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Treatment of intrabony defects using titanium prepared platelet rich fibrin (T-PRF): A case report

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Abstract
T-PRF (Titanium prepared Platelet Rich Fibrin) is a third generation platelet concentrate developed to overcome the hazardous effect of silica in the glass vacutainers used for the preparation of (PRF) Platelet Rich Fibrin and it has also showed more polymerized fibrin formation with a longer resorption rate in the tissues. The purpose of this case report is to present clinical and radiographic outcomes of two intrabony periodontal defects treated with T-PRF. After surgical treatment with autologous T-PRF, six months follow up revealed a significant reduction in Probing Depth (PD) and Relative Attachment Level (RAL) gain as well as radiographic defect depth reduction and bone density increase, supporting the role of various growth factors present in the T-PRF in accelerating the soft and hard tissue healing. From the presented case, it can be concluded that T-PRF is clinically and radiographically efficacious in the treatment of a periodontal intrabony defect. Thus, suggesting its role as a sole regenerative material in the treatment of intrabony defects.
Conclusion: From the presented cases, it can be concluded that T-PRF is efficacious clinically and radiographically in the treatment of a periodontal intrabony defects. It is an autologous preparation and found to be clinically effective and economical than any other available regenerative materials including PRP. However, long term, multicenter randomized, controlled clinical trials will be required to know its clinical and radiographic effect over bone regeneration.

Keywords: intrabony defects, titanium-prepared platelet rich fibrin (T-PRF)

Introduction
Periodontal regeneration has become the primary therapeutic goal which aims at restoring lost supporting tissues. The most positive outcome of periodontal regenerative procedures in intrabony defects has been achieved with a combination of bone grafting and guided tissue regeneration. Recently, the use of biologic mediators has shown to have the potential to alter the host tissue so as to stimulate or enhance wound healing process by releasing an array of growth factors [1].
Platelet Rich Fibrin (PRF) is the second generation platelet concentrate, developed first by Choukroun *et al*. in 2001. It does not require any anticoagulant or gelling agent for its preparation, thus making the PRF protocol easier to collect a fibrin clot by polymerization process through centrifugation, yielding natural fibrin architecture responsible for slow release of growth factors for ≥ 7 days [2].
Even though, successful clinical results have been obtained with L-PRF, some physicians have reported the possible health hazard with silica particles in the glass tube; fraction of which remains suspended in the buffy coat, fibrin and platelet poor plasma layers [3]. Therfore, these particles might reach the patient when the product is used for treatment.
Recently, the use of titanium tubes in the preparation of PRF (T-PRF) showed more polymerized fibrin formation with a longer resorption rate in the tissues as titanium seems to be more effective in activating platelets than the silica activators in glass tubes, thus establishing that T-PRF provides a more firm fibrin [4].
Hereby, presenting a case report to evaluate the efficacy of T-PRF in the treatment of periodontal intrabony defects.

Case presentation

This present case report includes 2 patients who reported to the Department of Periodontics, with the complaint of food lodgement and pain in the gums. The pateints were systemically healthy and reported no history of dental trauma, no deleterious habits.

Case 1

A 32 year old male presented with the chief complaint of food lodgement and pain in the lower left mandibular molar region. On intraoral examination, there was bleeding on probing and the deepest probing pocket depth (PD) on the disto-buccal aspect of the tooth # 36 was 9mm and no mobility was detected.

Case 2

A 43 year old male reported with the complaint of food lodgement and bleeding of gums in the lower right mandibular molar region. On intraoral examination, there was bleeding on probing and the deepest probing pocket depth (PD) on the disto-buccal aspect of the tooth # 46 was 8 mm and no mobility was detected.

