CASE REPORT

Multidisciplinary approach in the immediate replantation of a maxillary central incisor – A six and a half year follow-up

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ABSTRACT

This report proposes a discussion of the various peculiarities of a tooth 21 replantation in a 9-year-old patient and describes different treatment facets and a 6-year follow-up of the case. The splint was maintained for a 3-month period. After a 1½ year therapy with calcium hydroxide to control inflammatory resorption, the final canal obturation was performed 18 months after trauma with mineral trioxide aggregate. Two years after replantation, the orthodontic treatment had been initiated and 5 years after avulsion, whitening of tooth 21 was also done. Clinical and radiographic follow-up at regular intervals revealed that the treated tooth was still functional, showing normal mobility, resorption stabilization, and normal appearance of the bone tissue and lamina dura, testifying the treatment has been so far successful. The possibility of submitting avulsed teeth to other dental treatments once, there is close professional monitoring by controlling the risks and benefits of each therapy, as well as the patient's cooperation, extra-oral time, and storage media for transport to the dentist among other details is emphasized.

Key words
Ankylosis, mineral trioxide aggregate, tooth avulsion, tooth replantation

INTRODUCTION

Avulsion, which involves total tooth displacement from its socket, causing rupture of periodontal fibers, is a true emergency case. In both deciduous and permanent dentitions, maxillary central incisors are the most frequently avulsed teeth.[1-3] Treatment implies a dental replantation procedure[4] whose success is directly connected with the extra-alveolar period, storage medium, type of splint used, period of endodontic treatment, medication prescribed, oral hygiene, and the patient's general health condition.[5-8]

Storage in dry medium can cause irreversible injuries to the periodontal ligament,[9] a severe diffuse inflammatory response is triggered throughout the root surface, usually enhanced by the presence of bacteria and their by-products inside the canal after pulp necrosis. Loss of vitality is a common occurrence in replantations, as the apical tissue is susceptible to bacterial contamination.[1] When external inflammatory resorption occurs, the pulp must be removed due to bacterial penetration in the dentinal tubules, which stimulates the root surface inflammatory process. This occurs even more rapidly in younger patients, who have wide and permeable tubules. The treatment protocol for inflammatory resorptions involves the mechanical-chemical preparation of the root canal and the use of calcium hydroxide intracanal medication.[6,10] Final obturation of the root canal must be done between 12 and 18 months after resorption control.[2]

Mineral trioxide aggregate (MTA) is a mineral oxide material, which shows excellent biocompatibility and marginal sealing.[11] It has recently begun to be used as a final sealing material in some cases of traumatized teeth owing to the fact that it contains several properties of calcium hydroxide.[12-16]

Clinical and radiographic follow-up of avulsed teeth is essential to define prognosis and should be kept for

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longer periods between 5 and 10 years.[17] In addition to resorption control, other treatment needs arise in the meantime, such as the correction of malocclusions and color changes of traumatized teeth. Orthodontic movements of traumatized teeth have received relatively little attention in the literature, and there is a lack of clinical protocols for their management.[18,19] Trauma is one of the most common causes of crown darkening,[20,21] as it generally causes pulp hemorrhage that spreads through the tubules. Hemolysis causes the release of iron sulfide, which is responsible for crown darkening. Abbott and Heah[21] state that internal tooth whitening in devitalized traumatized teeth is generally successful, often after one session only. These authors did not find any cases of external inflammatory resorption in their study.

This report proposes a discussion on the various peculiarities of a tooth avulsion case with immediate replantation, such as a long retention period, root canal filling with MTA, orthodontic treatment, new trauma, and avulsed tooth whitening.

CASE REPORT

A 9-year-old female patient, accompanied by her father, was referred to the Traumatology Service of the Dentistry School after suffering avulsion of the left maxillary central incisor (21) presenting full root formation in December 2004. The cause of avulsion had been a bicycle fall in the courtyard, and the tooth was kept in a clean paper napkin (dry medium). The information provided was that the accident had occurred about 35 min ago, and so this was the approximate time of extra-alveolar tooth situation.

