

Management of Intrusive Luxation of Labially Erupted Immature Maxillary Incisor: A Case Report

Noraida Mamat*, Fadzlinda Baharin, Zuliani Mahmood

Paediatric Dentistry Unit, School of Dental Sciences, Universiti Sains Malaysia, Health Campus, 16150 Kubang Kerian, Kota Bharu, Malaysia

ABSTRACT

Intrusive luxation is one of the most severe types of dental trauma, which causes damage to the pulp and supporting structures of a tooth. Intrusive luxation is associated with an increased risk of pulp necrosis and the development of inflammatory or replacement resorption. Thus, the case report presents a severely intruded immature maxillary incisor with an uncomplicated crown fracture in a seven-year-old boy. The tooth was also ectopically erupted labially with the presence of a supernumerary tooth at the palatal side, which made the management complex. Spontaneous re-eruption was chosen as the treatment option given that the tooth had an immature root formation. The supernumerary tooth was extracted during the first visit to enhance the re-eruption of the intruded tooth. Further review after four months revealed signs of external root resorption and apical periodontitis, thus a root canal therapy with intracanal calcium hydroxide paste was immediately initiated. Radiographic evidence of a calcific barrier formation at the apex was observed after six months with no external root resorption. The tooth had re-erupted completely and migrated into arch alignment. At the end of 24 months, root canal treatment was completed with a favorable prognosis. Subsequent assessments were planned annually for a minimum of five years.

Key words: Intrusive luxation, Immature permanent tooth, Re-eruption, Trauma

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Corresponding author: Noraida Mamat

e-mail ✉: norraida@usm.my

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INTRODUCTION

Intrusive luxation is an axial dislocation of the tooth into the alveolar socket [1]. The prevalence of intrusive luxation is low in permanent teeth, ranging from 0.5% to 1.9% compared to other types of traumatic injuries, which accounts for 5% to 12% of luxation injuries [2]. Luxation injury is considered one of the most severe types of dental trauma that might elicit substantial damage to the periodontal ligament fibres, neurovascular bundle cementum, and alveolar bone [3]. These diverse consequences contribute to the complexity of the healing process. Intrusive luxation is associated with a high risk of complications during healing, such as pulp necrosis, inflammatory root resorption, dentoalveolar ankylosis, loss of marginal bone support, calcification of pulp tissue, disturbance of root development, and gingival retraction [4]. Nevertheless, these complications should

be minimized by the preferred treatment protocol. Factors such as patient's age, the severity of trauma and stage of root development may influence the treatment and prognosis of intrusive luxation [5]. Spontaneous re-eruption, orthodontic repositioning, and surgical repositioning are the commonly recommended treatment modalities for the management of intruded immature permanent teeth [6]. Nonetheless, contrary views exist on what comprises the best treatment for luxation injury [7].

This case report describes the challenge in managing an intruded labially erupted immature maxillary incisor in a seven-year-old patient with the presence of supernumerary.

CASE PRESENTATION

A seven-year-old boy was referred to the Paediatric Dentistry Clinic for the management of an upper tooth injury sustained upon falling at home three days earlier. No episodes of loss of consciousness or discharge from the ears or nose were recorded. However, the patient claimed to experience mild bleeding from the oral cavity, which stopped spontaneously. No previous dental trauma was reported and his medical history was unremarkable.

Intraorally, tooth 11 appeared to be severely intruded with only 2 mm of the incisal edge clinically visible. The tooth was characterised by an uncomplicated crown (enamel) fracture; slightly tender on palpation and percussion and demonstrated no mobility. The gingiva around the tooth was red and swollen but there was neither evidence of traumatic injury to any other teeth nor fully eruption of the adjacent teeth. Tooth 11 also ectopically erupted high labially with the presence of a supernumerary tooth at the palatal side. On further history, the patient's father informed that the supernumerary tooth was erupting soon after the right upper primary central incisor was exfoliated. Then, he noticed that tooth 11 was erupting high labially to the adjacent teeth.

An intraoral periapical (IOPA) radiograph revealed intruded tooth 11 with an enamel crown fracture (Figure 1). The root of tooth 11 was incompletely developed, whereas the periodontal ligament space was diminished and irregular. No evidence of root or bone fractures was observed. Furthermore, one supernumerary tooth was seen palatally to the intruded tooth (Figure 1). Pulp sensibility was only performed for teeth 12, 21, and 22 as a baseline since there was insufficient access to the intruded tooth. Possible spontaneous re-eruption was decided and immediate treatment was performed during the first visit by extracting the supernumerary tooth to enhance the re-eruption of the intruded tooth 11.

