

## DENTAL AVULSION, FROM DENTAL REPLANTATION TO DENTAL IMPLANT: A CASE REPORT WITH A 20-YEAR FOLLOW-UP

Erica Lopes Ferreira<sup>1</sup>, Flares Baratto Filho<sup>1,4\*</sup>, Gisele Maria Correr<sup>1</sup>,  
Denise Piotto Leonardi<sup>1</sup>, Luiz Fernando Fariniuk<sup>2</sup>,  
Edson Alves de Campos<sup>1</sup> and Paola Cristine Valença<sup>3</sup>

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### ABSTRACT

Traumatic dental injuries are common. Appropriate therapy depends on the ability of the professional to make a correct diagnosis and his knowledge and experience. This study reports a case of avulsed left central incisor and the crown-root fracture of maxillary right central incisor. Endodontic therapy of the replanted tooth was made and its course from the appearance of the resorption process to the loss of the tooth and placement of an implant was reported. Teeth conditions preservation, time between the trauma and treatment, and the development stage of the root are important factors influencing for success of the dental replantation.

**Keywords:** tooth injury, dental avulsion, root resorption.

### RESUMO

O traumatismo dental é uma injúria que ocorre frequentemente e o sucesso de seu tratamento depende de terapia adequada assim como o correto diagnóstico, conhecimento e experiência por parte do profissional. O presente estudo relata um caso de incisivo central superior esquerdo e a fratura corono-radicular do incisivo central direito. Foi realizado o tratamento endodôntico do incisivo reimplantado e o acompanhamento desde a instalação de um processo de reabsorção até a perda do dente e colocação de um implante na região. A condição de preservação do dente, o tempo entre o trauma e o tratamento e o estágio de desenvolvimento da raiz são fatores importantes e que influenciam no sucesso do reimplante dental.

**Palavras-chave:** injúria dental, avulsão dental, reabsorção radicular.

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Correspondence to: Dr. Flares Baratto Filho

\*R. Geraldo Lipka, 65/101, Mossunguê, 81200-590 Curitiba, PR, Brasil. Tel: +55(41) 3015-2712 — E-mail: [fbaratto@uol.com.br](mailto:fbaratto@uol.com.br)

<sup>1</sup>PhD, Department of Endodontics, Positivo University, Curitiba, PR, Brazil.

<sup>2</sup>PhD, Department of Endodontics PUC/PR, Pontifical Catholic University of Paraná, Curitiba, PR, Brazil.

<sup>3</sup>MSc Student, Department of Endodontics, Positivo University, Curitiba, PR, Brazil.

<sup>4</sup>PhD, Department of Endodontics, University of Joinville, Joinville, SC, Brazil.

## CLINICAL RELEVANCE

This case reported points out the problems that can occur over time in cases of dental trauma. Presently, other treatment options are available rather than the protocol followed in this case.

## INTRODUCTION

Dental trauma, such as luxations and avulsions, fractures of the tooth root and alveolar bone require immediate repositioning and the installation of a semi-rigid or flexible splint for stabilization [2]. These clinical situations can be a very serious for the patient and the professional. There are circumstances where loss of the traumatized tooth is inevitable in despite of a wideness of treatment options that can be conferred to maintain the tooth after the trauma. Avulsion (exarticulation) is a complete displacement of a tooth from its alveolus and represents a complex and dramatic injury that may affect multiple tissues [4, 25]. This tooth injury in permanent teeth are relatively rare ranging from 0,5% to 3% [3]. Success rates of replanted teeth are about 55% for mature teeth after 10 years [7].

