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MANAGEMENT OF SEVERE TRAUMATIC INTRUSION OF THE PERMANENT UPPER CENTRAL INCISOR: A CASE REPORT

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ABSTRACT

Aim: To demonstrate management of a severely intruded permanent anterior tooth in a pediatric patient, showcasing the prevention of ankylosis, as evidenced by CBCT findings during follow-up.

Materials and Methods: An 11-year-old female patient arrived at the clinic with complaints of discomfort and a severely intruded upper anterior tooth (#21), displaying more than 7mm of intrusion and producing a metallic sound upon percussion. Surgical repositioning of tooth #21 and wire and composite splint was applied under LA. Root canal treatment was started one month later, when signs of necrosis was observed. After cleaning and shaping of the canal, the canal was dressed with intracanal medication. After 4 weeks, mineral trioxide aggregate (MTA) was placed as an apical plug (5mm). The canal was filled with warm gutta percha and restored. The patient was followed up starting 3 weeks, 4 weeks, 6 week, 8 week, 6 months, 1 year, and 2 years showed that there is increase in the bone radiopacity around the traumatic tooth.

Result: After 2 months, the CBCT showed a 2.2 mm periapical radiolucency near tooth #21, widened periodontal ligament space, and lamina dura resorption. By 10 months, bone formed around the tooth apex, while the lamina dura reformed. After 2 years, increased bone radiopacity surrounded the tooth without ankylosis or replacement root resorption.

Conclusion: Using surgical reposition in severely intruded tooth combined with splinting and MTA as an apical plug proved effective in maintaining the tooth and preventing ankylosis, as demonstrated by follow-up assessments and CBCT findings.

KEYWORDS: Dental trauma, injuries , intrusions , immature permanent incisors , CBCT

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INTRODUCTION

Traumatic injuries are categorized as a worldwide health and social issue. These injuries are more likely to be sustained by children and adolescent than adults. Dental trauma is considered one of the most important subcategories of such injuries [1]. Despite diverse sources of data, numerous epidemiological studies on dental trauma in children and adolescents reach similar conclusions. The most prevalent cause of dental trauma is falling while playing. Other frequent reasons include conflict, vehicle collisions with objects, and bicycle accidents [2]

In several studies, the majority of trauma-related dental injuries were categorized as mild. Age groups showed differences in the proportional frequency of various types of injuries. In permanent dentition of children, combined traumas were frequently observed, with concurrent crown fractures most commonly occurring in teeth that experienced intrusion, subluxation, or concussion. Because combination of injuries were more likely to result in pulp necrosis, it is important to raise awareness of these injuries and stress the value of a thorough diagnostic process that records both incursion and fracture injuries [3].

The intrusion of permanent anterior teeth may lead to serious damage to the tooth and/or the surrounding tissues. Although mild intrusions can lead to periodontal regeneration, common healing outcomes include root resorption, ankylosis, marginal bone loss, pulp canal obliteration, and pulp necrosis. Acute therapy of dental intrusions in teenagers is complicated by the availability of three treatment options and two significant variables: tooth growth stage and intrusion volume. Treatment approaches are not accurate predictors of clinical results, most likely because injury-related characteristics, degree of intrusion, and stage of root growth influence clinical outcomes enough to confuse predictions. Following the completion of facial development, these unanticipated outcomes can require oral surgery, periodontal surgery, or dental implants for rehabilitation [4].

This report presents the management of a case of severe traumatic intrusion of the maxillary permanent central incisor with 2 years of follow-up.

MATERIAL AND METHODS

An 11-year-old girl presented to the emergency department at Taibah University Dental Clinics 5 days after experiencing dental trauma. She reported that her upper anterior tooth was intruded due to trauma causing persistent pain in the same area. A full medical and dental history were taken from the mother. She stated that her daughter fell on her face while playing. The patient was cooperative and her dental hygiene was good. Intra-oral photographs of the injured site were taken after obtaining the written consent by her mother. Ethical approval for this study was obtained from the Taibah University College of Dentistry Research Ethics Committee, reference number TUCDREC/140623/SFAlqadi.

An extraoral examination revealed swelling of the upper lip and redness. Intraoral examination showed that the soft tissue, oral mucosa, attached gingiva , and free gingiva were all normal except for the area surrounding tooth #21. In this area, laceration of the soft tissue was observed. Tooth #21 was intruded inside the socket by more than 7 mm (Figure 1). An electric pulp test and a cold test were performed for teeth #11, 21 and 22 and the results were normal. No mobility was observed in these teeth. Metallic sound was noticed upon percussion test for tooth #21

An orthopantomogram revealed intrusion in tooth #21 compared with the level of adjacent teeth (Figure 2). A periapical radiograph showed a 4.8 mm intrusion related to tooth #21, widening of the periodontal ligament space, and loss of the lamina dura in the apical third of the root. There were no signs of root fracture. The root foremen is closed radiographically (Figure 3).

