Case Report

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Dentistry Section

A Case Report of Periodontal Regeneration in Failing Tooth by Single Flap Approach using Sticky Bone and Platelet-rich Fibrin Membrane

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ABSTRACT

Periodontal regeneration aims to regenerate the diseased or lost periodontium. Regenerative periodontal therapy utilises growth factors, autogenous soft and hard tissue grafts for the purpose of regeneration. Platelet-rich Fibrin (PRF) is an autologous biomaterial which works on the principle of centrifugation. The injectable PRF (i-PRF) that is formed when centrifuged at low Revolutions Per Minute (RPM) produces an excellent matrix when mixed with bone graft called "sticky bone". Sticky bone possesses the property of mouldability along with its inherent potential of bone formation. The PRF matrix also enhances the wound healing through the release of various growth factors. PRF membranes which are obtained at higher centrifugation levels also act as a substitute to augment the soft-tissues. The present case is that of a 45-year-old male, who underwent a one-year follow-up for the management of endodontic periodontal lesion in the lower left first molar with sticky bone and PRF membrane by single flap approach. The patient was periodically reviewed clinically and radiographically and prosthetic restoration was given on accessing the radiographic bone fill after six months. After six months there was a significant difference in the radiographic bone fill, along with the reduction in the probing pocket depth from 7 mm to 4 mm and clinical attachment from 9 mm to 7 mm. The results indicate that sticky bone and PRF membrane serves as a predictable source for the management of intrabony defects.

Keywords: Bone regeneration, Centrifugation, Endodontic periodontal lesion, Growth factors, Periodontium, Prognosis

CASE REPORT

A 45-year-old male reported to the Department of Periodontics and Implantology with a chief complaint of sharp, pricking pain and food lodgement in his left lower back tooth region for the past two weeks.

On elaborating the history of presenting illness the pain was reported to be sharp in nature, moderate in intensity and intermittent in duration. The pain was aggravated on chewing and was relieved after sometime on its own. Also, the patient noticed food lodgement between his lower back tooth and he used toothpicks to clean it.

The patient was systemically healthy. On clinical examination, the patient had a restoration in relation to his left lower back tooth region (36), which was tender on percussion [Table/Fig-1].

The Periodontal Pocket Depth (PPD) was about 7 mm mesial and distal to 36 and 4 mm mid bucally. The tooth exhibited Grade-I mobility according to Miller's Mobility classification [1] with a Grade-III furcation involvement according to Glickman's classification [2].

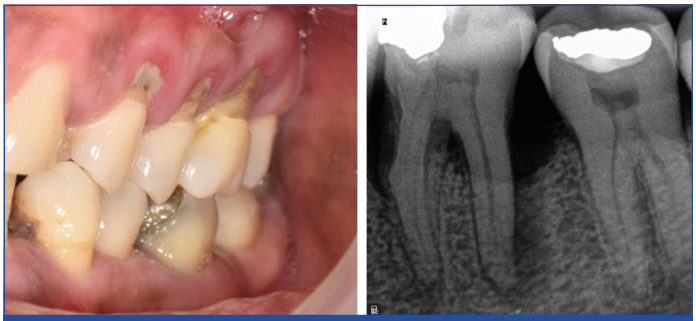
When tested for pulpal vitality using endo ice, the tooth showed no response in comparison to the contralateral tooth, which provides a provisional diagnosis of irreversible pulpitis in relation to 36.

On radiographic examination, the tooth (36) revealed a radio-opacity involving the enamel and dentin occlusally, which is suggestive of restoration, below which a radiolucency was extending involving the mesial and distal pulpal horns. The radiograph also revealed a radiolucency surrounding the middle third of mesial root and till the apex of distal root with vertical bone loss, furcal bone loss and widening of lamina dura [Table/ Fig-2].

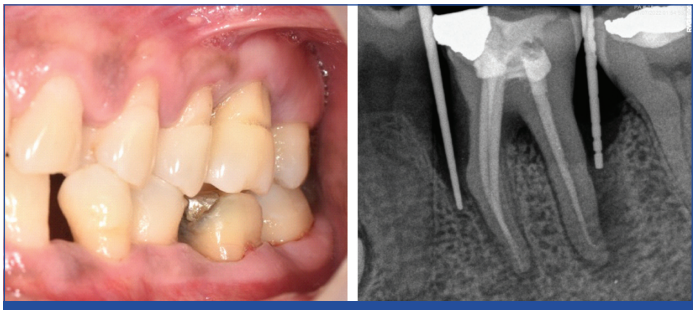
This gives a final diagnosis of primary endodontic with secondary periodontal involvement according to Simon's classification [3].

