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Research Paper

Internal Root Resorption "Sixty Four Thousand Dollar Questions to Dental Clinician " : A Case Series Report

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ABSTRACT: *An endodontist has to encounter a multitude of pulpo-pathologic conditions. One such challenging condition is resorption. Management of internal root resorption is a challenge to the endodontists . It may occur in cases with chronic pulpal inflammation, following caries or due to trauma in the form of an accidental blow. Most cases of internal root resorption are seen in anterior teeth, due to their susceptibility to trauma. However, it may be seen in posterior teeth, most likely because of carious involvement of the pulp. Internal as well as external resorption signifies a very complex pathological interaction of the cells of pulp, periradicular and periodontal tissues. These conditions demand a comprehensive understanding of the pathologic process, so as to identify the cause and arrest the resorptive phenomena. If the resorptive process perforates the root, treatment may be more difficult and is usually performed via surgical approach. Non-surgical repair of a perforating internal root resorption with MTA was conducted in this cases. Early diagnosis, removal of the cause, proper treatment of the resorbed root is mandatory for successful treatment outcome. This paper describes two case reports of internal resorption that were successfully managed with different treatment modalities. It also carries out an elaborate evidence based review on the relevant literature which must be taken into account while treating any case of resorption.*

Keywords: *Internal resorption; Mineral Trioxide Aggregate ; pulpal inflammation; trauma.*

I. INTRODUCTION

Resorption is defined as a condition associated with either a physiologic or a pathologic process resulting in loss of dentin, cementum or bone [1] .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. The diagnosis & management of internal resorption demands a deviation from the standard procedure. Total removal of pulp tissue is the key to success in arresting the process of internal resorption. The cause of internal resorption is not fully understood. The process is asymptomatic per say, which results in a late diagnosis. If the resorptive defect is located in the pulp chamber it may result in appearance of a "pink spot" lesion providing a clue to the operator. However if it occurs in radicular portion it often goes unnoticed until it has perforated the external surface. 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.

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 [7,8] .The prognosis of a case of internal resorption largely depends on the stage at which the process is detected & treated. The main motive of treatment is extirpation of entire pulpal tissue. Various materials available for the treatment of internal root resorption include MTA, glass ionomer cement, Super EBA, hydrophilic plastic polymer (2-hydroxyethyl methacrylate with barium salts), zinc oxide eugenol and zinc acetate cement, amalgam alloy, composite resin and thermoplasticized gutta-percha administered either by injection or condensation techniques.

Perforating internal resorption may complicate the prognosis of endodontic treatment due to weakening of the remaining dental structure and possible periodontal involvement. However, prognosis of the tooth can be influenced by the biomaterial employed for the treatment. MTA is most commonly used because of its biocompatibility, sealing ability and potential induction of osteogenesis and cementogenesis followed by thermoplasticized gutta-percha obturation techniques [9,10]. The presented case series elicits the challenges encountered in diagnosing, treatment planning, cleaning shaping and achieving a three dimensional obturation. This paper insights case series involving perforating internal resorption cases, which were successfully managed with different treatment modalities and showed successful healing after1 year follow-up period.

II . CASE REPORT

Case I- Perforating internal inflammatory root resorption with 11.

A 20 year old male patient reported to the Department of Conservative Dentistry & Endodontics, with a chief complaint of dislodged restoration in the maxillary right central incisor tooth (No.11). The patient gave history of trauma and previous endodontic treatment with 11, 21 four years back. His medical history was noncontributory. Clinical examination revealed absence of draining sinus, swelling & tenderness to percussion. However a dislodged restoration from the access cavity was noticed. A routine intraoral periapical (IOPA) radiograph was advised to assess the presence & quality of endodontic treatment and the periapical health.

