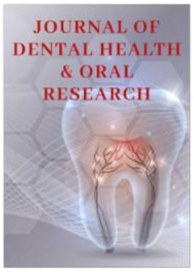

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Case Report

Management of Endodontic-Periodontal Defects Using a Combined Approach of Root Canal Therapy and Guided Bone Regeneration

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Abstract

Background: An accurate diagnosis in the endodontic, periapical and periodontal areas is essential for clinical success, especially when endoperiodontal lesions are present. These lesions, which involve both pulp and periodontal tissues, can have similar clinical presentations, making their correct identification difficult without a thorough diagnostic evaluation. A comprehensive diagnosis allows differentiation between whether the pathology has a primary endodontic or periodontal origin or a combination of both, which is essential for selecting the appropriate treatment. Combined assessment through pulp testing, periodontal probing, radiographic analysis and clinical evaluation reduces the risk of inappropriate treatment and significantly improves the prognosis. Ignoring any of these aspects can lead to therapeutic errors, unnecessary loss of tooth structure or even tooth extraction. Therefore, in this clinical case, we will show how root canal treatment, biomaterial-guided tissue regeneration and good soft tissue management are key to treatment success.

Case Report: A 55-year-old female patient presented with the complaint of "I have had a crownless tooth for some time." Following clinical symptoms and Computed Tomography (CT) studies, a diagnosis of a type II endoperiodontal lesion was reached. Root canal treatment was performed, followed by guided tissue regeneration surgery with the placement of a xenograft and resorbable membrane.

Conclusion: The Cone-Beam Computed Tomography (CBCT) study showed increased bone density, demonstrating good clinical and CT results after root canal treatment and periodontal regeneration, establishing a good pulp, periapical and periodontal diagnosis is essential for achieving excellent tissue regeneration results.

Keywords: Guided Tissue Regeneration; Xenografts; Resorbable Membrane; Endoperiodontal Lesions

Introduction

The American Academy of Periodontology (AAP) and the European Federation of Periodontology (EFP) define periodontal diseases as inflammatory conditions that affect the supporting tissues of the teeth [1,2]. These conditions are caused by specific microorganisms, leading to the progressive destruction of the periodontal ligament and alveolar bone [3,4]. Periodontal treatment aims to eliminate the etiological factors responsible for the loss of the tooth-supporting structures, thereby preventing disease progression, minimizing symptoms and facilitating the restoration of damaged tissues. Treatment options can be classified as surgical or non-surgical, depending on the risk of disease progression [5]. Periodontal therapy focuses on eliminating or reducing the bacterial load to halt the inflammatory process. However, it is essential to complement this with the reconstruction of periodontal tissues, given their limited self-regenerative capacity [6]. For this reason, regenerative surgery focuses on repairing defects using biomaterials, such as resorbable or non-resorbable barrier membranes, which are placed between the gingival soft tissues and the affected area [7]. This placement prevents the formation of epithelial and gingival connective tissue, allowing cells from the periodontal ligament to promote regeneration at the defect site [8]. These membranes are often combined with bone substitutes such as xenografts, allografts and alloplastic materials, whose primary function is to provide mechanical support to stimulate regeneration and facilitate the formation of new bone tissue [7]. The objectives and outcomes of guided tissue regeneration include improved clinical conditions, achieving a probing depth of ≤5 mm without bleeding on probing, as well as radiographic evidence of regeneration in intraosseous defects and Class I and II furcation defects [9]. Accurate evaluation of both hard and soft tissues is crucial for informed decision-making, as advanced stages of periodontal disease present significant clinical challenges due to their potential to compromise structures adjacent to the periodontium, including the dental pulp [10]. Although the relationship between the periodontium and the dental pulp has been the subject of numerous studies, it is recognized that these entities are treated differently despite their close anatomical and physiological connection. This interplay is relevant to the development of endo-periodontal lesions, which may arise due to various factors such as biofilm accumulation, deep periodontal pockets, tooth mobility, occlusal trauma, carious lesions or other irritants that can affect the pulpal, periapical and periodontal status. In this context, radiographs complement clinical evaluation by reducing the variability associated with manual measurements [11,12]. However, two-dimensional imaging can result in tooth superimposition, which hampers the identification of bone defects, infrabony lesions and furcation involvement [13]. Currently, Cone-Beam Computed Tomography (CBCT) has become a valuable diagnostic tool in the context of regenerative treatments for bone tissue. This method provides precise information on pulpal morphology, canal location, bone defects and nearby anatomical structures at risk. The use of CBCT holds great potential, as it enhances pulpal, periapical and periodontal diagnosis and improves treatment planning, thereby enabling more predictable and satisfactory outcomes [11]. The aim of this article is to present the interdisciplinary management of an endoperiodontal lesion with regenerative biomaterials.