Routine haematological investigations of bleeding time, clotting time, complete blood count, random blood sugar level were found to be normal. With patient's informed consent, Phase I therapy of oral prophylaxis with scaling and root planing was done #36 was relieved from occlusion to avoid any undue occlusal forces [Table/Fig-3].

The patient was referred to the Department of Endodontics and tooth number #36 was endodontically treated [Table/Fig-4].



[Table/Fig-1]: Preoperative image showing restoration mesio-occlusally in relation to mandibular left first molar.
[Table/Fig-2]: Preoperative radiograph showing radiolucency surrounding the mesial and distal roots with evident bone loss. (Images from left to right)



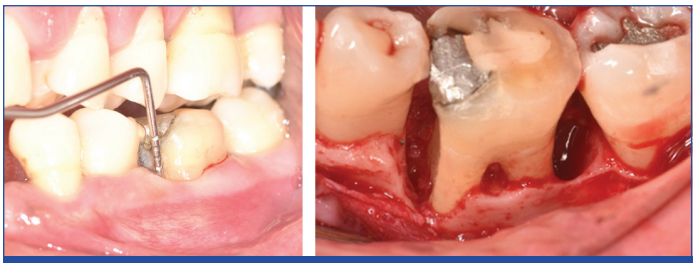
[Table/Fig-3]: After root planing and root canal treatment with occlusal reduction.
[Table/Fig-4]: Radiograph of post-endodontic treatment. (Images from left to right)

Root canals were obturated using 4% gutta-percha and post-endodontically core build-up was done using type-II Glass Ionomer Cement (GIC) leaving the mesially filled amalgam intact as it was found to be intact.

After two months on re-evaluation of periodontal status with remaining pocket depths of 6 mm, clinical attachment, Grade-III furcation

and angular bone loss, the patient was subjected to periodontal regenerative surgery [Table/Fig-5].

Under local anaesthesia (2% Lignox), using a single flap approach, a full thickness mucoperiosteal flap with intra-sulcular and interdental incisions was reflected on the buccal side involving adjacent teeth on either side [Table/Fig-6].

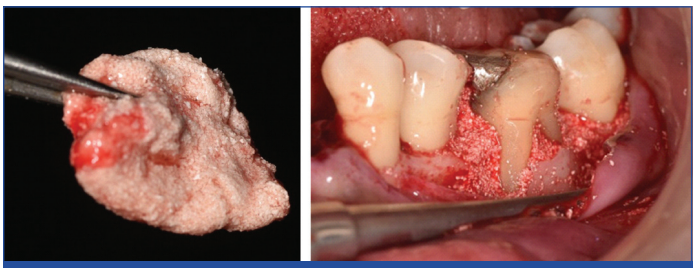


[Table/Fig-5]: Re-evaluation of periodontal status two months after endodontic treatment. **[Table/Fig-6]:** Phase II therapy. Single flap approach on buccal side showing intrabony defect in relation to 36. (Images from left to right)

The defect site was debrided using area specific Gracey curettes #9-10, #11-12, #13-14 and the granulation tissues were removed. Saline irrigation was done and root bio-modification was done using 24% Ethylenediaminetetraacetic Acid (EDTA).

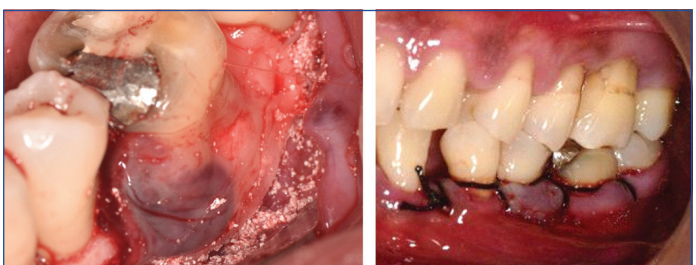
Under aseptic condition, 10 mL of blood was drawn from the patient's antecubital fossa and they were separated in two vacutainers containing 5 mL of blood each. According to Miron's protocol, centrifugation was done at 700 Revolutions Per Minute (RPM) for three minutes to obtain Injectable-Platelet-rich Fibrin (i-PRF) [4] and according to Choukroun's protocol centrifugation was done at 3000 RPM for 10 minutes to obtain PRF membrane [5]. After centrifugation, PRF was separated from the fibrin clot that was formed on top portion and it was compressed and allowed to rest to form into PRF membrane. The i-PRF was collected and mixed with an alloplast bone graft material (B-OstIN- 60% hydroxyapatite and 40% β tricalcium phosphate) for the formation of sticky bone matrix [Table/Fig-7].

