ISSN Print: 2394-7489
ISSN Online: 2394-7497
IJADS 2022; 8(2): 104-107

www.oraljournal.com
Received: 07-01-2022
Accepted: 20-02-2022

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Management of a complicated horizontal root fracture in a 12-year-old child using mineral trioxide aggregate: A case report

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DOI: https://doi.org/10.22271/oral.2022.v8.i2b.1496

Abstract
Root fractures occur more commonly in fully erupted permanent teeth with closed apices in which the completely formed root is solidly supported in the bone and periodontium. The consequences can be multifaceted because of collective damage to the pulp, dentine, cementum, bone, and periodontium. Management of horizontal root fractures depends on several factors, with the effect of various clinical modalities have been suggested. This case report describes the treatment of permanent maxillary right central incisors, treated with mineral trioxide aggregate (MTA) and follow up showed a successful treatment outcome.

Keywords: Horizontal root fracture, mineral trioxide aggregate, splinting

Introduction
Root fractures defined as fractures involving dentine, cementum and pulp, include only 0.5–7% of all dental injuries. The age group between 10–20 years old are the maximum likely to be affected. Horizontal root fractures are mostly detected in the maxillary anterior region. Almost 75% of them mark maxillary central incisors [1], of male patients as a result of trauma associated with automobile accidents, sports injuries, fights, etc. [2]

Diagnosis of horizontal root fracture is based on the evidence found in clinical and radiographic examinations. Root fractures often present clinically as a slightly extruded tooth, often lingually displaced [3]. The tooth is often mobile, but the grade of mobility is commonly resolute by the fracture location [3]. Treatment outcomes of fractured teeth may be predisposed by numerous factors, such as degree of dislocation, stage of root formation, location of the fracture, time period between trauma and treatment, and type of dental trauma displacement of the coronal fragment compared with no displacement of the coronal fragment [4].

According to the type of lesion and anatomical and functional characteristics, healing can take place by interposition of calcified tissue, interposition of connective tissue or interposition of bone tissue. The technique in which these lesions heal depends on the health of the pulp, dentine, cementum, and alveolar bone and the degree of dislocation of the fragment [5].

If a rupture of the pulp takes place, revascularization of the coronal region should happen before fracture healing. The exact nature of these procedure leftovers unknown. However, it is supposed that one of two measures occurs: invasion of cells from the apical pulp or from the periodontal ligament. If the pulp becomes necrotic and infected, the coronal portion will require root canal treatment [6]. MTA found to be effective as a pulp capping, and pulpotomy agent has been shown to promote root-end induction in teeth with immature apices [7-9]. This case report describes the treatment and follow-up of a right permanent maxillary central incisor, with horizontal root fracture using MTA.

Case report
A 12-year-old male patient was referred to the Department of Pediatric and Preventive dentistry with a chief complaint of trauma to the upper front region of the jaw.

Extraoral clinical examination revealed swelling around the oral cavity and erosive injuries to the lips and skin surrounding the oral cavity. On intraoral examination, permanent maxillary right central incisor showed grade II mobility and occlusal disturbance with extrusion of the tooth. On radiographic examination no signs of alveolar bone fracture were observed. Horizontal root fracture was radiographically evident between the middle third and the apical third of the root of the permanent maxillary right central incisor and fragments appeared to be separated by a radiolucent line.

Initially, following local infiltrative anesthetics, cleaning of the affected area was done with povidine iodine solution and normal saline to achieve asepsis. The coronal fragment was repositioned and confirmed with periapical radiograph. Then the stabilization was done using composite bonded semirigid splint made with ligature wire and kept for 4 weeks. After three weeks, vitality testing was done for the permanent maxillary right central incisor and was found to be non-vital. Endodontic intervention was done in relation to permanent maxillary right central incisor to prevent pathological resorption.

Access cavity was prepared in permanent maxillary right central incisor and necrotic pulp tissue was removed using barbed broach. The root canal was prepared to size 40 using standardized instrumentation technique in coronal third of the tooth. Irrigation was performed copiously with 2.5% sodium hypochlorite (NaOCl). For the right central tooth, both the coronal and apical root fragments were endodontically treated and single visit with white MTA (MTA-Angelus, Angelus, Brazil). After the stabilization splint was removed, the patient was recalled at 1, 3, 6 and 12 months for follow-up.

After 12 months follow-up examination revealed satisfactory clinical and radiographic findings with hard tissue repair. The tooth was clinically free of symptoms and presented physiological mobility. The radiographic examination of the root-fractured tooth reveals periodontal space of a normal width as well as normal lamina dura connection and hard tissue healing of the fracture line, possibly with the cementoid material.

