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Management of complicated crown-root fractures using intentional replantation: two case reports

CASE REPORT

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Abstract – The management of complicated crown-root fractures is a challenge. Intentional replantation with 180° rotation may be a useful procedure to overcome this problem. In Case 1, a 23-year-old woman with complicated crown-root fractured teeth #11, #21, and #22 was referred for treatment. All fractured teeth were extracted, rotated 180°, and replanted in a slightly extruded position. After 3 months, root canal treatment was completed and the final restorations fabricated. At the 18-month follow up, the patient was asymptomatic, the tooth was functional, and no root resorption was observed radiographically. At the 90-month follow up, slight cervical root resorption of tooth #11 was noted. In Case 2, a 27-year-old woman with a crown-root fractured tooth #21 was referred for treatment. Despite immediate repositioning of the coronal fragment and a 2-week stabilization with a wire splint, the coronal fragment remained separated from the apical tooth segment. The apical segment was extracted, rotated 180°, and replanted in a slightly extruded position. After 1 and 4 weeks, the root canal treatment was completed and the final restoration fabricated, respectively. At the 24-month follow up, the patient was asymptomatic and apical healing was completed.

Complicated crown-root fractures are a type of dental trauma in which the fracture line tends to originate in the crown portion of the tooth, extends apically into the root in an oblique direction and frequently exposes the pulp. To manage complicated crown-root fractures, clinicians must consider not only function but also the esthetics of the fractured tooth. Surgical crown lengthening (1), orthodontic extrusion (2), and intentional replantation (3) have been used to manage complicated crown-root fractures.

Among these various treatment options, the intentional replantation of a fractured tooth has been considered as a reliable procedure. Intentional replantation with rotation, which involves extracting and repositioning the fractured tooth to facilitate subsequent restoration to its original form and function, was firstly introduced by Tegsjö et al. (4). They reported an 86% success for 56 intentional replantation cases after 4 years (5). Demonstrating the reliability of intentional replantation, Kahnberg et al. (6) reported an 80% success for 15 cases after 2 years. They also reported 91% success for 23 cases after 2 years in another study (7). They suggested that the modified extrusion technique increased the success of intra-alveolar transplantation. Finally, in a 10-year study, they reported approximately 95% success for 21 cases (8). They demonstrated the reliability of intentional replantation.

Intentional replantation has several advantages over other treatment options for managing complicated crown-root fractures. First, the procedure takes less time than other techniques. Second, it enables more precise identification of the fracture line after extraction. Finally, intentional replantation can maintain the esthetic properties of the fractured and adjacent teeth, whereas a gingivectomy or crown lengthening in the anterior region may compromise esthetics.

The aim of these two case reports is to present the management of complicated crown-root fractures using intentional replantation with tooth rotation, which resulted in favorable long-term outcomes.

Case 1

A 23-year-old woman was referred to our clinic for the treatment of fractured teeth #11, #21, and #22 caused by a fall. According to the patient, a partial pulpotomy was performed on all three teeth at another dental clinic with temporary fillings placed in the access openings. Clinical

and radiographic examinations revealed complicated crown-root fractures in all three teeth. No other fracture types were noted (Fig. 1a–c). Because multiple tooth fractures had occurred and a less time-consuming treatment was required, it was decided to treat the patient with intentional replantation with 180° rotation and slight tooth extrusion.

The remaining pulp tissue was extirpated from the three crown-root fractured teeth. The root canals were irrigated with 5.25% NaOCl and saline and then sealed with temporary filling material. After 3 days, the fractured teeth were extracted carefully under local anesthesia with 3.6 ml of 2% lidocaine and epinephrine (1:100 000). The extractions were performed with a flat-beak forceps to minimize damage to the cementum and periodontal ligament. The extracted teeth were examined carefully to identify possible vertical root fractures. Then, the teeth were replanted in a slightly extruded position with 180° rotation to expose the fracture lines supragingivally. The sequence of replantations was #11, #21, and #22. The replanted teeth exhibited 2° mobility. For initial stabilization, a 4-0 black silk suture and composite resin (Z100; 3M ESPE, St. Paul, MN, USA)-wire (0.7 mm orthodontic wire) splint were placed (Fig. 1d–e). The patient was given postoperative instructions and prescribed 500 mg amoxicillin t.i.d. for 5 days to prevent infection (9). The suture and resin–wire splint was removed 1 week after replantation. The mobility of the replanted teeth was reduced to 0–1° after splint removal. The replanted teeth were isolated with rubber dam, the root canals were shaped to 40-02 ISO size with K-hand file using step-back technique, and a mixture of calcium hydroxide and sterile saline as an intracanal medicament was placed to prevent infection and infection-related root resorption (Fig. 1f).

