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Endodontic and Surgical Management of an Invasive Cervical Resorption in a Maxillary Central Incisor: A Case Report

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The current study aims to report a case of invasive cervical resorption in a maxillary left central incisor with a history of dental trauma. After thorough clinical and tomographic evaluations, cervical cavitation, an irregularity in the gingival contour and crown discoloration were observed. Furthermore, presence of an extensive and well-defined area of invasive cervical resorption with pulp communication was discovered. The suggested diagnosis was asymptomatic irreversible pulpitis. The resorption area was treated with the complete removal of granulation tissue, sealed with light-curing glass ionomer cement. Then, the chemo-mechanical preparation and obturation of the root canal were performed. After two years of clinical follow-up and cone-beam computed tomography examination, there were no clinical signs and symptoms, the filling of the resorption area remained intact, and no hypodense image in the cervical region of tooth #21 could be detected. The management reported in this case presented a possible viable treatment for invasive cervical resorption, provided that correct diagnosis is made.

Keywords: Cone-beam Computed Tomography; Invasive Cervical Resorption; Resorption Treatment

Introduction

Tooth resorption is defined as a physiological phenomenon (in primary teeth) resulting mainly from activated clasts action, and can be characterized by progressive or transitory cementum and dentin loss [1]. Based on its initial location, pathological root resorption is categorized as either internal, *i.e.* within the root canal system, or external, *i.e.* on the root's outer surface. When the pulpal or periodontal origins cannot be determined, due to the involvement of both surfaces, it can be classified as internal-external resorption [2].

Invasive cervical resorption (ICR) is a type of external resorption, which typically begins in the cervical third of the root, and can expand apically, coronally, or both. In ICR, , the pulp generally remains intact; except in the last stage of progression when resorption may perforate the involved root [3]. There are several hypotheses on the nature of resorptive process; nevertheless, the most accepted theory proposes that the damage and/or deficiency of the cementum layer below the epithelial attachment can expose the root surface to clastic cells, which may then resorb dentinal tissue [4].

The etiology of ICR is still not fully understood. It has been proposed that ICR can be caused by a developmental anomaly resulting in a gap in the cementoenamel junction or damage induced by chemical or physical trauma. Consequently, the damaged and unprotected root surface becomes vulnerable, and the clastic cells may initiate the resorption [5, 6]. On the other hand, a study by Hiremath *et al.* [7] has not demonstrated a direct link between risk factors and the occurrence of ICR. Therefore, the etiology of ICR is being referred to as idiopathic in many cases.

The main objective of the present study was to report the management of ICR affecting a maxillary central incisor with a history of dental trauma. In the reported case, surgical intervention was necessary, followed by endodontic treatment and a six-month follow-up. In addition, the current investigation discussed the clinical and radiological characteristics of ICR that should be considered for the most appropriate decision-making.

