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Four-year Follow-up of a Direct Anatomical Fiber Post and Esthetic Procedures: A Case Report

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Clinical Relevance

The use of an anatomical fiber post improves the fit between the root canal and the fiber post, reduces the risks of failure, and improves the fiber post retention. This case report presents a successful clinical case after four years using this protocol.

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SUMMARY

Knowledge about the stability of fiber posts cemented in widened canal spaces over time is scarce in the literature. Thus, the purpose of this case report was to evaluate the performance of a direct anatomical post in a widened canal space over the course of four years. The present clinical case describes the rehabilitation of a widened canal space using a direct anatomical post (a resin composite combined with a prefabricated glass fiber post) associated with an all-ceramic crown and other restorative procedures. This technique is easy to perform and may solve some of the problems associated with the cementation of a poorly adapted fiber post in a widened canal space.

INTRODUCTION

Endodontically-treated teeth, with great loss of dental tissue, require the cementation of fiber posts to provide retention of the restorative material.[1] The cementation of fiber posts allows better distribution

Figure 1. *Initial esthetic appearance of anterior teeth. Tooth No. 9 with darkened crown, multiple lines of microfractures, vestibular enamel weakness, and composite resin restorations.*
Figure 2. *Occlusal view of anterior teeth. Palatal restoration of access to endodontic treatment.*
Figure 3. *The operative field was isolated with a modified rubber dam by cutting the anterior region.*

of the masticatory stresses,[2] reducing the risk of root fractures[3-5] as they present a modulus of elasticity similar to dentin.

Widened canal spaces are commonly seen in dental practice. They can be the result of carious lesions, previous restoration with excessive post and core diameters, endodontic overinstrumentation, internal resorption, developmental anomalies or even oval-shaped root canals,[6,7] and incomplete physiological root formation in young patients.[8,9] Widened canals are more susceptible to fracture because they are weaker when it comes to supporting physiologic masticatory forces.[9-11]

Several clinical protocols were reported in the literature for treatment of widened canal spaces with great dental tissue loss. Some authors have attempted to reduce the root canal width with composite resin restoration.[12-14] Another option is the use of a direct anatomic fiber post. This technique requires the anatomical shaping of the prefabricated fiber posts with a composite resin into the root canal.[15] This technique provides a close adaptation of the post to the root canal, reduces the resin cement thickness, and therefore, improves the retentive properties of these anatomic posts.[15-19]

Although promising results have been obtained with the direct anatomic-post technique,[15,18] no study has so far reported clinical follow-ups of this technique. Thus, the aim of this clinical case is to describe the anatomical shaping of a prefabricated post (direct anatomical post), highlighting the important clinical steps involved in the success of this clinical protocol for widened canal spaces as well as reporting the clinical outcome after four years of clinical service.

TECHNIQUE DESCRIPTION

A 25-year-old female patient was seeking dental treatment. Her main complaint was the darkened appearance of the upper central incisor (tooth No. 9 in the universal numbering system) (Figure 1). During dental anamnesis, she reported that she had undergone two endodontic retreatments and many attempts at internal dental bleaching.

After clinical and radiographic examination, we observed the presence of a successful endodontic treatment in an oversized root canal (Figure 2), the presence of a darkened crown with multiple lines of microfractures, weak buccal enamel, and the presence of defective composite resin restorations. Teeth numbers 7, 8, and 10 had extrinsic tobacco stains with morphological and contouring changes. We proposed the cementation of an all-ceramic crown after cementation of a direct anatomic post on tooth number 9, placement of a ceramic laminate veneer on tooth number 8, and restoration of the incisal edges of teeth numbers 7 and 10 with composite resin.

An initial impression with addition silicone (Virtual, Ivoclar-Vivadent, Barueri, SP, Brazil) was done to prepare stone models and a diagnostic wax-up on the maxillary incisors. A mock-up was also prepared in order to make the procedure more predictable. After that, in-office dental bleaching was performed with 35% hydrogen peroxide for 40 minutes for two sessions with a one-week interval between them

Figure 4. *Evaluation of adaptation of a No. 5 post within the root canal.*
Figure 5. *Removal of anatomic post after modeling with composite resin.*
Figure 6. *Direct anatomic post (fiber post + composite resin).*

(Whiteness HP Blue, FGM, Joinville, SC, Brazil). This was associated with reanatomization of the esthetic dental details. Two weeks after the last bleaching procedure, we initiated the restorative procedures.

The operative field was isolated with a modified rubber dam technique using No. 2A clamps (Hu Friedy, Chicago, IL, USA) on the first premolars. This technique removed the upper lip from the operative field and allowed direct sight of the teeth and periodontal tissue in the area to be treated (Figure 3).

Root Canal Preparation

No. 3 and No. 4 Gates drills were used for gutta-percha removal of the root canal. After gutta-percha removal, a No. 5 fiber post (ParaPost Fiber Lux No. 5/Taper Lux, Coltène/Whaledent Inc, Cuyahoga Falls, OH, USA) was checked for adaptation inside the root canal (Figure 4). Due to a mismatch between the post and the root canal space, fabrication of a direct anatomical fiber post was indicated. For this purpose, the corresponding drill of the No. 5 fiber post (ParaPost Fiber Lux No. 5/Taper Lux, Coltène/Whaledent Inc) was used for canal preparation, and in this same visit, the post was anatomically characterized with composite resin for better adaptation into the root canal and retention of the indirect crown.

