



Mineral Trioxide Aggregate for the Management of Apical Horizontal Root Fracture: A Case Report

Running title: Managing Apical Root Fracture with MTA: Case Report

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ABSTRACT: Traumatic injuries of teeth are very common which may lead to fracture of teeth as well as surrounding structures. Horizontal root fracture has a good prognosis if treated properly. A 50 year old patient reported with pain in her upper and lower teeth. On clinical and radiographic examination horizontal fracture was diagnosed with tooth 11. Cleaning and shaping of both the fragments were carried out followed by obturation of the canal with MTA (Mineral Trioxide Aggregate). Along with 11, 21, 23, 31, 32 and 42 also showed symptoms and were endodontically treated. Further patient wanted esthetic rehabilitation so intentional root canals were performed and prosthesis in the upper and lower arch were given. One year follow up showed healing and absence of any symptoms. Thus it can be concluded that MTA is a good option to treat horizontal root fractures.

Key-words: Esthetic, Healing, Horizontal Root Fracture, MTA, Obturation

I. INTRODUCTION:

Dental trauma can result in a diverse spectrum of injuries, ranging from enamel fractures to tooth avulsions. Crown fractures are the most prevalent in the permanent dentition, while root fractures represent approximately 0.5-7% of dental trauma in the same dentition. The maxillary central incisors are predominantly affected, accounting for

80% of cases, due to their anterior location and protrusion associated with the eruptive process [1]. Root fractures, as defined by Andreasen, are a type of dental fracture involving the dentin, cementum, and pulp tissue. During initial trauma assessment, some root fractures might go undetected as they are only visible through radiographic imaging methods [2]. The diagnosis of a horizontal root fracture is based on findings from clinical and radiographic evaluations. Clinically, root fractures often manifest as a slightly extruded tooth, typically displaced lingually. The tooth may exhibit mobility, with the degree of mobility generally dependent on the fracture's location [3].

Horizontal fractures are categorized based on the following criteria: 1. Fracture location (cervical, middle, and apical); 2. Extent of the fracture line (partial and complete); 3. Number of fractures (simple, multiple, and comminuted); 4. Position of the coronal fragment (displaced and non-displaced). Apical fractures are the easiest to manage and have the most favorable prognosis, while coronal root fractures are the most challenging to manage and may have the poorest prognosis [4].

Since its introduction in 1993, mineral trioxide aggregate (MTA) has become extensively utilized in endodontics due to its numerous advantages, including exceptional biocompatibility, superior sealing capabilities, and robust mechanical



properties [5]. Due to its potential to stimulate periodontal ligament regeneration and induce the formation of cementum-like hard tissue when applied adjacent to periradicular tissues, it can be considered for managing root fractures.

This case report describes the successful management of a horizontal root fracture in the apical third portion of a maxillary central incisor by using MTA along with esthetic rehabilitation

II. CASE REPORT:

A 50 year old female reported the department of Conservative Dentistry and Endodontics of K.D Dental College and Hospital, Mathura with the complaint of pain in her upper and lower front tooth region. Patient gave history of a road traffic accident 5 months ago which resulted in ocular trauma and facial fractures. She underwent extraction of tooth 22 and 41 at that time along with surgical procedures and was undergoing treatment for her eyes. Clinical examination revealed fractured 11, 21. Grade II mobility was present in both the upper central incisors and Grade I in tooth 31 and 42. Tooth 11, 21, 23, 31, 32 were tender to percussion and did not respond to thermal and electric pulp testing. Also, there was evidence of initial access cavity preparation on the labial surface of the fractured 21 which was done by the previous dentist but was not continued due to the ocular surgery. The oral hygiene of the patient was very poor. Radiograph revealed a horizontal fracture in the root portion of tooth 11 at the junction of middle and apical third and slight periapical radiolucency (Figure 1A, 1B & 1C). After the clinical and radiographic examination a diagnosis of pulpal necrosis with apical periodontitis was made w.r.t tooth 21, 23, 31, 32 and pulpal necrosis with apical periodontitis and horizontal root fracture was made for tooth 11.

