

Conservative Management of Traumatic Intrusion and Crown Fracture in an Immature Permanent Incisor: A Pediatric Case Report

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Abstract: *This case report describes the conservative management of a traumatic intrusion and enamel-dentin crown fracture in a permanent central incisor of an 8-year-old boy. Following a sports injury, the patient presented with a 6-mm intrusion of tooth 11, along with subluxation of adjacent teeth. The chosen treatment approach emphasized spontaneous re-eruption, avoiding immediate endodontic intervention. Over a six-month period, clinical and radiographic assessments confirmed successful re-eruption, continued root development, and maintained pulp vitality. The outcome underscores the importance of early intervention, accurate diagnosis, and careful monitoring in managing combined dental trauma in immature teeth.*

Keywords: crown fracture, tooth intrusion, re-eruption, immature permanent teeth, dental trauma

1. Introduction

Trauma to the oral cavity can significantly impact aesthetics, chewing, and speech, leading to emotional and psychological consequences, especially in children [1, 2]. Such injuries can alter a patient's physical appearance and subsequently affect their lifestyle [1]. Injuries may involve hard dental tissues and the supporting structures of the teeth [3]. These injuries can vary in severity, ranging from minor cracks to complete fractures of the tooth's crown or root [3, 4].

Combined dental trauma involving a fracture of the crown with intrusion of the tooth is a complex injury that requires a multidisciplinary approach for optimal management [4]. Crown fractures can be classified as uncomplicated (involving enamel and dentin without pulp exposure) or complicated (involving enamel, dentin, and pulp) [5]. Management of crown fractures depends on the extent of the injury [4]. For uncomplicated fractures, treatment options include direct restoration, indirect pulp capping, or pulpotomy, with pulpotomy showing the highest success rate [5]. Intrusion is a severe form of dental luxation where the tooth is displaced axially into the alveolar bone. This type of injury often results in damage to the periodontal ligament and alveolar bone, and it carries a high risk of pulp necrosis and root resorption [6]. The management of intruded teeth varies based on the stage of root development. For teeth with incomplete root formation, spontaneous re-eruption is often preferred. In contrast, for teeth with complete root formation, orthodontic or surgical repositioning may be required [7]. When a crown fracture is associated with intrusion, the treatment plan must address both components. Regular follow-ups are crucial to monitor for complications such as pulp necrosis, root resorption, and periodontal healing. Radiographic and clinical evaluations should be conducted periodically to assess the status of the tooth and surrounding structures [8, 9].

This case is significant because it reinforces the viability of spontaneous re-eruption in immature intruded teeth and

highlights the role of minimally invasive approaches in preserving pulp vitality and promoting natural healing.

2. Clinical Case

A child arrived at the dental office after sustaining a trauma to the maxillofacial area. The injury occurred 24 hours earlier while playing soccer on an asphalt surface. In an attempt to save the ball as a goalkeeper, the child fell on his chin while jumping from a standing position. He did not lose consciousness following the injury and showed no signs of headache, vomiting, amnesia, or blurred vision.

After the trauma, the child experienced mild pain in the area of the injured teeth, chin, and lips. There was bleeding from the gums of the affected teeth, and a fragment of tooth 11 was lost during the injury.

Overall, the child was in good general condition, with no systemic diseases or allergies. His skin appeared normal in color and turgor. Upon palpating the facial skeleton, no fractures of the facial bones were detected. Examination of the temporomandibular joint revealed no swelling, clicking, or crepitus. There were no restrictions in the movement of the lower jaw, and occlusion was normal. There was a contused wound in the chin and lip area, but no tooth fragments or foreign bodies were found.

Intraoral status:

Tooth 11 was severely intruded into the alveolus and had a horizontal fracture at the cutting edge, affecting both the enamel and dentin. The depth of the intrusion was measured at 6 mm, using the incisal edge of tooth 21 as the reference point. Tooth 11 was not mobile, and there were no issues with the occlusion. However, there was blood coagulum present in the gingival sulcus. Fractures of the lateral incisors were also observed. Teeth 21, 22, and 12 had subluxation.

Table 1 reveals the intraoral situation during the first appointment.

Table 1: Intra- and extraoral pictures**Electro-odonto diagnostics**

Electro-odonto diagnostics (EOD) was performed, revealing that the maxillary traumatized teeth did not respond to stimulation up to 200 μ A. In contrast, the mandibular incisors reacted normally.

X-Ray Examination

A periapical radiograph was conducted, which showed the following findings:

- Intruded tooth 11 exhibited incomplete root development, characterized by an immature apex, thin root walls, and a wide root canal.

- The depth of the intrusion was measured at 6 mm, using the cutting edge of tooth 21 as a reference point.
- The periodontal space was not visible along the entire length of the root.
- The enamel-cementum junction of tooth 11 was deep within the alveolus compared to the adjacent tooth 21.
- Teeth 12, 21, and 22 also displayed signs of incomplete root development.

Table 2 reveals the results from the x-ray.

