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## Delayed tooth replantation after traumatic avulsion of a maxillary incisor: A case report

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### Abstract

Tooth avulsion is a severe dental injury impacting the pulp tissue, periodontal ligament, and alveolar bone. This condition occurs most frequently in individuals under the age of 19, with the maxillary anterior teeth being particularly susceptible. Managing an avulsed permanent tooth presents significant clinical challenges. Replantation, defined as the reinsertion and temporary stabilization of a tooth dislodged by traumatic injury, requires careful consideration of several factors. The prognosis of replantation is directly influenced by the physiological condition of the periodontal ligament, the manner in which the avulsed tooth is handled extra-orally, the stage of root development, the duration of extraoral dry time, and the type of storage medium used. This report presents a case of delayed replantation of an avulsed tooth following an extended period of dry storage. The tooth underwent endodontic treatment, splinting, and, after adequate follow-up, orthodontic rehabilitation.

**Keywords:** Traumatic dental injury, avulsion, replantation, extra-oral time, root canal therapy

### Introduction

Avulsion or exarticulation refers to the complete displacement of a tooth out of its socket/alveolus <sup>[1]</sup>. It accounts for 0.5-3% of all dental trauma and is considered a significant form of dental injury <sup>[2]</sup>. It can occur in primary and permanent dentitions, with an incidence of up to 52% in primary teeth and 16% in permanent teeth <sup>[2, 3]</sup>. The injury is commonly secondary to assault or accidental trauma <sup>[4]</sup>. Due to the resilient nature of the alveolar bone and children's participation in sports, it is more frequent in young permanent teeth <sup>[5]</sup>. The maxillary central incisor is particularly vulnerable to this injury because of its morphology and position in the dental arch <sup>[3]</sup>.

The treatment option, outcome, and prognosis are dependent on the stage of root development, extraoral dry time and the emergency measures ensued at the time of avulsion <sup>[6]</sup>. Replantation, the process of reinserting a dislodged tooth into its socket, is often the treatment of choice. Andreasen defines delayed replantation as when this procedure is performed more than five minutes after the tooth is avulsed <sup>[5]</sup>. We report a case of a 15-year-old male with avulsion of left maxillary central incisor who presented 3 hours after the incident using the SCARE guidelines <sup>[7]</sup>.

### Case Presentation

A 15-year-old male child presented with a history of trauma to his left upper front tooth as a result of fall over a metal bench in his school. The tooth loosened after the impact and the patient forcefully pulled it out to get rid of the pain. The removed tooth was then brought to the hospital wrapped in a paper after approximately 3 hours.

The patient had insignificant medical history. Any other physical injuries were absent and neurological disturbances were ruled out. The patient mentioned that forwardly placed upper front teeth was present beforehand which might have been the cause of the tooth avulsion. We confirmed if the patient received Tetanus toxoid injection after the trauma. Intraoral examination of the soft tissues showed no injuries. Examination of dentition revealed missing left maxillary central incisor (21).

Percussion, palpation and pulp vitality test (cold test) were done from canine to canine and right maxillary central incisor (11) and left maxillary lateral incisor (22) revealed increased mobility. The mobility was noted to be grade I mobile in both 11 and 22 using Miller's index. The anterior maxillary jawbone was palpated which showed no evidence of fractures. Radiovisiography (RVG) revealed an empty alveolar socket with an intact lamina dura in the 21 region; there was no other injury or fracture of the adjacent teeth and associated alveolar structures, and 21 had closed root apex with no other signs of injury. The patient was advised of the potential complications associated with replanting an avulsed tooth that had been outside the mouth for around 180 minutes, including inflammatory resorption, replacement resorption or ankylosis, and possible tooth discoloration.