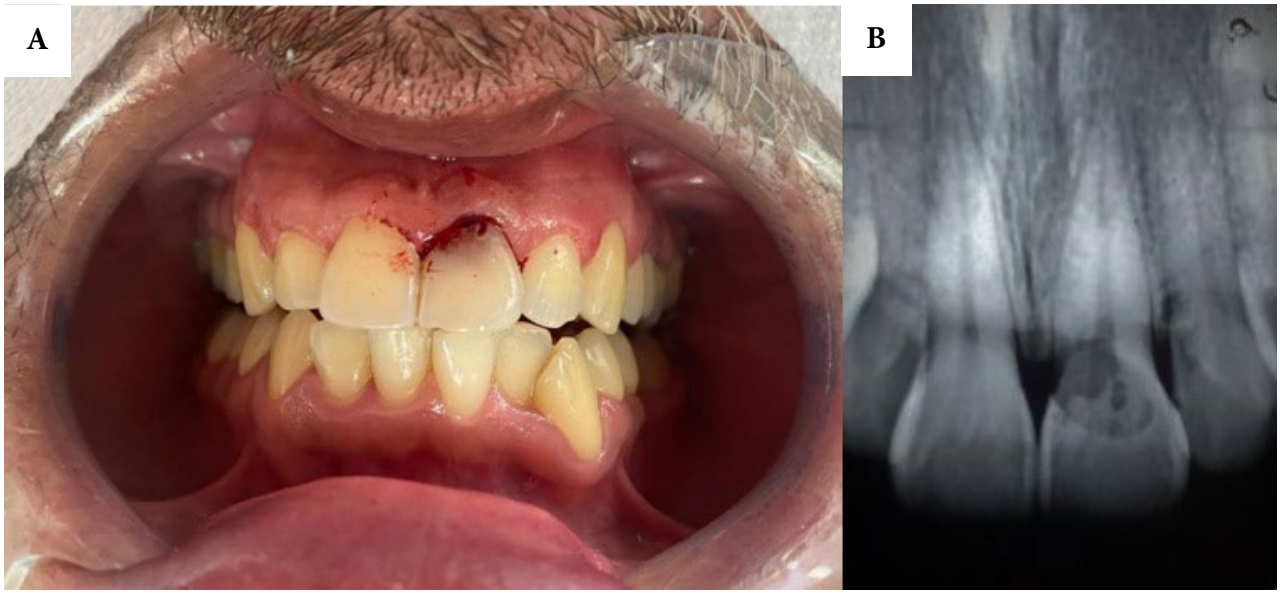

Figure 1. *A*) The initial clinical appearance of tooth #21 demonstrating cervical resorption and crown discoloration; *B*) Initial periapical radiographic image of tooth #21 indicating the presence of a large radiolucent area in the cervical region

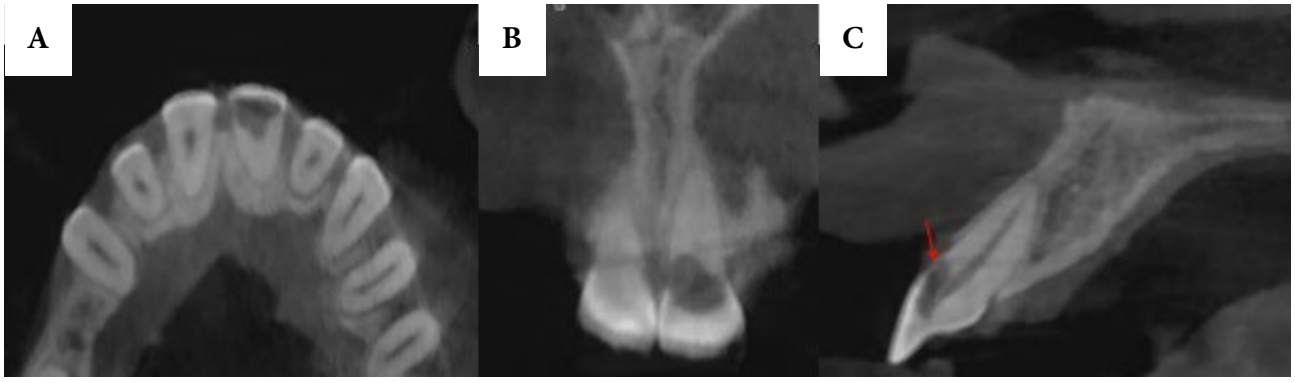

Figure 2. *A*) Axial section in the cervical region showing circumferential extension between 90º and 180º of the resorption area; *B*) Coronal section of tooth #21 demonstrating an extensive hypodense supracrestal image; *C*) Sagittal section, visualizing the portal of entry (red arrow)

Case Report

A 43-year-old male patient was referred to the Endodontics residency program at the Faculdade de Odontologia do Recife (FOR), Recife, PE, Brazil, for the endodontic assessment of tooth #21. The patient did not present any systemic alteration. The patient's chief complaint was related to aesthetics, due to the change in the color of tooth #21. During the anamnesis, the patient reported a history of dental trauma in the affected region three years prior to the first appointment. In the clinical examination, the presence of cervical cavitation, irregularity in the gingival contour and discoloration of tooth #21 were observed (Figure 1A). Tooth #21 responded positively to the cold test with less intensity and duration than the control tooth (Endo-ice, Hygenic Corp, Akron, OH, USA). The periapical radiographic examination (Figure 1B) showed an extensive radiolucency in the cervical region of tooth #21.

Cone-beam computed tomography (CBCT) was performed to assist in the clinical diagnosis and selection of the most appropriate treatment (Figure 2). Thus, from the axial, coronal and sagittal sections (Figures 2A, 2B, 2C), it was possible to visualize the presence of extensive ICR in tooth #21. The lesion was well-defined, close to coronal pulp, possible communication with the pulp tissue and no extension to the root dentin. A diagnosis of asymptomatic irreversible pulpitis was suggested for tooth #21. Therefore, endodontic treatment associated with surgery was indicated to remove the communication path from the pulp chamber. After thorough explanation of the treatment plan to the patient, his written informed consent was obtained.

