INVASIVE CERVICAL RESORPTION: CASE REPORT

REABSORÇÃO CERVICAL INVASIVA: RELATO DE CASO

RESORCIÓN CERVICAL INVASIVA: INFORME DE UN CASO

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DOI: 10.54899/dcs.v22i84.3710
Recibido: 02/11/2025 | Aceptado: 06/11/2025 | Publicación en línea: 18/11/2025.

ABSTRACT

Invasive cervical resorption is a rare and more aggressive form of external root resorption that begins in the cervical region, at the cementoenamel junction. In advanced cases, it can lead to pulpal and periradicular changes and even tooth loss. There are several predisposing factors, including trauma, orthodontic treatment, parafunctional habits, and periodontal treatment, as well as different therapeutic approaches, without, to date, a definitive protocol and/or a standard approach for this pathology. This study aims to describe the clinical case report regarding the diagnosis, internal and external (surgical) treatments performed on a patient with invasive cervical resorption in teeth 35 and 37. The methodology consists of a clinical case study of a 65-year-old patient with a history of occlusal trauma, including radiographs, cone-beam computed tomography (CBCT), and clinical photographs with a 1-year follow-up. This case highlighted the importance of interdisciplinary collaboration for early diagnosis and proper management of the affected teeth, as well as the dependence of the approach to this pathology on the signs and symptoms presented by the patient

Keywords: Biodentine. Surgery. Endodontics. External Resorption. Invasive Cervical Resorption. MTA.

RESUMO

A reabsorção cervical invasiva é uma forma rara e mais agressiva de reabsorção radicular externa que se inicia na região cervical, na junção cemento-esmalte. Em casos avançados, pode levar a

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alterações pulpares e perirradiculares e até mesmo à perda dentária. Existem diversos fatores predisponentes, incluindo trauma, tratamento ortodôntico, hábitos parafuncionais e tratamento periodontal, bem como diferentes abordagens terapêuticas, sem, até o momento, um protocolo definitivo e/ou uma abordagem padrão para essa patologia. Este estudo tem como objetivo descrever o relato de caso clínico referente ao diagnóstico, tratamentos internos e externos (cirúrgicos) realizados em um paciente com reabsorção cervical invasiva nos dentes 35 e 37. A metodologia consiste em um estudo de caso clínico de um paciente de 65 anos com histórico de trauma oclusal, incluindo radiografias, tomografia computadorizada de feixe cônico (TCFC) e fotografias clínicas com acompanhamento de 1 ano. Este caso destacou a importância da colaboração interdisciplinar para o diagnóstico precoce e o tratamento adequado dos dentes afetados, bem como a dependência da abordagem a essa patologia nos sinais e sintomas apresentados pelo paciente.

Palavras-chave: Biodentine. Cirurgia. Endodontia. Reabsorção externa. Reabsorção Cervical Invasiva. MTA.

RESUMEN

La reabsorción cervical invasiva es una forma rara y más agresiva de reabsorción radicular externa que se inicia en la región cervical, en la unión cemento-esmalte. En casos avanzados, puede provocar alteraciones pulpares y perirradiculares, e incluso la pérdida dental. Existen diversos factores predisponentes, como traumatismos, tratamientos de ortodoncia, hábitos parafuncionales y tratamientos periodontales, así como diferentes abordajes terapéuticos. Hasta la fecha, no existe un protocolo definitivo ni un abordaje estándar para esta patología. Este estudio describe el caso clínico de un paciente con reabsorción cervical invasiva en las piezas dentales 35 y 37, incluyendo el diagnóstico y los tratamientos quirúrgicos (internos y externos). La metodología consiste en el estudio de un caso clínico de un paciente de 65 años con antecedentes de traumatismo oclusal, que incluye radiografías, tomografía computarizada de haz cónico (CBCT) y fotografías clínicas, con un seguimiento de un años. Este caso puso de relieve la importancia de la colaboración interdisciplinaria para el diagnóstico precoz y el tratamiento adecuado de las piezas dentales afectadas, así como la dependencia del abordaje de esta patología de los signos y síntomas que presenta el paciente.

Palabras clave: Biodentine. Cirugía. Endodoncia. Reabsorción Externa. Reabsorción Cervical Invasiva. MTA.

