Restoring implants using lithium-disilicate, CAD/CAM fabricated restorations

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Today’s consumers are always searching for the ultimate bargain, even when it comes to their dental care. They want high-quality results and minimally invasive treatments. The majority of modern dental procedures and techniques are trending toward satisfying these demands.

As a result, CAD/CAM technology has been incorporated into an increasing number of dental procedures, enabling dentists and their teams to offer state-of-the-art care to patients in half the time of traditional methods.

Moreover, when it comes to implant-supported restorations, CAD/CAM technology efficiently and effectively produces restorations that demonstrate high-strength properties for durable, long-lasting results that can withstand implant forces. Research has shown that aesthetic, ceramic, CAD/CAM-fabricated molar crowns supported by implants gained high strength values when used in conjunction with adhesive cements, particularly in cases with titanium and zirconia implant abutments.1, 2

One of the most challenging aspects of a restorative case, however, is matching the abutment, restoration and adjacent dentition in perfect harmony. This is especially difficult with single-unit restoration cases because human dentition exhibits different colours, shades, tones and hues. It never presents one simple colour found on the standard shade guide.

Yet, using highly aesthetic lithium-disilicate value blocks (IPS e.max CAD, Ivoclar Vivadent) milled in the E4D in-office CAD/CAM system, dentists can create restorations that are durable, strong and indistinguishable from surrounding dentition, facilitating the highest level of aesthetics and function.

Material selection/fabrication

The E4D in-office CAD/CAM system enables clinicians to design, fabricate and place first-rate aesthetic restorations in a single visit. The high-quality ceramic restorations also demonstrate excellent strength, fit and longevity suitable for a broad range of indications and contribute to predictable outcomes.3, 4

Among the benefits of utilizing the E4D in-office CAD/CAM system to design and fabricate lithium-disilicate restorations is the ability to capture state-of-the-art, powder-free digital impressions. These can be taken from multiple angles for customized accuracy and optimal efficiency. Additionally, both hard and soft tissues can be scanned, depending on the case.

Preparation and margin assessment are completed simultaneously, and high-tech software fab-
icates multiple digital models at once. If needed, sculpting tools facilitate corrections by reimaging, eliminating the need for constructing multiple models or placing temporaries.

During the milling process, the unit’s robust design minimizes vibrations, resulting in micron-precise accuracy for enhanced fit and function of the final restoration.4

As dental practices have moved toward in-office CAD/CAM, innovative ceramic materials have been developed that address material issues regarding strength and aesthetics. These new and improved ceramics are designed to endure CAD/CAM processing without chipping or fracturing. They can be milled to full contour for improved fit and function.5

For example, there are many advantages to placing monolithic lithium-disilicate restorations (IPS e.max CAD). These restorations exhibit the same structural and esthetic properties of ceramic, yet demonstrate high-strength resistance to long-term mastication forces.4 They also blend seamlessly with natural dentition.

Additionally, these restorations are indicated for full-coverage posterior and anterior crowns, although the material itself may be milled for cases requiring thin veneers, minimally invasive inlays and onlays, partial crowns, implant superstructures and three-unit bridges.5, 6

Research shows that restorations fabricated with CAD/CAM perform better and are more durable compared to other available restorative options.4

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Fig. 2: Pre-operative right buccal view of retained primary molars 55 and 65.

Fig. 3: Pre-operative mesial view of retained primary molars 55 and 65.

Fig. 4: The zirconium abutments (Astra OsseoSpeed, DENTSPLY) were placed and scanned using the E4D intraoral scanner.

Fig. 5: The zirconium abutment margins were marked in the buccal area.

Fig. 6: Viewing zirconium in subgingival locations was simplified using the E4D ICE system.

