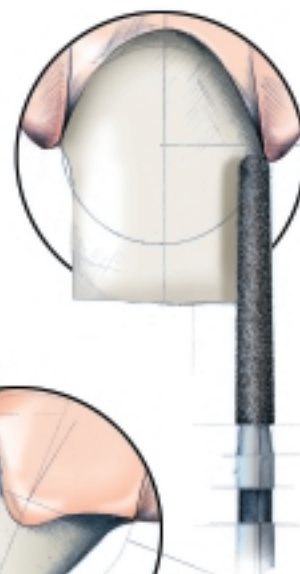
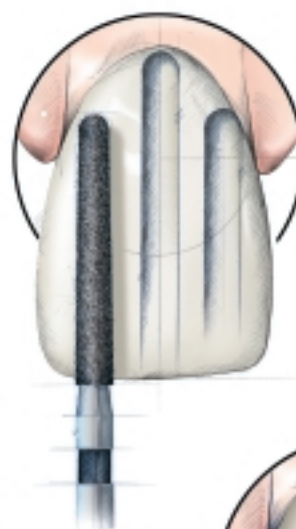
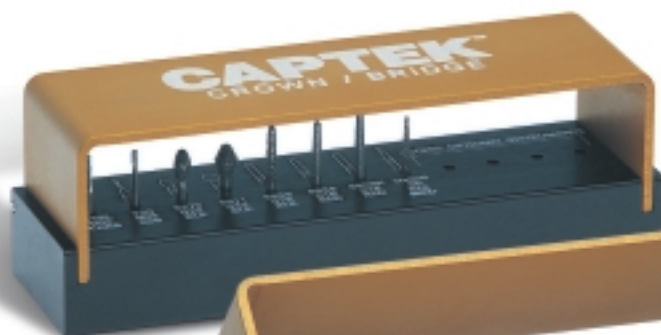


Esthetic Technique™

Clinical Case Studies and Technique Review



Crown Considerations, Preparations, and Material Selection for Esthetic Metal-Ceramic Restorations

Edward A. McLaren, DDS

Greg Vigoren, DDS

A Crown Preparation System That Produces Ideally Smooth Supragingival and Subgingival Margins

Cary E. Goldstein, DMD

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A Supplement to *Contemporary Esthetics and Restorative Practice®*

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Dear Reader:

There has been a continuous increase in demand for more esthetic, or "tooth-colored," restorations by the dental profession and the public over the past few decades. This demand has come about because of an increased public awareness of and desire for esthetic materials over metallic-based restorations, the introduction of new technologies by industry and the scientific community, and a growing population of clinicians who have elected a preference for enhancing the esthetics of their patients. It would be safe to assume that all clinicians would favor an esthetic restorative procedure as long as there was no significant compromise in health care delivery to their patients.

Dr. McLaren and Dr. Vigoren have presented a comprehensive discussion of improving esthetics without compromising basic principles of ceramic crown restorations. Specifically, they focus their article on the proper use of the Captek™ technique of a metal-ceramic crown. Using a balance of science and personal experience, they are able to discuss in depth many of the basic guidelines and principles that can assist clinicians with achieving successful results when using this technology. They discuss important factors such as depth of preparations, indications for specifically designed burs or diamonds, type of core materials present, and single vs multiple units. The end result is a three-dimensional, integrated outline of the principles of ceramic crown restorations. Both the experienced and novice clinician will benefit from the authors' experiences and knowledge.

Dr. Goldstein reviews the use and significance of a series of diamond instruments that should assist clinicians when performing various esthetic procedures. Behind each procedural step are principles related to optimizing the final esthetic procedure. Dentists should find this information useful in developing a consistent approach to tooth preparation rather than relying on a history of inconsistent preparation routines that may not meet the demands of today's newer technologies.

Dental Learning Systems would like to thank Brasseler USA® for sponsoring this clinical series for the dental profession.

Sincerely,

 Duke sig

E. Steven Duke, DDS, MSD
Professor and Chairman
Department of Restorative Dentistry
Indiana University School of Dentistry

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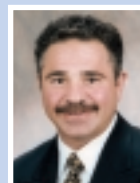
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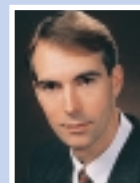
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Crown Considerations, Preparations, and Material Selection for Esthetic Metal-Ceramic Restorations

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ABSTRACT

In recent years, many dentists and patients have opted for metal-free restorations amid concerns regarding esthetics and potential metal toxicity. The use of a Captek™ substrate with a new-generation, lower-fusing porcelain has demonstrated excellent esthetic results, proving that it is possible to fabricate porcelain-fused-to-metal restorations that rival any all-ceramic restoration. This article will discuss the clinical considerations in the use of crown systems, and preparation guidelines for esthetic metal-ceramic restorations using Captek™ cores.

LEARNING OBJECTIVES

After reading this article, the reader should be able to:

- describe the preparation techniques for single- and multiple-crown situations.
- identify situations in which a core system should be used.
- discuss the clinical situations in which full-coverage crowns supported by a high-strength core should be considered.
- explain the difficulties in controlling proper tooth reduction in clinical situations where multiple crowns are necessary.

