All-Ceramic Restorations Using VITA YZ CAD/CAM Zirconia Veneered with VM9 Porcelain

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The ability to use an esthetic, all-ceramic material for posterior restorations has been a long-standing goal in the dental industry. The popularity and trend of performing esthetic procedures has brought in a more demanding and sophisticated clientele. Patients are expecting to have several options for esthetically pleasing, functional, and durable restorations in all areas of the dentition. This makes the technology to restore any tooth to its normal shape, esthetics, and function a high priority for all dental professionals.

The ability to restore teeth with materials that mimic tooth structure in shape and esthetics as well as translucency is not a new concept; it has been a common practice for more than 15 years with the advent of porcelain veneers and more recently, pressed ceramics. Unfortunately, the strength of available materials typically dissipates when moving away from the anterior teeth to begin restoring the posterior region. An all-ceramic material's strength properties and limitations are tested in these cases and can create a significant challenge.

To remedy this, new materials that combine strength, esthetics, and biocompatibility have been developed and brought to market. For example, the In-Ceram materials were one of the first and strongest materials to enter the marketplace exhibiting a success rate of 99.1% after 6 years in the mouth[1] and retaining very natural color characteristics. These materials allowed for the creation of a more slender framework, leaving extra room for the esthetic veneering porcelain. The next development of materials was through computer-aided design/computer-aided manufacturing of stabilized yttrium zirconia blocks, which have proven to be the strongest all-ceramic dental material available without any compromise of esthetics.[2] With the more recent development of restorations using a zirconia substructure and the highly esthetic properties of porcelains like VITA VM9 (Vident), Everest (KaVo), and Lava (3M ESPE), many of the earlier challenges are now being solved. The ability to restore the dentition with tooth-colored materials with strength properties comparable to metal is a remarkable benefit.



Figures 1 through 3—The preoperative photos of the patient before treatment. Extensive wear, worn down and/or broken restorations and teeth are present.

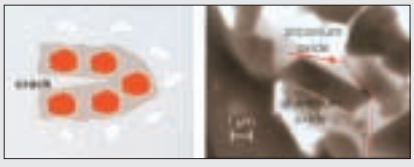
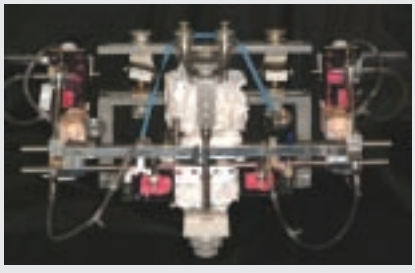
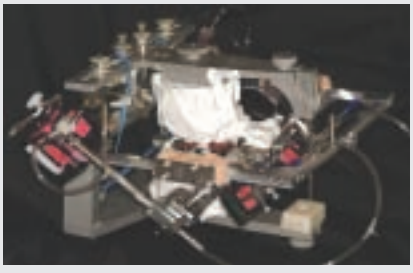


Figure 4—Principle of transition strengthening (left) and a scanning electron microscope photo of a crack (next to red line) that is running through the infiltration glass of the substructure material and limited (head of the arrow) by a zirconium oxide grain (white).

Figures 5 and 6—The case being programmed onto a Stuart Articulator using a Basta gnathograph tracing.

Case Presentation

In this case, a 71-year-old patient presented with a fractured porcelain-fused-to-metal bridge, broken crowns, and a severely worn dentition (Figures 1 through 3). Additional findings included joint noises bilaterally and muscle rigidity in the facial and jaw muscles. The challenge was to address the esthetic rehabilitation of a severely worn dentition as a result of heavy functional wear and broken down restorations.

Treatment Planning and Preparation

The patient's heavy parafunctional habits have destroyed many of his teeth in addition to damaging some of his existing dental work. The posterior interferences in his existing bite have led to extensive wear on the anterior teeth which has caused over coupling of the anterior dentition. The interferences in his bite act as a fulcrum that causes the jaw to direct more pressure onto the anterior teeth, while at the same time repositioning the temporomandibular joint (TMJ) into an unstable position. To restore his teeth to proper height and shape, the jaw and TMJ must first be in the correct position. Then and only at that time can the posterior interferences be diagnosed.

The material used to restore this case was an all-ceramic material known as inVizion (Vident). This material was chosen over traditional porcelain-fused-to-metal restorations because of its ability to limit crack propagation in the ceramic as well as for its strength properties. This material is unique in that it limits cracks in the porcelain from getting bigger and adopts a self-repairing process through transformation strengthening (Figure 4). This type of ceramic restoration combines the proven strength of zirconia ceramic frameworks with the highly esthetic properties of ceramic veneering material. With more than 900 MPa of flexural strength and a fracture toughness of 7.0 MPa to 8.0 MPa, yttrium stabilized zirconium oxide is among the strongest all-ceramic dental materials available.[2] The zirconia framework can be customized in a number of different shades for a more natural color match.

Occlusion

Initial therapy started with a superior repositioning appliance (SRA) that allowed the fabrication of

Figure 7—The diagnostic wax-up, over impression, and preparation reduction splint.

Figure 8—The Aesthetic Dental Designs preparation bur block by Brasseler USA.

