Case Report

Surgical extrusion of a crown-root fractured immature permanent incisor: 36 month follow-up

Kırzıoğlu Z, Karayılmaz H. Surgical extrusion of a crown-root fractured immature permanent incisor: 36 month follow-up

Abstract – Crown-root fracture is defined as a fracture involving enamel, dentin and pulp and can be classified as either complicated or uncomplicated. The tooth with crown-root fracture presents a lot of problems during coronal restorations and extraction was formerly used in many cases. But loss of a permanent incisor in a young patient may create severe emotional problems and alternative treatment approaches must be considered. This report presents the successful results of a surgical extrusion of a complicated crown-root fractured, immature permanent incisor in a 9-year-old boy. Examination 36 months after the trauma indicated that the treatment had provided functional and esthetic results.

Zuhal Kırzıoğlu, Hüseyin Karayılmaz

Department of Pedodontics, Faculty of Dentistry, Süleyman Demirel University, Isparta, Turkey

Key words: dental trauma; crown-root fracture; surgical extrusion; orthodontic extrusion

Dr Zuhal Kirzioğlu, Süleyman Demirel Üniversitesi, Diş Hekimliği Fakültesi, Pedodonti Anabilim Dalı, Çünür Kampüsü, Isparta, Turkey
Tel.: +0 246 211 32 28
Fax: +0 246 237 06 07
e-mail: zuhal@med.sdu.edu.tr; karaylmaz@yahoo.com

Accepted 25 October, 2005

Crown-root fracture is defined as a fracture involving enamel, dentin and pulp and can be classified as either complicated or uncomplicated. According to the force and direction of the impact, a fracture line can start at some point of the crown and extend longitudinally through the pulp chamber extending to the subgingival area and alveolar bone crest (1, 2).

The tooth with crown-root fracture presents a lot of problems during coronal restorations. The following situations must be considered when choosing a treatment approach (3):

- localization and degree to which biological width has been invaded;
- the pulpal involvement;
- the root development stage;
- the tooth eruption stage;
- the presence of the fragment adequately adapted to the tooth remnant.

In most of the cases, where the fracture line extends to the marginal bone crest, extraction of the tooth is possibly selected. However, many treatment alternatives for this kind of fracture have been recommended (1, 3, 4):

- periodontal gingival and osseous surgery to expose an adequate amount of tooth structure for a crown margin;
- orthodontic or surgical extrusion of the root until all the fracture site is supragingival sufficient for restoring the tooth;
- combined orthodontic extrusion and periodontal gingival and osseous recontouring for adequate margination;
- fragment recemented even with invasion of biological width;
- removing the clinical crown segment and retaining the submerged root with its vital pulp followed by placement of a fixed bridge across the space.

The aim of this report is to present the successful results of the 36-month follow-up of a 9-year-old boy with surgical extrusion of the crown-root fractured immature permanent incisor.

Case report

A 9-year old, healthy boy was brought to the Süleyman Demirel University, Faculty of Dentistry, Department of Pedodontics by his father in December the 2001. He had fallen down stairs at school and got injured 15 days previously. He had been consigned to our clinic by the hospital after the initial examination and antibiotic therapy.

Medical history and the extra-oral examination were normal. The intra-oral and radiographic examination revealed an uncomplicated crown fracture of the maxillary left central incisor and a complicated crown-root fracture of the maxillary right central incisor which had the most serious injury (Fig. 1). The fracture lines, starting from the mesial part of the crown, extended to the marginal bone level and constituted three tooth fragments. On the mesial side of the tooth, the fracture was very deep and was preventing access to the margin of the fracture site. Radiographic examination did not reveal any horizontal root fractures and confirmed the absence of supporting tissue fractures. The roots of the central incisors were still immature and had no periapical radiolucency. The boy had no pain but he was very upset which was an indication of the psychological impact of such trauma. Both of the central incisors were symptomless and responded to the electrical pulp test. Thereupon, all of the fragments were brought together and restored with orthodontic band and glass ionomer cement after the pulp capping treatment (Figs 2 and 3).