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INTRODUCTION

Root resorption has been a major challenge for clinicians and specialists due to the complexity of its sometimes irreversible and abnormal process, which results in the loss of hard

tissues (cementum and dentin) (Heithersay 2007, Patel, Kanagasingam *et al*. 2009, Kandalgaonkar, Gharat *et al*. 2013). Constant damage and/or aggression to the protective organic tissues of the outer canal wall (predentin and odontoblast layer) or to the outer root surface will result in the classically categorized root resorption based on its location on the root surface, such as internal root resorption (pulpal origin) or external root resorption (periodontal origin) (Heithersay 1994, Heithersay 1999, Patel, Foschi *et al*. 2018).

External root resorption can be superficial, very common in orthodontic treatment; inflammatory, when there is bone resorption to accommodate defense cells in teeth with necrotic and infected pulp; replacement, where the root is replaced by bone, frequently after avulsion, followed by reimplantation, or intrusion; and invasive, or external, cervical resorption, where clastic cells adhere to the exposed dentin, below the junctional ligament, and begin to destroy the mineralized tissue (Andreasen 1985, Heithersay and Wilson 1988, Patel and Saberi 2018).

Challenging and poorly understood, invasive cervical resorption (ICR) is an invasive, progressive, and non-linear condition that begins in the cervical region of teeth due to deficiencies or damage (mechanical and chemical) at the amelodentinal junction (Tronstad 1988, Gulsahi, Gulsahi *et al*. 2007, Mavridou, Hauben *et al*. 2016, Rotondi, Waldon *et al*. 2020). Patients with a history of orthodontic treatment, trauma, internal bleaching or a combination thereof, a history of dentoalveolar and orthognathic surgery and periodontal treatment, as well as bruxism, clenching, i.e., constant stimuli that damage the cervical region of the tooth and maintain clastic cells, become vulnerable to this pathology (Heithersay 1999, Heithersay 1999, Gunst, Mavridou *et al*. 2013). The etiology of ICR is not yet clearly determined, and the possible etiological factors are still considered predisposing.

Invasive cervical resorption can be present in a single tooth or multiple teeth, and the upper central incisors, upper canines, and upper premolars are the teeth most affected by this pathology. The rate of progression of ICD is difficult to determine, but an approach in early stages allows for better (Mattar, Pereira *et al*. 2008, Gunst, Mavridou *et al*. 2013, Kandalgaonkar, Gharat *et al*. 2013).

The first clinical classification for RCI was suggested by Heithersay (1999) and based on location, size, proximity to the pulp and degree of root invasion is represented in four classes: Class 1 (small cervical lesion and little superficial extension into the dentin), Class 2 (well-defined invasive resorptive lesion, with extension close to the coronal pulp, but with little or no extension into the radicular dentin), Class 3 (greater invasion by resorptive tissue into dentin,

coronal involvement of at least one third of the root) and Class 4 (resorptive process extending beyond the coronal third of the root canal). In 2018, a group of researchers (Patel, Foschi *et al*. 2018) suggested a three-dimensional classification based on volumetric analysis of cone-beam computed tomography, allowing for a more precise diagnosis and providing a universally applicable description of the lesion among colleagues in relation to treatment outcomes and prognostic factors by analyzing the lesion height (1=supra-crestal, 2=subcrestal in the coronal third of the root, 3=subcrestal in the middle third of the root and 4=subcrestal in the apical third of the root), circumferential spread of the defect (A=less than or equal to 90º, B=less than or equal to 180º, C=less than or equal to 270º, D=greater than 270º) and the proximity of the lesion to the root canal (d=lesion confined to dentin, p=probable pulpal involvement).

Due to its multivariate characteristics, a comprehensive and accurate diagnostic approach, combining interdisciplinary clinical assessments with imaging technologies and materials that perform better in hostile environments such as those promoted by this pathology, is fundamental in the pursuit of more satisfactory results and also crucial for improving diagnostic accuracy and determining personalized treatment strategies.(Asgary, Nourzadeh *et al*. 2019)

This case report describes the diagnosis of invasive cervical resorption in the left lower molar and premolar teeth (teeth 18 and 20), followed by endodontic and surgical treatment to seal the cavities. The patient returned for a two-year follow-up, and it was observed that all the restorative material had been removed, the cavities were exposed, and the pathology had recurred with new areas of resorption. A new surgical procedure was performed with intraoperative restoration over the restorative material.

