

Repair of class IV Ellis Fracture in the Permanent Central Incisor with a Crown Restoration and Fiberglass Post

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Abstract

Background: A dental injury is an emergency requiring immediate treatment to reduce pain and restore the tooth's function and aesthetics. The maxillary central incisors are the teeth most commonly affected by trauma. Some articles have reported that 58.6% of patients aged 7–15 years old have sustained dental injuries in the form of maxillary incisor crown fractures. This may occur before or after root formation is complete, and the results may range from pulp inflammation to pulp necrosis. A class IV Ellis fracture describes a traumatized tooth that has become non-vital, with or without the loss of the tooth structure. It is important to determine the pulp vitality and root development stage in order to create a treatment plan. **Case report:** This paper describes the management of a class IV Ellis tooth fracture in a permanent central incisor via crown restoration with a fiberglass post after an endodontic procedure in a 14-year and 8-month-old patient. **Discussion:** Non-vital traumatized teeth require root canal treatment followed by crown and post core restoration for intra coronal retention. A fiberglass post and resin is an option in this case because of its advantages when compared to a metal post, including good aesthetics, adhesion to the dentin (mono block dentin-post-core system), and modulus of elasticity, which is almost the same as that of dentin. It can distribute pressure equally in the root, reducing the risk of fracture. **Conclusion:** The 14-week follow-up examination showed that the restoration remained in place and was successful.

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Introduction

Anterior tooth fractures are the most common type of dental trauma in children, often affecting those individuals 12–36 months and 7–15 years of age.¹ The average incidence of injuries to the anterior teeth reported in the literature ranges from 4–46%, with 36.8% in the primary dentition and 58.6% in permanent dentition.² Traumatic dental injuries are more prevalent in permanent teeth (58.6%) than in the primary dentition (36.8%). Physical activity at home, at the playground, and at school accounts for a significant proportion of dental injuries in young children.^{1,3}

Pulp necrosis is one consequence of dental trauma, which can vary depending on the type of fracture. An uncomplicated fracture (enamel and dentin) can cause pulp necrosis 2–5% of the time; however, in a complicated fracture (enamel, dentin, and pulp), the survival of the pulp varies between 63 and 94%. The appropriate treatment can maintain pulp vitality in 75.8% of the cases over a long period of time.²

Dental injuries are emergency situations that require immediate treatment to reduce pain and restore the function and aesthetics of the tooth, as well as the patient's psychological well-being. A class IV Ellis fracture is one type dental fracture that causes pulp necrosis, with or without the loss of the crown structure. This condition is sometimes asymptomatic, so the patient may not seek dental treatment immediately after the injury. Unfortunately,

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untreated traumatized teeth can undergo further damage, such as necrosis, discoloration, periapical infection, and root resorption, which can lead to loose teeth.⁴

Various treatment modalities are available, depending upon the clinical, physiological, and radiographic status of the tooth. For example, a complicated crown fracture may require an endodontic procedure. A post-endodontic tooth loses a considerable amount of its hard tissue structure, requiring the intracellular retention of pegs to support the final restoration.^{5,6} Traumatized anterior teeth need both functional and aesthetic treatments, with metal fused to a porcelain crown with a fiberglass post being the preferred material for aesthetic reasons. The use of fiberglass as a post material can be a good alternative for overcoming certain potential problems, such as root fractures.^{5,7}

Case report

A 14-year and 8-month-old male patient presented to the Pedodontic Clinic at the RSGM Faculty of Dentistry at the University of Indonesia with an aesthetic complaint regarding a maxillary central incisor. His dental history revealed that an accident at home 2 years previously caused a coronal tooth fracture of his anterior teeth. Both clinical and radiographic examinations were conducted. The clinical examination revealed a fracture in the middle third of the crown and non-vital pulp of the maxillary left central incisor, and an enamel-dentin fracture without pulp exposure in the maxillary right central incisor (Figure 1).



Figure 1. Apical teeth upon presentation.

However, there was no mobility or displacement. A periapical radiograph confirmed pulpal involvement in the maxillary left central incisor accompanied by a periapical abscess, and an enamel-dentin fracture of the right central incisor with no pulpal involvement (Figures 2).



