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Management of a tooth with internal root resorption – A case report

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Abstract

Internal Root resorption results due to the clastic activity of multinuclear cells. It might be physiologic; such occurs in deciduous dentition or sometimes pathologic. It causes progressive loss of dental hard tissues. There are various causes of root resorption, among them trauma is thought to be the prime initiating factor. It mostly associated with maxillary anterior teeth and found during routine radiographic examination as in most of the cases patient is usually symptom free. However, if it goes undiagnosed or if left untreated it may expand in size and cause root perforation and may eventually loss of the tooth. Early diagnosis with proper diagnostic methods is helpful to prevent further extension of the resorption. Cone Beam Computed Tomography (CBCT) is one of the advanced modalities which clearly denotes the size and extent of the resorptive lesion. Root canal treatment remains the only treatment modality to manage such cases. Thorough irrigation of the root canal with sodium hypochlorite along with irrigation activation, calcium hydroxide intra-canal medicament and use of mineral trioxide aggregate lining the resorption area and/or sealing the root perforation are the cornerstone to manage internal root resorption cases.

This case report describes the management of a maxillary permanent central incisor with internal root resorption in which Mineral Trioxide Aggregate (MTA) was used to seal the resorbed area followed by endodontic therapy with 6 months follow up.

Keywords: Internal root resorption, trauma, perforation, cone beam computed tomography, mineral trioxide aggregate, root canal treatment.

Introduction

The term "Resorption" means "a physiologic or pathologic loss of dentin, cementum, and/or bone not immediately due to caries or trauma".[*1]* Resorption may be a physiologic event (such as root resorption of deciduous tooth) or it can be pathological. Andreasen has classified tooth resorption as Internal (Inflammatory, Replacement) and External (Surface, Inflammatory and Replacement).[2]

Internal root resorption is the progressive destruction of intraradicular dentin and dentinal tubules along the middle and apical thirds of the canal walls as a result of clastic activities.[3] It is seen as a radiolucent area around the pulpal cavity, usually of incisors and mandibular molars. The various etiological factors suggested for internal root resorption include traumatic injury; infection and orthodontic treatment.[4] .

Resorption occurs in two stages: Degradation of the inorganic mineral structure followed by disintegration of the organic matrix.[5] Internal inflammatory resorption involves progressive loss of dentin, whereas root canal replacement resorption involves subsequent deposition of hard tissue that resembles bone or cementum but not dentin.[6] Internal inflammatory resorption can be perforating or non-perforating root resorption.

Clinically, the condition is usually asymptomatic, however, it may include the presence of a reddish area – pink spot, which represents the granulation tissue showing through the resorbed area. Radiographs are mandatory for diagnosing internal resorption, which reveals a round-to-oval radiolucent enlargement of the pulp space.[2,4] The margins are smooth and clearly defined with distortion of the original root canal outline.

Root canal treatment should be initiated as early as diagnosis is made to limit the propagation of resorption by severing the blood supply to the resorbing tissues. Mineral trioxide aggregate (MTA) is a biocompatible material that can be used for perforation repair due to its superior sealing ability **[7],** fibroblastic stimulation [8], and antimicrobial activity [9]. In addition, MTA can also create a favorable environment for periodontal healing and allow new cement growth on its surface [10].

This case report describes the management of a maxillary permanent central incisor with inflammatory non-perforating internal root resorption in which MTA was used to seal the resorbed area followed by non-surgical endodontic therapy with 6 months follow up.

Case Report

A 53-year-old male patient reported to the Department of Conservative Dentistry and Endodontics, with pain in the upper front teeth region since last 2 month. The pain was throbbing in nature and it was spontaneous. History revealed that he had visited a dentist 1 month ago with complaint of pain in upper front tooth region and endodontic treatment was initiated with relation to maxillary right central incisor. Pain was mild to moderate in intensity, aggravates on chewing food. Patient had a history of trauma due to fall from bicycle 2 years back in maxillary anterior teeth region.

