

## CASE REPORT

# An alternative to dental trauma guidelines: replantation of avulsed primary incisors with 3.5-year follow-up

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**Abstract**

**Background:** Avulsion of primary teeth may require comprehensive consideration because such teeth are not replanted. This case report highlights and discusses the complexities of clinical decision-making in a pediatric dental trauma, in which adherence to guidelines may be balanced against the potential benefits of deviating from them in exceptional cases. **Cases:** A 2-year old and 7-month-old male child visited our clinic with the chief complaint of avulsion of primary maxillary incisors. The extraoral time was less than 30 min. After obtaining the informed consent to the parents, the teeth were replanted and pulpectomies were performed on the teeth. A 3.5-year follow-up examination confirmed the stability of the replanted teeth with no adverse outcomes. **Conclusions:** In summary, this case demonstrated that, under well-defined circumstances, replantation can serve as a viable alternative, potentially guiding more personalized approaches in similar clinical scenarios.

**Keywords**

Primary tooth; Replantation; Tooth avulsion; Traumatic dental injury

## 1. Introduction

Traumatic dental injuries affecting the primary dentition represent a significant public health concern, with an estimated 22.7% of children affected worldwide, predominantly within the 2–6-year-old age range [1]. Such injuries may damage the primary teeth and/or supporting structures [2]. Among these injuries, avulsion of the primary teeth poses considerable challenges due to the risk of harm to developing permanent successors [3, 4]. Additionally, avulsion of primary teeth can lead to complications, such as developmental anomalies in the crown and/or root and changes in eruption patterns [5]. Therefore, management of the avulsion of primary teeth requires a careful balance between immediate care and long-term outcomes.

In contrast to avulsed permanent teeth, which should be replanted promptly, avulsed primary teeth are not replanted. Many dental associations, including the International Association of Dental Traumatology (IADT), have established management guidelines for avulsion injuries of primary teeth which state that replantation should not be performed [3–6]. These guidelines aim to minimize significant risks, including aspiration during the procedure, psychological burden on the child, and damage to the developing permanent tooth buds [3, 5]. Nevertheless, alternative treatments, such as no restoration and space maintainers, have been associated with potential aesthetic and phonetic issues and may not be well tolerated

in young children [7]. Contrary to these guidelines, a recent systematic review with a comprehensive analysis of treatment outcomes for replanted primary teeth concluded that replantation is a viable option under favorable biological conditions [8]. However, the review also emphasized that the decision to replant primary teeth should be approached with caution, considering the potential procedural complications and limitations of such treatments in young children. This case report describes a rare case of the long-term prognosis of avulsed primary maxillary incisors in a 2-year-old child whose case was driven by a unique set of circumstances.

## 2. Case presentation

A 2-year and 7-month-old male patient visited our dental clinic after experiencing dental trauma. The chief complaint was complete avulsion of the maxillary primary incisors involving designated teeth #51, #52 and #61, following a fall on a hard surface during playtime. The incident occurred less than 30 min before the clinic visit, and the teeth were immediately immersed and kept in milk. Extraoral examination revealed minor soft-tissue lacerations and swelling. Intraoral examination revealed empty alveolar sockets of the avulsed teeth with blood clot formation but no ongoing bleeding (Fig. 1a). Radiography images suggested total avulsion of the teeth, although the periapex and permanent buds were not visible (Fig. 1b).

