, this could cause a reduction in the condylar growth and result in asymmetry of the mandible, for example, TMJ hypoplasia (Figure 5.1).[3]

FOCAL POINT

Trauma can cause muscle pain, TMJ pain and arthralgia, and intracapsular changes.

The "Initial Patient Questionnaire" asks when the problem began and whether the patient has suffered whiplash or trauma to the head or neck. These responses will alert the practitioner as to whether the patient has acute TMD symptoms secondary to trauma. These patients may have complaints of muscle pain, TMJ pain, other pains, new TMJ noises, and/or disruption of smooth TMJ movements. These symptoms may not manifest until weeks to months after the traumatic event.[2]

QUICK CONSULT

Observing for Trauma History

The "Initial Patient Questionnaire" responses will alert the practitioner as to whether the patient has acute TMD symptoms secondary to trauma.

Many factors can cause or contribute to these complaints and need to be considered when trauma is the initiating contributing factor or has greatly exacerbated chronic symptoms. The more common possibilities include bone fracture, referred odontogenic pain secondary to tooth trauma, comorbid cervical disorder, and psychosocial issues related to the trauma, obtaining treatment, or the treatment for the trauma. The literature reports many other less common disorders that have been related to traumatic events. If the patient has signs and/or symptoms suggestive of disorders beyond the practitioner's ability, the practitioner should refer the patient to someone with greater expertise in this area. A method for identifying these practitioners is provided in "Practitioners with TMD Expertise and Fellowship Programs" in Appendix 13.

Even though a patient has only an acute problem, the TMD examination should be performed as recommended in Chapter 3, "Clinical Examination." Cervical pain is even more prevalent among patients whose TMD is secondary to trauma from a motor vehicle accident.[4,5] It is recommended a panoramic radiograph be taken to rule out a fracture causing or contributing to the pain. If the patient was not appropriately evaluated for a fracture following the trauma and the practitioner suspects the patient may have a fracture in a bone that would not be revealed by the panoramic radiograph, then appropriate radiographs are indicated.

QUICK CONSULT

Evaluating Patients with History of a Motor Vehicle Accident

Among patients whose TMD is secondary to trauma from a motor vehicle accident, cervical pain is more likely to be present.

TECHNICAL TIP

Contributing Factor of Trauma

When trauma is the initiating contributing factor or has greatly exacerbated chronic symptoms, it is recommended a panoramic radiograph be taken to rule out a fracture causing or contributing to the patient's pain.

Depression, anger, and hostility are significantly more common with these patients.[5] Sometimes patients angrily complain about the injustice of their situation, whereas others may disclaim these feelings but also internally stew with these thoughts. Some practitioners routinely refer all TMD patients who suffered significant trauma to a psychologist to evaluate for such perpetuating contributing factors.

QUICK CONSULT

Observing for Psychosocial Contributors

Depression, anger, and hostility are significantly more common with patients whose TMD symptoms were initiated by trauma.

Significant trauma may cause patients to have neuropsychological and cognitive functioning deficits that may comprise memory and concentration impairment, rapid mental fatigue, weakness, sleep disturbances, anxiety, and so on.[4–7] Patients with such deficits should be evaluated and treated with a multidisciplinary approach by medical personnel trained in this area. In conjunction with these therapies, traditional TMD therapy can be provided for the masticatory system.

The trauma's severity and the patient's TMD perpetuating contributing factors are major determinants for how readily the TMD symptoms will resolve. The patient may require anything from no or minimal treatment to very extensive multidisciplinary therapies; even with extensive therapy, some patients with trauma-induced TMD do not improve.[8]

FOCAL POINT

The trauma's severity and the patient's TMD perpetuating contributing factors are major determinants for how readily the TMD symptoms will resolve.

Initial therapy for many of these patients may encompass discussing TMD self-management instructions and prescribing a muscle relaxant, anti-inflammatory, and/or analgesic medication. The "TMD Self-Management Therapies" handout (Appendix 4) recommends that patients limit use of the masticatory system by eating a soft diet, eliminating oral habits, and so on. It also recommends the use of heat and cold, but the practitioner may desire to alter these instructions verbally to using cold over the affected area for the first 48 hours after injury and then applying heat as needed.

TECHNICAL TIP

Determining Initial Therapy

Initial therapy for many of these patients may encompass discussing TMD self-management instructions and prescribing a muscle relaxant, anti-inflammatory, and/or analgesic medication.

As a general pharmaceutical guide, I tend to prescribe the following for patients with constant pain at these intensities. This will vary with the patient's fluctuating pain intensity pattern, the patient's palpation tenderness, and the emotional impact these are causing. If the patient has a low level of

pain (3/10 or below), I would tend to prescribe the patient 800 mg ibuprofen, t.i.d. If the pain is greater and primarily of muscle origin, I would tend to prescribe 5 mg diazepam, 1–2 tablets h.s. If the patient has significant daytime muscle pain, I would consider discussing the possibility of the patient taking one-half tablet in the morning and afternoon; the potential side effects and ramifications must be discussed. If the pain is above 3/10 and primarily of TMJ origin, I consider prescribing 500 mg naproxen, b.i.d. If the pain is above 6–7/10 and primarily of TMJ origin, I consider prescribing the DexPak 6-Day TaperPak-naproxen regimen discussed in "Anti-Inflammatory Medications" in Chapter 17. In healthy adults, the anti-inflammatory and the muscle relaxant can be taken together; if additional analgesic relief is needed, acetaminophen can be added.

After providing this therapy, if the patient returns requesting stronger medications, some other pathology is probably involved, for example, pulpalgia from an incomplete tooth fracture. Based on the patient's history and practitioner's experience, the practitioner may elect to provide additional temporary TMD therapies (e.g., temporary soft appliance) or initiate long-term therapy (e.g., making impressions for an acrylic appliance). Comparative studies reveal considerable variability as to whether patients with posttraumatic TMD respond differently to TMD therapies than do patients whose TMD developed independently of trauma.[4,9,10]

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Chapter 8

TMD Secondary to Dental Treatment

FAQs

Q: If a dental patient develops temporomandibular disorder (TMD) after a dental procedure, was the dental treatment the cause of the symptoms?
A: There are many potential causes for TMD to develop following a dental procedure (see Table 8.2). A patient's propensity for developing TMD may play a major role for one individual manifesting TMD after dental treatment, whereas a dentist using excessive and/or prolonged forces on the mandible may play a major role for another individual manifesting TMD after dental treatment.

Q: If a patient returns to my office with a medial pterygoid spasm and the patient is provided the therapy you recommend, how long will it take the disorder to resolve?
A: Depending on its severity and patient compliance, this disorder generally resolves in 5–10 days, but could take many weeks.

Q: Would it be helpful for a patient with significant TMD symptoms to be given nitrous oxide-oxygen inhalation?
A: My observations are that nitrous oxide-oxygen inhalation is very helpful for keeping TMD symptoms from being aggravated by dental treatment.

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When 230 sequential TMD patients were asked what they perceived as the cause for their TMD symptoms, most (61%) did not associate the onset of their symptoms with any particular event, whereas 4% related it to orthodontic treatment and 3% related it to other dental procedures (see Table 6.1).

QUICK CONSULT

Observing the Onset of TMD Symptoms

Most patients with temporomandibular disorder (TMD) do not associate the onset of their symptoms with any particular event.

Many individuals have minor sporadic aches or pains in various areas of the body that are not bad enough that they just ignore them. Then when this minor disorder flares up, they often try to recall what occurred during that time to have caused the flare-up.

This may similarly occur with TMD patients. Since TMD often occurs for no known reason, if these individuals just happened to have had dental work, they may believe the dental treatment was the cause for their symptoms.

For many TMD patients, their pain appears to develop slowly and worsen in a fluctuating pattern until a severity is reached for which they desire to obtain relief. For other individuals, TMD symptoms may fluctuate over time, but never develop the severity for which therapy is desired. The propensity for any one individual to develop TMD from dental treatment may vary with the degree of low-level or subclinical symptoms.

FOCAL POINT

The propensity for any one individual to develop TMD from dental treatment may vary with the degree of low-level or subclinical symptoms.

A dentist can also provide dental therapy appropriately for an individual who is in the midst of developing TMD, and the patient may not even be aware of developing TMD because the symptoms are so minimal. Because of the patient's propensity for developing TMD, the dental treatment may cause this individual to manifest TMD from the dental treatment.[1] Conversely, it is possible for a dentist to place such excessive and/or prolonged forces on the jaw that someone who is not predisposed to developing TMD would develop the disorder.

Understandably it would be prudent for dentists to inquire about TMD symptoms and perform a cursory TMD evaluation prior to performing dental treatment, for example, during the periodic dental examination. A cursory TMD evaluation can be done by measuring the patient's opening, identifying the presence or history of temporomandibular joint (TMJ) noise, and checking for tenderness in the anterior region of the temporalis and masseter muscles, TMJs, and lateral pterygoid areas (Table 8.1).

QUICK CONSULT

Protecting Yourself

It is recommended dentists inquire about TMD symptoms prior to dental treatment, measure the patient's opening, and check for tenderness in the anterior region of the temporalis and masseter muscles, TMJs, and lateral pterygoid areas.

Many elements of dental treatment can initiate TMD symptoms or aggravate a chronic TMD condition (see Table 8.2). For example, a medial pterygoid spasm may occur from piercing the medial pterygoid muscle during an inferior alveolar injection, a myositis may occur from extracting an infected tooth, and generalized muscle and/or

Table 8.1. Cursory TMD evaluation palpations for dental patients.

Anterior region of the temporalis muscle	Bilaterally palpate approximately 1.5 in. behind the eye canthus and 0.5 in. above the zygomatic arch (Figure 3.6).
TMJ	Three areas of the TMJ need to be palpated bilaterally, and any one of these can be tender without tenderness of the others. A common mistake is not having the patient open sufficiently to adequately palpate the TMJ. (1) Ask the patient to open approximately 20 mm and palpate the condyle's lateral pole. (2) Ask the patient to open as wide as possible and palpate the depth of the depression behind the condyle with the fingertip. (3) With the finger in the depression, pull forward to load the posterior aspect of the condyle (Figure 3.7).
Masseter muscle	Bilaterally palpate the center of the masseter muscle (Figure 3.8). If unsure of the muscle's extent, ask the patient to clench, and its extent can easily be felt.
Lateral pterygoid area	Slide the fifth digit along the lateral side of the maxillary alveolar ridge to the most posterior region of the vestibule (the location for the posterior superior alveolar injection). Palpate by pressing in a superior, medial, and posterior direction (Figure 3.22). If tenderness is observed, referred pain may be generated by applying heavier sustained pressure.

Table 8.2. Postoperative causes for TMD symptoms.

- The patient may have been predisposed to developing TMD and could not tolerate the forces that needed to be applied for the dental procedure.
- The patient may have referred pain from the treated tooth.
- The patient may have a myositis from treating an infected tooth.
- The patient may have a medial pterygoid spasm from an inferior alveolar injection.
- The patient may have muscle, TMJ, and/or tooth pain from providing an inharmonious occlusion.
- The patient may have muscle and/or TMJ pain from over and/or prolonged jaw stretching.
- The treated tooth's altered anatomy may not allow patient's stabilization appliance to fully seat, so the occlusion on the appliance is not adequate or the patient stopped wearing the appliance.
- The patient may have muscle and/or TMJ pain from psychosocial contributors that coincidentally occurred around the time of the dental treatment.
- Any combination of these.

TMJ pain may occur from placing a restoration with an inharmonious occlusion.

If a patient returns to the practitioner's office and complains of TMD pain after a dental procedure, the pain may also be postoperative tooth (or other dental structure) pain referring to the masticatory muscles and/or TMJ. An example of referred pain that dentists frequently observe is among patients with a mandibular third-molar osteitis, for which TMJ and/or ear pain is a common complaint. Referred pain to the masticatory muscles or TMJ may be observed from any tooth or deep structure that is causing postoperative dental pain.

A quick test to determine whether the treated tooth is contributing to the TMD symptoms is to percuss the tooth with the mouth mirror handle.[2] If it is not tender, the tooth is probably not contributing to the

TMD symptoms; if the tooth is tender, it is recommended the protocol outlined in "TMD Pain Caused by a Tooth" in Chapter 3 be followed.

Consider whether the patient normally wears a stabilization appliance at night and now that the anatomy on the treated tooth has changed, the patient may not be able to fully seat the appliance, so its occlusion may be causing the patient's TMD aggravation or the patient may have stopped wearing the appliance. If the treated tooth opposes the appliance, the occlusion against the appliance may be aggravating the patient's symptoms. Another consideration is that a significant psychosocial contributor that the patient has not even considered (e.g., moving in with a boyfriend, starting college) coincidentally occurred around the time of the dental treatment.

The following section of this chapter provides suggestions that can be used to prevent aggravation of preexisting TMD symptoms or for patients who appear prone to developing TMD symptoms following dental treatment. The next two sections discuss pain that may occur in the medial pterygoid muscle and disorders that can cause a patient to be unable to close into maximum intercuspation (MI) after dental treatment. The last two sections then discuss TMD sequelae generated from placing occlusally inharmonious restorations and TMD symptoms secondary to obstructive sleep apnea (OSA) appliances and treatment suggestions.

Preventing Aggravation from Dental Treatment

Prolonged or extensive opening of the mouth in addition to forces applied to the mandible may aggravate the masticatory muscles and TMJs. Some individuals relate they have TMD symptoms only after aggravating events such as dental treatment, and some TMD patients who have not completely eliminated their TMD symptoms relate they suffer symptom flare-ups from dental treatment. Many techniques are available to decrease the aggravation that patients may experience from dental treatment.

Make the patient's appointments for when the patient has minimal symptoms. If the patient has a daily symptom pattern, make the appointment for the portion of the day when the symptoms will be minimal. If the patient can predict future stressful or relaxing times, these usually affect the TMD symptoms, so appointments can be scheduled when the symptoms will be minimal. Some patients prefer short appointments, whereas others may prefer longer appointments that enable them to suffer through the postoperative discomfort fewer times. If several procedures are to be performed at one appointment, do the more difficult one first, because the patient should have greater stamina early in the appointment.

TECHNICAL TIP

Making Appointments

Make a patient's appointments for when the patient has minimal symptoms.

Some patients relate their masticatory muscles and TMJs become sore or stiff during dental treatment and would appreciate the opportunity to take a break periodically to move their jaw. The practitioner may wish to inform patients they are "allowed" to take stretching breaks and devise a form of communication so patients can notify the practitioner when they would like a break.

A number of patients find they have less TMD discomfort after using a bite block, whereas others relate its use aggravates their symptoms. If a bite block is used, the

practitioner should place it so the patient is open no further than will be needed for most of the intended procedure. The practitioner can periodically ask the patient to open wider and, as the patient requests, periodically remove it for stretching breaks. Once the bite block is placed, the patient should be informed that this is all the wider the practitioner needs him or her to open (at this time), that the patient should rest the teeth only lightly on the block (not bite it), and that the patient should indicate whenever a break is desired. Patients who previously found that the use of the bite block aggravated their symptoms may want to try it again using these recommendations.

With all patients, be cautious not to overly strain the masticatory system. Whenever force is applied to the mandible, a balancing force should be applied with the nondominant hand to support the mandible. Some patients are more prone to developing TMD, and forces that do not bother most patients may cause TMD symptoms among patients more predisposed to the disorder. The occlusion of all new restorations must be adjusted so they are in harmony with the rest of the dentition or the patient may develop TMD symptoms.

TECHNICAL TIP

Making Appointments

Make a patient's appointments for when the patient has minimal symptoms.

Some patients may desire premedication, others prefer postoperative medication, and some may need both. Many patients who develop mild to moderate TMD pain from dental procedures receive adequate relief from 800 mg ibuprofen, t.i.d. Depending on the severity of their symptoms, they may desire to start 1 or 2 days before the procedure and take it afterward for as long as needed. If ibuprofen does not provide adequate relief, I tend to prescribe patients who have TMJ arthralgia 500 mg naproxen, 1 tablet b.i.d. starting 1 or 2 days before the appointment. If the pain is primarily of muscle origin, I tend to prescribe 5 mg diazepam and ask the patient to take a tablet the night before and 1 hour prior to the appointment; the potential for daytime drowsiness and ramifications must be discussed with the patient.

Nitrous oxide-oxygen inhalation is also very beneficial in preventing TMD aggravation from dental appointments. We had one patient who had constant 7 out of a possible 10 bilateral jaw, preauricular, and temple pain, in which nitrous oxide-oxygen inhalation was used throughout her dental appointments. This was able to help keep the masticatory muscles relaxed during the procedures, and the patient had minimal aggravation of her TMD symptoms.

The fear of symptom aggravation may cause TMD patients to be reluctant to seek routine dental care and perform routine oral hygiene.[3] Empathy for their disorder and encouragement to obtain routine dental care and perform routine oral hygiene are usually quite beneficial for these patients.

Some TMD patients need restorations prior to fabricating a long-term occlusal appliance. This situation can be handled with one or more of the following techniques from which the practitioner may choose, provided in Table 3.3:

1. Restore the teeth on the arch that needs the least treatment, fabricate an appliance for this arch, and adjust the appliance's occlusal surface as the opposing restorations are placed.
2. Provide a temporary appliance (e.g., soft appliance), adjust the appliance's occlusal surface as the opposing restorations are placed, fabricate the final appliance for the restored arch, and adjust the appliance's

occlusal surface as the opposing restorations are placed.
3. Pharmaceutically manage the patient's TMD symptom until a temporary or the final stabilization appliance can be provided (e.g., cyclobenzaprine (Flexeril) 5 mg, 1–2 tabs h.s.; nortriptyline 10 mg, 1–5 tabs 0–3 hours prior to bed, m. dict.; or amitriptyline 10 mg, 1–5 tabs 1–6 hours prior to bed, m. dict.). One study found patients obtained equivalent TMD symptom benefit from 10 mg of amitriptyline and a stabilization appliance (Figure 17.1).[4]

Medial Pterygoid Muscle Pain

The most common disorder observed for the medial pterygoid muscle following dental treatment is a **medial pterygoid spasm**,[5] which may have been induced by trauma from the anesthetic needle piercing the medial pterygoid muscle during an inferior alveolar injection and/or the deleterious effect from the anesthetic solution.[6,7] The spasm may involve the entire muscle or be limited to the traumatized portion of the muscle.[8] The majority of patients treated for this disorder previously received multiple inferior alveolar injections, but some only had a single injection.

A patient who develops this disorder typically returns to the practitioner's office 1 or 2 days after a dental procedure that required an inferior alveolar injection. The patient complains of significant pain in the medial pterygoid muscle region and limited opening. Palpation of the masticatory muscles and TMJs typically reveal no or minimal tenderness, until the medial pterygoid muscle is palpated. The patient's limited opening often makes it difficult to palpate the medial pterygoid muscle, but once this is palpated, the patient's eyes usually "light up," and there is no doubt that this is the source of the pain.

The practitioner may want to confirm that the medial pterygoid muscle is the source of the limited opening by attempting to force the patient's mouth open into this restricted range. This can be performed by placing the index finger over the incisal edges of the mandibular incisors and the thumb over the incisal edges of the maxillary incisors and pressing the teeth apart by moving the fingers in a scissor-type motion (Figure 1.2). The patient will usually feel tightness or pain at the location of the restriction. The patient can then point to this location and the practitioner can palpate it to confirm that the previously felt discomfort may be reproduced by palpating in that location.

The practitioner may desire to begin with the "TMD Self-Management Therapies" handout provided in the Appendix; this provides a good initial education for many contributors that may interfere with this disorder resolving.

Stretching is the most beneficial therapy for a spasm.[9] The stretch should be slow, gentle, and into the restricted range. The force applied and duration held should be determined by patient tolerance, while ensuring the muscle is not aggravated. It is recommended that the muscle be stretched and held by the index and middle fingers for 30–60 seconds, 10 or more times a day, as demonstrated in Figure 8.1.

The stretch is more beneficial if the patient first heats the muscle; I recommend the patient use a heating pad for 10 minutes prior to each stretch. Anatomically, it would appear that superficial heat would not be beneficial for the medial pterygoid muscle because the muscle is fairly deep and superficially blocked by the ramus, but clinical experience has confirmed that patients with this disorder

Figure 8.1. Stretching exercise recommended for a masticatory closure muscle spasm, contracture, or a TMJ disc displacement without reduction with limited opening. This exercise is recommended rather than the "Closure Muscle-Stretching Exercise" in Appendix 6, because these conditions require more forceful stretching, which may cause the digastric muscles to become painful.

commonly report superficial heat is beneficial.

An analgesic (e.g., 800-mg ibuprofen, t.i.d.) can be provided, which enables the patient to better tolerate the disorder's discomfort and may allow the patient to provide a better stretch of the muscle. Muscle relaxants have been shown to be beneficial for muscle spasms,[10] so when this disorder is more severe, I generally prescribe 5-mg diazepam, 1 to 2 tablets h.s. and if severe enough to warrant, I add to the instruction for the patient to take one-half tablet in the morning and in the afternoon, if it does not cause drowsiness; I warn the patient about potential daytime drowsiness.

TECHNICAL TIP

Prescribing Medication for a Medial Pterygoid Spasm

For patients with a medial pterygoid spasm, I generally prescribe 800-mg ibuprofen, t.i.d., and 5-mg diazepam, 1 to 2 tablets h.s.

Depending on its severity and patient compliance, this disorder generally resolves in 5–10 days, but could take many weeks. If these initial therapies do not resolve the spasm, consider referring the patient to a physical therapist experienced with treating the masticatory musculature. If the spasm continues to recur, then traditional TMD therapies (e.g., occlusal appliance therapy or identifying and changing contributing factors) should be implemented.

On one occasion, a patient who had only minimal improvement with her limited opening was asked to implement a more aggressive stretching technique. This entailed her using wooden tongue depressors to stretch the medial pterygoid muscle more actively (up to tolerance), 10 or more times a day, and hold the stretch for 1 minute. She inserted as many wooden tongue depressors as would fit between her maxillary and mandibular incisors, and held them together with a rubber band. She next inserted an additional tongue depressor at the far end and slowly slid it between the others, providing additional stretch to her medial pterygoid muscle, as demonstrated in Figure 8.2. She continued to insert tongue depressors up to tolerance and eventually regained her normal opening. Tongue depressors could similarly be held together by placing them inside a finger cot or the finger of a glove. A case scenario of a patient with a medial pterygoid spasm is presented in "Case 8" in Part V.

Figure 8.2. Forceful stretching procedure that may be desired for a resistant medial pterygoid spasm, contracture, or fibrous ankylosis.

Clinically, a **medial pterygoid myositis** presents in a similar manner as a spasm. The myositis can be due to a bacterial infection of the muscle, which can occur from the presence of an abscessed tooth or extracting an infected tooth.[11] A practitioner might have to attempt to differentiate whether a patient has a medial pterygoid spasm or myositis, if the patient had an inferior alveolar injection to extract an infected tooth and returned complaining of significant medial pterygoid muscle pain and limited opening. If the patient has a fever or lymphadenopathy, this would suggest an infection is present, and antibiotics are indicated.

QUICK CONSULT

Observing a Medial Pterygoid Myositis

Clinically, patients with a medial pterygoid myositis present similarly to those with a medial pterygoid spasm.

The importance of following TMD patients and their symptoms cannot be overemphasized. An oral surgeon once referred me a patient who had TMD symptoms (generalized unilateral pain and palpation tenderness) after a tooth extraction. Based on the patient interview and clinical examination, the patient's symptoms were diagnosed as TMD. Two or three weeks later, she returned complaining that her airway was starting to become restricted. At my request, the patient returned that day to the oral surgeon, and a computed tomogram was made and suggested the symptoms were caused by a space infection. Once her infection was treated, her TMD symptoms resolved.

Inability to Close into Maximum Intercuspation

Occasionally at the end of a dental procedure, some patients have difficulty putting their teeth into MI. This can be a momentary or prolonged problem and can make it nearly impossible for the practitioner to adjust the occlusion of a new restoration.

Holding the mouth open wide for an extended period tends to fatigue a susceptible inferior lateral pterygoid muscle and inflame a susceptible TMJ. If a patient is predisposed to developing either of these problems, the susceptible structure may be the source for the patient's inability to close into MI.[11,12] Palpating the TMJs and lateral pterygoid areas (Table 8.1) should enable the practitioner to determine the source; this problem may be unilateral or bilateral. The top left section of the "TMJ Disc–Condyle Complex Disorders" diagram (Appendix 3) may help practitioners explain the cause and symptoms to patients.

TECHNICAL TIP

Explaining Cause and Symptoms to Patients

The top left section of the "TMJ Disc–Condyle Complex Disorders" diagram (Appendix 3) may help practitioners explain the cause and symptoms to patients.

If only the lateral pterygoid muscles are tender, they are probably fatigued (almost certainly due to the aggravation of preexisting myalgia) and are unable to stretch to their normal relaxed length. Therefore, they hold the condyles in a slightly translated position, and the first occlusal contact is often on the anterior teeth. In this situation, the TMJs are not tender to palpation, and the practitioner may be able to stretch the lateral pterygoid muscles, enabling the patient to close into MI. Stretching of the lateral pterygoid muscles is demonstrated in Chapter 9, "Lateral Pterygoid Spasm." If pain occurs in the TMJ while performing this stretch, there is probably some TMJ arthralgia, and continued stretching to this length will probably aggravate the arthralgia.

TECHNICAL TIP

Stretching the Lateral Pterygoid Muscle

If only the lateral pterygoid muscles are tender, stretching them often enables patients to close into MI.

If only the TMJs are tender to palpation, the diagnosis is TMJ arthralgia, and an anti-inflammatory medication should help prevent or resolve this problem; see "Anti-Inflammatory Medications" in Chapter 17. If both the lateral pterygoid areas and TMJs are tender to palpation, then both problems are probably present. If the TMJs are considerably more tender than the lateral pterygoid areas, the lateral pterygoid muscles may be sore from holding the condyles forward to protect the inflamed TMJs (protective muscle splinting) and, once the TMJ arthralgia is treated, the muscle splinting usually resolves.

TECHNICAL TIP

Reducing TMJ Arthralgia

If only the TMJs are tender to palpation, an anti-inflammatory medication should help prevent or resolve this problem.

Patients who report that this problem commonly occurs every time they receive dental treatment would probably benefit from using applicable suggestions in the section on "Preventing Aggravation from Dental Treatment" or see Table 8.3. Some patients may report they have TMD symptoms also at other times that are significant enough for them to desire TMD therapy.

As a general premedication guide, I tend to prescribe patients who have TMJ arthralgia an anti-inflammatory (e.g., 500-mg naproxen) and those who have muscle fatigue (probably aggravation of preexisting myalgia) a muscle relaxant (e.g., 5-mg diazepam). The dosing varies with the severity of the symptoms; that is, if symptoms are mild, ask the patient to take the medication 1 hour prior to the appointment, but if symptoms are severe, ask the patient to start the night before the appointment, 1 hour prior to the appointment, and an appropriate time after the appointment, as needed. If the patient is to take a muscle relaxant during the day, the potential side effects and ramifications must be discussed.

QUICK CONSULT

Prescribing Anti-Inflammatory and Muscle Relaxant Medications

I tend to prescribe patients who have TMJ arthralgia an anti-inflammatory (e.g., 500-mg naproxen) and those who have muscle fatigue a muscle relaxant (e.g., 5-mg diazepam).

If a patient requests medication for the discomfort from the dental procedure, the practitioner may desire to consider the patient taking the medication for a few days postoperatively. In healthy adults, the anti-inflammatory and muscle relaxants may be

Table 8.3. Preventing TMD aggravation from dental treatment.

- Make appointments for when the patient's symptoms are minimal, for example, in accordance with the patient's daily pain variation, when the patient anticipates there will be less stress in his or her life.
- Request that the patient ask for stretching breaks whenever he or she begins to feel the jaw stiffen.
- Request that the patient massage his or her masseter and temporalis muscles with a pressure slightly greater than what is needed to produce pain, whenever these muscles begin to feel sore.
- Use a bite block, if the patient finds this beneficial.
  - The patient does not bite on it, but just rests his or her teeth on it.
- Balance all forces applied to the mandible with the other hand.
- Use premedication and/or postoperative medications, as the patient desires.
  - Most patients find 800-mg ibuprofen, t.i.d. adequate
    - It may be beneficial to start 1 or 2 days before the appointment.
  - If ibuprofen is inadequate and the pain is primarily from the TMJ, recommend the patient take Aleve or prescribe 500-mg naproxen, 1 tablet b.i.d. starting 1 or 2 days before the appointment.
  - If ibuprofen is inadequate and the pain is primarily from the muscles, prescribe a muscle relaxant (e.g., 5-mg diazepam, 1 hour prior to appointment).
    - It may be beneficial to start the night before the appointment.
- Use nitrous oxide-oxygen inhalation during dental appointments.
  - This should help to keep the masticatory muscles relaxed, hence help to decrease the TMD symptoms during and after the dental treatment.

taken together; if additional analgesic relief is needed, acetaminophen can be added.

The inability to close into MI is not exclusively associated with dental treatment, but may be a chronic fluctuating problem for some individuals, with the source being the TMJ and/or the lateral pterygoid muscle. In fact, some dentists have informed me that they themselves experience having this problem after providing certain difficult dental procedures, after stressful events, or after a stressful day.

QUICK CONSULT

Observing Chronic Inability to Close into Maximum Intercuspation

The inability to close into MI is not exclusively associated with dental treatment, but may be a chronic fluctuating problem for some individuals, with the source being the TMJ and/or the lateral pterygoid muscle.

A lateral pterygoid muscle that is overused and remains fatigued might develop a spasm.[11] The spasm can occur independently of dental treatment and may cause a prolonged inability for the patient to close into MI. The diagnosis and treatment for this are discussed in Chapter 9, "Lateral Pterygoid Spasm."

Some patients may be able to close into MI immediately after the dental procedure, but develop this inability hours to days later. One patient was referred to me with this symptom pattern in addition to constant severe pain and tenderness in the lateral pterygoid area. The practitioner had unknowingly placed a large restoration over a maxillary premolar with an acute pulpalgia. The patient also had premolar pain to a lesser degree and a ligamentary injection along the premolar provided temporary relief of the lateral pterygoid pain. It is believed the pulp's deep pain input caused a spasm of the lateral pterygoid muscle.[11] Once the practitioner endodontically cleaned the premolar's canal,

the constant pain and inability to close into MI resolved.

Occlusal Interference Sequelae

Many studies have demonstrated that placing a restoration with an occlusion that is not in harmony with the rest of the dentition may cause patients to develop TMD symptoms.[13–15] These may develop relatively rapidly, occur on the ipsilateral and/or contralateral side of the restoration, and consist of masticatory muscle pain, TMJ pain, and/or new TMJ noises. The inharmonious change may be as minor as a pit and fissure sealant.

QUICK CONSULT

Placing an Inharmonious Restoration

Placing a restoration inharmonious with the rest of the occlusion may cause TMD symptoms, which develop relatively rapidly, occur on the ipsilateral and/or contralateral side of the restoration, and consist of masticatory muscle pain, TMJ pain, and/or new TMJ noises.

When a patient returns to the practitioner's office and complains of TMD symptoms that the practitioner believes are due to the recent placement of an occlusally inharmonious restoration, clinical experience has shown the restoration should be adjusted until the patient relates it feels comfortable.[16] The interference may be located in MI or any other position.

If the complaint is with a posterior tooth, first check whether the MI contacts on the new restoration are too heavy. Once it is observed the MI contacts are evenly distributed on the dentition, then check whether the tooth strikes in the eccentric positions. It is recommended the tooth's other contacts be marked with a thin red articulating film in the following manner: manipulate the patient's mandible into centric relation and ask the patient to squeeze so his or her teeth slide into MI, help the patient to return to centric relation and ask the patient to rub side to side on that tooth, ask the patient to bite down (into MI) and rub side to side, and finally ask the patient to slide the mandible forward. Next, use thin black articulating film and ask the patient to tap hard in MI. Clinical experience has shown that highly polished crowns reflect the red oral mucosa, making it difficult to observe the red marks on the crown, so a different color may be needed in this situation. I find occlusal indicator wax to be an excellent adjunct for identifying occlusal discrepancies, and it eliminates the reflection problem with polished crowns.

Reduce the new restoration wherever the red marks are located. The tooth should be adjusted so it feels comfortable to the patient. Occasionally, a restoration is adjusted as described, but the patient relates that it still feels uncomfortable. Clinically it has been observed that nonrestored portions of the tooth may need to be adjusted in the same manner prior to the patient relating that it feels comfortable. It is speculated this may occur because these teeth become tender to percussion, and prior nonideal contacts may no longer be perceived as comfortable.

Clinically it has also been observed that patients may believe a new restoration has an excursive contact when there is none. The excursive contact is found on an adjacent tooth and when removed, the symptoms resolve. It is speculated this may occur because the replaced restoration had an excursive contact, which felt natural to the patient. With this contact gone, another tooth

contacts in the excursive position and feels unnatural to the patient.

An anterior tooth may also need to be adjusted in centric and excursive movements. Observe whether the new restoration has heavier contacts than the other anterior teeth and adjust so it feels comfortable to the patient. If it appears the adjustments may compromise the patient's esthetics, the practitioner may need to discuss the possibility of providing minor adjustments of the opposing teeth.

Once the tooth feels comfortable to the patient, the TMD symptoms generally resolve rapidly. There is not a direct relationship between a newly placed interference and the development of TMD symptoms. In studies, some patients did not develop TMD symptoms from the placement of an interference, some in the control group (who unknowingly only had the placement of an interference simulated) developed TMD symptoms, and a few patients took up to 6 weeks to obtain symptom resolution after the interference was removed.[17,18]

QUICK CONSULT

Adjusting an Inharmonious Restoration

Once the tooth feels comfortable to the patient, the TMD symptoms generally resolve rapidly.

It is suspected that some of the control patients who developed TMD and the patients whose symptoms took an inordinate amount of time to resolve had a high predisposition for developing TMD symptoms. The likelihood of a patient's TMD symptoms not resolving once the tooth feels comfortable is low, but it is possible.

A patient who does not respond well to refining the occlusion, and for whom referred pain from the tooth has been ruled out, may have had his or her masticatory system aggravated during the dental procedure (e.g., from prolonged opening). Initial therapy for such patients may encompass discussing TMD self-management instructions and prescribing muscle relaxants and/or anti-inflammatory medications. If medications are desired, as a general guide, I tend to prescribe patients who have TMJ arthralgia an anti-inflammatory (e.g., 500-mg naproxen, 1 tablet b.i.d.) and those who have muscle pain a muscle relaxant (e.g., 5-mg diazepam, 1–2 tablets h.s.). The patient's case should be followed to ensure the symptoms resolve, and, if they do not, traditional TMD therapies should be instituted.

QUICK CONSULT

Failing to Relieve Symptoms

A patient who does not respond well to refining the occlusion, and for whom referred pain from the tooth has been ruled out, may have had his or her masticatory system aggravated during the dental procedure (e.g., from prolonged opening).

Obstructive Sleep Apnea Appliances

Obstructive sleep apnea (OSA) appliances have been shown to help patients manage snoring and OSA. These appliances hold the mandible in a protruded (50–75% of maximum protrusion) position the entire night, and some OSA patients develop TMD from wearing this appliance. These TMD symptoms generally develop right after the appliance is delivered, but tend to resolve over the next year (see Figure 8.3).[19,20]

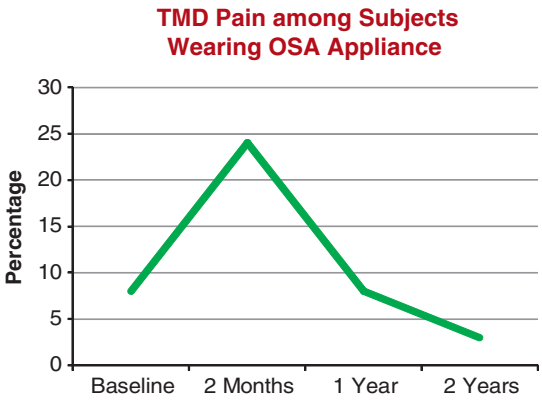

Figure 8.3. Change over time in the percentage of subjects wearing an obstructive sleep apnea appliance who had TMD pain.[19]

Patients with preexisting TMD signs and symptoms do not generally experience a significant exacerbation of these signs and symptoms. Therefore, OSA patients with TMD signs and symptoms can be offered an OSA appliance.

FOCAL POINT

A relatively small number of OSA patients will develop TMD from OSA appliances, and these appliances can be offered to OSA patients despite having preexisting TMD signs and symptoms.

Prior to fabricating an OSA appliance, it is recommended practitioners inquire about TMD symptoms and perform a cursory TMD evaluation by measuring the patient's opening, identifying the presence or history of TMJ noise, and checking for tenderness in the anterior region of the temporalis and masseter muscles, TMJs, and lateral pterygoid areas (Table 8.1). It is also recommended that all patients who are to be provided an OSA appliance be warned that TMD symptoms and TMJ noise may develop from wearing the OSA appliance, and if they are present, they may worsen.

Over time, some patients wearing an OSA appliance develop a posterior open bite,[20,21] and one study reported its prevalences at 4, 7, and 14 months were 5.8%, 9.4%, and 17.9%, respectively.[20] Generally, patients obtain such improvement of their OSA symptoms from wearing the appliance that they do not mind the decrease in chewing efficiency from the posterior open bite.

Several exercises have been studied that appear to reduce the tendency for patients wearing an OSA appliance to develop TMD symptoms or a posterior open bite.[22,23] The one I prefer is to instruct patients upon awaking, to place and hold a piece of plastic ($30 \times 10 \times 3$ mm) between their maxillary and mandibular central incisors. Next, patients slide their mandible as far forward and backward as possible for 5 seconds and then bite firmly on the plastic with their mandible positioned in a relaxed position for 10 seconds. Patients repeat this series of movements for 3 minutes.[22] An easy way to obtain this piece of plastic is to take a sheet of athletic mouthguard material and with a pair of scissors cut a piece that is approximately 30×10 mm.

Since OSA appliances tend to aggravate the masticatory musculoskeletal system, it is conceivable that additional TMD therapies may benefit patients who develop symptoms from wearing these appliances. It is speculated that the TMD therapies shown to be more beneficial for morning pain (e.g., employing a relaxation exercise just prior to sleep) would have greater benefit for these patients.[24] Additional TMD therapies are discussed in Part IV, "Multidisciplinary Treatment Approach."

For patients who do not obtain satisfactory improvement from these techniques, their TMD symptoms may benefit from a

stabilization appliance (the standard flat-surface appliance). It is recommended patients alternate the use of the OSA and stabilization appliances at their discretion, using their judgment to balance the appliance wear with their TMD and snoring or sleep apnea symptoms.

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Chapter 9

Lateral Pterygoid Spasm

This is the most common disorder seen among the emergency TMD patients I am referred. Patients and their dentists are often frantic because it develops almost instantaneously, and the patient can no longer close his or her teeth into maximum intercuspation (MI) and can no longer open wide. The patient also has constant pain and palpation tenderness of the lateral pterygoid area. A case scenario of a patient with this disorder is presented in "Case 17" in Part V.

QUICK CONSULT

Observing Emergency TMD Patients

The lateral pterygoid spasm is the most common disorder seen among the emergency TMD patients I am referred.

Observing for Lateral Pterygoid Spasm

Lateral pterygoid spasm develops almost instantaneously, and the patient can no longer close his or her teeth into maximum intercuspation, can no longer open wide, has constant pain, and has palpation tenderness of the lateral pterygoid area.

A spasm is the involuntary contracture of a muscle, causing pain and interfering with the muscle's ability to move.[1] This disorder has awakened many of us during the middle of the night with a painful cramp in one's calf muscle.

When the inferior lateral pterygoid muscle has a spasm, it is in a partially shortened state and holds the condyle in a partially translated position. This is generally far enough forward that the teeth no longer occlude into MI.[2,3] Additionally, the slope of the articular eminence dictates that, with the condyle translated, there is a space that forms between the ipsilateral posterior teeth (see Figure 9.1).

Similar to awaking with a calf spasm in which the individual has difficulty and increased pain when attempting to move the foot up or down, the person with a lateral pterygoid spasm has difficulty and increased pain attempting to translate the condyle forward or retrude the jaw so the teeth fit into MI. The patient usually complains of the inability to put the ipsilateral posterior teeth together without excruciating pain, and the first tooth contact is in the area of the contralateral canine (if the patient has a normal tooth alignment). Since the patient

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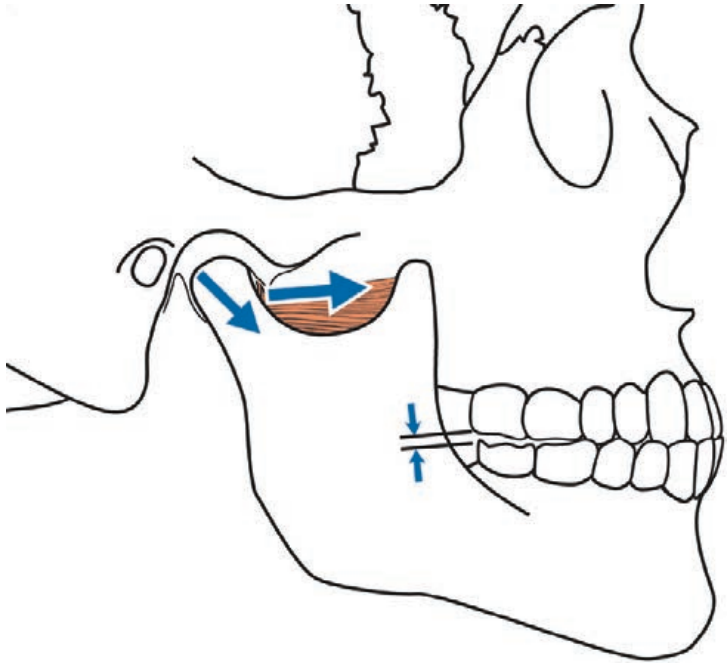

Figure 9.1. Lateral pterygoid spasm often causes a gap between the ipsilateral posterior teeth.

also has difficulty translating, he or she usually has a marked limited opening.

The severity of the spasm may vary, so the extent of these symptoms will differ from patient to patient; for example, a patient with minimal symptoms may complain about pain only when closing into MI. The overview drawing (top left) of the "TMJ Disc–Condyle Complex Disorders" diagram (Appendix 3) is used to visually explain the lateral pterygoid spasm symptoms to the patient.

TECHNICAL TIP

Explaining Lateral Pterygoid Spasm Symptoms

The overview drawing (top left) of the "TMJ Disc–Condyle Complex Disorders" diagram (Appendix 3) is used to visually explain the lateral pterygoid spasm symptoms to the patient.

By far, the most common reasons for the condyle to be held in a partially translated location are a lateral pterygoid spasm, TMJ arthralgia, or a combination of these disorders.[2,3] When the TMJ's retrodiscal tissue is inflamed, it can physically push the condyle forward or the lateral pterygoid muscle can be in a state of protective muscle splinting[4] in which the patient subconsciously holds the condyle forward to avoid compressing the inflamed retrodiscal tissue. When TMJ arthralgia is the sole cause for the patient's inability to occlude in MI, the lateral pterygoid muscle is healthy, and the patient would not have the significant limited opening as commonly observed with a lateral pterygoid spasm.

Once the history is obtained, the "Recommended Initial Palpations" in Chapter 3 (Table 3.1) are performed in addition to palpating the lateral pterygoid area. This provides the practitioner with a tentative

approximation of the relative lateral pterygoid spasm to TMJ arthralgia contribution to the patient's symptoms.

The practitioner may desire to use shim stock to confirm which teeth occlude. This is performed by placing shim stock along the occlusal surface of each maxillary tooth, asking the patient to close on the shim stock and try to hold it with the opposing teeth (Figure 3.27). I then record which maxillary teeth are able to hold the shim stock.

The primary treatment I use for a lateral pterygoid spasm is stretching the inferior lateral pterygoid muscle, as depicted in Figure 9.2. I perform this stretch to better approximate the lateral pterygoid spasm and TMJ arthralgia involvement, and the potential for it to provide effective therapy. To stretch the inferior lateral pterygoid muscle, place the thumb on the most posterior ipsilateral teeth and wrap the fingers around the mandible. One may prefer to use the dominant or nondominant hand. Some practitioners like to place gauze between the patient's teeth and their thumb to prevent discomfort from pressing on the cusp tips.

Push down with the thumb and pull up on the chin. This rotates the mandible, distracts the condyle, and provides more room to mobilize the condyle. While distracting the condyle, slowly push the mandible posteriorly up to approximately 4 lb of force and hold for about 30 seconds. Release the force, but maintain the hand position on the mandible. After about 5 seconds, repeat the 30-second stretch of the lateral pterygoid muscle. Perform six of these stretches, remove the hand, and ask the patient to close lightly.

If a lateral pterygoid spasm is the primary source for the patient's symptoms, the patient generally relates that the teeth fit together better and the pain has decreased. This

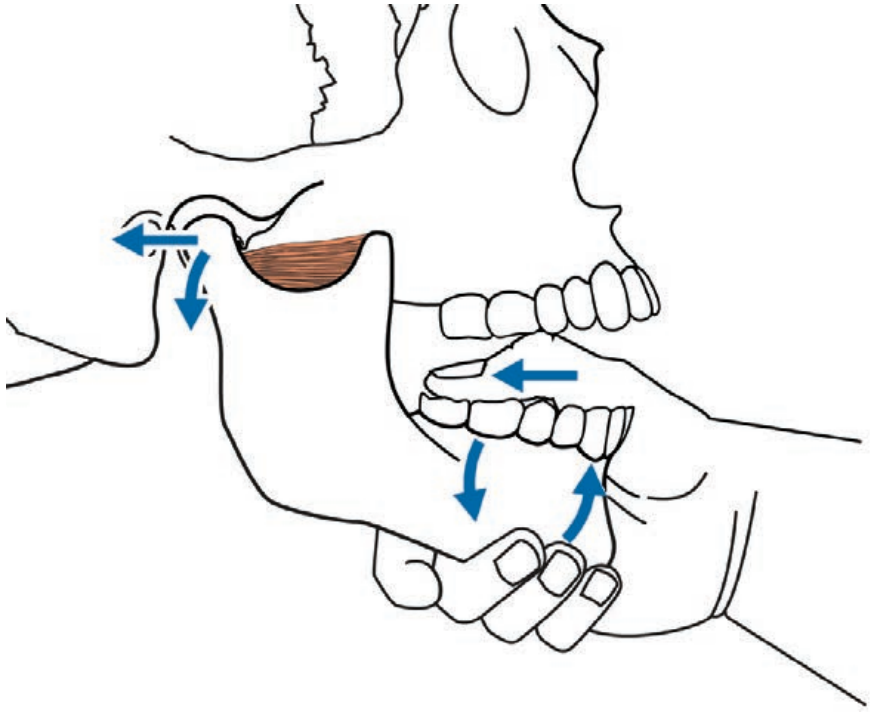

Figure 9.2. Stretching lateral pterygoid muscle.

suggests if the patient were to perform this stretch throughout the day, he or she may be able to resolve the disorder merely through lateral pterygoid muscle stretches.

If TMJ arthralgia is the primary source for the patient's symptoms, as the stretch is performed, the patient generally relates it aggravates the pain, so I then only stretch the lateral pterygoid muscle up to tolerance, and afterward ask the patient to close lightly. If there is any improvement, this would suggest a lateral pterygoid spasm is involved. Based upon the findings of this test, I speculate the involvement of each of these disorders.

TECHNICAL TIP

Differentiating Lateral Pterygoid Spasm and TMJ Arthralgia

Diagnose lateral pterygoid spasm, TMJ arthralgia, or a combination, based on a patient's symptom response to stretching the lateral pterygoid muscle.

Practitioners need to keep in mind that other, rarely observed disorders (e.g., tumor in TMJ) may cause similar symptoms and are beyond the scope of this book.[5,6] I once observed an individual who had an external ear infection that caused a similar inability to close into MI. The patient clearly knew the ear was the source of his pain and recognized the inability to close into MI; additionally the opening was not restricted. If a patient does not adequately respond to initial therapy or there is cause for other concerns, the practitioner may want to take a screening image of the TMJ with a plain radiograph (e.g., transcranial radiographs) or panoramic radiograph.

It is recommended that lateral pterygoid spasm treatment be provided in a tiered approach and the initial therapies be observed to determine whether they adequately resolve the problem. Initially provide the patient with the "TMD Self-Management Therapies" handout (Appendix 4) and with an exercise protocol to stretch the lateral pterygoid muscle. If the muscle pain is severe enough to justify medications, patients usually benefit from an analgesic (e.g., 800-mg ibuprofen, t.i.d.) and a muscle relaxant (e.g., 5-mg diazepam, 1–2 tablets h.s.).

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Providing Tiered-Approach Treatment

It is recommended that lateral pterygoid spasm treatment be provided in a tiered approach and the initial therapies be observed to determine whether they adequately resolve the problem.

The patient should perform this gradual active stretch of the inferior lateral pterygoid muscle up to tolerance, ensuring that neither the muscle nor the TMJ is aggravated from this procedure. It is recommended the patient perform a series of six stretches, six times a day, and hold each stretch for 30 seconds with a 5-second break between stretches.

If the patient cannot perform the stretches in this manner or prefers not to place his or her fingers in the mouth, an alternative technique has been recommended in which the patient uses a wooden tongue depressor to disengage the teeth and help retrude the mandible. The patient performs this exercise by placing a tongue depressor between the maxillary and mandibular incisors with the extraoral end of the tongue depressor tipped down at an angle of approximately 45° to the vertical. The patient slowly protrudes the mandible along the tongue depressor, then relaxes the jaw and retrudes the mandible up the incline,[7] and holds the retruded position as recommended previously.

At the follow-up appointment, the great majority of my patients with lateral pterygoid spasm report that performing the "TMD Self-Management Therapies" handout recommendations and the exercises resolved or are controlling their symptoms, and they have no desire to escalate therapy. If these initial therapies do not resolve the spasm or if the spasm continues to recur, then traditional TMD therapies (e.g., occlusal appliance therapy, identifying and changing contributing factors) should be implemented and have been shown to be beneficial.

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Reducing Symptoms of Lateral Pterygoid Spasm

The great majority of my patients with lateral pterygoid spasm report that the stretching exercises have resolved or are controlling their symptoms, and they have no desire to escalate therapy.

If the diagnosis includes TMJ arthralgia, it is generally recommended that the patient be provided an anti-inflammatory medication. If there is only mild TMJ arthralgia in comparison to the lateral pterygoid spasm, I consider prescribing 500-mg naproxen, b.i.d. If the primary diagnosis is TMJ arthralgia, if the condition is of recent onset or an acute aggravation of a chronic condition, and if the pain is mild to moderate, I provide the patient with the "TMD Self-Management Therapies" handout and tend to prescribe 500-mg naproxen, b.i.d. If the pain is a 6/10 or above, I consider prescribing the DexPak 6-Day TaperPak-naproxen regimen discussed in "Anti-Inflammatory Medications" in Chapter 17, in addition to the "TMD Self-Management Therapies" handout (Appendix 4). These patients should be followed to ensure the symptoms resolve; otherwise, traditional TMD therapies should be initiated and have been shown to be beneficial in resolving TMJ arthralgia.

Since the inability to close into MI is due to a temporary condition, it is important the practitioner does not adjust the occlusion at this transitory position. It is also important to be cognizant that TMD-stretching exercises (as in Appendix 6) are generally for closure muscles and will tend to aggravate a painful lateral pterygoid muscle.

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Chapter 10

Intermittent and Continuous Forms of TMJ Disc Displacement without Reduction with Limited Opening

FAQ

Q: If a patient has a temporomandibular joint (TMJ) disc displacement without reduction with limited opening, should the practitioner attempt to "unlock" the TMJ?

A: The longer the patient has had the TMJ disc displacement without reduction with limited opening, the less likely the dentist will be able to unlock the TMJ. There is no distinct time limit after which this procedure should not be attempted, but the success rate decreases rapidly as the condition extends beyond 1 week.

TMJ disc displacement without reduction with limited opening occurs suddenly with a marked restricted opening of less than 40 mm; the initial restricted opening is generally about 20–30 mm. Patients are usually aware that the structure that caused the click or pop now blocks them from opening wide. As patients attempt to open maximally, their mandible usually deflects toward the ipsilateral side. As patients attempt to move lateral and protrusive, their movement toward the ipsilateral side is fairly normal, while their movement toward the contralateral side and protrusive movement are restricted. Since they can no longer click or pop the TMJ, these noises are no longer present.[1] These signs and symptoms have been shown to be a reliable clinical indicator for identifying this condition.[2]

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Observing for TMJ Disc Displacement without Reduction with Limited Opening

Patients with this disorder present with some similarities to patients with a lateral pterygoid spasm; that is, both patients have limited opening, and their contralateral and protrusive movements are generally restricted.

Differentiating from Lateral Pterygoid Spasm

Patients with a TMJ disc displacement without reduction with limited opening present with many differences from patients with a lateral pterygoid spasm, the primary one being that the former can generally close their teeth into maximum intercuspation without pain.

Clinically, it has been observed that some patients with this disorder cannot or are reluctant to demonstrate the deviation upon maximal opening or the expected unrestricted movements. This may be due to pain on the contralateral side or guarding of the painful TMJ.

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Asking Patients about Symptoms

Patients are usually aware that they are no longer able to open beyond where their TMJ used to click or pop and their initial restricted opening is approximately 20–30 mm.

Many patients will initially have the intermittent form, which may last for seconds to days, and they are diagnosed with a **disc displacement with reduction with intermittent locking**. These patients report that the marked restricted opening occurred suddenly and just as suddenly released. Some patients relate that they perform specific maneuvers (e.g., moving the mandible from side to side) that helps to release it.

This disorder may progress to the continuous form in which the lock never releases and these patients are diagnosed with a **disc displacement without reduction with limited opening (closed lock)**. Over time, most individuals are able to regain their normal opening (40 mm or greater) and are diagnosed with a **disc displacement without reduction without limited opening**.

This disorder is demonstrated in the bottom right section of the "TMJ Disc–Condyle Complex Disorders" diagram (Appendix 3). As the individual opens and the condyle attempts to translate, the condyle is blocked by the disc's posterior band and cannot reduce onto the disc. As the patient repeatedly bumps into this restriction or attempts to open beyond it, the retrodiscal tissue is forcibly stretched, releasing inflammatory and pain mediators into the synovial fluid (see Figure 10.1), which causes (or increases) TMJ arthralgia.

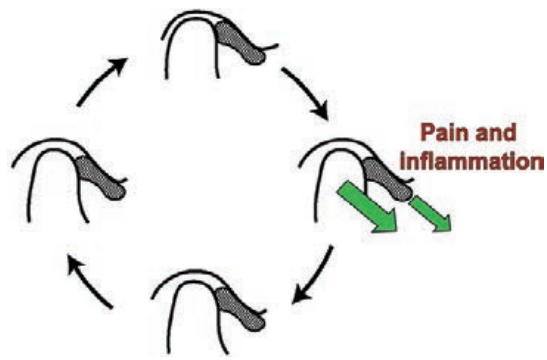

Figure 10.1. Condyle is caught behind disc's posterior band, and as patient tries to translate the condyle (open wider), the disc is pushed forward, stretching the retrodiscal tissue, causing inflammatory and pain mediators to be released into the synovial fluid, causing the patient to experience pain, and increasing the patient's TMJ palpation tenderness (TMJ arthralgia).

Patients with this disorder present with some similarities to patients with a lateral pterygoid spasm; that is, both patients have limited opening, and their contralateral and protrusive movements are generally restricted. Fortunately, there are many differences that enable practitioners to separate these diagnoses clinically; for example, a patient with a TMJ disc displacement without reduction with limited opening generally can close his or her teeth into maximum intercuspation without pain.

TECHNICAL TIP

Explaining TMJ Disc Displacement without Reduction with Limited Opening

This disorder is demonstrated in the bottom right section of the "TMJ Disc–Condyle Complex Disorders" diagram (Appendix 3), which should be helpful in explaining the disorder to patients.

FOCAL POINT

As the patient repeatedly bumps into this restriction or attempts to open beyond it, the retrodiscal tissue is forcibly stretched, releasing inflammatory and pain mediators into the synovial fluid.

The patient with a TMJ disc displacement without reduction with limited opening generally points to the TMJ as the source of the pain, and the TMJ is generally the most palpation-tender masticatory structure. The masticatory muscles often tighten in response to the TMJ pain (protective muscle splinting), so they are also frequently tender and painful, but not as tender as the TMJ. If there is a question about the source of the restriction, the patient's mouth can be stretched to aggravate the restricting structure (as discussed in "Additional Evaluations" in Chapter 3), and confirm this location by reproducing the pain through palpation.

Some patients with this disorder also complain about painful anterior and/or posterior digastric muscles, which are small jaw-opening muscles that are not developed to provide repeated forceful contractions. These muscles are generally painful from the patient repeatedly opening his or her mouth, pushing against the disc, in an attempt to free or stretch this restriction. Occasionally, these muscles are as painful as the TMJ.

Direct trauma occasionally causes a TMJ disc displacement without reduction with limited opening.[1] If the patient relates that the sudden limited opening is due to external trauma, then muscle injury, TMJ arthralgia, and fracture should also be considered as possible causes of the restriction. In this situation, a panoramic radiograph should be taken to rule out a fracture.

This disorder's onset is most commonly related to repeated loading of the TMJ through activities such as parafunctional habits. It is speculated that the progression occurs from thinning of the retrodiscal tissue by the parafunctional habits loading the condyle against the retrodiscal tissue, and causing the condyle to move upward in the mandibular fossa relative to the posterior band.[3–5]

An easy manner in which to explain this disorder to patients is through the use of the "TMJ Disc–Condyle Complex Disorders" diagram (Appendix 3). Start by orienting the patient to the diagrams and explain the mechanism of the disc displacement with reduction (which the vast majority of patients had prior to the onset) in the bottom left diagram. Explain that the condyle repeatedly loaded the retrodiscal tissue (through parafunctional habits, eating tough foods, etc.), thereby thinning the tissue so the condyle is now higher in the mandibular fossa. For the

condyle to reduce onto the disc, it must now fall further to travel below the posterior band. This is now difficult, and in the patient's situation, the condyle cannot move below the posterior band. The posterior band now blocks the condyle from translating forward, as shown in the bottom right diagram.

Depending on how I plan to treat the disorder, I may inform the patient that the tension held in the muscles (the closure muscles: masseter, temporalis, and medial pterygoid) contributes to the continuation of the disorder by bracing the condyle higher in the mandibular fossa. I also might inform the patient that the tension held in these muscles continues to load the retrodiscal tissue, aggravating the TMJ. This tension is usually related to stress, parafunctional habits, or eating.

Intermittent Disorder (Disc Displacement with Reduction with Intermittent Locking)

Some patients complain that this disorder occurs only intermittently (may last seconds to days) and is not present at the time of the dental appointment. It is recommended that the mechanical problem just discussed be reviewed and inquiry be made about the type of events that seem to precede or initiate the disorder.

Based on a study that followed untreated subjects with this disorder, it appears that the TMJs of the majority of individuals with the intermittent disorder (disc displacement with reduction with intermittent locking) will progress to the continuous disorder with a limited opening (disc displacement without reduction with limited opening), and then regain their opening (disc displacement without reduction without limited opening). None of the subjects in the study who moved through these stages developed significant symptoms or needed treatment, suggesting among the general population that it is rare for an individual to develop the classic symptoms that are seen with the continuous disorder where the opening is limited.[6] It appears that only a small portion of the population has a problem regaining their opening, but they are the ones who discuss it with their practitioners, giving practitioners a false sense of the high prevalence of symptoms from individuals moving through these stages.

In spite of this, patients who inform their practitioners of having this intermittent disorder, it is recommended that these patients receive conservative therapy to attempt to keep it from progressing and/or minimize the symptoms associated with its progression. Patients commonly report that an increase in their intermittent locking severity is associated with daytime parafunctional habits, nocturnal parafunctional habits, or eating, which are the times the condyle is most heavily loaded against the retrodiscal tissue.[4]

If the patient awakes with the intermittent disorder, nocturnal parafunctional habits are probably the primary contributor, and it is recommended that the practitioner (1) review the "TMD Self-Management Therapies" (Appendix 4), with special emphasis on sleep posture; and (2) provide the patient with a stabilization appliance that is worn at night, which has been shown to unload the TMJ.[7–10] If the disorder is not adequately resolved by these therapies, other traditional temporomandibular disorder (TMD) therapies should benefit this disorder (see "Integrating Conservative Therapies" in Chapter 19).

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Observing Waking Intermittent Symptoms

If the patient awakes with the intermittent disorder, nocturnal parafunctional habits are probably the primary contributor.

If the intermittent disorder occurs during the day, the primary contributors are probably daytime muscle tension and/or parafunctional habits. In addition to the TMD self-management instructions, it is recommended that the patient become aware of the daytime muscle tension and parafunctional habits and learn to break them (breaking these parafunctional habits is discussed in "Breaking Daytime Habits" in Chapter 14). If this does not adequately resolve the disorder, I would ask a psychologist to help the patient break the daytime parafunctional habits (as discussed in "Breaking Daytime Habits" in Chapter 16). If the patient needed additional assistance, it is recommended that therapy be escalated by fabricating an appliance for the patient to wear at night to decrease the impact any nocturnal parafunctional habits may have on the problem. Until the patient learns to control the daytime muscle tension and parafunctional habits, the appliance may also be worn for a limited time during the day, especially in situations the patient relates to preceding or initiating the disorder (except for eating). If these techniques do not adequately resolve the disorder, other traditional TMD therapies should benefit this disorder (see "Integrating Conservative Therapies" in Chapter 19).

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Observing Daytime Intermittent Symptoms

If the intermittent disorder occurs during the day, the primary contributors probably are daytime muscle tension and/or parafunctional habits.

For patients with the intermittent disorder, three techniques can be discussed that they may find beneficial for "unlocking" their TMJ, provided in Table 10.1. About half of my patients can "unlock" their TMJ by placing their finger about 0.5 in. anterior to their TMJ, pressing medially and slightly posterior, and moving the mandible side to side. It is speculated that this pressure tends to push tissue between the condyle and fossa, helping to distract the condyle, enabling it to slide more easily under the posterior band of the disc.

Table 10.1. Techniques for patient to attempt to unlock a disc displacement without reduction with limited opening.

1. Place your index finger about 0.5 in. in front of your locked TMJ, press inward and posterior. While doing this, move your lower jaw side to side. About half of the patients are able to "unlock" their TMJ in this fashion. If this does not work for you, go to the second technique.
2. Relax and massage your temporalis and masseter muscles. As these muscles relax, move your lower jaw side to side. If after a few minutes of performing this, your TMJ did not unlock, go to the third technique which may cause some discomfort.
3. Move your lower jaw as far as possible to the side in which the TMJ is *not* locked, then open as wide as you can. This attempts to forcibly unlock your TMJ and may cause some discomfort.

▼ TECHNICAL TIP

Unlocking a TMJ Disc Displacement with Reduction with Intermittent Locking

For patients with the intermittent disorder, three techniques can be discussed that they may find beneficial in unlocking their TMJ, provided in Table 10.1.

A second procedure is for patients consciously to relax and massage the

temporalis and masseter muscles. As these muscles relax, ask patients to move the mandible side to side. It is speculated that the closure muscles are often tight when the intermittent disorder occurs, bracing the condyle higher in the fossa. As these muscles relax, the condyle distracts slightly, enabling it to slide more easily under the posterior band of the disc as the patient moves the mandible to the contralateral side.

A third technique some find beneficial is to slide the mandible as far as possible to the contralateral side and then open maximally.[1,11] This attempts to forcibly reduce the condyle onto the disc and often causes discomfort as this vigorous reduction occurs.

It is recommended that patients first try pressing in front of the TMJ because this is a quick nonaggravating maneuver. If that does not unlock the TMJ, then try relaxing and massaging the temporalis and masseter muscles while moving the mandible side to side. It is recommended that the third maneuver be used as a last resort because of the discomfort that often occurs when the condyle abruptly reduces.

There is another technique that can be utilized in your office if this disorder is caught immediately after the lock occurred. It entails bilaterally placing cotton rolls between the last occluding teeth in mouth and asking the patient to lightly close on them. Next, the practitioner places the palm of the dominate hand under the chin and the palm of the other hand on top of the patient's head. Progressively apply a relatively strong upward force on the chin for 5 minutes. By using the cotton rolls as a fulcrum, the condyle distracts slightly, enabling it to slide more easily under the posterior band of the disc as the patient moves the mandible to the contralateral side.[5]

It is recommended that patients with the intermittent disorder be treated with conservative therapies in an attempt to resolve their intermittent locking and TMD pain. Otherwise, it is feared that the disorder may progress from intermittent to continuous, and TMD pain severity appears to be one of the factors predicting which patients will be thus affected.[12] A case scenario of a patient with a TMJ disc displacement with reduction with intermittent locking is presented in "Case 13" in Part V.

Continuous Disorder (Disc Displacement without Reduction with Limited Opening, Also Known as Closed Lock)

In treating patients who have the continuous disorder, one practitioner reports that manipulation to unlock the TMJ is often successful for patients who have been locked for less than a week, but the success rate decreases rapidly as the condition extends beyond 1 week.[1] There is no distinct time limit after which this procedure should not be attempted, and is only up to the practitioner's and patient's discretion.

One technique is to first have the patient attempt to self-unlock. Ask the patient to consciously relax and massage the closure muscles, and then make several attempts at unlocking the TMJ by moving the mandible to the contralateral side as far as possible and opening maximally. If this is unsuccessful, the practitioner can manually distract the TMJ by placing the thumb on the most posterior ipsilateral teeth, wrapping the fingers around the chin, and pressing down on the posterior teeth and up on the chin (Figure 10.2). This motion is similar to removing the cap from a soda pop bottle. Some practitioners like to place gauze between the teeth and their thumb to prevent discomfort from pressing on the cusp tips. After distracting the TMJ for approximately 30 seconds, maintain the force and ask the patient to repeat the prior movements several times.[4] If this is

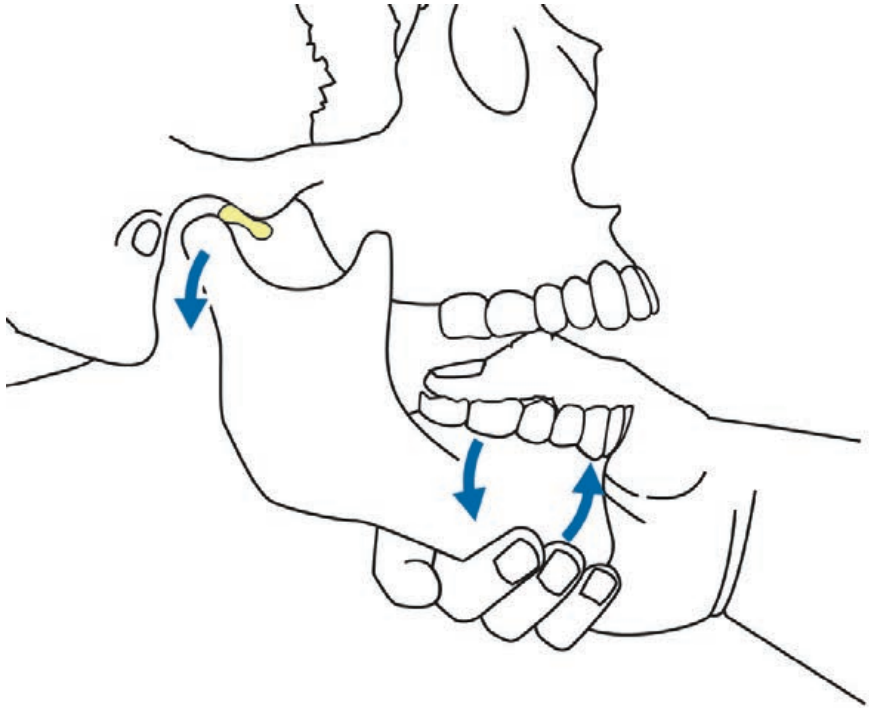

Figure 10.2. Manually distracting the TMJ.

unsuccessful, while continuing to distract the TMJ, the practitioner can attempt to move the condyle forward and medial (the usual location of the disc) in an attempt to unlock the TMJ (Figure 10.3).

The practitioner can easily tell whether the unlocking procedure was clinically successful because the patient immediately regains the normal opening, even though findings on magnetic resonance imaging often show that complete reduction is not obtained.[13]

If these were unsuccessful and the patient and practitioner would like to continue attempting to unlock the TMJ, many additional procedures can be used in conjunction with the manipulation. They attempt to decrease the patient's pain (which reduces the patient guarding) and/or relax the patient (which reduces the tension in the closure muscles). These procedures include nitrous oxide–oxygen inhalation, lateral pterygoid muscle anesthetic injection, lateral pterygoid and masseter muscle anesthetic injection, TMJ anesthetic injection, and an oral anti-inflammatory and/or muscle relaxant prescription.[14–16] Once these medication(s) have taken effect, the practitioner can attempt to unlock the TMJ by the same manipulations described previously.

If the practitioner is successful at unlocking the TMJ, the patient often needs to wear an anterior positioning appliance to hold the condyle in the reduced position (Figure 10.4). Otherwise, the condyle will tend to lock again when it is retruded off the disc. A quick, easy technique for fabricating a temporary anterior positioning appliance is to use the putty that is used for crown and bridge impressions.[17] Ask the patient to place the anterior teeth end to end, which provides a stable reproducible position where the condyle is usually reduced on the disc. Mix the putty into the shape of a

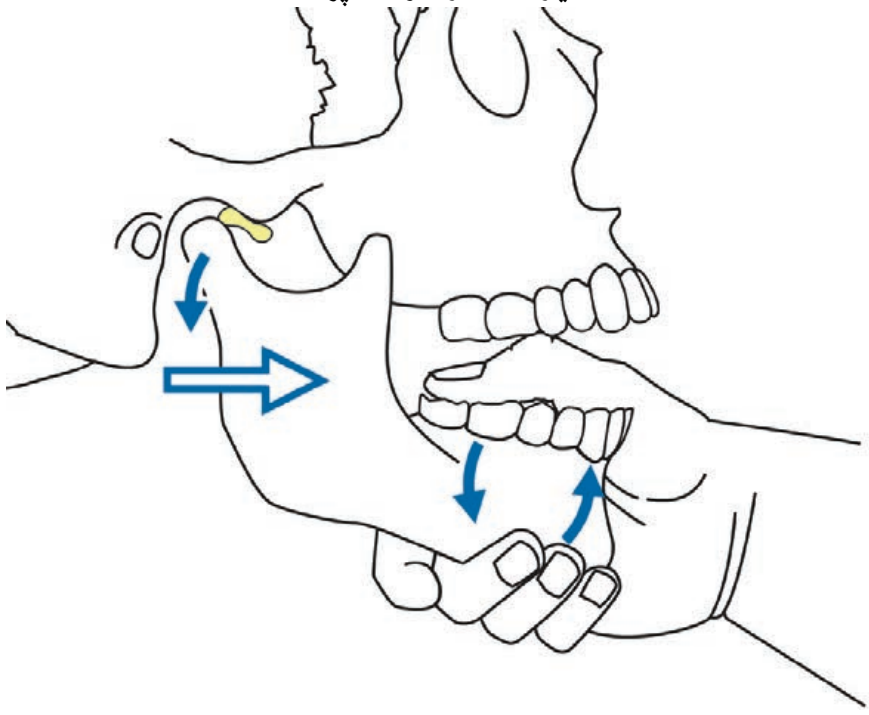

Figure 10.3. Moving the condyle forward and medial while manually distracting the TMJ.

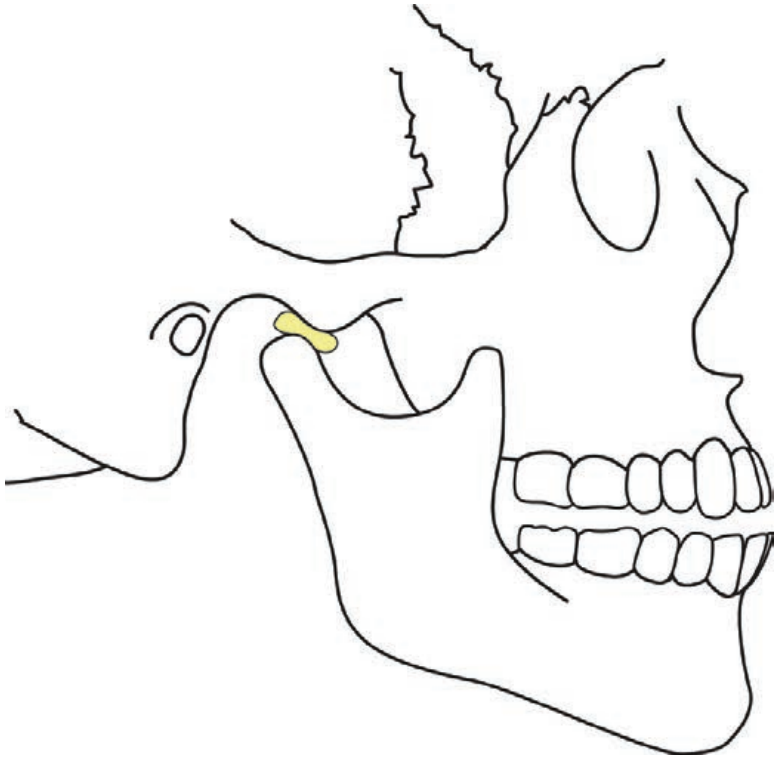

Figure 10.4. The condyle in the reduced position.

thick rope 4–5 in. long, ask the patient to open, place the material along the occlusal–incisal surfaces of the teeth, and ask the patient to close to the prior end-to-end position, but stop the patient so about 1 mm of material remains between the maxillary and mandibular anterior teeth. Adjust the appliance so it is retentive for the mandibular teeth and has only approximately 1- to 2-mm-deep indentations for the maxillary teeth (Figure 10.5 and Figure 10.6).

Figure 10.5. Maxillary view of the temporary anterior positioning appliance.

Figure 10.6. Mandibular view of the temporary anterior positioning appliance.

TECHNICAL TIP

Fabricating a Temporary Anterior Positioning Appliance

A quick, easy technique for fabricating a temporary anterior positioning appliance is to use the putty that is used for crown and bridge impressions.

It is recommended that patients wear the appliance 24 h/day, including while eating (these patients will generally drink their meals during this phase of treatment). Depending on the pain severity associated with this disorder, the practitioner may desire to prescribe an anti-inflammatory and/or muscle relaxant (as will be discussed later and in Chapter 17, "Pharmacological Management").

The long-term treatment plan for these patients generally includes wearing a stabilization appliance (the standard flat-surface appliance) at night. Because of the time needed for its fabrication, if the patient does not already have one, the practitioner may desire to make impressions to fabricate one as soon as the patient can tolerate it.

Patients should wear the temporary putty appliance 24 h/day for the first 2–4 days before transitioning to nighttime-only wear.[1] The number of days of continuous wear varies with patients' propensity for the TMJ to relock. Similarly, over time, patients transition to wearing the stabilization appliance, modulated by the propensity for the TMJ to relock. A case scenario of a patient with a TMJ disc displacement with reduction with limited opening that was unlocked is presented in "Case 14" in Part V.

Clinically, I am not successful in unlocking the TMJs for many patients with this disorder. Even though the TMJ could not be unlocked or the practitioner does not feel comfortable attempting these manipulations or managing the patient once the TMJ unlocks, the vast majority of these patients do well with conservative TMD therapy.[14,18] In fact, many patients with this disorder improve without treatment;[6,19] the symptoms tend to gradually fade away over a few weeks or months.[20]

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Unlocking the TMJ

Clinically, I am not successful in unlocking the TMJs for many patients with this disorder.

FOCAL POINT

Even if patients' TMJs are not unlocked, the vast majority do well with conservative TMD therapy.

One study followed the cases of individuals who chose not to have treatment for this disorder (their symptoms tended to be mild) and found that the approximate portions of the group at 6, 12, and 18 months whose symptoms had resolved were one-third, one-half, and two-thirds, respectively.[19] The investigators found that younger individuals more readily become asymptomatic without treatment.[21]

It is speculated that the reason people can progress through this disorder is that they often unintentionally apply a stretching force to their retrodiscal tissue. Every time an individual with this disorder opens to the restriction, the condyle pushes the disc forward (see Figure 10.1). This may unintentionally occur when the person talks, laughs, puts food in the mouth, and so on. Repeatedly bumping or pushing the disc in this manner will often sufficiently stretch the retrodiscal tissue over time. As the retrodiscal tissue is stretched, the disc moves forward, eventually the disc is pushed out of the condyle's translation path, and the individual regains the normal opening. As this progression occurs, the retrodiscal tissue typically gets stretched less often, and the amount of inflammatory and pain mediators released into the synovial fluid is correspondingly reduced, allowing the TMJ arthralgia to improve proportionally. If the microtrauma to the retrodiscal tissue (from parafunctional habits, muscle tension, etc.) is satisfactorily small, the TMJ arthralgia may totally resolve.

FOCAL POINT

Every time an individual with this disorder opens to the restriction, the condyle pushes the disc forward. Repeatedly bumping or pushing the disc in this manner will often sufficiently stretch the retrodiscal tissue over time.

Even though many individuals can progress through this disorder with no or minimal treatment, others have excruciating pain and desperately need help. Conservative treatment for this disorder primarily attempts to reduce the TMJ arthralgia and TMJ loading. This promotes a synovial fluid environment that facilitates more rapid adaptive alterations of the retrodiscal tissue.[22] Additionally, patients often benefit from adjunctive up to tolerance stretching to help mobilize the disc out of the condyle's translation path.[1,23]

Sufficient studies have not been completed to suggest a specific conservative therapy regimen, and conservative therapy's success is highly variable from patient to patient.[18,24] Most patients with this disorder are successfully treated with conservative TMD therapies, but some patients will not satisfactorily improve and will need to have their level of therapy escalated.[18]

The amount of conservative therapy I initially provide these patients varies with the level of their pain, the length of time they have had the disorder, and whether their limited opening has improved. It is recommended that all of these patients be provided with the explanation discussed earlier and a "TMD Self-Management Therapies" handout (Appendix 4), emphasizing the

importance of observing for and breaking any daytime contributing habits.

QUICK CONSULT

Providing Conservative Therapy

The amount of conservative therapy I initially provide these patients varies with the level of their pain, the length of time they have had the disorder, and whether their limited opening has improved.

Most of my patients receive a stretching exercise unless they have such severe TMJ pain that it is believed that performing the exercise will be too painful at the time, or a patient has rapidly regained most of the opening and the exercise is considered unnecessary. The exercise tends to aggravate the TMJ, but most patients are prescribed an anti-inflammatory medication, so they generally can tolerate the exercise. The patient is instructed to perform the exercise as shown in Figure 8.1, hold the stretch 30–60 seconds, and sporadically perform this approximately six times throughout the day. The patient needs to balance the amount of force, length of time the stretch is held, and number of times the stretch is performed throughout the day, so the resulting TMJ pain is tolerable.[1,23] Patients are asked, when possible, to preheat the TMJ with a heating pad prior to the exercise and continue for a few minutes after the exercise.[25]

As a general pharmaceutical guide, I tend to prescribe the following for patients with constant pain. This will vary with a patient's fluctuating pain-intensity pattern, the TMJ palpation tenderness, and the emotional impact of the disorder. If the patient has a low level of TMJ pain (3/10 or below), I tend to prescribe 500 mg naproxen, b.i.d. If the TMJ pain is above 3/10, I consider prescribing the DexPak 6-Day TaperPak-naproxen regimen discussed in "Anti-Inflammatory Medications" in Chapter 17. If nocturnal parafunctional habits appear to be contributing to the TMJ arthralgia (the patient awakes with TMJ pain), I also tend to prescribe 5 mg diazepam, one to two tablets h.s., to decrease the nocturnal parafunctional habits until a stabilization appliance can be inserted.

If there is muscle pain, I tend to prescribe 5 mg diazepam, one to two tablets h.s. If the patient has significant muscle pain causing a substantial amount of daytime pain, I consider discussing the possibility of the patient also taking 1/2 tablet in the morning and afternoon; the potential side effects and ramifications must be discussed. I maintain the patient on 5 mg diazepam, one to two tablets h.s., and/or nonsteroid anti-inflammatory drugs as long as it appears they are beneficial. This is the only TMD disorder for which I might continue prescribing diazepam for longer than 2–3 weeks.

I find it very helpful to also refer these patients to a physical therapist knowledgeable with these disorders. The physical therapist I work with sees the patient two to three times a week, provides heat followed by mobilization of the condyle, monitors the patient's progress, encourages the patient to stretch the retrodiscal tissue and break daytime muscle tightening habits, answers questions, and informs the patient when the stretching should be reduced and eventually stopped.