Medical history of the patient was non-contributory. The patient was informed about the various diagnostic and clinical investigation procedures to be conducted and a valid consent was taken. On clinical examination the tooth was found to be severely attired and there was a temporary restorative material on labial aspect of the tooth. The tooth had a negative response when tested with Endo-Ice (Coltene, Cuyahoga,OH) and warm gutta percha and responded positively to both percussion and palpation. Periodontal probing exhibited probing depths that were less than 3mm and mobility was within physiologic limits.

On clinical examination, there was a crown fracture involving the pulp in respect to maxillary right central incisor. Left central incisor was RCT treated and restored with composite resin. Tenderness elicited on vertical percussion in respect to right central incisor. Clinically no mobility was observed, no pus draining sinus or no swelling was evident (Fig. 1)

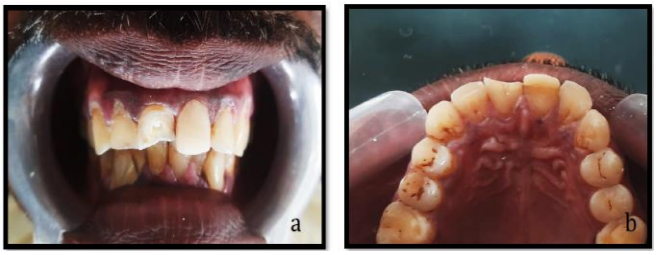

Fig. 1: Intra oral clinical photograph (a) Labial view; (b) Palatal view

On intra-oral radiographic examination, a well-defined radiolucency of uniform density having a ragged outline in the apical third of maxillary right central incisor was seen along with presence of periapical radiolucency. (Fig.2)

Fig. 2: Preoperative radiograph showing well-defined radiolucent areaon the maxillary right central incisor tooth with irregular border at the apical third. Periapical radiolucency is also seen. Adjacent left central incisor is RCTtreated.

Patient was sent for CBCT for confirmatory diagnosis.

CBCT image shows there is presence of a well-demarcated resorbed area at the apical third of the tooth which is almost oval in shape and there is presence of dentinal layer surrounding the resorbed zone which ensures there is no root perforation at all (Fig.3). There is also evidence of periapical bone destruction in respect to maxillary right central incisor which denotes presence of periapical lesion (Fig.3d).

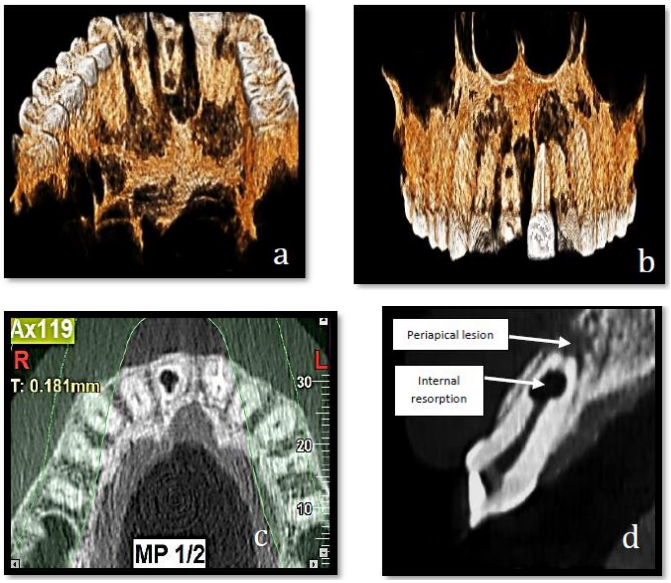

Fig. 3: CBCT imaging showing a well-defined resorptive lesioninapical third of maxillary right central incisor tooth. Evidence of a layer of dentine present surrounding the resorbed area confirms there is no root perforation as such.

(a) Palatal view; (b) Labial view; (c) Axial view; (d) Sagittal view

Based on CBCT findings, the lesion was diagnosed as inflammatory internal root resorption and treatment was planned accordingly.