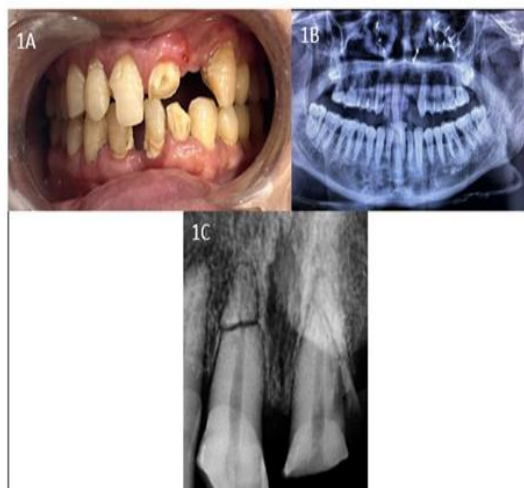


Figure 1A: Clinical view, 1B: Pre-operative OPG, 1C: Pre-Operative IOPAR

Root canal therapy was planned for the necrosed teeth and for tooth 11 obturation with MTA was chosen. The patient was explained about the treatment and informed consent was taken. After the administration of LA (2% lignocaine with 1:80,000 adrenaline) access opening was done in the upper CI, and canal was negotiated in 21, 23 and in 11 the fracture line was passed and the apical portion of the fractured segment was negotiated. Working length was determined radiographically (Figure 2) and canals were prepared in step back preparation using hand k file with apical file size of 60/0.02 (Dentsply Maillefer, OK, USA) in 21, 23 and upto size 70/0.02 in 11.

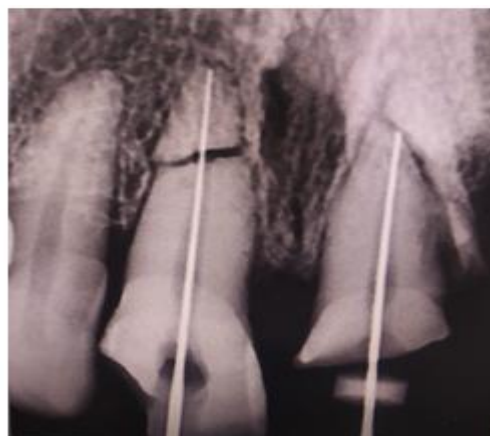


Figure 2: Working Length determination

During the preparation, canals were copiously irrigated using 5.25% NaOCl, 17% EDTA and normal saline. Calcium hydroxide dressing was placed in all the teeth followed by temporary sealing of the cavity using Cavit (3M Espe, Seefeld, Germany) and patient was recalled after 14 days. In the next appointment there was still pain present and slight percussion was present so it was decided to give the calcium dressing again for 14 days. In the third appointment 21 and 23 were asymptomatic so obturation was carried out using GP and AH Plus sealer (Dentsply, de Trey, Konstanz, Germany) by lateral condensation technique.

For tooth 11, MTA (Angelus, Londrina, PR, Brazil) was taken and mixed according to the manufacturer's instruction and with the help of MTA carrier was carried to the canal and condensed using a plugger. Small increments were taken and condensed step by step so that no void is left in between. Also radiographic evaluation was done to check for proper condensation of MTA. A



moist cotton was placed on the top of MTA and the cavity was temporized (Figure 3). In tooth 21 and 23 composite resin (Filtek Z250, 3M ESPE, Seefeld, Germany) was used to seal the cavity.



