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A case report on rehabilitation of fractured maxillary anterior teeth using custom cast post and core and pre-fabricated fiber post and core

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Abstract
Crown fractures of permanent anterior teeth due to trauma is the most frequent type of injury encountered. Anterior crown fractures lead to discomfort and serious psychological, esthetic, and functional effects on the patients. This case report describes the post and core treatment of a maxillary central incisor. An 18-year-old female patient reported to the Department of Conservative Dentistry and Endodontics with the chief complaint of broken teeth in the upper front tooth region. On clinical examination, there was Ellis class III fracture of 11 and 21 resulting in loss of significant tooth structure necessitating post and core treatment. Treatment was initiated with access opening, the canal was located, working length was established followed by chemo-mechanical preparation and obturation. Post-space preparation was done in the canal post cementation with custom cast post and core in 21 and Pre-Fabricated Fiber Post and Core in 11 followed by full coverage crowns.

Keywords: Aesthetics, anterior tooth, custom cast post and core, pre-fabricated fiber post and core, fractured tooth

Introduction

Endodontic treatment is the regular procedure for treating the teeth in which pulp tissue is irreversibly inflamed or necrotic due to carious process or dental trauma. The remaining tooth structure is the key factor for determining the long term prognosis of endodontically treated teeth. [1] As a result, such tooth may require a post for rehabilitation. [2] Rehabilitation of a root filled teeth is related to several factors such as location, remaining amount of dentin walls, post cementation length, post system, final restoration and presence of the ferrule. [3] In anterior teeth with more than 50% tooth structure loss, post and core followed by full coverage restorations are mandatory. [4]

The foundation restoration for a mutilated tooth is a custom-made post and core. The primary objective of this procedure is providing retention for the core restoration, which replaces lost coronal structure. Post and core can be a one-piece custom-made post or prefabricated post with composite build-up. [5]

Cast metal posts have a high elastic modulus and have been used for several decades in restorative dentistry for restoring mutilated, endodontically treated teeth. [6] The custom-made post and core is indicated in various circumstances such as, when there is a gross loss of tooth structure, deep bite, in teeth with large canals and when a change in angulation is anticipated for improving aesthetics. [7]

This article reports a case of upper anterior teeth which were endodontically treated and rehabilitated using custom made cast post and core and pre-fabricated fiber post and core, followed by full coverage crowns.

Case Report

A 21-year-old male patient came to the Department of Conservative Dentistry and Endodontics, with a complaint of fractured upper front teeth and wanted to get that treated. The patient gave of history of accident six months back. (Fig 1) On intra-oral examination, complicated crown fracture was noted in relation to 11 and 21. Mild extrusion and discolouration of 12 were also noted. On examination, there was no pain and swelling. A vitality test of 12,11 and 21 was done with electric pulp tester and the cold test, and did not show any response. Radiographic examination showed fractured 11 and 21with pulp involvement and well-defined periapical radiolucency in relation to 12. On thorough clinical and radiographic examination, a diagnosis of asymptomatic apical periodontitis in relation to 12 was made. The treatment planned was root canal treatment of 12,11 and 21 followed by pre-fabricated fiber post and core in relation to 11 and custom cast post in relation to 21 and rehabilitation with full ceramic prosthesis. Aesthetic reshaping and non-vital bleaching in relation of tooth 12 are also planned.

After the rubber dam isolation, the aesthetic reshaping of 12 was done. Access cavities of 12,11, and 21 were prepared with endo access bur #2 (Densply, Mallifer, Switzerland). Working length was determined using an apex locator (Canal pro, Coltene, USA) and reconfirmed with radiographs. Biomechanical preparation of the canals was performed with hand instrumentation (Mani, Tochigi Ken, Japan). Apical preparation of 11 and 21 was done up to file size #70 and step back was done up to #90. Preparation of 12 was done up to file #40 and stepback upto #70. Canal irrigation was carried out with 15 mL of 3% sodium hypochlorite (Percan, Septodont, India) and 17% EDTA, intermittently. Calcium hydroxide paste (Metapex, Metabiomed, S Korea) was used as an inter-appointment medicament and the access cavity was temporized with Zinc Oxide Eugenol (ZnOE) cement.