The access cavity was modified under rubber dam isolation (Hygenic, Coltene Whaledent), and the working length was determined by using electronic apex locator (CanalPro, Coltene Whaledent) as well as confirmed by radiograph. (Fig.4)

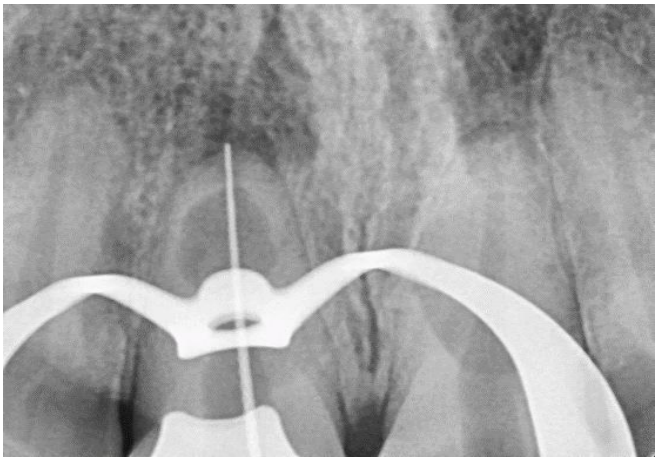

Fig. 4: Determination of working length radiographically

After determination of the working length, root canal was prepared by circumferential filing along with the application of 17% EDTA gel (NeoEDTA, Orikam) and 30-gauge side vented needle was used for thorough irrigation with 5 ml of 5.2% sodium hypochlorite and final irrigation done with normal saline. During irrigation, the irrigating solution was activated by ultrasonic tip (Ultra X silver ultrasonic tip, Orikam) (Fig.5)

Fig. 5; ULTRA X SILVER ULTRASONIC TIP, #20,2%

Subsequently calcium hydroxide intracanal medicament (RC Cal, Prime Dental Products) was placed and the access cavity was temporarily sealed with Cavit G (3 M ESPE, St Paul, MN). Patient was recalled after 14 days. In follow-up appointment the patient was completely asymptomatic. Root canal was irrigated thoroughly with 5ml of 5.2% sodium hypochlorite and normal saline to clean the root canal and the canal was dried with absorbable paper points (DiaDent). A resorbable collagen matrix (ColoPlug, Cologenesis Healthcare Pvt Ltd) (Fig.6a) was placed at the apical end of the tooth with root canal plugger (Buchanan Hand Plugger, SybronEndo) in order to create an apical barrier.

After creating apical barrier, white MTA powder (Bio Structure MTA, SafeEndo) (Fig.6b) was mixed according to manufacturer's instruction and placed with MTA carrier at the apical third of the canal and the internal wall of the resorbed area followed by firmly condensed by using plugger (Buchanan, Dentsply) and a wet paper point was placed in the root canal. (Fig.7a) The access cavity was temporarily sealed with Cavit G (3 M ESPE, St Paul, MN).

Patient was recalled after 24 hours and evaluation of MTA plug formation was done radiographically as well as clinically. After that the root canal wall was coated with AH plus sealer (Dentsply Maillefer) and the remaining portion of the root canal was obturated with thermoplasticized gutta percha (Dentsply Sirona) by backfill technique. (Fig.7b) Post endodontic restoration was done with composite resin (Te-Econorm Plus composite, Ivoclar) (Fig.7c)

Fig. 6: (a)Resorbable Collagen matrix ColoPlug; (b) Mineral Trioxide Aggregate (MTA)

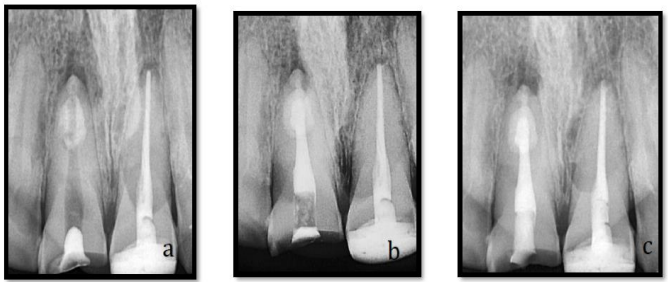

Fig.7: (a) MTA plugging at apical third of the root; (b) obturation by backfill; (c) Post endodontic restoration

The patient was then recalled after one week, at one month, three month and six-month interval for periodic follow-up. There is gradual decrease in periapical lesion evident in radiograph (Fig.8)