The longer patients have had this disorder, the less likely they are to do well with conservative therapy.[24] Therefore, at the initial exam, if a patient reports having had the disorder for more than 2 months or so, especially if the patient has not observed improvement in limited opening, I tend to include a stabilization appliance as part of my initial therapy. A stabilization appliance, in addition to these other therapies, generally provides greater benefit for these patients.[18,24]

If a patient cannot open wide enough that an adequate mandibular impression can be made, the practitioner has several options: (1) make only a maxillary impression and fabricate an appliance that does not need an opposing cast, for example, soft appliance; or (2) make the mandibular impression after removing a portion of the tray's lingual flange. If this results in an inadequate impression and a mandibular appliance is preferred, fabricate a temporary mandibular appliance (e.g., soft appliance) and, if desired, replace it once the opening sufficiently improves.

During treatment, closely monitor the opening and pain level to ensure the patient is responding well to the initial therapy. If it appears the patient is not responding quite positively to this therapy over the next 1 or 2 weeks, and a stabilization appliance is not being used, escalate therapy by adding the appliance.

While under therapy, it is not uncommon for a patient to report that his or her TMJ has unlocked. This situation is different than when a practitioner manipulates a patient to unlock his or her TMJ, for in this situation, the TMJ does not tend to relock immediately and therefore an anterior positioning appliance is not needed. Even though the TMJ unlocked, it is important that the patient continue therapy and become as asymptomatic as possible, for patients with greater pain and/or intermittent locking appear to have a greater propensity for redeveloping this disorder.[6,12]

If a patient does not appear to be improving from the conservative therapy or is frustrated with the slow progress, the practitioner may desire to escalate treatment to an invasive procedure.[26] Studies show that conservative therapy, arthrocentesis, and arthroscopic surgery provide a similar degree of improvement for this disorder.[18,27] Flushing the pain and inflammatory mediators out of the TMJ through arthrocentesis or arthroscopic surgery appears to enable patients to rapidly stretch the retrodiscal tissue. If the perpetuating contributing factors (e.g., parafunctional habits) were never adequately controlled, the TMD pain may return after the surgery and the contributing factors would need to be addressed.[18,28]

QUICK CONSULT

Escalating to an Invasive Procedure

If a patient does not appear to be improving from the conservative therapy or is frustrated with the slow progress, the practitioner may desire to escalate treatment to an invasive procedure.

Additionally, referral for these procedures should not be unnecessarily delayed when it becomes evident that conservative therapy will not be successful; the longer the patient has this disorder, the less likely it is that much benefit will be derived from arthrocentesis and the more likely that arthroscopic surgery or a more invasive surgery may be needed.[29,30] TMJ injections with anesthetic, steroid, and/or sodium hyaluronate (not yet approved by the Food and Drug Administration [FDA] for use in the TMJ) have also been recommended and are also reasonable considerations for treating this disorder.[31–33]

If surgical intervention was chosen as the first line of treatment, the contributing factors that caused this disorder to develop (e.g., parafunctional habits) will often need to be dealt with after the surgical intervention. If they are not satisfactorily reduced, there is a high likelihood that TMD symptoms will return.[18]

A case scenario of a patient with a disc displacement with reduction with limited opening that was treated with conservative therapies is presented in "Case 15" in Part V.

An alternative hypothesis for this disorder has been presented in the literature, in which TMJ loading causes a breakdown of the synovial fluid, potentiating the tendency for the superior portion of the disc to adhere to the articular eminence in a fashion similar to a suction cup. It is theorized that the anterior displacement is caused by the disc adhering to the articular eminence while the condyle is translated and, as the condyle retrudes, the disc remains anchored anteriorly. Conservative therapy can decrease the TMJ loading, allowing the reconstitution of the "healthy" synovial fluid, thereby promoting the release of the adhered disc. Pressure injections and arthrocentesis can be beneficial for treatment of this condition and are recommended if conservative therapy is not successful.[26,34] As more information is obtained about this condition, it may become recognized as an independent TMD disorder.

Practitioners must bear in mind that a patient's inability to translate may be due to a neoplastic growth within the TMJ. Neoplasia arising within the TMJ are rarely the cause for TMD,[35] but the practitioner may desire to make a screening radiograph, such as a transcranial or panoramic radiograph, during the initial evaluation or if the initial therapy does not improve the patient's condition.

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Chapter 11

TMJ Subluxation and Luxation

A **TMJ subluxation** is diagnosed when a patient relates a history of momentary inability to close the mouth from a maximal open position, in which the patient had to perform a specific maneuver to close the mouth. It is common for individuals whose condyle gets caught in this manner to be able to self-reduce.[1,2]

A **TMJ luxation** (also known as open lock) is diagnosed when a patient presents with or relates a history of being unable to close his or her mouth from maximum opening and requires or required a practitioner to manipulate the condyle back into the mandibular fossa.

These disorders are due to the condyle being trapped in front of the articular eminence.[3] The entrapment may be from the articular eminence obstructing the posterior movement of the disc–condyle unit, the disc obstructing the posterior movement of the condyle, or a combination of the two.[4]

QUICK CONSULT

The Difference between TMJ Subluxation and Luxation

A temporomandibular joint (TMJ) subluxation is diagnosed when the patient is able to self-reduce and a luxation is diagnosed when the patient must have someone else reduce the condyle from the maximal open position for him or her.

These disorders are extremely easy to diagnose. The patient relates a history of a sudden catching or locking near maximal opening (e.g., from a yawn, dental procedure, or yelling). If the duration is more than momentary, the closure muscles become painful, tend to develop spasms, and make it progressively more difficult to reduce the condyle over time.[5] As individuals are unable to self-reduce, they often become distressed

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because the pain increases as they attempt to close their mouth.[2,6]

If a patient is unable to self-reduce this disorder, the sooner the condyle is manipulated, the easier it is for the practitioner to reduce the condyle into the mandibular fossa.[5] If the luxation just recently occurred, it will probably be fairly easy to reduce through manipulation.[5] Among patients who have had the luxation for a month or more, few can have it reduced through manipulation.[2]

QUICK CONSULT

Observing Ease of Manipulation

If a patient has a luxation, the sooner the condyle is manipulated, the easier it is for the practitioner to reduce the condyle into the mandibular fossa.

Prior to attempting to reduce a patient's luxation, explain to the patient how the temporalis and masseter muscles are tight and bracing the condyle in front of the articular eminence. Explain that he or she will need to concentrate to relax these muscles as the condyle is pushed down and around the eminence. While the patient is concentrating to relax his or her closure muscles, put gauze bilaterally over the mandibular molars, place your thumbs over the gauze (some practitioners place their thumbs on the buccal shelves), and wrap your fingers around the chin. Ask the patient to open wider, which physiologically causes the closure muscles to relax. As he or she attempts to open wider, bilaterally press down on the molars, press up on the chin, and slowly slide the mandible posteriorly.[6,7] Fortunately, so far, I have always been successful with this maneuver.

If this is unsuccessful, some practitioners recommend having an assistant activate the gag reflex by touching the patient's soft palate with a couple of cotton-tip applicators, while the practitioner reattempts to maneuver the mandible.[6,7] The gag reflex should more vigorously stimulate the opening muscles, providing a greater physiological inactivation of the closure muscles.

If this fails to reduce the condyle, medications may enable the manipulation to be successful. The medications are used in an attempt to relax the patient (which reduces the tension in the closure muscles) and/or decrease the pain (which reduces the patient's guarding). They may include nitrous oxide–oxygen inhalation, TMJ anesthetic injection, intravenous sedation, or general anesthesia.[2,5,6,8]

Most general dentists will escalate therapy by using nitrous oxide–oxygen inhalation. If they are still not able to reduce the condyle into the mandibular fossa, they will refer the patient to an oral surgeon.[5]

Patients whose condyles were successfully reduced or who have a subluxation or luxation history may desire to prevent this from recurring. In this situation, it is recommended that preventative therapy be provided in an escalating fashion. First, educate the patient about the mechanical problem; explain that, if the patient learns not to open too wide, the problem will not occur. The top left diagram of the "TMJ Disc–Condyle Complex Disorders" handout (Appendix 3) may help to explain TMJ subluxation and luxation visually to patients. Warn them to be very cautious when they yawn, yell, and have dental treatment.

Some find that this satisfactorily prevents the disorder, whereas others have difficulty remembering to restrict their opening and thus desire to escalate therapy. The next therapy recommended is a stabilization appliance worn at night, which, clinical experience has shown and others have observed, generally reduces the frequency and intensity of this disorder.[9–11] This may be due

to the appliance's capability to decrease the TMJ loading, thereby improving the quality of the TMJ's lubricant (sodium hyaluronate).[10,12,13] Others theorize that this disorder is primarily due to a muscular contributor and the appliance decreases the disorder's frequency and/or intensity through improvement of the muscular contributor.[11]

QUICK CONSULT

Reducing the Subluxation's or Luxation's Frequency and Intensity

Wearing a stabilization appliance at night generally reduces the frequency and intensity of the disorder.

If the appliance does not satisfactorily diminish the disorder, it is recommended that the practitioner discuss three other options and let the patient decide which of these he or she is interested in pursuing:

1. If the patient desires help remembering to restrict the opening, it is recommended that the patient be offered a referral to an orthodontist to have buttons placed on the molars. Plastic fishing line or elastics are placed around the buttons, so when the patient tries to open wide, he or she is reminded to restrict the opening. The patient wears this for 2 months.[7]
2. If the patient has trouble self-reducing when the disorder occurs, it is recommended that the patient be taught how to distract and reduce his or her condyle.[7] The technique I recommend is to take a Monoject curved tip syringe 12 cc (or comparable syringe), cut the curved tip from the barrel of the syringe, and place the syringe barrel over the occlusal plane so it is running from left to right and as far posterior as the patient can tolerate. The patient then sits at a desk with the chin resting in the hand, concentrated on relaxing the closure muscles, and allows the weight of the head to place an upward force on the chin. The syringe barrel will act as a fulcrum and this should adequately distract the condyle so the patient can then retrude the mandible and reduce the condyle back into the mandibular fossa (Figure 11.1). This will work for either a unilateral or bilateral luxation.
3. If the disorder is a significant problem, it is recommended that the patient be offered a

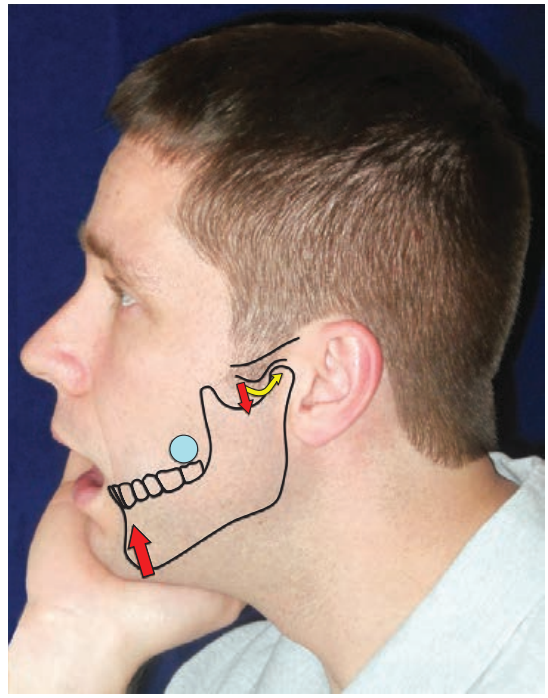

Figure 11.1. Patient unlocked a TMJ luxation by resting his chin in his hand, concentrating on relaxing his closure muscles, allowing the weight of his head to place an upward force on his chin, distracting the condyles, and then gently retruding his mandible. The Monoject syringe barrel was placed over the occlusal plane, as posterior as the patient could tolerate, and acted as a fulcrum to enable the upward force to distract the condyles.

referral to an oral surgeon to discuss a surgical treatment for the disorder.[8]

TECHNICAL TIP

Self-Reducing a TMJ Luxation

Sometimes, I teach the patient how to distract and reduce his or her condyle (Figure 11.1).

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Part III

Occlusal Appliance Therapy

Occlusal appliances have been used to improve temporomandibular disorder (TMD) symptoms for over 100 years.[1] They generally provide a beneficial effect for masticatory muscle pain, temporomandibular joint (TMJ) pain, TMJ osteoarthritis, TMJ noise, restricted jaw mobility, and preventing TMJ subluxation and luxation.[2–5] Many studies have demonstrated the effectiveness of the stabilization appliance (the traditional flat-surface occlusal appliance).

FOCAL POINT

Occlusal appliances generally provide a beneficial effect for masticatory muscle pain, TMJ pain, TMJ osteoarthritis, TMJ noise, restricted jaw mobility, and preventing TMJ subluxation and luxation.

Occlusal appliances are the most common therapy dentists use to treat TMD.[2] Some dentists limit their TMD therapy to occlusal appliances, most probably because they have not been taught how and/or when to provide other therapies. For patients with more severe TMD pain, occlusal appliances alone will only provide modest improvement, will not provide satisfactory relief, and will not provide any relief for some.[4,6] These appliances should be thought of as only one of many potential conservative TMD therapies. Effective integration of conservative TMD therapies is discussed in "Integrating Conservative Therapies" in Chapter 19.

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QUICK CONSULT

Providing Conservative TMD Therapies

Occlusal appliances should be thought of as only one of many potential conservative TMD therapies.

FOCAL POINT

Occlusal appliances alone will not provide many TMD patients with satisfactory symptom relief and will not provide any relief for some.

The benefits obtained from using occlusal appliances only occur during the period patients wear them and are lost when patients stop wearing them.[7,8] This does not mean that all patients will need to wear these appliances for the rest of their lives because contributing factors (e.g., stress) may have reduced and other therapies (e.g., relaxation) may have been implemented, causing the appliance to no longer be needed.

Occlusal appliances can cause irreversible changes with jaw movement and occlusion. This problem is generally limited to patients who wear their appliance long term for more than 12 hours a day, especially if their appliance covers only part of the dental arch.[9] Patients who do not maintain their appliance or oral hygiene sufficiently may develop caries, gingival inflammation, and/or mouth odors.[4,10]

Practitioners provide a vast variation of occlusal appliances. Therefore, when one begins studying occlusal appliances, the subject matter appears overwhelming. Basically, appliances can only be fabricated to vary (1) whether the appliance allows the mandible to slide freely from maximum intercuspation (e.g., stabilization appliance) or holds the mandible in a predetermined condylar position (e.g., anterior positioning appliance), (2) the condyle's position when a patient occludes in maximum intercuspation on the appliance, and (3) the physical aspects of the appliance, that is, whether it covers all of the teeth in the arch, whether it covers the maxillary or mandibular teeth, the type of material it is fabricated with, its thickness, and its form of retention.

The two most common appliances used to treat TMD patients are the stabilization and anterior positioning appliances. The **stabilization appliance** has a flat surface occluding with the opposing dentition, which provides a gnathologically stable occlusal environment (the reason they are

called stabilization appliance) and generally uses the mutually protected occlusal scheme. This appliance enables patients to move freely from maximum intercuspation and is most commonly used for patients with heavy nocturnal parafunctional habits that are contributing to tooth attrition or TMD symptoms.

The **anterior positioning appliance** is primarily used for patients who have a disc displacement with reduction and holds the mandible in the anterior location where the condyle is reduced onto the disc. In this manner, the disc–condyle mechanical disturbances are temporarily eliminated, and any forces loading the condyle are transmitted through the disc's intermediate zone rather than the retrodiscal tissue.

The reason occlusal appliances are clinically effective is not fully understood. This section uses the occlusal appliance literature and clinical observations to provide a better understanding of these appliances, so practitioners may use them more effectively with their various TMD patients.

◉ QUICK CONSULT

Understanding the Mechanism for Effectiveness

The reason occlusal appliances are clinically effective is not fully understood.

To help your hygienists better identify patients in your practice who would benefit from an occlusal appliance, a recommended "Referral Criteria for Hygienists" is provided in Appendix 1.

Over the last decade, there has been a growing concern as to whether the various appliances contain bisphenol A (BPA). BPA has been reported to be linked with heart disease, coronary artery disease, obesity, diabetes, and immune system and reproductive disorders.[11] It was present in some plastics, and has been banned from baby bottles in the European Union, the United States, and Canada.

Dentists are likely to encounter patients concerned as to whether the planned appliance contains BPA. It would be prudent to preemptively request your laboratory to ask their distributors whether the appliances you provide contain BPA. I have done this for the appliances I provide and have been told that Impak and Ivocap materials do not contain BPA.

FOCAL POINT

Request your laboratory to ask their distributors whether the appliances you provide contain bisphenol A (BPA).

Since crowns supported by dental implants do not have periodontal ligaments, they will not move vertically when patients heavily clench on their occlusal appliance or move lateral when patients insert or remove their appliance. To ensure the implants are not overloaded when patients perform these activities, place on your occlusal appliance laboratory prescriptions which teeth will be covered by the appliance that are implant supported crowns. Your laboratory technician should provide a small space around the implant supported crowns and limit the retention obtained from these crowns. Recommended accommodations for implant supported crowns in the opposing arch are discussed in "Appliance Adjustments" in Chapter 12 and "Design and Adjustments" in Chapter 13.

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Chapter 12

Stabilization Appliance

FAQs

Q: What do you think about the new appliance materials and is there one that you prefer?
A: Appliances fabricated from many of these new materials can compensate for minor errors that might cause an acrylic appliance to rock or cause pressure on teeth, hence the internal surface rarely needs to be adjusted. They are generally softer than the traditional acrylic appliances and still provide adequate wear resistance for most patients. I refer to this category of materials as intermediate materials because their hardness is between the traditional hard and soft appliance materials. Among appliances fabricated with one of the intermediate materials, I prefer appliances fabricated with Impak, as discussed in "Hard, Intermediate, or Soft Material" and "Appliance Examples" in this chapter.

Q: What do you think about the NTI (Nociceptive Trigeminal Inhibition Tension Suppression System) appliance?
A: On average, the traditional stabilization appliance provides better temporomandibular disorder (TMD) symptom improvement and does not have the probability of causing the significant number of occlusal changes that are associated with the NTI;[1,2] hence, I do not recommend or provide patients with an NTI. The NTI is discussed in "Full or Partial Coverage" in this chapter.

Q: If a patient is provided an acrylic appliance for tooth attrition, will the opposing teeth wear if the patient continues to grind?
A: The acrylic appliance is softer than enamel, so when he or she grinds, the acrylic will wear rather than the teeth.[3,4]

Q: Do you recommend practitioners use a centric relation (CR) interocclusal record and adjust the appliance in CR?
A: Obtaining an interocclusal record and adjusting the appliance in CR provides the practitioner with a more reproducible maxillomandibular relationship, requires less effort to obtain a well-adjusted appliance, and provides the patient with an appliance that maintains its

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stable occlusal environment. Unfortunately, many TMD patients cannot tolerate the condyles being seated in CR and/or cannot relax the muscles satisfactorily so CR can be attained.

Q: Do you ever provide patients with appliances that do not cover all of the teeth in the arch?
A: It is very rare for me to provide an appliance that does not cover all of the teeth in the arch because a full-coverage appliance reduces the probability of teeth moving while the patient uses it.

Q: Is a maxillary or mandibular appliance more effective?
A: Both maxillary and mandibular appliances can be fabricated to provide virtually a perfect gnathologic articulation, and they appear to have comparable efficacy.[1,5]

Q: Do you adjust the occlusion of athletic mouthpieces that you deliver?
A: I always adjust the occlusion of the athletic mouthpiece because it makes the mouthpiece more comfortable, less likely to cause occlusal changes, and less likely to cause patients to develop TMD symptoms.

Stabilization appliances provide a gnathologically stable occlusal environment in which the mandible can slide freely from maximum intercuspation (MI). Numerous practitioners use these appliances for many non-temporomandibular disorder (TMD) purposes. Their use is advocated when nocturnal parafunctional habits are believed to be contributing to tooth attrition, tooth pain, tooth mobility, recurrent tooth fractures, and periodontal disease. Additionally, these appliances are used to prevent harm to restorations (e.g., veneers) and to deprogram proprioception prior to dental treatment and observe a patient's tolerance to an increased vertical dimension.[1,4]

FOCAL POINT

Stabilization appliances are advocated when nocturnal parafunctional habits are believed to be contributing to tooth attrition, tooth pain, tooth mobility, abfractions, recurrent tooth fractures, and periodontal disease. Additionally, these appliances are used to prevent harm to restorations (e.g., veneers) and to deprogram proprioception prior to dental treatment and observe a patient's tolerance to an increased vertical dimension.

TMD patients generally report a decrease in morning symptoms with the use of a nocturnal appliance.[1,5] Nocturnal muscle activity has been generally shown to decrease with nighttime appliance wear, but parafunctional activities (e.g., bruxing or clenching) do not stop.[4,6] One study found that even patients whose nocturnal muscle activity increased with nighttime appliance wear reported a decrease in TMD symptoms.[6]

FOCAL POINT

TMD patients generally report a decrease in morning symptoms with the use of a nocturnal appliance.

Why stabilization appliances benefit many TMD patients is not well understood, but several hypotheses have been proposed. It appears more than one may apply simultaneously, and the impact of each varies for every individual.

The most common hypothesis is that stabilization appliances can replace a patient's occlusal disharmonies with virtually a perfect gnathologic articulation.[3,4,7] It is frequently

observed that TMD symptoms improve among new patients who bring a poorly adjusted appliance to the appointment and the appliance's occlusion is significantly improved.

A second hypothesis is that wearing the appliance causes patients to be more attuned continually to their oral cavity and parafunctional habits, thereby enabling them to catch and alter these habits.[4] Some studies provided acrylic appliances that did not occlude with the opposing dentition and found that these appliances improved TMD symptoms.[8] It is postulated the symptom improvement is primarily due to a change in the patient's cognitive awareness from wearing the nonoccluding appliance.[4] When, out of curiosity, nonoccluding palatal appliances were fabricated for two patients with daytime TMD symptoms, both reported symptom reduction. One related that the appliance shifted every time she started to clench, making her aware of what she was doing, so she stopped. The other reported that the appliance made her very cognizant of her mouth, and thus she noticed and reduced her daytime habits.

A third hypothesis for the TMD symptom improvement observed with the use of stabilization appliances is related to the increase in vertical dimension that occurs from their wear. An increase in vertical dimension is speculated to benefit both the temporomandibular joint (TMJ) and the musculature.[9] The nonoccluding palatal appliance has also been shown to increase the resting vertical dimension.[10]

A fourth hypothesis is that stabilization appliances can be fabricated so they decrease the load on the TMJ during different oral activities. Decreasing the load placed on the TMJ reduces the continual TMJ aggravation that occurs from parafunctional habits, thereby promoting healing of the TMJ.[1,11] Similarly anterior positioning appliances can change the location within the TMJ that the load is transmitted, for example, from inflamed to noninflamed tissues.

Mandibular Positions and Interocclusal Record

Centric relation appears to be the most musculoskeletally stable position for the mandible. In CR, the condyles are seated in their most anterior-superior location against the disc's intermediate zone (the thinnest avascular portion of the disc) and the posterior slopes of the articular eminences. Theoretically, a stabilization appliance appropriately adjusted using CR would be optimally effective.[7,12]

◉ QUICK CONSULT

Using Centric Relation

Centric relation (CR) appears to be the most musculoskeletally stable position for the mandible.

CR is a very reproducible position; if the interocclusal record is made using CR, the resulting appliance occlusion in the mouth will be very similar to the occlusion developed on the articulator. Therefore, obtaining an interocclusal record and adjusting the appliance using CR should require the least amount of effort for practitioners.

If the interocclusal record is made and the appliance adjusted in a position anterior to CR, the patient can retrude the mandible from this position. When the patient were to lay down on his back at night and relax the masticatory muscles to go to sleep, the condyles would retrude from this anterior position. As the condyles retrude, they slide superior along the articular eminence, causing the posterior portion of the mandibular occlusal plane to move superior. As the patient then occludes onto the appliance, only the

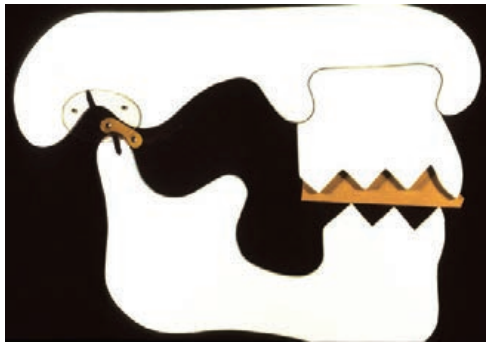

Figure 12.1. A model simulating occlusion on a stabilization appliance adjusted with the mandible in a position anterior to centric relation (CR).

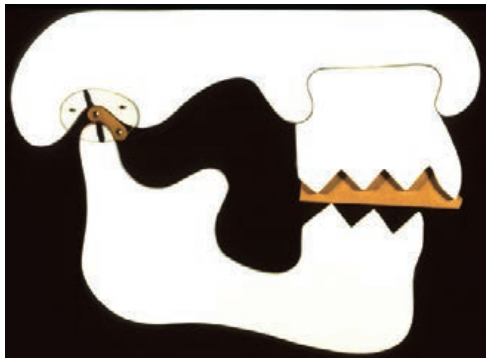

Figure 12.2. A model simulating occlusion on the stabilization appliance in Figure 12.1, with the mandible retruded; note only the most posterior tooth contacts the appliance.

most posterior tooth or teeth would occlude on it, as demonstrated in Figure 12.1 and Figure 12.2. Any single contact on a posterior tooth is considered to be an occlusal interference, so consequently, adjusting an appliance in a protruded position furnishes an appliance that may provide the patient with an unstable occlusal environment.

Unfortunately, many TMD patients cannot tolerate the TMJs being seated in CR and/or cannot relax the muscles satisfactorily so CR can be attained.[12] Hence, when non-TMD patients need a stabilization appliance, it is recommended that their interocclusal record and adjustments be made using CR.

Many TMD patients who have TMJ arthralgia find it painful to have their condyles seated into CR.[12,13] If the practitioner were to adjust these appliances so MI coincided with the condyles being seated in CR, one would anticipate that whenever these patients clenched on the appliance in MI, the condyles would seat in CR, reproducing this pain and aggravating their TMD.

Some patients have TMJ noises (clicking, popping, or crepitus) caused by mechanical interference within the TMJ. This interference may be caused by the disc, the retrodiscal tissue, or irregularities on the head of the condyle and/or the articular eminence, as discussed in "TMJ Noise" in Chapter 3. If the condyles are seated firmly into CR, the TMJ mechanical interference often becomes more pronounced and may cause a susceptible individual to develop a disc displacement with reduction with intermittent locking or disc displacement without reduction with limited opening.[14]

Early in my TMD training, a patient reported that about once a month her right TMJ locked and did not allow her to open wide (a disc displacement with reduction with intermittent locking). No TMJ arthralgia was detected, so I bilaterally manipulated her mandible to seat the condyles into CR. Her right TMJ locked as the condyles were seated in CR; she telephoned me later that day to let me know that her TMJ had finally unlocked for her.

Based on clinical experiences and my understanding of the TMJ's biomechanics, it is recommended that CR be used only for TMD patients who have no detectable TMJ arthralgia, TMJ noise, or history of TMJ locking. It is also recommended that CR not be used if patients have any discomfort when attempting to seat the condyles into CR.[12,14] Therefore, the vast majority of my TMD

patients do not have their interocclusal records made or appliances adjusted using CR.

TECHNICAL TIP

Using Centric Relation

It is recommended that CR be used only for TMD patients who have no detectable TMJ arthralgia, TMJ noise, or history of TMJ locking.

Instead of using CR, it is recommended that an unrestrained condylar position that approaches CR but does not encroach upon inflamed retrodiscal tissue nor firmly seat the condyles be used. Therefore, if a patient were to have his or her appliance adjusted to this position and clench on the appliance in MI, the condyles would tend not to forcibly seat or load against any structure. I refer to this unrestrained condylar position as the neutral position.

To obtain the condyle's **neutral position**, adjust the back of the dental chair so it is approximately 10° above the horizontal plane of the floor. Ask the patient to tilt his or her head back as far as possible, place the tongue on the roof of the mouth, and slide it back as far as possible. Lightly place a finger on the inferior portion of the patient's chin and repeatedly ask the patient to close and open his or her mouth (Figure 12.3). After a few arching movements, the patient develops a consistent arching of the mandible.

Each of the recommended positions helps to retrude the mandible and prevents the tendency of some patients to protrude the mandible inadvertently. The reader can easily observe how these positions tend to retrude the mandible on himself or herself. Sitting in your normal posture, close your teeth lightly and observe your first tooth contact. Then, tilt your head back as far as possible and again close your teeth lightly and observe your first tooth contact; most people notice that the mandible is more retruded. Continuing to hold your head back, place your tongue on the roof of your mouth and slide it back as far as possible. Once again, close your teeth lightly and observe your first tooth contact; most people notice that the mandible is further retruded.

Figure 12.3. The condyle's neutral position is obtained by the back of the dental chair being approximately 10° above the horizontal plane of the floor; asking the patient to tilt his head back as far as possible and place his tongue on the roof of his mouth and slide it back as far as possible; lightly touching the inferior portion of the patient's chin; and asking the patient to close and open his mouth repeatedly.

Placing a finger on the inferior portion of a patient's chin helps to steady the mandible so he or she more easily develops a consistent arching of the mandible. Based on these recommendations, most TMD patients will have their interocclusal records and appliances adjusted in the neutral position. It is not as repeatable as CR, but, as the appliance is adjusted, most patients establish a consistent contact position.

Prior to making an interocclusal record, position the patient, review the procedure with the patient, and manipulate the mandible into the planned condylar position (CR or neutral position). Discuss the interocclusal record procedure planned with

Figure 12.4. Pink baseplate wax for the interocclusal record: warmed, folded in fourths, and cut with a pair of scissors or alginate spatula in the shape of a trapezoid.

Figure 12.5. Wax interocclusal record.

the patient. I let the patient know I will place warm wax in his or her mouth, manipulate the mandible as performed earlier, and ask the patient to bite into it slowly.

Pink baseplate wax is preferred for the interocclusal record. It can be warmed over a flame, under running hot water, or in a waterbath. I fold it in fourths and cut it with a pair of scissors or alginate spatula in the shape of a trapezoid (Figure 12.4). The wax should be soft enough that it does not provide any resistance as the patient closes into it.

If a practitioner would like the wax to adhere temporarily to the maxillary teeth during the interocclusal record, the teeth can be dried with gauze. Manipulate the mandible into the planned condylar position. Ask the patient to open approximately 10 mm, align the trimmed baseplate wax, and ask the patient to close slowly into the wax. Ask the patient to stop closing as soon as indentations are satisfactory to provide a stable mounting for the casts (Figure 12.5).

Attempt to remove the wax without distorting it. If the teeth were dried prior to placing the wax in the mouth, the wax is more difficult to remove without deforming. Wax that has a minor amount of distortion can be warmed and straightened on the cast. Check to ensure the patient did not perforate the wax. A perforation of the wax suggests the teeth contacted and the mandible probably shifted along this contact. If a wax perforation is present, I retake the interocclusal record.

I do not use a **facebow** for occlusal appliance records because (1) my interocclusal record is approximately as thick as the desired appliance thickness, (2) acrylic is easily adjusted and inexpensive compared with gold or porcelain, and (3) many TMD patients have preauricular tenderness, and a facebow would almost certainly be quite painful.

If an acrylic stabilization appliance is being requested, I ask the laboratory technician to adjust the articulator's pin so the closest opposing posterior tooth contact is 2.5–3 mm once the casts have been mounted.

Some dental patients need **extensive prosthodontic therapy**, requiring their occlusion be restored using CR. Occasionally, one of these patients has a TMJ disorder in which the practitioner cannot use CR; for example, the patient has TMJ arthralgia to the degree that the patient cannot tolerate the condyles being loaded in CR. I recommend providing the patient a stabilization appliance that is adjusted in the neutral position. As the therapies recommended in this book help the TMD symptoms to resolve, slowly (within patient's tolerance) modify the appliance's occlusion so it is adjusted in CR.

Follow the patient to ensure he or she provides consistent occlusal contacts on the stabilization appliance at each visit and remains symptom free. It is recommended the patient remain in this status for 3–6 months

prior to initiating CR-required dental treatment. There are some patients whose occlusion you may not be able to stabilize, and a compromised maxillomandibular relation may need to be used for the prosthodontic therapy.[15]

Some practitioners and sales representatives advocate using a "neuromuscularly determined" mandibular position obtained through a Myomonitor. This maxillomandibular relation has no advantage over the traditional positions used for stabilization appliances.[3,16]

An informal survey of dental laboratory technicians revealed most dentists do not send their laboratory technicians an interocclusal record when requesting a stabilization appliance. In this situation, laboratory technicians generally mount the casts in MI and open the vertical dimension of the articulator. This generally provides appliances that take more adjustment than if one of the above-mentioned relationships was used. Also, if the occlusal plane is not level, adjusting the occlusion for a patient with the mandible retruded from MI may require the practitioner to perforate the appliance in order to obtain even posterior contact.

If you use the above-mentioned recommended techniques and consistently receive appliances with the occlusion not as close to the final mandibular position as you think it should be, your laboratory technician may be using MI rather than your interocclusal record. This occurred with one of the laboratories I used, despite that I articulated the casts with the interocclusal record and sent them to the lab bound together with rubber bands.

Another caveat is that if you are not skilled at making an interocclusal record, send your casts to the laboratory without an interocclusal record, and the laboratory technician will mount your casts in MI and open the vertical dimension of the articulator. This will generally provide a stabilization appliance with a moderately acceptable occlusion.

Physical Variables

Practitioners can choose among many physical alternatives when designing a stabilization appliance. This section should help practitioners better understand their choices and decide which appliance physical variables they prefer for their various patients and situations.

Full or Partial Coverage

A **full-coverage appliance** (which covers all of the teeth in the arch) reduces the probability of the teeth moving when the patient uses it. Therefore, a full-coverage appliance is recommended except in rare situations.

A **partial-coverage appliance** may cause teeth it covers to intrude and/or teeth not included in it to extrude. One patient only wore an appliance at night that did not cover the second and third molars, then 10 years later it was observed that these uncovered molars had supraerupted and were the only teeth that occluded.[17]

Generally, practitioners who provide patients with partial-coverage appliances instruct their patients to wear the appliance only at night, but occlusal appliances tend to improve TMD symptoms, so some patients may choose to wear it up to 24 hours a day to obtain additional relief despite the instructions. The more a patient wears a partial coverage appliance, the greater the risk that uncovered teeth will extrude and covered teeth will intrude.

Mandibular appliances that cover only the posterior teeth can be made to be quite esthetic and have minimal speech interference.

Some patients who have worn this partial-coverage appliance 24 hours a day have experienced occlusal changes to the degree that the anterior teeth now contact when the appliance is worn and the posterior teeth have an open bite the thickness of the appliance when it is out of the mouth.[7,18] Some practitioners provide this appliance for patients to wear during the day and a full-coverage appliance to wear during the night.

Similarly, there is a case report of a patient who was provided an appliance that did not cover his erupted third molars. He wore the appliance 24 hours a day and, by 5 weeks later, had developed an open bite in which only his third molars occluded when the appliance was not worn.[19]

Not only do practitioners need to be concerned about tooth movement with partial-coverage appliances, but they may not be as effective as full-coverage appliances.[20,21] One study provided patients with maxillary appliances that only occluded with teeth 22–27 (Figure 12.6). Patients who received little or no relief from the appliance had it modified into a full-coverage appliance, and 66% reported their TMD symptoms were greatly or completely improved by use of the full-coverage appliance.[21]

Figure 12.6. An example of a partial coverage appliance. This appliance occludes only with the mandibular anterior teeth and would enable the practitioner to orthodontic move or restore the mandibular teeth while the patient continues to wear the appliance.

This type of partial-coverage appliance has also been shown to compress the structures within the TMJ.[22] This is a concern for any partial-coverage appliance in which only anterior teeth occlude on the appliance.[23]

There are several prefabricated partial-coverage appliances on the market that may similarly induce tooth movement and not be as effective as a full-coverage appliance. The NTI (see Figure 12.7), is one of these prefabricated partial coverage appliances that has been shown to not be as effective as the full-coverage appliance, cause occlusal changes, cause loading of the TMJ, and is so small that there are reports of it being inhaled during sleep.[1,2,14,24]

Partial coverage appliances do enable practitioners to avoid specific areas of the mouth. For instance, a patient may develop TMD symptoms while having a mandibular molar uprighted for the eventual fabrication of a bridge. If an occlusal appliance is needed, the patient could temporarily wear a maxillary appliance at night that only occludes with the mandibular anterior teeth (Figure 12.6). For the above-mentioned reasons, no prefabricated partial coverage appliances are recommended except in rare situations.

Maxillary or Mandibular

Both maxillary and mandibular appliances can be fabricated to provide virtually a perfect gnathologic articulation, and they appear to have comparable efficacy.[7] They each have specific advantages, so my choice will vary with a patient's dental conditions and planned wear schedule.

Mandibular appliances generally cause less speech interference and are less visible when

Figure 12.7. NTI appliance covering teeth 8 and 9 and the mesial portion of 10; it occludes with teeth 24 and 25.

speaking.[7,12] It would be preferable to fabricate a mandibular appliance for a patient who is to wear an appliance during the day.[7,12] For a patient to obtain immediate disocclusion of the posterior teeth with a mandibular appliance, the maxillary anterior teeth must guide along an anterior ramp. This guidance ramp generally extends anterior to the mandibular anterior teeth (Figure 12.8) and also prevents maxillary anterior tooth supereruption. If the patient has a large overjet, this ramp is often unacceptably long,[9] and the maxillary anterior teeth are generally held superiorly by contact with the mandibular lip rather than the mandibular teeth.[12] Therefore, if a patient has a large overjet, a guidance ramp is generally not needed, but observe for maxillary anterior tooth supereruption at follow-up appointments.

Maxillary appliances provide stability for the maxillary anterior teeth. Patients with periodontal disease of the maxillary anterior teeth tend to develop flaring of these teeth.[25]

Figure 12.8. A mandibular appliance depicting the guidance ramp extending anterior to the anterior teeth, enabling the maxillary anterior teeth to provide immediate disocclusion of the posterior teeth. Notice that the angle of the anterior guidance is only about 5° steeper than the appliance's occlusal plane.

Thus, if a patient has compromised bone support of the maxillary anterior teeth, it is recommended that a maxillary appliance be fabricated to prevent this flaring.

If a patient has a forceful protrusive habit (primarily identified by severe anterior tooth attrition), the mandibular appliance's anterior guidance ramp will transfer more lateral force to the maxillary anterior teeth than usual. Out

of fear that excessive parafunctional forces may similarly cause flaring of the anterior teeth even for patients with normal bone support, if a patient has severe anterior tooth attrition (Figure 12.9) it is recommended that a maxillary appliance be fabricated so as not to risk the possibility of contributing to the maxillary anterior teeth flaring.[25]

If a patient has missing teeth, an occlusal appliance can bridge over the edentulous areas and provide occlusal contacts for the opposing teeth. The appliance can also be fabricated to provide posterior edentulous extensions (Figure 12.10). It would be preferable to fabricate the appliance for the arch that will provide greater occlusal stability; this is generally the arch with more missing teeth (Figure 12.11 and Figure 12.12). Occlusal appliances can also be fabricated to be worn over complete or partial dentures.

Hence, if a patient has compromised bone support of the maxillary anterior teeth or severe tooth attrition, a maxillary appliance is recommended. If none of these apply, it is recommended that the practitioner observe for missing teeth and seek to fabricate the appliance for the arch that will provide greater occlusal stability. If the practitioner plans for the appliance to be worn during the day, the patient would probably prefer a mandibular appliance. If greater occlusal stability could be obtained with a maxillary appliance, but the practitioner plans for the appliance to be worn during the day, it is recommended the practitioner attempt to balance the difference in occlusal stability with improved esthetics and speech to determine the better arch on which to fabricate the appliance. One can also choose to fabricate a maxillary appliance for nighttime wear and a mandibular appliance for daytime wear.[7]

Figure 12.9. An example of patient with severe tooth attrition, for which a maxillary appliance is recommended.

Figure 12.10. An appliance with a posterior edentulous extension enables the patient to obtain occlusal contacts over this area. The lighter colored portion of the appliance is due to it being relined.

Figure 12.11. Because of the patient's missing teeth, fabricating a maxillary rather than a mandibular appliance for this patient would provide greater occlusal stability.

Figure 12.12. The maxillary appliance fabricated for the patient in Figure 12.11.

Some patients have a strong preference for either a maxillary or mandibular appliance; try to accommodate their preference if it will not cause any harm. If it is preferable to fabricate their appliance on the other arch, discuss the reasons for this, and my experience is that patients will generally go along with my recommendation. A summary of these recommendations are provided in Table 12.1.

Hard, Intermediate, or Soft Material

For many years, there were only two general categories of materials for fabricating stabilization appliances—hard acrylic and soft thermoplastic (used for athletic mouth guards) materials. An informal survey of dental laboratory technicians during that era revealed most dentists had their stabilization

Table 12.1. Recommendations for whether to fabricate a maxillary or mandibular stabilization appliance.

Recommendations	Determinates
Only fabricate a maxillary appliance,	If maxillary anterior teeth are prone to flare, for example, patient has compromised bone support of the maxillary anterior teeth or has a forceful protrusive habit suggested by severe anterior tooth attrition.
Patient would prefer a mandibular appliance,	If patient is to wear the appliance during the day.
Fabricate a maxillary or mandibular appliance,	1. For the arch which would provide greater occlusal stability, this is usually the arch with more missing teeth. 2. To accommodate patient preference, if not contraindicated.

appliances fabricated from the hard acrylic material.

Over the past 50 years, many other products have become available that dental laboratory technicians use to fabricate stabilization appliances. Most of new material choices have a flexibility between the hard acrylic and soft thermoplastic materials that I call intermediate materials. A recent informal survey of dental laboratory technicians revealed approximately 90% of dentists are requesting one of the intermediate materials for their stabilization appliances.

FOCAL POINT

Approximately 90% of dentists are using one of the intermediate materials for their stabilization appliances.

Despite that there are many choices of materials from which stabilization appliances can be fabricated, there are few comparative or longitudinal studies evaluating wear and fracture resistance, and ability to maintain their properties (e.g., ability to not breakdown or discolor over time). The results of the only known wear study comparing several hard and intermediate materials are provided in Figure 12.13. With this limited information, the following is the best insight I can provide for stabilization appliances fabricated with these materials.

There are several studies that compared the hard acrylic and soft thermoplastic appliances that are discussed later. The findings suggest there is no significant difference in TMD symptom improvement obtained from a well-adjusted hard and a well-adjusted soft stabilization appliance.

I assume and clinical experience supports there is no significant difference in the TMD symptom improvement obtained from a well-adjusted hard, intermediate, or soft stabilization appliance. If one reviews the hypotheses for the reasons stabilization appliances benefit many TMD patients (discussed at the beginning of this chapter), one will notice that probably the only variation a different material would have is if it alters the appliance's ability to provide an ideal occlusal environment.

QUICK CONSULT

Varying Appliance Material

Probably the only variation that appliance material would have on an appliance's efficacy would be related to its ability to provide an ideal occlusal environment.

Appliances fabricated with the **hard or intermediate materials** (1) provide a precise occlusal mark, allowing practitioners to obtain

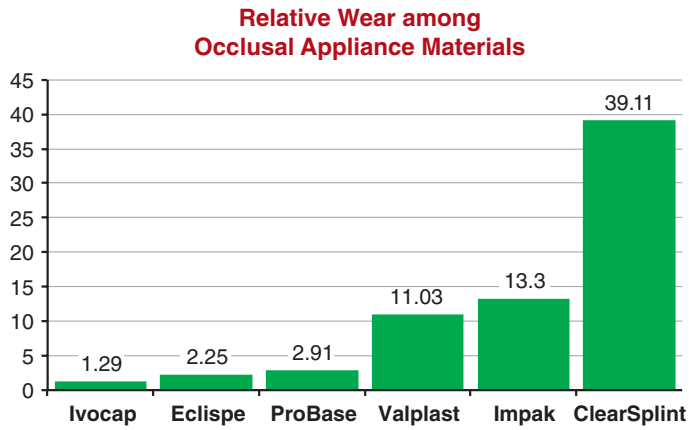

Figure 12.13. Relative wear among occlusal appliance materials. Ivocap, Eclipse, and ProBase (a standard acrylic) are hard materials, while Vlaplast, Impak, and ClearSplint are intermediate materials. See these sections for more details about the materials.[26]

a very accurate adjustment of the appliance; (2) can be fabricated with additional material in specific locations, so these areas (i.e., edentulous areas, crossbites, and other large discrepancies) can attain contact with the opposing dentition; and (3) may bond with self-curing acrylic, enabling practitioners to add missing contacts, add retention (by internally relining the appliances), and repair fractured appliances.

In regard to patient **allergies**, I telephoned the manufacturers of the tradenamed materials discussed in this chapter and all report there is no latex in their product. If a patient has a methyl methacrylate allergy, the best choice for this patient would be an appliance fabricated with one of the vinyl products (described later), which have no methyl or ethyl methacrylate. If the allergic patient needs a hard appliance, the best choice would be an appliance fabricated with the Ivocap material. Most methyl methacrylate allergies are from the free-floating monomer, and this material is so dense, it essentially has no free-floating monomer.

Hard material has been the primary appliance material for many years and has well-documented scientific support for its efficacy. There are many fabrication techniques that are used for these appliances in addition to using a hard thermoplastic sheet molded over the patient's cast as the base and intraorally adding self-curing acrylic.[7]

A fairly recently marketed hard appliance material is the Ivocap material (manufactured by Ivoclar). These stabilization appliance are fabricated by continuously injecting the material at 80 psi throughout its processing, which provides an appliance with absolutely minimal porosity and is probably the strongest and most durable plastic appliance currently available; it was the most resistant to wear among the samples tested (Figure 12.13).[26] Laboratory technicians need to fabricate these appliances on hard die stone with minimal shrinkage or these appliances are extremely tight for patients and require extensive internal adjustments.

I once had a patient who fractured her stabilization appliance in a different location nearly every week. I had a slightly thicker Ivocap stabilization appliance fabricated for her, and it resolved the fracturing problem. I do not often use Ivocap stabilization appliances, but it appears to be an appliance to consider for patients who continually

fracture or rapidly wear their stabilization appliances. Another consideration for patients who continually fracture or rapidly wear their appliances would be to fabricate a soft thermoplastic stabilization appliance opposing the acrylic appliance, as discussed in "Appliance Examples."

Another recently marketed hard appliance material is the light polymerized material Eclipse. The material comes in sealed envelopes with each envelope containing enough material for one stabilization appliance. After adapting it to the cast (opposing cusp indications can also be placed), the cast and material are placed in a light unit, and the material is cured. After Ivocap, it was the most resistant to wear among the samples tested (Figure 12.13).[26]

Interra appears to be a similar material as Eclipse, also light cured, supplied by the same manufacture, and comes in similar sealed envelopes. Interra is designed to enable dentists to fabricate a stabilization appliance in approximately 1 hour in their offices. The material is sized, molded over the patient's teeth, partially light-cured in the mouth, and placed in a light oven for its final cure.[27]

Intermediate material stabilization appliances have the following advantages to appliances fabricated with hard materials: (1) they are more comfortable for the supporting teeth, (2) the softer material can compensate for minor errors that might cause an acrylic appliance to rock or cause pressure on teeth, hence the internal surface rarely needs to be adjusted, and (3) its softness helps dissipate the clenching forces. An informal survey of patients found that most patients prefer softer appliances to the hard appliances.[28]

Other than the dual laminate material (discussed later in this section), there are two basic classes of intermediate appliance materials: vinyl and hybrid materials. Appliances made from either are relatively firm at room temperature, and the hybrid materials become very flexible when warmed. There are many variables that determine the hybrid's room temperature firmness and the temperature at which it becomes flexible.

When adjusting the occlusion of appliances fabricated from intermediate materials, I have to be careful not to deform the appliance, or it may take a few seconds to bend the appliance back to the correct shape; patients may need to take similar care when cleaning their appliance.

Appliances made with the **vinyl materials** will not adhere to self-curing orthodontic acrylic, so dentists will not be able to reline or repair these appliances with self-curing acrylic. These appliances may dry out, so it is recommended that patients keep them immersed in water when not in use. There is no methyl or ethyl methacrylate in these appliances, so these appliances are recommended for patients allergic to methyl or ethyl methacrylate. Common trade names for vinyl appliances are Valplast and Flexite.

Appliances made with **hybrid materials** will bond with self-curing acrylic, so dentists will be able to reline and repair these appliances with self-curing acrylic. Astron and Impak materials are the most common hybrid materials used by dental laboratories in the United States.

Appliances fabricated with **Astron materials** are waxed, invested in hydrocolloid, and cold-cured. Common trade names for Astron appliances are ClearSplint and Ultraflex. Appliances fabricated with **Impak material** are waxed, invested, and processed similarly to the fabrication of dentures, which appear to provide more dense appliances than the Astron appliances, so these appliances will probably resist wear and fracture better. Fabrication is much more labor intensive than for the Astron appliances, so the laboratory price for these appliances is generally higher.

The powder to liquid ratio greatly varies the appliance's hardness, the temperature at which

it becomes flexible, and the wear characteristics. The dental laboratory that fabricates our dental school's appliances found dentists prefer appliances that are heat cure-processed with a powder to liquid ratio of 4:1 (used in the study shown in Figure 12.13). This provides appliances that when warmed they become quite flexible (so they will flex around minor discrepancies between the cast and tooth surfaces), and when cooled to the mouth temperature they retain their new shape and have a similar hardness as acrylic appliances.

Since acrylic is more resistant to wear than Impak (Figure 12.13) and acrylic bonds to Impak, most laboratories will bond acrylic over the occlusal surfaces of these appliances when requested for patients with heavy nocturnal parafunctional habits. This appliance is discussed further in the "Appliance Examples" section of this chapter. Common trade names for Impak appliances are Remedeze and Bruxeze appliances.

A laboratory can also give its own names to the various intermediate appliances, but if you discuss the appliance materials with the above-mentioned names, you should be able to determine the type and characteristic of their various locally named appliances.

I also consider the **dual laminate thermoplastic materials** to be an intermediate appliance material. Appliances fabricated with it have a soft internal surface and a hard thermoplastic external surface (discussed in "Appliance Examples" in this chapter). Once the material is molded over the cast, self-curing acrylic is added to its external surface by the laboratory technician or intraorally by the practitioner to provide the occluding portion of the appliance.

Self-curing acrylic can bond with the appliance's hard thermoplastic external surface but cannot bond to the soft inner internal surface. Therefore, clinically, I find it best to replace a fractured dual laminate thermoplastic appliance rather than trying to repair it by bonding the hard thermoplastic surfaces together. Clinical experience has also taught me the 1.8-mm material is too fragile for these appliances, and I use the 2.5-mm-thick or thicker material. To accommodate for the soft layer, these appliances need to be fabricated approximately 1 mm thicker than other hard or intermediate appliances, which is rarely a problem.

Clinically, the only disadvantage I have found with dual laminate thermoplastic appliances is that the internal surface more readily discolors over time, and after about 3 years, many practitioners and patients desire for the appliance to be replaced.

FOCAL POINT

> Because of the advantages and disadvantages discussed, the vast majority of the stabilization appliances I request are fabricated with the Impak material, and sometimes I request acrylic cover the majority of the appliance's occluding surface.

Soft material stabilization appliances are typically fabricated from a soft thermoplastic sheet that is warmed and formed over the cast. Since the author is not aware of a clinically feasible method to add additional material to these appliances, it is recommended the 0.15-in. (3.8-mm)-thick material be used. This and the 4.0-mm-thick material are the maximum thicknesses commercially available that provide the greatest opportunity to perfect a patient's occlusion. These appliances are fast and easy to fabricate; it would be relatively simple for a dental staff member to fabricate these in the practitioner's office.

For many years, the findings of studies evaluating the efficacy of soft stabilization appliances for TMD were contradictory. Since the material is resilient, some investigators did not adjust or adequately adjust these

appliances. This resulted in findings one would expect from providing TMD patients with inadequately adjusted hard appliances—many patients had symptom aggravation.[29,30]

More recently, studies have found that TMD patients obtain comparable symptom improvement with soft and hard stabilization appliances.[31,32] The different results appear to be due to the soft stabilization appliances being adequately adjusted; they must be meticulously adjusted, just as a practitioner would adjust a hard appliance.[5]

Some practitioners find that patients tend to play with soft appliances and speculate that soft appliances may trigger parafunctional habits.[33] Clinically, it has been observed that patients tend to play with a soft appliance that is not well adjusted. Patients given an unadjusted soft appliance often occlude against only one or two opposing teeth and tend to clench on the appliance to produce more occlusal contacts. Conversely, patients provided a well-adjusted appliance with even posterior contacts find they have a solid bite when they close onto the appliance and thus do not have the tendency to play with the appliance.

A study was once conducted to evaluate the speed at which occlusal changes could take place. The investigators induced these changes by having patients wear unadjusted soft appliances.[34] This study appeared to create concern that soft appliances may cause occlusal changes. To determine whether this occurs for patients wearing adjusted soft appliances, another study used shim stock to follow the occlusion in patients wearing adjusted soft appliances and determined that they do not cause the occlusion to change.[35]

If a practitioner were to provide soft appliances to TMD patients without adjusting the occlusion, it is anticipated that their symptom response would be similar to the findings obtained by Nevarro and colleagues.[30] After providing unadjusted soft appliances, they found the numbers of patients who reported TMD symptom improvement, no change, and aggravation were one, two, and six, respectively. Clinically, similar patient responses have been observed from working with practitioners who routinely did not adjust the occlusion on their soft appliances.

Two studies followed TMD patients provided with soft appliances for 12 months; both reported patients obtained significant TMD symptom improvement.[32,36] The one that reported about the durability of the appliances most adequately withstood the parafunctional habits, and 39% of the soft appliances were discolored at the end of the 12 months.[36]

There appears to be a consensus in the literature that if **children** during their primary or mixed dentition need to be provided a stabilization appliance, a soft stabilization appliance is the appliance of choice.[1,3,37,38]

Soft appliances can be fabricated for either the maxillary arch or the mandibular arch. An appliance to be used as an **athletic mouthpiece** should be fabricated for the maxillary arch. It is also recommended the occlusion be adjusted for athletic mouthpieces because it makes a mouthpiece more comfortable, less likely to cause occlusal changes, and less likely to cause a patient to develop TMD symptoms.[39,40]

Since soft stabilization appliances are easily fabricated, are inexpensive, and may be inserted at an initial appointment, practitioners may desire to use soft stabilization appliances in many situations:

1. In emergencies. For example, a patient is in acute distress (especially if an acrylic appliance may not be available for some time) or presents with a nonrepairable appliance that the patient depends on.
2. When the soft appliance will serve as a prognostic tool to evaluate whether a stabilization appliance would be beneficial.

A practitioner may be unsure whether a patient has TMD or whether appliance therapy will improve the patient's complaint (e.g., tinnitus or headaches). Patients who obtain symptom reduction with the use of a soft appliance generally also benefit from the use of an acrylic appliance.[41]

3. When a practitioner desires an easily adjustable interim appliance. For example, a patient has a lateral pterygoid spasm, the practitioner knows the patient will have significant occlusal changes as symptoms improve, and during this transition a soft appliance would be easy to adjust, whereas the acrylic appliance may need to be relined.
4. When a practitioner desires to use a stabilization appliance with a child during his or her primary or mixed dentition.[3]
5. When a patient's financial situation is an overwhelming concern.

Conversely, there are situations in which it is recommended that soft stabilization appliances not be used:

1. When a patient has such a significant occlusal discrepancy that the soft appliance material would not be thick enough to accommodate for the discrepancy.
2. When a patient has missing teeth in which the soft thermoplastic appliance will not be able to provide occlusal contacts for the opposing teeth.
3. When a patient has moderately severe or severe tooth attrition from nocturnal parafunctional habits. Soft appliances appear to wear more rapidly than acrylic appliances, so patients with excessively heavy parafunctional habits may wear through the soft appliance in a relatively short time.

Occasionally, soft appliances are fabricated to oppose a hard or intermediate appliance. This is generally performed when (1) the patient's heavy parafunctional habits are causing the opposing teeth to rapidly wear the appliance or (2) the appliance does not provide adequate TMD symptom improvement. One study found after providing these TMD patients a soft appliance opposing their hard appliance that patients obtained a significant decrease in TMD symptoms; 63% rated it as good TMD symptom improvement, and 12% rated it as some improvement.[42] This is discussed further in "Appliance Examples," later in this chapter.

Thick or Thin

Muscle contraction is achieved by actin and myosin sliding along each other; its efficiency is related to the degree the actin and myosin overlap, which varies with a muscle's length.[43,44] The optimum physiological muscle length is speculated to be at the location the muscle has its minimal surface electromyelographic (EMG) activity. The vertical opening at which the masseter and temporalis muscles produce their minimal surface EMG activity varies from patient to patient but falls within the range of 4.5–18 mm.[45,46]

It has been postulated that a stabilization appliance would be more effective if it were fabricated at the vertical opening where the muscle has its minimal surface EMG activity. To test this hypothesis, TMD patients were randomized into three groups. One group was provided stabilization appliances that increased the vertical dimension by 1 mm, the second group was provided appliances with the thickness of one-half the opening that produced minimal masseter muscle surface EMG activity (average, 4.4 mm), and the third group was provided appliances with the thickness of the opening that produced minimal EMG activity (average, 8.2 mm). The third group experienced the most rapid

reduction in TMD symptoms, the second group's symptom reduction took slightly longer, and the first group's symptom reduction took the longest time. The findings of this study suggest that thicker appliances (up to the minimal EMG activity) may resolve TMD symptoms more quickly.[47] A second study supported these results after comparing change in nocturnal EMG activity with different appliance thicknesses and found only subjects with **thick** (compared with nonoccluding, thin, and medium) **appliances** had significantly lower nocturnal EMG activity.[48]

Through my teaching experience, it has been observed that many dentists believe an occlusal appliance cannot be thicker than a patient's freeway space. They fear that if the appliance is thicker than 2 or 3 mm, the patient may clench on it uncontrollably and increase the TMD symptoms. Patients also tend to initially find thicker appliances more obtrusive and generally prefer to have a thinner appliance, especially if they previously had a thin appliance.

It is not advocated that 8-mm-thick stabilization appliances be fabricated for patients because **thinner appliances** appear to be reasonably effective and have a high degree of patient acceptance. It is important for dentists to realize stabilization appliances can be more than 2 or 3 mm thick without causing detrimental consequences. Therefore, the additional millimeters needed for the dual laminate thermoplastic appliance's thickness should not present a problem, nor should it be a problem if the practitioner's laboratory accidentally fabricated an appliance a little thicker than requested.

It is generally recommended that appliances be fabricated between 1 and 4 mm thick.[7] As mentioned in "Mandibular Positions and Interocclusal Record" in this chapter, when requesting a hard or intermediate stabilization appliance, I ask the laboratory technician to adjust the articulator's pin so the closest opposing posterior tooth contact is 2.5–3 mm once the casts have been mounted. Requesting stabilization appliances be fabricated at this thickness generally enables me to provide the patient with an appliance that does not have perforations, has sufficient thickness for attrition, and will probably be more effective.

Appliance or Clasp Retention

Appliance retention is achieved by portions of the appliance acting as guide planes while other sections flex and engage into undercuts. The undercuts are generally in the buccal embrasures of the posterior teeth, and the portion that flexes into the undercut can be the appliance itself or clasps added to it.

The appliance should have a similar degree of retention as a removable partial denture. The retention should not be so strong that it might cause the patient to break a fingernail, but not so weak that he or she can dislodge the appliance with the tongue.

Clinically, it has been observed that some patients given appliances with insufficient retention report their TMD symptoms were aggravated by their appliances. It is speculated the symptom aggravation may be from patients holding their opposing teeth on the appliance to stabilize it or from playing with the loose appliance. It has also been observed that patients given appliances with insufficient retention report they unconsciously remove them at night while they sleep.

TECHNICAL TIP

Evaluating an Appliance's Retention

Once the appliance fits comfortably, check its retention. The appliance should have a similar degree of retention as a removable partial denture.

If the appliance does not have enough retention, for appliances with clasp retention, the clasps need to be adjusted to further engage the undercuts. For appliances without clasps and an internal surface that can bind with self-curing or light-curing acrylic, the internal surface needs to be relined. Relining the internal surface as described in "Internal Reline" in this chapter generally provides an ideal amount of retention.

There are many reasons an appliance is too retentive. The most common reason a new appliance has too much retention is that it fits too tightly, thereby causing excessive frictional retention. The appliance needs first to be adjusted so it is comfortable (a technique explained in "Internal Adjustments" in this chapter); then the retention should be reevaluated.

Generally, an appliance that fits comfortably and is too retentive has excessive retention in the posterior due to the appliance engaging too deeply into the buccal embrasure undercuts. In this situation, if clasps provide the retention, they need to be adjusted to decrease it. If the inner portion of the appliance provides the retention, these sites should be reduced by lightly running an acrylic bur over them. When adjusting this, it is recommended that practitioners err on the side of reducing the retention too little rather than too much and that these sites be repeatedly reduced until the proper retention is achieved.

My personal preference is to have the appliance's internal material engage the undercuts rather than clasps added to the appliance.

Summary of Physical Variables

It is very rare that I recommend an appliance other than a full-coverage stabilization appliance, one that covers all of the teeth in the arch. In deciding whether to recommend a maxillary or mandibular appliance, I first consider the propensity for the maxillary anterior teeth to flare. If there is compromised bone support of the maxillary anterior teeth or severe tooth attrition, I am afraid the maxillary anterior teeth may flare, so I only recommend a maxillary appliance. If I plan for the patient to wear the appliance during the day (usually for a few months) as a temporary crutch until he or she breaks the daytime habits, and there is a low propensity for the maxillary anterior teeth to flare, I generally recommend a mandibular appliance.

Next I consider on which arch the appliance would provide the greatest occlusal stability. Usually placing the appliance on the arch with more missing teeth provides the greatest occlusal stability. Many TMD patients have all of their teeth (except their third molars), have good bone support of the maxillary anterior teeth, have only minor tooth attrition, and will only wear the appliance at night. I have no preference whether they receive a maxillary or mandibular appliance. I discuss the benefits of each, and they may have a preference, especially if they previously had an appliance. From patients who have worn both appliances, I have not found a strong tendency that patients prefer one over the other appliance, except that mandibular appliances tend to stimulate the gag reflex less. A summary of these recommendations are provided in Table 12.1.

Next I consider whether the appliance should be made with hard, intermediate, or soft material. If the patient has a history of continually fracturing or rapidly wearing his or her hard or intermediate appliance, I recommend one fabricated with Ivocap material. If the patient has never worn an appliance and has severe tooth attrition, I also recommend an appliance fabricated with Ivocap material.

For the vast majority of my patients, I recommend an appliance fabricated with Impak material (comparable with Remedeze appliance). If the patient has moderate to severe tooth attrition, I request the majority of the appliance's occluding surface be covered with acrylic, to resist appliance wear from heavy parafunctional activity (comparable with Bruxeze appliance).

If the patient relates he or she is allergic to methyl or ethyl methacrylate, I recommend an appliance fabricated with a vinyl material; common trade names are Valplast and Flexite appliances.

If the patient is a child with primary or mixed dentition, I try to obtain adequate symptom relief with nonappliance TMD therapies recommended in this book. If I must use an appliance, I only use a soft stabilization appliance. I also provide soft stabilization appliances for adults when they need one as an emergency appliance, as a prognostic tool, or as an interim appliance, or if they need an appliance and their financial situation is an overwhelming concern.

If I request the laboratory fabricate a hard or intermediate stabilization appliance, I ask the laboratory technician to adjust the articulator's pin so the closest opposing posterior tooth contact is 3 mm once the casts have been mounted. I also request the laboratory to fabricate the appliance so its retention is obtained by the appliance engaging the buccal embrasures of the posterior teeth.

Appliance Adjustments

The stabilization adjustments are the most critical phase for providing an effective appliance, and it is essential that its occlusion and fit are comfortable.[5,49] It is common for me to hear new patients report they previously received an appliance that was too tight, causing them pain, so they stopped wearing it. Delivering a well-adjusted appliance is challenging, and one fabricated entirely with acrylic takes me about 45 minutes to deliver.

FOCAL POINT

> The stabilization adjustments are the most critical phase for providing an effective appliance.

After completing my appliance adjustments, I ask the patient to insert the appliance, to tell me whether the posterior occlusion is hitting as evenly as possible, and to tell me whether he or she knows of anything that can be done to improve the appliance. Sometimes I am unaware of a minor problem that may annoy a patient (e.g., a rough spot on the lingual flange, a rough excursive movement, excessive bulk, or a tendency for the appliance to cause gagging) and cause the patient to not wear it or play with the annoyance, which could lead to aggravation of the TMD symptoms.

Occasionally, patients report they unconsciously remove their appliance during sleep. It is my clinical experience that, in this situation, the appliance appears to bother patients in some manner while they sleep and, once this problem is corrected, they usually stop removing it. Four approaches have been found that commonly correct this problem: (1) tighten a loose appliance, (2) loosen a tight appliance, (3) perfect the appliance's occlusion, or (4) thin a bulky appliance.

Internal Adjustments

The majority of new appliances with a hard inner surface that I receive from the laboratory are too tight and need internal adjustments. This section primarily pertains to appliances fabricated with a hard inner surface

because clinical experience has shown that appliances with an intermediate or soft inner surface rarely need internal adjustments.

Prior to attempting to insert an appliance in a patient's mouth, ensure the appliance appears appropriate, and determine whether any adjustments are indicated prior to insertion; for example, whether it is overly bulky or whether there are sharp areas that could hurt the patient. Also observe to ensure the appliance is not overextended beyond the most posterior teeth, unless this extension is to obtain the contact of a more posterior opposing tooth.

As the appliance is initially inserted, do not use a tremendous amount of force. Occasionally, my residents who would insert an appliance with too much force will have great difficulty or be unable to remove it. In these situations, the end of the mouth-mirror handle can be placed interproximally on the edge of the appliance flange in an attempt to forcibly work the appliance loose.

TECHNICAL TIP

Inserting an Appliance

As the appliance is initially inserted, do not use a tremendous amount of force or it may be difficult to remove.

If the appliance will not seat by using a moderate amount of force, ask the patient where the appliance feels tight. Generally, the restriction is located along the anterior teeth, and my experience in this situation is that the labial extension is often overextended. Laboratory technicians fabricating appliances with hard inner surfaces (instructions are provided in Appendix 8, "Laboratory Occlusal Appliance Instructions") are instructed to extend the appliance only 1–1.5 mm below the incisal edge of the anterior teeth. When the appliance is too tight over the anterior teeth and the labial extension is longer than requested, it is generally most productive to first shorten the extension to the requested length.

If the appliance is too tight for it to seat and the labial extension is the correct length, clinical experience has shown the best manner for marking tight internal areas is using Accufilm (Parkell, Farmingdale, NY). Place a piece of Accufilm (the black color best marks an appliance) between the appliance and the teeth, in the area of the restriction, and firmly seat and remove the appliance (Figure 12.14).

TECHNICAL TIP

Identifying Internal Tight Areas

The internal appliance locations that need to be relieved can be identified by placing a piece of Accufilm (the black color best marks an appliance) between the appliance and the teeth, and firmly seating and removing the appliance.

The appliance's retention is usually provided by the portion of the appliance that fits into the buccal embrasures, so at first, attempt to remove the restriction by adjusting only nonretentive areas. In addition to adjusting the areas that mark with Accufilm, there are often interproximal fins of material that do not provide a benefit and can also restrict appliance seating. These fins run faciolingual as formed by the occlusal or incisal embrasures of the teeth (Figure 12.15). While adjusting the Accufilm marks, it is recommended that these fins also be reduced.

This procedure may take repeated markings and adjustments. With a clear appliance, the practitioner can see whether the appliance is seated, and it is seated when there is no observable space between the appliance and the incisal edges or cusp tips.

Figure 12.14. The black side of an Accufilm sheet marks the heaviest internal contacts on an appliance.

Figure 12.15. Black Accufilm marks on the internal surface of an appliance. Note the interproximal fins of material that run faciolingual, which fill in the occlusal and incisal embrasures of the teeth. These can also restrict appliance seating.

When adjusting the internal Accufilm markings, I tend to be fairly conservative in the beginning and become more aggressive with each successive adjustment. After 5 to 10 adjustments, if the appliance does not appear to be seating, I remove about 0.25 mm from the buccal and lingual surfaces, ensure the appliance is not tight, and reline its internal surface. This generally provides a well-fitting appliance more rapidly than continuing to adjust the appliance.

TECHNICAL TIP

Adjusting Conservatively or Aggressively

When adjusting the internal Accufilm markings, I tend to be fairly conservative in the beginning and become more aggressive with each successive adjustment.

Another common problem that occurs when attempting to seat a hard appliance fully is that it rocks. In this situation, rock the appliance back and forth to locate the fulcrum. Place Accufilm between the appliance and the area of the fulcrum and apply firm pressure over the fulcrum to create a definitive mark. Aggressively adjust the fulcrum area and err on the side of removing excess material. If several attempts to remove the rock are unsuccessful, the appliance's internal surface can be relieved and relined. To do this, remove about 0.25 mm of acrylic from all surfaces (including the occlusal or incisal surface) in the area of the rock, relieve retentive areas to ensure the appliance is not tight, and reline its internal surface.

Once the appliance's internal surface is adjusted so the appliance fully seats, ask the patient whether it feels too tight in the fully seated position. If it is too tight, mark the appliance with Accufilm and adjust the nonretentive surfaces accordingly.

Clinically, it has been observed that the anterior teeth cannot tolerate as much pressure as the posterior teeth. If a patient is unsure whether the pressure is excessive, I explain to the patient that an appliance is like a new pair of shoes: you will notice it is there, but over time (minutes to hours) the pressure sensation worsens if it is too tight. If the patient continues to be unsure, I often recommend the other appliance adjustments be performed to give the patient more time to determine whether it is too tight.

Accufilm nicely marks hard and intermediate internal appliance surfaces where a tooth firmly contacts the appliance, but it will not mark soft internal appliance surfaces nor a soft-tissue impingement. For soft internal appliance surfaces, adjust the areas as the patient directs and, for discomfort from the soft tissue, if needed, use pressure-indicator paste or spray.

Once the appliance fits comfortably, check its retention. The appliance should have a similar degree of retention as a removable partial denture. The retention should not be so strong that the patient has unwarranted difficulty removing it but be sufficient so the patient cannot dislodge it with the tongue. An appliance being too retentive is generally due to it engaging the posterior undercuts too deeply, and the depth of engagement should be reduced.

If the appliance does not have enough retention, and the internal surface provides the retention and can bind with self-curing or light-curing acrylic, reline the internal surface. For appliances with clasp retention, the clasps need to be adjusted to engage the undercuts further.

Internal Reline

The appliance's internal surface can be relined with self-curing or light-curing acrylic. Self-curing acrylic has a bad taste, but I continue to teach this technique out of fear that the students may not have access to light-curing acrylic in their future dental practices. When only part of the appliance is being relined, it generally does not fully seat, creating a gap where the reline material was not added (Figure 12.16). Therefore, I generally reline the entire internal surface so there are no internal gaps or junctions.

TECHNICAL TIP

Relining the Internal Portion of an Appliance

When relining the internal portion of an appliance, I generally reline the entire internal surface so there are no internal gaps or junctions.

Prior to providing the internal reline, remove any Accufilm marks on the internal surface; otherwise, the marks will be buried below the clear reline and may visually bother the patient. It is recommended that the procedure be discussed and the mandibular manipulation demonstrated to patients so they will not be startled during the procedure and disrupt its progress.

To reline an appliance with self-curing acrylic, first moisten the entire internal portion of the appliance with monomer (which makes the appliance's surface tacky) and shake out the excess. Pour approximately a teaspoon of powder in a paper cup, add a little more monomer than is required to moisten all of the powder granules, and mix with a wooden tongue depressor. While mixing the acrylic, have the patient swish with

Figure 12.16. This appliance lacked posterior retention, so acrylic was added to the internal portion of its posterior area. The appliance was seated in the mouth, and the patient was asked to squeeze on the appliance to seat it further. Note the gap between the anterior teeth and the appliance due to the incomplete seating of the appliance.

Figure 12.17. Internal appliance reline: moist acrylic is added to the internal surface of the appliance.

mouthwash to help lubricate the teeth and desensitize the taste buds.

Put the acrylic into the appliance with the tongue depressor, ensuring that about 1 mm of the mixed acrylic covers all of the internal surfaces, and scoop out the excess material with a gloved finger (Figure 12.17). Place the appliance into the patient's mouth, manipulate the mandible to the position that will be used to adjust the appliance, and ask the patient to squeeze the appliance into place. Asking the patient to squeeze it with the correct mandibular position will enable the resulting occlusion on the appliance to be fairly accurate.

Ask the patient to hold pressure on the appliance for 1–1.5 minutes, during which a periodontal probe can be used to remove the excess acrylic that has squeezed facially from the appliance. If the buccal flanges are short of the undercuts, the flanges will probably need to be extended to engage the undercuts, so the excess acrylic should probably not be removed from these areas. Some practitioners wait and remove this excess with a pair of scissors during one of the intermediate occasions when the appliance is removed and the material has a rubber consistency.

At 1.5 minutes after placing the appliance in the mouth, dislodge it from the supporting teeth (not from the mouth) and reinsert it. Continue this every 30 seconds until the acrylic reaches its final set (Figure 12.18). It has been observed that the acrylic's setting shrinkage will usually cause the appliance to

Figure 12.18. Internal appliance reline: once the acrylic hardened, the appliance was removed from mouth.

Figure 12.19. Internal appliance reline: excessive reline material is reduced and the edges smoothed.

fit too tightly if one stops prior to the acrylic's final set.

Inserting and removing the appliance every 30 seconds appears to compress the acrylic in the undercut areas properly so they are not too deeply engaged. There appears to be a critical time (approximately 3–4 minutes into the procedure) in which the appliance suddenly takes a little more force to dislodge. I have had two incidents in which residents did not follow my instructions (e.g., "I just turned and did a little paperwork"), and the appliance had to be removed in pieces.

At the end of this procedure, patients generally like to swish with mouthwash. Trim the reline material back to the original flanges, unless the buccal flanges should be lengthened (Figure 12.19). If lengthening the buccal flanges, trim and smooth the area, leaving approximately 2 mm of material to engage the undercuts. Reevaluate the appliance's retention and make any adjustments that are needed.

The light-curing acrylic can be used to reline the appliance's internal surface in a similar manner. Once the light-curing acrylic has been added to the internal portion of the appliance and seated in the mouth, ask the patient to squeeze the appliance into place with the mandibular position that will be used to adjust the appliance. A periodontal probe can be used to remove the excess acrylic that has facially expressed from the appliance.

With the appliance seated, use the light wand intraorally to partially cure the acrylic (for less than 1 minute). Remove the appliance, trim the excess acrylic, replace the appliance, and use the light wand to continue curing the acrylic.[50] Multiple partial curing procedures followed by dislodging the appliance may provide the best results.

Occasionally, patients will need a restoration placed on a tooth that is covered by an occlusal appliance. Whenever a filling or crown is placed on one of these teeth, the new restoration's contours are different, which generally keeps the appliance from seating fully. Clinical experience has shown that if the patient had a small to medium-sized filling placed, a few internal appliance adjustments are often sufficient to allow the appliance to accommodate for the new restoration, and sufficient appliance-tooth contacts will remain so the tooth will not shift under the appliance.

If an appliance does not seat fully after the placement of a small to medium-sized filling,

mark the appliance's internal surface by attempting to seat the appliance with Accufilm between the new restoration and the appliance. Aggressively remove the areas of the appliance that were marked by the new restoration and err on the side of removing too much acrylic. Generally, after a few adjustments, the appliance can seat as it did prior to the restoration.

If the patient had a crown or an extensive filling placed, it is probably more efficient to relieve and reline the internal portion of the appliance where the restoration is located. To do this, remove about 0.25–0.5 mm of acrylic from all aspects of the appliance where the restoration may touch. Insert the appliance and, if the new restoration causes pressure on or restricts seating of the appliance, relieve the appliance until it seats fully and comfortably. Accufilm can be used to identify the areas of pressure or restriction.

Various techniques can be used to reline an appliance for a single tooth, and this is one of the few situations in which I perform a partial appliance reline. It is important when performing this reline that the added acrylic does not keep the appliance from seating fully. If this occurs, there will be a gap between the appliance's internal surface and the adjacent teeth, and the appliance's occlusion will have shifted. To prevent this, I often place a vent hole in the appliance and mix the acrylic so it is a little more moist than used in the previously discussed reline.

External Adjustments

If the appliance stimulates the gag reflex, reduce the appliance when adjusting the internal surfaces. The degree of reduction is balanced between making the appliance too fragile and making it comfortable; it has to be acceptably comfortable or the patient will not wear it. Clinical experience has shown that mandibular appliances tend to stimulate the gag reflex less, but some patients suffer less gagging with a maxillary appliance.

Any lingual portion of the appliance has been observed to elicit a patient's gag reflex. Unless the patient directs certain areas be reduced, it is recommended that the posterior lingual flange first be thinned to 0.5–1 mm thick. If this is not satisfactory, shorten the lingual flange as needed; I rarely have to reduce it beyond the cervical margins of the teeth. If necessary, cut the posterior lingual portion so it overlaps the lingual cusps only by 1 mm and the anterior lingual flange to the cervical margins of the anterior teeth.

Once the appliance fits comfortably and has appropriate retention, adjust its occlusion. If a patient plans to wear an orthodontic retainer or partial denture opposing the appliance, adjust the appliance with it in place. This ensures the appliance will not occlude too hard on the retainer or denture.

TECHNICAL TIP

Adjusting Appliance's Occlusion

Once the appliance fits comfortably and has appropriate retention, adjust its occlusion.

The appliance's occlusal surface should be flat so the anterior teeth can slide smoothly along the appliance surface from the centric position and provide immediate disocclusion of the posterior teeth.[9] If the occlusal surface has cuspal indentations, as the mandible begins to move excursively, the cusp tip may bump the indentation's edge, disrupting this smooth flow. Therefore, the laboratory technician should not leave indentations and, if they are present, remove them as the appliance's occlusal surface is adjusted.

Instruct the patient to insert and remove the appliance for each adjustment. This ensures the patient can insert the appliance,

Figure 12.20. Accufilm held in this position can mark contacts from central incisors to third molars.

Figure 12.21. It is recommended that Accufilm never be held in this position because patients tend to protrude the mandible in this situation.

ensures the appliance does not have too much retention, frees the practitioner to do other things (e.g., pick up the articulating forceps while the patient seats the appliance) and, if the cheek is caught during insertion, the practitioner would not be aware of this and continue to attempt to seat the appliance.

Mark the opposing tooth contacts on the appliance with two sheets of Accufilm in the articulating forceps, using black to mark the centric contacts. Hold the forceps at a slight angle in the mouth so the patient can mark the third molar as well as the central incisor at the same time (Figure 12.20). It has been observed that if the anterior teeth are marked independently (Figure 12.21) patients tend to protrude the mandible for these markings, providing incorrect centric marks.

With the mandible in the desired position (neutral position or CR, as discussed in "Mandibular Positions and Interocclusal Record" in this chapter) and the Accufilm in place, ask the patient to tap on the appliance. As the patient does so, ensure the patient does

not deviate from his or her normal closing arch. Some patients shift their mandible to the side that is being marked. If this occurs, request the patient to "tap straight up and down with your jaw in the center." If the patient cannot stop shifting the mandible, simultaneously place Accufilm on both sides of the appliance, which usually eliminates this problem. It is also important that the patient does not have his or her head tilted to the side when the appliance is marked; this causes the mandible to shift to the side, and the markings will also be incorrectly positioned.

It is important to realize that only the supporting cusps provide the centric contacts from the opposing posterior teeth. Therefore, the maxillary appliance occludes with the mandibular buccal cusps, whereas the mandibular appliance occludes with the maxillary lingual cusps. The nonsupporting cusps never touch the appliance, except when a tooth is rotated to the degree that the supporting cusp cannot harmoniously occlude with the appliance, in which case one can attempt to occlude the nonsupporting cusp with the appliance.

To enhance the appliance adjustment, adjust the centric marks with the acrylic bur's flat side rather than its point (Figure 12.22 and Figure 12.23). This helps to provide a flat occlusal surface and reduces the probability of posterior excursive interferences.

As the practitioner repeatedly marks and adjusts the appliance, he or she should slowly develop even, centric marks from the opposing posterior teeth. At least one contact

Figure 12.22. If an appliance is adjusted with the flat side of an acrylic bur, the adjustment tends also to remove potential excursive contacts, increasing the speed with which the practitioner can perform the adjustment.

