

Class IV Composite Repair

A Heavily Textured Central Incisor

Robert L. Strain, DDS

Key Words: Class IV fracture, composite, incisal, Accreditation Case Type IV

// Directly bonded restorations can satisfy a patient in a single appointment, often with little or no tooth reduction.



Introduction

Conservative dentistry can solve many esthetic problems. Directly bonded restorations can satisfy a patient in a single appointment, often with little or no tooth reduction.

Composite materials currently available exhibit outstanding characteristics for duplicating the appearance of natural teeth. Hybrid composites exhibit excellent tensile strength and blending characteristics. Microfilled composite resins exhibit outstanding characteristics for duplicating the appearance of natural tooth structure, especially the characteristics of translucency and reflectance.

There are occasions when a tooth could be restored with a ceramic restoration, but a direct composite is still the preferred option.^{1,2} Two such situations are when the pulp of an injured tooth has not sufficiently matured, and when gingival tissues have not adequately receded to form a mature gingival crest. These situations occur in pre-adolescent and adolescent patients.

Direct composite restorations can be used to replace substantial amounts of tooth structure if proper design, occlusal forces, and patient habits are taken into consideration.

This article addresses AACD Accreditation Case Type IV (in this particular case, treatment of an incisal edge fracture on a left central incisor). The case demonstrates the techniques for disguising the fracture line and replicating highly textured surface enamel. Mid-treatment modifications to the restoration and the adjacent central incisor are discussed.



Figure 1a: The “before” smile view shows the large fracture of tooth #9.



Figure 1b: The “after” smile view shows a natural, polychromatic, and esthetic result.

Patient History and Chief Complaint

The patient was a healthy 10-year-old male with an American Society of Anesthesiologists (ASA) Type I health evaluation. He had no medical contraindications to dental treatment.

The patient had a history of minimal preventive and restorative dentistry. He had developing dentition with incomplete eruption and had not had orthodontics. His left maxillary central incisor had sustained a minor Class IV fracture of the mesial incisal edge and the left central incisor had sustained a major Class IV fracture involving both incisal edges in a schoolyard accident (Figs 1a-2b). He was initially referred to another dentist who recommended a three-month wait to see if the tooth remained vital prior to placing a crown.

Diagnosis and Treatment Plan

Diagnosis

The patient presented with a horizontally fractured left central incisor involving both incisal corners. This accounted for 35% to 40% of the missing tooth structure. A very small fracture was present on the right central incisor. Strong mamelons remained on the right central incisor and the lateral incisors. There was no visible pulp exposure. Tooth #9 responded as being vital to a cold sensitivity test.

Radiographs taken as part of the examination included maxillary anterior periapicals. The required AACD guideline photographs were obtained at the initial cosmetic consultation. Impressions for diagnostic models were made.³ A hard and soft tissue exam revealed no underlying hard or soft tissue pathology. An occlusal evaluation revealed a Class I molar relationship and a developing Class I cuspid relationship. There was an approximately 40% overbite with no excess anterior overjet.



Figure 2a: The 1:2 retracted preoperative view.



Figure 2b: The 1:2 retracted postoperative view.

No additional fractures within the damaged teeth or adjacent teeth were visible on the radiographs or with transillumination. The patient had no anterior enamel wear. Mamelons were still present on the lateral incisors and right central incisor. The incisors were heavily textured both macroscopically (depressions) and microscopically (striae), which added complexity to polishing the finished restorations.

Gingival heights of #8 and #9 were nearly symmetrical, with slight differences in gingival architecture that would not affect a finished restoration. There was an apparent slight mesial angulation of both teeth, which might correct as the canines completed eruption. Otherwise, orthodontics could provide better angulation for these teeth. Tooth #8 had considerable variations in hues, chroma, and opacity/translucency.

All teeth remained vital three months after the traumatic injury. The parents chose to wait despite being advised to treat immediately. They did choose to complete treatment with conservative cosmetic bonding as described below.

Treatment Plan

The patient had a pleasant display of teeth when smiling, other than the fractured central incisors, which was the chief complaint. He smiled easily, even with the damage. The advantages of direct composite restorations were discussed. The patient's mother was encouraged to have this treatment completed as soon as possible.

