



Maintaining a Hopeless Traumatized Maxillary Central Incisor as a Transient Treatment Option: A Case Report with a 3-Years Follow-Up

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An open apices tooth is among the rare types of traumatic dental injuries is horizontal root fracture. Many factors may affect the treatment and prognosis of root fractures, like the time between trauma and treatment, degree of dislocation and mobility, stage of tooth development, fracture site, and patient's age. This case presents a horizontal root fracture of a maxillary central incisor in an 8-year-old boy. The tooth was considered for extraction due to excessive mobility and deep probing depth, but the patient's parents refused to extract the tooth. After one year, during the follow-up examination, we noticed an unprecedented healing process had been initiated. Due to the weak crown-to-root ratio, the traumatized tooth was splinted to the surrounding teeth to reduce the wrecking forces and promote healing. In a three-year follow-up, the cone-beam computed tomography examination showed that the coronal and apical fragments continued to develop separately. Also, it was observed that the mobility and probing depth were reduced significantly.

Keywords: Fracture Healing; Horizontal Root Fracture; Incisor; Tooth Root

Introduction

Injuries to permanent teeth (e.g., root fractures, damage to dentin, cementum, and pulp) are rare health issues with a prevalence of only 0.5%-7%. Root fractures primarily affect maxillary central incisors in males 11-20 years old [1-3]. Categorization of the teeth mentioned above injury encompasses horizontal and vertical root fractures. The primary classification is horizontal root fracture. However, predominantly affects central incisors of the maxilla in at-length erupted teeth having an entire root formed in the middle-third of the root. This category mainly includes traumatic injuries during falling, fighting, sports, or being hit in the face [4]. Fracture line location and its link with the gingival crevice are crucial long-term prognostic determinants for the tooth [5-7]. Four types of healing patterns have been observed regarding root fractures: 1) Healing *via* calcified tissue, 2) Healing *via* interproximal tissue, 3) Healing *via* interproximal bone and connective tissue, and 4) Inter-

proximal inflammatory tissue without healing [8]. Radiographic evaluation with different angles is necessary to diagnose horizontal root fracture [9, 10]. In this respect, periapical radiographs represent some limitations to diagnosing and managing horizontal root fractures. Therefore, cone-beam computed tomography (CBCT) has been advised to be implemented to accurately diagnose, manage, and assess the prognosis of dentoalveolar trauma such as root fracture [9, 11, 12]. The present study reports a horizontal root fracture with a hopeless prognosis that unintentionally survived and underwent a healing process. Besides, the efficiency of CBCT in managing and evaluating prognosis is described.

Case Presentation

An 8-year-old boy, who had a bicycle accident three days before, was referred to the Dental Traumatology department of Shiraz Dental School, on August 18, 2018. The patient had been vaccinated against tetanus. Also, he did not experience





Figure 1. A) Clinical appearance of the traumatized region 3 days after trauma; B) Periapical radiograph showing horizontal root fracture of the left maxillary central incisor



Figure 2. A) Splinting the damaged tooth to its adjacent tooth with a 0.3 mm twisted wire and photo-polymerized composite two years after the trauma; B) Periapical radiograph of tooth #9: seemed that the tooth was undergoing the type-3 healing process

headaches, nausea, unconsciousness, or vomiting at the time of the accident or after the injury. Thorough clinical and radiographic examinations were performed. The left maxillary central incisor was sensitive to palpation and had Grade III mobility. The obtained radiographs confirmed the occurrence of horizontal root fracture at the middle-third of the root (Figure 1). The stage of root development was 9 according to Nolla method, *i.e.*, the root was almost completed, and the apex was open [13]. In addition, it was unresponsive to pulp sensibility tests.