A No. 5 glass fiber post was conditioned with 37% phosphoric acid gel (Total Etch, Ivoclar-Vivadent) for 15 seconds, followed by water rinsing and drying. The fiber post was coated with a layer of a silane coupling agent (Monobond Plus, Ivoclar-Vivadent) for one minute, and the surface was gently air-dried (five seconds). The two-step etch-and-rinse adhesive system (Tetric N-Bond, Ivoclar-Vivadent) was applied in two coats, followed by solvent evaporation and light-curing (10 seconds). The fiber post was covered with a nano-hybrid composite resin (Tetric N-Ceram, Ivoclar-Vivadent), and the set (fiber post + composite resin) was inserted into the root canal previously lubricated with a hydrosoluble gel (KY, Johnson & Johnson, São José dos Campos, SP, Brazil) (Figure 5).

This set was removed and replaced twice, and the excess resin at the cervical margin was removed. The composite resin was light-cured for 20 seconds with the post inside the root canal. The relined fiber post was then removed (Figure 6), and the composite resin was light-cured for an additional 20 seconds on each surface to completely polymerize the relining resin. All light-curing procedures were performed with an LED light-curing device (Radii Plus, SDI Limited, Bayswater, VIC, Australia) using a power density of 1,200 mW/cm^2. After removal of the retentive areas, the direct anatomic post was inserted again to ensure adequate adaptation.

Post Cementation

The root canal and the relined fiber post was rinsed abundantly with water and air to remove the

Figure 7. *Incisal edges with composite resins performed on teeth No. 7 and No. 10 with the aid of the mock-up.*
Figure 8. *Application of the try-in paste prior to cementation of the all-ceramic crown and ceramic laminate veneer.*

lubricant gel, and after that, the post was conditioned with 37% phosphoric acid gel (Total Etch, Ivoclar-Vivadent) for 15 seconds. A self-adhesive resin cement (SoloCem Dentin, Coltène/Whaledent Inc) was introduced into the root canal space with an intracanal mix tip (Easy-Mix, Coltène/Whaledent Inc) and the fiber post was seated. The excess resin cement was removed, and the remaining cement was light-cured through the post for 20 seconds in each of the dental surfaces to ensure adequate polymerization of the resin cement.

After fiber post cementation, the coronal portion of the anatomical post was incrementally filled with a composite resin (Empress Direct Dentin A1, Ivoclar-Vivadent) to reestablish the anatomical contours to the tooth. Each 2-mm composite resin increment was light-cured for 20 seconds. With the aid of the mock-up, the incisal edges of the composite resin were stratified on teeth numbers 7 and 10 to achieve esthetic anatomic contours (Figure 7).

After that, the core of tooth number 9 was prepared to receive an all-ceramic crown. This preparation was performed with numbers 2135, 3098 MF, and 2135 FF diamond burs (KG Sorensen, Barueri, SP, Brazil) in a high-speed handpiece under water cooling. The preparation resulted in a ferrule at the coronal edge measuring 2.0 mm high and 1.2 mm deep. The preparation also had a 2.0-mm incisal reduction and 1.0 to 1.5-mm buccal and palatal reductions. All angles were rounded, and the cervical finish line was continuous, defined, and clear.

On tooth number 8, the preparation for a ceramic veneer was initiated with a 1013 diamond bur (KG Sorensen). Guides from 0.5 to 0.7 mm in depth were prepared following the slope of the buccal surface of the tooth with a 2135 rounded-tip diamond bur. Reductions of 1.5 to 2.0 mm were also performed at the incisal surface. The dental preparation was refined with a 2135 FF diamond bur (KG Sorensen).

After that, the preparations of teeth numbers 8 and 9 were finished and polished with Swiss Flex discs (Coltène/Whaledent Inc). Finally, provisional restorations were cemented on these teeth. In the next clinical session, an impression of the preparations was taken with addition silicone (Virtual, Ivoclar-Vivadent) and sent to a prosthetic laboratory.

The all-ceramic crown and ceramic laminate veneer were fabricated with the IPS e-max System (Ivoclar-Vivadent). The ceramic pieces were checked in position with the try-in paste of the resin cement (Figure 8). After necessary adjustment and color selection of the resin cement color, the internal area of the crown and of the veneer were conditioned with hydrofluoric acid (IPS Etching Gel, Ivoclar-Vivadent) for 20 seconds, washed with an air-water spray for one minute, and cleaned with 37% phosphoric acid gel (Total Etch, Ivoclar-Vivadent) for 30 seconds.

