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Use of a Direct Anatomic Post in a Flared Root Canal: A Three-year Follow-up

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Clinical Relevance

A standard fiber post does not adapt well to a flared root canal preparation, leaving a large cement space between the post and the tooth structure. Direct anatomic posts provide an alternative technique for restoring these teeth with less chance of debonding.

SUMMARY

The following case report describes the three-year follow-up after rehabilitation of a flared root canal using a direct anatomic post (a resin composite combined with a prefabricated glass fiber post) associated with metal-free ceramic restoration. The report presents the clinical protocol for the fabrication of the posts, which provide an intimate fit to the remaining root and mechanical properties similar to those of the dental structure. These posts serve as an alternative to conventional metal cores.

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INTRODUCTION

Teeth submitted to endodontic treatment typically have extensive loss of dental structure and require the use of intraradicular retainers and filling cores to hold the final restoration.[1] However, the mismatch between the root canal space and post diameters is a clinically relevant concern.[2] Wide root canals can be the result of carious lesions, previous restorations with excessive post and core diameters, endodontic overinstrumentation, incomplete physiological root formation, internal resorption, developmental anomalies, or even oval-shaped root canals.[3,4]

Although cast-metal cores can be made to adapt well to the remaining root structure, they can produce a wedging action under masticatory forces, resulting in root fractures and condemning the tooth to extraction.[5] Prefabricated fiber posts do not

Figure 1. *Initial smile.*

Figure 2. *One can notice the presence of a fractured provisional restoration of direct composite resin on tooth 21 ISO (8 Universal).*

resemble the individual root canal anatomy and adapt inaccurately, thereby obliging the operator to employ excessive amounts of resin cement to replace lost structure.[6] In this way, several techniques have been suggested to restore weakened root canals, and among them, there is the technique of anatomical shaping of prefabricated fiber posts with a composite resin into the root canal.[7] This technique provides a close adaptation of the post to the root canal, reduces the resin cement thickness, improves the mechanical and retentive properties of restored teeth,[7-11] and significantly reduces the chance of root fracture.[8,12,13] Therefore, anatomical posts seem to be an effective method to improve the biomechanical behavior of flared root canal preparations.

Good laboratory results were observed with this technique.[8-10,13] For instance, Clavijo and others[8] and Silva and others[13] demonstrated that anatomical posts showed similar fracture strength to that of metallic posts and superior performance to those of non-relined fiber posts in flared root canals. Faria-e-Silva and others[9] and Macedo and others[10] showed that fiber post relining resulted in higher bond strength than prefabricated posts without relining in flared root canals. Based on these positive results, the aim of this clinical case was to describe the anatomical shaping of a prefabricated (direct anatomical) post, to discuss the important clinical steps involved in the success of this clinical protocol, and to report the three-year follow-up of this clinical rehabilitation.

CASE REPORT

A 30-year-old female patient sought specialized dental treatment with the complaint of lack of esthetics associated with the upper central incisor (tooth 21 in the ISO system or tooth 8 in the universal numbering system). Under clinical and radiographic examination, we diagnosed the presence of a wide and faulty composite resin restoration (Figures 1 and 2) and a periapical lesion. Endodontic retreatment, fiber post cementation, and an all-ceramic crown were recommended. An initial impression with addition silicone (Express XT [commercially available in the United States as Express VPS], 3M ESPE, St Paul, MN, USA) was done to prepare stone models, a diagnostic wax-up, and a mock-up.[14]

After this, gutta-percha was removed, leaving 4 mm of the apical seal, and the corresponding drill of the Exacto 3 post (Ângelus, Londrina, PR, Brazil) was used for canal preparation (12 mm; Figure 3). In the same visit, the post was anatomically characterized with composite resin for better adaptation into the root canal and retention of the indirect crown.

For this purpose, a glass fiber post 3 was conditioned with 37% phosphoric acid gel (Total Etch, Ivoclar-Vivadent, Schaan, Liechtenstein) for 15 seconds, followed by rinsing and drying. The fiber post was coated with silane (Silane, Ângelus) for one minute, and the surface was gently air-dried (for five seconds). The two-step etch-and-rinse adhesive system (Tetric N-Bond [commercially available in the United States as Heliobond], Ivoclar-Vivadent) was applied and light-cured for 10 seconds (Radii Plus, SDI Limited, Victoria, Australia; 1200 mW/cm^2). The fiber post was covered with a nanohybrid composite resin (Tetric N-Ceram [commercially available in the United States as Tetric EvoCeram], Ivoclar-Vivadent; Figure 4), and the set (fiber post and composite resin) was inserted into the canal (Figure 5), previously lubricated with a hydrosoluble gel (KY, Johnson & Johnson, São José dos Campos, SP, Brazil).

