

## **EXTERNAL ROOT RESORPTION ASSOCIATED WITH ORTHODONTIC TREATMENT: CASE REPORTS AND TREATMENT OPTIONS**

*Tudor Alexandru Hantoiu, Assistant, MD, PhD Candidate*

*Adriana Monea, Lecturer, MD, PhD*

*Liana Hantoiu, Assistant, MD, PhD*

*Mariana Pacurar, Prof., MD, PhD*

*Monica Monea, Associate Prof., MD, PhD*

University of Medicine and Pharmacy from Tirgu Mures (Romania)

Department of Odontology and Oral Pathology Department of Orthodontics

---

### **Abstract**

External root resorption was recognized as a late complication of traumatic injuries to the teeth, which usually occurs after orthodontic treatment, orthognatic or dentoalveolar surgery, bleaching techniques or other similar conditions. The purpose of our paper is to discuss the predisposing factors and to present treatment options for teeth with cervical resorption, with emphasis on surgical endodontic approach and prognosis. The study group consisted of 24 patients with an average age of 34 years with 25 cervical defects included in class 1-4 of resorption, according to Heithersay classification. The treatment was nonsurgical in 12 cases (48%), endodontic treatment before surgery in 7 cases (28%) and surgery before endodontic treatment in 6 cases (24%). Our results showed that the predisposing factors were: orthodontic treatment (39%), trauma (29%), surgery in the cemento-enamel region (20%) and bleaching of teeth (12%). The rates of success for nonsurgical endodontic treatment was 83,3%; for teeth in class 3 and 4 it was recorded in only 17%, in 1 case the resorption continued and 3 teeth were extracted due to root fracture. The conclusions are that teeth with invasive cervical resorption must be under periodic radiological examination, to make sure that the resorptive process had stopped. These teeth have a high risk of fracture and the patients must be instructed to prevent plaque formation in order to avoid periodontal complications.

---

**Keywords:** Cervical root resorption, orthodontic complications, pink tooth

## Introduction

The mineralized tissues of permanent teeth are not normally resorbed, as they are protected against this process by the predentin, inside the root canal, and by cementum on the root surface. Nevertheless, in certain situations, resorption can be initiated by mechanical irritation, increased pressure in the tissue or infection (Fuss et al., 2003; Haapasalo et al., 2008; Hegde et al., 2013). Cervical resorption is a rather uncommon condition that was a subject of intense debate by clinicians for many years. It is a rather rare defect, not well recognized that can occur after orthodontic tooth movement, orthognathic or other dentoalveolar surgery, bleaching and a wide variety of traumatic injuries of the teeth (Patel et al., 2009; Andreasen, 2012; Heithersay, 2004).

Invasive cervical resorption can occur in any permanent tooth and is characterized by a massive loss of tooth structure; destruction of coronal enamel and dentin is followed by proliferation of a highly vascularized tissue that becomes visible through the thin enamel, aspect called *pink spot* (Altundasar et al., 2009). As the name implies, this begins in the cervical area of the tooth, below the epithelial attachment. The damaged area of the root surface can be very small and the resorbing cells may penetrate the tooth through these spaces, causing the resorptive process to spread into the dentine (Morais et al., 2012). Usually it is asymptomatic and is diagnosed during a routine examination, but the patient can also present pain, when the process enters the root canal causing pulp inflammation.

The resorption sustained by infection is an important endodontic condition that can occur inside (internal resorption) or outside (cervical resorption, external inflammatory root resorption) the root. It is characterized by the release of important cytokines, as interleukin-1, tumor necrotising factor, lymphotoxin, strong mediators of hard tissue resorption (Heithersay, 2007; Chung et al., 2006; Liang et al., 2003).

A clinical classification of cervical resorption had been developed by Heithersay (Heithersay, 2004) for research purposes and also to provide a clinical guide for cases with this pathology:

- Class 1 - small invasive resorption lesion near the cervical area with shallow penetration into the dentine;
- Class 2 - well defined resorption lesion that had penetrated close to the coronal pulp chamber but shows little or no extension into the radicular dentine;
- Class 3 - a deeper invasion of the dentine, not only involving the coronal part but extending into the coronal third of the root;
- Class 4 - denotes a large resorption process that had extended beyond the coronal third of the root.

The purpose of our paper is to present the predisposing factors and treatment options for teeth with external invasive cervical resorption, with emphasis on surgical endodontic approach and prognosis.

