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Review Article

Treatment of Avulsed Teeth: A Review of Ideal Conducts and Treatments

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Abstract

This study aims to review the appropriate management of dental avulsion through a literature review. Dental avulsion is a common occurrence among both children and adults, and prompt management of this type of trauma is essential for a favorable long- term prognosis. Dental trauma may result from falls, sports accidents, traffic incidents, among others. As a consequence, avulsion may occur, characterized by the complete displacement of the tooth from its socket, involving rupture of the periodontal fibers. The possibility of reimplantation and treatment depends on several factors: the type of dentition, extent of injury, origin of the trauma, time elapsed since the trauma, and conditions under which the avulsed tooth was stored. Without proper management, rehabilitation through reimplantation may be unfeasible, leading to prosthetic solutions that can negatively impact both the patient's financial situation and quality of life. The literature includes diverse studies and case reports, all of which underscore the importance of adequate handling to ensure a good prognosis. Key factors for success include the correct storage of the tooth after the trauma and immediate access to emergency care. Therefore, it is essential that dental surgeons are well-prepared to manage such occurrences effectively.

Keywords: *Avulsion; Oral Surgery; Tooth Reimplantation.*

INTRODUCTION

Dental avulsion is defined as the complete displacement of a tooth from its socket due to the rupture of the periodontal fibers responsible for its attachment. According to the International Association of Dental Traumatology (IADT), this condition may result from sports, traffic, and occupational accidents, as well as falls and physical assaults. Although more frequent during early childhood, adolescents and adults are also susceptible. The most commonly affected teeth are the maxillary anterior teeth, as their frontal position makes them the first point of contact during trauma.

Prompt and effective management of this type of injury is crucial to achieving a favorable prognosis. Key factors include the proper conservation of the avulsed tooth and immediate pursuit of emergency care. The ideal treatment depends on the combination of appropriate clinical actions and evaluation of specific criteria, such as the type of dentition (primary, mixed, or permanent), the integrity of the tooth, and the circumstances surrounding the accident (how, when, and where it occurred). These factors influence the decision-making process regarding the need for antibiotic therapy, feasibility of radiographic examination during the first visit, and the possibility of reimplantation.

Furthermore, trauma management and patient cooperation play a critical role in the recovery and rehabilitation process, preventing complications such as resorption in cases of reimplantation, infections, and post-treatment malocclusion. Therefore, it is essential that dental professionals master the appropriate clinical protocols and are capable of managing such cases effectively, providing the patient with clear guidance regarding prognosis and required care, in order to preserve oral functions and avoid negative impacts on their quality of life.

METHODOLOGY

To support this literature review, Fourteen national and international scientific articles were analyzed, retrieved from the databases “PubMed,” “SciELO,” and “MedLine.” The aim was to select publications that addressed the epidemiology of dental avulsion, its diagnosis, management, and prognosis, based on clinical trials and systematic reviews, following recent protocols.

The search was filtered to include studies published between 2019 and 2024. The keywords used were: “avulsion of permanent teeth,” “avulsion of primary teeth,” “case reports of dental avulsion,” “treatment of avulsion,” “management of the tooth after avulsion,” and “avulsion of teeth after trauma.”

At the end of the screening process, tem articles were selected for inclusion in the literature review and discussion. The remaining articles were used as supplementary references.

REVIEW OF THE LITERATURE

Cagetti et al. (Italian Journal of Pediatrics, 2019) aimed to define guidelines for the ideal approach to trauma in children, focusing mainly on evaluation criteria during intra- and extraoral clinical examinations, as well as radiographic assessments. Understanding the history of the trauma precedes this analysis and aids in determining the necessary interventions. It is important for the dental surgeon to know when, how, and where the trauma occurred, as well as the time elapsed between the event and the search for care. Clinical evaluation should consider the patient’s pain level, the type of dentition (primary, mixed, or permanent), associated regions to identify additional injuries, presence of hematomas, lacerations, and abrasions of perioral soft tissues, foreign bodies, and intermaxillary relationship. Additionally, signs of hematomas, swelling, and facial asymmetry may be observed extraorally. It is also necessary to consider the medical and dental history and the presence of systemic conditions. For radiographic diagnosis, a periapical exam is applicable if viable, depending on the pain level, involvement of associated regions, and the child’s cooperation.

