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TOOTH AVULSION- A DENTAL EMERGENCY

Dental Science

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ABSTRACT

Traumatic dental injuries occur most commonly in children and adults and causes be fall, accidents, sports injuries etc. Tooth avulsion comprises around 1-16% of these injuries. It is one of the rare emergencies in dentistry. The success of treatment depends on the extra oral time period and viability of periodontal ligament. The storage medium for the avulsed tooth is a important factor affecting prognosis of the tooth. Proper diagnosis of the avulsed tooth and treatment planning helps in a favorable outcome. 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

Traumatic injury; Avulsed tooth; storage media; management

INTRODUCTION:

Dental Avulsion is the complete displacement of a tooth from its socket in alveolar bone owing to trauma. One of the most rare and serious traumatic dental injuries is avulsion.(1) It accounts for 0.5% to 16% of traumatic injuries in the permanent dentition and 7% to 21% of injuries in the primary dentition.(2,3) Avulsion of permanent teeth occurs most commonly in children of 7 to 9 years old, due to engagement of children in playful and sports practices. In this age they have relatively resilient alveolar bone which provides only minimal resistance to extrusive forces, and the maxillary central incisors are the teeth most commonly affected.(2)

Males are more prone to dental trauma of permanent dentition than the females due to their more active participation in contact games and sports.(4) Causes of Most traumatic dental injuries are unintentional injuries due to falls,collisions and being struck by an object. Other causes which contribute to tooth trauma are automobile accidents, sports activities, domestic violence and assaults.

The ideal treatment for an avulsed permanent tooth is immediate replantation of tooth into its respective socket. When immediate replantation of an avulsed tooth is not possible, then tooth should be stored in conditions that maximize the preservation of the PDL during transportation of tooth from site of accident to the dental office. To prevent dehydration of the root surface during transportation, the storage medium must be of correct osmolality and pH. Milk fulfils this requirement and is considered an excellent medium.(2) Studies have shown that even 10 minutes of dry storage results in desiccation of the periodontal ligament cells and eventual loss of the tooth. **Pileggi and Dumsha**,(5) assesed post traumatic periodontal ligament cells, viability stored in Hanks balanced salt solution, milk, saline and water using collagenase and dipase treatment. The viable cells were assessed using trypan blue exclusion test. It was concluded that following 30 minutes dry storage & 45 mintues storage in transport media, milk appeared superior compared to saline and hanks balanced salt solution for storage of avulsed teeth. They also suggested that collagenous and dipase assay appeared to be a viable method for evaluating periodontal ligament cell viability.

In this way, short extra-alveolar time, endodontic therapy, administration of systemic antibiotics and adequate handling and maintenance of the tooth up to the moment of replantation are the conditions leading to a better prognosis However, adverse situations may occur, such as ankylosis and different types of root resorption, depending especially on the storage time and the characteristics and temperature of the storage medium.(6) The initial goal of avulsed tooth is to keep the tooth vital, to keep it functional, to prevent resorption and ankylosis resulting in normal growth of the alveolar ridge.

Storage media:

The utmost important step during the management of an avulsed tooth is handling of the tooth from the time of injury till the tooth is replanted back into its socket. A viable periodontal ligament cells are capable of proliferating over denuded areas on the root and for re- establishing of a normal attachment apparatus on the tooth and bone. So it is very important to store tooth in an appropriate storage medium, which should maintain or improve the vitality of the cells during the extra-alveolar period. Different types of storage media have been investigated, such as Hank's Balanced Salt Solution, viaspan, culture media, saline; natural products like water, saliva, bovine milk and its variations, propolis, green tea, Morusrubra, egg white, coconut water; rehydrating solutions etc.

An **Ideal storage medium** would be one that is capable of preserving the viability, Mitogenicity and clonogenic capacity of the damaged PDL in order to facilitate repopulation of the denuded root surface there by preventing further root resorption and it should be readily available for use in emergency situations.(7)

Most commonly available storage media are tap water, milk, saliva whereas HBBS is a standard saline solution used to support the growth of many cell types in research.

TAP WATER is the most easily available medium at any accident site is tap water but is the least favorable due to its bacterial contamination, hypotonicity, non-physiological pH of 7.4 to 7.79 and an osmolality of 30 mOsmol Kg-1, which causes rapid PDL cells lysis.(8)

SALIVA (buccal vestibule) is used as a storage medium due to its availability, but it has unfavorable characteristics, such as non-physiological pH and osmolality, high microbial contamination and hypotonicity. saliva storage produces one-third less cell damage than dry storage or storage in tap water, so it is preferable to use it rather than keep the tooth in dry conditions.(8)

MILK- It is readily available in almost all the situations. The American Association of Endodontics indicates milk as a solution for avulsed teeth, for keeping the viability of the human cellular periodontal ligament. Due to the presence of nutritional substances such as amino acids, carbohydrates and vitamins milk is considered as better medium for storage than other storage mediums.(9)

Harkaczet al.[10] showed that milk with lower fat content may be more appropriate at maintaining cell viability than milk with higher fat content.

