eISSN 2255-0569

CASE REPORT

Fiberglass materials in the extreme reconstruction of a second maxillary premolar with apical periodontitis

Materiales de fibra de vidrio en la reconstrucción extrema de un segundo premolar maxilar con periodontitis apical

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Received: 23 - IV - 2023
Accepted: 22 - V - 2023

doi: 10.3306/AJHS.2023.38.05.160

Abstract

Introduction and aim: Dental reconstruction of endodontic teeth represents a great clinical challenge in restorative dentistry. The biomechanical factors of the tooth to be restored, the position of the tooth in the arch, and the habits and parafunctions of the patient play an important role in the longevity and fractures of endodontic tooth reconstructions. When there are a ferrule allows us to perform adhesive techniques with guaranteed isolation of the operative field, dental restoration should be considered a reliable and long-lasting therapeutic option, even when the loss of tooth structure is severe. The aim of this manuscript is to expose the conservative treatment in a second maxillary premolar with extreme lost structure and apical periodontitis.

Clinical case: A 47-year -old woman was referred for the evaluation of extraction of second upper right premolar with extreme coronal destruction and periapical lesion. Conservative treatment was recommended because the destruction of the coronal tissue was supragingival and it was believed that the apical lesion could be resolved with endodontic treatment. Endodontic treatment and adhesive dental reconstruction with elastic fiberglass post (FRC), short fiber-reinforced composite (SFRC) as dentine-replacing material and microhybrid composite was done.

Results: In the six-year follow-up, the healing of the periapical lesion is observed, and the dental reconstruction is maintained functionally and esthetically.

Conclusion: With the limitations of this clinical case, we can conclude that this type of reconstruction is a therapeutic option to consider in the extreme rehabilitation of endodontic teeth.

Key words: fiberglass materials, extreme reconstruction, apical periodontitis, endodontically treated teeth, case report.

Resumen

Introducción y objetivos: La reconstrucción de dientes endodonciados representa un gran reto clínico en odontología restauradora. Los factores biomecánicos del diente a restaurar, la posición del diente en la arcada y los hábitos y parafunciones del paciente juegan un papel importante en la longevidad y fracturas de las reconstrucciones dentales endodónticas. Cuando existe una férula que nos permite realizar técnicas adhesivas con garantía de aislamiento del campo operatorio, la restauración dental debe considerarse una opción terapéutica fiable y duradera, incluso cuando la pérdida de estructura dental es grave. El objetivo de este manuscrito es exponer el tratamiento conservador en un segundo premolar maxilar con pérdida extrema de estructura y periodontitis apical.

Caso clínico: Una mujer de 47 años fue remitida para valoración de extracción de segundo premolar superior derecho con destrucción coronal extrema y lesión periapical. Se recomendó tratamiento conservador porque la destrucción del tejido coronal era supragingival y se creía que la lesión apical podría resolverse con tratamiento endodóntico. Se realizó tratamiento endodóncico y reconstrucción dental adhesiva con poste elástico de fibra de vidrio (FRC), composite reforzado con fibra corta (SFRC) como material de sustitución de la dentina y composite microhíbrido.

Resultados: En el seguimiento a seis años se observa la curación de la lesión periapical y la reconstrucción dental se mantiene funcional y estéticamente.

Conclusiones: Con las limitaciones de este caso clínico, podemos concluir que este tipo de reconstrucción es una opción terapéutica a considerar en la rehabilitación extrema de dientes endodonciados.

Palabras clave: materiales de fibra de vidrio, reconstrucción extrema, periodontitis apical, dientes tratados endodónticamente, reporte de caso.

Introduction

Dental reconstruction of endodontic teeth represents a great clinical challenge in restorative dentistry[1]. We always begin with teeth with severe tissue destruction, a consequence of etiologies as diverse as caries, destructive dental processes or fractures, which implies that there will be many factors that hinder the success of the restoration, since they are teeth with minimal remaining structures that will be subjected to significant occlusal forces, particularly in patients with parafunctions.

Very often the loss of tooth structure is located below the soft tissues and the periodontium that surrounds the tooth, which prevents us from having an adequate ferrule for reconstruction. In such cases, the clinical importance of the tooth must be weighed carefully and the possibilities of crown lengthening or abandoning the dental reconstruction and all restorative possibilities must be examined.

