CASE REPORT

A Short Time Period in the Treatment of an Open Apice Intruded Tooth: An 8-year Follow-up

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Abstract

Aim: Among traumatic dental injuries, intrusive dislocation is considered to be one of the most serious injuries. Despite the high success rate in complacent patients, the traditional technique of calcium hydroxide inoculation has drawbacks. The good antimicrobial and sealing properties combined with excellent biocompatibility and high success rates of the mineral trioxide aggregate (MTA) encourage its use.

Background: The objective of this study was to report a successful case of intrusive dislocation in a short time with a follow-up of eight years.

Case description: A patient, seven years of age, presented intrusive dental dislocation, confirmed by radiographic examination, which revealed besides axial displacement of the central incisor towards the bone, incomplete root development. The passive repositioning was chosen as the treatment modality. After cleansing of the root canal, therapy with hydroxide paste was performed for 30 days, and then the apex was closed using an artificial barrier made with apical MTA buffer to facilitate root canal obturation.

Conclusion: Clinical and radiographic signs at 6 months and 8 years of preservation evidence the success of the therapy.

Clinical relevance: Teeth with incomplete root formation when traumatized may have their development process interrupted; consequently their root canals remained ample with thin and fragile walls and the open apex which represents a great challenge to the accomplishment of endodontic therapy. The process of apexification with MTA as in this case is an alternative to traditional therapy based on calcium hydroxide, conferring a faster treatment and a decrease in the odds of fracture of the tooth since from the confection of the apical barrier there is a possibility of being the same restored at an early stage.

Keywords: Dental trauma, Intrusive luxation, Permanent tooth, Treatment.

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Introduction

Dental trauma, given its prevalence and consequences, is considered to be a public health problem.[1,2] Individuals with fractures may present, besides aesthetic sequels, social, functional, and therapeutic problems.[3,4] Dental trauma is more frequent in childhood and adolescence, and maxillary incisors are the most affected teeth.[5,6]

Among the traumatic lesions, intrusive dislocation is considered to be one of the most serious lesions. Characterized by the axial displacement of the tooth towards the alveolar bone, the intrusion can severely affect the pulp tissue and support structures, and the management and prognosis of the lesion are influenced by its extent and severity and also by the root development stage of the involved tooth.[7] Thus, due to their specific anatomical characteristics, teeth with incomplete root formation, when traumatized, represent an additional challenge to treatment.[8]

The clinical signs of intrusion are often occlusal misalignment, stiffness, and percussion, which will sound hard and harsh as compared to that of a normal tooth.[9,10] Radiographically, the teeth with intrusive dislocation present a difference in the position of the apices when they are compared to the normal neighboring teeth and may show a loss of the periodontal space.[11,12] The modalities of the treatment of the teeth with intrusive dislocation include, essentially, passive repositioning, which is based on waiting for spontaneous reuptake of the tooth or active repositioning by orthodontic traction or surgical repositioning.[11,13] However, despite this variety of therapies, the rehabilitation of teeth with intrusive dislocation is always a challenge, and in most cases the need for endodontic treatment may occur. This is because intrusive dislocation is generally associated with a high risk of complications, including pulpal necrosis, external inflammatory resorption, ankylosis, and marginal bone loss.[14] When the decision is made that pulp necrosis has occurred or in the presence of periapical radiolucency, endodontic treatment should begin immediately. Calcium hydroxide was used to fill the canal until the open apex closure, and became the most widely accepted material to promote apexification. The usual time required to achieve apexification is superior to 12 months.[15,16]

Despite the high success rate in complacent patients, the traditional technique of calcium hydroxide inoculation has disadvantages, such as the long treatment time due to the need for multiple sessions and the difficulty in maintaining coronal seal integrity between appointments.

In addition, when placed for long periods, the calcium hydroxide pastes may increase the dentin fragility risk of root fracture.[17,18] The good antimicrobial and sealing properties combined with the excellent biocompatibility and high success rates of the mineral trioxide aggregate (MTA) reported in studies[19–21] encouraged its use. The results of a systematic review with a meta-analysis comparing the clinical and radiographic endodontic treatment outcomes

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available in the management of immature permanent necrotic teeth favored the application of MTA in relation to calcium hydroxide and regenerative endodontic procedures (REPs).[22]

Similarly, a recent case series study considered MTA firming as a viable and predictable treatment approach for the long-term success of non-vital immature teeth. Clinical and radiographic findings revealed that 96% of the teeth treated with the technique were considered "healed" and in operation for an average of 8.29 years after therapy, in addition to none of the teeth having fractured in this period.[23]

The objective of this study was to report a successful clinical case of intrusive luxation in a short period of time with a follow-up of eight years.

