

Considerations on the clinical approach and sequelae after late replantation

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ABSTRACT

Introduction: Tooth avulsion is a severe injury. Management of teeth and soft tissues affected during and after replantation is important utmost importance to obtain a favorable prognosis. **Objective:** This study aimed to discuss the conduct of late replantation, based on a case report, and suggest other therapeutic approaches. **Case report:** Female 9-year-old patient suffered avulsion of tooth #11 which was kept dry for two hours. Replantation of tooth #11 was performed followed by flexible retention for 15 days. The tooth showed a positive response to pulp

sensitivity test for five months. Subsequently, we started endodontic treatment with ten periodic changes of calcium hydroxide-based intracanal medication combined with propylene glycol. Clinical and radiographic control, carried out after six months, revealed replacement root resorption, which remained in place for three years. **Conclusion:** Although late replantation is a treatment option, other clinical approaches should be studied and considered to minimize future sequelae.

Keywords: Endodontics. Dental trauma. Root resorption.

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Introduction

Tooth avulsion is a severe injury commonly found in anterior permanent teeth in children between 7 and 10 years old,¹ and affects the periodontal ligament, alveolar bone, cementum, gingiva and pulp.² For avulsed teeth kept dry for an extra-alveolar period longer than 30 minutes, it is confirmed that most periodontal ligament cells are necrotic and resorption is expected.³

Immediate replantation of an avulsed tooth into the socket is largely indicated;⁴⁻⁶ however, this is often not possible due to lack of knowledge among those involved⁷ or the accident having occurred in a location far from a dental care facility. On the other hand, when there is extensive damage to periodontal ligament after tooth avulsion, there may be a fusion between root surface and alveolar bone. This fusion is also known as dentoalveolar ankylosis.^{8,9} Sequelae after replantation of an avulsed tooth are common, with a prevalence of 57-84%.^{5,8,10-12} Replacement resorption is more rapid in individuals aged between 8 and 16 years old compared to older ages, in which the affected tooth remains functional for long periods.¹³

Although understanding that the extra-alveolar period and storage conditions affect the prognosis of avulsed teeth,¹⁴ late replantation is still employed.¹⁵ Frequently the clinician has no treatment options for those cases, thus justifying the implementation of this

protocol for aesthetic reasons and to maintain alveolar bone height. Thus, this study aimed to discuss the protocol of late replantation, based on a case report, and suggest other therapeutic approaches.

Case report:

Late replantation and developing sequelae

Female 9-year-old patient, systemically healthy, went to a Specialized Center of Dental Trauma of Maringá ten days after a bicycle fall. In this incident, tooth #11 was avulsed. This tooth was kept dry for two hours until replantation. Physical extraoral examinations evidenced the girl was in good general health condition, but showed lacerations on the upper lip. Despite unfavorable conditions, was decided to replant the tooth and perform flexible splint.

After 15 days, the splint was removed. Endodontic treatment started after five months because the tooth presented positive response to pulp sensitivity testing in the control period. Ten periodic changes were made with calcium hydroxide dressing material combined with propylene glycol. From the 6th month onwards, during clinical and radiographic approaches, replacement root resorption was detected, which remained under follow-up for three years (Fig 1). The tooth was extracted and a Hawley plate with artificial tooth was placed. The patient was subjected to orthodontic treatment for planning and implant placement.

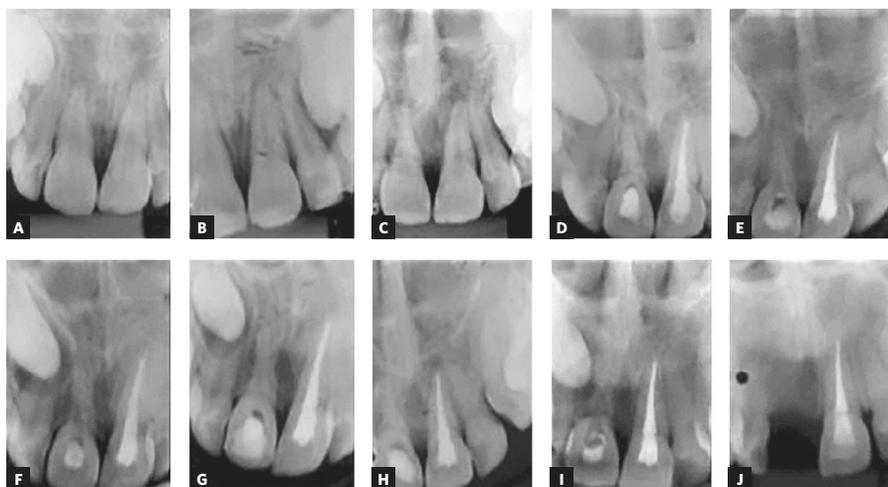


Figure 1. Periapical radiographs during treatment. **A)** Ten days after replantation. **B)** One month and ten days after replantation. **C-H)** Follow-up every three months. **I)** Follow-up every six months. **J)** Post-extraction.

Discussion

Expectation of a poor prognosis resulting in ankylosis, infraocclusion and replacement resorption is observed in cases of avulsed teeth with an extra-alveolar period longer than 30 minutes and stored in a dry environment, similarly to that reported in this study. Although any kind of treatment had been performed in the injured tooth, some authors recommend treating the root surface with 2% sodium fluoride¹⁶ or 2% stannous fluoride,¹⁷ since such treatment may slow down the resorption process.

