Filling core associated with the fiberglass pin: Clinical case report

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https://doi.org/10.14436/2447-911x.17.3.128-146.oar • Submitted: July 10, 2020 • Revised and accepted: August 21, 2020

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How to cite: Santos GAF, Capobianco V, de-Bem SHC, Camargo J, Bueno RB, Custodio W, Godoi APT. Filling core associated with the fiberglass pin: Clinical case report. J Clin Dent Res. 2020 Sept-Dec;17(3):128-46. **Contact address:** Ana Paula Terossi de Godoi. Fundação Hermínio Ometto - FHO. Av. Maximiliano Baruto 500, Araras/ SP, Brasil, CEP: 13.607-339, . E-mail: anapaulatgodoi@yahoo.com.br - ana.godoi@fho.edu.br. *The authors report no commercial, proprietary or financial interest in the products or companies described in this article.. Patients displayed in this article previously approved the use of their facial and intraoral photographs.*

ABSTRACT

Introduction: The filling core associated with the fiberglass pins, appeared to meet the aesthetic demand and provide better distribution of chewing loads in the root, bone and periodontium, minimizing the rate of root fractures. ***Objective:*** Thus, the objective of this study was to present a clinical case report of rehabilitation of endodontically treated teeth, using a direct intra-radicular retainer, made with fiberglass pins (FGP), anatomically individualized with composite resin and, subsequently, metal-ceramic crown. The present clinical case describes the rehabilitation of the element 11 that presented a root canal with a diameter and shape not compatible with prefabricated FGP. ***Conclusion:*** Based on the 5-year follow-up after installation, it could be concluded that both the professionals involved and the patient considered the clinical outcome satisfactory. This used technique minimizes the resin cement layer that can cause FGP retention failures, having, therefore, similar adaptation characteristics to the conventional cast metal core technique. Moreover, as seen in the literature, intra-radicular retainers made by this technique, present a modulus of elasticity very close to the remaining dentin, thus being able to avoid fractures of the dental remaining over time.

KEYWORDS

Dental aesthetics. Dental pins. Composite resins.

INTRODUCTION

Dental rehabilitation that requires intra-radicular retainers is a challenge for dentistry, since these devices are used on teeth that present endodontic treatment and usually in situations of major coronary destruction due to different factors, such as caries lesions, large restorations, and dental trauma[1]. This challenge is even greater when the root canal is large and/or fragile.[2,3]

Thus, the long-term clinical performance of endodontically treated teeth depends mainly on the amount of tooth structure remaining,[4] more specifically on the amount of dentin in the buccal-lingual direction,[5] since teeth with extensive tooth loss have reduced capacity to resist forces during function, and a proper abutment is essential to maintain an artificial core that restores tooth loss.[4,6]

Originally employed to increase the structural strength of root remnants of endodontically treated teeth with large tissue losses from the internal walls of the canal the pins are now used as structural reinforcement for large direct restorations. The pins can be divided according to their anatomical shape into: single taper, double taper, cylindrical (parallel), two-stage cylindrical and cylindrical with conical end; according to their surface configuration into: smooth, serrated and threadable; and according to the manufacturing material into: metallic and non-metallic. The metallic ones can be titanium, stainless steel or metallic alloys; while the non-metallic ones are divided into: non aesthetic (carbon fibers) and aesthetic (glass or quartz fibers, carbon fibers coated with glass or quartz and zirconium dioxide).[7]

Considering that FGP had a good aesthetic property, efficient adhesion to the dental structure when combined with adhesive systems and dual resin cements, high mechanical resistance, and a modulus of elasticity similar to dentin, it was proposed to use them as root retainers for fixed prosthesis. This thera-

peutic proposal was based on the ability of FGP to distribute stress more evenly to the dental structure, protecting the root from possible fractures. This protection is mainly due to the possibility of replacing the destroyed intra-radicular dentin more safely, since the traditional cast metal core can generate a wedge effect, leading to root fractures, thus leading to tooth extraction.[8]

However, when used alone, FGP may not adapt well to large or very conical root canals, which may lead to retention failure, since it is delegated only to resin cement[9] which makes pin displacement easier,[9,10] resulting in a higher fracture rate induced even by chewing forces.[11]

