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Intraradicular splinting with endodontic instrument of horizontal root fracture – case report

CASE REPORT

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Faculty of Dentistry, Department of Endodontics and Conservative Treatment, Gazi University, Ankara, Turkey **Abstract** – This case report describes the treatment of a horizontal mid-rootfractured incisor with an alternative fixation technique. As a result of clinical signs of pulpal necrosis, both the coronal and the apical root fragments were endodontically treated and obturated at single visit, and the fragments were stabilized internally through insertion of a stainless-steel endodontic file into the root canal. Four-year follow-up examination revealed satisfactory clinical and radiographic findings with hard tissue repair of the fracture line. This technique can be a quick remedy for patients with root-fractured tooth, especially for those who cannot make a second visit to the dental clinic.

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Root fracture in permanent teeth is quite uncommon with frequency between 0.5% and 7% among all cases of dental trauma (1). The fracture can be at the cervical, middle or apical region of the root, involving the cementum, dentin, pulp and the periodontal ligament.

The traditional treatment modality has been repositioning of the coronal fragment and immobilization through fixation to the neighboring teeth by means of a semi-rigid or rigid splint (e.g., orthodontic wire/composite resin splint, acid-etch/resin splint) and maintaining the splint for 2–3 months. The vitality status of the traumatized tooth should also be checked during this period. In 20-44% of the horizontal root fracture cases, however, the pulp becomes necrotic (1) and this necessitates endodontic treatment to be carried out. In most of the cases, the endodontic treatment of the coronal fragment is sufficient, as the pulp in the apical fragment remains vital. On the contrary, in case of necrosis, endodontic treatment of both fragments, endodontic treatment of the coronal fragment and surgical removal of the apical fragment, extraction of the coronal fragment and endodontic treatment and orthodontic extrusion of the apical fragment are the other treatment options.

Healing in teeth with horizontal root fracture is with one of these types: healing with hard tissue, interposition of connective tissue, interposition of bone and connective tissue and interposition of granulation tissue (1). While the first three types are considered favorable and the 'healing with hard tissue' is the most desired, the last one represents inflammatory state, and is unfavorable.

Recent studies have cast doubt on the usefulness of rigid fixation; it has been suggested that healing was either more often or equally observed in horizontal rootfractured teeth where rigid fixation was avoided compared with the cases it was applied (2, 3). In this paper, successful treatment of a horizontal mid-root fracture case with intraradicular fixation through insertion of an endodontic file has been reported.

Case report

On October 20, 2001, a 19-year-old male was referred to our clinic with a complaint of a loose and uncomfortable incisor. He had a history of traumatic impact on his face during a fight. The trauma had happened 1 month ago. The patient had visited a general dentist, but did not receive any treatment. The clinical examination revealed occlusal displacement with luxation in the upper right central incisor. The tooth was discolored and did not respond to the electric pulp test. Discomfort was noted during percussion and palpation. Radiographic examination revealed a horizontal fracture in the middle-third of the root, separating the coronal and the apical root fragments from each other (Fig. 1). The patient told that he would be at a remote location and could not visit our clinic or any other dentist for a considerable time. Endodontic treatment of the tooth at single visit was



Fig. 1. Preoperative radiography showing horizontal fracture in the middle-third of the root of the central incisor.

decided. Following local infiltrative anesthetics, the coronal fragment was repositioned, and this was confirmed radiographically. Endodontic access was achieved. Necrotic pulp tissue was removed and a slight malodor was noticed, suggesting the presence of bacterial activity in the root canal. Both the coronal and the apical fragments were included to the endodontic preparation. The root canal was prepared to size 40 using standardized instrumentation technique. Irrigation was performed with 2% sodium hypochlorite. The root canal was filled with gutta-percha and sealer (AH-26, Dentsply, Konstanz, Germany) using the lateral condensation technique. Just before completion of the root canal filling, a size 40 Hedström file was inserted into the root canal with clockwise winding motion to further reduce the fracture and also to achieve anchorage from the apical fragment for the coronal fragment. The file was separated intentionally, approximately at the cervical level (Fig. 2). The access cavity was restored with composite resin. No external splinting was applied. The neighboring tooth (upper left central incisor) was also found to have suffered the traumatic impact with a coronal fracture at the corner, involving the enamel and dentin. This tooth responded positively to the electric pulp test, and was restored with composite resin. The patient was appointed for annual control, but did not attend the appointments until 4 years past the treatment. The reason for which he visited the clinic was not related with his treated tooth, but with another tooth that developed a carious lesion. At that time, the clinical and radiographic examination of the traumatized teeth revealed favorable condition. The teeth were clinically free of symptom and presented physiological mobility. The upper left central incisor was vital. The radiographic examination of the root-fractured tooth revealed periodontal space of a normal



Fig. 2. Immediate postobturation radiography of the root-fractured incisor with the endodontic file inserted to the canal.



