

Indication for Intentional Replantation of Teeth

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Abstract: *Intentional replantation can be used for root canal re-treatment when other methods are deemed unsuitable. This procedure is based on the approach used to obtain good clinical outcomes for replantation of an avulsed tooth. The key to a successful procedure is atraumatic extraction and replacement in the socket without damage to the periodontal ligament. This case series presents the long-term outcomes of various cases of intentional replantation, and shows a clear distinction between the treatment outcomes for fused/convergent-and multi-rooted teeth.*

Keywords: *avulsed teeth, intentional replantation of teeth, long-term follow-up, fused/convergent root*

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I. Introduction

Unfortunately, root canal treatments are not always successful. The success rate for root canal treatment has been reported to be 86-93% (1). In cases where the treated tooth subsequently becomes infected, root canal re-treatment is required. However, there is no consensus regarding the optimal treatment method in cases of complete obliteration of the pulp canal or a separated instrument in root canals of molars. Micro-endodontic therapy is one option. This case series describes the use of alternative treatment methods in cases of endodontic therapy failure.

II. Case Series

The patients in the following cases were treated at the author's dental clinic from 1989 to 2017.

Case 1

Replantation of avulsed tooth

A 15-year-old boy was hit on the mouth by a baseball, resulting in avulsion of his right maxillary central incisor. He presented with the tooth more than one hour after the accident. Clinical examination revealed mobility of the left maxillary two incisors, indicating that they were nearly avulsed. His upper lip was lacerated (Figure 1). The right maxillary central incisor was replanted; the left two maxillary incisors were repositioned, and fixed with a splint, and the upper lip was sutured (Figure 2). At the one year follow up examination, no clinical problems were detected (Figure 3). From two years until twelve years after replantation, development of replacement and inflammatory resorption was observed in the right maxillary central incisor, as indicated by slowly advancing resorption of the root. Thirteen years post-treatment, the right central maxillary incisor was exfoliated. The left two incisors remained intact (Figure 4,5) because the roots of these teeth were protected by blood clots in the mouth (Figure 1). This case demonstrates that periodontal healing is related to the extra-alveolar duration (2, 3), which is a key factor in the prognosis of intentional replantation (case 2, 3, and 4).

Case 2:

Intentional replantation of second left maxillary molar

A 28-year-old woman complained of spontaneous pain of the second left maxillary molar. Root canal re-treatment had previously been unsuccessful, because of obliteration of the pulp canal (Figure 6). After atraumatic extraction with forceps, extra-oral root canal filling was performed with guttapercha points within 10 minutes after extraction, and the tooth was re-inserted in the socket left maxillary molar socket. The periodontal ligament was confirmed to be attached to the surface of the root (Figure 7). The patient's first molar received normal root canal treatment, because no obliteration of the pulp canal was observed. Twenty-six years after the procedure, there is no ankylosis or root resorption in the second left maxillary molar. The tooth is asymptomatic and completely functional (Figure 8).

Case 3

Intentional replantation of second right mandibular molar

A 34-year-old woman complained of spontaneous pain of her second right mandibular molar that her dentist could not treat. Preoperative radiographs revealed a periapical granuloma (Figure 9). Atraumatic extraction of the tooth was performed with forceps, and the periodontal granuloma was removed. Extra-oral root canal filling was performed with gutta-percha points within ten minutes after extraction, and the tooth was

replaced in the socket. Twenty-one years after the procedure, the tooth is asymptomatic and completely functional; periapical healing was observed with no radicular resorption, but with slight ankylosis (Figure 10).

Case 4:

Intentional replantation of second left mandibular molar

A 26-year-old woman presented with acute pain of the second left mandibular molar. The root canal was curved and obliterated (Figure 11). After extraction of the tooth via forceps, the periapical granuloma was removed with a curette; extra-oral root canal filling with gutta-percha points and retrograde canal filling with glass ionomer cement were performed within 15 minutes after extraction. The tooth was then replaced in the socket. Four years later, the patient presented with gingival abscess because of inflammatory root resorption (Figure 12). Twenty-four years after replantation, the two roots were almost entirely resolved, with only the apex of the distal root remaining (Figure 13). The cause of root resorption was the removal of the periodontal membranes during extraction. This case demonstrates that extraction of multi-root teeth can damage the root surface. In this case, hemisection was indicated because the tooth did not have a fused/convergent root.

