Surgical extrusion of a crown-root fractured tooth: 3.5-year follow-up

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ABSTRACT

Introduction: Different treatment approaches are indicated for crown-root fractured teeth. Surgical extrusion is a one-step procedure that implies immediate repositioning of the tooth into its normal position. The aim of this case report was to report the multidisciplinary treatment of a crown-root fractured maxillary premolar. **Methods:** In this case, a crown-root fractured maxillary premolar was treated by means of the surgical extrusion technique. After solving the issue of periapical radiolucency, the tooth was restored with porcelain-fused-to-metal crown. **Results:** At the 3.5-year follow-up, the tooth was asymptomatic and there were no radiographic and clinical signs of progressive root resorption, marginal bone loss or periapical disease. **Conclusion:** The favorable results of this case demonstrate that surgical extrusion may be an alternative treatment to existing protocols.

Keywords: Tooth fractures. Traumatology. Surgical instruments. Orthodontics.

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Introduction

A crown-root fracture is defined as a fracture involving the enamel, dentin, and cementum. It comprises 5% of all dental injuries. The fractures may be grouped according to pulpal involvement into uncomplicated and complicated.[1] Treatment of complicated crown-root fractures is often challenging due to difficulty in achieving isolation with a rubber dam for a dry operating field, which might compromise the hermetic seal.[2] Treatment options for such cases include: (i) orthodontic[3] or surgical extrusion;[4] (ii) gingivectomy and osteotomy/osteoplasty;[5] (iii) intentional reimplantation;[2] and (iv) extraction.

Surgical extrusion implies immediate repositioning of the tooth into its normal position. Although it is suggested that orthodontic forces render a more biological way of extruding a tooth, surgical extrusion is a one-step procedure which is simpler and less time-consuming than orthodontic extrusion of horizontal and oblique crown-root fractures.[4,6]

The objective of this report was to present the management of a crown-root fractured maxillary premolar by means of surgical extrusion with a 3.5-year follow-up.

Case report

A 50 year-old female patient was referred for treatment with the primary complaint of discomfort in her maxillary left premolar which was reported to have been traumatized one-week previously while chewing on hard food. The medical history was noncontributory. Intra-oral examination revealed an oblique crown-root fracture on the maxillary second premolar, and the palatal cusp of the respective tooth had fractured 4 mm subgingivally (Fig 1). On the radiographic examination, the tooth was fully developed and had no periapical radiolucency. No definite fracture line was visible (Fig 2).

The mobile fractured palatal fragment was extracted under local anesthesia; subsequently, temporary

Figure 1. Clinical view of fractured maxillary left second premolar.

Figure 2. Pre-operative radiographic view of fractured maxillary left second premolar. No definite fracture line is visible.

endodontic treatment with calcium hydroxide was initiated before surgical repositioning. The crown length of the buccal fragment was also shortened from the cuspal edge (Fig 3). The surgical procedure involved careful mobilization of the tooth with an elevator and cutting of the marginal periodontal fibers with a sharp scalpel. The tooth was taken with a forceps and extruded in about 4 mm. Stabilization of the root in its new position was achieved with a stainless steel orthodontic passive archwire with diameter of 0.016 x 0.022 inch (GAC International Inc., Bohemia, New York , USA), 0.018 x 0.025 inch slot brackets and a molar tube (Roth Omni, GAC International Inc., Bohemia , New York , USA) all of which were used for a period of 3 months (Fig 4). Antibiotic therapy was prescribed for 10 days and the patient motivated to maintain oral hygiene. Root canal therapy was completed ten days after extraction. The root canal was instrumented with ProTaper rotary files (Dentsply Maillefer, Ballaigues, Switzerland) in a crown-down manner, and enlarged up to 30/0.09 taper. One milliliter of 5.25% NaOCl was used for irrigation between each change of instruments. After final irrigation, the root canal was dried with paper points and filled with gutta-percha (Diadent, Chongju, Korea) and AH Plus sealer (Dentsply De Trey GmbH, Konstanz, Germany) by means of the cold lateral condensation technique (Fig 5). Three months later, the splint was removed. At the end of the 6-month period, initial periapical radiolucency was completely solved (Fig 6), the tooth was restored with porcelain-fused-to-metal crown and luted with a glass ionomer-based luting agent (Ketac Cem, 3M ESPE, St Paul, MN, USA).

A 3.5-year follow-up examination revealed that there were no radiographic and clinical signs of progressive root resorption, marginal bone loss or periapical disease (Fig 7).

Figure 3. Clinical view of fractured maxillary left second premolar following extraction of the mobile fractured palatal fragment. The crown length of the buccal fragment was shortened from the cuspal edge.