Betul Sem-Yavuz et al. (2020) evaluated the most commonly used media for storing avulsed teeth, including milk, saliva, saline solution, tap water, warm water, disinfectant solution, diluted salt water, ice, and wrapping in gauze. Among these, milk is reported as the most suitable storage medium, as it preserves periodontal ligament cells for several hours.

Yannis Abraham et al. (2021) conducted a study of dental trauma cases in Australia and, based on their analysis, defined na epidemiological profile of trauma, its management, and the factors influencing prognosis. According to the study, the most affected teeth are the maxillary central incisors, followed by the maxillary lateral incisors and the mandibular central incisors. These injuries result from various incidents, such as traffic and work-related accidents, falls, sports injuries, and assaults. Immediate reimplantation is the best approach and requires adequate storage in a medium such as milk or saline solution, thus preserving periodontal ligaments and biological structures. Other media like water, saliva, alcohol, and saline are not effective due to unsuitable pH levels. When placing the tooth in a container, it should be handled by the crown to avoid damaging the root structures. Successful reimplantation depends on the time between the event and the search for care, which should not exceed 60 minutes, since attachment fibers begin to deteriorate within 5 minutes after avulsion. Failure can result from inadequate storage, loss of fiber viability, incorrect repositioning, and the use of rigid splints, increasing the risk of root resorption, ankylosis, healing problems, inflammation, and phonetic and masticatory dysfunctions.

The IADT (2020) established new protocols and guidelines for the management of dental avulsion. The association classifies this trauma as a dental emergency and recommends that the patient remain calm, handle the tooth by the crown without touching the root, and reposition it into the socket. If cleaning is necessary, it should be done gently with milk, saline solution, or the patient’s saliva. The patient should then bite on gauze to keep the tooth in place. If immediate reimplantation is not possible, the tooth should be stored in the best available aqueous medium, with the best options being milk, HBSS (Hanks’ Balanced Salt Solution), saliva (e.g., by spitting into a cup), or saline solution. The dentist should be consulted immediately. Reimplantation is not recommended for primary teeth, as it may damage the permanent tooth germ. The decision to reimplant depends on root development and the condition of the periodontal ligament.

N. Zerman (2024) evaluated cases of delayed reimplantation through a systematic review, highlighting the negative factors that influence treatment failure. According to the study, delayed reimplantation is more common than immediate reimplantation due to delays in seeking care. When the extra-alveolar time is excessive, reimplantation is contraindicated. Factors such as multiple caries, severe periodontal disease, advanced age, psychological conditions, immunodeficiency, and lack of cooperation should be considered. Reimplantation is considered delayed if it occurs more than 24 hours after trauma, subacute if within 24 hours, and acute if within 2 hours. In addition to intra- and extraoral clinical exams and accident details, the integrity of the avulsed tooth should be assessed. According to the author, teeth with open apices have a better prognosis due to improved revascularization. Common pulp complications include discoloration, inflammatory internal resorption, and pulp canal obliteration. After repositioning, splints should be used to stabilize the tooth. The choice of splint depends on the timing of reimplantation: rigid splints are more effective in delayed cases,

offering greater stability during critical healing phases, while flexible splints are preferred for their softness and adaptability in immediate reimplantation. Antibiotic therapy should be prescribed by the dental surgeon and is not indicated in all cases. It should be considered based on the risk of infection, patient health conditions, and extent of the injury.

Bianca Del Negro et al. (Denmark, 2021) assessed the impact of primary incisor avulsion on sequelae in permanent teeth. In this study, the authors analyzed 266 cases of primary dentition avulsion and found that 115 (43.2%) permanent teeth exhibited trauma-related sequelae. Children were monitored from the first consultation until eruption of the permanent teeth, allowing associations between the trauma and resulting disorders to be identified. According to the analysis, sequelae occur due to the close proximity of the primary tooth to the developing germ of the permanent tooth, which may be damaged during the avulsion. Consequences include incomplete bone formation, premature odontogenesis of successor teeth, root dilaceration, germ splitting, opacities, hypoplasias, and delayed eruption. The complexity of the sequelae depends on the child's age and trauma severity and is also related to the dental arch affected and the number of avulsed teeth. Thus, the study concludes that the younger the child, the greater the risk of sequelae in permanent dentition, highlighting the importance of regular follow-up to minimize impacts on function, speech, and aesthetics.