Clinical Case Presentation

A 55-year-old female patient presented to the Periodontics and Implantology postgraduate clinic at the Faculty of Dentistry of the Universidad Juárez del Estado de Durango. The patient reported mild pain during mastication in tooth #46. During the anamnesis, she denied any relevant medical history. Clinically, a generalized marginal and papillary swelling was observed, along with non-carious cervical lesions, the presence of biofilm, bleeding on probing and an ill-fitting restoration in tooth #16. In quadrant IV, tooth #46 showed 3 mm of attachment loss, a probing depth of 13 mm on the distal aspect, grade II mobility and caries in the groove on the buccal surface. Pulp vitality and periapical tests were performed to assess the status of the pulp and periapical tissues of the affected tooth (Fig. 1). Radiographically, tooth #46 exhibited normal alveolar bone and trabecular pattern, a three-wall bone defect, widening of the periodontal ligament space, reduced lamina dura, a radiolucent area in the apical region and a radiopaque area in the coronal portion associated with a defective restoration (Fig. 1). The Cone-Beam Computed Tomography (CBCT) scan revealed a hypodense area in the periapical region, loss of the buccal cortical plate and confirmed the presence of a three-wall defect (Fig. 2). Based on these findings, the periodontal diagnosis was: Generalized Stage III, Grade B Periodontitis [3]. The pulpal and periapical diagnosis was: Pulpal necrosis with symptomatic apical periodontitis [14].

