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CLINICAL CASE OF A RARELY DIAGNOSED TOOTH ROOT INTERNAL RESORPTION

HEBOYAN A.G.[1]*, AVETISYAN A.A.[2], MARGARYAN M.M.[2]

[1] Department of Prosthodontics, Yerevan State Medical University after M. Heratsi, Yerevan, Armenia
[2] Department of Therapeutic Dentistry, Yerevan State Medical University after M. Heratsi, Yerevan, Armenia

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ABSTRACT

The article presents a clinical case of tooth root internal resorption which resulted in root canal perforation. The treatment of internal resorption is rather challenging to the dentists. It may occur as a result of pulpitis, which in its turn might be caused by dental trauma, periodontal infection, orthodontic treatment and teeth whitening in case the patient's dental status is not taken into consideration and possible complications are not considered and prevented in advance. Though the resorptive process mechanism is to some extent investigated, its etiology still remains unclear. Internal resorption is mainly observed in anterior teeth, as they are more often exposed to trauma. However, it can also be found in posterior teeth as a result of tooth decay. Successful treatment outcome is conditioned by early diagnosis, cause elimination and proper treatment of resorptive tooth.

The peculiarity of present clinical case is that the progression of root internal resorption led to root canal perforation resulted in connection between root canal and periodont resulting in periodontitis. However, conventional treatment cannot be used for this kind of periodontitis; additional materials and methods are required to control the process and achieve a favorable outcome. In this case, as in case of external resorption, the choice of treatment strategy is due to a number of factors, such as the location and size of the lesion, as well as presence or absence of pulpo-periodontal communication.

Within the framework of this clinical case several research methods, such as periapical X-ray, cone beam computed tomography, determination of gingival crevicular fluid quantity and pH were used to diagnose pathology, to plan and implement the treatment. During the treatment different materials and endodontic instruments were used, among which mineral trioxide aggregate is worth mentioning. The latter is considered to be biocompatible material used in complicated cases of endodontic treatment, particularly in presence of root canal perforation. In this clinic case the use of mineral trioxide aggregate was completely justified as there was a wall perforation in the middle third of the root canal i.e. in the mesio-vestibular part.

KEYWORDS. *internal resorption, perforation, mineral trioxide aggregate.*

INTRODUCTION

In a healthy organism, the inner and outer walls of the tooth root are protected by a slim antiresorptive barrier. Precementum protects the outer wall, while predentin and odontoblasts protect the inner and outer walls of the root dentin. Resorptive cells under no conditions colonize on non-mineralized surface [*Al-Qawasmi R et al., 2003 a, b*]. A number of mechanical, chemical and thermal factors which might lead to early mineralization of protective barrier and promote the resorptive process have been established [*Brynolf I, 1970*].

Resorption is defined as a condition associated with either physiologic or pathologic processes resulting in loss of dentin, cementum and bone [*Ne R et al., 1999*]. Andreasen G. has classified tooth resorption as internal (inflammatory, replacement) and external (surface, inflammatory and replacement) types [*Tronstad L, 1988*]. Resorption is more common in men than in women.

ADDRESS FOR CORRESPONDENCE:
Artak G. Heboyan
Department of Prosthodontics
2 Koryun Street, Yerevan 0025, Armenia
Tel.: (+374 93) 21-12-21
E-mail: heboyan.artak@gmail.com

Internal root resorption is the progressive destruction of intra-radicular dentin and dentinal tubules along the middle and apical thirds of the canal walls as a result of cell destructive activity [*Patel S et al., 2010*]. It is seen as a radiolucent area around the pulpal cavity, usually in incisors and mandibular molars. Traumas, infection, orthodontic treatment and teeth whitening are considered to be etiological factors [*Silveira F et al., 2009*].

In case of a tooth with questionable prognosis there is always a dilemma between endodontic treatment or tooth extraction with subsequent implant replacement. A case of internal resorption was first reported by Bell in 1830. Since then various cases of internal resorption had been described in the literature [*Bell T, 1830*].