No lacerations of the surrounding tissues were found upon clinical examination. The tooth was copiously washed with saline solution, and the socket was thoroughly irrigated with this solution to remove blood clots. Tooth replantation was performed immediately by applying bi-digital pressure, and anesthesia before the procedure was unnecessary [Figure 1]. Periapical radiography showed adequate tooth 21 repositioning [Figure 2]. A semi-rigid nylon 90 splint and composite resin encompassing teeth 21, 22, 53, and 11 were placed [Figure 3]. Postoperational therapeutics was restricted to antibiotics prescription (amoxicillin 500 mg) 3 times a day for a seven period, analgesic (paracetamol 750 mg) and occlusal rest recommendation (liquid and pasty food). Anti-tetanus vaccination was updated.

The patient returned only 3 months after trauma, on which occasion clinical and radiographic evaluations, as well as splint removal, were performed. A slight mobility and a slight darkening of the crown were found, and radiographic evidence suggested inflammatory resorption at the apical end of tooth 21 [Figure 4]. Chemical-mechanical preparation of the root canal was done, and a paste of calcium hydroxide, propylene glycol, and iodoform was placed in the canal. This material was initially exchanged at 15 and 30 days intervals, and later every 2 months, always with radiographic accompaniment. Stabilization of the inflammatory resorption was observed radiographically after seven-month follow-up.

Figure 1: Replantation of avulsed tooth 21

Figure 2: First radiograph showing tooth 21 soon after replantation

Figure 3: Semi-rigid splint involving tooth 21 (avulsed), 11, 53, and 22

Follow-up was continued every 3 months, and after 1½ year of calcium hydroxide intracanal medication use, because of the beneficial properties, no radiographic evidence of external inflammatory resorption areas was found; a final endodontic obturation procedure was then performed. Gray MTA (MTA, Angelus, Londrina, Brazil) was manipulated according to manufacturer's recommendations and placed in the canal with a lentulo spiral drill. After a year and a half posttrauma, orthopedic treatment was initiated with the use of orthodontic expanders, at the same time, it was made filling with MTA cement [Figure 5]. An extension plate of the maxilla and mandible was installed on both dental arches due to a diagnosed atresia, and special care was taken to avoid orthodontic force on replanted tooth 21 [Figure 6]. Clinical and radiographic follow-up were continued at 3-month intervals.

Six months after the installation of orthodontic appliances, the patient presented a large enamel crack on tooth 21 due to a new trauma (subluxation) of the tooth that had occurred during sports practice. Radiographically, it was detected the disappearance of the lamina dura at the apical end at the mesial aspect, which was suggestive of replacement resorption [Figure 7]. During the clinical and radiographic follow-up visits, the stabilization of the ankylosis area was noted. A coronary darkening of the left central incisor was observed clinically. Esthetic compromising, then became the patient's main complaint. At that point maxillary expansion was completed, and internal dental whitening was performed; at first, an initial color sampling was done; then, following absolute isolation, cervical sealing with light-cured glass ionomer at a 2 mm distance from the dentin enamel junction was done. Whiteness hydrogen peroxide 35% whitening agent (FGM, Joinville, SC, Brazil) was used in three 15-min applications per session during two clinical consultations. After chromatic evaluation, the efficacy of the whitening procedure was verified, and final sealing of the crown opening with light-cured composite resin was again made possible [Figure 8].

The case has had a 6½ year follow-up to the present time, and the tooth is functional, shows regular mobility, and

Figure 4: Periapical radiograph showing inflammatory resorption at the apical end of tooth 21

Figure 5: Aspect of endodontic filling with mineral trioxide aggregate cement

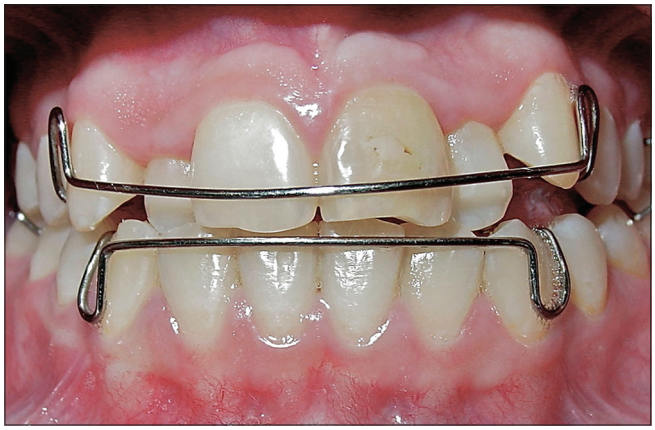

Figure 6: Orthodontic appliances for maxillary and mandibular expansion 28 months after replantation

