Case Report

Root fracture in immature tooth: report of a case

Güngör HC, Büyükgüral B, Uysal S. Root fracture in immature tooth: report of a case.

Abstract – Root fracture injuries affect 0.5–7% of permanent teeth. Although this type of injury is rarely seen in teeth with immature root formation, the prognosis is generally good depending on the site of the fracture. A case report of horizontal root fracture in maxillary central incisor of an 8-year and 3-month-old girl and its treatment was presented.

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Andreasen and Andreasen have defined root fractures as injuries involving dentin, cementum and pulp (1). This type of injury has been reported to affect 0.5–7% of teeth in the permanent dentition (2–4). Injuries caused by fighting and foreign bodies striking the teeth are the most common etiological factors for root fractures. As with other type of traumatic injuries, the maxillary central incisor region is predominantly affected. Root fractures are uncommon in teeth with incomplete root development and those in various stages of eruption (5, 6). They may be transverse (horizontal), oblique or vertical, however, horizontal and oblique fractures are the most commonly seen types (7).

Horizontal root fractures, comprising less than 3% of all dental injuries (8), are more likely to take place in fully erupted permanent maxillary central incisors with completely formed root (9). They are frequently seen in the middle third of the root followed by apical and coronal third fractures (6, 10). There may be multiple or single fractures. Fractures, which are single and distant from the cervical level, are believed to have better prognosis (7).

The presented case aims to report a root fracture injury in an immature tooth and its management.

Case report

An 8-year and 3-month-old girl was brought to the pediatric dentistry clinic by her mother after she hit the desk at school 3 h earlier. Her medical history was non-contributory. Clinical examination revealed markedly increased mobility of maxillary left central incisor. The crown was extruded 4 mm and slightly dislocated in a palatal direction. Fracture of the labial socket wall was not noticed. The clinical presentation of the case resembled a luxation injury, however, radiographic examination disclosed a horizontal fracture in the middle third of the root (Fig. 1).

The initial treatment plan comprised reduction, repositioning and rigid splinting of the coronal fragment. Under local anesthesia, the fragment was reduced and repositioned with ease using gentle digital manipulation. Rigid splinting, which was made up of composite and 0.5 mm stainless steel orthodontic wire was planned. After etching of labial surfaces of both maxillary central incisors and primary canines on either side (permanent lateral incisors have not fully erupted), bonding agent was applied. Light-curing composite resin was applied to the etched enamel surfaces to secure the stainless steel wire on the teeth (Fig. 2). The patient was

Fig. 1. Initial radiograph of the patient showing severe dislocation of coronal fragment in maxillary left central incisor.

Fig. 3. Postoperative 3-month radiograph of the tooth showing external surface resorption distal to the fracture line.

Fig. 2. Radiograph taken following repositioning and splinting of the tooth.

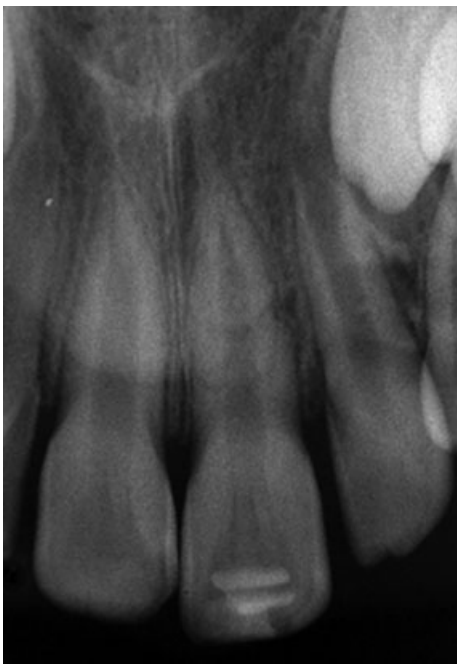

Fig. 4. In the radiograph taken at postoperative 14 months, the fracture line is discernible. Satisfactory healing is evident.

reminded of importance of good oral hygiene. She was also prescribed antibiotics (amoxycyline), analgesics, and chlorhexidine mouthrinse.