CASE REPORT

A 65-year-old female patient was referred to the office by her general practitioner complaining of sensitivity and suspected caries at the root of her first lower premolar (Figure 1). In her health questionnaire, the patient reported treatment for hypertension and depression. The patient had undergone previous orthodontic treatment and had no history of trauma. Cone-beam computed tomography revealed extensive hypodense imaging in the middle distobuccal third of the left lower premolar (Figure 2a and b) and in the cervical third of the mesial root of the left lower second molar (Figure 2c), both aspects consistent with invasive cervical resorption involving 3 quadrants, proximity to the pulp, and progression (Heithersay Class 4, 3Cp Stage 2)

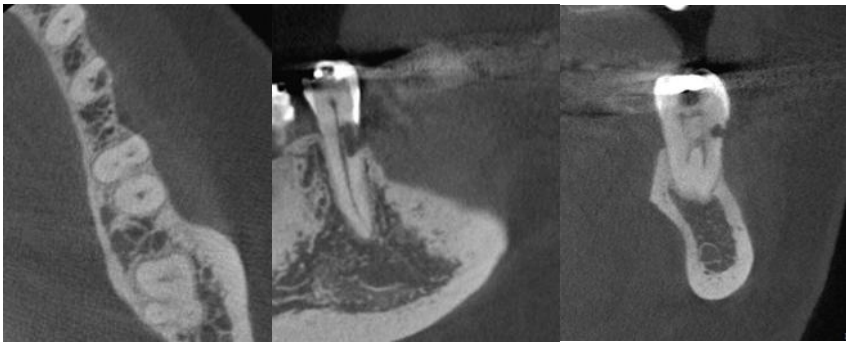
and supraosseous invasive cervical resorption involving one quadrant, proximity to the pulp and progression (Heithersay Class 3, 1Ap Stage 2), respectively.

Figure 1. Initial clinical photos of teeth 35 (a) and 37 (b) initial radiograph of teeth (c)

a b c

Source: Authors.

Figure 2. Axial tomographic slices of tooth 35 (a), sagittal slices of tooth 35 (b) and sagittal slices of tooth 37 (c). Prexion CT scanner



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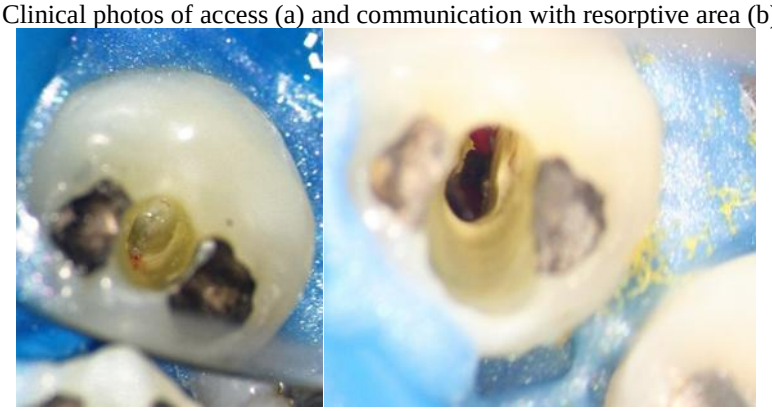
Source: Authors

Clinical examination revealed that the first lower premolar showed no pain on percussion, a positive palpation test, a positive sensitivity test with late onset and return, and during periodontal evaluation, bleeding and a probing depth of 5 mm were observed on the distobuccal surface. The second lower molar showed no pain in palpation or percussion, a normal sensitivity test, and no probing depth greater than 3 mm. No increased mobility was observed in either tooth. The patient did not present any signs or symptoms of clenching or bruxism.

After clinical, radiographic, and tomographic evaluation, the patient was informed of the guarded prognosis, and the treatment options were explained: extraction and implant or endodontic treatment followed by surgical intervention as a trial. The patient chose to keep the teeth and signed the informed consent form.