After 3 months, the right central incisor was diagnosed as having pulp necrosis. The patient and his parents were informed about the risk of tooth loss. After all the treatment options were considered, orthodontic extrusion of the tooth was decided with the patient and his parents. The normal over-jet, over-bite and dental class I morphology represented no contraindication for the planned procedure. The orthodontic band and fragments were removed and

Fig. 1. Clinical appearance of the patient.

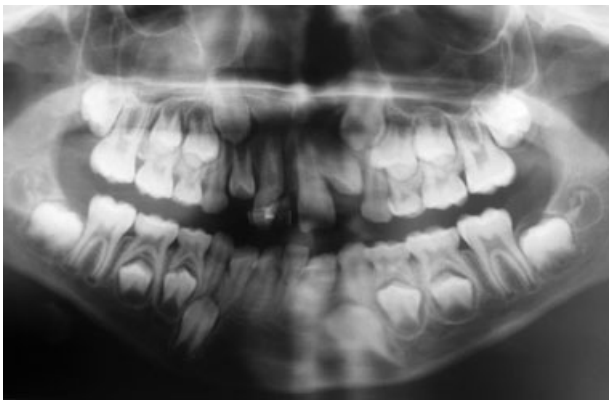

Fig. 2. Orthopantomographic view of the patient.

Fig. 3. Radiographic view of the tooth after pulp capping treatment.

temporary endodontic treatment with calcium hydroxide was initiated before the orthodontic extrusion procedure (Fig. 4). An orthodontic band with a J-hook on the buccal surface was prepared, adapted and cemented to the tooth with glass ionomer cement. Extrusive force was applied to the right central incisor using elastics and a removable orthodontic appliance (Fig. 5). The force to extrude the incisor did not exceed 20 g. The patient and his parents were instructed on the usage of the elastics and appliance and the importance of plaque control using chemical and mechanical methods together with diet advice.

In his control visit, it was determined that the patient did not use the elastics and the appliance because of being ridiculed by his school friends.

Fig. 4. Radiographic view of the tooth after temporary endodontic treatment with calcium hydroxide was initiated.

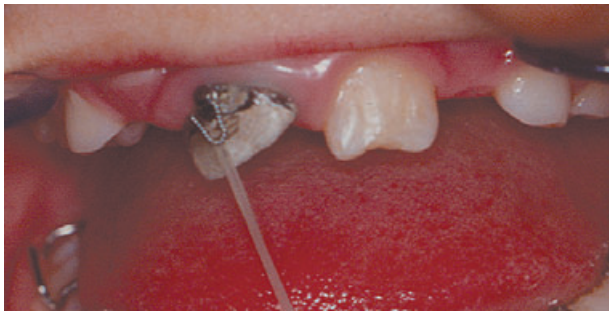

Fig. 5. Orthodontic extrusion of the tooth.

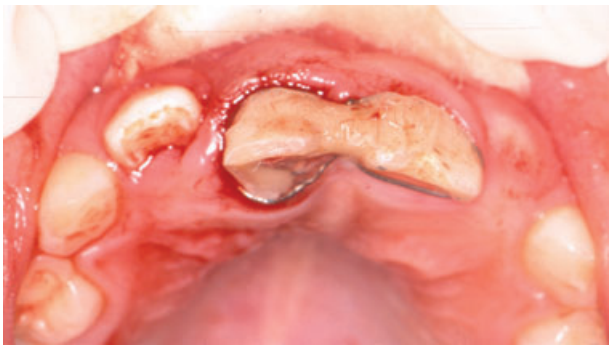

Fig. 6. Clinical appearance of the tooth after surgical extrusion.

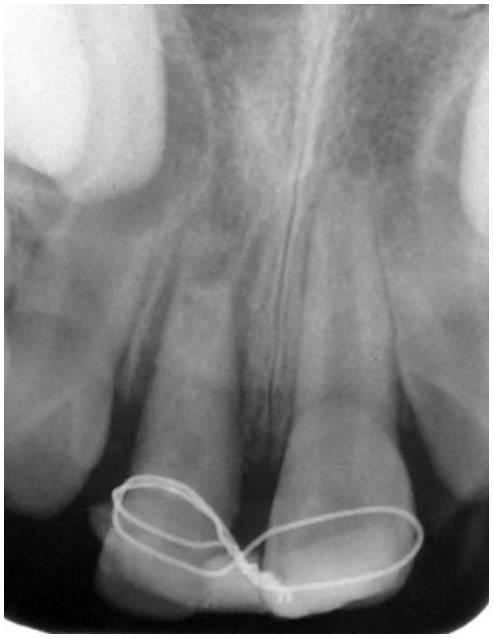

Fig. 7. Radiographic view of the tooth after surgical extrusion.