### **Material and Methods**

Between 2010- 2014 we examined 25 cases of teeth with invasive cervical resorption (5 molars, 11 canines, 6 first premolars, 3 second premolars) in 24 patients with an average age of 34 years (19-62 years). Careful attention was given to dental and medical history, in order to identify any possible predisposing factor for this condition. In 9 cases the resorption lacunae were diagnosed by a routine radiographic examination, as the patients were under orthodontic or periodontal treatment and in 16 cases the patients had severe pain due to pulp inflammation. According to Heithersay's classification, the resorptive defects of 9 teeth were considered to be class 1, 10 teeth class 2, 4 teeth class 3 and in 2 teeth class 4.

In 7 teeth with class 1 resorption and 5 with class 2 defect the treatment consisted of complete curettage of granulation tissue, careful control of the integrity of pulp chamber, cleaning of the defect and restoration with glass-ionomer cement. For the rest 7 cases, we considered the endodontic treatment completed during the first visit, followed by coronal restoration during the second visit, in order to avoid late dental pulp complications (inflammation or necrosis).

The treatment option for 6 cervical defects in class 3 and 4 was a combination of surgery and endodontics, which involved periodontal flap reflection, curettage of granulation tissue, restoration of the defect with composite resin or glassionomer cement and repositioning of the flap in the original position.

The endodontic treatment was completed before the final restoration of the defect with composite resin or glassionomer cement. For root canal preparation we used the standardized technique, lateral cold condensation with AH Plus and gutapercha cones under IRM as temporary filling and glass-ionomer cement or composite resin as final restoration. In class 4 cases it was not possible to complete the root filling prior to surgery, as it was impossible to identify the root canal in the apical third of the root. In these cases a flap was raised, the root canal was obturated and in the same meeting the resorptive process was closed. Antibiotics and antiinflammatory drugs were prescribed for 7 days, then the sutures were removed.

The follow-up consisted of retroalveolar radiographs every 6 months to identify any signs of resorption and periodontal probing for periodontal evaluation.

## Results

Orthodontic treatment was the most common etiological factor of invasive cervical resorption in the study group (9 teeth, 36%), followed by trauma (8 cases, 32%), surgery in the cemento-enamel region (5 cases, 20%) and bleaching of teeth (3 cases, 12%).

We present the treatment of two cases in class 3 and 4 in which the predisposing factor of cervical resorption was considered to be orthodontic treatment performed 5 respectively 12 years ago(Fig. 1A-D, 2A-D).



Fig.1. Tooth 13 with class 3 cervical resorption in a patient of 34 years old, with a history of orthodontic treatment. The preoperative radiograph shows a large defect in the distal aspect of the tooth, which starts in the cervical area and extends in the coronal third of the root. After endodontic treatment the resorptive area was exposed and restored with composite resin.

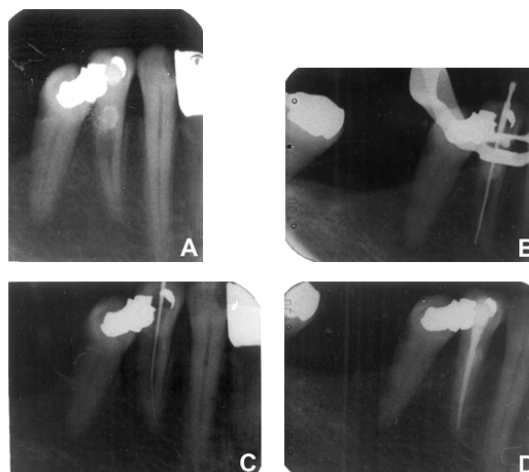


Fig.2. Tooth 44 with class 4 cervical resorption which penetrates deep into the middle third of the root, in a patient of 42 years old with a history of orthodontic treatment and bleaching procedures. It was impossible to perform the endodontic treatment without raising a periodontal flap, because we could not penetrate the apical part of the root without direct view. The defect was restored with glassionomer cement.

The rate of success for nonsurgical treatment was 83,3% as in 5 teeth (16,7%) the resorption was present again after a period of 6-12 months. In the group of teeth in class 1 and 2 the follow-up showed good results, with light discoloration of the restoration and no history of dental pulp inflammation. In teeth from class 3 and 4 the success was noted in only 17% of the cases, as 1 had a continuous resorption and 3 were extracted due to fracture. These results indicate a satisfactory treatment outcome only for teeth in class 1 and 2 and a poor prognosis for those in class 3 and 4.

