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A Novel Protocol For Bone Healing In Periapical Defects Using Prf With Antibiotic-Infused Collagen: A Case Report

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ABSTRACT

Periapical pathology resulting from pulpal necrosis can lead to extensive bone destruction, particularly in cases involving through-and-through defects affecting both buccal and lingual cortical plates. This case report presents a novel approach combining advanced platelet-rich fibrin (A-PRF) and an antibiotic-loaded collagen graft (Enzomac CM) for the surgical management of a large periapical lesion. A 22-year-old female patient with a history of dental trauma presented with a non-vital maxillary lateral incisor and a radiographically diagnosed periapical cyst extending across multiple teeth. A combined endodontic and surgical approach was adopted, including root canal treatment, lesion enucleation, apicectomy, and graft placement. The graft material, composed of PRF and Enzomac CM granules containing collagen, mupirocin, and metronidazole, was used to fill the bony cavity. Postoperative CBCT evaluations at six months and one year revealed significant reduction in lesion size and satisfactory bone regeneration. This case highlights the therapeutic potential of combining PRF with a medicated collagen scaffold to enhance periapical healing, especially in complex defects where soft tissue ingrowth can impede osteogenesis.

KEYWORDS: Preoperative Clinical and Radiographic Examination, Diagnosis and Treatment Planning.

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INTRODUCTION

Periapical pathology arises from pulpal necrosis and induces inflammation in surrounding tissues, which may be either symptomatic or asymptomatic. [1] It often leads to bone loss and persistent lesions causing extensive through-and-through defects involving both buccal and lingual cortical plate erosion. [1 2]

Management involves eliminating infection and inflammation through endodontic or surgical interventions. [3] Endodontic surgery promotes predictable periapical healing, but through-and-through defects may impair outcomes due to soft tissue ingrowth obstructing bone regeneration. [4]

Emerging literature supports the use of membranes in such defects to block connective tissue ingrowth and promote repopulation by osteogenic cells.[5] Taschieri et al. showed that combining PRGF with organic bovine bone markedly enhances bone regeneration. [6] Similarly, Guo-Hao Lin et al. found that GTR membranes effectively supported the healing of large periapical lesions over two years. [7]

PRF, a second-generation platelet concentrate, enhances healing, regeneration, and immune regulation. [8] Collagen supports early bone formation by guiding mineralization and cell growth. [9]

This case report evaluates a novel PRF and antibiotic-loaded collagen graft combination for treating large periapical lesions —a technique with limited prior documentation.

CASE REPORT

A 22-year-old female patient presented to the Department of Conservative Dentistry and Endodontics with the chief complaint

of discoloration in the upper left lateral incisor. She reported a history of blunt chin trauma 10–11 years ago, managed conservatively with analgesics.

Preoperative Clinical and Radiographic Examination

Extra oral examination was unremarkable, with no swelling or lymphadenopathy. Intraorally, tooth 22 showed discoloration (Figure 1). Teeth 21 and 22 were nonresponsive to pulp vitality tests and exhibited no mobility. Radiographically, a well-defined periapical radiolucency was observed involving teeth 21, 22, and extending to the mesial root of 23, suggestive of a periapical cyst (Figure 2). Cone-beam computed tomography (CBCT) using CS 9300 3D (Carestream Dental LLC) revealed a lesion measuring 9.9 x 9.2 x 8.8 mm across coronal, axial, and sagittal views (Figure 3).

Figure 1 – preoperative radiograph Figure 2 – preoperative clinical image

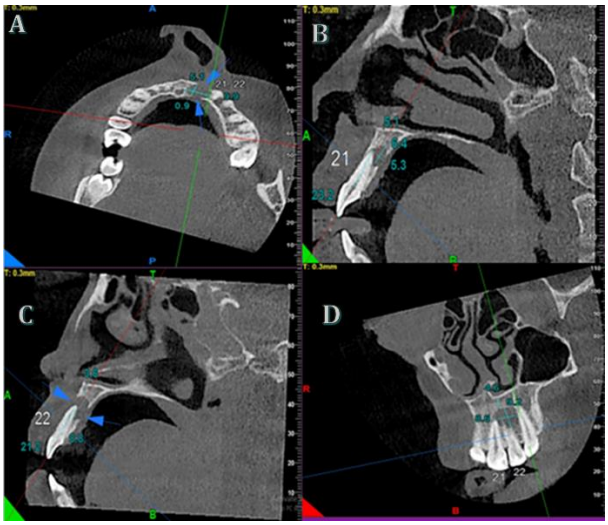

Figure 3 – preoperative cbct

Diagnosis and Treatment Planning

A provisional diagnosis of a large periapical lesion was made. A combined nonsurgical and surgical approach was planned, and informed consent was obtained.