III. Discussion

Avulsion of permanent teeth is most common in young dentition, where root development is still incomplete and the periodontium is very resilient (2, 3). Intentional replantation is different from replantation of avulsed teeth, because the duration of the extra-alveolar period and handling of the tooth during the period can be controlled. Many authors agree that it should be reserved as a last resort to save a tooth after other procedures have failed or are deemed likely to fail. There are many potential adverse outcome of intentional replantation, such as root fracture, resorption, and ankylosis caused by damage to the periodontal ligament. Intentional replantation may be more suitable for the second molar, which may have fused/convergent roots, and single-rooted teeth, because such teeth are easily extracted via forceps, minimizing damage to the periodontal ligaments. In the case of multi-rooted teeth, hemisection or apicoectomy is indicated rather than intentional replantation. Saleem et al. (5) reported that the factors influencing periodontal healing include the following: 1. the extra-alveolar time; 2. presence of preoperative radiolucency; 3. Patient's age; 4. root –end filling; 5. The degree to which the root surface is damaged. A systematic review of articles from 1966 to 2014 revealed a success rate of 88% for intentional replantation (6). However, there are only a few studies that report long-term successful follow-up data (as long as 15 years) (7,8). Because most complications occur within one year after replantation, follow-up should extend for at least 3 years to inspect for late complication(5). Further, although rare, new resorptive progress has been observed even after 5 or 10 years (9). Therefore, long-term follow-up is necessary because root resorption and ankylosis can occur many years after the procedure, as in case 4. Further long-term studies are needed to fully clarify the indications for intentional replantation.

Clinical recommendations

1. The forceps should be placed on the enamel above the cemento-enamel junction. If the crown is broken and the tooth cannot be extracted with forceps, orthodontic extrusion is an option for avoiding root fracture and damage to the periodontal ligament. After orthodontic extrusion, when sufficient movement of the tooth(grade II) can be felt with tweezers, the tooth can be extracted atraumatically. A recent study showed that orthodontic extrusion before intentional replantation improved survival rates (4).
2. The prognosis of intentional replantation depends upon root formation. Teeth with a fused/convergent root are suitable for atraumatic extraction. Multi-rooted teeth or teeth with dilacerated roots are not suitable for this procedure; the extraction of such teeth has damaging effect on the periodontal ligament and can cause root fracture.
3. The extra-alveolar period should not exceed 15 minutes. The extracted tooth should remain bathed in a physiological salt solution. It should be ensured that sufficient periodontal membrane remains attached to the root surface, otherwise, the procedure must be abandoned.
4. The aim of these recommendations is to minimize damage to the periodontal ligament, thereby facilitating optimal periodontal healing.

IV. Conclusion

From the clinical outcome in Case 1, we infer that the prognosis of an avulsed tooth depends on whether the periapical ligament is damaged. This series of long-term follow-up cases demonstrated that teeth with fused/convergent roots are the most suitable for intentional replantation, as damage to the periodontal membrane can be avoided. Further, atraumatic extraction facilitates optimal periodontal healing.

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V. Figure Legends

Figure 1 A 15-year-old boy who was hit on the mouth by abaseball. Mouth and radiographic view on arrival at the dental clinic

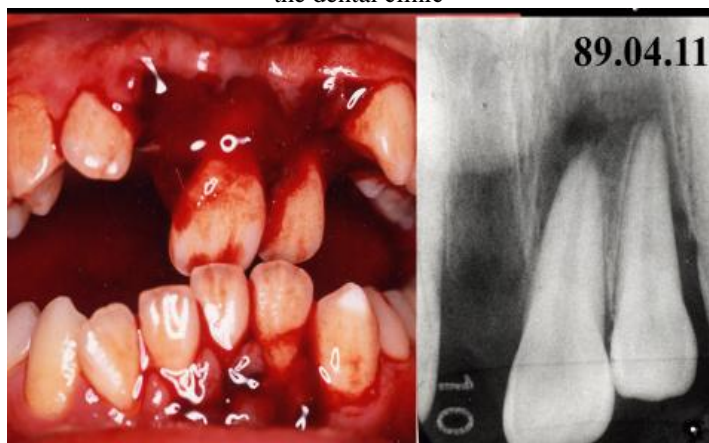


Figure 2 Post-operative photograph of patient: Sutures of lip and fixing with asplint



Figure 3 Photograph at oneyear follow-up examination



Figure 4Development of replacement and inflammatory resorption (arrow) from two years to eight years eight months

