CASE REPORT/CLINICAL TECHNIQUES

Guided Tissue Regeneration in Class IV External Cervical Resorption: A Case Report

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ABSTRACT

External cervical resorption (ECR) is a type of dental resorption that originates from the loss of the cementum's protective layer. The direct exposure of dentin to the periodontal ligament may lead to the invasion of clastic cells through an entry point on the external root surface into the dentinal tissue, causing resorption. Depending on the extension of ECR, different treatments are proposed. Although the literature presents distinct materials and methods for restoring ECR areas, an existing gap is related to care in the treatment of the supporting periodontal tissue. Guided tissue regeneration (GTR)/guided bone regeneration includes the stimulation of bone formation in bone defects using different types of membranes (resorbable and nonresorbable), regardless of its association with bone substitutes or grafts. Despite the benefits of guided bone regeneration, the application of this method in cases of ECR is still under-explored in the literature. Thus, the present case report uses GTR with xenogenic material and polydioxanone membrane in a case of class IV ECR. The success of the present case is related to the correct diagnosis and treatment plan. Complete debridement of resorption areas and restoration with biodentine were effective in tooth repair. GTR contributed to the stabilization of supporting periodontal tissues. The association of the xenogeneic bone graft with the polydioxanone membrane proved to be a viable option for restoring the health of the periodontium. *(J Endod 2023;■:1–7.)*

KEY WORDS

biodentine; external invasive resorption; guided bone regeneration; polidioxanone

SIGNIFICANCE

Depending on its stage of development, the treatment of ECR poses great challenges regarding the presence of infiltrative and fibro-osseous characteristics of the resorptive lesion. Although GTR provide mechanical support and permit surrounding healthy tissue to migrate and promote osteogenesis and osteoconduction, its application in cases of ECR is still under-explored. Thus, the present case report describes using GTR in a case of severe ECR.

External cervical resorption (ECR), also known as invasive cervical resorption (ICR), is a resorptive dental process originating from the loss of the cementum's protective layer. The direct exposure of dentin to the periodontal ligament (PDL) may lead to the invasion of clastic cells through an entry point on the external root surface into the dentinal tissue, causing resorption. The tissue is progressively replaced by inflammatory granulomatous tissue, and in more advanced stages, it can demonstrate fibro-osseous characteristics[1,2].

Although the cause of ECR initiation remains obscure, predisposing factors such as trauma, orthodontic treatment, intracoronal bleaching, and iatrogenic procedures that can cause cementum damage, PDL compression, hypoxia, and chronic irritation as sole factors or a combination of factors have been identified[3,4]. Mavridou et al[3] demonstrated that ECR is multifactorial, and the combinations of potential predisposing factors, such as orthodontics followed by the extraction of an adjacent tooth, orthodontics with traumatic injury, and orthodontics with parafunctional habits have a much higher frequency of occurrence than other factors.

Depending on the extension of ECR, different treatments have been proposed. According to Heithersay[2,4], in less invasive forms of ECR (classes I–II), the resorption tissue should be removed, followed by a restoration of the resorption cavity. When ECR are diagnosed at its stage of development as class III and IV, the treatment poses far greater challenges regarding the presence of infiltrative and fibro-osseous characteristics of the resorptive lesion. In addition, the resorptive tissue is the origin of several channels that encircle the root canal and extend into the radicular dentine. A further consequence is the interconnection of these infiltrating channels with the PDL at other sites on the root surface. In advanced stages of ECR class IV, another option is to leave the tooth untreated and monitor the progression of ECR. Nevertheless, this approach may put at risk the health of the supporting bone as a site for implant placement. Another clinical option is a prosthodontic replacement. The success rates of class IV cases are unclear, and approaches to different treatments have been described with adjunctive strategies[4-6].