Fig. (1) Clinical photographs showing intrusion of tooth #21 by more than 7 mm.

Fig. (2) An orthopantomogram showing intrusion of tooth #21. There were no other significant findings.

Fig. (3) Periapical radiograph showing a 4.8 mm intrusion in tooth #21 in comparison with the level of tooth #11.

In consequence to the severity of the intrusion and apical development of the root, After administering local anesthesia (Mepivacaine Hydrochloride 2 %and Epinephrine 1:100,000, Septodont, 94107 Saint-Maur-des-fossés Cedex, France), the intruded tooth was luxated gently with an elevator to minimize cell damage to the periodontal ligament and the cementum. The intruded tooth was repositioned and splinted using 0.5 mm stainless-steel multistranded flexible orthodontic wire and an acid etch-composite resin technique. The splint extended from tooth from tooth #11 to tooth #22 and left for 4 weeks (Figure 4). The mother was instructed to maintain a good oral hygiene, using a soft dental brush, avoid any type of sports, and keep her daughter on a soft diet for 2 weeks. In addition, chlorhexidine mouthwash (0.1%) was prescribed. A postoperative periapical x-ray was taken to confirm the position of tooth #21 after splint placement (Figure 5 (a)).

Fig. (4): Surgical repositioning of tooth #21 and placement of composite splint from #11 to #22.

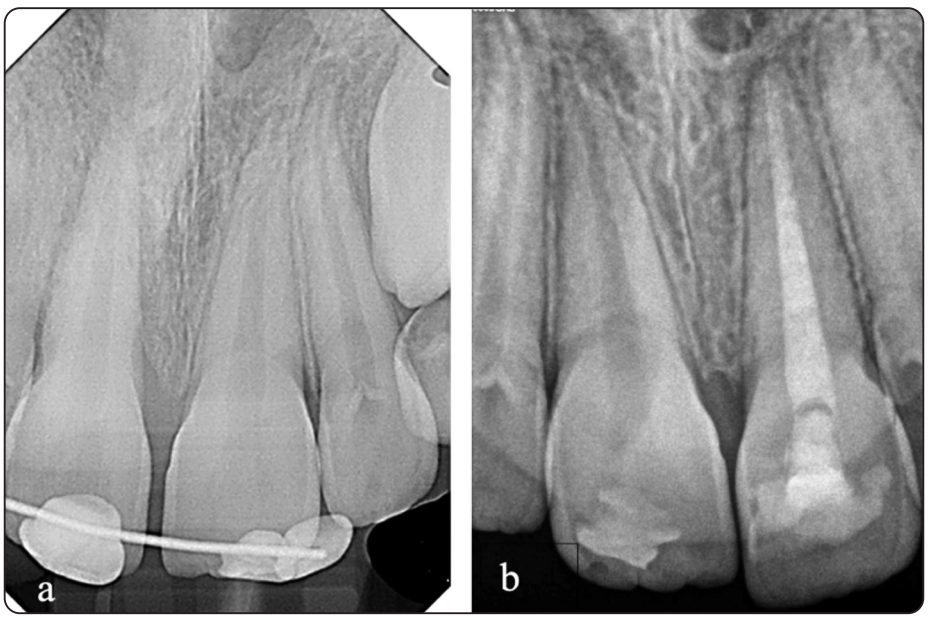

Fig. (5) (a) Periapical radiograph showing relocation of tooth #21 with a composite splint.(b) Periapical radiograph showing tooth #21 after endodontic treatment and restoration with a composite resin.

RESULTS

After 4 weeks, the tooth showed signs of necrosis as indicated by the negative results of pulp sensibility tests. At this stage, the decision was made to start root canal treatment in order to prevent root canal infection, apical periodontitis, and infection-related resorption [5]. Root canal treatment was performed over multiple visits in accordance with the American Association of Endodontics guidelines [6]. At the initial visit, the tooth was isolated with a rubber dam, and the canal was cleaned, shaped with the master file #50 which indicate an open apex root. Then dressed with non-setting calcium hydroxide as the intracanal medication (UltraCal XS, South Jordan, UT, USA). The canal was redressed with calcium hydroxide 2 weeks later. When the patient returned 4 weeks after the start

of root canal treatment, mineral trioxide aggregate (MTA) (PD Dental, Vevey, Switzerland) was placed as an apical plug (5 mm). The canal was filled with warm gutta-percha using warm vertical compaction (Calamus Dual, Santa Barbara, CA, United States) and the tooth restored with composite resin (Figure (b)).

