Delayed tooth replantation after traumatic avulsion resulting in complete root resorption

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ABSTRACT

Traumatic injuries of newly erupted permanent anterior teeth are common during childhood. Management of tooth avulsion in the permanent dentition often presents a challenge Replantation of the avulsed tooth can restore esthetic appearance and occlusal function shortly after the injury. This article describes the management of a 9-year-old child with an avulsed maxillary permanent incisor that had been air-dried for about 24 h. The replanted incisor retained its esthetic appearance and functionality only 1 year after replantation. In the present case, improper treatment measures such as prolonged dry conditions of the avulsed tooth before replantation, rigid splinting may explain rapid complete root resorption. Even if it is impossible to avoid resorption completely, the overall knowledge of both dentists and patients regarding immediate measures in case of traumatic dental injuries should be improved to delay the progress of resorption.

Key words: Ankylosis, Replacement root resorption, Tooth avulsion, Tooth replantation, Traumatic dental injury

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INTRODUCTION

Avulsion is a serious injury that causes damage to dental and supportive tissues, ranging from 1% to 16% among dental injuries. An age when the relatively resilient alveolar bone provides only minimal resistance to extrusive forces, and the maxillary central incisors are the most commonly affected teeth.

Healing with a normal periodontal ligament (PDL) after replantation will occur only if the innermost cell layers along the root surface are vital. Clinical studies have shown that the prognosis is best for teeth replanted within 5 min after avulsion, yet such optimal treatment is not always possible.

Prolonged nonphysiological storage of avulsed teeth before replantation results in total necrosis of the PDL and healing by replacement root resorption becomes the only option, a process that results in ankylosis.[1] Ankylosis of the teeth in young patients eventually leads to infraocclusion, because of growth.[2]

The complication, such inflammatory resorption, may also occur when the resorption process exposes dentinal tubules and root canals that contain infected necrotic tissues. Ultimately, resorption may result in loss of the tooth.

This case report describes the management of a child dental trauma with an avulsed maxillary permanent incisor resulting in complete root resorption within a short period.

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CASE REPORT

A healthy 9-year-old boy was referred to our Department of Dental Medicine for emergency treatment of traumatically avulsed maxillary right central incisor after a car accident occurred 24 h before. The boy's health history was noncontributory: He was not taking any medication and had no drug allergies or systemic illness.

The extraoral examination showed abrasions on the chin, as well as a swollen upper and lower lip [Figure 1].

The intraoral examination revealed avulsed right permanent maxillary central incisor. The tooth had visibly immature apex and was left in milk after the injury [Figure 2]. The patient was in mixed dentition with a class I skeletal relationship.

Radiographs of the area showed no remaining tooth particles in the sockets of the avulsed tooth. However, an alveolar fracture was suspected in the socket of right central incisor [Figure 3].

The decision of replantation was carried out under local anesthesia; the contaminated coagulum was gently curetted and rinsed from the socket with a sterile isotonic saline solution [Figure 4].

Extraoral endodontic treatment of the tooth was done; the necrotic PDL was delicately removed with a sterile saline solution gauze sponge [Figure 4] then the tooth was placed in a solution of 0.12% chlorhexidine for 20 min [Figure 5]. Extirpation of the totality of the pulp was done [Figure 6]. The tooth was treated endodontically, cleaned, and shaped [Figure 7] followed by root canal filling with gutta percka with thermocompactage technique [Figure 8].

The tooth was finally replanted slowly under digital pression; a rigid splint was done with orthodontic wire for 4 weeks and extended from first right

Figure 1: The extraoral examination: Abrasions on the chin, swollen upper, and lower lip

