The Factors that Influence the Dentist’s and Technician’s Choice of Restorative Materials

Full Crowns in the Esthetic Zone

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Today, manufacturers provide the dental technician and restorative dentist with a multitude of different materials for esthetic, full crown restorations for natural teeth and dental implants. Over the past several years, there has been a general trend toward using all-ceramic crowns. One purported reason is an improvement in overall appearance due to increased light transmission and translucency.

Deciding on the most appropriate crown for a specific restorative situation involves considering the strength and fracture resistance, fabrication ease, and long-term predictability. A skilled ceramist can closely simulate the hue, chroma, value, and internal characterization found in natural dentition regardless of the restorative material employed. The dentist’s responsibility is to provide the proper tooth preparation needed to create the optimal crown. Proper tooth reduction requirements and guidelines for choosing between ceramometal, pressed and layered all ceramic, and composite resin crowns are explained.

Examples of clinical cases are also shown in this report.

Key Words: interdisciplinary treatment, tooth preparation design, full crown porcelain restorations, dental esthetics, Creation™ porcelain, Authentic™ pressable ceramic, Sinfony™, Captek ™, comparative crown strength, dental implant crown

Successfully fabricating and delivering full crowns in the esthetic zone requires diagnosis, case selection, experience and close collaboration between the dentist and technician. Proper preparation design is an integral part of this process. Often, the technician encounters insufficient reduction, especially on the palatal or lingual surfaces. Inadequate space leads to compromises in porcelain layering, contour, emergence profile, and internal coloration. Dental manufacturers have introduced all-ceramic materials that purportedly address the dentist’s perception that ceramometal crowns lack optimal esthetics. There is a general assumption among dentists that all-ceramic crowns have inherently superior esthetics that compensate for limitations in the ceramometal system or technician skill. However, these perceived deficiencies are usually less the fault of a particular restorative material and more of a cumulative effect of deficiencies in preparation and in a technician’s knowledge and experience.

The decision to use a specific type of crown should be based upon the treatment expectations, strength, fabrication ease, and long-term predictability. This is particularly important when the chosen restoration deviates from a standard that has proven successful for many decades—the ceramometal crown. Collaboration between the dentist and technician prior to patient treatment enables the skilled ceramist to develop the hue, chroma, value and internal characterization found in natural dentition regardless of the restorative material used.
Figs. 1a and 1b. Diagram of the minimal tooth reduction for optimal esthetics of a full coverage crown restoration on a central incisor. Incisal reduction of 2.5 to 3 mm provides light transmission and translucency of the incisal edge. The gingival-axial reduction should be at least 1.2 mm (a). The facial and palatal reductions of 1.2 to 1.5 mm allow sufficient space for porcelain layering and proper palatal contours (b).

Figs. 2a and 2b. The preoperative view of the demonstration typodont model. Tooth #9 will receive a ceramometal crown restoration using a precious metal alloy and a circumferential porcelain margin; tooth #10 will be restored with a self-curing acrylic resin core that is veneered with Sinfon™, and tooth #11 will have a pressable ceramic core veneered with layered porcelain (Authentic™).

PREPARING NATURAL ANTERIOR TEETH

Prior to initiating treatment, the dentist and the technician must review facebow mounted diagnostic casts, the extra-oral and intra-oral photographs of the teeth relative to generally accepted esthetic parameters, and have a thorough understanding of the patient’s goals. The diagnostic wax up guides the dentist through the appropriate tooth reduction. With proper preparation provided on a master cast, the ceramist can fabricate a crown to simulate the natural tooth. Reduction between 2.5 mm to 3.0 mm is important to develop a translucent incisal edge. Facial and palatal reduction between 1.2 to 1.5 mm allows sufficient room for proper porcelain layering within the appropriate contours (Fig. 1).

