Case Report
Minimally invasive intervention in external cervical resorption: a case report with six-year follow-up

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Abstract: Root resorption consists of the loss of mineralized tissue (enamel, dentin, and cementum) of the inner or outer surface of the tooth due to the action of clastic cells. The correct diagnosis, the location, degree of tissue destruction, and the type of treatment are obstacles to the resolution of these lesions. The external cervical resorption is initiated in the amelocemental region progressively resorbing cementum, dentin, and enamel, constituting multiples ducts of resorption in an apical direction. This study reports a clinical case of treatment of a tooth affected by external cervical resorption with six-year clinical and radiographic follow-up. A 28-year-old male patient attended the clinic reporting a stain in the element 11. On clinical examination, there was a pinkish stain in the cervical lingual region, small cavitation in the enamel cervical region, and gingival bleeding with no insertion loss. Radiographically was observed a change at the root in the right central incisor, which was diagnosed as external root resorption. The negative response to the pulp sensitivity test confirmed the condition of pulp necrosis, indicating the need for endodontic treatment. To the treatment, it was opted for a minimally invasive approach, with endodontic access, instrumentation, and monthly exchanges of calcium hydroxide, for three months. After this period, the root canal has been filled with gutta-percha and sealer 26, in the apical third. The cervical and medium third were filled with MTA (mineral trioxide aggregate) leaving a central space for later fiberglass posts placing. The fiberglass post has been cemented with resinous cement and the tooth restored with resin composite. After six years of a radiographic control semiannual and annual, noticed normality in the periradicular tissues and disruption of the resorption process, was observed. The clinical management minimally invasive adopted reported in this case presents a viable treatment for external root resorption of the cervical third, especially in anterior teeth.

Keywords: Dental trauma, external root resorption, external cervical resorption, treatment of reabsorption, MTA, minimally invasive intervention

Introduction

The process of tooth resorption occurs when the mineralized dental tissues experiment some local aggression and begin to undergo the action of clastic cell activity, either on the inner or outer surface of the tooth [1]. In the dental surface exposed to aggression, some enzymes like phosphatase and collagenase, are released, which promotes the destruction of the organic matter, exposing the mineralized surface of the teeth [2]. The clasts, in turn, adhere tightly to these surfaces, and through the release of acid creates a low pH microenvironment that promotes demineralization [1]. The resorption can occur in the dentin, in the inner part of the pulp cavity, or the cementum in the external portion of the root, it can communicate in some later stages, being classified as external-internal resorption [3].

Internal root resorption is a relatively rare disease process. Radiographic examinations present an image with an expansive, and radiolucent contour with a ballooning aspect, well-delineated, and regular contours, especially when it occurs in the middle and apical third of the root [4]. If it is located in the cervical region, it is possible to observe a pink coloration of the dental crown, as a result of the process of tooth resorption, besides with the excessive proliferation of the granulation tissue, this signal is
known as a pink tooth of Mummery [5]. After confirmation of the diagnosis of internal root resorption, the therapy consists of endodontic treatment. Before root canal filling, calcium hydroxide-based intracanal medication is required to promote the necrosis of odonoclasts [6].

In contrast, external root resorption occurs on the root surface covered by cementum as a result of localized aggression in the periodontal ligament or cementum [7]. Radiographically, it presents as a radiolucent area of the root, with few defined borders. The walls of the canals are visible and appear through the radiolucent defect, as the resorption process does not invade the pre-dentin, and the contour of the root canal remains intact [8, 9]. In this context, the external cervical resorption is presented as a big challenge due to its location, in the region corresponding to the amelocemental joint, right below the junctional epithelium [10]. According to their extension, external resorption can be classified in class 1, when presents a small injury in the cervical region, with no dentine pervasiveness; class 2 when there is dentine pervasiveness toward the pulp, but without extension in the medium direction of the root; class 3 that presents a deeper invasion of the root being extended until the root medium third and class 4, when the resorption trespasses the root beyond the medium third [11]. The treatment requires periodic monitoring to verify the resorption control [10].

The resorption has a multifactorial origin [12]. The predisposing factors can be idiopathic but are also related to dental traumatism, orthodontic movement, internal tooth bleaching, periodontal treatment, and dental surgery. It is usually asymptomatic and is diagnosed on routine radiographs, and if untreated, has the potential to compromise the anatomical characteristics, functionality, and aesthetics [8, 9].