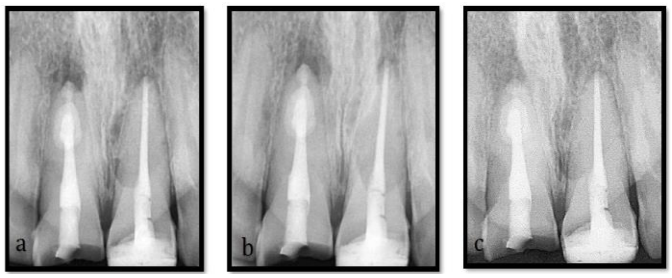

Fig.8: Follow-up radiograph of maxillary right central incisor (a) one-month post-operative; (b) three-month post-operative; (c) six-month post-operative. Note the periodic healing of periapical radiolucency

Discussion

Root resorption – both internal and external are mainly inflammatory in nature which often become challenging to distinguish. [11] Multinucleated osteoclast cells are mainly responsible for root resorption.[12] Wedenberg et al. stated in his study that internal resorption of root can be of two type, either transient or progressive. The progressive nature of root resorption mainly associated with a continuous inflammatory process from a definitive source of infection.[13]

Internal resorption can be detected by: Visual examination based on changed color in tooth crown, radiographic diagnosis, conventional and cone beam computed tomography, light microscopy and electron microscopy. [3,14] Radiographically Internal root resorption is diagnosed as an oval shaped enlargement of the root canal space, and the canal is not visible through the resorption area. [15] Also, the defect for internal resorption is a widening of the canal. First case of internal root resorption has been reported as early as 1830. [16] When resorption involves the crown portion of the tooth, it shows a pinkish hue, often described as ‘pink tooth of Mummery’, named after anatomist James Howard Mummery. This is thought to be due to escape of blood from ruptured blood vessels that in turn lead to the blood get entrapped inside the pulp chamber. [17] Trauma is the prime initiating factor for internal root resorption. It may be due to the damage to the organic sheath, predentin and the odontoblast cells covering the root dentin. This in turn leads to expose the mineralized tissue to pulpal cells those having resorbing potentials. Other contributing factors may include long standing inflammatory pulpal diseases, untreated cracked tooth, transplanted tooth, tooth invagination, orthodontic treatment and even viral infection such as Herper zoster virus. [18-19,20] Occurrence of internal root resorption is rare, Haapasalo et al. mentioned that the occurrence of internal resorption has seen in between 0.01% and 1% of cases.[21] Thoma et al. investigated internal root resorption in 1,000 teeth, and resorption found in 1. [22] Progression of the internal resorption depends upon the remaining vitality of the pulp tissue as the remaining viable pulp apical to the resorptive area provide nutrients to the clastic cells and provides stimulation. [2,23]

Resorptive defects are generally asymptomatic, thus they remain frequently undiagnosed.[24] Usually the classical appearance of internal resorption is easy to identify in radiographs, seen as a well demarcated round to oval widening of root canal space. However, in multi-rooted teeth and teeth with a wide pulp chamber, resorption

may begin at a distinct portion of pulp chamber and spread locally into circumpulpal dentin. In such cases, it is quite difficult to differentiate between internal and external cervical root resorption until the resorption area is accessed directly and clean during endodontic treatment. [14] Radiograph taken from different horizontal angulation (Tube-shift technique) or a cone-beam computed tomography (CBCT) or a cone-beam volumetric tomography (CBVT) image of a suspected tooth allows proper observation regarding the dimensions of the lesion in axial, sagittal, and coronal planes. Thus multiplaner extent of the resorptive lesion as well as judgement regarding whether root perforation is present or not can be made efficiently.[25] One of CBCT's major advantages over computed tomography (CT) scanners is the reduction in radiation exposure. CBCT gives information about the following: (i) lesion size, shape and location (ii) presence of root perforations, apical bone lesion (iii) root wall thickness, (iv) localization of anatomical structures such as maxillary sinus, mental foramen, and inferior alveolar nerve. All these criteria corroborate the differential diagnosis and prognosis of root resorption

In general, there are three treatment options for internal resorption

1. No treatment with eventual extraction if and when the tooth becomes symptomatic.
2. Immediate extraction.
3. Saving it by doing internal treatment that include conventional root canal treatment.

