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Pageant of Masters: Combining Sound Material Selection and Treatment Planning

Advances in ceramic material science and laboratory techniques enable selection of the ideal restorative option for each clinical objective and patient expectation.

Clinical excellence depends on advances in restorative materials and the creative talents of the dental team. Esthetics are not about a particular product, but about utilizing the product with the same degree of success, regardless if the case consists of a single crown, multiple crowns, or a combination case of veneers and crowns (Figures 1 and 2). To achieve an ideal outcome with indirect restorations, the members of the restorative team must work collectively from the same set of guidelines and protocols. Ideally, all members of the restorative team should have an opportunity to collectively evaluate the patient during the treatment planning phases. As this is not often feasible given geographic constraints, a detailed communication protocol can predispose a case for success.

Key to the interdisciplinary communication protocol is each of three primary elements: 1) study models of the patient's intraoral condition; 2) digital photographs of the patient in various views, inclusive of both the prepared dentition and the shade of the prepared tooth (Figure 3); and 3) a minimum of 3 accurate impressions. It is crucial for the technician understand both the morphology and shade of the prepared tooth structures so the correct ceramic system can be chosen. The capture of multiple impressions is equally important because while minor distortions are smooth and unrecognizable, it would be very difficult to have the same type of distortion in numerous impressions. So the technician can check the restorations on the various models for accuracy, thus improving the ultimate fit of the restoration. These requisites apply to porcelain-fused-to-metal (PFM) restorations as well as all-ceramic materials and the zirconia solutions that have recently been introduced to dental professionals.



Figure 1. Developing the substructure frame prior to actual buildup.



Figure 2. The definitive crowns and veneers were positioned; notice the harmonious blend between the two types of restorations.



Figure 3. Accurate shade capture is critical and this information should be forwarded to the technician with the initial impressions.



Figure 4. Two copings: one prior to trimming and the other following thinning of the margins and shaping.



Figure 5. A zirconium oxide adhesive was applied in a thin wash.

Zirconia materials, for example, can be viable ceramic options when patients demand metal-free restorations and for ideal light transmission in certain clinical situations. In addition to the aesthetic benefits of zirconia, preliminary studies of such materials by the University of Goettingen-Huels and University of Zurich-Haemmerle have supported the strength and longevity of restorations created using zirconia frameworks. Zirconia fixed partial denture (FPD) frameworks can now span up to 14 units within a single restoration.



Figure 6. Preoperative appearance demonstrates the presence of preexisting restorations with opaque and gray marginal discoloration.

Recommendations for Clinical Success

- Know your powders. With any ceramic you must experiment and bake simple tabs or crowns for practice to ensure that you know and like the outcome.
- When fabricating combination cases of veneers and crowns it is crucial to know the prep color and use the same type of ceramic system for both restorations for a consistent blend in colors between the restorations.
- When fabricating crowns and veneers it is pivotal to build the initial crown coping with the same color as the prepped tooth of the veneer (Figure 1). The initial crown coping must bake separately so that it has shrunk and is the size of the prepped tooth of the veneer. Once the backgrounds are established then simultaneous application of ceramic can be done on both the crowns and veneers with the same layering technique.
- Make sure that you let the patient be involved and approve each step of the process, the diagnostic waxup the provisional and especially the final outcome before permanent cementation.

Adhesion of the ceramic to the zirconia coping has traditionally been a concern. Figure 4 shows one coping before trimming and one after thinning down the margins and shaping with diamonds and a cold-water spray so as to not initiate micro cracks. With the Venus® Porcelain (Heraeus Kulzer, Armonk, NY) system, zirconium oxide adhesive paste is applied to the Zirconia framework (Figure 5). The organic pigments in the adhesive offer increased control of the application, and burns out without leaving residue. The firing temperature is 1050°C with a hold time of 10 minutes. This firing simultaneously results in the cleaning of the framework and realigning the monoclinic zirconium oxide crystals into the tetragonal phase. Zirconium oxide adhesive provides an unsurpassed bonding to the zirconia coping as well as enhancing the fluorescent quality of the framework. Following the ZR adhesive bake, which should exhibit a glossy surface, Liner Paste, which is available in different shades, should be applied to create the desired substructure color. Porcelain



Figure 7. The provisional restoration was cemented to ensure proper tissue management prior to delivery of the definitive restorations.



Figure 10. Postoperative appearance of the definitive crowns and veneers demonstrates harmonious integration and a natural shade match.



Figure 8. The restorations were fabricated simultaneously using the platinum foil technique for the porcelain veneers.



Figure 9. A clear cement material was utilized to avoid creating an opaque discoloration of the definitive restorations.

buildup can then be performed according to traditional protocol, without concern for tearing after the initial firing.

The fabrication process for an all-ceramic restoration using a zirconia core is similar to the process used for a PFM restoration. While PFMs continue to provide biocompatible results with an excellent fit, preexisting restorations may exhibit opaque and gray shadowing around the margin (Figure 6), and replacement with a zirconia crown and/or all-ceramic veneers may be indicated to build out the buccal corridor and to improve the overall aesthetics. The use of a diagnostic waxup and a

controlled provisionalization phase will further allow improved communication for the fabrication of the definitive restoration (Figures 7 and 8). Upon completion of the restorations, the veneers can be tried in individually for fit and collectively for alignment for the patient's approval. Care should be taken to ensure appropriate cement selection to avoid shade alteration or contact interference (Figure 9). If the crowns need to be modified, it is possible to go back in to the furnace to alter both the shade and shape. So it is recommended to place the veneers first and establish the final color and then make sure the crowns blend in prior to cementation (Figure 10).

Zirconia options do allow the technician to develop well-integrated margins for optimal results. The use of this material also allows the technician to easily create a life-like layer with brilliant surface characteristics with efficiency and simplicity. Such ceramics facilitate the development of translucency within the restoration that accurately mimics nature.

While there is no single product solution that can solve every restorative case, insightful material selection that is performed based on the type of foundation used will allow for an overall improvement in the definitive result. As restorative materials continue to evolve, technicians will be able to create improved harmony and color match with the adjacent teeth, which will directly increase overall patient satisfaction with the definitive result.

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