Esthetic metal ceramics have seemed almost oxymoronic to many dentists and patients. The esthetic push in recent years has been for the metal-free restoration under the guise that superior esthetics can be obtained only without using metal substrates in crown restorations. Also, concerns over potential metal toxicity have led the public and many dentists to choose metal-free restorations. Many of these metal-free systems, marketed as alternatives to

conventional porcelain-fused-to-metal (PFM) restorations, have little or no clinical or toxicity data to support their use. High-gold alloys have proven safe and are tolerated well by patients; it has been only the use of nonprecious alloys that have created toxic reactions in patients.¹ Porcelains have proven to be highly biocompatible, which favors a healthy gingival response, and are frequently used in restorations for veneers, metal-ceramic, or high-strength ceramic copings.²

However, it is possible to fabricate PFM restorations that rival any all-ceramic restoration esthetically³ with the proper use of new-generation porcelains and alloy systems.⁴ Specifically, the use of a Captek™^a substrate with Vita® Omega 900^b, a new-generation, lower-fusing porcelain, has demonstrated excellent esthetic results (Figure 1). The specific framework design parameters for the esthetic fabrication of porcelain-veneered Captek™ crowns is dealt with elsewhere.^{4,5} As critical as the design parameters are for the restoration to obtain an esthetic result, also critical is the proper tooth preparation to allow room for the esthetic material.

CROWN CONSIDERATIONS

Ideally, the least amount of tooth structure possible should be removed when preparing teeth for crown restorations. In situations where minimal tooth structure removal is required, a porcelain-bonded restoration is indicated, assuming it will satisfy the functional and esthetic requirements of the patient (Figures 2 and 3).⁶ Excess tooth structure should never be mutilated to satisfy the requirements of a certain material when a more conservative approach will satisfy functional, biologic, and esthetic requirements. Clinical situations that require a conventional PFM are the same for a Captek™-supported restoration.

^aCaptek, Altamonte Springs, FL 32714; 800-921-2227

^bVita Zahnfabrik, Germany distributed in US by Vident™, Brea, CA 92621; 800-848-2726



Figure 1—Porcelain-fused-to-gold crowns on teeth Nos. 8 and 9 fabricated with a Captek™ substrate and Vita® Omega 900, a new-generation, lower-fusing porcelain.



Figure 2—Preoperative condition where the structural integrity of the remaining tooth was ideal for bonded porcelain.



Figure 3—Postoperative view of bonded porcelain veneers on teeth Nos. 8 and 9. Note the esthetic integration of these very conservative, bonded porcelain restorations.

Full-coverage crowns supported by a high-strength core should be considered in the following clinical situations: to replace an existing PFM restoration; when there is a compromised substrate (tooth); and when there is need for support for the porcelain. It is important to understand that porcelain gets its strength from being bonded to a high-strength substrate—either enamel, metal, or ceramic core. If the substrate has only dentin or composite—both of which are low modulus (flexible) materials—then the less flexible and more brittle ceramic will absorb a disproportionate amount of stress under load, which increases the chance for brittle failure.⁷ In a study that looked at the failure load of bonded, pressed ceramics to materials of different elastic moduli, it was concluded that the failure load was proportional to the flexibility of the substrate.⁸ The more flexible the substrate, the lower the failure load. Thus, thin teeth or extremely broken-down teeth, especially those with a large (and flexible) composite buildup, should not be considered for bonded porcelain restorations that have no core support. In these clinical situations, a crown should be placed that uses a high-strength core.

A core system should also be used in situations where porcelain would be subjected to high shear and tensile stresses. Porcelain can

extend several millimeters occlusally or incisally in situations where the stresses placed on it will be primarily compressive in nature and the substrate is stiff.

It is possible to fabricate PFM restorations that rival any all-ceramic restoration esthetically with the proper use of new-generation porcelains and alloy systems.

PREPARATIONS

The correct reduction for the room necessary for the esthetic fabrication of a Captek™ or, for that matter, any PFM restoration is paramount. Evaluation of more than 700 Captek™ restorations in which the primary author performed all clinical and ceramic procedures has led to the determination that 1.2 mm of overall labial crown thickness was the minimum ideal dimension for predictable esthetics. All of those 700-plus restorations were documented and measured for final crown dimensions before cementation, and subjective analysis was made as to the esthetic success of the cemented restorations. It was determined

that a 1.2-mm facial crown dimension allowed predictable shape reproduction and subjective esthetic success. Thus, it is recommended to reduce facially to allow for a final restoration with a facial dimension of 1.2 mm. This may not mean that 1.2 mm of tooth structure needs to be removed facially. Esthetic and functional requirements will dictate whether more or less tooth should be removed, because labializing or lingualizing the facial surface may need to be accomplished. The correct reduction for a single crown is fairly easy, but the correct reduction for multiple-crown situations is much more complex.

SINGLE-CROWN SITUATIONS

Reduction for single crowns is generally dictated by the adjacent teeth, which is easy to visualize and compare. It is sometimes necessary to build up the tooth to the desired final shape before initiating the preparation process to better visualize the correct amount of reduction necessary for the final restoration. Before crown preparation, caries and old restoration removal with concomitant foundation restoration placement should be accomplished.

