ESTHETIC RESTORATION PROCEDURES FOR ENDODONTICALLY TREATED ANTERIOR ROOTS

ABSTRACT
Fractured endodontically treated teeth below the gingival margin are often extracted and restored with implants or other prosthetic treatment options in many cases. However, dentists should carefully consider other treatment options for these teeth before deciding on extraction due to the risk of vertical and horizontal bone resorption subsequent to extraction as this resorption will result in an unesthetic outcome especially in the anterior region. The introduction of the fiber-reinforced posts has significantly improved the treatment of endodontically treated teeth associated with extensive loss of tooth structure by increasing retention and disturbing the stress along the root as well as reducing the risk of fracture. This clinical case describes the restoration procedures of horizontally fractured and endodontically treated anterior roots and presents a 3-year follow-up.

Key words: Esthetics, Fiber-Reinforced Posts, Full Ceramic Crowns.
INTRODUCTION

Post-and-core systems are frequently used to restore endodontically treated teeth with extensive loss of tooth structure. For several years, root having filled anterior teeth with extensive loss of tooth structure have traditionally been restored using cast or fabricated metal posts as the core reconstruction under porcelain-fused-to-metal crowns or extracted in many cases. Rigid metal posts resist lateral forces without distortion, resulting in stress transfer to the less rigid dentin, and therefore potentially causing root fracture. Their major disadvantage, however, is esthetics, as the metal shows through the newer all-ceramic restorations. Furthermore, the presence of a metal post can cause shadowing the soft tissues adjacent to the root surface, and this adversely affects the esthetic outcome in the anterior region. Moreover, the use of nonprecious metals might cause root discoloration due to the deposit of metal corrosion products over time.

The introduction of improved all-ceramic systems makes it possible to achieve optimal esthetics allied with the necessary mechanical properties to withstand functional stresses. The potential of these materials to be bonded to enamel and dentin has also contributed to the increased application of metal-free crowns in recent years. With the development of new adhesive technologies in the last few decades, clinicians can maintain superior esthetics when restoring severely compromised endodontically treated teeth.

Translucent and white fiber posts have increased in popularity in the last few years, mainly due to the fact that they can be used in high-demand cosmetic procedures, such as all-ceramic restorations. Translucent posts are not visible through these types of restorations, thus, yielding better esthetic results than metal and carbon fiber posts. Furthermore, the need for light translucent posts to mimic natural tooth under all-ceramic restorations requires the use of translucent fiber posts to replace metal posts in the esthetic zone of the oral cavity. In recent literature, it has been stated that high esthetic results and similar mechanical properties have been achieved in hard dental tissues through the restoration of endodontically treated teeth with esthetic fiber-reinforced posts. This report describes the restoration procedures of horizontally fractured endodontically treated anterior teeth and presents a clinical case of such treatment and the subsequent 3-year follow-up.

CASE REPORT

A 26-year-old female patient attended to the Department of Restorative Dentistry with the chief complaint of endodontically treated anterior teeth (right upper canine, right and left upper lateral and central incisors), all of which were restored with a porcelain-fused-to-metal bridge 9 years ago and which were recently fractured from the cervical margins. The teeth had already been endodontically treated. All of the teeth had lost their crown structures. The main treatment goals were to strengthen her anterior roots using fiber-reinforced posts and to restore her fractured teeth with full ceramic crowns.

First of all, the teeth were carefully evaluated using radiographs and clinical parameters. The initial radiographic examination revealed a root perforation on the right upper central tooth probably caused by an iatrogenic application of the root canal instruments. Figure 1 and 2 present the first radiographic appearance of the teeth after the removal of the bridge.

All of the roots were below the gingival margin. Therefore, gingivectomy was performed using DELight Er:YAG laser (HOYA ConBio Laser, Chicago, IL, USA) with low-fluence irradiation at 35 mJ with 10 Hz and the gingival margins of the roots were contoured (Figure 3). Post spaces were prepared with the drill of the selected faan, Liechtenstein) according to the manufacturers’ instructions after two weeks. With the help of the radiographs all of the roots were flared leaving at least 4 mm gutta-percha apically. The root canal walls were etched with 35% phosphoric acid for 15 seconds washed with distilled water and gently air-dried. Excess water was removed from the post space using paper points. A three-step adhesive system (Syntac Primer, Syntac Adhesive and Heliobond, Ivoclar Vivadent, Schaan, Liechtenstein) was applied to the root canals according to the manufacturer’s instructions. After the posts were silanized (Monobond-S, Ivoclar Vivadent, Schaan, Liechtenstein) for 60 seconds, a dual-cured resin cement (Variolink II, Ivoclar Vivadent, Schaan, Liechtenstein) was applied and the posts were inserted into the root canals. Excess material was removed with a microbrush and then the posts were light-cured for 60 seconds from each directions of labial, palatal and vertical. Composite cores with a 1.0-mm wide circumferential shoulder margin 0.5 mm below from the gingival margin and approximately 1 to 2 mm ferrule were formed using a hybrid resin composite (Tetric Ceram, Ivoclar Vivadent, Schaan, Liechtenstein).

