Dental Traumatology 2005; 21: 160–164

DENTAL TRAUMATOLOGY

Case Report

Orthodontic movement of a horizontally fractured tooth: a case report

Erdemir A, Ungor M, Erdemir EO. Orthodontic movement of a horizontally fractured tooth: a case report. Dent Traumatol 2005; 21: 160–164. © Blackwell Munksgaard, 2005.

Abstract – Intra-alveolar root fractures are relatively uncommon, and sometimes may be healed without treatment. Diagnosis of intra-alveolar root fracture is frequently made by exclusion of clinical signs of other traumatic injury, and by radiographic examination with films taken at different tube angulations. This case report presents a horizontal root fractured tooth that was healed satisfactory without treatment and moved orthodontically after prolonged time from trauma.

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Key words: root fracture; root fracture repair; orthodontic movement

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Accepted 31 March, 2004

Traumatic injuries in teeth and their supporting structures occur most commonly in young patients, and vary in severity from enamel fractures to avulsions (1). Root fractures, combined injuries of pulp, dentin, cementum and periodontal ligament, are less frequent injuries comprising 0.5–7% of all trauma cases (1–3).

Horizontal root fractures are more frequently observed in the maxillary anterior region and in the 11–20 year age group male patients (1). They occur in fully erupted teeth with complete root formation (4, 5) and are frequently seen in the middle third of the root followed by apical and coronal third fractures (5, 6). The prognosis of the root fractures in the coronal third is poorer than the root fracture in the middle or apical third. The clinical presentation of a horizontal root fractures may vary from an extruded or displaced crown to a clinically normal tooth (5). Generally, fractured roots are diagnosed within a short time after the injury but occasionally they are identified at subsequent routine dental appointments (7).

The reduction and alignment of the displaced segments and stabilization and relief of the occlusion may be applied in horizontal root fractures if it is located below the alveolar crest and there is no oral communication (6, 8, 9). Then the tooth should be monitored for pulpal vitality (9). Fractures that do not heal after the initial treatment may need additional treatment consisting endodontic, periodontal and orthodontic procedures (5). However, healing of root fractures without treatment is also presented in many reports (6–8, 10–12).

The sequelae of root fractures may be divided into four categories; (i) healing with calcified tissue, (ii) healing with connective tissue, (iii) healing with bone tissue, and (iv) granulation tissue without healing (8). Different types of healing may depend on the proximity, repositioning and the fixation of the fragments and on the absence of infection (8).

This paper reports a case of horizontal root fractured tooth that was healed satisfactory without treatment and moved orthodontically after prolonged time from trauma.

Case

A 15-year-old man referred to the endodontic clinic at the School of Dentistry, Selçuk University, Turkey in 1996. He had recurrent pain and swelling on the maxillary anterior region. The patient's medical history was unremarkable. Clinical examination revealed that there were hyperemia and edema in the apical region of the maxillary right incisor tooth. It

was tender to palpation and percussion. The adjacent teeth were not tender to palpation and percussion.

Preoperative radiographs appeared radiolucency in the apical region of the maxillary right incisor and horizontal root fracture in the middle third of the maxillary left incisor (Fig. 1). A trauma history (a bicycle accident) was revealed in his anamnesis 5 years ago. The patient said that a fistula pathway was seen sometimes in the maxillary anterior region but he did not seek any professional care. Mobility was normal in the maxillary left incisor. Based upon the results of electric and thermal pulp tests and appearance of current radiographs, the pulp of the maxillary right incisor was diagnosed as necrotic. The other five maxillary anterior teeth were normal to all pulp tests.

The patient received local anesthesia of 2% lidocaine with 1:100 000 epinephrine. A rubber dam was placed and a conventional endodontic access opening was made. The coronal pulp tissue was removed and the chamber was irrigated with 5.25% sodium hypochlorite. The working length was determined with an electronic apex locater (Root ZX, J. Morita Corp., Kyoto, Japan) and it was confirmed with radiographs. The canal was enlarged to size no. 50 at working length. An intra-appointment medicament of calcium hydroxide paste was placed and a dry sterile cotton pellet was sealed in with temporary restorative filling material (Cavit G, 3M ESPE, Germany).

The tooth was tender to percussion on the second appointment. The canal was enlarged to size no. 60 at working length and the flaring was performed. Calcium hydroxide paste was placed again.

Fig. 2. Postoperative radiograph.

The tooth was asymptomatic on the third appointment. The root canals were irrigated with 5.25% sodium hypochlorite and dried with paper points. The canals were obturated using Sealapex (Kerr, USA) and laterally condensed gutta-percha technique. A temporary restoration was placed and a postoperative radiograph was taken (Fig. 2). The tooth has been asymptomatic thereafter.

Because the pulp tests were positive and radiographs did not show any signs of pathology, any treatment was not performed in the maxillary left incisor. The patient was rescheduled for control.

The radiolucency in the apical region of the maxillary right incisor had disappeared after

Fig. 1. A periapical radiograph showing a radiolucency in maxillary right incisor and a horizontal root fracture in maxillary left incisor.

Fig. 3. Control radiograph after 6 months following endodontic treatment.

Fig. 4. Control radiograph of the teeth with orthodontic brackets after 1 year post-treatment.

Fig. 5. Control radiograph after 12 years post trauma and 6 years post orthodontic treatment.

6 months (Fig. 3). The maxillary left incisor was vital.

When the patient came to endodontic clinic for control after 1 year post treatment, orthodontics brackets were seen on his teeth (Fig. 4). Orthodontic treatment was started 3 months previously. The radiographs showed that the coronal fragment was moved relative to the apical fragment. It was advised that orthodontic treatment should be stopped, because the orthodontic problem was not significant. Its pulp tests remained positive, but the tooth mobility increased slightly.

