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Case Report

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Single Tooth Replacement Using Fiber-Reinforced Composite Resin Bridge- A case report

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Abstract

For the replacement of an anterior tooth lost due to trauma or a periodontal diseases, a range of treatment approaches exists, including implants and conventional Maryland bridges. The integration of fibers in composite resins significantly enhances their resistance to fractures. Fiber-reinforced composite (FRC) bridges present a promising alternative to traditional prosthetic techniques. Opting for FRC bridges presents a conservative approach when compared to conventional fixed dental prostheses or implant treatments. This technique is characterized by its minimal invasiveness and reversibility, often allowing completion within a single visit. This article is focused on presenting two clinical cases demonstrating the successful replacement of a single tooth using a FRC bridge.

Keywords: Prosthetic techniques, Single Tooth Replacement, FRC bridge.

INTRODUCTION

Anterior tooth loss is a commonly encountered injury, especially among children and adults. Conversely, the elderly, who tend to maintain their teeth for more extended periods, may experience advanced cases of caries or periodontal diseases that may lead to tooth extractions. Immediate treatment is crucial for patients with missing anterior teeth, focusing on both aesthetic and functional restoration [1].

There is a range of treatment options available, spanning from implants to conventional Maryland bridges, for the replacement of a missing anterior tooth [2]. When both general and local conditions permit, implants stand out as the treatment of choice. It is generally advised to defer their consideration until the completion of the growth period, typically around the age of 18. Given implant considerable cost, financial limitations may also factor into their feasibility. Therefore, it is prudent to explore alternative, economically feasible treatment options for tooth replacement, whether as a primary intervention or as a long-term provisional solution prior to pursuing implant therapy [3].

Originally employed as a splinting material for teeth affected by periodontal conditions and to stabilize avulsed teeth, fiber-reinforced technology has evolved to encompass the replacement of both anterior and posterior teeth. The determination to utilize a FRC bridges relies on factors including its position in the oral cavity and the extent of occlusal forces. Research suggests evaluating the condition of abutment teeth, the absence of periodontal disease or effectively treated controlled periodontal conditions, as well as the absence of parafunctional habits. Additional crucial considerations involve an unchecked medical history that detrimentally affects oral health, such as diabetes, the span of the edentulous space, loading on the pontic tooth, and the type and format of the fiber, along with the employed technique [4].

Currently, FRC bridges are applied using two distinct techniques: direct and indirect. The direct technique offers the advantage of completing the prosthesis in a single appointment, eliminating the need for laboratory work and reducing treatment costs. However, it requires a technician with extensive expertise in fiber handling and operative area preparation, including isolation with a rubber dam. Conversely, the indirect FRC bridges technique is conducted in a laboratory setting. The proficiency of the laboratory technician in fiber manipulation, coupled with precise operative area isolation and FRC bridges cementation, determines the success of this approach. Drawbacks include higher costs and the necessity for multiple appointments [5-7].

The new generation of composite resins, are designed in shades that mimic both dentin and enamel, yields outstanding aesthetic results, accurately emulating the natural look of teeth, with a notable emphasis on

the incisal third of anterior teeth [8]. Nevertheless, the longevity of fiber-reinforced resin composites is influenced by several factors: 1) the distinct attributes of the fibers and resin matrix; 2) the thorough impregnation of fibers with resin; 3) the strength of the bond between fibers and matrix; 4) the proportion of fibers within the composite matrix; 5) the alignment of fibers; and 6) the positioning of fibers within the prosthesis structure [9].

Recent progress in adhesive technology and the incorporation of improved composites and fibers in dental practices have led to the efficient and cost-effective implementation of aesthetic and conservative prosthesis procedures for single missing teeth [10]. This article presents a two cases where a FRC bridge was utilized, employing the natural tooth as a pontic for the replacement of a central permanent incisor in both patients.

CASE REPORT

Case 1

A 48-year-old female patient applied at our dental clinic with an absence in her maxillary central incisor. She had previously lost a maxillary central incisor due to periodontal disease. She raised concerns regarding both aesthetic appearance and functional issues. Radiographic assessments and model analyses were conducted, after which various treatment options were presented. The decision was made to opt for a FRC bridge, a choice determined by its aesthetic appeal and conservative treatment approach. This decision was made in response to the patient's limited financial means, providing a cost-effective alternative.

Upon examination, it was noted that the patient had taken steps to preserve the tooth. The central incisor, once extracted, was found to be in a reasonably good state, making it a viable option for use as a pontic (Figure 1A and 1B).

