

## SUCCESSFUL TREATMENT OF A MULTIPLE DENTAL TRAUMA: CASE REPORT OF COMBINED AVULSION AND INTRUSION

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### ABSTRACT

The occurrence of a combined injury involving both avulsion and intrusion is extremely rare, and an ideal treatment of this type of dental trauma is not well established. So, our objective is to relate several challenges that the professional might have to deal with. In this case report, the trauma injuries were: #11 avulsed tooth was avulsed and replanted after 30 minutes of dry storage; #21 tooth presented a light intrusion; #22 tooth was avulsed and missed, resulting in a clinical gap. The early stage of development of the teeth was critical for the treatment plan and outcomes. The replanted avulsed tooth did not demonstrate ankylosis, even after the dry storage and the extensive time of splinting. The intruded tooth re-erupted naturally to the normal position.

**Keywords:** avulsion, intrusion, multiple trauma.

### RESUMO

A ocorrência de lesões traumáticas dentárias envolvendo, simultaneamente, avulsão e intrusão em um mesmo paciente são muito raras, assim como o tratamento adequado para este tipo de trauma dental, ainda não está bem estabelecido. Desta forma, nosso objetivo será descrever os desafios que o clínico encontra frente a um evento desta natureza. Neste relato de caso, os traumas dentários ocorridos foram: avulsão do elemento dentário #11, o qual foi reimplantado após 30 minutos, estocado em meio seco; leve intrusão do elemento dentário #21 e avulsão e perda do elemento dentário #22, o que resultou no surgimento de um diastema. O estágio inicial de desenvolvimento dos dentes envolvidos foi um fator crítico para a condução e o resultado do tratamento. O elemento dentário reimplantado não apresentou anquilose, mesmo após ter sido mantido em meio seco e esplintado por um longo período. O elemento dentário intruído retornou à sua posição natural após sofrer reirrupção.

**Palavras-chave:** avulsão, intrusão, múltiplos traumas.

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## INTRODUCTION

Traumatic injuries to newly erupted permanent anterior teeth are common during childhood and adolescence. Definitely, intrusive luxation and avulsion are the most serious, complicated and controversial dental traumas [24].

An intrusive luxation is an axial displacement of the tooth into the alveolar socket [4, 6]. In a recent epidemiological study, Andreassen et al. [7, 8] found that intrusion of permanent teeth is a rare injury, affecting only 1.9% of traumatic injuries involving permanent teeth. The main etiologic factor appeared to be falling, which resulted in axial impacts on maxillary or mandibular teeth, crushing the periodontal ligament fibers. This kind of dental trauma over a maxillary permanent incisor produces severe damage to the tooth, periodontal ligament and pulp tissues [8].

The dental avulsion is more frequent in the permanent incisors of children from 7 to 9 years of age, when the central incisors are erupting and the periodontal ligament provides only minimal resistance to an extrusive force [1, 2]. When a tooth is avulsed, attachment damage, pulp necrosis and small localized cemental damage occurs. If the periodontal ligament left attached to the root surface does not dry out, the consequences of tooth avulsion are usually minimal [3, 21]. However, if excessive drying occurs, these periodontal ligament cells will elicit a severe inflammatory response, with physiologic bone re-contouring on the root surface, what will cause tooth loss [1, 23].

The occurrence of a combined injury of both an avulsed and an intrusively luxated tooth is extremely rare. A previous study, analyzing the etiology and the pathogenesis of traumatic dental injuries did not show an association between these injuries in 196 cases of avulsion and 40 cases of intrusive luxation [2].

This case report describes the management of a rare traumatic dental injury, involving two different traumas: an avulsion and an intrusive luxation.

## CASE REPORT

A 7-year-old male patient was referred to a private clinic immediately after falling onto the ground with total avulsion of the right central incisor (#11) and the left lateral incisor (#22). Reports of the first appointment related that the child had laceration injuries on the gingival tissue between teeth #12 and #22, and that the #11 avulsed tooth stayed out of the socket for 30 minutes in dry storage. The left lateral incisor (#22) was lost after the trauma. Emergency treatment at the time involved rinsing the avulsed #11 tooth in saline solution, repositioning it in its socket with no fixation. A gingival suture was performed between #11 and #21 teeth to connect vestibular and palatal papilla.