During the initial appointment, the avulsed tooth was gently cleaned with sterile saline solution to remove any attached debris. The tooth was held cautiously by crown to avoid damage to periodontal ligament cells. Extra-oral endodontic treatment of the tooth began with endodontic access cavity preparation that was done with the prime objective of gaining straight line access to apical foramen. An access cavity was prepared, after which the pulp was removed and the working length was determined using a #15 K file (Dentsply Maillefer, Switzerland). The working length was established as 19 mm following Ingle's method. The root canal was shaped and prepared using rotary instruments from the ProTaper Gold file system (Dentsply Maillefer, Switzerland) up to size F3 to the working length. After each file change, the canal was alternately irrigated with normal saline and a 2% sodium hypochlorite solution. After a saline rinse, the canal was dried with absorbent paper points. Three dimensional obturation of the root canal was done using Metapex (Meta Biomed, South Korea) followed by placement of temporary restoration (TMP-RS, Prime Dental Products, India). The root surface of the avulsed tooth was treated with a 1.23% acidulated phosphate fluoride (APF) gel for 20 minutes. The tooth was then gently repositioned in the socket with slight digital pressure, and its position was confirmed with RVG. The repositioned tooth had proper occlusion, so no occlusal

adjustment was needed. Following radiographic confirmation, the replanted tooth was stabilized in its socket with splinting, using light-cure flowable composite resin (Nexcomp Flow, Meta Biomed, and South Korea) and flexible wire for two weeks. The labial surfaces of the maxillary anterior teeth were spot-etched at the middle third of the crown using 37% phosphoric acid for 20 seconds, then rinsed and air-dried. A bonding agent (Meta P&Bond, Meta Biomed, and South Korea) was applied and light-cured for 20 seconds. Flowable composite was added to the etched spots, and the orthodontic wire was secured by light-curing each tooth for 20 seconds. The patient was discharged with oral analgesics, and a five-day course of antibiotics (amoxicillin 500 mg + clavulanic acid 125 mg twice daily and metronidazole 400 mg three times daily) was prescribed. The patient was also instructed to consume soft diet, maintain adequate oral hygiene and was recalled after a week.

During the one-week follow-up, it was observed that the mobility of the replanted tooth had decreased to grade I, and there were no signs of changes in the surrounding tissue. On 2-weeks follow up, the splint was removed and root canal irrigation was done followed by placement of calcium hydroxide and iodoform paste (RC Cal-I, Prime Dental Products, India) as intracanal medicament. On subsequent follow up, progressive decrement of the tooth mobility was seen. Further weekly follow up visits were called for proper evaluation. At the one-month follow-up visit, the clinical examination revealed normal physiological mobility and normal probing sulcus depth for the replanted tooth. Final obturation was done around 5 weeks later using gutta-percha and zinc oxide eugenol-based sealer (RC Fill, Prime Dental Products, India) by the cold lateral compaction technique followed by glass ionomer cement (GC Gold Label II, GC Corporation, Tokyo) restoration.

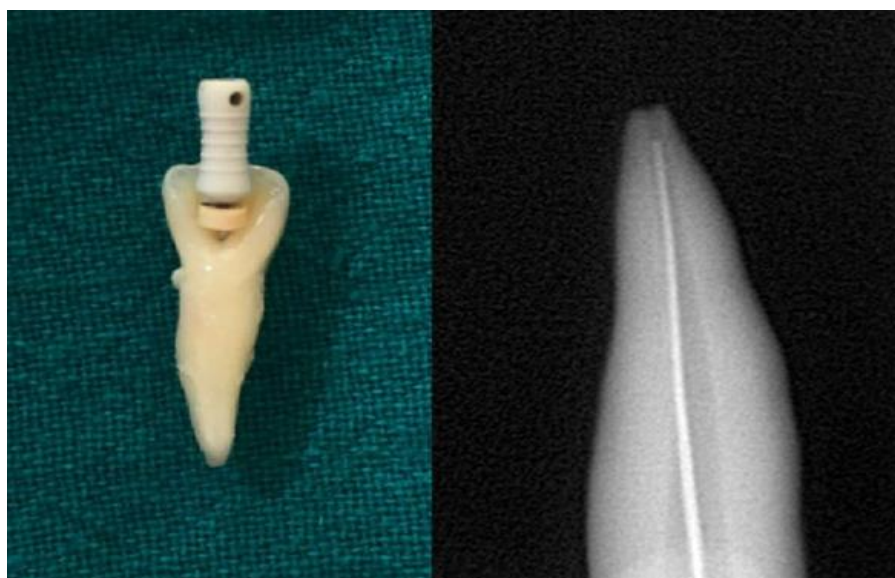
After the endodontic treatment was completed, the patient was kept on a regular follow-up for 3 months during which no complications were observed. Following this uneventful period, orthodontic treatment was initiated after a thorough evaluation and radiographic examination.



