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Replacement of a Missing Maxillary Central Incisor Using a Direct Fiber-Reinforced Fixed Dental Prosthesis: A Case Report

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Clinical Relevance

Fiber-reinforced fixed dental prosthesis using the direct restorative technique may be accomplished with ideal contours and tooth morphology when a proper material selection and a step-by-step protocol is followed. This option becomes useful as an interim restoration in many clinical situations.

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SUMMARY

The use of the direct fiber-reinforced fixed dental prosthesis (FDP) restorative technique presented in this article will result in an ideal restoration considering both esthetics and function in a single appointment. Although indirect techniques are available and may be used, they are time-consuming, resulting in higher cost; therefore, a simplified approach combining a prebonded fiber-reinforced mesh with a sculptable micro-hybrid composite will deliver an acceptable esthetic result with proper function.

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INTRODUCTION

Replacing a single missing tooth in the anterior area is a challenge for the clinician, but a number of restorative options are available. Implant-supported crowns are ideal for mature patients with sufficient alveolar bone, while resin-bonded fixed dental prostheses (FDPs) offer more conservative preparation of abutment teeth than conventional FDPs.[1] However, these options are all costly, and for any indirect FDP, the clinician must deal with either the opacity of a metal framework or with adhesive bonding of lab-processed resin or ceramic.

For patients of limited means, a direct fiber-reinforced composite (FRC) FDP can also be a good alternative. Advantages of this option are minimal or no tooth preparation; optimum adhesion of the enamel-bonded resin composite to the prosthesis, since both have a reactive surface; ease of customizing the esthetics of the restoration; reparability of the restoration if needed; and enhanced strength of resin connectors due to the presence of glass fibers.[2] According to Jiang and others,[3] FRC FDPs are also a good alternative to replace up to three lost anterior teeth with compromised periodontal support on

Figure 1. *Preoperative view.*

adjacent teeth, and they reported a survival rate of 89.7% in a four-year clinical study. FRC FDPs can also be made using a denture tooth or the crown of the lost tooth.[4-7] For a resin composite pontic, layering techniques used for direct restorations of teeth can be adapted to produce optimum esthetics. A recent study by Malmstrom and others[8] has concluded that after two years, the cumulative success rate of FRC FDPs was 84.32%, while the survival rate was 92.7%, making this alternative a good, conservative, and cost-effective treatment option.

In this two-year clinical report, the authors describe the use of a direct resin composite FDP, reinforced with polyethylene fibers, for replacement of a maxillary central incisor.

CASE REPORT

A 57-year-old man was referred to the general dentistry clinic at Eastman Institute for Oral Health after having tooth No. 8 extracted following trauma. He stated at the initial appointment that he had economic concerns and was seeking a "temporary" solution for his problem. After determining from his medical history that he was American Society of Anesthesiologists class I, clinical examination revealed the absence of tooth number 8 with healing gingival tissue, clinical attachment loss on teeth Nos. 7 and 10, and a noncarious cervical lesion on tooth No. 9 (Figure 1), which was considered indicative of occlusal trauma on protrusion. Response to vitality testing of the remaining incisors was normal. Periodontal examination revealed no bleeding on probing and normal sulcular depths, although considerable bone had been lost in the edentulous space of No. 8 due to the tooth's having been traumatized nearly to the point of avulsion. All prosthetic restorative options were presented to the patient, who chose the FRC FDP approach. Benefits and drawbacks of this treatment were discussed.

