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Management of Traumatized Permanent Maxillary Immature Incisor with Oblique Subgingival Crown-root Fracture

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Abstract

Background: Trauma to the anterior teeth is a common injury in young children. The maxillary incisors being the most affected. Although root fractures are rare, they do occur and were previously and often considered hopeless and were extracted. The time between the injury and the initiation of treatment, level of the fracture line, and stage of root development are some criteria to be considered when choosing a treatment approach for a complicated tooth fracture. This case report describes the management of a traumatized immature maxillary central incisor with Elise class IV fracture with vertical oblique subgingival fracture of the root.

Materials and method: Apexification was carried out using biodentine followed by removal of the fractured segment. A fiber post was cemented in the root canal with resin cement. The coronal portion of the tooth was restored using anterior light cured composite material. The tooth was examined and evaluated after 1 week and after 2 months by clinical examination and radiographical evaluation of root development.

Results: The follow up evaluation revealed clinical and radiographical success. Radiographic view showed continued development in the apex of the root and showed normal periodontal ligament space and dense lamina dura.

Conclusion: Extraction should not be the first choice of treatment for extensively damaged young permanent teeth in the anterior region; instead, alternative treatment modalities must be considered**.** The traumatized immature tooth was saved and restored.

Key words: traumatized teeth, subgingival root fracture, immature permanent incisors.

Introduction

Traumatic injuries occur more commonly in young patients and vary in severity from enamel fractures to avulsion. Trauma to developing teeth is common in patients between the ages of 8 and 12 years and might lead to pulpal necrosis with subsequent halted development of the root [(1)].

The resultant divergent dentinal walls and open apex render these teeth more susceptible to fracture, especially in the cervical area. Retention of these teeth, however, remains critically

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important because other alternatives, such as implant supported restorations or fixed prostheses; require completion of craniofacial growth for acceptable outcomes [2, 3].

Diagnosis of root fracture is an important procedure to assess the prognosis and determine the appropriate treatment for the individual tooth. For a successful outcome, it is imperative to arrive at an appropriate diagnosis and design a treatment plan accordingly as soon as possible [4].

The prognosis of the affected tooth is influenced by several factors, such as age of the patient, stage of root formation, degree of dislocation of the coronal fragment, mobility of the coronal fragment and width of diastasis between the fragments [5].

Case Report

A 10-year old child attended the Pedodontic clinic at the teaching hospital of the college of dentistry, University of Baghdad. The child complained of pain in an anterior tooth due to a fractured tooth. When a complete explanation of the history of the involved tooth and clinical examination was taken the following was revealed:

a) The maxillary right central incisor was subjected to trauma two weeks ago at school due to a fall from the school's stairs.
b) The crown of the tooth fractured and fell off at school and the fractured segment of the crown was not brought back with the child.
c) The child experienced painful sensitivity and sought treatment at a medical center nearby his home but was given antibiotics and analgesics only. No attempt was made to treat the tooth clinically.
d) Clinical examination revealed a class II dento-alveolar overjet, which increases the susceptibility to anterior tooth injury. The upper right central incisor was fractured (class IV Elise classification) at the middle third labially extending toward the palatal side to end subgingivally (supraosseous). Palataly the fracture line was oblique extending subgingivally separating a piece palataly (complete). The piece was slightly mobile held in position by the periodontal ligaments but the extension could not be seen clinically (figure 1).
e) Radiographically the fractured line was identified but was vague (figure 2). Root development was more than two-thirds of its length and the apex of the maxillary right central incisor was not completely formed (immature).

Treatment options were explained to the patient. The risk of failing to achieve a successful end result and the decision to extract the tooth was also considered by the dentists and the parents. Consent was obtained from his parents for the treatment chosen.

Anesthesia was established labially and palataly by local infiltration (lidocaine hydrochloride 2% with 1:80,000 adrenaline, Lignospan special, Setodont, France). The root canal was extirpated using a barbed broach and instrumentation of the canal was done to slightly debride the dentine and to shape the canal. Care was taken so as to maintain the fragment piece in its position. Irrigation of the root canal was done during the entire procedure using normal saline (sodium chloride 0.9% w/v I.V infusion, ADWIC Pharmaceuticals Division, Egypt). The length of the canal was registered with aid of a radiographic image. After drying the canal with paper points a non-setting calcium hydroxide dressing was applied (Metapex, Meta Biomed Co. Ltd., Chungcheongbuk-do, Korea)

to the estimated working length and the tooth was closed with a temporary filling for a period of one week (figure 3) [6].

