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CASE STUDY

Fiber-Reinforced composite resin bridges as a treatment alternative for posterior missing tooth

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ABSTRACT

Dental restoration alternatives for posterior missing tooth range from dental bridges to implant dentures. Fiber-reinforced composite (FRC) resin bridge is one option for the replacement of a single tooth missing. FRC bridge is known as an alternative replacement method for single posterior missing tooth with minimally invasive preparation of abutment teeth. The simplicity of the production method in the FRC bridge provides the possibility of a single-visit bridge treatment. This report aims to present two successful treatments for missing posterior tooth by two different methods of immediate restoration using the FRC resin bridge. Treatments were performed directly using two different fiber materials, pre-impregnated quartz unidirectional fiber, and quartz fiber post. The use of unidirectional quartz fiber and quartz fiber post in the posterior tooth exhibited superior results due to its strength and geometry of fiber placement. In conclusion, the fiber-reinforced composite bridge is a possible option for managing the upper posterior missing tooth.

Keywords: bridges; fiber-reinforced composite; immediate restoration; posterior teeth

INTRODUCTION

Nowadays, restoration of a single posterior missing tooth is still challenging among dentists. While there have been significant improvements in techniques, treatment modalities which vary from a fixed partial denture to implant dentures, remain laborious.[1] Each modality has different challenges in terms of technique, complexity, cost-benefit, and even treatment time.[2] Implant dentures may be the best option for the replacement of a single missing tooth, but unfavorable for cases that require fast treatment or less cost.[3]

The fiber-reinforced composite (FRC) bridge is a viable option for resolving issues regarding technique, complexity, cost, and treatment time.[2] Survivability of the FRC bridge have been studied in recent years, resulting in 94.7 - 95.2% long-term survivability varying from 6-9 years.[2,4] The survivability of FRC depends on fiber materials, preparation technique, length of the fiber, parafunctional habit, occlusal force, and pontic design.[2,4,5]

Restoration of a single posterior missing tooth with an FRC bridge is uncommon among dental practitioners due to the wide use of porcelain fuse to metal bridge.[6] However, the simplicity and long-term survivability of the FRC bridge in the replacement of a single posterior bridge present an opportunity to process the treatment. The FRC bridge is possible to perform with direct, semi-direct, or indirect techniques.[7] The direct technique allows for the implementation of a simplified technique due to the elimination of impression and mock-up design. This treatment aimed to perform a single restoration of the first mandibular premolar and first mandibular molar missing teeth with direct FRC bridges using two different fiber materials, pre-impregnated quartz unidirectional fiber, and quartz fiber post.

METHODS

Case 1

A thirty-year-old female patient came to Cakradent Dental Clinic and presented with a missing

posterior tooth 24 (Figure 1). Extraction was carried out due to the hopeless premolar caused by caries. The patient requested immediate restoration of the tooth. The technique was performed with a definitive direct hybrid retained type FRC bridge. Written informed consent was obtained from the patient for publication and any accompanying images. The abutment of tooth 23 was in a good condition and tooth 25 had small caries on the mesial side (Figure 2). Preparation techniques were inlay preparation on tooth 25 and wing preparation on tooth 23 (Figure 3). Preparation was performed using a pear-shaped diamond bur to produce a minimally invasive wing preparation of tooth 23. The inlay box preparation was performed using short flat-end fissure bur with around 2 mm depth allowing the space for FRC direct framework (Figure 4).

Subsequently, the inlay and wing cavities were etched with 37% phosphoric acid (Hexaetch, Hexa Dental) for 20 s, rinsed for 10 s, and dried with a cotton pellet. The etched surfaces were covered with a layer of an etch-and-rinse adhesive resin (Ambar, FGM Dental), using a micro brush, and cured for 20 s with an LED light-cure unit. A kidney-type sectional matric was placed in the edentulous area to perform a modified ridge lap pontic design (Figure 5). A flowable resin (SDR Flow+, Dentsply Sirona) was used to cover the inlay and wing retainers. It was then followed by the placement of pre-impregnated quartz unidirectional fiber horizontally and added vertical pin as pontic reinforcement (Quartz Splint UD, RTD) (Figures 6 and 7). The next step was layering the flowable resin composite on the FRC framework and subsequently placing composite resin (Spectra ST

Figure 1. Pre-treatment condition occlusal side

Figure 2. Pre-treatment condition buccal side

Figure 3. Hybrid retained preparation of teeth 23 and 25

Figure 4. Inlay preparation of tooth 25

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HV, Dentsply Sirona) incrementally to build pontic and covered all fiber framework material. Finally, when the FRC was complete, the occlusion was checked, premature contacts were relieved, and the restorations were polished with a composite finishing and polishing kit (Figures 8, 9, and 10).