Before the cementation procedures, the surfaces of the prepared teeth were etched with 37% phosphoric acid gel (Total Etch, Ivoclar-Vivadent) and rinsed after 15 seconds with an air-water spray. Excess water was removed by gently blowing air, leaving the dentin slightly moist. For tooth number 8, a light-cured adhesive system (Excite, Ivoclar-Vivadent) was applied in two coats to the prepared tooth surface. Gently blowing air was used for solvent evaporation. The adhesive was not light-cured. Then, the light-cured resin cement Variolink Veneer (Ivoclar-Vivadent) was placed into the ceramic veneer and seated into position. The excess resin cement was removed, and the veneer was light cured for 40 seconds on each of the dental surfaces.

For tooth number 9, a dual-adhesive system (Excite DSC, Ivoclar-Vivadent) was applied in two coats to the prepared tooth surface. Gently blowing air was used for solvent evaporation, followed by light-curing for 10 seconds. The base and catalyst components of the dual resin cement Variolink II (Ivoclar-Vivadent) were then mixed, and the resin

Figure 9. *The outcome of the restorative procedures after seven days.*
Figure 10. *The outcome of the restorative procedures after four years.*
Figure 11. *Radiograph of tooth No. 9. The direct anatomic post perfectly adapted after four years of treatment.*

cement was introduced into the indirect crown. After the crown was seated, the excess resin cement was removed, and the cement was light-cured through the indirect crown for 40 seconds on each dental surface.

After cementation, the cervical edges of indirect restorations and the gingival health were checked, and the excess cement was removed with a Bard-Parker number 12 scalpel blade for better hygiene and prevention of biofilm retention in the cervical region.

The outcome of the restorative procedure after seven days and four years can be seen in Figures 9 and 10, respectively. After four years, we did not observe morphological alterations of the indirect restorations and marginal discolorations clinically; and as viewed radiographically, the direct anatomic post was perfectly adapted (Figure 11).

DISCUSSION

Tooth number 9 presented a widened canal space with thin remaining root dentin. The cementation of a conventional fiber post would have required the use of a great quantity of cement in order to fill the spaces among the fiber post and the tooth structure. This situation might lead to adhesive failures.[19]

This is one of the reasons we opted for the placement of a direct anatomical post. This represents an easy protocol for dental practitioners when compared with traditional indirect posts: Simple additional clinical steps are incorporated into the procedure, which avoids laboratory procedures that would be required for indirect techniques.

Apart from that, this protocol has other advantages. This technique improves fiber post retention, reaching the same level of retention as that achieved in narrow root canals with well-adapted posts.[18] In addition, it avoids future adhesive failures because it requires reduced resin cement thickness for cementation.[15,19] As reported by Gomes and others,[18] the good performance of this technique can be attributed to the high hydraulic pressure it exerts on the cement against the dentin walls, resulting in better contact between the cement/post set and dentin.[16,20] This pressure reduces blister formation in the cement,[20] thus eliminating sources of flaw-initiating sites and increasing the number of tubules filled with resin cement[21] due to better penetration of resin into demineralized dentin. This results in a more uniform hybrid layer with longer resin tags and adhesive lateral branches.

Other details of this clinical protocol deserve mentioning. We used self-adhesive cement for the cementation procedure. This material does not require rinsing, which solves the problem of substrate moisture control, especially in the root canal, and simplifies the clinical procedure. This type of cement seems to be less sensitive to the operator's skills and to the root region,[22,23] which is an additional advantage over other conventional cementation systems.[24]

In this case report, the anatomic reanatomization of the fiber post was performed with a nano-hybrid composite (Tetric N-Ceram, Ivoclar-Vivadent). This material has been widely used for restorative procedures. According to different studies,[25,26] nano-hybrid composites usually present higher mechanical and physical properties than microhybrid composites. They also present higher color stability throughout time, even with preheating techniques,[27] making this kind of composite the first choice for this technique.

Another clinical step in this protocol deserves discussion. Several studies suggest the application of silane coupling agents on fiber posts to enhance adhesion to composite resins.[28,29] Silane solutions can be described as hybrid organic-inorganic compounds that are able to promote adhesion between organic and inorganic matrices due to an intrinsic dual reactivity.[30] This is the reason for the fiber post in the present case report being coated with a layer of the silane coupling agent before modeling with composite resin.

However, there is no consensus in the literature. Opinions differ on the efficiency of post silanization. There are other authors[31] who claim that the use of silane may be useless to improve the bonding of the post with polymeric materials. This means that further laboratory studies still need to be conducted in order to elucidate whether better resin bonding of the post with the composite resin is in fact reached; otherwise, this clinical step could be omitted, making the procedure simpler.

Finally, the satisfactory clinical outcome of the procedure was confirmed by the four-year clinical evaluation. However, long-term follow-ups are still required and should be the focus of future investigations.

CONCLUSION

An anatomical direct post is a quick and easy option that allows the preservation of weakened root structures due to multiple endodontic treatments. After four-year periodic evaluation, an anatomical direct post and the performed restorations showed no radiographic or clinical evidence of alterations and presented a correct clinical performance.

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Regulatory Statement

This study was conducted in accordance with all the provisions of the local human subjects oversight committee guidelines and policies of the Ponta Grossa State University, Brazil.

Conflict of Interest

The authors certify that they have no proprietary, financial, or other personal interest of any nature or kind in any product, service, and/or company that is presented in this article.

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