After a week the tooth was reopened and the dressing was removed mechanically by the use of reamers and washed out by irrigating the canal with copious amounts of sterile normal saline [6]. After that drying the canal with paper points was done and apexification was carried out.

Biodentine (Biodentine™ Septodont, St. Maur-des-Fossés, France) was chosen to form an apical plug in the procedure of apexification. It was handled according to the manufacturer instructions. After mixing the material it was immediately carried into the root canal orifice by the use of an amalgam carrier and into the canal to the apical region by the use of a finger plugger (Dentsply Maillefer Swiss Made type) [7]. The working length of the finger plugger was adjusted 3-4 mm shorter than the estimated working length so that the apical plug formed was 4-5mm. The plug was checked radiographically. If creation of an ideal plug failed from the first attempt, it was rinsed with sterile saline with mechanical removing by reamers and the procedure was repeated. A cotton pellet was applied in the coronal portion of the orifice in order to allow the material to set. Biodentine sets in 12 minutes but it was left to set for half an hour in this case just to be sure (figure 4) [8].

Removal of the loose fragment was the next step. The segment was removed by separating the periodontal ligaments holding it palatally using a dental probe and tweezers. A cotton pellet was applied with pressure on the bleeding area for ten minutes to control the bleeding. A stainless-steel band was applied held by a matrix band retainer and wooden wedges mesial and distal to the tooth. The margins of the fracture line were now clinically visible. A fiber post (glass fibre post #4 Fibrapost, Produits Dentaires SA, Switzerland) that fitted the root canal to reach the apical plug was prepared. Resin cement (self-adhesive resin cement, RelyX™ U200, 3M ESPE, Germany) was mixed according to the manufacturing instructions and was applied inside the root canal by the use of a reamer to coat the canal walls with efficient amount. The post was then inserted to the full length of the remaining portion of the unfilled canal. Excess resin cement was pushed out as the post was inserted. The cement was left for 10 minutes to set. The coronal portion of the post fiber was adjusted using a high speed turbine so that it would not interfere with the contour of the final build-up of the coronal portion.

The crown was restored to its normal shape, obtained by observing the left maxillary central incisor, with a light cured composite filling material (tetric EvoCeram, ivoclar vivadent) (figure 5 a-g).

Follow up clinical and radiographic examination was done at 1and 4 months recalls (figure 6). Clinical examination performed at the follow-up visits revealed adequate clinical function, the absence of pain and tenderness to percussion or palpation, as well as the absence of mobility and sign or symptoms of inflammation or infection; moreover, radiography displayed the intact PDL and lamina dura. It also showed the completion of root development and apical closure.

Discussion

Subgingival fracture of a tooth presents a challenging restorative problem. Diagnosis of root fracture is an important procedure. Intraoral radiography is the most widely used

imaging modality to detect root fracture. However, three-dimensional (3D) images using various CT methods have been adopted to overcome the inherent disadvantages of conventional radiographical methods, that is, magnification, distortion and anatomic superimposition of two-dimensional (2D) images [9, 10] .

Diagnosis of the fracture in this case was done using conventional radiographic technique because after explaining the technique, advantages and amount of radiation the child would be exposed to by the cone beam computerized tomography, the parents refused to use it for diagnosis. The main reason for refusal was the exposure to high amounts of radiation. Anyway, the line of fracture was seen and located.

Extraction should not be the first choice of treatment for extensively damaged young permanent teeth in the anterior region; instead, alternative treatment modalities must be considered. Age is an important criterion for managing a tooth with pulp exposure, because older pulps are less cellular and more fibrous, and may have less blood supply, affecting the treatment outcome. Another factor that affects the treatment modality is the time spent after the trauma and until treatment is sought [11, 12].

In this case the root of the traumatized tooth was immature and the arrival to the dental clinic was after two weeks so continued growth of the root by a vital pulpotomy was excluded. The idea of choosing the technique for treating this case was adopted from previous studies, from the clinical evaluation of treatment prognosis and the willingness of the child and parents to cooperate.

The apical plug thickness was 4-5 mm which resulted in a remaining empty root canal of 13-14 mm This was favorable so that the bulk of the fiber post and the resin cement would bond to the middle and coronal portion of the root dentin which was considered as the area of strongest adhesion to the resin cement and the post fiber. This was explained in a previous study that the bond strength seems to be influenced by tubule density and area of atubular dentin. At the apical third the dentinal tubules decrease compared to the more coronal regions, and because the adhesion is enhanced by penetration of the resin into the tubules, its values are low at the apical third [13, 14, 15]. The fitness of the prefabricated fiber post is a critical factor in post retention and it should not rely only on the bonding ability of resin cement for post retention [16].