**Fig 1:** Alveolar socket of maxillary left central incisor following tooth avulsion.



**Fig 2:** Avulsed tooth (21) after being rinsed with normal saline.



**Fig 3:** Working length determination of the avulsed tooth (21) done using the radiographic method.



**Fig 4:** Avulsed tooth (21) repositioning done in the alveolar socket using slight digital pressure.



**Fig 5:** Radiographic verification for correct positioning of 21 in its alveolar socket.



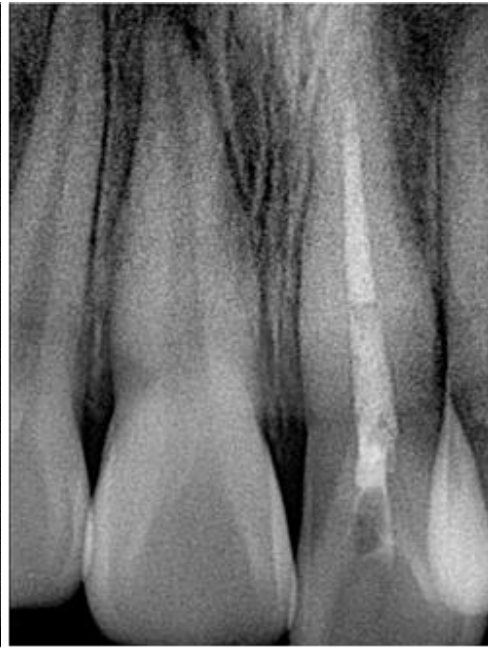
**Fig 6:** Avulsed tooth repositioned and splinting done with orthodontic wire and composite.



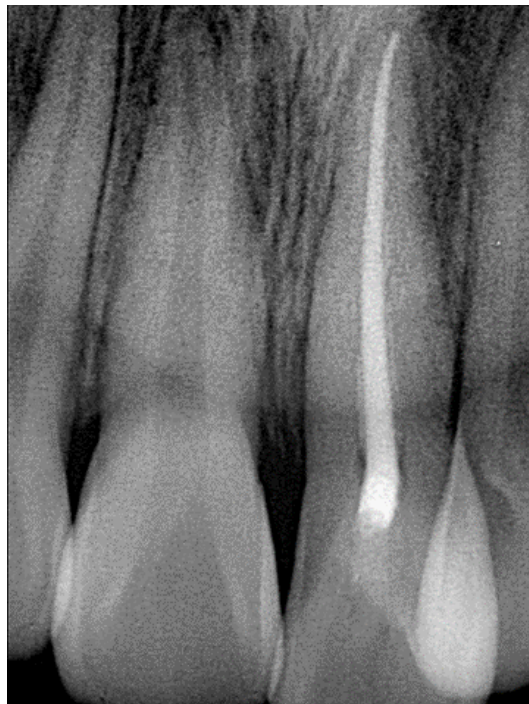
**Fig 7:** Intra-oral clinical image taken at 2-weeks follow-up visit after removal of the splint.



**Fig 8:** Intraoral Radiograph taken at 2 weeks follow-up visit after removal of the splint.



**Fig 9:** Intraoral Radiograph taken at 1-month follow-up visit.



**Fig 10:** Radiograph showing completed root canal therapy with 21.



**Fig 11:** Orthopantomogram taken at 3-months follow-up visit for initiating orthodontic treatment.

## Discussion

As per the severity, the treatment of avulsed tooth is variable and complex since the prognosis is influenced by multiple factors like the status of periodontal ligament (PDL) cells at the time of replantation, storage media, extra-oral dry time, time elapsed and stage of tooth development.<sup>[6]</sup> Replantation of the tooth is often the preferred modality for managing an avulsed tooth.<sup>[8]</sup> The prognosis of a replanted tooth is strongly influenced by the extra-oral environment in which the tooth has been stored. In our case, the extra oral dry time was 3 hours which is similar to the case presented by *Ravi et al.* where the tooth was stored under adverse conditions and replantation was done 3.5 hours later, yet yielded good results till a follow-up period of 24 months without evidence of resorption.<sup>[9]</sup> According to *Donaldson and Kinirons*, dry time is the most crucial factor determining the risk of post-implantation root resorption.<sup>[10]</sup> *Trope et al.* further suggest if excessive drying occurs before replantation, the damaged periodontal ligament cells can trigger a severe inflammatory response across a wide area of the root surface resulting in root resorption<sup>[11]</sup>.