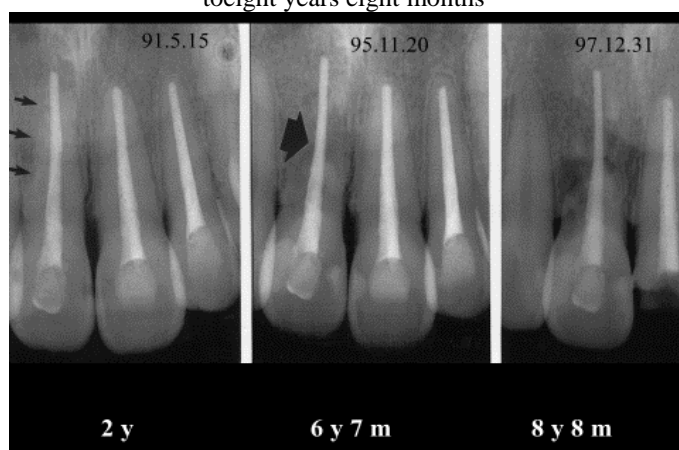


Figure 5Thirteen years later, the right incisor was exfoliated

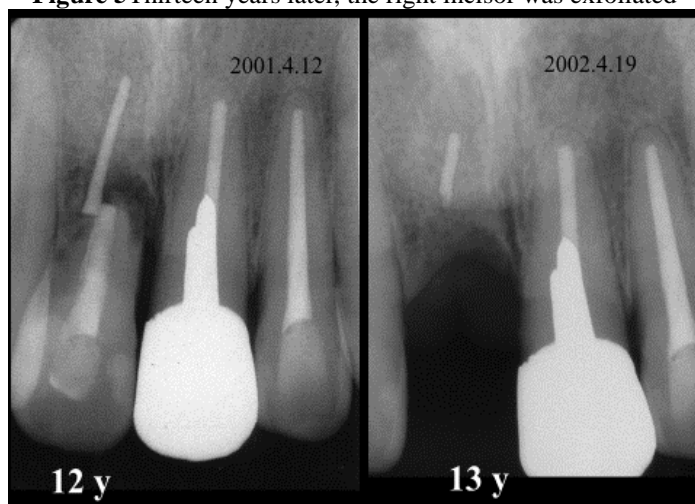


Figure 6 A 28-year-old woman with spontaneous pain of the second left maxillary molar. Unsuccessful endodontic treatment result in periapical lesion of the first and second left maxillary molars

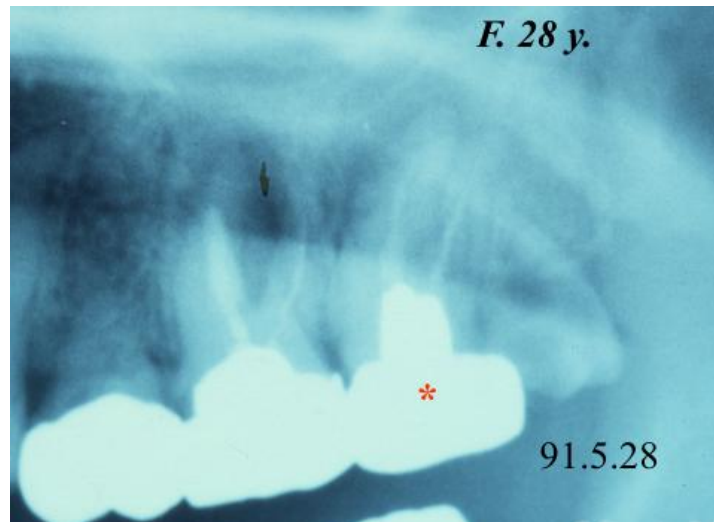


Figure 7 Left: Extracted second molar is covered with the periodontal ligament
Right: Four years later after procedure

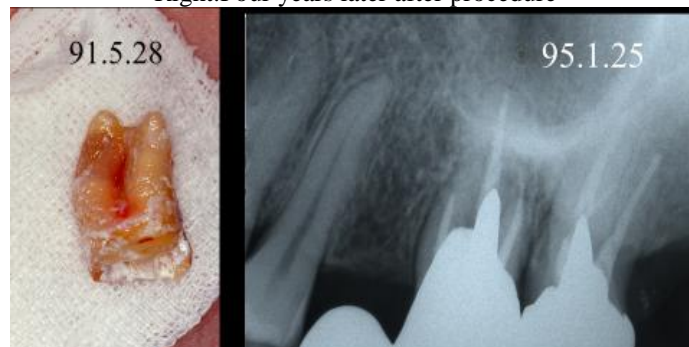


Figure 8 The tooth is asymptomatic. Twenty-six years after procedure.



