

Complete permanent tooth avulsion – current therapy concept and prognosis

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KEYWORDS

avulsion, trauma, replantation

SUMMARY

Complete permanent tooth avulsion is trauma relating both to teeth not fully developed and the mature ones. The aetiology may vary, but usually it does not determine the choice of treatment method.

The current concept of avulsed permanent teeth is based entirely on the decision on the expediency of tooth replantation and its possibly swift performance, as long as there are indications for it. This is aimed at maintaining the tooth in the oral cavity for as long as possible, or as long as it takes to start the further stages of the treatment. It is important to determine the exact time of injury and to establish whether any first-aid operations in the mouth were performed and what they were. The course of action in the dental office depends on the time the tooth spent outside the socket, its maturity and the environment in which the tooth was stored. The role of the dental practitioner, in addition to the professional treatment of the injuries which have already occurred, consists in the prevention, education and the promotion of appropriate attitudes in the patients. In complete avulsion, the prognosis is strictly dependent on these factors and the occurrence of complications is often associated with late treatment initiation or lack of knowledge among the persons present at the injury with respect to the way in which an avulsed tooth should be handled. In order to promote the appropriate behaviour in the society, the International Association of Dental Traumatology (IADT) provides recommendations for patients concerning trauma to the teeth via its website, posters and a mobile application.

INTRODUCTION


Complete dental avulsion, or, in other words, dislocation of a tooth, consists in a complete loss of contact between the tooth and the alveolar socket as a result of the interruption of all the ligaments of the periodontium. This type of trauma occurs mostly in patients aged 7-10 years and consists 0.5-16% of all the traumatic injuries of the teeth. Front teeth are the most common to sustain the trauma – mainly maxillary incisors, less frequently mandibular ones. This injury is often associated with damage to the soft tissue and the fracture of the alveolar process (1).

The aetiology of avulsion, similarly to other tooth trauma, is varied. However, falls, sports practice and – at the later age – fights are among the main causes. It should also be noted that children with malocclusion, such as complete or partial distal occlusion, distal occlusion with protrusion or apertognathia, are more vulnerable to tooth injuries (2). Children with impaired muscle coordination and nervous

system diseases, such as epilepsy, as well as suffering from other conditions affecting their physical fitness, are also predisposed to such events.


Therapy of complete permanent tooth avulsion consists in its replantation or the abandonment of the procedure and the activities accompanying the chosen course of action. The decision on the selection of the method of treatment is difficult because of the complexity of the injury and the possible complications connected with the medical activities. It is also dependent on many factors, and often must be taken very quickly. The prognosis in the case of a permanent tooth avulsion is not only the consequence of the proceedings in the dental office. The time spent outside of the tooth socket is currently considered the most important factor here. Also, factors such as the medium in which the dislocated tooth is transported and the first aid procedure undertaken are significant.

The chances for a good prognosis are currently increasing, owing to the more structured indications for a particular





Save a tooth!

Most permanent teeth can be saved after an injury if you know the right course of action




What should be done if the tooth is **BROKEN**






1 Find the broken-off fragment of the tooth





2 The broken-off fragment can be glued back to the tooth



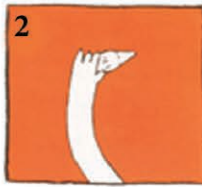
3 For this purpose, go to the dentist immediately

What should be done if the tooth is **DISLOCATED**






1 Find the tooth




2 Hold it by the crown

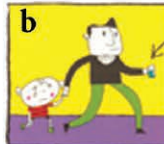


3 Plug the sink and rinse the tooth with cold running water


4 Choose one of the ways




a Put the tooth back into the socket




b Place the tooth in a container filled with milk or physiological saline



c If you have no milk or saline, place the tooth in the mouth between the cheek and the gums




5 Go to the dentist immediately, no later than within two hours




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1950

Fig. 1. Poster „Save your tooth”. Source: (11)

therapy, depending on the co-existing factors. Unfortunately, lack of public awareness, resulting mainly from too little information, frequently worsens the prognosis of treatment in such serious tooth injuries.

The article below aims at demonstrating that the treatment of total tooth dislocation is strictly dependent on the factors described above and that nowadays, in many situations, it is possible to preserve the tooth, maintaining it in the mouth, even as a temporary measure, necessary for further treatment.

TREATMENT OF COMPLETE TOOTH AVULSION – FIRST AID

The current concept of the treatment of complete permanent tooth avulsion is based on the knowledge that the most important factor increasing the chance of maintaining a tooth is its immediate replantation if there are no contraindications. Long-term prognosis worsens significantly when replantation is postponed for longer than 10 minutes after the injury (3).