Figure 2: Avulsed tooth had been left in milk after the injury for 24 h

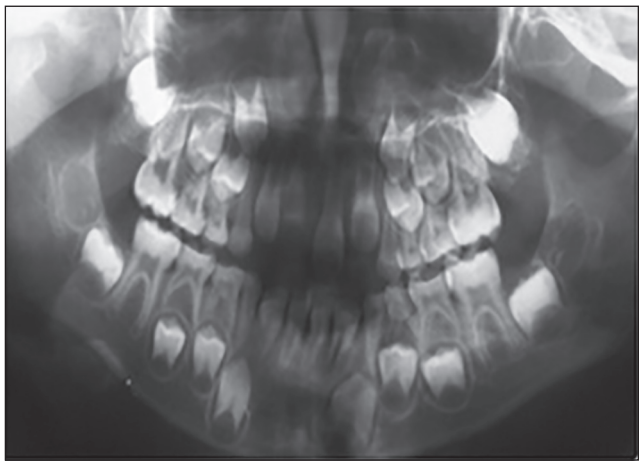

Figure 3: Panoramic radiograph: Empty socket of the avulsed teeth suspiscion of an alveolar

Figure 4: Coagulum gently curetted and rinsed from the socket with sterile isotonic saline solution

Figure 5: Tooth placed in a solution of chlorhexidine 0.12% for 20 min

Figure 6: Extirpation of the totality of the pulp

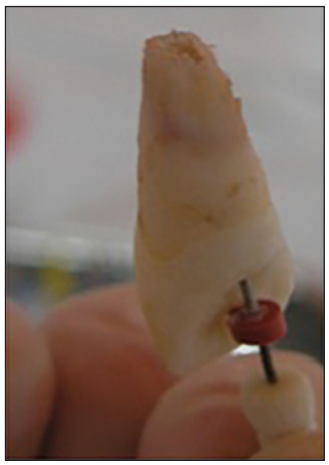

Figure 7: Cleaning and shaping of root canal

Figure 8: Root canal filling with gutta percka with thermocompactage technique

primary maxillary molar to first left primary maxillary molar [Figure 9].

The patient was placed on systemic antibiotic (amoxicillin 2 g/day for 7 days) with analgesic medicament on demand. The patient received instructions about an appropriate soft diet and adequate oral personal hygiene (chlorhexidine 0.12% mouth rinse twice a day for 1 week and a soft toothbrush to brush her teeth after each meal). He was, then, placed on a soft diet and told to avoid biting directly with his front teeth.

Oral hygiene instructions were given and the patient was subjected to an appointment for follow-up. The patient was seen 14 days later: He was slightly tender in the area of trauma, whereas oral hygiene was poor. The retro-alveolar radiograph showed no pathological signs [Figure 10], so the patient was instructed to clean more thoroughly in this area and was appointed for an additional follow-up and splint removal 2 weeks later.

Two weeks later the patient return to our clinic, the splint was removed, and the gingiva of the avulsed incisor was somewhat inflamed but less than the previous appointment. The patient was instructed to clean more thoroughly and was appointed 1 month later for continued follow-up. Unfortunately, he returned 1 year later with chief complain, the unaesthetic appearance of his right permanent central incisor witch looked shorter than the adjacent incisor [Figure 11] ankylosis with infraclusion of this tooth was suspected.

Intraorally examination revealed infraclusion of the tooth which was tender to percussion with metallic sound and mobile.

The retro-alveolar radiograph showed fusion between alveolar bone and the root surface of the right maxillary permanent incisor without a separating attachment apparatus (dentoalveolar ankylosis) associated with osseous replacement [Figure 12]. Extraction of the tooth was conducted showing the total resorption of the root [Figure 13]. A partial denture was fabricated with his tooth to maintain the space [Figure 14].

Figure 9: Digital reimplantation with slow pression and rigid splint for 4 weeks

Figure 10: Retro-alveolar radiograph 14 days after trauma showing no pathological signs

Figure 11: Intraoral examination after 1 year: Infraclusion of the right permanent central incisor tooth

Figure 12: Retro-alveolar radiograph control after 1 year: Dentoalveolar ankylosis with osseous replacement

Figure 13: Total resorption of the root of the tooth

Figure 14: A partial denture was fabricated with his natural tooth to maintain the space

DISCUSSION

Long-term retention of an avulsed tooth is related to the healing of the PDL and the survival of PDL cells along the root surface of the avulsed tooth.

