CAD/CAM Single-Visit Crowns for the Everyday General Practice

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Like many offices, much of the treatment we plan happens during the hygiene examination. You're familiar with the scenario. We are working on a patient, then comes a notification from the hygienist that the patient is ready for the dental exam. We take a break from the procedure that we are doing and greet our patient in the hygiene room. We catch up on what is new in their life, review their X-rays, and conduct the dental exam to reveal any issues. On this day, when evaluating the patient to be discussed, we asked him if anything was bothering him with regard to his teeth. The patient's response was, "I keep getting food caught between my teeth on the lower right side." Upon intraoral exam, it was determined that the patient had an existing crown on tooth #30 that was more than 10 years old and had an open contact on both the mesial and distal (Figures 1 and 2). There was mild inflammation and some bleeding on probing and flossing. There was an existing crown distal to #30 and a natural tooth on #29. It was determined that replacing tooth #30 would be the best option to close both contacts. The patient was scheduled the following week to replace the crown. This is where the similarities to many offices end with respect to treatment of the restoration.

The following case study will discuss how the lower right first molar was treated in a single visit using computer-aided design/computer-aided manufacturing (CAD/CAM). The patient returned 1 week later to have a lithium dislocate restoration (IPS e.max from Ivoclar Vivadent) placed on the lower right first molar. The patient was seated, topical anesthetic placed for 2–3 minutes and then given an inferior alveolar nerve block along with a supplemental long buccal nerve infiltration. Two carpules of lidocaine 1:100,000 anesthetic were given. Profound anesthesia was achieved after approximately 5–7 minutes. Once the patient was adequately anesthetized, an electric handpiece and a 557 bur were used to make a horizontal perforation approximately 2 mm from the mesial buccal cusp tip into the dentin. A vertical perforation from there to the edge of the margin into dentin was performed to improve the chances of the restoration being removed easily. A size 1 WAMkey (Golden Dent) was inserted and twisted to break the cement bond of the crown and gently lift the crown off of the preparation (Figure 3).

Figure 1. Initial photo occlusal

Figure 2. Preoperative photo from the buccal

Figure 3. WAMkey inserted to remove crown

Figure 4. Winter CAD/CAM Posterior Preparation bur kit used for posterior preparations

Figure 6. CEREC Primescan preparation image

Figure 7. Model axis screen shot

Figure 5. Preparation with cord packed subgingival

Figure 8. Final margination after minor edit

Figure 9. Initial crown proposal
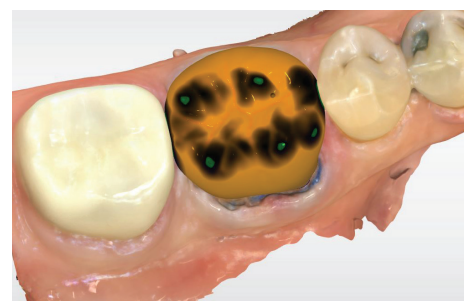
Figure 10. Editing tools used to modify the proposal
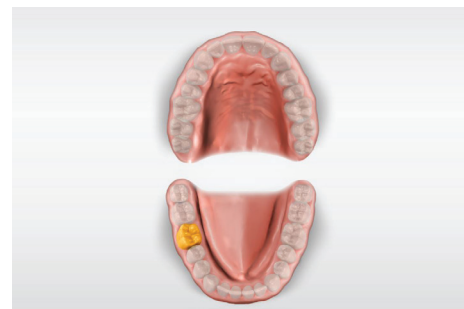
Figure 11. Activating articulator to reveal excursive contacts
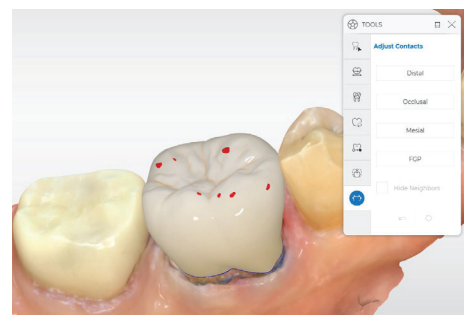
Figure 12. Excursive contacts interferences shown

Using the Winter CAD/CAM Posterior Preparation bur kit from Brasseler, we modified and smoothed margins and transitions using 1.2-mm or 1.5-mm coarse diamond burs (Figure 4). No buildup was needed in this case.

