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Fiber-Reinforced Composite-Fixed Partial Denture: A Case Series

Dhananjay Dhiren Sheth[1]*, Ajay V. Sabane[1], Stuti C. Jha[2], Hilleri Mori[1], Pritesh Menghe[1], Rohan Bhave[1]

Abstract

In most societies, lack of anterior teeth is a serious problem in a patient's social life. While traditional removable partial dentures and implant support restorations are often the treatment of choice, fiber-reinforced composites are a conservative, fast, and cost-effective alternative for single and multiple tooth replacement.

Keywords: Anterior, Esthetic, FRC-FPD, Fiber, Bridge, Composite

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Background

Loss of anterior teeth is a common form of injury, especially in children and adolescents. On the other hand, elderly people who maintain their teeth for a long period of time often develop tooth decay and periodontal disease, leading to tooth extraction. Patients with lost anterior teeth need immediate attention for restoration for esthetic and functional reasons. With increasing patient demand for tissue preservation and aesthetics, and the desire to reduce treatment costs, dentists are making minimally invasive and chairside (direct) dental prostheses with fixed removable partial dentures (FPDs).[1,2] We are looking for materials and technologies that enable us. In recent years, the development of fiber-reinforced composite (fiber-reinforced polymer) has allowed dentists to produce resin-bonded, esthetically pleasing, metal-free tooth restorations for single, and multiple tooth replacements. Fiber-reinforced composite (FRC) and FPDs are an alternative to composite-bonded FPDs for metal frames and may be alternatives to full-surface crown support FPDs and implant support crowns.[3,4] FRC, made of fiberglass, is the only currently accepted cosmetic material that can be treated intraoral to form a bridge frame, while firmly adhering to the remaining dentin and achieving strength. Definitely suitable for human bite function. Many studies have focused on improvement of FRC FPD's strength.[5,6] The most accepted concept for FRC FPD fabrication is based on the use of continuous unidirectional (bundle) glass fibers in a polymethylmethacrylate dimethacrylate resin matrix as the substructure for the FPD.

With FRC FPDs, there are two approaches to using fibers: one is based on conventional tooth preparation and lab-made restorations, while the other is based on the use of fibers in restorations mini-invasive (conservative) by direct or indirect production. FRC system allows to use different containers even in the same FPD (combined type).[4]

For example, if clinical conditions allow the correct design of the FRC framework, removing old fillings may create space for occlusal support of the FRC framework or repairs that maintain the surface perfectly. It can be manufactured. At present, there are a limited number of clinical studies on fiber-reinforced FPDs in the dental literature. However, based on these results, it is reasonable to expect FRC prostheses to have a long life, especially for prostheses manufactured using the direct method.[4,7,8]

[1]Department of Prosthodotics and Crown and Bridge, Bharati Vidyapeeth Dental College and Hospital, Pune, Maharashtra, India.

[2]Department of Periodontology, Bharati Vidyapeeth Dental College and Hospital, Pune, Maharashtra, India

Corresponding Author: Dr. Dhananjay Dhiren Sheth, Department of Prosthodotics and Crown and Bridge, Bharati Vidyapeeth Dental College and Hospital, Pune, Maharashtra, India. Phone: +91-8208274236. E-mail: dsheth1993@gmial.com

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This paper describes the technique involved using minimally invasive approach along with laboratory support.

Case Description

Case 1

A 30 2-year-old patient reported to the Department of Prosthodontics and Crown and Bridge, at Postgraduate Clinic, Bharati Vidyapeeth Dental College and Hospital, Pune, with a chief complaint of missing upper right lateral incisor teeth and compromised esthetics [Figure 1].

Clinical examination

The patient has a normal horizontal and vertical overlap, and canine protected occlusion. After consulting with the patient, it became clear that the high cost of treatment made it impossible to insert an implant to replace the missing tooth. To protect the material of the remaining teeth, the production of conventional FPDs was avoided and rejected by the patient. The treatment with a removable partial denture was also rejected as patient demanded fixed restoration. Traditional repair options using implants or crown-retaining FPDs remained open in the future. Indirectly manufactured FRC-FPDs have been selected to provide superior esthetics, maintain tooth structure, and delay more invasive treatments.

Figure 1: Pre-operative

Figure 2: Application of light cure resin strip

Treatment plan

Diagnostic impressions were taken and casts were poured. The casts were mounted in occlusion to check for the occlusal clearance and the available space for tooth preparation on the palatal surfaces of the central incisor and canine adjacent to the edentulous area. Once the evaluation was done, the patient was called for further treatment which included site preparation for the FRC-FPD.

The teeth were prepared on the palatal surface with a high-speed air turbine airotor (150,000 speed with water cooling). The preparation was 1.5 mm deep and 3 mm wide with a rectangular shape which extended half the palatal surface of the teeth from the line angle. Post-preparation the area was dried with air way syringe and a single impression technique was used with Putty (3M™ Express™ XT Putty Soft VPS Impression Material) and Light Body (3M™ Express™ VPS impression material). The impression of the lower arch was taken in alginate (Zhermack).

