

Case study

TITLE - BRAIDED GLASS FIBER REINFORCED COMPOSITE RESIN BRIDGE - AN ALTERNATIVE TREATMENT FOR MANAGEMENT OF MISSING ANTERIOR TOOTH: A CASE REPORT

Abstract

Missing anterior teeth is of great concern during a patient's lifetime in many communities. A variety of treatment options, from implants to traditional bridges are often used in order to replace missing anterior tooth. However, it is often accompanied by variety of barriers such as an increased number of chairside visits and better costs. Fibre-reinforced composites (FRCs) have gained increasing and great acceptance in mainstream prosthodontics as viable alternatives to alloy-based restorations recently. In compaision to other restorative systems this is often a conservative approach that carries a minimum risk of pulp exposure or sensitivity and periodontal inflammation, which maintains the health of supporting tissues. Therefore the aim of this case report was to present a clinical case of a congenitally missing mandibular central incisors bilaterally which were replaced by means of a FRC bridge wherein, we employed a semi-direct (direct and indirect) technique. This technique provides a conservative, esthetic, and noninvasive treatment, economically more acceptable, nonirritating, and noniatrogenic. FRC bridges can therefore be considered as a permanent treatment modality.

Keywords

congenitally missing teeth, Fiber-reinforced composite, pontic, esthetics

INTRODUCTION

Loss of anterior teeth is a common form of injury, particularly in children and adults. On the other hand, elderly people, who keep their teeth for longer period of time, tend to have advanced caries or periodontal diseases which may lead to extraction of teeth. Patients with lost anterior teeth require immediate attention to restore it for esthetic and functional reasons [1]. A variety of treatment modalities, ranging from implants to standard Maryland bridges, can be used to replace missing anterior tooth [2]. Conventional porcelain-fused-metal (PFM) bridge or a resin-bonded fixed partial denture (Maryland bridge) are also the common treatment modalities for the replacement of a missing tooth. The first is highly invasive treatment in terms of tooth reduction and could be aesthetically compromised. The latter is less invasive, but the disadvantage of the metal framework which is unaesthetic, necessity of dental reduction or preparation (grooves, etc.), and lack of longevity could limit its use [3]. In such situations, Fiber-reinforced composite (FRC) bridges may be a good substitute for conventional prosthetic techniques [2]. The durability of fibre-reinforced resin composites is accumulatively related to: 1) the individual

properties of the fibres and resin matrix; 2) impregnation of fibres with resin; 3) fibres to matrix adhesion; 4) the volume of fibres in the composite matrix; 5) fibres orientation and; 6) location of fibres in the prosthesis construction [4]. The composite resin that is not compacted is not strong enough and can crack and break easily when used as the main building block for a new tooth. Thus, the employment of composite resin reinforced with fiber is necessary to increase structural strength and toughness. FRC is considered as one of the best and simple options for short span bridge as it is cost effective, esthetic and wear resistant [5]. The inherent strength of fibre-reinforced resin composites including the better aesthetics afforded by an alloy-free composition formed the basis for choosing the bridge design described in this case report.

CASE REPORT

A 36-year-old male patient had a major esthetic complaint due to congenitally missing lower central incisors. (Figure 1)



Figure 1: Intraoral picture with bilaterally missing lower central incisors

The patient has normal horizontal and vertical overlap with canine-protected occlusion. On examination no extra-oral abnormalities were detected. Intra-orally the soft tissues were healthy and oral hygiene was maintained. The space for restoring both central incisors was not possible due to insufficient space and therefore it was decided to bridge the gap with single central incisor with no midline alignment as patient's need was to close the space present between two lateral incisors. After discussion with the patient, it became clear that the implant placement was not possible for the replacement of missing teeth due to insufficient space. In order to conserve the remaining tooth substance, the fabrication of a conventional fixed partial denture was avoided and refused from patient. But the options for the conventional treatment with crown-retained FPDs were kept open for the future. FRC FPDs were chosen in order to provide good esthetics, preserve tooth substance, and postpone more invasive treatments. The treatment was completed in two appointments.

In the first appointment alginate impression of upper and lower arch was recorded and dental stone model was poured. Wax-up pattern for missing central incisor was made on model cast (Figure 2)



Figure 2: mock wax-up done on the diagnostic cast

and template was made using silicone impression material. Template was used to fabricate the artificial pontic with restorative composite. The pontic was built layer by layer using various enamel, dentin and translucent shade (Ivoclar Tetric N Ceram). Finishing and polishing was completed using composite finishing discs in order to achieve the natural esthetic prosthesis appearance (Figure 3).