Fig. 7: Image of the final restoration design proposed by the E4D design software for milling using lithium-disilicate material.
The lithium-disilicate crystals in the IPS e.max material, in particular, deflect, branch or blunt cracks, increasing the flexural and overall strength of the material to a range of 360 to 400 MPa. These high-strength characteristics, capacity for milling to full-contour and placement with adhesive bonding or conventional cementation render IPS e.max CAD monolithic restorations practical for restoring in-office implant restorations. Additionally, a strong bond between the restoration and underlying tooth substrates can be achieved.

**Case presentation**

A 28-year-old patient presented with retained primary molars 55 and 65 (Figs. 1–3). These would be extracted and replaced with implant-supported crown restorations fabricated in-office using the E4D CAD/CAM system and a lithium-disilicate (IPS e.max CAD) material. The Value 1 Impulse blocks were selected because they are ideal for implant crowns, providing the ideal level of translucency.

Implants were placed and the patient was provided with zirconium abutments (Astra OsseoSpeed, DENTSPLY). To fabricate the crown restorations, the abutments were scanned using the E4D intraoral scanner (Fig. 4), and the zirconium abutment margins were marked (Fig. 5).

The E4D ICE software enabled easy viewing of the zirconium margins in subgingival locations (Fig. 6).

The restoration’s material thickness was verified using the E4D Autogenesis software. The blue areas equaled 2 mm and the green 1.5 mm, which was ideal for the selected IPS e.max CAD lithium-disilicate material.

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The E4D design software was used to virtually create the lithium-disilicate crown restorations for the two premolars (Fig. 7). The software also enabled verification of material thickness (Fig. 8). In particular, the E4D Autogenesis software was used to create ideal tooth anatomy and contours, with the buccal area 2 mm thick and the distal area 1.5 mm thick, which was perfect for the lithium-disilicate (IPS e.max CAD) material (Fig. 9).

The Value 1 Impulse blocks (IPS e.max) were milled and fired in one cycle, resulting in highly esthetic and monolithic crown restorations (Fig. 10).

The implant screw access canals were sealed using a provisional inlay material (Systemp.inlay, Ivoclar Vivadent). To prepare the lithium-disilicate crowns for placement, the internal aspects were etched with 5 per cent hydrofluoric acid (IPS Ceramic Etching Gel) for 20 seconds, then rinsed and dried.

Then, a silane primer (Monobond Plus) was placed inside the crowns for 60 seconds and also on the zirconium abutments as a zirconium primer for 60 seconds, using the phosphoric acid methacrylate and sulfide methacrylate to bond to zirconium. The restorations were then cemented using a universal resin cement, without primers (Multilink, Ivoclar Vivadent).

**Conclusion**

IPS e.max CAD restorations provide predictable results for restoring implants (Figs. 11–14). The Value Impulse blocks lend to the creation of restorations that blend seamlessly with the adjacent natural dentition, yet they provide the ideal level of translucency to mask zirconium abutments.

In this case, the patient was pleased with the natural looking treatment results that were achieved by combining the IPS e.max CAD material with E4D in-office fabrication technology.

**References**

5. Buchler B. Simple and efficient crown fabrication with an advanced CAD/CAM system. 2012; Dental Tribune.

**About the Author**

Walter G. Renne, DMD, is a 2003 graduate of the College of Charleston and a 2008 graduate of the Medical University of South Carolina College of Dental Medicine. He is active in undergraduate dental education and holds a full time faculty position in the Department of Oral Rehabilitation at MUSC. He is the course director for CAD/CAM technologies and ceramics and runs the E4D CAD/CAM clinic at MUSC. Renne maintains an active general dentistry practice utilizing both the CEREC AC and E4D systems. His special interests in patient treatment include advances in CAD/CAM dentistry, adhesive dentistry and conservative dentistry. He is active in dental research and currently has a patent pending for a new dental adhesive that is permanently antimicrobial in addition to having revolutionary bond durability components that prevent enzyme degradation of the hybrid layer. This bonding agent may prevent recurrent caries and bond breakdown in the long term. You may contact Renne at renne@musc.edu.