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Revitalizing Endo-Perio Lesions: Harnessing the Power of Concentrated Growth Factor

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ABSTRACT:
Endodontic-periodontal lesions (EPLs) pose a significant clinical challenge due to their complex interplay between pulp and periodontal tissues. These lesions arise from various etiological factors, including caries, trauma, and restorative procedures, triggering distinct pathogenic processes. Platelet-rich plasma (PRP) and platelet-rich fibrin (PRF) have shown promise in treating EPLs, albeit with drawbacks such as the need for anticoagulants and a time-consuming preparation process. Concentrated growth factor (CGF), a newer second-generation platelet concentrate, offers a natural and efficient alternative. This manuscript presents a case report of a 21-year-old female patient with an endo-perio lesion on tooth 11, managed using CGF in conjunction with demineralized freeze-dried bone allograft (DFDBA) and open flap debridement. The patient's treatment journey, from diagnosis to surgical procedure and post-operative care, is meticulously described. The preparation of CGF and its application in the regenerative procedure are outlined, highlighting its superior biological properties and potential for tissue regeneration. The manuscript underscores the efficacy of regenerative approaches in addressing EPLs and emphasizes the promising role of CGF in achieving successful clinical outcomes. Furthermore, the long-term success rates of regenerated teeth reported in existing studies provide substantial support for the durability and efficacy of regenerative therapies in periodontal treatment. In conclusion, using CGF alongside DFDBA and open flap debridement represents a sophisticated and evidence-based approach to addressing intrabony defects in periodontitis patients, offering hope for lasting periodontal health and regeneration.

1. Introduction

Endodontic-periodontal lesions (EPLs) present a longstanding challenge in clinical dentistry due to their intricate nature. These lesions involve a complex interplay between the pulp and periodontal tissues, with various physiological communication pathways facilitating their interaction, including exposed dentinal tubules, lateral and accessory canals, and the apical foramen. Since effective treatment hinges on a precise diagnosis, it is imperative to pinpoint the primary cause before initiating therapy [1,2]. Endodontic and Periodontic lesions can arise from diverse causes such as caries, trauma, restorative procedures, chemical irritation, or intense thermal stimulation, each triggering a unique pathogenic process. Typically, an inflammatory response within the pulp initiates the cascade, leading to localized oedema and increased intrapulpal pressure, ultimately resulting in cellular demise. The heightened pressure can then drive toxic agents through different anatomical pathways, such as the apical foramen, lateral canals, or dentinal tubules, culminating in retrograde periodontitis [3].

Platelet-rich plasma (PRP) and plasma rich in growth factors (PRGF), classified as the first generation of autologous platelet concentrates (APCs), have shown promise in treating extensive periapical lesions, apicomarginal defects, combined endo-perio lesions. However, they have drawbacks such as the need for

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anticoagulants, artificial polymerization, and a time-consuming two-step centrifugation process [4].

Platelet-rich fibrin (PRF), considered the second-generation platelet concentrate and categorized into L-PRF, A-PRF, i-PRF, CGF, PRFM, and Vivostat PRF, offers an alternative.

Concentrated growth factor (CGF), a newer second-generation platelet concentrate, is prepared by centrifuging blood samples at alternating and controlled speeds using a specialized centrifuge. This process results in a denser fibrin matrix with higher growth factor concentrations than PRF and PRP. The production process of CGF mirrors that of platelet-rich fibrin and is entirely natural, devoid of any biochemical additives. Consequently, CGF circumvents issues related to immunoreactions, toxicity, cross-contamination, and ethical concerns commonly associated with other methods. Furthermore, CGF is rich in various growth factors and cytokines, including transforming growth factor (TGF), insulin-like growth factor (IGF), platelet-derived growth factor (PDGF), and VEGF. CGF is created through a centrifugation process involving alternating and controlled speeds using a specialized centrifuge. This technique, known as differential centrifugation, forms a denser fibrin matrix with higher concentrations of growth factors than what is typically observed in PRF and PRP [5-8]. The CARE checklist was followed to describe the case reports[9].

An accurate diagnosis is crucial for successful treatment outcomes in periodontal and dental pulp issues. This necessitates thorough history-taking, detailed intra-oral and extra-oral examinations, and the judicious application of specific diagnostic tests tailored to the individual case. This case report underscores the promising potential of CGF in conjunction with DFDBA as an adjunctive therapy for endo-perio lesions, offering favourable outcomes in terms of tissue regeneration and functional rehabilitation.

