Complex restorative challenges with the E4D chairside CAD/CAM system

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In my practice, I like to take advantage of new technology to enhance patient outcomes. Using chairside CAD/CAM allows us to utilize new adhesive and ceramic technologies and provide high-strength esthetic restorations in a single visit while preserving natural tooth structure. I have used chairside CAD/CAM since 1998 in various forms, and the E4D Dentist System™ (D4D Technologies) clinically since 2007.

The E4D Dentist System is designed for same-day delivery of full and partial restorations. Clinically versatile, it can also accommodate cases where there may be a need to separate the procedure into two visits. The E4D Dentist System can be used to scan, design and mill all-ceramic restorations.

Virtual models are used to create the appropriate crowns, veneers, inlays, onlays and laboratory-fabricated ceramic bridges, while incorporating the opposing dentition, a wax-up or scans of a provisional or preoperative condition.

With E4D, clinicians can scan both hard and soft tissue, pre- or post-preparation, and record bite registrations. The E4D is the only digital CAD/CAM system with the ability to scan in the mouth, directly on the impression or on a model without using contrast agents or opaqueing mediums.

Case overview

A 32-year-old woman presented with a fractured upper left premolar (tooth #13). Her medical history included high blood pressure, diabetes controlled with oral medications and fibromyalgia. Significant caries was present, and a bitewing radiograph showed carious pulpal exposure.

A variety of restorative options were discussed with the patient, including extraction and implant placement, extraction and insertion of a three-unit bridge or preservation of the tooth with endodontic therapy and crown placement.

The patient elected to maintain the natural tooth, choosing endodontic therapy and an all-ceramic crown for esthetic reasons. The tooth was prepared, the caries removed, endodontic therapy was performed and a temporary filling was placed.

Approximately three weeks after endodontic therapy, the patient returned for a post and core procedure and crown preparation. Upon evaluating the remaining tooth structure after removing the temporary filling, it was determined that a post and core was necessary.

A Premier® Cure-Thru® IntegraPost® was chosen.
because of its esthetic, light-transmitting zirconia glass fiber properties as well as its strength. After the post space was prepared, it was treated with the Premier Integra adhesive system including IntegraBond™, IntegraCem™ resin cement to cement the post and CompCore™ AF Stack for the core build-up.

_Preparation_

The Two Striper® TS2004.5 coarse football was used for the initial occlusal reduction of the preparation. This spiral football diamond has a maximum width of 2.3 mm, which serves as a depth-guide and allows one to remove enough tooth structure to ensure adequate occlusal clearance.

The Two Striper 770.8 coarse round-end taper was used to create the desired axial reduction and margin finish lines. Diamond bur selection should be based on the block material preparation guidelines, recommended reduction parameters and margin type.

Two Striper brand diamonds supplied by Premier Dental have always been my choice for fast and accurate crown and bridge. Manufactured with natural diamonds and utilizing a technologically advanced bonding process, it is no coincidence that the E4D milling system exclusively uses Two Striper milling diamonds to produce smooth and accurate ceramic restorations.

The patient in this case opted for two shorter appointments. Therefore, an impression was taken of the prepared core build-up to create a physical model that would later be scanned for an E4D single-unit crown.

_Critical steps when creating a detailed impression_

I can’t over emphasize the importance of creating a good prep and obtaining good tissue management in order to make a superior digital or conventional impression. Obtaining a good impression requires adequate tissue retraction and hemostasis. To effectively capture the preparation margins without distortion, the preparation must be free of blood, saliva and other fluids.

An alternative to retention cord soaked in hemostatic agent, which requires packing and can put pressure on as well as tear gingival tissue, is Traxodent® Hemodent® Paste Retraction System by Premier® Dental, which is extruded into the sulcus via a bendable syringe tip.

The syringe tip is placed at an angle to the gingival sulcus without penetrating the sulcus. This facilitates the placement of the material slightly into the sulcus, which is important for adequate hemostasis.

Next, a size-3 anatomically formed retraction cap is carefully placed over the preparation with the scalloping on the working or preparation end, facing interproximally. The patient then gently bites down on the cap. After two minutes, the retraction cap is removed.

The hemostatic retraction paste is thoroughly rinsed using an air-water syringe and a suction tip, leaving an open, retracted sulcus.

Before the impression is made, the preparation margins are evaluated to ensure there is access for the impression material to all the margin areas. In this case, a posterior T-LOC™ Triple Tray® (Premier Dental) was selected for making the impression. This type of tray is wide enough to ensure that it does not impinge on the alveolar process.

Its thin, flexible mesh allows adequate closing into occlusion without distortion, and it has retentive features built into the tray rim to stabilize and retain the impression material without the need for adhesive.