Radiographic assessment

In both the cases standardized digital intraoral periapical radiographs (IOPARs) were taken with the paralleling technique showed the presence of angular bone loss. In order to standardize the geometry, a modification of holders (RINN XCP™, Dentsply, Kodak) connected to an individual customized bite registration block was used. The radiographic defect depth was measured using AutoCad software (Autodesk 2015) [5] and bone density was assessed using computer graphic software Adobe Photoshop 7.0 [6] for teeth #36 and tooth # 46.

Keeping all the findings in mind, the periodontal therapy was planned. The pateints were informed about the therapy and informed consent was taken.

Initial therapy consisted of oral hygiene instructions followed by non-surgical periodontal therapy by means of scaling and root planing using hand and ultrasonic instruments.

Pateints were recalled after 4weeks and the persistence of pockets was seen, so the periodontal regenerative therapy was planned.

Before the therapy, the pateints' blood investigations were done, which revealed platelet count, haemoglobin level, bleeding time and clotting time within normal limits.

T-PRF preparation

Just prior to the surgery, intravenous blood was collected in a 10 ml sterile titanium test tube without anticoagulant by venipuncturing of antecubital vein. The tubes were immediately centrifuged at 3000 rpm for 10 minutes in a centrifuge machine (C-852, REMI, Mumbai, INDIA). Blood centrifugation immediately after collection allows the composition of a structured fibrin clot in the middle of the tube, just between the red corpuscles at the bottom and acellular plasma (Platelet Poor Plasma (PPP)) at the top. T-PRF clot thus formed was separated using sterile tweezers and scissors and transferred onto PRF box and a stable fibrin membrane was obtained by squeezing serum out of the T-PRF clot. A part of membrane was minced to be used as graft material and another part was trimmed as membrane to cover the defect.

Surgical procedure

Both the cases were performed with the same surgical protocol as follows

An intrasulcular incision was made on the buccal and lingual aspect of the teeth being treated. A full thickness flap was raised and the inner surface of the flap was curetted to remove the epithelium and granulation tissue. Root surfaces were thoroughly planed using hand instruments and ultrasonic scalers. The direct examination after debridement, confirmed the presence of combined defect with respect # 36 and three-walled defect with respect to #46.The minced T-PRF was filled into the intrabony defect and another part of it was adapted over the grafted defect. The flaps were repositioned to their presurgical levels and sutured with 3-0 non-absorbable silk sutures utilizing an interrupted technique followed by placement of periodontal pack.

After the operation, the patient was prescribed suitable antibiotics and analgesics(amoxicillin 500 mg, tid. for 5 days, Diclofenac sodium 100 mg. t.i.d for 2 days), and Chlorhexidine rinses (0.2%) were prescribed twice daily for 2 weeks.

Post- operative care

Periodontal dressing and sutures were removed 1 week postoperatively. Patients were advised to initiate mechanical plaque control consisting of brushing and flossing or interproximal brushing from the second postoperative week. The pateints were recalled at 1month, 3 and 6 months.

Clinical parameters were re-examined after 3 months and 6 months and showed that the application of T-PRF in intrabony defects achieved significant probing depth reduction and clinical attachment gain. Table (1) .The radiographic measurements evaluated after 6months post-therapy, revealed significant bone fill and also exhibited a significant increase in bone density compared with each preoperative radiograph. Table (2)

Discussion

A variety of therapeutic approaches for managing periodontitis involve various modalities to arrest the progression of periodontal tissue destruction, as well as regenerative techniques intended to restore structures destroyed during the disease process.

Titanium prepared Platelet‑rich fibrin (T-PRF); a third generation platelet concentrate was developed by Tunali in 2013 to overcome the hazardous effects of silica in the glass tubes used for PRF preparation. Histomorphometric analysis of T-PRF showed more polymerized fibrin formation with a longer resorption rate in the tissues as titanium seems to be more effective in activating platelets than the silica activators in glass tubes [4]. This has shown to increase the duration of release of growth factors with that of PRF, attributing to the thicker fibrin meshwork.