Small carious lesions or old restorations can be removed during the gross reduction steps of the crown preparation. Figure 4 dem-

onstrates the UCLA Center for Esthetic Dentistry Metal-Ceramic and All-Ceramic Preparation Kit (338.31.620) by Dr. McLaren[®]. The first step in the process is to break contact with the adjacent teeth (Figure 5) using the coarse diamond (#5858-014[®]). The marginal area is prepared next with either a KS1[®] or KS2[®] diamond (Figures 6A and 6B). The marginal preparation is done right to the level of the gingiva (Figure 7). The marginal area is the most critical area when preparing for a PFM with a porcelain margin or an all-ceramic crown, and experience has shown that a 360-degree, 1-mm shoulder preparation with a 90-degree exit angle and rounded internal line angles is ideal for these restorations (Figure 8).

[®]Brasseler USA[®], Savannah, GA 31419; 800-841-4522

All other areas of the preparation can be altered on the worked die by the ceramist if necessary to create more room, and can subsequently be adjusted intraorally by the dentist. An underprepared

An underprepared marginal area is impossible to compensate for in the laboratory.

marginal area is impossible to compensate for in the laboratory and would require repreparation and reimpressioning, hence the rationale for preparing the margin early in the preparation process.

Axial reduction is next, and

can be controlled by a number of techniques. Classically, it is recommended to use depth cuts to gauge the amount of reduction. This technique works only if the amount of tooth structure removal is the same as the amount of tooth structure that will be replaced. It does not work if the labial position of the tooth is being altered in the final restoration. Depth grooves generally allow the correct reduction in single-crown situations where the final restoration will follow the contour of adjacent teeth. Depth grooves are placed with a KS1, KS2, or KS3[®] diamond (Figure 9) depending on the necessary reduction. The same diamond used for the depth cuts is used to remove the remaining tooth structure to the desired depth (Figure 10). The goal for a Captek[™]



Figure 4—The UCLA Center for Esthetic Dentistry Metal-Ceramic and All-Ceramic Preparation Kit by Dr. McLaren.



Figure 5—Breaking contact with the #5858-014 diamond on a demonstration model in which natural teeth are mounted.



Figure 6A—Profile view of initial margin placement done with either the KS1 or KS2 diamond.



Figure 6B—Facial view of margin placement done with either the KS1 or KS2 diamond.



Figure 7—Initial margin placement is done right to the level of the gingiva facially and interproximally. Interproximally, a KS1 is used so as not to damage adjacent teeth.

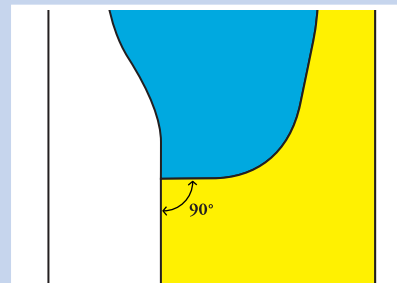


Figure 8—Shoulder margin with rounded axial-gingival line angle.

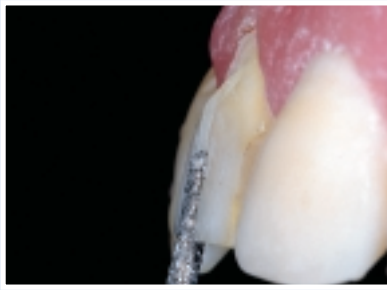


Figure 9—Depth grooves are placed with either a KS1 or KS2 diamond.



Figure 10—Axial reduction is completed using the same KS diamond used for the depth cuts.



Figure 11—Incisal edge reduction using the KS3 diamond.



Figure 12—Using the 2-mm Reduction Guide to check the occlusal reduction on tooth No. 30.



Figure 13—Lingual reduction is accomplished on anterior teeth with the egg-shaped KS4-024 diamond.



Figure 14—Lingual reduction for posterior teeth is done with a KS2 or KS3 diamond.

restoration should be to allow for 1.2 mm of space labially. Incisal or occlusal reduction is initiated with a KS3 diamond. Incisal edge reduction of 2 mm is adequate for good esthetics. The diameter of the KS3 is 1.6 mm, so going slightly deeper gives the necessary 2-mm reduction (Figure 11). The adjacent incisal edge can also be gauged as

a reduction guide. Posteriorly, it is necessary to have 2.5 mm of occlusal reduction for both esthetic metal-ceramic and all-ceramic restorations, especially if natural, unworn occlusal anatomy is desired in the final restoration. The best aid the authors have found to accomplish this reduc-

^dKerrLab, Orange, CA 92867; 800-537-7123

tion is the 2-mm Reduction Guide^d. If the 2-mm guide passes with only slight binding through the occluded opposing arches, then there is close to 2.5 mm of interocclusal space (Figure 12). Lingual reduction is done with the KS4-024^e diamond for anterior teeth (Figure 13) and a KS2 or KS3 for posterior teeth (Figure 14) to allow for at least 0.7 mm of crown thickness for anterior teeth and 1.0 mm thickness for posterior teeth.

Before finishing the preparation, one layer of Ultrapak[®] #000^e is placed in the sulcus (Figure 15). This generally gives 0.5 mm of gingival displacement. The margin is apically positioned 0.5 mm with either a KS1 or KS2 (Figure 16) diamond or, in cases with excessively scalloped gingival margins, the KS6^e. The depth to which the margin should be placed in the sulcus is a complex issue and affect-

^eUltradent Products, Inc, South Jordan, UT 84095; 800-552-5512



Figure 15—A clinical case with Ultrapak[®] #000 cord placed to obtain initial gingival retraction so that the margins can be finished. The margin was prepared to the level of the retraction cord.



