ARTICLES SCIENTIFIQUES

Management of severely Intruded Immature Maxillary teeth by Regenerative Approach

Prise en charge régénérative des dents maxillaires immatures sévèrement intruses par une approche régénérative

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Abstract

Intrusive luxation is a severe form of dental trauma that can lead to a number of serious complications, including pulp necrosis and root resorption. Management of intrusive luxation depends on a variety of factors, but spontaneous re-eruption or orthodontic/surgical repositioning are the most common options. Repeated trauma to the same tooth can negatively impact the prognosis, making treatment even more complicated.

This case report describes the clinical management of an immature necrotic tooth that suffered a second dental trauma. The tooth had previously been treated with pulp revascularization, but this failed. The patient was ultimately managed with an alternative filling therapy. It also highlights the complexity and challenges of managing intrusive luxation, particularly in cases of repeated trauma. It also underscores the importance of individualized treatment planning and the need for careful long-term follow-up.

Key words

intrusive luxation, pulp revascularization, platelet-rich fibrin, blood clot, immature too

Résumé

La luxation intrusive est une forme sévère de traumatisme dentaire pouvant entraîner de nombreuses complications graves, notamment la nécrose pulpaire et la résorption radiculaire. La prise en charge de la luxation intrusive dépend de divers facteurs, la ré-éruption spontanée ou le repositionnement orthodontique/chirurgical sont les options les plus courantes. Les traumatismes répétés sur la même dent peuvent avoir un impact négatif sur le pronostic, rendant le traitement encore plus complexe.

Ce cas clinique décrit la prise en charge thérapeutique d'une dent immature nécrosée ayant subi un deuxième traumatisme dentaire. La dent avait déjà été traitée par revascularisation pulpaire, sans succès. Le patient a finalement été traité par un traitement endodontique conventionnel.

Ce cas clinique souligne également la complexité et les défis de la prise en charge des luxations intrusives, notamment en cas de traumatismes répétés. Il insiste également sur l'importance d'un plan de traitement individualisé et d'un suivi à long terme attentif.

Mots clés

luxation intrusive, revascularisation pulpaire, fibrine riche en plaquettes, caillot sanguin, dent immature

INTRODUCTION

Dental trauma presents a multiple of challenges, encompassing psychological, social, and therapeutic considerations. Intrusive luxation, a severe form of dental injury, occurs when a tooth is displaced into the alveolar bone along its axis, usually affecting single rooted teeth such as the central or lateral incisor in children aged 6-12 years. Accidental falls are a common cause of traumatic intrusion, accounting for only 0.3-1.9% of permanent tooth traumas (1,2). The immediate loss of vascular supply in the pulp and severe damage to the periodontal ligament often lead to pulp necrosis and root resorption, with long-term complications (3). Management of the trauma depends on the patient's age, the degree of root development, and the degree of intrusion, with spontaneous re-eruption or orthodontic/surgical repositioning as possible options. However, repeated trauma to the same tooth can negatively affect endodontic treatment and prognosis (4).

This case report details the clinical management of an immature necrotic tooth that suffered a second dental trauma, previously treated with pulp revascularization and subsequently managed with an alternative filling therapy.

CASE REPORT

An 8-year-old girl was referred to our endodontics department 48 hours after experiencing dentofacial trauma resulting from a fall down the stairs. During the intraoral examination, we observed complete intrusion of two teeth, specifically tooth 21 and tooth 22, while the left maxillary canine was malposed (fig 1). Our diagnosis was subsequently confirmed by a panoramic radiograph (fig 2). Given that the teeth were immature and the intrusion exceeded 7 mm, we decided to perform surgical repositioning, followed by revascularization. This option seemed to be the best treatment for this case. We provided a complete explanation of the treatment procedures, risks, and benefits to the parent and obtained informed consent.

Figure 1 Total intrusion of teeth 21 ;22

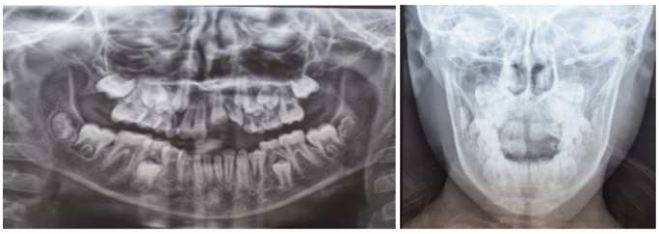

Figure 2 Radiographs showed incompletely formed apices on teeth 21 22 and a totally intrusion

The teeth 21 and 22 were surgically extruded and stabilized in a position similar to the symmetrical teeth by a semi-rigid stainless steel splint (fig 3). Due to the alveolar fracture associated with the intrusion, this semi-rigid splint will be left in place for six weeks (fig 4).

