CONSERVATIVE and *Esthetic* Restoration of a Class IV Fracture

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Abstract

Class IV fractures are frequently seen in general dental practices. The successful restoration of such a fracture in an anterior tooth can pose significant challenges, particularly in a young patient. This article addresses the case of a 12-year-old boy whose fractured tooth #8 had already been unsuccessfully restored several times. A conservative approach that focused on the case's crucial functional aspects is described. Also included are details of thorough treatment planning and communication with the patient, a precise composite layering protocol, and careful use of tints and opaquers to achieve an esthetic, functional result.

Key Words: conservative, harmony, excursive movements, surface texture, characterization

Introduction

Restoring a single fractured central incisor can be extremely challenging. The goal of the restorative dentist is to provide an esthetic, lifelike result that mimics a natural tooth. Obtaining an excellent result requires an understanding of composite layering, careful use of tints and opaquers, replication of incisal translucency, establishment of proper anatomical form, creation of surface texture, and an appropriate polish.[1-3] Because the patient in this case was young and a conservative treatment was desired, direct composite resin was chosen for the restorative material. However, creating a nice esthetic result is not the only factor that needs to be considered; functional aspects also must be addressed. The creation of a smooth, harmonious guidance pattern, both in protrusive and lateral excursions, is crucial to success.[4]

Case Presentation

Patient Complaint and History

The patient, a 12-year-old boy, had been referred by another dentist for restoration of tooth #8. At the consultation appointment, treatment options were discussed with the patient and his mother. The incisal half of the tooth had been fractured six months previously (Figs 1-4). It had been restored three times with composite but the restorations had come off (two of them had lasted 48 hours or less). The patient and his mother wanted his tooth to look natural and last longer. The challenges involved in restoring this fractured tooth were explained to them and included the patient's age, the size of the fracture, the tooth's color variance and surface texture, and the need for future treatment.

The patient had no significant medical history and no dental history other than the fracture of and repairs to #8. His mother was not pleased with the esthetics or the short duration of the previously restored composite.

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Figure 1: Preoperative full-face frontal view (1:10).

Figure 2: Preoperative full natural smile (1:2).

Figure 3: Preoperative retracted frontal view (1:2).

Figure 4: Preoperative retracted anterior view (1:1).

Findings and Treatment Plan

A periapical radiograph was obtained to check for any disease. It showed a normal root and pulpal appearance. The tooth was asymptomatic, did not exhibit mobility, was negative to percussion, and showed no signs of any periapical disease. Clinically, there was no pulp exposure, but the fracture was close to the pulp horn **(Fig 5)**. When a front tooth is traumatized, the dentist should inform the patient of the possible outcome and potential future complications. In this case, there was a chance that the tooth would require endodontic treatment or that it could become symptomatic. The patient also was told that the tooth might turn a darker color than the adjacent teeth. Several restorative options were presented, which included porcelain (indirect) and composite (direct) and the benefits and limitations of each. Considering the patient's age, it was determined that composite resin was the most conservative and best choice. The patient and his mother were informed that, due to the patient's age, the composite restoration would need to be repaired or redone in the future and that a radiograph would be taken every year to check the periapical status.

The 24 photographic views (12 before treatment and 12 after) required for AACD Accreditation were taken[5] (Nikon D7000 camera with R2 Dual Point Flash Bracket [Nikon; Melville, NY] and Lumiquest Pocket Bouncers [Photomed International; Van Nuys, CA]) and study models were obtained and mounted on a SAM 3 articulator (Great Lakes Orthodontics; Tonawanda, NY). Next, a functional wax-up was fabricated to work out all excursive movements and establish proper anatomic form **(Fig 6)**.[6-9] A lingual putty matrix (Exafast putty, GC America; Alsip, IL) was made from the diagnostic wax-up **(Fig 7)**. The putty matrix allows the creation of the lingual contour and incisal edge position. This technique is beneficial because it enables the restoration to be layered from the lingual to the facial aspects and the restoration develops the character and depth to mimic the natural adjacent teeth. Bleaching was suggested prior to restorative treatment to obtain the best color match. However, the patient's mother was happy with the color of his teeth and was ready to proceed with the restoration of #8.

Treatment

Preparation: The facial and lingual aspects of #8 were beveled to improve the esthetics and provide increased surface of enamel for better bond strength **(Fig 8)**. A flame-shaped fine diamond bur (8862.31.014, Brasseler USA; Savannah, GA) was used to create a bevel of approximately 3 to 4 mm on the facial aspect of the tooth. The tooth was then acid-etched with 35% phosphoric acid gel (Ultra-Etch, Ultradent Products; South Jordan, UT) on both the enamel and the dentin for 30 seconds.[10]

Figure 5: Preoperative maxillary occlusal view (1:2).

