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Replantation of an Avulsed Tooth: A Case Report

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Abstract

Avulsion is an uncommon and severe form of dental trauma that requires prompt and complex intervention. This case report presents the successful management of an avulsed maxillary central incisor that was replanted after remaining outside the oral cavity for 90 minutes, having been in dry storage. A 9-year-old male patient arrived with an alleged history of fall from staircase, hit on face and missing upper front tooth. Clinical assessment revealed avulsion of tooth 21, which was replanted in accordance with International Association of Dental Traumatology (IADT) guidelines and stabilized using a splint. Conventional root canal therapy was initiated two days after replantation, after which the splint was removed. Follow-up examination at one month demonstrated the absence of clinical symptoms and no evidence of resorption on radiographic evaluation.

Keywords: avulsion, replantation, extra oral time, storage media

Introduction

Dentoalveolar trauma encompasses a range of injuries affecting the teeth and their supporting structures, with avulsion representing one of the most severe forms. Dental avulsion is defined as the complete displacement of a tooth from its alveolar socket following trauma, resulting in significant damage to the periodontium, blood vessels, and nerve connections. Although avulsion is relatively rare compared to other dental injuries, its prevalence among traumatic dental events ranges from 0.5% to 16%.[1]

This injury most frequently affects the maxillary anterior teeth, particularly the central incisors, and is especially common in children aged 7 to 12 years. The higher incidence in this age group is attributed to factors such as increased participation in physical activities, developing motor skills, and the presence of immature root apices. Males are more commonly affected than females, with a male-to-female ratio as high as 3:1 in some studies.[2]

Common causes of tooth avulsion include falls, sports accidents, motor vehicle collisions, and facial trauma, with predisposing factors such as increased overjet and insufficient lip coverage further elevating the risk.[1] Immediate and appropriate management is critical for the prognosis of avulsed teeth, as timely intervention can significantly influence the long-term outcome and the preservation of oral health.[3]

The primary line of management for an avulsed permanent tooth is immediate replantation, which involves reinserting the tooth into its socket as soon as possible following the injury. According to the International Association of Dental Traumatology (IADT) guidelines, prompt replantation is critical because it significantly improves the prognosis by preserving the viability of the periodontal ligament (PDL) cells on the root surface. The IADT emphasizes that the extraoral dry time—the period the tooth remains out of the mouth and not stored in a suitable medium—should be minimized, ideally less than 60 minutes, as prolonged dry time leads to irreversible PDL cell death and increases the risk of complications such as root resorption and ankylosis.[4] If immediate replantation is not possible, the tooth should be stored in an appropriate medium such as milk or Hanks' Balanced Salt Solution (HBSS), which helps maintain cell viability far better than water or dry storage. Milk is particularly recommended due to its favorable chemical properties and accessibility at accident sites. Overall, rapid replantation and proper storage are essential steps, as they directly influence the long-term survival and function of the avulsed tooth.[5] The risk of ankylosis is extremely high—up to 85.7%—when teeth are stored dry for more than 60 minutes before replantation. Ankylosis leads to the fusion of the tooth root to the surrounding bone, resulting in gradual replacement of the root by bone (replacement resorption). Although less common than replacement resorption, inflammatory root resorption can also occur, especially if there is bacterial contamination or inadequate endodontic management. This case report highlights the comprehensive procedures executed in the successful replantation of an avulsed maxillary central incisor despite an extended extra-oral duration of 90 minutes and dry storage.

Case Presentation

A 9 year old boy reported to the department of Pediatric and Preventive Dentistry with alleged history of fall from staircase, hit on face and missing upper front tooth since the same day morning. History of trauma due to fall morning at around 6.30 am in which the patient had fallen from the staircase and hit by his face at the home. The tooth was in the socket till the child spit, nearly 30 minutes after the trauma. There was no history of loss of consciousness, vomiting, headache and nasal bleeding. He reported to the dental OPD around two hours after the trauma and the tooth was placed in a plastic cover. Immediately after reaching OPD, the tooth was transferred to milk storage medium holding the crown of tooth. There was no relevant medical history and family history, his immunization status was uptodate.

