

## Accidents Happen



Dr. Lynn Arnold, DMD

One of the most challenging tasks for the astute clinician is creating predictably aesthetic and durable restorations to restore the single central incisor, whether it is called for because of a tooth fracture or a preexisting defective restoration. The final goal is to create a symmetric restoration that is indistinguishable from the natural counterparts extending to it. This involves matching color, shape, and texture to relate to the adjacent teeth and surrounding soft tissues. Advances in materials, techniques, and technology have allowed us to create more aesthetic and durable restorations than blended in with the surrounding natural dentition.<sup>1</sup>

### THE TOOTH

Quite frequently, the immediate placement of an anterior restoration is because of an emergency tooth fracture. In the case presented, this active patient flew in from a ski trip with

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the crown of tooth No. 8 broken off above the gum line, with no complete dent of sensitivity (Figure 1). He needed an immediate temporary and expedient treatment that would restore the tooth to the next appointment while still giving uncompromised aesthetics, function, and progress. As for the history of the tooth, an earlier accident had left the patient with an endodontically treated tooth, a metal post, and a FFM crown. This crown had been made wider than tooth No. 8 to close the diastema space that existed before the accident. We discussed different treatment options, including an all-porcelain crown for tooth No. 8 and bonding to veneering tooth No. 8 to close the space, yet maintain occlusal symmetry.<sup>2</sup>

When treatment planning, the patient's desires are as important, if not more important, than the clinician's preferences for technique and choice of restoration. This planning

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Figure 1. Tooth No. 8 fractured above the gum line.



Figure 2. ShadeEye MDC Chromameter.



Figure 3. ShadeEye MDC taken the shade of tooth No. 8.



Figure 4. A1 shade 92 that placed in Shade Eye accurate lab reproduction.



Figure 5. Shade Contemporary Cutting Kit.



Figure 6. 10 and 12 degree restoration used placed in the crown, and 17 degree teeth placed in case prior to taking final impression.



Figure 7. Removing 6 crown, bonding 10 and 12 crown, springing impinger off into the case, to bubble expansion through the teeth.



Figure 8. Final impression, impinger left, positive (SM 3DFE).

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Figure 9. Lab-fabricated shell, wax, stainless steel, and model wax.



Figure 10. Shell and wax in the shade.



Figure 11. Approximate crown.



Figure 12. Post and core built.



Figure 13. Wax core connected with shell, stainless steel attached teeth.



Figure 14. 5/16 inch metal block of tooth No. 8.



Figure 15. Placing the wax base of second crown.



Figure 16. Shade Contemporary Printing Kit.

must take into consideration the number of patient visits, function, and preparation chosen. The patient or parent has done for the stress closer, but also to not have the discrepancy to with between tooth No. 8 and 9 that his original FFM restoration exhibited. He also did not want to remove any tooth structure from tooth No. 8 for veneer preparation. Despite the urgency for a final restoration to be placed, aesthetics, symmetry, and occlusal relationships were extremely important to him.<sup>3</sup>

New bonding agents and crown materials allow us to offer aesthetic all-porcelain restorations that are still strong and durable. In addition, composites can bond to the tooth in ways that are not always aesthetically pleasing. Especially in anterior cases, I choose all-porcelain restorations for their ability to recreate the vitality and shade of natural dentition. Combined with the improved bonding materials available, ceramic materials exhibit the

straight and fit needed for clinical success. The final treatment decision for this patient was a laboratory-fabricated post and core and an all-porcelain crown for tooth No. 8. The diastema space would be closed by evenly splitting the difference in space between the No. 9 crown and bonding on the mesial of No. 8.<sup>4</sup>

### TREATMENT

We got started immediately. No anesthesia was needed. I

firm took an alginate impression of the upper arch and poured it up in Speed Stone (Dentsply) to fabricate a template for the provisional. The next step is the often challenging but always critical color match. Color choice is an extremely crucial factor when designing a natural restoration that is indistinguishable, especially in an anterior aesthetic case such as this one. The ShadeEye MDC is a highly accurate electronic shade-taking device designed to precisely and consistently identify the true shade of the tooth to be duplicated (Figure 2). It eliminates variables such as lighting conditions, surrounding colors, the individual's eye for color, and fatigue, and demonstrates the exact color to the technician for duplication (Figure 3).