In the first treatment session, after local anesthesia employing 2% mepivacaine with 1:100,000 epinephrine (DFL, Rio de Janeiro-RJ, Brazil), granulation tissue was surgically removed from the resorption area. Next, intrasulcular incision

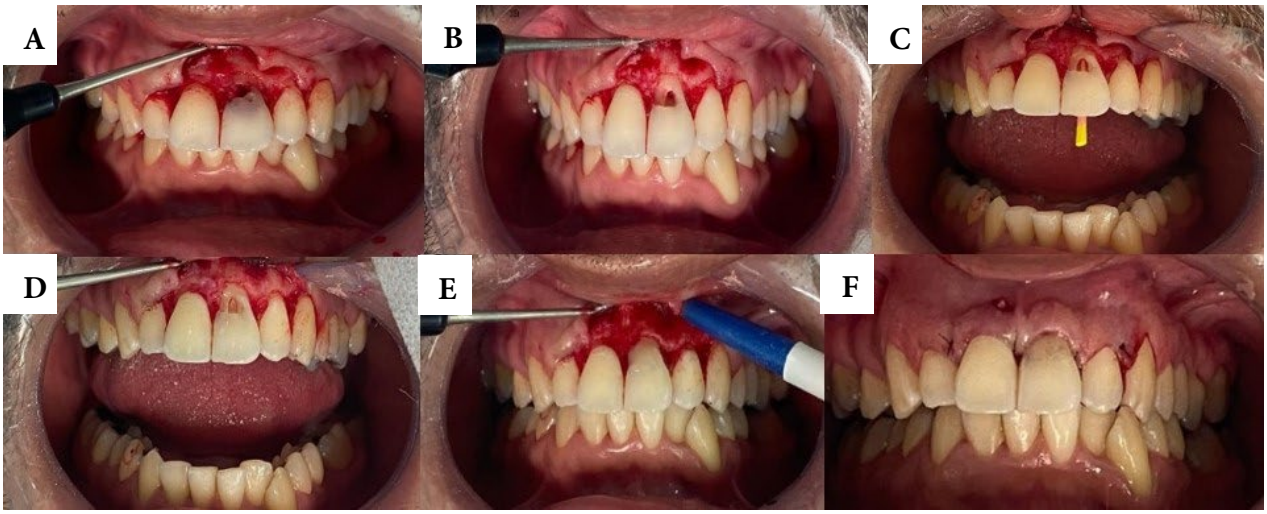

Figure 3. *A*) Intrasulcular incision to visualize the granulation tissue in the resorption area; *B*) Removal of the granulation tissue from the coronal region with a spherical bur; *C and D*) Insertion of a gutta-percha cone inside the root canal to avoid obliteration by the restorative material; *E*) Sealing the external cervical resorption area of tooth #21 using light-curing glass ionomer; *F*) Filling the entire resorption area with glass ionomer and finishing with a conical diamond bur, with a suspensory suture at the end of the surgical procedure

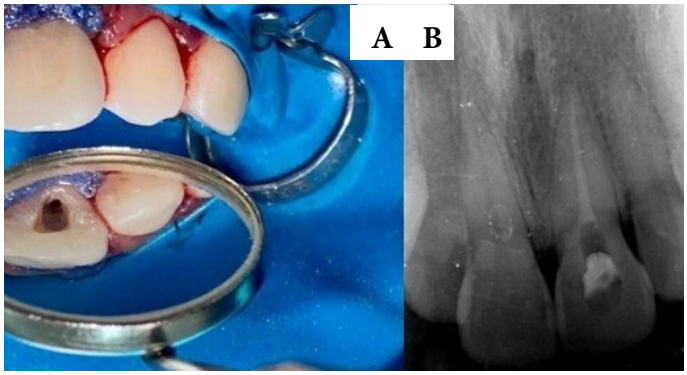

Figure 4. *A*) Complete isolation of the operative field, preserving the periodontium, with the coronal access via the palatal surface; *B*) Periapical radiograph showing the intracanal medication, *i.e.* calcium hydroxide

was performed,resorption area. Next, intrasulcular incision was performed, followed by a detachment of dental papilla. Then, the surgical periosteal flap was raised (Figure 3A), and the removal of granulation tissue was performed using a #1014 HL spherical diamond bur (KG Sorensen, Cotia-SP, Brazil) in a high-speed handpiece (Gnatus, São Paulo-SP, Brazil) followed by a #3072 conical bur (KG Sorensen, Cotia- SP, Brazil) under irrigation with sterile saline solution (Jp Farma, Ribeirão Preto-SP, Brazil) to perform the refinement of cervical region (Figure 3B). Therefore, the communication with pulp chamber could be visualized. To avoid any obliteration of the root canal by the restorative material, a gutta-percha cone was inserted inside the canal for future access opening (Figures 3C and 3D).

