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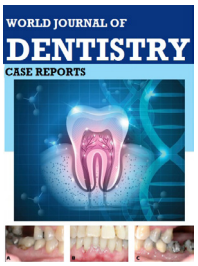

Restoration of Endodontically Treated Tooth with Short Fiber-Reinforced Composite and Glass Fiber Post: Case Report

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ABSTRACT

This case report describes the use of short fiber-reinforced composite and fiber post to construct a tooth foundation in a patient with a severely compromised tooth structure. The patient, a 31-year-old female, presented with a large carious lesion on his maxillary right first premolar. After careful evaluation and root canal treatment, a conservative approach was chosen, and the constructing tooth foundation was treated with a fiber post and short fiber-reinforced composite. After abutment construction, the restoration was performed with zirconia crown. The patient was followed up for six months, and no adverse events were noted. The use of short fiber-reinforced composite and fiber post appears to be a viable treatment option for restoring a compromised tooth structure with minimal invasiveness.

Key Clinical Message:

This case report demonstrates the effective use of short fiber-reinforced composite and glass fiber post for reconstructing the foundation of a compromised maxillary right first incisor. A conservative approach involving root canal treatment and restoration with zirconia crown showed stability over a six-month follow-up without adverse events.

Introduction

Dental caries is a common disease that can result in loss of tooth structure. To overcome this problem, abutment restorations are the treatment of choice for restoring endodontically treated teeth and can restore the abutment tooth to a shape suitable for crown placement [1,2].

Various materials and techniques have been used for abutment construction, such as metal post core, glass fiber post, and resin core, and these approaches have demonstrated favorable clinical outcomes. However, post failures, secondary caries and root fractures have been observed with each construction [3]. Several clinical studies have suggested that utilizing fiber posts for abutment construction may result in better clinical outcomes compared to metal posts, although a distinct difference has not been definitively demonstrated [4,5]. In addition, a systematic review conducted in 2015 found that the presence of fiber post cores and ferrules had no significant effect on the prevention of root fractures.6 Therefore, the ideal materials and methods for abutment construction remain unclear [6]. In 2013, a short fiber-reinforced composite material (s-FRC) (everX Posterior; GC, Tokyo, Japan) was introduced to imitate the stress absorption properties of dentin. s-FRC are expected to be used as a dental material for abutment construction and crown restorations, utilizing fibers with different orientations and lengths to achieve both elasticity and strength. Recent studies have shown that s-FRC has a higher load-bearing capacity than other materials used in crown restorations [7]. s-FRC consists of a resin matrix combined with randomly oriented glass fibers and inorganic particulate filler, making it a promising material for abutment construction [8-10]. However, the efficacy of s-FRC as an abutment building material has not been fully established. This case report describes the successful outcome of an abutment construction and prosthetic treatment using s-FRC material for abutment material.

Case History/examination

A 31-year-old female patient presented to a dental clinic complaining of pain in her maxillary right first incisor, and was subsequently diagnosed with acute pulpitis (Figure 1) Radiographic images revealed the presence of a permeable lesion that had infiltrated the pulp cavity.

Figure 1: Intraoral photographs were taken at the initial examination.

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Methods (Differential diagnosis, investigations and treatment)

Informed consent was obtained for prosthetic treatment, and on the same day of the initial visit, the patient underwent pulp extraction and temporary crown restoration in order to restore masticatory function and prevent tooth movement during the root canal treatment. After the completion of root canal therapy and filling, abutment construction was performed. The abutment was created using a 1.0 mm diameter straight type glass fiber post (FiberKleer Post 4X, Pentron Japan, Tokyo, Japan) and a short fiber reinforced flowable composite resin (everX Flow, GC Europe, Leuven, Belgium) (Figures 2A, B, C) using Bioblock technique [11].

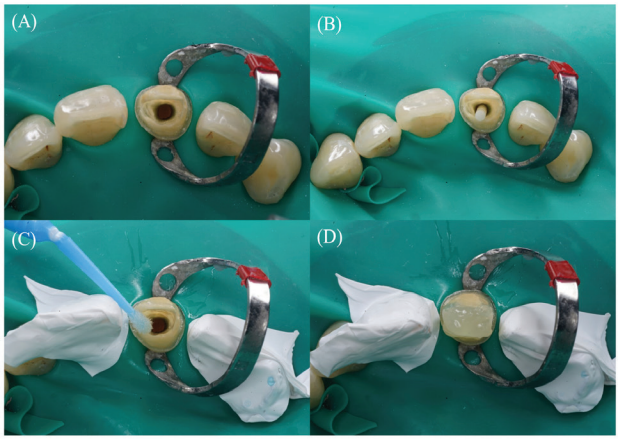

Figure 2: (A) The abutment tooth after root canal filling. (B) Photograph showing the fibre post being pointed out. (C) The abutment tooth had been primed and bonded. (D) The abutment tooth was raised with s-FRC material.

The composite resin was cured by light irradiation during the lamination process (Figure 2D). The abutment preparation were shaped with a thickness of 1.5 mm on the occlusal surface and 1.5 mm on the labio-lingual proximal and distal sides, with a rounded shoulder form 0.5 mm above the gingival margin (Figures 3A, B). The subgingival morphology was assessed using temporary restorations for a period of two weeks. Gingival compression was achieved using a compression thread (Ultrapak#000, Ultradent, Tokyo, Japan), and silicone impression material (Imprint4, 3M Japan, Tokyo, Japan) was used to conduct impressions. A trial fit was performed to ensure proper contact points, fitting, and occlusion, and both the operator and the patient found the aesthetics to be satisfactory. The abutment tooth was etched (Total Etch, Ivoclar Vivadent, Tokyo, Japan) and bonded (Adhese Universal, Ivoclar Vivadent, Tokyo, Japan) before a final prosthetic crown, zirconia crown (Zolid, Gen-X, Amann Girrbac, Austria) was placed (Figures 4A, B) with resin cement (Variolink Esthetic DC, Ivoclar Vivadent, Schaan, Liechtenstein). In conjunction with these treatments, a basic periodontal treatment was performed after the acute procedure and the stabilisation of the periodontal tissues was confirmed before the final prosthesis was placed.

