Using a Next Generation All Ceramic Material with Seamless Shade Progression for Highly Esthetic Anterior Restorations

Introduction

Since their introduction, zirconia restorations have been used increasingly and successfully for a variety of tooth- and implant-supported restorations as alternatives to less-esthetic metal-ceramic treatments, and their indications have ranged from single- to multi-unit restorations. Zirconia restorations typically demonstrate better mechanical properties and fracture resistance than other all-ceramic materials. In particular, transformation-toughened zirconia has demonstrated the best mechanical properties and long-term stability.

However, zirconia restorations have presented dentists and laboratories with several challenges. For example, confusion has arisen regarding proper bonding protocols, which are essential for the long-term success of fixed full-coverage and partial-coverage restorations (e.g., inlays/onlays, veneers). The technique sensitive adhesive bonding procedures involve multiple pretreatment steps of bonding surfaces using primers, or the use of self-adhesive cements that contain adhesive monomers. Conversely, veneered zirconia restorations have demonstrated long-term success when conventional cementation is performed.

Additionally, the material’s poor translucency and greyish-white appearance have traditionally compromised esthetics and required the use of a veneering ceramic to impart life-like optical properties. Unfortunately, complications have been associated with chipping of the veneering porcelain, which can be influenced by many factors. As a result, realizing optimal esthetics in zirconia restorations has required balancing assorted influences, including preparation shades, cementation choices, veneering ceramic, and finishing and polishing.
All Ceramic Material

Most recently, however, a new oxide disc that reproduces the continuous shade progression and translucent properties of natural dentition was introduced (IPS e.max® ZirCAD® Prime, Ivoclar Vivadent) and is indicated for a broad range of applications—from single tooth crowns to 14-unit bridges.

The IPS e.max ZirCAD Prime disc features a Gradient Technology (GT) manufacturing technique that combines three processing steps. As a result, the new IPS e.max ZirCAD Prime is not built up with layers. IPS e.max ZirCAD Prime discs are available in 16 A-D shades and 4 BL shades.

Case Presentation

A female patient presented with a history of tetracycline staining and previously placed zirconia restorations (i.e., veneers on teeth #6, 7, 10, and 11; full-coverage zirconia crowns on teeth #8 and #9) on her maxillary anterior teeth (Figs. 1-2). She was very dissatisfied with the frequent and repeated loss of retention of the veneers, which could be attributed to the zirconia material, as well as to the mostly dentin preparations. Although it was not her immediate priority, the patient was also concerned about the crowding of her mandibular teeth.

Based on a comprehensive examination (i.e., intraoral, photographs, bite registration, etc.), the patient was presented with three treatment options, and the advantages and disadvantages of each were discussed with her. The first option—which the patient ultimately agreed upon and accepted—involved placing full-coverage restorations on teeth #5 through #12 and #30 milled from an inherently shade optimized material (IPS e.max ZirCAD Prime). The second option involved placing the same type and number of restorations, but would also involve orthodontic treatment of her lower arch. The third option incorporated placing single full-coverage provisional restorations on teeth #5 through #12 and #30; full orthodontic treatment of the patient's upper and lower arches; and post-orthodontic placement of the same type and number of restorations as in the first and second options.
Preparation and Provisionalization

Because the patient wanted to address her maxillary teeth first and only thereafter undergo orthodontics for her lower teeth, the protocol to complete option one was initiated. To create the provisional restorations, preoperative analog impressions were made of the patient's upper and lower arches. The existing restorations were removed; the preparations refined and cleaned; and traditional impressions taken of the preparations.

A wax-up was made using the preoperative impression, after which a matrix was made for use in creating the provisional restorations. The matrix was loaded with provisional material, placed over the preparations, and allowed to set. The matrix and provisionals were removed, after which the provisionals were trimmed, polished, and temporarily cemented into place. The patient was pleased with the provisional restorations (Fig. 3), which could then be used as the basis for designing and fabricating the definitive IPS e.max ZirCAD Prime full-coverage zirconia restorations.