Figure 9—The Vita 3D Master Shade Guide System with the added bleached shade tabs.

Figures 10 and 11—The final YZ CAD/CAM milled zirconia restorations with VM9 veneering porcelain on solid models.

Figures 12 and 13—The final zirconia/VM9 restorations cemented into place with MaxCem self-etching, dual-cure resin (Kerr Corporation).

a new acrylic bite before ever touching the dentition.[3] This is an important step that made it possible to verify the jaw positioning and function before any tooth preparation was performed. As the symptoms decreased and the patient's jaw repositioned to a stable state, his muscle rigidity decreased. The occlusal table of the SRA was relined periodically as the jaw repositioned. The SRA allowed the jaw to move free of any interferences, decreasing muscle tension and habitual posturing. This resulted in a corresponding shift in the patient's bite. The jaw eventually rested in an unstrained and natural position. After reaching a repeatable position on the SRA, a hinge-axis recording was taken (Figures 5 and 6). Records were taken to re-create and verify the positioning to determine the new working vertical dimension. At this stage, a full mouth diagnostic wax-up was fabricated to achieve the final esthetics and function. A template was also made to create the provisionals (Figure 7).

All the maxillary teeth were prepared the first day with the Aesthetic Dental Designs bur kit (Brasseler USA) (Figure 8). A final impression was taken using a nonimpregnated #00 cord (Ultradent) and a polyvinyl impression material (Take 1, Kerr Corporation). No astringents were used. Provisionals were created (Fill-In, Kerr Corporation) with the desired final esthetics from the pretreatment diagnostic wax-up. A flat posterior occlusal table was used for the opposing teeth to achieve the same function of the now replaced SRA, until the final restorations were fabricated. This provisional technique allowed for no posterior interferences during parafunctional movements and nocturnal habits.

The following day, all the lower teeth were prepared and impressions were taken along with 5 vertical wax bites to verify the arc of the opening on the articulator. The opposing provisionals were removed for the wax bites and at the same time, a hinge axis facebow was taken. The mandibular teeth were provisionalized using an over impression from the pretreatment diagnostic wax-up to maintain the occlusal anatomy; however, the opposing flat occlusal plane had to be relined to the new opposing cusps and occlusal table for optimal fit.

Shade selection and related information pertaining to the three dimensions of color (value, chroma, and hue) were chosen using the VITA 3D-Master shade guide (Vident) (Figure 9). The internal anatomy, as well as perikymata, embrication lines, maverick stains, and localized hypocalcifications were communicated to the laboratory technician by means of photographic images and drawings.

Delivery Appointment (Adhesion)

On the final delivery appointment, the provisionals were removed and the restorations were examined and tried-in to check margins, interproximal contacts, and esthetics (Figures 10 and 11). After verification, the restorations were removed and steam cleaned. The inside of the restorations were then sprayed with the CoJet System (3M ESPE), a surface coating sandblasting material for application of a silicate coating. This coating forms the basis for chemical bonding to a resin-bonding agent. The tooth structure was cleaned with an OptiClean bur (Kerr Corporation) and then the restoration was seated on the tooth using Maxcem white luting cement (Kerr Corporation). After all the restorations were cemented into place, the excess cement was removed and the contacts and bite were verified.

Conclusion

The fabrication of esthetic, durable, all-ceramic restorations is now made possible through the combination of new technology and new materials. The all-ceramic material used in this case created natural looking ceramic restorations that are esthetically pleasing, durable, and biocompatible (Figure 12 and 13). At the completion of treatment, the patient gained a solid bite and comfortable, everyday function—something he had been missing for a long time. Esthetically, the patient was also pleased with the appearance of his new smile.

References

1. Segal BS. Retrospective assessment of 546 all-ceramic anterior and posterior crowns in general practice. *J Prosthet Dent.* 2001;85(6):544-550.
2. McLaren EA, Giordano RA. Zirconia-based ceramics: material properties, esthetics and layering techniques of a new veneering porcelain, VM9. *Quintessence of Dental Technology.* 2005;28:100.
3. Basta T. FACE Occlusion Manual. FACE, Burlingame, Calif.

Product References

Products: VITA VM9, inVizion, Vita 3D-Master shade guide
Manufacturer: Vident
Location: Brea, California
Phone: 800.828.3839
Web site: www.vident.com

Product: Everest
Manufacturer: KaVo
Location: Lake Zurich, Illinois
Phone: 800.323.8029
Web site: www.kavousa.com

Products: Lava, CoJet System
Manufacturer: 3M ESPE
Location: St. Paul, Minnesota
Phone: 800.634.2249
Web site: www.3m.com/espe

Product: Aesthetic Dental Designs bur kit
Manufacturer: Brasseler USA
Location: Savannah, Georgia
Phone: 800.841.4522
Web site: www.brasselerusa.com

Product: non-impregnated #00 cord
Manufacturer: Ultradent
Location: South Jordan, Utah
Phone: 888.230.1420
Web site: www.ultradent.com

Products: Take 1, Fill-In, OptiClean bur, Maxcem white luting cement
Manufacturer: Kerr Corporation
Location: Orange, California
Phone: 800.537.7123
Web site: www.kerrdental.com