Table 2 Periapical x-ray and panoramic x-ray

Based on clinical and paraclinical examinations, we determined that this was a combined trauma:

- Intrusion and fracture of the dental crown without pulp involvement – tooth 11;
- Subluxation – tooth 21;
- Subluxation and enamel fracture – teeth 12, 22;

has an intrusion of 5.5 mm from the cutting edge, which has decreased by 0.5 mm since the first appointment. Teeth 12, 21, and 22 did not react to electronic stimulus of up to 200 μ A (EOD). Pulse oximetry was done. Tooth 12 showed value 92%, tooth 21 - 81%, and tooth 22 - 88% on the test about pulse oximetry (table 5).

3. Treatment Plan**First appointment**

The soft tissues were cleaned using a hydrogen peroxide swab followed by a chlorhexidine swab. The parents were informed about potential future complications that may arise in the coming months, such as gum swelling, staining or darkening of the crown, increased mobility, or the occurrence of a fistula. They were advised to seek help if any of these issues occur.

Follow-up – 1 week after the injury

Teeth 12, 21, and 22 were stable and showed no mobility. A measurement with a periodontal probe indicated that tooth 21

The exposed dentin of tooth 11 has been covered with glass-ionomer cement (GIC) to prevent bacterial penetration into the pulp. The sharp edges of the fractures on teeth 12 and 22 have been smoothed using an abrasive disc to prevent additional trauma to the lips.

Follow-up – 2 weeks after the injury

The intrusion depth of tooth 11 was reduced by 1 mm. Teeth 12, 21 and 22 did not respond up to 200 μ A on an EOD test. The stability of teeth 12, 21, 22 was preserved. The child and parents were warned to continue with the gentle diet.

During the next six months several follow-up visits were made. Clinically, there were no signs of inflammation

surrounding the injured teeth. No redness or fistulas were observed in the area around teeth 12, 11, 21, and 22. Additionally, there was no increased mobility noted in the injured teeth. Light percussion and palpation of teeth 12 and 22 revealed no pain. However, there was slight pain on percussion and palpation around teeth 11 and 21.

Table 3 shows the pictures from the follow-ups. Spontaneous and visible re-eruption of the intruded tooth was observed. Measurement with a periodontal probe indicates that tooth 21 has intruded by 2.5 mm, which is a reduction of 3.5 mm. Tooth 11 has almost completely re-erupted. When tested with cold stimuli on the injured teeth pain was reported after 1-2 seconds, which subsided once the irritant was removed.

Table 3: Six months follow-ups.



Table 4 shows the x-rays 6 months after the trauma. Re-eruption of tooth 11 is visible. The teeth continued their root development, the apex was not closed yet. No signs of any

inflammation are visible on the x-ray even 6 months after the injury. The teeth will be permanently restored using composite material.

Table 4: X-rays 4 and 6 months after the injury

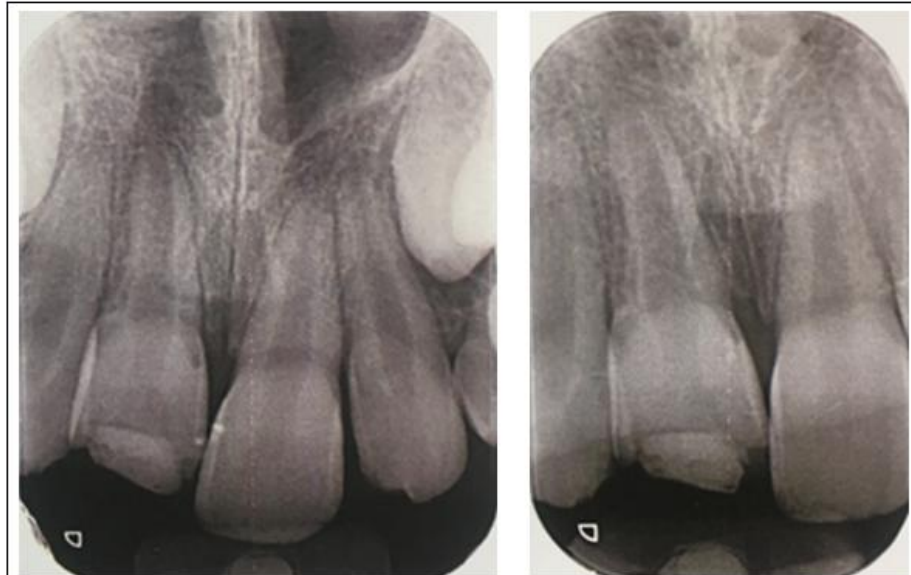


Table 5 shows the results from the pulse oximetry (PO) and EOD tests. The teeth returned to normal values in pulse oximetry and EOD.