A football diamond was used to help smooth the occlusal aspect of the prep and the transitions to the axial walls. A Size 1 braided cord from Ultradent was packed into the sulcus before imaging to expose all margins and allow the camera and the clinician to properly see the perimeter of the restoration (Figure 5). A fine red stripe diamond bur from the kit is used with
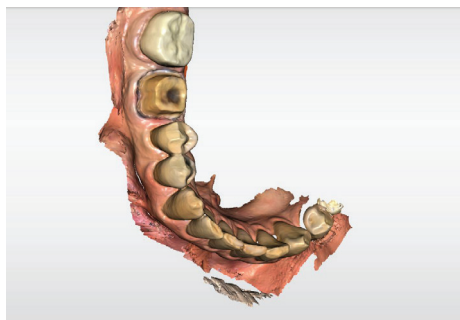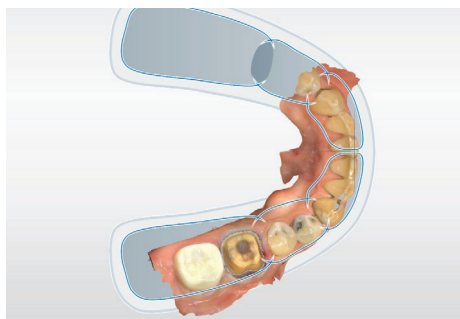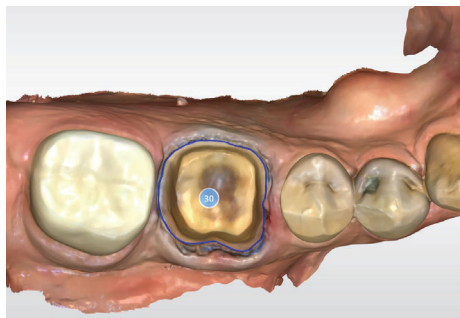
the electric handpiece and turned to 8000 rpm. The electric handpiece will minimize chatter of the bur, and the torque of the electric handpiece combined with the slow rpm allows the operator to create a final smoothing of the preparation margins. This will help when fabricating the restoration to ensure a proper marginal adaptation.

The patient was imaged using the CEREC Primescan. The upper arch and lower arch were imaged to the contralateral canine so the articulator function could be used (Figure 6). The patient is asked to bite hard, and a buccal bite image was taken from

the molar to the canine to allow the software to articulate the 2 models.

After all the images are completed, the models are articulated by the software, along with the axis of the

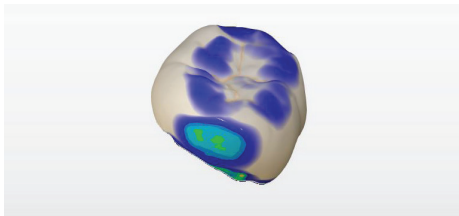Figure 13. FGP applied to remove excursive interferences

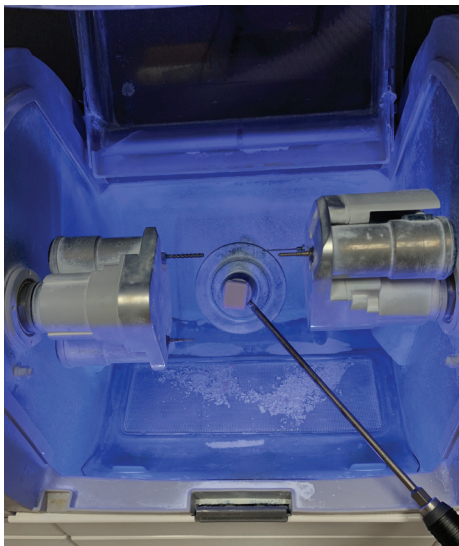Figure 14. Ideal interproximal and occlusal contacts

Figure 16. Crown out of mill with sprue attached
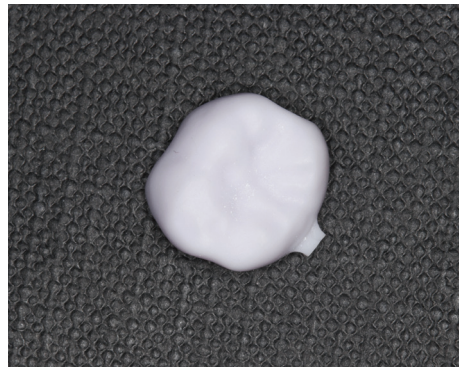

Figure 15. Block placed in mill

Figure 17. Interproximal mark using floss and articulating paper

In this case, the dental assistant did all the margination adjustment and crown design. The initial proposal of the crown is given (Figure 9).