The treatment option for the avulsion is the tooth replantation. The clinical procedures must follow an order that will allow maximum permanence of the tooth in the oral cavity [5]. It is well established that the prognosis of traumatized teeth in general and of avulsed teeth in particular depends on prompt and appropriate treatment [1, 10, 25]. Teeth subjected to trauma should be splinted after repositioning in order to prevent motion and injury to the pulp or the periodontal ligament during the healing phase [4]. In spite of this, recent studies have dared the rules for the avulsed teeth handling evidence that the duration of splinting period and type of splint are not significant variables in pulpal and periodontal healing [7]. An estimated mean of survival time for replanted avulsed permanent teeth is 57 months [22]. The most common complications after avulsions are necrosis of the pulp and root resorptions. Resorption and eventually tooth loss happens and can be related to ankylosis or inflammatory resorption [6]. Treatment is often complex, time consuming and expensive and requires multidisciplinary approaches such endodontic and periodontal treatments, surgery, orthodontic movements, as well as esthetic coronal restoration [23].

The present report describes the clinical procedures from the moment the avulsion occurred, the replantation, the resorption process that led to tooth loss and the placement of an implant. Clinical-radiographic follow-up was performed during 20 years and led to a revision of the treatment protocol for dental avulsion.

## CASE REPORT

A 21-year-old Caucasian male suffered a car accident that led to the crown-root fracture of the maxillary right central incisor and the avulsion of the maxillary left central incisor (Fig. 1). Emergency hospital and dental treatment were performed. The left central incisor was replanted 5 hours after the accident. The dental element had remained dry in the automobile until dental care (Fig. 2).



**Figure 1** – Crown-root fracture of the maxillary right central incisor and the avulsion of the maxillary left central incisor (September 1987).

The region was radiographed and fracture of the alveolar bone was not found. The tooth and the alveolus of the left incisor were washed with saline and replantation was performed with a slow and firm movement. The tooth was stabilized with a semi-rigid splint with 1.0 mm nylon thread and light-cured resin was applied from the right canine to the left canine. Pulpectomy of the right central incisor was performed and a corticoid-antibiotic dressing was applied (Otosporin, Glaxo Wellcome-ICI, Rio de Janeiro, RJ, Brazil).

After 10 days, the splint was removed and a rubber dam was placed on the replanted tooth. The left central incisor root canal was instrumented with stainless steel hand files to the working length till the #45 size and 2% NaOCl was used for irrigation. The determination of root canal length was made subtracting 1 mm of the tooth length. A coronal access, exploration and cleaning of the root canal were per-

formed. A calcium hydroxide-based dressing (Hidróxido de Cálcio, Salvena, Curitiba, PR, Brazil) with propylene glycol as the vehicle and zinc oxide for radiopacity was applied. One percent sodium hypochlorite was used for irrigation.



**Figure 2** – The left central incisor was replanted 5 h after the accident. The dental element had remained dry in the automobile until dental care (September 1987).

The dressing was removed after one week with 1% sodium hypochlorite irrigation, the canal was dried and the dressing was replaced. The dressing was changed every 15 days for the first two months. After this, it was changed every 30 days, up to 1 year (Fig. 3). The coronal access was sealed with glass ionomer cement. During the dressing changes, radiographs were performed and apical external replacement resorption was found.

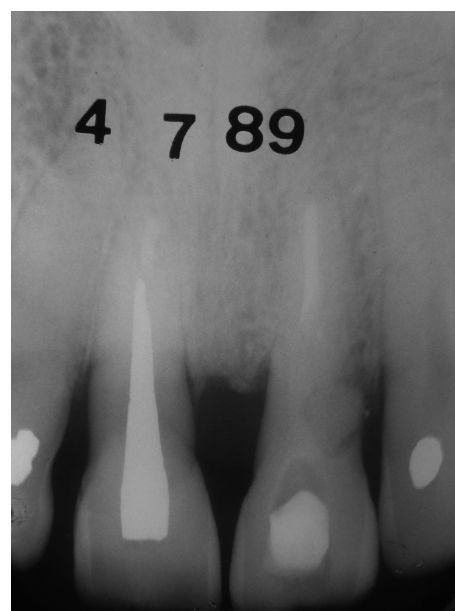
The right central incisor was endodontically treated with stainless steel hand files to the working length and 2% NaOCl was used for irrigation. A post-core system was placed and the original dental fragment was placed with adhesive (Fig. 3).