This set was removed and replaced twice, and the excess cervical resin composite 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 additionally light-cured for 20 seconds on each surface for additional polymerization.

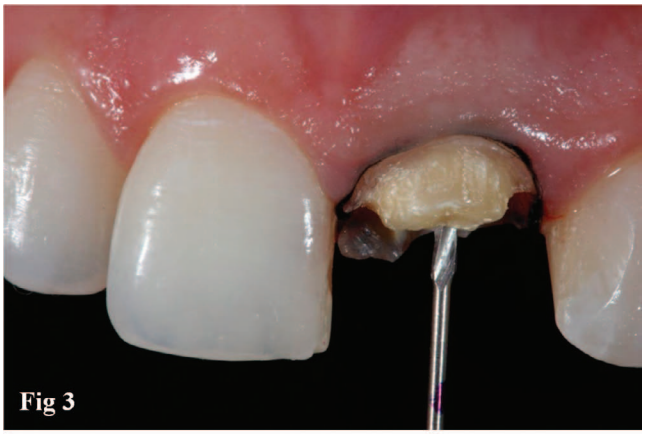
After removal of the retentive areas (Figure 7), the direct anatomic post was inserted into the root canal, and the core was built up with a fiber core (Reforcore, Ângelus) and a nanohybrid composite resin (Tetric N-Ceram, Ivoclar-Vivadent) through incremental filling. Each increment was light-cured for 20 seconds.

The core was then prepared to receive an all-ceramic crown. A ferrule at the coronal end on the buccal and palatal surfaces, 2.0 mm in height and 1.2 mm in depth, was prepared; on the mesial and distal surfaces, the same dimensions were achieved, but the margins ended on resin. Reductions of 1.5 to 2.0 mm were performed on the occlusal surfaces and 1.0 to 1.5 mm on buccal and palatal surfaces. All angles were rounded, and the cervical finish line was continuous, defined, and clear. After preparation, the composite core was finished and polished with Sof-Lex aluminum oxide discs (3M-ESPE; Figure 8). The post was removed (Figure 9), and both the root canal and the relined fiber post were rinsed abundantly with water and air to remove the lubricant gel.

The post was conditioned with 37% phosphoric acid gel (Total Etch, Ivoclar-Vivadent) for 15 seconds. A self-adhesive resin cement (RelyX U200 [commercially available in the United States as RelyX Unicem 2], 3M ESPE) was introduced into the root canal space and on the post surface. The fiber post was seated (Figure 10), the excess resin cement was removed, and the remaining cement was light-cured through the post for 40 seconds. Finally, a temporary restoration was cemented.

In the next session, an impression of the prepared crown was taken with addition silicone (Express XT, 3M ESPE) and sent to a prosthetic laboratory. The all-ceramic crown was fabricated with the IPS e-max System (Ivoclar-Vivadent). After testing and adjustments, the internal area of the crown was conditioned with hydrofluoric acid (IPS Etching Gel, Ivoclar-Vivadent) for 20 seconds and water-rinsed for one minute.

The surfaces of the prepared tooth were etched with 37% phosphoric acid gel (Total Etch, Ivoclar-Vivadent) and rinsed for 15 seconds with an air-water spray. Excess water was removed by gently blowing air, leaving the dentin slightly moist. A dual-cure adhesive system (Excite DSC [commercially available in the United States as Excite F



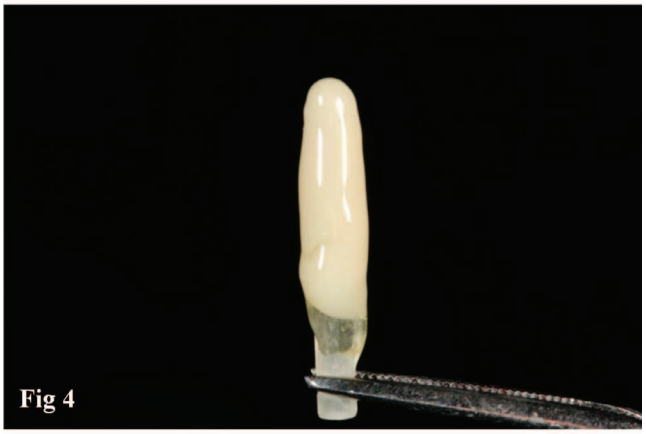


Figure 3. *After removal of the crown, root canal preparation with the corresponding drill of the fiber post selected.*

Figure 4. *After appropriate superficial treatment, the fiber post was covered with a nanohybrid composite resin.*

Figure 5 *The set (fiber post + composite resin) being inserted into the canal.*

Figure 6. *The relined fiber post being removed from the root canal.*

Figure 7. *Removal of the retentive areas of the direct anatomic post.*

DSC], Ivoclar-Vivadent) was applied and light-cured for 10 seconds. The base and catalyst components of Variolink II (Ivoclar-Vivadent) were mixed and introduced into the indirect crown. The crown was seated, the excess resin cement was removed, and the cement was light-cured for 40 seconds on each crown surface. Excess cement was removed with a #12 scalpel blade, and the outcome of the restorative procedure after seven days can be seen in Figures 11 and 12 and after three years in Figure 13.