The main reasons for carrying out the procedure using a prefabricated fiber post were that it showed higher bond strength than the prefabricated zirconia post, due to presence of epoxy resin in the chemical structure of fiber post. This will give a capacity for this post to form a chemical bond with the cement [13].

Recently developed self-adhesive resin cements do not require pretreatment of the dentin. Because these cements do not use an adhesive system, they drastically reduce the number of application steps, shortening clinical treatment time and decreasing technique sensitivity since it minimizes procedural errors throughout the treatment phases [17].

Utilization of fiber posts to restore endodontically treated teeth is mainly advantageous for preventing root fractures [18].

As conclusion, traumatically fractured teeth with an oblique crown-root fracture and immature root could be successfully treated. The treatment modality depended on the age of the child and the time elapsed between the subjection to trauma and the start of treatment.

References

1- Schmoldt SJ, Kirkpatrick TC, Rutledge RE, Yaccino JM. Reinforcement of Simulated Immature Roots Restored with Composite Resin, Mineral Trioxide Aggregate, Gutta-percha, or a Fiber Post after Thermocycling. JOE 2011; 37(10): 1390-1393.

2- Andreasen FM, Andreasen JO, Bayer T. Prognosis of root-fractured permanent incisors: prediction of healing modalities. Endod Dent Traumatol 1989; 5:11–22.

3- Op Heij DG, Opdebeeck H, Steenberghe DV, Kokich VG, Belser U, Quirynen M. Facial development, continuous tooth eruption and mesial drift as compromising factors for implant placement. International Journal of Maxillofacial Implants 2006; 21: 867–78.

4- Prithviraj, Bhalla HK, Vashisht R, Regish KM, Prema. An Overview of Management of Root Fractures. Kathmandu Univ Med J 2014; 47(3):217-25.

5- Shruthi N, Sreenivasa Murthy BV, Sundaresh KJ, Mallikarjuna R. Diagnosis demystified: CT as diagnostic tool in endodontics. BMJ Case Rep 2013; 2013.

6- Sj€ogren U, Figdor D, Sp_angberg L, Sundqvist G. The antimicrobial effect of calcium hydroxide as a short-term intracanal dressing. Int Endod J 1991; 24:119–25.

7- Nayak G and Hasan MF Single visit apexification with Biodentine. The Korean Academy of Conservative Dentistry. RDE 2014;39.

8- Gurudutt N, Mohammad FH. Biodentine-a novel dentinal substitute for single visit apexification. Restor Dent Endod. 2014; 39(2):120-125.

9- Nair MK, Nair UP, Gröndahl H-G, Wallace JA. Accuracy of tuned aperture computed tomography in the diagnosis of radicular fractures in non-restored maxillary anterior teeth-an in vitro study. Dentomaxillofac Radiol 2002; 31:299-304.

10- Mora M, Mol A, Tyndall D, Rivera EM. Effect of the number of basis images on the detection of longitudinal tooth fractures using local computed tomography. Dentomaxillofac Radiol 2007; 36:382–386.

11- Zahedpasha S, Safarcherati H, Rahmati-Kamel M, Mehrani-Sabet J. Multidisciplinary management of subgingival crown–root fracture of an immature permanent maxillary central incisor. Dent Res J (Isfahan) 2012; 9(3): 357–360.

12- Massler M. Therapy conductive to healing of the human pulp. Oral Surg Oral Med Oral Pathol. 1972; 34:122–30.

13- Al-Jumaily AA, Al-Azzawi HJ. Comparison of regional bond strength among different types of posts luted with different types of cement. J Bagh College Dentistry 2014; 26(1): 1-6.

14- Ferrari M, Mannocci F, Vichi A, Cagidiaco MC, Mjör IA. Bonding to root canal; structural characteristics of the substrate. Am J Dent 2000; 13(5):255-60.

15- Al-Jaff AF, Al-Azzawi HJ. Comparison of bond strength in different levels of post space of fiber-reinforced post luted with different resin cements. J Bagh College Dentistry 2011; 23(3): 1-5.

16- Pahlevan A,Mirzaei M,Akbarian S. Shear bond strength of zirconia post to root dentine with two different cements and comparison with fiber post. JIDA 2011; 23(1):17-23.

17- Monticelli F, Ferrari M, Toledano M. Cement system and surface treatment selection for fiber post luting. Med Oral Pathol Oral Cir Bucal 2008; 13: 214–21.