Figure 12.23. If an appliance is adjusted with the point of an acrylic bur, the adjustment tends to leave areas that may be excursive interferences that may need to be removed later.

from each posterior tooth should evenly occlude with the appliance, unless the tooth is malposed, for example, not within the arch's occlusal plane, and does not occlude with the opposing dentition. The centric marks from the anterior teeth should be light or none in comparison with the posterior marks. The canine marks may be in harmony with the marks from the anterior or posterior teeth.

The appliance should allow the patient to slide into excursive positions easily. Therefore, adjust the appliance so it has minimal disocclusion of the posterior teeth.[12,51] For efficiency, as I adjust the anterior centric contacts, I generally also adjust the angle of the anterior guidance ramp so it is only about 5° steeper than the appliance's occlusal plane (Figure 12.8).

TECHNICAL TIP

Occluding Cusps

Only supporting cusps provide an appliance's centric contacts. Therefore, the maxillary appliance occludes with the mandibular buccal cusps, whereas the mandibular appliance occludes with the maxillary lingual cusps.

As the appliance is being adjusted, periodically observe the distance the various cusp tips are from occluding with the appliance. If most of the cusp tips are a significant distance from occluding, it may be faster to reline the entire occlusal surface than removing acrylic to obtain the desired occlusion. If all of the cusp tips except one or two are hitting evenly on the appliance, and the cusp tips are 0.5 mm or more from occluding with the appliance, it may be faster to add acrylic to that portion of the appliance. Occasionally, a cusp tip is buccal or lingual to the appliance's occlusal surface, and the occlusal surface needs to be extended. Adding acrylic to an appliance's external surface is discussed in the next section, "External Reline."

The amount of acrylic to remove with each adjustment varies with how much each contact should be reduced. This changes with the number of centric marks obtained and how far the other cusp tips are from occluding with the appliance. If only one or two contacts are marking the appliance and the other cusp tips are a sufficient distance from marking, reduce each mark several times the amount that it takes to remove the mark; this more rapidly allows the other cusp tips to come into contact. When most of the cusp tips are marking and the other cusp tips are close to marking, I usually grind just enough to remove each mark plus a little extra on the heavier marks. When all of the desired cusp tips are marking and the practitioner is attempting to create uniform centric marks, he or she should lighten the heavier marks by only about 50%. With experience, these various degrees of adjustments become second nature.

Occasionally, patients have less biting strength on one side of their mouth and consistently tap lighter on that side. As the practitioner attempts to develop uniform bilateral marks of equal intensity, generally, the appliance is inadvertently adjusted so the weaker side hits harder than the stronger side. Therefore, as adjusting the appliance for centric contacts nears completion, periodically ask the patient to close on the appliance (without Accufilm in the mouth) and to say whether the left or right side hits first or harder. Adjust the appliance so the patient feels that both sides hit evenly and each side of the appliance has marks of equal intensity independent of the other side.

Occasionally, patients cannot repeatedly close to the same position on the appliance, even though the practitioner uses the mandibular positioning technique previously described. In this situation, I adjust the

Figure 12.24. Accufilm marks of centric contacts on adjusted appliance.

Figure 12.25. Red Accufilm marks of excursive contacts and black Accufilm marks of centric contacts on adjusted appliance.

appliance to the degree I am able, allow the patient to use the appliance, and, when the patient returns, he or she can generally provide repeatable centric contacts.

Once the desired centric contacts are obtained (Figure 12.24), begin adjusting the excursive movements. First, observe the distance the posterior teeth separate as the patient slides the mandible into the excursive positions. This gives a feel for how much and in which direction(s) the anterior guidance needs to be lowered.

Place two sheets of red Accufilm in the patient's mouth as previously described, and ask the patient to grind his or her teeth side to side and forward and backward; do this for both sides of the mouth. Then place the black Accufilm in the patient's mouth and ask the patient to tap on the appliance to re-mark the centric contacts. This provides the appliance with black centric contacts on top of the red excursive marks.

Repeatedly adjust the posterior portion of the appliance so no red posterior excursive marks are produced and the anterior portion of the appliance so the amount of separation between the closest posterior contact and the appliance is only 0.5–1 mm, as demonstrated in Figure 12.50, Figure 12.51, and Figure 12.52.[5,51] I prefer to have the anterior guidance distributed among as many anterior teeth as possible (Figure 12.25). Some practitioners prefer to have the anterior guidance provided only by the canines, which is also an acceptable technique.[7]

Since crowns supported by dental implants do not have periodontal ligaments, they will not compress when patients heavily clench on them. Ensure these crowns will not be overloaded when the patient heavily clenches and bruxes while wearing the appliance. Mark the centric contacts while the patient is maximally clenching on the appliance. This will maximally compress the teeth occluding with the appliance, but not the occluding implant-supported crowns; the implant-supported crowns will tend to mark the appliance heavier.[52] Adjust the appliance so the occluding implant-supported crowns are just out of occlusion. In spite of being out of occlusion, there is no fear that these crowns will extrude.

Observe how the implant-supported crowns contact the appliance in excursive movements and adjust the appliance so the implant-supported crowns are a safe distance away

from the appliance in these movements. Keep in mind that the appliance excursive guidances tend to wear over time, which then may allow the implant-supported crowns to contact during these movements. Follow the patient's wishes as to whether the occlusion on the implant-supported crowns need additional relief. Recommendations for implant-supported crowns covered by the occlusal appliance are discussed in the introduction section of Part III.

If it is planned for the patient to wear the appliance during the day, after the appliance is adjusted in the reclined position, reposition the dental chair into the sitting position, and ask the patient to sit with feet to the side so they are on the floor. Adjust the appliance in this position because it simulates the patient's normal upright position. Adjusting the appliance in this position generally takes only a few additional adjustments.

TECHNICAL TIP

Adjusting Appliance for Daytime Wear

If it is planned for a patient to wear an appliance during the day, after the appliance is adjusted in the reclined position, reposition the dental chair into the sitting position, ask the patient to sit with feet to the side, and adjust the appliance with the patient in this sitting position.

Clinical experience has demonstrated the appliance's occlusion should be well adjusted to provide its maximal effect.[49] Patients referred to me with a poorly adjusted appliance sometimes obtain considerable symptom improvement after having the appliance's occlusion improved.

Sometimes the appliance is perforated during adjustments. These perforations are generally over the cusp tips of teeth underlying the appliance, so perforations would rarely compromise its ability to support the occlusal contacts of the opposing teeth and would not have a detrimental effect on its efficacy. If I perforate the appliance, I always show the perforations to the patient, who otherwise may think the appliance is breaking. Once I explain that the perforations are not a concern and the appliance would need to be thicker for it to not have them, I have never had a patient request the appliance be thickened to eliminate them.

TECHNICAL TIP

Observing Perforations

Appliance perforations are generally over the cusp tips of teeth underlying the appliance, so perforations would rarely compromise the appliance's ability to support the occlusal contacts of the opposing teeth and would not have a detrimental effect on the appliance's efficacy.

Once the appliance's occlusion is adjusted and the markings demonstrate the portion of the occlusal surface that is needed to support the opposing teeth, contour the sides of the appliance. Clinically, most patients appear to need only about 7 mm for anterior guidance, so any unnecessary portion of the guidance ramp can be removed. Clinically, most patients appear to prefer to have the appliance's occlusal surface line angles rounded so they have a similar occlusogingival curvature as the teeth they cover. In some cases, an occlusal contact may be near the appliance's line angle, so this portion of the appliance may be able to have only minimal contouring.

Thin the flanges and the portions that overlay the side of the teeth so they are approximately 1 mm thick. If the appliance will be worn only at night, one may desire to leave these thicker so there is less chance of

fracturing the appliance. The external surface needs to flow smoothly and have a relatively smooth surface; otherwise, patients tend to play with areas of disharmony, which may cause an increase in TMD symptoms.

If the appliance will be worn during the day, patients generally prefer a mandibular appliance with the lingual surface as thin as possible. Make the entire lingual surface of the mandibular appliance no more than 1 mm thick, and carry the flange below the tongue's resting position so patients do not continually rub across its border as they speak. If a patient has mandibular tori, trim the lingual flange so it blends into the superior portion of the tori.

Patients who will wear a maxillary appliance during the day generally prefer shorter lingual flanges that are no thicker than 1 mm. For most patients to obtain immediate disocclusion of the posterior teeth, a guidance ramp generally needs to extend lingual to the maxillary anterior teeth. Patients usually prefer the area gingival to this ramp to be concave, so the appliance's bulk is minimized.

After my appliance adjustments are completed, I ask the patient to insert the appliance, to tell me whether the posterior occlusion hits as evenly as possible, and to tell me whether he or she knows of anything that I can do to improve the appliance. Sometimes, a minor problem may annoy a patient (e.g., a rough spot on the lingual flange, a rough excursive movement, excessive bulk, or a tendency for the appliance to cause gagging) and cause the patient to play with the annoyance, which could lead to aggravation of the TMD symptoms.

Clinical experience has shown that it is not necessary to provide the patient with a highly polished occlusal appliance. Smooth the flanges and along the occlusal surface edges with coarse pumice. I do not pumice the occlusal portion where the opposing teeth mark, for fear that this may disrupt the occlusal patterns.

External Reline

There are numerous reasons for adding clear acrylic to the external surface of an appliance, and it is most commonly done when a practitioner is inserting an appliance. For instance, while adjusting the appliance, the practitioner may observe that all of the cusp tips except one or two occlude evenly on the appliance, and the nonmarking cusp tips are 0.5 mm or more from occluding with it. In this situation, it is generally faster to add acrylic to the nonmarking portion of the appliance rather than thin the appliance until all of the cusp tips evenly occlude.

A second situation can occur after an appliance is seated and the practitioner observes the occlusion with the opposing arch is quite different from the occlusion that was fabricated for the appliance. This discrepancy could be due to an interocclusal record error, laboratory technician error, or the variability with neutral position. The practitioner may prefer to add acrylic to the entire occlusal surface because the appliance may not be thick enough to accommodate the large occlusal discrepancy and the practitioner would probably find it faster. In this situation, I generally mark and aggressively adjust the appliance contacts several times to minimize the amount of acrylic that will need to be added to the occlusal surface.

QUICK CONSULT

Avoid Interocclusal Record Errors

To avoid interocclusal record errors, ensure the patient's head is maximally rotated back, tongue is on the roof of the mouth and as posterior as possible, and the wax is dead soft.

Some practitioners routinely intraorally add acrylic to the entire occlusal surface of certain

appliances. This is most commonly done when fabricating an appliance by using a 2-mm hard thermoplastic shell molded over the patient's cast in which the occlusal contacts are obtained by adding acrylic to the appliance's occlusal surface.[7] An example of this appliance is presented in "Hard Thermoplastic Stabilization Appliance" in this chapter.

The entire occlusal surface may also need to be relined for patients who heavily grind on their appliance at night. The appliance may wear thin, and the patient may periodically return to have acrylic added to the entire occlusal surface.

The reline technique is similar for each of these situations and can be performed with either self-curing or light-curing material. For simplicity, the self-curing technique is explained, but can be similarly used with the light-curing material.

Begin by removing any marks on the surface that will be covered by acrylic; moisten the area with monomer and shake off the excess. For one or two cusp tips (Figure 12.26), only a drop of monomer may be necessary. Pour the estimated needed acrylic powder into a paper cup, add only enough monomer to moisten all of the powder granules, and mix with a wooden tongue depressor.

If adding acrylic only so one or two nonmarking cusp tips occlude with the appliance, place a piece of acrylic about 5 mm in diameter and 3 mm high onto the desired location(s) (Figure 12.27). If desired, the buccal portion of the appliance may be marked with a pencil to delineate the location where the acrylic is to be added. Wait until the acrylic firms to the consistency of clay before placing the appliance into the mouth. Sometimes, while waiting, the acrylic slumps or flows and needs to be remolded. Once the appliance is in the mouth, manipulate the mandible to the position used to adjust the appliance and ask the patient to close and tap onto the appliance (similar to tapping on Accufilm). Some patients tend not to close fully onto the appliance, resulting in the added acrylic being too thick.

Remove the appliance and place it in warm water so the acrylic will cure faster. A few patients wish to rinse their mouth with mouthwash at this time. Once the acrylic is hard (Figure 12.28), mark the cuspal indentation depth(s) with a pencil and use the flat side of the acrylic bur to reduce the added acrylic. It has been observed that if the acrylic

Figure 12.26. Adding single contact to an appliance, which is missing a contact mark from the right first premolar.

Figure 12.27. Adding single contact to an appliance: acrylic in clay consistency.

Figure 12.28. Adding single contact to an appliance: hardened acrylic removed from a patient's mouth.

Figure 12.29. Adding single contact to an appliance: contact added to an appliance.

is reduced so the pencil mark(s) are lightened by about 50%, the Accufilm mark(s) on the added acrylic will be very close to the other marks on the appliance (Figure 12.29). A larger portion of the occlusal surface can be relined in a similar fashion (Figure 12.30).

If acrylic is to be added to the entire occlusal surface, dampen the area with monomer, place the acrylic with a tongue depressor, and mold it with gloved fingers. As with the other techniques, wait for the acrylic to firm into the clay consistency before placing the appliance into the patient's mouth. The acrylic may tend to flow into the internal area of the appliance, so the appliance is generally held with the occlusal surface toward

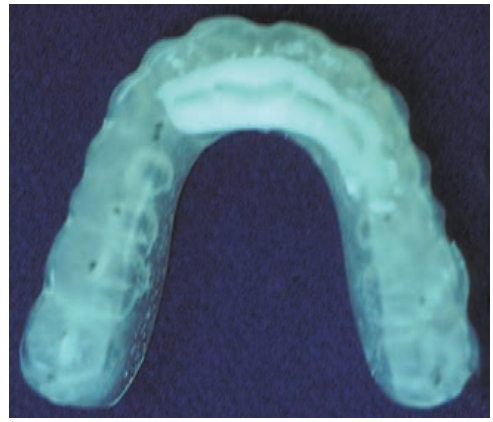

Figure 12.30. Adding acrylic to an anterior appliance segment: hardened acrylic removed from a patient's mouth.

the floor and the new acrylic is remolded as needed. Once the acrylic is the consistency of clay, place the appliance in the mouth, manipulate the mandible to the position where the appliance will be adjusted, and ask the patient to close slowly onto the soft acrylic. As the patient closes, observe whether the soft acrylic needs to be repositioned. If so, ask the patient to open while the soft acrylic is shaped into the proper position. Again manipulate the mandible and ask the patient to close slowly into the soft acrylic and to stop when the jaw is at the desired vertical dimension.

The appliance is removed, placed in warm water to speed the curing process, and/or placed in a pressure-curing unit to decrease the added acrylic's porosity. Many patients wish to rinse their mouth with mouthwash at this time. Once the acrylic is hard (Figure 12.31), mark the cuspal depths with a pencil (Figure 12.32) and use the flat side of the acrylic bur to reduce the added acrylic so that all of the indentations are removed and the pencil marks are lightened. The external surface of the appliance is adjusted as previously described (Figure 12.33, Figure 12.34, and Figure 12.35).

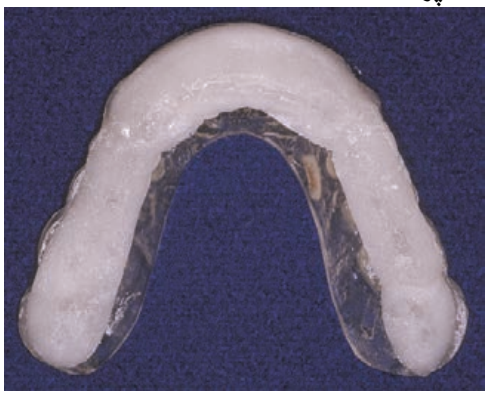

Figure 12.31. Adding acrylic to entire occlusal surface: acrylic in clay consistency.

Figure 12.33. Adding acrylic to entire occlusal surface: Accufilm marks of centric contacts on an adjusted appliance.

Figure 12.32. Adding acrylic to entire occlusal surface: cusp depths marked with pencil.

Figure 12.34. Adding acrylic to entire occlusal surface: red Accufilm marks of excursive contacts and black Accufilm marks of centric contacts on an adjusted appliance.

Figure 12.35. Adding acrylic to entire occlusal surface: relined appliance in mouth.

Adding acrylic to the occlusal surface sometimes causes undesirable concavities along the side of the appliance. These are easily filled by moistening the area with monomer and similarly mixing the acrylic, placing it in the concavity, and contouring it with a gloved finger. A smooth finish can be achieved by applying a little monomer over the surface and further smoothing with a gloved finger.

Appliance Repair

Fractured occlusal appliances made with acrylic or hybrid intermediate material (e.g., Impak) can be repaired in the mouth or by the laboratory. If no portion of the appliance is missing and the fractured pieces can be aligned by hand, the appliance can be given to the laboratory in this state for repair. If a portion of the appliance is missing and the practitioner wants the laboratory to fix it, the appliance needs to be seated on the teeth and an impression made over it. The stone cast is poured with the appliance seated in the impression material. If the opposing dentition occludes with the missing piece, the practitioner may want the laboratory also to adjust the occlusion with the added section. This would require that the practitioner also make an impression of the opposing teeth and provide a means to mount the opposing cast with the appliance (an interocclusal record between the appliance and the opposing teeth).

I prefer to repair broken occlusal appliances directly in the mouth because it is relatively quick and the patient does not have to be without the appliance. My experience is that repairs of acrylic appliances do not tend to refracture in the location they previously broke, but the appliances made with the 2-mm thermoplastic material tend to refracture at that location. For this reason, I have not attempted to repair appliances made of the dual laminate thermoplastic material, and I do not know of a technique to repair soft thermoplastic appliances.

QUICK CONSULT

Repairing Broken Appliances

I prefer to repair broken occlusal appliances directly in the mouth because it is relatively quick and the patient does not have to be without his or her appliance.

Occasionally, patients develop a hairline fracture extending along an appliance's occlusal surface. It is speculated that these cracks usually occur as a result of the occlusal surface not being thick enough to withstand the patient's heavy clenching activity. Therefore, it is recommended that the fracture be repaired and the occlusal surface thickened simultaneously. I prefer to seal the crack by flowing clear acrylic into the hairline fracture, which requires opening the fracture to provide a space for the acrylic. Open the hairline fracture with a bur (e.g., a number 330 bur). If the appliance is sufficiently thick along the fractured area, provide a slight bevel to the external margins of the cut made. Then reline the entire occlusal surface of the appliance as described in the previous section ("External Reline") so an additional 1–2 mm of acrylic is added over this area. This simultaneously seals the hairline fracture and thickens the appliance's occlusal surface.

The most common occlusal appliance fracture I see is the appliance that has broken into two pieces with the fracture in the anterior region. In this situation, increase the cross-sectional area of the fractured surface and provide approximately 1 mm of space between the two halves by slightly overbeveling the internal and external edges of the fracture (Figure 12.36).

After beveling the edges, insert both halves onto the teeth to ensure both halves fit properly and there is a space between the beveled edges for the acrylic. The halves are removed, and the beveled edges are moistened with monomer. Pour the estimated needed acrylic powder into a paper cup, add only enough monomer to moisten all of the powder granules, and mix with a wooden tongue depressor. Independently place acrylic on the beveled edges of each half, place both halves onto the teeth, and press the soft acrylic to join the two portions. If necessary, a gloved finger can be used to add acrylic to overbulk the area slightly (Figure 12.37). Ask the patient to bite on the appliance to ensure it is fully seated.

Figure 12.36. Intraoral appliance repair: fractured edges are beveled.

A portion of the acrylic often flows or is pressed into an interproximal undercut. Therefore, the appliance needs to be raised off the supporting teeth periodically or the acrylic residing in the undercut will harden and may not allow the appliance to be removed. Approximately 2–3 minutes after placing the two halves in the mouth, raise the fractured portion of the appliance off the teeth (not from the mouth) and reinsert the appliance. Continue this every 30 seconds until the acrylic reaches its final set. Then remove the appliance, trim the added acrylic to the desired shape, and polish the appliance (Figure 12.38).

Occasionally, patients have a portion of their appliance missing, such as one of my patients who related her dog got a hold of her appliance. After inserting the appliance to ensure it fits properly, bevel the fracture's external edge to increase its cross-sectional area. Moisten the beveled edge with monomer, similarly mix acrylic in a paper cup, and place the appliance onto the patient's

Figure 12.37. Intraoral appliance repair: added acrylic hardening in the mouth.

Figure 12.38. Intraoral appliance repair: repaired appliance.

teeth (without acrylic on it). As the mixed acrylic loses its sheen, apply the acrylic with a gloved finger to the area where it is missing and have the patient close the opposing teeth into it. Check to ensure the added acrylic is thick enough that the supporting cups of the opposing teeth occlude into it.

Approximately 2–3 minutes after adding acrylic to the appliance, carefully dislodge it so the added acrylic does not lock the appliance into the undercuts. Reinsert the appliance and continue this every 30 seconds until the acrylic reaches its final set. Remove the appliance and trim the acrylic to the desired shape. If the missing portion occludes with the opposing teeth, mark the cuspal depths with a pencil, use the flat side of the acrylic bur to reduce the added acrylic so the pencil marks are lightened by about 50%, and adjust the appliance's occlusion in the usual manner.

If there does not appear to be a cause for the appliance breaking (e.g., a dog chewing it), the occlusal surface may be too thin for the patient's heavy clenching activity and the occlusal surface may also need to be thickened. The entire occlusal surface can be thickened in combination with replacing the missing portion of the appliance.

QUICK CONSULT

Observing Broken Appliances

If there does not appear to be a cause for the appliance breaking, the occlusal surface may be too thin for the patient's heavy clenching activity and the occlusal surface may also need to be thickened.

If the appliance is fractured in addition to missing a piece, the practitioner may desire to separate these into two procedures, repairing the fracture first and then replacing the missing portion. If multiple steps will be needed to repair an appliance, there comes a point at which it would be better to fabricate a new appliance.

Appliance Examples

The following examples are provided to help readers better apply the principles discussed for stabilization appliances. These examples were chosen because of the various procedures they demonstrate, rather than recommending any certain appliance form or technique. These procedures can be used in many combinations to fabricate various appliances.

The first three examples are hard appliances, the next two examples are intermediate appliances, and the final example is a soft appliance. In Appendix 8, "Laboratory Occlusal Appliance Instructions," are fabrication guidelines for the laboratory technician.

Pressure-Cured Mandibular Acrylic Stabilization Appliance

Many techniques can be employed to fabricate an acrylic stabilization appliance, and the appliance's attrition rate will vary with the selected acrylic and processing method. When the same acrylic is used, a pressure-cured appliance is more resistant to attrition than one that has been bench cured.[53]

The pressure-cured appliance is more work for the laboratory, so the fee is generally higher. For this appliance, the practitioner makes impressions of the maxillary and mandibular teeth and the desired interocclusal record. The casts are mounted on an articulator with the interocclusal record (Figure 12.39), and the desired areas are blocked out on the arch for which the appliance will be fabricated. (For details, see Appendix 8, "Laboratory Occlusal Appliance Instructions.") I generally request the laboratory block out the deep grooves on the teeth and all undercuts except the buccal embrasures of posterior teeth (Figure 12.40). This leaves the buccal undercuts of the posterior teeth open, which provides an appliance that engages into these undercuts, thereby supplying retention to this area.

Using the mounted blocked-out cast and the opposing cast, a new registration relating these casts is made. The blocked-out cast is duplicated and mounted on the articulator by using the new registration (Figure 12.41). The appliance is waxed onto the duplicate cast, and the wax pattern on the cast is placed in a flask (Figure 12.42 and Figure 12.43). In

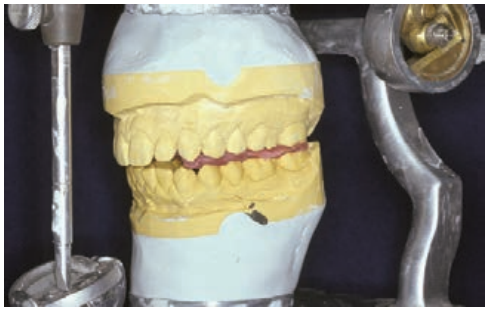

Figure 12.39. Pressure-cured mandibular acrylic stabilization appliance: casts mounted.

Figure 12.40. Pressure-cured mandibular acrylic stabilization appliance: blockout placed on mandibular cast.

Figure 12.41. Pressure-cured mandibular acrylic stabilization appliance: duplicated cast of blocked-out model mounted with new registration.

Figure 12.42. Pressure-cured mandibular acrylic stabilization appliance: waxed appliance.

Figure 12.43. Pressure-cured mandibular acrylic stabilization appliance: wax pattern placed in a flask.

Figure 12.44. Pressure-cured mandibular acrylic stabilization appliance: adjusted on articulator.

Figure 12.45. Pressure-cured mandibular acrylic stabilization appliance: completed.

Figure 12.42, note that an anterior guidance ramp extends anteriorly from the mandibular anterior teeth, enabling the appliance to provide immediate disocclusion of the posterior teeth. In Figure 12.43, note that the guidance ramp's guidance is only about 5° steeper than the posterior occlusal plane. This shallow guidance angle will minimize the resistance encountered when the patient attempts to move the mandible in an excursive direction.[12,51]

Once the appliance is cured, it is removed from the flask. The original master cast is replaced on the articulator, and the appliance is seated on this cast. The occlusion is marked and adjusted, and the appliance is polished (Figure 12.44, Figure 12.45, and Figure 12.46). In Figure 12.45 and Figure 12.46, note that the entire facial and lingual portions of the appliance and the acrylic lingual to the anterior teeth are approximately 1 mm thick.

The appliance is inserted in the patient's mouth. If the appliance cannot fully seat with a moderate amount of force or causes an uncomfortable pressure, its internal surface is adjusted, as explained in "Internal Adjustments" in this chapter.

Once the appliance fits comfortably, adjust the external surface as discussed in "External Adjustments" in this chapter. Repeatedly mark

Figure 12.46. Pressure-cured mandibular acrylic stabilization appliance: note the thickness of buccal and lingual flanges, and the acrylic thickness lingual to the anterior teeth.

Figure 12.47. Pressure-cured mandibular acrylic stabilization appliance: centric contact Accufilm marks on adjusted appliance; it is a little heavy on the one second molar, but this will be lightened when adjusting the excursive movements.

and adjust the appliance so as to obtain at least one centric mark from each posterior tooth and light to no marks from the anterior teeth in comparison with the posterior marks. Note in Figure 12.47 that the canine marks

Figure 12.48. Pressure-cured mandibular acrylic stabilization appliance: red Accufilm marks of excursive contacts and black Accufilm marks of centric contacts on the adjusted appliance.

may be in harmony with the marks from the anterior or posterior teeth.

Once the desired centric contacts are obtained, adjust the excursive positions. Adjust the posterior portion of the appliance so no excursive marks are produced. Adjust the anterior guidance ramp so that, when the patient is in the excursive positions, the closest posterior contact is only 0.5–1 mm from the appliance and the forces along the guidance ramp are distributed as evenly as possible among the anterior teeth, as demonstrated in Figure 12.48, Figure 12.49, Figure 12.50, Figure 12.51, and Figure 12.52.

Maxillary Acrylic Stabilization Appliance

The principles for the maxillary appliance are almost identical to those for the mandibular appliance. There are two prominent differences: (1) the excursive movements are in the opposite directions on the appliance, so the anterior guidance ramp will be lingual to the anterior teeth; and (2) the opposing supporting cusps that provide the appliance's

Figure 12.49. Patient occluding on appliance in the neutral position.

Figure 12.50. Patient occluding on appliance in right lateral: note the minimal disocclusion of the posterior teeth.

Figure 12.51. Patient occluding on appliance in left lateral: note the minimal disocclusion of the posterior teeth.

Figure 12.52. Patient occluding on appliance in protrusive: note the minimal disocclusion of the posterior teeth.

posterior centric contacts are the maxillary lingual cusps for the mandibular appliance, whereas they are the mandibular buccal cusps for the maxillary appliance.

For the fabrication of this appliance, make impressions of the maxillary and mandibular teeth and an interocclusal record. Once the laboratory has fabricated the maxillary acrylic stabilization appliance, attempt to insert it into the patient's mouth with a moderate amount of force.

After the appliance seats fully and fits comfortably, adjust the appliance as discussed in "External Adjustments" in this chapter. The canine marks may be in harmony with the anterior or posterior marks (Figure 12.24).

After obtaining the desired centric contacts, adjust the excursive movement. The posterior portion of the appliance is adjusted so no excursive marks are produced. The anterior guidance ramp is adjusted so the closest posterior contact is only 0.5–1 mm from the appliance when the patient is in excursive positions and the forces along the guidance ramp are distributed as evenly as possible among the anterior teeth (Figure 12.49, Figure 12.50, Figure 12.51, and Figure 12.52).

Hard Thermoplastic Stabilization Appliance

Hard thermoplastic materials are available in a large variety of thicknesses. Those that have a thickness of 1 mm or less will flex around the convexities of the teeth and are often used to form bleaching trays, trays used in fabricating temporary crowns, and so on.

The 2-mm and 2.5-mm material are typically used to fabricate occlusal appliances.[7] The 1-mm material appears to be too fragile for long-term appliance use, and material 3 mm provides unnecessary bulk for the appliance.

I use the 2-mm hard thermoplastic appliance when an appliance is desired for the patient to wear during the day that is very esthetic and has minimal effect on speech. Patients can use this appliance as a daytime reminder for a few weeks to months to help them break their daytime habits.[37,54] It is preferred that patients learn to break their daytime habits rather than rely on wearing this appliance to relieve their TMD symptoms. Clinically, it is observed that some patients who are initially provided this appliance for daytime wear become unmotivated to break their daytime habits.

These patients should always remove their appliance prior to eating.

QUICK CONSULTS

Fabricating an Appliance for Daytime Wear

I use the 2-mm hard thermoplastic appliance when an appliance is desired for the patient to wear during the day that is very esthetic and has minimal effect on speech.

Wearing an Appliance during the Day

It is preferred that patients learn to break their daytime habits rather than rely on wearing an appliance during the day. Clinically, it is observed that some patients who are initially provided a 2-mm hard thermoplastic appliance for daytime wear become unmotivated to break their daytime habits.

Therefore, though I use this appliance infrequently, I have most often used it for (1) patients who have been working to break their daytime habits and continue to have significant daytime pain for which their occlusal appliance is beneficial, but find their appliance not esthetically acceptable or that it interferes with speech (these patients are generally asked to wear their current appliance at night and this new appliance during the day [never eating with it]); and (2) patients who have intermittent daytime pain, are not willing to treat their pain with traditional behavioral techniques, and want an esthetic appliance for intermittent daytime use.

Since the purpose of this appliance is to minimize the traditional appliance esthetic and speech problems, I make a mandibular appliance without an anterior guidance ramp for the maxillary anterior teeth. Only an impression of the mandibular teeth is needed, and the laboratory is requested to fabricate a clear 2-mm hard thermoplastic appliance, as specified in Appendix 8, "Laboratory Occlusal Appliance Instructions."

Figure 12.53. Hard thermoplastic stabilization appliance: the 2-mm shell.

Once the appliance is fabricated (Figure 12.53), insert it in the patient's mouth. If the appliance does not seat fully with a moderate amount of force or causes an uncomfortable pressure, the internal surface of the appliance is adjusted, as explained in "Internal Adjustments" in this chapter. Adjust it so it is comfortable and satisfactorily retentive.

The thermoplastic material is 2 mm thick prior to appliance fabrication, but thins to approximately 1 mm once it is warmed and stretched across the patient's cast. Clinical experience has shown that this is rarely thick enough to develop the desired maxillary occlusal contacts without creating multiple perforations of the appliance's occlusal surface. Therefore, once the appliance fits comfortably, it routinely needs to have clear orthodontic acrylic added to obtain the appliance's occlusal scheme from the maxillary first premolar's lingual cusp to the most posterior tooth.

A grease pencil is often used on the appliance to delineate the anterior extent to which acrylic needs to be added. Using monomer, moisten the area of the appliance

where acrylic is to be added. Pour approximately a teaspoon of acrylic powder into a paper cup, add only enough monomer to moisten all of the powder granules, and mix with a wooden tongue depressor. Place the acrylic on the desired area, slightly overestimating the amount of acrylic needed. Wait for the acrylic to firm into a clay consistency before placing the appliance into the patient's mouth. The acrylic may slump or flow while you are waiting, and it is important to ensure the acrylic does not flow into the internal portion of the appliance. Therefore, the appliance is generally held so that the added acrylic is toward the floor, and the acrylic generally has to be remolded once or twice during this wait.

Once the acrylic is the consistency of clay (Figure 12.54), place the appliance in the patient's mouth, manipulate the mandible to the position that will be used to adjust the appliance, and ask the patient to close slowly into the soft acrylic. As the patient initially closes into the acrylic, observe whether it needs to be repositioned and, if needed, mold it into the proper position. Again manipulate the mandible, and ask the patient to close slowly into the soft acrylic and stop as soon as the teeth touch the hard acrylic substructure. If the patient closes further than this first contact, the mandible shifts and the cuspal indentations are not in the desired location.

The appliance is removed, placed in warm water to speed the curing process, and/or placed in a pressure-curing unit to decrease the added acrylic's porosity. Some patients wish to rinse their mouth with mouthwash at this time. Once the acrylic is hard, mark the cuspal depths with a pencil (Figure 12.55), and use the flat side of the acrylic bur to reduce the added acrylic until the pencil marks are almost erased. Repeatedly mark the appliance with black Accufilm, and adjust the appliance so at least one centric mark is obtained from each posterior tooth, these marks appear as uniform as possible, and the patient feels that both sides hit evenly (Figure 12.56).

Adjust the appliance so the patient can slide the mandible easily into excursive positions, disoccluding the posterior teeth with the closest posterior contact being 0.5–1 mm from the appliance. It is preferred that the maxillary canines provide the posterior disocclusion, but the canines generally do not touch the appliance, thereby preventing them from providing immediate disocclusion of the posterior teeth. Therefore, the occluding

Figure 12.54. Hard thermoplastic stabilization appliance: acrylic of clay consistency added to the shell.

Figure 12.55. Hard thermoplastic stabilization appliance: hard acrylic, with cusp depths marked with pencil.

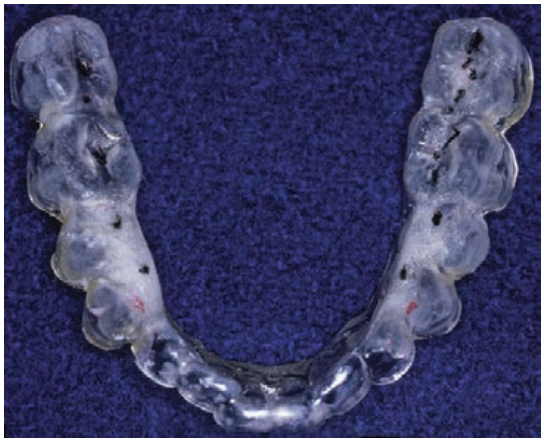

Figure 12.56. Hard thermoplastic stabilization appliance: black Accufilm marks of centric contacts on adjusted appliance and red Accufilm marks of excursive contacts.

Figure 12.57. Hard thermoplastic stabilization appliance: provides a very esthetic appliance that minimally disrupts speech; for daytime appliance wear.

maxillary first premolar's lingual cusp can be used to disocclude the posterior until the canine contacts the appliance and can disocclude the posterior teeth.

Adjust the posterior portion of the appliance so no red posterior excursive marks are produced except for the maxillary first premolar's lingual cusps and/or canines (Figure 12.56).

Since the patient will be wearing this appliance during the day, after adjusting the appliance in the traditional manner, adjust the appliance with the patient in an upright position. Reposition the dental chair into the sitting position and ask the patient to sit with feet to the side so they are on the floor. Mark and adjust the appliance with the same criteria.

Once the appliance's occlusion is adjusted, ensure the added acrylic is smooth and flowing. Sometimes, undesirable holes or concavities form when acrylic is added to the occlusal surface. These are easily filled by moistening the area with monomer and similarly mixing the acrylic, placing it in the concavity, and contouring it with a gloved finger. A smooth finish can be achieved by applying a little monomer over its surface and further smoothing it with a gloved finger.

Once the appliance is satisfactory, ask the patient to insert it. Inform the patient that the appliance will be smoothed later, but that you want to ensure that the posterior teeth hit the appliance as evenly as possible and determine whether the patient knows of anything that would make the appliance more comfortable. Once the appliance meets with the patient's approval, smooth the sides of the added acrylic and ask the patient whether it feels smooth enough.

I use this appliance only when the patient needs to wear an appliance during the day and needs one that is very esthetic and has minimal effect on speech (Figure 12.57). There is a concern that this appliance does not provide support for the maxillary anterior and that the maxillary anterior teeth might supraerupt if the patient wore this appliance full time. It appears this is not often a problem because many people have maxillary anterior teeth that are so far anterior that their mandibular teeth rarely occlude with them, and the lower lip provides the support for these teeth.[12] To preclude the possibility of the

maxillary anterior teeth supraerupting, if the patient needs to wear an appliance at night, it is recommended one be fabricated that will maintain the position of these teeth, that is, a maxillary appliance or mandibular appliance with an anterior guidance ramp.

Impak Stabilization Appliance

This is the appliance I and our dental school most commonly use. Impak is a hybrid intermediate material that can become flexible when heated and hard when cooled to the temperature of the patient's mouth.

The dental laboratory that fabricates our appliances found dentists prefer appliances that are heat cure-processed with a powder to liquid ratio of 4:1. This provides appliances that when warmed are quite flexible (so they will flex around minor discrepancies between the cast and tooth surfaces) and when cooled to the mouth temperature retain their new shape (compensating for the minor errors with the cast) and have a similar hardness as acrylic appliances.

Most of these appliances are made entirely with Impak (comparable with the Remedeze appliance), but if the patient has moderate to severe tooth attrition, I request the appliance's occlusal surface be covered with acrylic, to resist appliance wear from heavy parafunctional activity (comparable with the Bruxeze appliance).

We found placing this appliance in a hot water bath set at 160° or in hot water from a coffee maker for 1 minute causes the appliance to be quite flexible, so it will flex around any minor discrepancies between the cast and tooth surfaces. We seat the warmed appliance over the patient's teeth, repeatedly remove it from the teeth (but not the mouth) and reseat it.

I send the laboratory maxillary and mandibular casts and an interocclusal record.

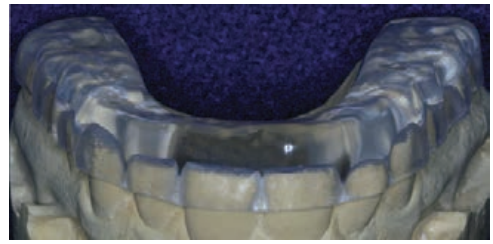

Figure 12.58. An appliance fabricated with Impak material.

Since excessive appliance material in the interproximal undercuts will flex away from these undercuts during the heating, fitting, and cooling process, I like to start with an appliance that is slightly overextended into these undercuts and is too retentive (Figure 12.58). If there remains too much retention following the heating, fitting, and cooling process, I will shorten the flanges.

If the appliance is made entirely with Impak, during the heating/fitting process, the mandible is manipulated into the desired position, and the patient is asked to squeeze a little into the material. This helps to mold the occlusal surface to better fit the opposing occlusion.

The occlusion is adjusted with an acrylic bur, as described for the previous appliances. I find when I adjust the occlusion for these appliances, I have to be careful not to deform the appliance, or it may take a few seconds to bend the appliance back to the correct shape.

I prefer the Impak stabilization appliance to the hard stabilization appliance for the following advantages:

1. From the heating, fitting, and cooling process, it will compensate for minor errors with the cast and generally provides an ideal amount of retention that feels comfortable to the patient. One of the reasons we made this the primary stabilization appliance provided by our dental students is that is it easy for the

students to obtain a comfortable internal fit.
2. It will bond with self-curing acrylic, enabling me or the laboratory to reline its occlusal surface and repair the appliance.
3. If the patient has a restoration placed on a tooth covered by this appliance, its flexibility when heated may allow the practitioner to readapt the appliance to the new restoration.

Dual Laminate Thermoplastic Stabilization Appliance

This material comes in sheets that have thermally laminated the soft thermoplastic material to the hard thermoplastic material. The material is warmed and molded over the patient's cast by positive pressure, so the soft material is against the teeth and the hard material is the external surface. This provides the appliance with most of the positive qualities of both the soft and hard thermoplastic appliances; that is, the soft material feels comfortable to the supporting teeth, the soft material can compensate for minor errors so internal adjustments are rarely needed, the soft material helps dissipate clenching forces, the hard material bonds with self-curing acrylic, giving it the versatility of an acrylic appliance, and the acrylic occlusal surface marks and adjusts with the precision of acrylic appliances.

In the construction of this appliance, I prefer the laboratory add the self-curing acrylic to the appliance's occlusal surface. Therefore, I send the laboratory a maxillary and mandibular cast and desired interocclusal record.

The laboratory technician mounts the models on the articulator, molds the dual laminate thermoplastic material over the cast, removes the excess material, and returns the cast to the articulator. At this stage, the laboratory technician is instructed to adjust the articulator's incisal pin so the closest opposing tooth is 1 mm from the dual laminate's occlusal surface. This provides a minimum acrylic thickness of 1 mm, which clinically appears appropriate for the needed intraoral adjustments.

The laboratory technician roughens the dual laminate's occlusal surface, moistens it with monomer, adds self-curing acrylic, and adjusts the acrylic occlusal surface (Figure 12.59, Figure 12.60, Figure 12.61). The added acrylic provides the same occlusal surface as would be established with the traditional acrylic appliance.

The laboratory technician is requested to carry the labial and buccal portions of this appliance to the gingival margin. The desired

Figure 12.59. Dual laminate thermoplastic stabilization appliance: fabricated and adjusted on articulator.

Figure 12.60. Dual laminate thermoplastic stabilization appliance: occlusal surface of a fabricated appliance.

Figure 12.61. Dual laminate thermoplastic stabilization appliance: the internal surface of a fabricated appliance; note the thickness of buccal and lingual flanges, and the acrylic thickness lingual to the anterior teeth.

labial extent varies with the angulation of the anterior teeth, and the requested labial extent can be reduced as needed. If this appliance is difficult to insert or the anterior portion has too much retention, I generally correct this by reducing the labial extent, but leave at least 1–1.5 mm of material labial to the incisal edge of the anterior teeth (the recommended labial extent used with acrylic appliances).

Similar to the soft thermoplastic appliances, the internal surface cannot be relined. Adjust the internal surface with an acrylic or number 8 round bur and, if this does not make the appliance fully seat comfortably, have it refabricated.

External relines and adjustments are made in the same way as those for acrylic appliances. Since the soft internal layer occupies a portion of the interocclusal space, the vertical dimension of this appliance will be a little larger than that of comparable acrylic appliances.

The disadvantage of this appliance is that the soft inner layer tends to discolor over time and after about 3 years, it looks so bad that most patients want it replaced.

Soft Thermoplastic Stabilization Appliance

Soft thermoplastic material is available in a large variety of thicknesses and is commonly used for fabricating athletic mouth guards.[55] Similar to the hard thermoplastic material, once warmed and stretched across a patient's cast, it thins to approximately half its original thickness.

The 0.15-in. (3.8-mm)-thick and the 4.0-mm-thick material are the maximum thicknesses commercially available and generally provide an occlusal surface approximately 2 mm thick. This limited thickness is sometimes a problem and, if the patient has a significant occlusal discrepancy, this thickness may not be adequate for obtaining all of the desired occlusal contacts. Therefore, I routinely use this material for soft thermoplastic stabilization appliances, even though the resulting flanges are bulkier than I desire.

The practitioner needs only to make an impression of the teeth in the arch for which the appliance will be made and request the laboratory to fabricate a clear soft thermoplastic stabilization appliance, as specified in Appendix 8, "Laboratory Occlusal Appliance Instructions." The appliance rarely needs internal adjustments, but, if it does not completely seat or causes an uncomfortable pressure, determine the seating interference or ask the patient to identify the pressure area. (Accufilm does not adequately mark this appliance.) Adjust the internal surface with an acrylic or number 8 round bur. If the appliance cannot be made to fully seat comfortably, have it refabricated.

Once the appliance completely seats and is comfortable, evaluate its retention, which varies with the depth the material penetrated into the undercuts. This fluctuates with the temperature at which the material was warmed and the amount of force used to mold the material over the cast. If the

appliance is too retentive, use an acrylic or number 8 round bur and reduce the material that fits into the most retentive undercuts. If there is inadequate retention due to insufficient material penetrating into the undercuts, have the appliance refabricated. A positive pressure (up to 10 atm) machine will provide a much more retentive appliance than a vacuum (1 atm) machine;[40] this may require telephoning laboratories to determine which molding technique they have the capability to use.

The appliance's occlusal surface can be rapidly modified to provide a close approximation of the final occlusal surface. In order that the patient does not disrupt this procedure and can perform the necessary movements, first discuss the procedure with the patient, demonstrate the mandibular manipulation, and ask the patient to practice the excursive movements.

With the appliance on the cast, use an alcohol torch to warm all areas of the appliance that the opposing teeth may touch. Evenly warm the appliance by repeatedly sweeping the flame from one side of the appliance to the other. Clinical experience has demonstrated that when the appliance feels slightly tacky, it is ready to place in the mouth.

Once the appliance is seated on the teeth, manipulate the mandible to the position where the appliance will be adjusted, and ask the patient to slowly close into the softened appliance. Ask the patient to stop when the last tooth desired to occlude with the appliance is only lightly touching or just about to touch the appliance; this retains the maximal thickness for the appliance. Then, ask the patient to slide the mandible across the appliance into the previously practiced excursive positions.

This creates occlusal imprints of the opposing cusp tips into the appliance's occlusal surface. Place the appliance on the cast and mark the bottom of each cusp indentation with dark ink so they can easily be observed as an acrylic bur is used to modify the occlusal surface. Any nonsupporting cusp indentations present are removed well below the depth of their indentation, whereas the supporting cusp indentations are reduced so the ink marks are just barely removed.

The indentations from the anterior teeth provide guidance to disocclude the posterior teeth. These indentations are retained, but if there is material that extruded around the teeth, remove it and contour the area to allow for smooth excursive movements. The occlusal surface is contoured to form a flat plane, and the sides are contoured to flow smoothly onto the occlusal surface.

An indentation from at least one supporting cusp of every posterior tooth is desired. If the initial attempt did not obtain or almost obtain these imprints, the aforementioned steps may be repeated.

For the final adjustments, use the acrylic bur to adjust the occlusion marked on the appliance with articulating paper (Bausch Articulating Paper, Nashua, NH) because Accufilm does not adequately mark this material. The articulating paper marks are not the point contacts typically observed on acrylic appliances, but broad marks (Figure 12.62).

Figure 12.62. Soft thermoplastic stabilization appliance, centric articulating paper marks on adjusted appliance.

Clinical experience has demonstrated that even though the articulating paper marks appear uniform, the patient may detect the opposing teeth are not occluding evenly on the appliance. If the patient identifies heavier contacts that appear as even articulating paper marks, it is recommended that further adjustments of the appliance be made with the patient's guidance until it feels even to the patient.

The appliance is next adjusted so the anterior teeth disocclude the posterior teeth in excursive positions. The excursive movements are marked with articulating paper, and the new markings on the posterior portion of the appliance are adjusted.

The appliance may be polished with chloroform or halothane (a general inhalation anesthetic often used as a substitute for chloroform[56]). To obtain a smooth finish rapidly, seat the appliance on the cast and rub a dampened gauze firmly with either agent over any rough area of the appliance. Use water to rinse off any remaining polishing agent, ask the patient to insert the appliance, and ask whether there is anything that the patient would like done to improve the appliance.

Soft thermoplastic stabilization appliances can be fabricated for either the maxillary arch or the mandibular arch. Because of the bulkiness of its flanges, I generally fabricate this appliance for the mandibular arch. An appliance that is to be used as an athletic mouthpiece should be fabricated for the maxillary arch. I always adjust the occlusion of the athletic mouthpiece because it makes the mouthpiece more comfortable, less likely to cause occlusal changes, and less likely to cause the patient to develop TMD symptoms.[39]

The soft thermoplastic stabilization appliance is the only appliance I will provide a child with in the primary or mixed dentition. It is speculated these appliances will not significantly affect the development of the dentition and will not need the number of adjustments that the other appliances may require to accommodate minor tooth movements.[1,37,38]

Occasionally, soft appliances are fabricated to oppose a hard or intermediate appliance (Figure 12.63). This is generally performed when (1) the patient's heavy parafunctional habits are causing the opposing teeth to rapidly wear the appliance or (2) the appliance does not provide adequate TMD symptom

Figure 12.63. Soft thermoplastic stabilization appliance opposing an acrylic appliance.

improvement. One study found after providing these TMD patients a soft appliance opposing their hard appliance that these patients obtained a significant decrease in TMD symptoms; 63% rated it as good TMD symptom improvement, and 12% rated it as some improvement.[42]

The occlusion of a soft appliance that is opposing a hard or intermediate appliance is easy to adjust. Ask the patient to insert the hard or intermediate appliance and heat the soft appliance's occlusal surface with an alcohol torch by repeatedly sweeping the flame from one side of the appliance to the other. Seat the soft appliance onto the patient's teeth, ask the patient to close onto the softened appliance, and slide the mandible in the various excursive positions. After the soft appliance has cooled, mark its occlusal contacts (centric and excursive) with articulating paper (Bausch Articulating Paper, Nashua, NH) (see Figure 12.64). Adjust the heavier marks with an acrylic bur, remove any soft material that extruded during the movements, and smooth the appliance with chloroform.

Over-the-counter appliances sold for TMD symptoms or athletic mouthpieces are often purchased by individuals in an attempt to adequately resolve their TMD symptoms. There are many types of over-the-counter appliances; some are able to be customized through heating and molding, while others are just held in place by the teeth continually resting on them.

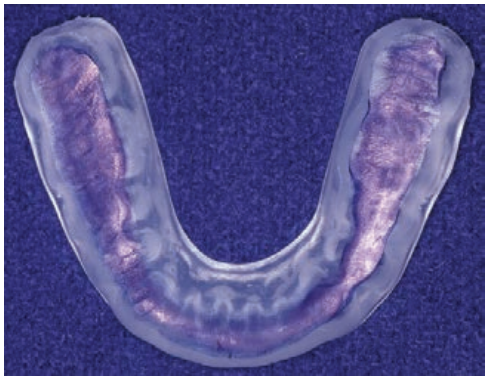

Figure 12.64. Articulating paper marks on adjusted soft thermoplastic stabilization appliance opposing an acrylic appliance.

It has been observed that individuals have mixed results with these appliances, and the belief is that a poor response may be related to (1) the opposing occlusal indentations having been made with the condyles in an inappropriate position; (2) the occlusal indentations not allowing the patient to move the mandible freely; or (3) the mouthpiece not providing adequate retention, requiring the patient to continually hold it in place by keeping the teeth together.

It is strongly recommended that patients do not use an over-the-counter appliance long term because of fear that it may cause occlusal changes if it does not cover or evenly occlude with all of the teeth.

Appliance Management

Great variations in the protocols that practitioners use when delivering occlusal appliances have been observed. Some practitioners (as myself) attempt to refine the occlusion fully at the insertion appointment. Occasionally, the lengthy appointment aggravates a patient's TMD symptoms to the degree that the patient wants to stop prior to completion of the adjustments.

Some practitioners make shorter insertion appointments, adjust the appliance so it is comfortable on the teeth that support it, and adjust the appliance's occlusion so one or two contacts are occluding on each side. At each follow-up appointment, its occlusion is further refined, and eventually the appliance becomes adjusted as described earlier.

Fully adjusting the appliance at its delivery has the advantage of the patient obtaining the

maximal initial treatment effect from the appliance, but the long procedure may cause some temporary TMD aggravation. The stepwise adjustment protocol causes minimal TMD symptom aggravation during appliance delivery, but some patients have symptom aggravation from wearing an inadequately adjusted appliance; the uneven occlusal contacts may induce some shifting of the teeth, which may delay the practitioner from obtaining a stable occlusion on the appliance; and it takes the patient longer to obtain the appliance's maximal treatment effect.

Whenever patients are provided an appliance, it is recommended they also receive the "Occlusal Appliance Care Instructions" handout (Appendix 5) and it be reviewed with them. The instructions inform patients about common problems they may encounter, maintenance of the appliance, reasons the appliance will need additional adjustments, and, if discomfort occurs, to stop wearing it and return to have the discomfort relieved.

Appliances can harbor microorganisms, so if the patient needs treatment for a candidiasis infection or you suspect fungal growth under the appliance, the appliance should be treated. The appliance can be disinfected in your office by soaking it in 1% sodium hypochlorite for 10 minutes.[57] The patient can also eliminate the metabolic activity of the *Candida albicans* by soaking it in 2 tsp of Clorox diluted with 1 cup (8 fluid oz) of water for 30 minutes.[58] Some practitioners ask their patients to do this on a weekly basis to prevent fungal growth, but I am afraid this may have a deleterious effect on the intermediate and soft appliances.

The recommended wear pattern will vary with the symptoms that are being treated. Patients who awake with TMD symptoms that last up to several hours and/or who have minimal daytime symptoms are asked to wear the appliance only at night.

FOCAL POINT

Patients who awake with TMD symptoms that last up to several hours and/or who have minimal daytime symptoms are asked to wear the appliance only at night.

If attempting to reduce significant daytime symptoms with the appliance, I would like the patient to wear the appliance during the day (1) as a reminder to help him or her observe and break the daytime habits (Figure 14.7)[37,54] and (2) to maximize the effects from the stable occlusal environment.[4] The patient is instructed to wear the appliance temporarily during the day and never eat with it. Nighttime appliance use often provides some prolonged benefits that carry over to help alleviate the daytime symptoms also.[59] Therefore, I instruct these patients to wear the appliance temporarily 24 hours a day and, over a few weeks to months, reduce its use slowly to primarily nighttime.

FOCAL POINT

If attempting to reduce significant daytime symptoms with an appliance, the patient is instructed to wear the appliance temporarily 24 hours a day (except when eating) and, over several months, reduce its use slowly to primarily nighttime.

Occasionally, patients who wear an appliance 24 hours a day (including while eating), and never put their teeth into MI, over time lose the ability to occlude their teeth into MI.[60] This situation may require orthognathic surgery to enable the patient to once again occlude into MI. One of the principal reasons patients are instructed to not eat with their appliance is that they generally put their teeth into MI while eating. Patients are allowed to wear their appliance 24 hours a

day for only a relatively short period (a few months), during which they are closely observed to ensure they are not losing the ability to occlude into MI.

Some patients recognize that their TMD symptoms and parafunctional habits are related to certain activities, for example, driving a car or using a computer. These patients are asked to wear their appliance during these activities (if they are willing) and at night. During the initial phase of daytime wear, patients observe the benefit they obtain from wearing the appliance during these activities and its cost (e.g., difficulty speaking and its visibility). From this, they decide how often they will wear the appliance during the day. Alternative conservative therapies should be provided, as needed, so patients can stop their daytime appliance use and limit the wear to nighttime.

Generally, as patients wear their new appliance, the masticatory muscles become less tense and the TMJ arthralgia reduces. These changes within the masticatory system usually alter the occlusion on the appliance. It has been observed that these changes are often proportional to a patient's symptoms and, with repeated appliance adjustments, the occlusion stabilizes.[61] No matter how well the appliance was initially adjusted, the patient needs to return for follow-up to refine the occlusion for these adaptive changes, to ensure the appliance is not causing any correctable problems, to ensure the appliance is beneficial, and, if needed, so that additional TMD therapies can be recommended.[3]

The length of time between the insertion and follow-up appointment will vary with a patient's symptom severity and how well the appliance could be adjusted. If a patient's symptoms are severe and/or the appliance cannot be adjusted adequately, the patient is given an appointment within a week. If a patient has minimal symptoms and a well-adjusted appliance was provided, the patient is generally given an appointment approximately 3 or 4 weeks later.

When the patient returns for follow-up, ask about any problems he or she may be having with the appliance. Occasionally, a patient relates that he or she unintentionally removes the appliance while sleeping. It appears patients subconsciously remove their appliances at night because the appliance aggravates them in some manner. Four different causes have been observed, and the patient generally stops removing it once the cause is corrected. The four problems I probe are whether the appliance is (1) too loose, (2) too tight, (3) not satisfactorily adjusted to the opposing dentition, or (4) too bulky. The appropriate corrections typically stop this problem.

Generally, patients report a significant reduction in the TMD symptoms upon awaking, and the daytime symptom reduction varies with how often a patient has worn the appliance during the day and/or learned to break the daytime habits. If the appliance needs only minor adjustments, the occlusion should be perfected, but the patient often does not even notice the difference or have any additional symptom improvement.

Even with the identified predictors for which patients have a high probability of improving or not improving with stabilization appliance therapy, it is not uncommon for me to be surprised with how effective it is for one patient and how ineffective it is for another patient. Fortunately, the percentage of patients who have no improvement from an appliance adjusted as previously described is relatively small.

All patients who are provided an occlusal appliance should have received the "TMD Self-Management Therapies" handout (Appendix 4) at the evaluation appointment. The end of this handout states that "a percentage of patients receiving [TMD] therapies report no symptom improvement

(i.e., 10–20% of patients receiving occlusal appliances report no improvement)." Therefore, the patient has been warned about this possibility, but this does not decrease the disappointment felt by the practitioner as well as the patient if symptoms do not improve.

Typically, our treatments in dentistry are successful, whereas in medicine, practitioners are accustomed to having a percentage of patients not benefit from a therapy. The success of TMD therapies is similar to that of other medical procedures provided for patients with chronic pain. The percentage of patients reporting minimal improvement from the use of a stabilization appliance should be minimized by following the recommendations for when to use a stabilization appliance in "Integrating Conservative Therapies" in Chapter 19.

If a patient has not obtained the expected improvement from using an appropriately adjusted appliance for several weeks, consider reevaluating the patient to determine whether the chief complaint may be due to a non-TMD condition and/or whether non-TMD contributors (neck pain, fibromyalgia, sleep apnea, etc.) were missed during the initial evaluation.[3] If a panoramic radiograph was not taken, the practitioner may desire to take one at this time.

Patients with untreated sleep apnea may awake with similar symptoms to patients who have TMD from heavy nighttime parafunctional habits, for example, temporalis and/or masseter muscle pain that lasts 0.5–1 hour.[62,63] In the initial patient evaluation questionnaire, patients whose pain is due to sleep apnea usually related they do not sleep well at night, and upon further questioning, they relate they are drowsy throughout the day and they or a bed partner relates they awake gasping for air. These patients should be evaluated for sleep apnea by a sleep study; if desired, the patient's physician can refer the patient for this evaluation.

QUICK CONSULT

Failing to Relieve Symptoms

If a patient has not obtained the expected improvement from using an appropriately adjusted appliance for several weeks, consider reevaluating the patient to determine whether the chief complaint may be due to a non-TMD condition and/or whether non-TMD contributors (neck pain, fibromyalgia, sleep apnea, etc.) were missed during the evaluation. If a panoramic radiograph was not taken, the practitioner may desire to take one at this time.

If a patient did not receive satisfactory improvement with use of the stabilization appliance, the practitioner may want to try a different mandibular position to determine whether it might make the appliance more effective. The most likely other position that would provide a beneficial effect is at the location where the masticatory system feels the most relaxed and comfortable for the patient.

Ask the patient to slide the mandible slowly anterior and determine whether there is a position at which the masticatory system feels more relaxed and comfortable. If the patient can locate such a position, the practitioner may find the appliance more effective with the mandible supported at this new position.

As the patient protruded the mandible to the new comfortable position, the condyle also translated. If the patient has a disc displacement with reduction, and a click or pop was detected within the TMJ as the condyle translated, clinically, this suggests the condyle moved onto the disc's intermediate zone (called the reduced position). To confirm clinically that the disc–condyle is reduced, ask the patient to open from and close to this protruded position and, if the disc–condyle is reduced, the patient's typical TMJ click or

pop will no longer be present. The bottom left diagram of the "TMJ Disc–Condyle Complex Disorders" handout (Appendix 3) may help readers to understand visually that once the condyle is reduced, the patient can open and close from that position without creating the normal joint noise. Contrary to what one would expect, this clinical test is not accurately supported by MRI findings.[64,65]

If a patient has a disc displacement with reduction, and the clinical test suggests the new position is where the disc–condyle is reduced, the proposed new appliance would be an anterior positioning one. It is recommended the practitioner follow the guidance provided in Chapter 13, "Anterior Positioning Appliance," for this appliance. Acrylic can be added to the existing stabilization appliance to modify it into an anterior positioning appliance.

If the new comfortable position is only 1 or 2 mm anterior from the previously used position, and the patient can close repeatedly at this location, the practitioner may desire to adjust the appliance to provide a stabilization appliance with the centric contacts at the new position. If the patient cannot close repeatedly at this new location, the practitioner may want to add acrylic to provide occlusal indentations that will help the patient maintain the mandible at this comfortable position.

The indentations can be added to the occlusal surface of the appliance with self-curing acrylic (Figure 12.65). Follow the guidance provided in "External Reline" in this chapter, and ask the patient to close into the identified comfortable position. Trim and adjust the appliance as instructed in Chapter 13. The wear schedule, warnings, and follow-up provided for the anterior positioning appliance would probably apply for this appliance.

If the patient could not find a comfortable position, but meets the criteria for an anterior positioning appliance, consider providing an anterior positioning appliance and follow the guidance provided in Chapter 13. It is recommended stabilization appliances be provided prior to using one of these alternative appliances because all have similar efficacy for most individuals, the risks for adverse sequelae from one of these alternative appliances is much greater, but some individuals who do not find a stabilization appliance beneficial may find one of these alternative appliances dramatically beneficial.[4,49,66]

Figure 12.65. Appliance with occlusal indentations, Accufilm contact marks on adjusted appliance.

Another potential therapy to consider is fabricating a soft appliance to oppose the patient's hard or intermediate appliance (Figure 12.63). One study found after providing patients who had not obtained satisfactory improvement from a hard appliance with an opposing soft appliance that patients obtained a significant decrease in TMD symptoms; 63% rated it as good TMD symptom improvement, and 12% rated it as some improvement.[42] Additional nonappliance therapies for TMD symptoms that occur upon awaking are provided in "Integration of Conservative Therapies" in Chapter 19. Patients provided a stabilization appliance generally have their conditions followed for

several months to determine the amount the occlusal changes against the appliance occurs between appointments and how sensitive the patient is to these changes. From these observations, the practitioner can determine the appropriate time for scheduling the next follow-up appointment. Typically, patients are eventually placed on an annual recall.

Using the conservative TMD therapies discussed in "Integrating Conservative Therapies" in Chapter 19, I try to reduce the patient's symptoms satisfactorily so that the appliance needs to be worn only at night. I plan for the great majority of my patients to wear their appliance at night for many years. Periodically, patients forget to wear their appliance at night, which provides an unintentional test of whether the appliance is still needed.

TMD tends to be a cyclic disorder that is often related to situations occurring in a patient's life, and there are many possible scenarios for how often the patient will need to wear the appliance. Some patients may need to wear it every night and others on a weekly basis, whereas others may find at some point that they no longer need it. If patients do not wear their appliance, the teeth tend to shift and, over time, the appliance becomes more difficult and/or painful to insert and wear.

It is common to hear patients returning for a new appliance say that they no longer needed it and so stopped wearing it. Then, 1 or 2 years later, a situation in their life changes, and they once again need an appliance. Therefore, even though a patient no longer needs to wear the appliance, it is recommended that the appliance consistently be worn every night. When the appliance reaches the condition where it should be replaced and is no longer needed, this is an appropriate time to discontinue its use.

Appliance therapy should be viewed as one of many conservative TMD therapies. Used in conjunction with other conservative therapies, it augments the symptom improvement that patients can obtain. Appliance therapy should not be viewed as temporary treatment for which occlusal rehabilitation is the final treatment approach.[3]

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Chapter 13

Anterior Positioning Appliance

FAQ

Q: Why does eliminating the temporomandibular joint (TMJ) noise clinically suggest that the condyle is positioned into the disc's intermediate zone?
A: The bottom left diagram of the "TMJ Disc–Condyle Complex Disorders" handout (Appendix 3) may help readers to understand visually that once the condyle is reduced onto the intermediate zone of the disc, the patient can open from and close to that position without creating the click or pop that normally occurs when the condyle moves under the disc's posterior band.

This appliance, which is traditionally used for patients who have a disc displacement with reduction, temporarily holds the mandible in an anterior location, where the condyle is positioned onto the disc's intermediate zone, also referred to as the location where the condyle is reduced onto the disc (Figure 13.1).[1] There appear to be two primary mechanisms by which the anterior positioning appliance reduces the temporomandibular disorder (TMD) symptoms: (1) it removes the disc–condyle mechanical disturbance from moving below the disc's posterior band, and (2) it transfers the condylar loading forces from the retrodiscal tissue to the intermediate zone.

FOCAL POINT

An anterior positioning appliance is traditionally used for patients who have a disc displacement with reduction. It temporarily holds the mandible in an anterior location where the condyle is reduced onto the disc (Figure 13.1).

When a patient occludes on this appliance, the condyle is maintained in the reduced position, causing the patient to be unable to make his or her normal TMJ clicking or popping noise by opening or protruding the mandible. If the mechanical disturbance responsible for the joint noise irritates the

Manual of Temporomandibular Disorders, Third Edition. Edward F. Wright.

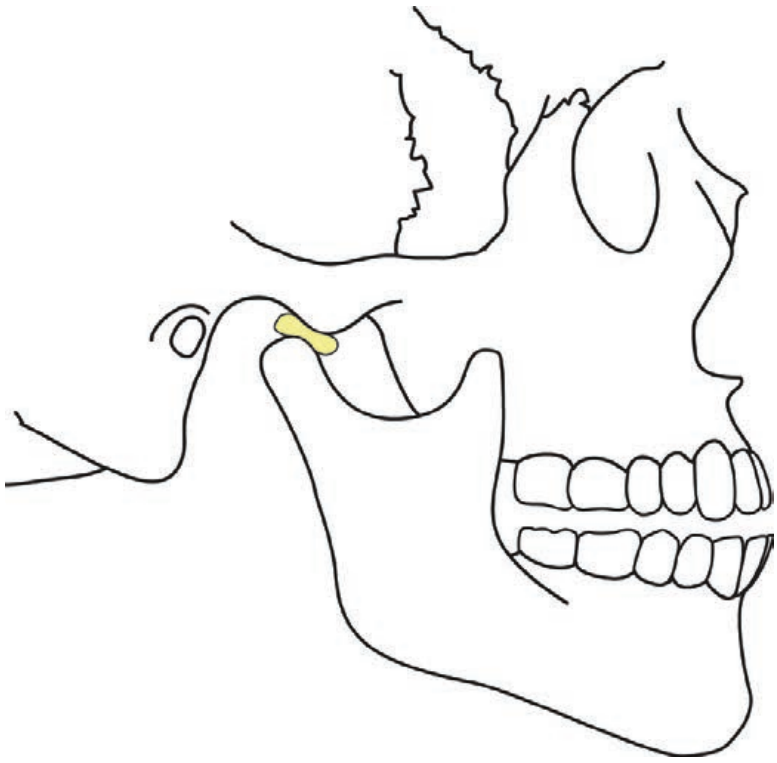

Figure 13.1. Condyle in the reduced position.

TMJ, and the patient has parafunctional habits that continually irritates this disturbance, wearing the appliance should minimize the consequent irritation.

If the patient were to clench while wearing this appliance, the force transmitted through the condyle would load the disc's intermediate zone rather than the retrodiscal tissue. Intuitively, this should benefit patients with retrodiscal tissue pain.[2]

The retrodiscal tissue can also be protected from loading forces by a stabilization appliance. If a stabilization appliance is adjusted using the neutral position (described in "Mandibular Positions and Interocclusal Record" in Chapter 12), the condyle is not braced against the disc assembly. Therefore, when the patient clenches in maximum intercuspation (MI) on this stabilization appliance, there is minimal load transferred to the disc assembly or pressure created within the TMJ.[3] In this manner, the stabilization appliance can also unload the inflamed retrodiscal tissue.

Anterior positioning appliances have been shown to reduce TMJ pain, muscle pain, and TMJ noise for many patients. Similarly, stabilization appliances improve TMD symptoms for most patients, even if their pain is related to a disc–condyle mechanical disturbance or intermittent locking at the opening where the noise occurs.[4–6]

FOCAL POINT

Anterior positioning appliances have been shown to reduce TMJ pain, muscle pain, and TMJ noise for many patients. Stabilization appliances similarly improve TMD symptoms for most patients, even if their pain is related to a disc–condyle mechanical disturbance or intermittent locking at the opening where the noise occurs.

It has been suggested that anterior positioning appliances may be more effective in reducing some TMD symptoms than are stabilization appliances.[7] Due to the probable efficacy of the stabilization appliance and the problems associated with the anterior positioning appliance,[1,8] it is recommended that practitioners first use a stabilization appliance and other conservative TMD therapies. Only after these fail to provide adequate symptom relief is it recommended that an anterior positioning appliance be considered.

Maintaining the mandible at the desired anterior location for an extended period may occasionally aggravate a patient's TMD symptoms. Clinically, it has been observed that a patient who finds that this mandibular location aggravates his or her TMD symptoms will usually find that this appliance exacerbates the symptoms.

Intuitively, it appears only patients who meet all of the following criteria have a high probability of gaining additional improvement from this appliance compared with the stabilization appliance:

1. The patient's TMJ mechanical disturbance appears related to his or her pain.
2. The TMJ noise is eliminated by placing the mandible in the recommended anterior location.
3. The masticatory system feels more relaxed or comfortable with the mandible located in the recommended anterior location.

This principle of temporarily altering a joint so it functions in a more comfortable position is similarly used to treat other musculoskeletal disorders in the body.[9]

Mandibular Position and Interocclusal Record

For this appliance, the mandible should be located where the condyle is reduced onto the disc and the masticatory system feels more relaxed or comfortable. The mandible cannot be positioned excessively anterior, because generally the more anterior the mandible is placed, the more strained the masticatory system feels to the patient. I identify the desired mandible location and make the interocclusal record with the dental chair back about 10–20° from its maximum upright position.

If the patient has a normal maxillomandibular relationship, it is recommended to evaluate initially whether the mandibular location where the maxillary and mandibular anterior teeth touch end to end is feasible. With the mandible at this location, ask the patient to open from and close to this position several times, and observe whether the click or pop has been eliminated.

If the click or pop is eliminated, this clinically suggests that this location positions the condyle so it is reduced onto the intermediate zone of the disc (Figure 13.1). The bottom left diagram of the "TMJ Disc–Condyle Complex Disorders" handout (Appendix 3) may help readers to understand visually that, once the condyle is reduced, the patient can open from and close to that position without creating the normal joint click or pop. Practitioners should bear in mind that this clinically identified mandibular location does not accurately identify the position for which all TMJs are fully reduced but is the technique that is traditionally used and provides clinically acceptable results for this appliance.[10,11]

If the position does not eliminate the click or pop, ask the patient to protrude the mandible further and retest whether this position eliminates the TMJ click or pop. Once the click or pop is eliminated, ask the patient whether this is a more comfortable position than his or her normal mandibular posture.

If the chosen mandibular location eliminates the click or pop, but the position feels uncomfortable to the patient, ask the patient to retrude the mandible slightly and retest whether the click or pop continues to be eliminated but the position now feels comfortable. Experiment to find the mandibular location at which the TMJ click or pop is eliminated and the masticatory system feels more relaxed or comfortable. If such a mandibular location can be identified, this is the recommended location for the interocclusal record. If a mandibular location that meets these criteria cannot be identified, for this patient, an anterior positioning appliance will probably not be more effective than the stabilization appliance.

If the anterior positioning appliance criteria are satisfied at the location where the anterior teeth meet end to end, this is a good location to use, for at this location the practitioner can visualize whether the mandible returns to the same position and it provides a stable position for the patient to hold the mandible.

If the identified mandibular location is different than where the anterior teeth meet end to end, patients can usually feel the desired mechanical disc–condyle relationship within their TMJ and can also easily maintain or return to this location. The practitioner may desire that the patient practice opening from and closing to this position several times, so the patient does not have difficulty finding this location while the interocclusal record is made.

The interocclusal record can be made by asking the patient to bite into softened wax or by syringing an interocclusal record material between the teeth, if the patient has a stable position to occlude while the material hardens. If the interocclusal record was made with the teeth occluding, ask the laboratory technician to open the articulator's vertical dimension approximately 1 mm.

Design and Adjustments

Similar to the stabilization appliance, the anterior positioning appliance should cover all of the teeth in the arch, fit comfortably over them, and provide even occlusal contacts for all of the opposing posterior teeth, and its external surface should flow smoothly (Figure 13.2).

The maxillary anterior positioning appliance is constructed with a ramp immediately behind the mandibular anterior tooth contacts (Figure 13.3). When people sleep, their muscles relax and the mandible tends to drift posterior. The ramp supports the mandible as it drops posterior, helps to maintain the

Figure 13.2. The maxillary anterior positioning appliance occluding with opposing teeth.

Figure 13.3. The maxillary anterior positioning appliance is constructed with a ramp. This ramp prevents the patient's mandible from retruding behind the appliance and guides the mandible forward, into the desired position when the patient attempts to occlude.

desired disc–condyle relationship, and guides the mandible forward into the desired position when the patient attempts to occlude. A mandibular appliance can be constructed with a similar ramp, but there is a greater tendency for patients to wear the mandibular appliance during the day, and mandibular appliances tend to be less effective.

The appliance can be fabricated from any of the hard and intermediate materials, and its internal adjustments are made as described for the stabilization appliance. Its external adjustments are made by marking the opposing tooth contacts with two sheets of black Accufilm held with articulating forceps. Place the forceps as described for the stabilization appliance, at a slight angle in the mouth so the patient can mark the third molar as well as the central incisor at the same time (see Figure 12.20).

Some practitioners fabricate the posterior occlusal surface of this appliance with cuspal indentations into which the opposing teeth fit,[12] whereas others recommend fabricating a flat posterior occlusal surface.[8] Both are acceptable, but I prefer the flat posterior occlusal surface because it is easier and faster for adjusting the appliance's occlusion.

Repeatedly mark and adjust the appliance, slowly developing even contacts from the opposing posterior teeth. Similar to the stabilization appliance, at least one contact from each posterior tooth should be obtained, and the anterior teeth should provide light or no marks in comparison with the posterior marks. Clinical experience has demonstrated that the appliance's occlusion should be well adjusted to provide its maximal effect.

QUICK CONSULT

Adjusting Appliances

Clinical experience has demonstrated that the appliance's occlusion should be well adjusted to provide its maximal effect.

Once the desired centric contacts are obtained, adjust the protrusive guidance ramp. It should be long enough that the mandibular anterior teeth cannot retrude behind it. If the mandibular anterior teeth were to retrude behind the ramp while the patient is sleeping, he or she might clench in this unadjusted location and exacerbate the symptoms. Therefore, position the mandible into the neutral position to determine how far the patient can retrude the mandible. If the ramp is too short, add self-curing clear orthodontic acrylic to extend it. If the ramp is longer than necessary, remove the excess portion (Figure 13.3).

As the patient glides from the neutral position into the desired anterior position, use two sheets of black Accufilm in the articulating forceps to mark the opposing anterior tooth contacts on the ramp. Repeatedly mark and adjust the ramp so it provides the patient even gliding marks along the ramp for the teeth, canine to canine.

Since crowns supported by dental implants do not have periodontal ligaments, they will not compress when patients heavily clench on them. Ensure these crowns will not be overloaded when the patient heavily clenches on the appliance or pushes against the protrusive guidance ramp. Mark the centric contacts while the patient is maximally clenching on the appliance. This will maximally compress the teeth occluding with the appliance, but not the occluding implant supported crowns; the implant supported crowns will tend to mark the appliance heavier.[13] Adjust the appliance so the occluding implant supported crowns are just out of occlusion. In spite of being out of occlusion, there is no fear that these crowns will extrude.

Observe whether any of the implant supported crowns contact the protrusive guidance ramp and adjust the appliance so the implant supported crowns are a safe distance

away from the appliance in these movements. Follow the patient's wishes as to whether the occlusion on the implant-supported crowns need additional relief. Recommendations for implant-supported crowns covered by the occlusal appliance are discussed in the introduction section of Part III.

Similar to the stabilization appliance, smooth the appliance and ensure the appliance feels comfortable to the patient.

Appliance Management

Originally, anterior positioning appliances were used to hold the mandible in the described anterior location for 24 hours a day (including while eating). Over time, patients were generally not able to retrude their mandible to MI because of contracture of the inferior lateral pterygoid muscle, proliferation of soft tissue posterior to the condyles, remodeling of condyles, and/or dentoalveolar changes.[8,14]

After a period of time, these patients receive orthodontics and/or prosthodontic reconstruction so MI coincided with this new mandibular location. Investigators following these cases observed that despite the extensive treatment provided, patients could not maintain this desired disc–condyle relationship.[15,16]

The most comprehensive study I have read that followed the posttreatment changes observed 12 patients who were first provided anterior positioning appliance therapy and then orthodontics that established a stable occlusion at the predetermined anterior position. Comparing superimpositions of the patients' cephalometric radiographs, the investigator found that over time, all of the patients had occlusal and TMJ changes, which included distal repositioning of the mandible, intrusion of the maxillary molars, and concomitant increase in overbite and overjet.[17]

Therefore, it is recommended that patients use the anterior positioning appliance only while they sleep and use their normal mandibular position during the day. In this manner, patients can maintain their normal MI occlusion and obtain TMD symptom relief by nighttime use of their appliance.[8,16,18] One author indicates that nighttime wear of the anterior positioning appliance appears to provide similar TMD symptom improvement as normally obtained from 24-hour wear.[19]

FOCAL POINT

It is recommended that patients use the anterior positioning appliance only while they sleep and use their normal mandibular position during the day.

When patients first wear the anterior positioning appliance at night, they commonly report that once they have removed the appliance upon waking, it takes up to an hour for their teeth to occlude into MI. Over the next month, this time generally progressively shortens. A small percentage of the patients will find that the time it takes to be able to occlude into MI progressively lengthens.

Sleep apnea appliances similarly hold the condyle anteriorly at night and some patients similarly have difficulty occluding their teeth into MI upon removing the appliance. Over time, some patients wearing the sleep apnea appliance lose the ability to put their teeth into MI and develop a posterior open bite.[20,21] One study reported the prevalences of this at 4, 7, and 14 months were 5.8%, 9.4%, and 17.9%, respectively.[20]

Therefore, it is recommended that patients use an anterior positioning appliance for as short a period as possible and transition to a stabilization appliance as soon as it provides satisfactory benefit. While patients wear an

anterior positioning appliance, it is recommended that they be followed every month to determine whether they begin to lose their ability to occlude into MI.

An easy technique to observe this is to document which opposing teeth are able to hold shim stock when the patient closes into MI (Figure 3.27). If a patient begins to lose the ability to close into MI, the most posterior opposing teeth will first start to lose their ability to hold shim stock. If this occurs, the patient should immediately discontinue wearing this appliance, and the provider may choose to convert the anterior positioning appliance into a stabilization appliance. If only minimal changes have occurred, the patient should regain the ability to hold shim stock.

An exercise that has been shown to reduce the tendency for patients wearing a sleep apnea appliance to develop a posterior open bite may also be beneficial for patients wearing an anterior positioning appliance. For this exercise, patients are instructed, upon awaking, to place and hold a piece of plastic (30 × 10 × 3 mm) between their maxillary and mandibular central incisors. Next, patients slide their mandible as far forward and backward as possible for 5 seconds and then bite firmly on the plastic with their mandible positioned in a relaxed position for 10 seconds. Patients repeat this series of movements for 3 minutes.[22] An easy way to obtain this piece of plastic is to take a sheet of athletic mouthguard material and with a pair of scissors cut a piece that is approximately 30 × 10 mm.

Since the mandibular position used for the anterior positioning appliance was at the location where the masticatory system felt more relaxed or comfortable, some patients have a tendency to wear their appliance 24 hours a day. If worn 24 hours a day, it is much more likely to cause the patient to not be able to close into MI. This problem is usually reversible if caught early, but is usually permanent if it is a long-standing condition.[23] Therefore, instruct patients to wear the anterior positioning appliance only while they sleep and closely follow the cases to ensure they do not start to lose their ability to close into MI.

◉ QUICK CONSULT

Observing for Maximum Intercuspation Changes

An easy technique for observing whether a patient is beginning to lose the ability to close into MI is to follow whether there is a change among the opposing teeth that can hold shim stock when the patient closes into MI.

Since significant complications are associated with the anterior positioning appliance, I view it as short-term therapy. Once the pain and limited range of motion have adequately resolved, the appliance should gradually be discontinued or replaced with a stabilization appliance. If the patient has not been transitioned to a stabilization appliance within a year, I ask the patient to stop wearing the anterior positioning appliance so we can test what occurs. I expect to observe one of three situations: (1) Their pain does not reappear, suggesting they no longer need an appliance. (2) They have only morning pain without the appliance, so the appliance is converted into a stabilization appliance to treat this pain. (3) Their mechanical symptoms and pain return, so they continue to wear their anterior positioning appliance and their cases are followed monthly.