Before we decide our plans, we must make a decision first on the prognosis of the tooth. If the resorption is contained within the root with no perforation, good prognosis for treatment with conventional endodontic treatment can be achieved. If the resorption perforates the root the prognosis is reduced. If the resorption is in the cervical area of the tooth, long term predictability of the tooth needs to be considered from a structural point, especially for anterior teeth. Restorability also must not to be forgotten before deciding the treatment plan and if the tooth is restorable and has a reasonable prognosis, saving it by doing root canal treatment is the choice. In some cases, surgical approach is needed when it is not possible to get access to the lesion through the canal. Surgical treatment should always be performed in a second intention, after orthograde treatment (or retreatment) has been performed, the coronal part of the canal being filled. In these cases because of the shape of the lesion, surgical approach allows to get direct access to the lesion and to perform a mechanical cleaning of the resorbed defect.

In internal resorption, our purpose of doing root canal treatment is to remove any remaining vital or necrotic tissues in the system that can sustain and stimulate the resorbing cells via their blood supply. Access cavity preparation should be conservative, preserving as much tooth structure as possible and should avoid further weakening of the already compromised tooth. In teeth with actively resorbing lesions, we might need to be extra careful since bleeding from the inflamed pulpal and granulation tissues can occur and might impair visibility during the initial stages of chemomechanical debridement. Another challenging step in resorbed tooth is working length determination with an apex locator as in case of resorptive perforation it may show inaccurate result, so we should rely on radiographic working length.[26]

Endodontic treatment (orthograde or retrograde) is only way out to treat such resorption defects as it removes the granulation tissues and severe the blood supply to clastic cells. Cleaning and debridement of canal space of a tooth with internal resorption is quite challenging and different

from conventional one. The shape of the resorption defect usually makes it inaccessible to direct mechanical instrumentation.[3]

Active resorptive lesion produce brisk bleeding while instrumentation, however when the vital pulp tissue is removed, bleeding stops immediately.[14] Endodontic instrumentation and passively delivered irrigating solution fails to reach the niches at the reorption site, this may cause inadequate debridement of organic debris and biofilms. Ultrasonic activation of irrigants may overcome this problem to some extent. Thus activation of irrigating liquids should be considered as an essential step during chemomechanical debridement. [27] However, even with the use of ultrasonic instruments, bacteria might still remain in confined areas.[28] Thus, an intracanal, antibacterial medicament improves disinfection of the inaccessible root resorption defects.[29] Calcium hydroxide has been shown to effectively eradicate microorganisms that persist even after chemomechanical debridement, also helps in controlling intracanal bleeding and to remove necrotic residual pulp tissue.[30,31] It has also been shown to have an additive effect when used in conjunction with sodium hypochlorite to remove bacteria and other organic debris from secluded spaces within the root canal. [32,33]

In this case, the resorption area was near to the radiographic apex,so the apex area and outer lining of resorbed area was filled with Mineral Trioxide Aggregate (MTA). MTA is a remarkable material with superior biocompatibility and excellent sealing property.[17] In cases where there is perforated resorption or there might be chance of perforation (such as large resorptive defect where remaining surrounding dentinal wall is too small), MTA should be considered to seal the resorption area. Biodentine is another bioactive material with superior physical properties, can also be used in this purpose. [14] The ultimate goal of endodontic treatment to create a fluid tight seal of the root canal space. In case of internal resorption, conventional method of obturation is not possible as the filling material fails to obturate the resorption zone. For this type of cases, the obturating material should easily flow towards the niches. Gutta percha being the most commonly used obturating material in day-to-day practice. [3] Gencoglu et al. in their study stated that thermoplastic gutta-percha techniques were significantly better in filling artificial resorptive cavities when compared to cold lateral condensation technique.[34] Since resorbed area was near to the apex, it was decided to use a resorbable collagen sponge to limit the MTA and prevent it from extrusion. The collagen sponge (ColoPlug) was cut into small pieces and it was then condensed beyond the canal apex using endodontic pluggers, until the periapical space was full in order to create a barrier for the MTA. The collagen pieces were condensed using a plugger with a rubber stopper at the working length. The lyophilized collagen sponge used in the present case, is absorbable and has porcine origin, with better biocompatibility than that obtained from animal skin (Gelfoam), because in 24 days it promotes complete alveolar bone healing with presence of trabecular bone and large amount of blood vessels and fibroblasts. [35] Possibly, this healing process also occurs after placement of the lyophilized collagen sponge in the radicular apical third in open apex cases, since healing of the periapical lesion is similar to alveolar bone socket [36,37]. In this case report the remaining root canal (after plugging the apical part with MTA) was sealed with Calamus thermoplasticized Gutta percha delivery system (Dentsply Sirona) followed by post endodontic restoration with light cure composite

