A Minimal Intervention Approach to the Treatment of a Class IV Fracture

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ABSTRACT

The goal of minimally invasive dentistry is ultimately to curtail the restoration/re-restoration cycle. When faced with Class IV fractures of the central maxillary incisors, the minimalist approach to treating such cases dictates that the operative decision be based on what would best extend the lifetime of the remaining tooth structure, with as little future intervention as possible. To this end, it is now possible to conservatively place direct composite restorations in the anterior region—for such indications as Class IV fractures—that replicate the form, function, and esthetics of natural teeth. This article presents a case in which a microfilled direct composite resin was used for a Class IV restoration to provide the minimal intervention that would ultimately keep the options open for long-term preservation of the restored tooth.

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INTRODUCTION

Much attention has been given in recent years to the need for clinicians to embrace minimally invasive and conservative techniques when providing patients with both necessary and elective dental treatments. However, much more than strictly limiting the amount of tooth structure that is removed during procedures, the concept of a minimalist approach to dentistry beckons us to examine our patients thoroughly, review their conditions comprehen-
sively, and consider their treatment alternatives critically. This is not to say—in this author’s opinion—that minimally invasive dentistry cannot be esthetic, durable, and predictably functional. On the contrary, we are fortunate to be practicing in an era when sound science and beautiful esthetics can be applied in a less technique-sensitive manner in order to answer today’s dental challenges in conservative and rewarding ways.

The rationale behind a minimalist approach is ultimately to curtail the restoration/re-restoration cycle, to benefit a patient over his or her lifetime. The goal is to conserve as much healthy tooth structure as possible through clinical procedures that first assess caries risk, detect the disease before lesion cavitation, restore caries with maximum retention of sound tooth structure, and seal unaffected areas.

Visible damage to the maxillary central incisors of an adolescent or young adult patient is a common clinical presentation, and we are often challenged to restore chipped and fractured dentition in this patient group. A variety of treatment options exist with which to restore such affected dentition. The alternatives include indirect restorations, such as crowns or veneers; or directly placed composite materials, once the health and stability of the dentition have been ensured. However, as previously noted, the clinician must select the most appropriate treatment alternative that will lead to as little future intervention as possible.

It is now possible to conservatively place composite restorations in the anterior region—for such indications as Class IV fractures—that replicate the form, function, and esthetics of natural teeth. As a result, it is now possible to conservatively place composite restorations in the anterior region—for such indications as Class IV fractures—that replicate the form, function, and esthetics of natural teeth. Therefore, as a profession, we can rise to the challenge of addressing both immediate and long-term oral care objectives when treating anterior Class IV fractures. First, placing direct composites has an impact only on the tooth structure that is affected, something especially important if the dentition have not been previously treated. Second, it recognizes that the anticipated desire for conservative treatment in the future requires a conservative therapy now. Minimal intervention applied to the operative field keeps the options open for long-term preservation of the restored tooth.
CASE PRESENTATION

A 15-year-old male presented with a fractured left central maxillary incisor, tooth #9 (Fig 1). Neither the patient nor his parents were interested in irreversible, indirect treatment options and were instead inclined to pursue immediate, more conservative restorative alternatives. They therefore elected to have the fractured central incisor restored with direct composite. To thoroughly assess the patient’s condition, a complete intraoral examination was performed and an oral history taken, including radiographs and photographs. The patient was in good health, and no pathologies were found that would contraindicate restoration of the affected tooth.

TREATMENT PLANNING

To fully evaluate the case, a visual assessment was performed and the patient’s occlusion was analyzed. Additionally, the morphologic, histologic, and optical characteristics of the adjacent teeth were noted.

From a material selection standpoint, when using direct composites to reproduce natural tooth structure, the clinician has traditionally required one of two things: either a variety of composite shades in order to duplicate what is observed in natural teeth—particularly in complex Class IV fracture cases; or a single composite material that demonstrates a chameleon effect and esthetic invisibility. To simplify the restorative process in this case, yet still provide the patient with nature-replicating esthetics and functional predictability, a microfilled composite (Gradia Direct, GC America; Alsip, IL) that mimics the reflectivity observed in natural teeth was selected.\(^8,10\)

To determine the appropriate composite shades, a shade guide based on the Vitapan Classical shades (Vident; Brea, CA) was used, and it was determined that the ideal dentin composite shade would be A2 (Fig 2). The selected dentin shade and the enamel composites were previewed on teeth #8 and #9 (Fig 3), and the shades identified visually were verified using a digital spectrophotometer (EasyShade, Vident).