The patient was prescribed analgesic for three days and instructed to perform meticulous oral hygiene, daily rinsing with 0.12% chlorhexidine mouthwash and a soft diet for a week. The patient was scheduled for recall in two weeks. Partial re-eruption of the intruded tooth 11 was detected with 5 mm of the crown clinically visible during the subsequent visit (Figure 2). The tooth was slightly tender upon percussion and palpation with no mobility, and the surrounding gingival was normal. Tooth 11 reflected a positive response when subjected to a pulp sensibility test.

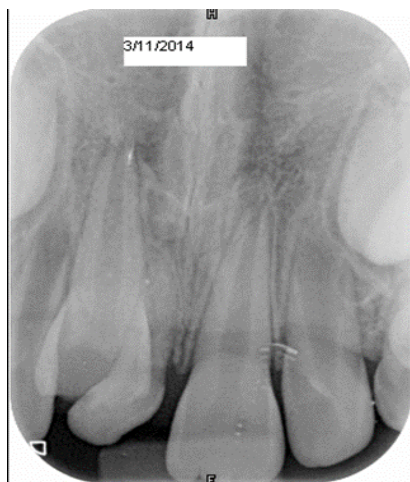


Figure 1: Initial intraoral periapical radiograph showing the intruded right immature maxillary central incisor with uncomplicated crown fracture, diminished and irregular periodontal space and presence of a supernumerary tooth palatally.

As depicted in Figure 3, tooth 11 was fully re-erupted and migrated downward into its position after four months of observation. The tooth was asymptomatic. An intraoral radiograph was taken which revealed signs of external root resorption with periapical radiolucency (Figure 4). The tooth was attempted for root canal treatment to arrest the root resorption with calcium hydroxide. Gaining access to the palatal tooth 11 was still challenging due to the intrusion and high labial location (Figure 5). A retraction cord was placed subgingivally for more visibility of the palatal surface after local anaesthesia and isolation using a rubber dam. The access was carefully performed at the slightly higher part of the palatal surface. The root canal was cleaned, followed by irrigation with 2.5% sodium hypochlorite and saline, dried with paper points and filled with calcium hydroxide (Apexcal). A composite resin was used to restore the fractured crown at the same visit.

The patient was scheduled for a monthly follow-up for six-months. The calcium hydroxide was changed at three months intervals. Follow-up radiographs at three and six-month placement of calcium hydroxide revealed adequate periapical healing. In the third month of calcium hydroxide placement, tooth 11 became greyish-discolored but asymptomatic (Figure 6). At the 10th month post-trauma, radiographic examination indicated the presence of a calcific barrier at the apex, and the external root resorption appeared to have ceased (Figure

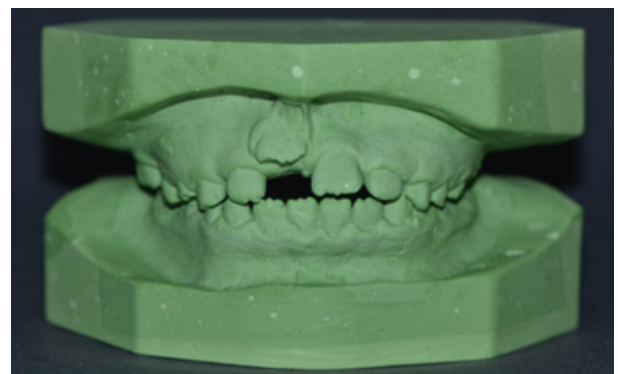


Figure 2: Dental cast of the patient at one month follow-up showing a partial re-eruption of the intruded tooth with 5 mm of the crown clinically visible.



Figure 3: Intraoral view at 4 months follow-up showing complete eruption of intruded tooth [full length of labial surface of the crown visible] and composite restoration.

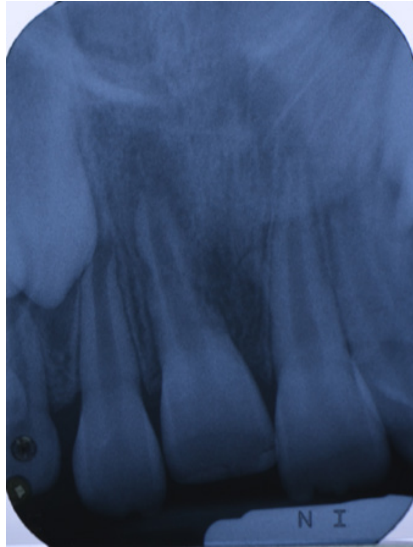


Figure 4: Intraoral radiograph at 4-month follow-up showing signs of external root resorption with periapical radiolucency.



Figure 5: Intraoral view of palatal side of right maxillary central incisor. Note limited access on palatal because of the intrusion and high labially located of the right maxillary central incisor.



