Multidisciplinary approach in the management of a complicated crown root fracture

ABSTRACT

Background This article describes the management of a complicated crown root fracture.

Case report A young patient presented with a crown root fracture of the maxillary left central incisor with an oblique subgingival fracture line. A multidisciplinary treatment approach including endodontic treatment, orthodontic extrusion, surgical extraction and intra-alveolar repositioning was used to gain sufficient crown length of the fractured maxillary incisor. The coronally repositioned maxillary left central incisor was stabilised by sutures and a resin wire splint. A resin core was built up followed by fabrication of an all-ceramic crown. Clinical and radiographic follow-up of the maxillary left central incisor after 24 months showed no signs of bone resorption or pathology and good aesthetics and functions were maintained.

Keywords Crown root fracture; Orthodontic forced eruption; Surgical extrusion.

Introduction

Complicated crown fractures are a common occurrence related to severe trauma, accidents or sports injury. Such patients need emergency care directed towards initial relief of symptoms as well as to restore the impaired functions, phonetics and aesthetics. The primary objective in treating such cases is the successful management of pain related to soft tissue lacerations and traumatic dental injuries such as fractures or avulsion. The incidence of complicated crown fractures accounts for approximately 18-20% of all tooth injuries in a permanent dentition [Andreasen, 1981]. Clinical management of a tooth fracture depends on its position, and extent of fracture line [Andreasen, 1984]. The prognosis for complicated crown-root fractures is often poor due to insufficient coronal structure and the fracture line below the gingiva. The amount of sound tooth structure necessary for biologic width and adequate tooth structure for ideal crown retention is 4 mm above the alveolar bone [Siebert, 1990]. Treatment options for such cases requires comprehensive assessment and treatment planning ranging from crown lengthening, orthodontic forced extrusion, surgical extraction and repositioning, and in extreme cases, extraction [Emerich-Poplatek et al., 2005].

This case presents the management of a complicated crown root fracture using a combined treatment approach including endodontic treatment, orthodontic forced extrusion, and intentional repositioned replantation, followed by aesthetic restoration.

Case report

A 16-year-old male patient was referred to the department of Endodontics, Korea University Hospital, for a complicated crown fracture of the maxillary left central incisor. Emergency treatment for a missing fragment of the maxillary left central incisor due to sports injury was carried out by a local dentist 6 weeks prior to his first visit to our hospital. The treatment included pulpectomy and a resin-wire splint from the maxillary left canine to the right canine to stabilise both maxillary central incisors due to luxation. Medical history was uncontributory. Clinical examination of the fractured maxillary left central incisor showed the fracture line 2 mm below the gingiva on the palatal aspect, leaving a 2 mm clinical crown on the buccal aspect. The access openings on both the central incisors were temporarily sealed with Caviton (GC, Tokyo, Japan) after pulpectomy. Radiographic examination revealed no apparent pathology on the maxillary left central incisor and fully developed roots with sufficient length of both maxillary central incisors. A slight external root resorption and adjacent alveolar bone resorption of the maxillary right central incisor was seen (Fig. 1). The initial treatment plan comprised endodontic treatment of both maxillary central incisors, followed by orthodontic forced eruption of the maxillary left central incisor to reveal the fractured buccal margin in order to gain sufficient crown length for optimum retention and esthetic outcome with an all-ceramic crown.

On the first visit to our dental hospital, the resin wire splint placed by the local dentist about 6 weeks before was removed, followed by endodontic treatment on both
maxillary central incisors. As planned, orthodontic forced eruption was carried out using a rectangular wire placed from the maxillary right lateral incisor to the left canine, which was activated by a single elastic thread (Fig. 2). Although elastic thread was changed biweekly for the next 4 weeks, no change in tooth position was observed. In an attempt to increase the orthodontic force, two activation threads were used during the next 2 weeks of follow up. Unresponsive results after 6 weeks of attempting forced eruption and metallic sound on percussion suggested ankylosis of the maxillary left central incisor (Fig. 3).