However, when we have a ferrule that can ensure the subsequent rehabilitation with a fixed prosthesis of the restored piece and that allows us to perform adhesive techniques with guaranteed isolation of the operative field, dental restoration should be considered a reliable and long-lasting therapeutic option, even when the loss of tooth structure is extreme[2]. Naumann et al.[3] consider that the most important factor in the survival of the restored endodontic tooth is the presence of a ferrule and the retention of some of the cavity walls. Rodriguez et al.[4] conclude that if the presence of the ferrule is uniform throughout the perimeter of the neck of the tooth, it is the best way to obtain the strongest resistance to fracture of the endodontic tooth.

The intraradicular post is a necessary complement to maintain the restoration in cases of severe destruction of dental tissue. Despite doubts about the benefits of the post in endodontic reconstruction, the selection of clinical cases, the type of post and the appropriate clinical technique lead to high success rates[5,6]. Different types of prefabricated posts or individual posts can be used for each root canal.

Precast post materials and designs range from metallic to carbon fiber, quartz, or glass posts. The shape can be conical, cylindrical or cylindrical-conical. Research has found no significant differences in resistance to fracture among the different post types[7]. They have a circular section, which makes it difficult to adapt the post to oval canals, with the cement occupying all the free space left by the post with the walls of the canal. We can solve this with individualized posts.

We can make individualized posts with fiberglass covered with unpolymerized composite (FRC) called elastic fiberglass posts[8]. Post preparation requires time and is not without some clinical difficulty, which has meant that it is not considered a practical therapeutic option in everyday dentistry. However, studies have given this type of post good results, obtaining more resistance to fracture in wide or oval canals and suffering a type of fracture with an increased possibility of repair than conventional prefabricated posts[9].

When we have narrow ducts, prefabricated posts yield better results; however, in wide ducts where we can introduce a significant number of fiberglass types and composites, the results vary.

We present a clinical case of extreme dental reconstruction. The extraction and subsequent prosthetic replacement of the tooth was assessed, but conservative treatment was opted for considering that we had favorable factors for clinical success. Treatment included an individually manufactured elastic post with FRC EverStick posts and a SFRC as dentine-replacing material.

Clinical case

This investigation complies with the Helsinki Declaration, and the patient signed an informed consent form.

A 47-year -old woman attended for an extraction of second upper right premolar[15]. After taking the medical history, in which there were no data of interest that could condition dental treatment, the dental clinical examination was performed.

The severe loss of tooth structure was noted as a consequence of a coronal caries process, which had damaged the pulp tissue (**Figure 1-A**). In soft tissues, no fistulous tract was detected. The tooth was not mobile, but there was painful percussion. The vitality test was negative. The radiographic examination revealed a radiolucent periapical image of approximately 4mm (**Figure 1-C**). Conservative treatment was recommended because the destruction of the coronal tissue was supragingival and it was believed that the apical lesion could be resolved with endodontic treatment.

The endodontic treatment was carried out in one session on November 25th, 2014. The tooth presented a single oval root canal, in the vestibule-palatal direction, which made cleaning with instrumentation difficult. A constant chemical cleaning of the canal was performed and after combined manual-mechanical instrumentation (K3™ Kerr Dental Files), the filling was performed with Sealapex™ cement (Kerr Dental), gutta-percha cone number 35, and lateral condensation with accessory tips (**Figure 1-D**). The provisional filling was carried out (**Figure 1-C**) and in the second appointment the dental reconstruction treatment was performed.

Due to the great coronal destruction of the tooth, the decision was made to perform reconstruction with an

intraradicular post. Given the oval shape of the canal, an individual post was made, adapted to its shape. For this, FRC everStick Post® GC 1.2mm and a SFRC as dentine-replacing, GC everX Posterior ® GC, was used to increase the retention of the restoration and reinforce the resistance to fracture of the tooth.