Nonsurgical Root Canal Therapy

Teeth 21, 22, and 23 were anesthetized, isolated under a rubber dam, and accessed. Working lengths were established using 15 no hand K-files (Mani Inc., Japan) (Figure 4), and biomechanical preparation was carried out using ProTaper Gold rotary files (DENTSPLY SIRONA, USA) up to F5 with 17% EDTA (RC HELP, PRIME Dental, India). Irrigation was carried out simultaneously with each file with 5.25% Sodium hypochlorite (PARCAN, Septodent, UK). The canals were medicated with calcium hydroxide (RC CAL, PRIME Dental, India) and temporarily restored. After two weeks, irrigation was performed with saline, NaOCl, and 17% EDTA. Passive ultrasonic irrigation was used to activate irrigants, and the calcium hydroxide dressing was repeated. On the next recall, with dry canals, obturation was completed using gutta-percha and Bio-C sealer (Bio C sealer, Angelus, Londrina PR, Brazil) by lateral condensation (Figure 5), followed by composite restoration.

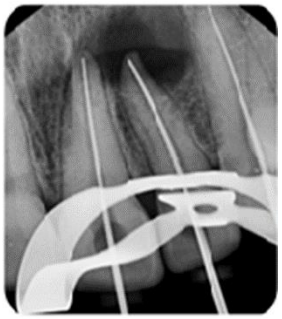

Figure 4 – working length

Figure 5 – obturation

Surgical Procedure

Two days later, surgical enucleation and apicectomy were performed on teeth 21 and 22. After antiseptic preparation with 0.2% chlorhexidine, a papilla base flap with intrasulcular and vertical releasing incisions (teeth 11 to 23) was raised (Figures 6 and 7). Osteotomy and curettage exposed a soft granulomatous lesion, which was thoroughly debrided (figure 8). Haemostasis was achieved using epinephrine-soaked cotton pellets. Apical resection and retrograde filling with MTA (Angelus, Brazil) were carried out using ultrasonic tips (Satelec Corp) (figure 9). The surgical site was irrigated. The graft material was prepared by mixing Enzomac CM particles and A- prf (figure 10). For preparation of A – prf 10 ml of blood was drawn from the patient's cubital vein with the consent of the patient and was centrifuged at 1500 rpm for 14 minutes. The graft material was placed in the bony cavity (figure 11). The flap was then repositioned and sutured using 3-0 mercyl suture by interrupted sling suture technique (Figure 12). Sutures were removed after five days, and the patient was followed up after a year (Figures 13, 14, 15)

Figure 6 – incision of the gingiva

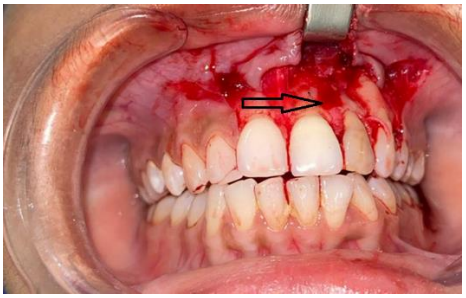

Figure 7 – reflection of the flap

Figure 8 – osteotomy

Figure 9– apicectomy and root end filling

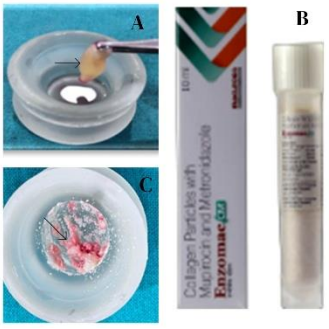

Figure 10 – graft material Enzomac CM and A- PRF

Figure 11: Graft places in the bony cavity.