Thus, our treatment plan had to be changed to a surgical approach to gain sufficient crown length by a series of procedures including extraction and repositioning. After the patient’s consent, the tooth was extracted atraumatically and repositioned 4 mm coronal to the initial position, thereby exposing the palatal fractured margin 2 mm above gingival margin (Fig. 4). The repositioned maxillary left central incisor was stabilised with sutures and a resin wire splint from the maxillary right central incisor to the left lateral incisor for 10 days. A total crown length of 6 mm on the buccal aspect was achieved by this intra-alveolar repositioning procedure. After satisfactory outcome was revealed by clinical examination and periapical radiograph at subsequent recalls, a resin core (LuxaCore, DMG, Hamburg, Germany) was placed over the exposed clinical crown gained by the surgical procedure and a temporary crown was delivered following tooth preparation of the maxillary left central incisor (Fig. 5). After gingival recontouring procedures over the following two months using the temporary crown, (Fig. 6) an all ceramic crown (IPS Empress II) was fabricated to achieve optimum aesthetic result (Fig. 7).

The radiographic follow-up after 24 months shows no sign of root resorption or pathology on the maxillary left central incisor, and no further progressive resorption on the maxillary right central incisor that was seen on initial visit (Fig. 8). Clinical follow-up of the maxillary left central incisor for 24 months after surgical repositioning showed that good aesthetics was maintained (Fig. 9).

Discussion

It is estimated that one fourth of the population under the age of 18 sustains traumatic injuries to the anterior

**FIG. 1** Periapical radiograph of the central incisors before treatment.

**FIG. 2** Buccal view of the attempted orthodontic extrusion.

**FIG. 3** Radiograph showing no change in tooth position of the maxillary left central incisor after 6 weeks of orthodontic extrusion attempt.

**FIG. 4** 4 mm surgical repositioning of the maxillary left central incisor. Note the space between alveolus and root.

**FIG. 5** Temporary crown on the maxillary left central incisor.

**FIG. 6** Gingival recontouring procedures over the following two months using the temporary crown.
teeth [Murchison et al., 1999]. The anterior positioning and protrusion of the central incisors make them more susceptible to injury and account for 80% of all traumatic injuries to anterior teeth [Andreasen and Ravn, 1982; Andreasen and Andreasen, 1994].

A review of published case reports indicates that oblique fractures contribute to 85% of traumatised incisor fractures from labial to palatal aspect in apical direction [Murchison et al., 1999]. Our case presented with the fractured line proceeding in apical direction with the clinical crown 2 mm on the buccal aspect and 2 mm subgingivally on the palatal aspect of the maxillary left central incisor. Approach towards treatment of subgingival tooth fracture is crucial as the fracture line compromises the biological width in terms of fulfillment of the obligatory ferrule effect [Sorensen and Engelman, 1990]. In the presented case, the placement of restoration was not possible because of insufficient tooth structure on the palatal aspect, caused by the oblique fracture line which compromised the biological width of the available crown. A comprehensive diagnosis and treatment planning is required in order to expose the subgingival fractured margin supragingivally, which could be attempted by various procedures including crown lengthening, surgical repositioning and orthodontic extrusion.

In this case, orthodontic extrusion was chosen as our first treatment modality because it allows a passive biological way of extruding the tooth and restores physiologic attachment without an apical shift of gingival margin [Suprabha, 2006]. However, non-response to orthodontic forces for 6 weeks as well as change in the percussion sound led to clinical diagnosis of ankylosed maxillary left central incisor. The diagnosis of ankylosis on a dental radiograph is difficult because of limited area which is not readily visible on a conventional two dimensional radiograph [Isaacs et al., 2001]. The factors that could have caused ankylosis in this case may be attributed to disruption of the periodontal fibers that led to fusion of cementum with the alveolar bone, as well as a long splinting period with a rigid wire and noncompliance of the patient for subsequent follow-ups. When satisfactory results were not achieved by orthodontic extrusion, change in modality was imperative, hence other treatment options including a surgical approach were considered in order to gain the necessary crown length. The options available were surgical extraction and repositioning, a non conservative approach like fixed partial denture or extraction followed by immediate or delayed implant placement. Considering the patient’s economic condition, implant therapy was not a favourable option and placement of a fixed partial denture would compromise the sound tooth structure of the adjacent tooth at a young age. Surgical extraction and repositioning were chosen as our alternative treatment modality in this case. However, success of surgical extraction and repositioning depends on a thorough diagnosis and careful planning. Points to be considered for such cases are that extractions should be performed asatraumatically as possible avoiding root damage and minimising extraoral time and there should be sufficient root length with no advanced pathology. The present case deals with an effective alternative treatment strategy for an ankylosed tooth with a complicated crown root fracture by surgical extrusion and intra-alveolar repositioning, which resulted in good aesthetics and function.

References