Figure 16—The apical position of the margin is placed with either a KS1, KS2, or, as shown, a KS6 diamond.



Figure 17—Final margin finishing is completed with either the #8845KR-018 or #8845KR-025 fine diamond.



Figure 18—The finishing carbide bur H158-014 can also be used to finish the margin.



Figure 19—Axial contours are finished with either the #8881-014 or #8856L-020 fine diamond.



Figure 20—Using a polypropylene matrix to gauge gross reduction.



Figure 21—A clinical case in which all maxillary teeth are to receive all-ceramic crowns. In these situations where adjacent teeth are prepared, the contact is broken using either the KS1 or KS2 diamond.



Figure 22A—Rough preparations immediately after old restoration removal.

ed by many variables.^{9,10} The ultimate goal of margin placement is to have an esthetic restoration/gingival interface without biologic complications (ie, violation of biologic width). The marginal area is then finished with either the #8845KR-018° or #8845KR-025° finishing diamonds, or the H158-014° carbide finishing bur (Figures 17 and 18). Axial contours are finished with the #8881-014° or #8856L-020° fine diamonds (Figure 19). For all-ceramic crowns, it is critical to round all internal line angles with one of the fine diamonds. This minimizes stress concentrations in the ceramic crown by eliminating sharp angles.

PREPARATIONS FOR MULTIPLE CROWNS

Clinical situations in which multiple crowns are necessary

present extreme difficulties in controlling proper tooth reduction. Often, old crowns are being removed or the three-dimensional shape of the tooth is going to be altered significantly. In these situa-

The depth to which the margin should be placed in the sulcus is a complex issue and affected by many variables.

tions, axial depth grooves are of limited value. It has generally been recommended to make a polypropylene vacuum-formed matrix to be used intraorally to control tooth reduction (Figure 20). While this is a useful adjunct, it is fraught

with potential problems. When placed over the teeth, it is difficult to judge if the changes in tooth form that are incorporated into the matrix are in fact correct esthetically and functionally. Also, it is easy to displace the matrix in one direction or another up to almost 1 mm without knowing it. All of the above conditions could easily lead to overprepared or underprepared teeth. McLean described a technique where the prototype (temporary) is completed on the prepared teeth and then measured with a caliper to gauge proper tooth reduction.¹¹ Although this is the best method, two or three relines may be necessary to finalize the reduction amount, which is not very practical. One problem with this technique is that acrylic monomers left on the prepared tooth will inhibit the set of



Figure 22B—A shell prototype is tried over the rough prepared teeth to assess esthetic and functional acceptance of the desired anatomical changes.



Figure 23A—The shell prototype is altered as necessary for esthetics and function. The prototype is then relined with a fast-set PVS bite registration material.



Figure 23B—The prototype is measured for optimal thickness, and appropriate adjustments are made to the preparation to obtain the ideal reduction.



Figures 24A and 24B—Two views of the final preparations on the master casts, demonstrating ideal reduction for Captek™ restorations.



Figure 25A—View of the seated, final Captek™ crowns.

polyvinyl siloxane (PVS) impression materials. Therefore, an alternative technique will be discussed to control axial reduction.

Preparations for multiple-crown situations begin by either removing the old crowns or breaking contact (Figures 21 and 22A). Contact is broken in the same manner as for a single crown, but larger diamonds can be used if the adjacent tooth is going to be prepared. The margins for all the teeth being prepared are placed second using either the KS1 or KS2 diamond. The margins are placed at this juncture following the same rationale as stated for single crowns. Gross axial reduction is done using the clear vacuum matrix as a guide, but should not be relied on for the final reduction for the reasons stated previously. Final reduction is accomplished using an alternative and very efficient technique that the authors

have used for years. After gross reduction, a preformed shell prototype made from the preoperative cast or a diagnostic wax-up is placed over the prepared teeth (Figure 22B). This prototype is then evaluated for esthetics and altered as necessary for esthetic

Clinical situations in which multiple crowns are necessary present extreme difficulties in controlling proper tooth reduction.

acceptance. The prototype can then be relined with a fast-set PVS bite registration material (Figure 23A) and measured to verify reduction (Figure 23B). The tooth is then reduced as necessary with any of the KS diamonds. Another

benefit of this technique is that debris is cleaned off the prepared teeth before final impressioning. One layer of Ultrapack® #000 is then placed in the sulcus to obtain the initial tissue displacement. The final finishing steps and diamonds used are exactly the same as for single-crown situations (Figures 24A and 24B). Figures 25A through 25C represent a completed case of Captek™-supported PFM restorations using the preparation protocol presented in this article.

SUMMARY

Many different criteria are involved in choosing the correct material or technique to treat a clinical situation. The authors presented a clinical rationale for choosing a crown system with a high-strength core of metal or ceramic vs an unsupported porcelain. Metal-ceramic restorations can rival all-ceramic restorations if



Figure 25B—View of the final Captek™ crowns. Note the esthetic match with the adjacent natural teeth.



Figure 25C—Full-face view of the same case. This is an excellent esthetic result for a patient in his late 60s.

the proper materials and design criteria are followed. Captek™ restorations require 1.2 mm of facial reduction for a predictable esthetic outcome, which is less than what is generally required for conventional metal-ceramics. Proper preparation techniques are of primary importance for esthetic success with metal-ceramic restorations.

