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CASE STUDY

IMMEDIATE TOOTH REPLACEMENT USING SINGLE-VISIT FIBER REINFORCED RESIN COMPOSITE BRIDGE

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ABSTRACT

Rehabilitation of a missing anterior tooth poses a challenge for the clinician. A variety of therapeutic options from implants to conventional Maryland bridges can be used to address this challenge. However cost, time and preservation of natural tooth structure limits their use. Recently, Fiber reinforced composite resin bridges have been suggested as a good alternative to conventional prosthetic treatment when fixed, conservative, economical and immediate tooth replacement is desired. This article describes a case of immediate tooth replacement by single-visit fiber reinforced resin composite bridge using impregnated glass woven fiber (Interlig, Angelus, Brazil) to reinforce composite resin as pontic. The procedure was completed chair-side, thereby avoiding laboratory cost and time. Eight month follow-up has shown a successful treatment outcome with no evidence of problems.

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INTRODUCTION

Loss of an anterior tooth due to caries or trauma may be a catastrophic event for young adults. An immediate replacement in such a scenario is important to provide a positive psychological approach and to maintain the facial aesthetics and phonetics. Several factors considered in this regard are minimal invasion, esthetics, cost and time at which the treatment in rendered. (Parolia *et al*., 2010) Various treatment options available in the management of this condition are: replantation of the avulsed tooth, removable partial denture(RPD), porcelain fused to metal (PFM) bridge, resin-bonded fixed partial denture (Maryland Bridge) and dental implants (immediate or delayed). (Marinello *et al*., 1997) Long-term success of a replanted avulsed tooth is always questionable because of the eventual resorption that follows. Lack of compliance and unpleasant esthetics, fails to make RPD a favorable option. While the PFM is an invasive treatment, the maryland bridge is less invasive but the non-esthetic aspect of metal framework, challenging long lasting bonding of metal to tooth and lack of longevity could restrict their use. Implants are the treatment of choice and should be considered when general and local conditions are favorable. However, their high cost could limit their use. (van Heumen *et al*., 2009) Lately, increased patient demand for esthetics, immediate and economical replacement of missing anterior tooth has led to the development of materials and techniques that enable conservative chair-side (direct) fabrication of fixed partial dentures (FPD) using fiber re-inforced composites (FRC) as the main treatment or long term provisional treatment before implant therapy. FRCs are resin-based materials containing fibers to improve their physical properties. Amongst various fibers, polyethylene and glass fibers in particular have been used for a number of clinical applications in dentistry *viz*: fixed space maintainer, endodontic post and core, splints, fixed bridges etc. (Gupta *et al*., 2015; Tuloglu *et al*., 2009) For fabrication of FRC FPDs, a direct or an indirect technique may be used. In the dental literature, there are presently a limited number of clinical studies on the fiber-reinforced FPDs; however, based on those results, direct fabrication of FRC prostheses have shown good longevity. When using the direct technique, a natural extracted tooth, acrylic resin tooth or composite resin can be used for pontic preparation. The prefabricated acrylic resin tooth often does not have acceptable shape, size and color and bond unpredictably to composite resin. Although a natural tooth pontic may offer good psychological benefits by being of the right shape, size and

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color but studies have shown that composite resin pontic not only offers good aesthetic results but also offers better bonding thereby enhancing functional results. (Belli and Ozer, 2000; Chafaie and Portier, 2004) The new generation of composite resins with dentine and enamel shades provides excellent esthetic mimicking the natural tooth. (Vanini, 1996) In addition, it has been demonstrated that reinforcement of composite by fibers increases the fracture toughness and resistance. (Pfeiffer and Grube, 2003) Thus, the combination of an esthetic, wear-resistant composite resin and tough fiber material gives a new option for composite bridge fabrication for replacement of a missing anterior tooth. This case report describes a clinical case in which a direct FRC bridge is fabricated for replacement of missing permanent central incisor using impregnated glass woven fiber (Interlig, Angelus, Brazil) to reinforce composite resin as pontic.

Case Presentation

A 23-year-old healthy male patient reported with a chief complaint of missing right upper central incisor. Patient's dental history indicated avulsion of maxillary right central incisor 1 month back. Clinical examination revealed normal horizontal and vertical overlap and canine-protected occlusion (Fig. 1). Adjacent teeth showed a normal response for vitality. Patient's oral hygiene status was good. An intraoral periapical radiograph (IOPAR) of the concerned area presented with a healed bony socket in relation to the avulsed maxillary right central incisor and root canal treatment with left maxillary central incisor. (Fig. 2) Patient denied the placement of implants and conventional FPD due to concerns regarding the cost and conservation of natural tooth structure. After discussing all the treatment options with the patient, directly made FRC FPDs were chosen in order to provide an immediate good esthetic solution and preserve tooth substance. The treatment was completed during one appointment. Occlusion was evaluated. Cotton roll for isolation was used as patient gave history of latex allergy. The required length of the Interlig fiber (Angelus, Londrina, Brazil) was predetermined using a dental floss from maxillary left canine to the maxillary right canine. The abutment teeth were roughened using coarse flame shaped diamond. They were then etched with 37% phosphoric acid (Eco-etch, Ivoclar vivadent, Liechtenstein) for 15-20 seconds, washed and dried followed by application and curing of bonding resin (Adper Single Bond 2, 3M ESPE, St. Paul, MN, USA). A thin layer of flowable composite (Tetric N-flow, Ivoclar vivadent, Liechtenstein) was placed on the abutment teeth and predetermined length of interlig fiber was cut (Fig.3) and pressed tightly against the surface of the teeth using a semi transparent silicone package of the fiber. The resin impregnated fibers were light cured initially through the silicone mold. Flow composite was used to seal the space between the fibers and the enamel surface. The fiber framework was again polymerized (Fig. 4)

