

Management of horizontal root fractures at various levels: A case series

James David Raj, Sindhu Ramesh, S. G. Khirtika

Department of Conservative Dentistry and Endodontics, Saveetha Dental College, Saveetha University, Chennai, Tamil Nadu, India

Correspondence: Sindhu Ramesh, Department of Conservative Dentistry and Endodontics, Saveetha Dental College, Saveetha University, 162, Poonamallee High Road, Chennai - 600 077, Tamil Nadu, India. Phone: +91-9840136543. E-mail: drsinsushil@gmail.com

ABSTRACT

Root fracture is one of the consequences of dental trauma. It comprises up to 3% of all dental injuries and is sometimes difficult to diagnose. The possibility of saving the fractured tooth depends on the level of the fracture and also on the vitality of the pulp. This case report is to present the use of mineral trioxide aggregate sealer in addition to fiber-reinforced composite post to reinforce maxillary central incisors with horizontal root fracture at the cervical and middle third.

Keywords: Dental trauma, endodontic therapy, healing, root fracture

Introduction

Root fracture occurs due to direct force upon the root structure. Frontal forces create zones of compression over the labial or lingual or palatal part of the root resulting in separation of the root into the coronal and apical fragment. This causes detrimental effects on the biological structures such as the cementum, dentin, pulp, and periodontium of the tooth.^[1]

Root fractures in permanent teeth are uncommon injuries and represent complex healing patterns and are seen more commonly in children. Incidence of horizontal root fractures ranges from 0.5% to 7% in permanent teeth and from 2% to 4% in primary teeth for all traumatic dental injuries.^[2,3]

Root fractures may be located at the coronal, middle, or apical portions. Mid third fractures are the most common, and cervical fractures are rare. These fractures are generally transverse to oblique and may be single or multiple, complete or incomplete.^[4]

Treatment involves repositioning and stabilizing the tooth in its correct position and monitoring for an extended period of time for pulpal vitality.^[5] Root fractures represent complex healing patterns due to concomitant injury to the pulp, periodontal ligament, dentine, and cementum.^[6]

The healing sequelae of root fractures can occur in four different ways which include healing with tissue, giving union across the fracture; healing with interposition of hard and soft tissue between the fragments; healing with interposition of only soft tissue or lastly no healing at all.^[7]

Mineral trioxide aggregate (MTA) is a biocompatible material that has various clinical applications in endodontics. It is used for some endodontic procedures involving root repair and bone healing.^[8]

The purpose of this article is to present the use of MTA sealer in addition to fiber-reinforced composite post to reinforce maxillary central incisors with horizontal root fracture at the cervical and middle third.

Case Reports

Case 1

A 29-year-old male was referred to the Department of Conservative Dentistry and Endodontics, Saveetha Dental College, Saveetha University, Chennai, Tamil Nadu, India, in the month of December 2011 with a complaint of mobility in the upper front tooth for the past

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1 week. The patient also reported that he met with a road accident when he skids off road as he lost control of his motorbike. Extraoral examination revealed lacerations on the lip and suture has been placed by a General Physician [Figure 1]. The intraoral examination revealed Grade II mobility in 11. Intraoral radiographs revealed radiolucent line at the apical third of 11 suggesting horizontal root fracture in the apical third of 11. Electric pulp test, heat test, and cold tests gave a negative response, but this initial lack of response to these tests in traumatized teeth does not imply an irreversible damage to the pulp.^[9]

Under local anesthesia, the tooth was repositioned using gentle digital manipulation. Rigid splinting of teeth was done using 0.7 mm stainless steel wire and composite resin.

The patient was put on analgesics and was advised to avoid mastication in the area. 4 weeks after the first visit, the patient returns to the office with intraoral swelling and pain in relation to 11. Still, there was no response to the EPT, heat and cold test which revealed complete necrosis of pulp. Therefore, root canal therapy was initiated. Obturation was done using Gutta-percha points and MTA Fillapex sealer, Angelus. The following week, using the peeso reamers, post space was prepared. Canal was conditioned with 37% phosphoric acid, bonding agent applied and cured for 20 s, and FRC post was treated with Monobond-S (Silane coupling agent) finally luted with RelyX arc, 3M ESPE dual cure cement [Figure 2]. Composite entrance filling was given in Figure 3.

After 90 days, the right maxillary central incisor's mobility was regarded as normal; thus, the splint was removed. After 1 year of clinical and radiographic follow-up, tooth presented no symptoms and radiographic pathology suggesting a repair of root fractures.

Case 2

A 51-year-old male was referred to the Department of Conservative dentistry and endodontics, Saveetha Dental College, Saveetha University, Chennai, India, with a chief complaint of pain and mobility in the upper front tooth for the past 2 days [Figure 4]. The patient also reported that he fell off the staircase and in the



Figure 1: Pre-operative photograph showing palatally tipped left central incisor

process, this trauma occurred. No extraoral findings were seen. The intraoral examination revealed Grade II mobility in 11. Intraoral radiographs revealed radiolucent line in the middle third of the root of 11 suggesting horizontal root fracture in the middle third aspect of the root of 11. Electric pulp test, heat test and cold tests gave negative response.

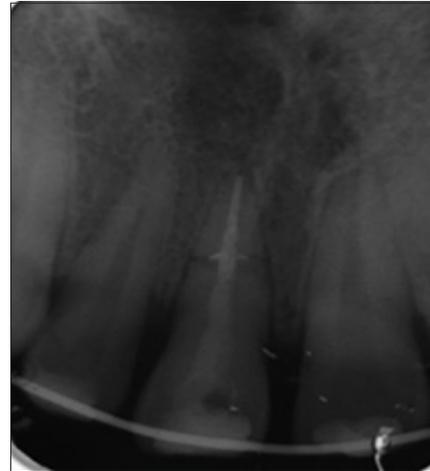


Figure 2: Endodontic treatment followed by fiber-reinforced composite post placement



Figure 3: Post-operative photograph

Under local anesthesia, the teeth were repositioned using gentle digital manipulation. Temporary semi-rigid splinting was given in relation to upper anterior (13-23) using 0.7 mm stainless steel wire and composite resin for a period of 12 weeks.