After one year of treatment with calcium hydroxide intracanal dressings, the endodontic seal was performed with gutta-percha cones (Maillefer, Ballaigues, Switzerland) and zinc oxide (SS White, Rio de Janeiro, RJ, Brazil) by the lateral condensation technique.



**Figure 3** – The calcium hydroxide-based dressing was applied in the left central incisor (November 1987 until December 1988).

Almost two years after the accident, a new radiograph was taken and cervical inflammatory resorption was observed. Trying to control this resorption, the seal was removed at the cervical portion and a calcium hydroxide dressing was again placed (Fig. 4).



**Figure 4** – Almost two years after the accident, a new radiograph was taken and cervical inflammatory resorption was observed and the calcium hydroxide-based dressing was again applied.

A new period of dressing changes was begun until a communication between the root canal and the resorbed area was found (Fig. 5). Zinc oxide was used for internal sealing of the communication, a new dressing was placed, and the tooth was finally restored. The tooth was maintained under clinical and radiographical control of the area with external cervical resorption and associated bone lesion. Four years after the accident, the resorption increased (Fig. 6).



**Figure 5** – Three years and a communication between the root canal and the resorbed area was found.

Almost five years after the accident, the tooth fractured at the cervical portion and was extracted (Fig. 7). The region received a dental implant (IMZ, Mannheim, Germany) (Fig. 8) that has been in place for 15 years (Fig. 9).

The right central incisor with crown-root fracture was endodontically treated and, after periodontal treatment, a post-core system was placed and the original dental fragment was placed with adhesive. Two years later, a prosthetic crown substituted the dental fragment, and nine years later a root fracture occurred and an implant (Interpore, Mannheim, Germany) and a prosthetic crown also substituted the tooth (Fig. 9).

## DISCUSSION

Dental trauma requires multidisciplinary treatment because it involves medical, dental and bio-psycho-social factors. According to the literature, dental avulsion corresponds to 5-16% of traumatic injuries,

occurring more frequently in the maxillary central incisors and in men [17, 18]. The main factor for the different values between these reports is that the patient with an avulsed tooth arrives at the clinic or hospital in different conditions, requiring different treatments and, therefore, different prognosis.



**Figure 6** – The resorbed area increased (November 1991).

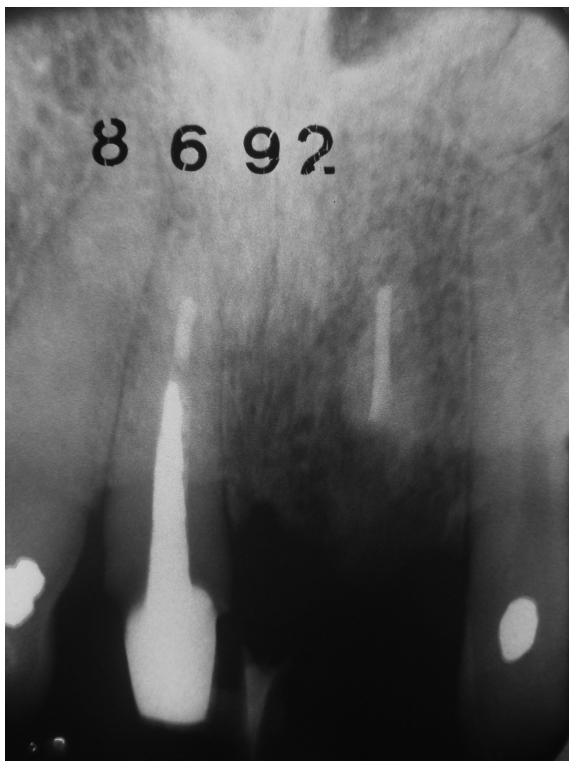
Standard protocols must be followed for patients with dental trauma, i.e., examination of the avulsed tooth, cleaning of the region and the tooth, replantation of the tooth, splinting of the tooth, appropriate medication and follow-up. Several factors are involved: extra-alveolar time, where the tooth was kept, and clinical procedures for the treatment of the avulsed tooth (endodontic therapy and surface treatment).