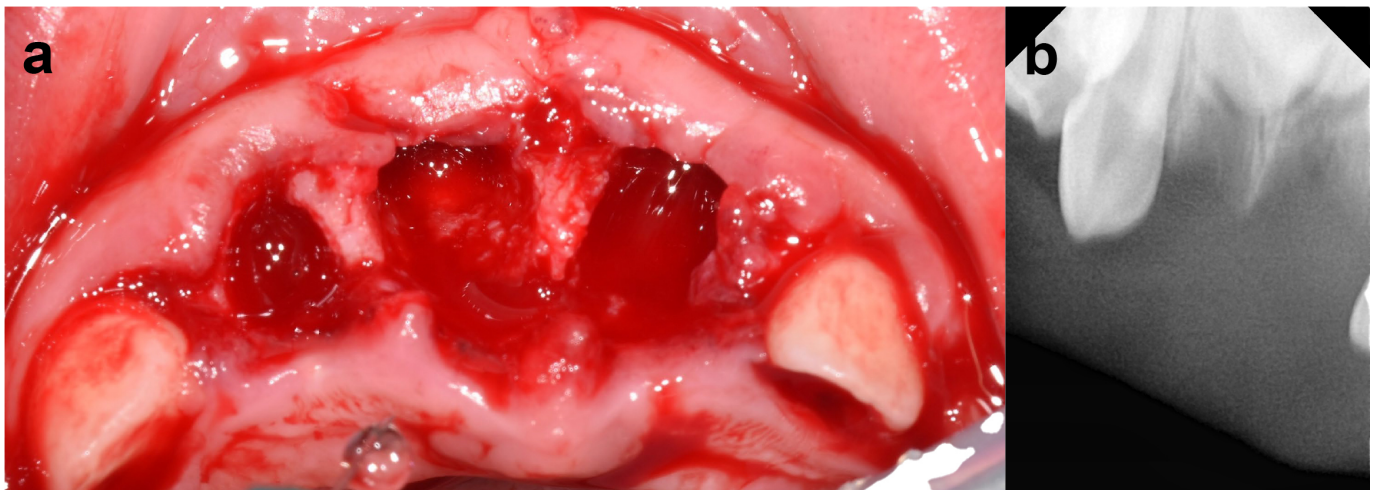
Following a thorough discussion with the patient's parents regarding the available treatment options and potential complications, the decision to proceed with replantation of the avulsed teeth was made jointly with the family. This decision was based on considerations including an extraoral dry time of less than 30 min, the parents' desire for aesthetic restoration, and the potential psychological impact of visible tooth loss on the child. Informed consent was obtained from the parents emphasizing their active participation in the decision-making process. The procedure was performed under local anesthesia, utilizing non-pharmacological behavioral management to ensure the child's comfort and cooperation.

The replantation procedure commenced with the avulsed teeth being gently cleaned with saline irrigation and replanted into their respective sockets. The gingiva was sutured using 4-0 non-resorbable sutures (Ethilon, Ethicon, Somerville, USA), and stabilization was achieved with a 0.5 mm flexible stainless steel wire splint (Dentaurum Twist-Flex splint, Dentaurum, Ispringen, Germany). The splint was passively adapted from teeth #53 to #63 and secured with a composite resin (Metafil Flow, Parkell Inc., Edgewood, USA) (Fig. 2).

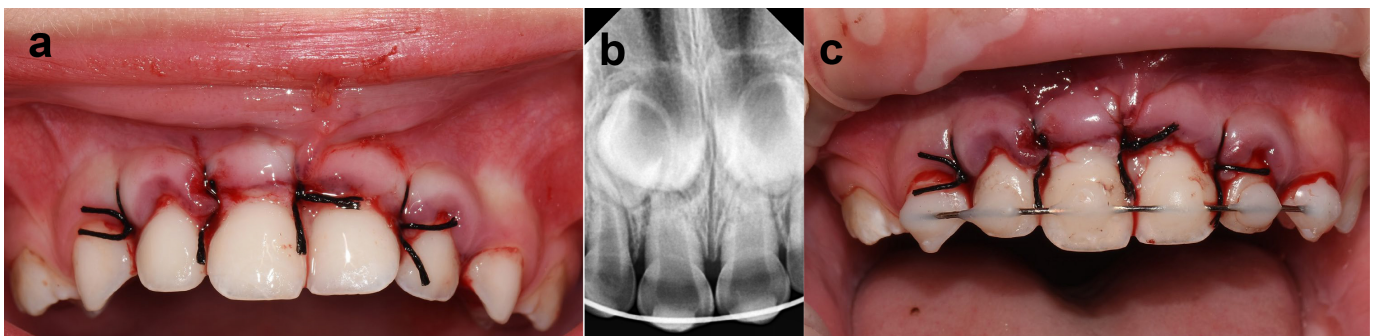
After replantation, comprehensive postoperative instructions were provided to the parents to ensure optimal healing and prevent complications. These instructions

emphasized maintaining a soft diet, practicing gentle oral hygiene using a soft toothbrush and avoiding strenuous activities that could affect the face. Additionally, the parents were advised in proper care of the stabilization splint, ensuring that it remained intact for approximately two weeks. Regular follow-up visits were scheduled to monitor the healing process and address any potential complications, such as mobility, discoloration, or signs of infection. The parents were also instructed to vigilantly observe the child for any adverse symptoms and to contact our clinic immediately if any concerns arose.

