



ISSN Print: 2394-7489  
ISSN Online: 2394-7497  
IJADS 2022; 8(4): 42-45  
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[www.oraljournal.com](http://www.oraljournal.com)

Received: 17-08-2022

Accepted: 21-09-2022

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## An update on management of avulsed teeth

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DOI: <https://doi.org/10.22271/oral.2022.v8.i4a.1625>

### Abstract

**Introduction:** Avulsion of permanent teeth is one of the most serious dental injuries, prompt and correct emergency management is essential to achieve the best outcome after this injury.

**Objective:** To analyze the literature on avulsed teeth, particularly its prevalence, storage media, consequences and treatment.

**Methodology:** In order to carry out this literature review, an electronic search was necessary using PubMed and Google Scholar with the words avulsed tooth, and prevalence, storage media, treatment.

**Results:** The prevalence of traumatic dental injuries is greater in male patients of school age. The most common treatment is reimplantation. The main adverse events are dental ankylosis and resorption. When immediate reimplantation is not possible, the most practical means of preservation is cow's milk, currently anti-reabsorption therapy is used to improve the prognosis in addition to the use of a semi-flexible stabilizer.

**Conclusion:** The treatment of choice for dental avulsion will always be reimplantation, whether immediate or delayed, regardless of how long the tooth is kept out of the mouth. Although there is no predictable prognosis, it does not mean that reimplantation should not be attempted, since the tooth will be of great importance in contributing to the mandibular and facial development of the child.

**Keywords:** avulsed tooth", "treatment", "prevalence", "storage media

### 1. Introduction

Avulsion of permanent teeth is one of the most serious dental injuries, and prompt and correct emergency management is essential to achieve the best outcome after the injury<sup>[1]</sup>.

Tooth trauma includes fractures, luxations and avulsions, which can be reduced in most cases. Avulsed primary teeth should never be replaced<sup>[2]</sup>. Traumatized patients require immediate and correct treatment to restore damaged structures and functions that have a major impact on the patient's daily life<sup>[3]</sup>.

Tooth avulsion is defined as the complete displacement of the tooth out of its socket with breakage of the periodontal ligament fibers, with some of them remaining attached to the cementum and the rest to the alveolar bone<sup>[4]</sup>. Avulsion of permanent teeth is one of the most serious oral health problems among active children and adolescents<sup>[3]</sup>.

Dental trauma and injuries in the primary dentition are difficult to treat, as the goals of treatment include restoring esthetics and function. The aim of this article is to analyze the literature on dental avulsion, as well as its prevalence, storage media, consequences and treatment.

### 2. Materials and Methods

Articles on the subject published through the PubMed, SCOPUS and Google Scholar databases were analyzed, with emphasis on the last 5 years. The quality of the articles was evaluated using PRISMA guidelines, *i.e.*, identification, review, choice and inclusion. The quality of the reviews was assessed using the measurement tool for evaluating systematic reviews (AMSTAR-2)<sup>[5]</sup>. The search was performed using Boolean logical operators AND, OR and NOT.

It was realized with the words “avulsed tooth”, “storage media”, “prevalence”, “treatment”, “clinical success”. The keywords were used individually, as well as each of them related to each other.

### 3. Results and Discussion

#### 3.1 Prevalence

Studies have established that more than one billion people alive have suffered a traumatic dental injury (TDI). It is a neglected condition that could be ranked fifth if included in the list of the world's most common acute/chronic diseases and injuries [6]. Dental trauma has a worldwide prevalence of 10-24%, it is often the cause of the first visit to the emergency room [7, 9, 14], specifically avulsion is between 0.1 to 4.3%, the most affected tooth was the upper central temporary incisor [12, 13].

TDI are more frequent in children under 5 years of age (56.1%) with a predominance of injuries suffered by the male sex (63.8%) [18]. It is related to inadequate lip coverage and increased overjet as risk factors associated with dental trauma [10, 11, 15].

Traumatic blows occurred mostly in spring, permanent teeth more than primary teeth, upper incisors more than mandibular incisors and central incisors more than lateral incisors [16].

Although there is controversy about the prevalence of traumatic dental injuries, it is considered to be around 15%, being more frequent in male patients of school age, where the most affected tooth is usually the upper permanent central incisor.

#### 3.2 Storage media

Natural products have been shown to be more effective in maintaining periodontal ligament (PDL) cell viability compared to synthetic products and milk has been found to be the single most recommended storage medium, based not only on PDL cell viability but also on practical considerations [17].