The defect site was condensed with the formed sticky bone matrix gradually, from the apical to the coronal portion of the defect [Table/Fig-8].



[Table/Fig-7]: Sticky bone matrix using β-OstIN β tricalcium phosphate and i-PRF. **[Table/Fig-8]:** Condensation of sticky bone matrix in the defect site. (Images from left to right)

The obtained PRF membrane was placed over the grafted site [Table/Fig-9]. Periosteum was RELIEVED beyond the mucogingival junction to reflect a partial thickness flap. Flaps were tension free which were coronally advanced and continuous sling sutures were placed using 3-0 silk [Table/Fig-10].



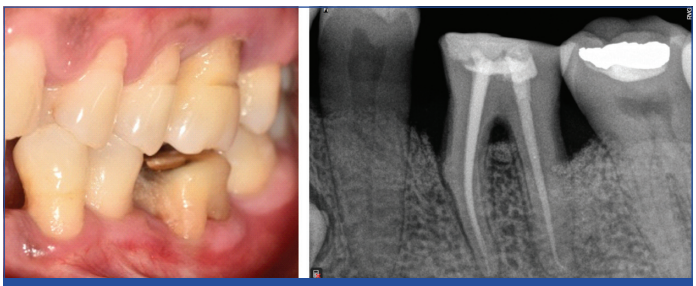
[Table/Fig-9]: Adaptation of PRF membrane on the grafted site. **[Table/Fig-10]:** Flap approximation using continuous sling sutures in 3-0 silk. (Images from left to right)

Coe-pak™ periodontal dressing was placed over the surgical site and the patient was put under analgesics and antibiotics twice a day for three consecutive days (Cap. Amox 500 mg, Tab. Metronidazole 400 mg, Tab. Zerodol SP).

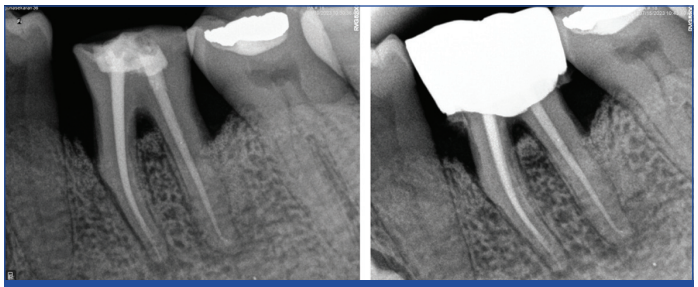
Postoperatively the patient was instructed to avoid brushing on the operated site; instead 0.02% chlorhexidine mouth rinse was prescribed. Also, the patient was advised to avoid eating hot and spicy food for three days and was asked to use external ice pack in case of swelling. Suture removal was done after two weeks.

On three months re-evaluation, gingival biotype was increased when compared to preoperative thickness with stable maintenance of the width of attached gingiva [Table/Fig-11].

Clinical and radiographic evaluation {Kodak RadioVisioGraphy (RVG) 6500 System} was done during baseline [Table/Fig-12], three months [Table/Fig-12] six months [Table/Fig-13] and 12 months [Table/Fig-14], where there was a significant bone fill, reduction in pocket depth and gain in Clinical Attachment Level (CAL) was evident [Table/Fig-15]. Mobility was reduced from Grade-I to no mobility after 12 months.