The first tooth to receive endodontic treatment was the premolar (due to worsening symptoms). Anesthesia was performed with 2% lidocaine with 1:100,000 epinephrine (Alphacaine, DFL, Rio de Janeiro, Brazil). Access to the pulp chamber (Figure 3a) was achieved under absolute isolation, using a light and magnification microscope (Zeiss®) with a 10x magnification, and a 1014 high-speed spherical bur (Angelus Prima Dental, Londrina, Brazil) under refrigeration. The canals were located (two canals that joined below the level of the resorptive cavity), and excessive bleeding was observed due to communication with the granulation tissue present in the resorption region (Figure 3b). The access rectification was completed with E2D ultrasound inserts (Helse Ultrasonics, SP, Brazil) in the ultrasound device (Newtron P5 xs - Acteon - Satelec, Indaiatuba, SP, Brazil), and odontometry was performed with an apex locator coupled to a VDW Gold motor (VDW, Munich, Germany). The preparation of the root canal system was performed with a Wave One Gold 25.07 file (Dentsply Sirona, Ballaigues, Switzerland) using reciprocating kinematics, and apex enlargement was performed with Kerr Flexofile manual files (Dentsply Sirona) with a diameter of #40, under irrigation with 2.5% sodium hypochlorite (Fórmula & Ação, São Paulo, Brazil) with a volume of 40 ml. The communication was cauterized using BeeFill 2in1 thermal compactor (VDW, Munich, Germany), and an intracanal medication based on calcium hydroxide (Ultracal, Ultradent Products Inc., USA) was inserted into the root canal system for 1 week.

Figure 3. Clinical photos of access (a) and communication with resorptive area (b) tooth 35



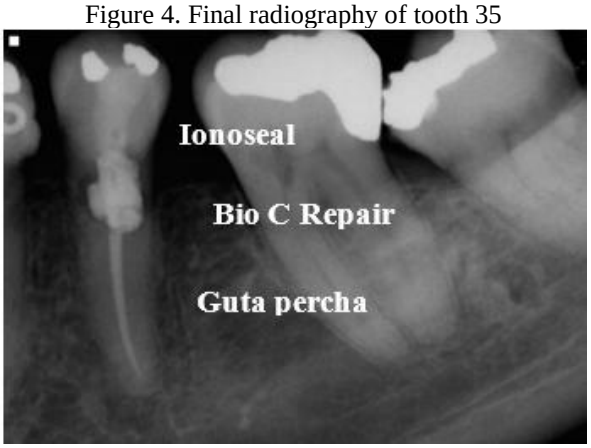
a b

Source: Authors.

The patient returned asymptomatic, and the intracanal medication was removed with 10 ml of 2.5% sodium hypochlorite under ultrasonic agitation with an E1 insert (Irrisonic Helse), and odontometry was confirmed. A 17% EDTA solution (Fórmula & Ação, São Paulo, Brazil) was used for 3 minutes followed by irrigation with 10 ml of 2.5% sodium hypochlorite and a final

irrigation with 10 ml of sterile distilled water was used under ultrasonic agitation. The obturation of the root canal system, using the single cone technique, was completed with a calibrated gutta-percha cone (Dentsply Sirona, Ballaigues, Switzerland) and Bio C Sealer calcium silicate-based cement (Angelus Indústria de Produtos Odontológicos S/A; Londrina, Brazil). The gutta-percha was cut below the level of resorption and filled with Bio C Repair cement (Angelus Indústria de Produtos Odontológicos S/A; Londrina, Brazil) up to the level of the pulp chamber, followed by protection of the repair material with a light-cured glass ionomer restoration (Voco, Cuxhaven, Germany) and restoration with Grandioso Heavy Flow resin (Voco, Cuxhaven, Germany) (Figure 4).