After 3 months no symptoms, such as periapical pathosis, abnormal mobility, sinus tracts, or root resorption, were observed clinically or radiographically. Then, the root canals were filled with gutta-percha and root canal sealer (AH-26; Dentsply De Trey, Konstanz, Germany), using the lateral condensation method (Fig. 1g). Final restorations with collarless porcelain fused to gold crowns were fabricated for the replanted teeth (Fig. 1h). There was loss of the interdental papilla associated with the replanted teeth. At the 18-month follow up, radiographic examination revealed apical healing of the replanted teeth, but slight cervical root resorption on the mesial surface of replanted #11 (Fig. 1i). Clinical examination showed no mobility or functional problems (Fig. 1j). Complete apical healing was seen at the 90-month follow up, but some cervical root resorption of replanted tooth #11 was apparent (Fig. 1k). Clinically, there were no signs or symptoms and the interdental papilla had regenerated (Fig. 1l).

Case 2

A 27-year-old woman was referred for the treatment of a fracture of tooth #21. Two weeks before admission to our clinic, she had fallen while riding a bike and fractured tooth #21. The patient stated that a composite resin–wire splint had been placed immediately at another clinic to reattach the fractured coronal fragment. Clinical and radiographic examination revealed a complicated crown-root fracture of tooth #21. No other root fracture types were noted (Fig. 2a–b). The coronal fragment had been separated from the apical tooth segment immediately after splint removal. Intentional replantation with 180° rotation was selected because the fracture line on the palatal side was subgingival, and the patient wanted a less time-consuming treatment. Under local anesthesia with 3.6 ml of 2% lidocaine and epinephrine (1:100 000), the apical tooth segment was extracted carefully with a flat-beak forceps (Fig. 2c). The extracted tooth segment was examined carefully for possible vertical root fractures and then replanted with 180° rotation in a slightly extruded position to change the subgingival fracture line to a supragingival position (Fig. 2d–e). One 4-0 black silk suture was placed around the replanted tooth because the replanted tooth showed no mobility. The patient was given postoperative instructions and prescribed 500 mg amoxicillin t.i.d. for 5 days to prevent infection (9). The suture was removed after 1 week, and single-visit root canal treatment of the replanted tooth was initiated (Fig. 2f–g). The replanted tooth was isolated with rubber dam, the root canal shaped to a 45-02 ISO size K-hand file using step-back preparation technique and filled with gutta-percha and root canal sealer (AH-26; Dentsply De Trey). At the 4-week follow up, clinical and radiographic examination revealed no symptoms, periapical pathosis, abnormal mobility, sinus tracts, or root resorption, Then, the final restoration was fabricated with lithium disilicate-reinforced glass ceramic post and crown (Empress II; Ivoclar Vivadent, Schaan, Liechtenstein). At the 24-month follow up, the patient was asymptomatic. Radiographic examination showed complete apical healing (Fig. 2h).

Discussion

In each reported case, crown-root fractured teeth were intentionally replanted with rotation. Wang et al. (10) believed a 180° rotation would lead to a better clinical outcome. By rotating the tooth, a subgingival fracture line on the palatal side of the fractured tooth is changed to a supragingival fracture line on the labial side.

Although intentional replantation has more advantages than other techniques, its major disadvantage is the potential for postoperative root resorption. Various types of root resorption including surface resorption, replacement resorption (ankylosis-related resorption), or infection-related resorption can be seen radiographically in some teeth after replantation.

Surface resorption refers to small resorptive lacunae that form in the root cementum. During intentional replantation, mechanical damage to the cementum surface occurs, resulting in a local inflammatory response and a localized area of root resorption. If no further inflammatory stimulus is present, periodontal healing of the root surface will occur within 2 weeks (11). Replacement resorption, which is caused by severe damage to the periodontal ligament and cementum, can occur as soon as 2 weeks after replantation (12). It results in the replacement of the root structure by bone tissue.

Fig. 1. (a) Pretreatment facial view of complicated crown-root fractured teeth #11, #21, and #22. (b) Pretreatment occlusal view of fractured teeth #11, #21, and #22. (c) Pretreatment periapical radiograph of fractured teeth. (d) Clinical view of 4-0 suture splint placed after intentional replantation with rotation of fractured teeth #11, #21, and #22 3 days after first visit. (e) Periapical radiograph of fractured teeth after intentional replantation with 180° rotation 3 days after first visit. Note extruded position of all three teeth to achieve supragingival positioning of the fracture line. (f) Periapical radiograph after placement of calcium hydroxide and temporary fillings 1 week after intentional replantation. (g) Periapical radiograph of root canal-filled teeth #11, #21, and #22 at 3-month follow up. (h) Final restorations of intentionally replanted teeth at 3-month follow up. Note loss of papilla between restored teeth. (i) Periapical radiograph of replanted teeth at 18-month follow up. Slight cervical root resorption (arrow) is observed on the mesial side of replanted tooth #11. (j) Clinical view of replanted teeth at the 18-month follow up. Loss of interdental papilla (arrows) remained. (k) Periapical radiograph of replanted teeth at the 90-month follow up. Cervical root resorption (arrow) of replanted tooth #11 is apparent. (l) Clinical view of replanted teeth at 90-month follow up. Interdental papillas of restored teeth are regenerated (arrows).