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The literature is still scarce of studies concerning the care of the supporting periodontal tissue in cases of ECR[7,8]. Guided tissue regeneration (GTR)/guided bone regeneration includes the stimulation of bone formation in bone defects using different types of membranes (resorbable and nonresorbable), regardless of its association with bone substitutes or grafts[9,10]. GTR provide mechanical support and permit surrounding healthy tissue to migrate and promote osteogenesis and osteoconduction[9,11]. The ideal biomaterial for barrier membranes should be resorbable, nonimmunogenic, and closely mimic the extracellular matrix in which morphology will allow cell adhesion, growth, migration, and differentiation[12-14].

Polydioxanone (PDO) is a colorless, crystalline, resorbable synthetic polymer of multiple repeating ether-ester units fully metabolized by the body. PDO membranes and scaffolds are biocompatible and histoconductive, stimulating bone and cartilage regeneration with long-term resorption[15-21].

Despite the benefits of guided bone regeneration, the application of this method in cases of ECR is still under-explored in the literature. Thus, the present case report describes using GTR with xenogenic material and a PDO membrane in a case of class IV ECR.

CASE REPORT

A 49-year-old male patient came to a private clinic complaining of sensitivity and a cavitated lesion in the buccal cervical region of the lower left canine. The patient's medical history did not indicate any diseases or systemic alterations, and he did not use any medication. The patient did not remember having suffered any trauma in the region and reported not having undergone previous orthodontic treatment. The cone-beam computed tomography examination revealed severe ICR in the canine, with a significant loss of buccal dentin structure and an absence of buccal cortical bone up to the apical third region. In the lower left lateral incisor, the presence of class IV ICR was also noted, with an entrance portal through the buccal surface and the absence of buccal cortical bone up to the apical third region (Fig. 1).

The clinical examination revealed sensitivity to palpation in the canine and lateral incisor region and the absence of edema. The patient did not report increased sensitivity on vertical and horizontal percussion tests on these elements. The canine's root was projected more buccally than the neighboring teeth and presented only a small band of keratinized mucosa with a periodontium of thin phenotype. With the aid of a clinical probe, the presence of deep cavitation of the cervical lesion on the buccal side of the canine was verified, with the patient experiencing pain during the probe. During the periodontal probing, bleeding was observed, but there was no periodontal pocket >3 mm. After discussing with the patient the possibility of maintaining the teeth and the risks and benefits of the surgery, it was decided to perform the endodontic treatment of the canine and lateral incisor utilizing surgical treatment and GTR.

The supragingival cavitation area was debrided and restored in the first session with glass ionomer (Riva self cure, SDI, Victoria, Australia). Then, endodontic treatments of the canine and lateral incisor were performed. The patient was anesthetized with 2% lidocaine with 1:100,000 epinephrine (Alphacaine, DFL, Rio de Janeiro, Brazil). The pulp chamber was accessed with a spherical high-speed diamond drill (1014) under refrigeration, followed by drills 1557 and endoZ (Angelus Prima Dental, Londrina, Brazil). The teeth were then isolated with a rubber dam. The teeth were then further examined, and odontometry was performed. After verifying the correct working length, the teeth were instrumented with rotary nickel-titanium files with final diameter #40 (LOGIC, Easy Dental Equipment, Belo Horizonte, Brazil). Upon changing each instrument, the tooth was copiously irrigated with 2.5% sodium hypochlorite. The irrigating solution was activated with a plastic instrument driven by a low-speed motor (Easy Clean, Easy Dental Equipment, Belo Horizonte, Brazil).

