Fiber-reinforced Composite Resin Prosthesis to Restore Missing Posterior Teeth: A Case Report

Sufyan Garoushi1, Daiichiro Yokoyama2, Akikazu Shinya1,2 and Pekka K. Vallittu1

(1) Department of Prosthetic Dentistry & Biomaterials Science, Institute of Dentistry, University of Turku, Turku, Finland, (2) Department of Crown & Bridge, The Nippon Dental University, School of Life Dentistry at Tokyo, Tokyo, Japan

Abstract: A fiber-reinforced composite inlay-onlay FPD was used for a single posterior tooth replacement in a patient refusing implant for psychological reasons. The FRC-FPD was made of pre-impregnated E-glass fibers (everStick, StickTeck, Turku, Finland) embedded in a resin matrix (Stick Resin, StickTeck, Turku, Finland). The unidirectional glass fibers were used to make a framework structure with high volume design placed in the pontic (edentulous) region. To reproduce the morphology of natural teeth, the framework structure was then veneered with Gradia (GC, Tokyo, Japan).

Key Words: Fiber-reinforced composite; FRC; Posterior prosthesis

Introduction

Over the last few years, the development of fiber-reinforced composite (FRC) has given the dental profession the possibility of fabricating adhesive, aesthetic, and metal-free dental replacements even in the case of molar teeth. FRC-fixed partial dentures (FPDs) are an alternative to metal-ceramic adhesive FPDs, and can offer an alternative to full coverage crown retained FPDs [1,2].

Previous studies have focused on improvement of FRC FPD’s strength [3-6]. The current commonly accepted concept to fabricate FRC FPDs consists of using continuous unidirectional glass fibers in dimethacrylate resin matrix as substructure of the FPD. There are few clinical reports on the fiber reinforced FPDs to date, and most are of relatively limited duration [2,7-9]. The concept of non-invasive or minimally invasive approaches for replacing missing teeth with FRC-prostheses was discussed in the last issue of the Journal [10-12].

This article evaluates a clinical case of indirectly made FRC FPD used according to the principles of the conservative (inlay and onlay) approach.

Case Analysis

The patient was a 20 year old female who lost retained deciduous lower right second molar. The fabrication of a traditional fixed partial denture was avoided due to the patient's young age and intact neighbouring tooth (premolar). The plan was to replace the missing tooth with an implant retained crown at a later date. Indirectly made FRC FPDs were selected in order to provide better aesthetics, stress relief of bonding surface, and a conservative fixed solution to the patient. The treatment was completed during two dental visits. The case has been followed for four years. The patient has been problem free.

Clinical Protocol

1. Preparation of abutment teeth

After occlusal analysis with articulating paper, old MOD amalgam restoration of the molar abutment was removed. A box-shaped proximal cavity was prepared on the distal side of the first premolar. The cavity preparations were similar to those for inlay and onlay restorations following the philosophy of maximum conservation of the tooth structure. Since the retention of the prosthesis was due to adhesive luting and not to parallelism, the walls of the cavity were flared between 5° to 15°. All internal line angles were rounded and the gingival floor was prepared with a butt joint. Occlusal reduction of 2 mm was made in order to obtain suitable placement of the fibers and composite resin veneer (Fig. 1).

2. Impression and temporization

An impression of the prepared and opposing teeth were made using an elastomer material (Examix fine regular type and Exafine putty type, GC, Tokyo, Japan). Then, the inlay-onlay cavities were provisionally restored with a chemical cure resin (Unifast III, GC, Tokyo, Japan). The shade of the final veneered composite resin was selected using vintage halo NCC (Shofu Inc, Kyoto, Japan) shade guide.

3. Prosthesis fabrication

Die stone was poured and the casts were mounted in a semi-adjustable articulator. The fiber framework (i.e. substructure) was then constructed with high volume design placed in the pontic region (Fig. 2). Finally, the fiber framework was finished, wetted with Stick resin, and veneered with Gradia laboratory composite (Fig. 3).

The FRC-framework and veneered composite resin, were polymerized with hand-light curing unit (Optilux –501, Kerr, CT, USA) for 40 s per layer (wavelength: 380 and 520 nm with maximal intensity at 470 nm, light irradiance 800 mW/cm²).

4. Try-in and adhesive luting of the prosthesis

At the time of luting, the provisional restorations were removed with a scaler and the preparations were cleaned with non-fuluolyd polishing paste (Pressage, Shofu Inc, Kyoto, Japan) and finishing
brush (Merssage brush, Shofu Inc, Kyoto, Japan) (Fig. 4). The prosthesis was evaluated intraorally to assess marginal fit, occlusion, and aesthetics before definitive cementing.

The adhesive cementation of the prosthesis followed the recommendations of the manufacturer. The area was isolated with a cotton roll and the cavity preparations were rinsed with an ED primer (Kuraray Medical Inc, Tokyo, Japan), then gently dried by air. The inner surface of the retainers were etched (60% acid etching gel, K-etchant gel, Kuraray Medical Inc, Tokyo, Japan) and then brushed with a clearfil porcelain activator and a clearfil megabond primer (Kuraray Medical Inc, Tokyo, Japan) (Fig. 5). Cementation was made by using dual cure cement (Panavia F2.0, Kuraray Medical Inc, Tokyo, Japan).

After removing the excess cement, and checking and adjusting the occlusion with articulating paper, the prosthesis was finished with diamond burs and polished with a polishing system (Enhance, Dentsply, GmbH, Konstanz, Germany).

Figures 6 and 7 show occlusal and lateral views of the finished restoration.

**Conclusion**

The use of FRCs as a direct technique for a bridge construction requires a high level of skill in the composite build-up and current knowledge of the aesthetic aspects of teeth. Restoration of the missing teeth in the mouth further challenges the clinician. To provide longer lasting FRC bridges, the indirect technique would be recommended. The lab technician is able to provide a strong fiber framework and a pontic of high aesthetic quality.

Based on the current clinical results, it is reasonable to expect FRC FPDs reach longevity of 5-10 years [6-8]. However, it needs to be emphasized the importance of using high quality and proven materials.
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