resin. The patient was periodically recalled for follow-up upto 6 months and was found asymptomatic. Treatment of the internal resorption was considered successful as evidenced by clinical and radiographical examination after an interval of 6 months.

Conclusion

In conclusion it can be said that early detection of resorption by the help of different diagnostic modalities, correct differential diagnosis of resorption, early detection of perforation, proper treatment planning, correct use of different treatment modalities and lastly periodic follow-up are the key to success in this type of cases.

References

1. American Association of Endodontists. Glossary of Endodontic Terms, 10th edition. www.aae.org/glossary. Accessed 22 November 2020
2. Tronstad L. Root resorption-etiology, terminology and clinical manifestations. Endod Dent Traumatol. 1988; 4:241–52. [PubMed: 3078294].
3. Patel S, Ricucci D, Durak C, Tay F. Internal root resorption: A review. J Endod. 2010; 36:1107–21. [PubMed: 20630282]
4. Silveira FF, Nunes E, Soares JA, Ferreira CL, Rotstein I. Double ‘pink tooth’ associated with extensive internal root resorption after orthodontic treatment: A case report. Dent Traumatol. 2009;25: e43–7. [PubMed: 19239482]
5. Bhaskar SN. 10th ed. St. Louis: C. V. Mosby; 1986. Orban's oral histology and embryology; pp. 206–8.]
6. Fernandes M, de Ataide I, Wagle R. Tooth resorption part I-pathogenesis and case series of internal resorption. J Conserv Dent. 2013; 16:4–8. [PMCID: PMC3548344] [PubMed: 23349568]
7. Torabinejad M, Watson TF, Pitt Ford TR. Sealing ability of a mineral trioxide aggregate when used as a root end filling material. J Endod 1993; 19:591–5.
8. Guven G, Cehreli ZC, Ural A, et al. Effect of mineral trioxide aggregate cements on transforming growth factor beta1 and bone morphogenetic protein production by human fibroblasts in vitro. J Endod 2007; 33:447–50.
9. Zhang H, Pappen FG, Haapasalo M. Dentin enhances the antibacterial effect of mineral trioxide aggregate and bioaggregate. J Endod 2009; 35:221–4.
10. Holland R, Filho JA, de Souza V, et al. Mineral trioxide aggregate repair of lateral root perforations. J Endod 2001; 27:281–4.
11. Uyanik MO, Nagas E, Sahin C, et al. Effects of different irrigation regimens on the sealing properties of repaired furcal perforations. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2009;107: e91–5.
12. Udagawa N, Takahashi N, Akatsu T, et al. Origin of osteoclasts: mature monocytes and macrophages are capable of differentiating into osteoclasts under a suitable microenvironment prepared by bone marrow-derived stromal cells. Proc Natl Acad Sci U S A 1990; 87:7260–4.
13. Wedenberg C, Lindskog S. Experimental internal resorption in monkey teeth. Endod Dent Traumatol 1985; 1:221–7.
14. Estrela C, Bueno MR, De Alencar AH, Mattar R, José Valladares Neto, Azevedo BC, et al. Method to evaluate inflammatory root resorption by using cone beam computed tomography. J Endod. 2009; 35:1491–7. [PubMed: 19840636]
15. Andreasen JO, Andreasen FM. Textbook and color atlas of traumatic injuries to the teeth. 3rd ed.