◉ QUICK CONSULT

Using Anterior Positioning Appliances

Since there are significant complications associated with the anterior positioning appliance, I do not view it as a potential long-term therapy.

Practitioners should bear the following in mind: (1) Anterior positioning appliance therapy is not intended to correct the disc–condyle relationship, but to facilitate the reduction in TMD symptoms, similar to other conservative TMD treatments.[1,24] (2) Even though a patient meets the anterior positioning appliance criteria, a stabilization appliance is generally similarly effective in reducing a patient's symptoms.[4,6,7] Since the anterior positioning appliance needs to be carefully followed for complications whereas the stabilization appliance has minimal complications, it is recommended that the stabilization appliance be used first. If the patient meets the anterior positioning appliance criteria and continues to have significant pain or TMJ intermittent locking after receiving a stabilization appliance and other conservative therapies, then it would be appropriate to consider an anterior positioning appliance.[8]

FOCAL POINT

It is recommended practitioners use the stabilization appliance prior to using the anterior positioning appliance because the stabilization appliance has minimal associated complications, and patients who meet the anterior positioning appliance criteria typically do well with a stabilization appliance.

Counsel patients who are to receive an anterior positioning appliance about potential complications associated with it and the importance of returning for their follow-up appointments. I have had difficulty with some patients returning for their required follow-up appointments, especially those who have responded quite well with the appliance. Therefore, prior to delivering this appliance, it is recommended that a statement be typed in the patient's record that the patient is advised that if he or she does not return for follow-up appointments, the patient should discontinue wearing this appliance, and have the patient sign this entry.

Some practitioners request their patients wear an anterior positioning appliance 24 hours a day (including while eating). These practitioners intend for their patients to eventually be unable to retrude the mandible, be unable to occlude into MI, and have a posterior open bite. These practitioners plan to restore the occlusion through orthodontics and/or prosthodontic reconstruction, so MI coincides with this new mandibular position.[25] These practitioners justify this therapy with their belief that the mechanical disturbance from the disc displacement with reduction is the primary cause for the patient's symptoms and must be eliminated to resolve the patient's TMD symptoms.

A disc displacement with reduction is quite prevalent among the general population and only a very minor contributor to the TMD symptoms in the vast majority of TMD patients. A TMJ click is most commonly due to a disc displacement with reduction, and joint noises are present in 25–35% of the general population.[8] I often compare joint noises in the TMJ with noises in other joints in the body, only recommend treatment when there is pain and/or catching, and the treatment goal is to only resolve the pain and/or catching, not the noise.

The goal of their anterior positioning appliance therapy is to restore the disc–condyle relationship to its "normal" position, but investigators following these types of cases observe that over time, not all patients are able to maintain this new disc–condyle relationship.[15,16] In my opinion, this is a very costly and unnecessary approach for treating this disorder.

In an attempt to prevent this therapy from being provided, the European Academy of Craniomandibular Disorders (EACD) recommends that an anterior repositioning

appliance only be used for a maximum of 6–8 weeks.[26]

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Part IV

Multidisciplinary Treatment Approach

Occlusal appliance therapy is only one of a multitude of therapies available to treat temporomandibular disorder (TMD). Since TMD is a multifactorial disorder (having many etiologic factors), many therapies have been shown to have a positive impact on an individual patient's TMD symptoms.[1,2]

FOCAL POINT

Occlusal appliance therapy is only one of a multitude of therapies available to treat TMD.

Physicians, physical therapists, chiropractors, massage therapists, and others treating the muscles and/or cervical region report positive responses to treatment of TMD symptoms.[2–4] Psychologists working with relaxation, stress management, cognitive-behavioral therapy, and other psychological aspects report reducing TMD symptoms with their therapies.[2,5] Orthodontists, prosthodontists, and general dentists observe a positive impact on TMD symptoms by improving the occlusal stability.[6–8] Surgeons report TMD symptom reduction from different temporomandibular joint (TMJ) surgical approaches.[9,10] Medications as well as self-management strategies used for other muscles and joints in the body have also been shown to reduce TMD symptoms.[11,12]

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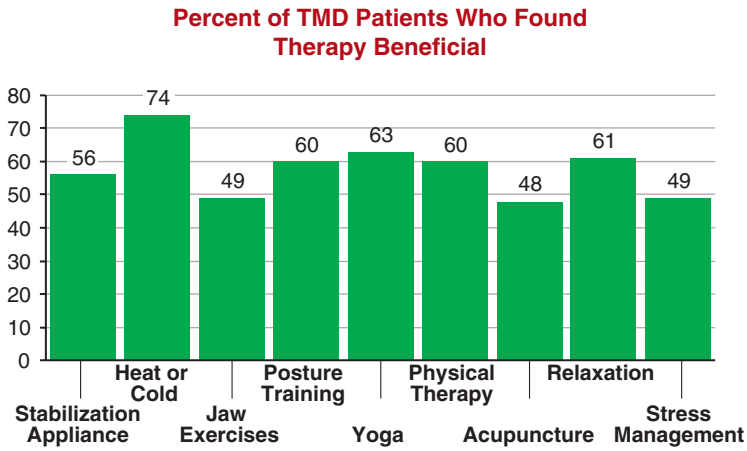

Figure IV.1. The percentage of TMD patients who found each of these therapies beneficial.[1] These percentages are lower than those found in most studies, and I speculate this is because many were chronic TMD pain patients who often do not respond as well to most treatments.

A survey of over 1500 TMD patients inquired about the various therapies these patients used and reported the percentage of patients who found each therapy beneficial (Figure IV.1).[1] This study demonstrates that there are many therapies that may be beneficial for TMD, and multiple therapies may be necessary to obtain satisfactory symptom relief. Based on the source of the subjects used in this study, I speculate many were chronic TMD pain patients, and the percentage of patients obtaining improvement is lower than what most readers observe among their TMD patients.

The literature supports this study's findings that a large number of potentially reversible conservative therapies are available to treat TMD patients. Not all TMD therapies are equally effective, and there is no one treatment that has been shown to be best for all TMD patients. By using the information obtained from the patient interview and clinical exam, practitioners can select the most cost-effective evidence-based therapies that have the greatest potential for providing long-term symptom relief for a particular patient.

Many of the therapies act through different mechanisms, enabling a practitioner to use multiple therapies simultaneously, which provides a synergistic effect. The most successful treatments often focus on therapies that decrease a patient's perpetuating contributing factors, which have kept the body from resolving the symptoms on its own.[13,14] These TMD

FOCAL POINTS

Many of the therapies act through different mechanisms, enabling a practitioner to simultaneously use multiple therapies, which provides a synergistic effect.

The most successful treatments often focus on therapies that decrease a patient's perpetuating contributing factors, which have kept the body from resolving the symptoms on its own.

management concepts are consistent with treatment of other orthopedic and rheumatologic disorders.[13–15]

Most TMD patients can be successfully managed by general practitioners,[16] and TMD patients who receive TMD therapy obtain significant symptom relief, whereas patients who do not receive treatment have minimal symptom change.[17,18] A practitioner's experience and expertise, and the availability of modalities, may impact the treatment plan.

While practitioners evaluate their patients, they must be cognizant that many disorders outside of the dentist's realm of treatment can contribute to the perpetuation of TMD symptoms, for example, widespread pain, neck pain, rheumatic disorders, poor sleep, or depression. Identifying (as delineated in Chapter 2, "Review of the 'Initial Patient Questionnaire'") and obtaining appropriate therapy for these disorders should greatly enhance the TMD symptom relief practitioners can obtain.[13] A patient's prognosis is often related to the length of time the problem has been present, the frequency and severity of the pain, the presence of other chronic pains, the degree of psychosocial contribution, the patient's previous response to therapy, and the patient's compliance.[19–21]

Patients do not follow through with many of our recommendations; in fact, one study found that their TMD patients had a mean compliance rate of 54%.[22] This is the reason I generally make a list of the recommended therapies for the patient, discuss them with the patient, and let the patient decide which he or she plans to use. I prefer to know the patient's plans, enabling me to document this in the record and saving me from writing unnecessary referrals or prescriptions.

Educating the patient and a good patient–practitioner relationship are important factors in improving patient compliance. The time spent educating a patient is a significant factor in developing a high level of

rapport and treatment compliance.[23] The time should be appropriate to educate the patient on clinical findings, diagnostic data, treatment options, and prognosis. This may require the practitioner or a trained staff member to show drawings to the patient, such as the "TMJ Disc–Condyle Complex Disorders" diagram in Appendix 3.

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Chapter 14

Self-Management Therapy

FAQs

Q: Which of the self-management therapies is the most beneficial?
A: Muscle pain is the most common cause for temporomandibular disorder (TMD) symptoms and self-massage of the painful muscles appears to be the most beneficial and most used self-management therapy.

Q: What do you do when a patient cannot control his or her daytime habits or muscle tension adequately to reduce the daytime symptoms satisfactorily?
A: Some patients cannot adequately control their daytime habits or muscle tension to reduce their daytime symptoms satisfactorily. Most of these patients are referred to a psychologist for additional help with changing these, especially if other psychosocial needs are observed.

Self-management therapy encompasses procedures patients are instructed to perform on themselves. They are convenient and inexpensive, compared with patients going to practitioners' offices to receive therapy. Patients generally select and use the portions that they personally find most convenient and effective. A survey among general dentists who treat TMD patients found that self-management therapy was the second most common therapy provided to TMD patients (occlusal appliances was the first).[1] Another survey found that approximately two-thirds of TMD patients provided self-management instructions were using various portions 1 month later.[2]

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Using Self-Management Therapies

Self-management therapies are convenient and inexpensive, compared with a patient going to a practitioner's office to receive the therapy.

These therapies may be very beneficial; two studies reported TMD patients obtained a 40% reduction in TMD pain from their use.[3,4] Another study compared self-management therapy and their usual TMD therapy, among TMD patients with minimal psychosocial contributing factors, and found no therapeutic difference between the therapies.[5] An additional study provided self-management therapy to their control group and found that these patients obtained a significant decrease in their TMD pain and increase in their ability to function.[6]

Once I complete my initial examination on a nonemergency TMD patient, I educate the patient about his or her disorder, discuss the causes for the disorder (e.g., muscle tension, excessive temporomandibular joint [TMJ] loading), and perpetuating contributing factors (e.g., neck pain, stress). I then discuss treatment options and begin with written self-management therapies.[7] After discussing treatment options, a surprising number of my patients choose to try the self-management therapies and escalate therapy if they do not obtain sufficient symptom relief.

Clinical experience has shown that the amount of improvement patients obtain from self-management therapy varies greatly.[3] It is speculated that this variation is primarily due to the patient compliance. The practitioner or a trained staff member needs to initially instruct and often motivate the patient to perform the self-management therapies. Once the patient discovers the benefit that is obtained by using them, he or she tends to be more self-motivated.

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Implementing Self-Management Therapies

The practitioner or a trained staff member needs to initially instruct and often motivate the patient to perform the self-management therapies.

This chapter provides many self-management therapies. It begins by discussing the self-management instructions (Appendix 4, "TMD Self-Management Therapies") that I give almost every patient who is diagnosed with TMD, and is followed by self-management therapies that are provided to patients with specific conditions.

Self-Management Instructions

A recommended self-management instructions handout is provided in Appendix 4, "TMD Self-Management Therapies." It begins with a short background about TMD, providing information that patients used to often ask me. After the self-management instructions, the handout informs patients that TMD cannot be "cured" but has to be managed, the treatments are not fully predictable, and the treatment plan may need to be altered based on a patient's treatment response.

The self-management instructions begin with massage[8] because TMD patients find massage provides a high degree of pain relief, pain control, and acceptability, and they frequently use it.[2,9] In one study of TMD self-management therapies, massage was the most often used therapy (24% used it for their TMD pain) and found to be the most helpful self-management therapy (61%

reported it as very or extremely beneficial).[10] As patients or massage therapists massage the muscles, they often notice tender knots within the muscles (trigger points). If these trigger points are compressed or kneaded (often performed with the thumb or knuckle), they generally inactivate the trigger point and the muscle pain decreases.[11]

The symptom improvement obtained from massage is only temporary, just as one would not expect permanent benefits from taking a muscle relaxant or performing an exercise. Since the benefits are temporary, patients who go to a massage therapist must continually return for repeated massages to maintain the benefits. On the other hand, patients who are instructed to perform their own muscle massage may derive benefits similar to those achieved from a therapist, but without the expense and loss of time.

TMD patients whose pain is primarily of muscle origin are more likely to benefit from massage therapy, and a practitioner may desire to encourage patients to massage the painful areas of their masseter, temporalis, and/or neck muscles multiple times throughout the day. Some patients find additional benefit by massaging their muscles with one of the over-the-counter topical muscle creams, for example, Icy Hot.

TECHNICAL TIP

Massaging Muscles

TMD patients whose pain is primarily of muscle origin are more likely to benefit from massage therapy, and a practitioner may desire to and encourage patients to massage the painful areas of their masseter, temporalis, and/or neck muscles multiple times throughout the day.

Many TMD patients have additional trigger points in the neck and shoulders. A common technique to compress cervical trigger points is to take two tennis balls and tie them together (using duct tape or placing them in a sock with a knot tied at the end to keep them together). The patient lies on the floor and positions the tennis balls so the neck is balanced between the two balls and the cervical trigger points are compressed. Trigger points in the shoulder can be similarly compressed by the patient lying on a single tennis ball.

TECHNICAL TIP

Compressing Cervical Trigger Points

A common technique to compress the cervical trigger points is for the patient to take two tennis balls, tie them together (i.e., using duct tape), lie on the floor, position the tennis balls so the neck is balanced between the two balls, and apply pressure onto the cervical trigger points.

Similar to muscle massage, trigger-point compression is only a temporary therapy that needs to be continually repeated. To keep the inactivated trigger points from reactivating, the contributing factors perpetuating the disorder have to be identified and adequately controlled.[12,13] The most common perpetuating factors for trigger points are the cumulative effect of long-standing repetitive overuse of the muscle, chronic muscle tension, and emotional stress. For the masticatory system, repetitive overuse would most likely be from parafunctional habits, whereas, for the cervical region, it would most likely be from poor posture.[12]

Home physiotherapeutics can involve using heat, cold, or alternating between heat and cold. No study has compared which is better for TMD patients, for specific TMD diagnoses, or for specific situations (other than

the use of cold following trauma). Empirically, most TMD patients appear to prefer heat,[13] but those with severe pain (9/10 or above) seem to find heat aggravates their pain, and so prefer cold. Other patients find their symptoms respond best by alternating between heat and cold. A survey among TMD patients reported that 74% found heat or cold beneficial for their TMD (Figure IV.1).[14]

TECHNICAL TIP

Recommending Physiotherapeutics

Empirically, most TMD patients appear to prefer heat, but those with severe pain (9/10 or above) seem to find heat aggravates their pain, and so prefer cold. Other patients find their symptoms respond best by alternating between heat and cold.

One study that compared a moist heating pad with moist towels found that almost twice the percentage of patients using the moist heating pad did not require any additional treatment (Figure 14.1).[15] It is speculated the response difference is due to the heating pad maintaining the tissue at a consistently high temperature, whereas the towels cool down with time. Based on this study, I recommend patients use a heating pad rather than a device that cools over time.

Another study compared the intraoral buccal mucosa temperatures obtained by using moist and dry heating pads over the cheek.[16] The authors found there was no difference between the two methods, but a few patients did prefer the moist over the dry heat. Understanding that compliance is related to the complexity of the requested procedure and that dry heat is simpler to use, I inform patients that a dry heating pad works just as well as a moist heating pad, but it is fine to use moist heat if the patient prefers.

If a patient also has cervical pain, the patient should be instructed to wrap the heating pad around that aspect of the neck when applying heat to the masticatory region. Another method for applying heat to the cervical region is for patients to use a portable heat wrap (e.g., ThermaCare). These wraps have been shown to provide a significant reduction in musculoskeletal pain and their effect generally lasts for several days.[17,18]

Patients use many methods for applying cold. Some desire to apply an ice cube wrapped in a wash cloth, and so on. Patients who routinely use cold seem to prefer to use a packaged ice substitute or to take a bag of

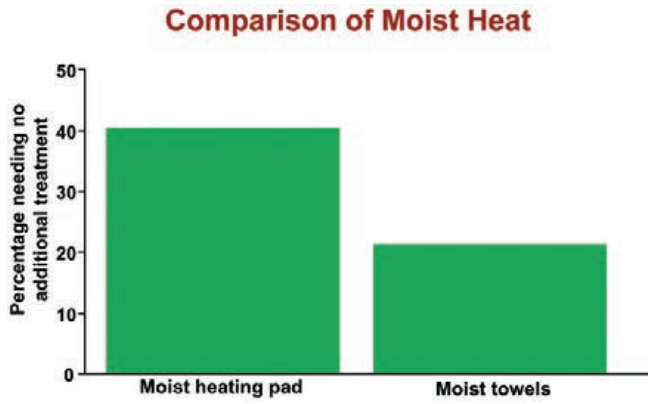

Figure 14.1. A higher percentage of TMD patients related that they did not need any additional therapy following sequential use of a moist heating pad compared with moist hot towels.[15]

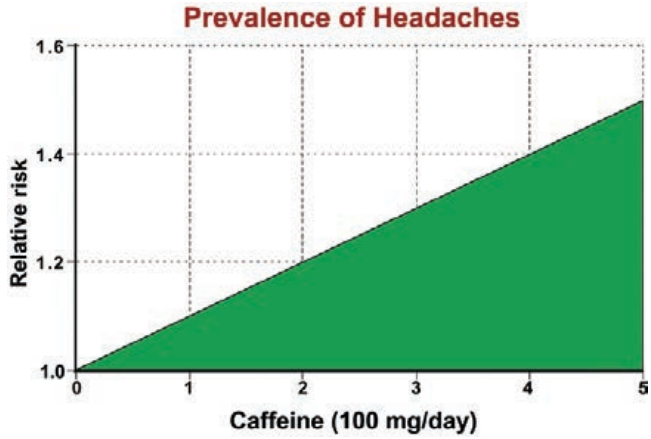

Figure 14.2. Correlation with caffeine consumption (100 mg of caffeine is in one standard brewed cup of coffee) and headache prevalence.[21]

frozen peas, loosen the peas by hitting the bag with the heel of their hand, wrap the bag in a towel, and apply it to their skin. These patients generally mark the bag in some manner so they do not later accidentally cook these peas for a meal.

Many TMD patients find that eating tough or chewy foods aggravates their TMD symptoms. Some patients observe that simultaneously chewing on both sides of the mouth reduces their normal symptom aggravation. Therefore, patients are advised to eat a moderately soft diet, cut other foods into small pieces, and try evenly dividing the food on both sides of their mouth and chewing on both sides. Some patients with very severe pain may prefer to drink Ensure® or Sustacal®, or place their food in a blender and drink it.

Caffeine has positive qualities associated with consuming it, for example, improved alertness and mood.[19] It may also have negative qualities associated with its consumption, for example, increased anxiety, muscle activity, headaches, and insomnia.[20] Many individuals can relate to the increased muscle activity and insomnia effects because they have experienced consuming too much caffeine, which caused them to shake from uncontrollable muscle contractions and/or have difficulty sleeping. A survey of over 3000 individuals found an association between the amount of caffeine consumed and headaches (Figure 14.2), and the amount of caffeine consumed and insomnia (Figure 14.3).[21]

Clinically, one well-known muscle researcher concluded that more than one cup of coffee (8 oz of normal brew) or one can of soda a day aggravate muscle trigger points (the most common source of TMD pain).[13] The amount of caffeine in beverages varies greatly.[20] As a general guide, I tell patients that a cup of coffee, a can of soda, and two cups of ice tea or hot tea are equivalent. It is recommended that TMD patients reduce their caffeine consumption to no more than one cup of coffee, one can of soda, or two cups of tea a day.

Many caffeine consumers have developed a chemical dependency to their caffeine intake and know that they will develop a severe headache if they do not drink sufficient caffeine.[22] These patients can reduce their caffeine consumption slowly without developing headaches or tiredness. It has been observed that patients consuming more than a pot of coffee a day can usually reduce

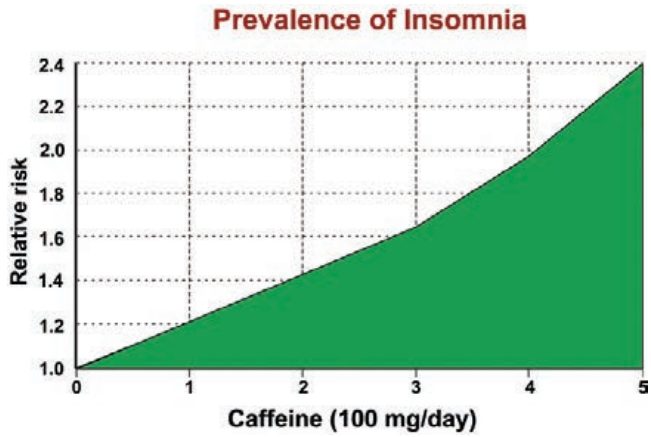

Figure 14.3. Correlation with caffeine consumption (100 mg of caffeine is in one standard brewed cup of coffee) and insomnia prevalence.[21]

consumption to one pot a day without developing these problems. These patients are asked to maintain that level for 1 week. It has been observed also that these patients and those on lower amounts of caffeine can usually reduce consumption by one cup of coffee or can of soda a week without developing caffeine withdrawal symptoms.

The TMD symptom response from decreasing caffeine consumption is quite variable. Some patients report no change, whereas others have a dramatic reduction or even elimination of their TMD symptoms. Empirically, patients who consume higher doses of caffeine appear to be more likely to have a more favorable response to restriction of their caffeine consumption. I ask all patients to attempt to reduce their consumption to no more than one cup of coffee, one can of soda, or two cups of tea a day, and hold this consumption level during treatment. They are informed that, once treatment is complete, they are welcome to resume consuming caffeine at whatever level they prefer but should observe for any increase in their TMD symptoms related to this. With this knowledge, they can make an educated decision about the amount of caffeine they want to consume.

◉ QUICK CONSULT

Restricting Caffeine Consumption

Empirically, patients who consume higher doses of caffeine appear to be more likely to have a more favorable response to restriction of their caffeine consumption.

Some individuals tend to tighten their masticatory muscles or clench their teeth when they are busy, irritated, driving a car, using a computer, or concentrating. Clenching or grinding the teeth requires the masticatory muscles to contract and often loads the TMJs. Many studies report correlations between masticatory muscle activity (even prolonged low-intensity activity) and TMD pain.[23–26]

◉ QUICK CONSULT

Informing Patients of Tendencies

Some individuals tend to tighten their masticatory muscles or clench their teeth when they are busy, irritated, driving a car, using a computer, or concentrating. This may be a primary contributor to masticatory muscle pain and/or TMJ arthralgia.

At the initial appointment, patients may realize that they lightly rest their teeth together, but generally are not aware that during these times of stress, their thoughts are on this stressor, so they do not realize that they are holding tension in their masticatory muscles or squeezing their teeth together. Patients who have neck or shoulder pain often know that they tend to hold excessive tension in the locations of their pain. For these patients, it is often helpful to use the comparison that holding tension in the neck or shoulders similarly contributes to their pain as holding tension in the masticatory system.

In an attempt to try to break these habits, patients are instructed to monitor themselves closely for holding tension, clenching, or grinding habits, especially while they are busy, irritated, driving a car, using a computer, or concentrating. Therefore, patients are asked to learn to keep their jaw muscles relaxed, teeth separated, and tongue lightly resting on the roof of the mouth just behind their upper front teeth. This is discussed in more detail in "Breaking Daytime Habits" later in this chapter.

◉ QUICK CONSULT

Asking Patients to Observe for Habits

Some TMD patients relate that they rest their teeth together only lightly, but frequently unconsciously squeeze their teeth together when they are busy, irritated, driving a car, using a computer, or otherwise concentrating.

Additionally, patients are instructed to observe for, and avoid, habits that put unnecessary strain on the masticatory muscles and TMJs, for example, resting the mandible on the hand or biting their cheeks, lips, fingernails, cuticles, or any other objects they may put in their mouth.

Posture appears to play a role in TMD symptoms, so patients are asked to maintain good head, neck, and shoulder posture. They are requested to be especially vigilant of their posture while using a computer and to avoid poor postural habits, such as cradling a telephone against their shoulder. A survey among TMD patients reported that 60% found posture training beneficial for their TMD symptoms (Figure IV.1).[14] Posture-improving exercises are provided in Appendix 7, "Posture Improvement Exercises," and discussed further in "Posture Exercises" in this chapter.

Patients are informed that their sleep posture is also important. They are requested to avoid positions that strain their neck or jaw, such as occurs with stomach sleeping. If they sleep on their side, they are asked to position their head so their cervical spinal column is in alignment with the rest of their spinal column and their mandible is in alignment with the maxilla.

Studies show that relaxation is beneficial for reducing TMD symptoms.[2,14,27] In the survey mentioned earlier, 61% related relaxation was beneficial for their TMD (Figure IV.1).[14] Patients are requested to set aside time once or twice a day to relax and drain the tension from their jaw and neck. Patients often benefit from simple relaxation techniques such as sitting in a quiet room while listening to soothing music, taking a warm shower or bath, and slow deep breathing. Relaxing in this manner generally not only reduces the pain but also enables patients to become aware of what tense and relaxed muscles feel like and to develop the capability to reduce their muscle tension immediately whenever they notice the muscles are tight.

Many TMD patients find that opening their mouth wide, such as in yawning, yelling, or prolonged dental procedures, aggravates their TMD symptoms. Therefore, patients are requested to avoid these activities.

Over-the-counter medications usually provide only minor TMD symptom relief. Patients who find these beneficial are instructed to take them as needed, but to avoid those that have caffeine (e.g., Anacin, Excedrin, and Vanquish).

To emphasize its importance, motivate the patient, and explain any confusion with performing these procedures, it is strongly recommended that the handout be reviewed with the patient. Based on the assumption that this handout will be reviewed with the patient, a few potential contributing factors (e.g., caffeine consumption or sleeping posture) were not asked about in the initial patient questionnaire, and it was assumed that they would be identified at this time. This review may be performed by any staff member trained to provide this education.[28]

TECHNICAL TIP

Motivating Patients to Perform Self-Management Instructions

To emphasize its importance, motivate the patient, and explain any confusion with performing these procedures, it is strongly recommended that the handout be reviewed with the patient.

FOCAL POINT

Based on the assumption that this handout will be reviewed with the patient, a few potential contributing factors (e.g., caffeine consumption or sleeping posture) were not asked about in the initial patient questionnaire, and it was assumed that they would be identified at this time.

Clinical experience has demonstrated that there is great variation in the effectiveness of the TMD self-management instructions, and it is believed that this difference is related to patient motivation. Here are a few techniques that may instill greater patient compliance: (1) give patients follow-up appointments at which they know they will be asked about performing the therapies; (2) obtain a promise that they will perform the therapy as requested; and (3) have them determine another routinely performed activity that will trigger them to do these therapies. For example, if a patient decides to use the heating pad while watching a nightly television program, hopefully when the show is broadcast, it will remind the patient to apply the heating pad.

Closure Muscle-Stretching Exercise

Studies suggest that providing a TMD patient whose pain is primarily in a closure muscle (masseter, temporalis, and/or medial pterygoid) with stretching exercises will decrease the TMD pain and increase the range of motion.[29–32] One study demonstrated that the amount of improvement derived from stretching exercises was comparable with that obtained from an occlusal appliance.[31] The closure muscles are often major contributors to TMD pain. Appendix 6, "Closure Muscle-Stretching Exercise," is a recommended stretching-exercise handout for these closure muscles. As with the self-management instructions, a trained staff member can effectively educate a patient and follow the patient's use of the jaw exercises.[31]

FOCAL POINT

Studies suggest that providing a TMD patient whose pain is primarily of muscle origin with stretching exercises will decrease the TMD pain and increase the range of motion.

If a patient is reluctant to try stretching, it can be helpful to introduce the concept by

explaining that the pain in these muscles is most probably due to their overuse, secondary to excessive parafunctional activity or excessive tension. As with an individual with leg muscle pain secondary to jogging, an initial therapy for the muscle would be to stretch it prior to and after exercising. Since the patient may be performing the parafunctional activity or maintaining excessive muscle tension throughout the day and night, the patient may have the best results from stretching the closure muscles periodically throughout the day.

This exercise is exclusively for patients who have painful closure muscles. This exercise uses the opening muscles (lateral pterygoid, anterior digastric, and posterior digastric) to stretch the closure muscles; if a patient's pain is primarily in an opening muscle, this exercise may aggravate the symptoms. Additionally, if a patient has significant TMJ arthralgia, the exercise may aggravate the TMJ, so it is recommended that this exercise not be provided to patients who have significant opening muscle or TMJ pain. A lateral pterygoid muscle-stretching exercise is provided in "Lateral Pterygoid Muscle-Stretching Exercise."

TECHNICAL TIP

Prescribing Stretching Exercise

If a patient has significant TMJ arthralgia, the stretching exercise may aggravate the TMJ, so it is recommended that this exercise not be provided to patients who have significant TMJ pain.

The benefits derived from stretching exercises appear to be increased by patients applying heat to the area prior to stretching. A study compared the increase in range of motion of the shoulder when heat was applied to the area before stretching, when stretching was followed by an ice pack, when heat was applied before stretching followed by an ice pack, when stretching only, and when there was no stretching (control) (see Figure 14.4). The results suggest applying heat prior to stretching exercises provides the greatest improvement.[33] Therefore, if a patient performs this exercise and is using heat on the painful closure muscles, encourage performing this exercise after sufficiently warming the muscle. Some TMD patients warm their painful closure muscles with hot shower water.

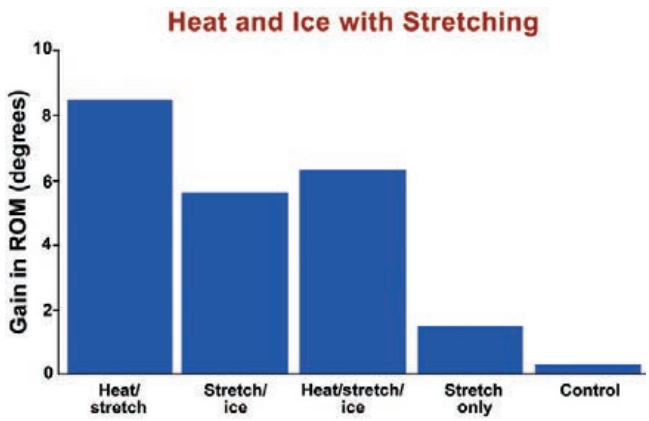

Figure 14.4. Heat followed by a stretch exercise is more effective than stretching followed by ice; heat stretching, then ice; stretching only; or not using any of these.[33]

For patients who do this, similarly encourage performing the exercise after warming the muscle in this manner.

Lateral Pterygoid Muscle-Stretching Exercise

The lateral pterygoid muscle can be stretched to reduce pain and/or tightness within it.[34] To stretch the lateral pterygoid muscle, the practitioner should place his or her thumb on the most posterior ipsilateral mandibular teeth and wrap the fingers around the mandible, as depicted in Figure 14.5. Use of either the dominant or the nondominant hand may be preferred. Some practitioners like to place gauze between the teeth and their thumb to prevent discomfort from pressing on the cusp tips.

TECHNICAL TIP

Stretching the Lateral Pterygoid Muscle

To stretch the lateral pterygoid muscle, the practitioner should place his or her thumb on the most posterior ipsilateral mandibular teeth and wrap the fingers around the mandible, as depicted in Figure 14.5.

The practitioner should push down with the thumb and pull up on the chin. This rotates the mandible, distracts the condyle, and provides more room to mobilize the condyle. While distracting the condyle, slowly push the mandible posteriorly up to approximately 4 lb of force and hold for about 30 seconds. Release the force, but maintain the hand position on the mandible. After

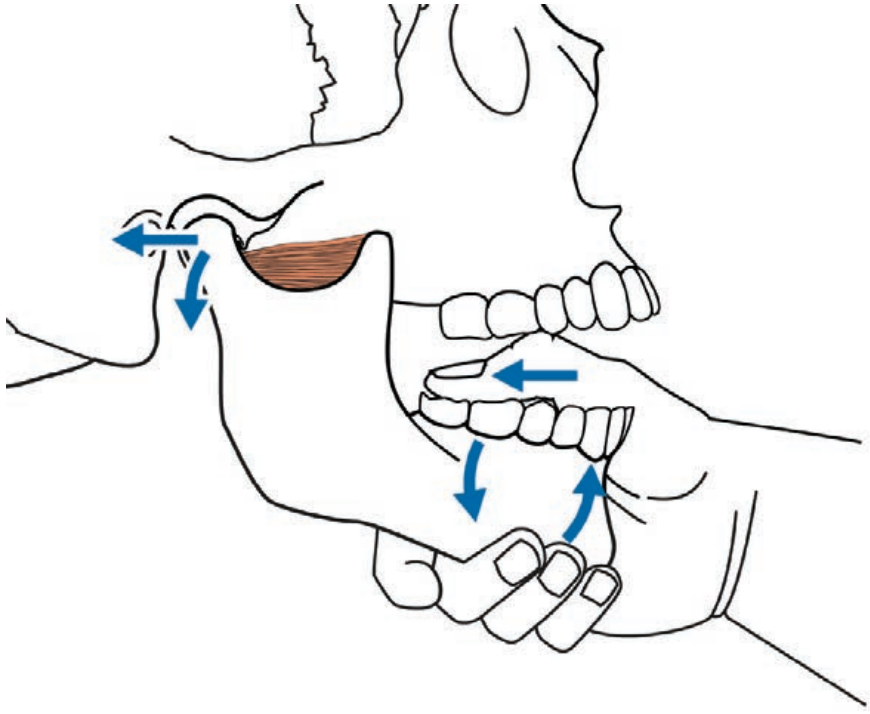

Figure 14.5. Stretching the lateral pterygoid muscle.

about 5 seconds, repeat the 30-second stretch of the lateral pterygoid muscle and perform the stretch six times. Ask the patient to practice this stretch on himself or herself and provide advice on performing the maneuver as needed.

Patients who have TMJ arthralgia may aggravate their pain when pushing the mandible posteriorly and thus may need to modulate the force of the stretch so the TMJ arthralgia is not aggravated. Patients are asked to perform a series of six stretches, six times a day, holding each stretch for approximately 30 seconds with a 5-second break between stretches.

Anatomically, it would appear that the lateral pterygoid muscle is too deep for superficial heat to be beneficial, but patients with a lateral pterygoid muscle disorder continually report its use is beneficial. As described for the closure muscles (Appendix 6, "Closure Muscle-Stretching Exercise"), patients who use heat over this area should have better results with this exercise by performing it after the area has been warmed sufficiently.[33]

Posture Exercises

Poor posture is extremely common among the general population and it increases the strain within the posterior cervical muscles, ligaments, and apophyseal joints. TMD studies and surveys of TMD patients have shown that posture exercises are beneficial for TMD pain.[14,35–37]

In a randomized clinical trial, the exercises provided in Appendix 7, "Posture Improvement Exercises," were found to improve TMD and neck symptoms significantly. The treatment group received these posture exercises and the self-management instructions in Appendix 4, whereas the control group received only the self-management instructions. The treatment group reported a mean reduction in their TMD and neck symptoms of 42% and 38%, whereas the control group reported a mean reduction of 8% and 9%, respectively (Figure 14.6). TMD patients who held their head further forward relative to the shoulders (having greater forward head posture) were significantly more likely to derive TMD symptom improvement from posture training and self-management instructions.[37]

◉ QUICK CONSULT

Recommending Posture Exercises

The treatment group, using the exercises provided in Appendix 7, reported a mean reduction in TMD and neck symptoms of 42% and 38%, whereas the control group reported a mean reduction of 8% and 9%, respectively (Figure 14.6).

Practitioners may wish to use the posture exercises in Appendix 7 to help their TMD patients obtain these benefits. Follow-up appointments are necessary to ensure the exercises are being performed properly and tend to motivate patients to comply better with the exercise schedule, especially if patients know they will be asked about their compliance and to demonstrate the exercises. Performing these exercises improperly may exacerbate the TMD or neck symptoms.

In addition to performing these exercises, patients must continually monitor their posture and maintain the desired new posture. Clinically, this new cognizance can be combined easily with other self-monitoring that should improve TMD symptoms, for example, continually monitor tongue posture, jaw posture, and jaw muscle tension. This self-monitoring enables patients to modify their posture or behavior as soon as they begin

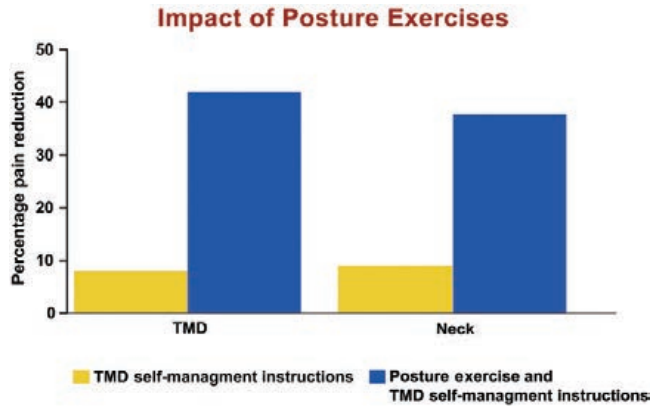

Figure 14.6. Posture exercise and TMD self-management instructions provide greater TMD and neck pain relief than TMD self-management instructions alone.[37]

to revert to their old undesirable postures or behaviors.

Knowing that TMD patients with a greater forward head posture have a higher probability of deriving TMD symptom improvement from these exercises, observe the degree of the patient's forward head posture during the initial evaluation. The greater the forward head posture is, the more likely I am to recommend these exercises.

Breaking Daytime Habits

TMD symptoms related to nocturnal contributing factors are present when patients wake up and usually last a few minutes to an hour or so. If the TMD symptoms last longer, worsen as the day progresses, or occur later in the day, daytime habits (parafunctional, emotionally induced muscle tension, etc.) generally are contributing to them.[24,38]

FOCAL POINT

If TMD symptoms last longer than an hour upon awaking, worsen as the day progresses, or occur later in the day, daytime habits (parafunctional, emotionally induced muscle tension, etc.) generally are contributing to them.

To help patients understand the relationship between their habits and TMD symptoms, the following analogy can be helpful. A man went to the physician because the man's right biceps and elbow were hurting and the elbow was popping and locking (I use the same muscle and joint complaints as the patient's masticatory muscle and joint complaints).

The doctor pressed on the man's right biceps and elbow, and observed their tenderness. He then pressed on the patient's right shoulder, left shoulder, and left arm (as I say these locations, I look at them) and found they were not tender. The doctor said (using an inquisitive facial expression), "This is odd; I wonder what could be causing this localized tenderness in the right arm." As I say this, I put my right hand on my knee, push down on the knee so my arm muscles flex, and make my right arm quiver. The doctor looked over at his right arm and said (using an astonished facial expression), "What are you doing with your right arm?" The man replied, "You should ignore this, because it is just a nervous habit I have when I get a little anxious or frustrated; it helps me get rid of my nervous energy." The doctor said, "No wonder you have pain in your right arm; anyone continually doing that would have your type of localized pain. You have to stop your crazy habit

if you want to get rid of your pain." I take my hand off of the knee, continue to flex the muscles in the arm, and make the arm quiver. The patient said he could stop that habit, do this instead, and could still get rid of his nervous energy in this manner. The doctor said, "No, you have to learn to let your arm relax and hang loose" (demonstrating this with my arm at the same time). "Once you learn to keep your arm relaxed, your biceps and elbow pain will disappear."

I tell the patient (demonstrating it with the arm) that pressing against the knee is similar to putting the teeth together and squeezing, whereas holding the arm out with the muscles flexed is similar to holding tension in the jaw muscles. You have to learn to let your jaw muscles relax and allow your jaw to hang loose (at the same time, I drop my arms and just let them hang). When you do this, your lips will lightly touch and you will find your teeth are separated by an eighth to a quarter of an inch.

In Question 26 of the "Initial Patient Questionnaire" (Appendix 2), patients recorded what percentage of the day their teeth are touching. If this is 20% or more, patients generally find it helpful if I ask them to rest their head against the headrest, close their eyes, take in a deep cleansing breath, let it out, and concentrate on relaxing their jaw muscles. After 5–10 seconds, I ask them to think about where their tongue is located and after another 5 seconds, I ask them to think about whether their teeth are together. I then ask them to open their eyes and sit up, and ask them where their tongue was located. I tell them to try to keep their tongue lightly resting in that position, this is generally conducive to them relaxing their jaw muscles. I ask them whether their teeth were together and generally they were not. I tell them that if they keep their jaw muscles relaxed, their teeth will be apart. We discuss when their teeth are together, they must be holding some tension in their jaw muscles and when they become busy, work on the computer, drive, and so on, they probably unconsciously squeeze their teeth together.

In Questions 27 and 28 of the "Initial Patient Questionnaire" (Appendix 2), patients identify the daytime oral habits they are aware of performing. Patients should be strongly encouraged (1) to always keep the tongue lightly resting on the roof of the mouth or where they found it in the above exercise and the teeth apart, (2) to stop any clenching or grinding of the teeth (the nighttime activity is beyond their control), (3) to stop performing any other oral habits they may have (e.g., chewing on cheeks, chewing objects, or biting nails or cuticles), and (4) to observe for any additional oral habits that may be contributing to their TMD symptoms.

These habits usually occur or intensify when patients are focused on other things, especially when they are busy, stressed, or concentrating (e.g., using the computer). Therefore, they generally need cues to alert themselves to check for whether they are performing these harmful habits. The cues may be external, such as a timer that alerts them every 5 minutes. Based on the pain intensity's fluctuations, patients can normally tell when their major contributing habits occur, which is the most beneficial time to use the cues. Clinically, it has been observed that it is best to work with the patients and help them determine what they will use for their external cues, in addition to when and how they will use them.

◉ **QUICK CONSULT**

Using External Cues

Daytime habits usually occur when patients are focused on other things, especially when they are busy, stressed, or concentrating (e.g., using the computer). Therefore, they generally need cues to alert themselves to check for whether they are performing these harmful habits.

If the habits are prominent while driving, some patients choose to place a portion of a yellow Post-it note over the car's speedometer, so that, every time they check their speed, they are reminded to also check for oral habits. In one situation in which the habits were prominent during computer use, one patient decided to place a rolled piece of tape (sticky side out) over the keyboard's "Z" key. This patient felt she would hit this key about every 5 minutes and, when the sticky side of the tape was touched, it would alert her to check for oral habits.

Over time, external cues tend to lose their startling effect, blend into the background, and stop alerting patients to check for oral habits. As this occurs, patients may desire to change the external cues or change to internal cues. Internal cues are aspects within the body that patients can also use to alert themselves about their oral habits. The most common internal cues that TMD patients use are the teeth touching the opposing teeth or an occlusal appliance, their pain intensity, and muscle tension. Clinically, patients appear to have the best long-term success if they have learned to use internal cues to maintain their new behaviors or postures. Some patients prefer to first work with external cues and later progress to internal cues.

Some patients find using a diary to record their activity and pain intensity hourly helps them to better identify the activities related to their major contributing habits and reinforces the need to break these habits. Some patients choose to become very cognizant about their major contributing habits, constantly monitor for them, and use them as internal cues to alert themselves to change the activity. For example, an individual who tends to hold tension in the masseter muscle uses masseter muscle tension as the internal cue and relaxes the masseter muscle whenever tension is noticed. If patients notice themselves reverting to their old harmful behaviors or postures, they need to institute the desired behavior or posture.

QUICK CONSULT

Recommending Diary

Some patients find using a diary in which they record their activity and pain intensity hourly helps them to better identify the activities related to their major contributing habits and reinforces the need to break these habits.

Some patients desire to use their pain intensity as their internal cue. As patients notice an increase in pain, they alert themselves, ask what they are doing to cause this, and change it. Once they satisfactorily control their habits so the pain decreases to a low level or becomes intermittent, ask patients to change their internal cue, from pain intensity to muscle tightness or tension. In this manner, they alert themselves whenever they begin to tighten their muscles and subsequently intentionally relax them. Patients usually find this enables them to keep their muscle tension from progressing and thereby prevents the pain from developing. Clinically, it has been observed that patients who can master using muscle tightness or tension as their internal cue seem to have the greatest long-term success in eliminating their daytime TMD symptoms and maintaining this benefit.

Some patients find breaking these habits and using the "TMD Self-Management Therapies" handout (Appendix 4) decrease their TMD symptoms satisfactorily. This is primarily observed among patients who are motivated to get better on their own and predominately have daytime pain.

Some other patients find wearing a stabilization appliance during the day helps them to continually be more attuned to parafunctional habits and what they are doing

with their oral cavity, thereby enabling them to catch and alter their daytime habits.[24,39] If a daytime appliance is desired, some practitioners prefer the 2-mm hard thermoplastic appliance discussed in "Hard Thermoplastic Stabilization Appliance" in Chapter 12 because of its low impact on speech and esthetics.

In one study,[40] subjects were randomly assigned to a habit-reversal stabilization appliance or a habit-reversal group. Subjects in both groups were instructed to avoid tooth contact and relax their masticatory muscles. The appliance subjects wore their appliances up to 20 h/day, while the habit-reversal subjects were not provided an appliance, but paged every 2 hours during the day for 4 weeks and instructed to check their tooth position and masticatory muscle tension when paged. Subjects in both groups obtained a significant decrease in TMD pain (Figure 14.7). This suggests if you instruct your TMD patients to avoid tooth contact and relax their masticatory muscles, patients working with reminders or wearing a stabilization appliance as a reminder will obtain similar symptom improvement. Empirically, I believe my patients obtain better TMD symptom relief at 4 weeks than the subjects in Figure 14.7, but that could be from my patients receiving a multidisciplinary approach rather a single therapy.

For various reasons, some practitioners provide a maxillary or mandibular stabilization appliance for their patients to wear temporarily during the day. Patients who also awake with TMD symptoms should be instructed to wear an appliance at night, too. I ask these patients to wear the same appliance during the day and at night, while I observe some other practitioners providing their patients with a mandibular "daytime appliance" and a maxillary "nighttime appliance." If patients use an appliance during the day, I refer to it as a habit-breaking appliance and instruct them that its purpose is to help alert them whenever their opposing teeth touch the appliance. I try to have

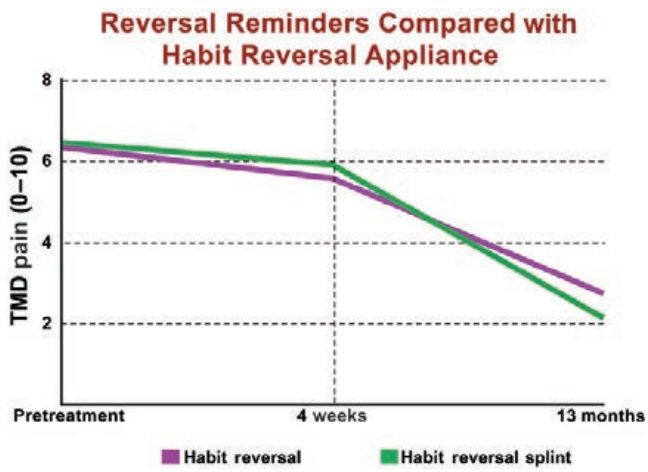

Figure 14.7. Comparison of subjects randomly assigned to a habit-reversal stabilization appliance or habit-reversal group with both groups instructed to avoid tooth contact and relax their masticatory muscles. Subjects in the appliance group wore their appliances up to 20 h/day and subjects in the habit-reversal group were paged every 2 hours during the day for 4 weeks and instructed to check their tooth position and masticatory muscle tension when paged. Both groups obtained significant decrease in TMD pain.[40]

patients break their daytime habits within several months and then request they limit the use of the appliance to nighttime and only a few hours during the day, if at all. Some patients find they still prefer to continue wearing their appliance for certain activities, for example, driving a car.

QUICK CONSULT

Using a Habit-Breaking Appliance

If patients use an appliance during the day, I refer to it as a habit-breaking appliance and instruct them that its purpose is to help alert them whenever their opposing teeth touch the appliance.

Some patients cannot adequately control their daytime habits or muscle tension to reduce their daytime symptoms satisfactorily. Most of these patients are referred to a psychologist for additional help with changing these, especially if other psychosocial needs are observed. These therapies and the referral process are discussed in Chapter 16, "Cognitive-Behavioral Intervention."

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Chapter 15

Physical Medicine

In the field of temporomandibular disorder (TMD), physical medicine procedures are referred to as **adjunctive TMD therapies** and generally provide additional improvement with TMD symptoms. If patients have not changed their perpetuating contributing factors, many of the improvements obtained through physical medicine procedures are only temporary, unless patients are taught to perform these procedures and continually use them on their own.

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Using Physical Medicine Procedures

In the field of TMD, physical medicine procedures are referred to as adjunctive TMD therapies and generally provide additional improvement in TMD symptoms.

FOCAL POINT

If patients have not changed their perpetuating contributing factors, many of the improvements obtained through physical medicine procedures are only temporary, unless patients are taught to perform these procedures and continually use them on their own.

In addition to physical medicine therapies, cognitive-behavioral intervention provides other commonly used adjunctive TMD therapies that have also been shown to reduce TMD symptoms (see Chapter 16, "Cognitive-Behavioral Intervention"). Some of the adjunctive TMD therapies are directed primarily at peripheral structures, whereas others provide primarily a central effect. Those primarily acting on the peripheral tissues are heat or cold applications, masticatory muscle exercises, physical therapy modalities, massage, trigger-point compression, trigger-point injections, chiropractics, and magnetic therapy, whereas treatments primarily having a central effect include acupuncture, relaxation therapy, biofeedback, and stress management.

Adjunctive TMD therapies are discussed separately, but are generally used in combination with other therapies. Not all of the physical medicine procedures discussed are recommended for TMD patients, but are presented in order that practitioners may make informed treatment decisions.

Many TMD patients desire adjunctive physical medicine procedures. Over a 1-year period in which TMD patients were being followed for symptom changes from

Manual of Temporomandibular Disorders, Third Edition. Edward F. Wright.

cognitive-behavioral interventions, 23%, 20%, 4%, and 3% of the subjects also sought treatment by a chiropractor, massage therapist, physical therapist, and acupuncturist, respectively.[1]

Myalgia is the most common source of TMD pain and **myofascial pain with referral** is a subcategory of myalgia (see Table 5.1). In myofascial pain with referral, the pain refers to other areas beyond the palpated muscle and this is generally due to the aggravation of localized tender nodules, known as **trigger points**, within the muscles. Temporomadibular joint **(TMJ) arthralgia** is another common source of TMD pain, which is characterized by TMJ tenderness. **Cervical pain** is another prevalent disorder among TMD patients, causing them to not obtain the usual TMD symptom improvement.[2,3] Most physical medicine procedures used to improve TMD symptoms are directed at one or more of these disorders.

Many of the physical medicine therapies provide only temporary improvement and the therapy typically needs to be continually repeated or the contributing factors perpetuating the disorder must be adequately controlled.

Trigger points are commonly found within muscles and their activation is generally a cumulative effect of various perpetuating factors, with the most common being repetitive overuse of the muscle, chronic muscle tension, and emotional stress.[4] Parafunctional habits are the most frequent cause of repetitive overuse of the masticatory system, whereas poor posture is the most frequent cause of repetitive overuse of the cervical region.

In the literature, comparisons are made between adjunctive TMD therapies and occlusal appliances. When these are discussed in Chapters 15 and 16, the appliances are acrylic stabilization appliances unless specified differently.

Muscle Massage

Massage therapists can improve most forms of muscle pain, and when a trigger point is found, they will compress and inactivate the trigger point during the massage. Muscle massage generally decreases the pain and increases the mobility of the region, and self-massage is discussed in Chapter 14, "Self-Management Therapy."

Most massage therapists want to treat muscle pain by repeating the massage weekly, which is time-consuming and costly for patients. If patients are taught to use self-massage, they may have an effective adjunctive treatment to use whenever they desire it. Some patients may find adding a topical liniment (e.g., Icy Hot) provides additional benefit. Two surveys of TMD patients found muscle self-massage to be one of the most beneficial of the alternative treatments evaluated, and one found that 24% of TMD patients use muscle self-massage for their TMD symptoms.[3,5]

Because of its efficacy, muscle self-massage is the first therapy discussed in the "TMD Self-Management Therapies" handout (Appendix 4), and it is recommended for patients who have sufficient masseter and/or temporalis muscle pain that self-massage would be worth their while. Appendix 4 discusses three self-massage techniques in which patients can simply place their fingers over these muscles, place their thumb on the medial aspect of their ramus to be able to apply a more forceful massage, and locate and knead their tender nodules within these muscles.

◉ QUICK CONSULT

Recommending Self-Massage

If patients are taught to use self-massage, they may have an effective adjunctive treatment to use whenever they desire it.

Yoga

Yoga combines the benefits from breathing exercises, stretching exercises, a fitness program, and meditation.[6] Yoga has been shown to reduce stress and inflammatory markers,[7] anxiety,[8] tension and migraine without aura headaches,[9] and many other pains.[10]

A survey taken within the United States found that the primary reasons individuals performed yoga was for wellness (64%), for health conditions (48%), and for back or neck pain (21%).[11] One study found that neck pain patients who received both yoga and physical therapy had a significantly greater improvement with their neck pain than those who only received physical therapy.[12]

A survey among TMD patients reported that 63% found yoga beneficial for their TMD (Figure IV.1).[13] No controlled studies have evaluated whether yoga is beneficial for TMD and I have not clinically followed my TMD patients who began yoga while I treated them for TMD and observed whether they obtained TMD symptom improvement from it. However, if a TMD patient with stress, anxiety, headaches, neck pain, or other musculoskeletal disorders relates he or she is considering to start yoga, I encourage the patient to follow through on the contemplation.

Yoga Alliance® (http://www.yogaalliance.org/) registers both individual yoga teachers and yoga schools who have complied with the organization's minimum educational standards. At their website, patients can locate registered teachers and schools and find general information about yoga. Once patients learn the poses, they may prefer to purchase a yoga video and perform this in their home.

Based on the literature, yoga can be a cost-effective program that has the potential for benefiting neck, headache, and TMD symptoms.

Trigger-Point Compression

This procedure is often provided in conjunction with massage therapy. It attempts to inactivate trigger points, thereby decreasing muscle pain and increasing mobility of the region.

One study randomized their patients with pain from upper trapezius muscle trigger points into three groups: only compressing the trigger points, only stretching the trapezius muscle, and provided both. The trigger-point compressions were provided by three 1-minute compressions with a 30-second rest between them, the stretches were provided by three 45-second stretches with a 30-second rest between them, and the combination was provided by a sequence of compression, rest, stretch, rest, and so on. After six sessions over 2 weeks, all groups had a significant decrease in pain with the percentage reduction among the trigger-point compression, stretch, and combination groups being 47, 47, and 67, respectively.[14]

Another study used trigger-point compression as one of their randomized treatments, in which the trigger points were initially compressed with the force that just initiated pain and then held this force on the trigger point. As the compression inactivated the trigger point, the force was increased up to where the pain reoccurred. This procedure was continued for 90 seconds. After six sessions of these compressions, the subjects reported a significant decrease in their pain.[15]

Trigger-point compression is discussed in Chapter 14, "Self-Management Therapies," and patients instructed in this technique may have an effective tool for maintaining trigger-point inactivation.

Trigger-Point Injection

This is another technique used to inactivate trigger points. Clinically, it is often observed

that patients relate the injection allowed them to relax and stretch their muscle, thereby decreasing the symptoms from the muscle.

Various solutions are used to inject into active trigger points, but 2% lidocaine without epinephrine, or mepivacaine 3% is a suitable anesthetic solution.[16] This generally provides immediate relief, and it is recommended that practitioners stretch the injected muscle and apply superficial heat after the injection.[17,18] The relief normally lasts days (much longer than the local anesthetic effect), and the pain never quite returns to the original level. Weekly sequential injections are generally provided, which enables the practitioner to obtain a stair-step reduction in the pain.

Recently, some case reports and studies have used BOTOX® (onabotulinumtoxinA, which is a botulinum toxin-A) and report short-term results for the decrease in pain that was obtained from inactivating trigger points. These injections are relatively expensive, its benefits only last approximately 3 months (similar to its duration in the treatment of facial wrinkles), and has associated risks (e.g., facial deformity at injection site).[19–21] Hence, the traditional therapies discussed in this book are much more cost-effective for the long-term control of TMD symptom than continually providing onabotulinumtoxinA injections. Additionally, there are questions as to whether onabotulinumtoxinA is better than or longer lasting than standard trigger-point injection solutions.[22,23]

As with other adjunctive therapies, if the perpetuating factors have not been adequately reduced, the trigger points tend to reactivate. Generally, trigger-point injections are provided only after traditional conservative management in addition to exercises and other physical therapy modalities have failed to have a lasting effect.[24]

QUICK CONSULT

Recommending Trigger-Point Injections

Generally trigger-point injections are provided only after traditional conservative management in addition to exercises and other physical therapy modalities have failed to have a lasting effect.

Trigger-point injections into the masticatory and neck muscles can be provided by dentists, and a recommended step-by-step detailed technique is presented by Abdel-Fattah.[17] Practitioners desiring to refer a patient for this therapy will find that some physicians provide these injections in their office, and most pain clinics have practitioners experienced in providing them.

Physical Therapy

This encompasses a wide variety of evaluation techniques and treatments commonly used for musculoskeletal disorders. A survey among TMD patients reported that 60% found physical therapy beneficial for their TMD (Figure IV.1).[13]

Physical therapy generally entails conservative noninvasive therapies that are typically used in combination with other treatments for TMD.[16,25] It is appropriate and common for dentists to refer TMD patients to physical therapists to reduce TMD pain or improve TMJ function, range of motion, and daytime or sleeping postures, or to evaluate and treat neck symptoms.[25–27]

A large survey of the general population found that 55% of the individuals who had TMD symptoms also had neck pain.[2] Associations between TMD and cervical pain are prevalent in the TMD literature.[20,22] TMD

and cervical pain are so interconnected that one study found that only providing exercises and therapies directed toward the neck provided significant improvement of the TMD symptoms.[19]

The goal in physical therapy is to improve TMD symptoms and teach patients to maintain this improvement. Therefore, patients do not need to continually return for treatment, minimizing the cost and time spent in therapy.

FOCAL POINT

The goal in physical therapy is to improve TMD symptoms and teach patients to maintain this improvement. Therefore, patients do not need to continually return for treatment, minimizing the cost and time spent in therapy.

Physical therapists often provide TMD patients with education and a combination of therapies. Patients most frequently receive exercises rather than passively receiving treatments that do not require them to participate actively in their own improvement. Most of the passive treatments are referred to as **physical therapy modalities**, which may include superficial heat, superficial cold, combination of heat and cold, ultrasound (deep heat), phonophoresis (deep heat with an anti-inflammatory or anesthetic medication driven by ultrasound waves), electrical stimulation, microcurrent electrical nerve stimulation (MENS), transcutaneous electrical nerve stimulator (TENS), and iontophoresis (a charged anti-inflammatory or anesthetic medication driven by an electrical gradient).

The literature suggests that exercises have the greatest potential for therapeutic benefit and enable patients to maintain this improvement. Therefore, physical therapists now tend to use more active therapies than in the past.[16,28,29]

A randomized clinical trial found that TMD patients given the posture improvement exercises (Appendix 7) and TMD self-management instructions (Appendix 4), on average, reported a 42% reduction in their TMD symptoms and 38% reduction in neck symptoms. Patients who held their head further forward relative to their shoulders had a higher probability of deriving TMD symptom improvement from the exercises and instructions.[30] Practitioners may desire to refer TMD patients who have more significant forward head posture to physical therapy for posture exercises or directly instruct and follow the cases of patients with the posture improvement exercises (Appendix 7).

The efficacy of physical therapy increases when performed in conjunction with occlusal appliance therapy.[25,31] I often consider referring TMD patients to physical therapy for any of the following (provided in Table 15.1):

Table 15.1. Recommendations for when to consider referring a patient to a physical therapist.

- The patient has neck pain worthy of treatment.
- The patient has cervicogenic headaches (headaches that can be reproduced by palpating the neck).
- The patient has moderate to severe forward head posture.
- The patient's TMD symptoms increase with abnormal postural activities.
- The patient desires help in changing poor sleep posture (e.g., stomach sleeping).
- The patient did not obtain adequate TMD symptom relief from initial therapies that did not include physical therapy.
- The patient is to have TMJ surgery.

1. **The patient has neck pain worthy of treatment.** TMD patients with neck pain do not respond to TMD therapy as well as those without neck pain.[32] Some TMD symptoms primarily come from the neck, and physical therapy in conjunction with home exercises can provide long-term benefit for neck pain.[25,33]
2. **The patient has cervicogenic headaches (headaches that can be reproduced by palpating the neck).** Cervicogenic headaches are headaches that originate in the neck, and clinically, it appears TMD patients tend to hold more tension in their masticatory muscles when they have a headache. Therefore, TMD patients with cervicogenic headaches who have their neck treated should have fewer headaches and may also obtain substantial TMD symptom improvement. Studies report physical therapy's beneficial effect on cervicogenic headaches,[34,35] and an example of one cervical exercise's long-term effect is demonstrated in Figure 15.1.[36]
3. **The patient has moderate to severe forward head posture.** These patients may obtain significant TMD symptom improvement from posture exercises in combination with TMD self-management instructions[30] and be most likely to derive substantial TMD symptom improvement from these.
4. **The patient's TMD symptoms increase with abnormal postural activities.** Instructing these patients in body mechanics (teaching patients how to perform tasks without straining the body) should help them maintain good posture, thereby reducing their TMD symptoms.[25]
5. **The patient desires help in changing poor sleep posture.** Stomach sleeping perpetuates TMD and neck symptoms. Physical therapists are trained to help change the sleep position of patients who cannot stop sleeping on their stomach.[25]
6. **The patient did not obtain adequate TMD symptom relief from other therapies.** Physical therapists are trained to treat musculoskeletal disorders throughout the body and can apply their skills to the masticatory system.

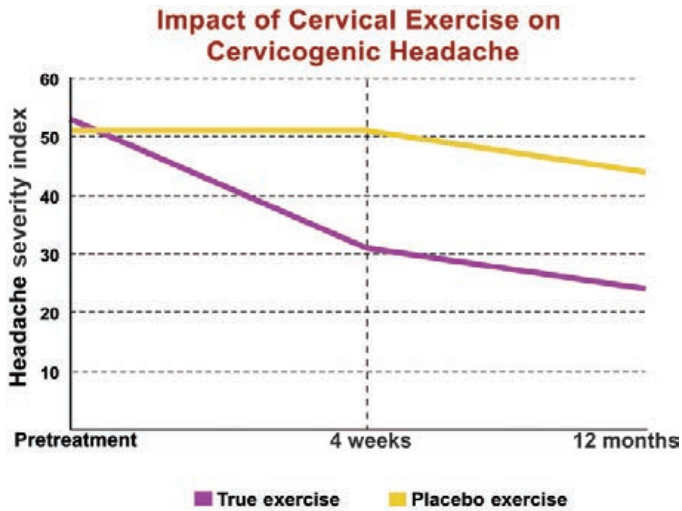

Figure 15.1. Demonstrates the clinically significant long-term effect a single cervical exercise can have on cervicogenic headaches.[36]

7. **The patient is to have TMJ surgery.** Patients who receive physical therapy after TMJ surgery may have significantly better results.[37] It is appropriate for these patients to be referred for physical therapy prior to surgery in order that they may learn about and possibly start the postsurgical exercises, and schedule the recommended postsurgical appointments.

Two examples of physical therapy referrals are provided in Appendix 10, "Examples of Physical Therapy Referral." To refer a TMD patient to a physical therapist, the practitioner can write the following on the prescription pad or office stationery:

1. The patient's chief complaint
2. The patient's TMD diagnosis, for example, myalgia and TMJ arthralgia
3. What the practitioner prescribes the physical therapist to perform. I generally write "Please evaluate and treat"; this allows the physical therapist to perform whatever treatment is believed necessary. Many third-party payers also require the requested frequency and duration of treatment be documented; two to three times a week for a month is a reasonable request. I generally write "as therapist recommends."
4. Any precautions the physical therapist should be aware of (e.g., previous surgery, tumor, screws, or wires in the region) and medical disorders that could complicate therapy (e.g., angioedema).

As with dentistry, TMD is not a primary field of physical therapy education. Physical therapists' TMD knowledge greatly varies with the university attended, and much of it is generally obtained from continuing education courses. Very few physical therapists have specialized training or extensive experience treating TMD patients, and great variations are observed in their abilities to treat TMD patients.

I am aware of two physical therapy certification programs that certify individuals with expertise in treating TMD patients. These organization websites list their certified physical therapists, so practitioners can identify trained therapists to refer their patients. The one certification is titled Certified Cervical and Temporomandibular Therapists (CCTT) and therapists with this certification are listed on the Physical Therapy Board of Craniofacial & Cervical Therapeutics website (http://www.ptbcct.org). The other certification is titled Certification in Cranio-Facial (CFC) and therapists are listed as alumni on the University of St. Augustine website (http://www.usa.edu/). The names and addresses of these therapists are easily obtained by placing the certification title in an internet search engine and clicking the selection for the organization.

If there is no physical therapist with either of these certifications nearby, then I recommend referring to a physical therapist with specialty training in orthopedics or manual therapy. These physical therapists have "OCS" or "MTC" after their names. OCS stands for Board Certified Orthopedic Clinical Specialist and MTC stands for Manual Therapy Certification.

These physical therapists can be located on the American Physical Therapy Association website (http://www.apta.org/) and selecting "Find a PT." Enter your zip code and select the expertise orthopedics. Select a physical therapist with the letters OCS or MTC after his or her name. These physical therapists have specialty certification in treating the cervical region and you may want to telephone him or her to determine how comfortable and experienced this individual is in treating TMD.

QUICK CONSULT

Selecting a Physical Therapist

I am aware of two physical therapy certification programs that certify individuals having expertise in treating TMD patients. These organization websites list their certified physical therapists, so practitioners can identify certified therapists to whom they can refer these patients.

If a practitioner is not aware of an appropriate physical therapist to whom he or she can refer a patient, many physical therapists with skills or interest in such special areas as TMD, the neck, or the spinal column will list these areas in their telephone book's yellow pages advertisement. Practitioners can also talk with other dentists in the area who refer their TMD patients to physical therapists, to determine who they have found can obtain satisfactory results.

Physical therapy is a benefit of most medical insurance policies. Some third-party payers require their patients use in-house or contracted physical therapists, and some require the consults to go through a physician. Because of the complexities with the medical insurance or if the dentist is not knowledgeable about the physical therapists in the area, practitioners may desire to write the aforementioned items on their prescription pad and request that patients see their primary care providers for the referral. Some patients may desire to speak with their third-party payer concerning referral procedures and copayment prior to making the physical therapy appointment.

ACUPUNCTURE

This intervention is commonly used for treatment of chronic headaches, neck pain, and low back pain and has well documented support for its ability to relieve pain for these disorders.[38] When acupuncture is used to treat chronic pain, it generally takes repeated treatments and several weeks to obtain its maximum therapeutic effect. Each treatment session usually lasts 25–45 minutes and is generally provided on a weekly basis. Once the treatments stop, acupuncture generally slowly loses its beneficial effect over several weeks.[39]

The pain relief that acupuncture provides appears to primarily be due to the release of endorphins into the central nervous system (reversed by naloxone, an opioid antagonist) and inhibition of the noxious pain control system.[40,41]

Even though its effect is short term, occasionally, studies observe that patients with a long-term pain disorder improve from acupuncture, such as with chronic low back pain.[42] It is speculated that the temporary pain relief obtained through acupuncture allows patients to mobilize the region and thereby obtain the long-term relief.[39]

Acupuncture has similarly been shown to provide short-term benefit for TMD,[43–45] in addition to when it is combined with manual therapy.[46] TMD patients generally need six to eight treatment sessions for TMD symptoms to respond adequately, and if it is a chronic disorder, patients need to return periodically for additional sessions to maintain these benefits.[24,47] My clinical observation of TMD patients whose treatment is limited to acupuncture is that most need an acupuncture treatment every 2 or 3 weeks to maintain their symptom relief.

Two randomized clinical trials compared the percentage of patients who obtained any TMD symptom improvement from acupuncture and stabilization appliance therapy; their findings are summarized in Figure 15.2.[48–50] In one study, patients were allowed to crossover and receive the treatment

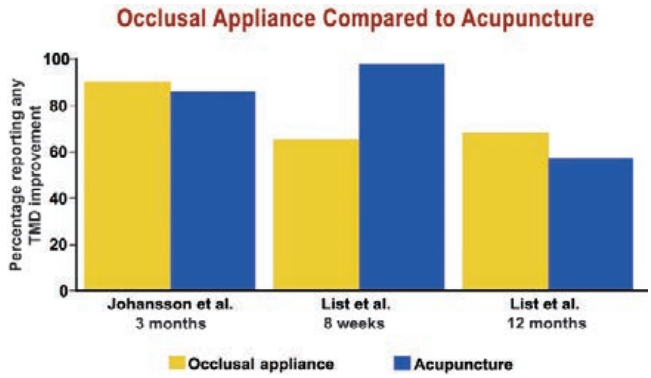

Figure 15.2. Initially, acupuncture was more effective than appliance therapy, but over time, acupuncture lost its effectiveness and appliance therapy was superior.

provided to the other group at the 6-month follow-up. Among the patients who received the stabilization appliance and chose to receive acupuncture, only 17% had any further subjective improvement from acupuncture, so it appears adding acupuncture to stabilization appliance therapy would not provide much additional benefit.[48]

Acupuncture can provide significant short-term TMD symptom improvement,[51] but there are simpler and less invasive therapies that provide sustained and comparable symptom relief.

FOCAL POINT

Acupuncture can provide significant short-term TMD symptom improvement, but there are simpler and less invasive therapies that provide sustained and comparable symptom relief.

CHIROPRACTICS

A survey of the general population found that nearly 8% of the adults and 3% of the children received chiropractic or osteopathic manipulative therapy in the past year.[52] A moderate percentage of TMD patients seek TMD symptom relief from chiropractors.[1,5,50] Chiropractic training varies considerably from school to school; therefore, chiropractors' treatment approaches and capabilities also vary greatly.[53] Some chiropractors attempt to relieve TMD-type symptoms through cervical spine manipulation, whereas other chiropractors work directly with the masticatory system.[54–56]

There is only one known clinical trial that evaluated TMD symptom change from spinal and masticatory chiropractic therapy, and all patients obtained short-term TMD benefit from this intervention.[56] My clinical observation of chiropractors treating patients for TMD is that most chiropractors do not teach the patients how to eliminate their perpetuating contributing factors, so I speculate this therapy would only provide a short-term benefit for most TMD patients with chronic symptoms.

It is speculated that dentists who refer TMD patients to chiropractors do so primarily to treat coexisting neck pain, and the literature suggests that chronic mechanical neck disorders have the best long-term results from mobilization and/or manipulation when patients are provided exercises to do on their own.[57] Clinically, I observe most chiropractors do not teach their patients exercises to maintain the symptom benefits, but generally

instruct their patients to return on a routine basis for long-term chiropractic therapy.

If a provider refers a patient to a chiropractor for cervical pain and the patient obtains and is able to maintain cervical pain resolution after two or three chiropractic treatments, this would appear to have been an effective treatment approach. On the other hand, if adequate relief is not obtained or the improvement is not maintained without continued spinal manipulation, then it is recommended that the patient receives more traditional interventions rather than further chiropractic therapy. There are no studies to suggest when a chiropractic referral would be the preferred intervention for cervical pain.

QUICK CONSULT

Recommending Chiropractic Treatments

After two or three chiropractic treatments, if adequate neck pain relief is not obtained or the improvement is not maintained without continued spinal manipulation, then it is recommended that the patient receive more traditional interventions rather than further chiropractic therapy.

Magnetic Therapy

For centuries, the use of magnetics has been advocated for relieving pain. It is a growing multibillion dollar industry that produces and markets magnetic necklaces, bracelets, bands, insoles, back braces, mattresses, and so on.[58] There are many anecdotal reports of their effectiveness in relieving pain, and it has been reported that therapeutic magnets have been worn by 90% of the senior Professional Golfers' Association players.[59] Studies have found therapeutic magnets to be beneficial for a broad range of pain disorders, for example, neuropathic, inflammatory, musculoskeletal, fibromyalgic, rheumatic, menstrual, and postsurgical.[60–63] While other studies have found that the improvement in pain from magnet therapy is similar to that obtained by a placebo magnet.[58]

The therapeutic strengths vary from 300 to 5000 G, in comparison with refrigerator magnets, which vary from 35 to 200 G, and magnetic resonance imaging (MRI) procedures, which can use up to 200,000 G.[64] A problem for consumers and clinical investigators is that some magnet suppliers are significantly overrating the strength designation of their magnets, and a study of comparing clinical trials found that the magnet's strength was an important component as to whether subjects found the magnet beneficial.[60,65]

Therapeutic magnets are considered safe, but individuals with pacemakers, insulin pumps, and other devices that may be affected by a magnetic field are advised not to wear one.[66] Therapeutic magnets produce a magnetic field that extends only several millimeters beyond the surface of the skin and should therefore be placed in direct contact with the painful area.[60,61] Consequently, magnetic bracelets or necklaces that dangle from an individual's body may provide less than optimal benefit.

There are many theories for the underlying mechanisms that may account for the magnet's proposed pain relief, but the underlying physiologic mechanism is still unclear.[60,67] Their efficacy is also in question; among the two systematic reviews that evaluated well-conducted controlled trials, one concluded that static magnets are able to induce pain relief,[60] while the other concluded that the evidence does not support the use of static magnets for pain relief.[66]

There are no known clinical trials evaluating the efficacy of magnetic therapy for TMD symptoms. Clinically, it has been observed that some patients have found that magnetic

therapy beneficial for their TMD pain, whereas some others have found that the coldness of the magnet aggravates their pain. Esthetic considerations limit the use of magnets to primarily evening and nighttime.

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Chapter 16

Cognitive-Behavioral Intervention

FAQs

Q: Are all psychologists able to help temporomandibular disorder (TMD) patients satisfactorily control their daytime oral parafunctional and muscle tension habits?
A: Few psychologists have specialized training or extensive experience in using cognitive-behavioral intervention to treat TMD symptoms, and those not experienced in treating TMD patients would initially appreciate suggestions of specific behaviors that need to be changed.

Q: Since relaxation has been shown to be beneficial for TMD symptoms, wouldn't it be helpful if I provide my TMD patients with a relaxation audio program?
A: Clinically, it has been observed that, when TMD patients are handed a relaxation audio program, few have the motivation to listen it and practice the therapy consistently.

Q: How could a biofeedback machine help patients learn to relax their muscles?s
A: Biofeedback enables patients to observe how different relaxation techniques can change their muscle tension and, with the feedback system, they usually can learn to relax their masticatory muscles and reduce their TMD symptoms. This is the reason it is often called biofeedback assisted relaxation.

It is well recognized that daytime parafunctional habits, tension, stress, anxiety, anger, depression, catastrophizing (thinking the worst of situations), pain-related beliefs, coping poorly with "life's stuff," and so on, negatively impact patients' TMD symptoms and their ability to improve from conservative TMD therapy.[1,2] Cognitive-behavioral interventions are adjunctive TMD therapies that attempt to help patients reduce their daytime parafunctional habits, daytime muscle tension, and psychosocial contributing factors.

Manual of Temporomandibular Disorders, Third Edition. Edward F. Wright.

FOCAL POINTS

It is well recognized that daytime parafunctional habits, tension, stress, anxiety, anger, depression, catastrophizing (thinking the worst of situations), pain-related beliefs, not coping well with "life's stuff," and so on, negatively impact patients' TMD symptoms and their ability to improve from conservative TMD therapy.

There are many systematic reviews that suggest cognitive-behavioral interventions are beneficial for TMD patients and provide them with the ability to sustain this improvement over time.[3–6] Cognitive-behavioral interventions are adjunctive TMD therapies that attempt to help patients reduce their daytime parafunctional habits and psychosocial contributing factors.

The "TMD Self-Management Therapies" handout (Appendix 4) provides patients with some techniques they can use to reduce these contributors. Patients with minor daytime habits and minor psychosocial contributors can often satisfactorily reduce their habits when they realize how these contribute to their pain. Patients with significant persistent daytime habits and/or psychosocial contributors often need additional help from a practitioner trained in cognitive-behavioral interventions.[7]

QUICK CONSULT

Differentiating Patients' Needs

Patients with minor daytime habits and minor psychosocial contributors can often satisfactorily reduce their habits when they realize how these contribute to their pain, whereas those with significant persistent daytime habits and/or psychosocial contributors often need additional help from a practitioner trained in cognitive-behavioral interventions.

Clinical trials demonstrate that the "average" patient who receives cognitive-behavioral therapy gains comparable TMD symptom improvement as that acquired from occlusal appliance therapy (see Figure 16.1 and Figure 16.2).[8–10] If used in conjunction with an occlusal appliance, patients generally obtain additional symptom improvement (Figure 16.2).[10] It has also been demonstrated that TMD patients with poor psychosocial adaptation have significantly greater symptom improvement when the dentist's TMD therapy is combined with cognitive-behavioral intervention (Figure 16.3).[11,12]

FOCAL POINTS

Clinical trials demonstrate that the "average" patient who receives cognitive-behavioral therapy gains comparable TMD symptom improvement as acquired from occlusal appliance therapy (see Figure 16.1 and Figure 16.2).

If cognitive-behavioral therapy is used in conjunction with an occlusal appliance, patients' symptoms generally improve more than from either single therapy (Figure 16.2).

During the initial TMD evaluation, patients commonly deny having daytime parafunctional habits and psychosocial contributors.[13,14] Many questions in the "Initial Patient Questionnaire" (Appendix 2) are designed to help identify these contributing factors. While contemplating the answers they will mark on the questionnaire, many patients reason what treatment may be recommended if they disclose psychosocial contributors, so some modify their answers. On occasion, patients did not respond to therapy as anticipated and, on further questioning, were found to have not been honest with these "Initial Patient Questionnaire" answers, primarily because

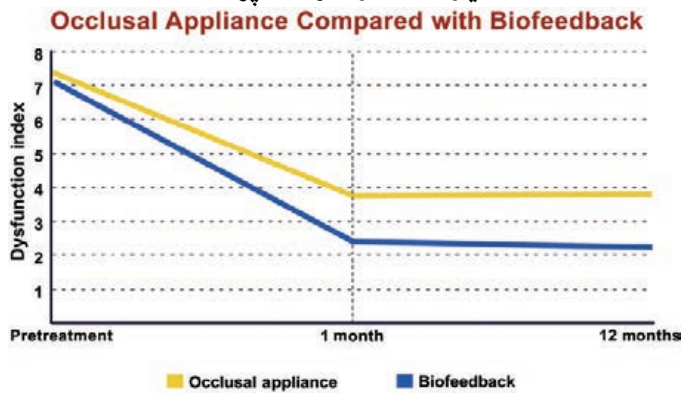

Figure 16.1. Occlusal appliance therapy and biofeedback can provide significant TMD improvement.[9]

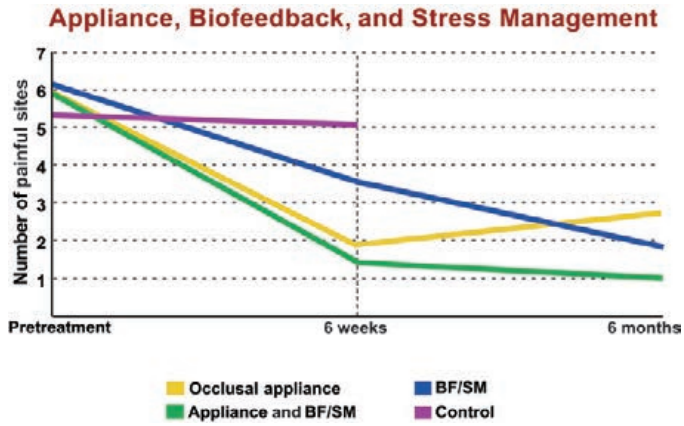

Figure 16.2. Occlusal appliance therapy alone, biofeedback assisted relaxation and stress management (BF/SM) alone, and their combination can provide significant TMD improvement.[10]

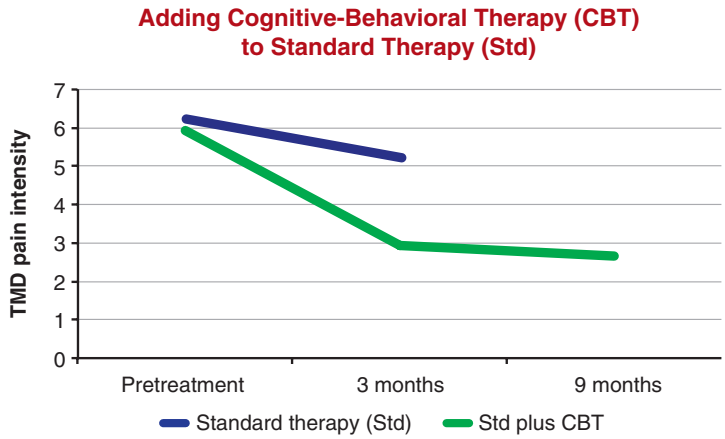

Figure 16.3. Adding cognitive-behavioral therapy to standard TMD therapy can provide significant TMD improvement. In this study, standard TMD therapy included stabilization appliance, jaw exercises, NSAID, and/or muscle relaxants, and cognitive-behavioral therapy entailed six 1-hour sessions.[11]

they were not open to receiving the needed cognitive-behavioral therapy.