Periapical radiograph revealed a radiolucent lesion with diffuse periapical radiolucency with blunting of the apex in the apical third of the root continuous with the radicular surface, suggestive of a perforating resorptive defect [Fig. 1 a,b). An oval shaped radiolucency also seen at the junction of coronal & middle one third of the root . Additionally, the pulp chamber was obliterated, indicating calcification of pulp chamber.Based on the radiographic findings, the lesion was diagnosed as a perforating internal resorption, and root canal therapy was initiated with 11. Hence it was decided to carry out endodontic treatment using MTA as the apical filling material. Adjacent tooth showed inadequate obturation and persistent apical periodontitis with respect to tooth 21. A cold sensitivity test, performed with ethyl chloride spray, gave a negative test result. A provisional diagnosis of pulp necrosis with chronic periapical periodontitis with 11 and asymptomtic apical periodontitis with 21 was made. CBCT scans (Planmeka) [figure1c] were taken, shows an internal resorption seen with the root of 11 that was peforated mesially.Treatment plan included endodontic treatment of tooth no. 11,21. It was decided to complete the endodontic therapy for the tooth 11 first.An informed oral and written consent was obtained from the patient.

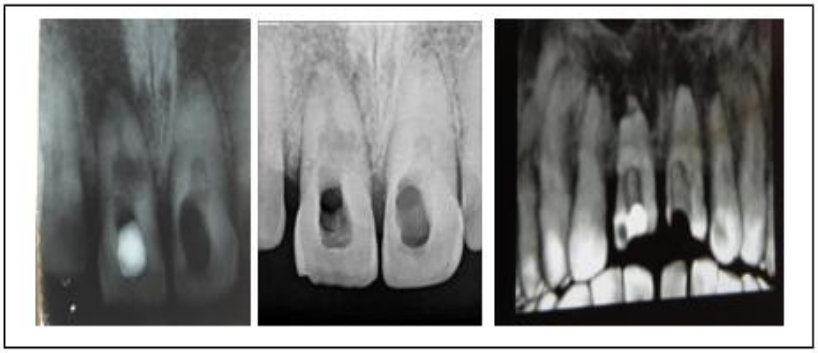

Fig 1

(*a*) (b) Preoperative radiograph showing crescent radiolucent lesion in the alveolar bone next to a resorptive lesion in the root with 11

c) CBCT image showing internal resorption and perforation with 11.

After rubber dam application, Access opening was initiated without local anaesthesia since the tooth was non-vital. Access cavity was prepared with high speed air turbine with careful attention to the direction of the diamond point to prevent accidental perforation. A dental operating microscope (opto) was used at magnification of 8X to examine the floor of pulp chamber, for any indication of canal orifice. In the final stages a no. 20 ultrasonic K- file attached to a piezoelectric ultrasonic unit was used to explore the orifice. An ISO no. 10 K- file was introduced in the canal & straight line access was established .

Canal was thoroughly irrigated with 2.5% sodium hypochlorite, a large resorptive cavity was observed in the apical and middle third of the root (Fig. 2*B*).The working length of the tooth was measured by radiograph [figure 2 a] and Root ZX apex locator (J Morita Mfg. corp., Kyoto, Japan). Biomechanical preparation was performed by crown down technique using gates glidden drills (Mani) in the cervical third. The middle and apical third was instrumented using flexofiles(Dentsply Maillefer . 2.5% sodium hypochlorite was used for irrigation. Finally sodium hypochlorite was introduced in the canal & ultrasonically activated with a no. 15 K-file attached to a piezoelectric unit for one minute. Irrigation was carried out using normal saline and 2% Chlorhexidine solution .Calcium hydroxide (Ultracal XS; Ultradent Products Inc., South Jordan, UT) was placed as a temporary dressing because the granulation tissue could not be removed completely by mechanical instrumentation. Canal was dried with sterile paper points & an intracanal paste made by mixing calcium hydroxide powder & distilled water was placed. The access cavity was sealed with CavitTM G (3M ESPE AG).The calcium hydroxide paste was changed 2 weeks later. In a third office visit 3 weeks later, the resorptive cavity was completely free of pulpal tissue. Communication with the external root surface was evident.