Afterwards, the patient was referred to the Dental Traumatology Center of the Dentistry School – UERJ (Brazil), where a detailed clinical and radiographic examination was performed. In the clinical oral exam, the trauma injuries were detected only on the maxillary teeth (Fig. 1).

- The avulsed right central incisor (#11) was correctly positioned in its socket;
- The left central incisor (#21) demonstrated a light intrusion;
- A gap could be observed between the left central incisor and the left canine associated with the avulsion of the left lateral incisor (#22).



**Figure 1** – The patient was submitted to previous emergency treatment at a private clinic. Injuries associated to the trauma: #11 avulsed tooth (positioned in the socket); light intrusion of #21 tooth; avulsed #22 tooth; and laceration injuries.

The radiographic examination confirmed the correct positioning of #11 tooth and the intrusion of #21 tooth. The empty alveolar socket related to the missing #22 tooth was also observed. The radiography also revealed incomplete apex formation of the teeth (Fig. 2).

At the Traumatology Center, a semi-rigid fixation was placed with #8 nylon thread plus light-curing resin, incorporating the intruded tooth (Fig. 3). Occlusal adjustment, antibiotic therapy, instruction about the importance of plaque control using chemical and mechanical methods were accomplished.

## Follow-up

A complete clinical and oral examination was performed in every follow-up session, including cold and electric pulp tests, percussion and radiographs of all anterior maxillary teeth.



**Figure 2** – Radiographic examination of the traumatized area. Position of the avulsed and intruded teeth and an empty socket related to the avulsed #22 tooth, with an incomplete apex formation. Teeth demonstrated incomplete root apex formation.



**Figure 3** – Semi-rigid fixation including the intruded tooth.

During the first three months, the patient was examined every 15 days to verify the stability of the #11 avulsed tooth and the pulp vitality of all anterior maxillary teeth. The semi-rigid fixation was only removed after this period. The #11 tooth demonstrated pulp necrosis and root canal treatment was indicated. Despite the intrusive luxation injury, a conservative treatment of the pulp tissue of #21 tooth was the elected treatment, considering the small displacement, the pulp vitality and the immature root development stage of the tooth.

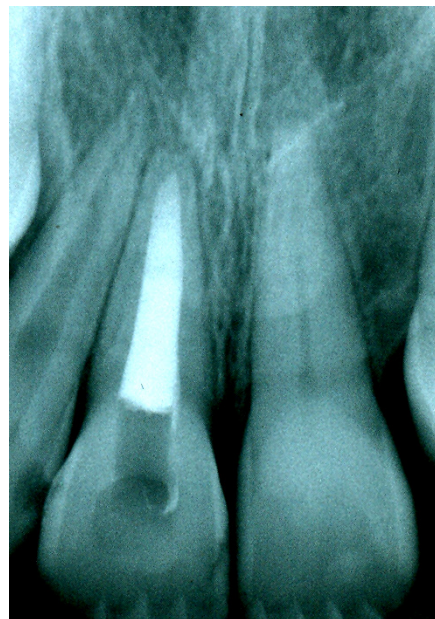
#### Endodontic Treatment of #11 tooth

After coronal opening, the root canal was prepared. A calcium hydroxide-based root canal dressing was used and changed every 3 months during one year. After this period, an apical plug with mineral trioxide aggregate (ProRoot™ – Dentsply, Tulsa, OK, USA) was set be-

fore the root canal obturation with gutta-percha and Pulp Canal Sealer (Kerr Corporation, Orange, EUA) (Figs. 4 and 5).



**Figure 4** – One year after the trauma. MTA apical plug.



**Figure 5** – One year after trauma. Root canal filling of the avulsed tooth. Root canal constriction of the intruded tooth.

#### One year

During the first year, follow-up sessions were performed every 3 months. One year after the trauma – when the root canal treatment of the #11 tooth had been finished –, it was possible to observe that the intruded #21 tooth re-erupted to the normal position. Diagnostic tests and percussion confirmed vitality of the anterior maxillary teeth (except for #11 tooth).