The sealing of resorption area was achieved with light-curing glass ionomer (Ionofast-Biodina, Ibiporã-PR, Brazil) (Figure 3E). Subsequently, finishing was performed with a #3072 truncated conical diamond bur (KG Sorensen, Cotia, SP - Brazil). At the end of the surgical procedure, a suspensory suture was performed (Figures 3F). In the first consultation after the surgery, absolute isolation of the operative field was performed at a distance to avoid dislodging any sutures (Figure 4A). Then, the access opening through the palatal surface was performed (Figure 4A). The gutta-percha, previously placed inside the canal to avoid pulp obliteration, was removed with a #30 Hedstrom file (Maillefer, Ballaigues- Switzerland, Switzerland).

The chemo-mechanical preparation was performed using the hybrid technique; *i.e.* reciprocating technique associated with manual technique. Initially, a #15 file (Maillefer, Ballaigues-Switzerland, Switzerland) was selected to perform the root canal exploration. Then, the cervical and middle thirds of the root canal were instrumented with a Reciproc R50 file (VDW, Munich-Bavaria, Germany). The working length (WL) of 24 mm was determined with Root ZX electronic apex locator (J Morita Corp, Kyoto, Japan) using the incisal edge as a reference. Subsequently, apical preparation was performed with a Reciproc #R50 file (VDW Munich-Bavaria, Germany) and hybridization with #55 K and #60 K hand files (Maillefer, Ballaigues Switzerland, Switzerland) to create the apical stop as well as proper gutta-percha cone locking.

The chemical solution used for irrigation was 2.5% sodium hypochlorite (Brilux, Paulista-PE, Brazil) delivered in a 5 mL screw-on syringe (Ultradent, Joinville-SC, Brazil) and a NaviTip tip (Ultradent, Joinville-SC, Brazil). Constant irrigation was performed positioning the syringe needle at 4 mm short of the WL

