ISSN 2515-8260 Volume 9, Issue 8, Autumn 2022

CASE REPORT

Esthetic Rehabilitation of Traumatically Fractured Anterior Tooth with Glass Fiber Reinforced Composite Post and Core- A Case Report

[1]Dr. Arunima Guru, [2]Dr. Ruchika Goyal

[1,2]Reader, Department of Pedodontics and Preventive Dentistry, Desh Bhagat Dental College and Hospital, Mandi Gobindgarh, Punjab, India

Correspondence:
Dr. Arunima Guru
Reader, Department of Pedodontics and Preventive Dentistry, Desh Bhagat Dental College and Hospital, Mandi Gobindgarh, Punjab, India
Email: arunima_guru@yahoo.com

Received: 24 February, 2022 Accepted: 22 March, 2022

ABSTRACT

The fracture of anterior teeth caused due to trauma is the most frequent type of injury in permanent dentition, especially among children and adolescents. The most commonly involved teeth are the maxillary central incisors because of their exposed position in the dental arch. Traumatized teeth require a quick functional and esthetic repair. Anterior crown fractures lead to psychological, esthetic, functional and phonetic problems that can affect social relationships and poses a challenge for the dentist to save these teeth. There is a loss of structural integrity, moisture and reduction in dentin toughness in endodontically treated teeth which necessitates special care during the treatment. Restoration of endodontically treated teeth should aim at replacing the missing tooth structure, maintain function, esthetics and protect against fracture and infection. This clinical case report presents the use of Glass Fiber–Reinforced Composite Post and Core for restoration of traumatically fractured permanent right maxillary central incisor in a 16-year-old female patient. Post-retained crowns are indicated for endodontically treated teeth with severely damaged coronal tissue. Metallic custom made and prefabricated posts have been used over the years. However, due to unacceptable color, extreme rigidity and corrosion, fiber posts were introduced. These are flexible, aesthetically pleasing and have modulus of elasticity comparable to that of dentine.

Keywords: Anterior teeth fracture, fiber post, trauma

INTRODUCTION

Trauma in children and adolescents require greater attention due to the physical and emotional state of both the patient and the family members. Fracture of the anterior teeth by trauma is the most frequent type of injury in the permanent dentition especially among children and adolescents, affecting up to 25% of this patient population.[1] Causes may include sports injuries, automobile accidents, fights, although falls are the most frequent cause. Endodontic treatment is usually required for the tooth affected by caries with pulpal involvement or trauma.

The restoration of endodontically treated teeth has been a debated topic. It represents a key factor during treatment planning because of its impact on the long-term prognosis of the

tooth.[2] Many changes occur to a tooth after root canal treatment, including the physical and chemical properties of dentin, its elasticity, resistance to fatigue, changes in the morphology and biomechanical behavior.[3] The practitioner should carefully examine the tooth. The tooth should be assessed for restorability, occlusal function and periodontal health and issues such as crown-to-root ratio should be evaluated. If these factors are found to be satisfactory, the tooth can be included in the comprehensive treatment plan.[4]

Restorations of endodontically treated teeth (ETT) are often achieved by using post and core.[5] For many years, the concept of using a post for the restoration of endodontically-treated teeth was based upon the philosophy that the post would "reinforce" the tooth and would provide additional retention for the core restoration. A post was generally placed in an attempt to strengthen the tooth however, a significant amount of dentin has to be sacrificed especially when a metal post is utilized, leaving the tooth more susceptible to fracture. So the real function of a post is not to strengthen the root but serves solely to improve retention of the core. Resistance to fracture of the non-vital tooth is related with the thickness of remaining root.[3]

Earlier prefabricated posts were made of metal which at times were visible through the tooth structure especially in the anterior region. Due to their high rigidity, metal posts vibrate at high frequencies when loaded with lateral forces. These forces can concentrate and cause longitudinal fractures of the root or metal corrosion and consequently lead to tooth loss. Some researchers have suggested that as these metallic materials have much higher moduli of elasticity than that of the supporting dentin, this mismatch in the moduli could lead to stress concentration eventually leading to its failure.[2]

Modern post materials such as carbon fiber, quartz, and glass fiber have been introduced into the dental practice. Resin-based restorative materials with tooth-colored fiber post are of choice these days due to advantages such as a suitable elastic modulus, esthetics, better bonding between post and cement, lower chair time and minimal tissue removal. The use of a fiber post with fractured teeth, as it interlocks the two fragments, minimizes the stress on the reattached tooth fragment.[6] Fiber's transparency makes it possible to use esthetic restorations for cases such as restoring a traumatized anterior tooth. Teeth restored with fiber posts, which have a modulus of elasticity close to the dentin, resist fractures better than teeth restored with metallic posts.[5]

This case report presents the use of Glass Fiber‑Reinforced Composite Post and Core for the restoration of traumatically fractured right permanent maxillary central incisor, in a 16 year old female patient.