After two weeks the dressing was removed and and it was decided to fill the apical third and middle third of the canal with MTA (Proroot MTA). MTA was mixed according to manufacturer's instructions and White MTA (Maillefer Dentsply) was condensed into the resorption cavity using a nonsurgical MTA carrier (Micro Apical Placement System, Produits Dentaires, Vevey, Switzerland) and root canal pluggers (Maillefer Dentsply).The MTA was condensed using root canal pluggers taking care to seal the resorptive area.

After confirming the placement of MTA using a radiographa moist cotton pellet was placed in the canal and the canal sealed with a temporary dressing (Cavit) . The resorptive defect in the canal was the repaired with MTA plug . The remainder of canal was backfilled with an E & Q Gun using thermoplastic guttapercha. Warm gutta-percha at the orifice was vertically compacted by using appropriate sized pluggers. A 2 mm thick layer of Glass Ionomer Cement was placed at the orifice for coronal seal. A postoperative radiograph shows densely compacted gutta-percha in the resorptive defect.[figure 2 b].Unfortunately patient didn't turn up for follow up and endodontic treatment with 21.

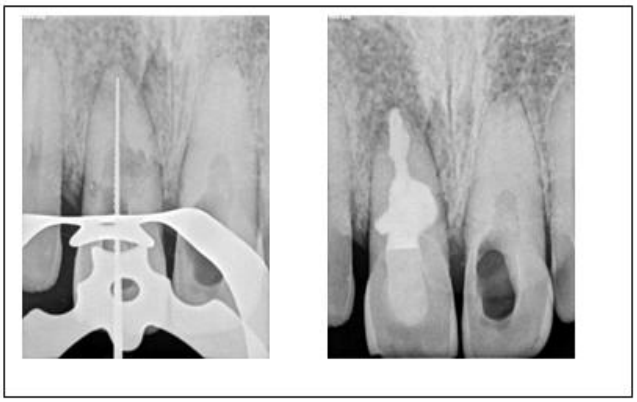

Figure 2
a) Working length radiograph
b) A radiograph taken immediately after filling of the resorption space with MTA and obturation of the root canals with gutta percha and sealer by hybrid method.

Case II - Perforating internal inflammatory resorption with 11

A 21-year-old male patient reported to the Department of Conservative Dentistry and Endodontics, with complain of discolored upper front tooth. He gave a history of trauma 4 years back. On clinical examination teeth #11and #21 revealed Ellis class IV fracture and Ellis classVIII [Figure 3a]. Tooth #11was nontender on percussion and showed grade 1 mobility. Tooth #21 was extracted . No intra-oral or extra-oral swelling was seen .On radiographic evaluation, a round radiolucent defect with resorptive area was evident in the cervical third and mid root level, and no periapical radiolucency was observed with 11 [Figure 3b]. Diagnosis which was established of perforating internal resorption, pulpal necrosis and chronic apical periodontitis in tooth #11. Treatment options presented to the patient included perforation repair with mineral trioxide aggregate (MTA) followed by crown, extraction of the tooth and restoration of the site with removable partial denture, fixed partial denture and an implant-retained crown. Consequences and complications were explained to the patient. Patient decided with the treatment of perforation repair, as he would retain his natural teeth, and other options could be still pursued if this particular treatment fails.

Figure 3
a) Pretreatment intraoral photograph.
b) Pretreatment IOPA with 11.