The radiographic exam demonstrated a complete root apex formation of all anterior maxillary teeth. Tooth #21 revealed root canal constriction, indicating signs of pulp damage. As pulp vitality was detected after the cold test, the endodontic treatment was not performed at the moment (Fig. 5).

The patient was advised to search for a rehabilitation treatment for the space between the left central incisor and the canine, which was produced by the avulsion of the #12 missed tooth.

Follow-up sessions were scheduled for every six months.

#### Four years

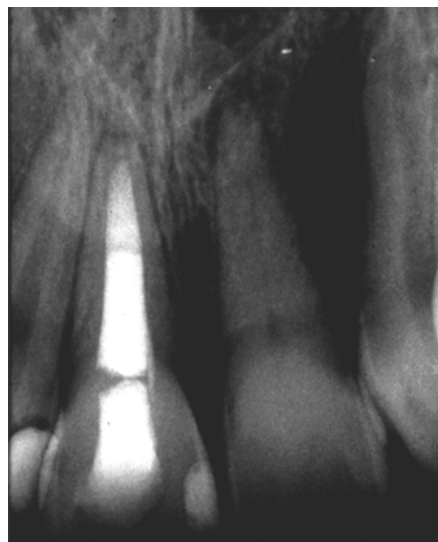
The patient did not return for the follow-up sessions. Therefore, a new examination of the patient was performed three years after the last appointment, i.e. four years after the trauma.

The oral examination revealed normal clinical appearance, signs and symptoms. The patient had not searched for a rehabilitation treatment for the gap of the #22 avulsed tooth. Nevertheless, the #23 tooth (and all the posterior maxillary teeth) moved mesially and occupied the space of the left lateral incisor (Fig. 6).

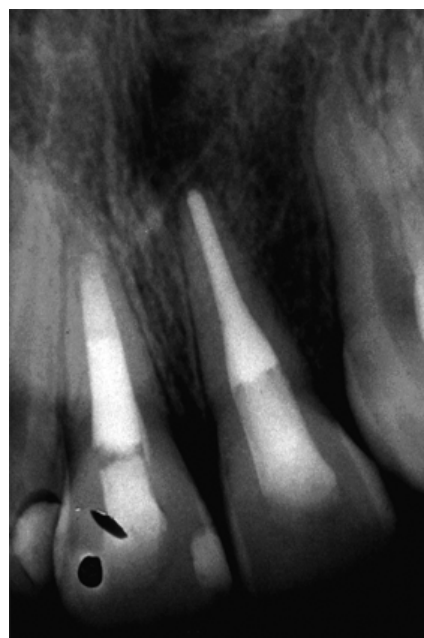


**Figure 6** – Four years after the trauma. The left canine on the position of the #22 missed tooth.

The radiographic exam revealed the success of the endodontic treatment of #11 tooth, with normal appearance of the periapical region. However, a radiolucency could be detected around the apex of the intruded #21 tooth (Fig. 7). Cold and electric pulp tests revealed a negative response as well as the tooth sensitivity to percussion. The endodontic treatment was then performed at the same session: the coronal opening was performed without anesthesia (confirming the diagnosis of necrotic pulp) and, after preparation, root canal filling was performed with gutta-percha and Pulp Canal Sealer (Kerr™) (Fig. 8).



**Figure 7** – Four years after the trauma. Radiolucency around the apex of the intruded tooth.



**Figure 8** – Root canal treatment of the intruded tooth.

#### DISCUSSION

Intrusive luxation and avulsion have different sources in the medical literature [1, 2, 7, 8]. Luxation injuries frequently affect two or more teeth, while avulsions usually involve a single tooth [4]. The International Association of Dental Traumatology (IADT) and several scientific articles provided guidelines and information about the treatment of these dental traumas when they appear individually. The literature concerning dental trauma provides too little information about the coexistence of two or more traumatic conditions of the dentoalveolar complex.

