



Diagnosis and Treatment of an Incomplete Crown-Root Fracture with Intentional Replantation: A Case Report

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ABSTRACT

Acute traumatic injuries to the maxillary incisors may lead to a crown-root fracture. If the fracture is left untreated, the fracture line will propagate and extend apically, resulting in microbial contamination of the attachment apparatus and subsequent bone loss. In cases with extensive periodontal involvement, extraction has been suggested. However, bonding and sealing the fracture line with a biocompatible material seems to be an effective alternative treatment option. In this case report, management of a central incisor with an incomplete crown-root fracture that showed signs and symptoms of vertical root fracture is discussed. As the extension of the fracture line was not clear, intentional replantation and sealing the fracture line with a glass ionomer was performed. The tooth showed no signs and symptoms at six-month follow up, and the radiographic examination exhibited substantial bone repair.

Keywords: Tooth Replantation; Glass Ionomer Cements; Tooth Fractures

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INTRODUCTION

Traumatic dental injuries often occur because of an accident or sports injury. Most of the time, these injuries are minor, without involving the pulp or the root of the traumatized tooth [1]. However, sometimes accidents might lead to more dramatic results, which involve the pulp and/or attachment apparatus. In complicated crown-root fractures, the enamel, dentin, and pulp of the affected teeth are involved, which contribute to 5% of all dental injuries [2]. An incomplete crown-root fracture is a subcategory of crown-root fracture in which the fracture line has not yet split the tooth into two separated segments [3]. This fracture line permits invasion of the oral bacteria into the pulp, resulting in pulpal inflammation. This might lead to necrosis of the pulp if left untreated. As the fracture propagates, periodontal

involvement along the fracture line occurs. If this condition is not treated in the early stages, the lesion progresses further, deep into the periodontium [3].

Consequently, bone loss alongside the fracture line will occur, and a deep-narrow bone defect or a coronally positioned sinus tract might be present.

These features can be similar to a vertical root fracture (VRF) which may complicate the diagnosis [4]. Therefore, to differentiate these fractures, it is essential to locate the origin and the etiology of the fracture. If the fracture has originated from the root and propagated coronally, the diagnosis would be a VRF. However, if the fracture has initiated in the crown, it would be categorized as crown-root fracture, regardless of the symptoms.

The prognosis of a tooth with crown-root fracture depends mainly on the extension of the fracture.



Fig. 1. Intra-oral examination shows a sinus tract associated with tooth #9.

The more apical the extension, the more difficult it is to create an environment for placement of a well-sealed coronal restoration. Management of such fractures requires a multidisciplinary approach considering both pulp and periodontium. When there is complete crown-root fracture, the coronal segment should be removed first. Then, based on the apical extension of the fracture, crown lengthening surgery or extrusion of the apical segment orthodontically or surgically might be indicated to expose the margins of sound dentin. In severe cases with extreme apically extended fractures, extraction is inevitable [5]. In cases of incomplete fractures, treatment is more challenging, as the extension of the fracture-line cannot be determined through clinical or radiographic examinations. However, efforts have been made to preserve such teeth [6-8]. In a case series, six teeth with VRF were successfully treated through intentional replantation. The root fragments were bonded with 4-META/MMA-TBB resin [6]. Also, a light-curable glass ionomer was suggested for the treatment of incomplete fractures [7,8]. In the present case report, management of a central incisor with an incomplete crown-root fracture with intentional replantation is described. Also the repair of the fracture line with glass ionomer was performed extraorally.

CASE REPORT

A healthy 12-year-old female with non-contributory medical history was referred to the Endodontic Department with a chief complaint of dental abscess.



Fig. 2. Radiograph obtained after the traumatic injury showed vertically oriented crown-root fracture

Intra-oral examination revealed an abscess located in the attached gingiva above the tooth #9 (Figure 1). There was a history of dental trauma six months ago, which had resulted in crown fracture of the tooth #9 (Figure 2). The tooth had received root canal treatment and direct composite restoration at that time by the previous dentist. All the anterior teeth responded normally to thermal sensibility tests, except tooth #9, which was unresponsive. Both maxillary central incisors were tender on percussion and palpation. Based on periodontal examinations, tooth #9 showed a pocket depth of 12mm and mobility of grade 2, while these values were within the normal range for the other anterior teeth. The occlusal contacts of the anterior teeth were examined with a carbon paper, and it was found that tooth #8 had a premature and traumatic contact in centric relation. A periapical radiograph was taken and showed a halo or "J" shaped radiolucency around tooth #9 (Figure 3).