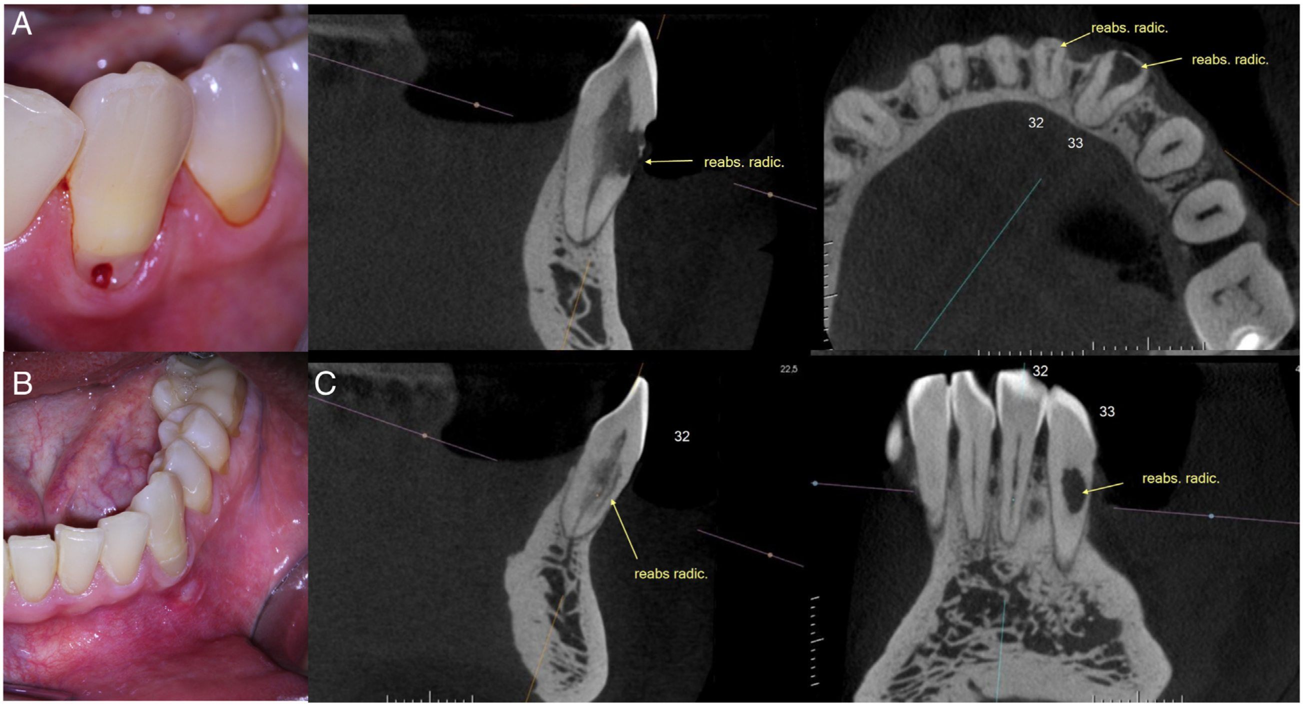

FIGURE 1 – (*A*) The preoperative aspect of external invasive resorption. (*B*) The clinical view of the restoration with glass ionomer of the supragingival cavitation area. (*C*) The tomographic images of external cervical resorption in the lower left canine and lateral incisor.

