

Review Article

Causes of primary tooth avulsion and replantation treatment

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ABSTRACT

During primary dentition, the etiology changes by age group. For instance, traumas secondary to collisions and falls are attributable to early movement within the first six years, while accidents secondary to frequent playing are the main reason within the following nine years, and violence is the most common etiology until the age of 25 years old. Previous studies have estimated that traumas from falls, sporting activities, bicycling, traffic accidents, and violence were the most common causes of dental injuries in children. Iatrogenic causes also contribute to 0.04-12% of dental injuries, including avulsions. According to the current evidence, whether to use reimplantation or not is still controversial and further investigations are needed. Among the various case reports, damage to the permanent successors, root resorption, clot formation, and pulp necrosis were documented as potential complications and adverse events with intended reimplantation. However, many techniques were reported to overcome these problems. Besides, favorable outcomes following reimplantation could be hypothetically obtained as sound articulation, proper mastication, and proper dentition. Therefore, this encourages reimplantation, however, further evidence is still needed to validate the proposed advantages and disadvantages of the approach.

Keywords: Dentistry, Avulsions, Dental trauma, Etiology, Reimplantation

INTRODUCTION

Traumatic dental injuries comprise a significant impact on the affected children as it can lead to significant issues as avulsions or malocclusions and dentoalveolar fractures, which can impact the affected child's psychology,

appearance and functions.¹ Estimates show that primary teeth avulsions have a prevalence rate of 5.8-19.4% of all dental injuries, which is reported to be 19.2% among laxative injuries.²⁻⁴ The development of primary tooth avulsion requires the need of a significant force and pressure against the affected tooth, which might also impact the periodontal ligament of the teeth and the

vasculature of the pulp, subjecting the affected region to significant complications.^{5,6} Many causes have been proposed for primary dental injuries and avulsions, and some management modalities have been proposed.^{7,8} Among the proposed treatment approaches, reimplantation has been reported. However, the recommendations of using it for avulsed primary teeth are still controversial. Accordingly, in this study, we aim to discuss the causes of primary tooth avulsion and replantation treatment, hoping to formulate significant evidence about the most beneficial approach to use.

METHODS

This literature review is based on an extensive literature search in Medline, Cochrane, and EMBASE databases which was performed on 18th June 2021 using the medical subject headings (MeSH) or a combination of all possible related terms. This was followed by the manual search for papers in Google Scholar while the reference lists of the initially included papers.^{9,10} Papers discussing the causes of primary tooth avulsion and replantation treatment were screened for relevant information, with no limitation placed on date, language, age of participants, or publication type.

DISCUSSION

Causes of primary teeth avulsion

Like traumatic dental injuries, primary tooth avulsion can result from many etiologies, which were reported to be indirect or direct injuries. It was previously demonstrated that the etiology is not the same with primary and permanent teeth, which is probably due to the underlying bone structure of each. Accordingly, tooth avulsion or displacement is more common in primary teeth due to the reduced mineralization of these teeth. During primary dentition, the etiology changes by age group. For instance, traumas secondary to collisions and falls are attributable to early movement within the first six years, while accidents secondary to frequent playing are the main reason within the following nine years and violence is the most common etiology until the age of 25 years old.^{11,12} Previous studies have estimated that traumas from falls, sporting activities, bicycling, traffic accidents, and violence were the most common causes of dental injuries in children.^{13,14} Besides, it was reported the bicycling was a common reason for dental injuries among school children, which was significantly reduced by around two-thirds when children were obliged to wear helmets.¹⁵ Some iatrogenic causes, as intubation during anesthesia, were also reported to account for 0.04-12% of all injuries.¹⁶ In this context, another study in the United Kingdom reported that dental injuries during such events accounted for around one-third of the total complications.¹⁷ The effect of socioeconomic status on dental injuries and avulsions is still controversial among studies in the literature, as some indicated that injuries are more prevalent in low socioeconomic communities while others indicate the opposite.^{18,19} Besides, having certain

anatomical and dental morphological characteristics might be a risk factor for developing dental injuries as the class of malocclusion, the size of the overjet, and the presence or absence of mouth guards.^{20,21}

Replantation treatment

Important considerations

Many treatment modalities have been proposed for managing primary teeth avulsion.²²⁻²⁴ These include no treatment as the avulsed tooth is disposed of and the sockets are left empty and cleaned using saline.²⁴ Another approach is by replacing the avulsed tooth using a removable or a fixed-anterior prosthetic appliance, or with porcelain-bonded retainers.²⁵ However, it should be noted that some of these modalities do not apply to children at a very young age because they are not usually cooperative. The other treatment approach is the replantation of the avulsed tooth. However, this process should be done under certain criteria and following protocols for replantation of primary teeth avulsion.^{22,23} Although the protocols for replantation of avulsed primary teeth are similar to that of permanent teeth, studies have reported some issues that should be considered by clinicians to obtain better outcomes. The first issue to be considered is the media where the avulsed tooth is stored until replantation. Investigations demonstrated that many media can be successfully used for this purpose including blood, child's saliva, milk, saline solution, or Hank's Balanced Salt Solution.^{6,8,26} The second consideration is that dentists should evaluate the value of the avulsed tooth by assessment of the root development.⁶ For instance, replantation of the avulsed primary tooth should not be conducted, if resorption of the root was observed by the dentist. Another consideration is the period that passed from tooth avulsion until replantation when the teeth are disconnected from the child's body. Studies showed that the avulsed tooth should not stay out of the child's mouth until replantation, if intended, for more than 30 minutes. This is recommended because in this way it would be easier to remove the clot from the socket of the avulsed tooth and preserve the periodontal ligament. In this case, clot removal can be easily achieved by a simple wash-up of the liquid still-forming clot. Researchers have pointed out that prolonged stay of the avulsed teeth outside the child's mouth can lead to hard clot formation, which will intervene against removing it from the socket.^{6,8,26} This can lead to significant morphological changes in the primary dentition, although the clot can still be managed by pushing it against the permanent tooth.^{26,27}

