

# Management of an Intruded Ankylosed Immature Permanent Maxillary Central Incisor: A Case Report and Review of the Literature

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**Objectives** Intrusive luxation is a severe type of dentoalveolar injury, which causes damage to the pulp and supporting tissues of a tooth, as the tooth is apically dislocated into the alveolar process.

**Case** This report describes a case of re-eruption of an intruded immature severely ankylosed upper permanent central incisor. A seven-year-old boy was referred to the pediatric dental clinic three months after a traumatic injury. Clinical and radiographic examinations revealed intrusive luxation of the immature left upper permanent central incisor. In the first visit, initial bracketing was performed, and the left central incisor was engaged. In the second visit (after four weeks), the tooth showed no movement and produced a metallic sound in percussion. The tooth was consequently luxated and engaged again with a heavier force and followed-up monthly.

**Conclusion** It re-erupted completely, and the follow-up periapical radiographs showed that root formation continued, and the root apex was approximately closed.

**Keywords** Tooth Intrusion; Tooth Injuries; Tooth Ankylosis; Dental Practice Management

## Introduction

Traumatic injuries to the orofacial complex are the second most prevalent type of dental injuries following caries.<sup>1,2</sup> The causes of traumatic injuries include falling, bicycle traumas, sport incidents, and fights.<sup>3</sup> Traumatic dental injuries mostly occur in children and teenagers, where tooth loss has lifetime sequels.<sup>4</sup> Dental treatment of a dentoalveolar injury needs to be initiated with the exclusion of possible head trauma, immunization confirmation, and inquiry into the accident details.<sup>5</sup> The incidence of intrusion injuries is estimated at 0.5-2% of all dental traumas, with a predilection for males.<sup>6</sup> The peak intrusion incidence has been reported in the age group of 6-12 years, and almost 20-30% of children have had dental injuries by the age of 12 years.<sup>7</sup> According to prevalence studies, male school children are more commonly affected, and dental traumas frequently occur during school holidays.<sup>5</sup>

Injury to teeth is one of the main problems of pedodontists, which requires an instant intervention.<sup>8</sup> To achieve favorable outcomes, accurate diagnosis, treatment planning, and follow-up are essential. A quicker treatment is associated with a better prognosis, as the risk of resorption and other posttraumatic sequelae is lower.<sup>5</sup> Due to relatively scarce reports of dental intrusion injuries, management guidelines are based on finite evidence, and there are various types of protocols.<sup>6</sup>

### Type of traumatic injuries to periodontal tissues

Injuries to periodontal tissues can be divided into concussion, subluxation, extrusive luxation, lateral luxation, intrusive luxation, and avulsion.<sup>9</sup>

### Intrusive luxation

Intrusive luxation is one of the most severe forms of traumatic injuries, which involves axial displacement of a

tooth into the alveolar bone and is often accompanied by an impacted fracture of the alveolar bone.<sup>9</sup> The most commonly involved teeth are the anterior teeth, mainly central incisors.<sup>5</sup> The low incidence of this injury (only 3% of all luxation injuries to permanent incisors and 5-12% of dental luxations)<sup>10,11</sup> suggests that clinicians may have limited experience in diagnosis and treatment of this type of injury.<sup>12,13</sup> During intrusive luxation, extreme damage to the pulp and supporting tissues occurs because of tooth movement toward the alveolar process. Consequently, pulp necrosis, different types of resorptions, such as radicular inflammatory resorption, replacement root resorption, and surface resorption, marginal bone loss, and gingival recession, may occur.<sup>9,14,15</sup>

### Clinical management of intrusive luxation

Depending on the severity of injury, management of an intruded permanent tooth may involve (1) allowing for spontaneous re-eruption, (2) surgical repositioning and fixation, (3) orthodontic repositioning, and (4) a combination of surgical and orthodontic repositioning.<sup>16</sup> For immature permanent teeth with mild intrusion (<3 mm), waiting for spontaneous re-eruption is particularly recommended, because of their extensive potential for eruption and pulpal or periodontal repair.<sup>9,17</sup> In case of moderate intrusion (3-6 mm) with an incomplete apex, the teeth may re-erupt or undergo orthodontic repositioning. Finally, in severely intruded teeth (>6 mm), the soft tissue is often severely displaced, and the crown may be completely covered by bone, therefore isolation and bracket bonding is difficult, making orthodontic repositioning crucial or impossible. Interventions should be performed for surgical repositioning of the tooth, regardless of the stage of root formation.<sup>9</sup> According to the UK guidelines, a thorough review of the published

literature has built consensus on the management protocols.<sup>6</sup> Given the uncommon occurrence of intrusive luxation, there is a scarcity of published data on the management and prognosis of this type of trauma. As recommended by Chako et al., it is important to report cases of intrusive luxation to reach consensus on the treatment approaches and outcomes.<sup>7</sup>

This case report describes the management process of a severely intruded, immature upper permanent central incisor in a seven-year-old patient which showed signs of ankylosis before the initiation of treatment.