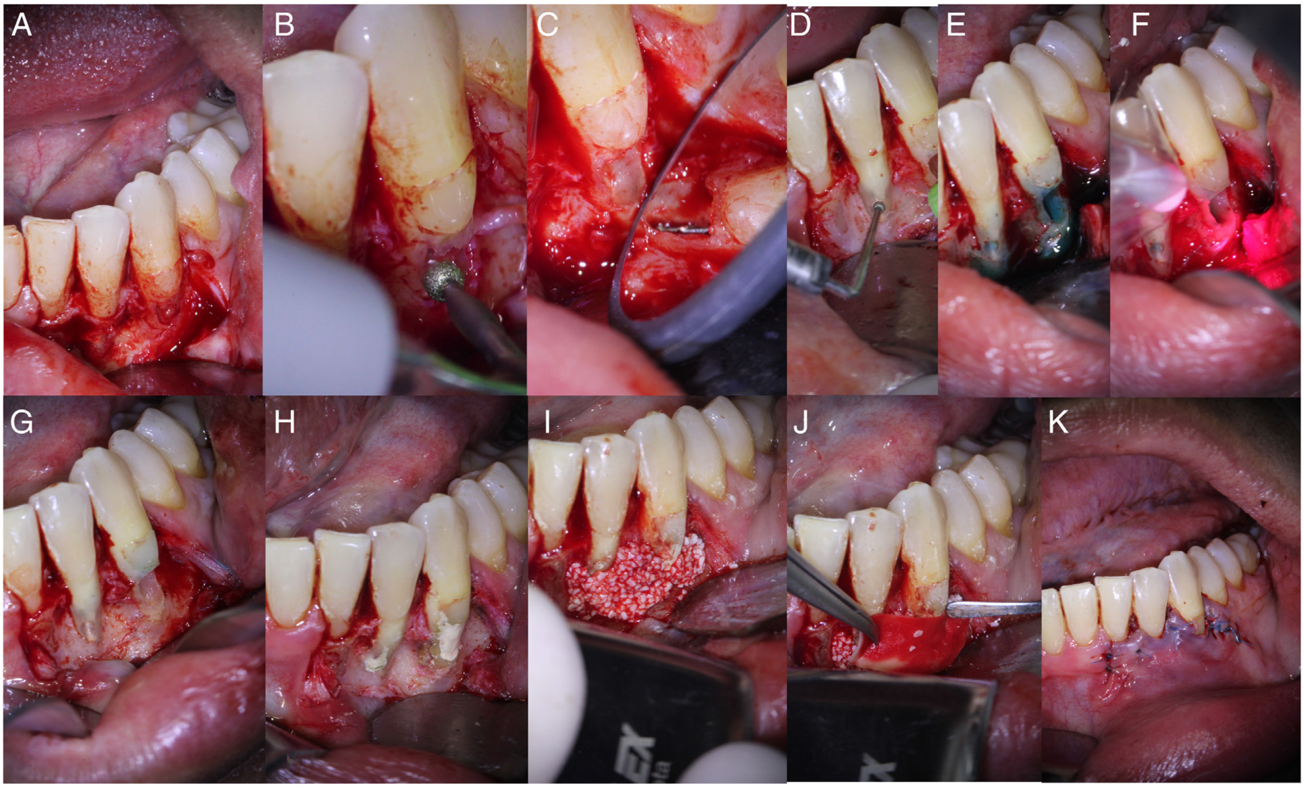

FIGURE 2 – (*A*) An intrasulcular incision with relief extending from the mesial of the central incisor to the distal of the canine, forming a full-thickness trapezoidal flap. (*B*) Debridement of the canine dentin resorption with a diamond spherical ultrasound tip. (*C*) Detail of the NiTi instrument inside the root canal during the trans-surgical root canal treatment of the canine. (*D*) The debridement of the incisor resorption entrance portal with a diamond spherical ultrasound tip. (*E–F*) The antimicrobial photodynamic therapy performed in the lateral incisor and the canine. (*G*) The clinical aspect before restoration of the lateral incisor and canine. (*H*) The restoration of resorption areas of the lateral incisor and canine with biodentine. (*I*) The xenogenic graft with lyophilized bovine bone. (*J*) The coverage of the graft with a synthetic polydioxanone membrane. (*K*) The clinical aspect after flap reposition and suture. NiTi, nickel-titanium.

As the canine resorption was extensive and bleeding was abundant, it was impossible to debride the entire area of resorption via the canal. It was then decided to complete the endodontic treatment of this tooth trans-surgically in another session. With the aid of the operating microscope, the area of resorption of the lateral incisor was located. It was debrided with smooth ultrasonic inserts compatible with the canal diameter. The rest of the granulation tissue removal was carried out with the "clearsonic" ultrasonic insert (Helse, São Paulo, Brazil). After complete removal of the resorption area, an irrigation protocol using 17% Ethylenediamine tetraacetic acid and Easy Clean agitation was performed for 1 minute, followed by a sequence of 3 repetitions of 3 ml irrigation with 2.5 % NaOCl solution and activation with Easy Clean for 1 minute. After adjusting the gutta-percha master cone (Odous de Deus, Belo Horizonte, Brazil) and drying the canal, the tooth was filled with bioceramic cement, using the cold lateral condensation technique (Bio C Sealer, Ângelus, Londrina, Brazil). The tooth was then restored with composite resin.