Figure 3 Teeth surgically repositionned

Figure 4 Semi-rigid splint for 6 weeks

After the surgery, the patient was prescribed Augmentin (500 mg, twice daily), along with a pain-relief medication and a mouthwash, to be taken for a duration of 7 days. Additionally, we advised the patient and their parents on maintaining proper eating habits and oral hygiene practices.

The second appointment was rescheduled after 2 weeks. At the second appointment, we observed no signs and symptoms (fig 5), and conducted the revascularization procedure in accordance with the AAE guidelines (5). Initially, we prepared access to pulpal cavities in both teeth. We meticulously removed remnants of necrotic pulp tissue using only manual files, to ensure that the canal walls were not grazed and the root apex was avoided. As expected, we observed no bleeding.

Figure 5 Radiological control after 2 weeks

The pulp chamber canal was irrigated with a 1% concentration of sodium hypochlorite (NaOCl), followed by 20 mL of 17% ethylene diamine tetra acetic acid (EDTA). EDTA is known to expose endogenous growth factor proteins embedded in the dentinal walls (6). The working length was taken radiologically, then calcium hydroxide (CaOH)was placed into the canal. Finally, the canal orifices was sealed by a temporary filling material

After three weeks, the second appointment for revascularization, no signs or symptoms were observed. The semi rigid stainless steel splint (SSS) was removed and a preoperative radiograph was taken. We anesthetized the patient was anesthetized and a rubber dam was placed.

The temporary restoration was removed, and the canal was irrigated with EDTA to remove the CaOH and was dried with paper points. Bleeding was induced into the canal up to the cementoenamel junction (CEJ) by passing a No. 30 K-file through the apex (fig 6,a). Platelet-rich fibrin (PRF) was prepared by centrifuging the patient's own blood (fig 6.b). PRF membrane was introduced into the pulp chamber and carried it to the apical portion with a plugger fig (6.c.d). The access openings was sealed with Biodentine (Septodont®) (fig 6.d,e). Follow-up visits were scheduled for 1, 3, 6, 9, and 12 months (fig7).

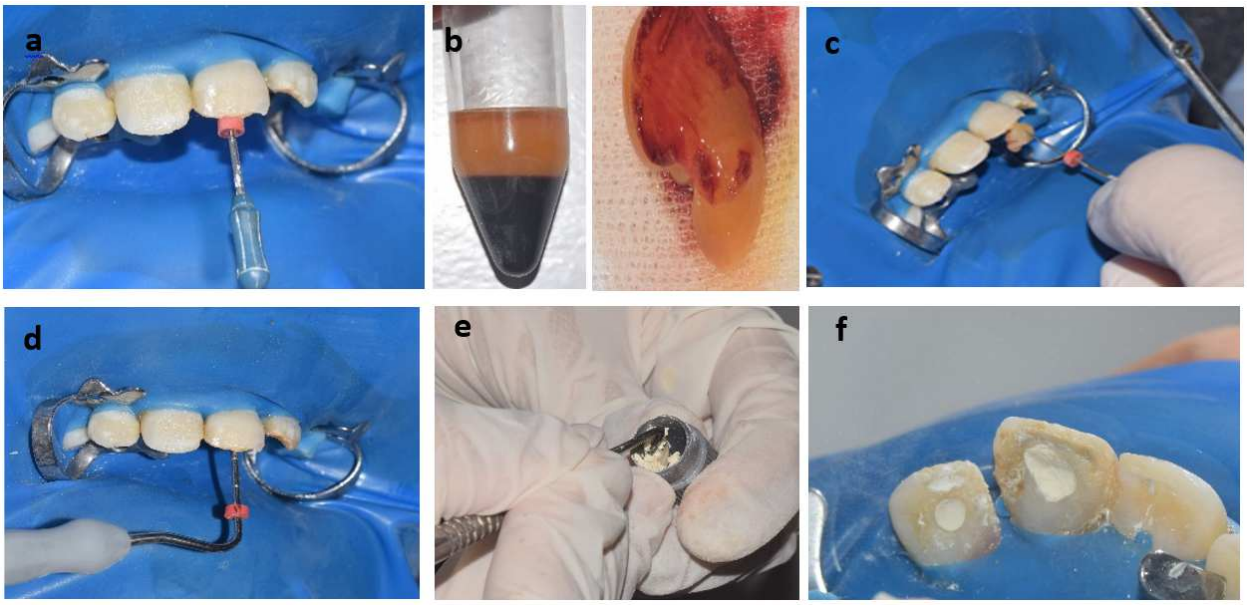

Figure 6 The process of clinical revascularization (a) inducing bleeding into the canal up to the cementoenamel junction (CEJ) (b) PRF membrane (c) PRF membrane was placed into the canal (d) PRF membrane carried it to the apical portion with a plugger (e) Biodentine preparation (f) coronal restauration