Thus, seeking to improve the technique, Grandini et al. (2003)[12] proposed an alternative to ensure a better adaptation of fiberglass pins to the root canal, this alternative being called FGP-associated filling core. These are made by using the pre-fabricated FGP rebasing technique and direct modeling of the root canal with composite resin. This allows a better adaptation of the pin to the canal, enabling a thinner layer of cement, favoring the longevity of the structure.[8,13]

Due to the different types of intra-radicular retainers and differences in indications and techniques, in addition to the lack of studies to follow up cases with non-circular root canal, the presentation of this clinical case was proposed, aiming at demonstrating the possibility of treatment with a 5-year follow-up. Thus, the objective of this study was to present a clinical case report using an intra-radicular retainer of the filling nucleus type, associated with FGP and metal-ceramic crown.

CASE REPORT:

The case was approved by the ethics committee from Fundação Hermínio Ometto under CAAE 59230116.4.0000.5385.

Female pacient, 37 years old, was seen at the Integrated Dental Clinic of Hermínio Ometto Foundation, complaining about the aesthetics of dental element 11 (right upper central incisor), which presented satisfactory endodontic treatment, unsatisfactory direct restoration and cracks in the remaining tooth (Fig 1). For this reason and also due to the patient's financial conditions, an indirect restoration using a metal-ceramic crown was chosen. Due to the previous endodontic treatment, the dental fragility found and the shape of the root canal (Fig 2) it was recommended the use of a filling core associated with the fiberglass pin (NP).

Figure 1: Aesthetic impairment of the right central incisor.

Figure 2: Format of root canal opening.

The process began with a coronal opening using a conical trunk diamond drill (KG Sorensen, Cotia, SP, Brazil), followed by the canal desobturation through heated Paiva condensers (Golgran, São Caetano do Sul, SP, Brazil) to remove the gutta percha in the canal light and then 32 mm wide drills (Maillefer - Dentsply, York, Pennsylvania, USA). This procedure was performed until the working length was obtained, leaving an apical endodontic remnant of approximately 4mm, which allowed fluids from the dental apex not to contaminate the root canal. Since the root canal was emptied for prosthetic purposes, no solvents were used during the removal of the obturator material.

The FGP selected to be used in this case was the Reforpost no. 2 (Angelus, Londrina, PR, Brazil). This was kept for 5 minutes in 70% alcohol (Santa Francisca Crop, Rio Claro, SP, Brazil) for its disinfection (Fig 3A). The treatment of the pin surface was started by the application of silane (Prosil, FGM, Joinville, SC, Brazil) for 1 minute (Fig 3B), following the application of the adhesive system (Single Bond 2, 3M ESPE, Sumaré, SP, Brazil) (Fig 3C). Finally, the light curing of the set for 20 seconds (Fig 3D).