At the 2-week follow-up, pulpectomies were performed on teeth #51, #52 and #61 under rubber dam isolation to ensure a contaminant-free environment. Access preparation was performed, and canal debridement was performed using barbed broaches (MANI Barbed Broaches, MANI Inc., Tochigi, Japan). Canal shaping was performed using K-files (Dentsply Maillefer, Ballaigues, Switzerland) followed by saline irrigation. The canals were dried with paper points (DiaDent paper points, DiaDent, Cheongju, Korea), and obturation was completed using a mixture of calcium hydroxide and iodoform paste (B1J1, Vitapex, Neo Dental Chemical Products Co. Ltd., Tokyo, Japan) [9]. The access cavity was sealed with reinforced zinc oxide eugenol cement



**FIGURE 1. At initial visit.** (a) Clinical photo. Displays the maxillary region post-trauma, highlighting empty alveolar sockets with blood clots and surrounding soft tissue lacerations where the primary incisors (#51, #52 and #61) were avulsed. (b) Periapical radiograph. Shows total avulsion of the primary incisors. The radiograph does not show the periapex or the permanent tooth buds; focus is solely on the affected area.



**FIGURE 2. Replantation procedure.** (a) Replantation of the primary teeth. (b) Periapical radiograph. The radiograph confirmed that the teeth were placed in the proper position in the alveolar sockets. (c) Tooth splinting.

(IRM, 00141696, Dentsply Caulk, Milford, DE, USA), and the final restoration was performed with glass ionomer cement (Ketac Universal Aplicap, 3M ESPE, 9636431, Maplewood, MN, USA). Following these procedures, the splint was removed, concluding the stabilization phase for the replanted teeth.

Throughout the treatment and during follow-up visits, we regularly engaged with the parents to assess their satisfaction with their progress and outcomes. The parents expressed satisfaction with the aesthetic and functional results of the treatment, appreciating the restoration of the child's smile and overall oral health. This positive feedback from the family underscores the success of our collaborative approach.

The patient attended regular follow-up appointments at 2 weeks, 6 weeks, 6 months, 1 year, 2 years and 3 years, and a final visit at 3.5 years to assess treatment outcomes. At each visit, the patient exhibited cooperative behavior that facilitated the management process and contributed to a successful outcome. Clinical and radiographic examinations confirmed the stability of the replanted teeth, with no signs of inflammatory root resorption or other complications throughout the 3.5-year follow-up period (Figs. 3,4).

### 3. Discussion

The management of avulsed primary teeth is a complex and nuanced issue in pediatric dentistry. Standard guidelines from the IADT and other relevant scientific/clinical societies typically advise against replantation due to the risk of compli-

cations such as ankylosis, detrimental effects on developing permanent successors and pulp necrosis [3, 5]. However, our case deviated from these guidelines in that despite the general recommendation against replantation of avulsed primary teeth, we proceeded with replantation under specific favorable conditions outlined in recent systematic reviews. Our decision was based on the short extraoral dry time and proper storage of the teeth (using milk), which are critical factors for successful outcomes. This scenario raises important considerations regarding the need for flexibility in clinical guidelines based on individual cases.

Previous studies have shown varied outcomes, and replantation of primary teeth is generally not recommended because of the potential for complications, such as damage to the developing permanent teeth, ankylosis and adverse effects on root resorption patterns [3–6]. However, under certain favorable conditions such as immediate post-trauma management, short extraoral dry time and appropriate handling and storage of the avulsed teeth, replantation can lead to successful outcomes [10–13]. Our case adds to the existing literature by documenting a 3.5-year follow-up in which the replanted primary incisors remained clinically and radiographically stable, with no signs of inflammatory resorption or other common complications. Successful replantation was achieved despite the initial prognosis and the general guidelines advising against such a procedure. Our findings suggest that replantation may offer significant benefits with stringent follow-up and careful case selection.