QUICK CONSULT

Identifying Daytime Habits and Psychosocial Contributors

During the initial TMD evaluation, patients commonly deny having daytime parafunctional habits and psychosocial contributors, but the "Initial Patient Questionnaire" (Appendix 2) is designed to help identify these contributing factors.

Cognitive-behavioral interventions primarily encompass habit reversal, relaxation, hypnosis, biofeedback, stress management, and cognitive therapy (focuses on changing patients' distorted thoughts).[15] These therapies are generally provided by psychologists in a combined comprehensive strategy thought most effective for the patient and/or disorder. Their long-term efficacy for TMD symptoms has been demonstrated,[12,16,17] and they are more effective for patients with daytime symptoms.[12,18,19]

QUICK CONSULT

Comprehending Cognitive-Behavioral Interventions

Cognitive-behavioral interventions primarily encompass habit reversal, relaxation, hypnosis, biofeedback, stress management, and cognitive therapy (focuses on changing patients' distorted thoughts).

Relaxation is often used with most of these cognitive intervention therapies, and patients are often requested to practice relaxing at least once a day. Practitioners should keep in mind that these therapies are time-consuming, and the patient must be motivated to practice them so maximum benefit is obtained and maintained over time.

QUICK CONSULT

Understanding Patient's Role

Practitioners should keep in mind that these therapies are time-consuming, and the patient must be motivated to practice them so maximum benefit is obtained and maintained over time.

It has been observed that, to identify which therapies may be most beneficial for a patient, some psychologists prefer to perform psychological testing prior to the cognitive-behavioral intervention. Other psychologists may provide a standard brief cognitive-behavioral intervention and test only those patients who do not improve sufficiently. A standard brief cognitive-behavioral intervention has been shown to be beneficial for most TMD patients but is not sufficient for some, such as those with dysfunctional chronic pain.[16,20,21]

TECHNICAL TIP

Treating with a Standard Brief Cognitive-Behavioral Intervention

A standard brief cognitive-behavioral intervention has been shown to be beneficial for most TMD patients but is not sufficient for some, such as those with dysfunctional chronic pain.

For many years, my patients who needed cognitive-behavioral intervention were primarily referred to a minimal intervention program, which entailed three sessions that were 2 hours long and 1 week apart. This intervention was sufficient for most of my TMD patients and, if satisfactory improvement was not obtained, psychological

testing was performed to identify which additional therapies might be most beneficial.[20]

Minimal intervention programs for patients with TMD will often have them use diaries and implement interventions (e.g., habit reversal, relaxation, and cognitive coping skills) that are thought to be most useful for the majority of these patients.[16,22] If a sufficient number of patients are referred for this therapy, the psychologist may be able to provide it in a classroom setting. This would minimize the cost of the therapy, and most of my patients related that they preferred the group setting rather than individual instruction.[20]

Clinically, it is observed that patients generally need to implement three phases to obtain substantial daytime symptom improvement. The degree of TMD symptom improvement and required assistance will vary with the severity of the patient's habits and psychosocial factors. These phases are as follows:

1. Patients must learn how to make their masticatory muscles relax (or drain the tension from these muscles) and learn what relaxed masticatory muscles feel like. For some patients, relaxation training is insufficient, and they will need biofeedback to help them learn to relax their muscles.
2. Patients must learn to identify when they are performing parafunctional habits and/or their masticatory muscles are tense. This is usually done through internal and/or external cues (explained in "Breaking Daytime Habits" in Chapter 14).
3. When patients are performing parafunctional habits, they must learn to stop them and relax their muscles; when their masticatory muscles are tense, they must learn to drain the tension from these muscles. These activities generally occur when patients are frustrated, busy, or thoughtfully engaged, as when using a computer or driving a car. Some patients do not want to release their tension or anger and may need stress management or cognitive therapy to help them with this.

Few psychologists have specialized training or extensive experience in using cognitive-behavioral intervention to treat TMD symptoms. There are many alternatives for selecting a psychologist who can provide this therapy.

Behavioral psychology is a specialty, and psychologists with this training should be able to apply their training easily to TMD patients. Some psychologists have specialized training in pain management and should be experienced in using relaxation and biofeedback in addition to treating psychological conditions common among patients with chronic pain. Numerous psychologists use relaxation, biofeedback, and techniques for breaking other behaviors, for example, smoking cessation and weight loss. These psychologists should be able to apply these techniques readily in treating TMD patients. Psychologists not experienced in treating TMD patients would initially appreciate suggestions of specific behaviors that need to be changed, for example, elimination of daytime parafunctional habits and holding tension in the masticatory muscles.

The Biofeedback Certification Institute of America (BCIA) is an organization that requires practitioners meet specific biofeedback education and training requirements, plus pass a written examination. Their website (http://www.bcia.org) enables individuals to search for certified practitioners within a selected range of a provided zip code. Biofeedback is used for many disorders other than TMD, so psychologists found through this source will probably also appreciate suggestions of specific behaviors that need to be changed.

Many dentists have worked with a psychologist for problems such as dental anxiety and needle phobia. Practitioners can telephone one of the psychologists with whom they have worked and ask whether someone in the community has expertise in treating TMD symptoms. Referring patients to a psychologist can be as easy as giving them the psychologist's name and asking them to make an appointment. The patient would tell the psychologist the problem during the initial visit, and the psychologist would assess the patient and then generally telephone the dentist to discuss the problem and the treatment approach.

Practitioners may prefer to write a note or summary on their prescription pad or office stationery. I fax the psychologist the patient contact information and a summary of my thoughts, such as examples provided in Appendix 11.

Some medical organizations or third-party payers may require the practitioner to write a consult. Some require their patients to use in-house or contracted psychologists, and some require the consults to go through their physicians. Patients may need to speak with their third-party payer regarding referral procedures and copayments prior to the practitioner making the referral.

Cognitive-behavioral intervention is a benefit of most medical insurance policies. Because of the complexities of the medical insurance, or if the practitioner is not knowledgeable about the psychologists in the area, the practitioner may write a summary on a prescription pad and request the patient see his or her primary care provider for the referral.

Breaking Daytime Habits

Most TMD patients with significant nocturnal parafunctional habits report that their TMD symptoms are worse upon awaking, and most TMD patients with significant daytime parafunctional habits (including holding an excessive amount of tension in their masticatory muscles) report that their TMD symptoms are worse later in the day or evening.[19,23] Theoretically, patients with significant daytime pain can become aware of their parafunctional habits and/or muscle tightness, break them, and thus dramatically reduce or eliminate their daytime pain (see Figure 1.5).

QUICK CONSULT

Understanding the Cause of the Daily Symptom Pattern

Most TMD patients with significant nocturnal parafunctional habits report that their TMD symptoms are worse upon awaking, and most TMD patients with significant daytime parafunctional habits report that their TMD symptoms are worse later in the day or evening.

These daytime parafunctional or muscle-tightening habits are often subconscious, and the patient may be totally unaware of performing them.[14,24] Patients will often unconsciously cross their ankles while they are sitting in the dental chair, and correlating this with their oral habits has often been found helpful. It is explained to them that, if they had knee pain that was aggravated by crossing their ankles, they would need to change this unconscious ankle-crossing habit. Since their pain is in the jaw, they need to identify and break their oral habits.

Question 26 ("What percent of the day are your teeth touching?") of the "Initial Patient Questionnaire" will give the practitioner a sense of the patient's awareness of possible

clenching activity. Many TMD patients lightly rest their teeth together and unconsciously squeeze them together when they become busy, concentrate, are irritated, drive a car, or use a computer. A pain diary often helps patients to correlate the activities that are most associated with their parafunctional or muscle-tightening activities.[14]

Decreasing these habits often entails having patients become very aware of their oral habits and masticatory muscle tension during the activities that are most associated with an aggravation of their TMD symptoms or throughout the entire day. They then attempt to break the behaviors by repeatedly reminding themselves to keep their masticatory muscles relaxed during this time. If they are successful, the daytime TMD symptoms should correspondingly decrease, motivating patients to continue work at breaking their daytime habits.

If a patient appears sufficiently motivated and has minimal daytime symptoms and/or minimal psychosocial contributors, it is recommended that the patient attempts to break the daytime parafunctional habits as part of the self-management therapies, see "Breaking Daytime Habits" in Chapter 14.

In one study, TMD patients were instructed to avoid touching their teeth together to keep their masticatory muscles relaxed. They were randomly assigned to be paged every 2 hours during the day, in which they were to check their tooth position and masticatory muscle tension, or to receive a habit-reversal stabilization appliance that was worn up to 20 h/day. At 4 weeks, subjects in both groups obtained a significant decrease in TMD pain (see Figure 14.7).[25]

Hence, a stabilization appliance can also be temporarily used as a reminder to help patients observe and break their daytime habits (for specific recommendations, see "Appliance Management" in Chapter 12).

TECHNICAL TIP

Breaking Daytime Habits

If a patient appears sufficiently motivated and has minimal daytime symptoms and/or minimal psychosocial contributors, it is recommended that the patient attempt to break the daytime parafunctional habits as part of the self-management therapies.

Habit-reversal therapy has been effectively used by psychologists for many years to treat nervous repetitive motion habits such as lip biting, cheek biting, tongue biting, nail biting, and tooth clenching. Psychologists often ask patients to begin with external cues to identify and break these habits. An external cue could be a piece of a yellow Post-it note placed over the car's speedometer, so that every time the patient looks at the speedometer, it reminds him or her to stop any habit and release any tension in the masticatory muscles.

Therapy also entails teaching patients what relaxed feels like and how to relax their masticatory muscles. With practice, patients are able to learn to quickly drain any tension found in these muscles.

As patients are able to make themselves pain-free by relaxing their muscles, psychologists often teach patients to use internal cues. An internal cue that is often used for TMD patients is to constantly be aware of the level of their masticatory muscle tension. Whenever any tension develops within a masticatory muscle, this immediately alerts the patients. By this time, these patients are usually aware that if they allow the tension to build, it will develop into pain. Over time, this becomes an unconscious habit for them, and hence, they are able to remain pain-free throughout the day.

More examples of external and internal cues are provided in "Breaking Daytime Habits" in Chapter 14.

Relaxation

Progressive muscle relaxation, imagery, hypnosis, yoga, prayer, and meditation appear to provide a similar physiological relaxation response. This response counters the hyperarousal state individuals may have from overstimulation of their fight-or-flight mechanism.[12] Psychologists commonly combine relaxation with habit-reversal therapy.[26]

TECHNICAL TIP

Reducing Hyperarousal State

Relaxation counters the hyperarousal state individuals may have from overstimulation of their fight-or-flight mechanism.

Relaxation has been shown to reduce TMD symptoms.[12,27,28] In a survey among TMD patients, relaxation was one of the self-management therapies that provided patients the most relief from their TMD pain.[29] Another survey among TMD patients reported that 61% found relaxation beneficial for their TMD (Figure IV.1).[30] Patients generally find relaxation not only temporarily reduces their pain but also helps them become aware of what tense and relaxed masticatory muscles feel like and develop the capability to relax these muscles rapidly whenever they notice their muscles are tight.

Unfortunately, practitioners cannot simply hand a relaxation audio program to patients and expect them to listen to it and receive the benefits. When TMD patients are handed such a program, few have the motivation to listen to it and practice the therapy consistently. Hence, minimal improvement is observed with this strategy (Figure 16.4).[31] Most TMD patients appear to need a trained relaxation instructor to motivate them to practice, assist them with problems they may encounter, and monitor their progress.

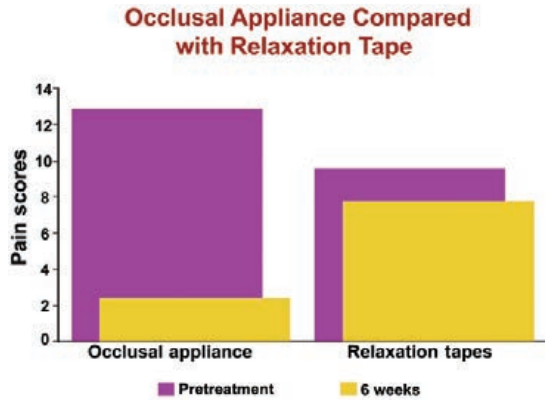

Figure 16.4. Minimal TMD symptom improvement is obtained by only providing TMD patients with relaxation tapes.[31]

Occasionally, patients prefer to practice this therapy on their own. They can be given the options of using a relaxation audio program purchased from a bookstore or online; quietly listening to soothing music; taking a warm, relaxing shower or bath; quietly sitting and taking slow deep breaths; and so on. Some patients may prefer to do this while using a heating pad. They should be encouraged to use the therapy form that provides them the greatest degree of relaxation and enjoyment. The more pleasurable the experience is, the greater is the probability of long-term compliance.

Each of these techniques should help patients obtain the physiological relaxation response and teach them what relaxed muscles feel like. Hopefully, patients will thus develop the ability to reestablish this relaxed state whenever they choose. The next step is for them to identify when they are tensing their masticatory muscles or performing parafunctional habits, and consciously stop these habits and induce the relaxed state they have learned. Since the patient would be implementing this relaxed state throughout the day, it is probably most helpful in treating daytime TMD symptoms.

Some patients have trouble relaxing their masticatory muscles, so biofeedback is commonly used to help patients accomplish this.[7] Biofeedback will be discussed later and is often referred to as biofeedback assisted relaxation.

It has also been suggested that if individuals who routinely have nocturnal parafunctional activity were to perform a relaxation session just prior to sleep, they will have less intense nocturnal parafunctional activity.[32]

Hypnotherapy

Hypnotherapy or hypnosis, which has been used for pain management since the mid-1980s, assists patients to reach a deep level of relaxation. Some patients and/or psychologists may prefer hypnotherapy for treating TMD symptoms and it has been shown beneficial for treating those symptoms (Figure 16.5).[33–35]

Hypnotherapy sessions generally last between 20 and 60 minutes. Throughout the session, patients maintain control of their thoughts and can come out of the relaxed state whenever they desire.[34] Explaining this to patients generally reduces any fear of adverse reactions.

During hypnotherapy, TMD patients are usually given hypnotic suggestions to release all physical and emotional stress and anxiety. They generally receive an audio recording that they listen to repeatedly at home, enabling them to practice reaching this relaxed state and to deal with any residual or future stress or anxiety.[34,36]

This provides a similar effect as relaxation therapy, which is aimed to improve daytime symptoms. Patients must similarly learn to identify when they are tensing their masticatory muscles or performing parafunctional habits, consciously stop these habits, and bring forth the learned relaxed state. Often, listening to the audio recording just prior to sleep enables patients to sleep more peacefully and decreases nocturnal parafunctional habits.[37]

Biofeedback Assisted Relaxation

Biofeedback was developed in the 1960s to provide patients a manner for observing changes in certain physiological measures (e.g., muscle activity, blood pressure, and skin temperature). Feedback of muscle activity (electromyelography [EMG]) is routinely used

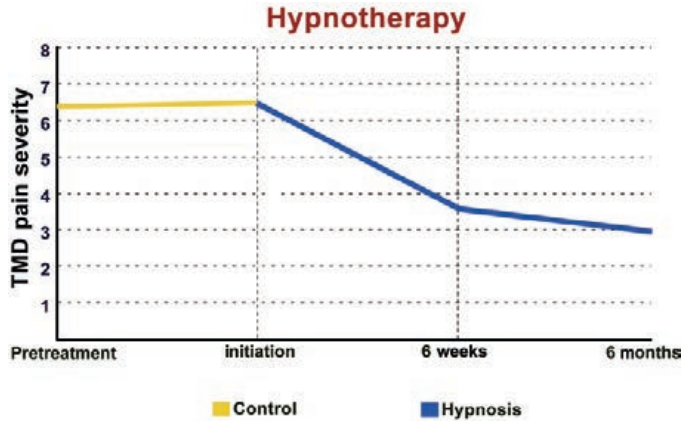

Figure 16.5. The TMD treatment effect from hypnotherapy.[35]

with TMD patients, who are taught how to lower their masticatory muscle EMG activity to relax these muscles.[12]

The patient usually observes the muscle's EMG activity on a computer monitor or the equivalent while the he or she performs various relaxation techniques. While observing the muscle's EMG activity, the patient is generally able to better learn how to relax the masticatory muscles. With the knowledge of how to relax the muscle, the patient is instructed to continually monitor for and maintain this relaxed state. This is used to control the daytime muscle activity and the pain associated with it.

A study that compared TMD patients who were restricted to only biofeedback or relaxation found that the average decrease in pain was 35% for the biofeedback group and 56% for the relaxation group.[38] This suggests that relaxation is actually the more beneficial component when these therapies are combined. Studies demonstrate that biofeedback assisted relaxation has a comparable efficacy as occlusal appliance therapy, and biofeedback assisted relaxation provides long-term TMD symptom relief (see Figure 16.1 and Figure 16.2).[4,17,39]

QUICK CONSULT

Understanding Biofeedback with Relaxation Therapy Efficacy

The study suggests that relaxation is actually the more beneficial component of the biofeedback with relaxation therapy.

In general, TMD patients with significant daytime parafunctional habits primarily complain about daytime or evening symptoms, whereas patients with significant nighttime parafunctional habits primarily complain of symptoms when they first awake. Studies suggest that biofeedback assisted relaxation is more effective for patients with daytime parafunctional habits, whereas an occlusal appliance worn at night is more effective for patients with nighttime parafunctional habits.[40–42] It is important for patients receiving biofeedback to be taught to transfer the learned techniques from the therapist's office into their everyday life. It is occasionally found that some biofeedback therapists do not help their patients incorporate this relaxed state into the stressful, hectic portion of the patient's day, and thus these patients often derive minimal benefit from the therapy.

TECHNICAL TIP

Comparing Biofeedback with Relaxation and an Occlusal Appliance

Studies suggest that biofeedback with relaxation is more effective for patients with daytime parafunctional habits, whereas an occlusal appliance worn at night is more effective for patients with nighttime parafunctional habits.

At one facility where I practiced, patients with significant daytime symptoms were routinely taught habit-reversal and relaxation techniques. Patients who related they could relax their entire body except for their masticatory muscles found biofeedback often exceptionally beneficial in reducing their remaining daytime symptoms.

Generally, patients with daytime muscle-tightening or parafunctional habits will have significant TMD symptom improvement from breaking these habits, biofeedback assisted relaxation, and/or an occlusal appliance temporarily worn during the day to increase their awareness of these habits.

Stress Management

Stress management is a cognitive approach to deal with the stresses, irritations, or frustrations that patients encounter. Some studies suggest that the average TMD patient does not cope as well with stress as patients without TMD.[43,44] TMD patients tend to tighten their masticatory muscles in these situations,[45] and stress management teaches coping skills to help them better manage these situations and their thoughts about them.

FOCAL POINT

TMD patients tend to tighten their masticatory muscles in stressful, irritating, or frustrating situations, and stress management teaches coping skills to help them better manage these situations and their thoughts about them.

Tension and emotional states are highly correlated with TMD patients' pain levels.[18] Clinically, it appears TMD is often related to the minor stresses and TMD patients commonly discount the contribution of stress. Many say their life is not stressful, but acknowledge they often hold tension in their jaw, neck, and/or shoulders and are frustrated, irritated, or overwhelmed a considerable amount of the time (see Question 22 of the "Initial Patient Questionnaire" [Appendix 2]). TMD symptoms tend to become aggravated when patients are busier, more frustrated, or irritated, and sometimes it takes a daily pain/busyness diary for them to see these associations.

It is observed that TMD patients generally agree with these tendencies when the terms "busy," "frustrated," "irritated," and "hold tension in your muscles" are used rather than the word "stressed." It is then explained that they need to learn to release the tension held in their masticatory muscles and learn coping skills to minimize the amount of time they feel busy, frustrated, or irritated. With this discussion, patients are usually open to work with someone to learn relaxation and/or stress management.

TECHNICAL TIP

Avoiding the Word "Stress"

It is observed that TMD patients tend to deny they are stressed, but agree they are busy, frustrated, irritated, and hold tension in their muscles. Therefore, I avoid using the word "stressed," and use the terms "busy," "frustrated," "irritated," and "hold tension in your muscles."

TMD patients often receive stress management in combination with biofeedback and relaxation therapies, and this combination generally provides a significant reduction in TMD symptoms that is maintained over time.[10,17,21]

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Chapter 17

Pharmacological Management

FAQs

Q: Does diazepam help reduce a temporomandibular disorder (TMD) patient's muscle pain and anxiety?
A: The most common time I prescribe diazepam is when a patient has acute TMD symptoms or an acute flare-up of TMD symptoms, and the masticatory muscles are a primary source of the patient's pain. These acute symptoms are commonly related to a stressful situation and diazepam will help provide temporary relief of the muscle pain and help alter the patient's perception of the stressful situation and its emotional impact. Clinically, diazepam appears to be a good short-term medication for these situations.

Q: Will dentists be accused of treating psychological disorders if we prescribe tricyclic antidepressants (TCAs) for our TMD patients?
A: No, at the low doses, TCAs are used for treating TMD, they do not provide an antidepressant effect, euphoria, or mood elevation, and have low abuse potential.

Q: Is glucosamine beneficial for patients with temporomandibular joint (TMJ) osteoarthritis?
A: Yes. A study among symptomatic TMJ osteoarthritis patients found that glucosamine provided the subjects with significant symptom improvement.

Clinical experience and controlled studies demonstrate that pharmacological management can generally reduce a patient's pain and sometimes speed recovery. Practitioners tend to have a favorite medication they generally prescribe to their TMD patients, even though no one drug has been shown to be best for the wide spectrum of TMD conditions. Many of the pharmacological principles used for

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musculoskeletal disorders of other areas of the body apply for the pharmacological management of TMD because medications generally affect the rest of the musculoskeletal system as they do the masticatory musculoskeletal system. Chronic TMD is often comparable with repetitive motion disorders in other parts of the body.

FOCAL POINT

Practitioners tend to have a favorite medication to prescribe to their TMD patients, even though no one drug has been shown to be best for the wide spectrum of TMD conditions.

Patients with chronic TMD symptoms typically need to change their perpetuating factors to obtain long-term control of their symptoms. Clinically, it is observed that some patients with chronic symptoms who are initially prescribed medication(s) that provide adequate symptom relief prefer to stay on these medication(s) long term rather than change their perpetuating factors.

Long-term and frequent ingestion of analgesics have been associated with a significant increase in the risk of many medical disorders.[1–3] Therefore, prescribing muscle relaxants to patients who have chronic TMD symptoms is avoided, unless they have an acute exacerbation. Patients with chronic symptoms who desire a prescription are typically prescribed medications that can be used long term, that is, nonsteroidal anti-inflammatory drugs (NSAIDs) on an as-needed basis, TCAs, and/or topical medications. If possible, chronic TMD symptoms are preferably controlled through nonpharmaceutical management, for example, self-management therapies, occlusal appliance therapy, and cognitive-behavioral interventions.

QUICK CONSULTS

Understanding Some Patients' Treatment Desires

Clinically, it is observed that some patients with chronic symptoms who are initially prescribed medication(s) that provide adequate symptom relief prefer to stay on these medication(s) long term rather than change their perpetuating factors.

Using Pharmaceutical Management

If possible, chronic TMD symptoms are preferably controlled through nonpharmaceutical management, for example, self-management therapies, occlusal appliance therapy, or habit-breaking techniques.

TMD pharmacological management most commonly involves over-the-counter analgesics (including NSAIDs) and prescription anti-inflammatory drugs, muscle relaxants, low-dose TCAs, topical medications, and nutritional supplements. "TMD Self-Management Therapies" handout (Appendix 4) recommends over-the-counter medications for patients who prefer to try one. Practitioners must weigh the medication's potential benefits against its side-effect risks, along with their competence in managing patients taking the medication.

There are reports that the selective serotonin reuptake inhibitor (SSRI) and serotonin–norepinephrine reuptake inhibitor (SNRI) antidepressants, in addition to many other medications, may contribute to TMD symptoms.[4,5] The knowledge regarding which medications are more prone to cause this side effect is currently insufficient to recommend a patient's physician change the medication. Therefore, if it is believed that a medication is contributing to a patient's TMD symptoms,

this possibility is discussed with the patient, this medication is considered a possible contributing factor, and the patient is treated in the usual protocol, presented in this book.

Psychoactive medications prescribed for psychiatric disorders should be provided by psychiatrists or physicians as part of comprehensive mental health therapy.

Analgesics

The salicylates, acetaminophen, ibuprofen, naproxen sodium, ketoprofen, and capsaicin are the major analgesics available without a prescription in the United States. Regular analgesic use of either salicylates or acetaminophen have both been associated with approximately a 2.5-fold increase in kidney failure.[3] One study found that as many as 86% of the acute liver failures in the United States were due to acetaminophen overdoses.[6]

NSAIDs are a commonly used analgesic for TMD as well as for other pains in the body, and patients whose TMD pain is primarily caused by TMJ arthralgia may obtain significant improvement from an NSAID.[7] Combining acetaminophen with an NSAID can provide better pain relief, allow for lower doses to be used, and reduce the potential for adverse effects.[8] A topical NSAID can be prescribed and has fewer side-effect risks (see "Topical Medications" in this chapter).

Capsaicin (Zostrix) is another analgesic agent that has been advocated for treatment of TMD and is specifically designed for topical application[9] (see "Topical Medications" in this chapter).

Anti-Inflammatory Medications

TMD therapy uses anti-inflammatory medications primarily to reduce inflammation within the TMJ. As the medication reduces TMJ inflammation, the associated pain and dysfunction correspondingly decrease. Practitioners should remember that chronic TMJ inflammation or arthralgia is generally secondary to excessive parafunctional activity overloading the TMJ.[10,11] Therefore, clinically, it is common to observe anti-inflammatory medications reducing TMJ arthralgia and associated symptoms while the patient is taking the medication; but, if a patient with chronic symptoms has not adequately reduced his or her parafunctional habits, the TMJ arthralgia and associated symptoms return after the medication is stopped.

◉ QUICK CONSULT

Observing the Effects of Anti-Inflammatory Medications

Clinically, it is common to observe anti-inflammatory medications reducing TMJ arthralgia inflammation and associated symptoms while the patient is taking the medication; but, if a patient with chronic symptoms has not adequately reduced his or her parafunctional habits, the TMJ arthralgia inflammation and associated symptoms return after the medication is stopped.

Anti-inflammatory medication is generally beneficial for patients with acute TMJ arthralgia caused by conditions such as a disc displacement without reduction with limited opening or secondary to acute trauma. Patients with a disc displacement without reduction with limited opening typically find that anti-inflammatory medication reduces the inflammation associated with the pain, enabling them to stretch the retrodiscal tissue and move their disc further anterior. With the disc more anterior, patients regain their opening, thereby decreasing the disc's interference, and the inflammation is less likely to return.

For **mild or moderate pain** related to TMJ arthralgia in which I would like a patient to take an anti-inflammatory medication, naproxen or naproxen sodium is generally recommended.[7] For more **severe pain** (6 of 10 or greater) related to TMJ arthralgia, a short course of oral corticosteroids followed by an NSAID is generally prescribed. These regimens are discussed further in their corresponding following sections.

The nutritional supplement glucosamine has also been shown to be beneficial for patients with TMJ arthralgia and to have minimal side effects.[12,13] If it is preferred that a patient use an anti-inflammatory medication long term, the nutritional supplement, a topical NSAID, or an NSAID taken orally on an as-needed basis would be reasonable choices (see "Nutritional Supplements" in this chapter).

Nonsteroidal Anti-Inflammatory Drugs (Ingested Form)

Since the association of rofecoxib (Vioxx) with cardiovascular events was reported, there have been intense discussions over the safety of selective COX_2 inhibitors and nonselective (traditional) NSAIDs. This resulted in some COX_2 inhibitors being removed from the market, recommendations to use acetaminophen more frequently for patients with musculoskeletal pain, and recommendations to better monitor patients taking NSAIDs long term.[14,15]

TECHNICAL TIP

Observing Ibuprofen and Naproxen Differences

Clinically, it appears to me that patients who have primarily muscle pain find ibuprofen more effective, whereas those whose pain is primarily from TMJ arthralgia find naproxen or naproxen sodium more effective.

Gastrointestinal (GI) symptoms (epigastric pain, bloating, nausea, and heartburn) are the most common reason patients discontinue the nonselective NSAID therapy. The NSAID-induced upper GI symptoms can be reduced if the patients also take a proton pump inhibitor (e.g., Prilosec) during the period they use the NSAID.[16] Nonselective NSAIDs have also been associated with more serious GI problems; it has been suggested that NSAID users have a three times greater risk of developing a serious adverse GI event than nonusers.[16]

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NSAID Induced Gastrointestinal Symptoms

The nonselective NSAID induced upper GI symptoms can be reduced if the patient also takes a proton pump inhibitor (e.g., Prilosec) during the period that the NSAID is used.

Naproxen and ibuprofen appear to be the safest with respect to cardiovascular risk and ibuprofen appears to be the safest with respect to GI risk.[14,17] NSAIDs usually provide some relief for mild to moderate TMJ arthralgia and/or muscle pain. No individual NSAID has been found to be superior in analgesic effect, and individual patient response is highly variable. Therefore, if a patient does not obtain satisfactory improvement with one NSAID, this does not indicate that a different NSAID would not be beneficial.[17]

The typical NSAIDs and dosages I prescribe are **ibuprofen** (Motrin), 800 mg t.i.d. or q.i.d.; **naproxen** (Naprosyn), 500 mg b.i.d.; and **naproxen sodium** (Anaprox), 550 mg b.i.d. A 550-mg tablet of naproxen sodium is equivalent to a 500-mg Naprosyn tablet. Primarily due to poor prescription insurance benefits, some patients prefer to take one of the three over-the-counter NSAID

formulations available, which are Motrin IB (200-mg ibuprofen), Aleve (220-mg naproxen sodium), and Orudis KT (12.5-mg ketoprofen), or their generic equivalents. I may ask the patient to increase the over-the-counter dosages and/or combine it with acetaminophen.

Clinically, it appears to me that patients whose TMD symptoms are primarily due to muscle pain find ibuprofen more effective, whereas those whose pain is primarily from TMJ arthralgia find naproxen or naproxen sodium more effective. If an NSAID is used to treat a patient with acute TMJ arthralgia, I generally prescribe naproxen, 500 mg b.i.d., for 2 weeks. Clinically, it is observed that naproxen appears to lose its effectiveness if a patient uses this dose on a continuous basis for more than 2 weeks.[18] Therefore, I generally ask patients to take 500-mg naproxen twice a day for 2 weeks and then only as needed (no more than a couple of times a week), if they desire to continue using it.

Due to the potential adverse effects from long-term NSAID use, patients are generally not maintained on an NSAID long term, except on an as-needed basis. Also, clinically, it is observed that most TMD patients do not obtain sufficient symptom relief to merit taking an NSAID on a continuous basis. If a patient needs to be on an NSAID long term, the preferred NSAID and dose are determined, and the patient is referred to a physician for long-term monitoring and management.[14,19]

QUICK CONSULT

Prescribing an NSAID Long Term

Due to the potential adverse effects from long-term NSAID use, patients are generally not maintained on an NSAID long term, except on an as-needed basis.

TECHNICAL TIP

Maintaining Patients on NSAIDs

If a patient needs to be on an NSAID long term, the preferred NSAID and dose are determined, and the patient is referred to a physician for long-term monitoring and management.

COX_2 inhibitors have an efficacy comparable with nonselective NSAIDs,[20] and even low doses as well as short-term COX_2 inhibitors use have increased risk for myocardial infarctions and arrhythmias.[14] Keep in mind that these medications are expensive, and NSAIDs generally do not provide TMD patients with much relief.

NSAIDs are primarily ingested and this section pertains to these formulations. If a patient has cardiac, renal, or GI risks from ingesting an NSAID, the practitioner may recommend a topical NSAID. They have comparable efficacy with low risk of the other effects; see "Topical Medications" in this chapter.

Steroidal Anti-Inflammatory Drugs

Corticosteroids are potent anti-inflammatory medications that can be used to treat moderate to severe pain (6 of 10 or greater) from inflammation. Due to their potential adverse effects from extended use, a short course is typically prescribed for TMD patients, followed by an NSAID. An expedient method of providing a 6-day declining dose of corticosteroid is by prescribing a **DexPak 6-Day TaperPak**, which is 21 1.5-mg dexamethasone tablets conveniently packaged with easy-to-follow directions.

If an oral corticosteroid is the preferred treatment, I generally prescribe a DexPak 6-Day TaperPak and 2 or more weeks of naproxen. Patients are routinely requested to

start the naproxen on the fourth day of DexPak use; this decreases the likelihood of adverse GI symptoms in the beginning when the corticosteroid dose is high, and extends the anti-inflammatory response. The prescriptions are written as follows: DexPak 6-Day TaperPak, one package, take as directed on package (m. dict. on package), and naproxen, 500 mg b.i.d., start on the fourth day of the DexPak use.

TECHNICAL TIP

Prescribing an Oral Corticosteroid

If an oral corticosteroid is the preferred treatment, I will generally prescribe a DexPak 6-Day TaperPak and twoor more weeks of naproxen, in which the patient starts the naproxen on the fourth day of DexPak use.

Corticosteroids are most often taken orally, but can be provided for TMD patients through topical application, phonophoresis, iontophoresis, and injection into the TMJ or another source of the inflammation.[18,21] TMJ corticosteroid injections are beneficial for reducing TMJ arthralgia, but chronic injections can cause condylar degeneration; therefore, they are usually limited to two injections during any 1-year period.[11] Surgeons generally also use a corticosteroid at the end of arthrocentesis and arthroscopic procedures to obtain its potent anti-inflammatory response postoperatively.[22]

Muscle Relaxants

Muscle relaxants decrease skeletal muscle tone and are generally prescribed for TMD patients with acute muscle pain or to temporarily decrease muscle activity.[23,24] Most muscle relaxants are primarily **central-acting agents**, and their mechanism of action is not clearly understood. The oral doses are well below the levels needed to induce muscle relaxation locally, leading some investigators to believe that the observed muscular relaxation is primarily accomplished through decreasing the patient's hyperexcitability within the central nervous system pathways.[18,24] The more common central-acting muscle relaxants include diazepam (Valium), cyclobenzaprine (Flexeril), carisoprodol (Soma), methocarbamol (Robaxin), and chlorzoxazone (Paraflex).

Occasionally, I would like to temporarily decrease a patient's nocturnal muscle activity and can generally accomplish this pharmaceutically by prescribing a central-acting muscle relaxant.[25,26] For instance, a patient with a disc displacement with reduction with intermittent locking, at the initial examination, relates that for the past month, he or she routinely awakes with the disc blocking the patient from opening wide, which lasts half an hour and has been worsening over the past few days. A concern is that, before a stabilization appliance can be provided, the disorder may worsen and the TMJ may not unlock one morning. Therefore, the patient is prescribed a central-acting muscle relaxant to take at bedtime (e.g., 5-mg diazepam or 5-mg cyclobenzaprine, 1–2 tablets h.s.) to decrease the nocturnal muscle activity and thereby decrease the probability of the disorder worsening. One study suggests this regimen is similarly beneficial to a stabilization appliance.[27]

TECHNICAL TIP

Decreasing Nocturnal Muscle Activity

Occasionally, I would like to decrease a patient's nocturnal muscle activity temporarily and can generally accomplish this pharmaceutically by prescribing a central-acting muscle relaxant.

Another situation in which I would consider prescribing patients a central-acting muscle relaxant to decrease their nocturnal muscle activity would be one in which the patient relates at the initial examination that he or she awakes with significant pain and would like some relief prior to my being able to provide a stabilization appliance. A central-acting muscle relaxant taken prior to bed should decrease a patient's nocturnal muscle activity temporarily, thereby decreasing the morning pain. This should reduce pain caused by either the muscle or TMJ arthralgia. If the pain is primarily due to TMJ arthralgia, naproxen or naproxen sodium may also provide adequate benefit.

The primary central-acting muscle relaxants and dosages I often prescribed for TMD are diazepam (Valium), 2–10 mg h.s. (low doses may be able to be taken in the morning and afternoon); and cyclobenzaprine (Flexeril), 5–10 mg h.s. (5 mg may be taken in the morning and afternoon). Both are sedating and are preferably taken only at bedtime.

Diazepam has been shown beneficial in treating muscle pain.[18,23] When patients have acute TMD symptoms or flare-ups of chronic TMD symptoms, anxiety is generally a significant contributor. I generally prefer to prescribe diazepam in these situations because (1) it has an antianxiety effect, (2) it is very inexpensive, and (3) patients generally have heard of Valium and know that it is not to be taken long term. Hence, I have not had patients wanting to do so, while I have had patients given similar muscle relaxants wanting to rely on the medication to control their TMD symptoms rather than changing the necessary contributing factors.

QUICK CONSULT

Prescribing Muscle Relaxants

When patients have acute TMD symptoms or flare-ups of chronic TMD symptoms, I generally prescribe diazepam because (1) it has an antianxiety effect, (2) it is very inexpensive, and (3) patients generally have heard of Valium and know that it is not to be taken long term.

Patients are generally prescribed 5-mg tablets of diazepam and asked to take one to two tablets at bedtime. On occasion, patients would like to take a muscle relaxant during the day. I discuss starting with one-fourth to one-half of the 5-mg diazepam tablet in the morning and afternoon. If a practitioner prefers, diazepam can be prescribed in 2-mg tablets. I add to the prescription "if does not cause drowsiness" and discuss with the patient trying the medication in such a manner that it will not be dangerous if it causes drowsiness. It is observed that patients are generally responsible when practitioners take the time to discuss these issues.

Cyclobenzaprine (Flexeril) is the muscle relaxant I generally prescribe if anxiety does not appear to be a significant contributor to the patient's symptoms. Patients are generally prescribed 5-mg tablets of cyclobenzaprine and asked to take one to two tablets at bedtime. If patients would like to take it during the day, I recommend 5-mg in the morning and afternoon, add to the prescription "if does not cause drowsiness," and discuss with the patient trying the medication in such a manner that it will not be dangerous if it causes drowsiness.

Rarely do I have a patient who takes a central-acting muscle relaxant for more than 3 weeks. Some patients have a combination of acute TMJ arthralgia and muscle pain, for which they may be prescribed a central-acting muscle relaxant together with an NSAID and acetaminophen.

Baclofen (Lioresal) is a **peripheral-acting muscle relaxant** that works at the spinal cord

level.[24,28] Since the masticatory muscles are primarily innervated by the fifth cranial nerve (the posterior digastric muscle is innervated by the seventh cranial nerve), it is understandable that most of my TMD patients relate that baclofen is not beneficial for their masticatory symptoms, but they generally find it valuable for their neck pain. Occasionally, one tablet of 10-mg baclofen, q3h p.r.n., is prescribed for neck pain and, since it does not act centrally, it typically does not cause sedation. It is preferable that patients have their neck symptoms treated by nonpharmaceutical therapies, that is, by improving their posture and learning neck exercises (usually taught by a physical therapist). Sometimes, baclofen is prescribed prior to the patient getting an appointment with the physical therapist and on an as-needed basis for residual symptoms.

BOTOX® (onabotulinumtoxinA or botulinum toxin-A) is another medication that is injected into muscles to decrease their activity and pain. This medication is discussed in "Trigger-Point Injection" in Chapter 15.

Tricyclic Antidepressants

Tricyclic antidepressants (TCAs) were originally prescribed to treat depression, but over the last 50 years have been used to treat chronic musculoskeletal disorders and neuropathic pain in doses well below those used for depression.[10,29] At these low doses, they do not induce euphoria or mood elevation, and have low abuse potential.[30]

A meta-analysis of 39 placebo-controlled studies that evaluated TCAs for patients with chronic pain indicates that TCAs can provide statistically significant pain relief.[31] Their primary therapeutic effect is thought to be related to their ability to increase the neurotransmitters serotonin and noradrenaline at the synapses within the central nervous system.[21,32]

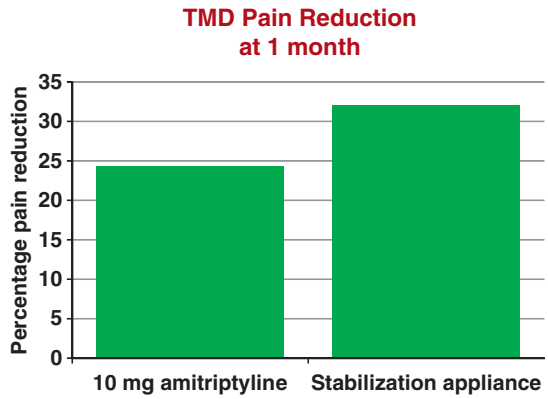

Figure 17.1. Comparison of reduction in TMD pain following taking 10 mg amitriptyline at night or wearing a stabilization appliance full time except eating or brushing teeth.[33]

TCAs have been reported to decrease TMD pain, decrease masticatory nocturnal electromyelographic (EMG) activity, and provide masticatory muscle relaxation for TMD patients.[33–37] Individual TMD patient response is highly variable, and some individuals will find no benefit from taking TCAs.[25,38,39] Figure 17.1 provides the outcomes of one study in which 10 mg of amitriptyline was compared with a stabilization appliance.[33]

TMD patients with neck pain tend not to improve as much from conservative TMD therapy as do other patients. If a patient did not obtain adequate neck pain improvement from working with a physical therapist, I next generally escalate therapy by prescribing a TCA. Other therapies that are beneficial for neck pain that I will generally add if the TCA does not provide adequate improvement are baclofen and a topical NSAID.

Disturbed sleep is a common problem among TMD patients that tends to worsen the TMD symptoms, and TMD patients with disturbed sleep tend not to improve as much from conservative TMD therapy as do other patients.[10,40] Sedation is a side effect for most TCAs and, if the TCA is properly chosen and

titrated, it might improve the quality of a patient's deep restorative sleep in addition to providing the traditional TCA benefits.[32]

QUICK CONSULT

Prescribing TCAs

Sedation is a side effect for most TCAs and, if the TCA is properly chosen and titrated, it might improve the quality of the patient's deep restorative sleep in addition to providing the traditional TCA benefits.

Amitriptyline (Elavil), nortriptyline (Pamelor), and desipramine (Norpramin) are frequently used TCAs in the treatment of chronic pain,[41] and the degree of sedation the average patient receives from these varies from extensive to none. Clinically, one of these TCAs is selected based on the degree of sleep disturbance the patient reports and whether the medication is needed while the patient is asleep or awake. Patients are asked to titrate the medication within the limits of the prescription so it provides the most desirable effect.

Amitriptyline (Elavil) has substantial sedation associated with it, and clinically, it is observed that amitriptyline is most effective for patients who have a significant sleep problem and awake with pain. I prescribe 10-mg tablets and recommend 10–50 mg 1–6 hours prior to bed. The patient is asked to start with 10 mg 3–4 hours prior to bed and increase the dose slowly, adjust the time the medication is taken prior to bed that is best for him or her, and balance the benefits and side effects of medications within the limits of the prescription.

Nortriptyline (Pamelor) has much less sedation associated with it, and clinically, it is observed that nortriptyline is most effective for patients who have no or mild sleep disturbance and awake with pain. I prescribe 10-mg tablets and recommend 10–50 mg 0–3 hours prior to bed. The patient is asked to start with 10 mg 1 hour prior to bed and increase the dose slowly, adjust the time the medication is taken prior to bed that is best for him or her, and balance the benefits and side effects of medications within the limits of the prescription. Some patients find 10 mg in the morning and afternoon beneficial if the dose does not cause drowsiness.

Desipramine (Norpramin) essentially has no sedation associated with it, and I use it for patients with daytime pain. I prescribe 25-mg tablets and recommend 25 mg in the morning and afternoon, as needed. Some patients have reported to me that taking it at bedtime keeps them from falling asleep.

Occasionally, I will prescribe amitriptyline or nortriptyline to be taken prior to bed in combination with desipramine to be taken in the morning and afternoon. The beneficial effects from taking TCAs typically occur within 3 days.[42] When prescribing a TCA, it is strongly recommended that the side effects be reviewed with the patient. These medications are associated with many side effects (listed in most medication manuals) that can have a profound effect on patients.

I prescribe TCAs for TMD, neck pain, and headache, and studies support their effectiveness for these disorders.[33,34,37] I generally do not prescribe these until I find that nonpharmaceutical interventions have not provided satisfactory relief.

TECHNICAL TIP

For What to Prescribe TCAs

I prescribe TCAs for TMD, neck pain, and headache, and studies support their effectiveness for these disorders.

TCAs can be used long term; they are nonhabituating and very rarely cause organ

toxicity with long-term use.[42] If a patient needs to be on a TCA long term, the TCA and preferred dose range are determined and the patient is referred to a physician for long-term monitoring and management.

◉ QUICK CONSULT

Prescribing TCAs Long Term

TCAs can be used long term; they are nonhabituating and very rarely cause organ toxicity with long-term use. If a patient needs to be on a TCA long term, the TCA and preferred dose range are determined, and the patient is referred to a physician for long-term monitoring and management.

Compared with TCAs, SSRI antidepressants are not as effective for treating chronic pain.[29] The SSRIs are very good medications for treating depression with comparatively minimal side effects and have the potential to increase parafunctional activity.[4,5]

Topical Medications

There are many topical medications that are beneficial for masticatory and cervical pain, and a number of these have come onto the market over the past decade. These medications are able to provide a high local concentration, while causing minimal systemic effects and risks of adverse events from long-term use. Therefore, I feel comfortable with patients using a topical medication long term.

As with ingested medications, topical medications generally only provide temporary symptom reduction for the time they are used. When used in the masticatory region, patients need to be careful not to get any in their eyes.

Over-the-Counter Topical Medications

Counterirritant creams (e.g., Icy Hot) generally have menthol as their primary active ingredient. Menthol causes antinociceptive and counterirritant sensations, which provide a soothing feeling for muscle soreness and joint pain.[43] Topical menthol gel has been shown to provide a significant reduction in muscle discomfort and may be an agent that TMD patients would like to use for their TMD or cervical pain.[44] These agents have a strong menthol smell, while all of the other discussed topical medications have minimal smell.

Salicylates (e.g., Aspercreme cream) are the active ingredient in some topical analgesic medications. Most of the topical salicylate literature investigates trolamine salicylate, which is the active ingredient in Aspercreme cream. It has been speculated that its beneficial effect is from acting as a counterirritant, desensitizing the afferent neurons, and interfering with the inflammatory process. Trolamine salicylate is absorbed to a depth of 3–4 mm and was not detectable in the serum for subjects using it.[45] Aspercreme cream does not have an odor and is included in the "TMD Self-Management Therapies" (Appendix 4) as one of the over-the-counter medications that TMD patients may want to use.

In a randomized clinical trial among patients with finger pain from osteoarthritis, the Aspercreme cream provided significantly better pain reduction than the placebo (Figure 17.2).[46]

In another randomized clinical trial, TMD patients with primary TMJ or masticatory muscle pain applied a trolamine salicylate cream over the painful region twice a day. The subjects reported that the cream significantly reduced their TMJ and muscle pain, but was more effective for their masticatory muscles. Once the therapy stopped, their pain slowly returned.[47]

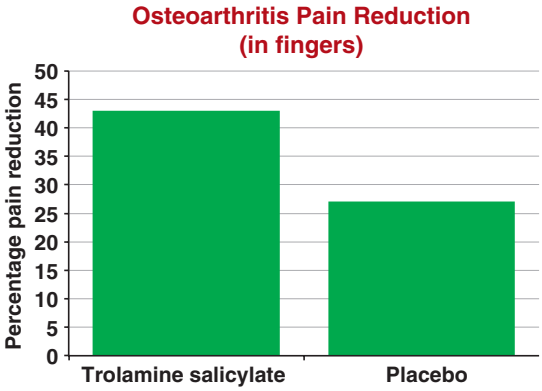

Figure 17.2. Percentage pain reduction among subjects with finger pain from osteoarthritis, after one application of a trolamine salicylate (Aspercreme cream) or placebo cream.[46]

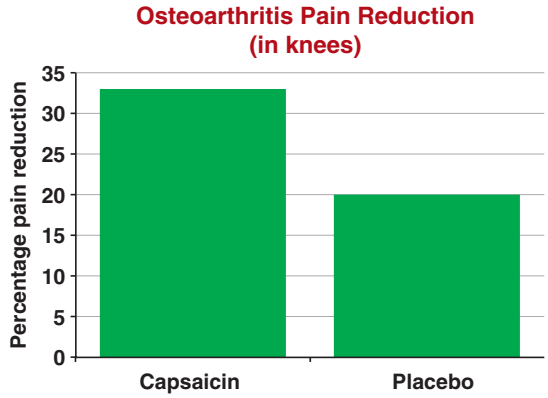

Figure 17.3. Percentage pain reduction among subjects with knee pain from osteoarthritis, after applying 0.025% capsaicin or a placebo cream four times a day for 4 weeks.[49]

TECHNICAL TIP

Recommending Aspercreme Cream

Many TMD patients find Aspercreme cream beneficial; it is an inexpensive and convenient way to temporarily reduce their TMD symptoms.

In a review of topical medications, the salicylate formulations were found to be beneficial (not highly beneficial), but topical NSAIDs were found to be much more beneficial (discussed in the "Prescription Topical Medications" section).[48] My patients express a similar observation and relate that the topical NSAIDs appear to be about twice as beneficial as the trolamine salicylate creams.

Capsaicin (e.g., Zostrix) is a topical analgesic cream whose mechanism of action is not clearly understood. It has been advocated for arthritis and neuropathic pain in other parts of the body, and some of my TMD patients find it beneficial over their TMJ and/or spinal column. In a randomized clinical trial among patients with knee pain from osteoarthritis, subjects found that 0.025% capsaicin cream provided significantly better pain reduction than the placebo (Figure 17.3).[49]

In a clinical trial on the face, after 3 days of applying 0.075% capsaicin four times a day, subjects had a significant reduction in their ability to perceive pain, while maintaining their normal tactile perceptions. Once the therapy had stopped, the ability to perceive pain slowly returned.[50] This study suggests that capsaicin can significantly reduce patients' pain without affecting their normal tactile perceptions; this is what I clinically observe.

Capsaicin comes in various strengths and should be applied three to four times a day. I recommend patients purchase the 0.1% capsaicin over-the-counter formula and regulate the dosing by the amount of cream they apply. Most over-the-counter high-potency (generally abbreviated on the package as HP) formulas are 0.1% capsaicin.

Capsaicin is the hot substance in chili peppers, so patients should be warned to wash their hands after applying the cream or they may later rub their eyes and feel a burning sensation in their eyes. Some of my patients find washing their hands after applying the cream does not completely remove the

medication, so they prefer to use plastic wrap over their fingers while applying the capsaicin.

You may want to consider recommending capsaicin to patients who have had multiple TMJ surgeries and unable to obtain satisfactorily relief from traditional TMD therapies. A common side effect is a warm feeling on the skin. I recommend patients not use capsaicin in conjunction with a heating pad or any of the other topical medications discussed.

An 8% capsaicin patch (Qutenza) is also available in the United States through a prescription; it has been approved by the Food and Drug Administration (FDA) for the management of postherpetic neuralgia.

TECHNICAL TIP

Recommending Capsaicin

I recommend patients purchase the 0.1% capsaicin over-the-counter formula and regulate the dosing by the amount of cream they apply. Most over-the-counter high-potency (generally abbreviated on the package as HP) formulas are 0.1% capsaicin.

Homeopathic preparations (e.g., Traumeel) are available, and many claim to be topical analgesics and/or anti-inflammatory preparations. Traumeel is one of the more common of these homeopathic preparations and has had its efficacy clinically supported by a number of clinical trials.[51]

In one clinical trial among patients with an injury of a tendon causing pain and limit movement (tendinopathy), subjects applied Traumeel or a topical NSAID (1% diclofenac gel) over the injury for up to 4 weeks and subjects in the Traumeel group had a little better pain reduction (Figure 17.4).[52] Traumeel is available at nutritional supplement stores and from websites (e.g., http://www.amazon.com).

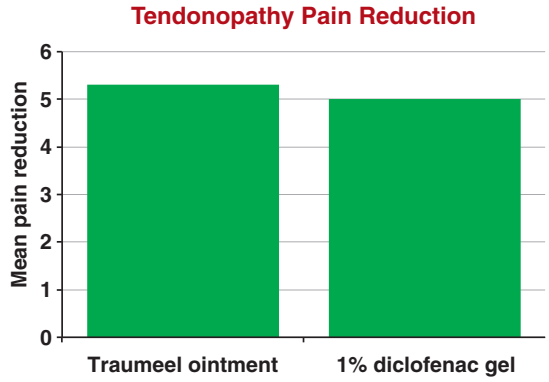

Figure 17.4. Mean pain reduction among subjects with injury of a tendon causing pain and limit movement (tendinopathy), after applying Traumeel or a topical NSAID (1% diclofenac gel) for up to 4 weeks.[52]

Portable heat wraps (e.g., ThermaCare) are not topical medications, but I want to remind readers that these are also over-the-counter products that have been shown to provide a significant reduction in musculoskeletal pain and their effect generally lasts for several days.[53,54] They are a nonpharmaceutical adjunct that may be desired when treating musculoskeletal pain of the cervical region; some are specifically designed to be used on the neck.

Prescription Topical Medications

Topical NSAIDs (e.g., Voltaren Gel, Pennsaid, Flector Patch) have been marketed in the European Union for over 10 years and marketed in the United States since 2007. Currently, Voltaren Gel, Pennsaid, and Flector Patch are the only topical NSAIDs marketed in the United States. Outside the United States, there are a number of over-the-counter topical NSAIDs available.[55] Studies suggest that topical diclofenac, ibuprofen, ketoprofen, and piroxicam all have similar efficacy and local skin reactions that are generally mild and transient, and do not differ from placebo.[56]

In 1 year within the United Kingdom, there were 18,000 hospital admissions for GI bleeding that were directly attributable to ingesting oral NSAIDs.[57] Studies demonstrate that topical and oral NSAIDs are equally effective, but topical NSAIDs rarely cause gastric or other adverse systemic reactions.[55–57] In fact, studies report that the mean plasma concentrations of Voltaren Gel (a topical NSAID) is approximately 6% of what would be present from an oral formula.[55]

Topical NSAIDs are costly in comparison with oral NSAIDs, but factoring in the consequences of the adverse reactions from oral NSAIDs, topical NSAIDs may be more cost effective. Considering this, the National Institute for Health and Clinical Excellence (NICE) recently recommended topical NSAIDs be considered prior to the use of oral NSAIDs, in their guidelines for osteoarthritis treatment.[57]

Voltaren Gel (1% diclofenac sodium gel) was the first topical NSAID marketed in the United States. It has been shown to be beneficial for both muscles and joints and appears to be more beneficial from continued (four times a day) use compared with occasional use.[58] In a randomized clinical trial among patients with knee pain from osteoarthritis, subjects applied 1% diclofenac gel or the vehicle (the gel without the medication) four times daily for 12 weeks. The medication reduced the knee pain significantly more than the vehicle alone (Figure 17.5).[59]

Voltaren Gel is sold as 100-g tubes of gel. Patients are instructed to measure 1–2 g of gel (measured with the dosing card that comes with the medication) and apply this amount over the painful areas four times a day, as needed. Patients should not wash the area for at least 1 hour after application.[60]

Voltaren Emulgel (1.16% diclofenac diethylamine gel) is marketed in Canada and many other countries around the world. It contains nearly equal concentrations of the same active ingredient as Voltaren Gel, but has a different salt bound to it. It is speculated to have a similar efficacy as Voltaren Gel and can be purchased on websites (e.g., http://www.amazon.com) at a significantly lower price than Voltaren Gel. Its application dosing and frequency are similar to Voltaren Gel.[61]

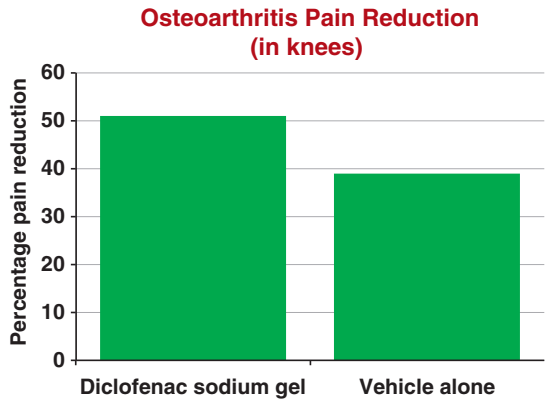

Figure 17.5. Percentage pain reduction among subjects with knee pain from osteoarthritis, after applying 1% diclofenac gel or the vehicle four times a day for 12 weeks.[59]

Pennsaid (1.5% diclofenac sodium in 45% dimethylsulfoxide solution) is a liquid that is dispensed in drops, is rapidly absorbed into the skin, and is applied four times a day. In a randomized clinical trial among patients with TMJ dysfunction, subjects applied 10 drops of Pennsaid over their TMJ region four times a day or ingested 50-mg diclofenac twice a day for 14 days. Both groups had significant relief without a significant difference between the groups (Figure 17.6).[62] I personally think the subjects' pain must have been relatively low because I do not observe my TMD patients obtaining this degree of pain relief from an oral NSAID.

Diclofenac Patch (Flector Patch, 1.3% diclofenac epolamine patch) is the third topical NSAID marketed in the United States. The adhesive patch is 10 cm × 14 cm and should be replaced every 12 hours. It is

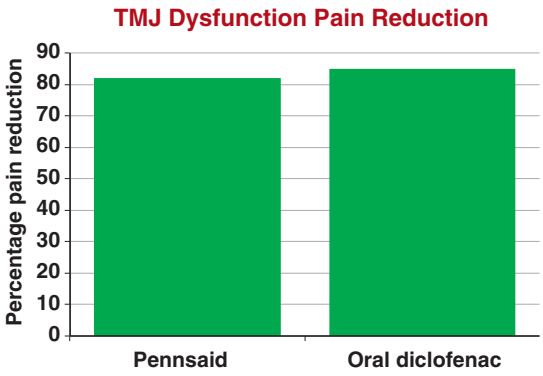

Figure 17.6. Percentage pain reduction among subjects with TMJ dysfunction after applying 10 drops of Pennsaid over the TMJ region four times a day or ingesting 50 mg diclofenac twice a day for 14 days.[62]

supplied as a box of 30 patches and you generally need to prescribe for an entire box. Similar to the other topical NSAIDs, it has been shown to be better than a placebo, and some speculate that its ability to continuously bath diclofenac over the skin may provide better pain relief than the topical NSAIDs that are applied four times a day.[63] One colleague who uses the Flector Patch for TMJ arthralgia asks his patients to cut the patch into approximately 1 in. × 1 in. pieces with a pair of scissors, prior to removing the liner covering the adhesive. His patients then apply the piece(s) over their TMJ(s) when they go to bed.

My clinical experience in treating TMD patients with topical NSAIDs is that TMD patients prefer Voltaren Gel. A study compared Voltaren Gel and Pennsaid and found that patients preferred Pennsaid.[64] I believe the preference difference among TMD patients is primarily due to these patients needing to apply the medication to vertical skin surfaces and they have trouble controlling the Pennsaid drops. Additionally, Pennsaid absorbs rapidly, which is nice if the patient needs to cover the surface with clothing. I have not prescribed TMD patients the Flector Patch because it is not esthetic on the face, so most patients would only be willing to use it at night.

TMD patients appear to find topical NSAIDs beneficial for muscle pain, but it does not seem to provide as powerful of an anti-inflammatory effect for TMJ arthralgia as I would expect. One author speculated the reason may be that most topical NSAID studies were performed over painful fingers and knees which can absorb the medication from all directions, while the TMJ can only absorb the medication from the lateral surface.[65]

Hence, topical NSAIDs appear to be more effective for muscle pain than for TMJ arthralgia.

TECHNICAL TIP

Prescribing Voltaren Gel

You may want to consider prescribing Voltaren Gel for patients with TMD pain, especially if they have a history of GI symptoms from ingesting an NSAID or are an older patient.

TECHNICAL TIP

Voltaren Gel Prescription Example

Rx: Voltaren Gel, 100 g (or 200 g) gel, apply 1 g (or 2 g) over painful areas four times daily p.r.n.

Lidocaine transdermal patch 5% (Lidoderm) has been shown to be beneficial for muscle[66] and osteoarthritis pain.[67] The lidocaine patch has not been evaluated for TMD pain, but I have heard colleagues relate that it is beneficial for patients who have had multiple TMJ surgeries and who are unable to obtain satisfactorily relief from traditional TMD therapies.

Lidoderm comes in a box of 30 patches, you generally need to prescribe for an entire box, and the size of the patch is 10 cm × 14 cm. Patients can use a pair of scissors to cut the patch to the appropriate size, prior to removing the liner covering the adhesive. A patch can be worn up to 12 hours in a 24-hour period (12 hours on and 12 hours off). There is minimal systemic absorption of lidocaine, but local skin irritation can occur.[21,68,69]

TECHNICAL TIP

Prescribing Lidoderm

You may want to consider a lidocaine transdermal patch for patients who have had multiple TMJ surgeries and are unable to obtain satisfactorily relief from traditional TMD therapies.

Nutritional Supplements

In my TMD practice, a growing number of TMD patients strongly resist or refuse to take medications, but are very willing to take nutritional supplements. Some nutritional supplements are as beneficial as NSAIDs, while causing minimal systemic effects, having minimal risks of adverse events from long-term use, and costing much less than pharmaceutical therapies.[70]

Nutritional supplements are not FDA evaluated or recommended, and the number of toxicity studies (particularly long term) is limited. Studies in the United States have revealed that some preparations have less of the supplement in each tablet than the container's label states.[71] An independent laboratory evaluates the contents of over-the-counter supplements and reveals on their website (http://www.consumerlab.com) which brands contain the amount claimed on the label.

Glucosamine is one of the most popular dietary supplements sold in the United States, is considered to be safe with only minor adverse events reported, and has been shown to be beneficial for TMJ osteoarthritis.[13,72] Glucosamine is widely accepted as a treatment for osteoarthritis, and glucosamine hydrochloride and glucosamine sulfate have been shown to be equally effective.[73] Unfortunately, the evidence of glucosamine's efficacy for treatment of osteoarthritis in the TMJ, as well as in other joints, is highly inconsistent.[13,74]

The best study that suggests glucosamine is beneficial for TMJ osteoarthritis is a randomized clinical trial among symptomatic TMJ osteoarthritis patients, in which those who took 500-mg glucosamine three times a day had greater improvement than subjects who took 400-mg ibuprofen three times a day. Seventy-one percent of these subjects had at least a 20% decrease in TMJ pain during function.[12]

Chondroitin is commonly combined with glucosamine and is also considered to be safe with only minor adverse events reported.[72] The evidence with it taken alone and in combination with glucosamine for the treatment of osteoarthritis is also inconsistent.[71]

The appropriate doses for glucosamine and chondroitin have never been evaluated, but studies typically use 500-mg glucosamine three times a day and/or 400-mg chondroitin three times a day. If a patient is interested in trying these supplements, these doses are generally recommended.

Glucosamine is inexpensive compared with chondroitin and may provide adequate benefits by itself. Therefore, patients are often asked to start with glucosamine alone and, if it does not provide adequate relief, then add chondroitin. Symptom relief from these supplements generally occur slower than with NSAIDs, and it is recommended that patients

use them for 30 days before deciding whether they are beneficial.[75]

These supplements do not provide immediate osteoarthritis pain relief, and once they are stopped, the pain does not immediately return, suggesting to some investigators that the symptom improvement is due to physical changes (e.g., thickening of the cartilage) within the joint.[70]

***S*-Adenosylmethionine** (SAMe) may also benefit symptoms from TMJ osteoarthritis. There is consistent evidence that SAMe can relieve osteoarthritis symptoms of other joints with a similar efficacy as NSAIDs. Clinical trials compared 1200 mg/day of SAMe with ibuprofen, naproxen, celecoxib, piroxicam, and indomethacin, with the results suggesting SAMe is equally effective.[76]

If a TMD patient would like to try SAMe, recommend 400 mg three times a day; similar to glucosamine and chondroitin, SAMe may take several weeks before osteoarthritis symptoms substantially improve. SAMe appears to be safe and has fewer adverse effects than NSAIDs. SAMe is considerably more expensive than glucosamine and chondroitin, and is likely to be the reason many of my patients would not want to use it.[77,78] It has also been found to cause more gastric upset than glucosamine and chondroitin.

Magnesium has been shown to be beneficial for tension and migraine headaches, and clinically appears to act as a mild muscle relaxant that is beneficial for myalgia.[79–81] If a TMD patient would like to try magnesium, it is recommended that 250 mg be taken twice a day in combination with calcium; some brands have the two combined into one tablet.

Vitamin B-2 (riboflavin) and **CoQ10** (coenzyme Q10) enhance the function of impaired mitochondria, have been shown to be beneficial for migraine headaches,[78,82,83] and clinically appear to benefit muscle pain. If a TMD patient would like to try vitamin B-2 or CoQ10, it is recommended the patient first try vitamin B-2 (because it is less costly) and take 100 mg four times a day.[82] The recommended dose for CoQ10 is 100 mg three times a day.[83]

Surveys estimate that 8% of TMD patients use an over-the-counter herbal supplement for their TMD pain, and nearly 70% of patients given a prescription do not discuss their supplement use with their healthcare providers.[84,85] There are a number of potential herbal supplements that patients can use for TMD symptoms, and some target the same biomechanism that TMD prescription medications target.[86] Hence, it is recommended that providers inquire about herbal supplements prior to prescribing patient medications.

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Chapter 18

Other Dental Procedures

FAQs

Q: In which situations would you recommend a dentist treat temporomandibular disorder (TMD) by adjusting a patient's occlusion?
A: The only time I recommend a patient's occlusion be adjusted at the initial visit is for patients whose TMD symptoms developed due to the placement of a restoration that was not in harmony with the rest of the dentition, or the TMD symptoms are due to a tooth with a reversible pulpalgia from an occlusal interference.

Q: Why do so many dentists think orthodontics is a sound TMD therapy?
A: During the active orthodontic phase, patients tend to have fewer TMD signs, and it has been proposed that teeth, being orthodontically moved, are so sensitive to percussion and opposing tooth contact that patients temporarily decrease their parafunctional habits. This may be the reason some practitioners and patients develop the illusion that orthodontics provide clinically significant long-term benefits in the treatment of TMD.

The more harmonious a person's occlusion is, the greater the person's occlusal stability, and the more orthopedically stable the masticatory system is for when the individual clenches or bruxes the teeth. Virtually, no one is gifted with an "ideal" occlusion, and improving an individual's occlusal stability should decrease the negative impact clenching or bruxing has on the masticatory system.[1–3] Stabilization appliances can generally improve a patient's occlusal stability, and it has been speculated that this is one of the mechanisms by which stabilization appliances can reduce TMD symptoms.[1,4]

FOCAL POINT

Virtually, no one is gifted with an "ideal" occlusion, and improving an individual's occlusal stability should decrease the negative impact clenching or bruxing has on the masticatory system.

Manual of Temporomandibular Disorders, Third Edition. Edward F. Wright.

TMD patients often have increased tone in their lateral pterygoid muscles and/or temporomandibular joint (TMJ) arthralgia, making it difficult to position the mandible in centric relation and/or obtain a reproducible closure position.[1,5,6] Some TMD patients have a lateral pterygoid spasm, which causes the condyle to be held in a partially translated position, and therefore these patients temporarily have a distorted occlusion. Some TMD patients initially hold their mandible in such an abnormal position from muscle and/or TMJ disorders that they cannot even close into maximum intercuspation.

For these reasons (among others), most practitioners recommend that TMD patients not be initially treated through an irreversible occlusal therapy.[7,8] There are primary two situations for which I recommend a patient's occlusion be adjusted at the initial visit: they are (1) the patient's TMD symptoms developed due to the placement of a restoration that was not in harmony with the established occlusion and (2) the patient's TMD symptoms are found to be due to a reversible pulpalgia that is determined to be from an occlusal interference (as discussed in "TMD Pain Caused by a Tooth" in Chapter 3).[1,9,10] In these situations, it is much more cost-effective and expedient to refine the occlusion than provide traditional TMD therapy. This typically resolves the TMD symptoms, but it must be kept in mind that TMD symptoms may develop for other reasons following the placement of a restoration (see Chapter 8, "TMD Secondary to Dental Treatment").

Since virtually no one has an ideal occlusion, practitioners can usually find dental procedures that could potentially improve the occlusal stability for nearly everyone. Before practitioners contemplate such procedures for reducing TMD symptoms, they must compare the procedure's perceived benefits with its costs, for example, price, time, and adverse sequelae.

When TMD is *not* the patient's complaint, there are many dental conditions for which improving a patient's occlusion may be warranted, for example, inadequate teeth to chew food properly, adverse occlusal forces causing tooth mobility, fremitus, tooth or restoration fracture, tooth sensitivity, and damage to supporting structures.[6,9] If the purpose of the therapy is to reduce TMD symptoms, many different dental procedures have been advocated, but, as a whole, most studies and systematic reviews have found insufficient TMD symptom improvement to justify these procedures.[5,10–14]

It is easy to get caught up in the TMD–occlusion controversy, but practitioners must realize most TMD patients with constant chronic symptoms (1) will be given a stabilization appliance that is worn at night that should provide an ideal occlusion, and (2) will be taught not to touch their teeth together during the day, except momentarily for swallowing and the occasional bumping while eating. By using these two therapies, the teeth almost never touch. If the teeth rarely touch, the occlusion is not a significant contributor for any residual TMD symptoms and any occlusal therapy probably would provide minimal to no further reduction in TMD symptoms.

Patients with intermittent pain are generally provided the treatment that addresses the contributing factors related to their pain; that is, patients who awake with pain are given a stabilization appliance that is worn at night, and those with daytime pain are taught not to touch their teeth together during the day. Therefore, any occlusal therapy probably would similarly have minimal impact for any residual TMD symptoms.

For patients having trouble breaking their daytime habits in order to reduce their

daytime TMD pain satisfactorily, I typically ask them to wear their stabilization appliance when the habits are worse and/or escalate behavioral therapy rather than provide occlusal therapy. It is felt that this generally provides the more cost-effective therapy and is likely to provide additional health benefits as coping strategies are learned for the situations that are causing the excessive muscle tension.

Some TMD patients have had their teeth equilibrated or received full-mouth reconstructions one or more times and continue to have significant TMD symptoms.[15,16] I have evaluated many TMD patients who had considerable pain despite having had multiple full-mouth equilibrations, and one patient who developed TMD symptoms as a result of being provided an ideal occlusion by a full-mouth reconstruction. The patient who developed TMD from full-mouth reconstruction said he previously could not occlude into maximum intercuspation, but now could and enjoyed continually clenching his teeth.

Conversely, some patients have no TMD signs or symptoms in spite of having a terrible occlusion (poor occlusal stability). Occlusal therapy tends to be costly and merely attempts to address one aspect of the multifactorial TMD problem. The TMD therapies provided in this book are comparatively much less expensive (in terms of price, time, adverse sequelae, etc.) and will provide greater symptom improvement than will occlusal therapy.

FOCAL POINT

Occlusal therapy tends to be costly and merely attempts to address one aspect of the multifactorial TMD problem.

QUICK CONSULT

Using a Multidisciplinary Treatment Approach

The TMD therapies provided in this book are comparatively much less costly (in terms of price, time, adverse sequelae, etc.) and will provide greater symptom improvement than will occlusal therapy.

A 20-year longitudinal prospective study and a systematic literature review support the concept that a patient's long-standing occlusion is generally not a significant factor in his or her TMD symptoms.[13,17] It is speculated that individuals subconsciously learn how their teeth occlude in their various mandibular positions, and they develop subconscious engrams as to what is normal for them. If a new restoration is placed that is not in harmony with the established occlusion, a number of patients are not able to adapt to the new restoration and develop TMD symptoms from it.[14,18]

This is the reason idealizing a patient's long-standing occlusion is generally not a cost-effective TMD therapy, while placing a new restoration that is in harmony with the established occlusion is of vital importance in restorative and prosthodontic dentistry.

FOCAL POINT

Idealizing a patient's long-standing occlusion is generally not a cost-effective TMD therapy, while placing a new restoration that is in harmony with the established occlusion is of vital importance in restorative and prosthodontic dentistry.

It is observed that many dentists prefer treating TMD by using the therapies they

commonly provide, for example, occlusal equilibration, restorative procedures, orthodontics, or orthognathic surgery. These treatments primarily attempt to increase occlusal stability and improve only one aspect of the many potential aspects TMD therapies can address. Dentists must keep in mind that there are many other professionals who can assist with other aspects of their TMD patient's care.

If a practitioner observes that orthodontics, orthognathic surgery, prosthodontics, or other dental procedures would improve a patient's occlusal stability, the procedure's perceived benefits must be compared with its costs, for example, in terms of price, time, and adverse sequelae. When comparing the benefits with the costs, occlusal therapy is very rarely a worthwhile endeavor if provided only to reduce TMD symptoms. If a patient desires the procedure, the decision to proceed should be based on the anticipated non-TMD benefits, for example, improving esthetics or chewing efficiency.[19,20]

In the future, I believe better guidelines will develop for the integration of occlusal therapy with TMD therapy. It has been observed, for instance, that TMD symptoms of several patients have been resolved by only the extraction of third molars. It appears to me that third molars erupting into a nonharmonious relationship decreases the occlusal stability and could cause patients to become symptomatic if the patients are prone to developing TMD symptoms. This could be the reason removal of these teeth eliminated symptoms for those patients. It has been speculated that deep third-molar wear facets or other third-molar occlusal disharmonies may be predictors for third-molar removal providing significant TMD symptom benefit. It has also been observed that many TMD patients report that having their third molars removed provided no TMD symptom improvement. Further studies in this and in integrating occlusal therapy with TMD therapies are needed.

QUICK CONSULT

Integrating Occlusal Therapy and Traditional TMD Therapy

In the future, I believe better guidelines will be developed for the integration of occlusal therapy and traditional TMD therapy.

Occlusal Equilibration

For many years, occlusal equilibration has been recommended for treatment of TMD,[3,21,22] and in a recent survey, 64% of the dentists recommended occlusal adjustment as a therapy for TMD.[23] Occlusal equilibration generally increases occlusal stability, thereby increasing the masticatory system's ability to tolerate excessive forces generated during parafunctional habits.[1,6]

Some practitioners provide only a partial equilibration by adjusting the most significant interferences. This has unpredictable results and may cause some TMD patients' symptoms to worsen (Figure 18.1).[24,25] For instance, a patient might have a prominent balancing interference on the second molar for which the patient has developed subconscious engrams to avoid contacting. The first molar may be positioned in such a way that when the prominent second molar's balancing interference is removed, the first molar's balancing interference comes into contact. Once the second molar's balancing interference is adjusted, the patient may start to play with the new first-molar interference and the TMD symptoms worsen. If a partial equilibration is performed, I warn the patient to avoid playing with new contacts that will probably be noticed.

A complete full-mouth occlusal equilibration is more predictable than a partial equilibration for improving TMD symptoms and is typically performed in the studies evaluating TMD symptom change.[15,26,27] Some individuals in these studies experience worsening of their symptoms, and postoperative thermal sensitivity is common.[15,28]

Intuitively, one can reason that stabilization appliances can generally provide a more ideal occlusion than can a full-mouth equilibration because acrylic can be added to certain aspects of the splint to provide a more ideal occlusion; for example, extra acrylic behind the maxillary anterior teeth might provide immediate disocclusion of the posterior teeth (coupling the anterior teeth). In a study that compared these, the practitioner spent a median of four 1-hour appointments equilibrating the subject's dentition. Subjects in the other group received stabilization appliances in combination with home exercises and obtained significantly greater TMD symptom improvement (see Figure 18.2).[15]

In the literature, a consensus has formed for three aspects of occlusal equilibrations:

1. Occlusal equilibration should not be provided as an initial therapy for TMD patients, except in specific situations, for example, when symptoms are due to the placement of a nonharmonious restoration.[7,9] Because of the increased tone in lateral pterygoid muscles and/or TMJ arthralgia, it may be difficult to position a TMD patient's mandible in centric relation and/or obtain a reproducible closure position.[1,6] Disastrous consequences could occur if the dentition is equilibrated in an undesirable position. Prior to attending my TMD Fellowship, I had been taught and practiced using occlusal therapy as my primary treatment for TMD patients. Some patients became very occlusally obsessed, would continually try to find minor remaining discrepancies, and, if the adjustment was not perfect, it was virtually impossible to satisfy them.
2. Occlusal equilibration should not be performed to treat or prevent TMD signs or symptoms.[5,10,11,29,30]
3. Occlusal equilibration (or any other occlusal therapy) is not needed to maintain a TMD patient's long-term symptom improvement that is obtained from

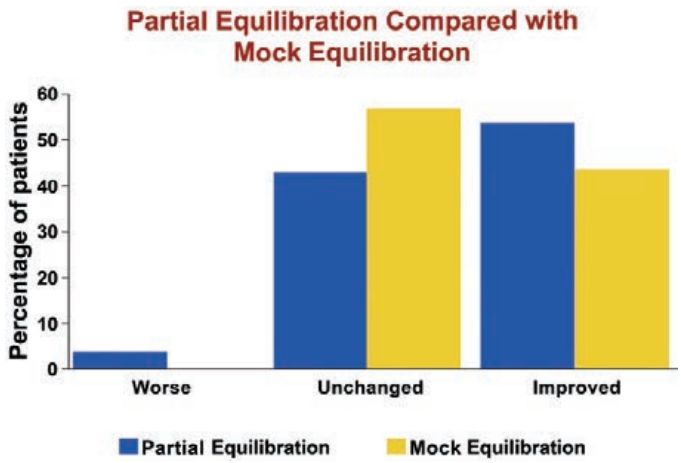

Figure 18.1. Partial equilibration only provided slightly better symptom improvement than mock equilibration and caused some individuals' symptoms to worsen.[24]

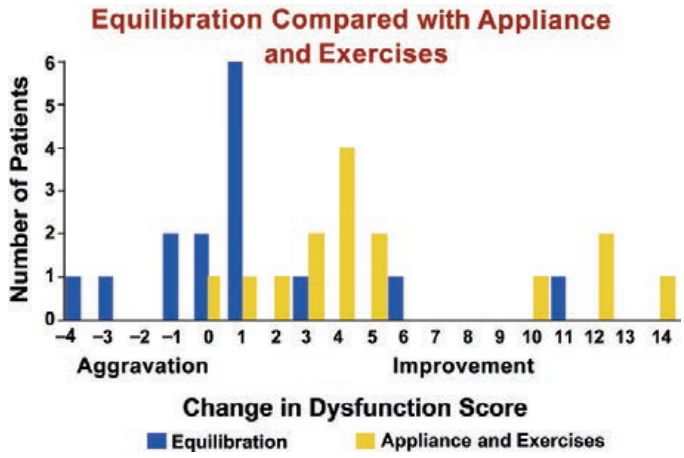

Figure 18.2. Stabilization appliances in conjunction with home exercises were more beneficial for TMD symptoms than 4-hour equilibrations.[15]

conservative TMD therapy.[9,31] This is discussed in "Long-Term Management" in Chapter 19.

If a full-mouth equilibration is performed, it must be done meticulously and has the potential to increase TMD symptoms.[15] An equilibration is time-consuming, difficult to perform, and requires great precision.[6,25]

QUICK CONSULT

Reducing TMD Symptoms through Full-Mouth Equilibration

If a full-mouth equilibration is performed, it must be done meticulously and has the potential to increase TMD symptoms.