The mobility of the tooth was within normal limits after 6 months. All of the anterior teeth were followed-up clinically and radiographically for 7 years (Fig. 5) and during that period the maxillary left incisor exhibited continued positive reaction to electric pulp tests. Although 12 years post trauma and 6 years post orthodontic treatment passed, the tooth was asymptomatic and it showed a good appearance clinically and radiographically.

Discussion

Accurate diagnosis of pulp status after root fracture is usually determined on the basis of clinical and radiographic examinations. The time before the diagnosis of the pulp condition is significant. Many investigators have suggested that the reversal of vitality of root-fractured teeth vary between a few months and 2 years (1, 6, 13).

Hargreaves (14) states that immediate splinting within an hour following the trauma gives the best results. However, according to Andreasen (1) splinting may be applied within a week. Nowadays splinting for 1–3 months is recommended. The International Association of Dental Traumatology (IADT) recommends that splinting of the teeth with root fractures is sufficient for 3 weeks in permanent dentition (9). Furthermore, healing of the horizontal root fractures with or without initial treatment is reported to occur in up to 80% of the cases (3, 6, 8).

Teeth with root fracture have more possibility of maintaining a vital dental pulp than luxated teeth without fracture (15). It was reported that dental pulp necrosis may range from 20 to 44% of the root fracture cases (5, 15), whereas in luxated teeth without fracture, necrosis occurs in at least 43.5% of cases (15).

When the fracture occurs in teeth, the force transmitted to the apical region of the tooth decreases. But if the fracture does not occur, the total force is transmitted to the apical region of the tooth. In addition revascularization can be obtained in fracture line. Furthermore it is believed that the fractured area provides an avenue of escape for fluid pressure from edema and allows for possible collateral circulation from the periodontal ligament to assist in maintaining vitality of the traumatized pulp (1, 16). Depending on these factors, the loss of pulp vitality in the maxillary right incisor and the protection of pulp vitality in the maxillary right incisor with root fracture are normal in this case.

About 75% of the teeth with root fracture exhibited calcified nodules that narrowed the pulp space (6) and this is a common finding (5). Some believe that the reparative dentin deposition and subsequent reduction of the pulp space has a close relationship with the dental pulp revascularization

or reinnervation (5). In this case report, radiographic examination showed that calcific obliteration material had in fracture line of both coronal and apical segments.

Ideally, the fragment should heal by reunion of the fragments with hard tissue. This type of healing could be achieved by splinting of the tooth as early as possible. Furthermore, if the displacement of coronal part during the accident is not severe, the chance of better prognosis increases (5, 17). In a recently study (18) consisting of 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 a root development, pulp sensibility, and repositioning of dislocated fragments were highly predictive of the frequency and type of fracture healing. Their studies findings indicated that teeth with no or slight loosening of the coronal fragment may not require splinting. Furthermore, that healing may be optimized by reposition of a displaced coronal fragment, and a short term splinting is apparently sufficient in these cases to secure healing (18). In our case, the severity of the trauma and the displacement of coronal fragment were probably not severe. This may be the reason why there is no distance in both of the fracture segments before treatment. But after the orthodontic treatment, the distance of the segments was increased.

Many clinically oriented orthodontists insist that movement of teeth will not lead to a deleterious effect on the dental pulp, although some lateral and/or apical resorption may result as a consequence of therapy (19). Anstending and Kronman (20) in 1972 investigated the effects of various types of orthodontic movement on the dental pulp and did find changes in the pulps of all teeth moved. But they could not tell whether these changes were temporary or permanent.

The risk, incidence and type of root resorption that can occur following all types of tooth trauma have been clearly delineated (4). The assessment of the effects of orthodontic tooth movement on previously traumatized teeth however, has received little attention in the literature.

Orthodontic movement of the teeth with repaired root fractures is possible, even if the fractures at the time of the accident are extensive with marked fragment dislocation. In cases where the repair occurs without separation of the fragments, the apical fragment may remain attached to the coronal portion throughout and following orthodontic treatment, but separation of the segments may be enhanced by orthodontic movement (21). It also was considered advisable that teeth with these types of fractures be observed at least 2 years before initiating orthodontic movement. A similar corroborating case report was published by Hovland et al. (22) in which a maxillary central incisor with a transverse fracture at the junction of the apical and middle third of the root was evaluated 2 years post-trauma. The tooth was responsive to sensitivity testing and mobility was within normal limits. The traumatized tooth was moved palatally and intruded during treatment. An 8-year recall shows the patient to be symptom free and in normal occlusion. Radiographically the horizontal fracture line was present without evidence of resorption, but the root canal space in the apical third appeared obliterated. Cephalometric tracings revealed movement of the entire tooth as a single unit. But in the present case the fractured tooth was extruded during the orthodontic treatment. Therefore fracture line could be communicated with the oral environment.

A factor with significant influence in the healing process in cases of horizontal fractures is the presence of a communication of the fracture line with the oral environment (5). Healing does not take place if an interaction between the fracture line and the oral environment exists, because of bacterial contamination from bacteria in the sulcus (5).

Because the orthodontic problem was not important in this patient esthetic and any marginal bone loss that brings about a communication between the fracture line and the oral cavity will endanger the life of the tooth, it was advised that orthodontic treatment should be stopped.

Pretreatment consultation with an endodontist is strongly recommended after the orthodontist carefully examines the radiographs if possible or predictable damage seems imminent.

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