A variety of editing tools can be used to idealize cusp height and position if needed, along with the thickness of the restoration on the occlusal, buccal, and lingual aspects (Figure 10). The software has an articulator function that allows the doctor to see excursive and protrusive movements and warn the clinician of those interferences so they can be adjusted for a more optimal bite with less postoperative discomfort or sensitivity (Figures 11 and 12). The functionally generated path (FGP) button will automatically remove those excursive interferences (Figure 13). The interproximal contacts are then optimized for size and intensity so there should be minimal adjustment on try in (Figure 14).

Once the restoration seems to be adequately designed, the doctor approves it. A VITA Easyshade (VITA North America) is used to determine the value and block shade of the tooth and is then verified with a VITA Lumin Shade Guide. The appropriate block is then selected by the assistant, properly placed into the milling unit, and manufacturing begins (Figure 15). The milling unit will verify that the block is placed correctly through a touch process. Once it is confirmed to be properly placed with the proper size block, it takes approximately 11 minutes to be fabricated on a standard mill. The machine and the mill will notify the operator when the process is complete. The restoration is removed from the milling chamber, and the sprue is removed with a lab bur (Figure 16). The restoration is placed to verify margins are closed and contacts are tight. To check that margins are sufficient, a sharp explorer along with magnification by the operator is used. Floss with articulating ink transferred onto it is used to mark the interproximal contact areas to determine if modifications are needed, and where to make specific adjustments (Figure 17). It is recommended not to adjust the

models, and the drawing of the margin (Figure 7). The CEREC Primescan has artificial intelligence that will help it learn the preps of the clinician and improve the accuracy of the initial margin proposals over time. This saves

the user valuable time during the designing process and expedites the procedure. The margins are verified and any adjustments needed are performed and verified by the person designing the restoration (Figure 8).

Figure 18. Object Fix placed in internal of crown before firing
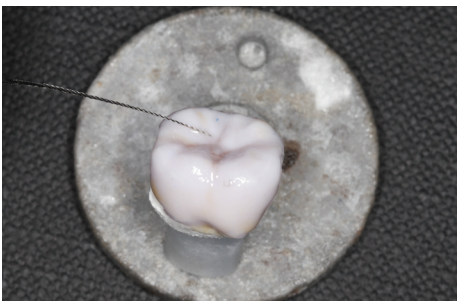
Figure 19. Endo file used with mahagony stain to enhance anatomy

Figure 20. Etch & Prime

Figure 21. Isolite size medium DV used on patient

occlusion until the restoration is permanently bonded or cemented so as not to fracture the unsupported material while functioning.

After the fit is verified and deemed satisfactory, the restoration is cleaned with soap, warm water, and a toothbrush for 30 seconds, rinsed thoroughly, and dried. The e.max needs to be crystallized in order to change the color and increase the strength of the final crown. IPS Object Fix (Ivoclar Vivadent) is placed into intaglio of the restoration and placed flush with the edges of the margins to support the restoration during the crystallization process. This will also help prevent the glaze from getting onto the margins of the final crown. A firing pin is inserted into the Object Fix (Figure 18). In this case, Dentsply Sirona Universal Stain and Glaze was used to characterize the restoration. A thin layer of glaze is initially placed circumferentially around the restoration. A red sable hairbrush is used for distribution of the glaze. To add a depth of color
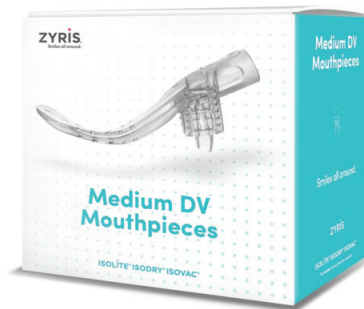
and improve the esthetics of the case, Shade 2 is placed circumferentially on the gingival half of the crown and blended to create a natural transition of color. It is also used selectively onto the occlusal table to help visually blend it with the natural teeth anterior to it in the arch. White was added to the cusp tips of the restoration to enhance them visually to the eye. A #10 endo file is used with a dot of mahogany and it is spread lightly across the occlusal fissure of the restoration. This creates enhanced depth of the grooves to the eye without having to take a bur to the fissure and thin it out, possibly weakening the restoration (Figure 19).

The crown is then placed in the oven and the "start" button is pressed. The speed cycle for e.max on the Ivoclar Vivadent CS3 oven is 14:25. The restoration will be crystallized, which will convert the shade and increase the strength of the crown. When the firing process is completed, the crown is placed on the shelf of the oven to cool for a few minutes. Once

the restoration has cooled enough to touch, a toothbrush and water are used to remove the residual debris from the Object Fix putty on the intaglio of the crown after firing. If there is any residual Object Fix over the edge of the restoration, a series of ceramic polishers is used to remove and repolish the area.