Orthodontic–Orthognathic Therapy

Many clinical studies have examined the relationship between orthodontic treatment and TMD. Longitudinal studies vary from orthodontic treatment providing statistically significant improvement, trends for improvement, to no significant improvement in TMD symptoms.[17,30,32–36] The TMD symptom improvement is probably due to an increase in occlusal stability,[31] but orthodontics also has the potential to decrease an individual's occlusal stability, thereby predisposing the patient to an increase in TMD signs or symptoms.[1] There is no evidence that any particular type of orthodontic procedure or treatment approach (with or without tooth extraction) is associated with an increased risk of developing TMD.[31,37–40]

During the active orthodontic phase, patients tend to have fewer TMD signs and symptoms, even though there is a high prevalence of new occlusal interferences.[41,42] A proposed rationale is that teeth being orthodontically moved are so sensitive to percussion and opposing tooth contact that patients temporarily decrease their parafunctional habits.[41] This may be the reason some practitioners and patients develop the illusion that orthodontics provides clinically significant long-term TMD benefits. A survey of American Dental Association members found that 7% of the general dentists and 26% of the specialists (47% were orthodontists) use fixed orthodontics to treat TMD symptoms.[43]

Once patients are in the retention phase, their teeth are no longer sensitive, parafunctional habits return, and TMD signs and symptoms become more prevalent.[41,42,44] This can set the stage for the onset or return of TMD symptoms, causing some patients to believe orthodontics caused the TMD signs and/or symptoms. This tendency is compounded by the propensity for individuals in their second and third decades of life tend to have an increase in frequency and severity of TMD signs and symptoms,[9] which is also a common time for them to receive orthodontics. In general, orthodontic treatment does not increase or decrease a patient's chance of developing TMD, even if the practitioner does not achieve a specific gnathologic ideal occlusion.[13,17,38–41,45]

FOCAL POINT

In general, orthodontic treatment does not increase or decrease a patient's chance of developing TMD, even if the practitioner does not achieve a specific gnathologic ideal occlusion.

Occasionally, during the active orthodontic treatment phase, TMD symptoms occur to the point that TMD therapy is needed. Depending on severity of the symptoms, orthodontic treatment may need to be slowed or temporarily discontinued as TMD therapy is provided.[2,40] The therapy may involve TMD self-management therapies (i.e., the handout in Appendix 4), medications, adjunctive therapies, and/or occlusal appliance therapy.[2,34] If occlusal appliance therapy is deemed necessary, some practitioners may want to continue moving the teeth and use a partial coverage occlusal appliance, an occlusal appliance with springs or jack screws within it, or single "pods" of cement (e.g., glass ionomer) added to individual teeth to act as miniocclusal appliances.[2]

Practitioners performing orthodontic therapy should warn prospective orthodontic patients that TMD symptoms could develop or worsen and to be prepared to deal with their onset or exacerbation.[2] Because of the potential for TMD signs and symptoms during orthodontic treatment, it is imperative that a TMD screening examination be performed prior to orthodontic therapy.[40]

Even though TMD symptoms tend to diminish during active orthodontic treatment, I recommend delaying orthodontic therapy for the following patients until their symptoms reduce sufficiently:

1. TMD patients using an occlusal appliance who cannot tolerate being without it. It is recommended their TMD symptoms be further reduced through adjunctive TMD therapies prior to initiating orthodontics.
2. TMD patients with such significant TMD pain that they desire relatively immediate reduction of their symptoms. These patients should be treated with traditional TMD therapy to sufficiently reduce their symptoms.
3. Patients who have a disc displacement with reduction with intermittent locking that occurs more often than once a week. It is feared that orthodontic therapy could sufficiently aggravate their TMD symptoms so that their lock progresses from intermittent to constant. This would be much more difficult to treat than the intermittent form. These patients should be treated with traditional TMD therapy to reduce the disorder sufficiently. Since these patients' TMD symptoms appear to have such a high potential of interrupting their active orthodontic treatment, it is recommended that TMD therapy be provided prior to initiation of orthodontic treatment. A controlled study observed

that TMD symptoms eliminated prior to orthodontic treatment were not likely to recur during the subsequent orthodontic care.[42]

For the correction of skeletal malocclusions, orthognathic surgery may be considered in conjunction with orthodontic treatment. Changes in TMD signs and symptoms and postoperative condylar resorption appear to be quite variable following orthognathic surgery.[46,47] Orthognathic surgery appears to generally provide a small benefit to minor worsening of TMD symptoms with a tendency for improvement.[46–49] The incidence of condylar resorption is approximately 6% among patients having a bilateral sagittal split osteotomy and the signs of this generally do not become evident until 6 months to 2 years postoperatively.[46,50]

There appears to be a problem with the reason some patients are obtaining orthognathic surgery. In one study, it was reported that 28% were obtaining a mandibular advancement osteotomy to reduce their TMD symptoms, and 18% were obtaining this procedure to prevent future TMD problems.[47]

The literature would suggest that surgical treatment for skeletal asymmetries and growth anomalies with the specific intent of reducing TMD symptoms is rarely indicated and should only follow careful evaluation and management of contributing factors.[9,47] However, in those TMD patients with severe skeletal malocclusion who desire improved esthetics, function, and/or occlusal stability, orthognathic surgery is often the treatment of choice.

Orthodontic and orthognathic therapy generally improve occlusal stability, thereby decreasing the negative impact that clenching and/or bruxing has on the masticatory system.[1–3] These procedures are costly and time-consuming, and studies show that most patients do not obtain clinically significant TMD symptom improvement. The therapies recommended in this book are much more cost-effective for treating TMD symptoms.

Prosthodontic Therapy

Prosthodontic therapy can also increase an individual's occlusal stability by replacing missing teeth, restoring teeth where cusps do not contact the opposing teeth, and providing more ideal occlusal relationships for minor dental malalignments. Improving occlusal stability through prosthodontic therapy is very costly and time-consuming, and periodically, prosthodontic therapy needs to be replaced.

If a patient's primary complaint is TMD symptoms, the therapies provided in this book are comparatively much less expensive (in terms of price, time, adverse sequelae, etc.) and will provide greater symptom improvement than will prosthodontic therapy. When comparing the benefits with the costs, prosthodontic therapy is very rarely a worthwhile endeavor if provided only to reduce TMD symptoms.[8,51,52] Additionally, patients who have nocturnal parafunctional habits will often need to wear a stabilization appliance at night after extensive prosthodontic rehabilitation.[19]

QUICK CONSULT

Reducing TMD Symptoms through Prosthodontic Therapy

When comparing the benefits with the costs, prosthodontic therapy is very rarely a worthwhile endeavor if provided only to reduce TMD symptoms.

If a practitioner is contemplating a prosthodontic procedure, the decision should be based on the anticipated non-TMD

benefits, for example, restoring function and improving esthetics.[19,20] I once had a TMD patient with complete dentures for whom a maxillary acrylic stabilization appliance was provided that snapped onto her maxillary denture teeth. She wore the appliance 24 h/day, including while eating (I do not recommend patients with natural teeth wear an occlusal appliance this often or eat with it), and obtained about 50% improvement in her TMD symptoms. She strongly believed her problem was caused by her dentures and, against my recommendations, had a new set made. The dentist took extraordinary measures to obtain the most accurate jaw position possible and made her a very nice set of dentures. As one would anticipate, the patient did not gain any additional TMD symptom improvement.

Prosthodontic therapy can enhance or worsen masticatory orthopedic stability and can cause or contribute to TMD symptoms.[52,53] I have been referred patients who received or were in the process of receiving fixed prosthetics, and who developed TMD symptoms from tooth pain associated with the procedure, and patients with masticatory muscle and TMJ pain from the long dental procedures.

TMD is a common disorder, so some patients desiring prosthodontic therapy will have TMD symptoms. Dentists need to proceed cautiously with these patients because they often have an increased tone in their lateral pterygoid muscles and/or TMJ arthralgia that make it difficult to position the mandible into centric relation and/or obtain a reproducible closure position.[1,6]

From holding the mouth open for the restorative procedure, some of these patients develop such lateral pterygoid tightness and/or TMJ arthralgia that they are then not able to close into maximum intercuspation so the occlusion on the new prosthesis can be adjusted. Satisfactorily reducing the TMD symptoms prior to the restorative procedures, premedicating the patient prior to the procedures, or providing nitrous oxide–oxygen inhalation during the procedures would be indicated for these patients. Specific recommendations are provided in Table 8.3, "Preventing TMD Aggravation from Dental Treatment."

Practitioners with patients who have TMD symptoms and are in need of extensive prosthodontics or who will need to be restored in a position different from maximum intercuspation should first stabilize the TMD.[20,51,54,55] The better the TMD symptoms are controlled prior to prosthodontic treatment, the better the final occlusal results may be.[56] If a patient has significant nocturnal parafunctional activity, Table 3.3 provides stabilization appliance alternatives for TMD patients who need multiple restorations.

If the TMD symptoms are significant and extensive prosthodontics is planned, the practitioner may desire to maintain the patient in this stable condition for 6 months prior to initiating prosthodontic therapy. Clinical judgment and a degree of compromise may be required for some patients.[51,52]

TECHNICAL TIP

Stabilizing TMD Prior to Extensive Prosthodontics

Practitioners with patients who have TMD symptoms and are in need of extensive prosthodontics or who will need to be restored in a position different than maximum intercuspation should first stabilize the TMD.

Because there are less expensive (in terms of price, time, adverse sequelae, etc.) and more rapid treatments for TMD, prosthodontic rehabilitation should not be used as a TMD

therapy and is not needed to prevent a recurrence.[9,51,55,57] Patients who have TMD and are in need of extensive prosthodontics should have the disorder stabilized prior to initiating prosthodontics.

TMJ Surgery and Implants

TMJ surgery is indicated for the treatment of a wide variety of pathological conditions. Among TMD patients, its purpose is to reduce their symptoms and dysfunction, not to make the TMJ disc–condyle relation "normal." The belief that a displaced disc is generally only a very minor contributor to TMD is supported by magnetic resonance imaging (MRI) studies that report that there is no relationship between disc position and TMJ symptoms[10,58] and that a large percentage of the general population has a displaced disc but not TMD symptoms.[59,60] Additionally, a disc that is surgically moved to its normal position becomes displaced again in the majority of cases.[61,62]

When conservative TMD therapy is used, as described in this book, it is relatively rare for TMD patients to need TMJ surgery. One study that tracked over 2000 TMD patients from many practices found that only 2.5% underwent TMJ surgery (1.4% arthrocentesis, 1.0% arthroscopy, and 0.1% open joint procedures).[63] In recent years, arthrocentesis has been shown to be effective for most patients referred for TMJ surgery and is now probably the most common surgical intervention for the TMJ.[62,64]

TMD referral candidates are patients with specific diagnoses who have not received adequate benefit from conservative therapy, desire more rapid improvement than is traditional from conservative TMD therapy, or will not benefit from conservative TMD therapy. There is a considerable gender bias for patients receiving TMJ surgery compared with conservative care. The male-to-female ratio was 1 to 10 for surgical care compared with 1 to 2 for nonsurgical therapy.[65]

Success from TMJ surgery appears to be related to the surgeon's experience and case selection. Patients who appear to have the greatest success from TMJ surgery are those with localized pain to the TMJ rather than more generalized pain.[61,66] When these patients are asked to identify the location of their pain, they use their index finger and point directly to their TMJ. Additionally, patients with parafunctional habits do not have as good of an outcome as patients without parafunctional habits.[67]

TMJ surgery is not beneficial for all appropriately selected and treated patients. There is no scientifically determined protocol for determining which TMD patients should be referred to a surgeon.[68] To provide referral guidance, the following generalizations are based on the literature and my clinical experience.

Other than for the obvious reasons (e.g., infection, fracture, or neoplastic growth), there are primarily three TMD disorders for which practitioners may want to refer TMD patients to a surgeon: TMJ arthralgia, disc displacement without reduction with limited opening, and TMJ ankylosis.

FOCAL POINT

> Other than for the obvious reasons (e.g., infection, fracture, or neoplastic growth), the primary TMD disorders for which practitioners may want to refer TMD patients to a surgeon are TMJ arthralgia, disc displacement without reduction with limited opening, and TMJ ankylosis.

TMJ arthralgia is common among TMD patients, is generally secondary to overloading of the TMJ from excessive parafunctional

activity,[10,62,66] and generally resolves with conservative therapy.[62,69] Invasive procedures can often rapidly reduce TMJ arthralgia and its associated symptoms. Trained practitioners may find that a corticosteroid or sodium hyaluronate injection into the TMJ adequately resolves the symptoms, or may want to flush out (arthrocentesis) or surgically remove the inflammatory and pain mediators.[70–72] When the mediators are surgically removed, a corticosteroid or sodium hyaluronate is generally deposited at the end of the procedure to obtain its potent anti-inflammatory response.[72,73]

The choice of procedures will vary with a patient's history, signs, symptoms, and imaging findings, and the practitioner's clinical exam, training, and experience. If removal of the inflammatory and pain mediators is all that is thought necessary, arthrocentesis would most likely be the treatment choice. If surgical alterations within the TMJ are contemplated, arthroscopic or open joint surgery may be recommended. These surgical options will be explained later.

Since TMJ arthralgia is generally secondary to excessive parafunctional activity, this activity needs to be adequately reduced or the arthralgia will probably return after the invasive procedure. Therefore, prior to making a surgical referral for TMJ arthralgia, the conservative therapies thought to be beneficial should be exhausted.[62,74]

Consider referring the patient whose TMD symptoms are primarily due to TMJ arthralgia when (1) the contributing factors are controlled as much as possible, (2) conservative therapy has not adequately resolved the pain, and (3) the pain from the TMJ is so significant that an invasive procedure is desired. Keep in mind that if the perpetuating contributing factors are not adequately controlled, the arthralgia may return after the surgery.

A TMJ disc displacement without reduction with limited opening can generally be treated by conservative therapies (see Chapter 10). Invasive procedures are an option if a patient does not appear to be improving from the conservative therapy, is frustrated with the slow progress, or desires to obtain the rapid improvement generally achieved through arthrocentesis or arthroscopic surgery.[62] TMJ injections with anesthetic, steroid, and/or sodium hyaluronate (not yet approved by the Food and Drug Administration [FDA] for use in the TMJ) have also been recommended and are reasonable considerations for treating this disorder.[70,72]

Studies show that conservative therapy, TMJ injection, arthrocentesis, and arthroscopic surgery provide a similar degree of improvement for this disorder.[62,64,70,72,75] Flushing the pain and inflammatory mediators out of the TMJ appear to eliminate the TMJ pain caused by these mediators, and mobilizing the mandible during these procedures appears to rapidly stretch the retrodiscal tissue and/or adhesions, thereby enabling patients to regain a normal opening.[74] If the perpetuating contributing factors (parafunctional habits, etc.) are not adequately controlled prior to the procedure, the inflammatory and pain mediators (causing TMJ arthralgia) may return after the surgery,[75,76] and the contributing factors will then need to be addressed to resolve the new symptoms.

Consider referring patients whose TMD symptoms are due to this disorder when patients (1) do not appear to be improving from the conservative therapy, (2) are frustrated with the slow progress and desire more rapid results through surgical intervention, or (3) desire to obtain the rapid improvement generally achieved through TMJ injection, arthrocentesis, or arthroscopic surgery.

My most common referral to oral surgeons are patients with this disorder who do not adequately improve from conservative therapy. Keep in mind that, if the perpetuating contributing factors are not adequately controlled, the TMJ arthralgia may return after the surgery.

TMJ ankylosis can be due to fibrous or osseous union within the TMJ, causing a firm restriction of the condyle, which is generally not associated with pain. It is most commonly caused by trauma during childhood and can be unilateral or bilateral.[77,78] Digital palpation of the ankylosed TMJ during maximal movements will demonstrate no or very limited translation of the condyle. The patient's limited opening due to ankylosis will not be improved by conservative TMD therapy.[79]

Treatment for fibrous ankylosis depends on the degree of dysfunction and discomfort. If a patient has adequate function and minimal discomfort, no treatment is indicated. If a patient desires to have the disc–condyle assembly released, TMJ surgery (e.g., arthroscopy or open joint surgery) will be needed.

Osseous ankylosis is rare, and treatment involves open joint surgery to resect and recontour the osseous structures or replacement with a prosthetic joint.[77,78,80] Consider referring patients with an ankylosed TMJ when the degree of dysfunction and discomfort are such that the patients desire surgical intervention.

Arthrocentesis, arthroscopy, and open joint procedures are traditionally used to treat TMD, but a modified condylotomy and joint replacement may be considered.

Arthrocentesis is generally performed in the surgeon's office using local anesthesia with conscious intravenous sedation. It uses two ports to provide constant flushing of the TMJ with saline. During the procedure, (1) the mandible is generally manipulated to allow the saline into the recesses of the TMJ, (2) the outflow may periodically be blocked to allow the saline to distend the capsule and stretch adhesions, and (3) the mandible is generally opened wide to also stretch adhesions and ensure the patient has no mechanical limitations in obtaining a good range of motion postoperatively. Steroid is often placed in the joint space at the end of the procedure, and the patient maintains a nonchew soft diet for a few days.[1,74]

The success rate in managing patients who have a painful limited opening is around 88%. No significant complications have been reported from this procedure; patients have temporary swelling and soreness over the TMJ and a slight posterior open bite for about 1 day following the procedure.[62]

Arthroscopy is generally performed under general anesthesia in an operating room. Two ports are also used to provide constant flushing of the TMJ with saline, and from one port, a camera projects an image onto a television monitor. Through the other port, some surgeons remove adhesions with lasers or even reposition the disc, but most surgeons just break or stretch adhesions by sweeping the arthroscope or irrigation cannula. During the procedure, the mandible is similarly manipulated to ensure the patient has no mechanical limitations in obtaining a good range of motion postoperatively. The patient maintains a nonchew soft diet for a few days, is given analgesics for pain control, and immediately begins stretching exercises.[74,81]

Multiple studies report an 85–90% success rate in managing patients who have a painful limited opening. Complications are more common than with arthrocentesis, reported to be between 2% and 10%, and generally reversible; patients have temporary swelling and soreness over the TMJ and a temporary posterior open bite following the procedure.[62,64,74]

Open joint surgery is generally performed under general anesthesia in an operating room

and usually requires a 1- to 2-day stay in the hospital afterward. This procedure is much less often performed than in the past. It enables surgeons to have better visibility and access than can be obtained with arthroscopy, and is generally required when treating an osseous ankylosis, removing a previously placed alloplastic disc, removing a neoplasm, and so on.[74,81]

If a healthy disc is causing a significant mechanical interference, the disc may be repositioned through open joint surgery, and patients are instructed to maintain a nonchew soft diet for 6 weeks. If a diseased or deformed disc is causing a significant mechanical interference, the disc's diseased or deformed portion is removed, and the patient is instructed to maintain a nonchew soft diet for 6 months.[74]

Postoperatively, patients usually experience preauricular swelling, posterior open bite, and limited opening that generally resolves in 2 weeks. The most common complication is facial nerve injury, which usually resolves within 3 months. Subsequent open joint surgeries have lower success rates, and after two surgeries, it approaches zero.[74]

Modified condylotomy is generally performed under general anesthesia in an operating room, and an overnight stay in the hospital may be required. The surgeon performs a sagittal split of the ramus, wires the dental arches together, and allows the condyle to obtain an unloaded position within the TMJ. The success rate of this surgery is similar to the other TMJ surgeries. The primary complication is excessive condylar sag, which results in a malocclusion.[74]

This surgery benefits patients primarily by decreasing the ability to load the TMJ.[81] It is believed that similar unloading of the TMJ can be achieved with a stabilization appliance that is adjusted using the neutral jaw posture described in "Mandibular Positions and Interocclusal Record" in Chapter 12. Additionally, minimal loading of the TMJ can be achieved throughout the day if the patient learns to keep the masticatory muscles relaxed.

Joint replacement can be partial replacement (i.e., limited to the condyle) or total replacement of the TMJ. A surgeon can replace portions of the joint with tissues from a patient's body (i.e., a rib to replace the condyle) or with various alloplastic prostheses available.

Two alloplastic total joint replacements are available in the United States. One is a custom fabricated prostheses (TMJ Concepts Patient-Fitted Temporomandibular Joint Reconstruction System) that requires the patient acquire a computed tomography (CT) scan from which an acrylic (stereolithographic) model of the patient's head is made. The surgeon performs the planned surgery on the model, a prosthesis is fabricated on the model, and the model with the prosthesis is sent to the surgeon for approval. These custom implants generally take 1–3 months to fabricate. The other total joint replacements (Biomet Microfixation TMJ Replacement System) are stock prostheses that come in various sizes and shapes. Both total joint replacements offer excellent surgical results.

Chronic TMD patients who have had multiple TMJ surgeries generally experience about a 50% reduction in pain and a 10- to 15-mm increase in opening from a total joint replacement.[74] These surgeries have a higher risk of complications than the previously discussed surgeries (e.g., facial nerve issues occurred after surgery with 18–30% of the patients), and the importance of working with an experienced surgeon cannot be underestimated.[80]

If you have a dental patient who has a TMJ replacement and are unsure of the patient's replacement type or management, it is recommended you refer the patient to, or work in conjunction with, someone who has

greater expertise in this area. There is no established antibiotic prophylactic protocol for when patients with an alloplastic total joint replacement receive invasive dental treatment, but it is recommended that they be provided with prophylactic coverage.[82]

Alloplastic disc implants composed of Teflon-Proplast and Silastic were used in the 1970s and 1980s as prosthetic replacements for discs. They have a history of fragmenting, stimulating a foreign-body response that can cause a progressive degeneration of the condyle and glenoid fossa. A specific protocol has been recommended for these implants and total joint prostheses.[83] If the practitioner is unsure of the disc implant type or management, it is recommended that the practitioner refer the patient to, or work in conjunction with, someone who has greater expertise in this area.

Postsurgical exercises are a very important component of the surgery's success.[84] If a physical therapist will be involved in a patient's follow-up, it is appropriate for the patient to be referred to a physical therapist prior to surgery. This enables the patient to learn about the postsurgical exercises, possibly start them, and schedule the recommended postsurgical appointments. Patients who receive physical therapy after TMJ surgery have better results.[85,86] The immediate postsurgical use of stabilization appliances is controversial.

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Chapter 19

Integrating Multidisciplinary Therapies

FAQ

Q: Why is such emphasis placed on reducing parafunctional habits for temporomandibular disorder (TMD) patients, while the physicians do not emphasize this in their treatment for knee or hip pain?

A: Decreasing the joint load is very beneficial for pain in loaded joints, for example, temporomandibular joint (TMJ), knee, and hip. For knee and hip pains, weight loss is encouraged and is one of the ways to decrease the joint load and pain. For TMD pain, reducing parafunctional habits can decrease the joint load to a small fraction of the previous amount and decreasing the load by this degree cannot be accomplished by weight loss for knee or hip pain. Reducing parafunctional habits will also decrease the muscle pain. Our literature demonstrates that this is a very beneficial TMD therapy for both muscle and joint pains.

Practitioners from many disciplines find that providing their disciplines' therapies to patients with TMD symptoms tends to improve their symptoms. Prosthodontists, orthodontists, and oral surgeons (providing orthognathic surgery) may observe this as they improve a patient's occlusal stability. Psychologists and psychiatrists may observe this as they treat patients for stress, anxiety, aggression, depression, and so on. Additionally, physical therapists, massage therapists, and chiropractors may observe this as they treat patients for neck pain.

Practitioners from many disciplines can target their therapies to treat patients' TMD disorders. Oral surgeons can remove the inflammatory and pain mediators from the TMJ. Psychologists can teach patients to break their daytime parafunctional habits and continually maintain their masticatory muscles in a relaxed state. Physical therapists, physicians, and massage therapists can treat

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the masticatory muscles and TMJ as they would most other muscles or joints in the body. Acupuncturists can balance the acupuncture meridian corresponding to TMD symptoms. Dentists can fabricate occlusal appliances and prescribe medications.

With practitioners from so many various disciplines able to help relieve TMD patients' symptoms and with many therapies that have been shown to benefit TMD symptoms, the goal in developing a treatment plan is to identify which practitioners and therapies would provide each patient with the greatest benefits with the least costs, for example, in terms of price, time, and adverse sequelae. This will vary with each patient, and awareness of the patient's perpetuating contributing factors (identified during the initial evaluation), to develop the patient's best personal course of treatment.[1]

FOCAL POINT

With practitioners from so many various disciplines able to help relieve TMD patients' symptoms and with many therapies that have been shown to benefit TMD symptoms, the goal in developing a treatment plan is to identify which practitioners and therapies would provide each patient with the greatest benefits with the least costs, for example, in terms of price, time, and adverse sequelae.

Treatment Summaries and Clinical Implications

The following treatment summaries and clinical implications are based on the literature and my clinical experience.

Self-Management Therapy

This has been reported to help 60–90% of TMD patients. These instructions are easy for patients to implement, and this should be the first treatment provided to the majority of patients diagnosed with TMD. Patients are asked to read the "TMD Self-Management Therapies" handout (Appendix 4) during their initial evaluation appointment. The handout is then reviewed with them to emphasize its importance and answer any questions. Additionally, some contributing factors are identified during this discussion, for example, excessive caffeine consumption and stomach sleeping. A trained staff member can effectively review these instructions with patients.[2,3]

TECHNICAL TIP

Observing Cervical Symptoms

Typically, TMD patients with neck symptoms do not derive as much improvement from conservative TMD therapies as do other patients. Therefore, it is improvement to reduce cervical symptoms among TMD patients who have them.

Massage and Trigger-Point Compression

These are effective techniques to temporarily increase the muscle's vasodilation, inactivate trigger points, and thereby decrease the muscle pain and associated symptoms.[4,5] Two surveys of TMD patients found muscle massage to be one of the most beneficial of the alternative treatments evaluated and are the first item recommended in the "TMD Self-Management Therapies" handout (Appendix 4).[5,6] These techniques can be applied to the masticatory and/or cervical regions. Some TMD patients prefer having a massage therapist provide these, but this is not a cost-effective therapy. Keep in mind that the contributing factors perpetuating the irritable trigger points must also be addressed and controlled, or the trigger points will tend to reactivate.

Lateral Pterygoid Muscle-Stretching Exercise

The lateral pterygoid muscle can be stretched (as depicted in Figure 14.5) to reduce pain and/or tightness within it.[7] The practitioner first performs the stretch to identify its effectiveness, and, if it is sufficiently beneficial, teaches this stretching exercise to the patient. Patients are asked to perform a series of six stretches, six times a day, holding each stretch for approximately 30 seconds. Patients who apply heat over this area prior to the stretch should have better results.

Closure Muscle-Stretching Exercise

The closure muscle-stretching exercise is designed to decrease the masseter, temporalis, and medial pterygoid muscle pain and increase range of motion.[8] Patients should be able to optimize the benefits derived from this exercise by warming the painful area(s) before stretching the muscles.[9] This exercise is easy to perform and not time-consuming. This exercise is not recommended to patients who have significant TMJ or lateral pterygoid muscle pain because it may aggravate those structures.

Ask appropriate TMD patients to read the "Closure Muscle-Stretching Exercise" handout (Appendix 6) during the initial evaluation appointment. Then review it with them and answer any questions. A trained staff member can effectively review these instructions with patients.[10]

Posture Exercises

"Posture Improvement Exercises," Appendix 7, provided a mean TMD and neck symptom reduction of 42% and 38% among TMD patients whose pain was primarily of muscle origin.[11] Typically, TMD patients with neck symptoms do not derive as much improvement from conservative TMD therapies as do other patients.[12] Therefore, it is improvement to reduce cervical symptoms among TMD patients who have them. Well-motivated patients with neck pain may find the posture exercise handout beneficial. Additionally, the study found that TMD patients with a further forward head posture obtained greater TMD symptom benefit from these exercises.[11]

Occlusal Appliances

These are generally beneficial for masticatory muscle pain, TMJ pain, TMJ noise, jaw mobility, and TMJ subluxation and luxation.[7,13–15] Wearing an occlusal appliance at night generally reduces morning TMD symptoms and requires minimal effort from patients.[7] There are many different types of appliances, but no one full-coverage appliance appears to be significantly superior to another.[14] The factors that help me determine whether to provide a maxillary or mandibular appliance are provided in Table 12.1.

QUICK CONSULT

Using an Occlusal Appliance at Night

Wearing an occlusal appliance at night generally reduces morning TMD symptoms and requires minimal effort from patients.

If the appliance does not provide adequate TMD symptom improvement, one study found that providing an opposing soft appliance occluding with the hard appliance (Figure 12.63) provided a significant decrease in TMD symptoms; 63% rated it as good TMD symptom improvement and 12% rated it as some improvement.[16]

Physical Therapy

This adjunct therapy is generally beneficial for masticatory and/or concomitant neck pain. A survey among TMD patients reported that 60% found physical therapy beneficial for their TMD (Figure IV.1).[17] For TMD patients who have neck pain to the degree that they desire to be referred to a physical therapist, this referral is generally performed at their initial evaluation appointment.

For patients whose TMD symptoms are refractory to TMD therapy, I also consider referring them for a physical therapist's assistance in treating the masticatory structures. The patient characteristics for when I consider referring TMD patients to physical therapy are provided in Table 15.1.

Practitioners may desire to refer TMD patients to physical therapy for stretching exercises, physical therapy modalities, posture and posture biomechanics training, education on changing or correcting sleep posture, education on diaphragmatic breathing, and treatment of concomitant neck pain. Two examples of physical therapy referrals are provided in Appendix 10, "Examples of Physical Therapy Referral."

Yoga

Yoga has been shown to provide significant benefit for musculoskeletal disorders and psychosocial symptoms that may contribute to TMD symptoms. A survey among TMD patients reported that 63% found yoga beneficial for their TMD (Figure IV.1).[17]

If a TMD patient with stress, anxiety, neck pain, or other musculoskeletal disorders relates that he or she is considering to start yoga, I encourage the patient to follow through on the contemplation. Based on the literature, yoga can be a cost-effective program that has the potential for benefiting neck, headache, and TMD symptoms.

Trigger-Point Injections

Trigger-point injections can be administered for persistent trigger points and may provide an immediate decrease in trigger-point pain and its associated symptoms. Trigger-point injections are recommended only after traditional conservative management in addition to exercises and other physical therapy modalities have failed to provide a lasting effect.

Recently, BOTOX® (onabotulinumtoxinA, which is a botulinum toxin-A) trigger-point injections have been used to reduce TMD symptoms and parafunctional habits, but these injections are expensive, only last approximately 3 months (similar to its duration in the treatment of facial wrinkles), and have associated risks.[18,19] Hence, the traditional therapies discussed in this book are much more cost-effective for the long-term control of TMD symptom.

Acupuncture

Acupuncture has been reported to be as effective as occlusal appliance therapy in relieving TMD symptoms, but appears to lose its effectiveness over time. A study also found that TMD patients who did not improve with occlusal appliance therapy usually did not improve with acupuncture. Treatment with acupuncture typically involves six to eight weekly treatments with periodic follow-up treatments to maintain its effectiveness.[20]

Based on the studies and clinical experience, acupuncture only provides transient pain relief.[19] I do not refer TMD patients for acupuncture because I prefer using other conservative therapies rather than

subjecting patients to long-term continual acupuncture treatments.

TECHNICAL TIP

Referring Patients for Acupuncture

I do not refer TMD patients for acupuncture because I prefer using other conservative therapies rather than subjecting patients to long-term continual acupuncture treatments.

Chiropractics

Chiropractics has been shown to be beneficial in treating neck pain and cervicogenic headaches.[21] Concomitant neck pain negatively impacts TMD, and the patients with such pain do not respond as well to conservative TMD therapy.[22] Chiropractics is one of many avenues that can be used to treat cervical pain. It is felt that this has been an effective treatment approach when a patient's neck pain is resolved and the improvement is maintained after two or three chiropractic treatments. On the other hand, if a patient cannot obtain adequate relief or maintain the improvement after two or three chiropractic treatments, I recommend traditional medical interventions be provided rather than further chiropractic therapy.

Some chiropractors also directly treat the masticatory system. These treatments vary with the chiropractor, but it is speculated that traditional TMD therapies are probably more effective. I currently do not refer patients to chiropractors, but they are a reasonable alternative for treatment of coexisting neck pain.

Magnetic Therapy

Some studies reported that magnetic therapy was beneficial for persistent neck pain, headache, and other muscle or arthritis-like pains, while others found that the pain improvement was similar to that obtained by a placebo magnet.[23,24] It is a growing multibillion dollar industry that produces and markets magnetic necklaces, bracelets, bands, insoles, back braces, mattresses, and so on.[23] Clinically, it has been observed that some patients find magnetic therapy beneficial in treating their TMD pain, others find magnets not beneficial, and a few others find that the coldness of the magnet aggravates their pain. It would be reasonable for TMD patients with refractory neck or TMD pain to try magnetic therapy. Esthetic considerations limit the application of magnetic therapy for the masticatory region primarily to the evening and night.

Breaking Daytime Parafunctional, Muscle-Tightening, or Fatiguing Habits

Breaking habits appears to be a very beneficial therapy for treating daytime TMD symptoms, but not the symptoms with which a patient awakes.[7] Practitioners may desire to refer patients who are not able to break these habits on their own to a psychologist for this treatment. Psychologists will often include relaxation and stress management in conjunction with internal and external cues to help patients break their habits and, if this does not adequately resolve the daytime pain, they can escalate therapy by providing biofeedback-assisted relaxation.

FOCAL POINT

Breaking daytime parafunctional, muscle-tightening, or fatiguing habits appears to be a very beneficial therapy for treating daytime TMD symptoms, but not the symptoms with which a patient awakes.

Relaxation

Relaxation has been shown to reduce TMD symptoms[25–27], and one survey among TMD patients reported that 61% found this beneficial for their TMD (Figure IV.1).[17] Generally, patients find that relaxation not only reduces their TMD pain temporarily but also helps them become aware of what tense and relaxed masticatory muscles feel like and develop the capability to relax these muscles rapidly whenever they notice the muscles are tight.

Clinically, it has been observed that few TMD patients who are just handed an audio program have the motivation to listen to it and practice the therapy consistently.[28] Most appear to need a trained relaxation instructor to motivate them to practice and assist them with problems they may encounter.

Patients who are motivated to practice this therapy on their own can be given the options of using a relaxation audio program purchased from a bookstore or the Internet, quietly listening to soothing music, taking a warm relaxing shower or bath, quietly sitting and taking slow deep breaths, and so on. Some patients may prefer to practice the therapy while using a heating pad. They should be encouraged to use the therapy form that provides them the greatest degree of relaxation and enjoyment. The more pleasurable the experience is, the greater is the probability for long-term compliance.

Once patients realize how relaxed muscles feel and develop the ability to reestablish this relaxed state whenever they choose, they must identify when they are tensing their masticatory muscles or performing parafunctional habits, consciously stop these habits, and bring forth the learned relaxed state.

This enables patients to obtain long-term daytime symptom relief. If this therapy is used just prior to sleep, it often leads to more peaceful sleep and a decrease in nocturnal parafunctional habits.[29]

Hypnotherapy (Hypnosis)

Hypnotherapy, or hypnosis, assists patients to attain a deep level of relaxation and is beneficial in treating TMD symptoms.[30,31] Throughout the hypnotic session, patients maintain control of their thoughts and can leave the relaxed state whenever they desire, therefore patients should not worry that unethical suggestions can be planted in their subconscious.[31] Patients are generally given an audio recording of one of the hypnotic sessions, which enables them to practice attaining the relaxed state and deal with any residual or future stress or anxiety.[31,32]

This provides a similar effect as relaxation therapy to improve daytime symptoms. Patients must similarly learn to identify when they are tensing their masticatory muscles or performing parafunctional habits, consciously stop these habits, and bring forth the learned relaxed state. Listening to the audio recording just prior to sleep often leads to more peaceful sleep and a decrease in nocturnal parafunctional habits.[33]

Biofeedback-Assisted Relaxation

Biofeedback-assisted relaxation is an effective adjunctive therapy to treat a TMD patient's daytime symptoms, but much less effective for the symptoms with which he or she awakes.[7,34] It is a time-consuming therapy, the patient must be taught to transfer its effect from the therapist's office into everyday life, and the patient must be motivated to practice it. The relaxation portion appears to be the more beneficial component of this combined therapy.[35] My experience is that habit-reversal and relaxation techniques are all that the vast

majority of TMD patients need. Patients who receive this therapy and find they continue to have daytime symptoms and relate they can relax their entire body except their masticatory muscles, often find biofeedback exceptionally beneficial.

Stress Management

Stress management teaches coping skills to deal with stressful situations in life. Such situations typically exacerbate the tendency for patients to perform parafunctional habits and hold more tension in their muscles. One study found that stress management combined with biofeedback, relaxation, and occlusal appliance therapy increased a TMD patient's rate of improvement and decreased the relapse that may occur with occlusal appliance therapy alone (Figure 16.2).[36] This therapy is time-consuming, and patients tend to be less compliant with counseling than with occlusal appliance therapy.[37] Therefore, patients being referred for this therapy should be interested in receiving it and motivated to practice it.

Pharmacological Management

This can generally reduce TMD pain and sometimes speed recovery. I avoid prescribing muscle relaxants to patients with chronic TMD symptoms, unless they have an acute exacerbation. If a patient with chronic symptoms desires a prescription, medications that can be used long term are typically prescribed, that is, nonsteroidal anti-inflammatory drugs (NSAIDs) on an as-needed basis, tricyclic antidepressants, and/or topical medications. Patients with chronic TMD symptoms typically need to change their perpetuating factors to obtain long-term control of their symptoms. If possible, it is preferable to control a patient's chronic TMD symptoms through nonpharmaceutical management, for example, self-management therapies, occlusal appliance therapy, and cognitive-behavioral interventions.

TECHNICAL TIP

Controlling Chronic TMD Symptoms

It is preferable to control a patient's chronic TMD symptoms through nonpharmaceutical management, for example, self-management therapies, occlusal appliance therapy, and cognitive-behavioral interventions.

TMD pharmacological management most commonly involves over-the-counter analgesics (including NSAIDs), prescription anti-inflammatory drugs, muscle relaxants, low-dose tricyclic antidepressants, topical medications, and nutritional supplements. The "TMD Self-Management Therapies" handout (Appendix 4) recommends over-the-counter medications for patients who desire to try one. Practitioners must weigh the medication's potential benefits against its side-effect risks, along with their competence in managing patients taking the medication.

Occlusal Therapy

This generally improves occlusal stability, thereby decreasing the negative impact that clenching or bruxing has on the masticatory system. Occlusal therapy addresses only one aspect of the many potential aspects TMD therapies can address. The TMD therapies provided in this book are comparatively much less expensive (regarding price, time, adverse sequelae, etc.) and provide greater symptom improvement than occlusal therapy. Dentists must keep in mind that there are many practitioners outside of the dental profession

who can assist with the other aspects of their TMD patient's care.

Most TMD patients have increased tone in their lateral pterygoid muscles and/or TMJ arthralgia, making it difficult to position the mandible in centric relation and/or obtain a reproducible closure position.[7,38] Providing occlusal therapy for these patients without first resolving these problems may have a disastrous outcome. For these reasons and others, most practitioners recommend that TMD patients not be initially treated through occlusal therapy.[39,40]

TMD patients with constant chronic symptoms (1) will be given a stabilization appliance that is worn at night, which should provide the patient with an "ideal" occlusion, and (2) will be taught not to touch their teeth together during the day, except momentarily for swallowing and the occasional bumping that occurs while eating. Using these two therapies, the teeth almost never touch. If the teeth rarely touch, the occlusion is not a significant factor in any residual TMD symptoms, and it is speculated that any occlusal therapy will provide minimal to no benefit.

Patients with intermittent pain are generally provided with the treatment that addresses the contributing factors related to their pain; that is, patients who awake with pain are given a stabilization appliance that is worn at night, and those with daytime pain are taught not to touch their teeth together during the day. Therefore, it is similarly speculated that any occlusal therapy would have minimal impact on residual TMD symptoms.

Contrary to what some practitioners advocate, occlusal therapy is not needed to maintain a TMD patient's long-term symptom improvement.[1,41,42] Long-term management is discussed in its section later in this chapter.

There are only two situations for which I recommend a patient's occlusion be adjusted at the initial visit, they are (1) the patient's TMD symptoms developed due to the placement of a restoration that was not in harmony with the established occlusion and (2) the patient's TMD symptoms are found to be due to a reversible pulpalgia that is determined to be from an occlusal interference (as discussed in "TMD Pain Caused by a Tooth" in Chapter 3).[7,43] In these situations, it is much more cost-effective and expedient to refine the occlusion than provide traditional TMD therapy. This typically resolves the TMD symptoms, but it must be kept in mind that TMD symptoms may develop for other reasons following the placement of a restoration (see Chapter 8, "TMD Secondary to Dental Treatment").

TMJ Surgery

This is indicated for the treatment of a wide variety of pathological conditions. Among TMD patients, its purpose is to reduce their symptoms and dysfunction, not to make the TMJ disc–condyle relation "normal." Using conservative TMD therapy, as described in this book, it is relatively rare for TMD patients to need TMJ surgery. One study that tracked over 2000 TMD patients from many practices found that only 2.5% received TMJ surgery (1.4% arthrocentesis, 1.0% arthroscopy, and 0.1% open joint procedures).[44]

TMJ surgery is significantly more expensive than conservative TMD therapy. Based on insurance records, the average cost of TMJ surgery (not including the hospitalization) is two to three times the cost of nonsurgical TMD therapy.[45] Other than for the obvious reasons (e.g., infection, fracture, or neoplastic growth), there are primarily three TMD disorders for which TMD patients might be referred to a surgeon: TMJ arthralgia, disc displacement without reduction with limited

opening, and TMJ ankylosis. The referral recommendations for these disorders are discussed in "TMJ Surgery and Implants" in Chapter 18.

A specific protocol has been recommended for patients who have received a TMJ implant or prosthesis.[46] If a practitioner is unsure of a patient's implant type or management, it is recommended the practitioner refer the patient to, or work in conjunction with, someone who has greater expertise in this area.

Integrating Conservative Therapies

A multidisciplinary treatment approach is generally more effective than any single TMD therapy.[47,48] The most common referrals I initially make are to a physical therapist for treatment of the neck and to a psychologist primarily to help patients in breaking daytime habits, relaxation, biofeedback, and so on.

TECHNICAL TIP

Referring Patients for Adjunctive Treatments

The most common referrals I initially make are to a physical therapist for treatment of the neck and to a psychologist primarily to help patients in breaking their daytime habits, relaxation, biofeedback, and so on.

Not every TMD patient needs a multidisciplinary treatment approach, and I do not mean to imply this because of the amount of material spent on this concept in this book. Practitioners generally find that patients with mild to moderate localized (compared with regional) symptoms or specific symptom characteristics (e.g., symptoms that primarily occur on awaking) do well with just TMD self-management therapies and an occlusal appliance worn at night. These TMD therapies are traditionally provided by dental practitioners and generally cannot provide satisfactory symptom improvement for patients with more significant daytime symptoms or in need of other therapies. One of the goals of this book is to help readers understand the wide choice of TMD therapies available and how to decide most effectively which would be the most beneficial for the majority of patients the readers evaluate.

During the initial patient evaluation, practitioners will generally identify non-TMD disorders (e.g., neck pain, sinus pain, widespread pain, rheumatic disorders, poor sleep, or depression) that may negatively impact a patient's TMD, that may decrease the probability that the practitioner will achieve satisfactory TMD symptom improvement, and that are part of a patient's list of perpetuating contributing factors.[12,47,49] Patients should be informed about the impact these disorders may have on their TMD symptoms and asked whether they would like a referral.

I may refer patients to a physician for shoulder and/or back pain (dentists can directly refer to physical therapy for head and/or neck pain), a rheumatologist or internist for unexplained generalized muscle and/or joint pain, a neurologist or internist for migraine headaches, an otolaryngologist or physician for ear and/or sinus pain, and a psychologist and/or psychiatrist (whichever the patient prefers, after the different treatment approaches are discussed) for depression or other psychological disorders. Practitioners should not be reluctant to seek additional providers' expertise for other contributing ailments.

Parafunctional and muscle-tensing habits are probably the most significant contributing factors for the majority of TMD patients and

can occur during the day and/or at night. It has been suggested that daytime and nocturnal parafunctional habits are different in their character and origin.[7,13,29]

QUICK CONSULT

Understanding the Most Significant Contributing Factors

Parafunctional and muscle-tensing habits are probably the most significant contributing factors for the majority of TMD patients.

Daytime parafunctional habits may include, but are not limited to, teeth clenching or grinding, cheek or tongue biting or chewing, fingernail or cuticle biting or chewing, unusual jaw posture habits, and a wide range of habits related to occupation. Additionally, a daytime habit of tensing or holding tension in the jaw or neck muscles may contribute to the TMD symptoms. TMD symptoms related to daytime habits have been closely related to increased emotional and psychosocial stress.[7,13,50]

Conversely, nocturnal parafunctional habits are generally limited to teeth clenching or grinding. These have been reported to be closely tied to emotional stress and sleep patterns.[7,13,51]

A patient's daily TMD symptom pattern may help identify whether the habits that contribute to the symptoms are primarily daytime and/or nocturnal. Patients whose nocturnal habits contribute to their symptoms will awake with symptoms, whereas those with contributing daytime diurnal habits will exhibit daytime symptoms.[7,13,51]

The efficacy of some treatments will differ for patients whose habits are primarily daytime or nocturnal. Studies indicate that relaxation and biofeedback are more effective for patients with daytime habits, whereas nighttime wear of a stabilization appliance is more effective for patients with nocturnal habits.[7,13,34]

Clinically, most patients can learn to break their daytime parafunctional and muscle-tension habits on their own.[52] Some will need a psychologist's help to use external and internal cues and learn how to relax their tight muscles (or drain the tension held in these muscles) (see "Breaking Daytime Habits" in Chapter 16). Patients cannot control their nocturnal parafunctional activity, so they need to wear an occlusal appliance at night if these habits are contributing to their TMD symptoms.

Intuitively, it makes sense that certain therapies would be more beneficial for patients with specific daily symptom patterns; for example, breaking a stomach-sleeping habit would probably be more beneficial for a patient who awakes with TMD symptoms rather than a patient who awakes symptom-free.

In light of these clinical findings as well as empirical observations, after providing the patient with TMD self-management instructions and indicated stretching exercises, I primarily consider the following therapies in this order **for patients who awake with TMD symptoms** (Table 19.1): ask the patient to improve sleep posture (e.g., ask the patient to stop sleeping on stomach), provide a stabilization appliance for the patient to wear at night, prescribe a medication that decreases nocturnal EMG activity (e.g., amitriptyline, nortriptyline, or diazepam), provide a soft appliance to oppose the hard or intermediate appliance (see Figure 12.63 and Figure 12.64), and ask the patient to perform a relaxation session just prior to going to sleep (this may require a psychologist to help your patient learn to relax).[7,16,53,54]

Keep in mind that an awaking headache may be from heavy snoring or sleep apnea causing fragmented sleep and/or a decrease in oxygen levels during sleep.[55,56] Patients with

Table 19.1. Primary therapies for patients who awake with TMD symptoms (recommend providing in this order).

1. Ask the patient to improve sleep posture (e.g., to stop sleeping on stomach).
2. Provide a stabilization appliance for the patient to wear at night.
3. Prescribe a medication that decreases nocturnal EMG activity (e.g., amitriptyline—10 mg, 1–5 tablets, 1–6 hours prior to bed; nortriptyline—10 mg, 1–5 tablets, 0–3 hours prior to bed; or cyclobenzaprine [Flexeril] 5 mg, 1–2 tablets h.s.).
4. Fabricate a soft appliance to oppose the patient's hard or intermediate appliance (see Figure 12.63 and Figure 12.64).
5. Ask the patient to perform a relaxation session just prior to going to sleep, which may require a referral to a psychologist to train the patient how to perform this.

Note: Awaking headache may also be from heavy snoring or sleep apnea causing fragmented sleep and/or a decrease in oxygen levels during sleep.

Some treatment effects generally carry over to the other portion of the day, so patients with mild daytime pain may find that these therapies provide them with satisfactory improvement.

Table 19.2. Primary therapies for patients with daytime TMD symptoms.

- Ask the patient to break daytime parafunctional and muscle-tensing habits, which may require a referral to a psychologist to assist the patient.
- Ask the patient to continually keep the masticatory muscles relaxed throughout the day, which may require a referral to a psychologist to train the patient. The psychologist may escalate therapy and use biofeedback to help the patient understand how to relax the masticatory muscles.
- Refer the patient to a psychologist to learn stress management and coping skills for life's irritations and frustrations.
- Provide the patient with a stabilization appliance to wear during the day (as a temporary reminder about daytime habits and keeping the masticatory muscles relaxed throughout day, and to increase the occlusal stability for when the patient clenches).
- Prescribe a tricyclic antidepressant that does not cause drowsiness (e.g., desipramine—25 mg, 1 tablet in the morning and 1 tablet in the afternoon).

Note: Some treatment effects generally carry over to the other portion of the day, so patients who awake with mild daytime pain may find that these therapies provide them with satisfactory improvement.

sleep apnea generally relate that they snore loudly at night, occasionally awake gasping for air, are drowsy throughout the day, and easily fall asleep during the day. If you suspect either of these may be contributing to the patient's symptoms, ask the patient to discuss this with his or her physician and to request a sleep study.

After providing the patient with TMD self-management instructions and indicated stretching exercises, I primarily consider the following therapies **for patients with daytime symptoms** (Table 19.2): ask the patient to break daytime parafunctional and muscle-tensing habits (this may require a referral to a psychologist to assist the patient), ask the patient to continually keep the masticatory muscles relaxed throughout the day (this may require a referral to a psychologist to teach the patient to relax these muscles), refer the patient to a psychologist to learn stress management and coping skills for life's irritations and frustrations, provide the patient with a stabilization appliance to wear during the day (as a temporary reminder about daytime habits and keeping the masticatory muscles relaxed throughout day, and to increase the occlusal stability for when the patient clenches), and prescribe a tricyclic antidepressant that does not cause drowsiness (e.g., desipramine).[57,58]

Clinically, some residual treatment effects appear to carry over to the other portion of the day, so a patient who only has mild

daytime pain may find that nocturnal use of the occlusal appliance provides satisfactory improvement of that pain. It is speculated that 85–95% of the general population have parafunctional habits sometime during their life,[13] so decreasing the nighttime aggravation of the masticatory system may make the patient better able to tolerate the aggravation from the daytime parafunctional habits.

Therapies that appear beneficial for both categories of patients include (Table 19.3) medications (e.g., topical or oral NSAIDs, muscle relaxants, and tricyclic antidepressants); physiotherapy provided at home or by physical therapist (e.g., heat, ice, ultrasound, and iontophoresis); jaw exercises (e.g., "Closure Muscle-Stretching Exercise," Appendix 6, or those provided by physical therapist); head and neck posture improvement exercises (e.g., "Posture Improvement Exercises," Appendix 7, or those provided by physical therapist); and cervical therapies provided by a physical therapist to relieve neck pain.

Some patients fall into both categories (having awaking and daytime symptoms), but they often have a more predominant category that can be identified. For these, consider all the aforementioned therapy categories, keeping in mind the more predominant category.

Table 19.3. Therapies beneficial for both TMD symptoms that occur upon awaking and during the daytime.

- Prescribe medications (e.g., topical or oral NSAIDs, muscle relaxants, tricyclic antidepressants).
- Ask the patient to perform physiotherapy at home or receive them from a physical therapist (e.g., heat, ice, ultrasound, iontophoresis).
- Ask the patient to perform jaw exercises (e.g., "Closure Muscle-Stretching Exercise," Appendix 6, or those provided by a physical therapist).
- Ask the patient to perform head and neck posture improvement exercises (e.g., "Posture Improvement Exercises," Appendix 7, or those provided by a physical therapist).
- Refer the patient for cervical therapies provided by a physical therapist to relieve neck pain.

It is recommended that these therapies be modulated with the symptom severity, anticipated compliance, abilities of adjunctive personnel (physical therapist, psychologist, etc.), impact on a patient's lifestyle (for both symptoms and treatment), and costs (in terms of price, time, adverse sequelae, etc.). Some TMD therapies have not been discussed here because I do not routinely use them, I have not developed a good clinical sense for their effect on the daily symptom patterns, and studies have not identified for which symptom pattern they are more effective.

Additionally, consider non-TMD disorders that may be negatively impacting patients' TMD symptoms, for example, neck pain, widespread pain, rheumatic disorders, sinus pain, poor sleep, and depression. Not obtaining adequate improvement with these non-TMD disorders decreases the probability of patients obtaining satisfactory TMD symptom improvement. I recommend TMD patients be informed of the impact these may be having on their TMD symptoms and the results of their treatment. Ask patients if they desire a referral for treatment of these non-TMD disorders.

It is recommended that the least invasive procedures be used first and, if this adequately resolves the pain, no other treatment is needed.[1,39] It is appropriate for patients to wear a stabilization appliance at night for as long as it may be beneficial (see "Long-Term Management" later in this chapter).

TMD Refractory to Initial Therapy

Despite the documented success of the various forms of conservative care, some TMD

patients do not improve. The reasons vary: the pain's primary etiology may be an unidentified disorder (i.e., referred pain from an acute pulpalgia[59,60]) that mimics TMD; relevant contributing factors may not have been adequately addressed or even recognized; and patients who have greater TMD pain, nonadaptive coping skills, more psychosocial tendencies, anxiety, depression, widespread pain complaints, neck pain, and nonspecific symptoms tend not to improve.[1,12,61–63]

QUICK CONSULT

Failing with Therapy

A patient's TMD symptoms may not improve because the pain's primary etiology is an unidentified disorder (i.e., referred pain from an acute pulpalgia) that mimics TMD, the relevant contributing factors are not adequately addressed or even recognized, or the patient has a characteristic of patients who tend not to do as well from TMD therapy; that is, they have greater TMD pain, nonadaptive coping skills, more psychosocial tendencies, anxiety, depression, widespread pain complaints, neck pain, and nonspecific symptoms.

There is no scientifically determined protocol for proceeding with patients whose TMD symptoms are refractory to initial therapy. If a patient has TMJ disc displacement without reduction with limited opening, it is recommended that the practitioner follows the guidance provided in Chapter 10 rather than the recommendations that follow.

If a patient has not obtained satisfactory improvement in TMD symptoms by using the recommended therapies, the following are recommended in the order listed:

1. Evaluate the patient's compliance with the therapies provided, such as TMD self-management therapies; any additional instructions (e.g., stretching exercises); relaxation when the patient is tense, stressed, or pain occurs; or biofeedback strategies in similar situations. The patient may be missing important facets of therapy and may need a better understanding of or motivation to perform the procedures.

   It is important to document the instructions that patients are given and periodically inquire about them. This reinforces the importance of the instructions and increases the probability of patients' performing them.
2. Reevaluate the patient for non-TMD. The patient's chief complaint may be due to a non-TMD condition (e.g., acute pulpalgia) and/or non-TMD contributors (e.g., neck pain, fibromyalgia) that may have been missed during the evaluation. If a panoramic radiograph was not previously taken, it is recommended one be taken at this time. Recommend appropriate evaluations for non-TMD conditions and contributors.
3. Review the list of the patient's perpetuating contributing factors and ensure they have been addressed to the degree possible. Some patients may have declined referrals for different components, or some of the components (e.g., fibromyalgia or posttraumatic stress disorder [PTSD]) may not be able to be treated adequately. Patients who previously declined referrals may change their mind at this time.
4. Consider whether the patient appears to have a significant psychosocial component to his or her contributing factors. By this time, the practitioner should have a feel for this and may have heard remarks suggestive of psychosocial stress; for example, "I hate my job" or "I hate my boss."

   Once, a patient with constant 6 out of a possible 10 bilateral jaw, preauricular, and

temple pain did not improve from traditional conservative therapy. At her reevaluation appointment, she was questioned about many possible contributing factors, including depression. She admitted she was constantly depressed and had checked "Never" on her initial patient questionnaire because she had previously been treated by a psychologist, the sessions had not helped, and she was afraid of being referred to a psychologist if she marked "Always." Upon discussing the treatments for depression, she was open to trying antidepressant medications. After a psychiatrist placed her on an antidepressant, her TMD pain dropped to a 2 to 3 out of 10.

If your patient appears to have a significant psychosocial component, refer him or her for a psychological evaluation.

5. Ask if the patient tried a tricyclic antidepressant medication. If not, it is recommended that the practitioner review the various tricyclic antidepressants ("Tricyclic Antidepressants" in Chapter 17) to determine which might be the most appropriate and ask whether the patient would be interested in trying this therapy.
6. If the patient has not gone to physical therapy for treatment of the masticatory structures, I recommend the practitioner to refer the patient at this time. The physical therapist can evaluate the patient for other contributors (e.g., neck pain or body mechanics at the patient's workstation) and implement local modality therapies. Some physical therapists can also teach other therapies within their realm that they believe would be beneficial, for example, diaphragmatic breathing or posture exercises.
7. If the patient still has not obtained satisfactory TMD improvement and wears a stabilization appliance, at this time consider altering the appliance to an anterior positioning. Does the patient meet the criteria (provided in Chapter 13, "Anterior Positioning Appliance") for this appliance? If the patient does not, it is speculated that this appliance has a low probability of helping the patient.
8. If the patient's parafunctional habits and other contributing factors have been controlled to the extent possible through conservative therapies and the patient has moderate to severe pain primarily from the TMJ, at this time consider referring the patient for a surgical evaluation.

Long-Term Management

Through conservative TMD therapies, attempt to satisfactorily reduce patients' symptoms so they need to wear their occlusal appliances only at night. I plan for the great majority of patients to wear their appliance at night for many years.

After patients have obtained and can maintain satisfactory symptom improvement, I like them to periodically test whether the therapies are still needed. Patients naturally do this by periodically forgetting to perform certain therapies, enabling them to discover how beneficial each is. Once they determine which are no longer needed, they can separately discontinue each to observe whether they can maintain their symptom improvement without them.

As symptoms improve, most patients on their own will (1) resume their normal diet and desired caffeine intake; (2) decrease or stop thermotherapy, jaw and posture exercises, and relaxation sessions; and (3) occasionally forget to wear their occlusal appliance or take their medications, unintentionally testing whether they need to continue these.

Even as patients improve and decrease some therapies they were provided, hopefully they will continue (1) to maintain the new tongue

and jaw postures they have learned, (2) to keep their muscles relaxed through internal cues, (3) to use the improved daytime and sleep postures they have learned, (4) to reduce their daytime parafunctional habits, and (5) to use the learned coping skills.

TMD tends to be a cyclic disorder that is often related to situations in a patient's life.[64] If the TMD symptoms recur, patients can implement the treatments that they discontinued.

QUICK CONSULT

Treating Recurrence of Symptoms

If the TMD symptoms recur, patients can implement the treatments that they discontinued.

Since patients may periodically have some degree of TMD symptom exacerbation, it is recommended that they continue wearing their occlusal appliance at night even though they find it is no longer needed, for, if they stop wearing their occlusal appliance, their teeth may shift and the appliance may no longer fit when they need it. It is also recommended that patients periodically return to their practitioner to ensure the appliance is appropriately adjusted. If patients find they have not needed their appliance and it needs to be replaced, this is probably an appropriate time to discontinue its use.

TECHNICAL TIP

Wearing Occlusal Appliance Long Term

Since patients may periodically have some degree of TMD symptom exacerbation, it is recommended that they continue wearing their occlusal appliance at night even though they find it is no longer needed.

The majority of TMD patients are between the ages of 20 and 40 years.[7] As patients age beyond this range, their TMD has a propensity to resolve. Therefore, over time, most patients will generally be able to discontinue their TMD therapies. Conversely, elderly individuals who never previously had TMD symptoms occasionally seek treatment for TMD. Typically, I find that their primary contributing factor is related to being a caregiver or fear related to a health issue.

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Part V

Case Scenarios

FAQs

Q: What measurements are the minimum for a normal opening and excursive movements?
A: Forty millimeters is the minimum for a normal opening and 7/7/6 mm are the minimum for normal excursive movements.

Q: Do stabilization appliances stop patients from bruxing?
A: No. Patients with nocturnal bruxing habits usually continue to brux, even when they wear a stabilization appliance.

The following 20 cases are of patients who were referred to me because of TMD-like symptoms, except for one patient who had tooth pain where there was no dental pathology. This section hopefully will help readers better identify patients who have and do not have TMD and provide readers with a better feel for how I integrate the various TMD therapies.

For the sake of expediency, most patients' identified perpetuating contributing factors (e.g., excessive caffeine consumption, stomach sleeping, neck pain, or poor sleep) are not reported. It is felt these factors have been adequately discussed previously in this book and need not be revisited here. During my initial evaluation for TMD, I always document patients' suspected perpetuating contributing factors and attempt to decrease them to the degree possible in order to reduce the TMD symptoms. Contributing factors that may not be changeable (e.g., widespread pain and posttraumatic stress disorder [PTSD] nightmares) are also important to document because occasionally one needs to justify the reason a patient is not obtaining the

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symptom improvement that other patients typically do.

QUICK CONSULTS

Perpetuating Contributing Factors

Most patients' identified perpetuating contributing factors (e.g., excessive caffeine consumption, stomach sleeping, neck pain, or poor sleep) are not reported in the following cases.

Decreasing Perpetuating Factors

During my initial evaluation for TMD, I always document patients' suspected perpetuating contributing factors and attempt to decrease them to the degree possible, in order to reduce the TMD symptoms.

The drawings provided with the cases depict the locations where patients drew their pain on the "Initial Patient Questionnaire" (Appendix 2), with the most significant locations indicated with a yellow star. The provided mandibular range-of-motion opening includes the overlap of the anterior teeth (40 mm is the minimum for a normal opening). For simplicity, the excursive movements are designated with three numbers separated by slashes. These numbers are the millimeters for which these patients moved their mandible in right lateral, left lateral, and protrusive directions, respectively (7/7/6 mm are the minimum for normal excursive movements).[1]

The designation 5/10 is used to represent that the patient's average pain is a 5 on a 0 to 10 pain scale and similarly designate the other reported pain levels. For simplicity, TMJ noise or dysfunction is only reported if it is present or the patient has a history of it. Readers should assume a patient's complaints are chronic and not due to the placement of a restoration, unless noted otherwise.

The masticatory and cervical structures were palpated as recommended in "TMD Palpations" in Chapter 3. If a muscle is tender to palpation, does not cause referred pain, and no other muscle diagnosis in Chapter 5, "TMD Diagnostic Categories," better describes the patient's condition, I recommend the muscle tenderness be diagnosed as myalgia. If the muscle causes referred pain, it is recommended the muscle tenderness be diagnosed as myofascial pain with referral.

As a general pharmaceutical guide, I will prescribe a muscle relaxant to decrease muscle pain and to decrease nocturnal muscle activity. The muscle relaxant I tend to prescribe will vary with the degree of anxiety the patient presents with and whether this is an acute situation (suggesting the disorder may be secondary to a fairly recent increase in stress in the patient's life). I tend to prescribe diazepam (Valium) when the patient appears to have more anxiety or this is an acute disorder, and cyclobenzaprine (Flexeril) when the patient appears to have minimal anxiety and this is a chronic problem.

I tend to prescribe 800-mg ibuprofen, t.i.d. if the patient requests medication and the pain is constant 3/10 or below and is of either muscle or TMJ origin. I tend to prescribe 500-mg naproxen if the pain is between 3/10 and 6 to 7/10 and primarily of TMJ origin. I tend to prescribe the DexPak 6-Day TaperPak-naproxen regimen if the pain is 6 to 7/10 or greater and primarily of TMJ origin, or I expect the patient to aggravate the TMJ arthralgia to this level from exercises that I ask the patient to perform.

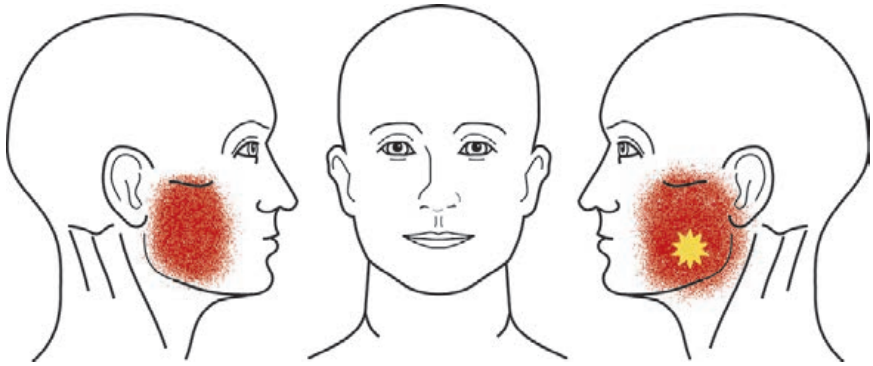
This guide will vary with the patient's fluctuating pain intensity pattern, the patient's palpation tenderness, and the emotional impact these are causing.

QUICK CONSULT

Diagnosing Myalgia and Myofascial Pain with Referral

If the muscle is tender to palpation, does not cause referred pain, and no other muscle diagnosis in Chapter 5, "TMD Diagnostic Categories," better describes a patient's condition, I recommend the muscle tenderness be diagnosed as myalgia. If the muscle causes referred pain, it is recommended the muscle tenderness be diagnosed as myofascial pain with referral.

Case 1: Pulpal Pathosis Mimicking TMD Symptoms



The patient related she had constant 2–3/10 bilateral dull/pressure pain (left worse than right) in the masseter muscle area. Every day, she had 8/10 throbbing pain in her left masseter muscle that could last minutes to hours and occur several times a day. Her pain was aggravated by eating, yawning, lying down, and drinking cold beverages. Her range of motion was 36 mm opening and 7/7/6 (right lateral, left lateral, and protrusive). Palpation of the masticatory and cervical structures identified that her tenderness was limited to both masseter muscles, with the left masseter significantly more tender than the right. The masseter muscle palpation reproduced her complaint.

Is there anything that appears unusual about her symptoms? Are these symptoms typical for a patient with TMD? Do the aggravating symptoms suggest anything? Based on her symptoms, I would ask her why lying down aggravates her symptoms and determine whether there is a rational explanation relating the symptom aggravation to TMD. The pain aggravation could be due to the patient lying on a tender masseter muscle, twisting the mandible in a certain painful manner, and so on. The patient may not have an explanation for the aggravation, and it may be due to an increase in intrapulpal pressure as observed when many patients with an acute pulpalgia lie down.

It is often observed that TMD pain (not tooth pain) aggravated by drinking cold beverages is associated with a pulpal pathosis that is referring pain to masticatory structures (e.g., muscles or TMJ), as depicted in Figure 1.1. Generally, I ask patients with this aggravator which tooth the cold beverage touches to cause the aggravation. The answer gives me a feel for which area of the mouth is probably contributing to the pain. This patient related that when cold liquid touched tooth 19 (mandibular left first molar), her left masseter muscle pain was aggravated, and it often elicited the throbbing component. A panoramic radiograph that was taken showed a deep carious lesion in tooth 19.

QUICK CONSULT

Observing for Drinking Cold Beverages Aggravating Symptoms

It is often noticed that TMD pain (not tooth pain) aggravated by drinking cold beverages is associated with a pulpal pathosis that is referring pain to masticatory structures (e.g., muscles or TMJ).

Next, I like to determine whether there is a connection between a patient's left masseter muscle pain and the tooth. I first determine whether the tooth has an acute pulpalgia, and if so, I determine the impact the pulpalgia has on the patient's left masseter muscle pain by a ligamentary injection along the tooth.

The patient's mandibular left posterior teeth were percussed with the mouth-mirror handle, and the patient related that only tooth 19 was tender to percussion. It is not uncommon for a TMD patient to have many teeth tender to percussion from heavy parafunctional habits. If a tooth is contributing to the pain, it should be significantly more tender than the other teeth.[2]

A very cold cotton pellet was then held to tooth 19 for approximately 5 seconds. The patient related that this aggravated her left masseter muscle area pain, caused it to become throbbing, and lingered for 2 minutes. The TMD-like symptoms are not always reproduced when a patient has an acute pulpalgia referring pain to these areas. An acute pulpalgia is also suspected when the test produces lingering pain only within the tooth, as is commonly observed with an acute pulpalgia.

If this test suggests the tooth has a pulpalgia, I next administer a ligamentary injection along the tooth to determine the impact the pulpalgia has on the TMD symptoms. About 1 minute after performing the ligamentary injection along the tooth, the patient reported her masseter muscle pain was gone. To obtain a positive response to this test, I like to see the ligamentary injection cause a dramatic reduction in the patient's pain.

Both the cold and anesthetic tests being positive suggest the pulpal disorder is causing or contributing to the left masseter muscle area pain. From the radiograph and these tests, it is obvious the patient has an irreversible pulpal disorder. If it is not obvious, the next step is to determine whether the pulpal disorder is a reversible or irreversible disorder. If the tooth does not have caries, an incomplete tooth fracture, or other pathology that could cause an irreversible pulpal disorder, then I will assume it is a reversible pulpal disorder.

The most common cause I observe for a reversible pulpal disorder is the patient continually bumping or rubbing the tooth. I then review techniques to stop the pulpal irritation (e.g., adjusting the occlusion of the tooth to remove excursive interferences and covering the tooth with a stabilization appliance), perform the procedure, and follow the patient to determine whether this adequately reduces the TMD symptoms.

For this patient, the acute pulpalgia of tooth 19 is causing or contributing to the left masseter muscle area pain. The right masseter muscle pain or tenderness may be independent of this finding. It was noted that although the pain was eliminated by the anesthetic test, the patient continued to have a limited range of motion. The right masseter muscle pain and tenderness, and limited opening when tooth 19 was anesthetized, suggest a minor underlying TMD condition.

Since the pain on the left was related to the pulpal disorder, and the left masseter was significantly more tender than the right, my clinical impression was that the diagnosis for this complaint was pulpal pathosis of tooth 19, and she also had a TMD diagnosis of

myalgia. If further understanding of this disorder or diagnostic techniques is desired, several relevant articles are available.[2–6]

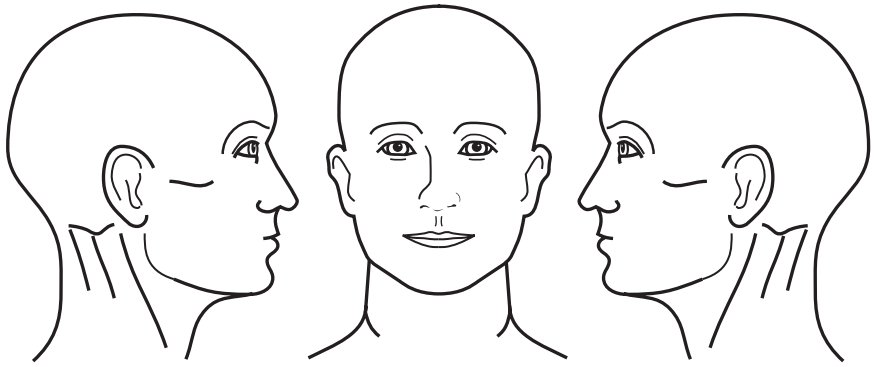
The treatment provided was (1) recommending she return to her general dentist for treatment of tooth 19; (2) reviewing with her the "TMD Self-Management Therapies" handout (Appendix 4), since she appeared to have a minor underlying TMD condition; (3) informing her that it was anticipated these therapies would adequately resolve her TMD symptoms, but, if they did not, she should return to my office for further evaluation and treatment. She never returned to my office, so it was assumed they adequately resolved her complaint.

Generally, I find that patients who have an acute pulpalgia as the primary etiology for their TMD symptoms relate (if asked) that their TMD pain is aggravated by drinking hot or cold beverages, but several of these patients with acrylic crowns covering the offending tooth not having this symptom have been observed. Acrylic crowns appear to provide sufficient thermal protection so the pulp may not be aggravated by these thermal changes.

I also find that if the acute pulpalgia is in a posterior tooth, the ipsilateral side has a periodic throbbing pain component and the contralateral side often has some minor TMD symptoms without the throbbing pain component, as in this case. If the acute pulpalgia is in an anterior tooth (teeth 6 through 11), the pain is often referred bilateral, and these patients report severe bilateral throbbing pain.[2,4,5]

Other symptoms that also suggest that the patient may have a pulpal disorder causing or contributing to the TMD symptoms are (1) the TMD pain is aggravated from laying down or bending forward and (2) the TMD pain awakes the patient from sleep.[2]

Case 2: Tooth Pain: No TMD Pain



The patient related that she had constant tooth 14 dull/pressure pain 5/10 upon awaking and 7/10 later in the day that daily became throbbing 8/10 pain for approximately 1 hour. The patient did not have TMD symptoms. The patient related that her dentist could not find any pathology with any of her teeth. Her dentist referred her to an otolaryngologist (ENT physician) to rule out a sinus disorder as the cause for her pain. The otolaryngologist had CT sinus images made and told her that the tooth pain was not from her sinuses.

Her dentist then performed a root canal on tooth 14 in an attempt to see whether this would relieve her pain, and it provided no

improvement. Her dentist then referred her for a TMD evaluation.

Her range of motion was 42 mm opening and 7/7/6 (right lateral, left lateral, and protrusive). Palpation of her masticatory and cervical structures revealed generalized tenderness of these muscles and both TMJs. Since local (dental) and regional (adjacent teeth, opposing teeth, and sinus) pathologies for this tooth pain had been ruled out, there was a high probability that this pain was referred pain from a masticatory structure. The most common masticatory structure that refers pain to the maxillary molars is the superior portion of the masseter muscle, as depicted in Figure 3.14.

The trigger points (tender nodules) within the superior portion of the masseter muscle were identified and pressure was held, up to tolerance, over the most tender nodule, and after a few seconds this reproduced the patient's tooth 14 pain. This suggested this muscle could potentially cause or contribute to her tooth pain. Since the more common pathologies for this tooth pain had been ruled out, the diagnosis for this tooth pain was myofascial pain with referral.

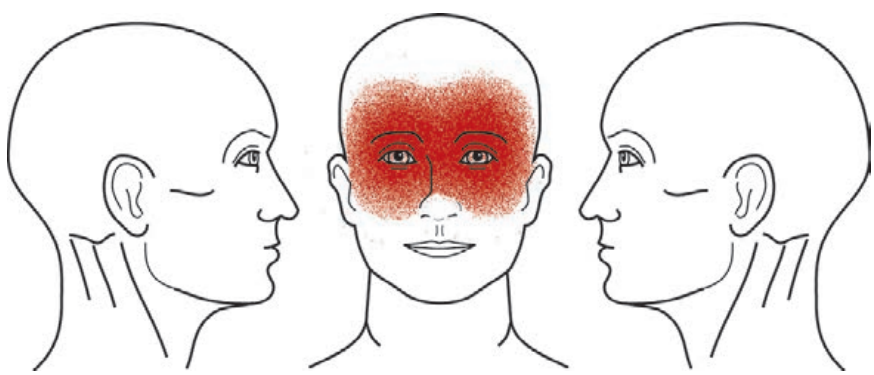
The TMD therapies used to treat muscle tenderness should also treat the muscle's trigger points and their ability to refer pain to other structures. Future case scenarios will discuss the most cost-effective TMD therapies to treat masticatory muscles, utilizing the patient's daily symptom severity pattern and the identified contributing factors.

It was not necessary for her dentist to perform the root canal to rule out the pulp as the cause for the patient's dental pain. This could have been achieved by providing a ligamentary injection along the tooth, and the patient would have related that this did not eliminate her tooth pain. It is estimated that each year, more than 680,000 teeth receive root canals when pain is due to another cause.[7]

If the most tender nodule within the superior portion of the masseter muscle had not reproduced her tooth pain, then other nodules within the muscle would have been tested, and then masticatory structure that less commonly refer pain to the maxillary molars (Figure 3.14) would have been similarly aggravated. Since this referred pain test is so simple, it is recommended it be performed earlier in the evaluation process for the tooth pain's source.

As with Case 1, it is common for patients with referred pain *not* to perceive the pain at the source of their pain, but only perceive it at the referred pain site. I would also like the readers to realize that the most common source of referred pain to mandibular posterior teeth comes from trigger points within the inferior portion of the masseter muscle (Figure 3.14).[8]

Case 3: Chronic Sinusitis



The patient related that every day she had 2/10 dull/pressure pain in the area marked on the drawing. Her pain occurred at variable times of the day, generally lasted 3–10 hours, and was aggravated by bending forward. Her range of motion was 40 mm opening and 7/7/6 (right lateral, left lateral, and protrusive). Palpation of her masticatory and cervical structures identified mild tenderness limited to bilateral masseter muscles and lateral pterygoid areas that did not reproduce (or aggravate) her pain complaint.

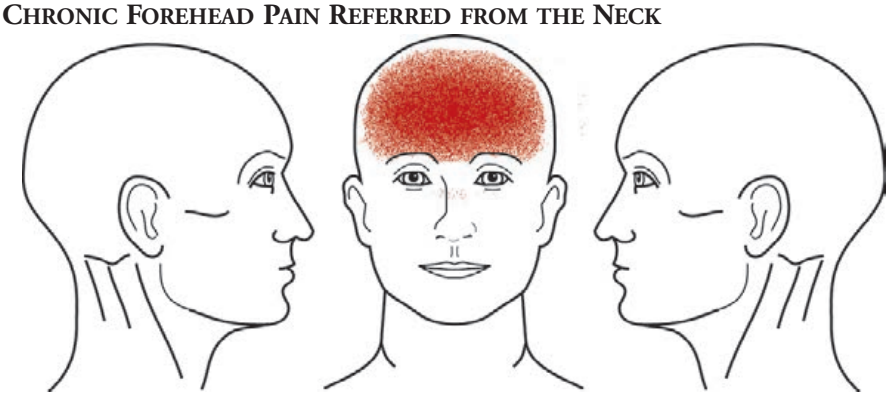
Are these symptoms typical for a patient with TMD? Bending forward can aggravate TMD symptoms, but this is also common among individuals who have sinus pain. Based on her symptom location, its aggravation when bending forward, and its inability to be reproduced through masticatory and cervical palpations, it was suspected that her pain might be due to sinusitis. I asked her whether she had tried an oral or nasal spray decongestant for her symptoms, and she had not.

Her maxillary and frontal sinuses were then palpated, and she reported this aggravated her pain. Sinus palpation cannot rule out sinusitis because some patients with sinusitis report this does not aggravate their pain. My clinical impression was that her pain was probably due to chronic sinusitis. Sometimes I provide a trial with an oral decongestant, nasal spray decongestant, and/or antibiotic (e.g., Sudafed [pseudoephedrine HCl] 60 mg, 1 tab q 4–6 hours; Afrin [oxymetazoline HCl] 0.05%, two sprays in each nostril q 12 hours; and/or Augmentin [amoxicillin/clavulanate] 500 mg, 1 tab t.i.d. for 10 days [all have generic formulations and are listed in Table 1.2]) to understand better the etiology of a patient's pain. Since this was her only complaint and I planned for her to see her physician for this, a decongestant and/or antibiotics trial was not provided.

The patient's masseter muscle and lateral pterygoid area tenderness may have been independent of her sinus pain. Since its treatment would only have involved self-management instructions that I typically provide during my initial evaluation and would not have had a negative impact if it were not needed, I chose to assume the tenderness was independent of the sinus disorder. Therefore, she was given a TMD diagnosis of myalgia and told I would like to give her some recommendations for how she could reduce the mild tenderness noted in her masseter muscles and lateral pterygoid areas.

The treatment provided to this patient was recommending she see her primary medical provider to evaluate her for probable chronic sinusitis and reviewing with her the "TMD Self-Management Therapies" handout (Appendix 4). She was told she could implement whichever of the self-management therapies she desired, and I informed her that if the muscles became symptomatic in the future, she could increase the implementation of these recommendations and return to my office for further evaluation, if she desired.

Case 4: Chronic Forehead Pain Referred from the Neck



The patient related every morning she awoke with 2–3/10 dull/pressure pain in her forehead, which lasted approximately 2–3 hours. Approximately once a week, this was a 6/10 throbbing pain that lasted approximately 5 hours after she awoke. The patient related she does not have sinus congestion.

Her range of motion was 42 mm opening and 8/8/7 (right lateral, left lateral, and protrusive). Palpation of her masticatory and cervical structures identified no tenderness among the masticatory structures, but I did find tenderness of her cervical muscles. By holding pressure, up to her tolerance, on the most tender firm nodules within her suboccipital muscles (cervical trigger points), her forehead pain could be reproduced; she felt that she would also develop the throbbing pain if pressure was maintained on these points, a common finding from greater aggravation of trigger points.

Does this patient have TMD? Since none of the masticatory structures were tender, and she did not have a history of TMJ noise, she did not have TMD. She had cervical muscle tenderness that caused referred pain, which was diagnosed as myofascial pain with referral.

Since her forehead headache could be reproduced by holding pressure on her cervical trigger points, it was felt the aggravation of these trigger points was contributing to her headache. Her throbbing pain may have been due to greater aggravation of the trigger points. It is common for individuals to have forehead and/or periorbital pain referred from the neck.[9] Many of these individuals notice only the referred pain (the forehead pain for this patient) and do not notice pain at the source (the neck for this patient).

FOCAL POINT

If a patient's forehead headache can be reproduced by holding pressure on his or her cervical trigger points, it is felt the aggravation of these trigger points is contributing to the headache.