Pontic was built up layer by layer using filler composite resin (Filtek Z350 XT, 3M ESPE, St. Paul, MN, USA) (Fig. 5). Patient's pre-operative pictures were checked to get a brief idea about the form and alignment of the missing tooth. A modified ridge lap pontic design was given to facilitate cleaning and to create an esthetic emergence profile. The shade of final veneered composite resin was selected using composite shade guide, and occlusion was carefully adjusted with articulating paper to avoid any premature contacts. Finishing and polishing of composite pontic carried out using the composite finishing kit (Fig. 6) and oral hygiene instructions were given to the patient. The outcome has been monitored for 8 months with no evidence of problems (Fig. 7).

Figure 1. Pre-operative clinical picture

Figure 2. Pre-operative IOPAR

Figure 3. Predetermined length of Interlig fiber was cut

Figure 4. Interlig fiber placed palatally

Figure 5. Composite resin pontic prepared irt 11

Figure 6. Post-operative photograph

Figure 7. 8 month follow-up

DISCUSSION

Patients with missing anterior teeth require immediate attention in order to restore function and aesthetics. A directly fabricated FRC bridge was opted in this case, in order to provide an immediate, cost effective and a conservative fixed solution to the patient. (Khetarpal *et al*., 2013) The clinical technique described here is noninvasive and reversible permitting all other restorative options to be carried out later if needed. The FRC framework was fully covered by veneering composite in order to obtain a final polishable tooth-colored surface. In this case, extension of the FRC bridge was kept from canine to canine because many authors have reported that fibers of the framework should cover as large surface as possible to eliminate the dislodging forces. The surface-retained FRC prostheses, was supported from both ends because of better bonding characteristics and biomechanical flexibility of the FRC framework thereby allowing abutment teeth to move without stressing the cement-framework interface in function, and loosening the prostheses. The composition of the polymer matrix and fiber orientation has a major role in bonding ability and durability of veneered composite to the FRC framework or resin luting cement. It has been concluded that pre impregnation of the fibers with the light-polymerizable dimethacrylate resin system containing linear polymer forms semi-interpenetrating polymer network (semi-IPN) after being polymerized offers better interfacial adhesion of FRC framework to composite veneer, better bonding site for veneered composite by means of interdiffusion bonding and durability and high strength. (Garoushi *et al*., 2011) Interlig possesses all these features. It is a braided glass fiber impregnated with light-cured composite resin hence Interlig was used here.

However, exposure of the fiber to the oral environment could increase the degradation of the fiber-reinforced structure and result in a surface difficult to polish. Glass fibers, in contrast to polyethylene fibers, must be protected from environmental damage. The strength of glass fibers are rapidly degraded on exposure to moisture and humidity. When the fiber is exposed, manufacturer recommends the removal of the exposed portion and repairing it with composite. Strict adherence to oral hygiene instructions is critical to maintain the health and the appearance of treatment results. The recent clinical data by Ozcan *et al*, on the semi-IPN resin matrix FRC FPDs made directly in patients mouth, suggest high survival percentages (>96% at five years), which reflects material development and learning of fabricating FRC FPDs. (Özcan, 2008) Laboratory investigations by Vallitu *et al*. have suggested that optimally designed FRC FPDs can provide higher load-bearing capacity than the conventional porcelain-fused to metal FPDs. Clinical studies by Lasilla *et al*. have shown a substantial clinical performance of the FRC FPDs, with an overall survival rate of 75% after about 5 years, which are higher than that of the FPDs with metal frameworks. (Khetarpal *et al*., 2013) From clinical point of view, there is a lack of long-term clinical research on FRC prostheses. The longitudinal studies reported general failure rates between 5% and 16% over periods up to 4-5 years. (Freilich *et al*., 2002) Van Heumen *et al*. showed a survival rate of 64% after 5 years follow-up of 3-unit anterior FRC prostheses made with the materials and techniques used in late 1990s. (van Heumen *et al*., 2009) One study reported a much higher failure rate of 40% over a 3-year period. (Bohlsen and Kern, 2003) Most common failures in FRC FPDs reported in the earlier studies were delamination of veneering composite at pontic area, which are normally easy to be repaired in patients' mouth. The current designing principles enable to fabricate FRC FPDs to eliminate known risks for technical failures. (Garoushi *et al*., 2011) As a conclusion, the combination of composite veneer, adhesive system, and FRC framework has introduced a new generation of metal-free direct teeth replacement. It is a viable alternative to conventional prosthesis in certain circumstances but further studies are desired to evaluate the long term success rate of the FRC bridges.

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