18- Goto Y, Nicholls J, Phillips K, Tungue T. Fatigue life of endodontically treated teeth with three post systems. Info @ cda-adc.ca CDA Resource center. CITED IN Subhy AG. Retention of three endodontic posts cemented with adhesive resin cement. J Bagh College Dentistry 2008; 20(2):1-8.

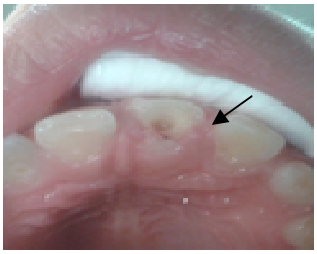

Figure 1: clinical occlusal view of the fractured tooth showing the line of fracture palataly.

Figure 2: diagnostic x-ray for the fractured maxillary right central incisor (arrow points the line of fracture)

Figure 3: injection of calcium hydroxide as a dressing for one week

Figure 4: apexification of the root with an apical plug of biodentine 4-5mm in thickness.

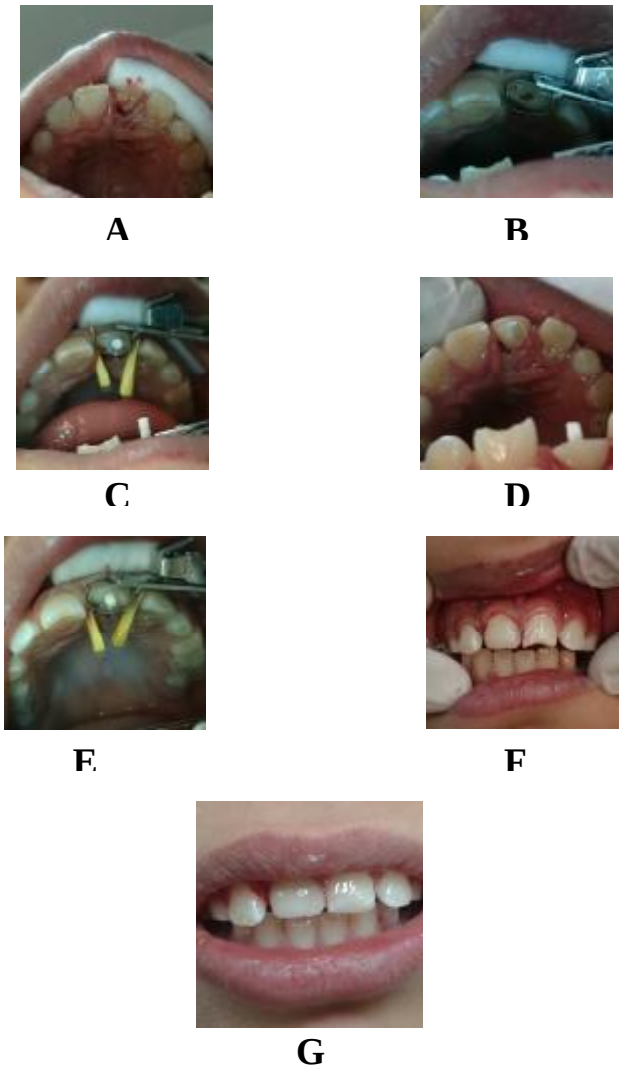

Figure 5: restoration of maxillary right central incisor; a-removal of fractured segment b-isolation of the tooth with matrix band and retainer c-cementation of fiber post using resin cement d-adjustment of fiber post e-isolation of tooth with fiber post cemented f-build up composite restoration of the right incisor crown g-restoration of the left incisor crown (figures from a-e were taken from image reflected on an intraoral mirror).

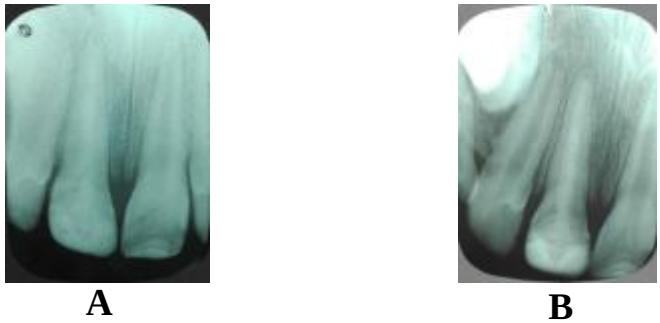

Figure 6: follow-up x-rays, a-at one month b-at four month.