Initially, I believed that an excellent result could be obtained with minor enamelplasty on #8 and direct resin on #9. Over the next couple of years, some improvement in the axial angle of the incisors could be expected to partially correct the angled incisal edges.

The initial treatment plan and treatment was as follows:

- minor incisal enamelplasty at #8
- mesial incisal distal (MID) composite at #9.

After completion of this treatment and advice from an Accreditation mentor that the case could be better, a decision was made to create more ideal outline form. Additions would be made to both central incisors.

The revised treatment plan and treatment was as follows:

- mesial incisal composite at #8
- MID at #9.

Treatment

Preparation

A diagnostic wax-up for #9 was developed (based upon the initial treatment plan) and a polyvinyl silane (PVS) (Exafast; GC America; Alsip, IL) matrix⁴ was made from this model prior to the treatment appointment (Fig 3).

A 2-mm shoulder preparation with a .5-mm depth was placed beyond the fracture line on #9 with a 856L-016 diamond bur (Henry Schein; Melville, NY). A 1-mm bevel was placed on the shoulder. Then a series of irregular feathered bevels was placed randomly on the facial surface.

Minor enamelplasty was performed on #8 to determine whether proper esthetics and occlusion would result solely by restoring #9.

Tooth #9 was restored to match the recontoured #8. Matrix strips (Henry Schein) were placed to isolate individual teeth. The surfaces to be bonded were etched with 40% phosphoric acid gel (Henry Schein). They were then coated with a two-step bonding system (Clearfil SE Bond, Kuraray Noritake; Okayama, Japan) containing a water-based primer.

Reference to the color maps (Fig 4) can help in understanding the incremental build,^{5,6} as follows:

1. The internal dentin mamelons were reestablished with A-1 hybrid composite (Venus, Heraeus Kulzer; South Bend, IN), taking care to overlap the fracture line with the composite. Three individual lobes were developed and light-cured to mimic natural teeth and the adjacent central incisor. A hybrid composite was chosen because of its distinct benefit over microfill composites due to its ability to mask sharp edges, preventing the dark background of the mouth from revealing the fracture line.
2. The PVS matrix was placed and a very thin shell was built for the lingual wall in light translucent microfill composite (Renamel, Cosmedent; Chicago, IL).
3. The facial surface was built up in stages, beginning with the most gingival area, using B1 microfill composite (Renamel). Small depressions were left near the incisal to be filled with very minimal ochre chroma (Kolor + Plus, Kerr; Orange, CA) covered by light translucent microfill composite (Renamel).⁷ Because of the tooth's high texture, the outer surface texture was modified to an irregular, non-worn texture using the tip of a #2 flat sable brush (Loew-Cornell; Erlanger, NY) just prior to curing. The translucent nature of these microfill resins allow the dentin layers to show through, creating excellent blending and high polishability.
4. The mesial and distal contacts on #9 were developed with B-1 microfill utilizing clear plastic matrix strips (Henry Schein) separating the tooth from adjacent teeth.
5. The resulting buildup appeared too low in value, so the lingual wall and some of the translucent composite were then replaced with white enamel-colored resin composite (Renamel). This change blocked the dark background show-through and provided the desired result.



Figure 3: The putty matrix in place, displaying the random feathered bevels to mask the finish line. Bonding resin has been applied.

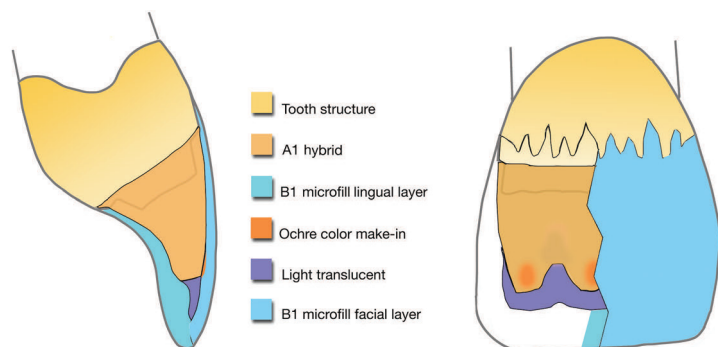


Figure 4: The color maps show the layers of composite used in the restoration. The frontal view shows a cutaway portion and the surface layer.