The VPS impression was sent to laboratory (K Dent, Kharadi, Pune) for cast pouring and the alginate impression was poured immediately due to its shelf life limitations. Later, the VPS impression was poured in the laboratory by trained technician and the cast was retrieved. Following the cast retrieval, the composite-reinforced light cure strip (angelus interlig single patient strip, impregnated glass fiber) was cut in a size of 15 mm and placed on the prepared site on the replicated cast at both the ends on the palatal surfaces of the prepared teeth [Figure 2]. After placement of the strip, it was cured with a light cure gun (Optilux-501) for 20 s. Then, the wax pattern was fabricated on the cured band with extending wings on the palatal surfaces of the teeth on the cast [Figure 3]. Post-fabrication of wax pattern a Putty index was obtained only on the buccal surface of the waxed up tooth that is to be replaced. Then, the composite (Prime Dent USA Composite Syringes) that matched the patient's shade of natural teeth was choosen. The composite was layer by layer cured and the tooth was fabricated with Putty index in place, on the cast. Once the composite tooth was fabricated, the whole prosthesis was removed from the cast and polished and cervical composite layering was done to match the gingival shade. Post polishing and final finishing of the prosthesis, it was cemented into patient's mouth. The prepared teeth were air dried using three way syringe and the area was isolated with cotton rolls. After that the prosthesis was tried in patient's mouth and checked for shade matching, occlusion and was approved by the patient. Once the prosthesis was approved by the patient, it was ready for cementation. The prepared teeth were acid etch with (37% phosphoric acid gel) and, then, thouroughly

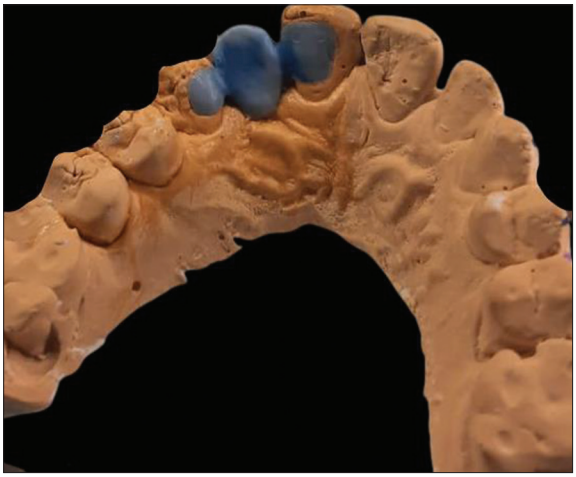

Figure 3: Wax up done with wing like extension on adjacent teeth

Figure 4: Post-operative view showing the finished prosthesis

Figure 5: Post-operative view showing the shade matching and soft-tissue camouflage

rinsed and air dried. Adhesive resins were applied according to the manufacturer's instructions (Scotchbond multipurpose adhesive, 3M ESPE, USA) to tooth surface and cured using light cure for 15 s. Then, the (3M RelyX U200 Clicker Self Adhesive Resin Cement) dual cure resin cement was dispensed ao a mixing pad and thoroughly mixed, after which it was applied on the surface of the prosthesis which will be bonded to the palatal surface of the prepared tooth surfaces. Then, the excess cement was removed and cured using light cure for 10 sec [Figures 4 and 5]. The articulating paper was then used and the prosthesis was checked for occlusion.

Case 2

A female patient age 30 reported to the department of Prosthodontics and Crown and Bridge, Bharati Vidyapeeth Dental College and Hospital, Pune, Postgraduate clinic with a chief complaint of missing teeth in the lower anterior region with compromised esthetics.

Clinical examination

Clinical examination revealed missing teeth with 31 and 41 [Figures 6 and 7]. Furthermore, 32, 42 were periodontically compromised with Grade 1 mobility. The patient was given multiple treatment options after evaluation of the diagnostic casts, radiographs, and systemic examination. The treatment options given to the patient who was implant supported bridge, conventional FPD, and removable partial denture. The patient wanted to avoid invasive procedure, and hence, the implant supported bridge was ruled out. The patient had periodontally compromised 32 and 42 abutment teeth, and hence, the conventional FPD was also ruled out. The patient wanted a fixed prosthesis, and hence, removable denture was excluded from the study.

Treatment plan

The patient was thoroughly diagnosed and diagnostic impressions were taken and casts were poured. The casts were mounted in occlusion to check for the occlusal clearance. After discussion with the patient, it was concluded that a minimally invasive approach of Fiber-Reinforced Composite-FPD was chosen as the optimum

Figure 6: Pre-operative view showing missing teeth and soft-tissue defect

Figure 7: Pre-operative view

treatment option for the patient. Once the evaluation was done, the patient was called for further treatment which included site preparation for the FRC-FPD.