The successful outcome of the endodontic treatments in



**FIGURE 3. Follow-up radiography.** (a) 6-month follow-up periapical radiograph. (b) 1-year follow-up periapical radiograph. (c) 2-year follow-up periapical radiograph. (d) 3-year follow-up periapical radiograph. (e) 3.5-year follow-up periapical radiograph.



**FIGURE 4. Follow-up images.** (a) 6-month follow-up periapical photograph. (b) 1-year follow-up periapical photograph. (c) 3-year follow-up periapical photograph.

our case was crucial, as evidenced by the absence of apical lesions and normal progression of root resorption, leading to the natural exfoliation of the replanted teeth. This underscores the effectiveness of endodontic procedures performed shortly after replantation, which not only preserved the teeth but also ensured that their natural life cycle was maintained without disruption. Careful management of these procedures contributed significantly to the overall success of the treatment, highlighting the importance of timely and precise endodontic intervention in cases of avulsed primary teeth.

This case suggests that the replantation of avulsed primary teeth may be viable under certain conditions where a favorable prognosis is likely. According to a recent systematic review, an avulsed primary tooth can be replanted if it has an extraoral dry time <60 min and is stored in an appropriate medium [8]. This review also suggested that replanted teeth require endodontic treatment. In the present case, the avulsed teeth met these criteria and had a favorable prognosis. Our patient outcome is consistent with the results of other studies [10–13]. This prompted us to consider whether factors such as patient age, biological healing and short extraoral dry time may contribute to better results than typically expected [14]. Furthermore, the replantation of avulsed primary teeth should be performed promptly, accompanied by meticulous follow-up [14].

The clinical significance of this case is not a call for revision of existing guidelines but the value of individualized management of pediatric dental trauma. Primary anterior teeth are responsible for the aesthetics and oral function of children [7]. Psychosocial aspects such as self-esteem, confidence and speech development may be affected by early tooth loss [15]. Thus, these considerations were significantly included in our decision-making process, along with the favorable replantation conditions. This case may encourage further research into the determinants of successful replantation of primary teeth and advocate for a deeper investigation into scenarios in which the benefits may surpass the associated risks.

This approach aligns with the philosophy of providing individualized care that emphasizes the patient's overall well-being and quality of life [16, 17]. Along with the need for individualized assessment, this case highlights the importance of regular checkups. These are crucial for the early detection of potential complications, such as ankylosis or infection, and for monitoring the overall oral development of the child. Regular dental visits help maintain the health of the replanted teeth and ensure that the child's dental hygiene and well-being continue to be supported as they grow. Although a 3.5-year follow-up period is generally adequate to observe the outcomes in primary teeth which are expected to exfoliate within this time, our findings are based on a single case. This may limit the generalizability of the results. Further studies with larger sample sizes would help to confirm the reproducibility and broader applicability of these findings. In addition, a longer follow-up period may elucidate other developmental issues with dentition as the child grows.

#### 4. Conclusion

This case documents a rare instance in which the replantation of avulsed primary maxillary incisors in a 2-year and 7-month-

old male patient resulted in a positive outcome over a 3.5-year follow-up period. In summary, this case contributes to current pediatric dental literature by demonstrating that replantation of primary teeth may be successful under specific circumstances. Our experience advocates for careful consideration of atypical presentations on an individual basis, ensuring that our clinical practice remains both evidence-informed and patient-centered.

#### AVAILABILITY OF DATA AND MATERIALS

All relevant patient data are contained within this article.

#### AUTHOR CONTRIBUTIONS

JHK and OHN—designed the research study. JHK—performed the research. YKC—provided help and advice on the research. FSA, JRY and OHN—wrote the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

#### ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was exempted from ethics review by Kyung Hee University Dental Hospital. Verbal informed consent for the described clinical procedures and written consent for anonymized use of the patient's de-identified medical records for scholarly reporting were obtained from the patient's parents.

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#### CONFLICT OF INTEREST

The authors declare no conflict of interest.

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