# Treatment of traumatized maxillary permanent lateral and central incisors horizontal root fractures

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## ABSTRACT

Traumatic injuries of teeth are the main cause of emergency treatment in dental practice. Horizontal root fractures are more frequently observed in the maxillary anterior region and young male patients. The most common type of root fracture is in the middle third, followed by apical, and coronal part.

This case report describes two horizontal root fractures of the maxillary right central and lateral incisors due to a sport injury. The lateral incisor was healed satisfactorily without treatment. The central incisor was endodontically treated.

**Key words:** Dental trauma, horizontal root fracture, repairs of root fracture, treatment of root fracture

Traumatic injuries of teeth are the main cause of emergency treatment in dental practice.[1] It occurs most commonly in young patients, and varies in severity from enamel fractures to avulsion.[2] Root fractures of permanent teeth are fairly uncommon[3] and horizontal root fractures are more frequently observed in the maxillary anterior region in the 11–20 years age group male patients.[4] This kind of fractures usually occurs because of severe trauma, such as traffic accidents and sports injuries, and it has been reported to occur in less than 3% of all dental injuries.[1] These fractures are often complicated in fully erupted anterior teeth, whereas they occur as cusp fractures extending variably down the root in posterior teeth.[5] Treatment of fractures below the alveolar crest consists of reduction and rigid fixation as soon as possible. The splint is usually left in position for at least a month, but fractures near the cervical line may require a longer time.[6-7] The majority of root fractures have been shown to undergo healing. It has been reported that 77% of root-fractured teeth healed, while pulp necrosis occurred in 20%.[8]

Usually, four types of healing sequelae are given:

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 last mode of healing, with granulation tissue, is a sign of pulp necrosis and an indication that endodontic treatment of the coronal portion of the tooth is necessary.[9] Pulp capping, pulpotomy, or pulpectomy, and root canal obturation are alternative treatment strategies, depending on the maturity of the tooth, size of the exposure, and duration between injury and treatment.[7] However, there are cases of horizontal root fractures with signs of healing without any treatment.[6] Additionally, the horizontal root fracture cases showed a higher number of pulp-vitality preservation than luxation injury cases without root fracture.[2] This study reports a case of maxillary lateral incisor with a spontaneously healed root fracture, and a maxillary central incisor with root fracture treated endodontically, both observed over a period of one year after treatment.

## CASE REPORT

A 20-year-old man suffered a sports injury involving the maxillary anterior region of the mouth. Examination of full mouth radiographs revealed horizontal root fracture of the maxillary right lateral and central incisors [Figures 1 and 2]. The patient reported a sports-injury incident that had occurred three days before. Soft- and hard-tissue examination showed no signs of scarring or any other evidence indicating previous trauma. The lateral incisor was asymptomatic with no spontaneous pain, no periodontal inflammation, and no sign of previous or actual fistulae, any tenderness or pain to palpation of the soft tissues, or pain to percussion. The tooth tested nonvital to electric pulp test. Radiographic examination revealed no periapical or periradicular pathology, but the patient complained of pain in his right central incisor and slight tenderness to apical palpation and percussion. The clinical examination

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revealed slight mobility in the maxillary right lateral incisor and moderate mobility and dislocation in the maxillary right central incisor.

The initial treatment involved repositioning using firm finger pressure to the coronal segment, fixation of the teeth with composite resin by acid-etch technique, and occlusal adjustment. After a week, discoloration, pain, and sensitivity to apical palpation and percussion were evident at the central incisor, and a decision was made to start endodontic therapy on this tooth. A local anesthetic was administered and the tooth was isolated with a rubber dam. The coronal pulp tissue was removed and the chamber was irrigated with 5.25% sodium hypochlorite. The canal was enlarged to size 50 at working length. An intra-appointment medicament of calcium hydroxide paste was placed. The tooth was tender to percussion on the second appointment. The canal was enlarged to size 60 at working length. Calcium hydroxide paste was placed again. The tooth was asymptomatic on the third appointment. The root canals were irrigated with 5.25% sodium hypochlorite and dried with paper points. The canal was obturated using Sealapex and root canal filling cone, with lateral condensation cone technique [Figure 3]. The tooth has been asymptomatic thereafter. As the clinical review and radiographs did not show any signs of pathology, no treatment was performed in the maxillary right lateral incisor. The patient was rescheduled for follow-up care. The splint was maintained in position for one month. After three months, the maxillary right lateral incisor tested vital to the electric pulp test, and the central incisor was asymptomatic. The mobility of the teeth was within normal limits. Teeth were followed up clinically and radiographically for one year and during this period, the maxillary right incisor showed continued positive reactions to electric pulp tests and the treatment was judged to be successful [Figure 4].