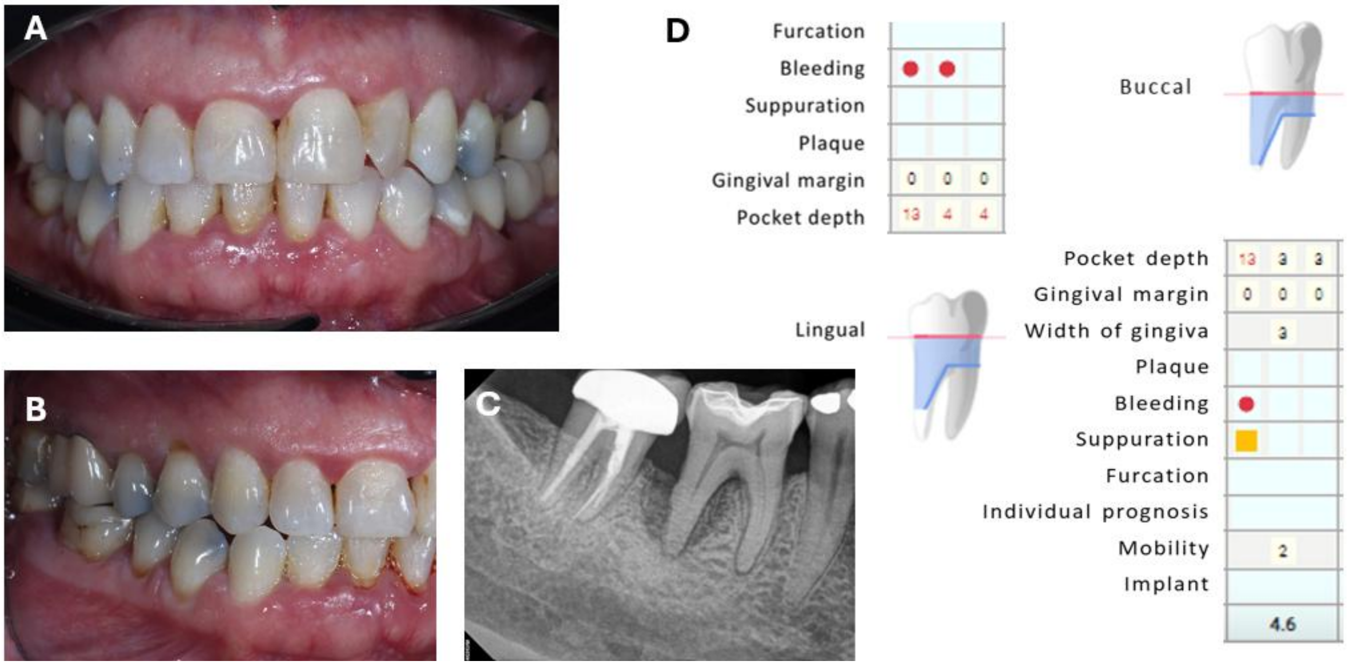

Figure 1: Diagnosis: A) Initial photograph of the patient; B) Clinically, swelling and discoloration are observed in tooth #46, with a defective restoration and caries on the buccal surface; C) Radiographically, significant bone destruction is noted, with a three-wall defect, retracted distal pulp horn and canal obliteration in the apical region; D) Periodontal chart of tooth #46 showing a probing depth of 13 mm, with the presence of suppuration and grade II mobility.

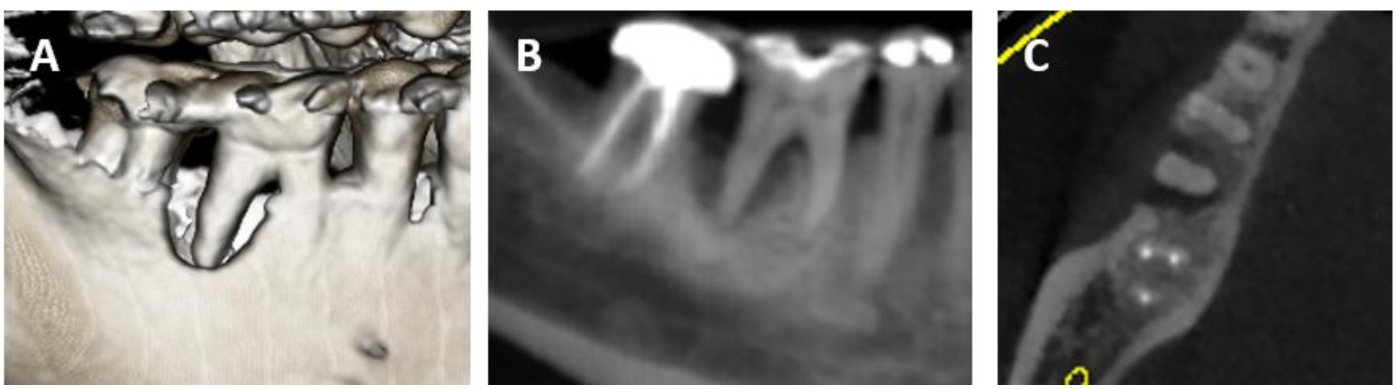

Figure 2: Tomographic Analysis: A) Volumetric reconstruction; B) Coronal view. C) Axial view.

Once the diagnosis was established, the patient underwent a treatment plan divided into four sequential phases, in accordance with the recommendations of the European Federation of Periodontology (EFP).

