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Multidisciplinary treatment options for tooth avulsion

Shakir Hussain Rather[1], Sohel Salim Sidat[2], Humaira Mir[1]
[1] Private Practitioner, Dentzmania Dental Care, Shopian, Jammu and Kashmir, India
[2] Priyadarshini Dental College and Hospital Chennai Tamil Nadu, India

Abstract
Dental avulsion is the complete dislodgement of a tooth from its alveolar socket caused by certain traumatic injuries such as falling, accident, sports injuries and comprises around 1-16% of these injuries. The ideal treatment is to reimplant the tooth in its respective socket. The success of reimplanting an avulsed tooth depends on the viability of PDL cells and peridontium to support the tooth and the storage media where the avulsed tooth is temporarily preserved. The proper use of storage media helps in maintaining the viability of the PDL cells whereas the incorrect use of the storage media may lead to necrosis of PDL cells or root resorption. This article reviews tooth avulsion as an emergency, the various storage media available and the guidelines for management of avulsed tooth in the dental office.

Keywords: avulsion, storage media, periodontal ligament and replantation

Introduction

Avulsion of permanent teeth is the most serious of all types of traumatic tooth injuries because the complete dislodgement of the tooth from its socket causes severe damage to the supporting tissues, vascular and nerve structures and pose a major public dental health problem [1]. Reported incidence of dental avulsion is 1-11% of all dental injuries to the permanent dentition, with the maxillary central incisor being the most frequently involved tooth. The age group of 7-10 years appears to be most affected. The prevalence in permanent dentition is around 33% for adults and 25% for children [2]. The treatment is to reimplant the avulsed tooth immediately but this is not possible in most cases considering other existing life threatening injuries, patient's emotional condition and simply lack of knowledge bout the reimplanting procedures. The lack of first aid knowledge about the avulsion among the public and health care centres delays immediate replantation and limits the prognosis of the avulsed tooth [3, 4]. For a good prognosis the extra oral dry time to which the avulsed tooth is exposed and the clonicity and progenicity of the viable PDL cells has to be maintained. This can be made feasible using a suitable storage medium for preserving the avulsed tooth that Maintains viability of periodontal fibres.

Management

The storage medium should be able to maintain the periodontal ligament cells so they can undergo mitosis to form clones of damaged fibroblasts of PDL which will cover the damaged surfaces of the root. The medium should also preserve the functional capacities of PDL cells [5, 6, 7, 8].

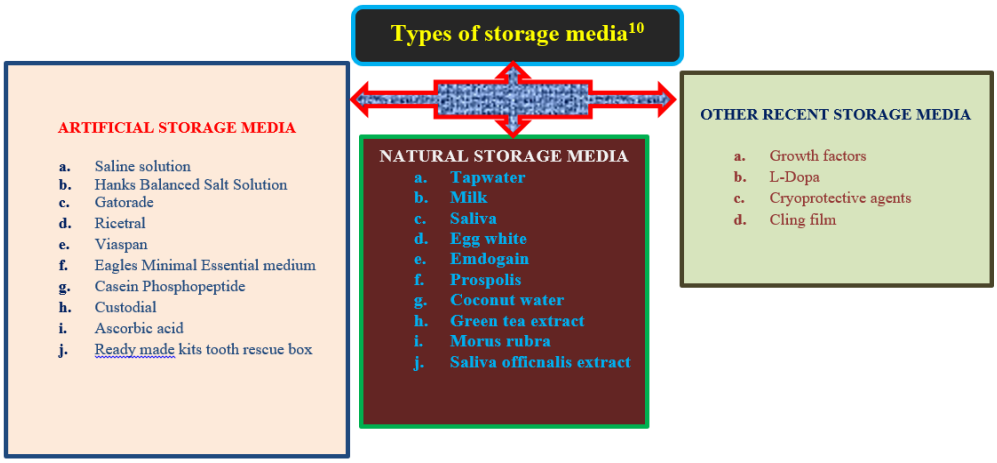

Fig 1

Use of tap water to store avulsed tooth is not recommended as it is not compatible with PDL cells because of its low PH and hypotonic osmolarity which causes cell lysis, and is reported to cause replacement resorption in avulsed teeth when they are place in itand is considered as least used storage media since its efficacy is very poor [9]. The osmolality of saliva (17mOsm) is much lower than physiological osmolality (60-70m Osm) thus causing cell

lysis due to hypotonicity and can only be used as an interim storage medium not more than 30 minutes [10].

Milk has been indicated by the American Association of Endodontists as the second best solution for transport of avulsed teeth after HBSS [11]. Milk is one of the sort after traditional storage media as it is cost effective. With a pH of 6.5-7.2 and the presence of essential nutrients important for maintaining the viability of PDL cells [12, 13], milk can be considered as acceptable storage medium in most situations, increasing the life of the PDL cells on the root surface, pasteruisation decreases the number of bacteria and its products. Several investigators like Blomlof L, Otteskog P 1980 [14], Marino *et al*., 2000 [15], Lekic *et al*., 1998 [16] compared milk with several other storage media and found that milk was superior to the others in maintaining the viability but not as good as HBSS [4]. Sour milk should not be used as it is harmful [17]. Refrigerated milk helps in maintaining the viability of PDL cells compared to milk in room temperature. Inspire all the favorable factors of milk as storage media it has not been proven to revive the degenerated cells [9, 10].