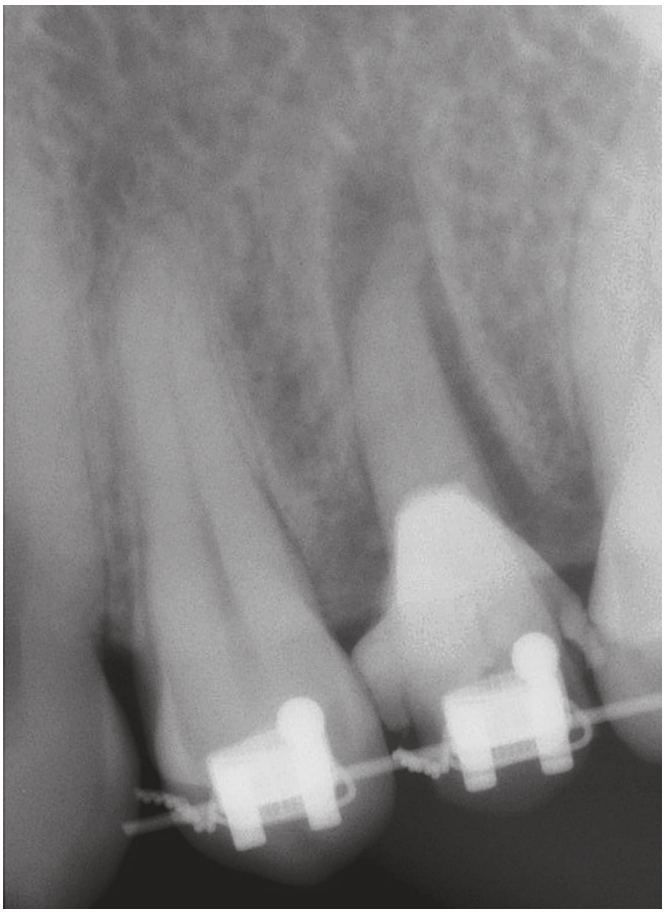

Figure 4. Radiographic view of maxillary left second premolar after extrusion and orthodontic stabilization.

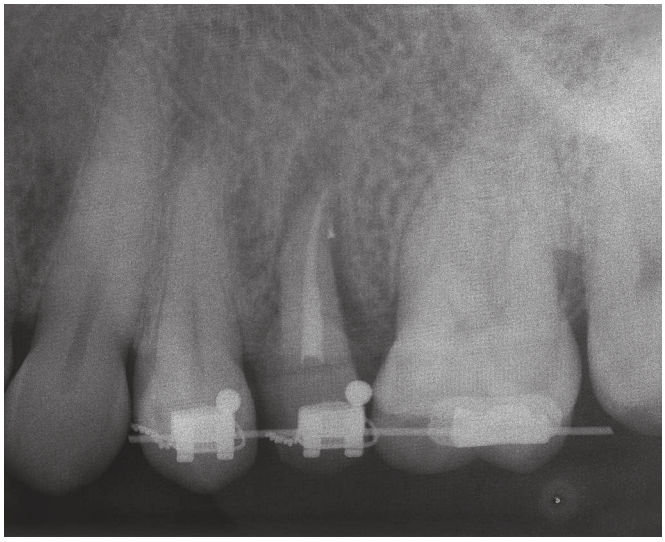

Figure 5. Radiographic view immediately after root canal filling.

Figure 6. Radiograph taken 6 months after endodontic treatment. Note the resolution of periapical radiolucency and that there are no signs of root resorption.

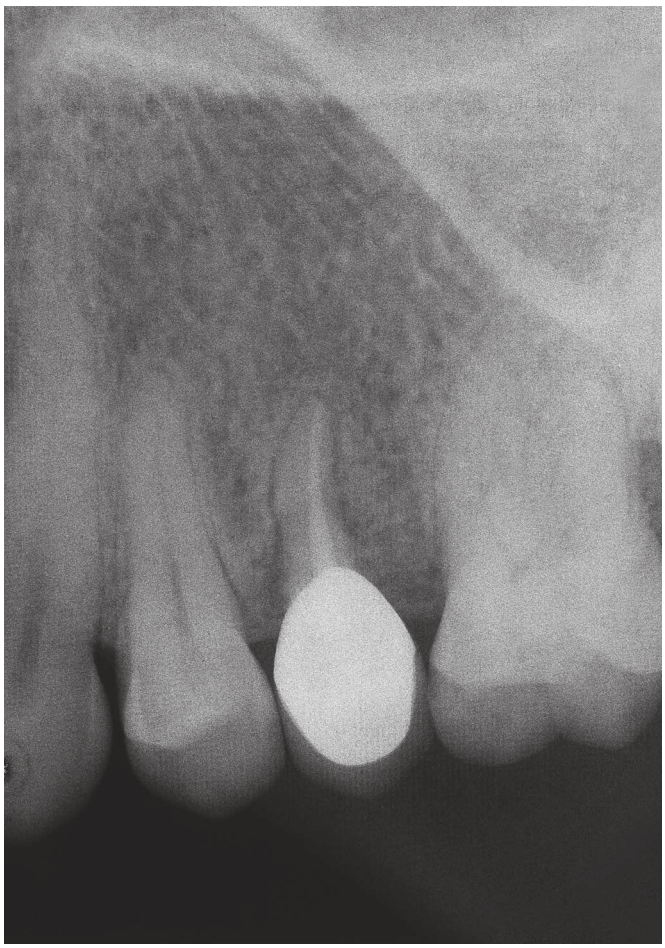

Figure 7. Radiographic view at a 3.5-year follow-up.