Case Description

A seven years old patient attended, accompanied by heads to the specialized dental office for the evaluation of dental traumatism. In anamnesis, a fall was reported as the cause of the trauma. There were no episodes of major bleeding or loss of consciousness after the fall. Physical examination revealed soft tissue lesions in the perioral region, as well as edema and blunt wound on the upper lip. On intraoral examination, we observed traumatic ulcers in the mucosa, small gingival bleeding in the region of the upper anterior teeth, and intrusion of tooth 21,[20] evidenced by the occlusal misalignment between the homologs.

The tooth in question appeared to be firm prior to the mobility test and echoed the metallic sound characteristic of the percussion. Pulpal vitality tests, including the cold test (Endo-Ice, The Hygenic Corp. Akron, OH, USA) and electrical testing (Analytic Technology, Redmond, WA, USA), elicited a negative response. Radiographic examination revealed, in addition to the axial displacement of the incisor towards the bone, obliteration of the space of the periodontal ligament, incomplete root development, and the presence of an open apex. No changes were observed in the remaining teeth.

In view of the clinical and radiographic findings (Fig. 1A), passive repositioning was chosen as the treatment modality. Emergency treatment was done by means of local antisepsis and treatment of mucosal lesions, in addition to prescribed drugs for infection prevention and pain control. The patient was also instructed to perform mouthwash with 0.2% chlorhexidine for 7 days.

The subsequent clinical and radiographic follow-up evidenced a satisfactory evolution of the case with gradual retraction of the tooth with intrusive dislocation. Radiographically, however, the presence of a radiolucent image, suggestive of a periapical lesion, confirmed the diagnosis of pulpal necrosis after 7 months from the previous meeting (Fig. 1B). Consequently, the root formation was interrupted and the tooth remained with the wide canal and apex open.

The root canal was cleaned with K #80 (Fig. 1C) manual file and irrigated with solution. The restoration process was performed with conservative palatine coronary access using a #1557 drill (KG Sorensen, Barueri, SP, Brazil) of 1% sodium hypochlorite (Lenza Farmacêutica Ltda, Belo Horizonte, MG, Brazil). After root canal cleaning, a calcium hydroxide paste was applied with the aid of Lentulo spiral (Dentsply Maillefer, Ballaigues, Switzerland) (Fig. 1D) and the tooth sealed with temporary restorative material Coltosol (Vigodent SA Indústria e Comércio, Rio de Janeiro, Brazil).

After 30 days of calcium hydroxide therapy, the apex was closed using an artificial barrier made with an apical plug of MTA (Angelus, Soluções odontológicas, Londrina, PR, Brazil) to facilitate the root canal filling.

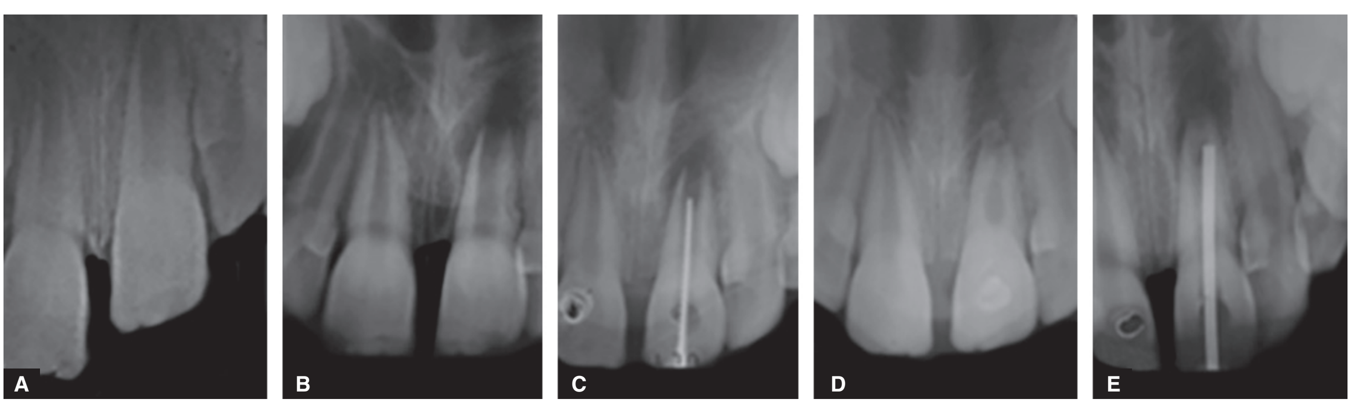
Before the apical plug was made, the MTA port and manual capacitor selection (Fig. 1E) were tested for thickness, and then the MTA port was manipulated according to the manufacturer's recommendations in a powder–liquid ratio of 3:1 and carried to the root canal with the aid of an MTA holder. After insertion, the material was condensed with handheld condensers under slight ultrasonic vibration (ENAC, ST 21, ENAC OE-W10, Osada Co., Tokyo, Japan) for 5 seconds. The formation of the mineralized barrier was confirmed radiographically (Fig. 2A).