CASE REPORT

A 16‑year‑old female patient reported to the department with a chief complaint of broken upper front tooth. The patient presented with crown fracture of her right maxillary central incisor. The history of trauma dated back to about two years when the patient had a fall while playing at home with siblings. At the time of injury, there was no bleeding and no medical or dental consultation was sought. The patient gave no history of pain when she came to our department. Her medical history was non-significant. On extra-oral examination, no significant findings were found. On intra-oral examination, there were no lacerations or evidence of alveolar bone fracture or any gingival inflammation. The right maxillary central incisor showed Ellis Class III fracture, with Grade I mobility and blackish discoloration. [Figure 1] The tooth was non-vital, with no response to the electric pulp test and other vitality tests. Radiographic examination showed complete root end development in the tooth of interest. [Figure 2A] The patient and parents were given detailed information about the treatment plan. An informed written consent was taken.

ISSN 2515-8260 Volume 9, Issue 8, Autumn 2022

Root canal treatment of the upper right central incisor was planned. Biomechanical preparation and debridement of the root canal was done and calcium hydroxide with Iodoform (Metapex) dressing was placed [Figure 2B]. After three weeks, obturation with gutta-percha was done [Figure 2C, D]. The gutta-percha was then removed using peeso reamers, leaving behind the apical 4 mm to maintain a good seal.

Figure 1: Pre-operative A) Intra oral view B) Extra oral view

Figure 2: Intra oral periapical radiographs w.r.t. 11 A) Pre-operative; B) Calcium hydroxide with Iodoform dressing; C) Master cone and D) Obturation with gutta percha

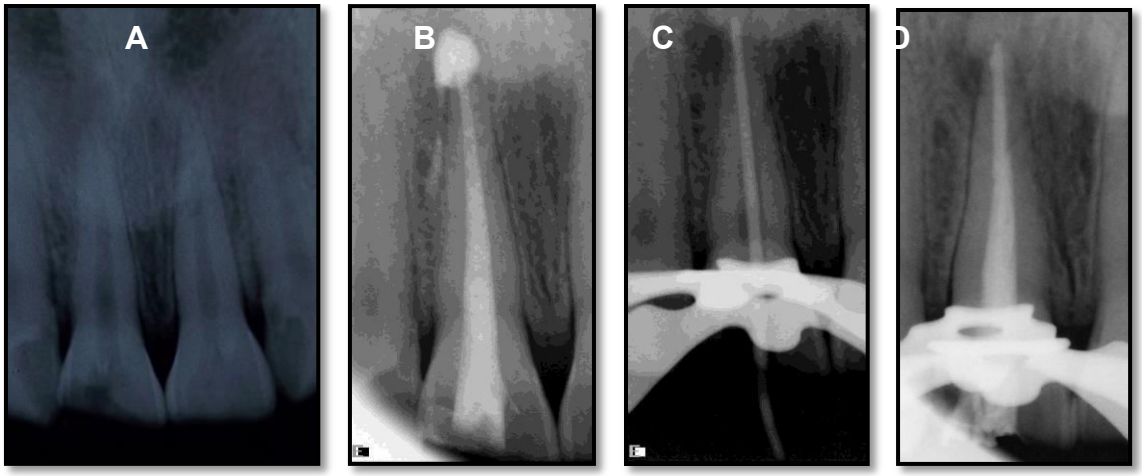

Figure 3: Cementation of post using resin cement in 11 Figure 4: Composite core build in 11