Figure 3: polished and finished composite pontic made using template

In the Second appointment, firstly the intracoronal groove was prepared i.e a horizontal channel to accommodate the width and thickness of the FRC resin reinforcement material in the middle third of the tooth. The dimensions of this groove usually range from 2 to 3 mm wide and 1 to 2 mm deep. The pontic was temporarily held in position with the help of silicone index to minimize rotation during the treatment. Commercially available Braided Glass Fiber impregnated with light cure (Interlig, Angelus) was used for FRC bridge. The length of the FRC Bridge was measured using Williams probe and extended till middle third of the abutment teeth lingually and crossed pontic area directly under incisal edge. Following the measurement, Interlig fiber was cut and wetted with bonding agent (IvoclarTetric N Bond Universal) and was kept aside away from light till its use to prevent initial polymerization. The mid-palatal and

proximal sections of adjacent lateral incisors were prepared according to the manufacturer's directions. In order to isolate the working area, lip retractors and cotton rolls were used. The palatal and proximal surfaces of the adjacent teeth and the pontic were acid etched with 37% phosphoric acid for 15 seconds, rinsed and air dried (Ivoclar N Etch). A layer of bonding agent was applied and thoroughly air dried and light cured for 20 seconds. A thin layer of restorative composite was placed on the lingual surfaces of the adjacent teeth which was extended slightly to the proximal surfaces of each tooth adjacent to the edentulous area which held the Interlig fiber on place during adaptation. The necessary adjustment were made and light cured for 40 seconds. Flowable composite (Ivoclar Tetric N Flow) was layered over the abutment teeth. A notch was made on lingual surface of artificial pontic and a small amount of restorative composite was applied on the surface of fiber contacting pontic. The artificial pontic after proper positioned on fiber in proper alignment, was light cured for 40 second (Figure 4).



Figure 4: Photopolymerization of the FRC resin bridge

After completion, the occlusion was checked in centric and eccentric positions in order to reduce the functional forces in the resoration (Figure 5).

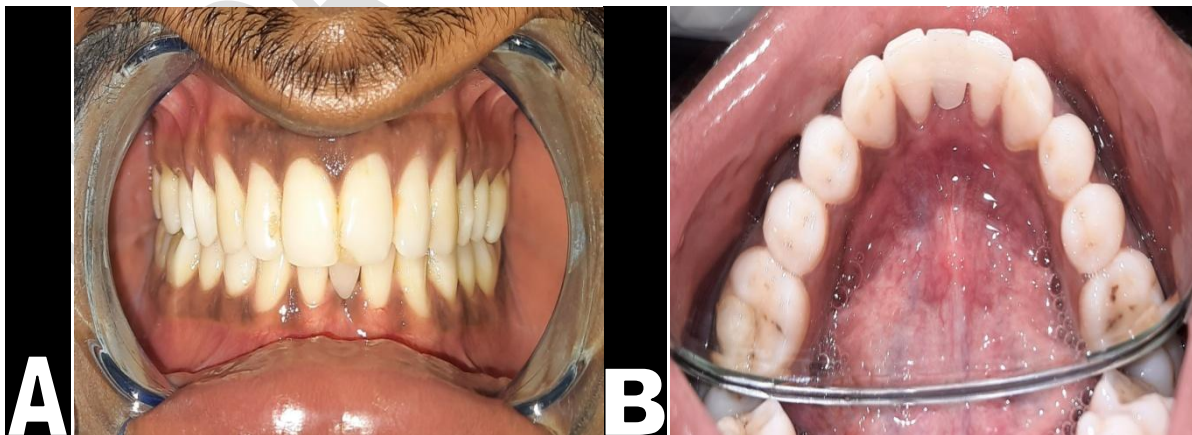


Figure 5: Post operative Fiber reinforced composite bridge
A) Labial view B) Lingual view

The patient was clearly informed about the importance of oral hygiene by giving more attention to plaque control and traditional home care procedures using proximal brushes and dental floss. The patient was seen for 1-week, 1-month, 3 month, 6-month, follow-up appointments. Overall the patient was satisfied with the esthetic outcome of the treatment modality.

DISCUSSION

Loss of teeth or congenitally missing teeth can psychologically and socially damage the patient, and teeth require immediate attention for the restoration of the aesthetics and function [6]. This trauma can often be minimized by immediate replacement of the teeth, using various treatment options. The minimal invasive approach, protection of tooth structure, aesthetic, and costs are the factors playing role in restoring the missing teeth [7]. In order to protect the healthy tooth tissues, a more conservative approach was made possible and described in this clinical report.