Hanks Balanced Salt Solution was introduced by John. H. Blank and consists of inorganic salts supplemented with glucose. HBSS is pH balanced (7.2), has an osmolality of 320mOsm/kg which provides an ideal osmotic pressure for PDL cells, biocompatible and is non-toxic in nature [11, 18, 19]. It is available in a container-Emergency Tooth Preserving System (ETPS) which serves as both an optimal storage and transport media.

A positive prognosis is almost assured when the tooth is replanted within the first five minutes. Replantation at the accident site requires personnel with some knowledge of treatment protocol. Information can also be given over the phone by the dentist. The avulsed tooth should be held gently and not by the root but by the crown. The tooth should be briefly washed for around ten seconds if it is dirty and then repositioned in the socket. If this is not possible or there is doubt, avulsed tooth should be placed in a suitable storage medium and the patient should immediately sought dental treatment. The media suggested in order of preference and availability are milk, saliva, physiologic saline with water being the least desirable [20, 21].

Management in dental office

The position of an already replanted tooth should be assessed and a complete history taken to assess the outcome. If the tooth is outside the mouth, the storage medium should be evaluated.

Clinical examination

Alveolar fractures can be suspected if there is movement of multiple teeth together or a segment of bone. Radiographs should be taken in three vertical angulations to ascertain horizontal root fracture in adjacent teeth.

Tooth With A Closed Apex [18, 19, 22]

The area is cleaned using water, saline or chlorhexidine and normal position of tooth verified both clinically and radiographically. Endodontic treatment is initiated 7-10 days after replantation and calcium hydroxide to be used as an intracanal medicament until obturation.

Tooth with extraoral dry time of less than 60 min

The root should be cleaned with a stream of saline and placed in the socket gently. 15-20 min is considered the optimal time upto which the viability of PDL cells remains high. Endodontic treatment is initiated at the second visit which is 7-10 days after the emergency visit. Calcium hydroxide is considered the drug of choice in preventing and treating inflammatory root resorption.

Extraoral dry time longer than 60 min

The periodontal ligament is not expected to survive and the root is prepared to be as resistant to resorption as possible. The tooth is soaked in acid for 5 min to remove all necrotic tissue including the PDL to prevent the initiation of inflammatory response. It is then placed in 2% sodium fluoride for 20 min and replanted. Endodontic treatment can be performed extraorally prior to replantation or 7-10 days later as in other cases.

Tooth with an Open Apex

Tooth has already been replanted in the mouth before reaching the dental clinic Wash the area with saline, water or chlorhexidine, do not extract the tooth and verify the position.6

Extraoral dry time is less than 60 min.

The tooth is replanted with the goal of revascularisation of the tooth pulp. The tooth is cleaned with a stream of saline and soaked in doxycycline for 5 min or covered with minocycline hydrochloride crystals. The tooth is treated similar as a closed apex tooth, i.e, it is gently rinsed and replanted. In these patients, endodontic treatment is not initiated until signs of pathosis occur. The patient is recalled every 3-4 weeks for vitality testing to check for revascularisation.

Extraoral dry time more than 60 min.

The periodontal ligament becomes necrotic and healing is not expected to occur. Replacement resorption will ensue progressively leading to ankylosis of the tooth.

1. Post avulsion a coordinated treatment plan involving specialists from different fields of pedodontia, prosthodontics, endodontics, orthodontics and oral surgery should be initiated for comprehensive evaluation. This is not feasible during emergency treatment.
2. Replantation allows interdisciplinary consultation and the formulation of a definite treatment plan.
3. Replanting the tooth can alleviate the embarrassment faced by the patient.
4. Another aim of doing delayed replantation in immature teeth is to maintain alveolar ridge contour.
5. Once the tooth is replanted, apexification procedure is started at the second visit.
6. A procedure was described by Malmgren in 1984 which was a conservative approach towards the management of ankylosed teeth and attempted to preserve the surrounding alveolar bone. This method was called □*decoronation*□. It involved the subcrestal removal of tooth crown. The root will resorb gradually while vertical bone growth occurs simultaneously, coronal to it. The existing bone volume is maintained avoiding the need for future ridge augmentation procedures. Malmgren recommended decoronation to be done in patients where the severity of infra-occlusion was moderate or is an index score of two (≥ 1/8 but < ¼ of crown height of neighbouring tooth) or more.

Dental implants are only considered after the patient had completed skeletal growth.

1. Preparation of socket

The socket should be cleaned and free of obstacles before replantation is done. A blunt instrument is used to reposition a collapsed socket wall.

2. Splinting

The splinting is recommended for 7-10 days. However in cases of avulsion occurring in association with alveolar fractures, it is done for 4-8 weeks.

3. Management of soft tissues-

Soft tissue lacerations are sutured and the assistance of a plastic surgeon might be prudent in areas of aesthetic importance like the lips.

Pharmacologic treatment: It is recommended to prescribe antibiotic therapy to prevent the occurrence of infection and root resorption in the first week after replantation. The antibiotic of choice is doxycycline given twice daily for seven days. In children under 12 years of age, penicillin V (500 mg, four times daily for seven days) can be prescribed.

Tetanus: If the tooth has contacted soil, the patient should be referred to a physician regarding tetanus booster.

6. Diet: The patient should be advised to take soft diet for two weeks.

7. Oral hygiene: Patient is advised to brush after every meal and rinse with chlorhexidine mouthwash twice daily for one week.

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