Outcome and follow-up

The patient was followed up for 9 months after the revascularization procedure. At each appointment, she reported no symptoms, and the teeth were clinically healthy and stable. There were no symptoms of inflammation. The teeth were not tender on percussion or palpation, and the probing depth remained within normal limits. Thermal and electric pulp testing was performed at each appointment

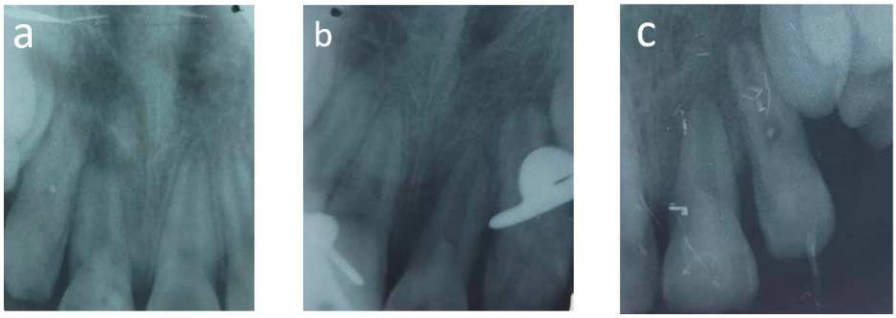

Figure 7 Long term follow-ups. (a) 3-month follow-up; (b) 6-month follow-up; (c) 9-month follow-up

X-rays showed that the root walls had thickened and the roots had developed. This was a positive sign, indicating that the revascularization procedure had been successful (fig7.ab.c).

At the 4th follow-up appointment (12 months), a grade 1 mobility was noted of the central tooth and grade 2 of the lateral tooth. The patient reported that she had a second trauma two months ago. The radiographic examination showed external inflammatory resorption at the level of both teeth. The vitality test was negative. A 3D radiographic examination (CBCT) was requested and confirmed the diagnosis. Our therapeutic decision was to perform endodontic treatment on tooth 21 and extract tooth 22, which is not restorable.

DISCUSSION

Treating intrusive dislocations, especially in immature teeth, is challenging due to varying opinions on the best approach. The stage of root development and the amount of intrusion are the primary factors influencing the choice of treatment (7,8).

For minor intrusive luxation of immature teeth (1-3 mm), treatment options include waiting for spontaneous re-eruption for a few weeks (3-4 weeks) or active repositioning. If the intrusion is more than 7 mm, active repositioning is necessary through surgical procedures or orthodontic appliances (2,9,10).

In this case, report, the intrusion was very severe and more than 7 mm. We chose surgical repositioning to immediately restore function and aesthetics and to start root canal treatment as soon as possible. The first 2-3 weeks after an intrusion injury are critical (11). External root resorption can occur if root canal treatment is not initiated during this time.

Loss of pulp vitality in immature permanent teeth makes them more susceptible to fracture and has a negative impact on their long-term prognosis. These teeth are traditionally treated by apexification using long-term calcium hydroxide dressing or by artificial apical closure via immediate placement of an apical plug consisting of hydraulic tricalcium silicate cement. However, these therapeutic modalities do not allow for continued root development, strengthen the walls, or regain vitality; therefore, the tooth remains fragile (12,13).

Numerous studies and cases have shown that necrotic and immature permanent teeth can be treated with revascularization (14,15). These procedures help to thicken the fragile dentinal walls and lengthen the underdeveloped roots. In this case, we used a modified revascularization technique that combined platelet-rich fibrin (PRF) and blood clot (BC) as a scaffold. A previous study by Nageh et al (2018) used a similar modified revascularization technique with successful outcomes (16). We believe that the combined effect of PRF and BC contributed to the success of the treatment.