Anita Thakur et al. (India, 2021) presented a complex case report in which a child suffered multiple avulsions after a traffic accident. An 11-year-old boy was hit by a motorcycle and fell violently to the ground, expelling both permanent and primary teeth from both arches. The mother initially collected the teeth dry in a box and sought medical care. In the emergency room, only lip sutures were performed, and the patient was referred to pediatric dentistry 24 hours later. In the specialized consultation, intraoral examination showed disordered occlusion, limited mouth opening, multiple bruises, and lacerations. Avulsed teeth included teeth 11, 12, 21, 22, 23, 24, 65, and 41, with associated trauma in teeth 31, 32, and 42, which were luxated in the socket. CT imaging confirmed alveolar fractures, and the patient underwent minor surgery under local anesthesia for repositioning and stabilization of avulsed and luxated teeth. Reimplantation of the maxillary teeth was not possible due to alveolar fractures. Antibiotic therapy was initiated with amoxicillin and clavulanate, and paracetamol was prescribed along with postoperative guidance, including a soft diet and hygiene with chlorhexidine for 14 days. Healing was satisfactory after 10 days, and sutures were removed. The patient was monitored at 2, 4, and 6 weeks. The splint was removed after 4 weeks, and at 6 weeks, following soft tissue healing, alginate impressions were taken for fabrication of a maxillary acrylic prosthesis. Due to the trauma, age, and prosthetic rehabilitation, the patient was advised to attend regular consultations to monitor the development of permanent dentition and adjust the prosthesis as needed.

GUIDELINES FOR THE MANAGEMENT OF AVULSION

Below are the treatment guidelines recommended by the International Association of Dental Traumatology (IADT, 2020) for cases of permanent teeth with complete root formation that were reimplanted at the accident site or before the patient arrived at the dental clinic:
The reimplantation site must be cleaned with chlorhexidine solution or saline, and the position of the reimplanted tooth must be assessed both clinically and via periapical radiography. If the position is inadequate, correction should be performed using light digital pressure, followed by radiographic confirmation. In cases of improper reimplantation or tooth displacement, repositioning may be performed within 48 hours after the trauma.

Local anesthesia may be administered, when necessary, preferably without a vasoconstrictor. Stabilization (splinting) is essential for rehabilitation and should be maintained for two weeks. The material used must be flexible, such as a stainless steel wire with a diameter of up to 0.16 mm or 0.4 mm, fixed to adjacent teeth using composite resin. In cases involving alveolar or bone fractures, more rigid splints should be used for a period of four weeks. It is important to avoid contact between soft tissues and the splint. If mucosal lacerations are present, they must be sutured.

According to the association, endodontic treatment is indicated only for cases in which the tooth presents with complete root development, aiming to prevent resorption processes. Endodontic therapy is also recommended in cases of pulp necrosis or infection of the root canals. The association emphasizes that teeth with incomplete root formation should not undergo endodontic treatment initially, as spontaneous pulp revascularization may occur—unless the risk of root resorption outweighs the chances of revascularization.

Endodontic treatment should be performed within two weeks after reimplantation. Rubber dam isolation must be adapted to adjacent teeth, and calcium hydroxide is the intracanal medication of choice, which may remain in the canal for up to one month. If na antibiotic/corticosteroid paste is selected as intracanal medication, it should be applied immediately or shortly after reimplantation and remain in the canal for up to six weeks. Canal obturation may be completed using conventional materials, as indicated by the specific case.

The guidelines support the use of systemic antibiotics, arguing that they may prevent inflammatory reactions resulting from trauma and reimplantation and reduce the risk of root resorption. The patient's systemic condition and medical history must be considered to select the most appropriate antibiotic. Amoxicillin and penicillin are the most commonly recommended drugs due to their efficacy against oral microbiota.

Initial management differs when reimplantation is not immediate but the avulsed tooth was stored in na appropriate solution. In such cases, it is necessary to assess whether the tooth is contaminated; if so, the surfaces should be cleaned with saline solution, or if there are coarse particles, the tooth may be gently agitated in the storage medium. The tooth may remain in the solution while clinical and radiographic examinations are performed. Reimplantation should then be carried out using gentle digital pressure. From this point onward, the same protocols as for immediate reimplantation should be followed.

Reimplantation is also indicated in cases of incomplete root development in permanent teeth. In these situations, the goal is to allow for pulp revascularization, enabling complete root development. However, external inflammatory root resorption may still occur, particularly in children. If this occurs, the progression of the condition must be controlled to prevent pulp necrosis.