T-PRF can be used in conjunction with bone grafts, which offers several advantages including promoting wound healing, bone growth and maturation, graft stabilization, hemostasis and improving the handling properties of graft materials.

In this case report, both cases showed the reduction in pocket depth and gain in clinical attachment level after T-PRF application (Table.1). The results obtained were similar to those of A. Chatterjee *et al*, where, the use of T-PRF in intrabony defects showed statistically significant improvements in probing depth reduction (mean

6.25±1.1mm) and CAL gain (6.74±1.55mm) [7]. These findings were also in accordance with the systematic review conducted by Trombelli *et al*, who concluded that the use of specific biomaterials/ biologics was more effective than Open Flap Debridement (OFD) in improving attachment levels in intraosseous defects [8]. This gain in clinical attachment level might have been a result of true periodontal regeneration by means of new attachment or, alternatively, of healing by repair, which implies the presence of a long junctional epithelium.

Radiographic analysis also exhibited significant defect fill and increased radiographic bone density over the defect areas (Table. 2). This is in accordance with the study of Tunali *et al*, who found that T-PRF could induce the formation of new bone with new connective tissue in a rabbit model of wound healing within 30 days of treatment [9].

The reason why T-PRF could improve periodontal osseous defects healing may be explained by the fact that it can upregulate phosphorylated extracellular signal-regulated protein kinase expression and suppress osteoclastogenesis by promoting the secretion of osteoprotegerin in osteoblasts cultures. T-PRF was also demonstrated to stimulate osteogenic differentiation of human dental pulp cells by upregulating osteoprotegrin and alkaline phosphatase expression [10]. Furthermore, many growth factors such as platelet-derived growth factor and transforming growth factor are released from T-PRF have slow-sustained release for at least 7 to 28 days or longer, which means that the T-PRF membrane stimulates its environment for a significant time during remodeling promoting angiogenesis and wound healing.

Photographs

Fig 1: Pre-operative Probing Depth (9mm)

Fig 2: Intra-operative

Fig 3: Minced T-PRF placed into the defect

Fig 4: T-PRF placed as a membrane covering the defect

Fig 5: Suturing

Fig 6: Post-operative Probing Depth after 6months (3mm)

Fig 7A and B: Radiographic Defect Depth at Baseline and after 6months post treatment