After the posts and composite core reconstructions were formed (Figure 4), a polyvinyl siloxane impression
was performed. Zirconia based (Cercon, Degudent, Hanau, Germany) full ceramic crowns (Cerabien CZR, Noritake, Aichi, Japan) were fabricated and luted with a glass-ionomer cement (Voco Meron®, Voco, Cuxhaven, Germany). Periapical radiographs and photographs were obtained before and after the operation and at all clinical procedures. The restorations were evaluated according to the modified USPHS criteria\textsuperscript{13,14} that included esthetics, color match, retention of the post and the restoration, periapical or periodontal pathology, marginal integrity, marginal discoloration, patient satisfaction, and tooth functioning. The restorations were evaluated at the baseline, 18 and 36 months by two calibrated examiners. The first and initial clinical and radiographical evaluation was performed after 18 months. Gingival health was also clinically evaluated with a periodontal probe to detect whether the gingival tissues had any periodontal pocket or bleeding on probing.

According to the evaluation criteria; esthetic results and marginal integrity were excellent, patient satisfaction was high, and tooth functioning was good after treatment as well as the improved gingival health of the anterior teeth, which was contoured using laser (Figure 5). At the first radiographical examination the final appearance of the anterior segment showed successful adaptation of the fiber-reinforced posts in the root canals.

First evaluation of the teeth was after 18 months. Clinically, esthetic appearance of the restorations, marginal integrity and gingival health were good after 18 months (Figures 6, 7). Mobility, gingival bleeding or gingival inflammation was not existing. The patient did not complain about any pain during percussion or palpation of the restored teeth. However, there were two small periapical lesions at the apical regions
of left upper lateral and right upper canine tooth, probably due to the previous endodontic treatment (Figures 8, 9). Therefore, apical resection was performed for both of the infected teeth (Figures 10, 11). After 3 years, we were able to reach and evaluate her again. The restorations showed excellent esthetic results after 3 years (Figure 12). There was no discoloration or debonding of the restorations. The restorations demonstrated good color match, retention, marginal integrity and functioning after 3 years. Gingival health was also good and patient satisfaction was still high. According to the radiographic examination, the left upper lateral and right upper canine tooth showed healing at the apical region at the same time (Figures 13, 14). The left upper lateral tooth had healing scar tissue at the apex of the root (Figure 14).

**DISCUSSION**

The loss of an anterior tooth is frequently caused by traumatic impact or iatrogenesis in young people.\(^{15}\) When an anterior tooth is extracted, the healing processes of a socket always involve a loss of tissue in the vertical and horizontal dimensions\(^{16-17}\) and has an adverse effect on the esthetic outcome.\(^{18-19}\) Furthermore, invasive treatment
alternatives, like tooth extraction, may lead to complicated orthodontic, surgical and/or prosthetic treatments subsequently. Therefore, clinicians should consider to conserve these teeth in the mouth as long as possible for the potential maintenance of the esthetic on the anterior segment. The findings of this case showed that fractured endodontically treated anterior roots could be preserved in function for at least 3 years in the oral cavity. The results of some previous case studies are available describing the use of posts during the prosthetic rehabilitation of severely compromised teeth in the anterior esthetic segment. However, there is no information about long term success of these restored teeth in these
case report studies. This case study gives a follow-up of 18 months and 3 years of endodontically treated anterior roots restored with fiber-reinforced posts and full-ceramic crowns. Two periapical lesions, which were located at the apical region of the left upper lateral and right upper canine tooth, were observed after 18 months. During the apical surgery, small fractured endodontic instruments were found and were removed from the apical region of these roots. These lesions probably occurred because of the previous inaccurate endodontic therapies. After 18 months from the apical surgery, both teeth showed adequate healing as observed by the radiographic evaluation.

The use of fiber-reinforced posts has been suggested to allow for the reduction of stress concentration and decrease the incidence of root fractures.23 Some clinical investigations have demonstrated the long-term clinical performance of the fiber-reinforced posts over an observation period of more than 5 years.24,25 Signore et al.25 evaluated the clinical effectiveness over up to 8 years of glass-fiber-reinforced posts, in combination with either hybrid composite or dual-cure composite resin core material, in 526 anterior endodontically treated teeth with one to four residual coronal walls covered with full-ceramic crowns. According to their results, the overall survival rate of glass-fiber-reinforced posts was 98.5% and this high rate was clinically satisfactory. In this case, all of the teeth had no residual coronal walls. However, the results were still clinically satisfactory. None of the posts and restorations were debonded or fractured. This success can be related to the superior advantages of the fiber posts. Fiber-reinforced posts have been recently used in restorative dentistry because of their superior properties, such as dentin-like rigidity. Furthermore, the elastic modulus of fiber posts is similar to that of dentin.26 These posts also have higher esthetic properties, require less dentin removal during treatment procedures, and can be bonded to dentin with adhesive luting resins.27 Furthermore, fiber-reinforced posts do not result in metal corrosion or allergic reaction and can be easily removed from a root canal when failure occurs due to the endodontic treatment.28,29

The clinical success of this case may also be related to the education level of the patient. The patient is a dentist, and thus she has high quality of oral hygiene habits. Furthermore, she does not have any harmful/parafunctional habits that may affect oral hygiene attempts negatively, such as smoking. When considering all of these factors, the restorations after 3 years has showed that the clinical service provided was satisfactory. However, the patient needs close monitoring in the near future.

The full ceramic restorations of endodontically treated upper anterior roots by using fiber-reinforced posts showed excellent esthetic results. Retention of fiber-reinforced posts used in extensive loss of tooth structure was good after 18 months and 3 years. Within the limits of this case study, it can be concluded that, fiber-reinforced post may serve as a good treatment alternative when restoring an endodontically treated tooth with extensive loss of tooth structures.

REFERENCES