The indications concerning the course of action to be taken immediately after the injury before going to the dental office (according to IADT) assume instant replantation, that is, re-insertion of the tooth into the socket, held by the crown, oriented according to the location of a neighbouring tooth. If the tooth is contaminated, it should be briefly rinsed with running cold water. Once the tooth is in the right place, the patient should be advised to bite on a tissue paper and go to the dentist as soon as possible (preferably within 60 mins). It should be remembered that only permanent teeth are replanted. If immediate replantation is not possible, it is recommended that the tooth, held by the crown, should be placed in a container with a suitable transporting medium. Special transport solutions available at the pharmacy – such as Save-A-Tooth – or milk can be used for this purpose. Currently, pasteurised milk is most commonly recommended due to its availability. A tooth may also be kept in the mouth, between the molars and the cheek. However, choking hazard should be considered here in the case of a restless patient (4). Water should not be used for this purpose as it causes the lysis of the cells of the periodontium, while it is important for the further treatment process that they are preserved.

TREATMENT – THE ROLE OF THE DENTAL PRACTITIONER

The procedure at the dental office begins with the physical examination and interview. It is crucial that during the dental and general medical interview the exact circumstances of the event are determined – what happened and where, what actions were taken at the accident scene and whether any general symptoms occurred, for example, loss of consciousness. In the physical examination, apart

from the rigorous evaluation of the injured tooth, alveolus and their surroundings, the condition of all the remaining teeth, soft tissues, the alveolar process of the jaw and the alveolar part of the mandible should be checked in order to rule out fractures.

The choice of the type of therapy used depends on whether immediate replantation has been performed outside the dental office or whether deferred replantation should be considered. In the case of the deferred procedure, it is important to determine whether the injury took place less than 60 minutes ago or whether the tooth has stayed outside the socket a for longer time than that.

If the tooth has been immediately replanted, it should be left in the current position and the operating field should be cleaned, for example, with chlorhexidine solution. If there is damage to the soft tissue, sutures should be applied. The position of the tooth should be checked radiologically and flexible splints should be applied for 14 days. Adequate antibiotic cover must be prescribed and the first follow-up visit scheduled.

A tooth remaining outside the oral cavity for up to 60 minutes in a wet or dry environment requires replantation in the dental office. If there are impurities on the surface of the tooth, it should be rinsed gently with saline. In this situation, the examination of the alveolus must also be performed, that is, rinsing the clot with saline and a gentle review aimed at determining whether or not a fracture of the alveolar process has occurred. Typically, these activities are preceded by anaesthesia. Following the tooth replantation, an evaluation is necessary and, if necessary, suturing of the soft tissues. If there is no doubt at to the position of the tooth in the radiographic examination, flexible splinting is recommended for 14 days, an antibiotic cover and the arrangement of the first follow-up appointment. If a tooth not fully developed has been subject to the injury, it is recommended that its root surface should be covered with minocycline hydrochloride microspheres or soaked with a doxycycline solution of 1 mg/20 ml of saline (5).

If a tooth has been outside the oral cavity for more than 60 minutes, the cells of the periodontium on the surface of the root have undergone necrosis. Therefore, the necrotic tissue should be removed using gauze. In the immature teeth with an open apex, whose development has not yet been completed, endodontic treatment outside the mouth is usually recommended before the replantation, as it is easier in this situation. In mature teeth, endodontic treatment is usually carried out after 7-10 days. Before replantation, the tooth can be immersed in citric acid for 5 minutes, and then in 2% stannous fluoride solution or 2.4% sodium fluoride solution for 20 minutes, in order to reduce the very high risk of complication in the form of replacement resorption (2, 6). Before the treatment, it is best to anaesthetise the patient and then rinse the socket with saline and gently examine it. The next step is the replantation and, if necessary, suturing

the soft tissues, as well as the radiological examination of the location of the tooth. The splinting time is longer in this case, lasting for 4 or even 6 weeks. As in other cases, an appropriate antibiotic is prescribed and the date of the next visit is arranged.

In each case of permanent tooth replantation, flexible splints are currently recommended, allowing for the most physiological teeth movement possible. For this purpose, flexible temporary composite materials, flexible orthodontic wire or fibreglass can be used. The use of dental brace brackets is also recommended. Pulpal diet should be prescribed for the entire period of splinting, as well as maintaining adequate oral hygiene by means of a soft brush and chlorhexidine mouth wash.

All diagnosed tooth avulsions require the administration of an antibiotic cover. The dosage and type of medicine must be tailored to the age and weight of the patient, taking into account the information about possible allergies from the medical history. Penicillin and tetracycline are most frequently prescribed (however, the possibility of tooth tissue discolouration should be kept in mind) The assessment of the anti-tetanus protection is also essential and, if needed, a referral to an entity authorised to administer the anti-tetanus serum.