The following series demonstrates preparing teeth #9-11 for a ceramometal, composite resin, and all-ceramic crown restoration, respectively (Figs. 2 through 7). The pretreatment situation is shown in Figure 2. A polyvinylsiloxane impression is taken (Lab-Putty, Coltène, Mahwah, New Jersey, USA) of either the pre-existing teeth or diagnostic wax up. The impression is sectioned to accurately record the facial and palatal contours (Figs. 3a and 3b). These matrices help the restorative dentist to determine adequate tooth reduction to give the technician room to produce an optimal esthetic result. The final preparations are shown in Figure 4. The facial and palatal guides verify that sufficient tooth reduction occurs prior to the final impression. A shoulder preparation may be substituted for the deep chamfer gingival margin. All line angles are rounded to eliminate acute

“The impression is sectioned to accurately record the facial and palatal contours.”
“Regardless of the restorative material employed, the esthetic appearance is the same.”

transitions that might complicate fabricating the metal coping or contribute to all ceramic crown failures.

In this example, tooth #9 will be restored as a ceramometal crown with a circumferential porcelain margin, tooth #10 will have a self-curing acrylic resin core (SR Ivocron, Ivoclar AG, Schaan, Liechtenstein) that is veneered with a light-cured composite resin (Sinfony™, ESPE America, Inc, Norristown, PA), and a pressable ceramic coping with layered porcelain (Authentic™, Microstar/Jensen Industries) will be fabricated for tooth #11 (Fig. 6).

The facial and incisal matrices confirm the proper contours for the metal and pressed ceramic copings (Figs. 6c through 6d). The definitive crowns are shown in Figure 7. Regardless of the restorative material employed, the esthetic appearance is the same. The minimum thickness required for the crown contours are 1.5 mm facial and 1.2 mm palatal (Figs. 8a through 8c). When the appearance of the definitive restorations is comparable, the dentist’s decision on the type of crown restoration should be based on the strength, longevity, predictability, and fabrication ease.3-10

Often when a dentist requests an all-ceramic crown it is because of the erroneous belief that ceramometal crowns cannot reproduce the translucency of the all-ceramic crown.
Figs. 6a-d The working cast is fabricated in the normal manner (a). The precious metal coping and pressed-ceramic copings are verified with the matrices (b-d).

Figs. 7a-d. The definitive crown restorations are shown on the soft tissue cast (a,b) and on the typodont teeth (c,d). The hue, chroma, value, and texture of each are the same regardless of the type of restorative material that is used.
Figs. 8a-c. The thickness of the facial and palatal surfaces averaged 1.5 and 1.2 mm, respectively. These dimensions are important to simulate natural esthetics and contours with the definitive crowns.

Figs. 9a-l. A clinical example of the steps guiding the dentist in proper tooth reduction. The diagnostic wax up (a) is used to fabricate the facial and palatal guides with a laboratory polyvinylsiloxane impression material (b,c). A soft tissue cast (d) is fabricated to transfer the contour of the soft tissues for proper gingival contours (Gengisil, Techim Group, Milano, Italy). The facial and palatal matrices ensure that adequate tooth reduction is present (e,f). The definitive ceramometal crowns are shown on the soft tissue casts (g,h). The result closely simulates the initial wax up and incorporates the hue, intensity, translucency, and internal colors found in natural teeth (i-l).
Implant-supported ceramometal crowns in the esthetic zone often require using a long-term provisional restoration to develop favorable soft tissue contours (a). The Sinfony™ veneered acrylic core crown allows the technician to duplicate the natural tooth during gingival maturation (b). The acrylic core must be opaqued to prevent the gray influence of the titanium abutment.

Logically, the dentist’s decision regarding the crown type should not be dependent upon the ceramist’s limitations.

The inherent challenges when fabricating translucent ceramometal crowns tax the skills of many ceramists. Although the all-ceramic crown may possibly compensate for the less skilled technician, the strength and longevity of the definitive restoration is compromised. Logically, the dentist’s decision regarding the crown type should not be dependent upon the ceramist’s limitations.