In the following session, an inferior alveolar nerve block was performed, and infiltrative anesthesia was applied through the buccal region from the left premolars to the lower incisors using Alphacaine. With a 15C scalpel blade, an intrasulcular incision was made with relief extending from the mesial of the central incisor to the distal of the canine, forming a full-thickness trapezoidal flap. After curettage of the granular tissue, the canine dentin resorption and the incisor resorption entrance portal were completely debrided with a diamond, spherical ultrasound tip under copious saline solution irrigation. The canine root canal was accessed again trans-surgically, instrumented with nickel-titanium files, irrigated with 2% chlorhexidine aqueous solution, and filled with gutta-percha and bioceramic cement (Bio C Sealer, Ângelus, Londrina, Brazil). The dentin was again cleaned with a spherical ultrasound tip under saline irrigation. Then antimicrobial photodynamic therapy was then performed. The resorption region was irrigated with 0.005 % methylene blue solution (Chimiolux; DMC, São Carlos, Brazil) used as a photosensitizer. The methylene blue solution within the dentin walls and surrounding tissue was irradiated with a low-intensity laser (Therapy XT; DMC, São Carlos, Brazil) using the following parameters: 100 mW, 9 J energy, continuous emission, 660 nm wavelength, and 90 seconds time. Between the application of the photosensitizer and the laser activation was a 5-minute waiting period. After laser irradiation was performed, the tissue was rinsed with saline to remove residual methylene blue solution. This protocol was described previously[5].

Root resorption areas were filled with Biodentine (Saint-Maur-des-Fossés, France). After the material was set, bone grafting was performed with medium-grained lyophilized bovine bone (Lumina Bone, Criteria, São Paulo, Brazil). The graft was then covered with a synthetic PDO membrane (Plenum Guide, Plenum, São Paulo, Brazil). The flap was repositioned, and the suture was performed with 5.0 nylon thread (NylonBlue, Techsuture, Bauru, Brazil) (Fig. 2). After 10 days, the suture was removed, and access to the canal was restored with resin. The patient's occlusion