Treatment Plan

Step 1: Infection Control and Patient Motivation

A plaque control index of 69% was recorded, which is considered poor according to O'Leary's Index. The patient was informed about the importance of improving oral hygiene and adopting a healthy lifestyle to reduce inflammation and promote an optimal response to periodontal therapy. As part of this phase, supragingival scaling was performed and oral hygiene instructions, including brushing technique, were reinforced to achieve long-term effective plaque control.

Step 2: Etiologic Treatment and Biofilm Control

After achieving initial biofilm control, the patient was referred to an endodontic specialist for root canal treatment of tooth #46. Subsequently, subgingival scaling was performed. Two weeks later, clinical improvement was observed, as shown in Fig. 3. Once the etiological factors of periodontal disease were controlled, a surgical intervention was planned to eliminate the 13 mm periodontal pocket located on the distal surface of tooth #46.

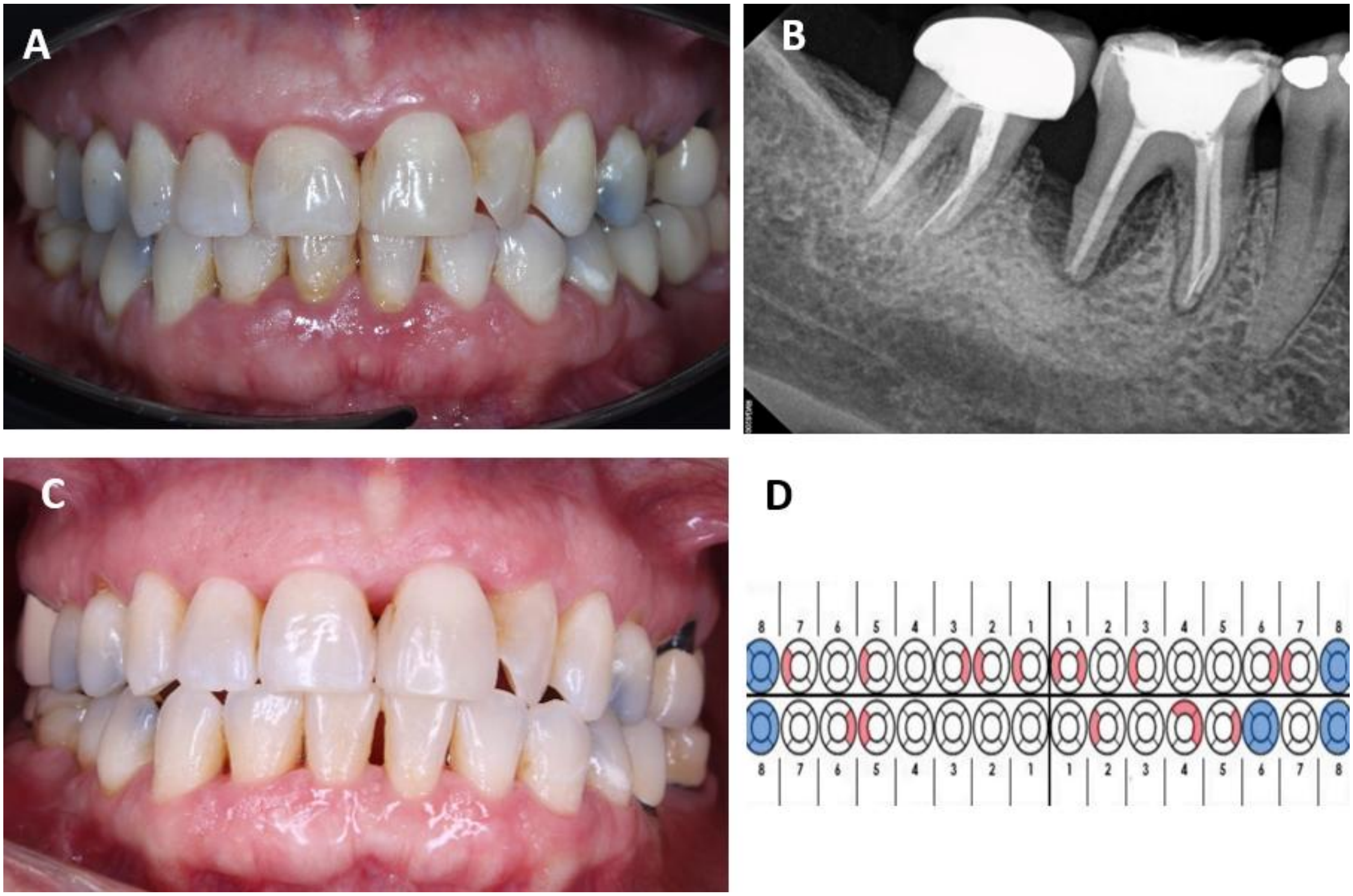

Figure 3: Treatment: A) Initial photograph of the patient upon admission to the postgraduate program; B) Final radiograph showing completed root canal treatment of tooth #46; C) Follow-up photograph taken two weeks later, after supragingival scaling and oral hygiene instruction; D) Plaque index image showing a 14.81% score, indicating significant improvement that allowed progression to surgical Phase III.

