# Management of a complicated crown-root fracture in a young permanent incisor using intentional replantation

## CASE REPORT

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Correspondence to: Zhengyan Wang DDS, MS, PhD, Department of Pediatric Dentistry, CB#7450, School of Dentistry, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599-7450, USA Tel.: +1 919 966-2739 Fax: +1 919 966-7992 e-mail: wangz@dentistry.unc.edu Accepted 18 January, 2006 **Abstract** – The purpose of this case presentation is to review the rationale for and illustrate the clinical procedures involved in intentional replantation of a maxillary central incisor following a complicated crown-root fracture. The treatment of complicated crown-root fractures in children often is compromised by a fracture below the gingival margin and/or bone. This makes isolation difficult and comprises the hermetic seal that is critical for a successful endodontic treatment. Orthodontic or surgical extrusion with gingivectomy has been suggested; however, these approaches can be expensive, time-consuming, esthetically compromising, and unsatisfactory when the fracture line is deep below the gingiva. Our presentation will discuss the treatment options for such cases and introduce the concept of intentional replantation as an option to manage complicated crown-root fractures in young permanent anterior teeth.

The treatment of complicated crown-root fractures in children often is compromised by tooth fractures that are well below the gingival margin and/or bone. This makes isolation for a dry operating field challenging and comprises the hermetic seal that is critical for successful endodontic treatment. Treatment options for such cases include: (i) Orthodontic or surgical extrusion (1), (ii) Gingivectomy and osteotomy/osteoplasty (2), (iii) Intentional replantation (3), and (iv) Extraction.

Intentional replantation is the deliberate extraction and reinsertion of a tooth into its socket. The goal of this procedure is to permit the completion of endodontic treatment or restoration, which might otherwise be impossible to perform. Intentional replantation has been used in the management of teeth with advanced endoperiodontal lesions (4), and following iatrogenic damage such as root perforation (5). The reported success rate of intentional replantation of previously failed conventional endodontic treatment teeth was 80.6% in a report of 31 cases (6). Recently, this procedure has been proposed for the management of complicated tooth fractures (7). We will present a clinical case of intentional replantation of a complicated crown-root fracture.

### **Case report**

• History: An 8 1/2-year-old female was referred for treatment of the tooth no. 8, which was reported to have been traumatized 12 months previously and it was restored without complication then. The current referral involved a second traumatic incident of unspecified etiology of tooth no. 8 that had occurred

2 weeks previously. The patient had no spontaneous pain but complained that tooth no. 8 was sensitive to percussion and cold air.

- Emergency visit and examination: A vertical mesioincisal angular crown-root fracture of tooth no. 8 was noted. The fracture began at the mesio-incisal incisal angle and extended subgingivally to the cementum and root structure. The previously placed composite restoration was missing (Fig. 1). The tooth was sensitive to cold testing, percussion, and had doubtful lingering pain. The mesial fragment had Class II mobility. No additional root fracture or periapical pathology was noted in four periapical radiographs obtained at different vertical angulations to assess for horizontal root fractures (Fig. 2).
- Diagnosis and treatment decision: Our diagnosis was a complicated crown-root fracture and possible irreversible pulpitis. The treatment decision required weighing several options. The tooth was not a good candidate for a Cvek pulpotomy because of the length of the time of pulpal contamination and the extent of the root fracture, which complicated access and obtaining an effective seal. Root canal treatment (RCT) was essential, but it was clear that the sub-gingival access on the mesial and palatal areas made the RCT vulnerable to failure because of difficulty in obtaining a definitive root canal seal. The root canal seal can be compromised by an inadequate coronal restoration. Our next treatment option focused on orthodontic extrusion in conjunction with periodontal surgery as needed following RCT. Our final option was extraction with immediate restoration and intentional replantation.



Fig. 1. Initial clinical presentation.



Fig. 2. Initial radiographs obtained at four different angles.

Because of the financial and time commitments involved with orthodontic extrusion, the patient's mother chose the option of extraction and intentional replantation. Informed consent was obtained for all procedures.

• Visit 1: Root canal therapy

The child returned the next day. Under local anesthesia, the mesial fracture segment was removed, vital pulp tissue was extirpated; the root canal was filled by using Gutta–Percha and sealer, the access cavity was temporized with IRM, and the tooth was assessed radiographically (Figs 3–5).



Fig. 3. Crown-root fracture segment.



*Fig. 4.* Clinical presentation immediately following pulpectomy and obturation of the root canal.



Fig. 5. Radiograph immediately after the endodontic treatment.