Figure 6: Full contour wax-up completed on an articulator.

Figure 7: Lingual putty matrix fabricated from the wax-up to help create the lingual shell.

Figure 8: Bevel of 3 to 4 mm on the facial aspect of the fractured tooth to blend composite and create an invisible margin.

The phosphoric acid was rinsed with water, and the tooth was air-dried but not desiccated, which helps to decrease sensitivity and improve bond strength.[11-13] OptiBond Solo Plus (Kerr Dental; Orange, CA) was applied in two separate coats, air-thinned, and light-cured (Bluephase Style; Ivoclar Vivadent; Amherst, NY).

Composite layering: The composite resin used for this case was Filtek Supreme Ultra (3M ESPE; St. Paul, MN). The composite resin was warmed in a hot water bath to increase its flowability **(Figs 9 & 10)**. The first shade, Amber Translucent, was placed into the putty matrix in the area of the missing tooth structure only and the matrix was seated in the patient's mouth. The composite was adapted to the matrix with a composite instrument (TNPFIA6, Hu-Friedy; Chicago, IL), blended into the lingual aspect of the tooth, and thinned out from the facial aspect to provide a translucent lingual shell from which to build in a facial direction **(Fig 11)**. The resin was light-cured and the putty matrix was removed, leaving the translucent lingual shell. Shade A3 Body was applied into the middle of the tooth using a composite instrument (PFIDD1/2 CompoSculpt, Hu-Friedy) to replicate the dentin shade and lobe formation **(Fig 12)**. A1 Enamel and A2 Enamel were used to develop line angles and create some facial form. Shade White Enamel was used in the mamelon developmental areas as well as the mesial and distal lobes to highlight the value. A combination of A3 opaque, ochre, and white tints (Kolor + Plus resin color modifiers; Kerr) was used to help mimic the hue and developmental subtleties shown in the adjacent teeth **(Fig 13)**.

The tints were placed with an explorer (XP23/UNC6, Hu-Friedy) and an endodontic hand file (Lexicon C-File, size 008, Dentsply Sirona; York, PA) and then smoothed where needed with a microbrush (Microbrush Plus fine, Microbrush Int.; Grafton, WI). Pink opaquer (Creative Color, Cosmedent; Chicago, IL) was used to help block out some grayness in the restoration. A final layer of shade Clear Translucent was applied to seal in the color and provide for final facial contours.

Finishing and polishing: The tooth was contoured with discs (Sof-Lex, 3M ESPE) to develop the facial planes, embrasures, and transitional line angles **(Fig 14)**. A four-inch digital caliper (Pittsburgh; Harbor Freight; Camarillo, CA) was used to measure the width of both central incisors and to place the incisal variations in correct proportion to those of the contralateral tooth. The lingual surface was smoothed with a football-shaped carbide bur (H379.022, Brasseler) and polished with a cup (Enhance, Dentsply Sirona). A #12 surgical blade (Integra Miltex; York, PA) was also used to remove any flash and ensure a smooth junction interproximally from the natural tooth to the restoration. Finishing strips (Sof-Lex medium- and fine-grit) were used interproximally to smooth and polish

Color Map - Frontal View

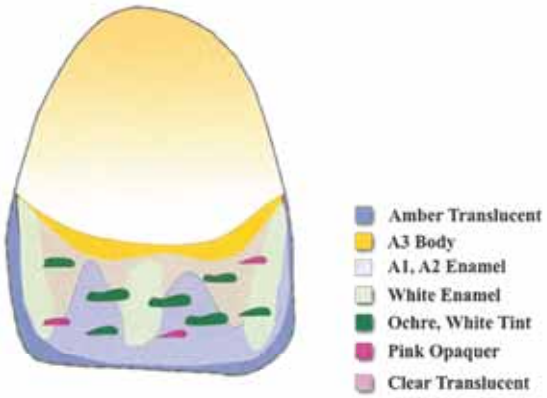

Figure 9: The frontal view color map shows where the composite and tints are placed. *(Illustration by James H. Peyton, DDS, FAACD)*