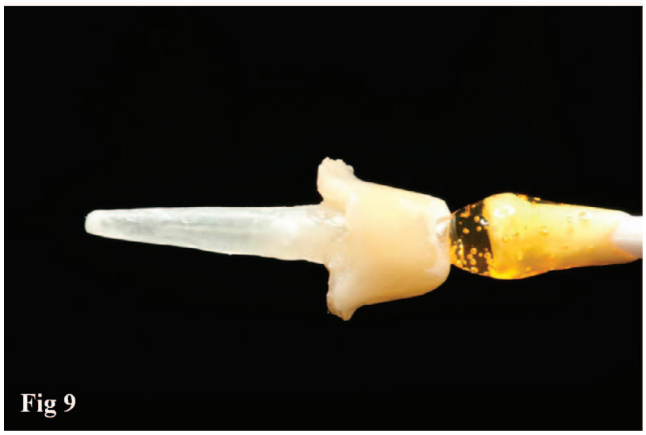


Figure 8. *Coronal preparation of the direct core after finishing and polishing.*

Figure 9. *The direct anatomic post ready to be cemented.*

DISCUSSION

The present case was suitable for the preparation of a direct anatomic post. As a result of the endodontic retreatment, the tooth had a flared root canal with thin radicular dentin. Introducing a conventional fiber post into the canal required a thick layer of luting cement to fill up the spaces between the loosely fitting post and the canal walls. This would have subjected the restoration and tooth to adhesive failure and/or post debonding.[15] Thus, using a post well-fitted to the canal shape allows the use of a thin, uniform layer of cement that increases retention.[7,11]

Some authors[16-19] suggest the restoration of flared root canals with composite resin to reduce canal width. However, the difficulties in providing an adequate curing at the deepest regions of the canal wall may affect the material's properties[20]

Figure 10. *The cementation of the anatomic post.*

Figure 11. *Close view of the outcome of the restorative procedures after seven days.*

Figure 12. *Lateral view of the outcome of the restorative procedures after seven days.*

Figure 13. *The outcome of the restorative procedures after three years.*

and its bonding to the adhesive layer. This does not occur with the direct anatomic post, as the composite resin attached to the fiber post is first cured inside the root canal, but it can also be further cured before the luting procedures.

Another suggested protocol is the use of accessory posts to fill in the mismatch around the main glass fiber post and the root canal.[8,21] Contrary to expectations, the thickness of the cement layer is not reduced significantly, as empty spaces still remain between the accessory posts and the root walls. Thus, the likelihood of the resin cement layer presenting large lacunae or bubbles is high,[22] reducing the adhesive performance of this technique.[23]

In the direct anatomical post technique, as performed in this case report, the fiber post is relined in the root canal, replacing the resin cement with composite resin,[7] which has better mechanical and physical properties.[7-10] This technique is relatively easy; only a few additional steps are required beyond those needed to lute a conventional fiber post. Indirect anatomic posts were claimed to have superior mechanical properties,[8] but they have the disadvantage of being more time-consuming and expensive to fabricate as a result of the need for a laboratory step.

The good performance of the anatomical post techniques in laboratory studies[8-10,13,23] can be attributed to the high hydraulic pressure they put on the cement against the dentin walls, resulting in better contact between the cement/post set and the dentin.[9,24] This pressure reduces blister formation in the cement,[24] eliminates sources of flaw-initiating sites; increases the number of tubules filled with the resin cement[25] because of better penetration of resin into demineralized dentin; and results in a more uniform hybrid layer, with greater resin tags and adhesive lateral branches.

Given the tendency to prepare esthetic metal-free restorations, the use of anatomical posts offers a solution when facing flared root canals in daily practice.

CONCLUSIONS

The use of direct anatomical posts in flared root canals is a practical and fast technique that can be applied for direct and indirect esthetic restorations with the aim of both increasing the bond strength between the fiber post and the root canals and minimizing the risk of fractures commonly observed with cast-metal posts.

Conflict of Interest

The authors of this manuscript 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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