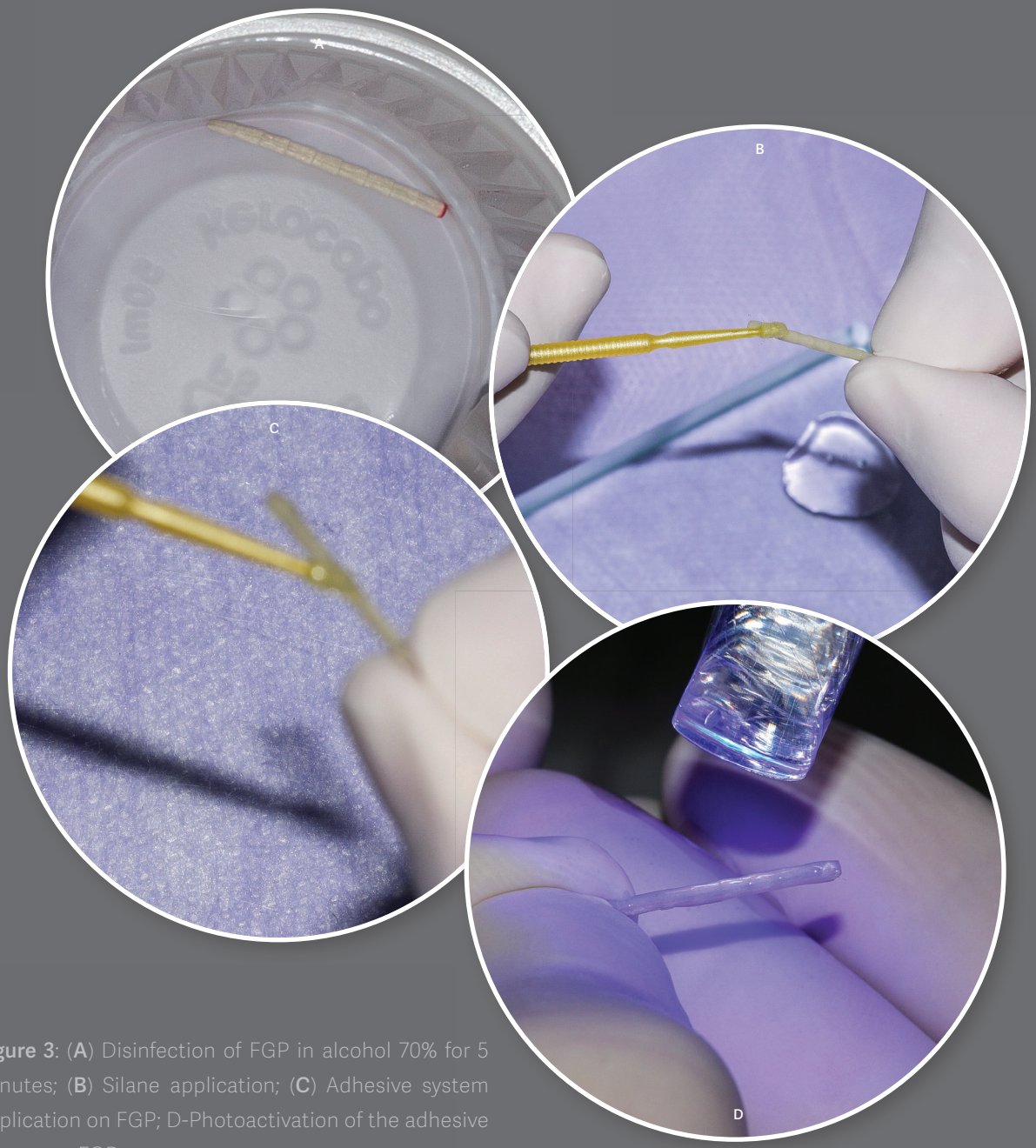


Figure 3: (**A**) Disinfection of FGP in alcohol 70% for 5 minutes; (**B**) Silane application; (**C**) Adhesive system application on FGP; D-Photoactivation of the adhesive system on FGP.

On the FGP already treated, an increase of micro-hybrid resin (Z100 - 3M ESPE, Sumaré, SP, Brazil) was added, coating it in the size of the canal of the dental remnant that was modeled (Fig 4A and B).