Local anesthesia was established via infiltration with articaine HCL 4% with epinephrine 1:100,000 (Septocaine, Septodont, Lancaster, PA, USA). The shade needed for the pontic, based on comparison with the adjacent teeth, was determined to be A3. Isolation was achieved with cotton rolls and saliva ejector. Restoration began with minor preparation of the noncarious cervical lesion to remove discolored dentin on tooth No. 9, using a high-speed handpiece and a No. 2 round carbide bur (SS White, Lakewood, NJ, USA) under air/water cooling. Two pieces of prebonded everStickC&B (GC America, Alsip, IL, USA) fiber-reinforced mesh were cut to a length that spanned the edentulous space. Teeth Nos. 7 and 9 were cleaned with Pumice Preppies (Whipmix Corp, Louisville, KY, USA), and facial, lingual, and proximal surfaces were etched for 30 seconds with 32% phosphoric acid (Uni-Etch, BISCO, Schaumburg, IL, USA), followed by rinsing and drying. This was followed by the application of a one-step dental adhesive system, OptiBond Solo, (Kerr Corp, Orange, CA, USA) to all etched areas and light-curing of the adhesive for 20 seconds with an LED light (Valo, Ultradent Products, South Jordan, UT, USA). Restorative procedures for the NCCL involved use of an A3 shade sculptable resin composite (Tetric Ceram, Ivoclar-Vivadent, Amherst, NY, USA) placed in two increments of 2-mm thickness, which were cured independently for 20 seconds each. Fabrication

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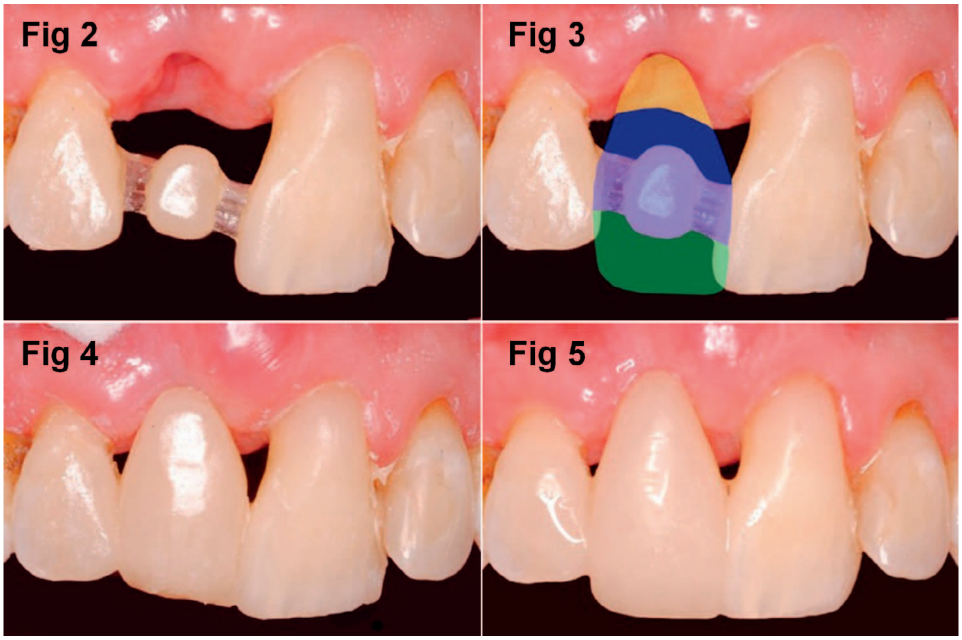

Figure 2. *Completed framework and "button shape" composite increment in place to start fabrication of composite pontic.*
Figure 3. *Color representation of the increments needed to complete the pontic.*
Figure 4. *Pontic after completion of modified ridge lap.*
Figure 5. *Completed restoration.*

of the FRC FDP was begun by bonding of one piece of the fiber mesh from the midlingual of tooth No. 7 to the midlingual of tooth No. 9. This was done using a small amount of A3 flowable resin composite (Tetric Flow, Ivoclar-Vivident) placed on the ends of the mesh. The mesh was then seated against the lingual surface of each abutment tooth and each end cured for 20 seconds. To avoid occlusion on the mesh, clearance of at least 1 mm between the mesh and opposing teeth was verified visually. A second shorter piece of mesh was bonded in the same manner to the facial aspect of the first and to the proximal surfaces of teeth Nos. 7 and 9. The two pieces of mesh were then joined and construction of the pontic initiated with a button-shaped increment of the shade A3 sculptable resin composite (Figure 2). It had been previously determined, since abutment teeth were monochromatic, that no resin layering was needed for the pontic. Gingival and incisal increments were added according to the design depicted in Figure 3. A modified ridge lap pontic design was chosen (Figure 4), and the pontic was restored to match the incisal edge and overall incisal length of tooth No. 9 (Figure 5).