While milk has been shown to prolong the viability of PDL cells prior to replantation compared to saline or tap water, the following media have also been shown to be highly effective: propolis, oral rehydration salts, rice water and film paper [18]. Such reservoir media are useful in preserving cell viability when immediate replantation is not possible [19].

Propolis may be the preferred storage medium prior to replantation when available in real-world settings [20], a study by Bunwanna A *et al.* suggests this extract as an alternative for a tooth banking medium for up to 12 hours [21]. Another preservation medium that has been investigated is Aloe vera [22, 23, 24], although it is important to emphasize that milk remains the most convenient, economical and readily available solution in most situations, as well as being able to keep periodontal ligament cells alive.

There are various substances useful as a means of preserving the avulsed tooth, the most widely accepted being cow's milk, Hank's balanced solution, coconut water and oral rehydration solutions. For practical considerations, milk is considered as the ideal means of preservation, having as a benefit the preservation of the vitality of the periodontal ligament cells.

#### 3.3 Consequences of Avulsion

Among dental injuries, avulsion continues to be serious with an unpredictable prognosis [25, 26], this type of trauma will present sequelae in most cases. The main ones are superficial resorption, followed by inflammatory resorption, resorption due to pulp infection or resorption due to replacement [27], this last one affect 51.0% of the re-implanted teeth [26].

Replacement resorption is a complication that occurs after replantation of avulsed teeth, which may require additional treatment in the future [28, 29]. Another complication that frequently occurs is dental ankylosis, which should also be taken into account since it is a typical biological response to late replantation of avulsed teeth [30, 31]. Teeth with mature root development were significantly more affected by ankylosis than teeth with immature root development [32].

When the trauma occurs in children under 2 years of age, when it affects the lower jaw, or when several teeth are involved, the risk of sequelae in the permanent teeth after avulsion of their predecessor is greater [33]. Traumatic injuries to primary teeth are a risk factor for the development of sequelae in permanent successors, so children who suffer trauma to their primary teeth should be monitored until the eruption of the permanent teeth for early diagnosis and treatment of possible sequelae [34, 35].

Among the most frequent complications of replantation of an avulsed tooth are ankylosis and resorption. Both are a typical biological response to replantation as a consequence of inflammation or necrosis of the periodontal ligament, so an unpredictable prognosis should always be considered.

#### 3.4 Treatment

The essential factors in the treatment of the avulsed tooth are proper diagnosis, treatment planning and follow-up, which together will be key to achieving a favorable outcome [36]. The outcome of treatment will depend on the storage of avulsed teeth in media capable of maintaining the viability of periodontal ligament cells when immediate replantation is not possible [24]. Late replantation of an avulsed tooth for a child is still worthwhile, even in cases of poor prognosis in which the tooth had prolonged dry extraalveolar storage. It should be done because of its importance to the mandibular and facial development of the child, as it will be of benefit until growth is complete [28, 29, 37]. A conservative approach to the late replanted tooth can be stable and functional with proper treatment procedures [38]. Splinting is specified as the Gold Standard [39], since it will allow immobilization of the teeth in the initial period, which is essential for periodontal ligament repair. The use of semi-rigid splinting is more indicated than rigid splinting [4], and it has also been documented that performing the revascularization procedure had benefits in immature teeth, since it allowed the tooth to develop both in length and dentin volume and helped in the partial closure of the apical foramen [40].

The use of antiresorption therapy should now be considered, as this is a new technique that prevents the common inflammation experienced by avulsed teeth after replantation, using a combination of antibiotics and corticosteroids [41].

The indicated treatment of the avulsed tooth is immediate or delayed replantation plus the use of a semi-flexible stabilizer, regardless of the unpredictable outcome that may occur, replantation will be of benefit to the craniofacial development of the child. Antiresorptive therapy is currently used to improve the long-term prognosis.

### 4. Conclusions

The treatment of choice for dental avulsion will always be replantation either immediate or delayed, regardless of how long the tooth is kept out of the mouth before re-implantation. Although there is no predictable prognosis, it does not mean that re-implantation should not be attempted, as the tooth will be of great importance in contributing to the mandibular and facial development of the child.

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**How to Cite This Article**

Daniela HM, Jorge Jaime FT, Myriam Angelica De La G, Hilda LMA, Julio CAO, Maria EVS, *et al.* An update on management of avulsed teeth: *International Journal of Applied Dental Sciences* 2022;8(4):42-45.

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