Figure 6: Intraoral view at 3 months post pulpectomy showing greyish discolouration of right maxillary central incisor.

7). The tooth continued migrating into its position. It was decided to proceed with the calcium hydroxide intracanal medicament to ensure there was no progress in the resorption process. The tooth was obturated with gutta-percha and root canal sealer (AH Plus, Dentsply MailleferU, SA) at the end of 12 months post-trauma (Figure 8). The final restoration was completed with composite resin and glass ionomer cement.

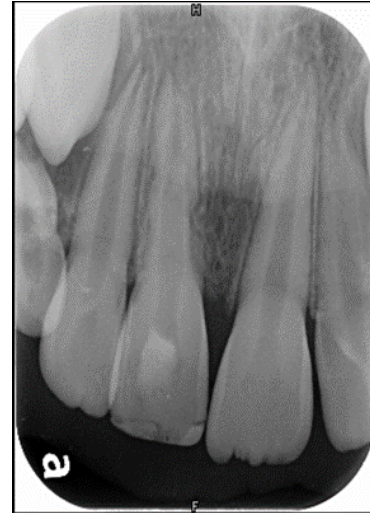


Figure 7: Intraoral periapical radiograph at 6 months post pulpectomy showing evidence of a calcific barrier formation at the apex.



Figure 8: Intraoral periapical radiograph showing apexification and root canal filling with gutta percha.

The patient was reviewed at six-month intervals. The tooth continued to be asymptomatic and nearly reached its supposed original position. No improvement was observed in the greyish discolouration of the tooth, thereby creating an aesthetic problem that would require future intervention.

DISCUSSION

Intrusive luxation is one of the most severe types of dental trauma that is often associated with significant damage to the periodontal ligament fibres and alveolar bone, and rupture of neurovascular supply to the pulp [3]. The healing and prognosis of intrusion depend on several factors [2], and the severity of intrusion was reported as the most important factor in determining the prognosis, followed by the degree of root development [8]. A study demonstrated that intrusions of up to 3.0 mm have an excellent prognosis, whereas those greater than 6.0 mm are associated with a poorer prognosis and a higher risk of pulp necrosis and inflammatory root resorption [8].

The treatment options for managing intruded immature permanent tooth includes waiting for spontaneous re-eruption or repositioning the tooth, either orthodontically or by surgical repositioning [6,9]. Overall, the clinical guidelines recommend monitoring and waiting for spontaneous re-eruption for all intruded immature permanent teeth [1,6,9]. There is no consensus on when to allow spontaneous re-eruption or active repositioning either surgically or orthodontically. Moreover, the best course of treatment for intruded immature permanent teeth is still debatable. A clinical study concluded that spontaneous eruption should be expected in patients with immature intruded permanent teeth [5]. This position was supported by another study in which spontaneous eruption facilitated the natural restoration of the tooth to its pre-injury position [10]. The spontaneous eruption occurred physiologically with mild alveolar resorption [10]. Further research revealed that spontaneous re-eruption is associated with fewer complications in the age group of 6-17 years compared to active repositioning [3,11,12]. In contrast, delayed repositioning of intruded teeth increased the risk of root resorption [8]. The advantages of repositioning include relief of compression zones in the peri radicular area, thereby facilitating better healing by cemental deposition rather than ankylosis [11]. Repositioning also enables early endodontic access in cases associated with pulp necrosis or root resorption. Nevertheless, the already damaged periodontal tissue might be further Traumatized by repositioning, which may exacerbate the complications during the healing period [11].

In this case, the patient was presented with severe intrusion in which only 2 mm of the crown was visible. Nonetheless, it was difficult to diagnose the severity of the intruded tooth 11 as it was ectopically erupting high labially and complicated by the presence of a supernumerary tooth. The stage of an eruption of tooth 11 before the trauma was also unknown, thus the severity of the intrusion was in apparent. Tooth 11 exhibited a high potential for spontaneous eruption and pulp or periodontal repair due to its immature root formation [11]. Hence, a conservative observation was decided as the management procedure.

The time interval from trauma to complete re-eruption ranged from 3 to 12 months irrespective of the degree of intrusion [11,12]. The present case reflected evidence of improvement in the re-eruption of tooth 11, which was complete as the whole length of the labial surface of the crown was visible after four months post-trauma. Additionally, the extraction of the supernumerary tooth accelerated re-eruption and migration of the tooth into the arch alignment. The presence of a supernumerary tooth stemmed from the changes in the path eruption of tooth 11 in this case. Tooth 11 was associated with an increased risk of traumatic injuries since it was erupting higher than the adjacent teeth and displaced labially. Another factor that may enhance re-eruption and migration of intruded tooth 11 is the spontaneous eruption of the permanent tooth following supernumerary extraction.