## Discussions

Invasive cervical resorption was first described by Wade in 1960, as a process in which there are alternating periods of resorption and repair, with ultimately the former outstripping the latter. He also suggested that it was similar to fibrous dysplasia of bone and could be regarded as fibrous dysplasia of the tooth (Levin et al., 2002).

The radiographic examination is critical for the diagnosis and treatment, because there are certain differences between internal and external root resorption. This can be accomplished by serial retroalveolar radiographs or by Cone Beam Computed Tomography (CBCT) which provides a perfect image and a clear differential diagnosis between these clinical conditions (Nunes et al., 2012; Sigurdsson et al., 2011; Bhuva et al., 2011; Patel et al., 2007; Clauder et al., 2009; Tsesi et al., 2008).

Mechanical stimulation of osteoclasts is seen in root-fractured teeth where the sharp edges of the root fragments are selectively resorbed; pressure resorption in the permanent dentition may be seen during orthodontic treatment, usually in the form of apical resorption and shortening of the roots ( Aquiar et al., 2007; Jacobovitz et al., 2008; Keinan et al., 2008; Ramchandani et al., 2007). Root resorption sustained by infection is the most important clinical condition from an endodontic point of view and its evolution depends on whether the microbial stimuli come from inside the tooth or the gingival sulcus ( Vier et al., 2004).

In our study, teeth with resorption defects in class 1 were treated by exposure of the defect, curettage of all granulation tissue and restoration with glass-ionomer cement or composite resin. Topical application of an aqueous solution of trichloroacetic acid 90% followed by curettage and tooth restoration was recommended by different authors ( Fuss et al., 2003;

Heithersay, 2004; Liang et al., 2003; Yamaguchi et al., 2006). The aim of the treatment should be the inactivation of the resorbing process and reconstruction of the defect with the aid of filling materials or biological graft systems. The most effective approach is to expose the lacunae surgically, remove the granulation tissue and restore the tooth with a suitable material ( Yu et al., 2011). We used an endodontic technique that allowed us to create a 3-5 mm long apical box which is more difficult to achieve in oval or ribbon-shaped canals.

During instrumentation we gave special attention to endodontic irrigation, as it plays an important role in removal of pulp tissue, blood clots and exudate. We used sodium hypochlorite 2,5% at pH 9 due to its excellent cleansing ability and good antibacterial effect and EDTA 17% at pH 7,4 which effectively removes smear-layer and dentin chips.

In class 3 and 4 defects in which a full thickness flap was raised, periodontal reattachment cannot be expected with composite resin or glass-ionomer but there is evidence that this might be possible using Mineral Trioxide Aggregate as a filling material ( Rossi- Fedele et al., 2009; Bakland et al., 2004; Kjaer et al., 2012; Silveira et al., 2009). Guided tissue regenerative techniques are interesting alternatives but further research is needed to confirm the clinical success. Teeth in which a perforation of the endodontic space occurred, due to an external resorptive process, must be root filled prior to surgical exposure of the resorptive defect; this way, if the defect has a small external opening it can be cleaned and obturated from the inside of the root canal, but follow-up examination must certify that the process has stopped.

## **Conclusion**

1. Teeth with invasive cervical resorption must be under periodic radiological examination, to make sure that the resorptive process had stopped.

2. Due to important loss of dental hard tissue from the cervical area of the tooth, these teeth have a high risk of fracture and their resistance is poor.

3. On the surface of the restorative material a long junctional epithelium is formed, an area of low resistance against infection, and a periodontal pocket can easily appear. Therefore, the patient must be instructed to prevent the formation of dental plaque.

## **References:**

Altundasar E, Demir B. Management of a perforating internal resorptive defect with mineral trioxide aggregate: A case report. J Endod, 2009; 35 (10): 1441-1444.