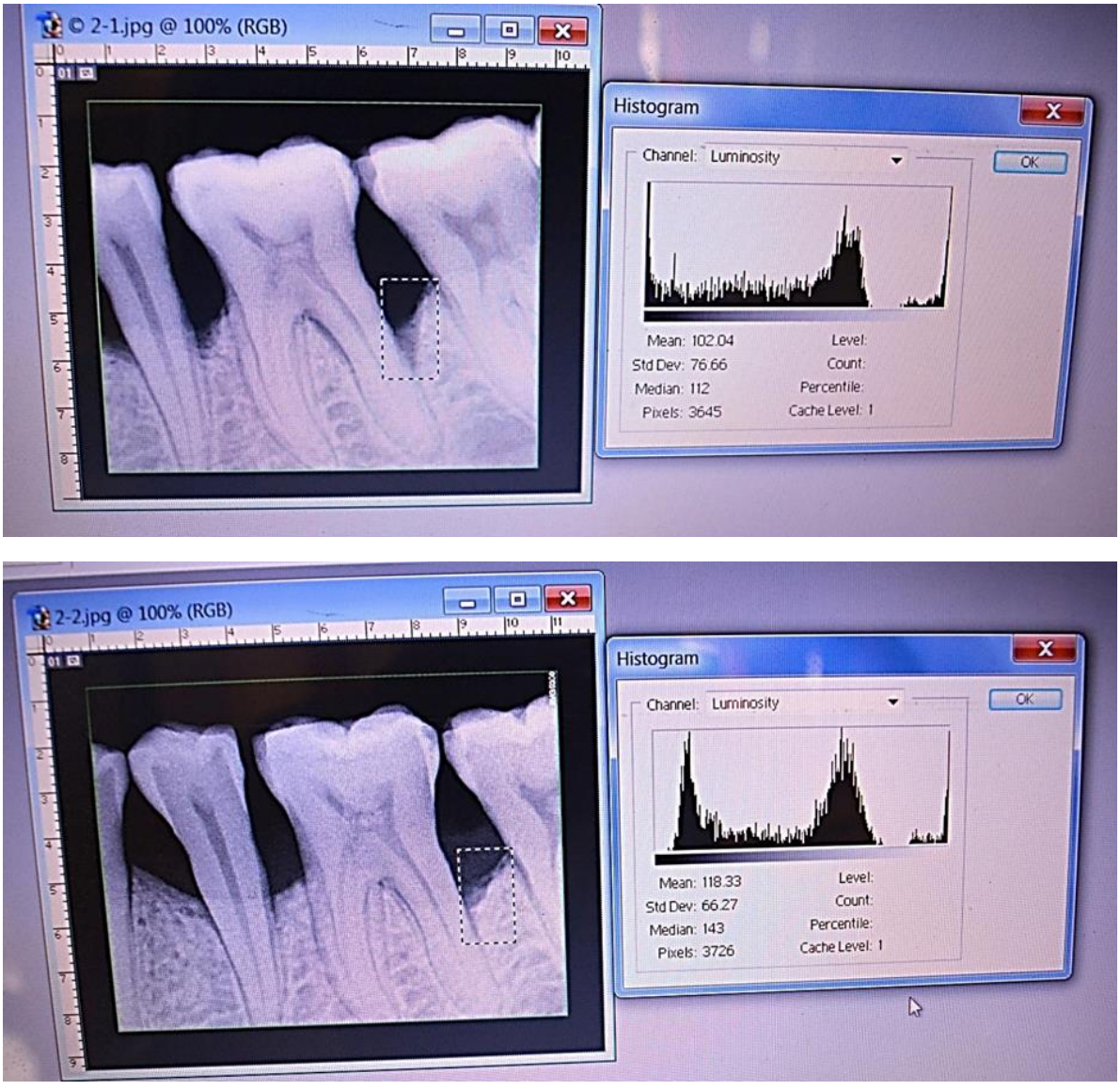

Fig 7A and B: Radiographic density (grey levels) of bone at baseline and after 6months post treatment

Case 2

Fig 8: Pre-operative Probing Depth (9mm)

Fig 9: Intra-operative

Fig 10: Minced T-PRF placed into the defect

Fig 11: T-PRF placed as a membrane covering the defect

Fig 12: Suturing

Fig 13: Post-operative Probing Depth after 6months (3mm)

Fig 14A and B: Radiographic Defect Depth at Baseline and after 6months post treatment