### MATCHING COLOR

The human eye is highly subjective in how it views color. However, color is a very scientifically exact property, and can be measured objectively by hue, value/luminance, and chroma/m saturation. This color can be quantified and expressed numerically. Tooth shade is a mixture of hue, value, and chroma, so reflecting the variation in the perception of these attributes is essential when you desire accurate and predictable shade reproduction in your restorations. The ShadeEye MDC ultimately uses a sensor to detect the exact color of tooth and express it in numerical form. At the push of a button, it records the ShadeEye MDC prints out the shade, value, and hue of the tooth, along with a precise "recipe" based on Shade's Vantage Halo Pretreat System. The human eye is highly subjective in how it views color. However, color is a very scientifically exact property, and can be measured objectively by hue, value/luminance, and chroma/m saturation. This color can be quantified and expressed numerically. Tooth shade is a mixture of hue, value, and chroma, so reflecting the variation in the perception of these attributes is essential when you desire accurate and predictable shade reproduction in your restorations. The ShadeEye MDC ultimately uses a sensor to detect the exact color of tooth and express it in numerical form. At the push of a button, it records the ShadeEye MDC prints out the shade, value, and hue of the tooth, along with a precise "recipe" based on Shade's Vantage Halo Pretreat System.

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only a machine, and simple characteristics such as incisal and translucency qualities must be emulated to the laboratory with drawings or preferably photos for the highest degree of shade reproduction. In this case, the ShadeEye MDC gives a reading of shade A1.75 B1 for both the provisional and final restoration, along with a printed recipe for Vantage Halo pretreat preparation.<sup>5</sup> The appropriate shade tabs were placed in a Cotee that matched the color of the patient's gingiva, and a digital photograph of these shade tabs in the adjacent tooth to be also matched was taken using a digital camera (Figure 4). The image print on Kodak quality photographic paper using the Kodak 1300 medical image printer was forwarded to the lab with the ShadeEye slip for reproduction.

### PREPARATION AND IMPRESSION

Caries detector was brushed on and rinsed off to detect any decay; none was revealed. Although the post and impregnated structure were gone, the metal and the margins looked fairly clean, so were refined for the post and all-porcelain crown using the Superflex sand-and-lapored diamond (SDBV-1) from the Shade Contemporary Cutting Kit (Figure 5). A Precisor anterior triple tray was used to capture the preparation, opposing arch, and bite registration in one impression. Because the flange was extended below the gum line, gingival retraction and size 00 (Ultradent) was packed subgingivally around the entire periphery of the tooth, and size 9 steel was then packed on top. The ends of the cords were left exposed to allow easy removal immediately before the impression was to be taken.

In order to allow air to escape from the crown and ensure that no air bubbles were trapped in the steel during the impression-taking procedure, a shortened 21-gauge needle was placed in the metal (Figure 6). Impression buff (IM-BPE) was dispersed by a thin metal bur into the steel and around the preparation.

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Figure 17. Super impinger that prepares the composite.



Figure 18. Super buff with Ultra-Fine 8 for final polish.



Figure 19. Final restoration seated and post bonded and adjacent tooth finish.

After the canal was filled with impression material, my assistant removed the extraction cords using rubber pliers as I followed her around the margin with my syringe tip filled with impression material (Figure 7). The patient then closed down on the Impregnum-loaded triple tray for 6 minutes. By using this hydrophilic polyether impression material, I achieved a highly accurate and stable impression that captured the preparation and the entire length of the canal (Figure 8). From this one impression, the laboratory could fabricate a highly accurate-fitting post and buildup structure and the final restoration (Figures 9 through 11).

### TEMPORIZATION

For temporization, I did a composite buildup on the poured model of the patient's maxillary arch. A vacuum former was used to form a thin clear splint over the wax-up model. The alignment and canal were fabricated prior to placing a short-end endodontic file to provide a temporary post. The template was filled with Tempbond B-1 (Kerr), an anterior temporary crown and bridge material, and placed over the tooth and allowed to set. After removing it from the mouth, the provisional was removed from the template and trimmed and polished using an acrylic resin bur, rubber points, and pumice. The acrylic-filled provisional was seated and held firmly with finger pressure until fully set. Articulating paper revealed the heavy occlusal contact points. The incom-

plete was removed for marginal trimming, occlusal adjustment, and polish. To achieve a stain-resistant surface, Optibond (Kerr) was applied to the external surface and cured. The provisional was then cemented using Tempbond Clear (Kerr). Occlusion was checked and adjusted, and the active provisional was polished.