Thereupon it was decided that surgical extrusion of the tooth was the best treatment approach.

The calcium hydroxide intracanal dressing was changed. After anesthetizing the region, the crown length of the tooth was shortened from the incisal edge. The tooth was carefully luxated with elevators and once it was mobile, the tooth was taken with a forceps and extruded and rotated nearly 10 degrees clockwise to prevent the necessitation of orthodontic therapy in future. The length of extrusion was 5 mm. After the tooth was splinted to the healthy left central incisor by 8-ligature wire and a light-cured resin, occlusal adjustment was performed and then the region was covered with surgical dressing (Figs 6 and 7). Antibiotic therapy was prescribed for 10 days and the patient agreed to maintain oral hygiene. After 1 week, surgical dressing and splint was removed. No postoperative infection developed although a slight mobility was determined. Thereupon the tooth was splinted again to the left central with a semi-rigid splint. Three weeks after the extrusion the mobility of the tooth decreased significantly to allow the endodontic therapy and the splint was removed. The calcium hydroxide intracanal dressing was maintained in the canal for 3 months after the treatment with temporary crown restoration and changed every month. At the end of the 3 month period, a calcified barrier was radiographically determined 1.5 mm above the radiographic apex and root canal therapy was applied in a conventional manner avoiding excessive forces. Both of the central incisors were restored with light cured hybrid composite resin (Figs 8–11).

Radiographic examination with a standardized technique and clinical examination including assessment of mobility, gingival pocket depth, periapical tenderness and trauma from occlusion was performed at 3rd, 6th, 12th, 18th, 24th, 30th and 36th

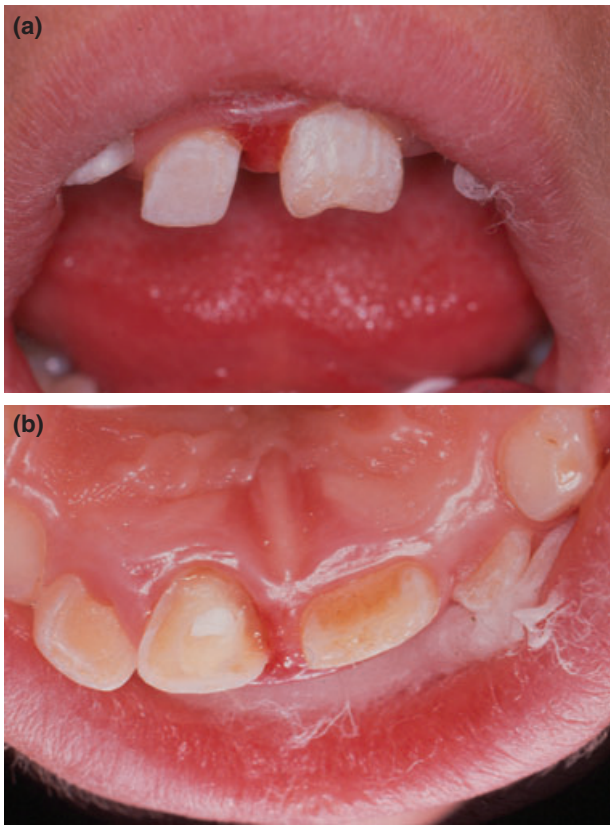

Fig. 8. Buccal (a) and palatal (b) appearance of the tooth 3 weeks after the surgical extrusion.

Fig. 9. Radiographic view of the tooth 3 weeks after the surgical extrusion.

months. During the follow-up period the tooth was clinically symptomless, the gingival pocket depth was normal and the patient was periodontally

Fig. 10. Clinical appearance of the central incisors after restoration.

