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Hybrid type Anterior Fibre-reinforced Composite Resin Prosthesis: A Case Report

Sufyan Garoushi*, Akikazu Shinya†, Akiyoshi Shinya† and Pekka K.Vallittu†

Abstract - *A variety of therapeutic modalities, from implant to conventional Maryland prosthesis, can be used for the replacement of a missing anterior tooth. In patients refusing implant treatment, when minimal teeth reduction is preferred, a fibre reinforced composite (FRC) prosthesis can be a good alternative to conventional prosthetic techniques. The purpose of this case report is to describe the clinical procedure for fabricating hybrid type FRC prosthesis with pre-impregnated unidirectional E-glass fibres. Fibre-reinforced composite, in combination with adhesive technology, appears promising treatment option for replacing missing teeth. However, further clinical investigation will be required to provide additional information on this technique.*

KEY WORDS: Case report, composite resin, fibre-reinforced composite

INTRODUCTION

Over the last few years, the development of fibre-reinforced composite (FRC) has offered the dental profession the possibility of fabricating resin bonded adhesive, aesthetic and metal-free tooth replacements even in case of molar teeth. FRC-fixed partial denture (FPD) is an alternative to metal-ceramic adhesive FPD and in some cases also to full coverage crown retained FPD[1,2]. Many studies have focused on improvement of FRC FPD's strength[3-6]. The most often accepted concept to fabricate FRC FPDs is based on using continuous unidirectional glass fibres in dimethacrylate resin matrix as a substructure for the FPD. With the FRC prostheses, there are two approaches in using fibres: one is based on conventional tooth preparation and laboratory-made restorations while the other is based upon using fibres in minimally invasive restoration (conservative) by direct or indirect fabrication. FRC prosthesis can be fabricated extraorally by which better polishing, degree of monomer conversion, and adaptation to the retainers is achieved. Using of FRC prosthesis enable the use of different retainer types even in the same prosthesis (hybrid). For example, it is possible to create space for the retainer by removing old filling or to make completely surface-retained restorations. There are some clinical reports on the fibre reinforced FPDs to date and most of them are of relatively limited duration of clinical use[2,6,7]. This article reports a clinical case of indirectly made anterior FRC FPD which was used according to the principles of conservative approach.

Case analysis:

A 20 years old female was referred by her orthodontist to the prosthodontic department to restore her congenitally missing upper left canine (Fig. 1). Upper left lateral incisor was root canal treated. Upper left first premolar was restored by MO composite restoration. The medical history of the patient revealed no specific problems. All therapeutic alternatives, from implant to traditional fixed partial denture and Maryland bridge could have been possible in this case. After discussion with the patient, it became clear that the placement of a single implant for the replacement of missing tooth was not possible due to high costs of the treatment. The fabrication of a conventional fixed partial denture was avoided in order to conserve the tooth substance because of patient's young age. The missing tooth was planned to be replaced with an implant retained crown later on. Indirectly made FRC FPDs were chosen in order to provide good aesthetics, stress relief of bonding surface and tooth substance preserving fixed solution to the patient. The treatment was completed during three visits to the dentist. The treatment outcome has been followed over three years without existence of any kind of problem.

Clinical protocol:

1. Teeth preparation

At first, an impression was taken for a study cast, the occlusion was checked using articulating papers and the existing MO composite restoration in the premolar abutment was removed. Box-shaped proximal cavity with buccal cusp reduction was prepared on the first premolar. Guttapercha root canal filling at the upper left lateral incisor was removed using Gates Glidden burs up to size 4 for the total length of 7 mm (4000 cycles min^{-1} with water cooling). The root canal was prepared to receive a laboratory fabricated glass fibre reinforced individual root canal post. The palatal surface of lateral incisor was prepared for an onlay plate. The teeth preparation was similar to those for inlay and onlay restorations and followed the principles of conservation of the tooth substructure. Since the attachment of the prosthesis was based on adhesive luting rather than to mechanical retention by parallelism, the walls of the cavity were flared between 5° to 15°. All internal line angles

* BDS, PhD
† DDS, PhD

were rounded and the gingival floor was prepared with a butt joint. Occlusal (buccal cusp) and palatal reduction of 2 mm were made in order to obtain a suitable placement of the fibres and composite resin veneer (Fig. 2).