Fig. 3. Periapical radiography six months after the traumatic injury shows j-shaped radiolucency in the mesial aspect of the tooth #9.

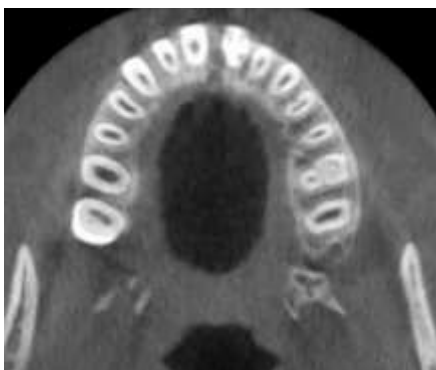


Fig. 4. Axial view of the CBCT showing bone resorption adjacent to the tooth #9.

Considering these findings, a CBCT was prescribed in order to facilitate an accurate diagnosis. Although no obvious root fractures were observed in the CBCT, the bone resorption pattern adjacent to the root area suggested a root fracture (Figure 4).

Based on the clinical, occlusal and radiographic examinations, the periapical diagnosis of tooth #8 was symptomatic apical periodontitis due to traumatic occlusion. Therefore, cusp reduction was performed to solve the problem. Although tooth #9 showed signs and symptoms of VRF, including deep-narrow periodontal pocket and a coronally positioned sinus tract, according to the history of dental trauma and origination of the fracture line from the crown, it was finally diagnosed as a crown-root fracture with apical extension of the fracture line into the root. Two treatment options were considered for tooth #9; 1-extraction or 2- intentional replantation and repair of the fracture line extra-orally. After consultation with the patient and her guardian, the latter treatment option was chosen. Under local anesthesia (lidocaine 2% with 1:80000 epinephrine (Persocaine, Daroupakhsh, Iran), the tooth was conservatively extracted using forceps. The socket was gently curetted (12 Miller Surgical curette) to remove any remaining infective or granulation tissue (Figure 5). Under magnification, an oblique fracture line was observed in the cervical third of the root extending from mid-buccal to the mesiolingual aspect.



Fig. 5. After extraction of the tooth, the socket was gently curetted.

The root was rinsed with normal saline, and the attached granulation tissues were removed by a scaler. Using a light-curable Glass Ionomer (Fuji II 2 LC Gold Label, GC, Japan), the fracture line was sealed (Figure 6). The tooth was replanted and carefully adjusted into its original position. The overall time that the tooth was dry out of the socket was less than 20 minutes. Rigid splinting was performed using composite resin and 0/7mm wire, as the tooth was diagnosed with grade 2 mobility prior to the treatment. The patient was advised to follow a soft diet, and antibiotic (amoxicillin 500mg every 8 hours for 5 days) was prescribed. After two weeks, the splint was removed. The tooth was sensitive to percussion, and grade 1 mobility was observed. At 3-month follow up, the sinus tract was resolved entirely and probing depth was reduced from 12mm to 3mm. Radiographic examination showed healing of the surrounding bone. The periapical radiography of 6-month follow-up exhibited formation of lamina dura and healing of the adjacent bone. Also, the pain on percussion was diminished, and mobility of the tooth was within the normal range (Figure 7).

DISCUSSION

Cracks in the anterior teeth are usually as a result of an acute injury. If the crack propagates longitudinally, it might involve the pulp and eventually result in fragmentation of the crown and root. Treatment consists of removal of the coronal fragment and subsequent restoration.

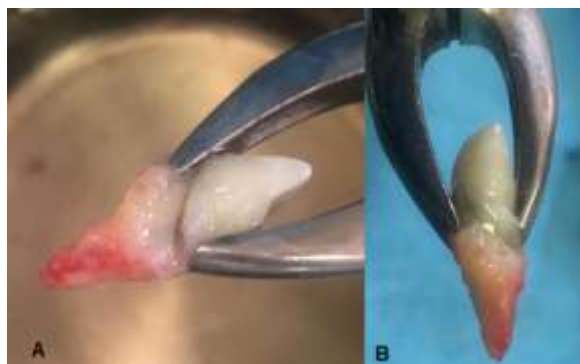


Fig. 6. (A) Photography of the tooth showing a fracture line in the cervical third of the root. (B) The fracture line was sealed with light curable glass ionomer.