Case Report

This case report elucidates the nuanced management of a 21-year-old female patient presenting with a chief complaint of mobility in the upper right anterior region, specifically tooth 11, persisting over three years. The patient's dental history revealed a significant traumatic incident three years prior involving the upper front teeth, necessitating root canal treatment three years ago at a private clinic. Upon referral to the Department of Periodontics and Implantology, meticulous clinical assessment and radiographic evaluation unveiled the presence of an intricate endo-perio lesion associated with tooth 11. A provisional diagnosis of localized periodontitis at stage 3, grade C, affecting tooth 11 was established. The proposed treatment strategy entailed performing a localized periodontal flap procedure and applying demineralized freeze-dried bone allograft (DFDBA) and concentrated growth factor (CGF) to address the intrabony defects. Comprehensive discussions regarding the potential risks and benefits associated with the planned procedure were conducted with the patient. Subsequently, informed consent was meticulously obtained in writing, ensuring the patient's thorough understanding and agreement with the proposed treatment approach.

Preparation of CGF

Concentrated growth factors (CGFs) were meticulously generated through a standardized protocol. Initially, 10 ml of blood was carefully drawn into sterile Vacuette tubes devoid of anticoagulant agents. Subsequently, the blood specimen underwent precise centrifugation using a sophisticated centrifuge apparatus (Medifuge, Silfradent srl, Sofia, Italy). The centrifugation process consisted of a series of precisely timed accelerations and decelerations: 30 seconds of acceleration, followed by 2 minutes at 2700 revolutions per minute (rpm), 4 minutes at 2400 rpm, 4 minutes at 2700 rpm, and finally, 3 minutes at 3000 rpm, concluding with a 36-second deceleration until complete cessation of motion.

Upon completion of centrifugation, the blood underwent separation into three distinct phases: the superior phase comprising platelet-poor plasma (PPP), the intermediary phase characterized by a dense fibrin block encapsulating CGFs, white blood cells, and stem cells, and the lower phase comprising a layer of red blood cells (RBCs). The fibrin block, containing the vital CGFs, was meticulously isolated from the red blood cell layer and meticulously pressed into a membrane utilizing sterile glass slides.

Surgical Procedure

Buccal and lingual sulcular incisions were meticulously executed after the administration of local anaesthesia utilizing Xylocaine 2% Adrenaline 1:80,000 (ICPA, India). Following adequate anesthetization, full-thickness mucoperiosteal flaps were precisely elevated, facilitating thorough debridement of the osseous defects. The surgical sites were then meticulously irrigated, ensuring optimal cleanliness, and subsequently dried in preparation for demineralized freeze-dried bone allograft (DFDBA) placement.

The DFDBA grafts were meticulously positioned within the defects, ensuring precise placement and coverage of the affected areas. Subsequently, the concentrated growth factors (CGFs) membrane was expertly trimmed and skillfully adapted to envelop the bone graft, the osseous defect and approximately 2–3 mm of the adjacent alveolar bone.

Finally, a periodontal pack was thoughtfully applied over the surgical area to provide support and protection during

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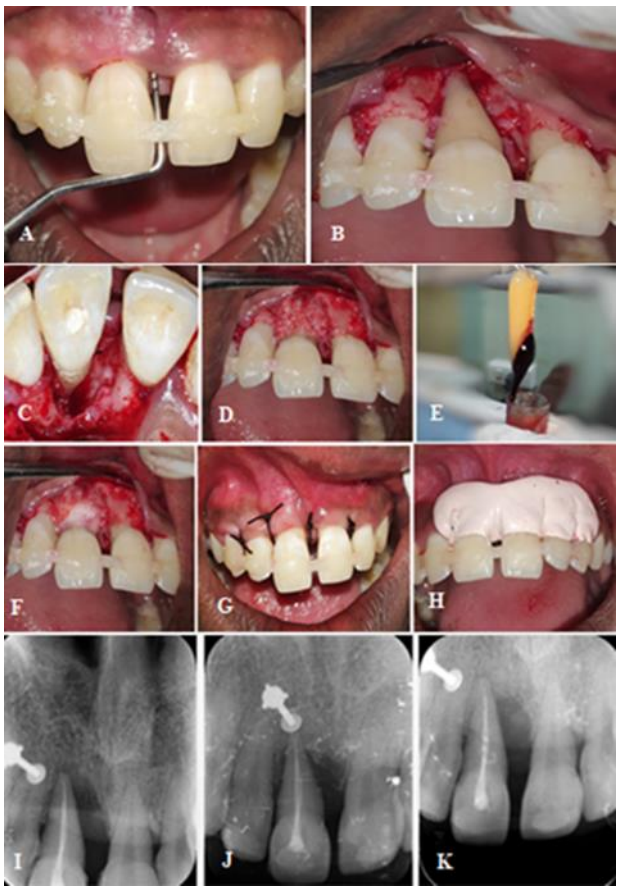
the initial healing phase, with instructions for its removal after ten days. This meticulous surgical approach aimed to optimize the outcomes of the regenerative procedure while ensuring patient comfort and promoting optimal healing. The patient was instructed to take 500 mg of Augmentin twice daily for one week and 200 mg of ibuprofen twice daily for five days. Additionally, they were advised to use chlorhexidine 0.2% oral rinse twice daily for one month