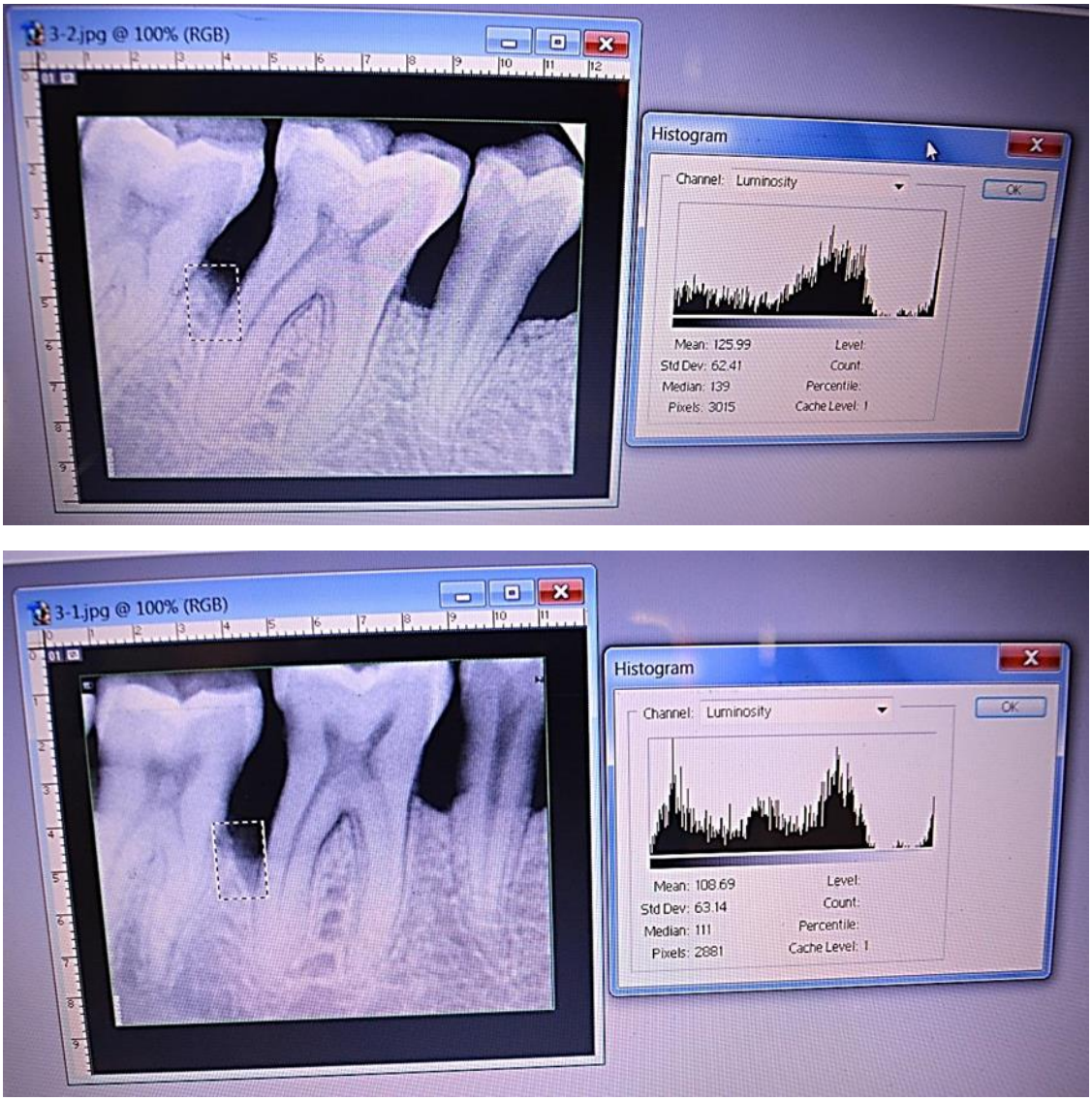

Fig 15A and B: Radiographic density (grey levels) of bone at Baseline and after 6months post treatment

Table 1: Clinical Parameters

	Probing depth (PD) in mm		Relative attachment level (RAL) in mm	
Tooth #	36	46	36	46
Baseline	9	8	14	13
3months	5	4	11	8
6months	3	3	11	10

Table 2: Radiographic Parameters

	Defect depth(DD) in mm		Bone density (BD)	
Tooth #	36	46	36	46
Baseline	5.58	5.50	102.04	108.69
6months	3.24	2.93	118.33	125.99
Defect Fill	2.34	2.57	16.29	17.30

Bone Density change

Conclusion

From the presented cases, it can be concluded that T-PRF is efficacious clinically and radiographically in the treatment of a periodontal intrabony defect. It is an autologous preparation and found to be clinically effective and economical than any other available regenerative materials including PRP. However, long term, multicenter randomized, controlled clinical trials will be required to know its clinical and radiographic effect over bone regeneration.

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