## Case Report

A healthy seven-year-old boy was referred to the pediatric dentistry clinic of Shahid Beheshti University of Medical Sciences with an intruded left central maxillary incisor. Reportedly, he had fallen in the school yard and damaged his front tooth three months ago. His parents disclosed that they had visited a hospital, but the clinician had only ordered a periapical radiography and decided that the tooth would re-erupt spontaneously. Besides, his parents observed that the tooth re-erupted 1 mm, but then stopped. Accordingly, he was referred to the dental school of Shahid Beheshti University of Medical Sciences. His medical history was unremarkable, and his vaccination was up-to-date. An intraoral examination revealed a severely intruded maxillary left permanent central incisor (about 7 mm). Only 3 mm of the crown was visible in the mouth, and the maxillary right permanent central incisor was slightly extruded (Figure 1).

The periapical radiograph of the tooth showed that development of the immature root continued (Figure 2), and the vitality test indicated that the tooth was vital.

In the first visit, initial bracketing was performed, and the left central incisor was engaged using a standard bracket system and stainless steel wire (0.016 inch). In the second visit (after six weeks), the tooth showed no movement and produced a metallic sound in percussion. It was decided that the tooth was ankylosed. Consequently, luxation was performed with scalpel No. 15 to detach periodontal tissues and slightly loosen the tooth; subsequently, it was engaged again under a heavier force (100 g). In the third visit after two weeks, the tooth was extruded 1 mm. The patient was visited every week for the 4<sup>th</sup>, 5<sup>th</sup>, and 6<sup>th</sup> times. In each session, 1-mm extrusion was observed. After six months, the tooth had re-erupted completely (Figure 3), and the root had continued its formation, as shown in the periapical radiograph acquired after treatment (Figure 4).

The follow-up periapical radiographs showed that root formation continued and that the root was almost closed. Additionally, thermal tests revealed that the tooth was vital, and no prophylactic endodontic treatment was

performed. The tooth was followed-up after 6 and 12 months. It was found to be vital, and the root was completely formed (Figure 5).



**Figure 1:** The maxillary left permanent central incisor is intruded severely (about 7 mm). Only 3 mm of the crown is visible in the mouth. The maxillary right permanent central incisor is slightly extruded.



**Figure 2:** The radiographic view of the tooth before treatment



**Figure 3:** The clinical view of the tooth after treatment



**Figure 4:** The radiographic view acquired immediately after the end of treatment



**Figure 5:** The two-year follow-up radiographic view of the tooth

All dental procedures performed in every session of treatment for the patient are presented in Table 1.

**Table 1-** Treatment steps in each session

Phase	Treatment stages
First visit	<ol style="list-style-type: none"> <li>1) Oral hygiene instructions.</li> <li>2) Forced eruption of the intruded central incisor (initial bracketing of the upper teeth with the engagement of maxillary left central tooth).</li> </ol>
Second visit (after six weeks)	<ol style="list-style-type: none"> <li>1) No tooth movement.</li> <li>2) Luxation with scalpel No. 15 (15 mm).</li> <li>3) Tooth re-engagement with a heavy force (100 g).</li> </ol>
Third visit (after two weeks)	<ol style="list-style-type: none"> <li>1) Tooth extrusion of 1 mm.</li> <li>2) New wire banded (0.016 stainless steel).</li> </ol>
Fourth, fifth, and sixth visits (in one-week intervals)	Tooth extrusion of 1 mm each time.
Sixth visit	Change of wire to NiTi 0.012.
Seventh visit (after seven weeks)	<ol style="list-style-type: none"> <li>1) Tooth extrusion of 1 mm (5 mm in total).</li> <li>2) Bracketing of the left central maxillary tooth, which is fixed 1 mm further gingivally than the adjacent teeth in order to level the teeth.</li> </ol>
Eighth visit (after nine weeks)	<ol style="list-style-type: none"> <li>1) Full eruption of maxillary left central tooth (7 mm)</li> <li>2) Intrusion of maxillary right central tooth (1 mm)</li> <li>3) Debonding.</li> <li>4) Tests: <ul style="list-style-type: none"> <li>• Palpation test: Normal.</li> <li>• Percussion test: Dull.</li> <li>• Thermal test: Normal.</li> <li>• EPT* : Normal.</li> </ul> </li> </ol>
Six-month follow-up after the end of forced eruption (18 months after trauma)	Tests: <ul style="list-style-type: none"> <li>• Palpation test: Normal.</li> <li>• Percussion test: Dull.</li> <li>• Thermal test: Lower than the first visit.</li> <li>• EPT: Higher than the first visit.</li> </ul>
Two-year follow-up	Tests: <ul style="list-style-type: none"> <li>• Palpation test: Normal.</li> <li>• Percussion test: Dull.</li> <li>• Thermal test: Negative.</li> <li>• EPT: Higher than the first visit.</li> </ul>

\*EPT : Electric pulp test

## Discussion

The most severe type of traumatic dental injury is intrusive luxation, which is responsible for 15-61% of all traumas to permanent teeth and is described as the apical dislocation of tooth in its socket.<sup>3</sup> Although intrusive luxation is infrequent, it is a severe form of dental trauma, because it is usually accompanied by extensive damage to the periodontal ligament and alveolar bone, injury to the Hertwig's epithelial root sheath, and cutting of neurovascular supply to the pulp.