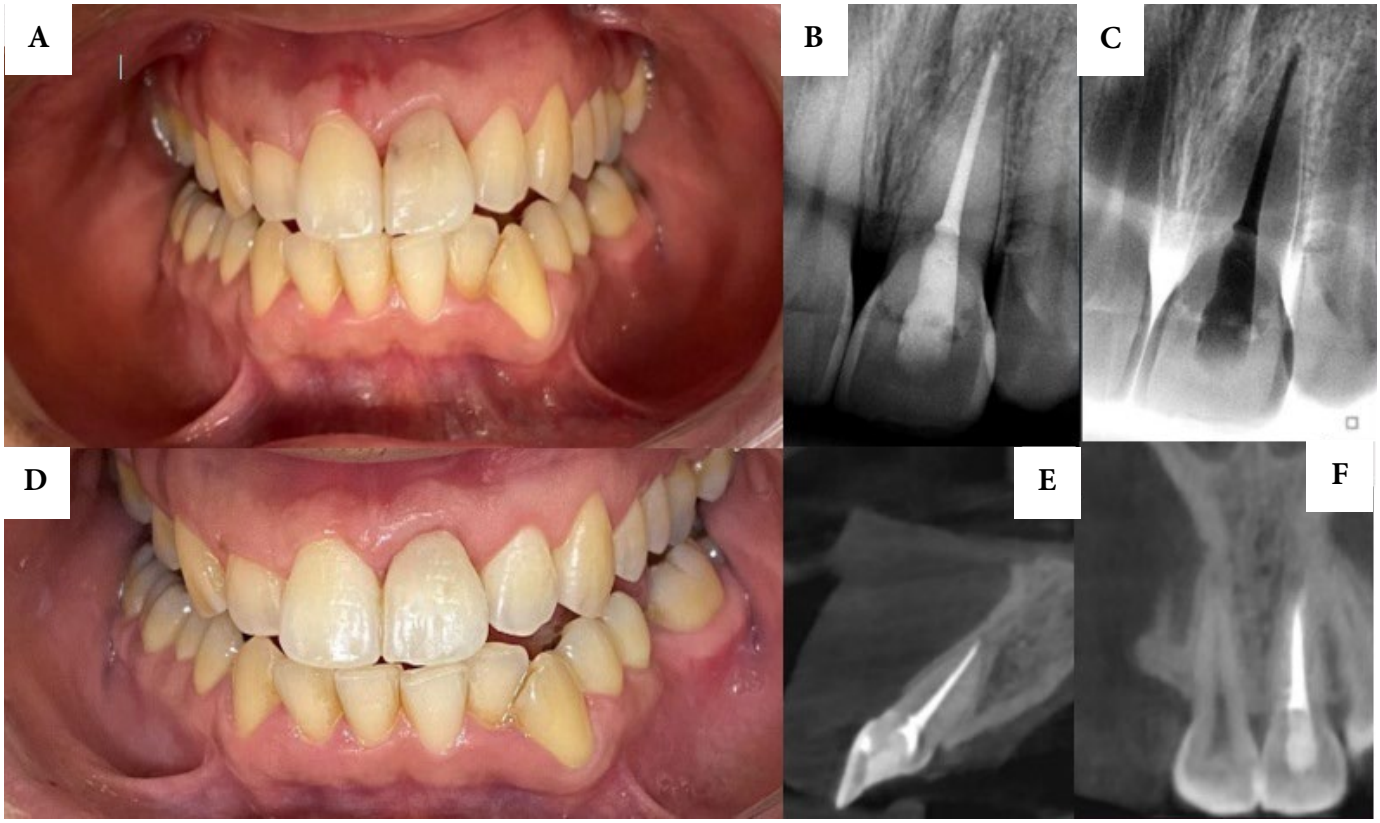

Figure 5. *A*) Clinical aspect of tooth #21 after removing the suture (15-day follow-up); *B* and *C*) Periapical radiograph immediately after the endodontic treatment of tooth #21; *D*) Clinical appearance after 30 days of treatment and restoration with resin-based dental composite restorative material; *E*) CBCT sagittal section showing the proper sealing of the portal of entry, and endodontic treatment after 2 years; *F*) Coronal section showing the tomographic appearance of tooth #21 demonstrating good sealing of the resorption area after 2 years of follow-up

for each instrument used. After apical preparation, 5 mL of sterile 0.9% saline solution (Jp Farma, Ribeirão Preto-SP, Brazil) followed by 5 mL of 17% EDTA (Maquira, Maringá-PR, Brazil) was used to remove the smear layer, shaken with Easy Clean (Easy, Equipamentos Odontológicas, Belo Horizonte-MG, Brazil) for 1 min (3 cycles of 20 sec). Then, a final irrigation consisting of 5 mL of 0.9% saline solution (Jp Farma, Ribeirão Preto-SP, Brazil) was performed. A calcium hydroxide-based medication (Ultracal XS, Joinville-SC, Brazil) remained in the canal for 15 days (Figure 4B).

In the second session (Figure 5B), the intracanal medication was removed after irrigation with 2.5% sodium hypochlorite (Brilux, Paulista – PE, Brazil), and the canal was prepared with a #60 K file (Maillefer, Ballaigues- Switzerland, Switzerland). Canal obturation was then performed using lateral condensation technique with gutta-percha main cone #60 (Tanari, Manaus-AM, Brazil), a blue digital spacer (MK Life- São Paulo-SP, Brazil) and FF accessory cones (Tanari, Manaus-AM, Brazil). Sealer Plus (MK Life, São Paulo-SP, Brazil) was used as resinous cement, and crown sealing was achieved with Z350/A3B resin (3M ESPE, Sat. Paul, MN, USA) on the palatal surface (Figure 5B and 5C). After 30 days of complete healing of the periodontium, the restoration of the buccal surface was performed with Z350/A3B resin (3M ESPE, Sat. Paul, MN, USA), (Figure 5D).

After 2 years, through clinical follow-up and CBCT examination, the absence of clinical signs and symptoms was determined by (i) assessment of the resorptive area sealed with restorative material, and (ii) absence of hypodense image in the cervical region of tooth #21 (Figures 5E and 5F).

Discussion

The current case report and the management of the presented study showed acceptable prognosis, as the resorption area was close to the coronary pulp; however, it did not invade the radicular dentin, and thus provided greater treatment longevity. A 43-year-old male patient had suffered from traumatic injuries to his face during a football match three years before the initial treatment.