A low displacement was also observed, and the tooth was probed up to the fracture line (6 mm). Besides, the right maxillary central incisor had Grade-I mobility and was responsive to electrical and thermal pulp tests. Extraction was recommended for the left maxillary central incisors because of deep probing depth, oral communication with the fracture line, and severe mobility. The patient was referred to the Surgery department of Shiraz Dental School, and follow-up sessions were suggested for the right maxillary central incisor. However, since the patient's parents insisted on keeping teeth #9, extraction was not performed. After five months, the patient made a new appointment with the chief complaint of tooth mobility, while his left maxillary central incisor had not been extracted. At this time, the teeth were still unresponsive to the vitality tests and probed to the fracture line at the buccal area. Thus, the patient has been

recommended to refer for tooth extracted again. At the subsequent follow-up session on July 9, 2019 (after one year), the tooth had not been extracted yet, and the patient's parents insisted on maintaining the teeth. A radiograph was taken, and signs of healing were observed surprisingly. Therefore, it was decided to give this tooth a chance. It was splinted to its adjacent teeth (from right maxillary to left maxillary canine) from the palatal region using 0.3 mm twisted wire (Dentaurum, Germany) and photopolymerized composite. The patient was recommended not to chew hard food.

After two weeks, the tooth was reassessed. The healing pattern was type three, *i.e.*, healing with interproximal bone and connective tissue. A two-stage follow-up session was assigned for the patient, but the patient did not come back until about one year later, on May 12, 2020. In this session, the splints were torn up. As a result, probing depth was still 3-4 mm, and the mobility was mild. Based on the low crown-to-root (C/R) ratio recorded for the left maxillary incisor in our last radiographic assessment, we splinted the damaged tooth to its adjacent tooth from the palatal region using 0.3 mm twisted wire to withstand the chewing and biting forces (Figure 2). After six months, the patient was re-examined. Tooth had no complications, and the probing depth was improved to 1-2 mm. In addition, a CBCT was taken to evaluate the prognosis of the tooth and to figure out the exact mechanism of the healing process and the crown to root ratio (Figure 3). This case report was written after obtaining informed consent from the patient.

Discussion

Root fractures are unusual injuries to the open apex permanent teeth that usually occur after traumatic accidents such as a vehicle or sports accidents, violence, or malocclusion [1, 14, 15]. Central incisors are the most common site of horizontal root fracture, and healing of the fractured roots may occur in three-quarters of these cases [16, 17]. The level of the fracture line, communication of the fracture line with the oral cavity, degree of tooth mobility, and vitality are four critical parameters that helped us manage the tooth with an appropriate treatment option. Root fractures at the middle and apical third usually have a more favorable long-term prognosis than the cervical third root fractures. However, if the mobility of the coronal fragment is severe, the sole treatment option would be extraction [18]. Factors affecting the healing of a tooth with root fracture are categorized into two main groups. The first group includes general and injury-related factors like patient age, stage of root development, fracture level, coronal fragment discoloration, coronal