- Andreasen JO. Pulp and periodontal tissue repair – regeneration or tissue mataplazia after dental trauma. A review. *Dental Traumatol.* 2012; 28: 19-24.
- Aquiar MC, Arana-Chavez VE. Ultrastructural and immunocytochemical analyses of osteopontin in reactionary and reparative dentine formed after extrusion of upper rat incisors. *J Anat* 2007; 10: 418-427.
- Bakland LK, Andreasen JO. Dental traumatology: essential diagnosis and treatment palnning. *Endodontic Topics.* 2004; 7: 14-34.
- Bhuva B, Barnes JJ, Patel S. The use of limited cone beam computed tomography in the diagnosis and management of a case of perforating internal root resorption. *Int Endod J,* 2011; 44 (8): 777-786.
- Chung H, Chang EJ, Kim SJ et al. Lipopolysaccharide from *Prevotella nigrescence* stimulates oteogenesis in cultures of bone marrow mononuclear cells and primary osteoblasts. *J periodontol res.* 2006; 71: 948-955.
- Clauder T, Shin SJ. Repair of perforations with MTA: clinical applications and mechanisms of action. *Endod Topics,* 2009; 15 (1): 32-55.
- Fuss Z, Tsesis I, Lin S. Root resorption – diagnosis, classification and treatment choises based on stimulation factors. *Dent Traumatol* 2003; 19:175-182.
- Haapasalo M, Endal U. Internal inflammatory root resorption: the unknown resorption of the tooth. *Endodontic Topics.* 2008; 14:60-79.
- Hegde N, Hegde NM. Internal and external root resorption management. A report of two cases. *Int J Clin Pediatr Dent.* 2013; (6): 44-47.
- Heithersay GS. Invasive cervical resorption. *Endodontic Topics.* 2004; 7:73-92.
- Heithersay GS. Management of tooth resorption. *Aus Dent J.* 2007; 52 (suppl 1):105-121.
- Jacobovitz M, Lima RKP. Treatment of inflammatory internal root resorption with mineral trioxide aggregate: a case report. *Int Endod J,* 2008; 41 (10): 905-912.
- Keinan D, Heling J, Stabholtz A, Moshonev J. Rapidly progressive internal resorption: a case report. *Int Endod J, Dent Traumatol,* 2008; 24 (5): 546-549.
- Kjaer I, Strom C, Worsaae N. Regional aggressive root resorption caused by neuronal virus infection. *Case Reports in Dentistry,* 2012, Article ID 693240, 2012-2019.
- Levin L, Trope M. Root resorption. In Hargreavesk, Goodis H(eds) *Dental pulp* 3rd Ed. Chicago, Quintessence, 2002, 425-448.
- Liang H, Burkes EJ, Frederiksen NL. Multiple idiopathic cervical root resorption; systematic review and report of four cases. *Dentomaxillofac Radiol* 2003; 32: 150-155.

- Morais CAH, Candido AG, Pires LC, Pascotto RC. The use of white MTA in the treatment of internal root resorption: case report. *Dent Press Endod*, 2012; 2(4): 51-56.
- Nunes E, Silveira FF, Soares JA, Duarte MAH, Soares SMCS. Treatment of perforating internal resorption with MTA: a case report. *J of Oral Science* 2012; 54(1): 127-131.
- Patel S, Dawood A, Whaites E, Pitt Ford T. The potential applications of cone beam computed tomography in the management of endodontic problems. *Int Endod J*, 2007; 40: 818-830.
- Patel S, Kanagasingam S, Pitt Ford T. External cervical resorption: a review. *J Endod*. 2009; 35: 616-625.
- Ramchandani PL, Mellor TK. Herpes zoster associated with tooth resorption and apical lesions. *B J Oral and Maxillofac Surg*. 2007; 45: 71-73.
- Rossi– Fedele G, Figueiredo J, Abbott PV. Teeth with double internal inflammatory resorption: report of two cases. *Aust Endod J*, 2009; 36 (3): 122-129.
- Sigurdsson A, Trope M, Chivian N. The role of endodontics after dental traumatic injuries. In Cohen,s *Pathways of the Pulp*, Mosby Elsevier, St Louis, Missouri 2011, 620-654.
- Silveira FF, Nunes E, Soares JA, Ferreira CL, Rotstein I. Double pink-spot associated with extensive internal root resorption after orthodontic treatment: a case report. *Dent Traumatol* 2009; 25: 43-47.
- Tsesi I, Fuss Z, Rosenberg E, Taicher S. Radiographic evaluation of the prevalence of root resorption in a Middle Eastern population. *Quintessence Int* 2008; 39 (1): 40-44.
- Vier FV, Figueiredo JA. Internal apical resorption and its correlation with the type of apical lesion. *Int Endod J*, 2004; 37: 730-737.
- Yamaguchi M, Aihara N, Kozima T, Kasai K. RANKL increase in compressed periodontal ligament cells from root resorption. *J Dent Res*. 2006; 85: 751-756.
- Yu VS, Messer HH, Tan KB. Multiple idiopathic cervical resorption: case report and discussion of management options. *Int Endod J*. 2011; 44: 77-85.