Endodontic therapy was initiated .After coronal access with no. #2 round bur, the pulp tissue was eradicated. Canal negotiation was done with no. 15 K file. Working length was taken using radiograph and apex locator (Root ZX II, J. Morita) [Fig. 4 a]. After working length determination, the canal was prepared by the crown down method. Master apical file size was ISO 60 considered. Copious irrigation with accomplished with 3% sodium hypochlorite . Calcium hydroxide intracanal medicament (Vitapex, Neo Dental Chemical Product Co., Ltd., Tokyo, Japan) was placed for 3 weeks.The access cavity was sealed with CavitTM G (3M ESPE AG. After 3 weeks calcium hydroxide was removed. Sectional obturation was done in the apical 5 mm with Obtura II (Obtura Spartan, Fenton, MO). The resorptive defect in the cervical third and middle third of root was repaired with MTA plug . After confirming the placement of MTA using a radiograph (Fig 4 b) a moist cotton pellet was placed in the canal and the canal sealed with a temporary dressing (Cavit) . Finally, the coronal chamber was restored with light cured fine particle micro hybrid composite (Tetric n Ceram, Ivoclar Vivadent).

A postoperative radiograph was taken confirming satisfactory filling of the root canal and resorptive defect. Patient was advised for implant with 21 and PFM crown with 11.Due to finanicial problems he refused for implant with 21 and opted for PFM fixed partial denture(FPD) .After 2 month ,crown preparation was done with 11,21,22 and PFM fixed partial denture(FPD) was done [figure 4c].Clinical and radiographic follow-up was conducted after 1year, showing a functional tooth with no endodontic pathology[figure 4d].

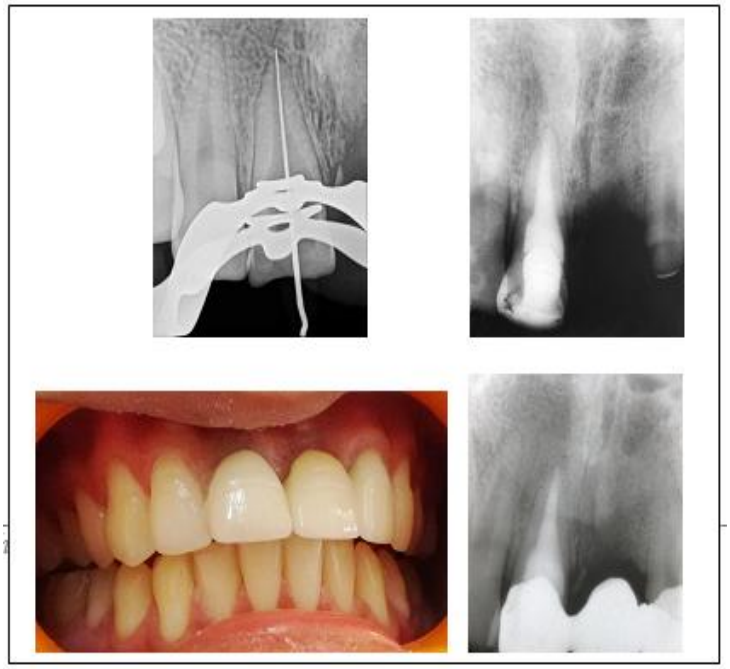

Figure 4
a) Working length IOPA.
b) Section obturation with Thermoplasticized gutta purcha technique and internal resorption sealed with MTA and post treatment IOPA with 11.
c) Metal Ceramic FPD with 11,21,22.
d) 1 year follow up IOPA.

III. DISCUSSION

There is always a dilemma of whether to treat a tooth with a questionable prognosis endodontically or extract it and subsequently place an implant. Bell first reported a case on internal resorption in 1830. Since then there have been numerous reports in the literature[11] .It is a multifactorial process associated with various factors, which may be categorized in to physiological resorption, local factors, systemic condition and idiopathic resorption. Internal inflammatory root resorption is a pathological process, initiated within the pulp space and associated with loss of dentine. It is often described as an oval shaped enlargement of the root canal space and is usually asymptomatic and detectable by radiographs. When diagnosed, immediate removal of the causative agent must be considered, aiming to arrest the cellular activity responsible for the resorptive activity [12,13]. Internal resorption is a usually asymptomatic the patient reported with esthetic reasons having pink discoloration due to intrapulpal hemorrhage, leading to red capillary granulations reflecting through the enamel as pink spots [14,15]. Patient complained of discolored tooth in one case and in another case history of trauma and complains of pain. Pulpal involvement is the reason for endodontic treatment. The options available for treatment were either endodontic treatment followed by crown or the extraction of teeth with replacement by an implant or prosthesis – fixed or removable. In this two cases, the patient opted for non extraction regimen.