Table 5: Results from the pulse oximetry and EOD tests

Time after the injury	Tooth 12		Tooth 11		Tooth 21		Tooth 22	
	EOD	PO	EOD	PO	EOD	PO	EOD	PO
24 hours after	200 μ A	-	-	-	200 μ A	-	200 μ A	-
1 week after	200 μ A	92 %	-	-	200 μ A	81 %	200 μ A	88 %
2 weeks after	200 μ A	84 %	-	-	200 μ A	65 %	200 μ A	89 %
1 month after	100 μ A	82 %	180 μ A	95 %	200 μ A	73 %	180 μ A	87 %
2,5 months after	47 μ A	84 %	126 μ A	82 %	98 μ A	81 %	33 μ A	85 %
4,5 months after	5 μ A	78 %	77 μ A	80 %	50 μ A	82 %	8 μ A	85 %
6 months after	9 μ A	94 %	28 μ A	90 %	24 μ A	95 %	18 μ A	92%

For six months, the tooth remained healthy, showing no signs of pulp or periodontal inflammation. It re-erupted to its normal position, and root development continued as expected. There were no complications, such as ankylosis, pulp necrosis, or external or internal root resorption.

4. Discussion

The treatment options for combined dental trauma involving a crown fracture with intrusion of the tooth are multifaceted and depend on the specifics of the injury, including the extent of the fracture and the degree of intrusion. Regular follow-ups are essential to monitor for signs of pulp necrosis, which is common in cases of intrusion. If necrosis is detected, root canal treatment should be initiated promptly [7].

For crown fractures, direct composite restorations or reattachment of the fractured fragment can be performed. Fragment reattachment is a minimally invasive option that can restore both function and aesthetics [10, 11]. After initial healing, definitive restorative treatment may be required, which could include crowns or veneers depending on the extent of the fracture and the aesthetic requirements [12].

The choice of treatment for combined dental trauma involving a crown fracture with intrusion of the tooth is influenced by several key factors: the extent of crown fracture, the stage of root development, the degree of the intrusion, the pulpal status, the time since the injury and others. The classification of the crown fracture significantly impacts treatment decisions. Complicated fractures, which involve the pulp, often necessitate endodontic treatment such as pulpotomy or root canal therapy [5, 7]. In our case the fracture involved only enamel and dentin. One week after the trauma the exposed dentin was covered with glass-ionomer cement (GIC). Covering exposed dentin after fractures is important primarily to protect the dental pulp from bacterial invasion and thermal sensitivity [13]. Dentin is a porous structure with tubules that provide a direct pathway for bacteria and their byproducts to reach the pulp tissue [13]. This exposure can result in pulpal infection and inflammation, potentially leading to more severe complications such as pulpitis or pulp necrosis [13]. The study by Cheng et al. highlights that the prognosis of crown fractures, whether complicated or uncomplicated, is significantly influenced by the treatment strategy employed [5]. Covering the dentin helps in preventing bacterial ingress, which is crucial for pulp survival [14]. Additionally, the review by Chen et al. discusses the biomechanical properties of dentin and emphasizes that exposed dentin can lead to rapid bacterial ingress, further justifying the need for coverage to prevent pulp damage [14].

The root development stage (immature vs. mature) is also crucial. Immature teeth with incomplete root formation may benefit from conservative treatments like pulpotomy to preserve pulp vitality and allow continued root development, whereas mature teeth often require more definitive endodontic treatment [15].

The severity of the intrusion influences the choice between spontaneous re-eruption, orthodontic repositioning, or surgical repositioning. Mild intrusions in immature teeth may be managed conservatively with spontaneous re-eruption,

while severe intrusions or those in mature teeth often require active repositioning [16]. In our case, the depth of the intrusion and the tooth's incomplete root development had a positive outcome. The tooth re-erupted within six months, successfully completed its root development, and regained its vitality. Additionally, no signs of pulp infection, inflammation, external or internal root resorption, or other complications were observed. The health of the pulp and periodontal ligament is a critical determinant. Teeth with signs of pulp necrosis or significant periodontal damage typically require root canal treatment to prevent further complications such as infection or resorption [7]. The interval between the injury and treatment initiation can affect outcomes. Prompt treatment is associated with better prognosis, particularly in preventing pulp necrosis and promoting periodontal healing [5]. The positive outcome in our case was aided also by the fact that the child sought help just 24 hours after the trauma, and the treatment plan was initiated promptly.

Younger patients with better healing potential and those who can comply with follow-up care may have different treatment approaches compared to older patients or those with poor compliance [15]. Untreated crown fractures, especially those involving the pulp, and tooth intrusion can lead to pulp necrosis due to disrupted blood supply and bacterial invasion [7]. This can result from bacterial penetration through the fracture site or due to necrotic pulp tissue, leading to apical periodontitis and potential abscess formation [7]. This is a significant risk in cases of intrusion, where damage to the periodontal ligament and root surface can trigger an inflammatory response, leading to resorption of the tooth structure [7]. Intruded teeth are at risk of ankylosis, where the tooth becomes fused to the alveolar bone, leading to loss of periodontal ligament space and potential infraocclusion, especially in growing children [16].

5. Conclusion

Careful monitoring of intruded immature permanent tooth with enamel-dentin fractures represents a more conservative treatment approach compared to surgical or orthodontic extrusion. The current case report indicates that such teeth have a significant potential for spontaneous eruption while maintaining their vitality and continuing root development. Additionally, covering the exposed dentin to protect against microbial invasion also contributed to a better treatment outcome.

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