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Treatment of a horizontal root fracture using MTA: 2-year follow-up

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Abstract

Horizontal root fractures are rare when compared to other types of injuries, with a reported incidence rate ranging between 0.5%-7.0%. Fixation of teeth with splints has been recommended as the conservative treatment for horizontal root fractures, given that the pulp usually remains vital in such cases and spontaneous healing with no treatment has been reported in the literature. However, further treatment, such as root canal treatment, can be necessary when the tooth shows signs of pathology. An 11-year-old boy was referred with a chief complaint of traumatized maxillary anterior tooth. Horizontal root fracture was determined in the case and the tooth was treated by using MTA. After 24 month clinical and radiographic follow-up there were no pathological symptoms. Filling the entire root canal of the coronal fragment with MTA and giving a chance to the apical fragment to heal spontaneously is an appropriate solution for teeth with horizontal root fractures.

Keywords: child, fracture, mineral trioxide aggregate, root fracture.

1. Introduction

Horizontal root fractures are not common injuries when compared to other types of injuries, and the appearance rate is 0, 5-7% in injured permanent teeth. [1] Immediate treatment comprises repositioning and stabilization of the coronal fragment in its correct position, after which the tooth is monitored for an extended period to observe pulp health, and the healing is observed in around 83% of cases. [2, 3] On the other hand, in 5-25% of patients, [1] horizontal root fractures require endodontic treatment when the pulp tissue of the coronal fragment shows signs of pathology such as pulp necrosis. [4] However, it may be difficult to fill the coronal part of the canal because of the open apex of the coronal fragment on the fracture line. Mineral trioxide aggregate (MTA) is a biocompatible material which was shown to have good sealing ability and the usage of MTA for treating the teeth with open apices is advised. [5] The following case report describes the treatment of a maxillary central incisor with a horizontal root fracture using MTA with its 24 month follow-up.

2. Case Report

An 11-year-old boy was referred with a complaint of luxation of his upper left incisor due to a trauma. Clinical examination indicated that the crown of the tooth was luxated 2 mm palatally and the tooth was mobile (Grade II). Radiographic examination revealed a horizontal root fracture in the apical third of the root (Fig. 1) and the dislocation of the coronal fragment with no radiographic pathologies neither in the fragment line nor periapical area.

The treatment plan consisted of relocating and splinting the coronal part of the tooth and close follow-up. The coronal fragment was relocated, and a splint was constructed from 0.3 mm orthodontic wire and composite resin (Grandio, VOCO, Cuxhaven, Germany) and bonded between the canines (Fig. 2). The splint was removed after 4 weeks. At the 3-month follow-up visit, a draining sinus showing a chronic abscess within the bone in the region of the fragment line was observed, and the coronal part of the pulp was determined to be infected. Accordingly, the treatment plan was changed to the endodontic treatment of the coronal part of the root canal.

The tooth was isolated with a rubber dam, and the root canal was instrumented to the working length, which was 1 mm short of the fracture line, using K-files (Dentsply-Maillefer Instruments SA, Ballaigues, Switzerland).

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Following the instrumentation, the canal was irrigated with 2.25% sodium hypochlorite, calcium hydroxide was placed in the canal, and the cavity was temporarily filled with Cavit (3M Espe, Seefeld, Germany). At the next visit, the calcium hydroxide was removed and the entire root canal of the coronal fragment was filled white MTA (MTA-Angelus, Londrina, PR, Brazil). A radiograph was exposed to assure proper placement; however, the radiograph showed overfilling of the coronal fragment with MTA and the accidental formation of a plug on the coronal entrance of the apical fragment (Fig. 3). Glass ionomer cement (3M Espe, Seefeld, Germany) was inserted over the MTA, and a final restoration was prepared using adhesive composite resin. Follow-up visits were conducted once every 3 months for 6 months and once every 6 months for a year, for a total of 24 months.



Fig 1: Radiographic image of the injured tooth prior to treatment.



Fig 2: Radiographic image of the tooth after the relocation of coronal fragment and application of the splint.



Fig 3: Radiographic image of the MTA at the coronal part of the root (Notice the overfilling and the plug formed on the apical fragment).



Fig 4: Radiographic image of the tooth after 24 months.

3. Discussion

Maintaining pulp vitality by means of repositioning of the coronal fragment and usage of splints for 4 weeks is the first choice for treatment of horizontal root fractures. [2] If the pulp does not become infected through the epithelial attachment and is properly fixed, it can heal spontaneously. [6, 7] Although the outcomes of horizontal root fractures are favorable (83%), complications such as pulpal necrosis can arise and generally occurs in coronal fragment. [1, 3, 4] When the coronal part of the root is determined to be necrotic, or the tooth shows symptoms of irreversible pulpitis, the necrotic pulp tissue should be eliminated from the coronal fragment in order to provide appropriate conditions for healing. [2] Endodontic treatment applied to the coronal fragment is generally sufficient; however, as with open apices, with a coronal fracture, it may be difficult to fill the coronal part of the canal because it may be impossible to achieve an apical stop as in apexification. [8] For teeth with open apices, traditional treatment modality is formation of an apical plug using calcium hydroxide, which is a predictable and proven treatment choice. [5] However, this treatment option has some disadvantages such as the high number of required visits, probability of poor patient compliance, and a long treatment period as 5 to 20 months. [5, 9] Additionally, long term calcium hydroxide therapy was reported to decrease fracture resistance of teeth when it is used for more than 30 days. [10] Because of above mentioned disadvantages in recent years, usage of MTA has been suggested and shown to be effective as a one-visit apexification material in treating teeth with open apices. Since obturation of the coronal fragments is similar to apexification procedure, [5] MTA can be a suitable option for these cases and the use of MTA can be considered an option for filling the coronal fragments in horizontal root fractures. Owing to its biocompatible properties and superior sealing ability, MTA facilitates wound healing under these conditions. [8, 11] There are limited reports in the literature regarding usage of MTA in treating horizontal root fractures, [12-14] that report successful healing which were described as; being functional with asymptomatic status, signs of repair between fractured segments and absence of apical periodontitis. Similar to these results, successful healing was observed in the present case without any clinical and radiological pathology at the end of the 24 months follow-up period. Additionally, tooth was functional without any complaints.

Unlike the similar cases, in the present case, MTA was overfilled above the fracture line, and an accidental plug

formed on the apical portion of the fractured root. In such a case, interruption of blood circulation could be expected to inhibit healing; however, healing was observed, with no adverse effects caused by the overfilling. This fortunate result may be due to the continuation of blood circulation at the apical foramen of the root and/or the biocompatibility of MTA, [5,11] which may have prevented a possible foreign-body reaction.

4. Conclusion

Appropriate diagnoses and treatment procedures have great importance for traumatized teeth. The use of MTA can be a successful solution for teeth with horizontal root fractures in cases where coronal pulp has lost vitality. On the other hand, additional clinical and long term follow-up studies are necessary.

5. References

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