The lingual surfaces of 32 and 42 were prepared with a rectangular box extending from the mesial axial surface 3 mm to the center of the tooth and 1.5 mm deep. Such preparation was done on lingual surface of 32 and 42 and the preparation finished and polished. Once the preparation was done, the area was isolated with cotton rolls and the teeth dried. Putty (3M™ Express™ XT Putty Soft VPS Impression Material) impression was made followed by light body (3M Express™ VPS Impression impression) [Figure 8]. The impression was inspected for any voids and was poured in dental stone III. Then, an impression was made of the upper arch using alginate (Zhermack) and poured. After the casts were retrieved, they were mounted in occlusion and sent to laboratory (K Dent Laboratory, Kharadi, PUNE) for fabrication of the prosthesis. The composite-reinforced light cure strip (Angelus Interlig Single Patient Strip, Impregnated Glass Fiber strip) was cut in a size of 25 mm and placed on the prepared surfaces of the teeth on the cast, after which it was cured with a curing light (Optilux-501). Once the strip was hard, wax up was done and putty index was made of the waxed-up teeth only on the buccal surface. The index was then used to layer by layer built up the teeth with composite (Prime Dent USA Composite Syringes) over the strip and then cured. Gingival layered composite resin was used to cover the cervical portion of the prosthesis thus covering the associated soft-tissue defect. After the prosthesis was fabricated, it was removed from the cast and polished.

Once the prosthesis was completed, the patient was called for cementation of the prosthesis. The prosthesis was tried in patients'

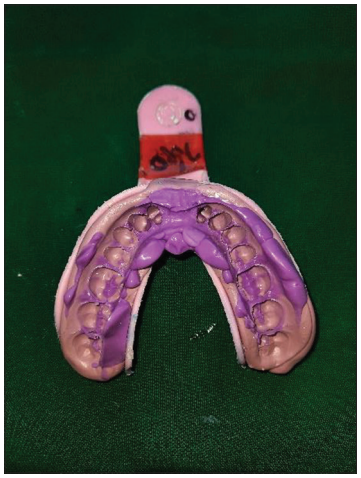

Figure 8: Final impression showing recording of prepared teeth and surrounding soft-tissue contours

Figure 9: Post-operative view showing the final prosthesis with soft-tissue camouflage

mouth and checked for aesthetics, phonetics and occlusion. Once it was confirmed by the patient, the area was air dried and isolated using cotton rolls. After which the prepared, teeth were acid etch with 37% phosphoric acid for 20 s and then rinsed off. Then, bonding agent (Scotchbond multipurpose adhesive, 3M ESPE, USA) was applied over the prepared surfaces and cured using ultraviolet light. Post application of bonding agent, the prosthesis was cemented using Relyx U200 resin-based cement and cured for 15 s. The prosthesis was again checked for retention, occlusion, esthetics, and phonetics [Figure 9]. The patient was re-called at an interval of 1 month, 3 months, and 6 months.[9]

Discussion

The FRC-FPD is a technique that should be employed as and where possible as it a cost-effective and time saving alternative to the conventional removable partial denture in which the patient also gets a psychological advantage of a fixed prosthesis. The treatment also is conservative and requires minimal preparation of abutment and also minimum appointments. The prognosis of the prosthesis is also satisfactory and should be considered as a viable treatment option even in cases, where the final treatment has to be delayed.

Conclusion

FRC FPDs demonstrated high overall survival with predictable performance outcomes. However, long-term performance remains unclear. Clinical significance FRC FPDs are viable medium-term management alternatives for replacing single anterior or posterior teeth in patients.

Clinical Significance

The treatment with FRC-FPD should be considered as a treatment option in clinical practice as it is a cost-effective and time saving treatment modality and also should be considered as a highly aesthetic fixed alternative to conventional FPD or Maryland Bridge. It can suffice the function of both temporary and permanent treatment option according to the patient needs.

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References

1. Aydin MY, Kargül B. Glass-fiber reinforced composite in management of avulsed central incisor: A case report. J Dent Child 2004;71:66-8.
2. Akin H, Turgut M, Coskun ME. Restoration of an anterior edentulous space with a unique glass fiber-reinforced composite removable partial denture: A case report. J Esthet Restor Dent 2007;19:193-7.
3. Butterworth C, Ellakwa AE, Shortall A. Fibre-reinforced composites in restorative dentistry. Dent Update 2003;30:300-6.
4. Vallittu PK, Sevelius C. Resin-bonded, glass fiber-reinforced composite fixed partial dentures: A clinical study. J Prosthet Dent 2000;84:413-8.
5. Vallittu PK. Flexural properties of acrylic resin polymers reinforced with unidirectional and woven glass fibers. J Prosthet Dent 1999;81:318-26.
6. 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;17:318-22.
7. 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;91:241-7.
8. Monaco C, Ferrari M, Miceli GP, Scotti R. Clinical evaluation of fiber-reinforced composite inlay FPDs. Int J Prosthodont 2003;16:319-25.
9. Ahmed KE, Li KY, Murray CA. Longevity of fiber-reinforced composite fixed partial dentures (FRC FPD)-systematic review. J Dent 2017;61:1-11.