Figure 4. Final radiography of tooth 35

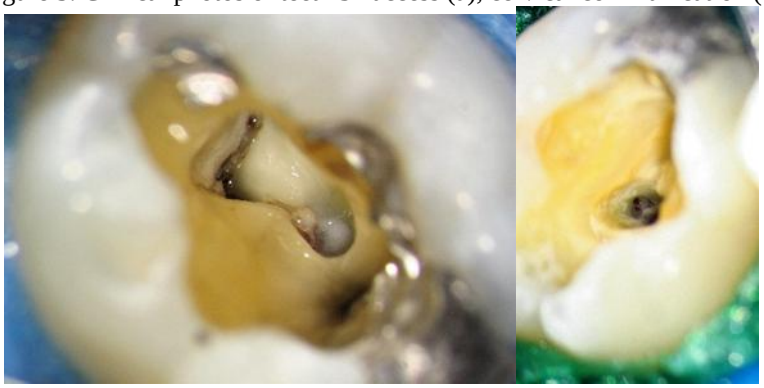


Source: Authors

Endodontic treatment of the second lower molar was also performed in two sessions, using the same biosafety criteria as for the premolar. After anesthesia and removal of the amalgam restoration, access to the pulp chamber was achieved, and there was no bleeding (Figure 5a and b), indicating pulp necrosis despite the positive sensitivity test. The canals were located and prepared with a Race file system (FKG Dentaire, Switzerland) 25.04 using rotary kinematics, following the manufacturer's instructions, and foraminal enlargement was achieved with Kerr Flexofile manual files of diameter #40. The medication used between sessions was Ultracal and a volume of 20 ml per canal of 2.5% sodium hypochlorite irrigating solution. In the following session, the intracanal medication was removed under ultrasonic agitation and 2.5% sodium hypochlorite. EDTA 17% was applied for 3 minutes, followed by a final irrigation with 15 ml of sodium hypochlorite (total) and 10 ml of sterile distilled water per canal. Canal obturation was performed using calibrated gutta-percha cones and Bio C Sealer obturation cement. Bio C Repair cement was placed in the coronal chamber, and the tooth was reconstructed with Grandioso

Heavy flowable resin (Voco, Cuxhaven, Germany) and Bulk Fill resin (Figure 6).

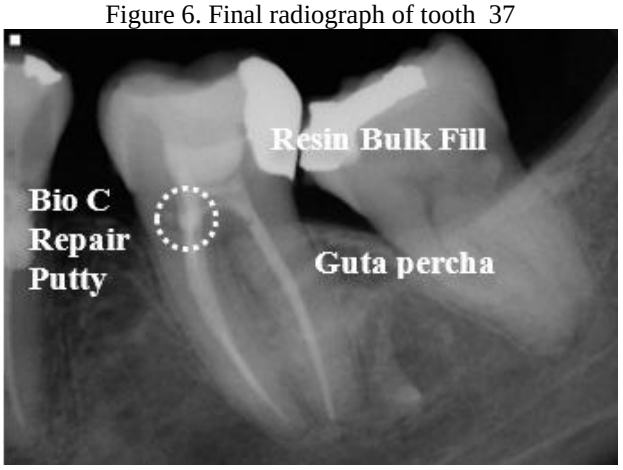
Figure 5. Clinical photos of teeth 37 access (a), cervical communication (b)



a b

Source: Authors

Figure 6. Final radiograph of tooth 37

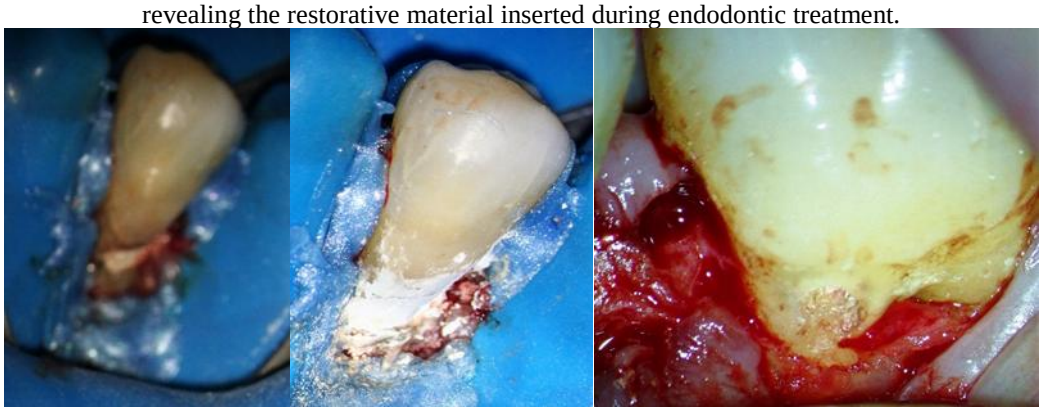


Source: Authors

One month after the completion of the endodontic treatments, surgery was performed to clean and seal the cervical resorption. The surgery was performed under anesthesia, with inferior alveolar nerve block using 2% lidocaine with 1:100,000 epinephrine (Alphacaine, DFL, Rio de Janeiro, Brazil) and supplemented with an infiltrative technique using 4% articaine with 1:100,000 epinephrine (DFL, Rio de Janeiro, Brazil). The full trapezoidal flap was created through an intrasulcular incision with a 15C scalpel blade extending from the mesial of the canine to the distal of the second molar. The removal of all granulation tissue from the first premolar was performed using mini curettes (Trinks, São Paulo, Brazil) and a Helse E 6D spherical ultrasonic insert under absolute isolation and light and magnification of a Zeiss microscope (Figure 7a). The resorptive defect was sealed with MTA HP repair material (Angelus Indústria de Produtos Odontológicos S/A; Londrina, Brazil) (Figure 7b). The second lower molar was also

approached with mini curettes, and the defect was enlarged to allow better access (Figure 7c). and sealing with the same repair material used on the premolar. After the initial setting time of the repair material the flap was repositioned and the suture was performed with 5.0 Nylon thread (Nylon, Techsuture, Bauru, Brazil) and radiograph was taken (Figure 8). After 12 days the suture was removed and the patient returned to the colleague for final restoration of the teeth, as well as evaluation of occlusal stability.