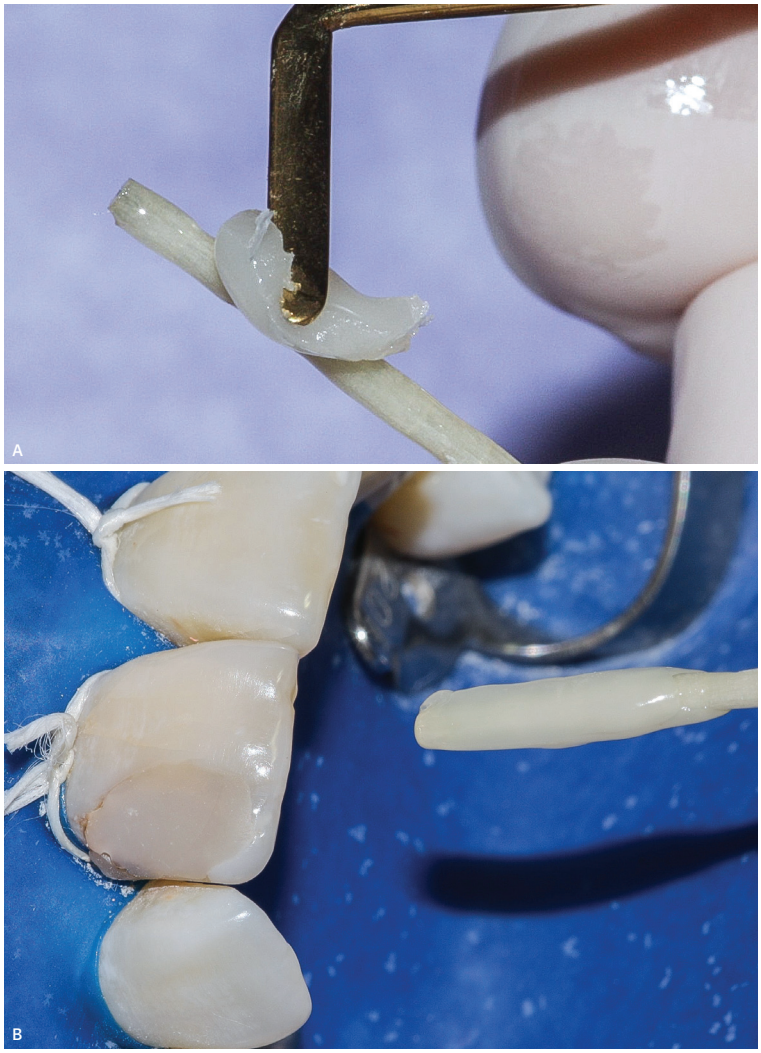
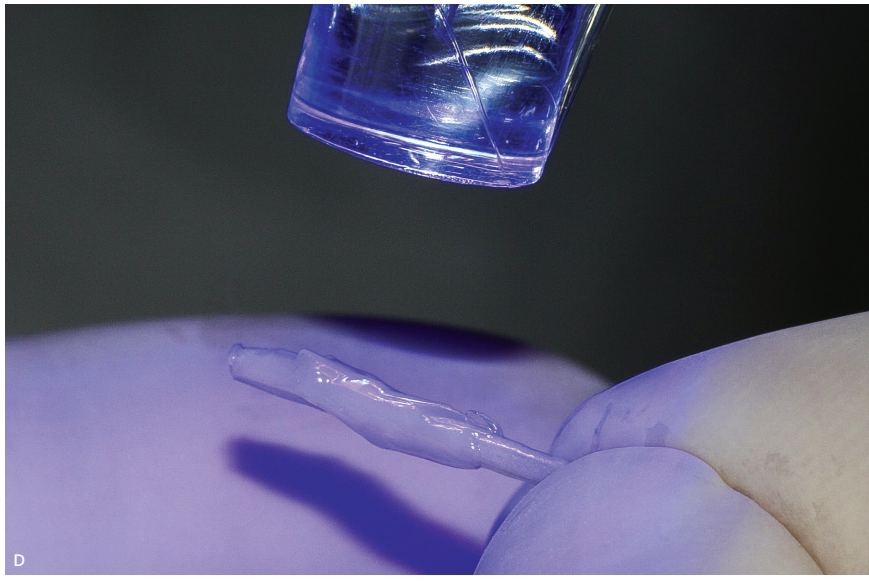


Figure 4: (**A**) Resin increment insertion over FGP; (**B**) FGP coated with composite resin in the length of the canal; (**C**) FGP in position for photoactivation for 2 seconds; (**D**) Final photoactivation for 40 seconds, performed outside the canal.

In order to model the pin, the FGP involved in the composite resin increment was introduced in the root canal that was previously isolated with water soluble gel (KY - Johnson and Johnson, São Paulo, SP, Brazil), thus avoiding that the resin could adhere to the walls of the root canal. In this way, the resin that coated the FGP could take the form of the canal, anatomizing the pin and giving rise to the nucleus of filling. The set in position was photopolymerized for 5 seconds (Fig 4C) for an initial polymerization of the composite resin. The core was then removed and replaced, for about 3 times, inside the canal. The core was finally removed completely from the root canal for the end of the photoactivation, as recommended by the composite resin manufacturer (Fig 4D). Once the polymerization was finished, the core was reinserted in the duct so that its adaptation could be verified.