Fig. 11. Radiographic view of the central incisors after restoration.

Fig. 12. 3 year follow-up: Aesthetic and functional integrity of the tooth is acceptable.

healthy. The percussion sound was normal and did not differ from adjacent normal teeth, indicating no ankylosis. There were no radiographic signs of progressive root resorption, marginal bone loss or periapical disease (Fig. 12). The tooth and restorations were functionally acceptable and aesthetically pleasing.

Discussion

Crown-root fracture is usually the result of a direct impact and is a relatively common trauma in maxillary anterior teeth of the children. The level and position of the fracture line and the amount of remaining root determines the type of the treatment (1–3). Crown-root fracture below the gingival attachment and alveolar bone level presents restorative difficulties and extraction was formerly used in many cases. But extraction must not be the first choice of treatment in children. Loss of a tooth in anterior region of a young patient may create esthetic and emotional problems not only in the young patient but also in the parents and alternative treatment modalities must be considered. In cases where the deepest aspect of the fracture is >2 mm below the bone level, extrusion of the tooth seems preferable to periodontal surgery. In cases <2 mm below the bone level, periodontal gingival osseous surgery seems appropriate. Osteotomy/osteoplasty and gingivectomy were aesthetically contra-indicated in anterior region (4, 5). For these cases, orthodontic and surgical extrusion have been recommended (1, 3–9). Although it is suggested that orthodontic extrusion renders a more biological method, the procedure requires multiple visits and excellent cooperation of the patient. Surgical extrusion is a one step procedure which is simpler and less time-consuming than orthodontic extrusion (6–8, 10, 11). In our case firstly, an orthodontic appliance with elastics was prepared and adjusted to the patient. However, because of the psychological stresses arising from being made of fun by his school friends, our patient did not use the appliance and the elastics. Thereupon it was decided that surgical extrusion of the tooth was the best treatment approach. Examination of our patient indicated that the treatment had provided functional and esthetic results 36 months after the surgical extrusion. The patient very much appreciated the treatment he received, because the initial damage of his tooth was quickly treated.

Kahnberg (6, 7) described two different surgical extrusion techniques including intraalveolar transplantation with bone transplants or without bone transplants and found that avoidance of surgery in the periapical area and keeping the apical area isolated from the oral cavity markedly reduced the incidence of root resorption. In this present case, the second technique involved careful extrusion of the tooth by marginal luxation with elevators and stabilization by 8-ligature wire and surgical dressing was preferred. Furthermore, in our case, splinting of the tooth with 8-ligature wire together with surgical dressing was found to be very effective compared to the researchers who stabilized the tooth with interdental sutures with surgical dressing (6–8, 11).

Dehydration of the root surface cells can lead to ankylosis or root resorption and the viability of the cementoblasts is undoubtedly of importance for healing of the socket (6, 12, 13). As the root never leaves the alveolus in this extrusion procedure, surgical extrusion may be compared with extrusive luxation of teeth which according to Andreasen (14) has a comparably favorable prognosis with root resorption occurring in only 7% of the cases. External root resorption in surgical extrusion has been reported 12% by Tegsjo et al. (15) over a period of 4 years and 5% by Çalışkan et al. (8) up to 3 years. In our case there were no radiographic signs of further progressive root resorption and the percussion sound and mobility was normal during the follow-up period.

The use of intracanal calcium hydroxide recommended by many authors is effective for the control of contamination, infection and resorption (14, 16, 17). But it has been hypothesized that calcium hydroxide may cause the resorption by passing through the apical foremen, although it has not been proven scientifically (18). In the present case, calcium hydroxide was used and maintained for 3 months as an intracanal medicament and no pathological signs were observed clinically or radiographically. These results were in accordance with much of the literature (6–8, 11).

Orthodontic extrusion restores the physiological periodontal attachment and preserves the alveolar bone. However, the procedure can be time consuming and has a long retention period making the patient's cooperation a critical factor. The cooperation of the patient is one of the most important criteria when the conservation of the tooth has been decided. If for some reason the patient objects to the orthodontic procedures, surgical extrusion of the tooth must be considered. Surgical extrusion offers several advantages. The treatment requires little time, the esthetics are quickly restored to an acceptable level and the procedure is easily accepted by the patient (6–8, 10, 11).