Surgical Treatment

Perioral asepsis and antisepsis were performed using povidone-iodine extraorally, along with a 0.12% chlorhexidine rinse [15]. Local anesthesia was administered to the right inferior alveolar, buccal and mental nerves using 2% lidocaine with 1:100,000 epinephrine (Fig. 4). Intrasulcular incisions were made around teeth #46 and #47, along with an apically directed releasing incision at tooth #45. A full-thickness flap was elevated using a P20 and Prichard Hu-Friedy® periosteal elevator, extending beyond the mucogingival junction. After reflecting the soft tissue, granulation tissue was debrided using an ultrasonic Cavitron and Hirschfeld file 3/7. Root planing and scaling were carried out with Gracey curettes 7/8 and 13/14, as well as Mini-Five curettes 1/2 and 3/4 (Fig. 4). The surgical site was thoroughly irrigated with sterile saline solution and 0.5g of Nukbone, a bovine-derived cancellous bone matrix substitute, was placed. The graft was covered with a customized Bioteck® lyophilized collagen membrane to ensure complete coverage of the surgical site. The membrane was stabilized with simple sutures and a cross suture anchored to the periosteum (Fig. 4). The repositioned flap was closed to achieve primary closure using simple interrupted sutures with 5-0 Vicryl (Fig. 5).