The patient was asked to visit after 10 days. Intracanal medicament was removed. Final irrigation was carried out with 2% chlorhexidine (Asep-RC, Anabond, India). Obturation of 12,11 and 21 was completed with gutta-percha (Densply, Maillefer Switzerland) and AH plus sealer (Dentsply, Konstanz, German) using the lateral compaction technique. (Fig 5b)

Follow-up examinations over 3 months revealed that the patient was asymptomatic and radiographic examination showed signs of healing. Therefore, the definitive post-endodontic restoration of 11 with fiber post and core and that of 21 with custom cast post and crown was planned.

Post-space preparation of 11 was done using peeso reamers size 2 leaving 5mm apical gutta-percha intact for apical seal. The root canal dentin walls were etched with 36% phosphoric acid for 15 seconds. The acid was then removed with water sprayed for 20 seconds and the root walls were carefully dried with absorbent paper points prior to bonding procedures. Prefabricated post was cleaned with alcohol. Self-adhesive resin cement (RelyX U200, 3M ESPE, Germany) was introduced into the root canal space with an intracanal mixing tip and the fiber post was seated. Excess resin cement was removed, and the remaining cement was light-cured for 20 seconds to ensure adequate polymerization of the cement. The material excess was removed with diamond bur and a periapical radiograph was taken to confirm the fiber post adaptation and root sealing. The core build-up was done using composite and the tooth was prepared to receive a zirconia crown (Figure 2). A two-step putty-wash impression with polyvinyl siloxane was performed. The crown was luted with self-adhesive resin cement (RelyX U200, 3M ESPE AG, Germany). (Fig 3a)

On next appointment obturated material was removed from the tooth 12 up to 2 mm below the cemento-enamel junction. Stains in the pulp chamber were removed using round bur with the minimal destruction. After removal of the gutta percha and stains, a 2 mm glass ionomer cement (Type 2, GC Corporation, Singapore) was placed over the gutta-percha as a barrier material. Using 37% phosphoric acid, pulp chamber was etched for 30-60 s, washed and dried, which resulted in the opening of dentinal tubules. Following this, 37.5% hydrogen peroxide (pola office ultradent, USA) bleaching agent was placed immediately in the pulp chamber and dry cotton was tightly placed over this, the access cavity was sealed with temporary restoration. The patient was recalled after 1 week for assessment. Discoloration of 12 was completely removed and shade of the tooth was enhanced. (Fig 3b) The hydrogen peroxide mixture was removed from the pulp chamber using abundant saline and the access cavity was sealed with composite resin restoration. Patient did not experience any post-operative symptoms.

Post space preparation of 21 was done with peeso reamer size #3 in the next appointment, leaving 5 mm of gutta-percha at apical end of the root canal to maintain a good seal. Tooth preparation was made with shoulder finish line on the labial and palatal sides in relation to 21. Metallic posts were fabricated using an indirect technique. A separating media was applied to the prepared post space, and an impression of tooth 21 was fabricated using inlay wax (GC Corp, Tokyo, Japan). (Fig 4a) A temporary crown was cemented before dismissing the patient. The wax pattern was then cast into the metal post and core. The fabricated cast metal post and core for 21 was cemented using zinc-phosphate cement (Prevest Denpro, USA), and an elastomeric impression was made. (Fig 4b,6b) The shade selection was done in natural daylight. The Zirconia crown was made for 21 and cemented with resin cement (RelyX U200, 3M ESPE AG, Germany) (Figure 6b).