Diagnosis of internal resorptions can be complex and often misdiagnosed. Various diagnostic tools used for detecting internal resorption are visual examination based on changed color in tooth crown, radiographic diagnosis, conventional and cone beam computed tomography (CBCT), light microscopy[16]. CBCT has been shown to help determine treatment complexity as well as aid the clinician in offering an accurate prognosis on the basis of the extent of the resorptive lesion.The lesion in this case was diagnosed as internal resorption. This diagnosis was based on radiographic examination (clearly defined margins, uniform density, and root canal walls appear to balloon out) and clinical (inability to probe the defect via the periodontal ligament) features and was confirmed on entering the mesial canal system. It filled a large cavity confluent with the root canal, which was inconsistent with external root resorption in which the pulp space is usually not involved (17, 18).

It is important to have knowledge to distinguish between internal and external resorptions. Classically, Gartner et al. described the radiographic features of internal and external resorption. Off-angle radiographs and the use of parallel radiographic technique are advocated differentiating internal from external resorption defects. A secondradiograph taken at a different angle often confirms the nature of the resorptive lesion. External resorptions will move in the same direction as the X-ray tube shift if they are lingually/palatally positioned. Conversely, they will move in the opposite direction to the tube shift if they are buccally positioned.

Internal resorptions should remain in the same position relative to the canal in both radiographs. Radiologically, internal resorptions present as a cloudy, mottled, radiopaque lesion with irregular margins as a result of the presence of metaplastic hard tissue deposits within the canal[19,20]. Differentiating internal from external resorption might be clinically challenging, especially if the metaplasia has occupied the entire resorptive cavity.

Presence of cervical caries was ruled out as there was no evidence supporting carious lesion while presence of invasive cervical root resorption was ruled out because of the history, clinical and radiographic findings. History of trauma and incomplete root canal treatment can be considered and moreover the resorption was more in the canal when compared to the external surface of the root making us think that resorption started from the root canal, ruling out other lesions and coming to a diagnosis of internal resorption with perforation. Ideally, nonsurgical treatment of perforating resorption is always advocated, however in the present case, nonsurgical intervention encountered difficulties in accessing resorptive defect as it was extending below coronal third of the root [21].

A negative sensitivity test result does not rule out an active internal resorptive process as the coronal portion of the pulp may be necrotic whereas the apical pulp which includes the resorptive defect may remain vital. If the pulp becomes necrotic after a period of active resorption it shall give a negative sensitivity result, radiographic signs of internal resorption & apical breakdown. As all these features where observed in the present case a diagnosis of pulp necrosis with chronic apical periodontitis was made. Although a radiograph can provide important clues to differentiate between the two, it can never be a sole diagnostic tool. The diagnosis of internal resorption should be confirmed throughout the treatment. Extirpation of pulp should cease any bleeding from the canal. Any bleeding, especially at the second visit should make the clinician suspicious of external resorption. Absence of bleeding in neither of the appointments rules out any possibility of external resorption in the present case series.

Any external perforation of the resorptive defect could have complicated the treatment procedure & its outcome. In complex cases of suspected perforative defects cone beam computed tomography (CBCT) can be used for diagnosis & management. Bhuva et al have shown that CBCT has a superior diagnostic ability & also resulted in an increased likelihood of correct management of internal resorptive lesions [22]. Thus modifications can be made to treatment procedures in view of additional information obtained from CBCT. The use of calcium hydroxide proved to be an effective aid in addition to mechanical instrumentation because its tissue-dissolving effect allowed remaining tissue to be flushed away after the calcium hydroxide paste had been in situ for several weeks. These tissue-dissolving properties are well documented in the literature [23]. Different approaches exist in the treatment of a perforating internal resorption. In the present case series, different examples with available different treatment approaches are included.