2. *Impression and temporization*

Impressions of the prepared and opposing teeth were taken using an elastomer material. Temporary bridge was made with a chemical cure acrylic resin. The shade for the veneering composite resin was selected using vintage halo NCC shade guide.

3. Prosthesis fabrication

Die stone was poured and the casts were mounted in a semi-adjustable articulator (Fig. 3). The FRC-FPD was made of resin pre-impregnated E-glass fibres embedded in a matrix of particulate filler composite resin.

The fibre framework (i.e. substructure) was then designed to have a root canal post and palatal plate at lateral incisor and onlay retainer in first premolar with a high fibre volume design placed in the pontic region (Fig. 4). The fibre framework was then finished, wetted with a resin, and veneered with laboratory composite (Fig. 5). The FRC-framework and veneered composite resin were polymerized with hand-light curing unit for 40 s per a layer (wavelength: 380 and 520 nm with maximal intensity at 470 nm, light irradiance 800 mW/ cm^2).

4.Try-in and adhesive luting of the prosthesis

The temporary restorations were removed with a scaler and the preparations were cleaned with polishing past and finishing brush. The prosthesis was evaluated intraorally to assess marginal fit, occlusion and aesthetics before definitive cementing.

Figure 1. *Lateral view showing congenitally missing upper left canine.*

Figure 2. *Occlusal view showing onlay teeth preparation.*

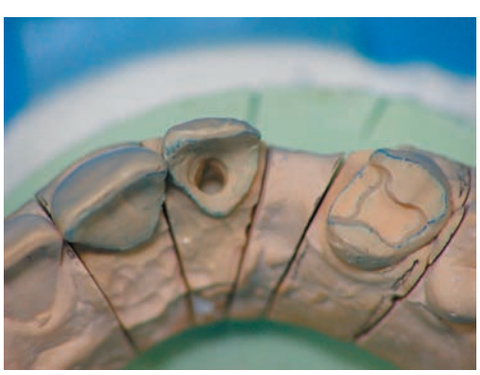

Figure 3. *Occlusal view of the cast to fabricate FPD in the laboratory.*

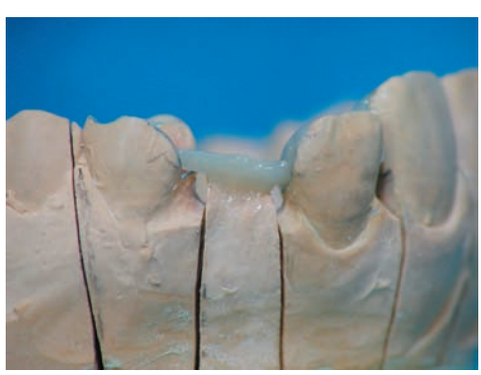

Figure 4. *Fiber framework has been finished and checked on the cast.*

Figure 5. *Finished FPD on the cast.*

Figure 6. *Occlusal view of the finished restoration.*

Figure 7. *Lateral view of the finished restoration.*

The adhesive cementation of the prosthesis was followed the recommendations proposed by manufacturer. First the inner surface of the retainers were etched (60 % acid etching gel) and then brushed with a porcelain activator and primer. Thus, the bonding of cement was based on adhesion predominately to inorganic phase of the FRC framework rather than to polymer phase which is the case in IPN-polymer matrix FRC products[8]. All bonding surfaces on enamel were etched (60 % acid etching gel) for 20 seconds. Bonding sites were isolated with cotton roles and the cavity preparations of dentin were rinsed with primer and gently dried by air. Then bonding agent was apply to all bonding surface. Finally adhesive surface were polymerized with hand-light curing unit for 40 s. Cementation was made by using dual cure cement.