A week later (December 2nd, 2014), in a second appointment dental reconstruction was performed. After removing the provisional filling and cleaning the cavities (**Figure 2-A**), 13-14-15 and 16 were isolated (**Figure 2-B**). The gutta-percha was removed from the coronal and middle third of the root, preserving the sealing of the apical third. The 1.2mm glass tape post was selected; two posts were used. The fibers were grouped ovally in the root part and fanned out in the coronal part. This was adjusted to the shape of the canal (**Figure 2-C**). Once the post had the proper shape (oval shape in the root area and fan in the coronal area), it was cured for 3 seconds with Demi™ Plus curing light (Kerr Dental) to keep the shape of the post stable and to be able to proceed to cement without deforming. The post was impregnated with Stick-resin® GC resin for 3 minutes before cementing it, protecting it from light (**Figure 2-D**) to ensure correct adhesion. Cementation was performed with the GC Grandia CORE® GC dual polymerization and self-etching technique, applying the adhesive and cement inside the canal with microtips and endodontic dispensing tip (**Figure 2-E** and **2-F**). Next, the post was placed in the canal, applying light but firm pressure and polymerizing for 20 seconds (**Figure 2-G** and **2-H**).

The MetaFix™ matrix ((Kerr Dental) **Figure 3-A**) was then placed and reconstruction proceeded. A light-curing self-etching adhesive G-ænial Bond® GC (**Figure 3-B**) was used, which was applied with a tip throughout the cavity and in the coronal portion of the post. After polymerization, GC everX Posterior® (**Figure 3-C**) was placed in the entire cavity floor, performing a 20-second polymerization cycle. Then, G-aenial Posterior® GC color A-3 composite was applied (**Figure 3-D**). Polymerization was carried out in each of the clinical steps with a Demi™ Plus lamp (Kerr Dental) at 1100 mW/cm^2 for 20 seconds. The matrix and the isolation were then removed, modeling and polishing the restoration. Radiographic control was performed (**Figure 3-E** and **3-F**).

Figure 1:

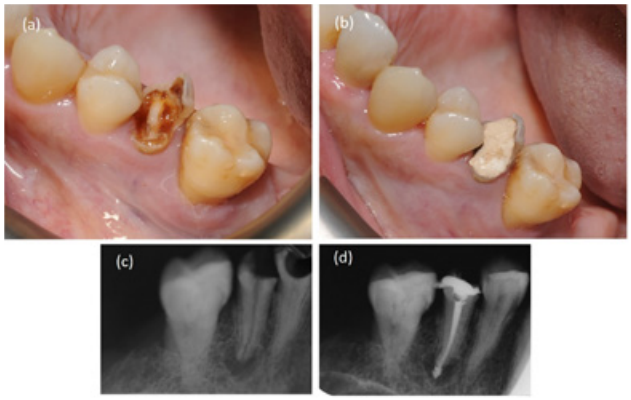


Figure 2:

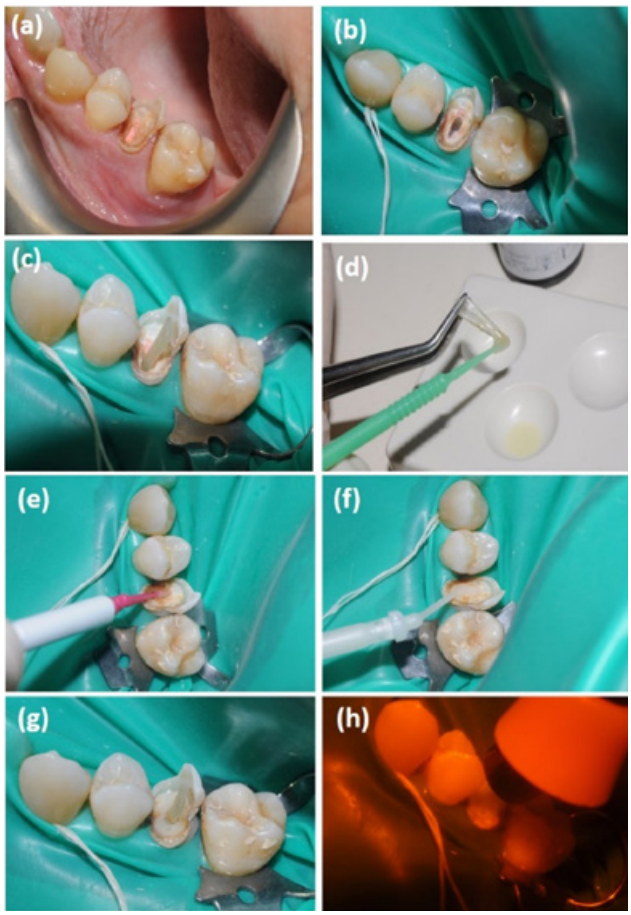
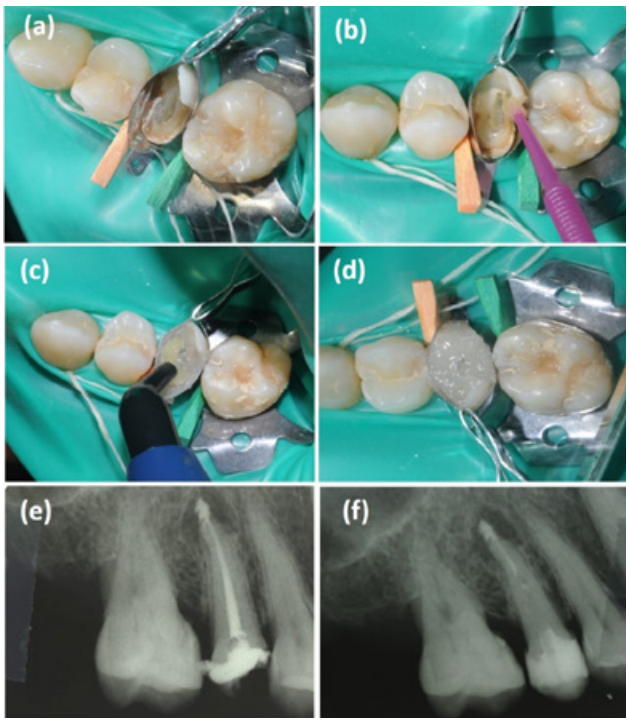
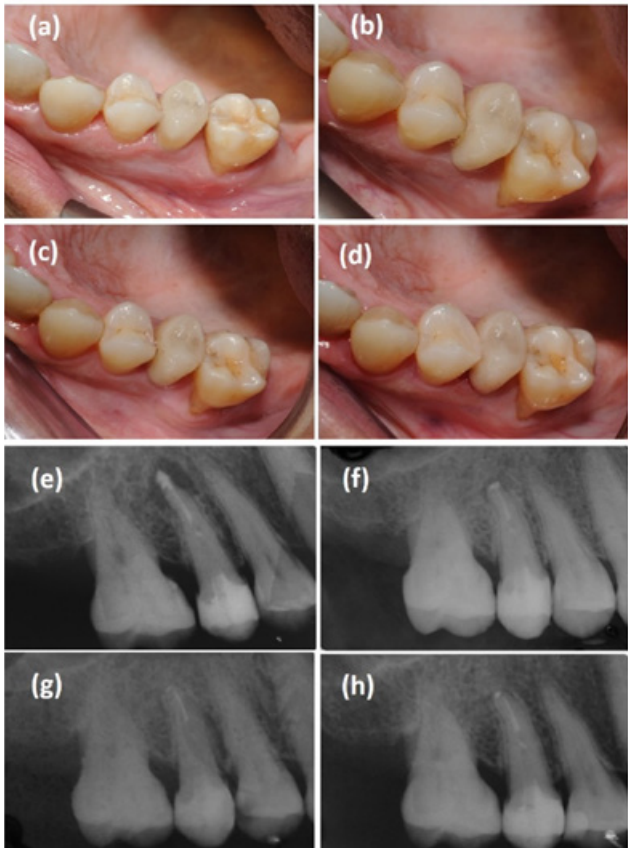


Figure 3:



Once the treatment was finished, a clinical and radiographic image was taken (**Figure 4-A** and **4-E**) and the patient was scheduled for follow-up visits to monitor the evolution of the apical lesion and reconstruction. Check-ups demonstrated the favorable evolution of the clinical case, with the resolution of the apical lesion and the maintenance of the reconstruction from both the functional and esthetic point of view. In **figure 4** the clinical and radiographic images are shown one year after treatment (**Figure 4-B** and **4-F**) and six years after treatment (**Figure 4-C** and **4-G**). In the last control, the patient had a caries lesion on the distal side of tooth 14, that was resolved in the same session by filling with Black's class II cavity preparation (**Figure 4-D** and **4-H**).

Figure 4:



Discussion

The biomechanical factors of the tooth to be restored, the position of the tooth in the arch, and the habits and parafunctions of the patient play an important role in the longevity and fractures of endodontic tooth reconstructions[10]. The recently published meta-analysis by Garcia, PP. et al.[11] concluded that the failure rates in anterior and posterior teeth with post and core restorations were similar in the short- and medium-term follow-up. They recommend the need for better designed clinical trials comparing survival and failure rates with longer follow-up times. This means that the clinician with extreme restorations does not have sufficient scientific support to make decisions, leaving them largely to their own experience and skill.