Finishing and contouring were accomplished with an FSD4 diamond (Komet USA, Rock Hill, SC, USA), aluminum oxide finishing strips (Sof-Lex, 3M-ESPE, St Paul, MN, USA), and a No. 12 surgical blade. Occlusion was checked using articulating paper (AccuFilm II Parkell, Edgewood, NY, USA) and adjusted using a football-shaped No. 7406 carbide finishing bur (Komet USA). Stable centric contacts were established on the remaining anterior teeth, with light-centric contacts on the pontic but no excursive contacts. Protrusive guidance was distributed evenly among the remaining anterior teeth, thereby reducing the excursive forces applied to tooth No. 9. Polishing of the lingual surface was done with an aluminum oxide Enhance point (Dentsply Caulk, Milford, DE, USA), with all other surfaces polished using aluminum oxide disks (Sof-Lex XT, 3M-ESPE).

The patient was recalled at six-month intervals, with follow-up photographs taken after two years. The prosthesis remained functional and esthetic over this interval, although the patient did fracture the incisal enamel of tooth No. 7 (Figure 6).

Figure 6. *Two-year follow-up photo.*

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DISCUSSION

The effectiveness of this FDP over two years largely matches the performance of this restoration type previously reported in the literature. To date, there is no evidence in this restoration of the common failure mode of fracture of the connectors, presumably because these have been fiber reinforced. Apparently, the anterior occlusal scheme developed during restoration of this edentulous space has adequately reduced the occlusal trauma that had been previously evident on tooth No. 9. The resin composite restorative material selected effectively mimics the translucency of the abutment teeth and has maintained a smooth, stain-resistant surface, despite its being primarily a posterior material chosen here for its strength and ease of sculpting.

The authors considered an ovate pontic design extended into the residual tooth socket for this restoration but decided that maintenance of the gingival architecture in an area with such bone loss would be unlikely and instead adopted a ridge-lap design. Although this has not yet been necessary, the authors anticipate adding resin to the pontic to retain ridge contact as the ridge resorbs. The FDP was designed to match the patient's adjacent open gingival embrasures, which were not an esthetic concern to him.

Although intended in this case as a definitive restoration, the authors consider this type of prosthesis to be ideal for patients too young to receive an implant, owing to little or no preparation of teeth adjacent to the edentulous space. If the crown of the lost tooth can be retrieved, the authors consider using it as a pontic to be the treatment of choice. The technique for this would be similar to that presented here, except that the lingual surface of the retrieved crown usually must be prepared to allow space for the fiber mesh and encasing resin composite when the fragment is correctly positioned. The authors recommend that for any design, the reinforcing mesh should remain covered with resin composite material following occlusal adjustment, since occlusion on the mesh could weaken it and lessen its reinforcing effect on the FDP connectors.

Fiber reinforcement products are available in two forms, silanated and impregnated with resin by the manufacturer and nonimpregnated, which requires silanation and resin impregnation by the dentist at the time of use. The authors recommend the use of preimpregnated fiber products because they have higher flexural strength and rigidity,[9] they increase the mechanical properties of composite FDPs,[10] and for their ease of use compared with nonimpregnated fiber products. For primarily esthetic reasons, the authors also recommend the technique used for this case of not extending the reinforcement mesh onto the facial surfaces of the abutments, so that it is not necessary to add facial resin to encase the mesh, which could compromise esthetics.

The authors acknowledge that this type of FDP could be fabricated in the laboratory but do not recommend this because of the risk of the resin used to secure the prosthesis to the abutments not adequately copolymerizing with the lab-processed pontic, thereby weakening retention. It is recommended that traumatic occlusion be eliminated on any type of resin-bonded prosthesis, as was done here for tooth No. 9. Given the two years of effective service already rendered by this restoration, the authors anticipate several more years of survival. Finally, the authors wish to point out that the techniques used for this type of restoration, such as direct shade matching or use of a lingual matrix, are very similar to those employed for layered resin composite restorations and will be familiar to any experienced clinician.

Conflict of Interest

The authors of this manuscript certify that they have no proprietary, financial, or other personal interest of any nature or kind in any product, service, and/or company that is presented in this article.

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