

Platelet Rich Fibrin and β -Tricalcium Phosphate for the Treatment of Grade-II Furcation Defect – A Case Report

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Abstract

Platelet-rich fibrin (PRF) is a second generation platelet concentrate, utilized for surgical procedures. The easy method of collection allows the harvesting of a fibrin clot rich in growth factors making it safe and economical material for regenerative procedures. This case report presents the treatment of a grade II furcation defect with a combination of PRF and a newly-introduced bone graft consisting of multi-sized particles of β -tricalcium phosphate.

Key Words: - β -tricalcium phosphate, bone graft, furcation involvement, platelet rich fibrin, periodontal regeneration.

Introduction

Periodontal tissue is destroyed in the course of periodontitis by disproportionate immunologic responses to a triggering agent, such as bacteria in biofilm.¹ It has been reported that molars with furcation involvement have a higher rate of periodontal breakdown and respond less favorably to periodontal therapy than those without furcation involvement or single-rooted teeth.² The varied nature and pattern of periodontal destruction in furcation area creates situations in which routine periodontal procedures are somewhat limited in efficacy and advanced procedures are generally required. Various materials have been used to resolve furcation defects including autografts, demineralised freeze-dried bone allografts (DFDBAs), bovine-derived xenografts, barrier membranes, and combinations of membranes and bone grafts.³ The use of biomimetic agents, such as enamel matrix derivatives⁴ and platelet rich plasma (PRP),⁵ have been reported to further enhance the treatment outcomes in furcation defects.

Platelet-rich fibrin (PRF) is a second generation platelet concentrate widely used to accelerate soft and hard tissue healing, composed of a strictly autologous fibrin matrix containing a large quantity of platelet and leukocyte cytokines. Its advantages over first generation concentrate, platelet-rich plasma (PRP), include ease of preparation /application, minimal expense, and lack of biochemical modification (no bovine thrombin or anticoagulant is required).^{6,7}

Resorbable tissue replacement (RTRTM), is a biocompatible synthetic alloplast material composed of β -tricalcium phosphate crystalline (β -TCP) structure with particles sizes ranging from 0.5 to 1 mm. The varying particle sizes tend to form both macro- and micro-porosities in the material. This unique property is claimed to make RTRTM promote an in-depth colonization by osteogenic cells and release calcium and phosphate slowly into the surrounding environment thus promoting new bone formation.⁸

Based on their properties, it can be assumed that the application of PRF in combination with RTR in periodontal regenerative therapy can be beneficial. However, till date, no published data is available regarding the combination of these two materials. This case report presents an attempt to

treat a grade II furcation defect with combination of PRF and RTRTM.

Case Report

A 45 year old female was reported to the Department Of Periodontology, Teerthanker Mahaveer Dental College and Research Centre, with a chief complaint of severe sensitivity, bleeding and food lodgement in lower left back tooth since last 3 months. A thorough medical history was taken and no significant findings were observed. On clinical and radiographic examination advanced grade II buccal furcation involvement and gingival recession on buccal aspect in relation to lower left first molar was observed. On measurement, the furcation had a vertical attachment loss of 7 mm and horizontal attachment loss of 6 mm (figure 1).



Figure 1: - Measuring horizontal depth of the furcation defect with Nabers probe

Full-mouth scaling and root planning in the region of 36 were performed. Oral hygiene instructions were given, patient was prescribed twice daily oral rinsing with 0.2% chlorhexidine solution and recalled after one week. On the second visit, based on the observations and probable treatment outcome, surgical treatment of the furcation defect with elevation of coronally advanced flap and application of PRF with RTR granules was planned.

Preparation of Platelet Rich Fibrin

After application of tourniquet on the left upper arm of the patient, the median cubital vein was located and 5 ml of blood was drawn and inserted into sterile vacutainer tubes. The tubes were loaded into the centrifugation machine and

the blood was centrifuged for 15 min at 3000 rpm. Absence of anticoagulant allows majority of platelets contained in the sample to trigger a coagulation cascade after which it settles into the following layers: red lower fraction containing red blood cells, upper straw coloured cellular plasma and the middle fraction containing the fibrin clot. After draining the plasma layer, the middle PRF fraction was separated with tissue pliers and compressed between moist cotton gauze squares (figure 2).