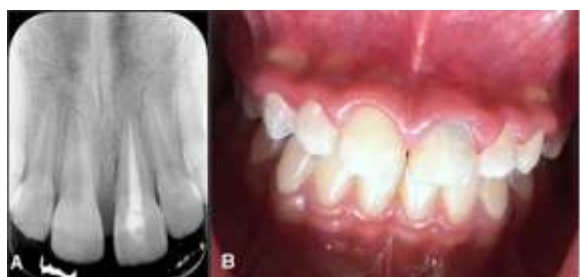


Fig. 7. Six-month follow-up. (A) Radiograph shows formation of lamina dura and bone formation in the affected areas. (B) Normal gingival tissue and absence of sinus tract are evident.

If the sound dentin is below the gingival level, crown lengthening surgery, orthodontic extrusion or surgical extrusion can be considered as treatment options in order to expose the dentin and provide an environment for placement of a well-sealed restoration [2]. However, crown lengthening surgery for a single tooth in the aesthetic zone may result in gingival margin discrepancy. Also, in the cases of incomplete crown-root fracture, as the exact extension of the fracture cannot be determined through clinical and radiographic examinations, it is not possible to define to what extent the extrusion should be performed. When the crack has extended extremely apically, the prognosis of the tooth is considered poor because of extensive periodontal and/or periapical involvement and bone loss. Thus, extraction is suggested as a primary treatment option [9]. In recent years, several case reports and case series are

published offering alternative treatment options, consisting repair of the fracture line both intraorally and extra-orally by means of intentional replantation [10-12]. The method used in many case reports, when there was an split tooth due to dental trauma was as follows: 1- minimally invasive extraction of the problematic tooth, 2- careful scaling of the tooth surface and the bony socket to remove any granulation tissues, 3- preparation of the fractured surfaces and bonding the fragments of the root with a bonding cement [13]. Special care should be taken not to prolong the dry time of the tooth outside the socket. This points to the importance of preserving periodontal ligament cells to prevent future risk of ankylosis [10, 13, 14]. Intentional replantation is considered as an accepted treatment procedure in the cases which non-surgical or surgical endodontic retreatment will not resolve the problem [15].

Coronally positioned sinus tract and a deep-narrow periodontal probing defect in an endodontically treated tooth are pathognomonic signs of VRF [16]. These features are due to the inflammatory process caused by bacterial invasion alongside the fracture line. The bone loss pattern can be similar to a crown-root fracture because of constant microbial ingress through the fracture line. This highlights the importance of a comprehensive dental history for an accurate diagnosis and subsequent treatment planning. Although it can be challenging to detect the exact extension of a fracture to the root, the use of CBCT imaging can be helpful. Even in cases where the fracture line cannot be observed in the image due to the small fracture line, the pattern of bone loss in the vicinity of the fracture can be suggestive to the presence of a fracture [17].

Among the materials used to repair the fracture line, dentin bonding agents and glass ionomer are the most suggested [6, 7, 18, 19]. In a clinical study, 23 vertically fractured roots were treated and bonded with 4-META/MMA-TBB resin, either through the root canal or extra-orally through intentional replantation. The overall survival rate after 22 months were 78% for both groups.

Therefore, bonding of fractured teeth with a resin luting cement seems to be suitable treatment modality for vertically fractured teeth [18].

In the present case, glass ionomer was the material of choice because of its several advantages. It has a good sealing ability and biocompatibility. The ability to bond to the surrounding dentin can help to prevent the spread of the fracture. Moreover, periodontal attachment can occur on this material [20]. Also, because the tooth had not yet been split into two separate fragments, it was not possible to place a bonding cement on the fractured surfaces, and instead it was decided that the entire fractured area would be covered with a glass ionomer.

Stabilization must be considered after replantation as an aid in healing the periodontium. Length of the root, tooth mobility and patient's compliance should be considered in determining the period and the rigidity of the splint [21]. Several methods are suggested for fixation, such as single suture crossed over the crown, composite resin spanning the interproximal gap, or composite resin and wire [22,23]. In the present case, because of the extensive preoperative bone loss, 0.7mm stainless steel wire and composite resin was used for 14 days to ensure stability.

CONCLUSION

In cases of incomplete crown-root fractures with severe apical extension of the fracture line, intentional replantation and repair of the fracture line with glass ionomer extra-orally, seems to be a promising treatment modality.

CONFLICT OF INTEREST STATEMENT

None declared.

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