Though the causes of internal resorption are not completely known, there are studies that confirm the primary role of pulpitis and bacterial factor in its pathogenesis of this condition. It is known that root resorption mostly occurs close to blood vessels. It is confirmed that active hyperemia supports and promotes the activity of odontoclasts with high partial pressure of oxygen. Viable pulp is preserved at resorption area and at the top of the root canal.

Internal resorption develops in the following order: sudden dental trauma results in intrapulpar bleeding. A hematoma is then formed which is replaced by granular tissue. Proliferation of granulation tissue compresses dentin wall, predentine formation discontinues, odontoclasts are differentiated from undifferentiated mesenchymal cells in the pulp tissue and the resorption begins.

Resorption occurs in two stages: degradation of the inorganic mineral structure followed by disintegration of the organic matrix [*Bhaskar S, 1986*]. Internal inflammatory resorption involves progressive loss of dentin, whereas root canal replacement resorption involves subsequent deposition of hard tissue similar to bone or cementum but not dentin [*Fernandes M et al., 2013*]. Internal inflammatory resorption can be perforating or non-perforating.

Clinically, resorption is usually asymptomatic, however, it may include the presence of “pink spot” i.e. reddish area which is the granulation tissue seen at the resorbed area. Radiographic examination is mandatory to diagnose internal resorption, which reveals a round-to-oval radiolucent enlargement of the pulp lesion [*Tronstad L, 1988; Silveira F et al., 2009*]. The edges are smooth and clear with distorted original root canal outline.

Various materials are available for the treatment of internal root resorption including Mineral trioxide aggregate (MTA), glass ionomer cement, hydrophilic plastic polymer (2-hydroxyethyl methacrylate with barium salts), zinc oxide eugenol and zinc acetate cement, composite resin and thermoplasticized gutta-percha administered either by injection or condensation techniques [*Mittal S et al., 2014*].

Proper treatment of the root canal ensures sufficient effect on the microbes and thereby reduces the resorptive process. Being a progressive process, root resorption requires urgent endodontic treatment. Tronstad L. suggests the use of calcium hydroxide as a temporary intracanal medicaments in the treatment of root resorption. According to the author, high pH neutralizes lactic acid produced by osteoclasts and reduces demineralization process [*Tronstad L, 1988*].

Present article describes a clinical case of tooth root internal resorption, resulted in root canal perforation , which was successfully treated.

Material and methods

To diagnose of the disease, the following studies have been conducted: periapical X-ray, cone beam computed tomography, determination of gingival fluid quantity and pH.

Periapical X-ray is a way of X-ray study, which results in two-dimensional images of 3-4 teeth. X-ray tube was placed vertically to the X-ray film.

Jaw scanning was performed with the help of Planmeca ProMax 3D Max cone beam computed tomography (Planmeca, Finland). Images were analyzed by Planmeca Romexis computer program (Planmeca, Finland).

The material for the determination of gingival crevicular fluid quantity was taken prior to the removal of the teeth 3 hours after breakfast. The study area was isolated with cotton rolls and was dried off by weak air jet. Gingival crevicular fluid was collected by PERIOPAPER (Gingival Fluid Collection Strips, Oralflow, Smithtown, NY 11787, USA) paper strip. The latter was thoroughly inserted into the gingival sulcus before reaching the slightest resistance and was left there for 30 seconds. Normally absorbent surface with gingival fluid is 0-5 mm^2.

In order to determine the pH of gingival crevicular fluid a special indicator "Plastic pH Indicator Strips" (Hydrion, USA) was used, which was into gingival sulcus. Gingival fluid pH can vary ranging from 6.30 to 7.93.

Case report

A 22-year-old male was admitted to the clinic with spontaneous severe toothache pointing out the maxilliary right central incisor. He noted that toothache had kept him awake at night and he had to take some pain-relievers (1 tab. Ibuprofen – 600 *mg*; 1 tab. Arcoxia – 90 *mg*). The patient didn't mention any concomitant disease in the medical history. He noted that he had hit in the face in childhood resulting in mandibular fraction.

On clinical examination a yellow-brown crust was noted at the left corner of the mouth (Fig. 1).