After removing the excess of cement, adjusting and checking the occlusion (group function) with articulating paper, the prosthesis was finished with diamond burs and polished. Figures 6 and 7 show occlusal and lateral views of the finished restoration.

CONCLUSION

Over recent years, the desire expressed by many patients for cosmetic and metal-free restorations has lead to the development of better performing aesthetic composite resins. The use of glass fibres as reinforcement for composite resins has provided appropriate mechanical strength for composite resin to be used in replacing missing teeth

Based on the existing knowledge, it is reasonable to expect good quality FRC FPDs reach longevity of 10 years[5-7].

MANUFACTURER'S DETAILS

- Gates Glidden burs (Dentsply Maillefer, Ballaigues, Switzerland).
- Elastomer impression material (Examixfine regular and putty type, GC, Tokyo, Japan).
- Chemical cure acrylic resin (Unifast III, GC, Tokyo, Japan).
- Vintage halo NCC shade guide (Shofu inc, Kyoto, Japan).
- Pre-impregnated E-glass fibers (EG Fiber, Kuraray medical Inc, Tokyo, Japan).
- Fibers matrix (EG Flow, Kuraray medical Inc, Tokyo, Japan).
- Composite veneer (Gradia GC, Tokyo, Japan).
- Light-curing unit (Optilux –501, Kerr, CT, USA).
- Polishing past (Pressage, Shofu inc, Kyoto, Japan).
- Finishing brush (Merssage brush, Shofu inc, Kyoto, Japan).
- Etch-gel (K-etchant gel, Kuraray Medical Inc, Tokyo, Japan).
- Primer and bonding agent (Kuraray medical Inc, Tokyo, Japan).
- Porcelain activator (Kuraray medical Inc, Tokyo, Japan).
- Dual cure cement (Panavia F2.0, Kuraray Medical Inc, Tokyo, Japan).
- Polishing system (Enhance, Dentsply GmbH, Konstanz, Germany).

ADDRESS FOR CORRESPONDENCE

Sufyan Garoushi, BDS, PhD. Department of Prosthetic Dentistry and Biomaterials Science, Institute of Dentistry, University of Turku, Lemminkäisenkatu 2, FI-20520 Turku, Finland. E-mail: sufgar@utu.fi

REFERENCES

1. Butterworth C, Ellakwa AE, Shortall A. Fiber-reinforced composites in restorative dentistry. Dent Update 2003; **30**:300-306.
2. Vallittu PK, Sevelius C. Resin-bonded, glass fiber-reinforced composite fixed partial dentures: a clinical study. *J Prosthet Dent* 2000; **84**:413-418.
3. Vallittu PK. Flexural properties of acrylic resin polymers reinforced with unidirectional and woven fibers. *J Prosthet Dent* 1999; **81**:318-326.
4. Kim SH, Watts DC. Effect of glass-fiber reinforcement and water storage on fracture toughness (KIC) of polymer-based provisional crown and FPD materials. *Int J Prosthodont* 2004; **17**:318-322.
5. Kangasniemi I, Vallittu PK, Meiers J, Dyer SR, Rosentritt M. Consensus statement on fiber-reinforced polymers: current status, future directions, and how they can be used to enhance dental care. *Int J Prosthodont* 2003; **16**:209.
6. Vallittu PK. Survival rates of resin-bonded, glass fiber-reinforced composite fixed partial dentures with a mean follow-up of 42-months: a pilot study. *J Prosthet Dent* 2004; **91**:241-247.
7. Monaco C, Ferrari M, Miceli GP, Scotti R. Clinical evaluation of fiber-reinforced composite inlay FPDs. *Int J Prosthodont* 2003; **16**:319-325.
8. Lastumäki TM, Lassila LV, Vallittu PK. The semi-interpenetrating polymer network matrix of fiber-reinforced composite and its effect on the surface adhesive properties. *J Mater Sci Mater Med* 2003; **14**: 803-809.