

# Bio-ceramic Cement as a Therapeutic Alternative for External Apical Inflammatory Resorption: Case Report

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## ABSTRACT

Root resorption is a condition characterized by demineralization of the dental tissue, which may be due to a physiological or pathological process. The physiological process is manifested by the natural exfoliation of primary teeth, however, the pathological is linked to the loss of mineralized structure in permanent teeth, in order to manifest itself as a result of several etiological factors, among them dental trauma and orthodontic movements. The aim of this study was to present, through a case report, the applicability and effectiveness of Bio-ceramic cements, in the face of the diagnosis of External Inflammatory Root Resorption (RRIE) with pulp necrosis. The dynamics of treatment associated the disinfection process of the root canal system using Sodium Hypochlorite (NaClO) at 2.5% as irrigant and Ca(OH)<sub>2</sub> as intracanal medication, with root canal filling with Bio-ceramic cement PBS HP CIMMO®. During clinical and radiographic follow-up and after completion of the case, regression of the fistula, absence of painful symptoms, and root neoformation were observed. It was concluded that the Bio-ceramic cements were effective in the treatment of the presented pathology, guaranteeing its safe use.

**Keywords:** Endodontics; Tooth injuries; Tooth movement techniques; Dental cements; Root resorption

## INTRODUCTION

Root Resorption (RR) is characterized by a condition associated with a physiological or pathological process, through which demineralization of dental tissue occurs through the activity of clastic cells that result in the loss of dentin, cementum and bone [1,2]. The physiological type occurs naturally, during exfoliation of the deciduous dentition. Pathological, on the other hand, affects the permanent dentition and can be triggered by several factors, such as: trauma, orthodontic movements, and chronic inflammation of infectious origin of pulp or periodontal tissues, surgical procedures, excessive pressure from an impacted tooth or even a tumor [3].

There were several classifications for dental resorptive processes, however, that of Andreassen J in 1970, although very old, are still the most accepted today [1]. According to this author, resorptions would be divided into internal or external, depending on their location, also presenting subtypes for them.

Internal resorption has its origin due to the involvement of the pulp tissue, characterized by an ovoid shape inside the pulp cavity, while external resorption has the beginning of action from injuries to the periodontal ligament, compromising the cementum layer that covers the pulp root surface, in order to cause, from superficial changes to the root contour, to cavitations in the cementum and dentin region [4].

Regardless of its classification, resorptions cause irreversible damage to the tooth structure, however, they are subject to control and treatment, as soon as their causes are discovered [3,5,6]. In situations where pulp tissue necrosis associated with the resorptive process is detected, endodontic therapy appears as an excellent treatment alternative, since the presence of infection from necrotic tissue and bacteria would end up stimulating the resorption picture and even preventing the repair [7,8]. For this, the execution of all stages of endodontic therapy must be performed properly, aiming to promote the repair process and stimulation of biomineralization [9,10].

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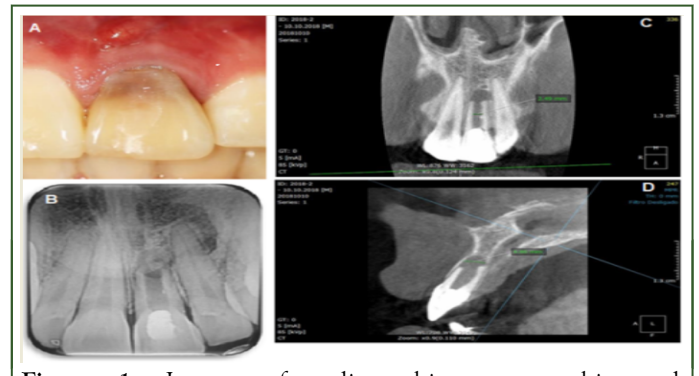
## CASE PRESENTATION

Patient, 22 years old, ASA I, male, feoderm, attended the dental clinic of Universidade Tiradentes-UNIT (Aracaju/SE) on November 19, 2019, complaining of dental darkening in unit 21, associated with the presence of fistula. During the anamnesis, the patient reported a history of trauma at age 12, pedaling a bicycle; he became unbalanced, impacting the upper incisors by protrusion. Externally, there was no tooth fracture, but the patient remembers that there was little mobility and slight bleeding in the gingival sulcus, he rinsed his mouth with water and did not seek dental care, as the tooth apparently had normal characteristics, with no change in color and no other modification.

On extraoral physical examination, no changes were observed. When performing the intra-oral clinical inspection, the presence of a nodular, circumscribed, erythematous lesion was observed in the region of the fundus of the vestibule, close to the apex of unit 21, suggestive of a fistula. In addition, the referred unit had a small cervical cavitation on the buccal surface suggestive of external cervical resorption, as well as a grayish and brownish color variation in the cervical third and yellowish in the middle third (Figure 1A).