The splint was retained for 12 weeks. Radiographic and clinical examination (sensibility and percussion tests) were performed each month following repositioning. At the first two recalls, the tooth did not respond to electrical and cold sensibility tests. However, the tooth was not tender to percussion tests and radiographic examination did not reveal any signs of developing pulp necrosis. Therefore endodontic intervention was not initi-

ated. At the end of the third month the splint was removed and the patient was scheduled for follow-up visits at 3-month intervals (Fig. 3).

At the 14-month recall, the patient reported no discomfort with her tooth. Clinically, the mobility of the tooth was in physiologic limits and no pain was observed in horizontal and vertical percussion tests. The tooth also responded normally to the electrical and thermal stimulation tests. In the radiographic examination, however, along with thickening of dentinal walls of the root, apex closure was noticed. Healing of the fracture with calcified tissue was evident (Fig. 4).

Discussion

It has been reported that, in up to 80% of cases, healing of the horizontal root fractures could take place with or without initial treatment (3, 5, 11–13). The healing sequelae of root fractures include:

1. Repair with calcified tissue, giving union across the fracture.
2. Healing with connective tissue.
3. Healing with calcified tissue and connective tissue.
4. Healing with granulation tissue.

The ideal outcome for horizontal root fracture injuries is healing by hard tissue union. This is thought to be most likely to occur if the fracture is fully reduced and fracture edges are rigidly held in close apposition for a period of 12–14 weeks (7). Fracture healing of this type requires an intact pulp and slight or no dislocation of the coronal fragment. In teeth with immature root formation calcified tissue healing is most often observed (6).

In this type of healing the fracture is repaired by formation of a dentin-like callus on the pulpal aspect, which is followed by ingrowth of cementum-like tissue from the periodontal aspect (1). Cementum deposition in the fracture line is often preceded by resorptive processes. Most often, cementum will not completely bridge the gap between fracture surfaces, but it is interspersed with connective tissue originating from the periodontal ligament (1). This and the radiodensity difference between cementum and dentin have been used to explain the fracture line often discernible in radiographs of horizontal root fractures healed with calcified tissue (1).

The literature indicates that many factors may influence the type of healing which occurs. The elapsed time following trauma until presentation for treatment, the stage of root development and any associated signs and symptoms such as mobility and pain are among these factors (14). In an extensive retrospective study by Andreasen et al. (15), it has been reported that treatment delay of up to several days played no significant role, optimal repositioning of root fractures with dislocation of the coronal fragment of up to 1 mm favored both healing with hard tissue and at the same time reduced the risk of pulp necrosis. However, the age of the patient, stage of root development, mobility and dislocation of the coronal fragment, and diastasis between fragments have been reported to have the greatest influence upon healing of root fractures (16).

The frequency of pulp necrosis following root fractures is relatively low. It occurs in 5–25% of the affected teeth (1). The risk is higher in mature teeth and those where significant dislocation of the coronal fragment has occurred (9). It is generally accepted that roots with incomplete root formation have a greater potential for maintenance of pulp vitality than those with closed apices (1). Feely et al. (14) have reported a statistically significant correlation between the stage of root development and the type of healing. They concluded that root-fractured teeth with immature roots had a better chance of healing than teeth with mature roots.

Pulp canal obliteration and root resorption are also commonly seen following root fractures. Pulp canal obliteration has been reported to occur in more than two-thirds of root fractured permanent incisors (9). On the other hand, root resorption is seen in about 60% of root-fractured incisors (17). In healing with calcified tissue, external surface resorption (peripheral rounding) mesial and distal to the fracture site is a characteristic finding which can be detected radiographically (1).

In the presented case, patient's timely referral was an important factor, which made repositioning easy and comfortable for the operators. The displacement of the coronal part was so severe that favorable healing would be compromised if the tooth were not repositioned at the initial examination. Along with appropriate management, careful follow up of trauma cases is needed. Potential regenerative properties of the pulp in young permanent teeth such as in this case are worth the wait to obtain better healing of the root fracture.

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