Figure 3: Obturation with MTA

After 2 days patient was again recalled and the cotton pellet was removed and the access cavity was restored using composite. On the same day under LA the endodontic treatment of tooth 31, 32 and 42 was started. The canals were prepared using rotary Protaper Universal system (Dentsply Maillefer, Ballaigues, Switzerland) upto F2 and calcium hydroxide dressing was placed. After 7 days the teeth were asymptomatic so obturation was done using single cone technique with GP and AH Plus sealer in all the three teeth and sealing of cavity was done using composite resin.

After almost 20 days and almost 2 month from the treatment initiation, the patient reported for routine checkup. There were no symptoms present in all the endodontically treated teeth and the mobility had also slightly reduced. The patient wanted esthetic rehabilitation so intentional RCT's were planned w.r.t teeth 12, 13, 24, 33, 43. Patient was informed about the procedure and under LA, root canal was initiated in 12 and 13. Both the teeth were obturated with lateral compaction technique and the master cone was 60 using AH Plus sealer. After 3 days tooth 24 was also treated and was obturated using 25/4 GP cones in both the buccal and palatal canals. After 7 days the RCT of lower teeth were also completed with F2 preparation in both teeth. All the cavities were restored using composite resin. Following the RCT treatments the patient was again reviewed for 7 days for any symptoms and as the patient was asymptomatic the tooth preparation of the upper arch was done for fabrication of PFM crowns. Once the upper teeth received the crowns the preparation for lower teeth were done and PFM crowns were fabricated (Figure 4).



Figure 4: Post-operative clinical view

The patient was satisfied with the esthetic appearance and was completely asymptomatic. Follow up was done at 3, 6 and 12 month which showed no symptoms. The radiograph showed healing of the fracture line in tooth 11 and no pain or tenderness on percussion was present (Figure 5).



Figure 5: 12 month follow up

III. DISCUSSION:

A root fracture constitutes a complex dental trauma that compromises the pulp, dentin, and periodontium. In numerous instances of dental trauma, horizontal root fractures are frequently observed [6]. The diagnosis is established through radiographic imaging. To ensure accuracy, radiographs should be taken from multiple angles. These teeth demonstrate significant healing potential, with an 80% success rate, compared to luxation injuries [7]. Horizontal root fractures can disrupt the neurovascular supply to the coronal segment, consistently leading to pulp necrosis in this region. In contrast, the apical segment remains viable due to preserved pulpal circulation [8]. However in the present case there was periapical radiolucency suggesting the necrosis in the apical portion as well. This led to the need to disinfect both the coronal as well as the apical segment.

Calcium hydroxide was used as an intracanal medicament to eliminate the symptoms as it has antimicrobial properties along with the ability of formation of calcific tissue barrier. Although for the formation of calcific tissue barrier the calcium hydroxide must be kept in the canal for longer



period of time. This also has certain disadvantages as many studies have proven that it may cause weakening of the root dentin. So in the present case calcium hydroxide was just used for its antimicrobial properties.

MTA has been documented as an osteogenic and biocompatible substance that promotes the formation of hard tissues through both inductive and conductive mechanisms. Its potent alkalinity confers bactericidal properties and encourages the development of cementum-like hard tissues, enhances osteoblastic adherence, and supports bone regeneration [9]. MTA may serve as a viable choice for managing fracture cases, and its application could be contemplated for filling fragments in horizontal root fractures. Due to its biocompatibility and excellent sealing capabilities, MTA supports effective wound healing in such scenarios [10]. Bramante et al. [11] performed the repair of a horizontal root fracture sealing with MTA. Erdem et al. [12] and Kusgoz et al. [13] each documented three instances of teeth with fractured roots treated using an MTA plug.

In the present case also MTA was used to fill both the apical and the coronal segments to create a proper seal and induce healing of the fracture. After a year follow up the healing slightly evident but the symptoms had subsided and also the prosthesis acted as a support to the fractured teeth.

IV. CONCLUSION:

MTA has proven to be a better choice for the treatment of horizontal fracture in the long term case as it forms calcific tissue barrier. Also diagnosis and timely intervention may significantly affect prognosis.

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