An avulsed tooth should be transported in a suitable medium with Hank's Balanced Salt Solution (HBSS) being considered the optimal choice.<sup>[12]</sup> However, recent evidence highlights milk as the most recommended natural storage medium.<sup>[13]</sup> In this case, milk would have been a preferable option, as it is easily accessible in rural settings and helps preserve the health of periodontal ligament (PDL) cells until replantation.<sup>[3]</sup>

Taking the patient's age into consideration, replantation of the tooth after its extraoral endodontic treatment to preserve esthetics, function, and psychological well-being was carried out. The presence of necrotic PDL cells might lead to the resorption of replanted tooth roots necessitating the need for proper cleaning of root surface before replantation<sup>[4]</sup> Hence mechanical debridement of the root surface was carried out followed by immersing in 2.4% acidulated phosphate fluoride (APF) before commencement of extraoral root canal treatment (RCT) according to International Association of Dental Traumatology (IADT) guidelines<sup>[14]</sup>.

Following RCT, calcium hydroxide (CaOH<sub>2</sub>) was placed as an intracanal medicament. CaOH<sub>2</sub> is well known for its high alkaline pH and is lethal to bacterial cells by causing protein denaturation, DNA damage, and disruption of cytoplasmic membranes, thereby effectively eliminating microorganisms from the root canal<sup>[12, 15]</sup>.

Stabilizing a replanted tooth is a crucial step for successful healing. According to current IADT guidelines, a splinting time of 4 weeks is recommended for a tooth that has been replanted after an extraoral dry time of more than 60 minutes<sup>[16]</sup> However, in this case, a flexible splint made of orthodontic wire and composite was used only for 2 weeks until the mobility significantly reduced since there was no evidence of cortical bone loss similar to the case presented by *Ravi et al.*<sup>[9]</sup>.

Researchers have estimated that 70 to 90 percent of all traumatic dental injuries sustained in a lifetime take place before the age of 19 years<sup>[17]</sup> Children with accident prone profile, i.e. class II division I or class I type II malocclusion are more prone for injuries because of the proclined maxillary incisors<sup>[18]</sup> and in such cases, timely orthodontic correction can be immensely helpful in avoiding traumatic dental injuries. Orthodontic treatment using a conservative approach can be a highly effective option for addressing malocclusions related to trauma and the avulsion of anterior teeth that are reimplemented shortly afterward<sup>[19]</sup>.

Frequently occurring because of trauma, the management of this condition is often inadequate due to the stressful condition created and, more importantly, the lack of proper knowledge. Our case highlights this issue, as the patient, unaware of potential future complications, forcibly removed the tooth to alleviate pain. Transporting the tooth wrapped in paper also reflects a clear lack of awareness which further warrants a need for awareness regarding the transport of an avulsed tooth.

## Conclusion

This case report highlights upon the fact that patient's knowledge of tooth avulsion and its management is critical to the outcome of avulsed teeth. Educating patients on proper transportation and storage of avulsed teeth is essential, as it significantly impacts treatment outcomes. Regardless of the time elapsed, replantation remains the best treatment option, as it helps preserve bone structure and function, ensuring support for future prosthetic needs if replantation ultimately fails.

## Consent

Written Consent Form was signed by the patient's mother, as the patient is a minor and the original article is attached along with the patient's chart as well.

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## Conflict of interest

None.

## Author Contribution

AK, MAH: Patient management, Manuscript write-up and proofreading.

MK, NS: Manuscript write-up, editing and proofreading.

JB, NR: Manuscript editing and proofreading.

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