Another issue to consider is the clean status of the tooth and the socket (Figure 1), as dentists should care for tooth and socket contamination before starting the replantation process to reduce infections and enhance prognosis.^{3,6,28} Cleaning the tooth can be achieved by putting it in a saline solution which removes the potential presence of any debris or dead cells where infections might accumulate. Moreover, the apical foramen and the root surface should

be adequately cleaned and the socket should also be irrigated with saline, according to the guidelines by the Dental Trauma Guide. Besides, suturing of any underlying present gingival laceration should be conducted before replantation. Additionally, Andreasen 29 previously described the process of repositioning and replantation and reported that the process should be conducted using the thumb and index and should be apical, rhythmic, and gradual to prevent any potential complications to the Haversian system of the socket.⁶



Figure 1 (a, b): Avulsed primary teeth and subsequent emptying of sockets.⁴⁸

The potential presence of pulp necrosis should also be considered, as previously reported the evulsion might induce damage to the surrounding vasculature of the nerve bundles, which might further induce root resorption.^{5,6,29} The subsequent failure of replantation can be a complication following these events due to the potential abscess formation. Accordingly, prior endodontic therapy is recommended to enhance the prognosis of replantation. However, evidence among studies in the literature is still controversial regarding the benefits of initiating endodontic therapy. Among the investigations which recommended it, the researcher suggested that adequate follow-up should be performed from the first visit following the replantation procedure. In addition, it also suggested frequent exchange of the filling materials of the root canal.^{6,8,30-32} Eisenberg 33 also reported that conducting endodontic therapy extra orally was also associated with favorable outcomes. In the same context, Filippi et al suggested that calcium hydroxide can be used to fill the root canal of the avulsed primary tooth after resecting the apex of the root to 1/4 or 1/5 from its original length.³² On the other hand, other case reports have demonstrated that favorable outcomes could be obtained from tooth avulsion with no need to performing endodontic therapy.^{3,34} However, caring for potential complications as pulp necrosis should be considered to preserve the tissue of the apical bone.⁶ To avoid the risk of aspiration of the

affected tooth, researchers have suggested that splinting is an efficacious modality that would allow for the free movement of the replanted tooth and should be considered for 2-3 weeks.^{6,8,32,35,36} Furthermore, the health status of the adjacent teeth should also be considered to allow for adequate attachment of the tooth with the periodontal ligament. Prescribing antibiotics, regular follow-up appointments, and advising the patient to minimize food digestion by the replanted tooth are recommended interventional approaches to enhance the prognosis and reduce the risk of developing any complications.⁶ It should be noted that replantation of the avulsed primary tooth is not recommended by the International Association of Dental Traumatology and American Association of Paediatric Dentistry and the current suggestions are based on case reports only. The reason behind prohibiting replantation is the potential adverse effects on the primary dentition.^{24,36}

Advantages and disadvantages

The first advantage of replantation is the successful prevention of articulation in the affected child. For instance, avulsions that affect the primary maxillary anterior teeth might lead to significant loss of some phonetics due to inadequate articulation, and the child becomes unable to properly pronounce the continuant consonants.³⁷ The second reported advantage is the prevention against the development of bad oral habits as tongue thrusting against the socket of the avulsed tooth.³⁸ The third advantage is the favorable events on the eruption of the permanent tooth which usually tend to fill the edentulous space, which might significantly lead to the development of discrepancies within the arch. This might also be associated with the delayed or failed eruption of the permanent tooth leading to ectopic events or malocclusions.³⁸ The fourth advantage of replantation is that it is important for mastication, which is significantly associated with nutrition in childhood. On the other hand, many disadvantages have been reported, and according to which authors suggested that replantation should not be conducted. Aesthetics is not usually a major demand for children 39 and damage to the permanent teeth might occur and therefore, replantation should not be performed.^{24,38,40,41} However, complete cleaning of the socket and removal of the blood clots. In addition, adequate removal of any underlying clot can obtain better outcomes.^{3,27} Besides, many case reports have indicated that damage to the permanent successors is inevitable even in cases when replantation is not performed. Pulpal necrosis, as a result of potential infection and abscess formation leading to resorption of the affected roots, is another potential disadvantage that might be associated with replantation.^{29,42,43} However, as mentioned before, endodontic therapy can enhance the outcomes and prevent such problems. Ankylosis was also reported.^{23,44,45} Nevertheless, taking adequate care of the avulsed teeth and the socket until replantation might reduce the risk of developing this complication. Kawashima et al have also reported that increased risk of aspiration might pose

another disadvantage for not conducting replantation, however, splinting can reduce this risk, as previously discussed.⁴⁶ The cooperation of the child might also be another challenge for the performing dentists and the suitable age for performing such a procedure might be until the child is at least four years old.⁴⁷

CONCLUSION

According to the current evidence, whether to use reimplantation or not is still controversial and further investigations are needed. Among the various case reports, damage to the permanent successors, root resorption, clot formation, and pulp necrosis were documented as potential complications and adverse events with intended reimplantation. However, many techniques were reported to overcome these problems. Besides, favorable outcomes following reimplantation could be hypothetically obtained as sound articulation, proper mastication, and proper dentition. Therefore, this encourages reimplantation. Nevertheless, further evidence is still needed to validate the proposed advantages and disadvantages of the approach.

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