16. Bell T. The anatomy, physiology, and disease of the teeth. Philadelphia, PA: Carey and Lee Publishing; 1830. 171–2.
17. Korolevsky EV, Komabayashi T, Foran D. Pink Tooth of Mummery in the Maxillary Left Canine after Fixed Partial Denture (FPD) Preparation. Case Rep Dent. 2019 Nov 13;2019
18. Barclay C. Root resorption. 2: internal root resorption. Dent Update 1993: 20: 292–294.
19. Walton RE, Leonard LA. Cracked tooth: an etiology for‘‘idiopathic’’ internal resorption? J Endod 1986: 12:167–169
20. Brady J, Lewis DH. Internal resorption complicating orthodontic tooth movement. Br J Orthod 1984: 11:155–157.
21. Haapasalo M, Endal U. Internal inflammatory root resorption: the unknown resorption of the tooth. Endod Topics 2006; 14:60–79.
22. Thoma K. Central osteoclastic resorption of dentine and complete repair with osteodentine in the permanent tooth of an adult. Dent Items Interest 1935; 57:28.
23. Andreasen JO. Traumatic injuries of the teeth. 2nd ed. Copernhagen, Denmark: Munksgaard International Publishers; 1981:193.
24. Sahara N, Okafuji N, Toyoki A, Suzuki I, Deguchi T, Suzuki K. Odontoclastic resorption at the pulpal surface of coronal dentin prior to the shedding of human deciduous teeth. Arch Histol Cytol 1992: 55:273–285.
25. Cotton, Taylor P., Todd M Geisler, David T. Holden, Scott A. Schwartz and William G. Schindler. “Endodontic applications of cone-beam volumetric tomography.” Journal of endodontics 33 9 (2007): 1121-32.
26. Nilsson, Elisabeth; Bonte, Eric; Bayet, François; Lasfargues, Jean-Jacques (2013). Management of Internal Root Resorption on Permanent Teeth. International Journal of Dentistry, 2013(), 1–7.
27. Cohen’s Pathways of the Pulp: Louis H. Berman, Kenneth M. Ilan Rotstein – 12th Ed.
28. Burleson A, Nusstein J, Reader A, Beck M. The in vivo evaluation of hand/rotary/ultrasound instrumentation in necrotic, human mandibular molars. J Endod. 2007 Jul;33(7):782-7
29. Siqueira JF Jr, Rôças IN, Santos SR, Lima KC, Magalhães FA, de Uzeda M. Efficacy of instrumentation techniques and irrigation regimens in reducing the bacterial population within root canals. J Endod. 2002 Mar;28(3):181-4.
30. Bystro¨m A, Claesson R, Sundqvist G. The antibacterial effect of camphorated paramonochlorophenol, camphorated phenol and calcium hydroxide in the treatment of infected root canals. Endod Dent Traumatol 1985; 1:170–5.
31. Sjgören U, Figdor D, Spa°ngberg L, Sundqvist G. The antimicrobial effect of calcium hydroxide as a short-term intracanal dressing. Int Endod J 1991; 24:119–25.
32. Anderson M, Lund A, Andreasen JO, Andreasen FM. In vitro solubility of human pulp tissue in calcium hydroxide and sodium hypochlorite. Endod Dent Traumatol 1992; 1:170–5.
33. Tűrkűn M, Cengiz T. The effects of sodium hypochlorite and calcium hydroxide on tissue dissolution and root canal cleanliness. Int Endod J 1997; 30:335–42.
34. Gencoglu N, Yildrim T, Garip Y, Karagenc B, Yilmaz H. Effectiveness of different gutta-percha techniques when filling experimental internal resorptive cavities. Int Endod J 2008; 41:836–42.

35. IA B, LA M, T O, R O, J N. Implantes das esponjas hemostáticas Gelfoam® e Hemospon® em alvéolos dentais, em ratos, após exodontia Estudo histológico comparativo. Rev Cien Odont. 2006; 9:43–9. [Google Scholar]
36. Bystrom A, Happonen RP, Sjogren U, Sundqvist G. Healing of periapical lesions of pulpless teeth after endodontic treatment with controlled asepsis. Endod Dent Traumatol. 1987;3(2):58–63. [PubMed] [Google Scholar]
37. Okamoto T, Alves-Rezende MC, Claudio CC, Rodrigues Tda S, Okamoto R. Effects of Tissucol and epsilon aminocaproic acid in the healing process following dental extraction in dehydrated rats. Braz Oral Res. 2006;20(1):33–9. [PubMed] [Google Scholar]