Figure 7. Clinical photos of the first surgery on tooth 35 revealing the repair material inserted during endodontic treatment (a); the new repair material in the setting phase during the surgical phase (b)and first surgery on tooth 37, revealing the restorative material inserted during endodontic treatment.



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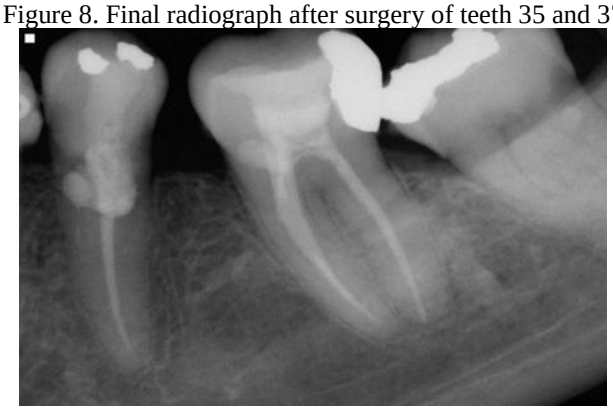
Source: Authors

Figure 8. Final radiograph after surgery of teeth 35 and 37



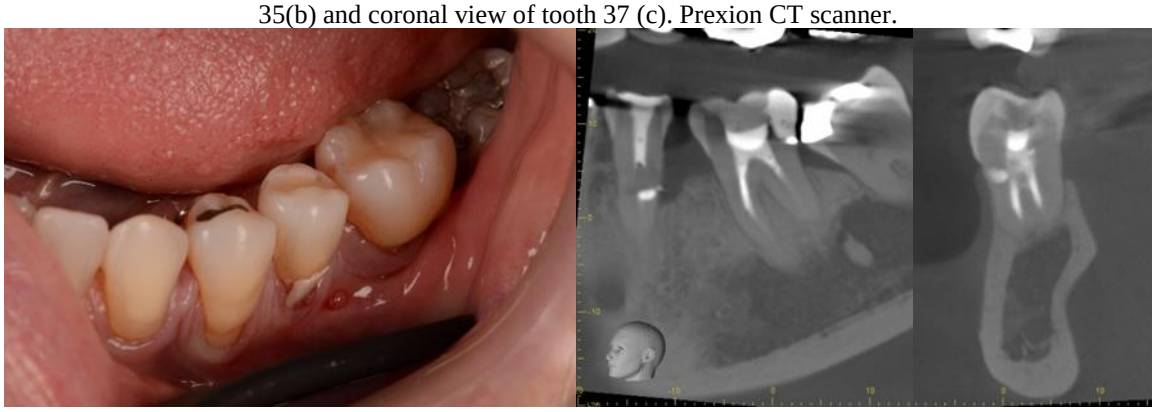
Source: Authors

The patient was followed up for 6 months after surgery and did not return for subsequent follow-ups. After two years, she returned complaining about discomfort in the operated area and the presence of gingival bleeding and local inflammation 4 months after periodontal scaling.

A new clinical (Figure 9a), radiographic and tomographic (Figure 9b and 9c) evaluation was performed and confirmed the removal of part of the reparative material from the previously surgically sealed resorptive cavity. The patient was informed about the diagnosis and prognosis

and opted for further surgery in the area.

Figure 9. Photo: Clinic reassessment with temporary restoration tooth 35(a); tomographic sagittal view of tooth 35(b) and coronal view of tooth 37 (c). Prexion CT scanner.