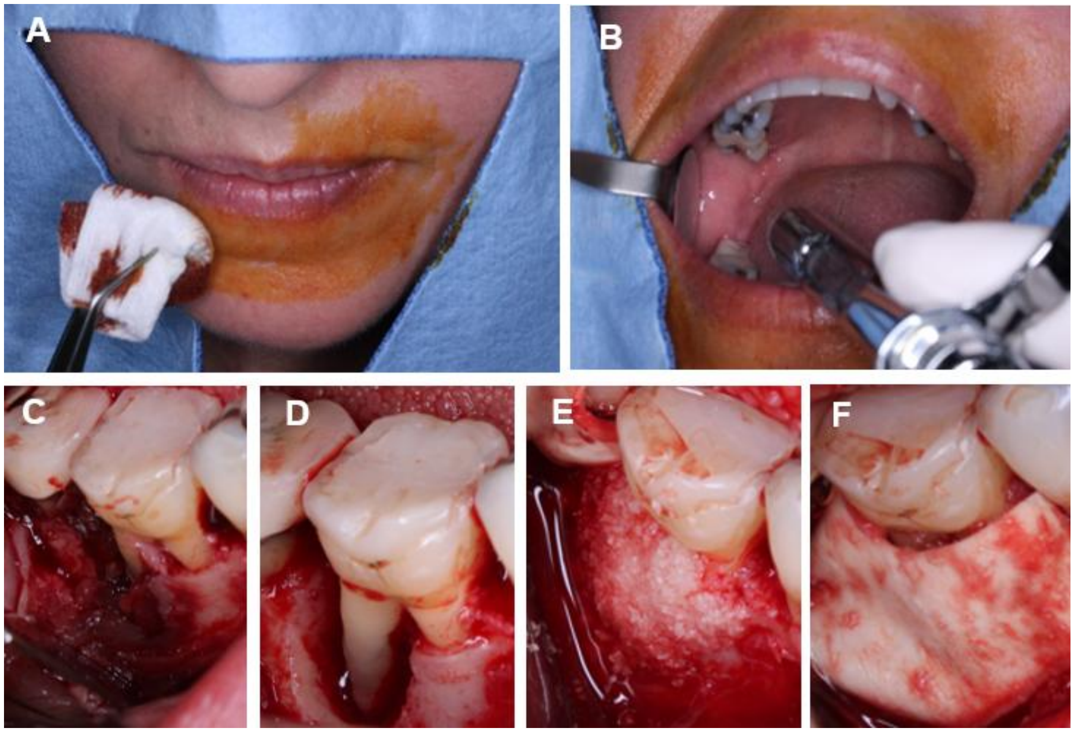

Figure 4: Surgical Procedure: A) Perioral asepsis was performed using povidone-iodine to maintain a clean, bacteria-free field; B) Local anesthesia was administered with 2% lidocaine and 1:100,000 epinephrine (Septodont®) to ensure a pain-free procedure; C) Intrasulcular incisions were made, including a releasing incision at tooth #45; D) Granulation tissue was removed and a three-wall defect was observed on the distal root, with no biofilm presence, which is a favorable finding. A xenograft of 0.5 grams (particle size between 500 and 1000 µm) of Nukbone Nanograft® was placed to promote bone regeneration; E) A BIOCOLLAGEN membrane (Bioteck®) was adapted and sutured to the periosteum to ensure proper stabilization and protection during the healing process.