Dental trauma is the most related factor to ICR, since it can damage the cementum, the periodontal ligament, and the surrounding alveolar bone. Furthermore, dental trauma is a common cause of transient apical rupture, external replacement resorption, invasive cervical resorption and internal resorption [8]. The teeth most commonly affected are the maxillary incisors and canines, maxillary first molars, and mandibular first molars [2, 9].

In previous studies by Heithersay *et al.* and Bachesk *et al.* [9, 10], it was initially demonstrated that orthodontic treatment, dental trauma, internal bleaching, dental/oral surgery, bruxism, and restoration might be related to ICR. Moreover, studies by Patel *et al.* [11] and Schwartz *et al.* [12] have shown that other factors might be linked to the onset of resorption, *e.g.* extraction of a neighboring tooth, malocclusion, periodontitis, autotransplantation, herpes zoster, playing wind instruments and bisphosphonate use. Mavridou *et al.* [2] and Gunst *et al.* [13] carried out a descriptive analysis of the factors associated with ICR and demonstrated that orthodontics (45.7%), dental trauma (28.5%) and parafunctional habits (23.2%) were the most frequently reported causes of the pathosis. Additionally, Patel *et al.* [11] reported that ICR has an unusual and complex pattern of invasion; therefore, it is necessary to identify its size, location, and circumferential distribution.

Treatment of ICR depends on knowledge, diagnosis and classification so as to obtain the most appropriate management [14]. Heithersay [9] has proposed a classification based on the extent of cervical resorption, according to its clinical and radiographic characteristics: Class I presents a small resorptive lesion near the cervical area with superficial penetration into the dentin; Class II addresses a well-defined invasive resorptive lesion that has penetrated close to the coronal pulp but exhibits little or no extension into the root dentin; Class III shows a more profound invasion of the dentin by tissue resorption, not only involving the coronal dentin but extending to at least the coronal third of the root; Class IV depicts a major invasive resorptive process that extends beyond the coronal third of the root to the middle third of the root canal. The presented clinical case can be categorised as class II Heithersay's classification. However, the mentioned classification becomes limiting because ICR has variable radiographic appearances, being inconclusive in two-dimensional exams [15]. The difficulty in the early diagnosis of ICR is quite evident, mainly because it does not present any signs or symptoms until its most severe form [16, 17]. Therefore, when radiographic findings indicate that ICR is occurring, the clinician should request a CBCT as it would enable them to determine the location, extension and height of the portal of entry, as well as the exact lesion dimensions, degree of circumferential propagation and resorption proximity to the root canal [18, 19].

Three-dimensional classification of ICR is proposed by Patel et al. [11], in which height, circumferential propagation and proximity to the root canal are analyzed. The height of the lesion can be better evaluated through tomographic findings in the axial, coronal and sagittal CBCT sections. According to the stated classification, the height of ICR can be graded as I in a supra-crestal defect that was seen in the present case report. The circumference of the lesion is graded according to its maximum extent within the root, and can be better assessed by CBCT axial slices, which were recorded as classification B in the current case report (circumferential spread: >90° - ≤180). Finally, the proximity of the lesion to the root canal, which can be better evaluated in the axial sections of CBCT, was classified as P (proximity) , meaning it had probable pulp involvement.

The treatment of root resorption may vary according to its severity, location, size and microorganism portal of entry [20]. The surgical approach in ICR cases can be a choice when there is no other way of eliminating the agent causing the inflammatory process. Surgical approach consists of raising a flap and a curettage of the cervical region, which consists of removing pathological tissue close to the area that is interfering with the repair, commonly observed radiographically [4, 21]. Light-curing glass ionomer cement has been advocated as a restorative material of choice due to its desirable properties; *e.g.* biocompatibility, fluoride release and chemical adhesion to dentin. To improve the aesthetics, it is recommended to leave the glass-ionomer cement subgingivally and replace the supra-gingival part with resin-based dental composite restorative material [22].

Conclusions

The management of ICR lesions requires in-depth knowledge of endodontics, periodontal surgery and restorative dentistry. The reported clinical study presents a viable treatment for an ICR case, as it can be assessed by the final analysis of the tomographic exam at 2-year follow-up. The intact sealing of resorption area was observed as well as the maintenance of the gingival contour, showing that success in the treatment is strongly related to effective planning and accurate diagnosis.

Conflict of Interest: 'None declared'.

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