Authors' Note: All clinical and laboratory procedures were performed by Dr. McLaren.

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A Crown Preparation System That Produces Ideally Smooth Supragingival and Subgingival Margins

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ABSTRACT

Crown preparation design kits can be quite complex. The technique described in this article offers simplicity and consistently accurate preparations for both anterior and posterior restorations. Depth cuts with the round 1.5-mm diamond ensure precise reduction for porcelain adaptation and proper esthetics. Nine instruments and a technique guide will lead the clinician through any crown design.

In developing the Goldstein Crown Design Kit™,^a the goal was to provide a selection of diamonds and stones that simplify crown preparation procedures in a variety of situations. Containing only nine instruments, the kit is designed to permit the dentist to address the esthetic requirements of anterior or posterior crown cases for patients with high or low lip lines. The kit's diamond selection was designed to accommodate all porcelain crowns, aluminous-core porcelain crowns, porcelain-fused-to-metal (PFM) crowns, or those fabri-

^aBrasseler USA®, Savannah, GA 31419; 800-841-4522

cated from gold. Smooth-finished, precise margins free of jagged enamel edges can be produced supragingivally or subgingivally, according to specific case requirements, enhancing the adaptation of the restoration to the tooth. Impressions made after preparation with the kit components reveal exceptional detail and facilitate accurate laboratory communications.

This article describes the multiple approaches to anterior preparations offered by the Goldstein Crown Design Kit.

TOOTH PREPARATION

Tooth preparation begins with depth reduction, using the 1.5-mm measured reduction, round diamond bur (#5801-016^a). This round diamond serves as the key to the success of the kit and the corresponding technique selected. The round diamond provides the precise dimensions needed to create the ideal preparation. Because the bur is round, it can be used on any surface of the tooth, a concept developed by Dr. Robert Stein and then popularized by Dr. Ronald Goldstein.¹

Using the round diamond bur, a 1.5-mm depth guide is scribed around the cervical to initiate creation of the margin (Figure 1). Sufficient reduction in the marginal



Figure 1—Scribing a 1.5-mm diameter depth cut around the cervical with the #5801-016 coarse round diamond.



Figure 2—Using the same diamond to create precise, 1.5-mm depth reductions up the facial aspect of the tooth.



Figure 3—Continuing over the incisal edge, down the lingual, and around the cervical with the same depth-reduction diamond.

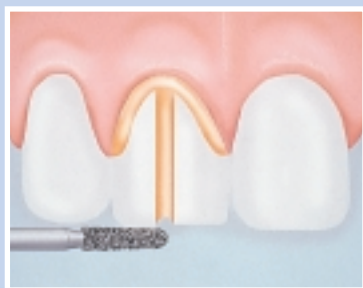


Figure 4—Depending on the size of the tooth, the small #5856-016 or the large #5856-021 barrel-shaped, tapered, coarse bulk-reduction diamond removes the incisal enamel.



Figure 5—Using either the #5856-016 or #5856-021 diamond to remove the interproximal enamel.



Figure 6—Removing the facial enamel down to the level of the initial depth guide with either the #5856-016 or #5856-021 diamond.

area permits ideal adaptation of either an all-ceramic crown or a PFM crown with a large enough porcelain margin to obscure the metal. Although some clinicians may prefer a depth reduction measuring less than 1.5 mm, the maximum depth produced by the bur yields a margin of ideal thickness, particularly from the laboratory technician's perspective, because space is sufficient to develop an esthetic margin.

Containing only nine instruments, the kit is designed to permit the dentist to address the esthetic requirements of anterior or posterior crown cases for patients with high or low lip lines.

After the initial depth-reduction procedure, the same diamond is applied up the facial aspect of the tooth, producing an exact 1.5-mm facial trough (Figure 2). The same round depth-reduction diamond can next be used over the incisal edge, swept down onto the lingual aspect of the tooth, and then used to scribe a 1.5-mm line around the cervical of the lingual (Figure 3).

The next diamond employed in

this technique is either the small (#5856-016^a) or large (#5856-021^a) barrel-shaped, tapered, coarse bulk-reduction diamond. For a small tooth, such as a lateral incisor, the small barrel-shaped diamond should be selected. For a larger tooth, such as a molar or central incisor, the larger diamond is an ideal choice.

First, the incisal edge (or occlusal surface for a molar) is reduced (Figure 4). Next, the same diamond removes the interproximal (Figure 5) and facial enamel (Figure 6) down to the extent of the depth grooves. Note that the coarse, cone-shaped diamond is used to open tight interproximal contacts and to place bevels for extra retention. Finally, this same diamond removes the lingual wall of enamel (Figure 7).

The next diamond in the sequence, the football-shaped diamond (#379-023^a) (Figure 8), can be used to shape the lingual concavity.

For all crowns, the healthiest margin—that is, the least invasive—is placed above the gingiva; therefore, analysis of the patient's lip line is critical—whether it is high, medium, or low—before undertaking tooth preparation and before the patient is anesthetized.

A patient with a low lip line can have any margin—including a facial collar of metal or a bevel—as long as the patient understands this and accepts it.