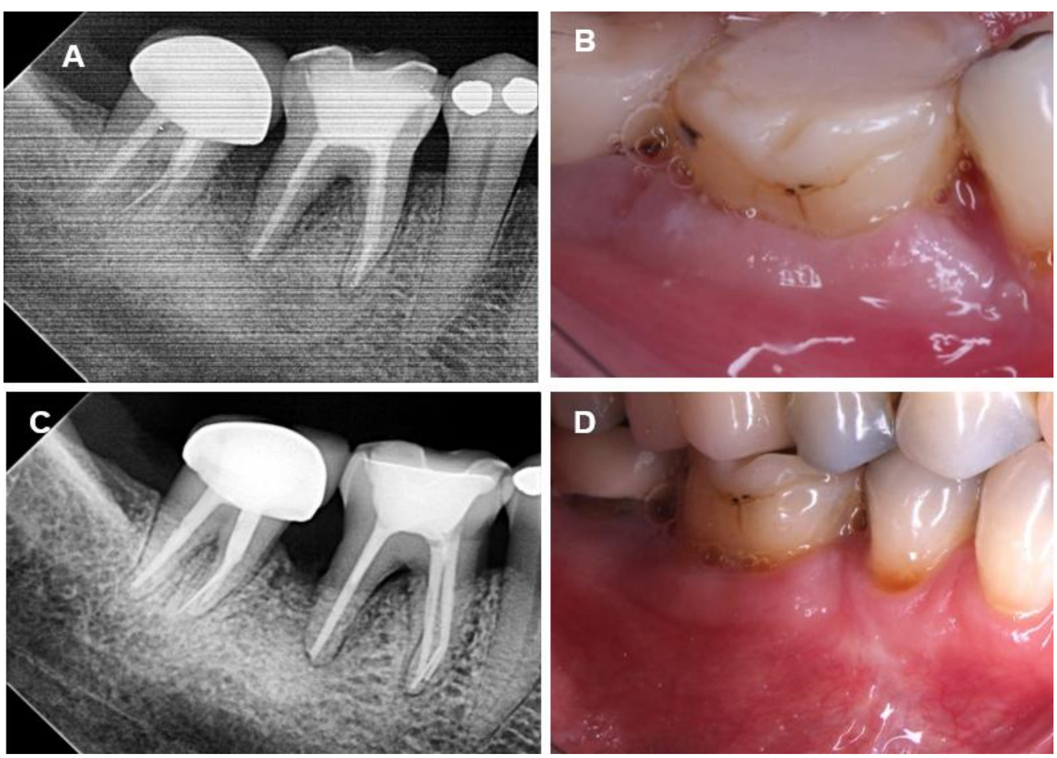

Figure 5: Clinical and radiographic follow-up. A) Immediate radiograph after GTR; B) Clinical photograph 15 days postoperatively; C) Radiographic follow-up 1 year after surgery; D) Photographic follow-up 1 year after the surgical procedure.

Discussion

Intraosseous defects associated with dental morbidity present a high degree of clinical complexity. When these defects are not treated promptly, particularly in cases of advanced bone loss, they tend to evolve unfavorably, often resulting in the loss of the affected tooth. In recent decades, various reconstructive procedures have been developed and implemented with the goal of regenerating or restoring periodontal attachment in deep intraosseous defects [16]. Among these techniques, Guided Tissue Regeneration (GTR) has proven to be one of the most effective, offering superior clinical outcomes compared to open flap debridement alone [17]. The success of GTR is influenced by multiple factors, including the morphology of the defect, the surgical technique employed and patient-specific characteristics. Caton and Zander demonstrated that after conventional periodontal therapy such as root planing and soft tissue curettage a long junctional epithelium typically forms, leaving the root surface exposed without true tissue regeneration [18]. The principle of GTR lies in preventing epithelial cell migration into the bone defect, thereby allowing the space to be repopulated by cells from the periodontal ligament capable of forming new bone, periodontal ligament and root cementum. This is achieved by using a barrier membrane that acts as a selective guide for cellular repopulation [19]. The resorption time of the membrane is a critical factor. Premature resorption—before adequate formation of immature bone or "woven bone" can compromise the dimensional stability of the defect, facilitate graft material dispersion and negatively affect healing [20]. In this context, xenogenic bone substitutes, particularly those derived from porcine bone tissue, have shown to be effective biomaterials for bone regeneration. These materials exhibit osteoconductive properties and excellent biocompatibility, without causing adverse reactions [21]. Currently, Cone-Beam Computed Tomography (CBCT) has become an essential tool in modern dentistry due to its ability to provide high-resolution, three-dimensional imaging with relatively low radiation exposure. Its use allows for precise assessment of complex anatomical structures, which is critical for accurate diagnosis, treatment planning and execution. The detailed information provided by CBCT enhances clinical decision-making, reduces risks and contributes to more predictable and safer outcomes for the patient. Ultimately, the success of regenerative procedures does not rely solely on the materials used or the surgical technique [22]. Active patient participation, adherence to periodontal maintenance therapy and the adoption of healthy habits are key factors in ensuring the long-term stability of grafts and successful integration of biomaterials [23].

Conclusion

Guided Tissue Regeneration (GTR) yields better results when planned with Cone-Beam Computed Tomography (CBCT), as it enables precise three-dimensional assessment of the bone defect and allows for more predictable surgical planning. Despite the lack of access to high-end biomaterials, clinically satisfactory outcomes can be achieved through appropriate selection of cost-effective materials and evidence-based surgical approaches. In this case, an endo-periodontal lesion commonly associated with poor prognosis and often leading to extraction was successfully managed. A conservative approach, guided by CBCT diagnosis and individualized treatment planning, enabled tooth preservation. This case demonstrates that well-founded clinical decisions can overcome economic limitations and provide viable alternatives for dental preservation.

Conflict of Interest

The authors declare that they have no conflicts of interest with the contents of the article.

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Author Contributions

All authors contributed equally for this paper.

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