Infection-related resorption is the response to a bacterial infection that produces a combined lesion of the dental pulp, periodontal ligament and bone. Resorption cavities expose dentinal tubules that communicate with an infected necrotic pulp, initiating or perpetuating the inflammatory process in the periodontal attachment apparatus and amplifying root resorption. To avoid surface root resorption or replacement resorption, damage to the cementum and periodontal ligament during surgical extraction should be minimized. In addition, intracanal medication with calcium hydroxide (13) and administration of systemic antibiotics are recommended to prevent infection-related root resorption (14).

In Case 1, slight root resorption was observed in the mesiocervical area of replanted tooth #11 at the 18-month follow up. This root resorption also was apparent at the 90-month follow up. It is probable that the root resorption occurred because of damage to the cementum and

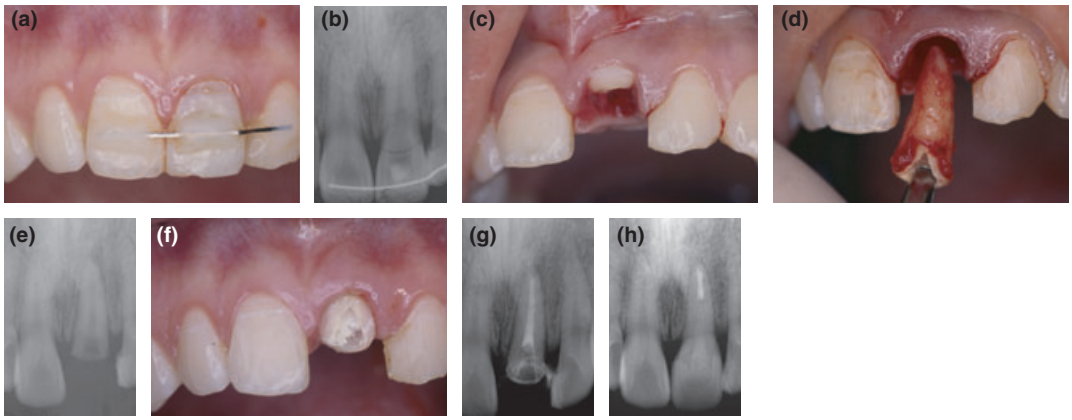

Fig. 2. (a) Pretreatment facial view of resin–wire splinted tooth #21 at first visit. (b) Pretreatment periapical radiograph of crown-root fractured tooth #21 at first visit. (c) Clinical view after removal of fractured coronal fragment tooth #21 at first visit. (d) Clinical view after extraction of apical segment of tooth #21 at first visit. (e) Periapical radiograph of replanted apical segment of tooth #21 in a rotated and slightly extruded position at first visit. (f) Clinical view after suture removal 1 week after replantation. (g) Periapical radiograph of root-filled replanted tooth #21 1 week after replantation. (h) Periapical radiograph of replanted tooth #21 at 24-month follow up showing restoration and complete apical healing.

dentin during the extraction procedure. Because calcium hydroxide was used as an intracanal medicament to prevent infection-related resorption, the resorption seen in this case was probably replacement resorption.

The differences in procedures used in Case 1 and Case 2 were whether calcium hydroxide was placed in the root canal and the type of stabilization used. In Case 1, a calcium hydroxide medicament was used, whereas in Case 2, no medicament was placed because the patient had insufficient time for a longer procedure. Regardless, follow-up radiographic examinations at 3 months (Case 1) and 4 weeks (Case 2) showed no infection-related resorption. This finding is in agreement with Dumsha et al. (15), who reported that if the root canal was not infected, root resorption did not occur when calcium hydroxide was not used. In Case 2, an additional wire splint was not necessary because initial stabilization was accomplished after replantation. In Case 1, a resin–wire splint was placed on the crown-root fractured teeth for 1 week because intentional replantation of multiple teeth caused insufficient initial stabilization.

In Case 1, the long-term outcome was judged to be acceptable, but not ideal. Slight cervical root resorption was evident at the long-term follow-up examinations in Case 1. However, considering the efficiency of treatment and the long-term favorable outcomes, intentional replantation with rotation appears to be a reliable treatment option for some cases of complicated crown-root fractured teeth. Knowledgeable clinicians and patient cooperation are important factors in preventing serious complications and achieving favorable long-term outcomes after intentional replantation and rotation of complicated crown-root fractured teeth.

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