For the clinician who wishes to continue, for example, to develop a porcelain margin for either an all-porcelain or PFM crown, the steps

Smooth-finished, precise margins free of jagged enamel edges can be produced supragingivally or subgingivally, according to specific case requirements, enhancing the adaptation of the restoration to the tooth.

described below produce an ideally smooth, polished margin with no exposed enamel prisms, thus allowing optimal adaptation of the porcelain to the preparation.

SUPRAGINGIVAL MARGIN POLISHING

To develop a smooth, polished supragingival margin, two smooth diamond burs that correspond in size to the coarse, barrel-shaped diamonds initially used are provided in the kit. The small, smooth, barrel-shaped diamond (#8856-016^a) corresponds to the small, coarse, barrel-shaped diamond (#5856-016); the large, smooth, barrel-shaped dia-



Figure 7—The #5856-016 or #5856-021 diamond is used to create the lingual wall reduction.

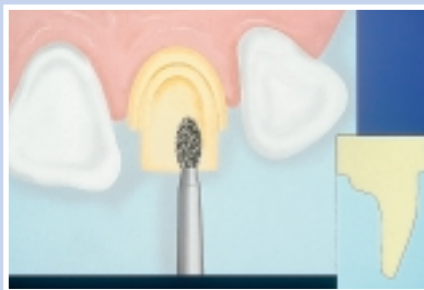


Figure 8—Shaping the lingual concavity with the #379-023 football diamond.



Figure 9—The red smooth diamond is used to round off all preparation line angles and to refine the margins. This is the finished supragingival preparation.

mond (#8856-021^a) corresponds to the larger coarse diamond (#5856-021). The smooth diamonds round off any sharp line angles in the preparation, and they also smooth the margins.

After the fine, barrel-shaped diamond has been used to smooth and round the line angles, the white stone (#649-420^a), included in the kit, should be applied around the margin one last time to produce a polished surface. Figure 9 shows a finished supragingival preparation that is ready for impression.

The burs in the crown design kit used to this point provide two types of preparations: one, a very rapid preparation for metal margins that require minimal smoothness; the other, a smooth, polished margin to meet the requirements for porcelain restorations. The instruments in the kit, however, also yield exceptional subgingival margins.

SUPRAGINGIVAL PREPARATION

If a subgingival margin is desired in an esthetic case involving a patient with a medium to high lip line, retraction cord (such as the purple Number 1 Ultrapak[®] cord^b, which packs dry) would be placed after the coarse barrel-shaped diamond is used. Cord packing should

begin from the midfacial surface of the preparation, and the cord would be packed circumferentially around the tooth until it abuts perfectly at the facial surface, right in the center of the tooth. For each tooth being prepared, the cord is packed very gently into the sulcus and left in place for 3 to 5 minutes, allowing the tissue to retract.

A patient with a low lip line can have any margin—including a facial collar of metal or a bevel—as long as the patient understands this and accepts it.

With the retraction cord left in place, the coarse, barrel-shaped diamond is used to drop the margin circumferentially all the way around the tooth to the height of the retracted tissue (Figure 10). The corresponding fine, barrel-shaped diamond is used to produce a smooth surface at the margin.

Because the margin is extended subgingivally, the next bur used in the sequence should be the tissue-protecting-end (TPE) cutting diamond (#10839-016^a), which features diamond grit only at the very

tip of the instrument (Figure 11). Because no diamond grit is on the sides of the bur, and because of its beveled configuration, the diamond-tipped end can be placed precisely on the edge of the tooth, and moved circumferentially around the margin.

The beveled configuration of the diamond essentially pushes the tissue out of the way and prevents tissue laceration when the instrument is placed close to the gingiva, even when working subgingivally. The instrument is applied around the edge of the tooth to completely smooth any jagged enamel prisms. After the smoothing procedure with the TPE diamond, the white stone (#649-420^a) is used for further finishing and polishing of the margin (Figure 12).

IMPRESSION PROCEDURE

To make an impression at this point, a white Number 1 GingiGel[®] cord^c is placed circumferentially around the tooth on top of the purple retraction cord (previously placed) and left in place for 3 to 5 minutes (Figure 13). The site should be washed, making certain the white cord is wet. The white cord is then removed, and the preparation is thoroughly dried and evaluated. If all margins are clearly visible, the impression

^bUltradent Products, Inc, South Jordan, UT 84095; 800-552-5512

^cVan R[®] Dental Inc, Oxnard, CA 93033; 800-833-8267



Figure 10—For a subgingival margin, a single-size #0 or #1 cord is placed, and the original bulk-reduction diamond is used to lower the preparation margin to the height of the retracted tissue. The margin is refined with the smooth red diamond.



Figure 11—The TPE diamond, #10839-016, is used to remove any jagged enamel prisms left at the margin.

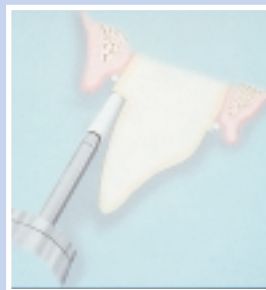


Figure 12—Finally, the white stone, #649-420, produces a fine polish to the entire margin. This key step ensures excellent marginal adaptation with the final restoration.