The patient was followed up clinically at regular intervals starting at 3 weeks, and then at 4 weeks, 6 weeks, 2 months, 6 months, 1 year, and 2 years. The clinical examination at each visit included assessment of the presence or absence of fistula tracts, gingivitis, and gingival dehiscence, as well as of the periodontal pocket depth [7]. The radiographic examination was done at 2 months, 10 months and 2 years by cone beam computed tomography (CBCT).

Two months later, clinical examination revealed complete healing of soft tissue and positive response of adjacent teeth to sensibility tests. CBCT on sagittal section diplayed aperiapical radiolucency lesion of 2.2 mm related to tooth #21, with widening of the periodontal ligament space all around the tooth and resorption in the lamina dura at the apex. There was no sign of internal root resorption, although resorption in the nasal floor was noted (Figure 6(a)).

After 10 months, Clinical examination revealed positive response to all sensibility tests and no signs of dental discoloration or teeth mobility as well as no metallic sound was noticed on the intruded tooth. CBCT showed bone formation around the tooth apex and periodontal ligament surrounded the root uniformly. Moreover, the lamina dura was reformed. There were no signs of any type of root resorption, and the nasal floor had started to remodel (Figure 6(b)). At the 2-year follow-up, all sensibility tests were repeated and the results showed positive response to electrical pulp test and cold test, no discoloration noticed and no signs of mobility or ant metallic sound that could indicated replacement root resorption. Radiographically,CBCT and PA confirmed the clinical signs and showed an increase in bone radiopacity around the traumatic tooth with no internal resorption or any irregular changes (Figure 6(c)).

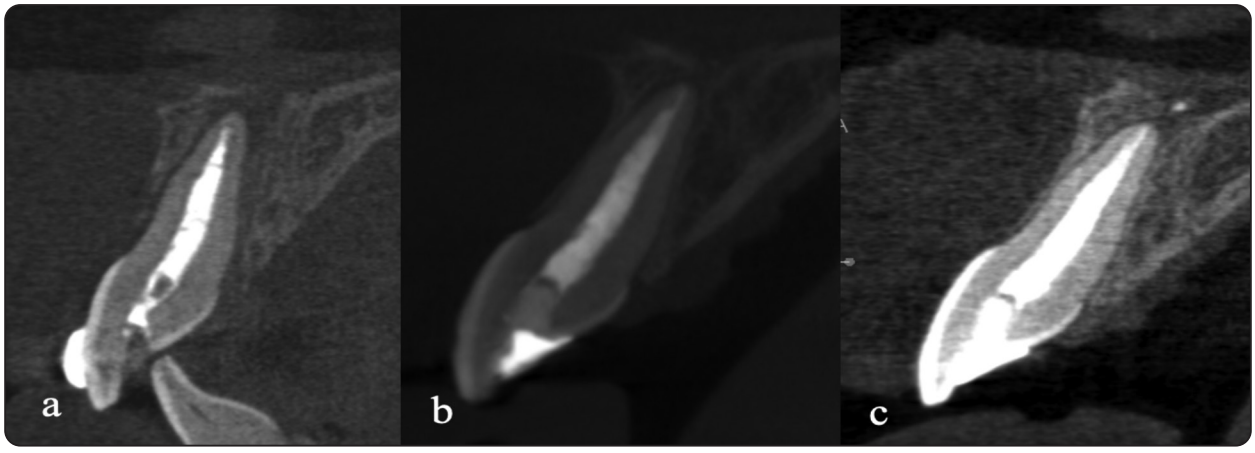

Fig. (6) (a) After 2 months of clinical intervention, a sagittal CBCT image showed periapical radiolucency, widening of the periodontal ligament space, loss of the lamina dura, and resorption of the nasal floor. (b) After 10 months, radiopacity had increased in the periapical area and the nasal floor had started to regenerate. (c) At the 2-year follow-up, remodeling had continued, with no internal resorption.

DISCUSSION

Preschoolers, teenagers, and adults can sustain traumatic dental injuries, affecting 20-30% of permanent dentition globally. Around 80% of oral trauma occurs before the age of 20. Therefore, children and adolescents are more susceptible to severe dental injuries . The literature indicates that children who have dental trauma to their front teeth are more likely to avoid smiling and laughing and to be more self-conscious than children who have had no dental trauma [8].