Figure 2: - Harvesting the PRF membrane from the vacutainer tube after centrifugation

Surgical Procedure

After the patient was prepared, inferior alveolar and long buccal nerve blocks and supplementary local infiltration were administered using an anesthetic solution (2% xylocaine hydrochloride with adrenaline). Two vertical incisions, one at mesial line angle of the second molar and the other on the distal line angle of the second pre-molar, extending from the gingival margin and beyond the mucogingival junction (MGJ) were given and joined by a crevicular incision. A full-thickness flap was raised to expose the furcation area and continued as a partial thickness flap beyond the MGJ to enable the coronal repositioning of the flap. The furcation area was debrided thoroughly and any residual calculus deposits were removed.

RTR granules[#] was mixed with normal saline to form a thick paste and the furcation defect region was slightly overfilled with this paste. The PRF membrane was trimmed and placed over the bone graft such that it extended at least 2mm beyond the margins of the furcation defect. The flap was then coronally advanced taking care not to expose the membrane and ligated with a sling suture around the first molar. Vertical incisions were approximated with interrupted direct loop sutures. Patient was given post-operative instructions, prescribed amoxicillin with clavulanic acid, 500mg, TID for 10 days, advised to use 0.2 % chlorhexidine mouthwash twice daily and recalled after a week.

In the recall appointment, healing was observed to be uneventful. Mild apical migration of the flap margin was noted but without any exposure of the membrane. At the 1

month post-operative visit, complete root coverage could be observed with thick, healthy gingival tissue covering the defect (figure 3). Patient was recalled later to assess the bone fill in the furcation area but she failed to report for further visits.



Figure 3: - One-month post-operative view shows complete root coverage.

RTR, Septodont, USA

Discussion

In the present case, an attempt was made to achieve the twin objectives of root coverage and defect fill in the furcation area of the first molar. Complete root coverage with gain in clinical attachment could be observed clinically at the 1 month post-operative visit. However, the extent of bone fill could not be assessed as the patient failed to report further.

Several studies performed to evaluate the efficacy of PRF in treating periodontal defects have demonstrated favourable results. Joseph *et al*,⁹ Thorat *et al*¹⁰ and Sharma *et al*¹¹ reported higher gains in clinical attachment levels and radiographic bone fill in infrabony defects when utilizing PRF with open flap debridement. Bajaj *et al*¹² reported higher gains in vertical clinical attachment levels in mandibular grade II furcation defects treated with PRF and OFD.

In the present case PRF was combined with bone graft material composed of multi-sized particles of β -tricalcium phosphate. Combination of PRF with bone graft materials has been reported to enhance its regenerative potential. Pradeep *et al*¹³ observed that hydroxyapatite when added to PRF, increased its regenerative effects when treating three wall intrabony defects. Lekovic *et al*¹⁴ stated that combining bovine porous bone mineral (BPBM) with PRF resulted in significantly greater pocket depth reduction, attachment gain and bone fill in infrabony defects. Bansal *et al*¹⁵ demonstrated significantly higher pocket depth reduction and attachment gain in infrabony defects on combining PRF with decalcified freeze-dried bone allograft (DFDBA).

The concept of using PRF for regenerative procedures is based on the presence of multiple growth factors within the membrane. During the centrifugation process, slow polymerization in the collected blood results in

development of a homogenous, 3-dimensional organization of fibrin meshwork that entraps circulating cytokines such as Interleukins-1 β , -4, and -6, and growth factors such as bone morphogenetic proteins, transforming growth factor- β 1, platelet derived growth factor-AB etc. When placed in the periodontal defect, this meshwork acts as a bio-scaffold with an integrated reservoir of growth factors which are released over prolonged periods thus enhancing the regenerative potential of the surrounding tissues.^{16, 17}

Using PRF instead of PRP eliminates the need for adding anticoagulant as prior to centrifugation. Also, the risk associated with the biochemical handling of bovine derived thrombin is minimized.¹⁸ According to the manufacturer, RTR can form macropores (100-400 μ m) as well as micropores (<10 μ m) after it is implanted into the defect.⁸ These multisized porosities can enhance the in-depth colonization of osteogenic cells and promote new bone formation. Also, the release of multiple growth factors from the PRF membrane may further enhance the regenerative potential of the bone cells, resulting in significant bone fill and attachment gain.

Conclusion

PRF in combination with RTR granules was observed to be a successful approach for obtaining significant root coverage associated with grade II furcation defect in a mandibular first molar. Further studies investigating the efficacy of a combination of these two materials are recommended to gain further insight on their regenerative potential.

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