To achieve isolation of the working area, lip retractors and cotton rolls were utilized. To initiate the procedure, the anterior teeth were etched with 37% phosphoric acid for a duration of 20 seconds. Next, it was rinsed and subsequently dried with compressed air. A bonding agent was applied, ensuring thorough air drying followed by light curing for 15 seconds. Afterwards, a fine layer of self-adhesive composite resin (BisCem; Bisco, Inc, Schaumburg, IL, USA) was carefully placed on the palatinal surfaces of the neighbouring teeth, extending slightly to the proximal surfaces of each tooth adjacent to the edentulous area. This served to secure the fiber in position during adaptation.

Subsequently, a light curing pre-impregnated glass fiber (Tender Fiber Due Glass Fiber, MICERIUM S.p.A. Italy) was secured using self-adhesive composite resin (Figure 3). The composite layer between the teeth and strip was maintained as thin as possible. After making necessary adjustments, light curing was performed for 60 seconds. To complete the process, composite resin was layered over the abutment teeth. Finally, a notch was created on the palatinal surface of the pontic, and a small quantity of self-adhesive composite was applied to the surface of the fiber in contact with the pontic (Figure 4).

To maintain a natural surface appearance, the use of polishing disks was deliberately not preferred for the finishing treatment. Following the procedure, the occlusion was examined both in centric and eccentric positions to mitigate any excessive functional forces on the newly placed restoration.

The patient received thorough education on the significance of oral hygiene, with specific emphasis on meticulous plaque control and adherence to traditional home-care practices such as utilizing proximal brushes and dental floss. Afterwards, the patient attended follow-up appointments at intervals of 1 month, 3 months, and 6 months for further evaluation.

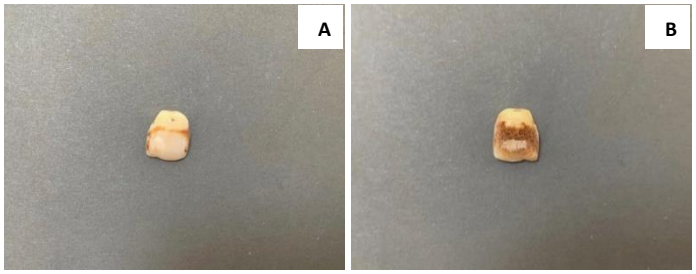

Figure 1: A and B- The pontic tooth

Figure 2: The fiberglass bonding to the adjacent teeth

Figure 3: Fiber-Reinforced composite resin bridge labial view

Case 2

Upon referral, a 16-year-old female patient sought replacement for her maxillary central incisor, which had been avulsed following a traumatic event. Her medical history revealed no significant health problems. The patient had brought the avulsed tooth with her, which was not in a very good condition (Figure 4A and 4B). The patient expressed a strong preference for cost-effective treatment while maintaining aesthetic standards. Following radiographic and intraoral examinations, various treatment options were introduced for consideration. Consequently, due to economic reasons FRC bridge option was chosen, utilizing the patient's own avulsed tooth as a pontic. As such, the decision was made to employ the avulsed tooth as a natural pontic in the creation of the anterior FRC bridge.

Because of the unsatisfactory state and visual aspect of the avulsed tooth, it was necessary to conduct aesthetic and restorative procedures on it prior to its use as a pontic.

A similar method, as outlined in the prior case, was employed to adjust the avulsed tooth. The measurement of the light curing pre-impregnated glass fiber strip spanned from the right lateral incisor to the left central incisor (Figure 5). By employing a premeasured fiber strip, related to the procedure in case 1, the avulsed tooth pontic was bonded to the adjacent vital teeth (Figure 6). Following the bonding, occlusion was meticulously examined in both centric and eccentric positions, placing particular emphasis on anterior guidance. The patient's level of contentment was notably high with the achieved outcomes.

The patient was extensively educated on the crucial role of oral hygiene, with special attention to consistent use of tooth brushing and dental floss. Following this, the patient participated in follow-up appointments at 1 week, 1 month, and 6 month intervals for continued evaluation.

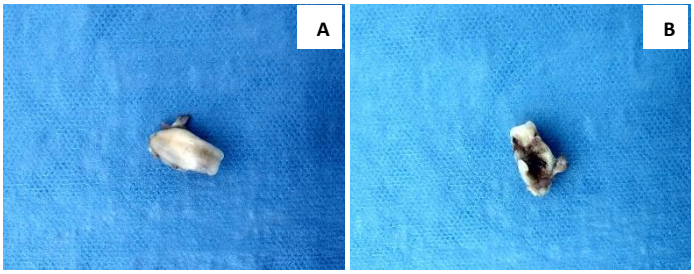

Figure 4: A and B- The extracted tooth

Figure 5: The fiberglass bonding to the adjacent teeth

Figure 6: Fiber-Reinforced composite resin bridge labial view

DİSCUSSİON

The field of non-invasive or minimally invasive approaches to replace missing teeth, particularly in cases where aesthetics are of greatest concern, has seen significant progress thanks to advancements in adhesive dentistry materials and techniques. Pre-impregnated fiber-reinforced composite allows for the prompt chairside workflow of a fixed partial denture with little to no preparation needed for the abutment teeth [11]. This aspect carries special significance for younger patients, given their increased susceptibility to endodontic treatment complications arising from extensive tooth preparation [12].