Intraoral examination revealed that the medial part of 11th tooth was previously restored with light cured composite. The adjacent teeth were not infected. The 11th tooth had the first-degree mobility, the adjacent ones didn't. 11th tooth percussion was mild positive, and the percussion of adjacent teeth didn't cause pain. During the palpation of transitional fold of 11th tooth, the patient mentioned mild pain (Fig. 2).

The clinical trial was followed by target periapical X-ray examination. The latter revealed the presence of transparent, round lesion with clear edges in the middle third of the root canal (Fig. 3).

This provided a basis for the diagnosis of root internal resorption. However, the presence or absence of the perforation can not be clarified by this method of investigation, because on the two-dimensional images overlay of anatomical structures occur and it's not possible to see the changes in vestibular and oral sides of the root, so it was decided to perform CBCT. The latter revealed perforation of the root canal wall (Fig. 4, 5, 6, 7, 8).

Before the therapeutic measures were implemented, the quantity of gingival fluid was determined, which a little exceeded the norm making up 6 *mm*^{2}. The gingival crevicular fluid pH was also determined, which was 6.5. The weak acid pH and the gingival crevicular fluid quantity exceeding the norm perhaps told about the presence of inflammatory process in periodontal complex [*Tronstad L*,1981].

Figure 1. *Yellow-brown crust*

Figure 2. *Alveolar ridge of 11th tooth and transitional fold on vestibular surface*

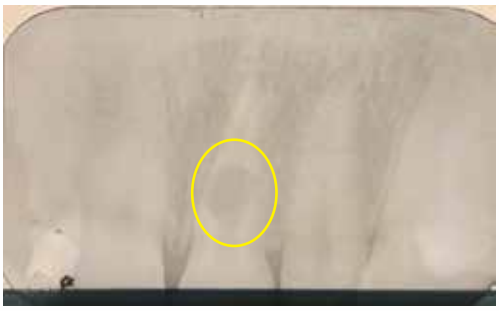

Figure 3. *Lesion of root canal internal resorption*

Figure 4. *The lesion of internal root canal resorption with root wall perforation*

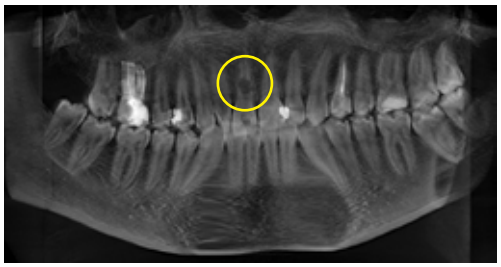

Figure 5. *The lesion of 11th tooth root internal resorption with root wall perforation*

Figure 6. *The lesion of 11th tooth root internal resorption with root wall perforation*

Figure 7. *The lesion of 11th tooth root internal resorption with root wall perforation*

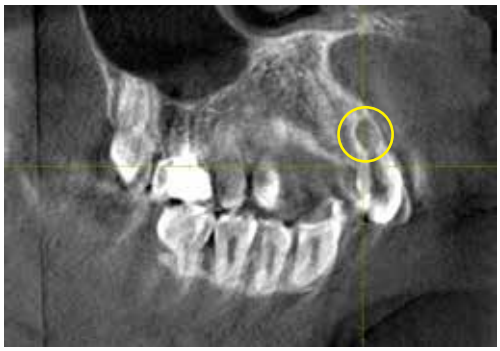

Figure 8. *The lesion of root internal resorption*

condensation method, B) the resorptive lesion filled with MTA

After appropriate studies, the following treatment was carried out: infiltration anesthesia and pulpal cavity opening was performed (Ubistesin Forte 4%, 1.7 *ml* with 1:100.000 epinephrine; 3M ESPE). Before endodontic intervention the tooth was isolated from the oral cavity by the rubber dam. The working length of root canal was determined by DentaPort Root ZX apex locator (Morita, Japan), after which the mechanical instrumentation and chemical irrigation of the root canal was carried out. The mechanical instrumentation of the root canal was performed via standard K and H files (M access, Dentsply Maillefer, Switzerland) extending apical opening up to 40 forming apical platform. Lubricant (RC-Prep) was used to provide a smooth transition of the instruments into the root canal and to ease the work. A 3% solution of sodium hypochlorite was used to clean root canal. Lastly, calcium hydroxide paste (UltraCal XS, Ultradent Products, Inc) was introduced into root canal, and the root canal was filled with temporary filling material (MD Temp, Meta Biomed, America).