Fig. 3. Four years post-treatment radiography showing periodontal space of a normal width, lamina dura continuity and hard tissue healing of the fracture line in the root canal-filled central incisor.

width, normal lamina dura continuity and hard tissue healing of the fracture line, possibly with sementoid material (Fig. 3).

Discussion

In this case, an endodontic instrument was used to fix the separated root fragments. This is uncommon in the literature. However, similar to the technique described in this case, another successful example has been mentioned elsewhere (4). For the same purpose, others have used metal pin (5) or dental post, which was placed passively inside the root canal together with endodontic cement (6).

In the presented case, endodontic treatment was carried out. Although a negative response to the electric pulp test at early examination is not indicative for endodontic treatment, discoloration of the crown increased the probability of pulpal necrosis. This was justified when the endodontic access was achieved; necrotic pulp tissue and malodor was noticed. Radically, both fragments were treated because there was the risk that the apical fragment was already infected or could be infected during treatment. In addition, the fact that the patient could not be in contact for an indefinite time prompted us to do endodontic treatment as such and in single visit. Research, however, indicates that healing is more frequent in horizontal root-fractured teeth when endodontic treatment of only the coronal fragment is carried out compared with when endodontic treatment of both of the fragments is carried out (7). In the mentioned study, failure was associated often with protrusion of gutta-percha into the space between the fragments; and, unlike the case presented here, guttapercha solubilizing techniques were used during root canal filling (7). Gross protrusion of endodontic filling materials did not occur in the presented case where conventional lateral condensation technique was used for the root canal filling, and only a tolerable amount of sealer protruded, and that did not compromise the healing.

By the clockwise insertion of the endodontic instrument into the canal (screw action), in this case, reduction of the space between the root fragments was aimed. Previous studies have shown that repositioning of the coronal fragment is essential for successful healing of the horizontal root-fractured teeth; fractured roots that radiographically revealed less space between the fragments after repositioning (optimal repositioning) healed more frequently with hard tissue repair than those with more space between the fragments (incomplete repositioning) (2, 3). By optimal repositioning, there exists possibly less stress on the stretched pulp; if not ruptured, then the conditions are better for the recovery of the pulpal functions including innervation and dentin deposition. Then hard tissue healing by mineral deposition from the pulpal side and the periodontal side begins. In the presented case, as the pulp was extirpated, the healing was thought to be through deposition of cementum by the periodontal ligament-originated tissue. It is thought that if the space between the fragments is reduced, it is more likely that the depositions on the apical and the coronal fragments fuse and the fracture becomes consolidated. Otherwise, the healing may be in the form of 'interposition of connective tissue' or 'interposition of bone and connective tissue' because of ingrowth of periodontal ligament tissue between the fragments (1). Reduction is also important for the elimination between the fragments of blood coagulum, which is a substrate for bacterial growth (3). Bacterial growth certainly jeopardizes the healing of the site.

Besides enhancing the reduction, the technique described here, anchoring the apical fragment provided stability to the coronal fragment. This was not a rigid fixation; the tooth (the coronal fragment) still had some mobility, but was protected from further traumatic impacts in the mouth. Studies questioning the usefulness of rigid fixation in horizontal root-fractured teeth did not find any advantage in terms of healing over no-splinting (2, 3). The success rate increased as much as the teeth could maintain some degree of mobility, and slightly flexible type of splint was found to be the most optimal splint (2, 3), perhaps through induction of the periodontal ligament cells to function to keep up the stability of the tooth.

In this case, treatment of a horizontal root-fractured tooth with single-visit root canal obturation and internal splinting using an endodontic file was presented. This technique is especially advantageous for patients those who cannot follow periodic dentist visits.

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