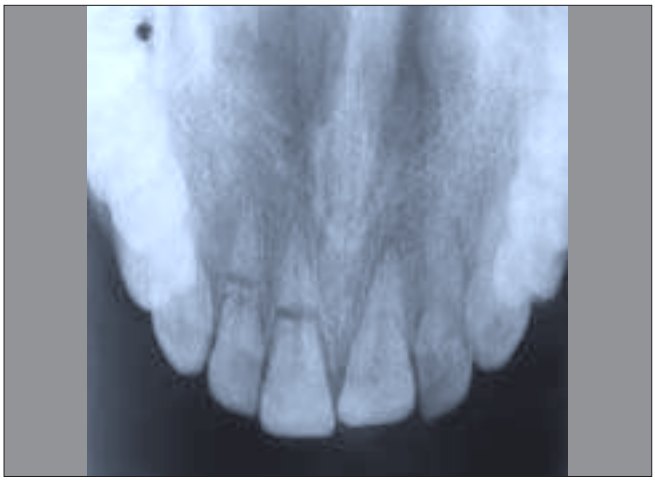

**Figure 1:** Preoperative occlusal radiograph showing horizontal root fractures of upper right central and lateral incisors

## DISCUSSION

A variety of traumatic conditions can cause root fractures, although the literature shows some predominant causes such as falling while playing and running, during sports activities, and blows received on the face. Maxillary central incisors are most vulnerable to injury, sustaining approximately 80% of all dental injuries, followed by the maxillary lateral and the mandibular incisors.[10] Hovland[11] reported that horizontal root fractures in the permanent dentition comprise from 0.2–7% of all traumatic injuries to teeth. In this case, the patient had horizontal root fractures on the right lateral and central incisors because of a sports injury. The most common types of root fractures are in the middle third of the root (57%), followed by fracture in the apical part (34%), and in the coronal part (9%).[7] In the present case, the teeth had horizontal root fractures in the middle and apical third with periodontal ligament injury.

**Figure 2:** Periapical radiograph showing horizontal root fractures of upper right central and lateral incisors

**Figure 3:** A periapical radiograph of the teeth after endodontic treatment

**Figure 4:** A periapical radiograph of the trauma region, one year after treatment. The lateral incisor was vital and both the teeth were asymptomatic

Dental treatment may not be necessary in cases of root fracture where there is no mobility or displacement of the coronal segment, and if the patient has no apparent complaints. It was reported that 31% of the patients with root fractures were identified coincidentally at subsequent dental radiographic examinations. The prognosis of root fractures depends on the state of the pulp tissue, occlusion, dislocation of the fragments, and the general health of the patient. If root fracture is diagnosed, emergency treatment involves repositioning of the segments in as close proximity as possible, and fixing in position with a splint to the adjacent teeth for 2–4 months.[10] However, according to some authors, splinting may be applied for a week.[12-13] Nowadays, splinting for 1–3 months is recommended, but no study on the effects of the splinting period on prognosis has been carried out yet.[4] In our case, maxillary right central incisor had moderate mobility and dislocation and maxillary right lateral incisor had slight mobility. We repositioned the coronal segment of maxillary right central incisor, fixed the teeth, and made an occlusal adjustment immediately. The splint was maintained in position for a month.

The prognosis for tooth survival following a horizontal root fracture can be summarized as quite good.[12] Healing of the horizontal root fractures with or without initial treatment is reported to occur in up to 70–80% of the cases.[2] This case is an example of the fact that a tooth with horizontal root fracture below the alveolar crest has a chance of survival even when it is not treated. In a recent study on fractures in the middle and apical parts of the root, splinting of the luxated coronal fragments and the duration of splinting were found to be of minor importance, whereas factors such as root development, pulp sensibility, and repositioning of dislocated fragments were highly predictive of the frequency.[4] The primary purpose of the treatment of fractured teeth is to maintain the vitality of the teeth.[1] Teeth with root fracture have more possibility of maintaining a vital dental pulp than luxated teeth without fracture. It was reported that dental pulp necrosis may range from 20–44% of the root fracture cases, whereas in luxated teeth without fracture necrosis occurs in at least 43.5% of the cases.[2,7] Pulpal necrosis is determined most accurately initially after the accident by radiographic evidence of an unhealing fracture, continued tooth mobility, spontaneous pain, and persistent or severe percussion sensitivity. Jacobsen and Zachrisson[14] reported that, in a sample of 51 root-fractured teeth, 17 did not respond to the electric pulp test at the time of injury; however, after 1–3 months, the teeth responded. It is common to observe the return of pulp vitality and normal color threemonths after the injury.[9] In the present study, the lateral incisor was asymptomatic with no pain or signs of inflammation. The tooth tested nonvital to electric pulp test after injury, but it tested positive after three months. It is concluded that fractured roots can heal spontaneously provided that the vitality of the pulp is preserved and displacement of fragments is prevented.[7] But the patient complained of pain in his right central incisor, the tooth showed a slight sensitivity to apical palpation and percussion. Root canal therapy is indicated when a pathology, usually owing to development of pulp necrosis, is evident.[1] After one week, discoloration, pain, and sensitivity to apical palpation and percussion was already evident at the central incisor, and a decision was made to start endodontic therapy on this tooth. In the present case, one year after the injury, the endodontic treatment was considered successful because following signs were absent: clinical symptoms, periradicular radiographic pathology, and abnormal mobility; and the lateral incisor was asymptomatic.

Consequently, the prognosis of root fractures depends on the extent of the fracture line, the pulp tissue situation, occlusion, dislocation of fragments, and the general health of the patient.

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