The tooth must be replanted as soon as possible to avoid damage to the periodontal ligament cells because their vitality decreases with time [6]. In the reported case, extra-alveolar time was a factor that contributed negatively to the prognosis. The acceptable time is 30 min [6], and in this case the tooth was replanted 5 h after avulsion.

The soaking and transport solution of the avulsed tooth influences the replantation success more than the extra-alveolar period. In the present case, the tooth was kept dry for a long period of time. According to the literature, the observed resorption process should have been expected [11, 13, 20, 24]. A more appropriate procedure would have been to keep the tooth in a soaking



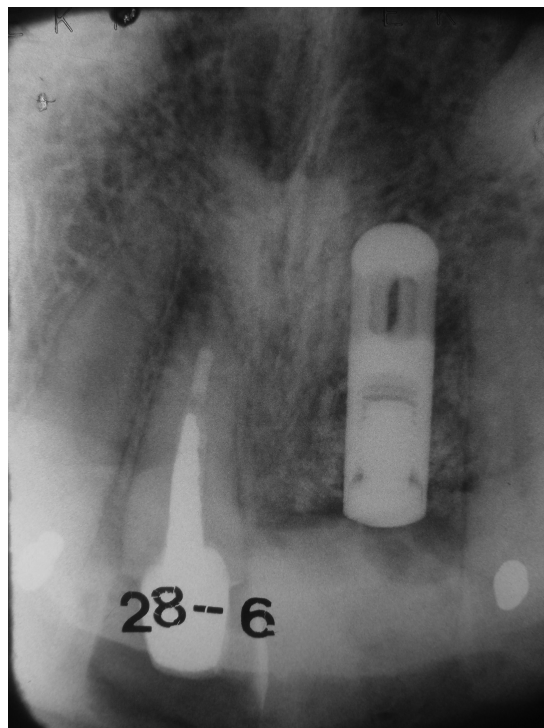
solution during transport, such as Hank or Viaspan solution [10]. However, milk could have been used because it is easy to obtain [12]. Saliva and tap water are also solutions cited by authors, however, these are the least efficient [11, 12, 17].



**Figure 7** – Almost five years after the accident, the tooth fractured at the cervical portion and was extracted.

For splinting of the replanted tooth, the literature highlights the semi-rigid or the flexible type, differing for the time of permanence [13, 17, 18, 19] and the rigid splint with stainless steel is only indicated when bone fracture or dental fracture occurs simultaneously [13]. The use of analgesics and/or anti-inflammatory medications and antibiotics post-replantation are recommended and, if necessary, tetanus vaccine or specific immunoglobulin should be given [13, 19].

Endodontic therapy must be initiated by pulp extirpation (in cases where there will not be re-vascularization). After instrumentation, a calcium hydroxide intracanal dressing must be placed for 7-10 days [8, 21]. Some authors suggest that the first dressing must have a hydrosoluble aqueous vehicle (distilled water, saline or anesthetic solution). One week later, the dressing must be changed and reapplied with a viscous hydrosoluble vehicle of slow ionic release (propylene glycol, polyethylene glycol, glycerin) [14]. In the present case, propylene glycol was applied from the initial dressing due to properties reported in the literature [15].