The first follow-up visit should be arranged 7-10 days after the injury. Completely developed teeth require endodontic treatment then. Usually, a few sessions of treatment are recommended, with the use of calcium hydroxide pastes. Cameron recommends filling the canal with Ledermix paste for 3 months and only then commencing the treatment with $\text{Ca}(\text{OH})_2$ pastes. The final filling of the root canal with gutta-percha and sealant should be performed if no lesions are determined in the periodontium around the apex. The course of action in the first period after the dislocation of teeth with a widely open root apex ($> 2 \text{ mm}$) replanted within 60 minutes from the injury is limited to check-ups, as in such teeth there is still a chance of revascularisation (3). Vitality control can be started as early as 2 to 4 weeks after the trauma, but frequently the regaining of the right response of the tooth pulp takes place later, after the repair of the nerve fibres. However, should the symptoms of pulp necrosis occur, endodontic treatment must start immediately. The first control X-ray should be performed about 3-4 weeks after the replantation, because then the first symptoms of inflammatory resorption can be observed. Subsequent clinical and radiological examination should be performed for several years, due to the fact that complications can occur even after many months. They are usually performed after 3, 6, and 12 months, and then every year for about 5 years (5).

It is important to note that there are contraindications to replantation. It is not indicated in the deciduous teeth, teeth with extensive lesions in the marginal periodontium and in patients with constitutional or systemic diseases, such as immunodeficiency or infective endocarditis (5).

PROGNOSIS

In such a serious injury as complete tooth avulsion, the prognosis depends primarily on:

- time the tooth has remained outside the alveolus,
- medium in which the tooth was stored outside the oral cavity,
- tooth development stage.

It is estimated that the replantation carried out within 30 minutes from the dislocation yields positive treatment results in 90% of the cases. If this time is extended from 30 to 90 minutes, the positive result is achieved only in 43% of the cases and after 90 minutes only 7% of the replantations are successful. Lack of subsequent root resorption is considered a positive replantation result (2).

Looking at the restoration of the vitality of the pulp, that is, regained circulation through revascularisation, it is only possible in the case of teeth in the early stage of development, with wide open root apex, replanted no later than 20-30 mins after dislocation (2).

In other cases, revascularisation is not possible, and it is the environment in which the tooth remains between the injury and the replantation in the socket which affects the reaction of the living periodontium tissue. The use of special solutions available in the pharmacy results in the best prognosis, for example, of HBSS – Hank's Balanced Salt Solution in which a tooth can be kept up to 24 hours. Pasteurised milk is a more accessible product, in which a tooth can potentially be kept up to 6 h. The patient's saliva can be used for this purpose for up to 2 hrs (3). Other transport media described as usable in the lack of the above are contact lens solution and sterile physiological saline solution. In recent years, other solutions have been sought which could allow for retaining the viability of the periodontium and would be easily accessible to patients and doctors. Among others, preparations for transporting organs to be transplanted, sage extract or coconut water have been tried (7). However, none of these substances began to be widely used in tooth avulsions.

COMPLICATIONS

Complications of complete dislocation and its treatment are frequent. These most often include pulp necrosis and subsequent root resorption, possibly disrupting tooth development and leading to its loss.

In completely developed permanent teeth, revascularisation cannot be expected and, in the case of death of the cells of the periodontium, resorption should be anticipated. In immature teeth with diagnosed pulp necrosis or radiological signs of root dying, swift commencement of endodontic treatment and apexification procedures is crucial as, in this case, inflammatory resorption may very easily lead to the loss of the tooth. Replacement resorption – ankylosis, that is, synostosis, causes the infraposition of the tooth in the case of incomplete development. The decision needs to be taken then on whether extraction and temporary prosthetic

of the gap will be more beneficial for the patient until the completion of the development or the decoronation. Decoronation is a relatively new procedure involving the removal of the tooth crown below the bone of the alveolar process, while the root is retained in order to maintain and preserve the tissues of the process so that further implantoprosthodontic treatment is facilitated (8-10). Permanent teeth which have ankylosed frequently remain in the oral cavity for many years which may be considered therapeutic success.

CONCLUSIONS

Complete dental avulsion is trauma which can lead to premature permanent tooth loss. The efforts of dental

practitioners should not consist solely in a reliable diagnosis and proper performance of procedures aiming at the maintenance of the tooth in the oral cavity, but should also include broad promotion of knowledge on the course of action to be taken directly after the injury (fig. 1). In the case of avulsion, increasing public awareness is of paramount importance in improving the prognosis. The procedure in the dental office is difficult, multi-step, often requiring long-term cooperation of many specialists and substantial involvement of the patient. However, early and proper diagnosis and appropriate therapy started quickly increases the chances of positive outcomes and patient satisfaction.

CONFLICT OF INTEREST

None

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