Color Map - Side View

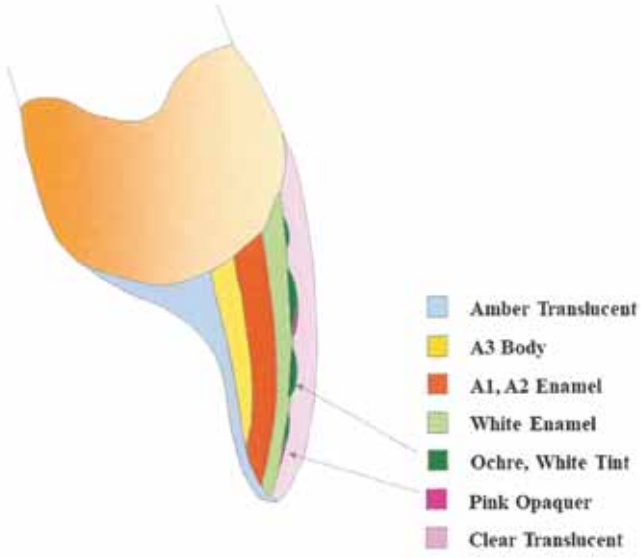

Figure 10: The side view color map shows the order and thickness of the composite layers. *(Illustration by James H. Peyton, DDS, FAACD)*

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Figure 11: Translucent lingual shell formed from using the putty matrix.

Figure 12: Dentin shade composite placed to begin building the tooth in a facial direction and creating the lobe formation.

Figure 13: Tints and opaquers placed to develop the internal characterizations and build depth into the restoration.

Figure 14: Primary tooth form before any surface texture. The restoration was evaluated at this stage and some small improvements in color, transitional line angles, facial planes, and embrasure form were made.

the mesial and distal surfaces. Perikymata were imparted with a flame-shaped fine diamond and a coarse diamond (8862.31.014 and BR6856.31.016, Brasseler) run over the tooth in a pendulum-like fashion at 2,000 rpm with an electric handpiece (Forza F5, Brasseler) with a brushless electric micromotor (Ti-Max NL400, NSK America; Hoffman Estates, IL). Using light pressure, a final polishing with Enamelize and a FlexiBuff disc (Cosmedent, Chicago, IL) provided a finish and surface texture very similar to that of the adjacent central incisor. Care was taken not to overpolish and risk losing the surface texture that was created.[14] Photographs were taken to evaluate the shape, value, hue, chroma, surface texture, width, and length, and adjustments were made as needed. Occlusal contacts were verified with articulating paper (TrollFoil, Troll Dental; Oakdale, MN) and lateral and protrusive excursive movements were observed **(Fig 15)**. The occlusal forces will be the ultimate factor in the longevity of this restoration and likely had caused the previous failures.

Reevaluation: One issue that was noted at this appointment was the dehydration of the teeth, which caused a change in value. The solution was to see the patient again one week later and re-evaluate the color and shape when the teeth were rehydrated. At this follow-up appointment, small changes were made to fine-tune the shape and enhance the surface texture. The patient and his mother were encouraged to treat his new tooth as "a jewel and not a tool."

Discussion

It was very rewarding to be able to provide the patient with a nice esthetic result. The functional aspect is just as or more important than the esthetic aspect in being able to predict long-term success. In this case, addressing the esthetic aspect required a plan of how to develop a lingual shell and layer the desired translucency and shading nuances. Using tints and colors appropriately was important, especially in matching an adjacent central incisor that had so many subtleties.[15] Regarding the functional aspect, there were several key factors. It was important to create a stable centric contact and a properly contoured lingual surface to be in harmony with the joints and muscles. Having the protrusive guidance too steep probably would lead to a failed restoration. It was necessary to consider the incisal edges of the lower anterior teeth and their relationship to tooth #8. Creating smooth leading and trailing edges on both the upper and lower incisors helped to protect the restoration. The lateral excursive movements also required attention so that no excess force would be applied to the restoration. The patient had canine guidance in lateral excursions with the central incisors picking up the guidance in crossover functional movements ("crossover" meaning that once the contact leaves the canine another tooth—in this case the central incisor—has to take the load).[16] There was some guidance on this restoration, but it was a smooth, harmonious transition as the guidance was passed from one tooth to another in an anterior direction.

Figure 15: Postoperative maxillary occlusal view (1:2).

Summary

The imperceptible restoration of a central incisor is a significant challenge. This young patient had had his maxillary right central incisor repaired three times in the previous six months and his mother was a little skeptical about having the restoration done yet again. It was important to gain their trust and educate them about the limitations and challenges that his case presented. Ultimately, embracing the challenge along with careful planning and execution of the case's functional and esthetic aspects led to a successful result (**Figs 16 & 17**). The patient was thrilled with the result and his mother was very happy that her son finally had a nice-looking tooth (**Figs 18 & 19**).

Figure 16: Postoperative retracted frontal view (1:2).

Figure 17: Postoperative retracted anterior view (1:1).

Figure 18: Postoperative full natural smile (1:2).

Figure 19: Postoperative full-face frontal view (1:10).

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