A. Baseline image of the first right maxillary incisor B, C. Intra-operative findings (Buccally and Palatally). D. Demineralized freeze-dried bone allograft (DFDBA) was placed into the defect. E. Three blood fractions were extracted via a centrifuge process: (1) an upper phase consisting of serum; (2) an intermediate phase composed of a dense polymerized fibrin block containing CGFs, white blood cells, and stem cells; and (3) the lower layer containing red blood cells. F. Concentrated Growth factor membrane was placed. G. Sutures placed. H. Periodontal Pack was placed. I. Pre-operative radiograph at baseline. J. Post-Operative Radiograph at one month K. Post-Operative Radiograph at one year.

2. Discussion

The present case report primarily focused on achieving regeneration facilitated using a novel autologous platelet concentrate known as concentrated growth factors (CGF). CGF has been shown to enhance the outcomes of regenerative treatments for periodontal intrabony defects. Its effectiveness in this regard likely stems from its biological components, including chemotactic and mitogenic platelet-derived growth factors (PDGF), which play crucial roles in tissue regeneration[10].

Unlike constant centrifugation methods, CGF is derived from autologous venous blood through centrifugation at variable speeds ranging from 2,400 to 3,000 rpm. This technique involves varying time intervals and centrifugation speeds, resulting in a more concentrated, thicker, and elongated fibrin matrix than other platelet concentrates[11]. Studies have demonstrated that CGF exhibits superior tensile strength and stimulates the growth of osteoblasts and gingival fibroblasts compared to second-generation platelet-rich fibrin (PRF)[12].

Several regenerative strategies exist, encompassing guided tissue regeneration (GTR), enamel matrix derivatives (EMD), bone substitutes, growth factors, and combinations thereof. In deep intrabony defects, regenerative therapies have shown significant clinical benefits compared to open flap debridement alone. Specifically, these therapies have resulted in a notable gain in clinical attachment level, averaging 1.34 mm[13]. This underscores the efficacy of regenerative approaches in promoting tissue repair and improving periodontal health outcomes. Additionally, incorporating CGF has demonstrated enhanced bone mineral density and trabecular architecture recovery compared to treatments without CGF[14].

A meta-analysis assessed the effectiveness of using CGF in conjunction with grafting materials compared to using grafting materials alone for treating periodontal intrabony defects, drawing from various published randomized controlled trials (RCTs). The findings indicate that the combined approach yielded superior results in terms of improvements in probing depth (PD), clinical attachment level (CAL), and bone fill (BF). This study offers valuable insights for clinicians in selecting optimal treatment strategies to achieve desired clinical outcomes in periodontal therapy[12].

Cortellini et al. (2004) found that the survival rate of regenerated teeth exceeded 96% even up to 16 years post-procedure[15]. This finding is supported by a recent longitudinal study conducted by Cieplik et al. (2020), which evaluated patients throughout 21 to 26 years following guided tissue regeneration (GTR) therapy. Their study considered multiple factors related to individual patients and specific sites, further confirming

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the durability and efficacy of regenerative approaches in periodontal treatment[16].

In conclusion, using concentrated growth factors (CGF), demineralized freeze-dried bone allograft (DFDBA), and open flap debridement represents a sophisticated and evidence-based approach to addressing intrabony defects in periodontitis patients. The unique biological properties of CGF and its demonstrated efficacy in promoting tissue regeneration offer considerable promise for enhancing clinical outcomes. This comprehensive treatment strategy stands as a beacon of hope in pursuing lasting periodontal health and regeneration.

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