DIAGNOSTIC WAX-UP

An impression was taken prior to preparing the tooth in order to create a diagnostic wax-up, an esthetically enhanced wax-up demonstrating the appropriate length of the restored tooth #9; and, ultimately, a high-viscosity putty stent (Exafast Putty, GC America) (Fig 4).\(^11,12\) The putty stent, once placed in the patient’s mouth, would be used for spatial reference as a volumetric, three-dimensional guide for placement of the composite restorations; and to preserve the facial/lingual line angle (Fig 5).\(^11,12\)

PREPARATION PROTOCOL

Tooth #9 was prepared with diamond burs to create a .5-mm modified lingual shoulder, in addition to a 2-mm facial bevel. An infinite/virtual bevel was also placed that would facilitate transitioning of the enamel shade of composite into the remaining tooth structure.\(^12,13\) This long bevel was approximately 0.3 mm in depth, extending 2 mm to 3 mm around the entire margin. This preparation would support the fracture resistance and durability of the
restoration by enabling the placement of a layer of composite at the restorative margins.\(^8\,13\)

**Composite Layering Technique**

Following preparation, tooth #9 was pumiced, rinsed, and dried, then etched for 20 seconds with a self-etching adhesive bonding system (UniFil® Bond, GC America). The self-etching primer (UniFil® Bond Self-Etching Primer) was gently air-dried for 5 seconds. The bonding agent was then applied to the preparations (Fig 6) and light-cured for 10 seconds with a light-emitting diode (LED) curing light (UltraLume LED 5, Ultradent; South Jordan, UT). This light was used throughout the restorative process.

After positioning the putty stent in the patient’s mouth, build-up of the restoration began with the placement of a 1.5-mm thick layer of the selected A02 dentin shaded composite on tooth #9 to form the lingual enamel layer (Fig 7). This shade was selected to control the restoration’s opacity and eliminate any show-through. The composite was carefully sculpted into place, after which it was light-cured for 20 seconds. It is important to note that throughout the composite placement process, use of the stent, as well as controlled use of composite placement instrumentation, helped ensure accurate and precise composite placement that would ultimately facilitate a simplified finishing and polishing protocol.\(^14\)

To preview the lingual enamel layer and assess opacity, the putty stent was removed. It was returned to the patient’s mouth for the placement of the bulk of the artificial dentin layer. The standard anterior shade A2 of the selected composite was placed in a 2-mm thick increment to form the body and mamelons of the restoration on tooth...
Prior to light-curing for 20 seconds, this layer was carefully sculpted into place just shy of the proximal and incisal edges, as well as onto the long bevel to mask the fracture line, in order to leave room for the final enamel layer.

To create natural-looking variations in shade and chroma, a high-value halo was created by placing Xtra bleach white (XBW) shade composite along the incisal third of tooth #9, sculpting it into place, and light-curing it for 20 seconds after removal of the putty stent (Fig 9). Greater translucency was created with the placement of a thin transitional layer of anterior gray translucency (GT) composite along the incisal edge, after which the tooth was cured for 20 seconds (Fig 10).

A thin final enamel layer of bleach white (BW) composite was placed on tooth #9 with the putty stent removed (Fig 11), then sculpted and light-cured for 20 seconds.

Before imparting surface texture and tertiary characterizations, the enamel layer and overall restoration was assessed with the putty stent in place (Fig 12). To ensure a complete depth of cure, transenamel light-curing was performed from multiple aspects.

**Finishing and Polishing**

During the finishing stages, when contouring and/or gross reduction of the composite resin restorations is performed, this author has found.
it beneficial to use a variety of burs and diamonds. In this case, to create the final form of the incisal edges and finish the embrasure between teeth #8 and #9, an ultra-fine polishing disc (3M ESPE; St. Paul, MN) was used. To refine the restoration’s surface, a green stone (Brasseler; Savannah, GA) was used, while micromorphology was created using a Brasseler carbide bur. To achieve a lifelike final luster, Brasseler polishing points and brushes were used, in addition to a chamois wheel. Upon completion, the final restoration on tooth #9 blended invisibly with tooth #8 (Figs 13 & 14).

**Conclusion**

When considering the manner in which to apply a minimal intervention approach to the restoration of a Class IV fracture in the anterior, it is perhaps prudent to remember that our first objective in treatment is to do no further harm. When we combine technical skill with the use of scientifically advanced composite materials that enable us to reproduce a tooth, we are now able to restore form and function in a beautifully conservative manner. When we implement conservative techniques, we are in fact allowing for the possibility of further esthetic options in the future, which is particularly important for young patients.

However, when employing minimally invasive composite layering techniques, it is incumbent upon clinicians to combine technical
skill with a heightened sense of observation so that the natural tooth structure can be meticulously reproduced. While products such as chameleon-like composites facilitate the easier creation of lifelike and esthetic direct restorations, it is still the responsibility of the clinician to analyze the characteristics and nuances of the individual tooth or teeth and to select the appropriately shaded material for placement.

Disclosure

The author has received financial and materials/product support from GC America.

References


Correction

Figure 9 on page 114 of the Fall 2005 issue of the Journal (vol. 21 no. 3) shows the finals, rather than the provisionals, for the case. The correct photograph of the provisionals is shown here. The AACD regrets the error.