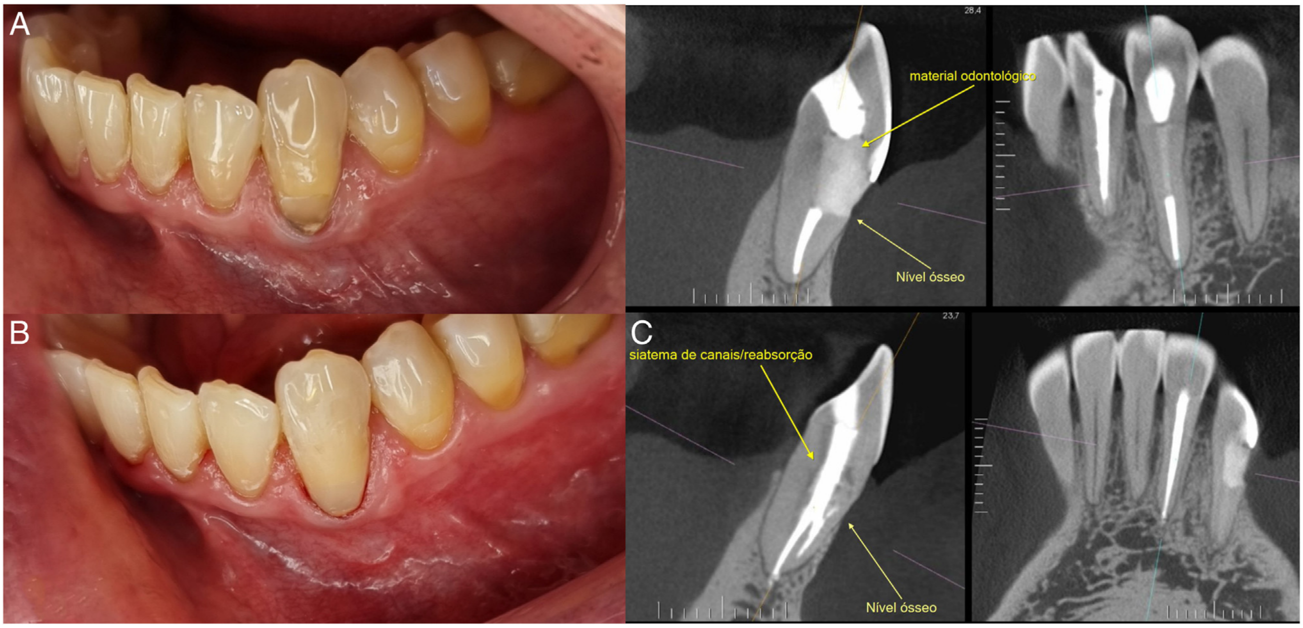

FIGURE 3 – (*A*) The clinical aspect at 12-month recall. (*B*) Final class V resin restoration of the canine. (*C*) CBCT images at 12-month follow-up of the lower left canine and lateral incisor. CBCT, cone-beam computed tomography.

and lateral and protrusion movements were stabilized through the occlusal adjustment. The patient was monitored for 1, 3, 6, and 12 months.

After 12 months, periodontal healthy was confirmed by clinical probing <3 mm in all the regions of the lateral incisor and the canine. The final restoration of the supra gingival cervical region was performed with composite resin, and a cone-beam computed tomography follow-up examination was carried out. Bone repair was observed, with increased bone thickness and height and no need for additional connective tissue grafting. (Figs. 3 and 4).

DISCUSSION

ECR cases greatly impact the clinical routine of endodontists, and the treatment can vary due to the complexity of this phenomenon[1-5]. Mavidrou et al[22] described 4 main criteria to evaluate before making a decision on what treatment to use: (a) the existence of pain, (b) probing feasibility of the resorption cavity, (c) 2-dimensional class and 3-dimensional characteristics and, (d) the existence of bone-like tissue. Careful clinical examination and high-resolution 3-dimensional tomographic images were essential in the diagnosis and treatment plan of the present case.

There was an absence of bone-like tissue in the canine resorption cavity. Probing was feasible through the resorption portal of entry, indicating the presence of soft (epithelium and granulation) tissue growth. The 2 treatment options were tooth extraction or combined internal and external treatment. An additional challenge of the case was the lack of a supportive periodontal structure to ensure the longevity of the elements. Faced with this challenge and the limited treatment possibilities, the patient was aware of the prognosis, and his willingness to accept the proposed treatment impacted the decision to retain the teeth.

The complete removal of resorptive tissue on the incisor was performed via the root canal with visual magnification and ultrasonic inserts. However, surgical intervention was necessary due to the extension of the canine resorption area. A spherical diamond ultrasonic insert under copious irrigation was the choice for complete debridement of resorption and clastic cells. The cleaning power and cavitation of the ultrasound permitted the removal of resorption without forming a smear layer, which can often be observed after the use of drills[23,24]. Due to the effectiveness of ultrasonic debridement, it was decided not to use trichloroacetic acid. Since the extent of canine resorption was considerably large, the acid could injure the underlying tissues. To complement the disinfection process, the antimicrobial photodynamic therapy[5,25,26] was used.

The choice of the best restorative material is paramount for success. The most plausible material options for this case were glass ionomer or bioceramic[27,28]. Due to its biocompatibility, resistance, and surface smoothness, the ionomer has been widely used in cases of supra osseous ECR[27-29]. However, since the GTR would be performed on the region to be restored, the use of bioceramic material was optimal for the present case. A specific brand of bioceramic cement called Biondentine (Septodont, Pomerode, Brazil) was used, due to its great biocompatibility, resistance, and the possibility of it being used as a restorative material in place of dentin[30-32].