Discussion

In complicated crown-root fractures, the risks and benefits of each treatment option should be carefully evaluated before making a treatment decision. In this context, the following should be considered: patient's age, root development stage, eruption potential and patient's/parent's preference.[2] In the present case, a surgical technique performed by means of simple extraction was found to be successful in extruding teeth with crown-root fractures.

Intra-alveolar transplantation and forceps eruption are also known as surgical extrusion methods. These methods were first introduced by Tegsjo et al[7] and were further developed by Buhler[8] and Kahnberg.[9] In the intra-alveolar transplantation technique, the surgical modality is based on the biological behavior of the dental reimplantation after avulsion. This technique involved full-thickness flap operation and apical exposure by osteoctomy. This method should allow the direct observation of the root for favoring a better therapeutic orientation. Following tooth extrusion, a bony transplant is carried out apical to the root so as to achieve tooth stability and prevent tooth relapse.[7] In the forceps-eruption technique, the root does not leave the socket. This method also eliminates both ostectomy and bone graft

on the root apical area, thereby performing just careful and gentle root luxation until the desired extrusion of the tooth is achieved.[10] Because the second technique is much easier and safer to perform, in the present case, the second technique was preferred and the use of heavy elevation was avoided.

Clinical studies have reported successful treatment outcomes yielded by surgical extrusion which may be useful and may save the root.[4,10-16] In the present case report, the outcome was in agreement with studies performed by Calişkan[4] and Khayat,[13] in which perodontal ligament (PDL) healing with no or slight root resorption (surface resorption) and a high occurrence of periapical healing were found. Calişkan[4] stated that this treatment modality could be compared with extrusive luxation of teeth, which according to Andreasen[17] had a comparably favorable prognosis with a low incidence of root resorption or ankylosis. Because the root does not leave the alveolar socket in surgical extrusion, the potential deleterious effect of drying the periodontal cells is eliminated, thus the vitality of the periodontal ligament and the maintenance of the cementoblastic layer are preserved.[18]

Semi-rigid splinting of the surgically extruded tooth has been generally considered the best practice to maintain the repositioned tooth in its correct position, as well as to provide the patient with comfort and improved function. Traditionally, interdental sutures, together with application of a surgical dressing[4,11-13,15] or the combination of wire and composite resin splints,[16] are preferred to stabilize those teeth. Orthodontic wire and bracket splints, fibre splints and titanium trauma splints are also known as semi-rigid splinting techniques.[19,20] In the case presented, splinting of the tooth with an orthodontic wire and brackets was found to be very effective. Placement of a medium thick 0.016 x 0.022-inch stainless steel orthodontic wire in 0.018 x 0.025-inch slots of brackets and tubes provides ease of semi-rigid splinting. The medium thick wire can perform small movements in relatively larger slots, thereby allowing physiologic tooth movements required for periodontal repair. Additionally, following bonding of brackets and tubes, the clinician can easily bend the stainless steel orthodontic wire and stabilize the surgically extruded tooth in the exact position desired. The ability to remove, bend and replace the wire offers the clinician multiple chances to adjust the position of the surgically extruded tooth vertically, buccolingually and mesiodistally before periodontal repair is completed. Hence, orthodontic wire and bracket splints have a critical advantage compared to the aforementioned splints, as they enable repositioning of the tooth until the best position is achieved.

The effects of the duration of splinting remain controversial, but it has been reported that long-term splinting may cause ankylosis and replacement resorption.[21] Recently, it has been recommended that fractured, avulsed or luxated teeth be splinted for up to two weeks, rather than six weeks,[22,23] and one week to 10 days is recommended for periodontal healing.[24,25] In the case presented, the duration of splinting was 3 months due to a limitation in the patient's schedule. Despite long-term stabilization, there were no radiographic and clinical signs of progressive root resorption, marginal bone loss or periapical disease.

Surgical extrusion is a treatment option to consider in the management of complicated crown-root fractures. It is a relatively easy treatment procedure that entails reduced time until prosthetic resolution and elicits low root resorption and/or ankylosis rates. Long-term evaluations are suggested to be performed at which point the final evaluation of the method will be made.

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