Within a month, 10 days periodically, a new dose of calcium hydroxide was introduced into the root canal, until the complete elimination of clinical symptoms. During each visit, the mechanical instrumentation and chemical irrigation of the root canal was performed by the above-mentioned means.

A month later a permanent filling of root canal was placed. The apical part of the root canal was filled by vertical condensation method, in which root canal filling material standardized N 45 Gutta percha con was used as a filler, and AH Plus (Dentsply, USA) as a sealer. The lesion of root canal resorption and perforated region were filled with ProRoot® MTA-þ (Dentsply, USA) (Fig. 9).

During next visit the coronary portion of the tooth was restored by Esthet X HD light cured composite (Dentsply, USA).

Discussion

Diagnosis of internal resorption is one of the most complicated clinical problems. Although internal resorption has its symptoms, however, it is quite difficult to identify it. The diagnosis of internal resorption is based on 2 aspects – presence of resorption symptoms on X-ray image and presence

of clinical manifestations. Internal resorption can be revealed by visual examination based on discolored dental crown, by X-ray examination performing traditional X-Ray and cone beam computer tomography, as well as by light-electron microscopy [*Estrela C et al., 2009; Patel S et al., 2009*].

The characteristic of internal resorption is the appearance of a round, symmetrical lesion on X-ray image. Regardless of X-ray image projection, the defect is located within the root canal, it has an appearance of enlarged pulp cavity or the root canal margin, the pulp cavity or the root canal are expressed in the form of a weak shadow inside the defect. In contrast, in external resorption the pathology lesion has uneven, separated, asymmetric boundaries. In case of image projection changes the defect, location is different, it has an appearance of an area separated from root surface, precise demarcation of healthy and resorptive parts of the tooth [*Heboyan A, Avetisyan A, 2011a*].

Internal root resorption is considered a chronic pathology, in which the patient does not have any complaints. Internal resorption may proceed slowly (for years) or rapidly (for several months). Since the decay rate can't be predicted, the infected pulp tissue should be removed after the first signs of pathological process appear, since the process is rarely self-limiting. Often, in medical history, the restoration of previously damaged tooth (for example, filling, orthopedic reconstruction, secondary caries treatment), minor injuries, tooth whitening are mentioned as the reason if the patient's dental status is not previously taken into account and possible complications are not balanced and prevented. Basically the doctor reveals the defect during X-ray examination. The pathological process can develop until the defect has not reached the periodontal tissue and until the pulp is not decayed. Root perforation, which leads to the development of periodontitis pathological changes, is usually accompanied by the patient's complaints [*Heboyan A, Avetisyan A, 2011*].

Pain can also occur as a result of crown perforation, when the metaplastic tissue, growing from periodontium to the oral cavity, is exposed to the irritant effects of aggressive factors. Since the tooth pulp is transformed into grantulation tissue as a result of internal resporption, in case of general resorption of the whole crown cavity, that tissue penetrates from the dental hard tissues, and "pink spots" are observed on the crown surface. As a result of further pulp necrosis, the pink color turns to gray. Discoloration of the tooth crown which is due to the internal root canal resorption results in aesthetic complaints of the patients. This causes the necessity to perform professional whitening after the endodontic treatment taking into account the dental status of the patient to prevent possible complications.

The treatment of internal resorption can be both conservative and surgical, depending on the defect size and deployment, as well as the presence or absence of perforation. If the resorptive lesion doesn't perforate the wall of the root canal, conservative endodontic treatment is recommended. In case there is a perforation, it's also possible to provide a conservative approach and use MTA to close the perforation. Perforated internal resorption may complicate the endodontic treatment prognosis by weakening the dentine structure and possible inclusion of periodontium. However, dental treatment outcome is conditioned by the use of biomaterial. MTA has high *pH* (12.5), is hydrophilic and hardens in humid conditions. After hardening it acquires solid consistency with high sealing and bacteriostatic (antimicrobial) properties. Thus, MTA is highly preferred for use, due to its viability, hermeticity and the potential for bone marrow and cementation [*Torabinejad M, Chivian N, 1999; Economides N et al., 2003*]. If there is a general destruction and perforation with oral cavity, there is a need for conservative-surgical interventions, and in some cases tooth extraction might be necessary [*Heboyan A, Avetisyan A, 2011b*].