Numerous factors influence the prognosis of intruded teeth. A multivariate regression analysis by Al- Badri et. Al. revealed that when the type of injury and stage of root development were accounted for, the effect of other factors was significantly reduced. Pulp necrosis risk increases with injury severity; in addition, teeth with completed root formation have a higher risk of pulp necrosis than do those with incomplete root formation [9]. It has been stated that the stage of root development has no effect on type of root canal treatment technique performed due to pulp necrosis. [10].

The challenge in our case was to maintain good health to the tooth and its surrounding structure without any complications such as replacement root resorption that lead to ankylosis which is the most common complication following severe intrusion [19]. Replacement root resorption is the most serious obstacle in growing patients due to its degenerative effect; thus, leaving the tooth in situ and resulting in infra-positioning and arresting the growth of the surrounding alveolar bone [20]. Multiple studies have found that replacement root resorption is related to the degree of intrusion [21, 22]. The success in our case represents as no ankylosis was observed up to the 2-year follow-up. This could be due to using an MTA and obtaining all its advantages in controlling the infection.

The decision of surgical repositioning was performed because the intrusion was more than 7 mm. In addition, the patient presented 5 days after the trauma and the mother mentioned that there was no spontaneous re-eruption noticed. The American Association of Endodontics recommends performing surgical or orthodontic repositioning within 3 weeks in cases of more than 7 mm intrusion in immature teeth and of more than 3 mm intrusion in mature teeth [6]. Therefore , the splint left for four weeks. Andreasen et al. reported in 2006 that the type of splint had no significant effect on the type of healing if surgical repositioning was performed. This also applied to the length of the splinting period (shorter or longer than 6 weeks) [23]. In the present case, a wire and composite splint was used for 4 weeks.

Apexification, a procedure to form a mineralized apical barrier, is one of the treatment options in such cases . Calcium hydroxide was the gold standard biomaterial for apexification for many years [11]. However, many studies have reported that using apexification with calcium hydroxideis inconvenient because it involves numerous visits over a prolonged period [12]. In addition, cervical root fractures have been reported in retrospective studies as a consequence of thin dentinal walls, as well as a weakened dental structure caused by calcium hydroxide [13]. MTA is currently used owing to its superior properties that include good sealing ability, an antimicrobial effect, and a capability to set in contaminated area with blood or water. Moreover, it is biocompatible, with low cytotoxicity, non-resorbable, and induces odontoblasts and hard tissue barriers [14-17]. In addition, its use in apexification to reduces treatment time and the number of visits required [18]. However, calcium hydroxide is utilized as an intracanal medicament for four weeks before the installation of MTA due to its capacity to minimize bacterial infection. [10].

CONCLUSION

Despite the uncertainty regarding the prognosis of intruded permanent teeth, the present case showed that surgical repositioning, splinting, and MTA as an apical plug were effective in maintaining the tooth.

Author Contributions:

Conceptualization, Soha Alqadi and Sarah Almuzaini; Investigation, Doaa Felemban; Original Draft Preparation, Soha Alqadi , Razan Alekhmimi and Arwa Bafail; Review & Editing, Ebtihal Zain-Alabdeen; Visualization, Arwa Bafail.

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Informed Consent Statement:

Informed consent was obtained from the patient's mother for her daughter to be imaged and to publish her case report.

Data Availability Statement:

Data is contained within the article or supplementary material

Conflicts of Interest: The authors declare no conflict of interest.