Clinical cases are presented in Figures 10-14. Crown choice was based on the strength and long-term predictability combined with the individual patient’s treatment goals. Although the decision to restore anterior teeth with all-ceramic crowns is
certainly appropriate when the preparation design is ideal and the dentin color does not need to be masked, the possible increased risk of fracture and failure must also be considered. In the posterior region, because of the increased occlusal forces, the dentist must choose a crown design that incorporates high strength with esthetics (Figs. 11a through 11d). Implant-supported, all-ceramic crowns (Figs. 12a through 12d) that are cemented on titanium abutments or crowns placed on teeth restored with cast posts and cores will not have an esthetic advantage over the ceramometal crown. Therefore, the ceramometal crown becomes a prudent design because eliminating the influence of the metal color is required in either case and its increased strength has a decided advantage (Figs. 13a and 13b). However, if a limited number of titanium posts are present, then all-ceramic anterior crowns combined with metal ceramics is an acceptable alternative (Figs. 14a and 14b).
Figs. 12a–d. Dental implant-supported porcelain crowns cemented on titanium abutments have no esthetic advantages if the definitive crown is either all ceramic or ceramometal since both restorations require an opaqued substructure prior to porcelain layering. Examples of ceramometal crowns cemented on titanium abutments include an upper right central incisor (a), a lower right central incisor (b), an upper left central incisor (c), and a Captek™ (Precious Chemicals, Inc, Altamonte Springs, FL) crown on a lower right cuspid implant (d).
CONCLUSION
Collaboration between the dentist and the dental technician is important when choosing the appropriate full porcelain crown restoration. A close relationship permits an open exchange of ideas to best address the patient’s needs and treatment goals. Technicians frequently encounter inadequate space for an esthetic, properly contoured full crown. This compromises the porcelain layering techniques that simulate natural dentition. With proper preparations, the dental technician can use various materials—full ceramic, composite, metal ceramic, pressed ceramic, or zirconium. However, the predictability and longevity of the ceramometal crown restoration should not be discarded for all-ceramic crowns unless the advantages outweigh the risks.

Dentistry is an evolving profession. This fact stimulates the dentist and technician to continually improve their skills, knowledge, and expertise. The best interests of the patient can only be served when the dentist and technician make decisions based on well-established science rather than subjective preference based on a manufacturer’s marketing.

“Technicians frequently encounter inadequate space for an esthetic, properly contoured full crown.”
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#1 Why has the general trend in dentistry been toward all-ceramic crowns?
   a. They are cheaper
   b. They are stronger
   c. They have increased light transmission
   d. All of the above

#2 What factors should be considered when choosing a restorative material?
   a. Strength and fracture resistance
   b. Ease of fabrication
   c. Long-term predictability
   d. All of the above

#3 The proper tooth preparation is the...
   a. Dentists responsibility
   b. Necessary for all ceramic crowns
   c. Is rarely received in the laboratory
   d. All of the above

#4 Inadequate space leads to compromises in...
   a. Porcelain layering
   b. Contour and emergence profile
   c. Internal coloration
   d. All of the above

#5 There is a general assumption amongst dentists that all-ceramic crowns have better esthetics that compensate for the...
   a. Limited skills of the technician
   b. Lack of space in the preparation
   c. Limited esthetics of PFM restorations
   d. Both a and c

#6 Decisions to use a specific crown type should be based upon...
   a. Strength
   b. Ease of fabrication
   c. Long-term predictability
   d. All of the above

#7 How much incisal reduction is necessary to develop a translucent incisal edge?
   a. 1.0mm-2.0mm
   b. 1.5mm-2.5mm
   c. 2.5mm-3.0mm
   d. 3.0mm-3.5mm

#8 How much facial or palatal reduction is necessary for proper ceramic layering?
   a. 0.5mm-0.7mm
   b. 0.8mm-1.0mm
   c. 1.0mm-1.2mm
   d. 1.2mm-1.5mm

#9 The all-ceramic crown may compensate for less skilled technicians...
   a. But it costs too much for most dentists
   b. But strength and longevity are compromised ceramic
   c. But proper space and margin preparation are difficult to get
   d. All of the above

#10 The ceramists limitations should not dictate the dentists...
   a. Fee structure
   b. Decisions regarding crown type
   c. Turnaround times
   d. All of the above