Conclusion and Results (Outcome and follow-up)

A 6-month follow-up was performed after crown placement and the patient's progress was excellent. The restoration of endodontically treated tooth with short fiber-reinforced composite and glass fiber post can be a viable option for tooth reconstruction, providing durable and esthetically pleasing outcomes. Further studies with a enough sample size and longer follow-up periods are required to confirm the long-term success of this approach.

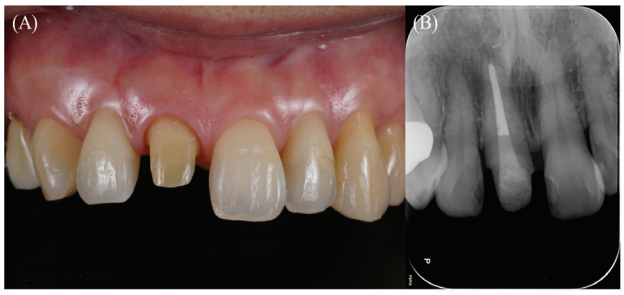

Figure 3: (A) The tooth was composed of s-FRC material and reinforced with a glass fibre post. (B) This dental radiograph was taken after the abutment had been constructed.

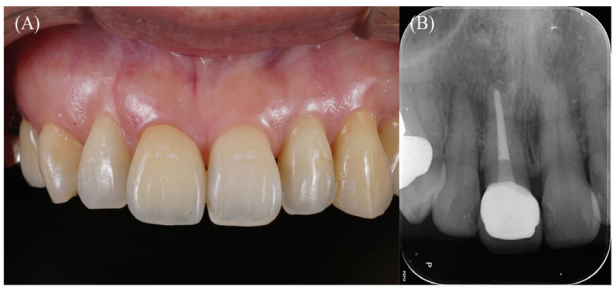

Figure 4: (A) This intraoral photograph was taken after the all-ceramic crown had been placed. (B) This dental radiograph was taken after placement of the all-ceramic crown to diagnose progress. No abnormal findings were observed.

Discussion

This case report describes the successful use of a s-FRC and a glass fiber post to construct an abutment for a maxillary right first incisor. The abutment was closely monitored for a period of six month, during which no fractures or dehiscence of the abutment material were observed. These findings indicate that utilizing s-FRC and glass fiber post abutment construction could be an effective strategy for mitigating root fractures and crown dehiscence in comparable cases.

In this case report, a s-FRC was used for core build-up, and a glass fiber post was used as the core material. Recent review papers have reported that the effectiveness of glass fiber posts does not necessarily increase the mechanical strength of endodontically treated teeth, but is justified for the maintenance of coronal structure [12]. Previous studies have conducted a 15-year follow-up of cast post and resin post restorations (372 and 1,752 cases, respectively) and reported survival rates of 55.4% for cast post restorations with adhesive resin cement, and 78.7% for resin post restorations [13]. Furthermore, a 16-year observation study comparing metal posts and fiber posts reported no significant difference between the two types of posts [14]. While there is no clear evidence supporting the effectiveness of glass fiber posts compared to metal posts, using a fiber post material with an elastic modulus similar to that of dentin, such as glass fiber post and s-FRC, may be important in preventing root fractures in first incisor subjected to occlusal forces. Although there are no reported studies evaluating the outcomes of combined therapy with fiber posts and s-FRC, the use of a s-FRC material may potentially help to distribute the stress applied to the tooth and improve the effectiveness of the technique presented in this case report.

This case report confirms that s-FRC is a suitable restorative material with good handling properties and adequate curing when used as an abutment material. Material properties required for abutment construction include the ability of the material to reach the deep root canals and achieve adequate cure. Traditionally, rapid and continuous curing can leave the adhesive interface intact, but it can also cause microcracks to form just outside the cavity surface margin due to polymerisation shrinkage stress [15]. The s-FRC used in this case is a light-cured composite resin, and curing was performed layer-by-layer while the material was stacked. It was considered important to perform this technique when using s-FRC for abutment construction, in order to check the depth of the material in the root canal and repeat the light-curing process. It has also been shown that by reducing the light intensity and increasing the curing time, improved marginal adaptation can be achieved whilst maintaining the excellent physical properties of the composite resin [16]. In this case, it is believed that the technique of gradual curing of the composite resin during light curing helped to reduce the occurrence of micro-cracks and allowed for reliable abutment construction.

The 6-month follow-up demonstrated that the tooth restoration remained stable and functional, without any signs of root fracture or post failures. This outcome suggests that the restoration of endodontically treated tooth with short fiber-reinforced composite and glass fiber post is a promising technique for restoring damaged teeth with a durable and long-lasting solution. Further research is needed to evaluate the long-term performance of this approach and to compare it with other dental restoration materials.

DATA AVAILABILITY STATEMENT

Research data are not shared.

AUTHOR CONTRIBUTIONS

Rin Yoshioka: Conceptualization, Writing - Original Draft. Kohji Nagata: Data Curation, Writing - Review & Editing. Gentaro Mori: Formal Analysis, Resources. Lassila Lassila: Review & Editing. Vallittu K. Vallittu: Review & Editing.

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None.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

CONSENT

Written informed consent was obtained from the patients to publish this report in accordance with the journal's patient consent policy.

ETHICS STATEMENT

The patient has signed a written informed consent in accordance with Journal's policy.

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