A heavy-body impression material (Imprint 3 Penta Heavy Body, 3M ESPE) was chosen because it offers adequate working time in addition to a short setting time, which minimizes the time the material needs to be in the mouth, adding to patient comfort. The light-body material (Imprint 3 Quick Step Light Body Impression Material, 3M ESPE) was extruded around the prepared tooth and margin areas, while the heavy-body material was loaded into the tray.

The heavy-body material was “overloaded” on both sides of the tray. The tray was then placed in the
mouth and the patient was instructed to close into her maximum interocclusal position for 2.5 minutes. Upon removal, the impression was evaluated to verify all of the margins could be identified.

A temporary crown was fabricated using a bis-acryl, light-cured, temporary composite material placed inside a putty impression matrix of the unprepared tooth. After trimming the margins, adjusting the occlusion and polishing, the temporary was seated and cemented with non-eugenol temporary cement.

_Fabricating the final restoration with CAD/CAM_

The final restoration for this case was fabricated using IPS e.max® lithium disilicate (HT block shade A2, Ivoclar Vivadent). The preparation side of the dual-arch impression was directly scanned. The restoration was designed utilizing the bite information from the neighboring teeth and the occlusion, ensuring a highly accurate restoration.

After milling, the ceramic CAD glass block, or “blue block,” was tried on the model and adjustments were made. IPS e.max stain and glaze were applied and the restoration was crystallized to its final hardness. The chameleon effect and higher strength of the IPS e.max all-ceramic material provides excellent esthetics and resistance to functional forces.

_Final restoration delivery_

When the patient returned for the final delivery of the restoration, the temporary was removed and the preparation was pumiced to remove any temporary cement residue for optimal bonding.

After try-in of the milled restoration to check for shade, fit, contacts and proper occlusion, any necessary adjustments were made with fine diamonds at medium speed before it was polished. A rubber dam was applied to ensure a dry field. If there is any seepage in the marginal tissue, Traxodent can be applied for two minutes.

Before final seating, the IPS e.max CAD restoration was etched with 5 percent hydrofluoric acid (IPS Ceramic etching gel, Ivoclar Vivadent) for 20 seconds, rinsed and dried thoroughly.

The preparation side of the restoration was then silanated to promote adhesion of the composite to the restoration (Monobond Plus, Ivoclar Vivadent). After being left to react for 60 seconds, the silanating agent was air-dried.

The restoration was seated using a universal, self-etching luting composite (MultiLink transparent, Ivoclar Vivadent). This dual-curing material is designed to be used with a wide variety of indirect restoration materials; it sets quickly and has demonstrated high-strength bonding values and long-term stability. After the enamel-dentin A/B primer was mixed in a 1:1 ratio in a mixing well, it was applied to the tooth surface with a microbrush and scrubbed vigorously for 15 seconds. The tooth surface was then gently air-dried.

With the Multilink Automix syringe with tip in place, the material was expressed directly into the crown. After the crown was fully seated, the A/B primer was light cured for only two seconds at each line angle to achieve a gel state. Excess cement was immediately removed with an explorer. Contacts were flossed to remove excess cement interproximally. Light curing was completed by curing for 20 seconds each from buccal, lingual and occlusal angles.

The Premier diamond Compo-Strip® was used in the proximal regions to ensure that all cement was removed; final, proper occlusion was confirmed; and the patient was dismissed with postoperative instructions.

_Conduction_

The same critical steps required for conventional crown and bridge restorations must be followed in order to achieve a highly functional and esthetic restoration using the E4D CAD/CAM system. Effective tissue management and proper tooth preparation must be accomplished in order to obtain a predictable, functional, long-lasting restoration.

Traxodont Hemodent Paste Retraction System provides effective hemostasis and retraction so that preparation margins can be easily read.

Proper understanding of the Two Striper diamond geometry can help dentists to efficiently prepare teeth based on the restorative material preparation guidelines.

If these steps are followed, the E4D scanner can effectively detect preparation margins, thereby helping to ensure that your designs are an accurate foundation upon which to build a quality, accurate, durable restoration._

_about the author_

Robert B. Mongrain, DMD, is a 1979 graduate of the University of Florida College of Dentistry. He currently has a private practice in Tulsa, Okla. He is an adjunct faculty at the University of Oklahoma College of Dentistry. He is a member of the AGD, ADA and board member of the Academy of CAD/CAM Dentistry. Mongrain is active as a consultant and speaker on dental materials, digital radiography, digital imaging, CAD/CAM and technology integration. He is a past member of the 3M Council for Innovative Dentistry and past instructor for Dentistry by Design. You may contact him at rbmbike@aol.com.