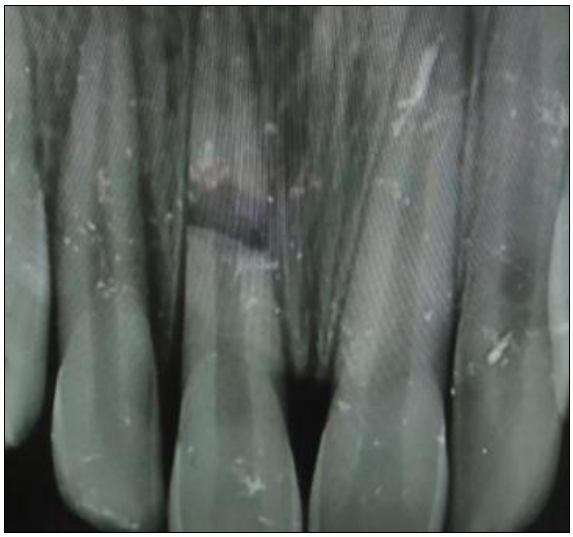

Fig 1: Pre operative IOPA Horizontal root fracture i.r.t 11

Fig 2: Splinting

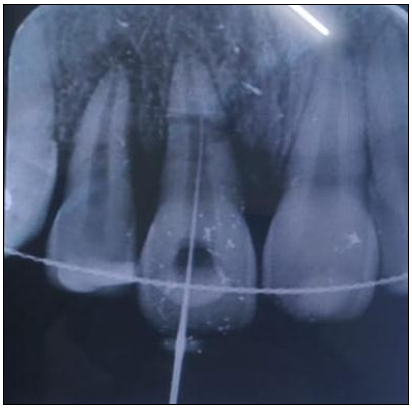

Fig 3: Working length determination

Fig 4: MTA placement till fracture line

Fig 5: IOPA of 3 months follow up

Fig 6: IOPA of 6 months follow up

Fig 7: IOPA of 12 months follow up

Discussion

Root fracture is a multifaceted injury to the periodontal ligament, pulp, dentin and cementum. Damage to the coronal segment can be considered a luxation injury, with resulting trauma to the periodontal ligament and neurovascular supply to the coronal pulp. The apical fragment remnants essentially intact. To facilitate healing, optimal repositioning and stabilization of teeth is considered essential [10].

The diagnosis of root fractures depends on the level of the fracture line, the pulp tissue situation, occlusion, dislocation of fragments and the overall health of the patient [11]. The International Association of Dental Traumatology has newly recognized a consensus statement on diagnosis and treatment of dental traumas [6]. According to these guidelines, an accurate plan should be attained through the proper clinical as well as radiographic examinations, followed by sensibility tests and patient care instructions. If the fracture line is in communication with the oral cavity, the immobilization is difficult and microbial contamination of the pulp with subsequent pulpal necrosis is inevitable [12].

Dental pulp necrosis may be defined from 20 to 44% of the root fracture cases whereas in luxated teeth without fracture, necrosis happens in at least 43.5% of cases [4, 13-15]. Effective management of root fractures often includes a multidisciplinary combination of endodontic, orthodontic, periodontic and prosthetic therapy [11-12]. Treatment opportunities with root fractures typically include reduction of the fracture and stabilization by rigid fixation or a variable time [4]. According to Andreasen, splinting may be applied within a week [12]. Nowadays splinting for 1-3 months is recommended, but no study on the effects of the splinting period on diagnosis has been approved [4, 6, 16]. In the present case, permanent right maxillary central incisor had severe mobility and dislocation, therefore a long duration of the fixed appliance was considered safe and viable for healing.

Four types of conservative endodontic treatment that have been commonly described [17, 18] are (i) cleansing and gutta percha (GP) filling of the root canal of the coronal fragment only (ii) cleansing and filling of the root canal in both fragments; (iii) cleansing and GP filling of the root canal of the coronal fragment and surgical removal of the apical fragment; and (iv) treatment of the root canal with calcium hydroxide followed by filling with GP.

In the present case report, only the coronal fragment was endodontically treated and fragments were splinted using a composite bonded semirigid splint.

A long-term follow-up is required to check for any possible pathological alterations. In the present case follow-up after one year showed promising results with clinically pleasing aesthetics and radiographic healing with calcified tissue, the fractured line discernible but fragments well stabilized.

Conclusion

The main purpose of the treatment of fractured elements is to keep a steady tooth and, when it's possible its vitality. It is significant to remember that the preservation of a natural tooth during growth could be an excellent intermediate solution before implant rehabilitation. The clinician must judge every situation on its individual merits and select a process that fulfils the needs of the case while maximizing stability and minimizing mobility. Adopting appropriate treatment strategy of middle third fractures and using material like MTA, for treatment of horizontal fracture at apical third can result in optimum healing and prolonged retention of the teeth, which would otherwise require extraction.

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