On extraoral examination, there were no swelling, facial asymmetry, abrasions, lacerations and lip injuries. There was no evidence of bleeding extraorally and the patient was conscious. Maxilla, mandible, zygomatic arch and TMJ were palpated. There were no tenderness, pain, irregularities of bone contour, step deformity and segmental mobility during palpation. Occlusion of teeth was normal. There was no deviation in the mouth opening and closing. There were no tenderness or enlargement of regional lymphnodes.

On intraoral examination, the left maxillary central incisor (21) was missing (figure 1) and the socket was bleeding and there was extrusion irt 11. There were no displacement or fractures of neighbouring or opposing teeth. There were no lacerations, abrasions, hematomas, foreign bodies and tooth fragments on the lips, gingiva, buccal mucosa, and palate. The avulsed tooth had an intact crown and a well-formed root with a closed apex. There was no attached soft tissue or debris along the root surface. Palpation of the anterior maxillary segment was done and there was no dentoalveolar fracture. On palpation, there was extrusion in relation to 11 and grade 1 mobility in relation to 22. 11 and 22 were tender on touch and percussion.

Figure 1:

Figure 2:

Radiovisiography (RVG) revealed an empty alveolar socket with an intact lamina dura in the 21 region (figure 2) there was no fracture of the adjacent teeth and associated alveolar structures, increase in the periodontal ligament space apically irt 11, suggesting mild extrusion by approximately 2 mm and widening of lamina dura irt 22.

Definitive diagnosis were avulsion of permanent maxillary left central incisor (tooth #21) following trauma, with extra-oral dry time of approximately 1 hour 30 minutes and dry storage prior to presentation, subluxation in relation to 22 and extrusion by 2mm in relation to 11.

Patient was explained regarding all possible outcomes and follow up regarding replantation. Informed consent was obtained. Local anesthesia with adrenaline was administered. The socket was irrigated with sterile saline to remove debris or clots. The tooth was rinsed with saline. The tooth was replanted slowly and gently into the socket with slight digital pressure (figure 3).The correct position was verified clinically and radiographically(figure 4). A flexible fiber reinforced composite (passive) splint was applied for 4 weeks (figure 5).

Figure 3:

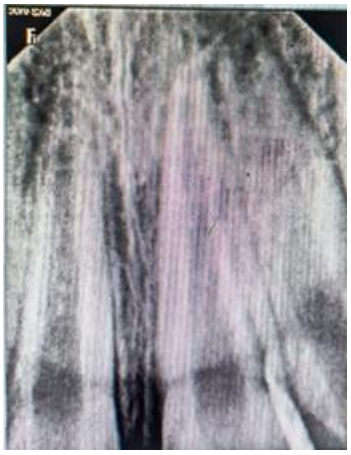

Figure 4:

Figure 5:

A 5-day course of systemic antibiotics (amoxicillin) and soft diet were prescribed. Advised 0.12% chlorhexidine rinse twice daily for 2 weeks. Patient was referred for tetanus booster. Patient was reviewed after 2 days and root canal therapy was initiated. After administration of local anaesthesia, an access cavity was prepared followed by extirpation of the pulp and working length determination irt 21. Calcium hydroxide intracanal medicament was placed in the root canal space and the access cavity was sealed with a temporary filling.

Discussion

Replantation of an avulsed tooth is considered the best treatment option to preserve both function and aesthetics whenever possible. The extraoral dry time and storage media of an avulsed tooth are critical determinant of its prognosis and long-term survival after replantation. This case report focuses on the replantation of an avulsed maxillary central incisor after an extra-oral dry time of nearly one hour 30 minutes.

In this case, the tooth was brought dry in a plastic sheet. The use of an appropriate storage medium is crucial for maintaining the health of PDL cells on an avulsed tooth, directly influencing the success of replantation and the long-term prognosis of the tooth.[6] Preventing desiccation (drying out) of the tooth is critical, as dry storage rapidly leads to irreversible damage and cell death, compromising the long-term prognosis of the replanted tooth. So the tooth was transferred to a container of milk as soon as the patient reported to the dental OPD. Transferring an avulsed tooth into milk is still significant because milk helps prevent further dehydration and necrosis of any remaining viable periodontal ligament (PDL) cells. While milk cannot revive already degenerated or non-viable cells, it can maintain the integrity of the root surface and reduce additional cell death, which may help limit complications such as root resorption and ankylosis after replantation. Additionally, milk's physiological pH, osmolality, and nutrient content make it superior to saliva, water, or air for short-term storage, providing a more favorable environment for any surviving cells.[7] In case report by Kadulkar et al,[8] despite the extended extraoral time of two hours, the use of milk as a storage medium supported successful

replantation procedures of an avulsed permanent tooth (21). Even though milk is a good and widely recommended medium due to its availability and effectiveness, propolis, HBSS and egg white have been shown in scientific studies to be better for preserving avulsed teeth when available.[6]