In fact Platelet-rich fibrin (PRF) is a second-generation platelet concentrate that does not require the use of blood thinners like thrombin. The platelets and white blood cells are trapped in an organized fibrin network created by PRF. This forms a reservoir for the continuous release of growth factors. The immune cells and cytokines circulating in the PRF clot also help to fight infection. The consistency of PRF also makes it easier to condense the materials used to achieve a coronal seal, such as mineral trioxide aggregate (MTA) or BIODENTINE. These advantages have led to PRF being considered an optimal bioscaffold for use in regenerative endodontic procedures (REP) (14,17,18).

During the first appoitement of revitalization we only use manuel files for instrumentation to avoid further weakening the dentinal walls to protect the stem cells in the apical area Regarding irrigation we were used 1% sodium hypochlorite (NaOCl) for 5 minutes. We then irrigated the canals with saline to flush away the NaOCl and reduce any toxicity that could hinder the regeneration process.

Research has shown that 5.25% NaOCl can reduce the strength of human dentin. Additionally, it can damage the stem cells in the apical area, which are important for odontoblast differentiation. Therefore, there is no need to use NaOCl at a concentration above 1.5% (19,20).

After irrigating with hypochlorite, we used 20 mL of 17% ethylenediaminetetraacetic acid (EDTA) to irrigate the canals for 5 minutes to remove the smear layer (14).

To complement the disinfection of the root canals, Calcium hydroxide was used as an intracanal medicament because it promotes the survival and proliferation of apical papilla stem cells, and also stimulates the release of transforming growth factor- 1 (TGF- 1) from dentin (21,22).

While triple antibiotic paste (TAP) (a 1:1:1 mixture of ciprofloxacin/metronidazole/minocycline) has been proposed as an intracanal medicament to disinfect the canal, its use is not without drawbacks. A study evaluating TAP's efficacy in revascularization cases found that it was successful in 51% of instances.

Other studies have also demonstrated TAP's effectiveness against endodontic microorganisms (23,24).

However, TAP also exhibits several limitations. Research has shown that over 80% of the paste cannot be removed from the tooth and that it can penetrate dentinal tubules rather than remaining confined to the canal lumen. Additionally, complete removal of TAP from root canals has proven challenging furthermore, TAP has been shown to exhibit toxicity towards stem cells, with higher concentrations reportedly detrimental to apical papilla stem cells (25,26).

During the second visit, we used 17% EDTA solution, which has a chelating effect that helps to eliminate calcium hydroxide and to release the growth factors embedded in the dentin during dentinogenesis. For this case, we used a modified revascularization technique that combined platelet-rich fibrin (PRF) and blood clot (BC) as a scaffold. For the coronal seal, we chose biodentine (Septodont®) to avoid the risk of discoloration that MTA can cause (27). During follow-up appointments, the teeth were asymptomatic radiographically. There was evidence of root development and increased thickness of the root walls. The vitality testing gave negative responses at the end of 9 months.

While some teeth treated with regenerative endodontics have shown positive responses to cold and/or electric pulp tests during follow-up visits, none of the teeth in this case exhibited such responses (28,29). Despite not being a definitive indicator of pulp tissue regeneration, a positive pulp test response is considered a prerequisite for regeneration. It is crucial to recognize that the absence of a pulp response does not necessarily equate to a lack of vitality. The presence or absence of responses to cold and electric pulp tests could be influenced by both the coronal level of regenerated tissue and the thickness of filling materials placed over this tissue (30).

Unfortunately, the patient suffered a second trauma, which caused severe damage to the pulp and periodontal tissues, leading to inflammation, infection, and external inflammatory root resorption. Several studies have shown that Teeth that have been traumatized multiple times are more likely to be extracted than teeth that have only been traumatized once. This is because a second trauma can cause severe damage to the tooth, making it difficult to save (31). Dental professionals must educate patients and their guardians about preventive measures to reduce the risk of dental trauma recurrence (32).

CONCLUSION

Pulp revascularization is a promising and effective therapy for the management of permanent immature necrotic teeth following dental trauma. It has been shown to promote tissue regeneration and preserve tooth vitality in a high percentage of cases. However, it is important to acknowledge the risk of recurrent dental trauma, which can potentially compromise the long-term success of the treatment. Dental professionals should be familiar with alternative approaches and techniques for managing immature necrotic teeth, such as apexification. In cases where pulp revascularization is not feasible or fails, these alternative approaches can be used to preserve the tooth and prevent further complications. It is important to tailor the treatment plan to the individual patient's needs and circumstances. Factors such as the age of the patient, the severity of the trauma, and the condition of the tooth will all influence the decision-making process.

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