• Visit 2: Intentional replantation (6 weeks later)

The tooth had been asymptomatic since the last appointment. Using local anesthesia, tooth no. 8 was extracted atraumatically. The extracted tooth was restored by using a dentin bonding agent and composite resin. After coating the root surface in Emdogain<sup>®</sup> to aid the prevention of ankylosis (8), the tooth was replanted. The correct reposition was confirmed radiographically, then a flexible splint was placed from tooth no. 6 to tooth no. 11 by using monofilament and composite resin. The total extraoral time was approximately 15 min (Figs 6–8). The patient was given postoperative instructions for a soft diet, careful but meticulous routine oral hygiene, and Doxycycline 100 mg b.i.d for 7 days.



Fig. 6. Extraction site and extracted tooth no. 8 with fracture line.



Fig. 7. Radiograph immediately after replantation.



Fig. 8. Clinical presentation of replanted tooth and flexible splinting.

- Visit 3: Splint removal (8 days after replantation) a The patient returned for splint removal and follow up. The patient's oral hygiene was good and she had been compliant with antibiotics prescribed. The patient had experienced minimal discomfort since the previous visit. A periapical radiograph revealed no evidence of periapical pathology (Fig. 9). The tooth exhibited Class I mobility. The splint was removed (Fig. 10).
- Visit 4: Contour of restoration (3 weeks following replantation).

The patient was asymptomatic at the visit. Tooth no. 8 was contoured and composite was added to enhance esthetics.



Fig. 9. Radiograph 1 week after replantation.



Fig. 10. Clinical presentation after splint removal.



Fig. 11. Radiograph 4 months after replantation.



Fig. 12. Clinical presentation after finishing resin restoration.

• Visit 5: Contour of restoration and follow up (4 months after replantation).

The patient was asymptomatic. Tooth no. 8 had Class I mobility. A periapical radiograph revealed no evidence of periapical pathology (Fig. 11). A 7.0 mm mesiolingual pocket was present. This was anticipated because of the resin restoration on the root surface. The resin restoration was contoured further and subgingival scaling was performed (Fig. 12). Oral hygiene instructions were given. The patient was scheduled for a

*Table 1.* Pros and cons of treatment options in management of crown-root fractures

Options	Pros	Cons
Surgical extrusion	Safe, rapid	Crown/root ratio is decreased Pulp vitality is not preserved
Orthodontic extrusion	Excellent esthetics Pulpal vitality may be saved	Crown/root ratio is decreased Time- and cost-consuming
Gingivectomy and osteotomy	Rapid Pulpal vitality may be saved	Crown/root ratio is decreased Gingival pathology may be persistent Comprised esthetics
Intentional replantation	Safe, rapid May finish restoration at the same time Normal crown/root ratio is preserved	Pulp vitality is not preserved Periodontal ligament may fail to attach to the restoration on root surface

follow-up appointment for 3 months but failed to return for follow-up care and was unresponsive to further follow-up recommendations.

#### Discussion

The treatment of complicated subgingival crown-root fractures in young permanent incisors is a challenging undertaking. We have reviewed the pros and cons (2) in Table 1. In young patients, the risks and benefits of each treatment option should be carefully evaluated in making a treatment decision, with consideration of the patient's age, root development stage, eruption potential and the patient's/parents' preference.

Intentional replantation offers others options to consider. As one example, the tooth can be intentionally replanted in a 180° rotation. This technique has been used to treat localized periodontally comprised teeth (9), such that remaining healthy periodontal ligament contacts the localized lesion area of the socket while the denuded root surface contacts the previously healthy socket areas. This approach can help achieve a better periodontal healing when undertaken in replantation of fractured teeth that involve alveolar bone fractures. This technique may also help minimize the development of narrow periodontal pockets along the fracture line, which lack both periodontal ligament and bone support (7). An upper anterior tooth with a deep lingual crownroot fracture can be rotated to the facial side to achieve a relatively more coronal position of the fracture line. This provides a better biological space for periodontal healing and minimizes periodontal pocket formation (10). In our case, the incisor was not rotated because there was no alveolar bone fracture and the satisfactory coronal

portion exposure was obtained with replantation without rotation.

Using intentional replantation, the fractured coronal fragments can be rebonded before tooth replantation. Because the root surface of the tooth fragment still has cementum and periodontal ligament, preserving the coronal fragment can benefit periodontal healing of a replanted tooth and decrease the risk of localized attachment loss that may occur with a resin restored root surface. Extraction of a fractured tooth and coronal fragment simultaneously is recommended to preserve the intact periodontal ligament. Selection of a resin with good quality dentin bonding is recommended (11).

#### Conclusions

Intentional replantation is a treatment option to consider in the management of complicated crown-root fractures. Special attention should be paid to atraumatic extraction techniques, limited extra-oral time, minimizing ankylosis by Emdogain application (8), and infection control by antibiotics. Clinical and radiographic follow up should be carried out for 5 years.

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