The periapical radiographic examination of unit 21 showed the presence of a radiopaque image that extended from the pulp chamber region to the level of the cemento-enamel junction, indicative of provisional sealing material, evidencing the previously initiated endodontic therapy. In addition, it was possible to verify that the pulp cavity, in its root portion, was extremely wide and with very narrow dentin walls, emphasizing the combination of two possibilities: cavity amplitude due to interruption of radicular dentin deposition due to trauma, associated with excessive wear of the canal walls due to previous endodontic treatment. Furthermore, the presence of radiolucency in the apical third, with poorly defined edges, linked to the existence of a periapical lesion, allowed the observation of an inflammatory external apical resorption process in development (Figure 1B). Also, during the clinical examination, the patient reported having had a CT scan a year ago at the dental clinic-UNIT. After evaluating the results, with the help of a radiologist, the following description was obtained: enlargement of the canal lumen, root resorption of the apical third and part of the middle third of the root, thickening of the periodontal ligament (Figure 1C), and a radiolucent area at the apex compatible with a periapical lesion, which caused a slight bulging of the vestibular cortex (Figure 1D).

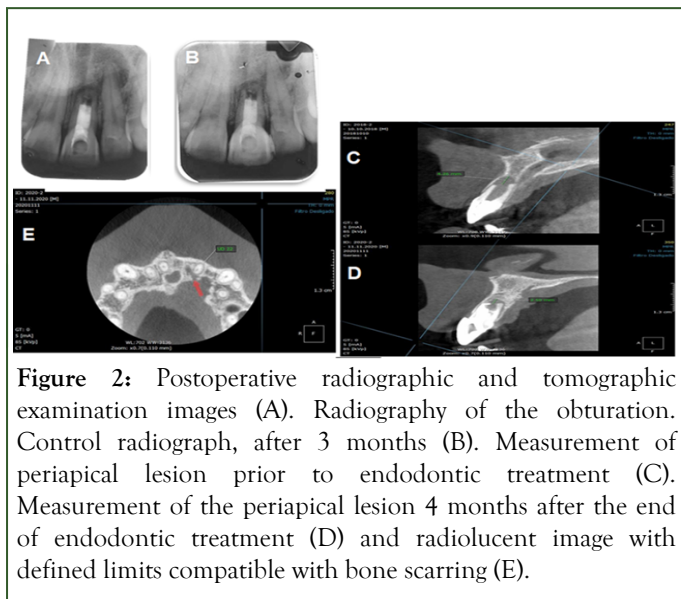
In view of the data collected in the clinical and radiographic examinations, the patient was diagnosed with external inflammatory root resorption, and it was suggested, as a line of treatment, the maintenance of the dental unit and the execution of endodontic therapy as a last alternative in an attempt to restore the patient's health unity. After completing the initial consultation, the patient signed the consent form to use the images of the case for academic purposes, and was rescheduled to start the proposed treatment.



**Figure 1:** Images of radiographic, tomographic and preoperative photography, Darkened crown and beginning of cavitation, suggestive of external cervical resorption (A). Initial periapical radiograph (B). Excessive wear of the canal walls and the presence of external apical resorption associated with the periapical lesion (C). Evidence of bulging in the vestibular cortex (D).

After performing three disinfection sections through irrigation with Sodium Hypochlorite (NaClO) at 2.5% of the root canal and intracanal medication, calcium hydroxide-based paste, in an aqueous vehicle (Ultracal XS, Ultradent, Indaiatuba SP) packaged in a syringe and connected to an Endo-Eze Tips (Ultradent, Indaiatuba, Sao Paulo) calibrated in the CRT, there was regression of the fistula in its entirety. The root canal was then filled with biological repair cement PBS HP CIMMO®, (CIMMO, Pouso Alegre, Minas Gerais), according to the manufacturers protocol. The insertion of this material into the root canal was performed with the aid of the McSpadden Condenser instrument number 80 (Maillefer, Dentsply, Ballaigues, Switzerland), coupled to the micromotor, soaked in cement and taken to the canal at the working length, until the entire pulp cavity was filled with cement. Then, condensation was carried out with Paiva foot number 3 (Golgran, São Caetano do Sul, Brazil) and cotton balls with the aid of clinical tweezers (Golgran, Sao Caetano do Sul, Brazil), due to the large amplitude of the canal, in order to achieve better material compaction. To conclude the dental unit session, a double seal was performed with cotosol (Maquira, Maringá, Brazil) and then light-cured glass ionomer cement (Ionoseal, Voco, Cuxhaven, Germany) was applied. Then, periapical radiography was performed to certify the quality of the filling (Figure 2A).

The patient returned for a clinical and radiographic control examination. It was possible to clinically verify fistula regression, absence of symptoms and clinical signs, through periapical radiography, a root neoformation (Figure 2B). Cone-Beam Computed Tomography (CBCT) of the dental unit 21 was then performed, and it was possible to observe the reduction of the apical radiolucent area on the vestibular surface and between cortices (Figures 2C and 2D). In possession of the tomography, it was also possible to verify the existence of an irregular radiolucent area with well-defined limits, apically to the lesion, located on the palatal face of unit 21 that extends to unit 22 compatible with a bone defect (Figure 2E).