The root canal was obturated with an inverted medium gutta-percha cone (Odous de Deus, Belo Horizonte, Brazil) followed by the use of three auxiliary cones by the lateral condensation technique prior to thermocompaction of gutta-percha by the McSpadden condenser (Fig. 2B). Once the obturation was completed, the tooth was provisionally sealed and the patient was referred for final restoration (Fig. 2C). Clinical and radiographic signs at 6 months (Fig. 2D) and 8 years (Fig. 2E) of preservation evidence the success of the therapy.

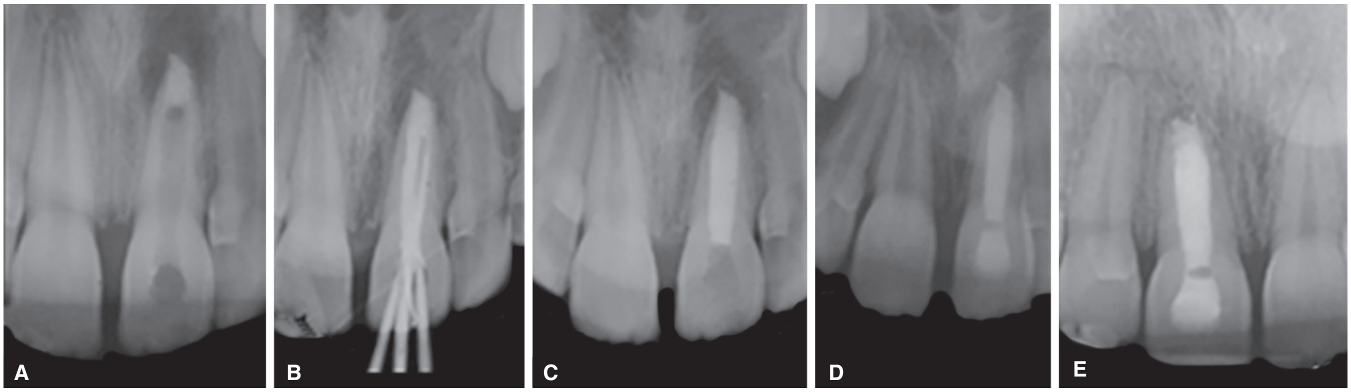
Discussion

Intrusive displacement is rare in permanent dentitions comprising about 0.3% to 1.9% of traumatic dental injuries.[11,24] The severity of the lesion together with the root development stage is the main factor for the determination of the treatment and prognosis of the case. As for its severity, the intrusion is divided into three stages: light dislocation in which the dental element presents an axial displacement of less than 3 mm, moderate displacement ranging from 3 to 6 mm, and severe intrusion with displacement greater than 6 mm.[11,25–27]

Among the treatment modalities, the first option, particularly for teeth with an open apex, is passive repositioning. This approach,



Figs 1A to E: (A) Preoperative radiograph; (B) Necrosis after 7 months; (C) BMP with #K80; (D) $Ca(OH)_2$ filled in canal; (E) Apical plug with MTA



Figs 2A to E: (A) Radiograph to check apical barrier; (B) Thermocompaction by McSpadden condenser; (C) Complete obturation; (D) Follow-up radiograph after 6 months; (E) Follow-up radiograph after 8 years

also adopted in the present case, was recommended by the British Society of Pediatric Dentistry in its guidelines in 2010[28] and by the International Association of Dental Traumatology in 2012.[28,29] However, despite being the most conservative of therapies there is the possibility of occurrence of root resorption or dental ankylosis during the reeruption.[30]