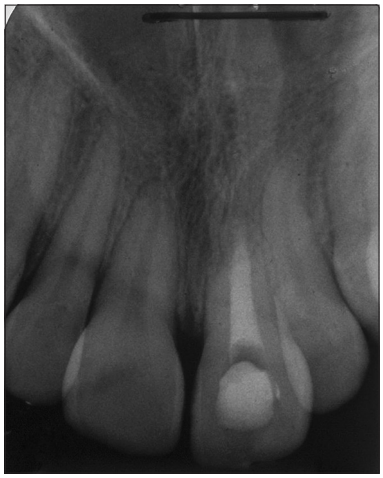

Figure 7: Periapical radiograph compatible with a replacement resorption area at the apical mesial end of tooth 21

there is no visible evidence of inflammatory resorption at root level [Figure 9]. The replacement resorption area has stabilized, and a better esthetic result with the tooth whitening has been obtained.

DISCUSSION

Adequate replantation of a permanent tooth within 30 min after avulsion has a 90% success rate. After 2 h, there is a 95% chance of tooth ankylosis occurrence in the long run (6). In this study, the patient suffered tooth avulsion at home and sought care within a favorable time limit; however, the tooth was stored in dry medium, which could have resulted in irreparable damage to the periodontal ligament.[9] Kinoshita *et al.*[22] state that avulsed teeth near home tend to be stored in adequate conservation means, which was not the case in this study. Such facts reveal the lack of parental knowledge as to which action to take in avulsion cases, and emphasize the need for educational and preventive campaigns in the community.[23-25] All due efforts toward tooth replantation must be made in loco as soon as possible[6] as replantation prognosis is determined by first care and the decisions taken within the first few minutes after avulsion.[26]

With reference to dental care, this case report sought to follow all the steps determined by the International Association of Dental Traumatology (IADT)[6] which should be observed by all dentists and include a detailed physical examination of the tooth and surrounding structures, radiographic examination – having care not to delay replantation due to radiographs – oral hygiene instructions, antibiotic therapy, analgesic prescription, and 0.12% chlorhexidine mouthwashes to prevent plaque buildup.[27-29] Tooth stabilization with nonrigid splint is also recommended and aims to keep the tooth in its original position, allowing both physiological and functional movement of the periodontal ligament.[30] A nylon thread attached with composite resin to guarantee this characteristic was used in this case. The IADT protocol[6] recommends splint removal between 7 and 10 days after trauma; however, the splint was kept for a longer period in this patient, once her return for consultation only occurred 3 months after trauma. Nonetheless, this seems not to have interfered with prognosis as the nylon thread allowed a slight mobility of the tooth, leading to the healing of the periodontal ligament, and ankylosis areas were not detected.

In cases of dental avulsion, the traumatology service of the dental school carries out monitoring of the appearance of resorption areas through weekly radiographs. It is worth mentioning that the Service now follows the IADT procedure that recommends the beginning of endodontic therapy between 7 and 10 days after trauma for teeth with a closed apex. External inflammatory resorptions advance rapidly in young patients[2] and can lead to serious sequels, what fortunately did not occur in this case.

Calcium hydroxide, which provides an alkaline pH inside the tubules capable of killing bacteria and neutralizing toxins with the potential to stimulate the inflammatory process, was used for the resorption treatment.[6,31] This therapy was effective, once the process stagnation could be detected after a 2-month period. However, regular exchanges of calcium hydroxide call for more frequent consultations and the patient's willingness to cooperate; besides, these exchanges can weaken the tooth.[9] Therefore, the final obturation should be performed from 12 to 18 months after the resorption process has been controlled.[32] In this case study, the root canal was finally filled with MTA 18 months after the complete remission of the inflammatory process. In some recent traumatized tooth cases,[12-16] MTA has been used as filling material for the whole canal because it has a mechanism of action similar to that of calcium hydroxide and is believed to paste release calcium ions through dentinal tubules into resorption areas, inducing repair.[33] One disadvantage of this material is the possibility of it causing crown darkening when gray MTA is used;[15] white MTA is then