Various treatment alternatives are available for the restoration of missing anterior permanent incisors in young children and adolescents [13]. Another viable treatment approach is the utilization of a Maryland Bridge, which entails the preparation of the palatal surface of abutment teeth for rest placement. It's important to note, however, that a major drawback associated with these bridges is the necessity to modify healthy teeth, coupled with potential aesthetic limitations stemming from the presence of a metal base [14]. Implants are frequently the preferred treatment option and should be contemplated when both general and local conditions are conducive. Nonetheless, it's typically recommended to delay implant placement until after the conclusion of the growth period, approximately around the age of 18 years [15]. Therefore, in our second case report, the young age of the patient was not suitable for both a conventional fixed partial denture and an implant treatment options. Furthermore, employing an extracted natural tooth results in favourable aesthetics and a genuine experience, ultimately leading to patient satisfaction.

The patient's preference for a single-visit treatment and the avoidance of removable prosthesis adds to patients comfort, as removable dental prostheses generally fall short in comparison to fixed dental prostheses. Moreover, an FRC bridge offers a more budget-friendly and pain-free treatment option, setting it apart from implant procedures [16].

In recent years, the evolution of fiber reinforced composite technology has provided the dental field with the capability to create adhesive, aesthetically, and entirely metal-free dental restorations [17]. Certain authors in the literature do not recommend the utilization of composite materials for definitive restorations, citing potential issues with increased wear, plaque accumulation, and unstable aesthetic outcomes [18]. In our clinical case, we effectively addressed and minimized these concerns by incorporating the natural teeth as a pontic. This strategy enabled us to circumvent complex and time-consuming laboratory procedures. Also, retaining the patient's natural teeth offers a significant advantage in that the patient can more easily adapt to the effects of tooth loss. Additionally, it ensures an ideal pontic in terms of color, size, shape, and alignment.

However, there is a lack of sufficient literature on the survival rate of FRC bridges. The study by Frese et al. [19] demonstrated a promising survival rate and high quality of FRC bridges over a median follow-up period of 4.5 years, affirming their reliability for restoring single missing teeth in the anterior region. In their clinical follow-ups spanning 5 to 25 years, Kubuloglu et al. [20] found that the success rate for metal-constructed adhesive composites was 76%, whereas for fiber-reinforced composite restorations, it was notably higher at 93%.

Recently, a systematic review on the longevity of FRC bridges encompassed 9 studies involving 592 FRC bridges placed in 463 patients. The follow-up periods ranged from 2 months to 8 years, with an overall survival rate of 94.4% at 4.8 years. The primary reasons for failures were debonding and delamination of veneering composites. Importantly, most of these failures were repairable, underscoring the potential to extend the lifespan of FRC bridge restorations [21].

Research conducted by various authors has indicated that the average lifespan of FRC bridges falls within the range of 3 to 5 years. This positions them as a suitable temporary option for substituting permanent anterior teeth in young children and adolescents. Nevertheless, their drawbacks manifest in challenges related to oral hygiene maintenance and a limited capacity to withstand greater occlusal forces [22,23]. In their case report, Doğan et al. [24] reported that the use of glass fiber resulted in no malfunctions or aesthetic loss during the one-year follow-up period for the fiber-reinforced composite.

At the end of 6 months, our cases exhibited no complications. However, we believe that a more extended clinical follow-up is necessary to conclusively establish the success of the restorations.

CONCLUSION

The loss of anterior teeth can have a substantial impact on an individual's psychological and social well-being. FRC bridges offer a minimally invasive, aesthetically pleasing, and cost-effective solution as a treatment. Moreover, incorporating the extracted natural tooth as a pontic provides an advantages in terms of shape, size and color, leading to positive outcomes both in terms of aesthetics and functionality. In the initial 6 months of this study, a fiber-reinforced resin bridge demonstrated its viability as a suitable solution for the replacement of a single anterior tooth. Given these promising outcomes, more extensive follow-up assessments are currently underway. Still, the long-term

endurance of the prosthesis remains subject to continued, extended observation.

Conflict of Interest

The authors declare that there is no conflict of interest**.**

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