The biological characteristics of calcium hydroxide turn it into a therapeutic option for intracanal medication. Calcium hydroxide has bactericidal activity^{18,19} and promotes denaturation of bacterial toxins.²⁰ In addition, it changes the environment to a more alkaline pH, which can slow down the action of clastic cells and promote hard tissue formation.²¹ The association of these effects promotes cleaning of the root canal, and thus minimizes the occurrence of inflammatory resorption.²² However, regardless of the number of periodic changes of intracanal medication and the use of this material with repair-promoting properties, there is no prevention of replacement resorption.

Regarding the duration of therapy with calcium hydroxide, literature findings are controversial. In this study, intracanal medication remained for one month and then intracanal dressing every 3 months were made, corroborating Andreasen and Andreasen.²³ When replacement resorption massively affects the root portion, follow-up is performed every six months. Root canal filling was not completed, since clinical and radiographic examination revealed there was no control of resorption.

An avulsed tooth may undergo ankylosis and replacement resorption. After replantation, this tooth affected by such sequelae may remain in position for years until the root is completely resorbed. This is because the rate of bone resorption seems to depend on patient's metabolism.^{13,24} In a retrospective study on replanted teeth, Andersson et al¹³ demonstrated that the resorption rate is significantly lower in patients aged 17-39 years old, in which the teeth remained functional for decades, compared with younger patients, aged 8-16 years, who maintained their teeth for a period of 3 to 7 years. This short

period mentioned above corresponds to that found in the present report.

In growing children, ankylosed teeth are not extracted because of functional and aesthetic reasons, as well as to prevent disturbance in alveolar bone growth. When osseointegrated implants are placed in young people in the anterior region, ankylosis also occurs because growth spurt has not been completed.^{25,26} Thus, in these individuals, treatment modalities proposed for tooth avulsion include orthodontic closure,²⁷ autotransplantation,²⁸ and decoronation.⁹

After tooth avulsion, in cases in which replacement resorption is expected to appear due to significant loss of the periodontal ligament, it is recommended to seek an orthodontist to check for alveolar bone growth, because there are inter-individual differences in age and growth resulting in a poor prognosis in children with teeth fully formed before the growth spurt.²⁵ To prevent implant infraocclusion, it is usually recommended the implant be placed after growth completion, i.e. after 15 years of age for girls and 18 for boys.²⁹ Although late replantation is considered a temporary solution to preserve bone and gain time for later prosthetic rehabilitation, in the present case, tooth loss occurred before the growth spurt, therefore, it was necessary to wait for dental implant placement to be carried out.

Autotransplantation may be a viable option for replacing missing permanent tooth.³⁰ It is defined as an inter-transplantation of impacted or erupted teeth from one location to another in the same individual in extraction sites or surgically prepared sockets when a suitable donor tooth is available.³¹ Most of the times, premolars are considered donors for replace the missing tooth.³² A factor of extreme importance for the success of the autotransplanted tooth is the stage of root development, being considered optimal when $\frac{3}{4}$ of the root are formed. As a result, the tooth will have pulp and periodontal proper repair conditions.³³ The presence of transplanted tooth while the patient is growing helps to keep the bone in place and allows vertical bone growth. This characteristic of autotransplantation is extremely important in this procedure,³⁴ as it can maintain function and preserve the alveolar ridge. This is advantageous for young patients compared to dental implants that are static and do not erupt

to compensate for future growth.^{35,36} Combination of orthodontic treatment and transplantation may be indicated for pre-surgical expansion of the donor site, and post-surgical alignment of transplantation to improve prognosis and outcomes.³⁷ In some cases, orthodontic treatment may solve the problem²⁷ by closing the space where the ankylosed tooth was, but there are other options as well, such as osteotomy with osteogenic distraction and osteotomy of the segment with immediate repositioning of dento-alveolar structures.³⁸

Decoronation is performed in ankylosed permanent incisors in infraocclusion, wherein the tooth is sectioned at the cervical third, in addition to being instrumented, thus stimulating bleeding in the apical region, allowing regeneration of alveolar height⁹ and complete preservation of width and height of the alveolar process. In addition, the apposition of coronal bone is observed in many cases, thus increasing bone volume of the site potentially receiving an implant.⁹ According to Diaz et al,³⁹ decoronation is: (a) a simple, surgically safe procedure, leading to preservation of height and thickness of alveolar bone structure; (b) a less traumatic technique compared to extraction of an ankylosed tooth; (c) considered a treatment option for teeth affected by replacement resorption when orthodontic closure and autotransplantation

are not possible; and (d) replacement with an adhesive crown is well accepted by the patient. Filippi et al⁹ also stated that decoronation is simple and safe for later placement of dental implant.

Another alternative treatment that has been reported is the use of EmdogainTM on the root surface and in the socket followed by replantation. Promising results have been reported with its use.^{40,41} This protein complex can enhance growth of cementoblasts on the denuded root surface, thus increasing migration and differentiation of progenitor cells, thereby regenerating the supporting tissue.⁴² Nevertheless, Schjøtt and Andreasen⁴³ demonstrated results of failure when using EmdogainTM in the treatment or prevention of ankylosis after six months of assessment. Therefore, the International Association of Dental Trauma (IADT) recommends more research be carried out in order to find evidence that reinforces the use of enamel matrix-derived protein.

Conclusion

Although late replantation represents a treatment option, as seen in the case reported herein, other clinical approaches including orthodontic movement, autotransplantation, decoronation, and the use of EmdogainTM need to be further disclosed and discussed, so as to minimize future sequelae.

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