The appropriate impression and lab work were then sent to the laboratory. After the model work was completed, the model of tooth No. 8 was waxed up, and a full-curve wax-up of tooth No. 9 was completed in order to determine the balanced tooth widths that would ultimately be achieved in the mouth. An incisal edge matrix was made of the wax-up to guide in the fabrication of the post and crown for tooth No. 8. The wax-up of tooth No. 9 was removed, leaving the wax on the mesial of tooth No. 8.

ceramic post, glazeless full was adapted over the post and die. To mask the dark root and the junction between the post and the core, opaque B1 was applied over the entire crown portion except for the last 1 mm at the facial margin here, a softer look was desired to blend the crown to the margin. This was baked and rechecked to the die. Porcelain margin material for dentin shade B1 was placed at the facial margin, and thickly covered. The entire prepared full. After baking the crown was baked and layered in the shade provided by the Shade ShadeEye MDC.<sup>6</sup> The crown was shaped and contoured with special emphasis on:

(1) gingival emergence profile to mask gingival recession;  
(2) labio-interproximal embrasure development;  
(3) incisal embrasure opening, and  
(4) facial anatomy and texture.

All four of these points had to match tooth No. 8 exactly. It was not enough just to match the length, width, and facial plane. Occlusion was adjusted for very light contact. This would remove stress from the restoration. After staining and glazing, the full was polished and the margins were filled and the margins were solid model to refine gingival contours and verify interproximal contacts. The whole crown was then polished with diamond paste and a cotton buff. Finally, the inside was etched with 9% hydrofluoric acid for 3 minutes and rinsed, and the crown was ready for cementation.<sup>7</sup>

### CEMENTATION

At the seating appointment, the provisional was removed. An explorer and scalpel checked for any residual composite on the interproximal surface of the adjacent tooth. The residual temporary cement was removed using air abrasion (Air Dent, Air Technique), and the post-and-core structure was tried in for evaluation of margin and fit (Figure 12). Gerisore (Dent-Mat) was chosen for cementation. 8 Expet (Kerr) was carefully applied to the gingival margin to control hemorrhaging and thoroughly rinsed. The post and internal surface of the porcelain restoration were etched with 9.8% hydrofluoric acid and rinsed. Filine coupling agent was painted on and air dried.

### DIRECT BONDING

The next step was to completely close the diastema space. A thin metal strip (Dead End Matrix, Dent-Mat) was placed interproximally to protect tooth No. 9 from the bonding material. The mesial surface of tooth No. 8 was microetched using the Air Dent air abrasion unit from Air Technique and 36% phosphoric acid (Figure 14), and thoroughly rinsed and air dried. Tenure Quick (Dent-Mat) bonding agent was brushed on and cured. A B-1 microfill (Vitronex, Dent-Mat) was added to the lingual and cured. Facial microfill composite (Vitronex, Dent-Mat) was placed on the facial and cured (Figure 15). After removing the metal strip, final polishing and finishing were done with the Shade Contemporary Polishing Kit, which includes six shapes of fine and superfine T and F diamonds and six Ceramite mild points and cups. Fine prepolith to polish to ultra polish (Figure 16). The diamonds were used to smooth the lingual incisal margin and interproximals of tooth No. 8.

The composite was cured, and then smoothed and contoured using the Shade map-on-polishing discs, super buff, and Ultra 9 polishing paste. The physical preparation, smoothing quality, and polishing characteristics of the composite allowed us to complete this 10-day restoration.

Additional smoothing of the interproximals was done using the Shade Finishing strips, and the contacts were verified with Sim. After polishing the composite with Shade map-on-polish, a final polish was performed using the super buff with diamond polishing paste (Figure 17 and 18).

### CONCLUSION

Whether you are restoring a single tooth or multiple teeth, it is always important that the patient is fitted with a habit decision to protect the dentition if needed, such as a bracing splint or mouthguard. In this case, the final step was to take a full upper arch alginate impression to fabricate an athletic mouth-