

# Delayed Replantation of Multiple, Avulsed Maxillary Young Permanent Teeth with Open Apex

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## ABSTRACT

**Aim:** Aim of this article is to present a case of delayed replantation of multiple, avulsed maxillary permanent teeth that had an extraoral dry time of about 22 hours with 6 month follow-up.

**Background:** Dental avulsion is a real dental emergency in which prompt management affects the prognosis of the tooth. Avulsed teeth need to be replanted at the earliest in order to insure the best possible prognosis which restores esthetic appearance and occlusal function. However, the long-term survival of replanted avulsed teeth is low due to ankylosis and root resorption.

**Case description:** The patient, aged 9 years old boy, reported almost 22 hours later the road traffic accident in which he lost one deciduous and five permanent teeth. The avulsed teeth were kept in dry environment. Since the patient was young, replantation of the avulsed tooth was planned and performed in the best interest of the patient and to relieve him from psychological, cosmetic and functional trauma.

**Conclusion:** In case of avulsed permanent teeth with prolonged nonphysiological storage, especially in adolescents and young adults, replantation should be performed irrespective of the outcome despite the risk of progressive replacement resorption and subsequent tooth loss.

**Clinical significance:** Reimplantation of avulsed teeth is a standard procedure. However, it has certain limitations. Most often their management is very challenging. This case report presents stepwise management of delayed replantation procedure.

**Keywords:** Delayed replantation, Avulsion, Young permanent teeth.

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## INTRODUCTION

Traumatic injuries to newly erupted permanent anterior teeth are common during childhood. With permanent teeth; school aged boys suffer trauma almost twice as frequently as girls. Sports accidents and fights are the most common cause of dental trauma in teen agers. The maxillary central incisors are most commonly injured teeth. Maxillary teeth protruding more than 4 mm are two to three times more likely to suffer dental trauma than normally aligned teeth.<sup>1</sup> Among all dental injuries avulsion occurs in 1 to 16% of cases.<sup>1,2</sup> Tooth

avulsion (ex-articulation, total luxation) following traumatic dental injuries implies total displacement of the tooth out of its alveolar socket and is a complicated dental injury. Dental avulsion injuries occur most frequently in children between the ages of 7 and 9 years,<sup>2</sup> an age when the alveolar bone surrounding the tooth is relatively resilient and tooth is incompletely formed with large open apex.<sup>3</sup> Avulsion of children's teeth can be very distressing for children as well as their parents.<sup>4</sup>

The most preferable management for the avulsed tooth is immediate replantation or keeping tooth in suitable storage media until dental visit.<sup>4</sup> The aim being to decrease the postreplantation inflammatory response, avoiding the tooth dryness and maintaining the viability of the periodontal ligament cell.<sup>5</sup> Viability of the remaining periodontal ligament cell on the root surface of a replanted tooth is the most important factor in determining its prognosis.<sup>6</sup> Replantation of a tooth beyond 5 minutes has been defined by Andresen as delayed replantation that affects its survival.<sup>2,7,8</sup> It was believed that delayed replantation more than 60 minutes of avulsed teeth with open apex had poor long-term prognosis: The periodontal ligament will be necrotic and not expected to heal and osseous replacement resorption or ankylosis will occur.<sup>8</sup> Andresen has reported that the tooth has been out of the mouth for more than 2 hours, there is 95% chance of external root resorption.<sup>7,9</sup>

In young patient loss of multiple upper front teeth will pose a serious psychological, cosmetic and functional trauma. Also social embarrassment is one of the greatest problems associated with tooth loss which negatively affect quality of life of growing children. So replantation of an avulsed tooth for a child must be done even if prognosis is questionable. The purpose of this case report is to present the clinical condition of avulsed and replanted maxillary multiple teeth that were treated with 6 month calcium hydroxide after an extended dry extra alveolar period in a growing patient.

## CASE REPORT

A patient aged 9 years old boy was reported to the clinic for treatment of avulsed teeth along with his parents. History revealed that the patient met with road traffic accident in which he lost upper front teeth. The patient and parents had gone to a general physician immediately after the accident

along with teeth but unfortunately it is not been replanted. The physician after examining gave a tetanus vaccine, prescribed antibiotics/analgesics and was referred to the dentist; and patient reported to us after 22 hours after the accident with avulsed teeth which had been kept dry in a piece of paper after injury. The patient's medical history was unremarkable.