In teeth with moderate intrusion, orthodontic traction is the indicated therapy, allowing the remodeling of the bone and the periodontal apparatus. The surgical repositioning in turn is adequate for the management of teeth with severe intrusive dislocation and will allow the early start of root canal treatment.[31] Despite the fact that it favors access to endodontic treatment, which may help to prevent the appearance of inflammatory root resorption, active repositioning may cause more trauma to the already damaged periodontal tissue, leading to an increase in complications during the healing period.[26]

Although the incidence of pulpal necrosis after intrusion is lower in teeth with an open apex when compared to those with total root formation, this is not an uncommon event, occurring in 63% to 68% of cases, because the blood supply of the pulp would be compromised in displaced teeth. Thus, as soon as the pulp necrosis is diagnosed, it is important that the root canal treatment be initiated in order to prevent complications.[32]

Pulp necrosis in teeth with incomplete rhizogenesis ceases the process of dentin formation and root growth is interrupted. When there is evidence of periapical radiolucency, endodontic treatment is needed. Under such conditions, the guidelines of the International Association of Dental Traumatology (2007) recommend that any tooth with necrotic pulp associated with a dislocation lesion be filled with calcium hydroxide temporarily. Its use is necessary to prevent and control both internal resorption and inflammatory apical root resorption.[33,34] Although the clinical success of the calcium hydroxide inoculation technique is proven, it has disadvantages, especially the long treatment time.[35,36]

Attempts at apexification at a time short period have been a challenge. It would have been observed 40 years before, when some studies demonstrated that the use of tricalcium phosphate could promote apexification similar to that found with calcium hydroxide, but the treatment was achieved in one appointment. It seems that such old studies were the MTA precursor studies.[35–37]

An excellent alternative, used in this study, is the application of MTA as an apical barrier. Its use shortens the time limit for the endodontic treatment, allowing the immediate accomplishment of the obturation and final restoration, thus reducing the possibility of recontamination of the root canal system as well as the risk of fracture[19,20,38,39] increasing the probability of obtaining favorable results.[39–41]

However, previous use of calcium hydroxide over a period of 30 days seemed to be extremely important for further decontamination of the root canal system.[42] It is important, however, to note that intrusive dislocation is an extremely serious lesion, according to Andreasen and Andreasen, about 30% of the teeth with intrusive dislocation may be lost even 15 years after the trauma, regardless of the stage of radicular development.[43] Faced with this, preservation becomes essential. The periodic clinical and radiographic follow-up and over time of the affected tooth, as approached in this study, enable the professional to prevent, diagnose, and treat early possible complications.[44]

Conclusion

The management of dentoalveolar trauma should be done judiciously. Also, the preservation of the case is as important as diagnosis and treatment. Clinical and radiographic monitoring over time is essential for the detection of possible common and subsequent sequelae in order to preserve the function and aesthetics of the traumatized tooth.

Clinical Relevance

Teeth with incomplete root formation when traumatized may have their development process interrupted; consequently, their root canals remained ample, with thin and fragile walls and the open apex, which represents a great challenge to the accomplishment of endodontic therapy. The process of apexification with MTA as in this case is an alternative to traditional therapy based on calcium hydroxide, conferring a faster treatment and a decrease in the odds of fracture of the tooth since from the confection of the apical barrier there is possibility of being the same restored at an early stage.

References

1. Traebert J, Peres MA, et al. Prevalence of traumatic dental injury and associated factors among 12-year-old school children in Florianópolis, Brazil. Dent Traumatol 2003;19:15–18. DOI: 10.1034/j.1600-9657.2003.00138.x.
2. Andreasen JO, Andreasen FM. Dental traumatologi: quo vadis. Taudlaegebladet 1989;93:381–384.
3. Cortes MI, Marcenes W, et al. Impact of traumatic injuries to the permanent teeth on the oral health-related quality of life in 12-14-year-old children. Community Dent Oral Epidemiol 2002;30(3):193–198. DOI: 10.1034/j.1600-0528.2002.300305.x.