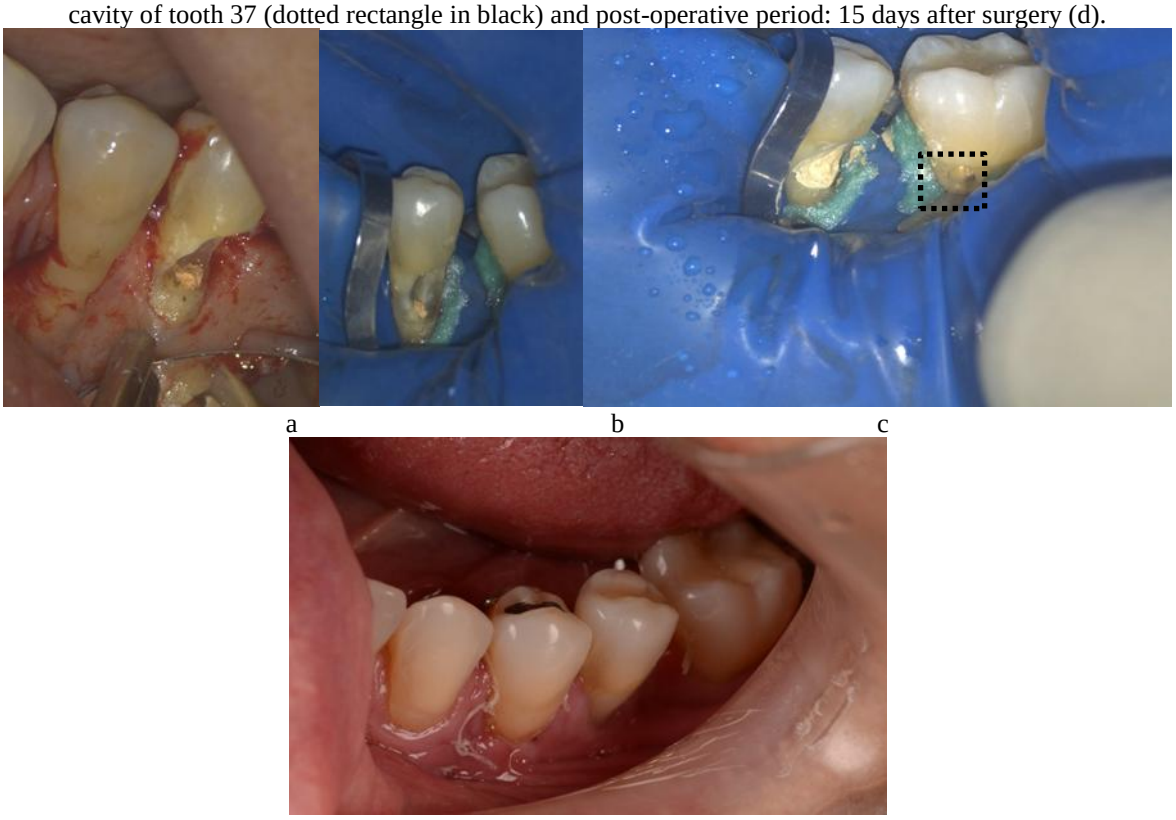


a b c

Source: Authors

The surgery was performed under anesthesia, with inferior alveolar nerve block using 2% lidocaine with 1:100,000 epinephrine (Alphacaine, DFL, Rio de Janeiro, Brazil) and supplemented with an infiltrative technique using 4% articaine with 1:100,000 epinephrine (DFL, Rio de Janeiro, Brazil). The total trapezoidal flap was created through an intrasulcular incision with a 15C scalpel blade extending from the mesial of the canine to the distal of the second molar, under light and magnification with a Leica microscope (Leica Cambridge, England) at 1x magnification. The removal of all reparative material and granulation tissue in the region (Figure 10 a, b and c) was performed with a piezosurgical ultrasound device (Mectron®) with PP1 inserts and completion of the root surface near the bone region with 40 µm diamond burs from the Intensiv Bevelshape kit (Intensiv Perioset®, Switzerland) and EVA ER4 contra-angle handpiece (NSK, Nakanishi, Tochigi-ken, Japan). The sealing of the resorptive defect was performed with Biodentine® repair material (Septodont, Saint Maur des Fosses, France) and after the hardening time, 12 minutes, according to the manufacturer's instructions, a restoration was performed over the repair material using Filtek Z350 XT composite resin (3M® ESPE) and Clearfil SE Bond adhesive system (Kuraray Noritake Dental, Tokyo, Japan). The flap was then repositioned and sutured with 5.0 Nylon thread (Techsuture, Bauru, Brazil). After 15 days the suture was removed (Figure 10d).

Figure 10. Clinical photos of the second surgery on teeth 35 and 37 revealing the cavity after removal of the previous restorative material in tooth 35 (a and b), after placement of Biodentine in tooth 35 (c): * exposed cervical cavity of tooth 37 (dotted rectangle in black) and post-operative period: 15 days after surgery (d).