The common post-intrusive trauma complications are pulp necrosis, marginal bone loss, root resorption, pulp canal obliteration, arrest of root development and gingival retraction [5,8]. Teeth with immature root formation have a lower risk of complication [5]. The consequence of intrusive luxation in this case was external inflammatory root resorption. One of the challenges of waiting for spontaneous re-eruption is that root resorption might become more advanced during the waiting period [11]. Advanced spontaneous re-eruption is a common complication that occurs in intrusive trauma with a prevalence ranging from 38% to 66% [4]. Such complications may be observed in intrusive luxation, due to severe crushing or damage of the periodontal ligament fibres, alveolar bone, cementum and neurovascular pulp supply [5]. External inflammatory root resorption is a pathological condition that occurs mainly as a result of activated macrophages and osteoclasts activities characterized by the removal of damaged periodontal ligament and cementum or dentin, and root canal infection [13,14]. Based on this finding, the intrusion in the present case is probably severe although the tooth had re-erupted and remained vital at that time. This result is consistent with previous findings in which the degree of intrusion and stage of root development were the main predictors of advanced resorption rather than the treatment method [4,5].

The resorption of tooth 11 was arrested after long-term calcium hydroxide treatment. Radiographic evidence of complete healing with the presence of a calcific barrier at the apex was visualized after six months, followed by obturation with gutta-percha as a definitive restorative root canal treatment. Calcium hydroxide is one of the most effective materials for treating external root resorption, which is attributed to its high alkalinity [i.e., pH ranging from 11-13] and high calcium ion concentration [15]. Calcium hydroxide should be maintained in the root canal for one to six months before final obturation [16]. It inhibits resorption and induces repair by calcific barrier formation due to its antimicrobial activity and tissue-dissolving ability [15]. Nevertheless, the duration of the apexification procedure with calcium hydroxide is another factor that needs to be considered [16]. For instance, long-term calcium hydroxide therapy was reported to weaken root dentine and predispose the tooth to fracture [16]. Meanwhile, the use of MTA and Biodentine characterized by good sealing ability, good marginal adaptation and a high degree of biocompatibility are alternatives to address the drawbacks of calcium hydroxide [17,18]. Recently, pulp revascularisation or regenerative endodontic approach has been studied as a promising alternative therapy to manage nonvital Traumatized immature teeth associated with external root resorption [19,20]. In the present case, the regenerative endodontic approach could not be commenced since the calcific barrier was already formed.

Ideally, endodontic therapy with the placement of calcium hydroxide should begin promptly since the tooth was

diagnosed with external root resorption. Nonetheless, the management was delayed in this case until better accessibility was observed on the palatal side for the endodontic approach. An endodontic intervention could be performed immediately by a gingivectomy on the palatal side to allow access to the pulp chamber [12]. This procedure would reduce the risk of complications. Another suggestion is to approach the pulp chamber from the labio-incisal surface of the tooth, as the full length of that surface was already available. Preferably, orthodontic repositioning was needed in this case to enable the tooth to migrate into its supposed position. This approach also will support early endodontics access [21]. A high rate of success was found in traumatically intruded teeth that were orthodontically extruded, either immediately or late [21].

A tooth may become discolored following trauma or endodontic treatment. Especially when the tooth's origin is within the pulp chamber. The blood pigment haematin plays a vital role in enamel and dentine staining following trauma-induced erythrocyte destruction and during pulp extirpation [22]. Other causes of discolouration in endodontically treated teeth include root canal filling materials, remnants of pulp tissue in the pulp horns and canal, intracanal medicaments and coronal restorations [23,24]. In the present case, tooth 11 had changed to blackish colour following the endodontic therapy for root resorption management. Discolouration of anterior teeth may affect a person's self-image and self-confidence. Furthermore, discolouration of anterior teeth is crucial in children and adolescent's age as facial appearance may affect friendship and confidence performance [25]. Non-vital bleaching is indicated for non-vital endodontically treated teeth. A previous study reported that young adolescents' teeth are easier to bleach relative to adult teeth as the enamel is more permeable and this permeability decreases with age [25]. This procedure should follow the safety and efficacy standards as defined by clinical research and best practice [26]. A satisfactory root canal filling must be present before starting the procedure.

CONCLUSION

Regular observation of clinical and radiographic treatment is mandatory in intrusive luxation injury to enable an immediate and timely intervention for any sign of post-trauma or treatment complications. This case presented a successful root canal treatment outcome using calcium hydroxide in addressing the healing complications associated with intrusive injuries. Repositioning the intruded labially erupted tooth-like in this case may also require orthodontic traction forces to facilitate the migration of the tooth into the arch.

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