4. Ramos-Jorge ML, Bosco VL, et al. The impact of treatment of dental trauma on the quality of life of adolescents—a case-control study in southern Brazil. Dent Traumatol 2007;23:114–119. DOI: 10.1111/j.1600-9657.2005.00409.x.
5. Petti S, Glendor U, et al. World traumatic dental injury prevalence and incidence, a meta-analysis-one billion living people have had traumatic dental injuries. Dent Traumatol 2018;34(2):71–86. DOI: 10.1111/edt.12389.
6. Schatz JP, Hakeberg M, et al. Prevalence of traumatic injuries to permanent dentition and its association with overjet in a Swiss child population. Dent Traumatol 2013;29:110–114. DOI: 10.1111/j.1600-9657.2012.01150.x.
7. Andreasen JO, Andreasen FM, et al. Textbook and color atlas of traumatic injuries to the teeth, 4th ed. Copenhagen: Munksgaard, 2007.
8. Windley W, Teixeira F, et al. Disinfection of immature teeth with a triple antibiotic paste. J Endod 2005;31(6):439–443. DOI: 10.1097/01.don.0000148143.80283.ea.
9. Andreasen JO, Andreasen FM. Textbook and color Atlas of Traumatic Injuries to the Teeth, 3rd ed. Copenhagen: Munksgaard; 1994.
10. Dumsha TC. Traumatic injuries to teeth. Dent Clin North Am 1995;39:85–87.
11. Andresen JO, Bakland LK, et al. 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. Dental Traumatol 2006;22:90–98.
12. Faus-Matoses V, Martínez-Viñarta M, et al. Treatment of multiple traumatized anterior teeth associated with an alveolar bone fracture in a 20-year-old patient: a 3-year follow up. J Clin Exp Dent 2014;6(4):425–429. DOI: 10.4317/jced.51374.
13. Thakur S, Thakur NS. A 5-year follow-up case of multiple intrusive luxative injuries. Dent Hypotheses 2012;3(3):118–120. DOI: 10.4103/2155-8213.103935.
14. Al Badri S, Kinirons M, et al. Factors affecting resorption in traumatically intruded permanent incisors in children. Dent Traumatol 2002;18:73–76. DOI: 10.1034/j.1600-9657.2002.180205.x.
15. 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;183:241–246. DOI: 10.1038/sj.bdj.4809477.
16. Rafter M. Apexification: a review. Dent Traumatol 2005;21(1):1–8. DOI: 10.1111/j.1600-9657.2004.00284.x.
17. Andreasen JO, Farik B, et al. Long-term calcium hydroxide as a root canal dressing may increase risk of root fracture. Dent Traumatol 2002;18:134–137. DOI: 10.1034/j.1600-9657.2002.00097.x.
18. Batur YB, Erdemir U, et al. The long-term effect of calcium hydroxide application on dentin fracture strength of endodontically treated teeth. Dent Traumatol 2013;29:461–464. DOI: 10.1111/edt.12037.
19. Bonte E, Beslot A, et al. MTA vs $Ca(OH)_2$ in apexification of non-vital immature permanent teeth: a randomized clinical trial comparison. Clin Oral Investig 2015;19:1381–1388. DOI: 10.1007/s00784-014-1348-5.
20. Torabinejad M, Ford TR, et al. Tissue reaction to implanted root-end filling materials in the tibia and mandible of guinea pigs. J Endod 1998;24:468–471. DOI: 10.1016/S0099-2399(98)80048-4.
21. Damle SG, Bhattal H, et al. Apexification of anterior teeth: a comparative evaluation of mineral trioxide aggregate and calcium hydroxide paste. J Clin Pediatr Dent 2012;36:263–268. DOI: 10.17796/jcpd.36.3.02354g044271t152.
22. Nicoloso GF, Pötter IG, et al. A comparative evaluation of endodontic treatments for immature necrotic permanent teeth based on clinical and radiographic outcomes: a systematic review and meta-analysis. Int J Paediatr Dent 2017;27:217–227. DOI: 10.1111/ipd.12261.
23. Ree MH, Schwartz RS. Long-term success of nonvital, immature permanent incisors treated with a mineral trioxide aggregate plug and adhesive restorations: a case series from a private endodontic practice. J Endod 2017;43(8):1370–1377. DOI: 10.1016/j.joen.2017.02.017.
24. Skaare AB, Jacobsen I. Dental injuries in Norwegians aged 7-18 years. Dent Traumatol 2003;19:67–67. DOI: 10.1034/j.1600-9657.2003.00133.x.