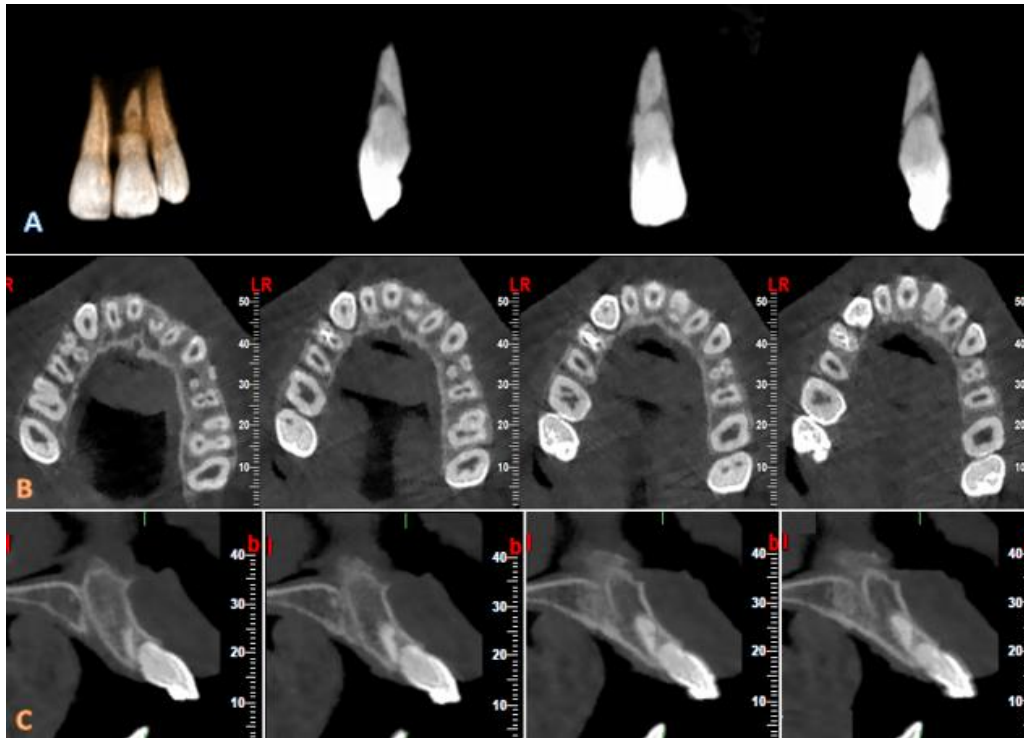


Figure 3. A) 3-D images of the fractured tooth presenting the tooth's buccal, mesial, and distal views, and the separate development of tooth fragments; B) Axial view reveals that the fracture space has been filled with bone and the development of tooth fragments; the PDL space is normal; C) Sagittal's view demonstrates the low C/R ratio of the fractured tooth

fragment mobility, and distance of fragments. The second includes treatment factors like the splint type, tooth reduction, and time between trauma and treatment [19-21]. The healing process occurs in four patterns: *i*) calcified tissue healing, *ii*) interproximal connective tissue healing and interproximal bone, *iii*) connective tissue healing, and *iv*) interproximal inflammatory tissue without healing [22-24]. Two crucial prognostic factors of horizontal root fractures encompass the fracture line level and healing pattern type [9].

In the current case, the patient had a bicycle crash, and the clinical and radiographic examinations for the right maxillary central incisor were indicative of horizontal root fracture. Meanwhile, several factors like severe mobility (grade III) and deep probing depth favored failure of healing and were representative of a hopeless prognosis. However, the unintentional 1-year period for not extracting the permanent teeth had initiated the healing process discovered in follow-up sessions. Despite the oral communication of the fracture line, each apical and coronal segment continued its development separately. The healing pattern was type 3, interproximal bone, and connective tissue healing, confirmed by dental x-ray radiographs. Afterward, the damaged tooth was splinted to its adjacent tooth to withstand the chewing and biting forces. One of the probable reasons this traumatized tooth had undergone a healing process

despite its low C/R ratio (2/1) may be related to the class II relationships of the jaws. As a result, the tooth was not in contact with the mandibular teeth, which minimized the occlusal and biting forces on the tooth.

On the other hand, implementing a functional non-rigid splint reduced tooth movements and restricted them to physiological movements.

The survival of this tooth in the mouth can be considered a transient treatment with some advantages. First, this tooth acts as a space maintainer and preserves the height and width of the alveolar bone, which favors further implant placement. The radiographic examination was representative of the same bone level of the traumatized tooth with its adjacent teeth. Besides, the phonetics and the esthetic of the patient were not disturbed.

Some studies have reported spontaneous healing of horizontal root fractures [11, 25-27]. However, to our knowledge, only one report is available that horizontal root fractured teeth with severe mobility were not extracted, and the healing process had occurred, which is in line with the case presented here [8]. Albeit, in that case, mobility was related to the advanced periodontal disease, and it was not associated with trauma exactly.

Lately, CBCT has been advised to be applied as the imaging modality of choice to diagnose and manage root fractures [9, 28]. Herein, CBCT was implemented to evaluate the bone level

of the traumatized teeth with their adjacent teeth and assess its prognosis, c/r ratio, and specific healing mechanism. CBCT was taken in a 3-year follow-up session and found that the bone level of the traumatized tooth was the same as its adjacent teeth. In addition, the prognosis of tooth #9 was evaluated through CBCT. However, it showed a poor performance due to improper C/R ratio, and maintaining the tooth was considered a transient treatment option.

Conclusion

To sum up, this case report may suggest postponing the extraction of a hopeless traumatized tooth with severe mobility and deep probing depth, which has a class II relationship with the jaws. Also, it is recommended to give the tooth the chance of survival as a transient treatment.

Conflict of Interest: 'None declared'.

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