Figure 5. Sectional matrices placement

Figure 6. FRC placement occlusal side

Figure 7. FRC placement buccal side

Figure 8. FRC final result palatal side

Figure 9. FRC final result buccal side

Figure 10. FRC final result buccal side

Case 2

A twenty-nine-year-old female patient came to Cakradent Dental Clinic and presented with a missing posterior tooth 26 (Figure 11). Extraction was carried out prior to orthodontic treatment. The previously intended treatment was molar distalization using fixed orthodontic appliances. However, the patient sought immediate restoration of the tooth for the reasons of time effectiveness. The technique was performed with a definitive direct retained type FRC bridge. Written informed consent was obtained from the patient for publication and any accompanying images. The abutment of tooth 25 was previously restored with resin composite with the vital condition, and tooth 27 was in normal condition. Prior to the preparation, tooth 25 was restored using a new resin composite (Figure 12). Preparation techniques were inlay preparation on teeth 25 and 26 (Figure 13). Preparation was performed short flat-end fissure bur with around 2 mm depth for the incoming FRC direct framework.

Later, the inlay and wing cavities were etched with 37% phosphoric acid (Hexaetch, Hexa Dental) for 20 s, rinsed for 10 s, and dried with a cotton pellet. The etched surfaces were covered with a layer of etch-and-rinse adhesive resin (Ambar, FGM Dental), using a micro brush, and cured for 20 s with an LED light-cure unit. A sectional matric was placed in the edentulous area to perform a modified ridge lap pontic design. A flowable resin

Figure 11. Pre-treatment condition occlusal side

Figure 12. Pre-treatment composite resin restoration of tooth 25

Figure 13. Inlay retained preparation of teeth 25 and 27

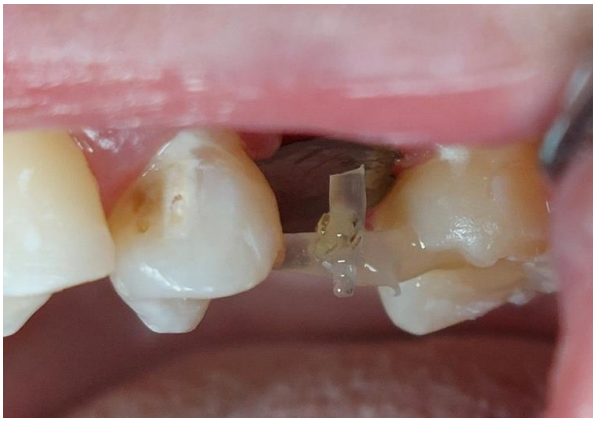

Figure 14. FRC placement buccal side

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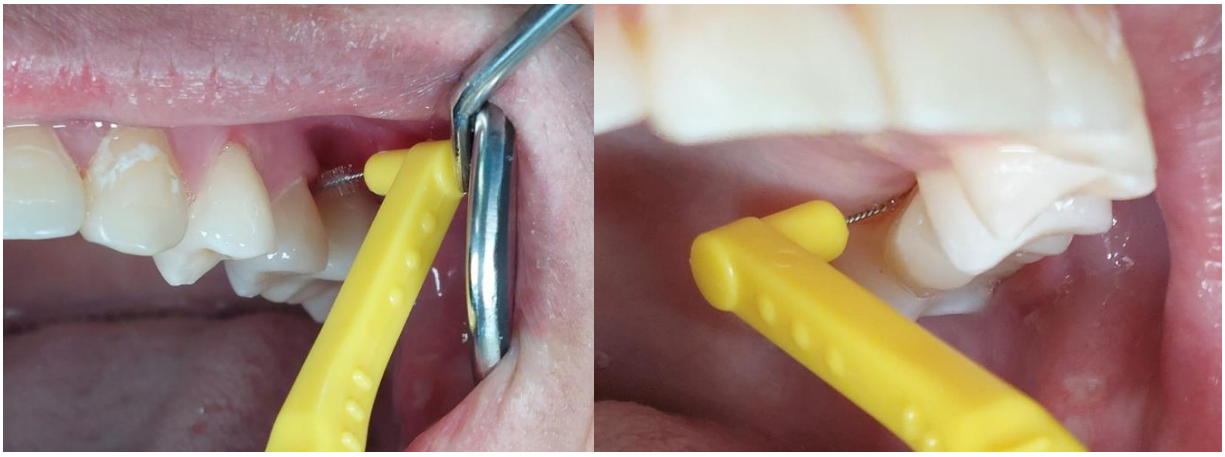
Figure 15. FRC placement occlusal side