In the case report 1, extensive resorptive defect was seen . MTA was used to make the apical plug of 5 mm because of its biocompatibility, sealing ability and potential induction of osteogenesis and cementogenesis. It was followed by thermoplasticized gutta-percha obturation to form a three-dimensional seal. A hybrid technique might also be used to obturate canals; the canal apical to the resorption defect is obturated with gutta-percha, and then the resorption defect and associated perforation are sealed with MTA [24]. In case report 2, this hybrid technique was used .Apical 5 mm was obturated with Gutta-percha (OBTURA II), as it has improved homogeneity and surface adaptation and proved to be significantly better than lateral condensation, the resorption defect and associated perforation was sealed with MTA.

Remineralization therapy with calcium hydroxide, which forms a hard tissue matrix against which to condense the root-filling material, has been advocated by others [25]. Application of MTA at the perforation site precluded, in this case, the need for surgical intervention or prolonged treatment with calcium hydroxide. MTA provided good sealing of the defect, subsequently allowing a conventional root canal–filling technique. More importantly, the biologic response to this material was excellent, and complete resolution of the alveolar bone lesion had occurred by the time of a follow-up visit 2 years after the procedure. Indeed, it has been shown that MTA stimulates the propagation of human osteoblasts by offering a biologically active substrate for the cells [26]. By contrast, materials previously used to repair perforations (eg, amalgam, Cavit (3M Espe, Seefeld, Germany), Super-EBA (Harry J. Bosworth Co., Skokie, IL), glass ionomers) have been associated with formation of a fibrous connective tissue capsule in contact with the adjacent bone. The formation of a periodontal defect has been a common finding adjacent to these materials. No periodontal pocketing was observed in this case series as MTA was used.Goldman et al, concluded that the Obtura II system performed

statistically better in obturating resorptive defects than Thermafil, and cold lateral condensation (CLC)[26]. The cold lateral compaction technique produced slightly fewer voids but a larger proportion of the canal space was filled with sealer with this technique.

Stamos and Stamos reported two cases of internal root resorption in which the Obtura II system was used to successfully obturate the canals [27].In situations when the root wall has been perforated, mineral trioxide aggregate (MTA) should be considered the material of choice to seal the perforation.

The advent of CBCT no doubt has improved the clinician's diagnostic capability for internal root resorption. Nevertheless, internal root resorption is often asymptomatic, and painful symptoms do not appear until an advanced stage of the lesion. The surgical operation microscope was believed to be a very valuable tool in managing this nonsurgical perforation repair. The magnification and illumination allowed good assessment of the cleanliness of the resorptive cavity and proper placement of the repair material. Furthermore, specially designed equipment such as the Micro Apical Placement system facilitated this action.The case series presented here was successful both clinically and radiographically. The use of biomaterials, such as MTA in teeth with perforating internal root resorption gave optimal results, as demonstrated by clinical, radiographic examination after a follow-up of over 1-year, and this might serve as an excellent alternative to implant placement and the patient was satisfied because he was able to keep the tooth.

IV. CONCLUSION

Internal resorption is an uncommon resorption of the tooth, which starts from the root canal and destroys the surrounding tooth structure. Internal resorption is an endodontic challenge which raises sixty four thousand dollar question to dental clinician for management. An Endodontist is bound to encounter such challenges.. An astute clinician applies knowledge of internal anatomy of tooth appropriate early diagnosis and treatment planning technologically state of art gadgets like CBCT, Surgical operating microscope and multidisciplinary effort can turn what at first glance looks like a hopeless situation into a very satisfactory outcome for patient.