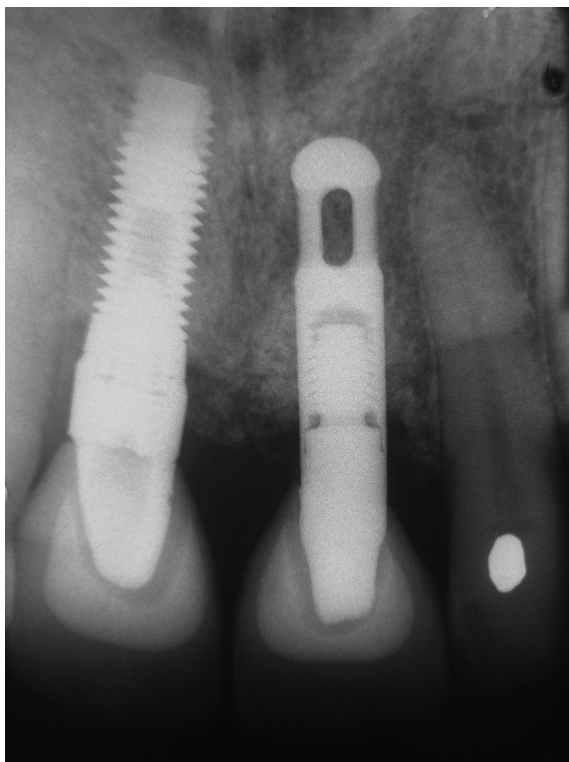
**Figure 8** – The region received a dental implant (June 1992).

Many studies show that frequent dressing changes are unnecessary and can damage the repair process. It has been shown that the pH reached in the dentine mass at the first dressing placement is not obtained in successive changes. Therefore, it is recommended to reduce the number of dressing changes and limit them to when needed, i.e., when the temporary seal is lost [14].

Research shows contradictory results regarding the time calcium hydroxide should remain in the root canal. Studies with the calcium hydroxide dressing showed the same results when left in the root canal for 30 days and for 6 to 12 months [16].

Inflammatory resorption is progressive when there is stimulation of resorption cells by an increase in pressure in the tissue, infection or systemic diseases, or change in the balance of osteoblastic and osteoclastic action which is favored by the acid pH. These are ideal conditions for hard tissue resorption. This is frequent with avulsed teeth but it can be prevented or stopped by calcium hydroxide dressings [1, 6, 24].

Endodontic therapy was performed with calcium hydroxide dressings because of their antibacterial, mineralizing and histocompatible properties, which are fundamental for successful treatment [24]. Calcium hydroxide decreases the inflammatory process of the dentine structure and the surrounding tissues leading to healing at physiological levels [24].



**Figure 9** – The dental implant has been in place for 15 years (December 2007).

Cervical inflammatory resorptions are rarely interrupted and, as shown in the literature, they are associated with trauma and internal bleaching (their evolution is silent and frequently associated to the presence of microorganisms). The gingival sulcus is a permanent source, although it has been reported that the diffusion of calcium hydroxide is quicker in the middle and cervical thirds [16]. Bone loss associated to the area of resorption can damage the implantation of the surrounding teeth and must be controlled with clinical and radiographic follow-up.

Another aspect to be considered is the instituted therapy. All periodontal ligament fibers had been destroyed due to the long extra-alveolar period and the lack of soaking solution. In this case, it would be recommended to perform the late replantation technique, in which endodontic treatment is performed before replantation with radiographic follow-up. Some authors recommend the surface treatment, i.e. the placement of the tooth in 2,4% sodium fluoride for 20 min and the use of biology-based product like enamel matrix proteins applied on the root surface prior replantation to slow the resorption process [4, 5, 22]. When the present case occurred, this protocol did not exist or it was not followed in Brazil. Currently, dental implants should also be considered in adult patients when prognosis is not favorable.

Immediate bone damage was observed, especially surrounding the avulsed tooth. Because of the resorption after replantation, a greater

amount of bone was found than when replantation is not performed. Currently, there are alternatives to avoid this bone loss such as graphs.

Emotional aspects of the patient must also be well evaluated in these cases. These patients must be informed of the entire treatment plan so that they can evaluate it with their family, in cases of young children, if this is the best therapy to be instituted.

Recently, literature proposed that the MTA should be maintained in the root canal to stop resorption processes and the placement of MTA for non-surgical treatment may be a good option, provided it is a carefully placed and condensed on the resorption area. In this case, when cervical inflammatory resorption was observed, if MTA existed this could be applied trying to control the root resorption instead the calcium hydroxide dressing [9].

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