Minimally invasive endodontics acts in the way of treating the disease maintaining the maximum integrity of dental tissues [13]. This alternative is configured in cases of external cervical root resorption where it is possible to avoid surgical treatment and prefer an intracanal approach [14]. Although previous studies described in Table 1 are successful in both approaches, external approaches require complete excavation of the lesions through the tooth structure, which may compromise treated teeth in the long term [15]. The minimally invasive treatment uses the dissolution properties of sodium hypochlorite irrigation and calcium hydroxide dressing aiming to interrupt the progress of resorption [16]. Thus, minimally invasive therapy in root resorptions works to allow the removal of resorptive gaps and the sealing of these with appropriate material, such as MTA (mineral trioxide aggregate) [17].

MTA consists of a powder composed of mineral oxides, calcium ions, and phosphorus ions, the main components of hard dental tissues, this material has excellent properties of marginal adaptation and antimicrobial activity [16]. MTA may be used in a humid environment, have a sealing ability, biocompatibility, and the potential induction of osteogenesis and cementogenesis, it is, therefore, the most commonly used material [18], both in cases of internal and external resorption [19].

This study aimed to conceptualize through a brief literature review and report a case of external cervical resorption class 3 that affected an upper right central incisor with a history of dental trauma, which opted to a minimally invasive intervention, without surgical intervention, and subsequently a six-year follow-up.

Case report

A clinical case was selected from the Extension Project “Prevention and Treatment of Dental Trauma” from the Nova Friburgo Health Institute of the Fluminense Federal University (ISNF/UFF), which was approved by the local research ethics committee.

Patient D.L., a 28-year-old male patient attended the clinic, reporting a stain located in the lingual region of the upper right central incisor. In the clinical exam, was noticed the presence of a pinkish stain in the cervical lingual region, small cavitation in the cervical enamel region, gingival bleeding with no insertion loss. In the sensitivity test, was noticed pulp necrosis. The anamnesis did not demonstrate any systemic disorder of the patient and was reported dental trauma occurred in tooth 11, 2 years ago. Radiographs were taken at different angles (Figure 1), in which it was possible to observe the presence of cervical external resorption in tooth 11 and the absence of periapical lesion.
<table>
<thead>
<tr>
<th>Author (year)</th>
<th>Tooth</th>
<th>Type of treatment</th>
<th>Treatment</th>
<th>Root resorption filling material</th>
<th>Follow-up</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alqedari (2019) [27]</td>
<td>Left maxillary first molar</td>
<td>Nonsurgical</td>
<td>Root canal therapy and filling the resorptive defect via intracanal approach</td>
<td>MTA</td>
<td>1 year</td>
<td>The normal coloration of the surrounding soft tissue, with probing depth within normal limits (3-4 mm). A normal response to percussion and palpation, restoration of the crestal alveolar.</td>
</tr>
<tr>
<td>Karukunar et al. (2018) [25]</td>
<td>Case 1: Left maxillary central incisor</td>
<td>Surgical</td>
<td>Case 1: root canal therapy and periodontal reparative surgery</td>
<td>Biodentine</td>
<td>6 months</td>
<td>Adequate healing of the defect, asymptomatic patients, and no signs of periradicular pathology were observed during the follow-up period.</td>
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<td></td>
<td>Case 2: Right maxillary central incisor</td>
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<td>Deshmukh et al. (2017) [28]</td>
<td>Left lower first premolar</td>
<td>Surgical</td>
<td>Root canal therapy and surgical management of the root resorption</td>
<td>MTA</td>
<td>1, 3, and 6 months</td>
<td>Successful both clinically and radiographically.</td>
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<tr>
<td>Shemesh et al. (2017) [14]</td>
<td>Case 1: Left maxillary central incisor</td>
<td>Nonsurgical</td>
<td>Root canal therapy and filling the resorptive defect via intracanal approach</td>
<td>Gutta-percha</td>
<td>Case 1: 5 years, Case 2, 3 and 4: 3 years</td>
<td>All cases showed teeth clinically asymptomatic with a normal radiographic appearance, and no new resorptive areas were visible.</td>
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<td></td>
<td>Case 2: Left maxillary central incisor</td>
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<td></td>
<td>Case 3: Left maxillary canine</td>
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<td>Case 4: Left maxillary central incisor</td>
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<td>Salzano and Tirone (2015) [17]</td>
<td>Case 1: Right maxillary first premolar</td>
<td>Nonsurgical</td>
<td>Case 1 and 3: Root canal therapy and filling the resorptive defect via intracanal approach</td>
<td>Case 1, 2, and 3: MTA Case 4: Biodentine</td>
<td>Case 1: 18 months, Case 2: 12 months, Case 3: 10 months, Case 4: 4 months</td>
<td>Asymptomatic teeth, absence of clinical and radiographic signs of resorption relapse were observed.</td>
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<td></td>
<td>Case 2: Left maxillary second premolar</td>
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<td></td>
<td>Case 3: Left lower first premolar</td>
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<td>Case 4: Left lower second premolar</td>
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<td>Hiremath et al. (2007) [24]</td>
<td>Right maxillary central incisor</td>
<td>Surgical</td>
<td>Surgical management of the root resorption</td>
<td>Calcium hydroxide + glass ionomer, later covered by composite resin</td>
<td>6 months</td>
<td>Gingival healing and tooth with positive vitality test were observed.</td>
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<tr>
<td>Baratto-Filho et al. (2005) [26]</td>
<td>Left maxillary lateral incisor</td>
<td>Nonsurgical</td>
<td>Root canal therapy and filling the resorptive defect via intracanal approach</td>
<td>MTA</td>
<td>2 years</td>
<td>Gingival normality.</td>
</tr>
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</table>
All radiographic shots were taken using a digital device (Kodak RVG6100, Rochester, NY). From the clinical evaluation, with the sensitivity test with a negative response, the diagnosis of cervical external root resorption in a permanent tooth with pulp necrosis was reached, revealing the need for endodontic intervention.