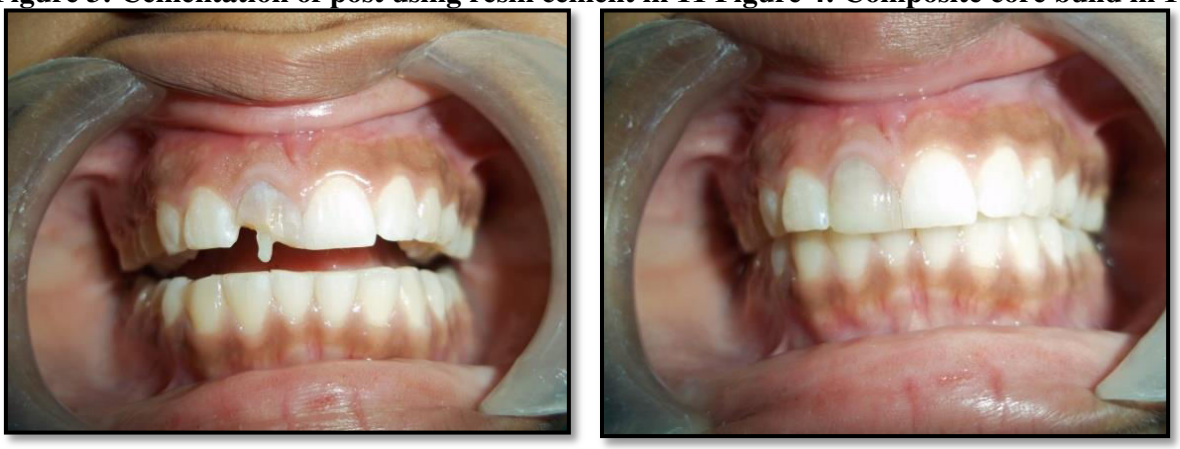

Figure 5: Tooth preparation for PFM crown **Figure 6: Metal coping in 11**

Figure 7: Post-operative A) Intra oral view **B) Extra oral view**

An intra-oral periapical radiograph was taken to confirm the post space and the fit of the post. Acid etching of canal was done with a 37% phosphoric acid gel for 20 seconds. Subsequently, the canal was rinsed copiously with water for 20 seconds and air dried with a gentle stream of air, making sure that there was no desiccation. Bonding agent was applied in the etched canal and light cured for 10 seconds. Then the glass fiber–reinforced composite post was placed into the canals up to the measured space, using a flowable composite [Figure 3]. The core build up was done with composite resin using the incremental technique and occlusal adjustments were made [Figure 4]. Then the tooth was prepared and after adequate gingival retraction, impressions were taken using silicon putty impression material [Figure 5, 6]. Complete coverage porcelain-fused-to-metal crown was fabricated and after evaluation of the crown in occlusion it was luted using Type I glass ionomer cement [Figure 7].

DISCUSSION

Traumatic tooth injures are common in children. More than 30% of the accidents occur at home and about 25% in school. Maxillary incisors are most commonly involved followed by upper and lower lateral incisors and the upper canines. Traumatized anterior teeth require quick functional and esthetic repair.[1] During the restoration of a traumatic endodontically treated tooth various factors need to be considered. These factors include retention of the restoration, the amount of remaining sound tooth structure, masticatory forces, prevention of microleakage and the esthetic appearance of tooth. Depending on the degree of instrumentation while doing root canal treatment, the tooth loses a significant amount of structural support. Now a days it is an accepted clinical practice to use a post to retain the coronal restoration after endodontic treatment when significant amounts of the coronal tooth structure is lost. The decision to use a post when restoring an endodontically treated tooth should be based on remaining tooth structure.[7] Posts are available in of a variety of materials including resin composite, metal and biologic material. Cast metal posts and cores are

commonly used because of their good mechanical properties. However, due to certain drawbacks of using metal posts, an alternative and more esthetic post system was required. Fiber posts were introduced two decades ago as an alternative to these systems. The early versions of fiber posts constituted carbon fiber embedded in a resin matrix. Their use was limited as they were black in color, leading to poor aesthetics. In addition, they were radiolucent.[8] The introduction to esthetic fiber–reinforced composite posts came in the 1990s. In recent years, various types of fiber‐reinforced composite resin posts have been introduced as an alternative to cast or prefabricated metal posts, as the elastic moduli of these fiber posts are closer to those of dentin. The distribution of the stresses to the root is more even and there is less risk of a root fracture. Fiber‐reinforced composite resin posts offer mechanical, functional and clinical advantages to the dentist and the patient.[1]

Dentists should take comfort in knowing that placing certain fiber posts to stabilize a core and reinforce an endodontically-treated tooth, is one of the most well-documented, scientifically-supported techniques available to us. Two decades of research have reinforced time and again the merits of fiber posts over other traditional post systems.[8] Hence used more because they are safer, aesthetic, conserve tooth structure and provide improved fracture resistance to these compromised teeth.[9]

Advantages of fiber posts include: a) Esthetics and they eliminate the need for the opaquer to mask the metal hue, b) Micro-retention achieved by acid etching is conservative method and hence superior to macro-retention, c) Fiber post/core is minimally invasive, d) The tapered design provides additional benefit of conserving radicular dentin and reducing functional stresses towards the apex without compromising strength, e) Fiber posts have high tensile strength, f) They show increased fatigue resistance and inherent rigidity, g) increased resistance to corrosion, h) Biocompatible to different core materials, i) They have good chemical bonding to Bis‐GMA resins, j) They can be easily removed by using special drills to allow endodontic re‐treatment without sacrificing dentin, k) Fiber posts can be radiopaque.

Fiber‐reinforced composite (FRC) posts contist of a high volume percentage of continuous reinforcing glass fibers embedded in a polymer matrix, which holds the fibers altogether. The matrix mainly comprises of epoxy or acrylic polymers, with or without filler materials. The fibers used in FRC posts may be unidirectional or bidirectional when classified according to fiber direction and whether they are pre‐impregnated with filled resin or unfilled resin. The stability of the fiber/polymer matrix and fiber post/core resin interface must be taken into consideration in evaluating the clinical longevity of FRC posts.[1]

Retention, resistance to fracture, and esthetics are the three important factors that are achieved with fiber reinforced composite post and core retained restorations for maxillary anterior teeth which make their use a wise decision. The most important aspect is that it can be done instantly and hence chair‐side time and number of appointments are reduced.

CONCLUSION

The use of a glass fiber reinforced composite root canal post and composite material can be a simple and efficient procedure for the treatment of anterior traumatized teeth, with excellent esthetic and functional results.

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