HANKS BALANCED SALT SOLUTION- It is a pH-balanced salt solution contains ingredients, such as glucose, calcium, and magnesium ions, which can sustain and reconstitute the depleted cellular components of the PDL cells. According to **Ashkenazi et al.**[11] HBSS was the most effective medium for preserving viability, mitogenicity, and clonogenic capacities of PDL cells for up to 24 h at 4°C when compared with other solutions. (11)

Hwang et al.[12] reported 94% cell viability after storage of cultured human PDL cells for 24 h in this medium, which is considered an excellent result. However, HBSS use is restricted to laboratory environments and is not readily available at an accident site, which makes it impracticable as a storage medium for avulsed tooth.

The tooth storage media that are mostly favoured when comparing Efficacy (in maintaining PDL cell viability) in the literature include: Eagle's culture medium = Viaspan = Euro collins = Custodiol = HBSS > Milk ≥ Propolis ≥ Green tea ≥ Egg > coconut water ≥ Ricetral. Based on the current literature, when comparing the practicalities of using these solutions, cost-effectiveness and ease of availability to the general public :

I. Milk seems to be most ideal transport media for avulsed tooth.
II. Patient own serum seems to be an ideal storage media for tooth autotransplant procedures .

Management:

Replantation is the treatment of choice in most situations, but cannot always be carried out immediately. The treatment outcome of replanted teeth can be influenced by various factors such as extra-alveolar duration, storage medium, concomitant dentoalveolar injuries, apical maturity of the root, endodontic treatment, patient's intraoperative compliance and recall appointments response, outcomes of replanted teeth.

Emergency treatment at the spot:

- Keep the patient calm.
- Hold the tooth by the crown portion (the white part). Avoid touching the root.
- Wash tooth under cold running water for 10 seconds if necessary and reposition it. Ask patient bite on a handkerchief to hold it in position.
- If not possible, place the tooth in a suitable storage medium, e.g. a glass of milk or a special storage media for avulsed teeth if available (e.g. Hanks balanced storage medium or saline). The tooth can also be transported in the mouth, keeping it between the molars and the inside of the cheek.
- Seek emergency dental treatment immediately.

Management at office:

A. If Tooth is replanted prior to the patient's arrival at the dental office or clinic.

- Leave the tooth in place.
- Clean the area with water spray, saline, or chlorhexidine.
- Suture gingival lacerations if present.
- Verify normal position of the replanted tooth both clinically and radiographically.
- Apply a flexible splint for up to 2 weeks.
- Administer systemic antibiotics.
- For tooth with **closed apex** initiate root canal treatment 7-10 days after replantation and before splint removal.
- Place calcium hydroxide as an intra-canal medicament for up to 1 month followed by root canal filling with an acceptable material.
- For immature teeth, **(open apex)** root canal treatment should be avoided unless there is clinical or radiographic evidence of pulp necrosis.
- Splint removal and clinical and radiographic control after 2 weeks.
- Clinical and radiographic control after 4 weeks, 3 months, 6 months, 1 year and then yearly thereafter.

B. Extraoral dry time less than 60 min.

a. Closed apex:

A dry time of less than 15–20min is considered optimal where periodontal healing would be expected.[13] A continuing challenge is the treatment of the tooth that has been dry for more than 20min (periodontal cell survival is assured) but less than 60min (periodontal survival unlikely).

- Clean the root surface with a stream of saline and soak the tooth in saline thereby removing contamination from the root surface.
- Administer local anesthesia.
- Irrigate the socket with saline.
- Examine the alveolar socket. If there is a fracture of the socket wall, reposition it with a suitable instrument.
- Replant the tooth slowly with slight digital pressure. Do not use force.
- Suture gingival lacerations if present.
- Verify normal position of the replanted tooth both, clinically and radiographically.
- Apply a flexible splint for up to 2 weeks, keep away from the gingiva.
- Administer systemic antibiotics.
- For tooth with **closed apex** initiate root canal treatment 7-10 days after replantation and before splint removal.[17]
- Place calcium hydroxide as an intra-canal medicament for up to 1 month followed by root canal filling with an acceptable material.