Figure 12: Suturing of the flaps

Figure 12: Suturing of the flaps

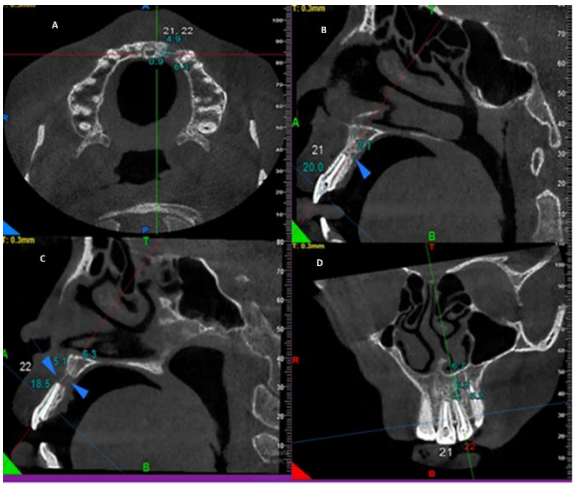

Figure 14: 6 months' follow-up of cbct

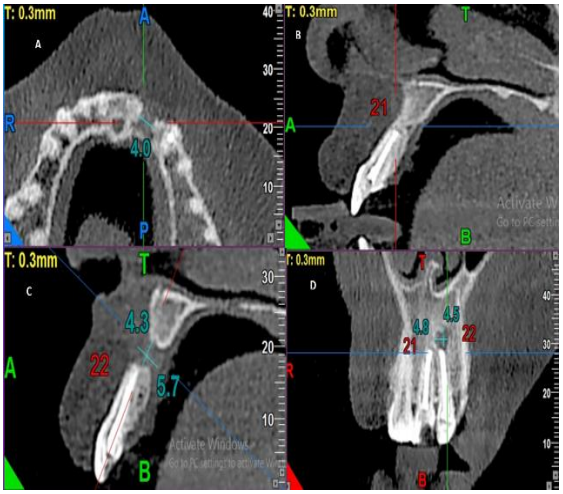

Figure 15: 1-year follow-up of cbct

DISCUSSION

The key objective of periapical surgery is to facilitate regeneration of periapical tissues and ensure bone healing. A major challenge, especially in through-and-through lesions, is the infiltration of connective tissue into the surgical site, which impedes osteoblast migration and bone formation. [10] to counteract this, graft materials—such as membranes and bone substitutes—are employed to support osteogenesis and exclude fibrous tissue.

Thanikasala et al. compared PRF alone and in combination with nanocrystalline hydroxyapatite (NcHA) and collagen. Their study showed that the combination group exhibited 100% healing at six months, compared to 92% with PRF alone and 86% in controls. [11] This indicates that adjunctive collagen enhances bone healing outcomes.

In the present case, a novel medicated collagen graft (Enzomac CM) was used alongside PRF to treat a through-and-through periapical defect. CBCT at six months and one year postoperatively revealed progressive reduction in lesion size and satisfactory bone regeneration (Figure 14 - 19).

Enzomac CM granules are composed of 90% collagen peptide, 2% mupirocin, and 1% metronidazole. This combination likely played a critical role in the healing process through both antimicrobial and regenerative mechanisms. Collagen acts as a highly biocompatible and osteoconductive scaffold, supporting cell attachment, migration, and differentiation. It also encourages fibroblast-mediated signalling, such as the release of FGF2, which promotes osteoblast proliferation. [12]

Metronidazole, apart from its antimicrobial effects, has demonstrated anti-inflammatory and immunomodulatory properties. It reduces cytokine production and free radical formation while suppressing macrophage activity and lymphocyte proliferation. [13] These effects likely contributed to the favourable healing response observed in this case.

Mihir R. Kulkarni et al.in a case series reports successful bone healing in periapical defects using PRF as the sole grafting material. PRF promoted excellent bone fill, likely due to its clot-stabilizing properties and the release of growth factors from platelets and leukocytes.[14]

Advanced PRF (a-PRF), prepared at 1500 RPM for 14 minutes, provides higher concentrations of platelets and leukocytes, promoting a sustained release of growth factors and enhancing tissue healing. The combined use of Enzomac CM and a-PRF thus presents a promising regenerative strategy for periapical lesions.

Arpitha M et al. reported that combining injectable PRF (i-PRF) with Type I collagen was similarly effective in healing through-and-through defects over a 12-month period, further supporting the utility of this combination. [15]

Amenah et al. in a clinical trial found that while collagen-based bone-filling material did not significantly improve overall periapical healing after endodontic microsurgery in four-wall defects, it showed a trend toward better buccal cortical plate re-establishment, indicating possible clinical benefits.[16]

Therefore, the synergistic use of this graft combination demonstrated a notable enhancement in the healing process of the periapical lesion, indicating its therapeutic efficacy in promoting faster and more predictable tissue regeneration.

CONCLUSION

The synergistic use of PRF with medicated collagen containing metronidazole and mupirocin offers a compelling grafting strategy for the regeneration of periapical defects. This novel approach shows promise in enhancing healing outcomes, particularly in challenging cases involving through-and-through lesions.

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