REFERENCES

1. Azami-Aghdash S, Ebadifard Azar F, Pournaghi Azar F, Rezapour A, Moradi-Joo M, Moosavi A, et al. Prevalence, etiology, and types of dental trauma in children and adolescents: systematic review and meta-analysis. Med J Islam Repub Iran. 2015;29(4):234.
2. Agouropoulos A, Pavlou N, Kotsanti M, Gourtsogianni S, Tzanetakis G, Gizani S. A 5-year data report of traumatic dental injuries in children and adolescents from a major dental trauma center in Greece. Dent Traumatol Off Publ Int Assoc Dent Traumatol. 2021 Aug;37(4):631–8.
3. Lauridsen E, Hermann NV, Gerds TA, Kreiborg S, Andreasen JO. Pattern of traumatic dental injuries in the permanent dentition among children, adolescents, and adults. Dent Traumatol Off Publ Int Assoc Dent Traumatol. 2012 Oct;28(5):358–63.
4. Humphrey JM, Kenny DJ, Barrett EJ. Clinical outcomes for permanent incisor luxations in a pediatric population. I. Intrusions. Dent Traumatol Off Publ Int Assoc Dent Traumatol. 2003 Oct;19(5):266–73.
5. Kenny DJ, Barrett EJ, Casas MJ. Avulsions and intrusions: the controversial displacement injuries. J Can Dent Assoc. 2003 May;69(5):308–13.
6. The Treatment of Traumatic Dental Injuries, ENDODONTICS: Colleagues for Excellence. Am Assoc Endodontists. 2014.
7. Altun C, Cehreli ZC, Güven G, Acikel C. Traumatic intrusion of primary teeth and its effects on the permanent successors: a clinical follow-up study. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2009 Apr;107(4):493–8.
8. Tewari N, Bansal K, Mathur VP. Dental Trauma in Children: A Quick Overview on Management. Indian J Pediatr. 2019 Nov;86(11):1043–7.
9. Clark D, Levin L. Prognosis and complications of mature teeth after lateral luxation: A systematic review. J Am Dent Assoc. 2019 Aug;150(8):649–55.
10. Plascencia H, Díaz M, Gascón G, Garduño S, Guerrero-Bobadilla C, Márquez-De Alba S, González-Barba G. Management of permanent teeth with necrotic pulps and open apices according to the stage of root development. J Clin Exp Dent. 2017 Nov 1;9(11):e1329-e1339. doi: 10.4317/jced.54287. PMID: 29302286; PMCID: PMC5741847.
11. Sheehy EC, Roberts GJ. Use of calcium hydroxide for apical barrier formation and healing in non-vital immature permanent teeth: a review. Br Dent J. 1997 Oct; 183(7):241–6.
12. Mohammadi Z. Strategies to manage permanent non-vital teeth with open apices: a clinical update. Int Dent J. 2011 Feb;61(1):25–30.
13. Andreasen JO, Farik B, Munksgaard EC. Long-term calcium hydroxide as a root canal dressing may increase risk of root fracture. Dent Traumatol Off Publ Int Assoc Dent Traumatol. 2002 Jun;18(3):134–7.
14. Torabinejad M, Hong CU, McDonald F, Pitt Ford TR. Physical and chemical properties of a new root-end filling material. J Endod. 1995 Jul;21(7):349–53.
15. Torabinejad M, Hong CU, Pitt Ford TR, Kettering JD. Antibacterial effects of some root end filling materials. J Endod. 1995 Aug;21(8):403–6.

16. Keiser K, Johnson CC, Tipton DA. Cytotoxicity of mineral trioxide aggregate using human periodontal ligament fibroblasts. J Endod. 2000 May;26(5):288–91.

17. Mitchell PJ, Pitt Ford TR, Torabinejad M, McDonald F. Osteoblast biocompatibility of mineral trioxide aggregate. Biomaterials. 1999 Jan;20(2):167–73.

18. T S Oliveira C, M A de Carvalho F, C O Gonçalves L, M N de Souza J, F R Garcia L, A F Marques A, et al. Mineral Trioxide Aggregate for Intruded Teeth with Incomplete Apex Formation. Bull Tokyo Dent Coll. 2018;59(1):35–41.

19. Campbell KM, Casas MJ, Kenny DJ. Ankylosis of traumatized permanent incisors: pathogenesis and current approaches to diagnosis and management. J Can Dent Assoc. 2005 Nov;71(10):763–8.

20. Tsilingaridis G, Malmgren B, Andreasen JO, Malmgren O. Intrusive luxation of 60 permanent incisors: a retrospective study of treatment and outcome. Dent Traumatol Off Publ Int Assoc Dent Traumatol. 2012 Dec;28(6):416–22.

21. Andreasen JO, Bakland LK, Andreasen FM. Traumatic intrusion of permanent teeth. Part 2. A clinical study of the effect of preinjury and injury factors, such as sex, age, stage of root development, tooth location, and extent of injury including number of intruded teeth on 140 intruded permanent teeth. Dent Traumatol Off Publ Int Assoc Dent Traumatol. 2006 Apr;22(2):90–8.

22. Ebeleseder KA, Santler G, Glockner K, Hulla H, Pertl C, Quehenberger F. An analysis of 58 traumatically intruded and surgically extruded permanent teeth. Endod Dent Traumatol. 2000 Feb;16(1):34–9.

23. Andreasen JO, Bakland LK, Andreasen FM. Traumatic intrusion of permanent teeth. Part 3. A clinical study of the effect of treatment variables such as treatment delay, method of repositioning, type of splint, length of splinting and antibiotics on 140 teeth. Dent Traumatol Off Publ Int Assoc Dent Traumatol. 2006 Apr;22(2):99–111.