Figure 16. FRC final result palatal side

Figure 17. FRC final result buccal side

Figure 18. FRC final result occlusal side



Figures 19 and 20. Embrasure are opened for the interdental brush to ensure cleanliness

(SDR Flow+, Dentsply Sirona) was used to cover the inlay and wing retainers. It was continued with the placement of a 1.4 mm diameter quartz fiber post horizontally and a vertical pin was added as pontic reinforcement (Matchpost, RTD) (Figures 14 and 15). The next step was layering the flowable resin composite on the FRC framework and placing composite resin (Spectra ST HV, Dentsply Sirona) incrementally to build pontic, and all fiber framework material was covered. Finally, when the FRC was complete, the occlusion was checked, premature contacts were relieved, and the restorations were polished with a composite finishing and polishing kit (Figures 16, 17, and 18). The embrasures were released to ensure self-cleansing and interdental brush cleaning (Figures 19 and 20).

DISCUSSION

Minimally invasive prosthodontics are proposed to minimize the extensive removal of tooth structure, thus increasing the survivability of the restoration.[8] The minimal preparation of tooth structure of fixed prostheses could eliminate or minimize the possibility of future endodontic complications compared to the conventional preparation method.[8] The advance of adhesive and dental composite technology in dentistry, which increases the usage of micromechanical bonds to the tooth structure, have made extensive removal of tooth structure unnecessary. [9]

Treatment options for minimally invasive fixed prostheses include metal ceramic, all-ceramic, or FRC based. Nowadays, all-ceramic restoration has become a common treatment due to its strength and esthetics; however, FRC bridges have several benefits, such as ease and low cost in production.[2,10] Regarding the FRC bridge production, there are two proposed methods: direct and indirect methods. The direct method allows the prostheses finish in one appointment, thus minimizing the treatment time and cost.[2] Direct method also has another advantage, such as laboratory cost savings and simplified tooth shade matching.[11]

In terms of the materials for FRC, there are several common synthetic materials: glass, polyethylene, carbon, and quartz fiber.[2,12] However, quartz fiber has higher fracture resistance than carbon and glass fiber.[12] The chipped veneer of the FRC bridge exhibits common failure in the treatment, but it also offers a benefit due to its ease of repair using resin composite materials.[13] Fiber placement geometry also plays a significant role in the survivability of FRC bridges.[14] The unidirectional placement of fiber shows higher strength in the load-bearing position such as in the posterior area, due to its strength to the perpendicular load of mastication.[13] The use of digitally driven treatment has been significantly enhanced and become more prevalent in the treatment of missing teeth.[15] However, the direct FRC bridge remains a promising treatment option of a single posterior missing tooth in the future due to its simplicity, less time-consuming, and low cost.

The evaluation of the direct FRC bridge treatment includes the FRC bridge condition and periodontal status of abutment teeth.[2] The evaluations of FRC bridge condition include veneered composite, connectors, and pontic. Common failures of direct FRC bridges are fractures of the connector and chipped veneering composite.[4,16] The advantages of FRC bridges are their ease of repair using micromechanical retention aged composite and has reliable retention on with fresh composite.[7] Suggestions for periodontal evaluation include six-month recall for abutment check-ups to eliminate potential periodontal and abutment problems, and adequate brushing including interproximal brushing.[2,16]

CONCLUSION

This clinical report described the prosthodontic management of a single posterior missing tooth in the maxillary position by implementing direct FRC bridge restoration. Future treatment could utilize another method such as quartz fiber in another position and improve research on the usage of quartz fiber in the treatment using FRC bridge.

CONFLICT OF INTEREST

The authors declare no conflict of interest with the data contained in the manuscript.

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