Similar to replantation of an avulsed tooth which is hard to manage, due to cementogenesis<sup>18</sup>, management of traumatically intruded teeth is challenging<sup>7, 19</sup>, and the process of healing subsequent to trauma is complicated.<sup>3</sup> Multidisciplinary strategies should be considered for treatment, ranging from conservative approaches, such as waiting for spontaneous re-eruption, to aggressive methods, such as surgical or orthodontic repositioning.<sup>9</sup> Orthodontic miniscrews are effective orthodontic devices with great mechanical properties, which can be used to extrude intruded teeth without affecting other teeth.<sup>3, 20</sup> Treatment plan depends on the level of tooth maturation. If root formation is not completed, it is suggested to wait

for spontaneous re-eruption.<sup>21</sup> However, to confirm the prognosis of an intruded tooth, the severity of intrusion has been reported to be the most important factor. Studies have shown that intrusions up to 3.0 mm have an excellent prognosis, while intrusions exceeding 6.0 mm have a poorer prognosis, with a higher risk of necrosis of the pulp and resorption of the root.<sup>7</sup> It is now proved that that both spontaneous re-eruption and orthodontic repositioning cause the least damage to supporting tissues among all treatment approaches.<sup>22</sup> The benefits of repositioning include the relief of compression areas in the periradicular area, which can provide better healing by cemental deposition, rather than bone deposition that leads to ankylosis.<sup>7</sup>

In the present case, the tooth did not re-erupt spontaneously after three months; therefore, forced eruption was performed, but the tooth did not move after one month and showed evidence of ankylosis. The parents stated that the tooth had re-erupted about 1 mm in the first month; nevertheless, it should be mentioned that this small re-eruption may be because of receding gingival inflammation and not an actual eruption. The incomplete eruption of a permanent tooth may be related to a small area of root ankylosis.<sup>23</sup> If the permanent tooth is visible

in the oral cavity and located in a lower occlusal plane relative to the adjacent teeth, ankylosis is a possible cause. Both Biederman and Skolnick suggested that a luxation technique is effective for the management of bony ankylosis.<sup>23, 24</sup> If the luxating technique is not immediately prosperous, it should be repeated within six months.<sup>25</sup> Therefore, the tooth was luxated, and force eruption was performed again with a heavier force; a follow-up was performed again after two weeks. Clinical measurements showed small eruption, and the tooth had normal movements with no metallic sound in percussion. Follow-up periapical radiographs revealed that root formation still continued. For immature teeth with a more eruptive potential (half or two-thirds of the root was formed), the ideal treatment is to allow for spontaneous eruption.<sup>20</sup> Although the incidence of pulp necrosis after intrusion of immature permanent incisors is lower than mature permanent teeth, it is not rare.<sup>15, 26</sup> The most important factors in pulp necrosis include the intensity of trauma and the diameter of the apical foramen, according to Andreasen and Pedersen's findings.<sup>21</sup> In our case, although the trauma was quite severe, as the tooth was immature, and the apex was open, it remained vital and asymptomatic; consequently, no endodontic treatment was applied.

Pulp necrosis may occur as early as weeks to months after intrusion or as late as two years after trauma.<sup>15</sup> This case was followed-up for two years, and he was recommended to continue the follow-up sessions yearly for five years.

Finally, it is worth mentioning that anterior teeth with undesirable aesthetics may negatively affect one's self-confidence and interpersonal relationships, particularly the upper central incisors, which are at the center of the aesthetic zone and most affected by trauma. The reconstruction of these teeth is important to avoid psychological problems, as well as speech and chewing alterations, thereby enabling a healthier growth for the child.<sup>5</sup>

### Gap of Knowledge

Management of traumatic dental injuries, particularly intrusions, is quite challenging, due to their impact on the periodontium. In the present case, since the ankylosis process had started, and the roots were immature, clinical management was relatively difficult; therefore, a rapid intervention followed by a regular follow-up was required.

### Conclusion

The present case confirms the possibility of re-eruption in an ankylosed intruded incisor, without the loss of pulp vitality. It also suggests that repositioning of an intruded tooth may require the use of heavy orthodontic traction forces and rapid force eruption.

### Conflict of Interest

No Conflict of Interest Declared ■

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