Figure 2. Radiographic view upon presentation

The treatment plan included root canal therapy for the maxillary left central incisor. The root canal was obturated using endodontic sealer via the laterally condensed gutta percha technique. After two weeks, the gutta percha was removed at 2/3 of the root length in order to place a fiberglass post and leave 5 mm of gutta percha to maintain an apical seal. The root canal was irrigated with 2.5% NaOCl and dried with a paper point.

All of the dental surfaces were etched with 37% phosphoric acid for 10 seconds. Then, a glass fiber post (FibreKleer™ 4x, number 1.5; Pentron Dental Products, Wallingford, CT, USA) was placed in the root canal using a dual-curing luting system (Breeze; Pentron Dental Products) prior to the application of a bonding agent. After the fiberglass post was cured, the core was made by adding composite resin into the coronal fragment (Figure 3).



Figure 3. Apical view with fiberglass post in place.

The working length of the fiberglass post was confirmed with a radiograph (Figure 4). In this case, due to the loss of more than 50% of the crown tissue and the deep bite of the patient, it was prudent to use an entire covered tooth surface restoration. The selected restoration was a partly veneer metal porcelain crown (Figure 5).



Figure 4. Radiographic view with fiberglass post in place.



Figure 5. Apical view after fracture repair.

Discussion

This paper described a pediatric class IV Ellis fracture of the maxillary left central incisor in a 14-year and 8-month-old boy. According to the literature, these are often the most fractured teeth (73%) because the anterior upper tooth position is more prominent inside the mouth. There is a traumatic pattern connected with children in the literature, in that permanent tooth trauma often occurs in children aged 7-15 years old, in boys twice as often as girls, because of the increase in their activities.^{1,3,8}

The clinical and radiographic examinations showed that this tooth fracture involved the pulp. Radiolucency at the apical end and a positive percussion test result showed the pathological condition of the periapical tissue. A negative vitality test result showed that the tooth was already non vital. In this case, the class IV Ellis fracture in the maxillary left central incisor was treated endodontically, because infection had reached the periapical tissue and root constriction had begun.^{4,9}

The treatment began with a root canal preparation of matching length, and the patient was given a ChKM solution (27% 4-chlorophenole, 71% racemic camphor, and 1.6% levo menthol) for one week to keep the root canal dry and sterile. After two weeks of treating the root canal, there were no patient complaints. The radiographic images showed no radiolucency in the apical maxillary left central tooth. Next, gutta percha was placed at 2/3 of the root length in order to hold the post. The literature states that the post length must be at least the same length as the clinical crown (or 2/3 of the root length), leaving 5 mm of gutta percha to maintain an apical seal. This amount is recommended because the apical area consists of many lateral canals and curvatures.^{5,7,10}

Some research has shown satisfying results if the root canal treatment is followed by a core post restoration as the intra coronal restoration. A fiberglass post and resin was the option in this case due to its good esthetics and adhesion to the dentin, when compared to a metal post. Another advantage of using a fiberglass post is that its modulus of elasticity is similar to that of dentin, creating a mono block dentin-post-core system. When the post is attached to the core, resin cement, and root, it forms a mono block or unity of similar structures with flexural characteristic that are almost the same as those of dentin; therefore, it can distribute pressure equally in all axes of the tooth, reducing the chance of a root fracture. This is markedly different from a metal post, which makes the tooth vulnerable to root fractures. A fiberglass post also has translucent characteristics, radiopacity, and comes in many sizes so that it can be adjusted to match the root canal width.^{5,6,10-12}

Fiberglass post cementing with dual-cure resin is indicated for the luting procedure, due to its low solubility, high mechanical quality, and good adhesive ability. This resin cement hardens with the use of light and chemicals; therefore, it is expected to undergo perfect cement hardening. Resin cement that is not exposed to light can be activated with an advanced chemical reaction, thereby hardening the cement perfectly.¹¹

In this case, due to loss of more than 50% of the crown tissue and the deep bite of the patient, it was advisable to use an entire covered tooth surface restoration. The selected restoration was a porcelain metal crown (partly veneer metal porcelain crown), due to the fact that the metal resists the occlusal load and the porcelain provides good esthetics (including a stable color over a long period of time), resists mal adaptation, and provides good.¹²

Conclusion

In this case, the recommended treatment was root canal therapy and a crown restoration with a fiberglass post, based on its ability to distribute pressure equally in the tooth root, thereby reducing the risk of root fracture. The 14-week follow-up examination showed that the restoration was successful.

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