In this clinical case, conservative method was selected as treatment tactics, provided by the fact that there was not too large destruction, absence of perforation communication with oral cavity and the possibility of accurate endodontic treatment.

Conclusion

Early diagnosis, elimination of the cause of this pathology and correct treatment of resorptive tooth are required to achieve a successful treatment outcome. Internal resorption begins in the root canal, break down surrounding tissues and in the absence of treatment, ultimately leads to the root canal wall perforation. The lat-

ter complicates the clinical process, and the percentage of treatment success decreases. In case of perforation the inflammatory process spreads on periodontal tissues, as evidenced by objective data changes, such as increae of gingivity crevicular quantity and weak acid of pH. Grey color of the tooth, which is due to pulp necrosis, need to be corrected by professional whitening after endodontic treatment taking into account the patient's dental status and preventing appearance of possible complications. After final filling of the root canal, periodic reviews are important to control the healing process and predict the final outcome.

REFERENCES

1. *Al-Qawasmi RA, Hartsfield JK Jr, Everett ET, Flury L, Liu L., et al.* Genetic predisposition to external apical root resorption. Am J Orthod Dentofacial Orthop. 2003a; 123(3): 242-252.
2. *Al-Qawasmi RA, Hartsfield JK Jr, Everett ET, Flury L, Liu L., et al.* Genetic predisposition to external apical root resorption in orthodontic patients: linkage of chromosome-18 marker. J Dent Res. 2003b; 82(5): 356-360.
3. *Bell T.* Philadelphia: Carey and Lee Publishing. The anatomy, physiology, and disease of the teeth. 1830. 171-172.
4. *Bhaskar SN.* 10th ed. St. Louis: C. V. Mosby. Orban's oral histology and embryology. 1986. 206-208.
5. *Brynolf I.* Roentgenologic periapical diagnosis. I. Reproducibility of interpretation. Sven Tandlak Tidskr. 1970; 63(5): 339-344.
6. *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: 44-48.
7. *Estrela C, Bueno MR, De Alencar AH, Mattar R, José Valladares Neto., et al.* Method to evaluate inflammatory root resorption by using cone beam computed tomography. J Endod. 2009; 35: 1491-1497.
8. *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.
9. *Heboyan AG, Avetisyan AA.* The current concepts of the development mechanisms of the tooth root internal resorption. Issues in theoretical and clinical medicine. Journal of scientific and practical medicine. 2011a; 14(2): 62.
10. *Heboyan AG, Avetisyan AA.* The current concepts of the development mechanisms of the tooth root internal resorption. Issues in theoretical and clinical medicine, Journal of Scientific and Practical Medicine. 2011b, 14 N2(62): 30-34.
11. *Mittal S, Kumar T, Mittal S, Sharma J.* Internal root resorption: An endodontic challenge: A case series. J Conserv Dent. 2014; 17(6): 590-593.
12. *Ne RF, Witherspoon DE, Gutmann JL.* Tooth resorption. Quintessence Int. 1999; 30: 9-25.
13. *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. Int Endod J. 2009; 42: 831-838.
14. *Patel S, Ricucci D, Durak C, Tay F.* Internal root resorption: A review. J Endod. 2010; 36: 1107-1121.
15. *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: e43-47.
16. *Torabinejad M, Chivian N.* Clinical applications of mineral trioxide aggregate. J Endod. 1999; 25: 197-205.
17. *Tronstad L, Andreasen JO, Hasselgren G, Kristerson L, Riis I.* pH changes in dental tissues after root canal filling with calcium hydroxide. J Endod. 1981; 7(1): 17-21.
18. *Tronstad L.* Root resorption – etiology, terminology and clinical manifestations. Endod Dent Traumatol. 1988; 4(6): 241-252.