After the patient’s free informed consent, coronal access to the root canal was performed using a spherical diamond drill (n.1012), and all the following procedures were executed in absolute isolation. After the removal of the pulp ceiling with an Endo Z drill, the root canal was instrumented with Reciproc R50 file (VDW, Munich, Germany) instrumentation under 2.5% sodium hypochlorite solution (Asfer, Chemical Industry LTDA) and 17% EDTA (ethylenediaminetetraacetic acid). The root canal was filled with a calcium hydroxide-based intracanal paste (Calen PMCC, SSWhite), and exchanges were made every 30 days for 3 months. A control radiograph was performed each clinical visit during these three months: To 30 days (Figure 2A) the space of the root canal was filled and a new exchange of intracanal medication was performed; 60 days (Figure 2B), which allowed the researchers to verify the minimal communication with the defect, and a new exchange of the intracanal medication and 90 days (Figure 2C), where the control of root resorption was obtained.

After this period, the root canal filling (Figure 3A) was performed in two steps with different types of materials. In the apical third, the filling was performed using the main gutta-percha cone (VDW, Munich, Germany) and Sealer-26 (Dentsply Maillefer, Pirassununga, Brazil) under thermoplasticized filling technique with McSpadden compactors (Dentsply Maillefer, Ballaigues, Switzerland). In the middle and cervical third, where the resorption defect was present, MTA was used following the manufacturer’s instructions. For the tooth fragility, a fiberglass post was used, and MTA was covered by a glass ionomer cement, to avoid solubilization when the acid attack was carried out and surrounded the preparation and later the intraradicular area. After 72 months, a radiograph was performed, to re-evaluate the tooth, no bone alterations were observed in the region of resorption or periapical lesion (Figure 3B).

Discussion

The diagnosis of cases of resorption is performed through imaging tests, the most common being radiographic examination with different angulations, to determine the position and area affected by the resorption defect [9]. The radiographic characteristics as the case history facilitate the diagnosis between internal or external resorption. In internal radicular resorption, it is possible to observe a radiolucent image of the contour of the pulpal borders, in contrast, external resorption involves the dental structure in an eventual and asymmetrical manner, producing an irregular radiolucent radiographic image with a conserved pulp con-
External cervical resorption with six-year follow-up

Dental trauma, considered a public health problem [21], occurs mainly in anterior teeth, which can generate functional, aesthetic, and psychological impacts [22], is one of the main predisposing factors for external root resorption [8] in this case, a past dental trauma history was reported by the patient, but without seeking immediate clinical care. As much as 15 years later, this case had a good prognosis, a study [21] report that the delay in clinical care in cases of dental trauma can harm the prognosis of the case, moreover, it is a relevant factor in the appearance of dental resorption, a complicating factor in the case treatment.