Figure 13—The finished preparation, with two cords placed for ideal retraction.

should be taken with the purple cord still in place. The purple cord should remain in place throughout the entire preparation and impression procedure because it acts as a gasket between the sulcus and the tooth, stopping crevicular flow or hemorrhage. This double-cord technique can produce a perfect impression because it eliminates any fluids at the preparation site.

Because the impression extends subgingivally, the laboratory technician can perfectly visualize the margins for die trimming and provide a proper emergence angle for the final restorations.

The Goldstein Crown Design Kit offers exceptional versatility in its applications, allowing the clinician to address virtually any crown preparation requirements with

speed and precision. Using the instruments in the appropriate sequence produces smooth, finished margins that can be accurately recorded during impression making, thus facilitating laboratory communications and reducing the likelihood of remakes and returns.

REFERENCE

1. Goldstein RE: In: *Esthetics in Dentistry*. London, England: Quintessence; p395, 1998.

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CE Quiz

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Program #: D452

1. In situations where minimal tooth structure removal is required, what restoration is indicated?
 - a. full crown
 - b. three-quarters crown
 - c. porcelain-bonded
 - d. amalgam
2. Full-coverage crowns supported by a high-strength core should be considered in which clinical situation?
 - a. bonding
 - b. brittle
 - c. feldspar
 - d. sintering
3. In one study,⁷ the failure load of bonded, pressed ceramics to materials of different elastic moduli was:
 - a. proportional to the flexibility of the substrate.
 - b. inversely proportional to the flexibility of the substrate.
 - c. logarithmically proportional to the flexibility of the substrate.
 - d. not proportional to the flexibility of the substrate.
4. A core system should be used in situations where porcelain would be subjected to:
 - a. high shear and high tensile stresses.
 - b. low shear and low tensile stresses.
 - c. high shear and low tensile stresses.
 - d. low shear and high tensile stresses.
5. How many millimeters of overall labial crown thickness was the minimum ideal dimension for predictable esthetics?
 - a. 0.6 mm
 - b. 1.2 mm
 - c. 1.8 mm
 - d. 2.4 mm
6. What was subsequently employed for the fabrication of the provisional restorations?
 - a. matrix
 - b. copper tube
 - c. no provisional was used
 - d. alginate impression
7. It is sometimes necessary to build up the tooth to the desired final shape before initiating the preparation process in order to:
 - a. fabricate the temporary.
 - b. check the occlusion.
 - c. ensure pulpal clearance.
 - d. visualize the correct amount of reduction.
8. For the marginal area of a PFM, experience has shown that what type of shoulder with rounded internal line angles is ideal for these restorations?
 - a. 180 degrees, 1 mm
 - b. 270 degrees, 1.5 mm
 - c. 270 degrees, 0.5 mm
 - d. 360 degrees, 1 mm
9. How much incisal edge reduction is adequate for good esthetics?
 - a. 1 mm
 - b. 1.5 mm
 - c. 2 mm
 - d. 2.5 mm
10. Posteriorly, it is necessary to have how much occlusal reduction?
 - a. 2 mm
 - b. 2.5 mm
 - c. 3 mm
 - d. 3.5 mm

PREP STEPS

New Instruments for Provisional Restorations



Figure 1—UK cutters.

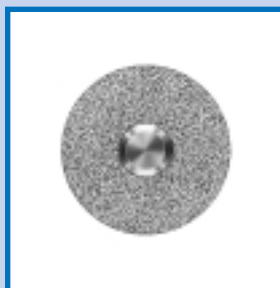


Figure 2—Diamond disc.

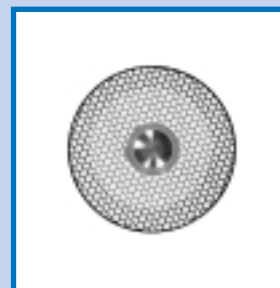


Figure 3—Vision Flex disc.



Figure 4—Acrylic polisher.



Figure 5—Diacomp point composite polisher.

Adjusting and polishing are inevitable for any provisional restoration, whether it is composite or acrylic, laboratory-fabricated or office-made. These new Brasseler USA® instruments can make adjusting temporaries faster, easier, and more precise.

Trimming facial and lingual margins:

The completely new blade geometry of the UK Universal tungsten carbide cutter (H138-023) facilitates fine shaping and contouring of tooth-colored materials. The clinician can control the desired material reduction and surface quality by varying the contact pressure—high contact pressure yields high material reduction; low contact pressure yields a smooth, finished surface. New, specially staggered, UK-toothing tungsten carbide cutters are ideal for trimming facial and lingual cervical margins and facial embrasures (Figure 1).

Trimming and identifying interproximal margins:

The efficient and long-lasting diamond disc (6918B-220) makes interproximal cuts that define facial embrasures without tearing or folding. To prevent clogging of the diamond disc when working on composite material, it is helpful to rinse the temporary in alcohol to remove the oxygen-inhibited layer (Figure 2).