This clinical report describes the successful esthetic replacement of a lower central incisor with fibre reinforced composite fixed partial denture (FRCFPD) over short-term follow-up. Using this technique, abutment teeth can be conserved with minimal or no preparation [8], which allows for other treatment options available in the future.

The adhesive bridges made of fiber-reinforced composites can be constructed directly intraoral or indirectly extra-oral. In this case pontic was fabricated extraorally (indirect) which offers better working conditions, higher composite transformation degree, and better polishing [7] and its luting with the help of glass fibre was done intraorally (direct). As this technique combines the benefits of direct and indirect technique, it is also termed as semidirect [3].

The use of different dentin and enamel composites to build up the intermediate tooth in accordance to the anatomical layering technique provides a vital final aspect, with natural opalescence, translucency, and opacity. Instead of direct fabrication of the missing tooth, the use of a denture tooth can also be taken into consideration [3].

In order to ensure the cleanability and to provide an appropriate gingival outlet profile the modified ridge lap design was used in designing the pontic [9]. This design was preferred for precise polishing and to obtain a smooth convex surfaces.

In this case, Interlig (angelus, dental) was used which is a braided glass fiber impregnated with light cured composite resin. It is biocompatible, esthetic, translucent and practically colorless and disappears within the composite without show through. It is produced by a process called Resination in which the fibers are pulled in a convoluted manner using a resin bath. Pressures on the roller force resin into fabric or bundles of fiber [10].

Factors enhancing the success rates of FCRs [11] -

1. A well-designed preparation of the abutment teeth.
2. Potential reinforcement provided for glass fibers; adhesion between the fiber and also the composite could increase the resistance and therefore the hardness of the material allowing deflection without fracture.

3. The prosthetic space in resin-bonded FPDs; the distance must not be larger than 15mm, as the FPD would suffer a higher deflection and may not be successful.

Regarding the survival rate of FRC bridges, Nimet unlu et al [12] after three years clinical evaluation, reported that FRC FPD are quite acceptable for at least three years. In the study conducted by, Martínez M.F.E. et al [13] with nine years of follow-up, the overall survival was 95.2% at the end of the study. Martin A et al [14] reported that a unidirectional, preimpregnated FRC can be used successfully to make bridges of variable retainer designs that last up to four or more years when a high-volume substructure is used. Vallittu P.K [15] reported that glass fiber reinforced composite fixed partial dentures exhibited an overall survival rate of 75% and functional survival rate of 93% after a follow-up period of 24 to 63 months.

In FRC FPD, the procedure is very much operator-dependent and it requires an appropriate case selection and a precise technique.

Chart 1. CASE SELECTION FOR FIBER-REINFORCED COMPOSITE BRIDGES [14]	
INDICATIONS	CONTRAINDICATIONS
Optimal Esthetic Result	Inability to Maintain Fluid Control
Desire for Metal-Free Material	Need for Long Bridge Span
Decreased Wear to Opposing Teeth	Patients With Parafunctional Habits
Need for Additional Retention	Patients Who Abuse Alcohol

However some risk factors may decrease the longevity of an FRC bridge. Thus there are certain limitations to the successful FRC restorations [16] -

1. Functional stresses and occlusal loading of the pontic should be minimum.
2. Vertical and horizontal overlap should not exceed greater than 3mm.
3. Structurally vital and intact supporting abutment teeth should be present.

The FRCFPD technique described is easy and straightforward. It is a reasonable and fast solution for patients who reject more invasive treatment. Though the success in these cases is good, further studies are needed to evaluate the long-term usefulness of a fiber-reinforced composite resin fixed partial denture (PFRCFPD).

CONCLUSION

The treatment described in this case report appears to be viable alternative to conventional, cosmetic, non-invasive treatment, alloy-based restorations that provide a economically more acceptable, nonirritating, and noniatrogenic treatment. The minimal invasive approach with fiber reinforced composite have shown satisfactorily results esthetically which can be considered as a

long-lasting, making it a long-term and economical treatment without any damage to the sound tooth structure. During the first 9–11 months of this study, a fiber-reinforced resin bridge was found to be a viable option for single anterior tooth replacement. In view of these encouraging results, longer term follow-up measures are being taken. However, the longevity of the prosthesis still requires long-term follow-up.

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