The patient was put on analgesics and was advised to avoid mastication in the area. 1 week later, the patient returns to the office complaining of pain in relation to 11. EPT and thermal tests showed a negative response in 11 which revealed complete necrosis of pulp. Hence, root canal therapy was initiated. Obturation was done using Gutta-percha points and MTA Fillapex sealer, Angelus by lateral condensation technique. The following week, using the peeso reamers, post space was prepared. Canal was conditioned with 37% phosphoric acid, bonding agent applied and cured for 20 s, and FRC post was treated with Monobond-S (Silane coupling agent) finally luted with RelyX arc, 3M ESPE dual cure cement [Figure 4]. Composite entrance filling was given in Figure 5.

Splint was removed at the end of 3 months (12 weeks). After 1 year of clinical and radiographic follow-up, tooth presented no symptoms and radiographic pathology suggesting a repair of root fractures (Figure 6).

Case 3

A 20-year-old male was referred to the Department of Conservative dentistry and endodontics, Saveetha Dental College, Saveetha



Figure 4: Pre-operative photograph showing fractured left central incisor



Figure 5: Endodontic treatment followed by FRC post placement

University, Chennai, India, with a complaint of pain and mobility in the upper front tooth for the past 2 days [Figure 7]. The patient also reported that he met with a road accident when he was riding his bike back home and got hit by a car. No extraoral findings were seen. The intraoral examination revealed 21 fracture of 12, 11, and Intraoral radiographs revealed a radiolucent line involving the Coronal third of 11 suggesting horizontal root fracture in the Coronal third aspect of 11. Electric pulp test, heat test, and cold tests gave negative response.

Under local anesthesia, the teeth were repositioned using gentle digital manipulation. Temporary semi-rigid splinting was given in relation to upper anterior (13-23) using 0.7 mm stainless steel wire and composite resin for a period of 12 weeks.

The patient was put on analgesics and was advised to avoid mastication in the area. After a period of 6 weeks, the patient reported back with discolored 11 and intermittent pain in 21. EPT and thermal tests showed negative response in 11 and 21 which reveals + complete necrosis of pulp.

Root canal therapy was initiated. Obturation was done using Gutta-percha points and MTA Fillapex sealer, Angelus by lateral condensation technique. The following week, using the peeso reamers, post space was prepared. Canal was conditioned with 37% phosphoric acid, bonding agent applied and cured for 20 s, and FRC post was treated with Monobond-S (Silane coupling agent) finally luted with RelyX



Figure 6: Post-operative photograph



Figure 7: Pre-operative photograph showing fractured left central incisor

arc, 3M ESPE dual cure cement [Figure 8]. Composite entrance filling was given, crown preparation was done, and Ceramic crown was cemented in 21, 11 [Figure 9].

Splint was removed at the end of 3 months (12 weeks). After 1 year of clinical and radiographic follow-up, tooth presented no symptoms and radiographic pathology suggesting a repair of root fractures.

Discussion

The long-term success should be identified by the absence of clinical and radiographic signs indicating pathological alterations. If these signs were observed in the follow-up, further clinical procedures will be required.^[10]

The success of the treatment of a root fracture depends, among other factors, on maintenance of pulpal vitality and level of fracture. The success rate varies but has been reported to be approximately 74%.^[9]

Success after root fracture depends on the degree of pulp injury and repair by a hard tissue bridge and repair by the ingrowth of connective



Figure 8: Endodontic treatment followed by FRC post placement



Figure 9: Post-operative photograph

tissue and hard tissue between the fractured pieces. If the dental pulp is necrotic, repair does not occur without root canal treatment.^[11]

According to Andreasen, the location of the root fracture does not effect pulp survival, and long-term rigid fixation of the coronal segment is the first choice of treatment. Avoidance of any occlusal contact of the involved tooth should also be managed. Further, dental treatment may involve endodontic therapy, intraradicular splinting and associated restorative treatments.^[12]

Endodontic intervention is required for non-healing fractures. The following are the treatment options carried out with varied levels of success:

1. Root canal therapy of both segments (Ingle and Bakland, 2002). This may be indicated in fracture cases when the segments are not separated, but leakage from the fracture line can lead to failure.

2. Root canal treatment of the coronal segment only, if this segment shows no mobility.^[2] This is the current recommendation, particularly with the view that the apical segment may contain vital, healthy pulp tissue.

The use of an intraradicular splint has been recommended by Weine *et al.* 1971.^[13]

Increased hard tissue formation and low level of inflammation are observed in MTA-filled root canals when compared to root canals filled with calcium hydroxide. Hence, MTA was selected in the root canal treatment of the present horizontal root fracture, because its use might improve the outcome of the treatment.^[8]

The remaining portion of the canal was completely filled with MTA to set an intracanal post and reinforce the root. Another reason for filling the canal with MTA sealer was the proximity of the fracture to the gingival sulcus, where we could take advantage of the excellent property of the material to set even in humid conditions. No other material has this ability and yet seals the cavity adequately to avoid bacterial contamination.^[14]

Conclusion

Horizontal root fractures can be managed efficiently by adopting appropriate treatment strategy using splinting, fiber post and core to restore fractures at various levels and using material like MTA which improves healing and prolongs retention of teeth and avoids the need for extraction.

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