Figure 8: Esthetic result after tooth 21 whitening

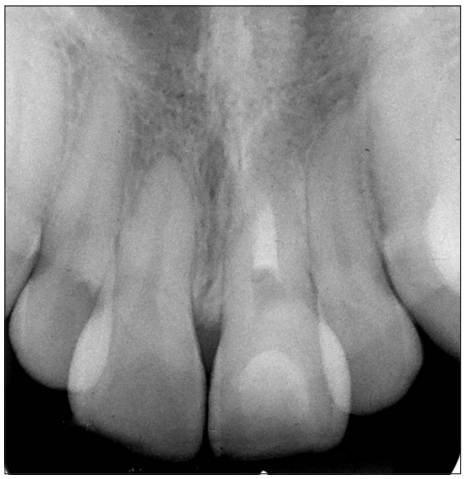

Figure 9: Radiograph showing resorption area stabilization 6½ years after replantation

an alternative for anterior teeth.[33-36] A crown darkening enhancement was noted when gray MTA was used as at the time the endodontic obturation was performed, white MTA was not commercially available in Brazil at the time when the tooth was filled.

A multidisciplinary tooth trauma approach is indispensable because many patients also have other dental treatment needs, such as in malocclusion cases when orthodontic intervention is needed. Every orthodontic treatment is a resorption risk factor, as an apical inflammation may develop due to the pressure applied to the root during movement, producing ischemic necrosis of the periodontal ligament;[37,38] in this case study, the patient had maxillary atresia. Installation of an upper and lower expansion was chosen because of the favorable growth phase it was in; also, it avoided pressure on the traumatized tooth. It must be emphasized that the minimum 1-year period after resorption stagnation recommended by Andreasen and Andreasen 2001[2] and Kindelan *et al.*, 2008[18] so as to begin orthodontic movement was observed. In agreement with the findings by Tondelli *et al.*, 2010,[19] this study also realized the difficulties professionals have in treating traumatized teeth orthodontically, which may be due to the lack of protocols in literature to deal with this specific situation.

Six months after the orthodontic appliance installation and activation, replacement resorption at the apical end was noted; this finding, however, coincided with the report of a new trauma on the same tooth. This subluxation was most probably the main reason for the appearance of ankylosis areas, as there had been no orthodontic force on the avulsed tooth that could justify any damage to the periodontal ligament, in spite of the fact that teeth with a history of previous resorptions to orthodontic treatment are more likely to show higher resorption indices during treatment.[19]

The maxillary expansion was finished, and replacement resorption stabilized after a 2-year period. At that moment, the patient's main complaint was the crown darkening. Internal whitening of the avulsed tooth was chosen, and the patient was warned of the possibility of an exacerbation in the resorption process, even though some authors have stated that the connection between devitalized tooth whitening and root resorption is unclear.[20,21] Special care to avoid any contact of the whitening agent with cervical periodontal tissues was taken using a physical barrier with glass ionomer cement after clearing the cervical third of the root canal. The permeability of the tissues in this area might be involved with the beginning of the cervical resorption processes.[20] So far, 1½ year after the whitening process was performed, no evidence of new resorption areas, tooth mobility, or other symptomatology has been found.

Many traumas have unfavorable prognosis due to the lack of cooperation of patients and their families, who often miss appointments or do not follow professional orientation. In this case report, the patient was always available and motivated for treatment, which was essential for the results obtained so far. The discussion on replantation success still persists, and in many cases, there may be color alteration in the dental crown and controlled root resorption that do not characterize failure.[39,40] The absence of symptoms and mobility, a normal eruption pattern, and percussion and sensitivity tests showing no alterations are characteristics that favor success, as suggested by the International Association of Dental Trauma.[41,42]

Therefore, considering all therapeutic choices that have been incorporated into the treatment of this patient, replantation has been successful, as the tooth is still functional and the critical growth period for other kinds of rehabilitation is over. The possibility of avulsed teeth receiving various dental treatments, provided there is strict professional follow-up by controlling the risks and benefits of each therapy, as well as the patient's cooperation, is emphasized.

CONCLUSION

The present case report shows that the multidisciplinary approach in the replantation of the avulsed teeth enables the reestablishment of function and esthetics.

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