Intraoral examination revealed that patient had lost his maxillary right and left permanent central incisors with open apex, maxillary right and left permanent lateral incisors with open apex, maxillary right deciduous canine with complete root and maxillary right first premolar with only one-third of root formed. The avulsed teeth were rinsed gently and thoroughly with normal saline and followed by antibacterial solution and then were stored in normal saline (Fig. 1). Socket on examination looked to be intact without any signs of socket wall fracture or collapse (Fig. 2). Periapical radiographs showed intact socket wall with no other hard tissue injury in the region. After comparing his age, extra-oral dry time of avulsed teeth, status of socket, patient's



**Fig. 1:** The avulsed teeth after cleaning stored in normal saline



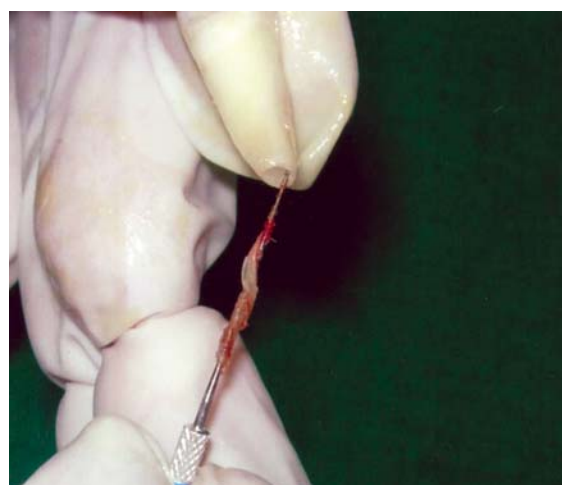
**Fig. 2:** Intact socket without any signs of fracture or collapse

cooperation it was decided to retain all the five permanent teeth, i.e. 14, 12, 11, 21, 22 (according to FDI notation system) by replantation and to discard the maxillary right deciduous canine, i.e. 53. Parents of the patients were explained regarding effect of external dry time on the replanted teeth and possible external tooth resorption and consent was obtained. Since the patient was young, replantation of the avulsed tooth was decided in the best interest of the patient and to relieve him from psychological, cosmetic and functional trauma.

Root surface of avulsed teeth were cleaned gently with wet gauge to clear it with attached nonviable PDL tissue. All the five permanent teeth had large open apex. As this was a case of delayed replantation, extraorally root canal treatment was planned. Pulp tissue was debrided from apical region of the teeth, conventional enlargement and cleaning of the root canal was performed (Fig. 3). After debridement, the root canals were dried with sterile paper points and teeth were filled with premixed calcium hydroxide iodoform paste (Vitapex-Neodental International, Inc) (Fig. 4). The root surfaces of the teeth were treated with 2.4% sodium fluoride (Fig. 5).

Local anesthesia was administered and the sockets were gently irrigated to remove any coagulum, granulation tissue and pathologic tissue with physiologic saline solution. Masson et al<sup>10</sup> found that coagulum removal by irrigation with saline resulted in a lower degree of ankylosis and resorption. The continuous irrigation of the socket could prevent contamination of the socket, resulting in reduced inflammatory process, which could lead to better healing.

The teeth were then replanted into respective sockets slowly with slight digital pressure. Once the teeth were properly positioned they were checked for alignment and occlusion (Fig. 6) and were splinted to the adjacent firm teeth with a 0.5 mm stainless steel round wire and acid etch composite (universal duo-shade nanocomposite, Coltene/



**Fig. 3:** Pulp tissue was debrided from apical region of the teeth



Fig. 4: Teeth were filled with calcium hydroxide iodoform paste



Fig. 6: After preliminary placement replanted teeth checked for alignment



Fig. 5: Root surface of the teeth treated with 2.4% sodium fluoride



Fig. 7: Replanted teeth were splinted to the adjacent firm teeth with a 0.5 mm stainless steel round wire and acid etch composite

Whaledent) (Fig. 7). Periapical radiograph was obtained to confirm proper positioning of the replanted teeth. Oral hygiene instructions were given and 0.1% chlorhexidine (Hexidine-ICPA Pharmaceuticals, India) mouthwash twice a day for 1 week was recommended. A 7 days course of systemic antibiotic, amoxicillin (Novamox) and metronidazole (Flagyl) was prescribed. Soft diet for 3 weeks was recommended. After 4 weeks patient was recalled for checkup and splint removal.

After 4 weeks splint was intact. On examination teeth were asymptomatic with slight percussion sensitivity but no spontaneous pain. Splint was removed and teeth showed normal mobility. Patient was recalled after 3 months and 6 months for follow-up in which clinically teeth were asymptomatic (Fig. 8). Clinical and radiographical follow-ups are still being continued.

## DISCUSSION

Social embarrassment is one of the greatest problems associated with tooth loss. Losing anterior teeth cause



Fig. 8: Intraoral photograph of patient after 6 months follow-up

serious social, psychological and emotional consequences that negatively affect quality life of the growing child. In addition to this there are other problems like; mental anxiety, nervousness, self-consciousness, speech problems, etc. So the recent guide lines recommend for replantation is to

maintain alveolar ridge contour because the ankylosed root will ultimately be transferred to bone during remodeling process.<sup>11</sup> Also replanted teeth can provide benefit to young patient waiting for the facial growth to be completed. Replanted tooth can maintain height and width of the socket for extended time period. Also in some cases this will negate the need for complicated prosthetic reconstruction when the facial growth is completed. So we feel replantation of an avulsed tooth for a child must be done even if prognosis is questionable.