C


D

It was then followed by the chemical preparation of the root canal. Antisepsis with 0.12% Chlorhexidine Digluconate (PerioGard, Colgate Palmolive, Rudge Ramos, São Bernardo do Campo - SP, Brazil), water jet washing and drying with absorbent paper cones (Dentsply, Petrópolis, RJ, Brazil) were performed. It continued with the conditioning of the canal, with application of 37% phosphoric acid (Atacktec Acid Conditioner, Caithec, São José dos Pinhais, PR, Brazil), for 15 seconds. Washed with water for 30 seconds and removal of excess moisture with an absorbent paper cone (Dentsply, Petrópolis, RJ, Brazil). Then, the adhesive system (Single Bond 2, 3M ESPE, Sumaré, SP, Brazil) was applied to the root canal, but without light curing it, otherwise, it could lead to non adaptation of the anatomically individualized pin in the canal.

The treatment of the NP for cementation was then performed. For this, 37% phosphoric acid (Atacktec Acid Conditioner, Caithec, São José dos Pinhais, PR, Brazil) was applied for 30 seconds, to remove any unwanted organic substance from the surface. The core was washed for 30 seconds with water spray and then, with the help of a Microbrush (Applicator Kg Brush- KG Sorensen, Cotia, SP, Brazil), the adhesive system (Single Bond 2, 3M ESPE, Sumaré, SP, Brazil) was applied on the composite resin (Z100 - 3M ESPE, Sumaré, SP, Brazil), but without its photopolymerization.

For the cementation, the resin cement of dual prey (AllCem Core - FGM, Joinville, SC, Brazil) was used, so that it could be trapped, even in the most apical portions, where the light of the photopolymerizer cannot reach. After handling the cement according to the manufacturer's recommendations, it was applied both inside the canal, with the aid of drills lentulus, as well as in the core. The filling core was then positioned in the remaining root, the excess cement was removed with microbrush (Applicator Kg Brush- KG Sorensen, Cotia,

SP, Brazil) and finally the entire assembly was photopolymerized for 40 seconds, finishing cementing.

After the cementing, the reconstruction of the coronary part of the filling core was started in order to finish the intraradicular retainer. Thus, the whole set was conditioned with 37% phosphoric acid (Atacktec Acid Conditioner, Caithec) and subsequent application of the adhesive system (Single Bond 2, 3M-ESPE, Sumaré, SP, Brazil) photoactivated for 20 seconds. The Z100 composite resin (3M ESPE, Sumaré/SP, Brazil) was used for the reconstruction, ensuring that the coronary portion of the filler core presented the forms of retention and strength of preparations for total metal-ceramic crowns in anterior teeth, i.e., double inclination of axial walls with total expulsivity of 10°, absence of live angles and termination in wide chamfer with bevel on the buccal surface.

Subsequently, the metal-ceramic crown was made, following the next sessions: molding with condensation silicone (Zetaplus-Zermack, Badia Polesine RO, Italy) by means of mechanical-chemical spacing with the use of 00 and 000 retractor wires (Ultrapak, Indaiatuba, SP, Brazil) and hemostatic solution (Hemostop - Denstsply, Petrópolis, RJ, Brazil); metallic coping proof, transfer molding with alginate (Jeltrate, Dentisply, Petrópolis, RJ, Brazil), intermaxillary register with red acrylic resin (Duralay, Reliance, Chicago, Illinois, USA) and choice of ceramic color; ceramic proof, adjustment and final cementation with zinc phosphate cement (SS White, Rio de Janeiro, RJ, Brazil). The result is shown in figure 6, and 5 years after the installation on the radiograph of Figure 7.

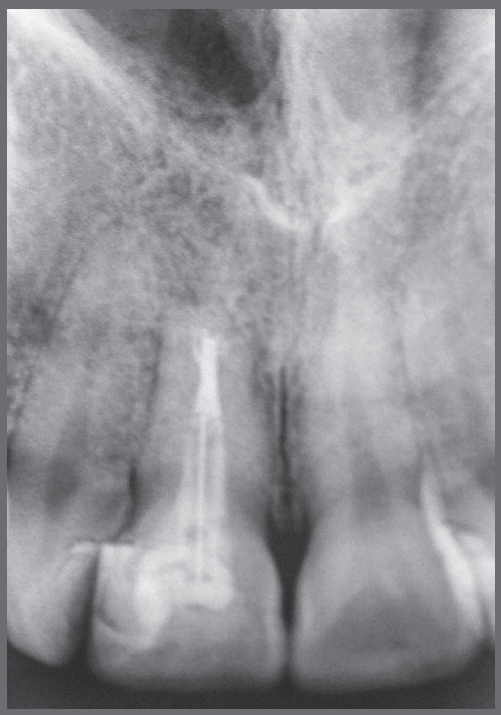


Figure 5: Immediate X-ray after anatomic FGP cementing.