QUICK CONSULT

Observing Forehead and/or Periorbital Pain

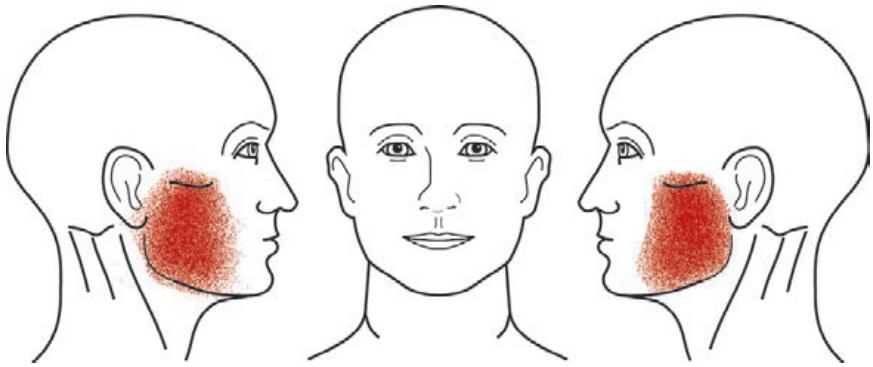
It is common for individuals to have forehead and/or periorbital pain that is referred from the neck.

In an attempt to decrease the cervical component contributing to her headache, her daily symptom pattern suggested that something was aggravating her cervical pain at night, so I inquired about her sleep posture, identified some potential aggravations (e.g., intermittent stomach sleeping), and offered her suggestions to improve these. Many other treatments can be provided for a patient whose cervical myofascial pain with referral is aggravated during the night, for example, providing posture improvement exercises (Appendix 7), referral to a physical therapist, recommending the patient use relaxation or self-hypnosis just prior to or while going to sleep, and prescribing a muscle relaxant or tricyclic antidepressant at bedtime.

There are other potential causes for this chronic form of forehead pain: the throbbing pain could be a migraine headache, other less common conditions, or a combination of these. I prefer initially to treat headaches that can be reproduced or aggravated by palpating cervical tender nodules, without symptoms of a more serious disorder, with a nonpharmaceutical approach directed at the source of the referral pattern. Because of variabilities with combined etiologies and practitioners' skills, response to cervical treatment and referred pain varies. I generally find positive results with this therapeutic approach, but will escalate to pharmaceutical management if unsuccessful or if the patient desires this as a first line of therapy. Sometimes a neurologist's expertise is needed to manage these patients pharmaceutically.

The treatment provided to this patient was recommending improvements in her sleep posture and referring her to a physical therapist. She was told that if she did not gain adequate improvement from this therapy, she should follow it up with her primary medical provider or return to my office.

Case 5: Myalgia Secondary to Nocturnal Parafunctional Habits



A 20-year-old patient related that every morning he awoke with 4/10 bilateral masseter muscle dull/pressure pain that lasted approximately 2–3 hours and would be aggravated by eating. His range of motion was 42 mm opening and 8/8/7 (right lateral, left lateral, and protrusive). Palpation of his masticatory and cervical structures identified approximately the same degree of tenderness limited to both masseter muscles. The masseter muscle palpation reproduced his pain.

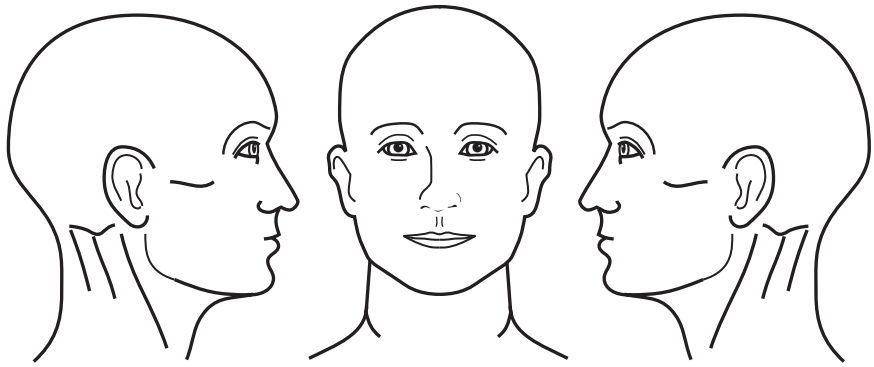
Since the masseter muscle palpation reproduced his symptoms, and no other TMD muscle diagnosis better describes his condition, his complaint was diagnosed as myalgia. The patient's daily symptom pattern suggested nocturnal parafunctional habits as the primary contributing factor. Since this young healthy man had no additional perpetuating factors, it was felt he would probably obtain satisfactory improvement from following the "TMD Self-Management Therapies" handout (Appendix 4) and a maxillary stabilization appliance worn at night.

The patient would probably also find implementing the "Closure Muscle-Stretching Exercise" handout (Appendix 6) beneficial, but I believed he would not need the exercise, so he was not offered it as part of his initial therapy. If he did not derive satisfactory improvement from the initial therapies, this would be the first additional therapy I would consider.

Some practitioners would prescribe medication for this patient to use until they inserted a stabilization appliance. If he was prescribed 800-mg ibuprofen at bedtime, he would probably awake with minimal pain. This is a legitimate option, but I tend not to prescribe medications to patients with this relatively low degree of pain and who it is felt will obtain adequate relief from nonpharmaceutical management. This is because of the following: (1) I like these patients to work with the self-management procedures rather than rely on pain medication. (2) This patient had this pain for quite a while, and it was felt he would find adequate relief when he received his occlusal appliance in a week or 2. (3) I find that most

patients with this symptom severity are not interested in taking medications and would not fill the prescription. (4) The self-management instructions handout discusses using over-the-counter medications, and patients are informed they can use the medications if they desire. It is appropriate to write a prescription and, if a patient with this symptom severity of muscle origin requested an analgesic, I would prescribe 800-mg ibuprofen.

Case 6: Tooth Attrition: No Pain



The patient had no pain, complained he was wearing down his teeth (Figure V.1), and said he would like to prevent further tooth wear. His range of motion was 55 mm opening and 9/9/7 (right lateral, left lateral, and protrusive). Palpation of his masticatory and cervical structures revealed no tenderness. Does this patient have TMD? Since none of the masticatory structures were tender, and he does not have a history of TMJ noise, he does not have TMD.

Figure V.1. Patient complained of worn dentition.

The diagnosis for this patient's complaint was tooth attrition. The wear appears to be due to daytime and/or nighttime parafunctional habits that could be accelerated by certain foods or other items he puts in his mouth. The patient was not aware of any abrasive substances that could be contributing to the wear. The treatment provided this patient was (1) to discuss the potential that he may be performing parafunctional habits during the day and at night, (2) to recommend he become aware of any daytime parafunctional habits and break them, and (3) to provide him with a maxillary acrylic stabilization appliance to wear at night.[10]

Patients with nocturnal bruxing habits usually continue to brux, even though they wear a stabilization appliance. The maxillary appliance will protect his maxillary teeth from additional wear. As the mandibular teeth brux across the acrylic appliance, the softer acrylic will wear, rather than his teeth.[1,11] This is similar to acrylic denture teeth opposing natural teeth: the denture teeth wear rather than the natural teeth.

QUICK CONSULT

If patients grind on their stabilization appliances at night, will they continue to wear their teeth?

Acrylic stabilization appliances are softer than their teeth, so the acrylic will wear rather than their teeth.

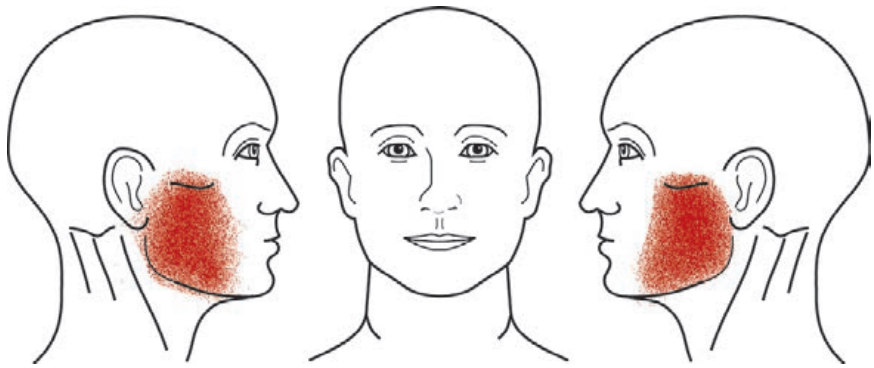
If the patient rapidly wears his acrylic appliance from heavy nocturnal parafunctional habits, the patient will be offered that I can periodically reline the appliance's occlusal surface with acrylic as is needed, or I can fabricate him a mandibular soft appliance and adjust it to oppose his maxillary appliance, as shown in Figure 12.63. Wearing these appliances together, the mandibular cusps can no longer dig into and wear the maxillary appliance.

TECHNICAL TIP

What can be done if a patient rapidly wears his acrylic appliance from heavy nocturnal parafunctional habits?

1. You can periodically reline the appliance's occlusal surface with acrylic, as needed.
2. You can fabricate a mandibular soft appliance and adjust it to oppose the maxillary appliance. Wearing these appliances together, the mandibular cusps can no longer dig into and wear the maxillary appliance (Figure 12.63).

Case 7: Myalgia Secondary to Daytime Parafunctional Habits



The patient related every morning he awoke pain-free, but developed 5/10 bilateral masseter muscle dull/pressure pain later in the day that lasted into the evening and was aggravated by function (e.g., eating). He took acetaminophen multiple times a day to keep his pain at a tolerable level; he did not take a NSAID because they cause gastric upset.

His range of motion was 38 mm opening and 7/7/6 (right lateral, left lateral, and protrusive). Palpation of his masticatory and cervical structures identified that tenderness was limited to both masseter muscles, which had similar levels of tenderness. Palpation of the masseter muscles reproduced his complaint.

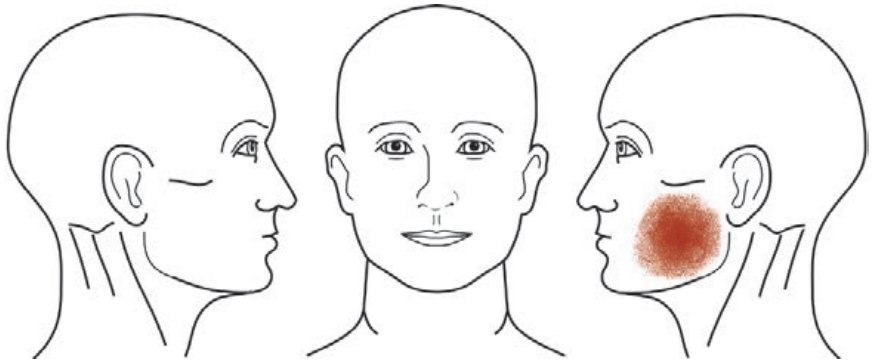
The diagnosis was myalgia. The symptom pattern suggested that any nocturnal parafunctional habit had minimal impact on his symptoms and that the daytime habits (includes muscle-tightening habits) were the primary cause of his pain. Based on the limited information provided (no additional perpetuating factors, etc.), the patient was

informed how his symptoms were affected by his daytime parafunctional habits, muscle tension, psychosocial stress, and so on.

At a minimum, I would initially treat such patients by offering them the "TMD Self-Management Therapies" handout (Appendix 4) and the "Closure Muscle-Stretching Exercise" handout (Appendix 6), and observe whether the daytime symptoms were reduced satisfactorily. The patient was also offered a prescription for Voltaren Gel, 200-g gel, to apply 1–2 g over painful areas 4 times daily p.r.n.; since blood plasma testing of patients using this topical NSAID only have about 6% of the agent in their blood compared with the amount found from an oral NSAID,[12] it rarely causes gastric upset and should reduce the severity of his symptoms.

There are many options if a patient cannot reduce daytime symptoms satisfactorily or desires to begin these additional therapies at the initial visit. These would be, for example, the temporary use of a daytime habit-breaking appliance, habit-reversal therapy (see "Breaking Daytime Habits" in Chapter 16), relaxation, or biofeedback. If the patient is interested, these options would be discussed and the patient could try to determine how he or she would like to proceed with escalating this therapy. I generally refer these patients to a psychologist, who usually initially provides habit-reversal therapy and relaxation. If this does not adequately resolve the symptoms, the psychologist will escalate therapy in the direction that appears most appropriate, for example, biofeedback or cognitive therapy.

Case 8: Medial Pterygoid Spasm



The patient related that two weeks ago, she received three left inferior alveolar injections, received a restoration in tooth 19 (mandibular left first molar), and the next day she had a severely limited opening. She returned to her dentist 1 week later with constant 1/10 dull/pressure pain from her left medial pterygoid muscle area and sharp 5–6/10 pain from the same area whenever she opened beyond her limited opening range.

Her general dentist found she could only open 17 mm and reproduced her pain by palpating her medial pterygoid muscle. She was provided TMD self-management instructions and prescribed 400-mg ibuprofen that she took every 6–8 hours, as needed for pain.

One week after seeing her general dentist, the patient related the ibuprofen was not beneficial and was not sure whether the heat was beneficial. She has constant 2/10 dull/pressure pain and momentary 8/10 sharp pain in the left medial pterygoid muscle area, approximately 10 times a day, when she

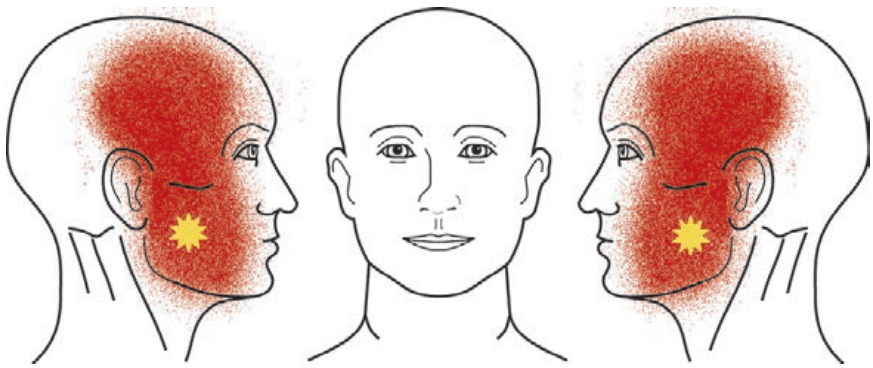
forgets to stay within her limited opening range.

Her range of motion was 17 mm opening and 5/5/5 (right lateral, left lateral, and protrusive). Palpation of her masticatory and cervical structures revealed tenderness was limited to her left medial pterygoid muscle, and this reproduced her pain. The patient did not have a swelling, lymphadenopathy, or fever, and she did not have a sense of her throat or airway closing.

The diagnosis was a left medial pterygoid spasm. The patient was instructed to stretch her medial pterygoid muscle (as depicted in Figure 8.1) 10 or more times a day and use heat for 10 minutes prior to each stretch whenever possible. Since the ibuprofen was not beneficial, the patient was prescribed diazepam 5 mg, 1–2 tablets h.s. p.r.n. for muscle pain.[13]

Clinical experience suggests this spasm would take approximately 2 weeks to resolve. If it did not resolve, care would have been escalated by referring the patient to a physical therapist. If the patient needed additional dental work performed in the mandibular left quadrant, I would ask the dentist to not perform another inferior alveolar injection until the patient was symptom-free for at least 2 weeks.

Case 9: Tension, Depression, and Poor Sleep as Contributing Factors



The patient related he had constant 6/10 bilateral preauricular and masseter muscle dull/pressure pain, and every morning he also had a 4/10 temporal headache. He related that his pain was worse when he awoke, again in the afternoon or evening, and it increased with mandibular function (e.g., eating). He also related that, during the usual day, he was tense all of the time, depressed half of the time, and could sleep only 4–6 hours because of insomnia. The patient also had constant 6/10 neck pain. His range of motion was 34 mm opening and 6/6/5 (right lateral, left lateral, and protrusive). Palpation of his masticatory and cervical structures revealed generalized tenderness of these muscles; his TMJs were not tender. Palpation of multiple muscle sites reproduced his pain, and palpation of his cervical musculature also reproduced his masticatory pain.

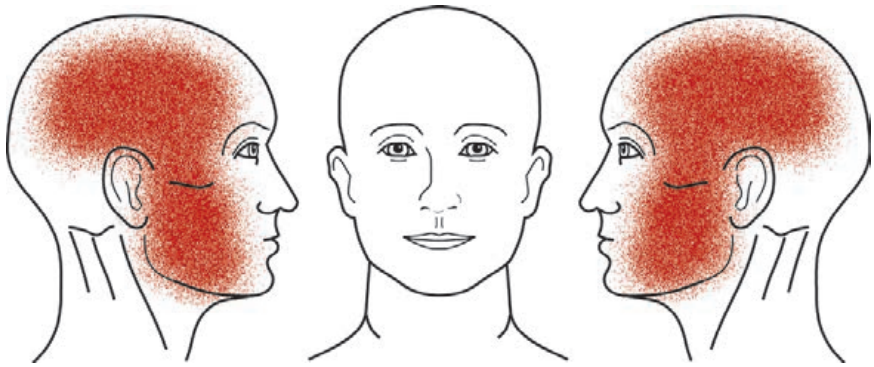
The TMD diagnosis was myalgia. The symptom pattern suggested both daytime and nighttime habits negatively affected his pain, with the nighttime habits being the greater contributor. Other identified contributors were tension, depression, and insomnia.

It was first explained to the patient how these factors contributed to his pain. He was informed how a psychologist could help him reduce his tension and depression, in addition

to teaching him habit reversal and relaxation (other needed therapies might also be identified by the psychologist). The possibility of referring the patient to a psychiatrist for medical management of his depression and insomnia was also discussed. The possibility of referral to a physical therapist for treatment of the cervical myofascial pain with referral was discussed. Such discussions help patients to realize the importance of these for adequately reducing their pain and to make the cost (price, time, etc.)–benefit decisions regarding which referrals they are open to receiving. Some patients initially decline certain referrals, but may be open to them later.

Initially, patients with these types of symptoms may be provided with this presentation followed by (1) the "TMD Self-Management Therapies" handout (Appendix 4), (2) "Closure Muscle-Stretching Exercise" handout (Appendix 6), (3) a stabilization appliance, and (4) whichever referrals patients are receptive to receiving. One of the more esthetic appliances could be fabricated and patients are asked to wear it temporarily for 24 hours a day, except when eating. The possibility of prescribing amitriptyline to help alleviate morning pain and improve insomnia should also be considered.

Case 10: Fibromyalgia as a Contributing Factor



The patient related he had constant 8/10 bilateral preauricular, masseter, and temple muscle dull/pressure pain, which was worse when he awoke and again in the evening, and it increased with mandibular function. He related he had constant 6/10 generalized muscle tenderness throughout his body, restless sleep, and generalized muscle soreness when he awoke that felt like he just did 1000 sit-ups. His range of motion was 45 mm opening and 8/8/7 (right lateral, left lateral, and protrusive). Palpation of his masticatory and cervical structures identified generalized tenderness of these structures, but no tenderness of his TMJs. Palpation of multiple muscle sites reproduced his pain.

He appeared to have a systemic disorder that was causing the constant 6/10 generalized muscle tenderness throughout his body. Since the masticatory symptoms were worse than his generalized body pain, local factors appeared to be making his masticatory symptoms more severe. Since his masticatory muscle palpation aggravated his pain, and no other TMD muscle diagnosis better described his condition, his TMD diagnosis was myalgia. His generalized body symptoms were consistent with fibromyalgia.

QUICK CONSULT

Deciding Whether Local Factors Are Contributing to Symptoms

If the masticatory symptoms are worse than the generalized body pain, local factors may be making the masticatory symptoms more severe.

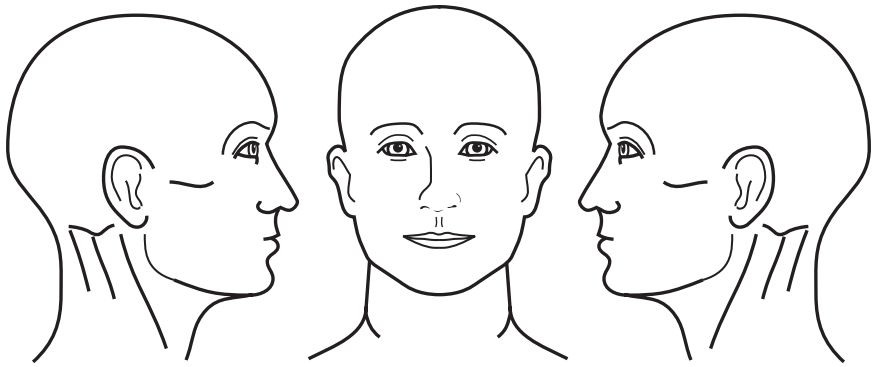
The patient's masticatory symptom pattern suggested nocturnal and daytime habits were probably contributing to his pain. The patient was first informed that studies suggest patients with widespread pain do not generally obtain the degree of TMD symptom improvement as most other TMD patients. It was explained how these factors are probably contributing to his masticatory pain problem and that the best results I could hope for by treating his masticatory TMD symptoms would be to reduce them to 6/10, as with the rest of his body. A referral to a physician to evaluate and manage his widespread pain and poor sleep quality was discussed.

FOCAL POINT

Patients with widespread pain are informed that studies suggest TMD patients with widespread pain do not generally obtain the degree of TMD symptom improvement as most other TMD patients.

He was initially provided with (1) the "TMD Self-Management Therapies" handout (Appendix 4), (2) "Closure Muscle-Stretching Exercise" handout (Appendix 6), (3) a stabilization appliance, and (4) referral to a physician for widespread pain (probable fibromyalgia) and poor sleep quality. If he did not obtain adequate improvement with his daytime symptoms, I would then consider referring him to a psychologist to learn habit reversal and relaxation.

Case 11: TMJ Disc Displacements and When to Treat Them: No Pain



The patient related that for the past year, he had a right TMJ click (which could be felt) every time he opened and closed his mouth (see "TMJ Disc–Condyle Complex Disorders" diagram, Appendix 3). He had noticed the noise was more prominent after eating tough foods or when stressed. His range of motion was 50 mm opening and 8/8/7 (right lateral, left lateral, and protrusive). Palpation of his masticatory and cervical structures revealed no tenderness.

The diagnosis was right TMJ disc displacement with reduction. Should this patient be provided with any treatment? A nonpainful disc displacement with reduction does not need to be treated.[1,14,15] The "TMJ Disc–Condyle Complex Disorders" diagram (Appendix 3) was discussed so he understood

the cause of the noise. He was informed that as with noises from other joints in the body, they do not need to be treated unless they cause discomfort. If discomfort occurred later, treatment would target the discomfort and may not have any effect on the noise. The patient was told he should return to my office for therapy if he developed discomfort (muscle or TMJ).

FOCAL POINT

A nonpainful disc displacement with reduction does not require treatment.

If a patient's TMJ made a loud TMJ pop, should the patient be treated for this? Sometimes patients have such a loud pop that it can be heard across the room, which may embarrass the patient, spouse, or friends to the degree that the patient wants the noise decreased. Conservative TMD therapies are not always effective in decreasing TMJ noise, and patients should be aware of this possibility prior to treatment. If the noise is a serious problem, and conservative therapy cannot satisfactorily reduce it, surgical intervention may be required. Patients who do undergo surgical intervention will probably continue to have some form of noise (crepitus, clicking, etc.) from the TMJ, but hopefully it will be less pronounced.

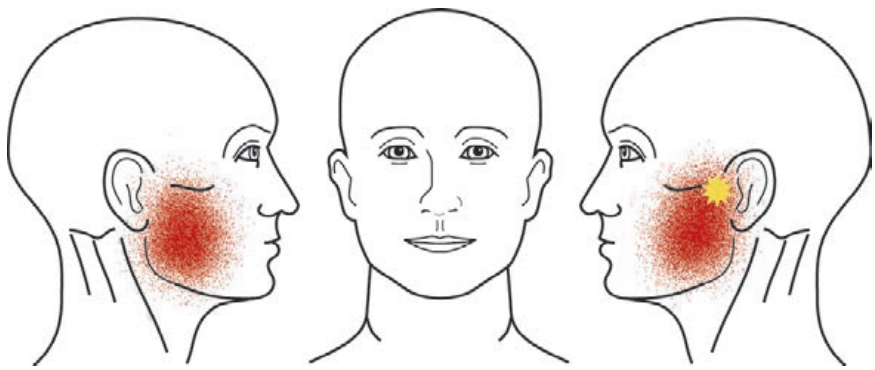
If a patient's noise is accompanied by intermittent catching or locking (disc displacement with reduction with intermittent locking), should the patient be treated for this? There is a concern that the patient's disorder may progress to a continuous lock (disc displacement without reduction with limited opening), which is difficult to treat and is the most common TMD disorder for which I refer patients to surgeons. For this reason, I recommend treating a patient who has intermittent catching or locking even though it may not be a significant problem.

QUICK CONSULT

Recommending Treatment for Intermittent Catching or Locking

I recommend treating a patient who has intermittent catching or locking even though it may not be a significant problem for the patient.

Case 12: TMJ Arthralgia



The patient related he had constant 3/10 bilateral preauricular and masseter dull/pressure pain that was worse when he awoke and would increase with mandibular function. He reported his left TMJ often clicked when he opened and closed his mouth, which could be felt. His range of motion was 36 mm opening and 6/6/5 (right lateral, left lateral, and protrusive). Palpation of his masticatory and cervical structures identified generalized

tenderness of the masticatory muscles and TMJs (the left TMJ most readily reproduced his pain and was the most tender), whereas the cervical structures were not tender.

The problem had three diagnoses—that is, primary, secondary, and tertiary diagnoses—that needed to be placed in the order of their contribution to the complaint. Since the primary complaint was pain, the structure that most readily reproduced his pain (the TMJ) was the primary contributor to his complaint. The diagnosis for TMJ palpation tenderness is TMJ arthralgia, so this would be the patient's primary TMD diagnosis. The muscles were also tender (to a lesser degree), and the diagnosis for muscle palpation tenderness is myalgia (when none of the other diagnoses better apply), so this would be the secondary TMD diagnosis. The patient also had a left TMJ click, which generally contributes minimally to a patient's pain. The diagnosis for a TMJ click is that the practitioner can feel is a disc displacement with reduction, so this patient's tertiary TMD diagnosis was left TMJ disc displacement with reduction.

TECHNICAL TIP

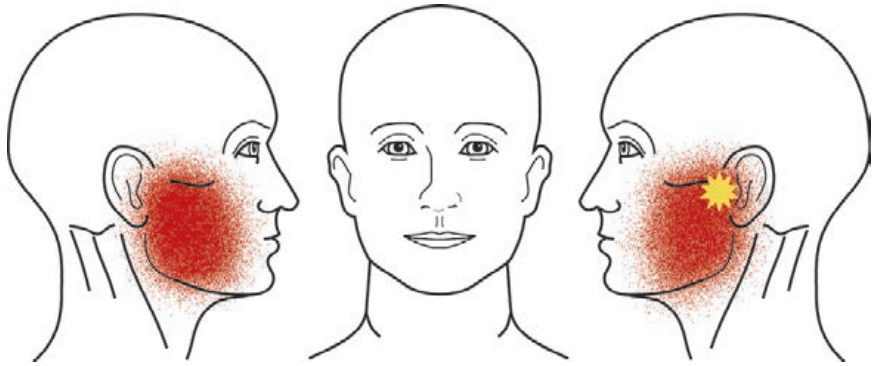
Recording Diagnoses

It is helpful to list the diagnoses (primary, secondary, tertiary, etc.) in the order of their contribution to a patient's complaint.

First the "TMJ Disc–Condyle Complex Disorders" diagram (Appendix 3) was discussed so he understood the cause of the noise. Since this young healthy man had no additional perpetuating factors, it was felt he would probably obtain satisfactory improvement from following the "TMD Self-Management Therapies" handout (Appendix 4) and a maxillary stabilization appliance worn at night. It was felt that a discussion of the self-management therapies and the carryover effect of the appliance worn at night would adequately resolve the daytime symptoms. If his daytime symptoms did not improve satisfactorily, then the therapies discussed in "Breaking Daytime Habits" in Chapter 16 would be implemented.

The patient had tender masticatory muscles, and the therapy presented in the "Closure Muscle-Stretching Exercise" handout (Appendix 6) is normally beneficial for tender or painful masticatory muscles. The problem is that these stretching exercises tend to aggravate the TMJs and, since his TMJ was quite tender, I was afraid the exercise might further aggravate his TMJ. The patient's pain severity was relatively low, and his TMJs may have tolerated the exercise, but, out of this concern, these stretching exercises were not offered to him.

Case 13: TMJ Disc Displacement with Reduction with Intermittent Locking



The patient related she had constant 5/10 bilateral preauricular and masseter dull/pressure pain that was worse in the evening and would increase with function. Her left TMJ continuously clicked when she opened and, two to three times a week, the disc blocked her from opening wide (beyond approximately 23 mm) and lasted seconds to minutes. The locking never occurred when she first awoke. When asked, she related she also had constant 5/10 neck pain. Her range of motion was 34 mm opening and 6/6/5 (right lateral, left lateral, and protrusive). Her left TMJ click could be felt. Palpation of her masticatory and cervical structures identified generalized tenderness of these structures, with the left TMJ most readily reproducing her pain and being the most tender. When palpating some of the patient's cervical trigger points, it reproduced some of her left preauricular pain.

The patient's problem had three TMD diagnoses and, since the primary complaint was pain, the structure that most readily reproduced her pain (the TMJ) was the primary contributor to her complaint, so the primary diagnosis was TMJ arthralgia. The masticatory muscles less readily reproduced her pain and were less tender, so the secondary diagnosis was myalgia. The clicking and intermittent locking was the final concern, and its diagnosis (and the tertiary TMD diagnosis) was left TMJ disc displacement with reduction with intermittent locking.

Since the patient's intermittent locking never occurred in the morning, I suggested her daytime parafunctional and/or muscle-tightening habits were greater contributors than were her nocturnal habits. This was supported by her greater symptom severity later in the day.

Another perpetuating contributing factor was her constant 5/10 neck pain. The referral pattern from her neck to her left preauricular area suggests her neck disorder could be contributing to her left preauricular pain, and the diagnosis for this disorder was myofascial pain with referral. Clinically, it appears that when TMD patients have neck pain they unconsciously hold more tension in their masticatory muscles. This may be the reason studies find TMD patients with neck pain do not respond as well to localized TMD therapies.[16,17]

The treatment provided to this patient was (1) using the "TMJ Disc–Condyle Complex Disorders" diagram (Appendix 3) explains the mechanism for her TMJ click and intermittent lock, and how her parafunctional habits and muscle tension contributed to this problem; (2) reviewing with her the "TMD Self-Management Therapies" handout (Appendix 4) and instructing her how to unlock her TMJ when it intermittently locks (provided in Table 10.1); (3) fabricating and inserting a stabilization appliance (one of the more esthetic appliances could be fabricated and the patient asked to wear it temporarily 24 hours a day, except when eating); (4) referring her to a physical therapist for treatment of her constant neck pain; (5) referring her for habit-reversal and relaxation therapy (if that does not satisfactorily relieve the daytime symptoms, we can escalate therapy); and (6) offering to prescribe 500-mg naproxen taken twice a day on an as-needed basis.

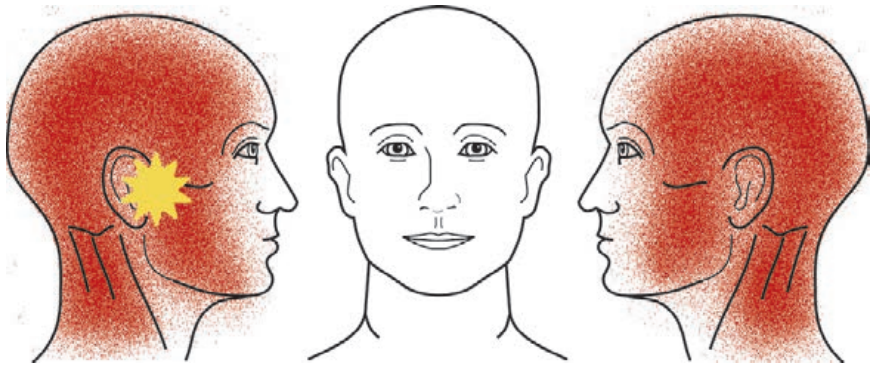
QUICK CONSULT

Observing an Intermittent Catching or Locking Pattern

The daytime pattern of a patient's intermittent catching or locking suggests the time of day when the primary contributing factors are occurring.

It is important to follow the patient to ensure the pain and intermittent locking are under control, because patients with either of these have been shown to have a greater propensity for this disorder progressing to the continuous form of locking (disc displacement without reduction with limited opening).[18,19]

Case 14: TMJ Disc Displacement without Reduction with Limited Opening: Unlocked



The patient related she had not worn her stabilization appliance the previous night, awoke with 4/10 right preauricular dull/pressure pain, and, an hour earlier, her right TMJ had locked (the disc blocks her from being able to open very wide) and would not unlock. She related she had constant 10/10 bilateral preauricular, masseter, temple, and neck pain. She also related that her right TMJ had not clicked or locked since it had been operated on for this problem a year ago.

Her range of motion was 19 mm opening and 5/1/3 (right lateral, left lateral, and protrusive). Palpation of her masticatory and cervical structures revealed their generalized tenderness, with exquisite tenderness of her right TMJ. These palpations aggravated her complaint, with the right TMJ reproducing the most intense portion of her pain. Palpation of her cervical muscles caused referred pain in her masticatory region.

What are the patient's TMD diagnoses? Since the TMJ arthralgia is due to the TMJ disc displacement without reduction with limited opening, the recommendations are to diagnose the TMJ disc displacement without reduction with limited opening as her primary TMD diagnosis, bilateral TMJ arthralgia as her secondary TMD diagnosis, and myalgia as her tertiary TMD diagnosis.

Should one attempt to unlock her right TMJ? Since it locked only an hour ago, I would recommend trying to unlock it. Techniques to unlock the TMJ and a technique to fabricate an immediate anterior positioning appliance that would be used once it is unlocked are discussed in Chapter 10.

Her condyle was reduced onto the disc (as depicted in Figure 10.2, Figure 10.3, and Figure 10.4), which was confirmed by observing that she regained a normal opening of 44 mm. Her mandible needed to be stabilized in this anterior position so the condyle would be maintained in the reduced disc–condyle position. If she were to retrude

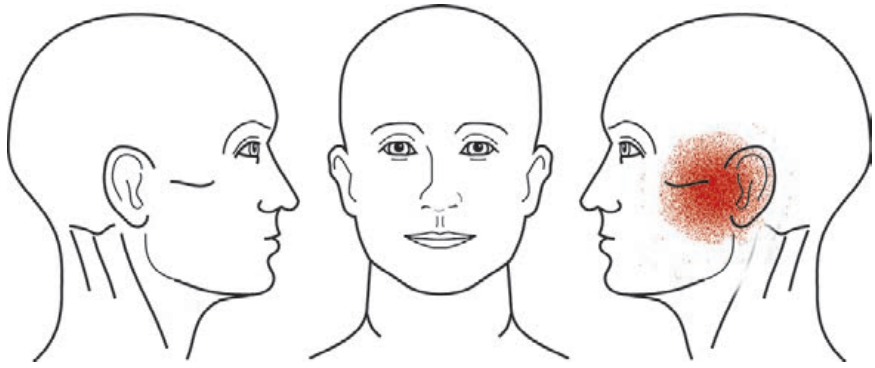
her mandible (i.e., close into maximum intercuspation), her condyle would move posterior off the disc, and her TMJ would probably lock again. Therefore, to stabilize her mandible in this position, a temporary anterior positioning appliance was immediately fabricated from the putty used for crown and bridge impressions (as shown in Figure 10.5 and Figure 10.6).

The patient related that her constant bilateral preauricular, masseter, temple, and neck pain had decreased from 10/10 to 9/10. She was instructed to wear the appliance 24 hours a day, including while eating, and was prescribed DexPak 6-Day TaperPak, taken as directed on the package; Naproxen 500 mg, 1 tablet b.i.d., starting on day 4 of the DexPak; and diazepam 5 mg, 1–2 tablets h.s. and 1/2 tablet in the morning and the afternoon, if that did not cause drowsiness. Patients are generally instructed to wear the temporary putty appliance 24 hours a day (including eating) for the first 2–4 days before transitioning to nighttime-only wear.[20] Patients modulate this transition with the propensity for the TMJ to lock again.

After 3 days, she transitioned from wearing the anterior positioning appliance to wearing her stabilization appliance 24 hours a day. Similarly, over time, she slowly reduced the daytime use of the stabilization appliance, again modulated by the propensity for her TMJ to lock.

She had been a patient of mine before and understood the mechanics of her TMJ disorder. She previously had a disc displacement without reduction with limited opening, which I could not resolve through conservative therapies, so she was referred to an oral surgeon. With magnetic resonance imaging (MRI), the oral surgeon found condylar bony irregularities, so he elected to perform open TMJ surgery to smooth them. It appeared to the surgeon and myself that the patient had significant psychosocial issues that were the primary contributor to her continued TMD symptoms. She was not interested in obtaining therapy for these issues and felt her TMD symptoms were satisfactorily minimal. Once this acute flare-up was resolved, she continued to wear her appliance at night and occasionally for short periods during the day.

Case 15: TMJ Disc Displacement without Reduction with Limited Opening: Not Unlocked



The patient related her left TMJ disc blocked her from opening wide. She had constant 6/10 left preauricular dull/pressure pain (worse later in the day) that increased with function and momentary 8/10 left preauricular sharp pain when she tried to

open wide, as depicted in Figure 10.1. Her range of motion was 21 mm opening and 2/5/4 (right lateral, left lateral, and protrusive). Palpation of her masticatory and cervical structures revealed tenderness was limited to her left TMJ, masseter, and temporalis muscles. The left TMJ was very tender and palpation most readily reproduced her pain complaint, whereas her masseter and temporalis muscles were less tender. In an attempt to confirm the source of her restriction, her jaw was stretched open beyond this limited opening to aggravate the restriction. She related this aggravation occurred within her left TMJ, suggesting that as the source of her restriction.

What were her TMD diagnoses? Since her primary complaint was that she could not open wide, left TMJ disc displacement without reduction with limited opening was her primary diagnosis. Her secondary complaint was her pain, so left TMJ arthralgia was the secondary diagnosis. She also had muscle tenderness, so the tertiary diagnosis was myalgia.

Should one attempt to unlock her left TMJ? More information was needed to make that decision. She related that her left TMJ started intermittently locking 5 months ago and had been continuously locked for approximately 6 weeks. She also related she was not willing to wear an anterior positioning appliance 24 hours a day. Since her TMJ had been locked for approximately 6 weeks, it is unlikely that her TMJ would unlock even if tried. One practitioner reported that manipulation to unlock the TMJ is often successful for patients who have been locked for less than a week, but the success rate decreases rapidly as the condition extends beyond 1 week.[20] Since she refused to wear an anterior positioning appliance 24 hours a day even if her TMJ could be unlocked, it would probably just lock again soon afterward. Thus, I did not attempt to unlock her TMJ.

It has been shown that patients with this disorder do not need to have their TMJ unlocked to regain their opening and minimize their symptoms. Over time, these patients often stretch their retrodiscal tissues through their normal oral activities, moving the disc sufficiently forward so the condyle translates freely, and patients regain their normal opening.[18,21] With the disc out of the way, there is no longer the mechanical interference within the TMJ, and the TMJ arthralgia reduces or resolves. If patients cannot stretch the retrodiscal tissue on their own, a TMJ injection with anesthetic, steroid, and/or sodium hyaluronate (not yet approved by the FDA for use in the TMJ) or arthrocentesis are generally very beneficial.[22–24]

FOCAL POINT

It has been shown that patients with a locked TMJ (TMJ disc displacement without reduction with limited opening) do not need to have it unlocked to regain their opening and minimize their symptoms.

Since the patient had not stretched her retrodiscal tissue on her own, I will ask her to forcibly stretch the retrodiscal tissue, which will cause more inflammatory and pain mediators to be released into the synovial fluid, thereby increasing her TMJ arthralgia. It is observed that as long as these patients have significant TMJ arthralgia, they generally refuse to aggravate their TMJ pain by stretching the retrodiscal tissue, so I must first minimize the inflammation to the degree possible with anti-inflammatory medications and then instruct them to perform stretching exercises, as shown in Figure 8.1.

I also refer these patients to a physical therapist knowledgeable with these disorders. Generally, she initially sees these patients two

to three times a week, provides heat followed by mobilization of the condyle, monitors the patient's progress, encourages the patient to stretch the retrodiscal tissue and break daytime muscle tightening habits, answers questions, and informs the patient when the stretching should be reduced and eventually stopped.

TECHNICAL TIP

Stretching Retrodiscal Tissue

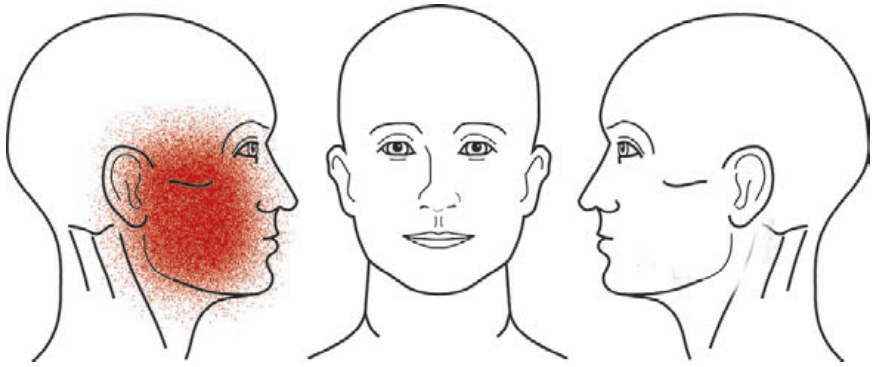
If patients have significant TMJ inflammation (arthralgia), I first minimize the inflammation to the degree possible with anti-inflammatory medications and then instruct them to perform stretching exercises, as shown in Figure 8.1.

This patient had related that during the intermittent locking phase, her TMJ locking always occurred later in the day, suggesting her daytime parafunctional and/or muscle-tightening habits were greater contributors to her locking than were her nocturnal habits. She also related that her current preauricular pain was worse later in the day, suggesting her daytime habits continued to be a more prominent problem for her than were the nocturnal habits.

She was provided the following treatment: (1) Using the "TMJ Disc–Condyle Complex Disorders" diagram (Appendix 3), I explained the mechanical interference that was occurring with her TMJ disc displacement without reduction with limited opening, how I planned for her to stretch the retrodiscal tissue so the disc would move anteriorly and she would regain her opening, and how her parafunctional habits and muscle tension contributed to her complaint (see Chapter 10). (2) The "TMD Self-Management Therapies" handout (Appendix 4) was reviewed with her. (3) To decrease the inflammation causing her TMJ arthralgia, she was prescribed DexPak 6-Day TaperPak, taken as directed on package and Naproxen 500 mg, 1 tablet b.i.d., starting on day 4 of the DexPak. To help decrease any TMJ loading that may be occurring from nighttime habits and to help keep the muscles relaxed during the day, she was also prescribed cyclobenzaprine (Flexeril) 5 mg, 1 to 2 tablets h.s. and 1 tablet in the morning and the afternoon, if it does not cause drowsiness. Cyclobenzaprine was prescribed rather than diazepam because anxiety did not appear to be contributing to her disorder. (4) She was instructed to perform the stretching exercise as shown in Figure 8.1, hold the stretch 30–60 seconds, and sporadically perform this approximately six times daily. It was explained that she needed to balance the amount of force, length of time the stretch was held, and its number of times performed throughout the day so the resulting TMJ aggravation was within her pain tolerance. She was also told that heating the TMJ with a heating pad for 10 minutes prior to performing the exercise usually allowed the retrodiscal tissue to stretch more, and it was recommended she continue the heat for a few minutes afterward. (5) She was referred to a physical therapist who would help mobilize the condyle, monitor her progress, and keep her appraised as to when she should reduce and stop the exercises. (6) She was offered a referral for habit-reversal and relaxation therapy to help her decrease her daytime muscle tightening habits.

The patient's progress was monitored to ensure her opening was increasing in a timely manner. If it was not, the patient would be offered a TMJ injection or a referral to evaluate the patient for arthrocentesis by an oral surgeon. Once the patient obtained her normal opening, she would be reevaluated for any residual TMD symptoms and treated accordingly.

Case 16: Osteitis Causing Inability to Open Wide



The patient related her right TMJ was locked, restricting her from fully opening her mouth. Tooth 1 (maxillary right third molar) had been extracted 5 days earlier, it was a difficult extraction, and "the surgeon put a lot of force on my jaw." She also related the pain from the extraction was completely gone, but she had constant 6–7/10 right preauricular and facial pain that increases with function.

The findings on periapical radiography of the extraction site were within normal limits (no root tips or fractured adjacent teeth were noted). Her range of motion was 25 mm opening and 3/5/3 (right lateral, left lateral, and protrusive). When patients move their mandible to the right, the left condyle translates and when patients move their mandible to the left, the right condyle translates. If this patient's right TMJ was "locked," she would have limited movement to the left, but her movement to the left was not restricted in comparison to her other movements. Hence, her left TMJ appeared to not have a translation problem.

Palpation of her masticatory and cervical structures revealed tenderness limited primarily to her right masseter, medial pterygoid muscles, and lateral pterygoid areas. The muscle palpation aggravated her pain, and her right TMJ was minimally tender. In an attempt to confirm the source of her restriction, her jaw was stretched open beyond this limited opening (as shown in Figure 1.2), and this caused aggravation within the general area of these tender muscles. These findings suggested that her disorder was a primary muscle disorder (myositis, spasm, or myalgia) and not related to her right TMJ.

This patient was seen at the end of the day on a Friday in our emergency clinic. I had been called to this clinic to do a quick assessment and make recommendations. Since my assessment was that her problem was of muscle origin, I reviewed the "TMD Self-Management Therapies" handout (Appendix 4) with her and recommended to the dentist that he prescribe her 800 mg ibuprofen, 1 tablet q.i.d.; and 5 mg diazepam, 1–2 tablets h.s. and 1/2 tablet in morning and afternoon, if that did not cause drowsiness. She made an appointment to see me first thing on Monday morning so I could perform a comprehensive TMD evaluation, observe for changes in her signs and symptoms, and recommend revisions in her therapy. After I left, the patient convinced the dentist that she also needed acetaminophen with codeine (Tylenol 3) for her pain, and he also prescribed that.

On Monday morning, the patient reported that her pain and her opening had not improved. She related the diazepam relaxed her, but it took the acetaminophen with

codeine (Tylenol 3) to relieve her pain. This did not make sense to me, because, if her disorder was caused by the muscles, once they relaxed from the diazepam, her pain should have decreased and the opening should have increased. Once she completed the "Initial Patient Questionnaire," it was discovered that cold beverages increased her pain, but she was not sure which tooth the cold liquid touched to cause the aggravation. While palpating her muscles and TMJs, it was observed that their tenderness had not changed and that none of the palpations reproduced her complaint.

My thoughts were that she may have an acute pulpalgia from a tooth in the area causing these symptoms. Bitewing radiographs revealed she had no large restorations or cavities on her right side. My next thought was of a possible osteitis in the extraction site, so her extraction site was irrigated, which reproduced her complaint. We packed the extraction site, and her pain was eliminated within 15 minutes. The next morning her opening was back to normal (46 mm).

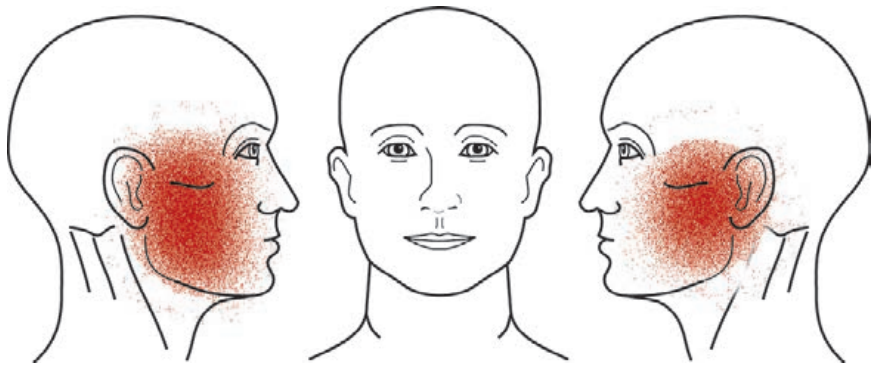
Occasionally, patients inadvertently lead practitioners into an erroneous thought process such as this. To arrive at the proper diagnosis, it is important to evaluate a patient's signs and symptoms (including those obtained from the "Initial Patient Questionnaire") and reproduce the chief complaint(s). When I palpated her muscles on Friday, the patient stated I was aggravating her pain, but when I inquired on Monday whether this was the same pain as her complaint, she said it was not.

QUICK CONSULT

Watching for Incorrect Assumptions

Occasionally, patients inadvertently lead practitioners into an erroneous thought process.

Case 17: Lateral Pterygoid Spasm



The patient related she could no longer interdigitate her right posterior teeth, could no longer open her mouth wide, and had constant 6/10 bilateral preauricular and masseter area dull/pressure pain (right much worse than left). Her pain was aggravated by trying to bite on her right posterior teeth, which caused a sustained 10/10 right preauricular sharp pain as long as she was biting. Her range of motion was 25 mm opening and 8/4/6 (right lateral, left lateral, and protrusive).

A sudden occlusal change generally suggests the lateral pterygoid muscle is holding the condyle in a partially translated position, as depicted in Figure 9.1. This most commonly occurs from (1) an ipsilateral lateral pterygoid spasm bracing the condyle in a translated position, (2) an inflamed ipsilateral retrodiscal tissue pushing the condyle forward, and/or (3) an inflamed ipsilateral retrodiscal tissue causing the lateral pterygoid muscle to contract (protective muscle splinting) and hold the condyle in a partially translated position so as not to impinge the inflamed retrodiscal tissue. As she bites into MI, the teeth force the condyle posterior and can cause pain by stretching the spasm and/or impinging the inflamed retrodiscal tissue.

When individuals have a lateral pterygoid spasm (similar to a spasm in the calf muscle), they cannot stretch the muscle (for the teeth occlude into MI), and they cannot contract the muscle (for the condyle to translate). The inability to translate the ipsilateral condyle causes them to have a limited opening and contralateral movements, as with this patient having a 25 mm opening and 8/4/6 (right lateral, left lateral, and protrusive). Clinically, the degree to which this occurs varies with the severity of the lateral pterygoid spasm. Limited translation can also occur with TMJ arthralgia.

The patient was asked to lie back in the dental chair, relax her mandible with it slightly open, and close her teeth together slowly. It was observed that her left canines were repeatedly the first teeth to contact, even though her teeth appeared to have normal alignment. This further suggests the right condyle is in a partially translated position.

Palpation of her masticatory and cervical structures revealed generalized tenderness of the masticatory structures, with the greatest tenderness in the right lateral pterygoid area, followed by the bilateral masseter, anterior region of the temporalis muscles, and left lateral pterygoid area, then followed by the TMJs. Masticatory palpations reproduced her pain. The right lateral pterygoid area was exquisitely tender, and the patient felt that its palpation exacerbated the most intense portion of her pain.

The symptoms and clinical exam most suggest that the disorder is a right lateral pterygoid spasm. To confirm this and determine whether inflamed retrodiscal tissue is contributing to this disorder, I slowly stretched the lateral pterygoid muscle as depicted in Figure 9.2.

When performing this stretch, I stretch to tolerance, and if there is no aggravation of the symptoms, I hold the stretch for 30 seconds, rest for 5 seconds, and repeat this five more times. These patients generally relate this reduces their pain and enables them to better occlude their teeth, which confirms a lateral pterygoid spasm is the primary cause for their symptoms. If the stretch causes pain, I immediately stop, and this suggests that inflamed retrodiscal tissue is being compressed and the inflamed tissue is contributing to their disorder. Patients with TMJ arthralgia involvement relate this pain aggravation comes from within their TMJ, and their TMJ arthralgia needs to be treated as discussed in this book. If it caused or contributed to a sudden occlusal change, I would prescribe the DexPak 6-Day TaperPak-naproxen regimen or 500-mg naproxen, 1 tablet b.i.d. until the occlusal problem resolved.

This patient related that there was no pain upon stretching, so I continued the stretch for 30 seconds, rested for 5 seconds, and continued a sequence of six stretches. The patient then related that her right preauricular pain reduced to a 2/10, and she could fully occlude her teeth into MI. My clinical diagnoses for her were a primary diagnosis of right lateral pterygoid spasm, a secondary

diagnosis of myalgia, and a tertiary diagnosis of bilateral TMJ arthralgia.

The lateral pterygoid spasm is the most common disorder I see among the referred emergency TMD patients. Patients and their dentists are often frantic because it frequently develops immediately, and patients can no longer close their teeth into MI or open wide. Occasionally, this occurs after dental treatment, creating quite a bit of anxiety for the dentist.

QUICK CONSULT

Observing for Lateral Pterygoid Muscle Spasm

The lateral pterygoid muscle spasm is the most common disorder I see among the referred emergency TMD patients. Patients and their dentists are often frantic because it frequently develops immediately, and patients can no longer close their teeth into maximum intercuspation or open wide.

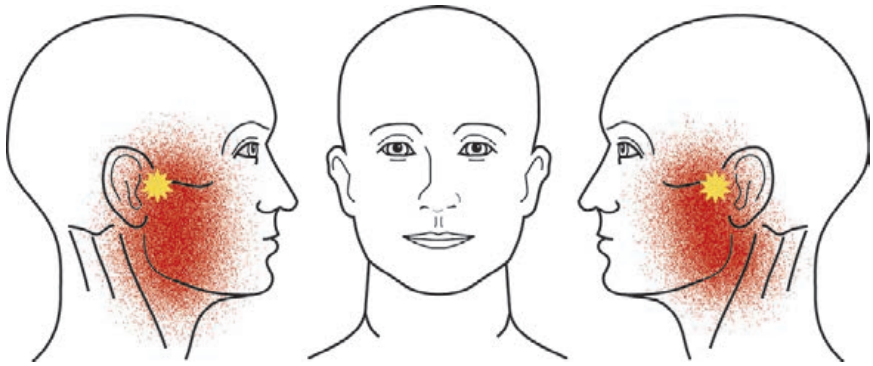
This patient was provided with the following treatment: (1) The drawing on the top left portion of the "TMJ Disc–Condyle Complex Disorders" diagram (Appendix 3) was used to explain the mechanics of her lateral pterygoid spasm symptoms. (2) The "TMD Self-Management Therapies" handout was reviewed with her. (3) An exercise to stretch the lateral pterygoid muscle, as depicted in Figure 9.2, was demonstrated to her, and she practiced the exercise to ensure she could properly perform it. She was asked to perform this stretch as a series of six stretches, six times a day, holding each stretch for 30 seconds with a five second rest between stretches. (Keep in mind the TMD-stretching exercise handout (Appendix 6) is for closure muscles and will probably aggravate a lateral pterygoid spasm.) (4) She was prescribed 5-mg diazepam, 1–2 tablets h.s., to relax the lateral pterygoid muscle and 500-mg naproxen, 1 tablet b.i.d., to alleviate the TMJ arthralgia and prevent it from being aggravated by the stretching exercises.

The great majority of my patients with a lateral pterygoid spasm report this therapy resolves or controls their symptoms to the degree that they do not desire to escalate therapy. If these initial therapies do not resolve the spasm or if the spasm continues to recur, then traditional TMD therapies (e.g., occlusal appliance therapy, or identifying and changing contributing factors) should be implemented and have been shown to be beneficial.

For a more complete explanation of diagnosis, stretching, and treatments for lateral pterygoid spasm, please see Chapter 9, "Lateral Pterygoid Spasm." Since the inability to close into MI is due to a temporary condition, it is important the practitioner does not adjust the occlusion at this transitory position.

Keep in mind that other, rarely observed disorders may cause similar symptoms (and are beyond the scope of this book). I once observed an individual with an external ear infection that similarly caused the patient to be unable to close into maximum intercuspation. The patient clearly knew the ear was the source of his pain and inability to close into MI; additionally, his opening was not restricted. If a patient does not respond to initial therapy adequately or there is cause for other concerns, the practitioner may desire to take a screening image of the TMJ with a plain (e.g., transcranial) radiograph or panoramic radiograph.

Case 18: Acute Exacerbation of TMD



The patient related she was in town for a week-long continuing education course and for the past 4 days had severe exacerbation of her TMD symptoms. Her usual pain was 5/10 bilateral preauricular dull/pressure pain that occurred every day and increased with function; it was never present when she awoke. For the past 4 days, she had constant 7/10 bilateral preauricular and masseter dull/pressure pain without daily variation and momentary 8/10 bilateral preauricular sharp pain when she opened wide.

Her range of motion was 30 mm opening and 5/5/4 (right lateral, left lateral, and protrusive). I could feel her bilateral TMJ clicks on opening and closing. Palpation of her masticatory and cervical structures revealed generalized tenderness of her masticatory muscles, with her TMJs being the most tender and her posterior digastric muscles being second most painful. Masticatory palpations reproduced her pain, and palpation of the TMJs most intensely reproduced her complaint.

What were her TMD diagnoses? The primary diagnosis was bilateral TMJ arthralgia, the secondary diagnosis was myalgia, and the tertiary diagnosis was bilateral TMJ disc displacement with reduction.

The patient reported she had received the following treatments for her TMD symptoms: (1) A maxillary acrylic stabilization appliance that she wore only at night. She reported this was not beneficial and, since her usual symptoms were primarily caused by daytime habits, I would have expected her not to obtain significant improvement from it. (2) She took 20-mg amitriptyline (a tricyclic antidepressant) at bedtime. She reported this was also not beneficial and, since her usual symptoms were primarily due to daytime habits, I would similarly have expected her not to obtain significant improvement from it. (3) Biofeedback (recommended for daytime symptoms), which she felt provided her minimal benefit. I was surprised that this did not provide her significant symptom improvement. In discussing her treatment, she related that she was taught to relax while in the therapist's quiet tranquil environment, but she had not been taught to transfer that ability into her normal environment. She was told that since she could now relax in his office, her treatment was complete. Therefore, I understood the reason she did not have a

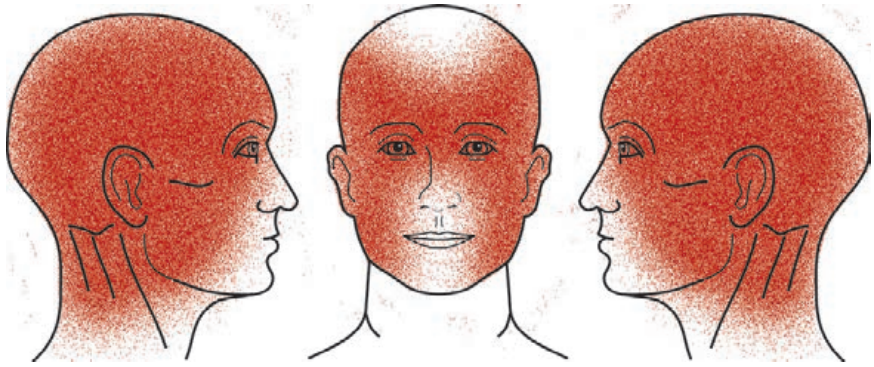
better symptom response. For learning to relax in the therapist's office is only the first step of this treatment, next the patient must be taught to continually maintain this relaxed state throughout the day, especially during the times of stress and when intensely focused on something (e.g., driving, working on the computer).

She was provided with the following treatment for the acute exacerbation: (1) The "TMJ Disc–Condyle Complex Disorders" diagram (Appendix 3) was used to explain visually the mechanism of her TMJ clicking and how her parafunctional habits and muscle tension contributed to the loading of her TMJs and their arthralgia. (2) The "TMD Self-Management Therapies" handout was reviewed with her. She was informed that the pain in her posterior digastric muscles (jaw opening muscles) suggested that she had a habit of repeatedly opening her mouth wide in an attempt to stretch or free her restricted opening. She was asked to observe for this and stop the habit, and her normal opening should return once she reduced her TMJ arthralgia. (3) Since she had been taught to relax, she was asked to try to implement this training every 5 minutes. She was to try to obtain and continually maintain the relaxed state she achieved in her therapist's office. (4) She was advised that she could temporarily use her stabilization appliance more often than only at night. The maxillary appliance is unesthetic, so I was sure she would not wear it in public, but would wear it more often when she was in her hotel room. (5) She was prescribed the following medications for the acute exacerbation of her chronic pain: DexPak 6-Day TaperPak, taken as directed on the package; 500-mg naproxen, 1 tablet b.i.d., starting on day 4 of the DexPak; and 5-mg diazepam, 1–2 tablets h.s. and 1/2 tablet in morning and afternoon, if that did not cause drowsiness.

A few options were feasible if she wanted to escalate therapy once she returned home: (1) It was recommended that the treating dentist refer her to a psychologist to provide her with habit-reversal training and teach her to implement relaxation and biofeedback training into her daily life. If indicated, the psychologist may also desire to provide her with coping skills and other therapies. (2) The practitioner may want to provide her with a more esthetic appliance that she would wear temporarily 24 hours a day, except when eating. (3) If the practitioner felt comfortable in prescribing a tricyclic antidepressant, I recommended prescribing her 25-mg desipramine taken in the morning and afternoon, to determine whether this reduced her symptoms and had minimal side effects.

If these additions to her therapy did not improve her symptoms satisfactorily, I recommended considering the following therapies in the order presented: (1) referral to a physical therapist to evaluate her for other contributors (e.g., neck pain or body mechanics at her workstation) and implementation of local modality therapies (e.g., iontophoresis to her TMJs); (2) alteration of her maxillary stabilization appliance to an anterior positioning appliance, if she met the criteria (provided in Chapter 13, "Anterior Positioning Appliance") for this appliance; or (3) referral for surgical evaluation, if she continued to have moderate to severe pain primarily from the TMJ and her parafunctional habits and other contributing factors had been controlled to the extent possible through conservative therapy.

Case 19: Multiple Forms of Head and Neck Pain after Crown Insertion



The patient related that since crowns on teeth 18 and 19 (mandibular left first and second molars) were placed a year ago, she had multiple forms of head and neck pain, including (1) 10/10 eye pain, once a week, that started as tightness in the back of her neck and progressed to throbbing pain in her right eye, associated with nausea and photophobia lasting 4–5 hours; (2) constant 6–7/10 bilateral temple dull/pressure pain that was worse in the evening and when eating; (3) constant 5/10 neck pain; and (4) 3/10 bilateral maxillary and frontal sinus area pain two to three times a week.

Her range of motion was 51 mm opening and 9/9/7 (right lateral, left lateral, and protrusive). Palpation of her masticatory and cervical structures revealed generalized tenderness of these structures, and her muscles were more tender than her TMJs. These palpations did not reproduce her eye pain, but they revealed temporalis tenderness that reproduced her temple headache, and palpations of the sinuses revealed tenderness that reproduced her sinus area pain.

Evaluation of her occlusion revealed her occlusal contacts appeared evenly distributed on all of her posterior teeth in maximum intercuspation. Accufilm marks of her excursive movements revealed no contacts on crowns 18 and 19, except for a very slight centric relation to maximum intercuspation slide, with much heavier marks with this movement on other posterior teeth.

Do you believe the occlusion on crowns 18 and 19 is the cause of her symptoms? Do you believe that adjusting the very slight centric relation to maximum intercuspation slide on these crowns would alleviate the pain? Since she had fairly even posterior maximum intercuspation contacts, and the slides were heavier on other teeth, it was felt her occlusion was playing only a very minor role in her TMD pain and that adjustment of the slide on these crowns would not change her symptoms.

It was felt the reason she associated her pain with the placement of the crowns could run along a continuum between the following: (1) She was very predisposed to TMD, and her masticatory system could not tolerate the normal strain needed for these procedures, which a normal patient has no problem tolerating. (2) She was not predisposed to TMD, and her masticatory system was subjected to unnecessary overstretching and/or prolonged procedures. The pain could have also started at that time by coincidence; that is, the dental procedure may have coincided with her starting a new job or with other stressors that were developing in her life.

Understandably, prior to performing dental treatment, it is prudent to inquire about TMD symptoms and perform a cursory TMD evaluation. Performing a cursory TMD evaluation on all dental patients by measuring

their opening and checking for tenderness in the anterior region of the temporalis and masseter muscles, TMJs, and lateral pterygoid areas (Table 8.1) is recommended. Additionally, palpations can be performed if further evaluation is indicated.

FOCAL POINT

Prior to performing dental treatment, it is prudent to inquire about TMD symptoms and perform a cursory TMD evaluation.

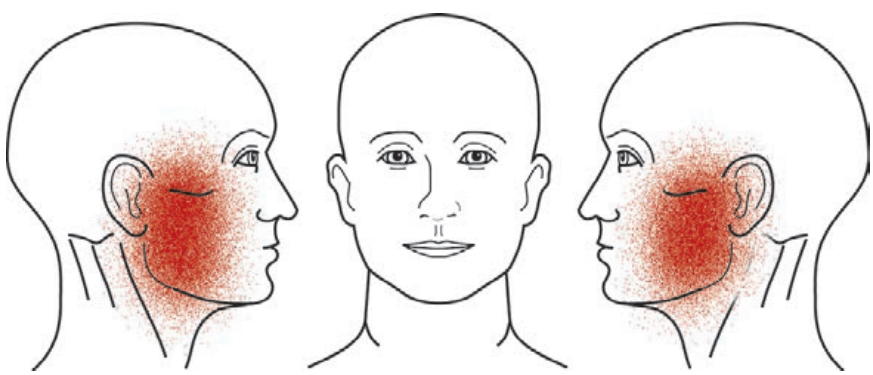
The patient was informed that since her eye pain could not be reproduced, I did not know what its source or sources were. It could be created by a local problem, be migraine pain, be referred from a different area (e.g., the neck), be a more central problem (highly unlikely), or be a combination of these. She was informed that the tightness in the back of her neck that occurred just prior to her eye pain could be a sign that her eye pain is coming from the neck, could indicate that the neck muscles are tightening in response to the beginning of the eye pain, or could be in response to a source that is behind both pains. She was given the choice of referral to a neurologist or first seeing what response she had from neck treatment by a physical therapist. Since she had constant 5/10 neck pain, she preferred to be referred to a physical therapist first and, if eye pain did not improve satisfactorily, then be referred to a neurologist.

Palpation of the temporalis muscles reproduced her temporal headache. She was informed that this is due to TMD and could be treated with standard TMD therapies. Her TMD diagnoses were myalgia and bilateral TMJ arthralgia. Recommendations for treatment of chronic headache patients are provided in Table 1.3.

For these TMD symptoms, she was provided with (1) the "TMD Self-Management Therapies" handout (Appendix 4), (2) the "Closure Muscle-Stretching Exercise" handout (Appendix 6), (3) one of the more esthetic stabilization appliances that she would wear temporarily 24 hours a day, except when eating, (4) a referral for habit-reversal and relaxation therapy; and (5) the choice of taking 800-mg ibuprofen, 1 tablet t.i.d. p.r.n. Patients tend to tighten their masticatory muscles in response to other pains (e.g., neck or sinus pain), so obtaining relief of these other pains is also important.

The patient was informed that since her maxillary and frontal sinus pain could be increased only by applying pressure over her sinuses, I believed this pain was due to chronic sinusitis. She related that she was aware this pain could be relieved with decongestants. We discussed her seeing her primary medical provider for this. She wanted to delay this and asked me to prescribe her a decongestant to be used when she had the pain, which I did.

CASE 20: APPLIANCE THAT POSITIONED CONDYLES INTO THEIR "PROPER POSITION"



The patient related she needed to wear her appliance 24 hours a day, even when eating, otherwise she had intolerable TMD pain. She had constant 3/10 bilateral preauricular and masseter dull/pressure pain that increases with function even with continuous wear of her occlusal positioning appliance. When she removed her appliance and closed into maximum intercuspation, her pain increased greatly.

Her range of motion was 30 mm opening and 5/5/5 (right lateral, left lateral, and protrusive). Palpation of her masticatory and cervical structures revealed generalized tenderness of her masticatory muscles and, to a lesser degree, her TMJs; the palpations reproduced her pain. Her primary diagnosis was myalgia and secondary diagnosis was TMJ arthralgia.

She related that she had constant 6/10 bilateral preauricular and masseter pain 2 years ago. Her dentist used sophisticated technology to determine the "proper positions" of her condyles and made her an occlusal appliance with occlusal indentations that positioned her mandible so the condyles were located in these positions. To reduce her TMD symptoms further, she was told that she needed orthognathic surgery and braces to align her teeth so they interdigitated at the position her condyles had been placed.

She was attempting to join the military, and I was responsible for screening recruits to identify those who had such significant TMD that they could not be deployed. I discussed with the recruit her desire to enter the service, how we are not equipped to repair or make occlusal appliances for deployed personnel who broke or lost their appliance, how the stress of the military would affect her TMD symptoms, and our limited ability to provide her with orthognathic surgery and braces as she desired.

Despite this, she still wanted to enter the service. She was informed that she had to demonstrate she could tolerate not wearing her appliance. She was provided the "TMD Self-Management Therapies" handout (Appendix 4) and "Closure Muscle-Stretching Exercise" handout (Appendix 6), which were reviewed with her, and it was suggested that she use these instructions. She left her appliance with me, worked with these instructions, and returned to my office 1 week later.

When she returned, she related that her symptoms had decreased and she could now occlude into maximum intercuspation without any symptom increase. I approved her for entering the service, returned her appliance, and asked her to wear it only at night. She was offered additional TMD therapies and joined our habit-reversal and relaxation therapy class.

She returned 2 weeks later stating her symptoms had continued to decrease, but now her appliance positioned her condyles so they were uncomfortable in that position. Her appliance was adjusted so it was the standard stabilization appliance. The patient applied the knowledge gained from our class, used her stabilization appliance at night, and was symptom-free a few weeks later.

The condyle's position within the mandibular fossa varies greatly among healthy individuals and there is no scientifically determined ideal condylar positioned.[25] There are different groups that each advocate using their specific technique to position the condyle into a specific location that each group believes is the best condylar position. One study compared appliances fabricated using a conventional jaw posture technique with appliances fabricated using the Myomonitor (to obtain the myocentric position). The results showed no significant EMG activity difference from clenching on the two appliances, and the appliance fabricated with the conventional jaw posture had a more positive EMG activity result.[1,26]

I am not aware of a better method for positioning the mandible on appliances than

what has been recommended in this book. Using one of these other systems appears to be a waste of time and money.

TECHNICAL TIP

Positioning the Mandible

I am not aware of a better method for positioning the mandible on appliances than what has been recommended in this book.

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Part VI

Fundamentals of Clinical Studies

Designs of and Advice for Performing Clinical Studies

The chief reason I perform clinical studies is that I have burning questions for which I want to determine the answer. I am generally surprised by some aspects of the results, because I had not previously speculated them. Almost every clinical trial I have performed has caused me to alter some portion of my diagnostic and/or treatment procedures and recommendations.

QUICK CONSULT

Determining which Clinical Study to Perform

I choose clinical studies that will answer one of my burning questions.

The degree of motivation needed to obtain the answer and publish the results should not be underestimated because the process is so time-consuming that there is a great tendency to quit prior to completing the process. Among clinical studies that are completed and have results presented in abstract form, less than half are subsequently published as journal articles. The most common reason that results of clinical studies are not published is that investigators are too busy to write the manuscript.[1]

Literature Review

Prior to performing a clinical study, I read everything I can find on the subject. PubMed is a good source for information, it is maintained by the National Library of Medicine, and its use is free to the profession. PubMed can be accessed at http://www.ncbi.nlm.nih.gov/pubmed. As I read prior similar studies, I observe what the investigators used as their measurement tools (e.g., palpation tenderness, pain diaries) and note their study designs, speculated theories, follow-up time periods, and patient population sources.

FOCAL POINT

Prior to performing a clinical study, I read everything I can find on this subject and observe for what measurement tools, designs, follow-up time periods, and patient populations other studies used.

Manual of Temporomandibular Disorders, Third Edition. Edward F. Wright.

The Cochrane Library manages systematic reviews that have been written on many healthcare subjects and a review of your subject or one close to it may be found on their website. Abstracts can be viewed for free and they can be accessed at http://www.thecochranelibrary.com/view/0/index.html.

Study Population

In temporomandibular disorder (TMD), we generally discuss four populations that can be evaluated, and each may require a different level of therapy for the individual to obtain satisfactory symptom relief. The first population consists of individuals who have minor symptoms that are not severe enough to cause the person to seek care. When an investigator does not have a sufficient patient pool, he or she may advertise to the general population and offer to pay individuals for participation as a subject in the study. This may cause the investigator to primarily study individuals with such minor TMD symptoms that these subjects may obtain satisfactory symptom relief with a different level of therapy than necessary for individuals who have symptoms severe enough to seek treatment.

A second population consists of individuals who complain to their general dentists about TMD symptoms. If the general dentist is not able to obtain satisfactory symptom relief with his or her usual treatment, the patient is generally referred to a dentist in the community who is considered to be the local TMD "expert." This dentist's TMD patients comprise the third population.

Around the country are tertiary care TMD facilities, with many located at dental schools. The dentists at these facilities generally have advanced training in TMD and orofacial pain, and the facility may have in-house adjunctive staff, such as a physical therapist and/or psychologist. The patient pool at these facilities is the fourth population and generally requires a higher level of treatment to obtain satisfactory symptom relief.

Whenever I read a TMD study, I consider the population that was evaluated and whether the results from the study are generalizable to the patients I treat. This may need to be taken into consideration when you contemplate the population you plan for your study.

Institutional Review Board (IRB) Approval

Another concern when performing a clinical trial is to ensure the subjects are ethically treated. Institutional Review Boards (IRBs) have been established at all institutions that receive federal grants for human studies, for example, universities with health science programs, hospitals, and military bases. These institutions made an agreement (referred to as the Common Rule) with the federal government that all of their employees or agents of the institution will obtain IRB approval prior to performing a clinical trial. IRB approval ensures that the subjects will be treated ethically.[2] Having a study approved by an IRB also provides some protection for the investigator.

The salaries of the IRB members are paid by the institution, so if you are not associated with an institution that has an IRB, you may need to ask someone from an institution with one to collaborate on the study. Many journal editors decline manuscripts if the study was performed without IRB approval.[3] I want IRB approval for all studies I perform, because I do not want to be challenged about the ethical treatment of my subjects, and I do not want to limit submitting my manuscripts to only journals that do not reject them for which IRB approval was not obtained.

TECHNICAL TIP

Working with an IRB

An institution pays the salaries of their IRB members, so to utilize an institution's IRB, the investigator may need to ask someone from that institution to collaborate on the study.

Developing Study's Parameters

If this will be your first clinical trial, start with a small trial and try to work with a mentor experienced in conducting clinical trials. A series of excellent articles, written by a journal's editorial board and experienced researcher-presenters, was published and would most likely be helpful to beginning investigators in formulating the research project,[3–5] with poster or abstract presentations,[6–9] and with writing the manuscript.[3,4,6,10–12]

As you start to contemplate the burning question that you think could and should be answered, work at developing a formal research question, called the hypothesis, in a way that can be answered with "true" or "false." As your thoughts develop about the study design, number of subjects, inclusion and exclusion criteria, and measurements (must be valid, reliable, and the standard being used), discuss these with your mentor and statistician. If your mentor or statistician has previously worked with the institution's IRB that you plan to use, he or she can probably provide you with insight on potential problems the IRB will have with certain aspects of your study design.

I have never received funding for a study, so I try to design my studies so the patients will benefit from participating in the study, for example, free or reduced cost for the evaluation or treatment. You will want some enticement for patients to join your study, or you will probably have problems recruiting patients. Funded studies often pay their patients to participate, which is generally a sufficient incentive.

Poor study design is one of the most common reasons a manuscript is rejected for publication.[3] Patient flow diagrams are recommended to help investigators better comprehend potential difficulties with the study design; they are also associated with improved quality of randomized clinical trial (RCT) reporting and are appearing more frequently in clinical trial publications.[6,13]

TECHNICAL TIP

Importance of Study Design

Poor study design is one of the most common reasons a manuscript is rejected for publication.

Strengthening Your Study

There are more than a hundred grading scales used by various medical publications to rate the quality of a study and amount of strength to give the recommendations. To obtain a perception of how your clinical trial may be rated and how you could strengthen it, you could evaluate it with the Strength-of-Recommendation Taxonomy (SORT). It is explained and can be downloaded without cost at http://www.aafp.org/online/en/home/publications/journals/afp/afpsort.html.

Once the study proposal has received IRB approval, you should register your study with the U.S. National Library of Medicine (http://www.clinicaltrials.gov). The registration documents the various aspects of the study to ensure that the investigator does not change these if the results are different than anticipated. When submitting the manuscript to some journals, the author must report whether or not the study was registered at this website.[14]

You will find that many journals have limits on the length of manuscripts that they will publish, making it challenging to include features that various rating systems use to rate studies or to include the interesting observations made during the study. In my early years of publishing my studies, I made the mistake of not including some features that would have brought about a better rating for the studies. These studies subsequently received a lower rating in systematic reviews than they deserved and were possibly excluded because the features were not included. The reviewing authors justifiably assume that if it was not mentioned, it was not performed. I therefore encourage you to become knowledgeable about the features used to rate studies and include them in your manuscript.

Additional means of strengthening your study are provided throughout this chapter.

Writing and Submitting Manuscript

I personally find it best to write the manuscript while the study is being performed and I am still exceedingly enthusiastic about the topic. The introduction and methods are easily completed based upon the research done prior to initiating the study and the design chosen. The results and discussion are speculated based upon what I anticipate the results will show, and I alter these as relevant articles are published and my results are obtained. I find, and others have told me, that once the results are obtained, one naturally loses enthusiasm for the topic and the motivation to write the manuscript.

FOCAL POINT

I find it best to write the manuscript while the study is being performed and I am still exceedingly enthusiastic about the topic.

Once the study is completed, I feel a moral obligation to disseminate the newly obtained knowledge, and I find that scientific journals are eager to publish these clinical manuscripts. My experience in submitting manuscripts to journals is that (1) the writer must have performed a thorough background literature search and fully comprehend the material, (2) the manuscript must be very well written, and (3) tables, illustrations, and/or photographs make the information more easily comprehended and the manuscript more attractive and thereby more likely to be accepted.[15,16] Editors assume that the attention to detail that was given to the writing, grammar, and references are reflective of the attention to detail that was given to conducting the clinical trial, so precision is critical.[17]

Select a journal that publishes articles similar to your manuscript and follow the journal's Author's Guidelines to the letter. Submit your manuscript with a brief cover letter that explains the importance of the information within your manuscript and how it supports the journal's mission.[18] Keep in mind that almost no unsolicited research study or other original observation manuscript is published without needing to be revised.[3]

If a publisher asks me to revise and resubmit my manuscript, I consider this as being provisionally accepted and I try to make all changes the reviewers requested. Be polite and positive when responding to the criticisms of your manuscript because the editor chose these individuals to review your manuscript, and these individuals donate their time to help improve your work. It is best to begin by thanking the reviewers for their comments and express that their recommendations will improve the value of the manuscript. It is also recommended that you respond to each criticism and explain the changes that you made to correct the perceived problem.[16,18,19] If any criticism is inappropriate or impossible

to make, I state that and substantiate it with references whenever possible.[20] Only once has a journal not eventually accepted my manuscript after asking me to revise and resubmit it.

If you are interested in having an article published and this will be your first publication, I recommend you start by submitting a literature review, clinical technique report, or case report. I recommend you first review journals that publish articles in your interest area and determine which journals publish the type of article you plan to submit. Read several of these articles and try to mold your thoughts into the chosen journal's desired format.

Practice-Based Research

If you are a private practitioner, the easiest option for conducting clinical research is to join the National Dental Practice-Based Research Network (http://www.nationaldentalpbrn.org/). This organization is primarily funded by the National Institute of Dental and Craniofacial Research (NIDCR), which is part of the National Institutes of Health (NIH). They will provide you with the training you will need, you will receive continuing education credit for certain training and orientation modules, and you will receive financial remuneration for the time you spend doing the research. They are currently trying to enroll 5000 dentists and hygienists, there is no enrollment or membership fees, and enrollment can be done through their above-mentioned website. Select "Testimonials" on their website to hear the reasons private practitioners enjoyed participating with their research.

It generally takes about 17 years for published researches to be implemented as common clinical practice,[2] and it is theorized that practice-based research will greatly shorten this time lag.[21] Additionally, about 90% of the dental care is provided in a practice-based setting, while only 2% of the published research is from a practice-based setting, and this network will help to change this disparity.[22] There have been numerous publications from the network on subjects such as questionable occlusal caries lesions[23] and restorative treatment thresholds for proximal caries.[24] A long list of their publications is available on their website.

There are also practice-based research networks outside the United States, for example, the Scottish Dental Practice Based Research Network (http://www.sdpbrn.org.uk/). If your practice is outside of the continental United States, you can ask your local dental school if there is a practice-based research network in your area.