Andreasen *et al.* concluded in their studies about PDL healing following replanted permanent incisors that the most significant factors in PDL healing were the stage of root development, the length of extra alveolar

dry storage, the length of wet storage, immediate replantation, and recommended immediate replantation where possible.[3]

Clinical and experimental studies have shown that even when teeth were replanted immediately, after a maximum of 5 min outside the alveolum, only 73% had normal desmodontal tissue after healing was complete.[4]

When dry storage was ranging between 30 and 60 min, evidence of inflammatory resorption appeared following replantation. When the extra alveolar dry time was 60 min or more and when tooth left in wet storage for exceed valid time replacement resorption was prominent; it is the situation for our patient in which the tooth was left in milk for 24 h.[5]

Storage medium

Ideally, storage of the avulsed tooth must be in a tissue culture medium like Hank's balanced salt solution (recommended as ideal storage medium by American Endodontic Association) or products developed specifically for organ storage purposes, such as Viaspan® and Euro-Collins®, or culture media, like minimum essential medium that allows the best opportunity for PDL cell preservation.[6]

However, the most common scenario is that such a product will not be readily available at the moment of the accident. Many authors found cold milk to be a suitable storage medium for a period of 2-3 h.[7] It is the most frequently recommended, with the best prognosis among other solutions that are likely to be available at the scene of an accident.[8-10]

Blomlöf[11] referred that 71% of PDL cells were viable after 3 h in milk storage and 50% after 12 h.

Its advantages include its high availability, ready accessibility, physiologically compatible pH and osmolality (fluid pressure), with the root-surface adhered PDL cells and presence of nutrients and growth factors.

Propolis, green tea, egg white, coconut water were other good storage medium described by Poi *et al.*[6] but are less available than milk in the scene of an accident.

Less effective storage media such as water, saline, or saliva were described in literature. Parents of our patient have left the tooth in milk, but the tooth was remained in this medium longer than the advised time.

Tooth preparation

In the case of tooth preserved dry for more than 1 h (Trope 2002; Floresetal 2007 International Association of Dental Traumatology [IADT] 2007; IADT 2012,) or tooth remained in a recommended medium longer than the advised time period.[7] The first action consists in removing the PDL and pulp of the avulsed tooth. These tissues become necrosed after being left dry for 1 h. It was the attitude followed in our case. An immersion in a 2% sodium fluoride for 20 min was recommended since it will allow a fixation of fluorides on the tooth surface and limit the resorption phenomena.[7] In our case, only an immersion in antiseptic solution type chlorhexidine was made.

Socket preparation

The practitioner verifies the socket quality, eliminates the clot by rinsing with physiological serum or aspiration.

Splinting

The replantated tooth should be held in place with a flexible splint made with stainless steel wire and composite resin. This type of splint reduces the incidence of ankylosis and allows for stimulation of the PDL during healing when PDL was not necrotic.

In our case, the rigid splint was done because of the suspicion of an alveolar fracture. This fact can explain the rapid occurrence of ankylosis process.

According to IADT guidelines, a splinting time of 4 weeks is generally recommended in case of delayed replantation (more than 60 min).[12,13] This duration of splint was respected in our patient, but flexible splint was not respected. In fact, duration seems to does not affect the likelihood of successful periodontal healing after replantation,[14,15] in contrast with kind of splint. Hence, in this case, the replacement root resorption may be caused by an inadequate tooth storage and rigid splint.

Antibiotics

Current guidelines recommend a one course of systemic antibiotics after replantation. Antibiotics were thought to minimize infection, so reducing the incidence of inflammatory resorption.[16] Tetracycline is the recommended antibiotic for patient aged more than 12 years. For the younger patient, penicillin is the preferred antibiotic; in fact it is the one prescribed for our patient.

Prognostics

The occurrence of ankylosis and replacement resorption was mainly influenced by the duration of the nonphysiologic extraoral storage time and storage medium.[17]

In a young patient, ankylosis retains the tooth at the replanted position disturbing the normal growth pattern of the alveolar process resulting in infraclusion. It was the outcome of our patient in just 1 year after replantation.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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