The scientific bibliography shows us different dental reconstruction techniques in endodontic teeth. The recent publication by Rodrigues, MP. et al. concluded that endodontic treatment followed by direct composite resin restoration is an effective method to restore the biomechanical performance of teeth. Reconstruction should not take long after endodontic treatment[12]. The use of SFRC as dentin and fiberglass posts can strengthen the dental structure and reduce the risk of fracture, especially in severely weakened teeth[13,14]. In the case we present, the dental reconstruction was carried out following these recommendations.

In cases of severe loss of tooth structure in which we indicate the placement of a post, the selection of the post, the adhesive technique and the cement are essential to the success of dental reconstruction. It is very important that we have good adhesion between the intra-root dentin, the adhesive, the cement and the post. For this we need to use compatible materials and ensure a good polymerization in the most apical area, the most critical point, especially when using non-self-curing cements. The goal is to have sufficient bonding between the materials and the dental structure so as to achieve a monoblock effect that can be more resistant to possible subsequent fractures.

There are different commercial brands of FRC with which we can make intraradicular posts. The study by Kivanc et al.[15], which compared Luminex, Dentatus, Ribbond and everStick posts, found no significant differences between the results of the different types of CRF.

To obtain a good bond between the fiberglass post and the cement, the surface of the post must be treated by applying different products (silane, H_2O_2, etc.) or by creating macroretention on the surface[16]. In the studies by Weingartner, Machado et al.[17], silanizing the post and using an adhesive that adheres the silanized post to the cement is the option with the best results in terms of retentive strength of the precast post. In the case of posts made with fiberglass reinforced with non-polymerized composites, the activation of the adhesion is required by impregnating the post with bonding. In the case we present, the post was impregnated with Stick-resin® GC to activate the adhesion of the semi-interpenetrating polymer network (semi-IPN), a non-polymerized organic matrix, a mixture of polymethylmethacrylate and Bis-GMA, which creates a network that can be dissolved by fresh monomers of adhesive resin, creating the so-called secondary IPN and increasing the potential for adhesion to other resins and to the tooth structure.

In addition, cleaning the dentin walls of the post bed with the complete removal of the smear layer is essential to obtain a correct interface between the dentin and the cementum. The use of laser-activated irrigation techniques on the dentin combined with the application of 17% EDTA has been shown to have a significant cleaning effect on the smear layer according to the studies by Kırmalı Ö, et al.[18]. Photodynamic therapy has also been evaluated in the preparation of the dentin walls for post cementation, showing negative effects on the bond strength on the dentin in the cervical third after cementation with Relyx ARC and on the dentin penetrability of the post, adhesive system of total etching in the prosthetic space of the cervical and apical third[19]. For all this, despite the popularization of adhesive cements in the fixation of fiberglass posts, long-term predictable bonding may be compromised due to procedures related to endodontic treatment and/or the sensitivity of the adhesive cementation protocols. The phenomena of microfiltration and degradation of the adhesive interface can jeopardize adhesion[20], causing decementation. The use of fiberglass posts also improves the transmission of the polymerization light along the canal, helping the polymerization of the cement in the most apical part.

Several studies have concluded that the use of SFRC as dentine-replacing materials offers significant improvement in the resistance to fracture of restored teeth[21,22], having good results in combination with conventional composites[23,24], as we have done in this clinical case, where the everX Posterior® GC and the G-aenial Posterior® GC color A-3 composite were used. This is particularly advisable in reconstructions with large cavities, as the bibliographic review published by Garoushi S, et al. concluded[25].

Whit the limitation of this report we could concluyed that that Endodontic success is linked to restorative success. The use of materials that help improve the resistance to tooth fracture and the meticulous clinical application of adhesive techniques can lead to restorative success even in teeth with severe destruction and loss of structures.

Acknowledgements
The author denies any conflicts of interest related to this study.

Statement of Ethics
This investigation complies with the Helsinki Declaration, and the patient signed an informed consent form.

Disclosure statement
Nothing to disclose.

Conflict of interest
The authors declare no conflict of interest, financial or otherwise.

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