Contouring interproximal forms, duplicating mamelon extensions, and personalizing provisional restorations:

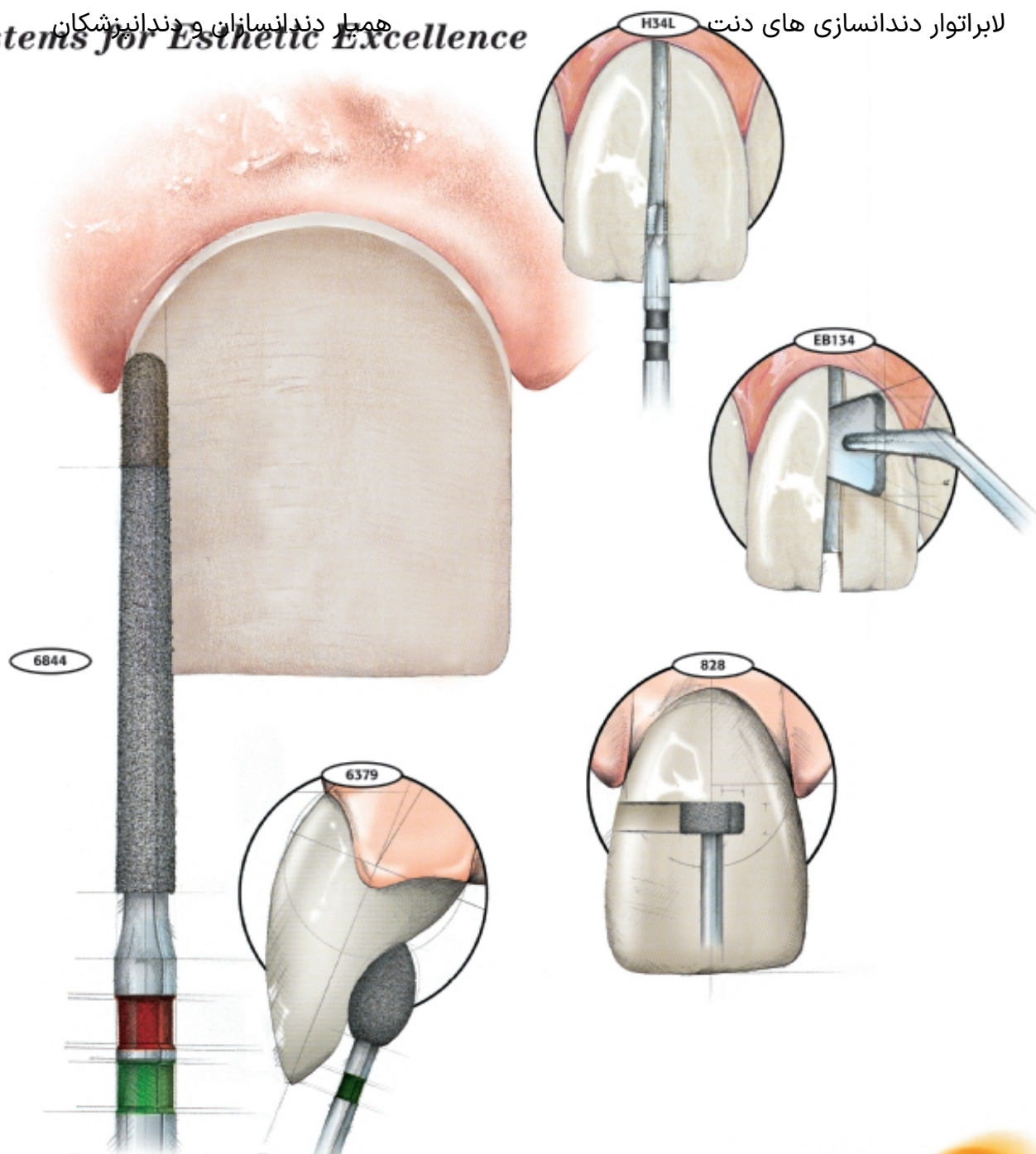
The new, open-meshed, diamond Vision Flex discs (6934-220 and 934-180) help to quickly and precisely remove bulk composite and acrylic and restore perfect proximal contour. The numerous honeycombs make the finishing disc flexible without impairing its stability. A new version of this disc, the 952-140 (Figure 3), has snap-on mounting with a precision-fit, quick-change sliding chuck, which stops the disc if it becomes engaged between the teeth. The 952-140 and 952-180 are available with a straight handpiece mandrel or slow speed for intraoral use.

Polishing temporary restorations:

The knife-edge acrylic polishers BRO3, BRO2, and BRO1 (Figure 4) allow the clinician to quickly restore a natural-appearing, lustrous surface. These polishers are autoclavable and, therefore, more hygienic and time-efficient than messy, wet, pumice polishing. For high-polish temporary composite restorations, use the autoclavable Diacomp points (DCH2DM and DCH2D) or Diacomp wheels (DCH8DM and DCH8M) (Figure 5).

Temporization Kits are available with complete instrumentation and assembled in cooperation with several lecturing clinicians.

This information is provided by Brasseler USA.



Multiple Preparation Protocol

As doctors incorporate new materials into their practice, it is necessary to identify the clinical techniques to achieve optimum results. Restorations such as full coverage all ceramic crowns require one type of tooth reduction while minimally invasive procedures such as indirect inlays or veneers require different guidelines. When a patient presents with multiple restorative requirements and preparation protocols, the challenge is to identify the instruments and methods that will ensure overall treatment success. Brasseler USA in conjunction with Dr. Larry Rosenthal has developed a rotary instrument system to simplify the process of instrument selection and enable dentists to complete tooth reduction in a step-by-step, clinically sound manner. Using precision designed, task specific instruments, clinicians can easily and predictably achieve the desired preparation designs and resulting restorative excellence.

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