b. Open apex:

- Clean the root surface with a stream of saline.
- Topical application of antibiotics has been shown to enhance chances for revascularization of the pulp and can be considered if available (minocycline or doxycycline 1 mg per 20 ml saline for 5 minutes soak). **Cvek et al.**[14] found in monkeys that soaking the tooth in doxycycline (1mg in approximately 20mL. of physiologic saline) for 5min before replantation significantly enhanced revascularization.
- Administer local anesthesia.
- Examine the alveolar socket for any fracture of the socket wall, reposition it with suitable instrument.
- Irrigate the socket with saline.
- Replant the tooth slowly with slight digital pressure.
- Suture gingival lacerations, especially in the cervical area.
- Verify normal position of the replanted tooth clinically and radiographically.
- Apply a flexible splint for up to 2 weeks.
- Administer systemic antibiotics.
- For immature teeth, **(open apex)** root canal treatment should be avoided unless there is clinical or radiographic evidence of pulp necrosis.
- Splint removal and clinical and radiographic control after 2 weeks.
- Clinical and radiographic control after 4 weeks, 3 months, 6 months, 1 year and then yearly thereafter.

C. Extraoral dry time more than 60 min:

- **a. Closed apex:** When the root has been dry for 60min or more, the periodontal ligament cells are not expected to survive and, it is certain that most PDL cells on the root surface are necrotic and resorptions are to be expected.[14]
- Remove attached non-viable soft tissue carefully, with gauze or soak tooth in acid for 5min to remove all remaining periodontal ligament to remove the tissue that will initiate the inflammatory response on replantation. The tooth should then be soaked in 2% stannous fluoride for 5min and replanted.[15]
- Root canal treatment can be performed extraorally prior to replantation, or it can be done 7-10 days after repalntation.
- Administer local anesthesia.
- Irrigate the socket with saline.
- Examine the alveolar socket for fracture of the socket wall, reposition it with a suitable instrument if present.
- Replant the tooth slowly with slight digital pressure. Do not use force.
- Suture gingival lacerations if present.
- Verify normal position of the replanted tooth clinically and radiographically.
- Stabilize the tooth for 4 weeks using a flexible splint.
- Administer systemic antibiotics.
- Splint removal and clinical and radiographic control after 4 weeks.[16]
- Clinical and radiographic control after 4 weeks, 3 months, 6 months, 1 year and then yearly thereafter.

b. Open apex: Delayed replantation has a poor long-term prognosis. The periodontal ligament will be necrotic and not expected to heal and the treatment for tooth kept extraorally for more than 60 min. with open apex is same as that of closed apex.

Treatment outcomes: There can be various types of resorptions and ankylosis seen in replanted tooth.

I. External resorption (root surface resorption) was divide into the following groups:

- Surface resorption - If there was a cavity on the root surface bordered by a normal PDL space and lamina dura, or a shortening of the root apex, again bordered by a normal PDL space and lamina dura.
- Inflammatory resorption-If there was radiographic sign of external

resorption cavities affecting both the root surface and adjacent bone. Mobility values were high until arrest of the inflammatory process by interceptive endodontic therapy.

II. **Repair-related resorption**: is characterized by localized areas along the root surface, which show superficial resorption lacunae repaired by new cementum. There are localized areas of damage to the periodontal ligament or cementum, which have been healed by periodontal ligament-derived cells.

III. **Replacement resorption:** It represents a fusion of the alveolar bone and the root surface and can be demonstrated 2 weeks after replantation. The etiology of replacement resorption appears to be related to the absence of a vital periodontal ligament cover on the root surface.[18]

IV. **Infection-related resorption:** It is characterized by bowl shaped resorption cavities in cementum and dentin associated with inflammatory changes in the adjacent periodontal tissue. Radiographically, inflammatory resorption is characterized by radiolucent bowl shaped cavitation along the root surface with corresponding excavations in the adjacent bone.

CONCLUSION:

As avulsion is a rare emergency and the management aspect of avulsion focus primarily on the prevention of ankylosis, to maintain the vitality of periodontal membrane and to protect pulp from bacterial invasion. People should be made aware towards immediate replantation at the site of injury as the PDL starts degenerating after 15-20min of extra-oral dry time. Replantation of teeth of teeth is advised even in circumstances of assured replacement resorption taking place. The benefits far outweigh the drawbacks. Also, the chances of resorption having an agreeable outcome cannot be ruled out.

Increasing awareness about tooth avulsion amongst parents and teachers and at community level can lead to better emergency management and a favourable prognosis.

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