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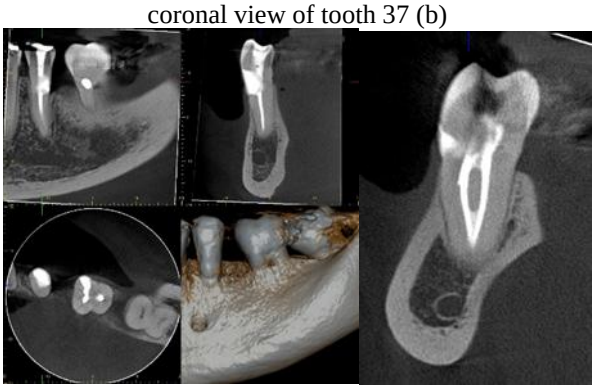
Source: Authors

Clinical was performed one year prior, and the patient showed no signs or symptoms. and tomographic evaluation (Figure 11a and b) showed complete repair of the region.

Figure 11. 1-year follow-up tomographic images highlighting the repair of the tooth 35 (all the slices) (a) and coronal view of tooth 37 (b)



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RESULT AND DISCUSSION

Removal and cleaning of the resorptive cavity of the lower premolar was not possible solely via the root canal, and a surgical approach was necessary for completion, using an ultrasonic insert and mini curettes, due to the extent of the resorptive area. Thanks to the effective cleaning of the region with the ultrasonic inserts, it was decided not to use trichloroacetic acid. Once the resorptive defect was addressed, with the removal of the granulation tissue, repair and reconstruction were performed with a filling material capable of maintaining tooth function (Heithersay 1999).

Early diagnosis leads to good predictability of cases diagnosed with RCI, as significant hard tissue destruction is avoided and treatment is consequently less invasive. In this case report, the lower molar was diagnosed with RCI, after tomographic evaluation, at a more favorable stage for the tooth.

A more assertive strategic approach to diagnosis, treatment, and follow-up for RCI cases involves a thorough evaluation of three-dimensional imaging, cone-beam computed tomography (ESE 2018)(Patel, Lambrechts *et al*. 2018), associated with a careful clinical assessment of the presence of pain, depth of probing of the resorptive cavity, and stage of resorption (formation or not of bone-like tissue), factors that are very relevant in making treatment decisions and predicting the outcome of the pathology in terms of survival, failure, and success(Goodell, Mines *et al*. 2018, Mavridou, Rubbers *et al*. 2022).

The prognosis for invasive cervical resorptive lesions is generally aligned with the available scientific evidence supported by the classifications suggested by the aforementioned authors, also considering access to the defect, its size and extent along the root, and will be less favorable for cases with greater lesion extent (Heithersay 1999, Mavridou, Rubbers *et al*. 2022).

As we have advance in the ability to make more accurate clinical diagnoses through tools such as computed tomography, the timing of intervention and offering better treatments allows us to predict better outcomes for that case, however, to date we do not have a protocol for the treatment of ICR (Chen, Huang *et al*. 2021). The objective in the approach to cases of invasive resorption is currently limited, with what we have available, to removing all resorptive tissue present, controlling its recurrence, removing possible maintaining factors, preserving as much dental structure as possible and restoring function to the tooth and aesthetics for the patient

seeking lower failure rates with internal, external or both approaches (Park and Lee 2008, Irinakis, Aleksejuniene *et al*. 2020).

CONCLUSION

Although the formal follow-up period was 12 months, this case demonstrates the long-term clinical success of early diagnosis and individualized management of invasive cervical resorption. The tooth remained functional for three years post-intervention, with tomographic evidence of increased bone density on the distobuccal surface of tooth 35—indicative of favorable bone remodeling even in complex scenarios.

This outcome reinforces the importance of a tailored approach based on the patient's clinical presentation, including a detailed evaluation of lesion location, extent, and accessibility. It also highlights the need for rigorous follow-up and interdisciplinary collaboration.

Further research is warranted to enhance the sensitivity and specificity of early diagnostic tools such as CBCT and conventional radiography, to elucidate the etiopathogenesis of this condition, and to optimize treatment protocols for long-term preservation of affected teeth.

ACKNOWLEDGEMENTS

The authors declare no conflict of interest. The research project is in accordance with ethical principles and has been approved by the Ethics Committee Nº 7.470.724.

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