Fig 1: Pre operative clinical view

Fig 2: Fibre post and core on 11

Fig 3a: Before non-vital bleaching of 12

Fig 3b: After non vital bleaching of 12

Fig 4a: Wax pattern for cast post and core on 21

Fig 4b: Cast post and core on 21

Fig 5a: Pre operative radiographic view

Fig 5b: Obturation of 11 and 21

Fig 6a: Post operative radiograph

Fig 6b: Post operative clinical view

Discussion

A pleasing smile with healthy teeth is an integral part of overall appearance and self-esteem. Anterior crown fractures lead to discomfort and serious psychological, esthetic, functional and phonetic problems that can affect social relationships.

Endodontically treated anterior teeth have thin coronal structure due to access cavity and crown preparations. When the remaining tooth structure cannot provide adequate support and retention for restoration, endodontically treated teeth are usually restored with posts. The post aids in the retention of core in a tooth with reduced coronal tooth structure. [8, 9] This post and dowel helps to retain definitive restoration.

In the restoration of anterior teeth, many factors are to be considered depending on the patient's expectations. Restoring such teeth using materials with a similar elastic modulus to dentin appears advantageous due to the reduced risk of root fractures. The fracture resistance of endodontically treated teeth is dependent mainly on the amount of remaining tooth structure, the quality of adhesion and the type of post as posts increase the fracture resistance of the root, especially in the absence of a full crown. [10]

Posts can be generally classified as custom cast post or prefabricated post and dowel to retain the definitive restoration. Custom cast post reproduces the internal morphology of the canal preparation by using wax or auto polymerizing resin, which is then casted in either precious or non-precious metal alloy. [7] Most fiber posts are relatively radiolucent and are ready to use whereas metal post requires more clinical and laboratory time. Cast posts confirm to the canal morphology and can be used in all types of canal configurations- oval or elliptical. A slight change in core angulation can be done using cast posts and hence they can be used for correcting proclined teeth unlike other prefabricated posts. [11] Also, according to Gomez Polo *et al*., cast metal posts have shown higher survival rates over 10 years. [12] Another advantage of cast posts is that they can easily be retrieved if the tooth requires endodontic re-treatment.

Due to the need for additional appointments, temporization and laboratory fee, and with the advent of aesthetic glass fiber posts, the use of custom-made cast post and core has reduced over the years.

A 2 mm ferrule can increase the resistance of the endodontically treated anterior teeth to fracture. [13] Sorensen and Engelman [14] suggested that this "ferrule effect" be defined as a 360-degree metal crown collar surrounding parallel walls of dentine and extending coronal to the shoulder of the preparation. Libman and Nicholls [15] defined it as a metal band or ring used to fit the root or crown of a tooth. The crown restoration braces the tooth around this ferrule to enhance the integrity and longevity, providing resistance and retention form on the root canal treated tooth. It helps to transfer the occlusal forces vertically to the periodontium as the artificial crown and root act as one unit.

A retrospective analysis by Readal M *et al*., [16] stated that custom cast post and core treated teeth demonstrate an acceptable survival time. Long-term survival rates of 83% after 10 years, (14) 90% after 9 years, [17] and 89% after 7 years, [18] have been reported. These studies show that certain factors influence the survival rates of cast post and core. These factors include the metal alloy used, the type of restoration done, and the kind of prosthetic restoration.
Fiber post placement requires less time and the evidence from the laboratory and clinical experience of technicians and dental professionals, respectively emphasizes on the use of glass fiber posts.

Conclusion
A large diversity of post systems is available today and a thorough knowledge about the advantages, disadvantages, indications and contraindications of each post system must be acquired to make a wise choice. The selection of a post system mainly depends on the remaining sound tooth structure. The anatomical post constituted a clinical alternative for coronal and radicular reconstruction on endodontically treated teeth with significant destruction of dentin tissue. In addition to rehabilitating the tooth, this clinical proposal promotes a more balanced distribution of tensions from mastication without compromising the remaining tooth, minimizing the risks of radicular fracture. Establishment of esthetics and function for the patient has been achieved in this case using cast metal posts, Pre-Fabricated Fiber Post and all ceramic crowns for rehabilitation of anterior teeth.

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