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Management of malposition following replantation of an avulsed maxillary Central Incisor: A Case report

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Abstract
Traumatic avulsion of a permanent tooth is a time critical dental emergency in which extraoral dry time and subsequent management substantially influence periodontal and pulpal outcomes. Although immediate replantation is preferred, the tooth may occasionally be returned to the socket in an anatomically incorrect position, creating an additional clinical challenge. We present the management of a 13-year-old boy with complete avulsion of the maxillary right central incisor. The avulsed tooth was transported dry, without being placed in any storage medium, and replanted approximately one hour after trauma. Following replantation, it remained incompletely seated and slightly extruded, causing difficulty with normal mouth closure. The patient reported to our department on the next day. Clinical and radiographic examination confirmed malposition of tooth 11, without crown or root fracture, and revealed a closed apical foramen. Under local anesthesia, the existing wire stabilization was removed, the tooth was carefully removed from the socket, and the socket was irrigated with normal saline. The tooth was repositioned anatomically and stabilized using a wire composite splint. Root canal treatment was initiated on the same day, with calcium hydroxide placed as an intracanal medicament for two weeks, followed by obturation using the lateral condensation technique. At six months, the tooth was asymptomatic, clinically stable, and free of abnormal mobility or periodontal findings. Radiographic examination revealed no evident periapical pathology. This case emphasizes the importance of clinical and radiographic verification of tooth position following replantation and demonstrates that timely correction of a malpositioned replanted mature incisor may achieve a favorable short-term outcome.

Keywords: tooth avulsion; tooth replantation; malposition; maxillary central incisor; root canal treatment; calcium hydroxide; traumatic dental injury

I. Introduction

Avulsion is one of the most severe traumatic dental injuries because the tooth is completely displaced from its socket, resulting in extensive injury to the periodontal ligament, cementum, alveolar socket, and dental pulp. The prognosis of a replanted permanent tooth is strongly influenced by the condition of the periodontal ligament cells at the time of replantation, with prolonged extraoral dry storage associated with progressive periodontal ligament necrosis and an increased risk of ankylosis and replacement root resorption [1,2].

The International Association of Dental Traumatology (IADT) emphasizes that an avulsed permanent tooth should be replanted as soon as possible whenever clinically appropriate. When immediate replantation cannot be achieved, appropriate storage in a physiologic or osmolality-balanced medium is preferred to dry storage [1]. The importance of extraoral dry time is supported by long term clinical evidence demonstrating a progressive increase in the risk of ankylosis with increasing dry storage time, particularly in teeth with mature roots [2].

Once replantation has been performed, accurate repositioning within the socket is essential. The IADT recommends clinical and radiographic verification of the position of the replanted tooth

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and short term stabilization with a passive, flexible splint, generally for two weeks in uncomplicated cases [1]. In mature teeth, endodontic treatment is indicated because revascularization of the pulp is not expected after avulsion; current guidance recommends initiating root canal treatment within two weeks following replantation [1,3].

The present case is clinically relevant because the tooth had already been replanted relatively promptly after avulsion but was left in an incompletely seated, slightly extruded position. The patient subsequently presented for definitive management, creating the unusual situation of secondary correction of an incorrectly positioned replanted permanent incisor. This case demonstrates the importance of reassessing the position of a replanted tooth clinically and radiographically before splinting.

Case Presentation

A 13-year-old boy presented to the department approximately one day after sustaining a fall that resulted in complete avulsion of the maxillary right central incisor (tooth 11). According to the history available at presentation, the avulsed tooth had been kept dry and was not placed in a physiologic storage medium. The patient reached a local hospital casualty approximately one hour after the trauma, resulting in an extraoral dry period of slightly more than one hour. The avulsed tooth was subsequently replanted into the socket and stabilized using direct wire fixation.

Following the initial replantation, the tooth was not completely seated within the socket and appeared slightly extruded. The altered position interfered with normal mouth closure. The patient reported toour department the following day for further evaluation and definitive management.

Extraoral examination revealed mild abrasions over the upper lip, while mouth opening was within normal limits. Intraoral examination demonstrated that tooth 11 was incompletely seated and displaced from its normal anatomical position, and slightly extruded. The extrusion resulted in premature occlusal contact, preventing the patient from achieving complete mouth closure or biting comfortably. Slight mobility was present. Direct wire stabilization between teeth 11 and 21 was evident.

A periapical radiograph was obtained to assess the position of the replanted tooth and the surrounding structures. The radiograph confirmed malposition of tooth 11 within the socket. The tooth had a completely formed root with a closed apex, and no associated crown or root fracture was identified.