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REFERENCES

[1]. Ne RF, Witherspoon DE, Gutmann JL. Tooth resorption. Quintessence Int 1999;30:9-25
[2]. Tronstad L. Root resorption-etiology, terminology and clinical manifestations. Endod Dent Traumatol 1988;4:241-52.
[3]. Patel S, Ricucci D, Durak C, Tay F. Internal root resorption: A review. J Endod 2010;36:1107-21.
[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.
[5]. Bhaskar SN. Orban's oral histology and embryology. 10th ed. St. Louis: C. V. Mosby; 1986. p. 206-8.
[6]. Fernandes M, de Ataide I, Wagle R. Tooth resorption part I-pathogenesis and case series of internal resorption.
[7]. J Conserv Dent 2013;16:4-8.
[8]. Shishir Singh Resorptions revisited - internal resorption : Two case reports ENDODONTOLOGY
[9]. Patel S, Dawood A, Wilson R, Horner K, Mannocci F. The detection and management of root resorption lesions using intraoral radiography and cone beam computed tomography — an in vivo investigation.
[10]. Int Endod J 2009;42:831-8.
[11]. 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.
[12]. Torabinejad M, Chivian N. Clinical applications of mineral trioxide aggregate. J Endod 1999;25:197-205.
[13]. Economides N, Pantelidou O, Kokkas A, Tziafas D. Short-term periradicular tissue response to mineral trioxide aggregate (MTA) as root-end filling material. Int Endod J 2003;36:44-8.
[14]. Bell T. The anatomy, physiology, and disease of the teeth. Philadelphia: Carey and Lee Publishing; 1830. p. 171-2.
[15]. Trope M, Chivian N (1997) Reabsorc¸a˜o radicular. In: Cohen S, Burns RC, eds. Caminhos da polpa, 6th
[16]. edn. Rio de Janeiro, BR: Guanabara Koogan, pp. 488–514.
[17]. Trope M (2002) Root resorption due to dental trauma. Endodontic Topics 1, 79–100
[18]. Gaskill JH. Report of a case of internal resorption. Dent cosmos. 1894; 36:1019-24.
[19]. Mummery JH. The pathology of 'pink spots' on teeth. Br Dent J. 1920; 41:301-11.
[20]. Gulabivala K, Searson LJ. Clinical diagnosis of internal resorption: An exception to the rule. Int Endod J 1995;28:255-60
[21]. Wedenberg C. Evidence for a dentin-derived inhibitor of macrophage spreading.
[22]. Scand J Dent Res 1987;95:381– 8.
[23]. Frank AL. External-internal progressive resorption and its nonsurgical correction. J Endod 1981;7:473– 6.
[24]. Gartner AH, Mack T, Somerlott RG, Walsh LC. Differential diagnosis of internal and external root resorption.
[25]. J Endod 1976;2:329-34.
[26]. Patel S, Dawood A, Ford TP, Whaites E. The potential applications of cone beam computed tomography in the management of endodontic problems. Int Endod J 2007;40:818-30.
[27]. Hsien HC, Cheng YA, Lee YL, Lan WH, Lin CP. Repair of perforating internal resorption with mineral trioxide aggregate: A case report. J Endod 2003;29:538-9.

[28]. Bhuva B, Barnes JJ, Patel S. The use of limited cone beam computed tomography in the diagnosis & management of perforating internal resorption. Int Endod J. 2011 Aug;44(8):777-86.
[29]. Turkun 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.
[30]. Jacobowitz M, de Lima RK. Treatment of inflammatory internal root resorption with mineral trioxide aggregate: a case report. Int Endod J 2008;41:905–12.
[31]. Benenati FW. Treatment of a mandibular molar with perforating internal resorption. J Endod 2001;27:474 –5.
[32]. Koh ET, McDonald F, Pitt Ford TR, Torabinejad M. Cellular response to mineral trioxide aggregate. J Endod 1998;24:543–7.
[33]. 27Goldman F, Massone EJ, Esmoris M, Alfie D. Comparison of different techniques for obturating experimental internal resorptive cavities. Endod Dent Traumatol 2000;16:116–21).
[34]. Stamos DG. A new treatment modality for internal resorption. J Endod 1986;12:315–9)

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