25. Andreasen JO, Bakland LK, et al. Traumatic intrusion of permanent teeth. Part 1. An epidemiological study of 216 intruded permanent teeth. Dent Traumatol 2006;22:83–89. DOI: 10.1111/j.1600-9657.2006.00421.x.
26. Andreasen JO, Bakland LK, et al. Traumatic intrusion of permanent teeth. Part 3. A clinical estudy of the effect of treatment variables such as treatement delay, method of repositioning, type of splint, length of splinting and antibiotics on 140 teeth. Dent Traumatol 2006;22:99–111. DOI: 10.1111/j.1600-9657.2006.00423.x.
27. Flores MT, Andersson L, et al. Guidelines for the management of traumatic injuries. I. Fractures and luxations of permanent teeth. Dent Traumatol 2007;23:66–71. DOI: 10.1111/j.1600-9657.2007.00592.x.
28. Albadri S, Zaitoun H, et al. UK National Clinical Guidelines in Paediatric Dentistry: treatment of traumatically intruded permanent incisor teeth in children. Int J Paediatr Dent 2010;20(Suppl 1):1–2. DOI: 10.1111/j.1365-263X.2010.01085.x.
29. Diangelis AJ, Andreasen JO, et al. International Association of Dental Traumatology Guidelines for the management of traumatic dental injuries. 1. Fractures and luxations of permanent teeth. Dent Traumatol 2012;28:2–12. DOI: 10.1111/j.1600-9657.2011.01103.x.
30. Chan AW, Cheung GS, et al. Different treatment outcomes of two intruded permanent incisors–a case report. Dent Traumatol 2001;17:275–280. DOI: 10.1034/j.1600-9657.2001.170606.x.
31. Cunha RF, Pavarini A, et al. Influence of surgical repositioning of mature permanent dog teeth following experimental intrusion: a histological assessment. Dent Traumatol 2002;18:304–308. DOI: 10.1034/j.1600-9657.2002.00117.x.
32. Andreasen FM, Vestergaard Pedersen B. Prognosis of luxated permanent teeth—the development of pulp necrosis. Endod Dent Traumatol 1985;1:207–220. DOI: 10.1111/j.1600-9657.1985.tb00583.x.
33. Haapasalo M, Endal U. Internal inflammatory root resorption: the unknown resorption of the tooth. Endodontic Topics 2006;12:60–79. DOI: 10.1111/j.1601-1546.2008.00226.x.
34. Majorana A, Bardellini E, et al. Root resorption in dental trauma: 45 cases followed for 5 years. Dent Traumatol 2003;19:262–265. DOI: 10.1034/j.1600-9657.2003.00205.x.
35. Cveck M. Prognosis of luxated non-vital maxillary incisors treated with calcium hydroxide and filled with guttapercha. Endod Dent Traumatol 1992;8:45–55. DOI: 10.1111/j.1600-9657.1992.tb00228.x.
36. Rafter M. Apexification: a review. Dent Traumatol 2005;21:1–8. DOI: 10.1111/j.1600-9657.2004.00284.x.
37. Koenigs JF, Heller AL, et al. Induced apical closure ofpermanent teeth in adult primates using a resorbable form oftricalcium phosphate ceramic. J Endod 1975;1:102–106. DOI: 10.1016/S0099-2399(75)80026-4.
38. Hachmeister DR, Schindler WG, et al. The sealing ability and retention characteristics of mineral trioxide aggregate in a model of apexification. J Endod 2002;28:386–390. DOI: 10.1097/00004770-200205000-00010.
39. Simon S, Rilliard F, et al. The use of mineral trioxide aggregate in one-visit apexification treatment: a prospective study. Int Endod J 2007;40:186–197. DOI: 10.1111/j.1365-2591.2007.01214.x.
40. De Jesus Soares A, Yuri Nagata J, et al. Apexification with a new intra-canal medicament: a multidisciplinary case report. Iran Endod J 2012;7(3):165–170.
41. Khalilak Z, Vali T, et al. The effect of one-step or two-step MTA plug and tooth apical width on coronal leakage in open apex teeth. Iran Endod J 2012;7(1):10–14.
42. Leonardo MR, Silveira FF, et al. Calcium hydroxide root canal dressing. Histopathological evaluation of periapical repair at different time periods. Braz Dent J 2002;13(1):17–22.
43. Andreasen JO, Andreasen FM. Intrusive luxation. In: Andreasen JO, Andreasen FM, ed. Textbook and Color Atlas of Traumatic Injuries to the Teeth, 4th ed. Oxford, UK: Wiley-Blackwell; 2007. pp. 428–43.
44. Gomes GB, da Costa CT, et al. Traumatic intrusion of permanent teeth: 10 years follow-up of 2 cases. Dent Traumatol 2013 Apr;29(2):165–169. DOI: 10.1111/j.1600-9657.2011.01105.x.