// There are occasions when a tooth could be restored with a ceramic restoration, but a direct composite is still the preferred option. //

Initial contouring to establish primary anatomy was completed with a medium-grit flame diamond (#260.8, Premier Dental; Plymouth Meeting, PA). An attempt was made to first develop the vertical anatomy, then horizontal and irregular features were placed with a round-tipped, multi-fluted #7378 bur (SS White; Lake Township, NJ), used with a very light touch and much discretion. Margins only were finished initially with a coarse-grit polishing disc (Soft-Lex; 3M ESPE; St. Paul, MN) rotating toward the margin. No medium- or fine-grit discs were applied due to the desire to retain the irregular reflection pattern to match #8. The tip of a fine-grit flexible point (FlexiPoint, Cosmedent) was used to smooth recessed surface areas. An initial polish was established with a goat hair with chamois wheel (#10250022HP, Cosmedent) brush mounted on a straight mandrel. An effort was made to minimize pressure to avoid flattening the texture that had been created in the previous step. A second polish step was completed using a chamois/brush combination on a straight mandrel, with a polishing paste suitable for microfill enamel.^{6,8}

A photograph was taken for study prior to the patient's return for post-treatment photos, which was to occur after tooth #8 had rehydrated. The patient's mother expressed her delight with the results. The patient enjoyed the attention he received posing for his "after" photos.

Refinement

At the follow-up visit, minor facial anatomical corrections were made based upon a study of the photograph taken at the end of the previous visit. The restoration was repolished and new photographs were taken.

This case was shown in its non-final form at an Advanced Accreditation Workshop at the 2013 AACD Annual Meeting. Comments from other attendees and the instructor/mentor were extremely positive, but it was suggested that the case could be improved. The patient was very willing to return to the office so that changes could be made as detailed below.

Despite an excellent match to tooth #8, after reviewing the postoperative photos, it was determined that the patient would benefit even more if the mesial incisal corners of both #8 and #9 were restored to more ideal tooth form in accordance with Accreditation criteria.¹ This would allow for a more attractive incisal embrasure. Also, there was slightly too much ochre chroma. There was a bit of excessive flash past the mesial margin.



Figure 5: Side-by-side comparison showing the initial result compared to intermediate completion and the final restoration where #8 also has a small composite repair on the mesial incisal.

A simple irregular bevel was placed on the mesial incisal of both teeth. An area of excess chroma was removed with the blunt end of a diamond. The areas were restored with B1 microfill composite (Renamel) bonded with bonding resin (only). The gingival mesial margin was trimmed with a #12B surgical blade (Henry Schein) and smoothed with a fine-grit sandpaper strip (Sof-Lex).

The patient was rescheduled to return the following week and a new set of final AACD Accreditation photographs were taken. The stages to achieve the final restoration are compared in Figure 5.

Summary

Direct bonded composite resin restorations are a conservative and valuable service that can be provided at a very reasonable cost. This case demonstrated the solution to two problems that dentists encounter in correcting Class IV enamel fractures: 1) hiding the fracture line and 2) replicating heavy surface texture (Figs 6a-7b).

Having this treatment option available allows patients to enjoy an attractive smile and can delay more extensive removal of tooth structure, which could weaken the tooth and create greater potential for pulpal necrosis. For juveniles, it allows maturation of gingival architecture and additional dentin development should more invasive tooth preparation be desired in the future. For the dentist, it is an opportunity to maximize the application of today's materials to mimic nature and provide great personal satisfaction.

Acknowledgment

This case, prior to treatment plan revisions, was presented at an Accreditation Workshop at the 2013 AACD Annual Scientific Session. Comments by Bradley J. Olson, DDS, FAACD, during and after the seminar were instrumental in the final results. The author also thanks James Peyton, DDS, FAACD, for his assistance in preparing the color maps and this article.



Figure 6a: The large Class IV fracture as seen on a 1:1 view.



Figure 6b: The 1:1 postoperative image shows the intricate surface texture that had to be duplicated.



Figure 7a: Full-face preoperative view; the large fracture is clearly visible.



Figure 7b: The full-face postoperative view shows a very happy patient.