Teeth replanted within 5 minutes have the highest survival rates, while delays beyond 60 minutes lead to a survival probability of only 50% after 5.5 years.[9] in this case the avulsed tooth was replanted after approximately 90 minutes. Prolonged dry time correlates with replacement resorption (51% of cases), Inflammatory resorption (22.5% of cases), often causing early tooth loss (mean: 1.7 years)[10] and reduced alveolar bone preservation, complicating future restorative options.[4] The current AAPD guidelines do not mention surface pretreatment for avulsed teeth with extraoral dry time greater than 60 minutes because, after this duration, most or all periodontal ligament (PDL) cells on the root surface are considered non-viable. Taking this into account, no surface pretreatment was done prior to replantation inorder to prevent delay in replantation. A case report by Rai et al,[11] described the delayed replantation of a permanent maxillary central incisor after 72 hours (3 days) of avulsion, during which the tooth was stored dry. The replanted tooth remained asymptomatic and functional for up to 6 years, serving as an interim prosthesis and providing significant psychological benefit to the adolescent patient. In a case report by Tomar S et al[12], tooth was placed in a 2% sodium fluoride solution for 20 minutes before replantation to delay osseous activity and minimize root resorption in case of an avulsed tooth with more than 48 hours of extraoral dry time.

Splinting is a crucial step after replantation of an avulsed tooth, as it stabilizes the tooth, supports periodontal healing, and reduces the risk of adverse outcomes such as ankylosis and root resorption. Current guidelines, from the AAPD, recommend short-term (about 2 weeks), passive, flexible splinting for avulsed teeth, as this approach is associated with better periodontal and pulp healing outcomes.[4] Flexible splinting stabilizes the tooth while allowing beneficial movement, optimizes healing conditions, and minimizes long-term complications.

Initiating root canal therapy within 2 weeks after replantation of an avulsed tooth is crucial to minimize the risk of inflammatory root resorption and early failure of the tooth. After avulsion, the pulp tissue is highly susceptible to necrosis and infection, particularly in mature teeth with closed apices, due to the disruption of the neurovascular supply. Early removal of necrotic pulp and disinfection of the root canal system prevent the spread of infection to the surrounding periodontal tissues, thereby reducing the likelihood of inflammatory resorption—a leading cause of tooth loss in replanted teeth.[13] Previously, root canal therapy was often performed on the tooth outside the mouth before replantation. In a case report by Tomar et al,[12] extraoral RCT was performed before replantation of the avulsed tooth. However, current guidelines recommend completing root canal treatment intra-orally after replantation, as this approach reduces extraoral time and minimizes related risks.[8] A 4-week application of calcium hydroxide as an intracanal medicament of avulsed tooth is crucial for infection control, prevention of root resorption, and promotion of tissue healing, thereby improving the prognosis of the replanted tooth. In our case, endodontic treatment was initiated 2 days

after replantation followed by placement of calcium hydroxide intracanal medicament for four weeks.[14]

For replantation, local anesthesia without vasoconstrictors is preferred to maximize perfusion and support tissue survival. But in this particular case local anesthesia with adrenaline was used, which is a limitation of the procedure.

A replanted tooth should be monitored regularly for the first 12 months and then annually for at least five years, with both clinical and radiographic evaluations at each follow-up to detect any potential complications like inflammatory and replacement resorption. Additionally, educating patients about emergency management of tooth avulsion and the appropriate use of storage media is crucial for the successful treatment of an avulsed tooth.[12]

Conclusion

Replantation of an avulsed tooth remains important for preserving function and aesthetics. Even with prolonged extraoral time and dry storage, replantation of an avulsed tooth can still result in a favorable outcome when all recommended guidelines and protocols are carefully followed.

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