## RESULTS AND DISCUSSION

The etiology of root resorption has often been the subject of scientific investigations, which, as explained being restricted to the cementum region or, as in more severe cases, reaching cementum and dentin [7]. According to these authors, its cause can be caused by several factors such as trauma, orthodontic movements, chronic periodontitis, chemical agents, force of impacted teeth and tumors [6]. Reinforced this statement, but stressed that these factors would not necessarily act in an associated way, and they could affect in isolation in the initiation of the resorptive process. In parallel with these studies, the present case report addresses a classic case of resorption of multifactorial origin, which was triggered by trauma and worsened by orthodontic movement. The patient reported having suffered dental trauma when he was around 12 years old, which corroborates the studies who warned that the age range most conducive to the emergence of dental trauma would be in second childhood, although this range has increased in recent times up to 18 years [7]. These authors also highlighted that the group of teeth most susceptible to such an event are the maxillary incisors, as they are the front line in frontal impacts.

The treatment discussed here has a scientific basis in the studies who reiterated that endodontic treatment would only be essential when the presence of pulp necrosis is detected, since, although this treatment does not have a direct relationship with the development of resorption, the persistence of the infectious condition would act to prevent the repair and potentiate the deleterious effect of clastic cells in their research on the frequency of inflammatory root resorption resulting from trauma to anterior teeth, showed that pulp mortification and the restoratives process can occur simultaneously as a result of dental trauma, since the traumatic injury would have a deleterious effect on the fibers of the periodontal ligament in order to compromise the blood supply, leading to pulp necrosis [8,11,12]. Validated this theory and reinforced that the disruption of this supply would lead to ischemia of the pulp tissue, promoting chromatic changes in the crown of the involved unit [5]. The selection of the indicated treatment must

associate professional experience with a technique that limits the damage and acts on the causal agents. In the case in question, endodontic therapy became mandatory for infection control, associating the technique of disinfection of root canal systems, repairing filling materials in an attempt to minimize the evident damage and recover the lost mineralized tissue. Therefore, filling with Bio-ceramic cement was adopted as the material of choice for treatment. This choice has scientific relevance supported who evaluated the repair capacity of these materials and observed their bioactive potential (tissue formation inducer), in addition to being biocompatible (low cytotoxicity), with excellent hermetic sealing capacity and antibacterial properties [13,14]. According to these authors, these characteristics are due to the fact that they present, in their composition, compounds similar to hydroxyapatite, which can perform an intrinsic osteoconductive activity and induce regenerative responses to the human body.

The studies on the applicability of Bio-ceramic cements in Endodontics, pointed out that Bio-ceramic cements for use as obturators emerged as a result of the improvement of characteristics already proven and verified by MTA (its precursor) [15,16]. However, they keep the high cost among themselves and the relative difficulty of handling for insertion into the root canal system as a disadvantage. According to this author, when these materials are stored in Phosphate-Buffered Saline (PBS), they are gradually covered with crystals similar to hydroxyapatite so that the contact of these crystals with the dentin forms an interfacial layer that penetrates the tubules and fibrils of dentinal collagen, filling the gaps between the filling material and the dentinal walls of the root canal. In the end, an interfacial bond between the cement and the canal walls would be formed in a superior way when compared to other types of cements. Studies carried out strengthened the advantages presented here [17,18]. However, they added that there are already new formulations of Bio-ceramics on the market that give the product greater plasticity and ease of application. In view of the root fragility measured in the case presented here and in light of the benefits measured in the research by with the use of PBS CIMMO® cement in the determination of periapical regeneration and presenting itself as a synthetic barrier to the inflammatory infiltrate inside the root canal, this material emerged as a more viable alternative in an attempt to reverse the condition of resorption and promote the neoformation of mineralized tissue in order to strengthen the compromised tooth and prevent a possible fracture with the consequent loss of the unit. In this way, it was possible to observe the validation of the expected results and stagnation of the pathological process [19]. In view of the literature, our case report established a clinical and radiographic follow-up period of 3 months after the completion of therapy with Bio-ceramic cement, and it was possible to clinically observe the fistula regression, absence of painful symptoms and clinical signs and, through periapical radiography, regression of the periapical lesion was verified, as well as root neoformation with gain in root length of the unit. After the initial four months, cone-beam computed tomography was performed, and it was possible to confirm all these radiographic findings. Although the literature warns of the need for additional long-term studies to establish

the benefits of Bio-ceramic cements in order to guarantee the safety and effectiveness of its use [20-22].

## CONCLUSION

It is undeniable the importance of an early diagnosis in obtaining success relative to the control of the root resorption process, however, in view of the results measured so far, in the case presented here, it was possible to conclude that the application of bio-ceramic cements fulfilled in a its role is efficient, promoting repair and stagnating the pathological process, becoming an effective way of treatment in cases of inflammatory external root resorption.

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