After the restoration is adequately cleaned, it is tried in again to verify fit at the margins and the interproximal contacts. The restoration can now be checked for occlusal forces since the strength has been increased by more than 3x after crystallization. Articulating paper is used and the patient is asked to bite down in maximum intercuspation and slide though excursive movements. Glazed e.max can be difficult to mark; therefore, petroleum jelly can be applied to the articulating paper to improve the marking of occlusal prematurities on the restoration. Any necessary adjustments are made, and those areas are polished. The intaglio of the crown is treated with Etch & Prime from Ivoclar Vivadent to allow proper bonding of the cement to the restoration (Figure 20). Etch & Prime is placed with a microbrush and scrubbed on the inside of the crowns and along the margins for 20 seconds and allowed to dwell on the tooth for another 40 seconds. After 60 seconds total, it is rinsed thoroughly, and dried. It is now set aside and ready for cementation.

A medium DV (Deep Vestibule) mouthpiece from Isolite Systems is placed in the patient's mouth to optimize isolation and minimize the chance of contamination of the tooth during the bonding process (Figure 21). It will also vastly lower the chance of the crown or any dental item being swallowed or aspirated during the cementation process. The enamel on the tooth is selectively etched for 20 seconds and rinsed for 10 seconds (Figure 22). It is lightly dried, and care is taken not to desiccate the tooth. Adhese Bonding

Figure 22. Selective etch on preparation

Figure 23. Bond placed and cured on preparation

Figure 24. Immediate seat and initial cleanup with cord in place

Figure 25. Final occlusal and buccal

Agent from Ivoclar Vivadent is used in this case and scrubbed onto the enamel and dentin for 20 seconds. It is then air-dried for 10 seconds and cured for 10 seconds (Figure 23). The restoration was bonded with Variolink Esthetic translucent shade from Ivoclar Vivadent. The cement was placed into the crown and onto the prep with firm pressure. The margins were verified to be closed with an explorer. The cement was tack cured for 1–2 seconds in each corner to allow initial cleanup of the gel-set cement (Figure 24). The contacts were flossed before any final cure to ensure no bonding of the contacts together.

When the floss was verified to clear the contact, the restoration was cured for approximately 5 seconds on the buccal and lingual. Apical pressure is applied to the occlusal portion of a crown and a GUM Soft-Pick was used interproximally to push any loose cement debris through the contact toward the lingual on both contact areas. A Montana Jack Scaler (Paradise Dental Technologies) is used

to remove any cement that may have adhered to the tooth or restoration and then the cord is removed. The contacts were flossed one last time. A final 10-second cure on all surfaces was performed with a Bluephase Style light from Ivoclar Vivadent. Final clean-up of all the cement was completed and a final X-ray taken. The entire procedure was completed in approximately 90 minutes with no physical impression, no temporary, and no second visit to seat the final restoration. The patient returned 2 weeks later to take a final photo of the restoration (Figure 25). The patient reported that the experience and

procedure, both during and after, was very comfortable. When asked which method of crown they preferred, it was stated that the digital same-day method was strongly preferred.

CAD/CAM dentistry allows the dentist to be efficient with their time and the time of the patient. The final results are both accurate and esthetic so no compromise should be noted in the dentistry performed. As technology becomes more and more prevalent in our dental world, the efficiency with which we can offer procedures to our patients will be a positive experience for all involved in the process.

Richard Rosenblatt, DMD

Dr. Rosenblatt presently owns a practice in Lake Forest, IL, which focuses on CAD/CAM and digital dentistry. He has been a faculty member of cerecdoctors.com since 2008. He is a basic trainer for Patterson Dental and has been a software Alpha and Beta tester for Sirona Dental Systems. He founded the Northern Illinois CEREC Study Club in 2005, which was one of the largest of its kind worldwide. He and his partners started The Chicago Study Club, a comprehensive dental study club, in 2017. He has lectured internationally on CAD/CAM and digital dentistry.

Dr. Rosenblatt grew up in Ocean Township, NJ. He graduated from Muhlenberg College, Allentown, PA, in 1991 and received the DMD degree from the University of Medicine and Dentistry of NJ. He completed a GPR at St. Joseph's Medical Center in Reading, PA. He is married with three children and enjoys skiing and playing golf in his spare time.