Fabrication

All patient records, including the wax-up and model of the provisional restorations, were forwarded to the laboratory, where an analog cast of the provisionals was made. The cast was digitally scanned for use in creating a virtual model, selecting the ideal tooth shapes from the software library, and designing the digital wax-up of the proposed IPS e.max ZirCAD Prime full-coverage crown restorations (Fig. 4). In particular, the gradation shading characteristics of the IPS e.max ZirCAD Prime would be maximized to facilitate efficient completion of the anterior tooth restorations.

In particular, the final resulting shade of the restorations would be Shade A1 at the patient's request. By using the IPS e.max ZirCAD Prime discs, some C1 would appear cervically, and minimal translucency would be created incisally for a more natural look. Interestingly, selecting the Shade A2, 20-mm disc would produce a shade approximating A1 (Fig. 5).

Once the design was complete, a model of the preparations was 3D printed for use in trying-on the restorations after milling to confirm accuracy of fit, contacts, and contour, and the restorations were then...
milled. After milling (Fig. 6), surface properties were added and the restorations sintered (Fig. 7). Although imparting color would typically be completed prior to sintering, in this case sintering was performed first in order to take advantage of the inherent color and gradation of the material disc.

After sintering, contacts and occlusion were adjusted and verified on the printed model (Fig. 8). Then, stain (e.g., Ivocolor Dentin SD2) was applied as thinly as possible near the cervical aspects of the restorations, and the mamelon forms were created using a mixture of Incisal SI1, E01 White, and Dentin SD2 stains (e.g., Ivocolor) that was placed near the incisal edges (Fig. 9). Once staining was complete, the restorations were finalized by applying glaze (e.g., Ivocolor FLUO Glaze Paste).
The restorations were returned to the model to verify esthetics. With the naked eye, the seamless shade progression and soft expression appeared very natural (Fig. 10). With the restorations lit from behind, the natural-looking gradation is more obvious (Fig. 11). Yet, despite the discoloration of the preparations (Fig. 12), the IPS e.max ZirCAD Prime restorations block the underlying dark shade (Figs. 13-16).

**Conclusion**

**Figure 10**
The seamless shade progression and soft expression appeared very natural to the naked eye.

**Figure 11**
The natural-looking gradation is more obvious when the restorations are lit from behind.

**Figure 12**
The preparations were very discolored.
Figures 13 through 16
Postoperative view of the IPS e.max ZirCAD Prime restorations; note that the underlying dark preparations are completely masked.
Today’s next generation all-ceramic materials offer laboratory ceramists and dentists an opportunity to provide strong and esthetic restorations. In this case, IPS e.max ZirCAD Prime represented a “one-disc solution” that satisfied the need for state-of-the-art all-ceramic restorations. Additionally, with the incorporation of the stain method, it enabled enhanced esthetics in an efficient manner.

**About the Authors**

Dr. Sam Khayat graduated in 2004 from his Postgraduate program in Prosthodontics at Boston University School of Dental Medicine. After running the Postgraduate Program of Advanced Education in Esthetic Dentistry at Tufts University for five years, he now dedicates his time to his private practice in Hingham, Massachusetts. He has a particular interest in digital dentistry, cosmetic dentistry, and full mouth rehabilitation.

Yuki Momma, RDT graduated from Yukioka Dental Technician School in Japan. Followed by his graduation, he started his career at Dental Lab Obal in 1998. In 2000, he joined Miyamoto Dental Clinic where he could directly have feedback on each restoration he made. While working at the clinic, he challenged himself by studying at Osaka Ceramic Training Center. Upon his completion at the training center, he moved to Boston and started working as a Master Ceramist at Gnathos Dental Studio in Weston, Massachusetts. He built his skillset as a ceramist for seven years and, in 2017, started Ceramic Artisan Dental Lab. Since he started his own laboratory, he has been more active about publishing articles and giving lectures. His articles are on DTG Magazine issue sixteenth and on Labline Spring 2018, as well as his presence at the lecture at DTG Symposium 2018 and his first hands-on course in September, 2018 in Boston. Lab Day Chicago 2019 will be his first lecture in 2019. Along with the lecture, he also plans a couple of hands-on courses in several locations in 2019.

**References**


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