Extra-alveolar dry time is most critical clinical factor associated with the development of postreplantation root resorption. Risk of resorption increases dramatically after 5 minutes of dry time with the probability of the resorption increasing by 29% for every additional 10 minutes of dryness. So when a tooth has an extraoral dry time of greater than 60 minutes the periodontal ligament is not expected to survive and eventual osseous replacement of the root is inevitable.<sup>12</sup> Donaldson and Kinirons found that the risk of early resorption increased in teeth that have additional damage or are contaminated.<sup>13</sup> So when several additional damage cannot be avoided and osseous replacement of root is considered certain, steps are taken to slow the replacement of the root by bone to maintain the tooth in the mouth for as long as possible. So in young patient a slow replacement of tooth root can be an important benefit compared to a root that is replaced quickly.<sup>14</sup> To render root to become more resistant to resorption some physical and chemical pretreatment prior to replant is been reported.<sup>15</sup>

In physical alteration of the root surface removal of dead periodontal cell along with possible contaminants is reported which slow down osseous replacement by decreasing inflammation at the site of replantation. Many methods are advocated to remove periodontal cells that range from periodontal curettage to immersing tooth in sodium hypochlorite or other weak acids. However, periodontal curettage may remove cemental layer from root and this in turn allow resorption process.<sup>16-18</sup> So we gently scraped the root surface with wet gauge, taking care not to do any damage to cementum layer and then tooth is immersed in sodium hypochlorite for removal of remaining cells.

Several substances have been used for the treatment of the root surface of replanted teeth in an attempt to increase their retention rate, like formol acid solutions (such as citric acid, hydrochloric acid, acidulated fluoride and neutral fluoride), alkaline substances (such as calcium hydroxide and sodium hypochlorite), antibiotics (such as tetracycline and rifacin), antibiotic/corticosteroid combination, corticosteroid, alendronate, vitamin C, carbonic anhydrase inhibitor (acetazolamide) and tooth enamel protein (Emdogain, Biora AB, Malmo, Sweden).<sup>15</sup>

Among the fluoride solutions, the use of 2% acidulated sodium phosphate fluoride has shown a decrease in inflammatory root resorption and the predominance of areas of ankylosis and replacement resorption.<sup>15,19</sup> Fluoride probably acts directly on the bone tissue, cementum and dentin, by converting hydroxyapatite into fluorapatite, or by a specific inhibitory action on the clastic cells, or even an association of both hypotheses. Another property of fluoride is its ability to inhibit microbial growth and metabolism, decreasing cell pH.<sup>15</sup> A reliable and long-term study on human beings done demonstrated that application of sodium fluoride 2.4% on root surface decreased the replacement resorption rate by 50%. So we followed the same technique.<sup>1</sup>

If the tooth remained dry for more than 60 minutes with no consideration for preserving the periodontal ligament, the endodontic therapy could be performed extraorally.<sup>20</sup> Calcium hydroxide has been placed in the canal in order to prevent inflammatory external root resorption. The clinical time recommended for the use of calcium hydroxide for avulsed teeth resulted in an extremely high rate of success.<sup>21</sup> While appropriate endodontic treatment is effective in the treatment of external inflammatory resorption, replacement resorption cannot be arrested or repaired. Although, there is no treatment known for dentoalveolar ankylosis, there are many alternative treatment suggested in the literature, such as keeping the ankylosed tooth or root, extraction and replacement by another tooth orthodontically, autotransplantation, implants or other prosthetic therapy.<sup>22</sup> However, loss or extraction of teeth in a growing alveolar process will result in resorption of the crest and loss of development in the region. For this reason extraction followed by prosthetic treatment in early ages should be avoided. Also in young growing patient, fixed prosthesis should be avoided possible because they may interfere with growth and development of tissue. When the tooth has been lost or extracted, it can be replaced by moving an adjacent incisor, usually a lateral incisor in to the space.<sup>23,24</sup>

Implant treatment is not in agreement with growing age because it will interfere with growth in the same way as an ankylosed tooth, resulting in infraposition. Diaz et al has recently suggested the surgical technique of decoronation for the management of infrapositioned ankylosed replanted incisors in young patients. Decoronation is recommended for ankylosed teeth to preserve the contour of the alveolar ridge, and when the infraposition of the tooth crown is more than 1 mm.<sup>25</sup>

## CONCLUSION

Although, the risk of progressive resorption and subsequent tooth loss is high in delayed replantation it can restore

patient's esthetics appearance and occlusal function shortly. So in case of avulsed permanent teeth with prolonged nonphysiological storage, especially in adolescents and young adults, replantation should be performed irrespective of the outcome.

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