Figure 1. Clinical and Radiographic presentation following traumatic avulsion and initialreplantation of Tooth 11 from a nearby local hospital.

Management of the malposition

As the replanted tooth was incompletely seated and caused occlusal interference, repositioning was planned. Following administration of local anesthesia, the previously placed direct wire stabilization was removed. Tooth 11 was carefully removed from the socket, and the socket was cleaned and irrigated with normal saline. The tooth was then repositioned into its appropriate anatomical position within the socket. Occlusion was subsequently checked by asking the patient to bite gently, and complete seating of the tooth was further confirmed radiographically.After satisfactory repositioning, the tooth was stabilized using a wire composite splint extending from tooth 13 to tooth 23.

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Figure 2. Repositioning and stabilization of tooth 11 with wire and composite splinting

Endodontic Management

Because tooth 11 had a closed apex, root canal treatment was initiated on the same day as the repositioning procedure. Biomechanical preparation of the root canal was performed using sodium hypochlorite as the irrigating solution. Calcium hydroxide was subsequently placed as an intracanal medicament for two weeks.

At the two week follow up appointment, the calcium hydroxide was removed and the root canal was obturated using the lateral condensation technique. The splint was also removed at this appointment.

Figure 3. Endodontic Treatment of Tooth 11: Working Length, Calcium Hydroxide Medication and Obturation

Figure 4. Postoperative Clinical and radiographic appearance following repositioning and splinting

Follow up and Outcome

At six months following treatment, the patient was asymptomatic. Tooth 11 appeared clinically normal and was not tender to percussion. No abnormal mobility was detected, and periodontal probing did not reveal an abnormal probing depth. Percussion did not produce a metallic sound. Periapical radiographic examination demonstrated the tooth in an appropriate position without evident periapical pathological changes.The six-month clinical and radiographic documentation demonstrated satisfactory esthetic alignment and a stable replanted tooth without clinically detectable ankylosis or radiographically evident periapical pathology.

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Figure 5 and 6 . Six-Month Follow-up: Clinical and radiographic outcome of replanted tooth 11

II. Discussion

The management of an avulsed permanent tooth is fundamentally a race against time. The periodontal ligament is the critical biological determinant of the prognosis, and its survival is directly influenced by extraoral storage conditions and duration. The present case involved a mature maxillary central incisor that was maintained in a dry environment for slightly more than one hour before replantation. Although the tooth was replanted relatively soon after injury, the absence of an appropriate storage medium represented anunfavorable prognostic factor.

The 2020 IADT guidelines classify an avulsed tooth with an extraoral dry time exceeding 60 minutes as having a poor long term prognosis because the periodontal ligament cells are expected to be nonviable. Nevertheless, replantation remains recommended in appropriate patients because it can temporarily restore esthetics and function and preserve the contour of the alveolar ridge [1]. This recommendation is particularly relevant in adolescents, in whom preservation of the natural tooth and alveolar architecture may provide important functional and developmental advantages.

The biological consequences of prolonged dry storage are well documented. Lauridsen et al. evaluated 400 avulsed and replanted human teeth and demonstrated that the risk of ankylosis increased significantly with increasing dry storage time. The risk was also significantly greater in teeth with mature root development [2]. In mature teeth with dry storage exceeding 60 minutes, the estimated risk of ankylosis was particularly high. These findings provide important prognostic context for the present case: the absence of clinically detectable ankylosis at six months is encouraging, but it cannot be interpreted as evidence of definitive long term periodontal success.

Müller et al., in a retrospective analysis of avulsed and replanted permanent teeth, reported functional periodontal healing in only 26.5% of teeth, while replacement resorption affected approximately half of the replanted teeth [4]. Importantly, inflammatory resorption was associated with earlier tooth loss than replacement resorption. These observations reinforce the need for prolonged clinical and radiographic surveillance after replantation, particularly when the extraoral dry time has exceeded one hour.

A further important aspect of the present case is the initial malposition of the replanted tooth. Replantation should not be regarded as complete merely because the tooth has been returned to the socket. The final position of the tooth should be assessed clinically for alignment, occlusion, mobility, and soft-tissue relationships and radiographically for the position of the root within the socket [1]. In the present case, the tooth was incompletely seated and slightly extruded, possibly due to the presence of a blood coagulum within the socket, resulting in difficulty with normal mouth closure and occlusion.

Maintaining this position could potentially have resulted in persistent occlusal interference, unfavorable periodontal adaptation, and an anatomically compromised outcome.