After reimplantation, patients and/or caregivers must be properly instructed regarding postoperative care to avoid complications and ensure splint and tooth stability. This includes avoiding contact sports, maintaining a soft diet for up to two weeks, and practicing careful oral hygiene with soft-bristle toothbrushes after each meal.

Periodic follow-up is essential to ensure a favorable prognosis. The first check-up should be scheduled two weeks after reimplantation, including clinical and radiographic evaluation.

Subsequent follow-ups should occur at 4 weeks, 3 months, 6 months, and annually for up to 5 years.

DISCUSSION

The literature demonstrates that, despite the existence of well-established guidelines for the management of dental avulsion, clinical practices still vary significantly, directly reflecting on case outcomes. Immediate reimplantation of the avulsed tooth is widely recognized as the best conduct, except in situations with specific contraindications, as it guarantees better functional, aesthetic, and emotional rehabilitation for the patient. However, factors such as the elapsed time until care, the medium used for tooth preservation, access to health services, and the knowledge of the professional involved decisively interfere with the prognosis.

Case reports included in this review illustrate different clinical approaches to dental avulsion situations, evidencing the effects of correct management and failures in care.

Bustamante-Hernández et al. (2020), in Spain, reported the case of a 28-year-old patient whose tooth 11 was reimplanted after 16 hours in a dry medium, indicating delayed conduct. Even so, through the use of imaging exams, endodontic treatment prior to reimplantation, apicoectomy, temporary immobilization, antibiotic therapy, and clinical follow-up for two years, the outcome was favorable, with no signs of root resorption or ankylosis. The case highlights the importance of specialized clinical intervention even in non-ideal scenarios.

In contrast, the case reported by Soukaina El Kharroubi et al. (2021), in Morocco, illustrates a scenario of excellence in management. Three avulsed permanent teeth were maintained in whole milk and reimplanted after 60 minutes. The adopted measures included immediate reimplantation, flexible splinting, antibiotic therapy, guided oral hygiene, and subsequent endodontic treatment, resulting in a highly positive prognosis. This case demonstrates how proper adherence to guidelines directly impacts the preservation of tissue integrity and the prevention of complications.

Another relevant example was described by Amandeep Kaur (2021), in India, where the avulsion of tooth 11 occurred accidentally during na endodontic procedure, 48 hours after the initial trauma. The immediate conduct of repositioning and stabilization was effective, allowing the continuation of endodontic treatment. After 24 months of follow-up, na intact periodontium, absence of root resorption, and adequate healing were observed, demonstrating that prompt and technical action can compensate for adverse events during treatment.

On the other hand, the report by Alfonso Aguirre Escobar (2022), in El Salvador, demonstrates the negative impacts of inadequate conduct. A pediatric patient suffered avulsion of tooth 11, which was improperly transported and not reimplanted by the first professional consulted. The decision for a removable partial prosthesis, without considering the viability of reimplantation, was classified as negligent, depriving the patient of more adequate aesthetic and functional rehabilitation. The subsequent fabrication of a provisional crown with the patient's own crown illustrates a palliative attempt in light of the lost opportunity for effective reimplantation.

Thus, it is possible to observe that, although reimplantation is widely indicated, its effectiveness depends on multiple factors: from the initial conduct of the patient and third parties, to the technical preparation and clinical decision of the professional involved. Well-conducted cases reinforce the role of guidance, prompt care, and adherence to guidelines to maximize clinical success. Conversely, failures in this process can irreversibly compromise oral health and patient quality of life, especially in younger age groups.

CONCLUSION

According to the literature review, it is noted that the protocols and conducts applied in avulsion management were diverse. From the analysis of case reports, it is possible to understand which actions were more effective and resulted in better final prognoses for patients, serving as reference in the approach. In these successful cases, it is evident that the initial conduct was essential for the course of treatment, following protocols of tooth preservation, immediate reimplantation, postoperative considerations, and periodic treatment.

Thus, it is understood that it is essential for the dental surgeon to master the correct protocols, applying semi-technical maneuvers, guiding the patient about the measures that can be adopted and about the prognosis. Moreover, to know how to apply the reimplantation technique when indicated, or to rehabilitate functions by other procedures, always employing the necessary considerations in the postoperative period.

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