Figure 9A 34-year-old woman with spontaneous pain of the second right mandibular molar. Left: The fused/convergent shaped root is easier to extract without damage to the periodontal ligament. Right: Pre-operative radiograph shows periapical lesion.

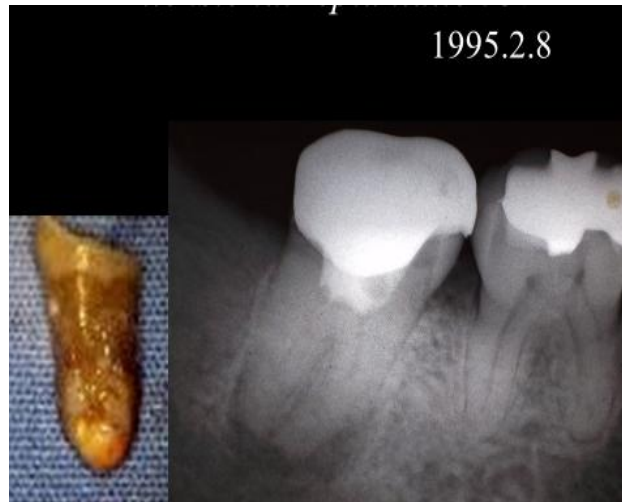


Figure 10 Twelve-one years later, slight ankylosis but no sign of root resorption is observed



Figure 11A 26-year-old woman with acute pain of the second left mandibular molar. Pre-operative radiograph shows a periapical lesion. The root is curved and the root canal is obliterated in the second left mandibular molar.

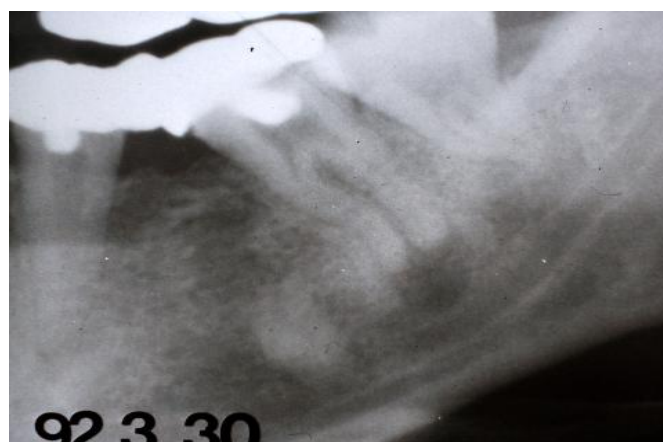


Figure 12 Four years after treatment, external inflammatory root resorption is observed

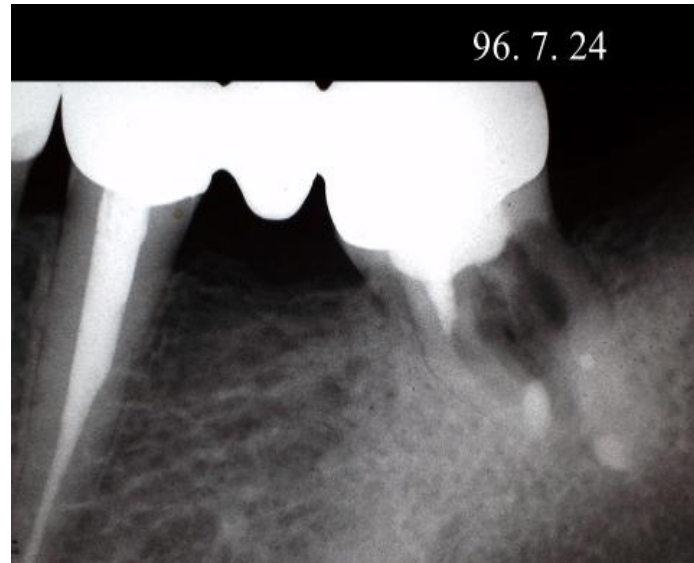


Figure 13 Twenty-four years after treatment, most of the root is resorbed except for the apex of the distal root (arrow)



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