[Table/Fig-11]: Healing after three months with increase in gingival biotype and adequate width of attached gingiva. **[Table/Fig-12]:** Postoperative 3 months with bone fill. (Images from left to right)



[Table/Fig-13]: Postoperative 3 months with bone fill. **[Table/Fig-14]:** Postoperative 1 year with post-endodontic restoration. (Images from left to right)

Clinical parameter-measured in millimeters (mm)	Baseline	3 months	6 months	12 months
PPD	7 mm	4 mm	4 mm	4 mm
CAL	9 mm	7 mm	7 mm	7 mm

[Table/Fig-15]: Clinical parameters of PPD and CAL at baseline, 3 months, 6 months and 12 months.
CAL: Clinical attachment level; PPD: Periodontal pocket depth

DISCUSSION

Periodontally regenerative therapy for intrabony defects have traditionally been managed through Open Flap Debridement (OFD) with or without bone subsitutes like autograft, allograft, xenograft or an alloplast [6]. Literatures dated back to 19th century for the treatment of intra bony defect relies mainly on the patient's oral hygiene maintenance after OFD. But the prognosis of the defect is largely governed by the type of defect [7].

According to Brkovic BM et al., there was no discernible difference in the amount of new bone fill in defects treated with and without Guided Tissue Regeneration (GTR) membranes [8]. On the other hand, Lee JS et al., suggested that the application of bone grafts in conjunction with a collagen membrane resulted in greater new bone production [9]. The only disadvantage of membrane usage is that it adds a chance for infection in case of membrane exposure,

pliable membranes don't prevent micromovements of the graft particles whereas non resorbable membranes require surgical re-enty for their removal. In the present case, PRF has been used as a membrane which enhanced the regeneration potential through the release of various growth factors.

PRF is a autogenous, second generation platelet concentrate. It was first developed by Choukroun J et al., in France in 2001. It has been time tested for various soft-tissue regenerations because of its superior wound healing properties. In 2009 an in-vitro study by Su et al., demonstrated that PRF could release various growth factors including Platelet Derived Growth Factor-α (PDGF-α), Transforming Growth Factor-β1 (TGF-β1), Vascular Endothelial Growth Factor (VEGF), Epidermal Growth Factor (EGF), and Insulin like Growth Factor-1 (IGF-1) [10].

These growth factors ultimately help in regeneration upon healing. The major advantages of PRF is that it is a bioactive material that requires less technical expertise with little biochemical alteration, more affordable, incorporates more circulating cytokines into the fibrin meshes with greater structural integrity and has a slower polymerisation rate that accelerates healing [11]. i-PRF contains autologous thrombin that stimulates coagulation as well as gelatinisation. Thus, when bone grafts are mixed with i-PRF, it forms a sol-gel mass with a definite shape and moldability. This gives the ease of packing the sticky bone into the defect site without dispersion or spillage of graft particles.

In 2021, a systematic review and meta analysis by Miron RJ et al., stated that PRF with bone grafts for the treatment of periodontal intrabony defects resulted in a significant bone fill rather than OFD alone [12].

Another systematic review by Chen L et al., highted the use of PRF and bone grafts for the treatment of intrabony defects wherein the use of bone grafts and PRF have shown to reduce the defect depth, PPD and a gain in gingival marginal level [13].

Wang and Boyapatti postulated the Primary closure, Angiogenesis, Space, Stability (PASS) principle for the success criteria of Guided Bone Regeneration (GBR). This principle relies on factors like primary wound closure, angiogenesis, space maintenance and stability of the barrier membrane. The pore size of GBR membrane is important to prevent proliferation of fibroblasts into the defect site while at the same time allowing the penetration of blood vessels. Till date, there is no consensus regarding the pore size of PRF membrane for it to act as a barrier membrane. Also, the degradation time of PRF is less than six weeks, which affects the stability and space maintenace properties [14]. Therefore, PRF alone cannot act as a GBR membrane; rather it enhances the wound healing potential and the soft-tissue regeneration because of a constant surge of growth factors [15].

PRF holds a few practical constraints like a quicker usage time because of loss of structural integrity if dehydrated, requires a specialised centrifuge and definite centrifugation protocol with speed and time for its preparation and the quantity of the procured PRF is less for huge defects [16]. Though easily and cost-effectively obtainable at chair-side, these limitations are to be considered during the procurement of PRF which influences the outcome of the surgery.

CONCLUSION(S)

Biologics have a key role in the process of hard and soft-tissue regeneration. Platelet concentrates which deliver growth factors play a tremendous role in the direction of regeneration. The results of the present case report indicate that sticky bone and PRF membrane can serve as a predictable source for the management of intrabony defects.

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