Prominent Clinical Study Designs

The following are the prominent clinical study designs, which are in a general ranking from least to most rigorous. These designs are not all encompassing, and some studies do not fall into any of the designs.

Despite case reports and reports of case series are sometimes considered inferior to other scientific publications, they have an important role in the progression of our knowledge. They provide many new ideas and potential treatments, they permit discovery of new disorders or unexpected outcomes (adverse or beneficial), and they play an important role in our education. These publications are sometimes the basis for which future clinical trials are performed.

FOCAL POINT

Case reports and reports of case series have an important role in the progression of our knowledge.

The cohort, case-control, and cross-sectional study designs are **observational studies** because they do not use a treatment intervention. If you are considering performing a study of one of these types, I recommend you read the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement that was written by methodologists, researchers, and journal editors. It is accessible from http://www.strobe-statement.org and has checklists for cohort, case-control, and cross-sectional studies. The statement has many excellent recommendations that would be beneficial for any clinical trial manuscript.

There is similarly Consolidated Standards of Reporting of Trials (CONSORT) criteria to assist authors in reporting RCTs. It was formulated by investigators and editors, has been revised as a response to feedback, and is available at http://www.consort-statement.org. It consists of checklists for the Title, Abstract, Methods, Results, and Discussion sections, in addition to a recommended patient flow diagram.[2] The statement similarly has excellent recommendations that would be helpful in the preparation of any clinical trial manuscript.

Case Report

This report may alert readers about potential rare disorders, iatrogenic problems that may occur, innovative techniques, or new potentially effective treatments. Readers cannot draw efficacy conclusions about recommended treatments presented in these reports because these reports usually only discuss one or a few patients treated and do not have a control group for comparison.[25] Readers must always be cautious about generalizing information into their practice from a case report about one individual. For instance, in a study of unadjusted soft appliances, the number of subjects who reported TMD symptom improvement, no change, and aggravation were one, two, and six, respectively.[26] Unknowingly, the case report could have involved the one individual who obtained TMD symptom improvement from the unadjusted soft appliance.

FOCAL POINT

> One must be cautious about generalizing information into their practice from a case report about one individual.

The case report may describe an unusual observation, such as that of a patient of mine who had bilateral preauricular pain and tinnitus, in which both symptoms were temporarily eliminated after I performed a ligamentary injection along tooth 8. The patient had an acute pulpalgia of tooth 8, and, once the tooth received root canal therapy, these symptoms greatly subsided.[27] This type of case report informs readers that this phenomenon exists.

A case report may describe an observation in which no intervention was provided. For example, a case report could have been written about a routine panoramic radiograph, in which the practitioner observed that his patient had a condyle fractured at its neck and considerably malpositioned. The practitioner may have also determined the patient's occlusion was not affected by the lack of condylar support and that the patient had no palpation tenderness or TMD symptoms. This report would suggest some individuals with fractured condyles do well without surgical intervention.

Case reports are important for developing our knowledge base. The last two case report examples may have been the foundation in which it was later determined which TMD-like symptoms suggest the symptoms may actually be due to a tooth pulpalgia or which

condylar fractures do not need to be treated.[28,29] Since case reports are discussions of diagnoses and/or treatments thought to have been the best for the patient or a few patients, IRB approval is not indicated.

Case Series Study

A case series reports the observations of a series of individuals (cases), is retrospective or prospective (Figure VI.1), and has no control group for comparison. Similar to the case report, since the study does not have a control group, one cannot make an efficacy comparison.[30]

A large number of my publications are of this category, in which I diagnose and treat my patients in my usual manner and report observations. It is fairly easy to obtain IRB approval for studies where the practitioners do not deviate from their usual diagnosis and treatment methods. Also, I have never received funding for my studies, and with this study design, I have not needed to pay my patients for participating.

A case series may report a disorder and prevalence. For example, I palpated the masticatory muscles, cervical muscles, and temporomandibular joints (TMJs) of 230 TMD patients during their initial exam and asked whether the palpation caused pain in an area different from where I palpated. If it did, I documented the location of my palpation and drew on a diagram of the head and neck regions the outline of where the referred pain was perceived. Once the study was completed, I made maps of the more common and less common referred pain sites (where the pain was perceived) for each source (Figure 3.15). I also made maps so practitioners could determine the most likely sources of referred pain for the various sites where the patient perceived the pain (Figure 3.14).[31] Dentists may find these maps helpful for a patient who, for example, is referred due to ear pain, and the physician states there is no otologic cause for this pain and asks the dentist to identify and treat the referred pain source.

In another case series, I expanded the acute pulpalgia case report I had previously published by adding 10 more patients. With the group of patients with this disorder, I was able to identify common symptoms that would suggest which patients with TMD-like symptoms may actually have symptoms caused or enhanced by an acute pulpalgia. I also added diagnostic tests that practitioners could use to identify patients with this disorder, plus treatment strategies for these teeth.[28] This information was also placed in "Intraoral Examination" in Chapter 3.

A case series may also report experimental treatments the author has found beneficial.

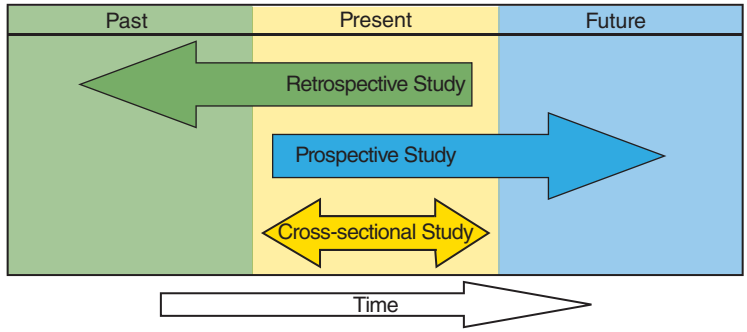

Figure VI.1. The time period over which the various studies evaluate their findings.

From this type of a case series, I read about one of the techniques I use for patients who have difficulty unlocking a disc displacement without reduction with limited opening. In this technique, the patient is instructed to first move his or her mandible as far as possible to the contralateral side and then open as wide as possible. This generally enables the condyle to reduce onto the disc and allows the patient to regain his or her normal opening.[32]

A case series may also report the effect of treatment. I performed several studies in which I followed changes in the ear symptoms after TMD therapies and attempted to determine clinical predictors to identify those patients who have a high probability of obtaining ear symptom improvement from TMD therapies. I began this series of studies by only evaluating tinnitus improvement obtained from TMD therapies.[33,34] After knowing of the results of this study, an otolaryngologist was interested in performing a similar study. He referred me patients with tinnitus, otalgia, and dizziness, and I treated them with only a stabilization appliance and TMD self-management instructions (limited to these therapies at the otolaryngologist's request).[35] After observing many patients had improvement with each of these ear symptoms and additional improvement was obtained from adjunctive TMD therapies, I expanded my next study further. I then followed the ear symptoms of TMD patients with tinnitus, otalgia, dizziness, and vertigo who received the TMD therapies that I thought would be most appropriate to resolve each patient's TMD symptoms. I was able to identify predictors for which patients have a high likelihood of obtaining ear symptom improvement from TMD therapies.[36]

When you read a study or evaluate your own data, observe whether the treatment you rendered provided clinically significant benefit. It is possible that the data suggest the treatment provided **statistically** significant benefit, but the benefit may not be **clinically** significant. So always observe the amount of improvement that was obtained and consider whether this is worth the treatment. A statistically significant difference is most likely to occur when the number of subjects is high, as in the study where 124 subjects received orthognathic surgery and the results showed the subjects had statistically significant TMD symptom improvement, but the authors brought to our attention that this represented only a small clinical TMD symptom improvement.[37]

TECHNICAL TIP

Statistical Significance

Always observe whether statistically significant data represent a clinically significant improvement.

Cross-Sectional Study

This is an observational study that measures specific features within a group, at a particular point in time or over a short period (see Figure VI.1). Its purpose is generally to measure the prevalence of specific features.[38] For example, individuals without TMD symptoms or TMJ noise received MRI of their TMJs, and investigators found 25–38% of the subjects had a displaced TMJ disc.[39,40] These studies suggest that a displaced disc is a fairly common condition.

I used this study design to resolve one of my burning questions. Previously, some practitioners claimed that a high percentage of TMD patients actually have an undiagnosed rheumatologic disorder and recommended serologic testing for all TMD patients or for TMD patients who did not respond adequately to initial therapy. So I referred 103 consecutive TMD patients to a rheumatologist

who evaluated them for rheumatologic disorders. Only one subject was identified with an inflammatory or autoimmune disorder, and the two most common rheumatologic disorders identified were nonmasticatory myalgia and fibromyalgia. It has been shown that TMD patients with myalgia of the cervical region or with fibromyalgia do not respond to TMD therapy as well as other TMD patients.[41–43]

Among the 103 subjects in my study, the rheumatologist found 15% had undiagnosed myalgia within the cervical region and 20% (compared with 4% in the general population[44]) had undiagnosed fibromyalgia (to the degree that they desired treatment). Some of the patients had both disorders, so 31% of these TMD patients had an undiagnosed rheumatic disorder that could negatively impact their TMD symptoms and treatment outcome.[43]

Myalgia and fibromyalgia diagnoses are made through a history and clinical examination, not through serologic testing. This study validated questions to alert practitioners about a patient potentially having one of these disorders, and these questions were placed into the "Initial Patient Questionnaire" (Chapter 2 and Appendix 2). Based upon the findings of this study, I recommend when practitioners evaluate a TMD patient, they use this "Initial Patient Questionnaire" to identify these patients in addition to other potentially important factors. Based upon the results of this study, I do not recommend routine serologic testing of TMD patients and this study suggests few TMD patients have an inflammatory or autoimmune disorder.[43]

Case-Control Study

This is an observational retrospective study design in which individuals who developed the disease (the case group) are compared with individuals who did not develop the disease (the control group). Subjects are asked historical questions to determine the risk factors for developing the disease. Individuals in each group are commonly matched (e.g., age, gender, education) to reduce bias. This study design might be used to identify risk factors for lung cancer by comparing answers from patients with lung cancer (the case group) with individuals who did not develop lung cancer (the control group). The investigator might ask about speculated risk factors, such as whether the individuals smoked and average number of cigarettes smoked each day.[38]

The TMD literature does not have many true case-control studies, probably because patient remembrance of TMD symptoms and risk factors would not be sufficiently accurate. TMD risk factors have been identified primarily through cohort studies, in which oral examinations, TMD palpations, TMJ imaging, and questionnaires were sequentially performed over a period of 10–20 years.[45–48]

Cohort Study

This is an observational study also to determine the risk factors for a disease. It is generally a prospective study but can be a retrospective study (see Figure VI.1). In the prospective design, disease-free individuals are recruited into the study, overtime exposures are recorded; some of the individuals develop the disease, and the various exposures are evaluated to determine whether they are risk factors for the disease.[49]

An example of a prospective cohort study is the European Prospective Investigation into Cancer (EPIC) study being conducted among more than 500,000 people in 10 European countries. In this study, many dietary and

other factors are being evaluated as to whether they are risk factors or protective factors for different forms of cancer.[50]

Some cohort TMD studies have been similarly performed to determine TMD risk factors. Oral examinations, TMD palpations, TMJ imaging, and questionnaires were sequentially performed over 10–20 years to determine associations between various potential risk factors and the level of TMD signs and symptoms.[45–48]

One study found oral parafunctional habits were the primary risk factor for developing TMD and predict the need for TMD therapy, while occlusal interferences were only weakly associated with TMD signs and symptoms. The study additionally found individuals who receive orthodontic therapy during adolescence were not at an increased risk for developing TMD.[45] Another study found the primary risk factors for individuals developing TMD were oral parafunctional habits, tooth wear, TMJ clicking, and a deep bite, while the risk factors for individuals developing TMJ clicking were tooth wear and history of nocturnal tooth grinding.[46] A third study found TMD symptoms tend to become more prevalent as one ages from 17 to 28, the symptom severity fluctuates over time, and males tend to recover from TMD symptoms more readily than females.[47]

Nonrandomized Clinical Trial

In this study design, subjects are treated with a therapeutic intervention, and the changes in outcomes are compared with the control group or during the control phase. There are five choices for **managing the control group or control phase**: (1) no-treatment control, (2) placebo control, (3) standard-of-care control, (4) subjects are their own control, and (5) historical control.

TECHNICAL TIP

Control Group Choices

There are five choices for managing the control group or control phase: (1) no-treatment control, (2) placebo control, (3) standard-of-care control, (4) subjects are their own control, and (5) historical control.

The **no-treatment control** may involve a clinical trial design with two or more groups in which one of the groups is not provided treatment. Another form of no-treatment control could involve patients who are on a treatment waiting list, in which they are followed over a period of time; this form of no-treatment control is called a **waiting-list control group**. A third form could involve a single group in which the subjects are followed for a no-treatment control phase followed by receiving the treatment, called a **delayed-treatment control**.

An example of a delayed-treatment control in a nonrandomized clinical trial involved 20 headache patients, referred to me by a neurology nurse practitioner. The patients completed a headache survey and began their headache duration/intensity, TMD duration/intensity, and medication intake diaries immediately after they stated their interest in participating in this clinical trial. A few weeks later I evaluated them for the clinical trial, and, if they met the inclusion and exclusion criteria, I made impressions and interocclusal records for stabilization appliances. About 2 weeks later, I inserted the appliances, provided TMD self-management instructions, and asked subjects to again complete the headache survey and to continue their diaries; this provided a delay treatment control phase that averaged a little more than 5 weeks.[51]

My goal for this clinical trial was to determine clinical predictors so that physicians

could identify those headache patients who would most benefit from TMD self-management instructions and a stabilization appliance. The subjects had great variations in the degree of headache improvement obtained, but no clear clinical predictors emerged to identify those headache patients who would benefit most from these therapies. An interesting caveat that did emerge was that patients with tension-type, migraine without aura, and migraine with aura headaches equally benefited from these therapies.[51] A recommended protocol for chronic headaches patients is provided in Table 1.3.

A **placebo control** is easily performed in pharmaceutical clinical trials in which one group is provided the medication being evaluated and the other is given a placebo medication that generally looks identical to the evaluated medication. The placebo medication can be formulated to cause no biological effect or can contain a substance that provides some of the anticipated side effects of the evaluated medication, helping to keep the subjects and the study's staff members from identifying which medication subjects received. Subjects are generally not aware of which medication they received, so they are **masked (blinded)** as to which group they have been assigned. It may also be easy to mask the study's staff members as to which medication subjects receive; this is a **double-masked (double-blinded)** study.[52] If the study's staff is aware of the subjects' group assignments, it is possible that unconscious statements could enable subjects to determine the groups to which they have been assigned, potentially affecting subjects' outcome measures and causing bias in the study's results. If the evaluator is not masked to the subjects' group assignments, the evaluator may unconsciously perform the evaluations or interpret the outcomes differently and bias the study's results.

TECHNICAL TIP

Importance of Masking Subjects' Group Assignments from Staff

If the study's staff is aware of the subjects' group assignments, it is possible that unconscious statements could enable subjects to determine the groups to which they have been assigned.

It is difficult to provide a true placebo in TMD clinical trials, but through your literature review, you may find or be able to improve upon another study's placebo control. One innovative clinical trial evaluated the TMD symptom changes that occurred after removing subjects' major occlusal interferences. Subjects were randomized into two groups, and subjects in the treatment group had their most significant occlusal interferences adjusted in the traditional manner. Subjects in the placebo group were treated in the identical manner with the same amount of time spent "adjusting" their most significant occlusal interferences. The only difference was that, prior to a placebo group member being "treated," the head of the bur was cut off and the bur was placed backward in the handpiece, so the polished shaft ran against the interference that was supposedly being reduced.[53] For information about this study's results, see Chapter 18 and Figure 18.1.

As eluded to in this example, it is also important to try to keep the amount of time the subjects interact with the study staff and investigators equal for each group. Otherwise, there is a tendency for the subjects in the group who had more interaction time to develop a better subject–staff relationship, unconsciously rating their treatment as better and biasing the study's results.

The **standard-of-care control** is commonly used in TMD clinical trials. This is the control that investigators will generally use when they want to evaluate whether a proposed treatment is better than the current standard of care or a less expensive therapy. One such clinical trial randomized TMD patients into either an adjusted hard acrylic stabilization appliance group or an adjusted soft thermoplastic stabilization appliance group. The appliances were fabricated and adjusted by one dentist, and a second dentist, masked to the subject's group, evaluated the subjects. The subjects in both groups obtained the same reduction in masticatory muscle pain.[54]

FOCAL POINT

The standard-of-care control is commonly used in TMD clinical trials.

Subjects as their own control may be used in dental clinical trials, that is, comparing two restorations that are placed in the same patient and comparing periodontal changes on one side of the mouth with the other side. In TMD clinical trials, the investigators may compare one of the subject's sides with the other or may use a cross-over design discussed later in the "Cross-Over Randomized Clinical Trials" section.

A **historical control** (or retrospective control) is the least desirable control to use.[5] An example would be where the data from a prior control group are used to compare with data from the treatment group. Many concerns arise, for example, was there a difference in the two populations, the two settings, and the subject–staff interactions? It would be more appropriate to use a new control, and if the investigators want to, they could compare the two studies' control groups in the discussion section of the manuscript.[5]

Another concern when designing the study is deciding how frequent and for how long after the intervention **follow-up evaluations** should be performed. The period needs to be long enough after the intervention to account for the treatment effect and potential problems. If the study is evaluating restorative materials or procedures, a minimum of 3–5 years may be necessary.[55] In TMD, this greatly varies with what is being evaluated; your literature review will give you information as to what other investigators have felt has been appropriate.

You also need to be concerned with the number of subjects who **drop out** of the study. If you have a high number of subjects who dropped out of your TMD treatment group, this may suggest that the treatment has not been effective, that subjects have not had relief of pain, and that they left the study to obtain relief from an alternative treatment. It is also normal for some subjects to move from the area or for an occasional subject to have only participated to receive the free treatment, having had no intention of abiding by his or her follow-up agreement. This is the reason that when subjects are paid for participating in a study, a large percentage of the payment is generally provided at the final visit. Several groups reviewing Cochrane studies allowed the percent lost to follow-up to be between 10 and 30%.[56] If the follow-up period is short, the percentage lost should be small in comparison with studies with a long follow-up period.

Randomized Controlled Trial

This trial design randomly assigns subjects to two or more groups (one is often a control group). The random assignment attempts to equally distribute the known and unknown variables among the groups, but it does not guarantee that all relevant prognostic factors

will be equally distributed. There are many techniques for randomizing subjects to the groups, and I recommend that you discuss the most practical forms for your proposed study with your statistician.

There are **four control groups that can be used in an RCT**: (1) no-treatment control, (2) placebo control, (3) standard-of-care control, and (4) subjects are their own control. These four types are discussed earlier in the "Nonrandomized Clinical Trial" section. The previously discussed waiting-list control, delayed-treatment control, and historical control could not be used in an RCT. The importance of masking subjects and study team members as to which group subjects are assigned, the importance of keeping subject–staff interactions equal for each group, follow-up evaluations, and subject dropout are also discussed in that section and would apply to RCTs.

There are two basic designs of RCTs. The most common design is the **parallel-group form**, in which subjects are randomized into the groups and subjects sequentially follow that group's protocol. Another RCT design is the **cross-over RCT**, in which all subjects receive the same interventions, but the order in which two or more interventions are applied is randomized.

Parallel-Group Randomized Clinical Trial

RCTs are the gold standard for making treatment effectiveness decisions, but it was felt that researchers needed better guidance for how to perform and report them. Therefore, an international group of clinical trialists, statisticians, epidemiologists, and biomedical journal editors developed the CONSORT Statement, which is available at http://www.consort-statement.org. It contains checklists for the Title, Abstract, Methods, Results, and Discussion sections, in addition to a recommended patient flow diagram.[57] Some journals ask their authors submitting RCT manuscripts to adhere to the CONSORT guidelines.[58]

One study used the CONSORT criteria to evaluate RCTs for TMD therapies and found that over the years, the quality of studies has improved and are more aligned with the criteria. The authors also provide additional recommendations for researchers planning to perform an RCT.[59]

I performed two parallel-group RCTs related to TMD. One of those had three groups: (1) a well-adjusted soft stabilization appliance, (2) TMD self-management instructions, and (3) a no-treatment control group. Subjects provided the soft stabilization appliance obtained significant TMD symptom improvement, subjects provided the TMD self-management obtained nonsignificant TMD symptom improvement, and subjects in the no-treatment control group had a slight increase in their TMD symptoms.[60]

Prior to performing the second parallel-group RCTs, I had observed that some patients obtain significant TMD symptom improvement from posture training alone, and I had heard about a TMD clinic that primarily treated its TMD patients through posture training. There had been several studies that compared the posture of TMD patients with nonpatients, without convincing results. I felt we needed to know whether posture training is beneficial and, if so, how beneficial posture training is for TMD patients.

Working with a very astute physical therapist and statistician, we devised a protocol for my TMD patients. Upon completion of my initial TMD evaluation, patients who met the inclusion and exclusion criteria and enrolled in the study were provided TMD self-management instructions. They were then randomized into a posture-exercise group or a no-additional-treatment control group. This design provided a disparity in the subject–staff interactions, but

the physical therapist felt that any placebo exercise could provide a posture change and recommended against it. The study was justifiably criticized for this weakness.[60] The posture-improving exercises that the physical therapist thought would be the most effective in improving my patients' posture are provided in Appendix 7, "Posture Improvement Exercises," and the study results are discussed in "Posture Exercises" in Chapter 14.

Cross-Over Randomized Clinical Trials

This is an excellent design to use when the effects from an evaluation or treatment can be completely eliminated because it uses the subjects as their own controls. This design generally contains one intervention or control, a "washout" phase lasting several days to a week to ensure the effects are completely eliminated, followed by another intervention or control. This design may contain more than two interventions or control phases with washout periods between each.

This design has been used to evaluate which chewing or clenching activities promoted TMD symptoms,[61] whether taking estrogen increased an individual's susceptibility for developing TMD symptoms,[62] whether taking a sleep medication was beneficial for TMD symptoms,[63] and whether wearing various appliances was beneficial for relieving TMD symptoms.[64]

One cross-over study I often cite, supporting the need to carefully adjust soft stabilization appliances, is one in which symptom-free bruxing subjects were provided a well-adjusted hard acrylic stabilization appliance and a soft stabilization appliance that was not adjusted in excursive jaw positions. The subjects were randomly assigned as to which appliance each received first, both groups had a 1-week washout period in which they did not use any appliance, and then each subject received the other appliance. When the 10 subjects wore the hard acrylic appliance, 8 had a significant reduction of muscle activity, but when they wore the soft appliance, only 1 had a significant reduction of muscle activity and 5 had a significant increase in muscle activity.[64]

Other Types of Publications You May Want to Consider

The following are not clinical trials, but they synthesize previously published information to provide additional information to the profession.

Literature Reviews

A literature review can be over a specific subject that is not well understood by many dentists. A colleague and I disagreed about how teeth with cracked tooth syndrome should be managed, so I performed a literature review to better learn how to diagnose and manage them. After synthesizing the information, I wrote a manuscript to help other dentists better comprehend this information.[65]

I performed similar literature reviews on the NTI and the soft stabilization appliances.[66,67] I enjoy performing these reviews because they expand my knowledge in an area I would like to learn more about, and publishers have been very receptive to publishing these clinical reviews. I believe it is important to organize and present the synthesized material in the most easily comprehendible manner possible, and photographs or illustrations are often needed to help explain the concepts presented. If you have not previously had your work published in a scientific journal, I recommend you begin with this type of literature review or a case report.

FOCAL POINT

If you have not previously had your work published in a scientific journal, I recommend you begin with a literature review or case report.

Systematic Reviews

We are continually inundated with information, some reliable and some unreliable. It is estimated that every day the biomedical literature presents another 75 trials and 11 systematic reviews.[20]

Systematic reviews were developed in the 1990s to provide a systematic approach to handling the large amount of information accumulating in the medical literature. The quality of systematic reviews greatly varies, their methodology quality continues to improve, and they are often considered the highest level of research evidence. PubMed (http://www.ncbi.nlm.nih.gov/pubmed/) and the Cochrane Library (http://www.thecochranelibrary.com/view/0/index.html) are excellent locations for viewing them; both websites provide their abstracts free of charge.[68,69]

Systematic reviews have been published on many aspects of TMD. In reading these reviews, there are two criticisms that I occasionally find. The first is that since the author has reviewed all of the quality literature on a subject, I would like to know the conclusion about the investigated subject, while some authors just provide a conclusion about the quality of the literature. The second is that it appears some other authors allow their personal biases to influence what they write in their discussions and conclusions.

If you plan to write a systematic review, the two most commonly used tools to assess these are the Overview Quality Assessment Questionnaire (OQAQ) and the Assessment of Multiple Systematic Reviews (AMSTAR),[70] so you should become familiar with these prior to writing the review. The OQAQ is provided in Oxman et al.[71] and the AMSTAR is available at http://www.nccmt.ca/registry/view/eng/97.html.

A systematic review is extremely time-consuming to perform. It entails a comprehensive search of relevant studies, uses rigorous methods for appraisal, collection, and synthesis of data, and should provide more reliable and accurate conclusions. They often include a meta-analysis of homogeneous data from comparable studies.[69,72]

FOCAL POINT

Systematic reviews are extremely time-consuming to perform.

Meta-Analyses

These are reviews of prior studies that statistically pool the data from two or more comparable clinical trials. It became popular in the medical literature around the 1980s, and now hundreds of meta-analyses are published in the medical literature each year. They generally combine data to estimate the effectiveness of a particular intervention.[73]

In order to improve the quality of meta-analyses, an international group that included experienced authors and methodologists developed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement, which consists of a checklist and a flow diagram. This statement can be found through the website http://www.prisma-statement.org/ and is provided in the free publication by Moher et al.[74]

If you are planning to perform a meta-analysis, I recommend you follow the PRISMA statement and work with a statistician experienced with meta-analyses. An

example of a systematic reviews and meta-analyses in the TMD literature is one in which intraoral orthopedic appliances were evaluated and data were statistically pooled when the studies were sufficiently similar.[75]

Considerations in Assessing Clinical Trials

There are more than a hundred grading scales used to assess a study's quality and the importance of its results.[76] The following is not meant to provide another rating system but just to provide a list of general thoughts that may be pondered when reading the report of a clinical study.

Hypothesis: Was the study's hypothesis appropriate for our current state of knowledge on this subject?
Ethics: Were the provided interventions (or nonintervention) ethically appropriate to perform on humans?
Generalizable: To what patient population are the results generalizable? Are these the patients you treat?
Randomization: Were the subjects randomized to the various groups? Does the randomization procedure appear appropriate?
Mask: Were the subjects masked as to which group they were assigned? Were the study's staff members also masked as to the groups subjects were assigned?
Control group: Was a control group one of the groups? If so, what type of control group was used? Did all groups have a similar amount of staff–patient interaction?
Outcome measures: Were the measures valid and reliable? Were they the standard being used for this type of study?
Follow-up: Were the subjects followed for a long enough period of time? Did a sufficient number of subjects return (Cochrane studies allowed the percentage lost to follow-up to be between 10% and 30%.[56])? Was there anything unique about the subjects who dropped out or did not return for follow-up that needs to be accounted for?
Results: Were the statistically significant findings also clinically significant?
Conclusions: Are the conclusions supported by the study's findings?

When you read a study, be cautious about the conclusions the author draws from the collected data, for some authors may be overly enthusiastic about the importance of their findings. An example of this comes from a joke I read many years ago. This hypothetical case series attempted to determine an association between what individuals chose from a buffet and an individual's weight. The study identified that 64% of the obese individuals chose cottage cheese, while only 3% of the normal-weight individuals chose cottage cheese. Using these data, the authors concluded that cottage cheese must be a major contributor for American's obesity problem!

Conclusions

The knowledge practitioners use to evaluate, diagnose, and treat patients comes from a range of personal clinical experiences and from evidence disclosed by carefully controlled clinical trials. Therefore case reports, literature reviews, clinical trials, and systematic reviews can each advance our current knowledge.

When the motivation for performing a clinical trial is to advance the state of our knowledge, each of the various clinical studies generally benefits the profession and society. Occasionally, the motivation is for political or economic gain, and every field of medicine has suffered from improperly motivated investigators.[5]

I believe the best TMD research generally comes from university-based orofacial pain (TMD) programs because they have a large pool of TMD patients, enabling them to easily conduct randomized clinical trials. Their faculty members are also generally experienced in conducting clinical trials and can help less experienced researchers as problems or questions arise.

Access to a good infrastructure (e.g., an IRB, experienced statistician, dental/medical library) is extremely helpful for conducting these studies. Any practitioner with a good pool of TMD patients could use the resources from a university or another institution and perform excellent clinical trials, as I did in the Air Force.

Private practitioners interested in participating in clinical research may want to join a practice-based research network in their region.

I hope this section provided you with some direction as to how you can seek answers for your burning questions and thoughts to consider when reading reports of clinical trials. Once you eventually obtain the answer to one of your questions, it then takes a great deal of time and motivation to write the manuscript and have it published. I wish you the best in advancing our clinical knowledge in your area of interest, and I am thankful for this opportunity to contribute to your success.

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Appendices

All appendices are in MS Word on the CD that accompanies this book. Feel free to copy them, alter them, and paste them onto stationery with your letterhead; they are not protected by copyright.

1. Referral Criteria for Hygienists
2. Initial Patient Questionnaire
3. TMJ Disc–Condyle Complex Disorders
4. TMD Self-Management Therapies
5. Occlusal Appliance Care Instructions
6. Closure Muscle-Stretching Exercise
7. Posture Improvement Exercises
8. Laboratory Occlusal Appliance Instructions
9. Example of Dental Record Entries
10. Examples of Physical Therapy Referral
11. Examples of Psychology Referral
12. Working with Insurance Companies
13. Sources for Additional TMD Information

Files on Accompanying CD

Appendices

1. Referral Criteria for Hygienists.doc
2. Initial Patient Questionnaire.doc
3. TMJ Disc–Condyle Complex Disorders.doc
4. TMD Self-Management Therapies.doc
5. Occlusal Appliance Care Instructions.doc

Manual of Temporomandibular Disorders, Third Edition. Edward F. Wright.

6. Closure Muscle-Stretching Exercise.doc
7. Posture Improvement Exercises.doc
8. Laboratory Occlusal Appliance Instructions.doc
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13. Sources for Additional TMD Information.doc

Appendices in Spanish

Initial Patient Questionnaire in Spanish.doc
TMD Self-Management Therapies in Spanish.doc
Occlusal Appliance Care Instructions in Spanish.doc
Closure Muscle-Stretching Exercise in Spanish.doc

TMD Course Presentations

Part I.ppt
Part II.ppt
Part III.ppt
Part IV.ppt
Part V.ppt

TMD Course Manual

TMD Manual.doc

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Appendix 1

Referral Criteria for Hygienists

Consider referring patient for TMD evaluation when patient has the following:

- Pain in area of masticatory muscles or TMJs
- Muscle stiffness within masticatory system
- TMJ catching or locking
- New or developing condition such as the following:
  - Posterior open bite
  - Anterior open bite
  - Shift in mandibular midline
- Frequent headaches
- Limited mandibular range of motion
  - Less than 40 mm opening, including overlap
  - Less than 7 mm right or left lateral
  - Less than 6 mm protrusive

Consider referring patient for stabilization appliance when patient has the following:

- Excessive tooth wear
- Mobile teeth
- History of fracturing teeth
- Nighttime grinding that bothers bed partner

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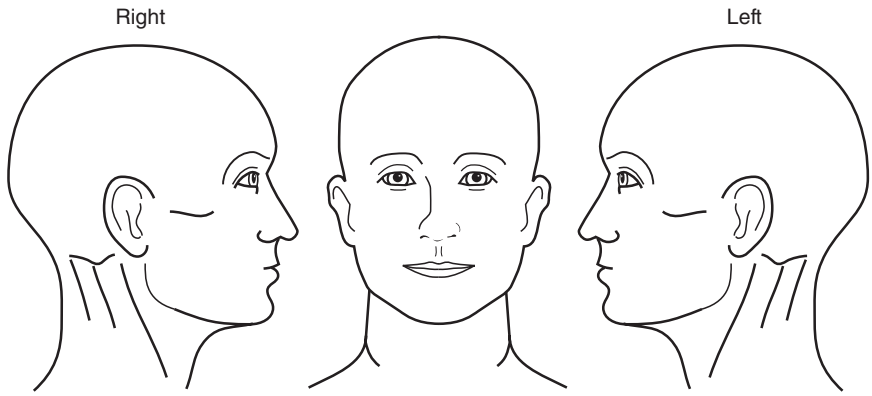
Appendix 2

Initial Patient Questionnaire

Name: _____ Date: _____

1. On the diagram below, please shade the areas of your pain:



2. When did your pain/problem begin? _____
   _____
   _____

3. What seemed to cause it to start? _____
   _____
   _____

4. What makes it feel worse? _____
   _____
   _____

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5. What makes it feel better? _____
_____
_____

6. What treatments have you received? _____
_____
_____

7. When is your pain the worst?
When first wake up ___ Later in the day ___ No daily pattern ___
Other ___

8. What does the pain keep you from doing? _____
_____
_____

9. Is your pain (check as many as apply):
Ache ___ Pressure ___ Dull ___ Sharp ___ Throbbing ___
Burning ___ Other ___

10. Does your pain:
Wake you up at night? Yes ___ No ___
Increase when you lie down? Yes ___ No ___
Increase when you bend forward? Yes ___ No ___
Increase when you drink hot or cold beverages? Yes ___ No___

11. Please circle the number below to indicate your *present* pain level.
(No pain) 0 - 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 (The worst pain imaginable)

12. Please circle your *average* pain level during the past 6 months.
(No pain) 0 - 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 (The worst pain imaginable)

13. Is your pain always present? Yes ___ No ___ How often do you have it? _____
_____
_____

14. Please describe any symptoms other than pain that you associate with your problem. _____
_____
_____
_____
_____

15. Have you had:
Head or neck surgery? Yes ___ No ___
Whiplash or trauma to your head or neck? Yes ___ No ___
Shingles on your head or neck? Yes ___ No ___

16. Do you have:
    A fever? Yes ___ No ___
    Nasal congestion or stuffiness? Yes ___ No ___
    Movement difficulties of your facial muscles, eyes, mouth, or tongue? Yes ___ No ___
    Numbness or tingling? Yes ___ No ___
    Problems with your teeth? Yes ___ No ___
    Swelling over your jaw joint or in your mouth or throat? Yes ___ No ___
    A certain spot that triggers your pain? Yes ___ No ___
    Recurrent swelling or tenderness of joints other than in your jaw joint? Yes ___ No ___
    Morning stiffness in your body, other than with your jaw? Yes ___ No ___
    Muscle tenderness in your body (other than in your head or neck) for more than 50% of the time? Yes ___ No ___

17. Is your problem worse:
    When swallowing or turning your head? Yes ___ No ___
    After reading or straining your eyes? Yes ___ No ___

18. Do your jaw joints make noise? Yes ___ No ___ If yes, which: Right ___ Left ___

19. Have you ever been unable to open your mouth wide? Yes ___ No ___ If yes, please explain: _____
    _____
    _____

20. Have you ever been unable to close your mouth? Yes ___ No ___ If yes, please explain:
    _____
    _____
    _____

21. Do you sleep well at night? Yes ___ No ___ Please explain: _____
    _____
    _____

22. How often are you overwhelmed, tense, aggravated, or frustrated during a usual day?
    Always ___ Half the time ___ Seldom ___ Never ___

23. How often do you feel depressed during a usual day?
    Always ___ Half the time ___ Seldom ___ Never ___

24. Do you have thoughts of hurting yourself or committing suicide? Yes ___ No ___

25. Do you play a musical instrument and/or sing more than 5 hours in a typical week?
    Yes ___ No ___

26. What percent of the day are your teeth touching? ____%

27. Are you aware of clenching or grinding your teeth: When sleeping? ___ While driving? ___ When using a computer? ___ Other times? ___ Not aware? ___

28. Are you aware of oral habits such as: Chewing your cheeks? ___ Chewing objects? ___ Biting your nails or cuticles? ___ Tapping your teeth together? ___ Thrusting your jaw? ___ Other habits? ___ Not aware? ___

29. What treatment do you think is needed for your problem? _____
_____
_____

30. Is there anything else you think we should know about your problem? _____
_____
_____

31. If your age is 50 or older, please circle the correct response:
Does your pain occur only when you eat? Yes ___ No ___
Are you pain free when you open wide? Yes ___ No ___
Do you have unexplainable scalp tenderness? Yes ___ No ___
Are you experiencing unexplainable or unintentional weight loss? Yes ___ No ___
Do you have significant morning stiffness lasting more than a half hour?
Yes ___ No ___
Do you have visual symptoms or a visual loss? Yes ___ No ___

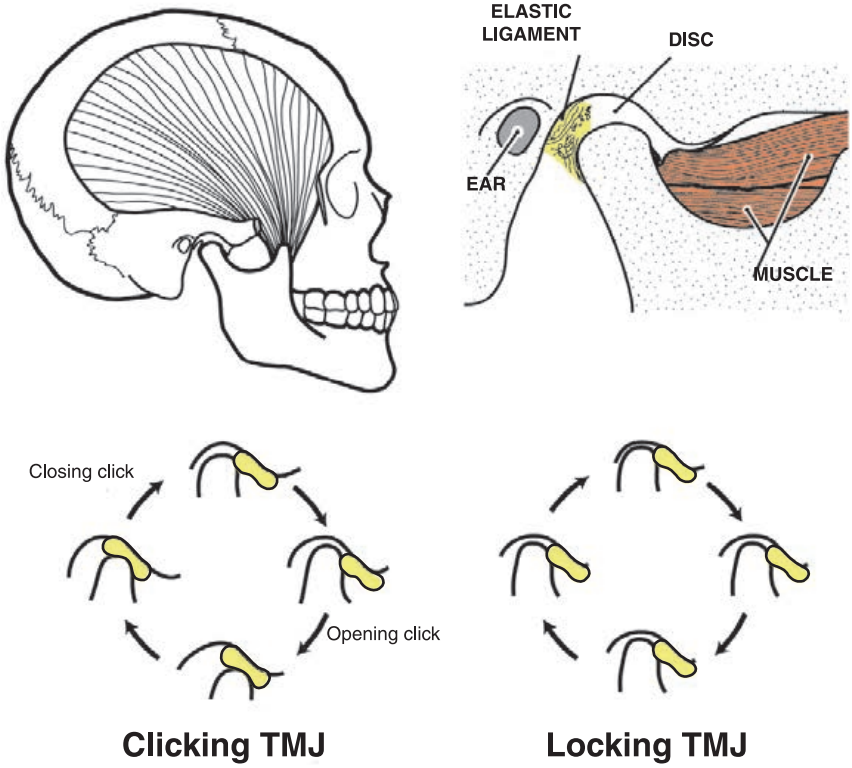
To the best of my knowledge the above information is correct and I give permission for a written report to be sent to my referring and treating doctors and dentists.

Signature_____ Date_____

(Readers choosing to use this questionnaire agree to indemnify and hold the publisher and author harmless for all losses, liabilities, damages [including indirect, special, or consequential], and expenses [including attorneys' fees].)

Appendix 3

TMJ Disc–Condyle Complex Disorders



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Appendix 4

TMD Self-Management Therapies

Your dentist determined you have a temporomandibular disorder that is often referred to as TMD. The "T" in TMD stands for the temple, "M" for the mandible or jaw, and "D" for a disorder within this complex. This disorder is usually due to an overuse of this system.

We use this system for many activities (talking, eating, yawning, laughing) and, when we are not engaged in these, we need to allow our jaw muscles and joints to relax. Many people have developed habits that do not permit their muscles or joints to relax for a sufficient amount of time. The following will help instruct you on how to reduce the TMD pain you are having:

1. Massage your painful muscles, as you find this beneficial. Use your index, middle, and ring fingers in a rolling motion over your skin with a pressure slightly greater than what is needed to produce your pain.
   a. When massaging the masseter muscle (jaw muscle), some patients prefer to simultaneously place their thumb inside their mouths and apply a counterforce with it. This works best if the right hand is used to massage the left masseter muscle and the left hand is used to massage the right masseter muscle.
   b. Some patients find it beneficial to locate and knead the most painful portion of the muscle for approximately 1 minute. Be careful not to hurt yourself by massaging your muscles too aggressively.
2. Apply heat, ice, or a combination of heat and ice to the painful areas. Use whichever provides you with the greatest amount of relief; most patients prefer heat.
   a. Use heat for 20 minutes two or four times each day. Some patients prefer to use moist heat, whereas others find dry heat just as effective and less of a hassle. Moist heat can be obtained by wetting a thin washcloth with very warm water. The washcloth can then be kept warm by wrapping it around a hot water bottle or placing it against a heating pad separated by a piece of plastic wrap.
   b. Use the combination of heat and ice two to four times each day. Apply heat to the painful area for approximately 5 minutes (less if it aggravates your pain). Then apply an ice cube wrapped in a thin washcloth.

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c. Apply ice wrapped in a thin washcloth until you first feel some numbness and then remove it (this usually takes about 10 minutes).

3. Eat soft foods like casseroles, canned fruits, soups, eggs, oatmeal, and yogurt. Do not chew gum or eat hard foods (e.g., raw carrots) or chewy foods (e.g., caramels, steak, and bagels). Cut other foods into small pieces, evenly divide the food on both sides of your mouth, and chew on both sides.
4. Avoid caffeine because it stimulates your muscles to contract and hold tension. Caffeine or caffeine-like drugs are found in coffee, tea, most sodas, and chocolate. Decaffeinated coffee also has some caffeine, whereas Sanka has none.
5. Your teeth should never touch except lightly when you swallow. Closely monitor yourself for a clenching or grinding habit. People often clench their teeth when they are irritated, drive a car, use a computer, or concentrate. Learn to keep your jaw muscles relaxed, teeth separated, and tongue resting lightly on the roof of your mouth just behind your upper front teeth.
6. Observe for and avoid additional habits that put unnecessary strain on your jaw muscles and joints. Some habits include, but are not limited to, resting your teeth together; tapping your teeth together; resting your jaw on your hand; biting your cheeks, lips, fingernails, cuticles, or any other objects you may put in your mouth; pushing your tongue against your teeth; and holding your jaw in an uncomfortable or tense position.
7. Posture appears to play a role in TMD symptoms. Try to maintain good head, neck, and shoulder posture. You may find that a small pillow or rolled towel supporting your lower back may be helpful. Ensure you maintain good posture when using a computer and avoid poor postural habits such as cradling the telephone against your shoulder.
8. Your sleep posture is also important. Avoid positions that strain your neck or jaw, such as stomach sleeping. If you sleep on your side, keep your neck and jaw aligned.
9. Set aside time once or twice a day to relax and drain the tension from your jaw and neck. Patients often benefit from simple relaxation techniques such as sitting in a quiet room while listening to soothing music, taking a warm shower or bath, and slow, deep breathing. Once you have learned to relax and drain the tension from your jaw and neck, continually monitor these. Whenever tension is observed, release it.
10. Restrain from opening your mouth wide, such as yawning, yelling, or prolonged dental procedures.
11. Use Aspercreme Creme over the affected area four times a day as beneficial. Or take anti-inflammatory and pain-reducing medications, such as Aleve, ibuprofen, Tylenol, and aspirin, to reduce joint and muscle pain. Avoid those with caffeine, for example, Anacin, Excedrin, or Vanquish.

There is no cure for TMD, and you may need to follow these instructions for the rest of your life. Your dentist may suggest other therapies in addition to these instructions. No single therapy has been shown to be totally effective for TMD, and a percentage of patients receiving therapies report no symptom improvement (i.e., 10–20% of patients receiving occlusal appliances report no improvement). Based on your symptoms and identified contributing factors, an individualized treatment approach will be recommended that may be revised as your symptom response is observed.

Appendix 5

Occlusal Appliance Care Instructions

The appliance is designed to protect and stabilize your jaw muscles and joints. It should help you feel more comfortable and allow healing to occur. To obtain its maximum benefit, use it in the following manner:

1. Do not bite on your appliance. The appliance is a reminder to help you learn to keep your teeth apart and jaw muscles and tongue relaxed. Constantly monitor your jaw position and tension, and remember to keep your tongue up and teeth off of the appliance.
2. Some patients need to gradually increase the amount of time they wear their appliance until they reach their recommended wear schedule. Occasionally, the appliance may cause a temporary increase in jaw tension or joint noises; a slower increase in wear time may be necessary. If your appliance hurts your teeth or gums, leave it out and come back to have it adjusted.
3. Do not wear your appliance when you eat.
4. Clean the inside and outside of your appliance at least daily with your toothbrush and toothpaste. It can be soaked with baking soda or a denture-cleaner solution to help clean it.
5. When you are not wearing your appliance:
   a. Be careful where you place it, because it is very fragile.
   b. Do not let it lie around because dogs and cats enjoy chewing on them.
   c. Do not leave it in a warm place (e.g., inside your car on a warm day) or it may warp.
   d. If your appliance will be out of your mouth for more than 8 hours, store it in a moist environment. You can place it with a few drops of water in a ziplock bag or margarine tub.
6. Some patients find their appliance causes them to salivate, whereas others find it causes them to have a dry mouth. This is generally only a temporary situation.

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7. When you take your appliance out, your jaw may take a few seconds to adjust back to the way your teeth normally fit together.
8. Always take your appliance to your dental appointments, especially to the initial appointments where we will be refining your appliance.

This advice should help you optimize the benefit you can obtain from your appliance and maintain your oral health.

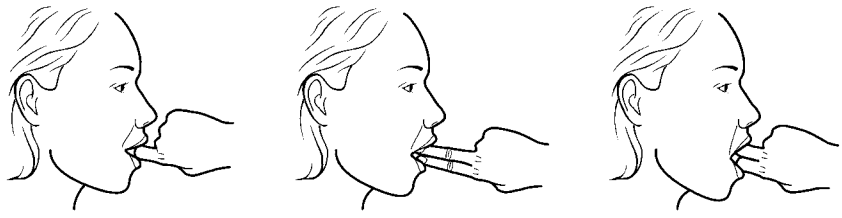
Appendix 6

Closure Muscle-Stretching Exercise

People unconsciously stretch many of their muscles throughout the day. Patients who have jaw muscle stiffness or pain often find a significant improvement in their symptoms with this jaw-stretching exercise. Your dentist believes your symptoms will improve if you perform this simple jaw-stretching exercise six times a day, between 30 and 60 seconds each time, at the opening and duration you determine is best for you.

It is best to warm up your jaw muscles before you stretch by slowly opening and closing your jaw about 10 times. You may also warm your muscles by applying heat to them (allow time for the heat to penetrate into your muscles). While stretching, you need to concentrate on relaxing your lips, facial muscles, and jaw. Do not bite on your fingers while stretching; they are only to give you a guide for the width you are stretching.

You will need to determine what opening and duration are best for you. To determine this, the first time you stretch, bend your index finger and place the middle knuckle between your upper and lower front teeth (see first figure). Hold this position for 30 seconds. If this does not aggravate your symptoms, the second time you stretch, increase the time to 45 seconds. If this does not aggravate your symptoms, the next time increase it to 60 seconds. If this does not aggravate your symptoms, increase your opening width to two fingertips (see second figure) and cut your time back to 30 seconds. Continue increasing your time and opening in this manner, but do not go beyond three fingertips. Find the largest opening and duration that does not cause even the slightest discomfort or aggravation of your symptoms and use this each time you stretch. If you experience any discomfort or aggravation, decrease your opening or time.



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As your symptoms improve or if you have a flare-up, you will need to increase or decrease this opening and time. Be very careful not to cause yourself any aggravation with this exercise because this may hurt your progress.

Patients report this exercise does not provide immediate symptom improvement, but takes about 1–2 weeks before benefits are noticed. Similarly, stopping does not cause immediate loss of these benefits, but also tends to take 1–2 weeks to be noticed. With the normal symptom fluctuation most TMD patients experience, it is often difficult for them to relate their symptom improvement or aggravation with the starting or stopping of this exercise.

Appendix 7

Posture Improvement Exercises

INSTRUCTIONS

Chin tucks	Tuck your chin back over the notch above your sternum, so that your ear is in line with the tip of your shoulder.
Chest stretch	Stand in a doorway or at the corner of a room. Lean forward, with your hands on the wall, until you feel significant stretch across the front of your chest. Do this exercise as requested in both positions.
Wall stretch	Stand with your back against the wall and your arms positioned as shown in the drawing. Straighten your upper back and flatten your lower back against the wall. Press your head back with your chin down and in, and pull your elbows back against the wall. Do this exercise as requested in both positions.
On-your-back neck stretch	Lie on your back with your hands clasped behind your head. As you exhale, slowly bring your elbows together touching in front of your face. As you inhale, slowly draw the elbows apart until they touch the floor.
Face-down arm lifts	Lie on your stomach as shown in the drawings (position 1 has the elbows at shoulder level and bent at 90°, whereas position 2 has elbows at ear level). Lift your arms, head, and chest off the floor and repeat until you can only move 50% through the range or to fatigue. Do this in both positions.

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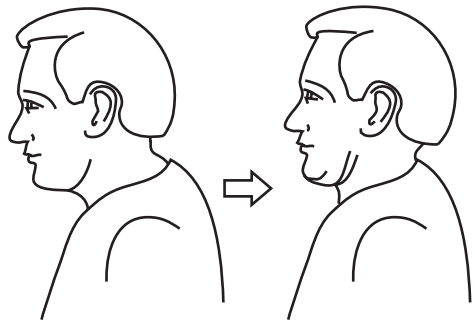
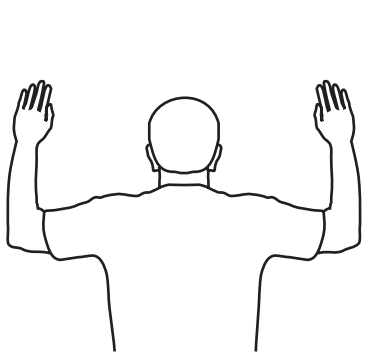
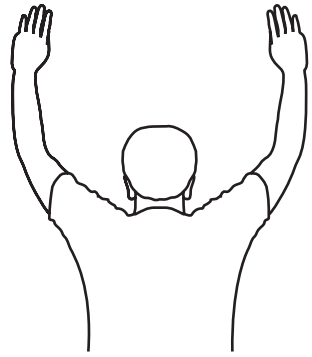
EXERCISES

Chin Tucks
Perform: 10 times on the hour
Hold: 5 seconds

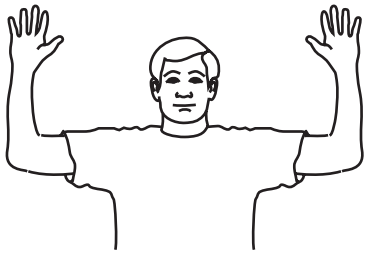


Chest Stretch
Perform: 3 times a day, 2 repetitions
Hold: 15 seconds

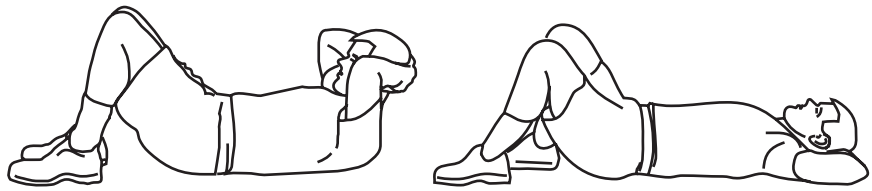




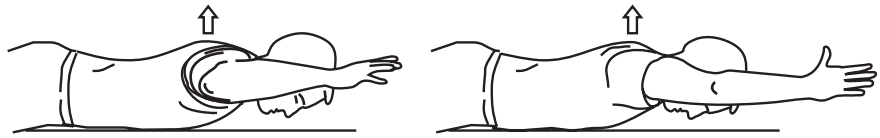
Wall Stretch
Perform: 3 times a day, 2 repetitions
Hold: 15 seconds



On-Your-Back Neck Stretch
Perform: before you retire, 10 repetitions



Face-Down Arm Lifts
Perform: once a day, 5 days/week



Appendix 8

Laboratory Stabilization Appliance Instructions

Maxillary or Mandibular Impak Stabilization Appliance

Please:

1. Debubble the cast(s) and block out (1) deep grooves on and between the teeth, and (2) all undercuts, with the exception of no blockout in the buccal embrasures of the posterior teeth. After mounting casts, adjust the incisal pin so the appliance's minimum occlusal thickness is 2.5–3 mm.
2. Extend the flanges so that (1) the facial extent is carried 2 mm below the interproximal contact for the anterior and posterior teeth, and (2) the lingual portion extends __ mm (5 mm for maxillary and 10 mm for mandibular) from the gingival margin, keeping it short of the vestibule and tori.
3. Fabricate the occlusal surface so the surface is flat without cuspal indentations, the nonsupporting posterior cusps are not in contact, the protrusive and canine guidances provide minimal posterior disocclusion (0.5–1 mm), and the occlusal line angles are rounded. Please make the facial flange so it is 1 mm thick and flows with the contours of the teeth and make the lingual flange so it is only 1 mm thick.

Thank you.

Maxillary or Mandibular 0.15-in. Soft Thermoplastic Appliance or Dual Laminate Thermoplastic Stabilization Appliance

Please debubble cast(s) and do not block out undercuts. Extend the flanges so that (1) the facial extent is carried to the gingival margin, and (2) the lingual portion extends __ mm (5 mm for

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maxillary and 10 mm for mandibular) from the gingival margin, keeping it short of the vestibule and tori.

For the dual laminate thermoplastic appliance, once the dual laminate material is on the articulator, adjust the incisal pin so the closest opposing tooth is 1 mm from the occlusal surface, enabling the thickness of the added acrylic to be 1 mm or more. Please add acrylic to the occlusal surface so the occlusal surface is flat without cuspal indentations, the nonsupporting posterior cusps are not in contact, the protrusive and canine guidances provide minimal posterior disocclusion (0.5–1 mm), and the occlusal line angles are rounded.

Thank you.

Maxillary or Mandibular 2-mm Hard Thermoplastic Appliance or Acrylic Stabilization Appliance

Please:

1. Debubble the cast(s) and block out (1) deep grooves on and between the teeth, and (2) all undercuts, with the exception of no blockout in the buccal embrasures of the posterior teeth.
2. Extend the acrylic so that (1) the buccal extent is carried 0.5 mm below the height of contour for the posterior teeth, (2) the labial extent is carried only 1–1.5 mm beyond the incisal edge of the anterior teeth, and (3) the lingual portion extends __ mm (5 mm for maxillary and 10 mm for mandibular) from the gingival margin, keeping it short of the vestibule and tori.
3. For the acrylic stabilization appliance, adjust the incisal pin so the appliance's minimum occlusal thickness is 2.5–3 mm. Fabricate the occlusal surface so the surface is flat without cuspal indentations, the nonsupporting posterior cusps are not in contact, the protrusive and canine guidances provide minimal posterior disocclusion (0.5–1 mm), and the occlusal line angles are rounded. Please make the facial acrylic so it is 1 mm thick and flows with the contours of the teeth, and make the lingual flange so it is only 1 mm thick.

Thank you.

Appendix 9

Example of Dental Record Entries

Initial Exam

S: Comprehensive TMD evaluation; CC: constant Rt preauricular dull/pressure pain, 4/10 upon awaking and 1/10 later in the day. Approximately once a week, she also awakes with 2/10 Rt temporal pain lasting approximately 2 hours. The pain began approximately 3 months ago after an increase in stress at work. The "Initial Patient Questionnaire" responses were reviewed with Pt.

O: Soft tissue and teeth were WNL. Palpation of selected masticatory and cervical structures revealed tenderness of her Rt and Lt masseter and Rt temporalis muscles, and Rt TMJ. The Rt masseter and Rt temporalis muscle palpations reproduced her pain complaints. A reciprocal click was present in her Rt TMJ. ROM: 38 mm opening, 6/6/5 (right lateral, left lateral, and protrusive).

A: Clinical TMD Dx: Myalgia, Rt TMJ arthralgia, and Rt TMJ disc displacement with reduction. Nocturnal and daytime parafunctional habits (Pt relates her teeth are touching 30% of the day), tension, and caffeine consumption appear to be her major perpetuating contributing factors.

P: Explained to Pt the mechanics of her Rt TMJ reciprocal click. Written and oral TMD self-management instructions given; Pt agreed to decrease her caffeine consumption to 1 cup of coffee a day. Max and man alginate imp and interocclusal record made for fab of a max acr stabilization appliance that Pt to wear at night. Pt reappt in 2 weeks for insertion of occlusal appliance.

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Insertion Appointment

Re: Myalgia, Rt TMJ arthralgia, and Rt TMJ disc displacement with reduction. Pt reports slt improvement, which she attributes to implementing the TMD self-management instructions. Her Rt preauricular pain upon awaking is now 3/10, and she has only intermittent 1/10 daytime symptoms; she continues to have weekly 2/10 Rt temporal pain. Ins max acr stabilization appliance for Pt to wear at night. Written and oral appliance care instr given. Pt reappt in 3 weeks for follow-up.

Follow-Up

Re: Myalgia, Rt TMJ arthralgia, and Rt TMJ disc displacement with reduction. Pt reports significant symptom improvement and has only 1/10 preauricular morning pain approximately once a week. Adj stabilization appliance and Pt reappt in 2 months for follow-up or to RTC sooner if improvement does not continue.

Follow-Up

Re: Myalgia, Rt TMJ arthralgia, and Rt TMJ disc displacement with reduction. Pt reports as long as she wears her appliance at night she has no TMD discomfort. ROM: 48 mm opening, palpation of selected masticatory structures revealed minimal tenderness, and reciprocal click is still present in Rt TMJ. Adj stabilization appliance and Pt to wear appliance nightly. Pt to RTC annually for follow-up or sooner if symptoms return, appliance needs adj, or another problem develops.

Appendix 10

Examples of Physical Therapy Referral

Dentists commonly refer TMD patients to physical therapists to improve TMD pain, TMJ function, range of motion, daytime or sleeping postures, and/or neck symptoms. In addition to improving a patient's symptoms, a goal in physical therapy is to teach the patient to maintain this improvement, which is typically done through home exercise the patient is taught. Physical therapy performed in conjunction with occlusal appliance therapy may attain better improvement in TMD symptoms than an occlusal appliance therapy alone. Locating a physical therapist knowledgeable in treating TMD patients is discussed under "Physical Therapy" in Chapter 15.

Two examples are presented below: the first is a patient whose TMD symptoms are limited to the masticatory system, and the second is a patient who has concomitant neck pain and the physical therapist is requested to treat just the cervical myofascial pain with referral.

These referrals can be made on a prescription pad or office stationery. If you commonly refer to a certain therapist, I recommend you ask the physical therapist for a referral pad because it generally just requires filling in blanks and has a map to the facility for the patient.

Many third-party payers require the requested frequency and duration of treatment be documented; two to three times a week for a month is a reasonable request, and generally third-party payers will allow practitioners to request "as therapist recommends." Inform the physical therapist of any precautions he or she should be aware of (e.g., previous surgery, tumor, screws, or wires in the region) and medical disorders that could complicate therapy (e.g., angioedema).

It is my preference to fax the physical therapist my initial evaluation findings, so the therapist benefits from my referred pain observations, thoughts about the patient's contributing factors, and my planned therapies. If the patient does not improve as anticipated, I telephone the therapist so we can discuss our perceptions for how we can escalate therapy.

CC: Constant 6/10 Rt preauricular pain.
Dx: Rt TMJ arthralgia, myalgia, and Rt TMJ disc displacement with reduction.

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Please evaluate and treat. Pt also relates she intermittently sleeps on her stomach and is unable to change this sleep position. Would you please help Pt break this habit? Thank you.

Precautions: None.

Pt was given an occlusal appliance and TMD self-management instructions.

CC: Daily 5/10 bilateral preauricular and masseter pain upon awaking that lasts for 1 hour, and constant 5/10 neck pain.

Dx: Masticatory myalgia and cervical myofascial pain with referral.

Please evaluate and treat Pt's cervical disorder. Palpation of her cervical muscles reproduced her masticatory pain. It is believed that the local component of her masticatory symptoms can be adequately relieved through TMD therapy, but patient needs treatment of her neck pain to relieve the cervical component.

Precautions: None.

Pt was given TMD self-management instructions and will be given an occlusal appliance at her next appointment.

Clinical experience suggests referring TMD patients to physical therapy for any of the following:

1. The patient has neck pain worthy of treatment. TMD patients with neck pain do not respond to TMD therapy as well as those without neck pain. Some TMD symptoms primarily come from the neck, and physical therapy in conjunction with home exercises can provide long-term benefit for neck pain.
2. The patient has cervicogenic headaches, which are headaches that originate in the neck, and can be reproduced by palpating the neck. Clinically it appears TMD patients tend to hold more tension in their masticatory muscles when they have a headache. Therefore, TMD patients with cervicogenic headaches who have their neck treated should have fewer headaches and may also obtain substantial TMD symptom improvement.
3. The patient has moderate to severe forward head posture. These patients have been shown to be more likely to derive significant TMD symptom improvement from posture exercises in combination with TMD self-management instructions.
4. The patient's TMD symptoms increase with abnormal postural activities. Instructing these patients in body mechanics (teaching patients how to perform tasks without straining the body) should help them maintain good posture, thereby improving their TMD symptoms.
5. The patient desires help in changing poor sleep posture. Stomach sleeping perpetuates TMD and neck symptoms and, if a patient cannot stop sleeping on his or her stomach, physical therapists are trained to help patients change their sleep position.
6. The patient did not derive adequate TMD symptom relief from other therapies. Physical therapists are trained to treat musculoskeletal disorders throughout the body and can apply their skills to the masticatory system.
7. The patient is to have TMJ surgery. It has been shown that patients who receive physical therapy following TMJ surgery have better results. It is appropriate for these patients to be given a physical therapy referral prior to surgery in order that they may learn about and possibly start the postsurgical exercises, receive preauthorization approval from their insurance company, and schedule the recommended postsurgical appointments.

Appendix 11

Examples of Psychology Referral

It is well recognized that daytime parafunctional habits, tension, stress, anxiety, anger, depression, catastrophizing (thinking the worst of situations), pain-related beliefs, not coping well with "life's stuff," and so on, negatively impact patients' TMD symptoms and their ability to improve with conservative TMD therapy. Cognitive-behavioral interventions are adjunctive TMD therapies that attempt to help patients reduce their daytime parafunctional habits and psychosocial contributing factors.

Patients with significant persistent daytime habits and/or psychosocial contributors often need additional help from a practitioner trained in cognitive-behavioral interventions. These interventions primarily encompass habit reversal, relaxation, hypnosis, biofeedback, stress management, and cognitive therapy (focuses on changing patients' distorted thoughts).

It has been observed that some psychologists desire to perform psychological testing prior to the cognitive-behavioral intervention to identify which therapies may be most beneficial for the patient. Other psychologists may provide a standard brief cognitive-behavioral intervention and may test only those patients who do not sufficiently improve.

Referring patients to a psychologist can be as easy as giving patients the psychologist's name and asking them to make an appointment. At the initial visit, the patient would tell the psychologist the problem, and the psychologist would assess the patient's condition.

It is my preference to fax the psychologist a note (as the examples below) to help him or her better understand my concerns. As with the physical therapist, if the patient does not improve as anticipated, I telephone the psychologist so we can discuss our perceptions for how we can escalate therapy. Occasionally, the physical therapist, psychologist, and I will confer about a complicated patient who is not improving as we anticipated. Locating a psychologist who can provide this therapy is discussed in the introductory portion of Chapter 16, "Cognitive-Behavioral Intervention."

In the first example provided below, the psychologist will probably primarily use habit-reversal therapy and, in the second example, primarily use stress management therapy:

Mrs. Jones has long-standing 6/10 daytime TMD symptoms that are primarily due to overloading her masticatory system from daytime oral habits. She has unsuccessfully attempted

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to break these habits on her own, and she is aware she touches her teeth together approximately 90% of the day and unconsciously squeezes them together when she becomes busy, frustrated, or deep in thought. Mrs. Jones would like your assistance to help her break her daytime oral parafunctional habits. She has an occlusal appliance that she wears for her nocturnal oral parafunctional habits. Thank you.

Miss Smith complains of 6/10 bilateral jaw pain, which was diagnosed as myalgia. Her primary contributing factor appears to be work-related stress. Her pain started 4 months ago, right after she started a new job that she finds very busy, hectic, and stressful. She would like to learn stress management and coping skills to better deal with her work situation. Would you please evaluate and treat as you feel is most appropriate? Thank you.

Appendix 12

Working with Insurance Companies

States that have laws that mandate medical insurance companies cover certain aspects of TMD therapy are Arkansas, California, Florida, Georgia, Illinois, Kentucky, Minnesota, Mississippi, Nebraska, Nevada, New Mexico, North Carolina, North Dakota, Texas, Vermont, Virginia, Washington, West Virginia, and Wisconsin. Small private insurance companies may be exempt from the law and may avoid covering these state-mandated procedures.

The Patient Advocacy Group listed in "Sources for Additional TMD Information" (Appendix 13) should be able to provide you with a copy of the portion of your state law that covers TMD-mandated procedures. Additionally, the American Academy of Orofacial Pain (also listed in Appendix 13) has an Access to Care Committee that should be able to provide you with answers to many of your insurance questions.

Electronic filing and proper coding tend to speed payment reimbursement and decrease the number of "misplaced" claim forms. Coding manuals and software are offered by one of the businesses listed in Appendix 13.

Medical TMD Diagnosis Codes[a]

ICD-9	ICD-10	
		TMJ Disorders
524.60	M26.60	Temporomandibular joint disorders, unspecified
524.61	M26.61	TMJ adhesion and ankylosis (osseous or fibrous)
524.62	M26.62	TMJ arthralgia
524.63	M26.63	Articular disc disorder (with or without reduction)
524.69	M26.69	Other specified temporomandibular joint disorders, for example, arthritis
830.1	S03.0	TMJ open dislocation (luxation as used in this book)
848.1	S03.4	TMJ sprain or strain

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		Muscular Disorders
728.85	M62.838	Spasm of muscle
729.1	M79.1	Myalgia and myositis (also use for myofascial pain with referral)

Dental and Medical TMD Procedure Codes

CDT	CPT	
		Initial Visit
D0150		Comprehensive oral evaluation (for normal TMD evaluation)
D0160		Detailed and extensive oral evaluation (for complex TMD evaluation)
D9310		Consultation
D9920		Behavioral management, by report (for each 15-minute increment)
		Treatment
D7880	21110	Occlusal orthotic device, by report
D9920		Behavioral management, by report (for each 15-minute increment)
		Follow-Up
D9920		Behavioral management, by report (for each 15-minute increment)
D9430		Office visit for observation (no other services provided)
		Other Codes
D0330	70355	Panoramic film
D0321	70328	Radiological examination, TMJ, open and closed mouth, unilateral
D0321	70330	Radiological examination, TMJ, open and closed mouth, bilateral
D0321	76101	Radiological examination, TMJ tomogram, unilateral
D0321	76102	Radiological examination, TMJ tomogram, bilateral
D0460		Pulp vitality tests
D9110		Palliative (emergency) treatment of pain
D9210		Local anesthesia not in conjunction with operative or surgical procedure
D9610		Therapeutic drug injection, by report
D9940		Occlusal guard, by report (for bruxism, if for TMD use D7880)
D9942		Occlusal guard repair or chairside reline

CPT Codes for Office Visit and Consultation

99201 to 99205	New patient office visit
99211 to 99215	Established patient office visit
99241 to 99245	Office consultation (for new or established patient)

[a]It has been observed that accepted medical diagnosis and procedure codes vary from insurer to insurer and from state to state. It is recommended each medical insurer be consulted as to their policy, and request this in writing, prior to claim submission. On October 1, 2014, ICD-10 will replace ICD-9 in the United States.

Sources:
CDT2013: Dental Procedure Codes. Chicago, IL: American Dental Association, 2012.
CPT: Current Procedural Terminology 2013. Chicago, IL: American Medical Association, 2012.
ICD-9: International Classification of Diseases ICD-9-CM 2013. Chicago, IL: American Medical Association, 2012.
http://www.icd10data.com/. Accessed August 29, 2013.
American Academy of Orofacial Pain. de Leeuw R, Klasser GD. (eds.). Orofacial Pain: Guidelines for Assessment, Diagnosis and Management. 5th ed. Chicago, IL: Quintessence, 2013:137–51.

Appendix 13

Sources for Additional TMD Information

Patient Brochures and Book

1. My favorite patient brochure is published by the National Institute of Dental and Craniofacial Research. It is brochure #OP-23, TMJ Disorders. It states irreversible treatments that have not been proven to be effective—and may make the problem worse—include orthodontics to change the bite; crown and bridgework to balance the bite; grinding down teeth to bring the bite into balance, called "occlusal adjustment"; and repositioning splints, also called orthotics, which permanently alter the bite. The brochure is free (including shipping and handling) and can be viewed and ordered from the National Oral Health Information Clearinghouse (up to 50 copies a month) through the web site http://www.nidcr.nih.gov/ or by telephoning (866) 232-4528.
2. The American Academy of Orofacial Pain (AAOP) has a good patient brochure. It can be viewed on their web site (http://www.aaop.org and select "Patient Resources" and then "Patient Information") or order via telephone (609) 504-1311.
3. My favorite book for patients provides an excellent understanding of how psychosocial issues contribute to TMD symptoms and provides a very nice overview of the various TMD therapies (with a very similar treatment philosophy as I have): Tanenbaum DR , Roistacher SL. Doctor, Why Does My Face Still Ache? Getting Relief from Persistent Jaw, Ear, Tooth, and Headache Pain. New York: Gordian Knot Books, 2012.

Patient Advocacy Group

The TMJ and Orofacial Pain Society of America is a nonprofit organization that provides help with patient issues, publishes quarterly newsletters, and should be able to provide you with the mandated law insurance information for your state. Visit their web site (http://www.tmjsociety.org) or telephone them (916-444-1985).

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TMD Practice Management Businesses

1. TMData Resources offers practice development consultations and a full line of services exclusively for TMD and snoring practices. They write and distribute TMD-related and snoring-related educational materials for doctor education, patient education, and physician referrals. They support TMJ patients with information and a national list of doctors who treat TMD. You can view their products and services (http://www.tmdataresources.com) or telephone them (800-533-5121).
2. Nierman Practice Management offers manuals and software for diagnostic and procedural codes, narrative reports, and other correspondence for collecting medical and dental insurance benefits for treatment of TMD. They also offer services for orthodontics, implants, general and esthetic dentistry, and sleep disorders. You can view their products and services (http://www.rosenierman.com) or telephone them (800-879-6468).

Practitioners with TMD Expertise and Fellowship Programs

I believe practitioners with the greatest clinical TMD expertise will be a Diplomate of the American Board of Orofacial Pain (ABOP). The names and locations of these individuals are listed on the ABOP web site (http://www.abop.net/ and select "Diplomate Directory"). A TMD or orofacial pain fellowship program would be another location one could find practitioners with clinical TMD expertise. These programs are listed at http://www.aaop.org/ (select "Education" followed by "Programs").

Professional TMD Organizations

There are two primary TMD professional organizations. They provide educational meetings, offer staff training at their meetings, worked with the American Dental Association to make TMD a recognized specialty, have diplomate certification boards, and each publishes one of the two journals listed below and provides other beneficial activities:

1. American Academy of Orofacial Pain (AAOP). Their web site can be viewed at http://www.aaop.org. The AAOP Central Office telephone number is 856-423-3629.
2. American Academy of Craniofacial Pain (AACP). Their web site can be viewed at http://www.aacfp.org. The AACP Central Office telephone number is 800-322-8651.

TMD Textbooks

The two outstanding TMD books are the following:

1. Okeson JP. Management of Temporomandibular Disorders and Occlusion, 7th ed. St. Louis: CV Mosby, 2013. Telephone 800-621-0387.

2. American Academy of Orofacial Pain. de Leeuw R, Klasser GD. (eds.). Orofacial Pain: Guidelines for Assessment, Diagnosis and Management. 5th ed. Chicago, IL: Quintessence, 2013. Telephone 800-621-0387.

TMD Journals

TMD articles can be found in most dental and medical journals. The following two journals are dedicated primarily to TMD and orofacial pain.

1. Journal of Orofacial Pain. Quintessence. Telephone 800-621-0387.
2. Cranio: The Journal of Craniomandibular Practice. Chroma. Telephone 800-624-4141.

Glossary

The words listed in the glossary are in bold print throughout the text.

Anterior positioning occlusal appliance holds the mandible in an anterior location, typically where the condyle is reduced onto the disc (as depicted in Figure 13.1). It is primarily used for patients who have a disc displacement with reduction, and this position holds the condyle in the reduced position so the disc–condyle mechanical disturbances are temporarily eliminated and any forces loading the condyle are transmitted through the disc's intermediate zone rather than the retrodiscal tissue.

Centric relation (CR) is the maxillomandibular relationship in which the condyles are seated in their most anterior-superior location against the disc's intermediate zone (the thinnest avascular portion of the disc) and the posterior slopes of the articular eminences. This is a very reproducible position and appears to be the most musculoskeletally stable position for the mandible.

Cervical pain is moderately prevalent among TMD patients and may not only directly affect the masticatory system and its ability to respond to therapy, but may also cause referred pain to the masticatory structures, which can add to a patient's TMD symptoms or be the sole cause for the symptoms.

Cognitive behavioral interventions primarily encompass habit reversal, relaxation, hypnosis, biofeedback, stress management, and cognitive therapy (focuses on changing patients' distorted thoughts). They are adjunctive TMD therapies that attempt to help patients reduce their daytime parafunctional habits and psychosocial contributing factors.

Contributing factors are the elements that directly or indirectly contribute to the TMD symptoms, impacting both muscle and TMJ pain. They can be subcategorized into predisposing, initiating, and perpetuating contributing factors. The perpetuating contributing factors are a TMD patient's contributing factors that perpetuate the disorder (not allowing it to resolve), for example, nighttime parafunctional habits, gum chewing, daytime clenching, stress, and poor posture.

Crepitus is a grating or crackling noise similar to the sound that is created when one walks over wet sand on the beach or wet snow and is often subdivided into course and fine crepitus. Crepitus is most commonly related to a patient having a degenerative joint disease.

Direct trauma is a physical blow to the masticatory system (macrotrauma), thus differing from indirect trauma or microtrauma.

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External cues are external stimuli that TMD patients use to remind themselves to check for oral habits or masticatory muscle tension. Examples of external cues are an unusually placed yellow Post-it note that will alert the patient or a timer that rings every 5 minutes. Over time, they tend to blend into the background and need to be changed. Many patients prefer to work first with external cues and progress later to internal cues.

Fibromyalgia is characterized by widespread muscle pain, multiple tender points over the body, poor sleep, stiffness, and generalized fatigue. It is moderately prevalent among TMD patients, can add to the patient's TMD symptoms, and can decrease a patient's ability to respond to TMD therapy.

Indirect trauma is a nonimpact jolt to the jaw analogous to cervical whiplash, which can result in TMD symptoms from damage to the muscle or TMJ.

Initiating contributing factor is an event that caused the TMD symptoms, for example, trauma to the jaw or the placement of a crown.

Internal cues are bodily features that TMD patients use to alert themselves when they are performing oral habits or have excessive masticatory muscle tension. The patient becomes very attuned to observing the chosen internal cue, so when it occurs, the patient notices it despite other mental activity. The most common internal cues that TMD patients use are the teeth touching the opposing teeth or an occlusal appliance, their pain intensity, and muscle tension. Clinically, patients appear to have the best long-term success with breaking daytime oral habits if they have learned to use internal cues to maintain their desired behaviors or postures. Many patients prefer to work first with external cues and progress later to internal cues.

Lateral pterygoid spasm is a condition in which the inferior lateral pterygoid muscle is in constant involuntary contraction at a partially shortened position. This is a common cause for patients reporting an inability to put the ipsilateral posterior teeth together without excruciating pain.

Maximum intercuspation (MI) is a maxillary to mandibular relation determined by the teeth, in which they are maximally intercuspating (occluding).

Microtrauma is chronic irritation to the masticatory structures, usually from chronic parafunctional habits. It generally predisposes or causes individuals to develop TMD and makes it more difficult to resolve the manifested symptoms.

Neutral position is an unrestrained condylar position that approaches CR but does not encroach upon inflamed retrodiscal tissue nor firmly seat the condyles.

Parafunctional habits are unproductive movement habits; in relation to TMD, these would be oral habits, for example, lip biting, cheek biting, grinding teeth, clenching teeth, and pursing lips.

Perpetuating contributing factors are the elements that directly or indirectly aggravate the masticatory system and prevent the TMD symptoms from resolving, for example, nighttime parafunctional habits, gum chewing, daytime clenching, stress, and poor posture.

Predisposing contributing factors are the elements that make an individual more susceptible to developing TMD, for example,

fingernail biting, clenching, and biting on objects. Individuals who are very predisposed to developing TMD may be those who develop TMD from a slight occlusal change, for example, from the placement of a pit and fissure sealant.

Primary diagnosis is the diagnosis for the disorder most responsible for a patient's chief complaint. This diagnosis can be of TMD origin (e.g., myalgia, TMJ arthralgia, or TMJ disc displacement without reduction with limited opening) or from a different source (e.g., pulpal pathosis, sinusitis, or cervicogenic headache).

Reduced position is where the condyle articulates with the disc's intermediate zone (center portion of the disc). This term is generally used when discussing a disc displacement with reduction; with the teeth in maximum intercuspation, the condyle articulates with the disc's retrodiscal tissue and as the condyle translates anteriorly, it moves below the posterior band and onto the disc's intermediate zone (reduced position). This sequence is depicted in the bottom left section of the "TMJ Disc–Condyle Complex Disorders" diagram (Appendix 3), and the reduced position is depicted in Figure 10.4. One of the definitions for reduced is to return to its normal position, for example, reduced an open fracture, reduced condylar luxation. In this situation, the disc–condyle alignment returns to its "normal" alignment when the condyle is sufficiently translated.

Referred pain is pain perceived at a location different than its source. This is similar to how a patient suffering from a heart attack may perceive pain only in the left arm, whereas the source is the heart. Masticatory muscles, TMJs, tooth pulps, and cervical muscles and cervical spine commonly cause referred pain to each other. The true source must be identified and treatment directed toward the source, not the site where the pain is felt.

Secondary diagnosis is another TMD diagnosis that contributes to the primary diagnosis. Typically, the primary diagnosis will be of TMD origin (e.g., myalgia), and the secondary and tertiary diagnoses will be other TMD diagnoses (e.g., TMJ arthralgia and TMJ disc displacement with reduction) that contribute to a patient's chief complaint. They are ordered by the degree they contribute to the patient's chief complaint.

Secondary gain is a situation in which a patient is rewarded for having TMD; for example, a patient receives disability payments or is excused from undesirable chores or work. Clinically, I do not commonly observe this situation, but, if it is present, the patient may not relate improvement from any therapy.

Stabilization appliances have a flat surface occluding with the opposing dentition, which provides a gnathologically stable occlusal environment. It allows patients to move freely from maximum intercuspation and is most commonly used for those with tooth attrition or TMD symptoms.

Stress management is a cognitive approach to deal with the stresses, irritations, or frustrations that patients encounter. Some studies suggest the average TMD patient does not cope as well with stress as do non-TMD patients. TMD patients tend to tighten their masticatory muscles in these situations, and stress management teaches coping skills to help them better manage these situations and their thoughts about them.

Symptom patterns include the period of the day in which the symptoms occur or are most intense (e.g., worse upon awakening) and the

location pattern (e.g., begins in the neck and then moves to the jaw).

Tertiary diagnosis is another TMD diagnosis that contributes to the primary diagnosis. Typically, the primary diagnosis will be of TMD origin (e.g., myalgia), and the secondary and tertiary diagnoses will be other TMD diagnoses (e.g., TMJ arthralgia and TMJ disc displacement with reduction) that contribute to a patient's chief complaint. They are ordered by the degree they contribute to the patient's chief complaint.

TMJ click or pop is a very prevalent noise among TMD patients and non-TMD patients, is most commonly related to a patient having a disc displacement with reduction, and by itself does not suggest the need for a patient to receive TMD therapy.

TMJ crepitus is a grating or crackling noise similar to the sound that is created when one walks over wet sand on the beach or wet snow and is often subdivided into coarse and fine crepitus. Crepitus is most commonly related to a patient having a degenerative joint disease.

TMJ luxation (also known as open lock) is diagnosed when a patient presents with or relates a history of being unable to close his or her mouth from maximum opening and requires or required a practitioner to release it.

TMJ subluxation is diagnosed when a patient relates a history of momentary inability to close the mouth from a maximal open position, in which the patient had to perform a specific maneuver to close the mouth.

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