Figure 6: Final esthetics after cementation of the metal-ceramic crown.

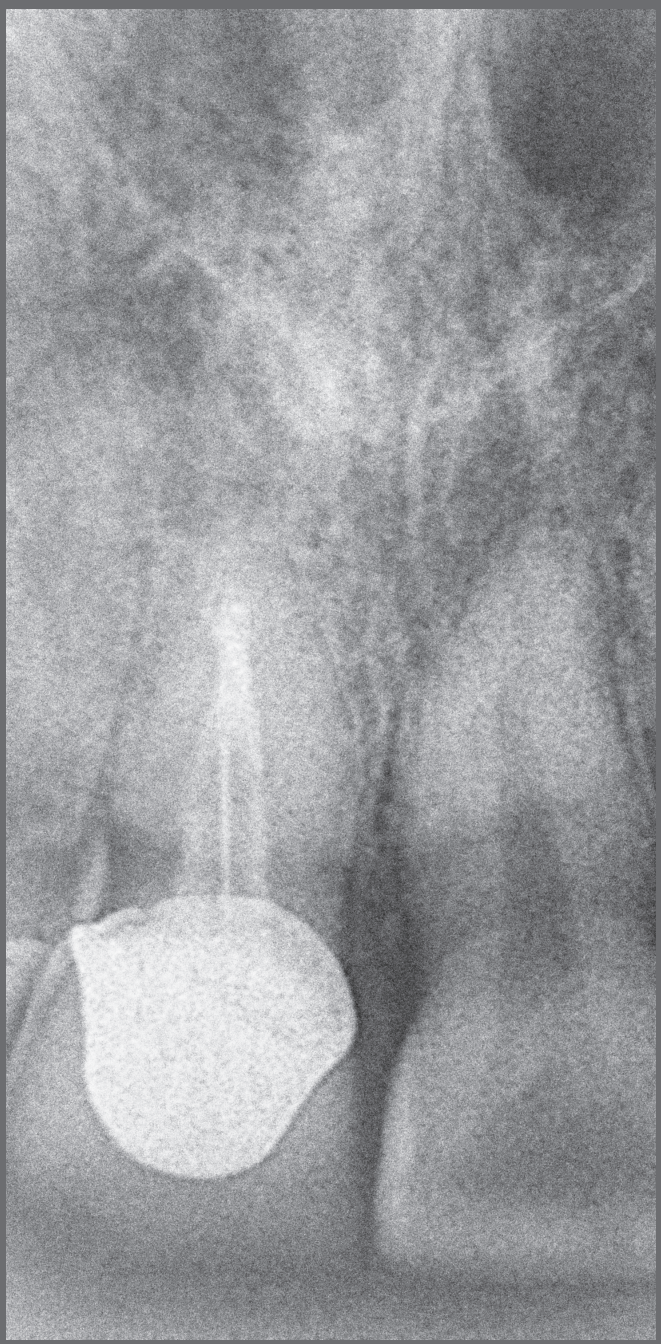


Figure 7: Radiography for follow-up after 5 years.

DISCUSSION

In oral rehabilitation, the technique chosen by the professional should always be as conservative as possible, thus allowing a good prognosis in the medium and long term, taking into account not only aesthetics, but also functional and biological aspects.[14]

The choice of the restorative procedure of a dental element should take into consideration some factors such as: amount of remnant, periodontal condition of the patient, location of the tooth in the arch, shape and length of the root canal, root width, biocompatibility of the material, its elasticity, predisposition to adhesion and retention, and its aesthetic.[15,16]

In this sense, the NP is an alternative for the retention of fixed prosthesis in teeth with extensive coronary destruction.[4,17,18] This can be seen in the present clinical case, because the tooth presented a large amount of composite resin restoration, some cracks in the remaining tooth and great aesthetic need by the patient.