Under successful conditions of our case, we are recommending the surgical extrusion of teeth with crown-root fractures as an alternative treatment approach when the orthodontic procedures are contraindicated. But it was suggested that the patients must be followed for 5 years so as to see

at which point the final evaluation of the method will be made (6, 7).

References

1. Andreasen JO, Andreasen FM. Crown-root fractures. In: Andreasen JO, Andreasen FM, editors. Textbook and color atlas of traumatic injuries to the teeth, 3rd edn. Copenhagen: Munksgaard; 1994. p. 257–77.
2. Andreasen JO, Andreasen FM. Classification, etiology and epidemiology. In: Andreasen JO, Andreasen FM, editors. Textbook and color atlas of traumatic injuries to the teeth, 3rd edn. Copenhagen: Munksgaard, 1994. p. 151–80.
3. Baratieri LN, Monteiro S Jr, Caldeira de Andrada MA et al. Tooth fragment reattachment (Chapter 6). In: Baratieri LN, Monteiro S Jr, Caldeira de Andrada MA et al., editors. Direct adhesive restorations on fractured anterior teeth. Translated from the 2nd Brazilian edn. Sao Paulo: Quintessence Books, 1998: p. 134–205.
4. Fountain BS, Camp JH. Traumatic injuries. In: Cohen S, Burns RC, editors, 6th edn. Pathways of the pulp. Chicago: Mosby; 1994. p. 436–85.
5. Malmgren O, Malmgren B, Goldson L. Orthodontic management of the traumatized dentition. In: Andreasen JO, Andreasen FM, editors. Textbook and color atlas of traumatic injuries to the teeth, 3rd edn. Copenhagen: Munksgaard; 1994. p. 600–33.
6. Kahnberg K-E. Intraalveolar transplantation of teeth with crown-root fractures. J Oral Maxillofac Surg 1985;43:38–42.
7. Kahnberg K-E. Surgical extrusion of root-fractured teeth a follow-up study of two surgical methods. Endod Dent Traumatol 1988;4:85–89.
8. Çalışkan MK, Türkün M, Gomel M. Surgical extrusion of crown-root-fractured teeth: a clinical review. Int Endod J 1999;32:146–51.
9. Koyuturk AE, Malkoc S. Orthodontic extrusion of subgingivally fractured incisor before restoration. A case report: 3-years follow-up. Dent Traumatol 2005;21:174–8.
10. Roeters J. Bressers P. The combination of a surgical and adhesive restorative approach to treat a deep crown root fracture: a case report. Quintessence Int 2002;33:174–9.
11. Çalışkan MK. Surgical extrusion of a completely intruded permanent incisor. J Endod 1998;24:382–84.
12. Andreasen JO. The effect of extraalveoler period and storage media upon periodontal and pulpal healing after replantation of mature permanent incisors in monkeys. Int J Oral Surg 1981;10:43–53.
13. Andreasen JO. Kristerson L. The effect of limited drying or removal of the periodontal ligament upon periodontal healing after replantation of mature permanent incisors in monkeys. Acta Odontol Scand 1981;39:1–13.
14. Andreasen JO. Traumatic injuries of the teeth. Copenhagen: Munksgaard, 1981. 151–95.
15. Tegsjo U, Valerius-Olsson H, Frykholm A, Olgart K. Clinical evaluation of the of intra-alveolar transplantation of teeth with cervical root fractures. Swed Dent J 1987;11:235–50.
16. Tronstad L, Andreasen JO, Hasselgren G, Kristerson L, Riis J. pH changes in dental tissues after root canal filling with calcium hydroxide. J Endod 1980;7:17–21.
17. Tronstad L. Root resorption etiology, terminology and clinical manifestations. Endod Dent Traumatol 1988;4:241–52.
18. Vanderas AP. Effect of intracanal medicaments on inflammatory resorption or occurrence of ankylosis in mature traumatized teeth: a review. Endod Dent Traumatol 1993;9:175–84.