// Having this treatment option available allows patients to enjoy an attractive smile and can delay more extensive removal of tooth structure. //

References

1. Spoor R. The use of direct composites in the conservative esthetic correction of the anterior dentition. *J Cosmetic Dent.* 2006 Fall;22(3):90-6.
2. Malterud M. Minimally invasive restorative dentistry: a biomimetic approach. *Pract Proced Aesthet Dent.* 2006 Aug;18(7):409-14.
3. American Academy of Cosmetic Dentistry (AACD). *Diagnosis and treatment evaluation in cosmetic dentistry: a guide to Accreditation criteria.* Madison (WI): AACD, 2001.
4. Fahl N Jr, Denehy G, Jackson R. Protocol for predictable restoration of anterior teeth with cosmetic resin. *Pract Proced Aesthet Dent.* 1995;7(8):13-21.
5. Fahl N Jr. Coronal reconstruction of a severely compromised central incisor with composite resins: a case report. *J Cosmetic Dent.* 2010 Spring;26(1):92-113.
6. LeSage B, Milnar F, Wohlberg J. Achieving the epitome of cosmetic art: creating natural tooth esthetics, texture, and anatomy using appropriate preparation and layering techniques. *J Cosmetic Dent.* 2008 Fall;24(3):132-41.
7. Blank J. Creating translucent edge effects and maverick internal tints using microhybrid resin. *Pract Proced Aesthet Dent.* 2006 Mar;18(2):31-6.
8. Peyton JH. Finishing and polishing techniques: direct composite resin restorations. *Pract Proced Aesthet Dent.* 2004 May;16(4):293-8. **jCD**



Dr. Strain maintains a practice in Rancho Mirage, California.

Disclosure: The author did not report any disclosures.

Examiners' Commentary

Microesthetics and Case Type IV

J.A. Reynolds, DDS, AAACD

// This case type tests the clinician's ability to seamlessly blend and shape composite resin with the natural tooth. //



Figure 1: Classic incisal fracture.



Figure 2: Microesthetics: Note the blending of the shading and texture of the resin.

Successful completion of Accreditation Case Type IV requires using composite resin to repair a Class IV fracture or close a diastema of at least 1 mm. The Class IV resin must replace at least 10% of the facial structure of an anterior tooth, and this young patient met the criteria.¹ This case type tests the clinician's ability to seamlessly blend and shape composite resin with the natural tooth. There should be special emphasis on managing the microesthetics of shade selection, surface finish, luster, and fracture line block-out. Global smile design principles play less of a role in the examiners' evaluations.

This is an example of the candidate choosing the right case for Accreditation submission. Although Dr. Strain had some detailed surface textures to emulate, varying color characterizations on the contralateral tooth were minimal. He chose a combination of hybrid

and microfill composites to combine strength and enamel replication.² Using a long, irregular bevel to create a gradual transition from sound tooth structure to the restoration, he did a good job overcoming the “glass effect,” a graying at the margin that can occur when blending composite over a bevel.³

If preoperative and postoperative photographic documentation are used in both the planning and final analysis of treatment, the level of dentistry we provide for our patients will certainly improve. Dr. Strain’s successful Accreditation case is no exception.

Self-analysis is an important step in building skill level and confidence. The Accreditation journey is an additional way to continue growth through consistent guidance and mentorship. Dr. Strain’s conservative use of composite resin will serve this young patient for many years to come.

References

1. American Academy of Cosmetic Dentistry (AACD). Diagnosis and treatment evaluation in cosmetic dentistry: a guide to Accreditation criteria. Madison (WI): AACD; 2001.
2. Miller M. Universal materials—do they really exist? *J Acad Gen Dent*. 2013 Sept-Oct 3013;61(6):14-5.
3. Helvey GA. The value of a restoration. *Inside Dent*. 2013 Nov;9(11):80-4. **jCD**

The Accreditation Examiners noted the following deficiencies during the examination:

- **Criterion #44:** *Does the surface exhibit the appropriate finish, polish, and luster?* The surface of the restoration appeared slightly pitted with some embedded blue polishing residue remaining.
- **Criterion #51:** *Has underlying tooth color been properly managed to allow for an optimal cosmetic result?* Examiners noted that the fracture line could have been blocked out more completely.
- **Criterion #53:** *Is the color (hue, chroma, value) selection appropriate/natural, not monochromatic?* The chroma appeared high in the middle third as compared to the contralateral tooth.



Dr. Reynolds is an AACD Accredited Member and has been an AACD Accreditation Examiner since 2003. He practices in Franklin, Tennessee.

Disclosure: The author did not report any disclosures.