Thus, in order to perform a total crown, returning the aesthetics to the tooth, it was necessary to retain it in the root remnant, thus following what is proposed by Mazaro et al. (2014),[16] who state that the use of intraradicular retainers is necessary in anterior teeth treated endodontically, since these are impacted forces that can lead to the fracture of the tooth remnant.

The choice for FGP was due to the coronary remnant having more than two thirds of the crown remnant, the patient having a stable occlusion, absence of parafunctional habits, periodontal disease, being an anterior tooth, the root remnant being weakened, and to allow a good distribution of the load along the root, since the FGP has a modulus of elasticity close to that of the dentine.[8,19,20]

Because they are prefabricated, FGP do not always adapt to the shape and diameter of root canals, being a problem found mainly in teeth with broad,

non-circular or fragile root canals,[21] which can be seen in the case presented.

Thus, in this case, it was necessary to individualize the FGP, since it was the canal of the upper central incisor with a diameter and shape not compatible with the pre-existing pins. The anatomization of FGP by modeling with composite resin, promoted a greater adaptation of the retainer to the root canal, conferring a thin layer of cement, seeking to promote greater bond strength between the retainer and the tooth[8,18,19,22]. This individualization of the fiberglass pin also decreases the contraction of polymerization at the dentin/cement and FGP/cement interfaces[13,23] and is associated with a lower chance of bubbles, cracks or gaps.[4]

This is clinically relevant, as these failures can initiate a stress concentration zone, which acts as a crack propagator and reduces the bond strength between the FGP and the conduit dentin.[13] Thus, the root fracture can be induced due to the wedge effect of a loose stem within the root canal.[4]

The preparation of the root canal took place in the same way as indicated in the literature, that is, authors such as Shiozawa et al. (2005),[24] Franco et al. (2009)[15] and Rocha et al. (2015)[25] bet on the correct biodynamics using the general rules of the preparation of the conduit where, with endodontic obturator material, 1/3 of the root canal of the remainder or apical 4mm of it must be preserved. Rocha et al. (2015)[25] still add that there must be a ratio of at least 1:1 between root length of the pin and crown height or, at least, that the pin extends for half the root length supported by bone tissue; and even if the intracanal wear during preparation does not exceed 1/3 of the remaining diameter.

The choice of FGP conditioning was due to greater acceptance, and reports in the literature, recommending what was explained by Clavijo et al., (2006)[8] and Souza-Junior et al., (2012),[20] when they also used the anatomically individualized pin technique, making use of the 70%

alcohol, silane pin conditioning and adhesive system. However, the conditioning of FGP is quite controversial. Vano et al., (2006)[26] state that the use of hydrofluoric acid on the pin before the application of silane, promotes better adhesion results.

On the other hand, Amaral et al (2010)[27] point out that the conditioning prior to the application of silane does not influence the results of adhesion. However, both authors agree that the application of silane is indispensable, since it increases the retention of the pin both in the canal and in the resin.

Another point that should be emphasized is the fact that a metal-ceramic crown was used instead of a metal-free crown that is more aesthetic, in view of the use of the NP and the aesthetic need of the case presented. This choice was mainly due to the patient's financial condition. Even so, the NP was used for the reasons already mentioned and also, so that it would be prepared for a future rehabilitation with free metal crown. That is, decreasing the chance of fracture during the removal of a possible molten metal core, in order to indicate a free metal crown.

In general, PFV has shown itself, both clinically and in scientific research, as a favorable rehabilitation therapy, with aesthetic, biomechanical and technical advantages, such as, for example, the shorter execution time compared to indirect intra-root retainers. Thus, the filling core associated with a fiberglass pin can be characterized as an indication of clinical success for the direct or indirect reconstruction of an endodontically treated tooth when the anatomy of the root canal walls after preparation is not perfectly circular, and when there is a significant loss of coronary structure.[21]

CONCLUSION:

The professionals and the patient involved, considered the result satisfactory, characterizing the success of the treatment after 5 years of installation. This technique is used to minimize the resin cement layer in a similar way to the technique with molten metal cores, presenting itself as an aesthetic alternative in cases where this need is present. In addition, intra-radial retainers made by this technique have an elasticity module very close to the remaining dentin, reducing the risk of root fractures.

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