The treatment of root resorption can vary according to the severity of the case, considering its location, size [23], and the identification of the stimulation factor that is an important weapon to establish the appropriate treatment. In this case, endodontic treatment was required due to the diagnosis of pulp necrosis, however, artifices were used to interrupt the resorptive process. Calcium hydroxide-based intracanal medication was used in this case, in addition to its dilute the residual pulp tissue that is inaccessible during chemical-mechanical preparation, eliminating microorganisms and paralyzing the release of its toxins, its dynamic influence in the reabsorbed region, reducing the action of osteoclasts may providing repair [24].

The surgical approach in cervical external root resorption is a treatment option of choice when...

Figure 2. Monitoring of intracanal medication exchange after 30 days (A), follow-up of the exchange of intra-canal medication with 60 days, it is possible to observe minimal communication with the resorption defect (B), and follow-up of the last exchange of intracanal medication, after 90 days. It was possible to observe the control of root resorption defect (C).

Figure 3. Image of obturation of the root canal, without apical third with conical gutta-percha and in the middle and cervical third, the MTA was used (A), and control radiograph after one year, for the reassessment of element 11, not being observed bone alterations in the region of resorption or presence of periapical lesion (B).
there is no elimination of the etiological agent of the inflammatory process, even after removal of the pulp tissue, cleaning, and filling of the root canal, maintaining persistent symptomatology. It is based on curettage procedures in the periradicular region, which consists of the removal of pathological tissue near the area that is interfering in the repair, which is observed radiographically. During the curettage procedure, there is also the removal of the tissue surrounding the tissue infected by the microorganisms, reducing the risk of recurrence after chemical-mechanical debridement, the walls of the cavity are prepared and filled with a biocompatible material, as well as in intracanal defects [10, 11, 15, 25].

Surgical treatment, in this case, would be very invasive and could aggravate the situation and worsen the periodontal prognosis, since to expose the reabsorbed tissue, it would be necessary to remove considerable bone and dentin. In contrast to surgical approaches, previous studies have reported cases with minimally invasive treatment that uses the dissolution properties of sodium hypochlorite irrigation, and calcium hydroxide dressing which aims to interrupt the progress of resorption [14]. Subsequently, the root canal is filled with gutta-percha, and the resorbed area is sealed with repair materials, such as MTA [14, 17, 26, 27]. The present study used the minimally invasive technique to preserve the dental element and not causing damage to the periodontal tissue.

The literature also reports that for the restorative material, amalgam, Super-EBA, glass ionomer cement, and resin composite [28]. The properties of MTA provide good sealing capacity and excellent biocompatibility [29]. MTA has the best association with bismuth oxide which, after hydrazine, results in a colloidal gel with an initial pH of 10.5, and then 12.5 after taking prey, becoming a high resistance structure [30]. When compared with other materials such as amalgam, Super-EBA, glass ionomer cement, and resin composite shows less bacterial infiltration [31]. Through microscopic analysis, no noticeable gap was observed between MTA and the dentin walls [19].

In this case, after the apparent resorptive process cessation, a white MTA was performed to seal the defect through intracanal access, followed by placing a fiberglass post for the tooth fragility. MTA is available commercially as gray or white, which is used when there is no risk of esthetic compromise, as gray may cause dimming of the dentin structures and the discoloration of the gingival contour [19].

Success rates for invasive cervical resorption treatments have been reported for classes 1 and 2 are 100%, while for class 3 injuries it is 77.8% and only 12.5% for class 4 [11]. The clinical management adopted and reported in this class 3 case presents a viable treatment for external root resorption in the cervical third, especially in anterior teeth. Using a follow-up, the result obtained in this case was satisfactory, we observed in the subsequent radiographs an absence of periodontal pocket, absence of periapical lesion, maintenance of the gingival contour, and repair of the resorption defect. In this way, the minimally invasive intervention was presented as a potential and adequate option for a favorable prognosis of the tooth.

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Disclosure of conflict of interest

None.

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References

[4] Lyroudia KM, Dourou VI, Pantelidou OC, Labri- anidis T and Pitas IK. Internal root resorption studied by radiography, stereomicroscope,
External cervical resorption with six-year follow-up