The decision to remove and reposition the tooth approximately one day after the original avulsion required careful consideration. Any additional manipulation of an avulsed tooth can potentially cause further damage to already compromised periodontal tissues. However, the alternative, leaving a visibly malpositioned tooth in an extruded position was also undesirable. The successful clinical outcome suggests that, when a replanted tooth is clearly malpositioned and produces functional interference, carefully controlled secondary repositioning may be justified.

The IADT recommends verifying the position of the replanted tooth clinically and radiographically following replantation and stabilizing it with a passive flexible splint for approximately two weeks in uncomplicated cases [1]. The two week splinting period used in the present case is therefore consistent with

contemporary trauma management principles. Evidence concerning the ideal splint duration remains limited, but a systematic review found no convincing evidence that prolonged splinting improves periodontal healing compared with short term splinting and concluded that available evidence does not contradict short-term splinting recommendations [5].

Endodontic considerations

The second major component of management was endodontic treatment. Because tooth 11 had a closed apex, spontaneous pulp revascularization could not reasonably be expected. The current IADT guidelines recommend initiation of root canal treatment within two weeks following replantation in mature teeth [1]. The European Society of Endodontology similarly recommends early endodontic treatment in mature replanted teeth to reduce the risk of infection related external inflammatory resorption [3].

In the present case, root canal treatment was initiated at the time of secondary repositioning, approximately one day after the initial replantation. Thus, although endodontic treatment was not initiated immediately after the original replantation, it was undertaken well within the currently recommended two-week interval. Sodium hypochlorite was used for canal irrigation and calcium hydroxide was placed for two weeks before definitive obturation.

Calcium hydroxide has historically been used extensively in replanted teeth because of its antimicrobial properties and ability to create an alkaline intracanal environment that may help control infection related inflammatory root resorption. A review by Zare Jahromi and Kalantar Motamedi identified calcium hydroxide as a commonly used intracanal medicament in the management of replanted teeth, while also emphasizing that the available clinical evidence remains limited [6]. The use of calcium hydroxide in the present case was therefore consistent with established endodontic management principles.

Root resorption remains one of the most important long term complications after replantation. A meta-analysis of avulsed and replanted teeth reported replacement root resorption as the most frequently observed form, followed by inflammatory and surface resorption [7]. The biological basis of replacement resorption is closely related to extensive periodontal ligament and cementum damage, while inflammatory resorption is associated with infection of the necrotic pulp space in the presence of damaged root surface tissues.

The six-month outcome in this patient is clinically favourable. Absence of tenderness, abnormal mobility, increased probing depth, or a metallic percussion sound is reassuring. The absence of radiographically evident periapical pathology further supports successful short term control of endodontic infection. However, these findings do not exclude the future development of replacement resorption or ankylosis. Such complications can become evident considerably later than six months, particularly in teeth that experienced prolonged dry storage [2,4].

Clinical significance

This case emphasizes three practical principles. First, replantation should not be considered complete until the position of the tooth has been clinically and radiographically verified. An incorrectly positioned replanted tooth may create an avoidable functional and periodontal problem.

Second, an unfavorable initial prognosis does not automatically justify abandoning the natural tooth. Even when the periodontal ligament is severely compromised by prolonged dry storage, replantation can preserve the tooth and alveolar architecture for a clinically meaningful period [1,2].

Third, endodontic management and long term surveillance remain essential. A clinically asymptomatic replanted tooth at six months should not be considered permanently successful. Continued periodic clinical and radiographic evaluation is necessary because replacement resorption, ankylosis, and inflammatory resorption may develop later.

Limitations

The principal limitation of this report is the relatively short documented follow up period of six months. Because replacement resorption and ankylosis may develop over a substantially longer period, longer follow-up would provide a more robust assessment of periodontal prognosis.

III. Conclusions

A malpositioned replanted permanent incisor represents a clinically challenging variation of traumatic dental avulsion management. In the present case, secondary repositioning of an incompletely seated and slightly extruded maxillary central incisor, followed by appropriate splinting and endodontic treatment, resulted in a satisfactory clinical and radiographic outcome at six months.

The case reinforces the importance of early reassessment of a replanted tooth, correction of clinically significant malposition, radiographic verification of its final position, timely endodontic

treatment in mature teeth, and prolonged follow up for root resorption and ankylosis. Although the prognosis of teeth subjected to prolonged dry storage remains guarded, preservation of the natural tooth may still provide meaningful short- and intermediate-term functional and esthetic benefits, particularly in adolescent patients.

Consent for Publication

Written informed consent for publication of the clinical photographs and radiographs obtained.

Conflicts of Interest

The authors declare that they have no competing interests.

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