The reestablishment of the supporting periodontal tissue was necessary since the canine root was projected buccally. There was a loss of the cortical bone, which was initially very thin. The choice to use xenogeneic bone graft was due to the great success achieved in implant dentistry in obtaining bone beds for implant placement. The xenogenous bone is used for alveolar ridge augmentation with reliable results, low morbidity, and decreased complication rate[33]. The performance of bone grafts in endodontic microsurgery has also been shown to be beneficial in repairing periapical tissues, with an improvement in the quality of the supporting tissues[34,35].

Along with the bone graft, the PDO membrane was used. Recent studies have shown that this material has suitable mechanical properties and excellent dimensional stability after swelling and is proven to be safe and efficient for use as resorbable membranes for bone

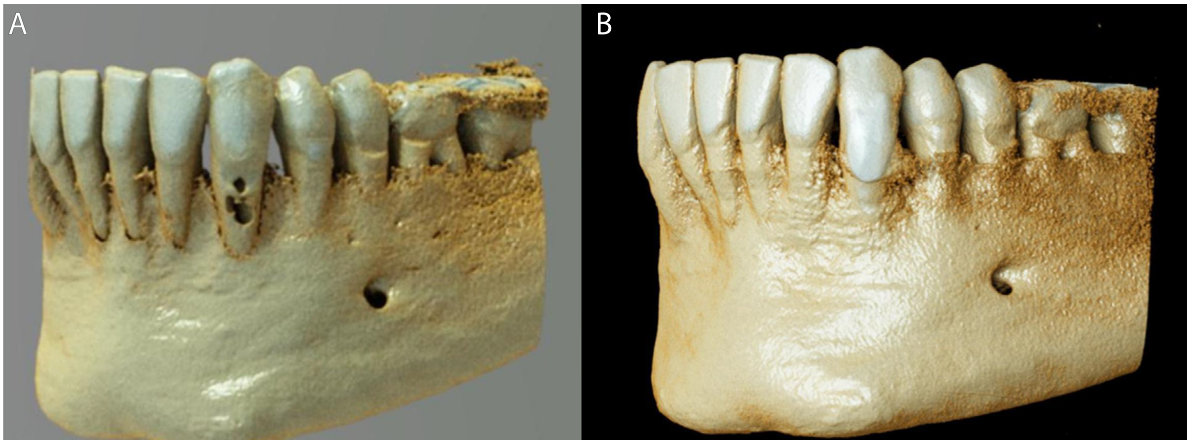

FIGURE 4 – (*A*) The preoperative 3-dimensional reconstruction. (*B*) Three-dimensional reconstruction 12 months after treatment.

regeneration[15-17]. The PDO membrane implantation in surgically induced bone defects has resulted in a large amount of newly formed bone tissue[18], per the satisfactory new bone formation observed in this case report. Then, buccal bone gain between the teeth was of paramount importance, as it reduced the protuberance caused by the canine root. Such gain in bone structure was fundamental for the protection of the dental element against new traumatic injuries that could induce a new resorption process. To the best of our knowledge, no work to date has reported the use of bone graft with a PDO membrane in cases of ECR.

To ensure the long-term success of ECR cases, it is essential to understand the cause and thus prevent its recurrence[1,3]. In the present case, an occlusal discrepancy was detected as a predisposing factor for resorption. The excess load may have caused the buccal root to tip, which decreased the buccal cortical thickness and predisposed the ECR. In association with this, frequent trauma to the thin mucosal tissue may have contributed to the advancement of the resorption process. The patient received occlusal adjustment and was instructed to improve plaque control using the softest toothbrush possible.

CONCLUSION

The success of the present case is related to the correct diagnosis and treatment plan. Complete debridement of resorption areas and restoration with a bioceramic repair material were effective in tooth repair. GTR contributed to the stabilization of supporting periodontal tissues. The association of the xenogeneic bone graft with the PDO membrane proved to be a viable option for restoring the health of the periodontium. Adjustment of occlusion and plaque control by the patient were also essential to ensure the survival of restored dental elements.

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The authors deny any conflicts of interest related to this study.

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