The exact mechanisms of the occurrence of these multiple traumas are not described; still, there is no accepted term to define them. Therefore, an ideal treatment of a dental trauma involving both avulsion and intrusion is not well established [13, 19]. Kenny, Barret & Casas (2003) highlighted the importance of always remembering that distinct conditions require different treatments [10]. So, the objective of describing this multiple dental trauma is to relate several challenges that the professional might have to deal with. The treatment and outcomes of a case of dental trauma -especially avulsion- are related to many factors:

1. stage of development of the tooth;
2. consequences of the trauma;
3. emergency treatment;
4. treatment plan and patient compliance to the treatment.

The reported clinical success of avulsed teeth replanted varies from 4% to 5%. Authors agree that the most important factor to avoid root inflammatory resorption is to minimize severe damage to the periodontal ligament cells, what increases after 18 minutes of dry storage [1, 7, 11, 14, 15, 17, 20]. In the present case, the avulsed tooth stayed in dry storage for 30 minutes, but the replantation proved to be successful after 4 years. This might be related to the early stage of development of the tooth by the time of the trauma [14].

Another important factor related to the success of the replantation is the endodontic treatment. Andreasen et al. (1995) related that 10-50% of immature teeth may be revascularized following replantation, but in the case of pulp necrosis the endodontic treatment is indicated. Avulsion causes an acute traumatism directly over the Hertwig's root sheath, which can impede, partially or completely, root development [1, 10, 13]. The endodontic treatment of teeth with open apices is a difficult challenge and calcium hydroxide dressing is used to treat the endodontic infection and to induce the apexification. In the present case, after one year, although the radiography demonstrated an apical hard tissue barrier, an apical stop was not clinically achieved. A ProRoot apical plug was therefore performed so as to improve root canal sealing. The mineral trioxide aggregate (MTA) has been proposed as a material suitable for apical plugging as it combines both biocompatibility and bacteriostatic action, with favorable sealing ability [12, 22]. It also serves as a barrier, allowing vertical condensation of warm gutta-percha in the remainder of the canal.

In this trauma, the most difficult and serious damage was the avulsed tooth. So, the main objective of the initial treatment was to preserve this tooth in the patient's mouth. For the avulsion, a splinting technique that allows a physiologic movement of the tooth during healing and that is in place for a minimal time period results in a decreased

incidence of ankylosis [16]. However, in the case of a tooth intrusion with open apex, no fixation is recommended because of the great potential of natural extrusion [1, 9]. In the present treatment, because of the missing of #22 tooth, it was necessary to include the intruded #21 tooth in the fixation. Even maintaining the fixation for the very long period of 3 months, the results achieved were considerably good. After one year, the intruded #21 tooth naturally re-erupted to the normal position and, after four years, the success was confirmed by the radiographs that demonstrated the absence of ankylosis of the #11 avulsed tooth.

Another critical issue regarding the outcomes of a dental trauma is the patient's compliance to the treatment. In many cases, a patient needs to return to the dentist's clinic several times; sometimes, for only some clinical and radiographic examinations, but others for a discomfortable intervention. This is the most common cause of patients' treatment neglect [11, 18]. The patient returned for every evaluation and treatment proposed during the first year, but, in the following three years, he missed the scheduled sessions. When the patient finally returned, pulp necrosis and periapical radiolucency of the #21 intruded tooth were detected. A conventional endodontic treatment solved the problem, but discoloration of the tooth crown and severe periapical inflammation might have occurred during this period. The treatment was even more successful through the natural resolution of the gap related to the #22 missed tooth. A very acceptable esthetics was achieved after a passive migration of the left canine and the posterior teeth to the position of the left lateral incisor missed tooth.

## CONCLUSION

This case report relates the challenges of the treatment of a dental multiple trauma. The treatment guidelines of avulsed and intruded teeth are well described in the literature when they occur individually. However, in a multiple trauma, the clinician has a very important role in the treatment. The authors agree that the objective of the treatment needs to be focused on the most serious damage and on the prognosis of healing. Therefore, the clinician has to be prepared to recognize the problems and to adapt the guidelines to these situations.

The early stage of development of the teeth was critical for the treatment plan and for the outcomes. The revascularization of the avulsed tooth with open apex did not occur. Nevertheless, the root did not demonstrate ankylosis, not even after the dry storage until replantation, and the extensive time of splinting. The intruded tooth re-erupted naturally to the normal position.

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