IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 17, Issue 12 Ver. 11 (December. 2018), PP 47-52
www.iosrjournals.org

Comparative Evaluation of Platelet-Rich Fibrin Biomaterial and Open Flap Debridement in the Treatment of Intrabony Defects

Dr Gazanfer Ali Shah[1], Dr Suhail Majid Jan[2], Dr Reyaz Ahmad Mir, Tutor[3], Dr Beanish[4]

[1]*Postgraduate Scholar, Department of periodontics, Governement Dental College and Hospital, Srinagar.*
[2]*Prof. Head of department, Dept of periodontics, Government Dental College and Hospital Srinagar*
[3]*Department of periodontics, Governement Dental College and Hospital, Srinagar*
[4]*Postgraduate Scholar, Department of periodontics, Governement Dental College and Hospital, Srinagar*
Corresponding author: Dr Gazanfer Ali Shah

Abstract
Background: *Platelet-rich concentrates are the most widely used regenerative biomaterials. Stimulation and acceleration of soft and hard tissue healing are due to local and continuous delivery of growth factors and proteins, mimicking the needs of the physiological wound healing and reparative tissue processes. This article aims to evaluate the clinical efficacy of open flap debridement (OFD) with or without platelet-rich fibrin (PRF) in the treatment of intrabony defects.*
Methods: *Fifteen subjects with thirty intrabony defects were treated with either autologous PRF with open-flap debridement (test,* n = *15) or open-flap debridement alone (control,* n = *15). Parameters included: relative attachment level and alveolar crest to the base of the defect (AC-BOD). The parameters were recorded at baseline and at 12 months postoperatively.*
Results: *Statistically significant (0.005) improvements were seen with all the parameters in test group than control groups.*
Conclusion: *Adjunctive use of PRF with OFD significantly improves defect fill when compared to OFD alone. PRF has consistently been showing regenerative potential; it is simple, easy and inexpensive biomaterial compared with bone grafts.*
Keywords: Intrabony defect, open flap debridement, periodontal grafts, platelet rich fibrin, reconstructive osseous surgery

---

Date of Submission: 16-12-2018 Date of acceptance: 31-12-2018

I. Introduction

The definitive goal of regenerative periodontal therapy aims at the reconstruction/regeneration of the tooth supporting apparatus, which has been lost because of periodontitis or trauma.[1] Periodontal regeneration is defined as the complete restoration of lost tissues to their original architecture and function by recapitulating the crucial wound-healing events associated with their development.[2]

A material or technique must histologically demonstrate that periodontal tissue regeneration (new attachment) is formed on a previously diseased/destroyed root surface, in order to be considered a regenerative modality.[3] In the last two decades, various biomaterials[4-9] have been developed and experimented for periodontal tissue regeneration based on their endogenous regenerative capacity, but there is no graft material that is considered as the gold standard.[10]

Platelet-rich fibrin (PRF), an autologous fibrin material as described by Choukroun *et al*. belongs to the second-generation platelet concentrate with cicatricial properties.[11] The preparation of this material as described by Choukroun is a simplified and an inexpensive (The preparation does not require any anticoagulants, bovine thrombin or any other gelling agent) procedure.[12] It consists of an intimate assembly of cytokines, glycanic chains, and structural glycoproteins enmeshed within a slow releasing fibrin network. This leads to more efficient cell migration and proliferation. This unique structure may act as a carrier for cells that are essential for tissue regeneration. After collection of venous blood in dry 10 mL tubes, it was centrifuged for 12 min at 2700 rpm (~400 g). As soon as the centrifugation process was complete, there are 3 layers that are seen: At the bottom layer red blood cells are seen, at the top layer acellular plasma also known as platelet-poor plasma was seen and between the two layers PRF was seen. After the centrifugation process was complete, it was observed that ~97% of platelets and 50% of leukocytes of the original blood volume were concentrated in the PRF.[13] Previous studies have shown a slow release of growth factors such as transforming growth factor β1, platelet-derived growth factor β, and vascular endothelial growth factor, especially during the first 7 days.[14,15] Zumstein *et al.*

reported that this release gradually slowed and continued up to 28 days.[16] This implies that the membrane stimulates its environment for a significant time during the wound healing process. PRF can be used alone,[17] or in combination with different bone substitutes.

Beneficial effects of PRF have been studied in various procedures, such as facial plastic surgery,[18] a sinus-lift procedure as a sole osteoconductive filling material,[19] and multiple gingival recessions cases treated with a coronally advanced flap.[20] PRF has been shown to act as suitable scaffold for breeding human periosteal cells in vitro, which may be suitable for applications in bone tissue engineering.[21]

It is very well-known that regeneration of tissues destroyed by periodontal disease cannot be achieved by conventional open flap debridement (OFD) alone. Thus, the use of PRF adjunctive to OFD is justified. The aim of this study is to evaluate the adjunctive effect of platelet-rich fibrin and OFD in the treatment of 2 or 3 walled intrabony defects.

II. Material And Methods

Thirty systemically healthy subjects were included in this 12 months follow-up, longitudinal interventional study carried out in the Department of Periodontics and Oral Implantology, Government Dental College and Hospital srinagar. Written informed consent was obtained from all those who agreed to participate voluntarily in the study. Inclusion criteria included: Intrabony defects ≥3 mm (distance from alveolar crest to base of the defect [AC-BOD]), defect on an intraoral periapical radiograph [IOPA] along with relative attachment level after Phase 1 therapy (scaling and root planning [SRP] in an asymptomatic tooth. Subjects with known systemic disease or on any medications known to interfere with the outcomes of periodontal therapy, or subjects using tobacco in any form, or subjects who have undergone any periodontal therapy in the preceding 6 months, pregnant or lactating mothers, were excluded from the study. Patients who had unacceptable oral hygiene after the reevaluation of Phase 1 therapy were also excluded from the study. In addition, furcation defects, nonvital teeth, external root resorption were also excluded.

Nonsurgical periodontal therapy (Phase 1 therapy)

At the initial visit, each patient underwent a full-mouth supra and subgingival SRP. In the first visit, all patients were given careful instructions regarding proper oral hygiene maintenance. Six-week post SRP, a periodontal evaluation was done to confirm the desired sites for the study.

Randomization

The selected sites were divided randomly (computer generated list) into control and test groups. The control group consisted of sites treated with OFD alone, whereas test-group sites were treated with OFD with autologous PRF. One operator (HA) performed all surgeries, whereas another investigator (SS) performed all clinical assessments, and the radiographic measurements were done by third investigator (RK).

Clinical and radiographic measurements

The clinical parameters recorded before surgical procedures included relative attachment level (RAL) along with hard tissue parameter; distance from the crest of the alveolar bone to the base of the defect (AC-BOD). They were recorded from the apical level of the pre-fabricated custom acrylic stents with grooves to ensure accurate placement of the University of North Carolina (UNC) no. 15 periodontal probe (UNC-15 periodontal probe. All IBD was evaluated at baseline and 12 months postoperatively. For the measurement of bone defect, distance from the crest of the alveolar bone to the base of the defect (AC-BOD) was considered. Paralleling angle technique was used to obtain standardized radiographs.

PRF preparation

The PRF was prepared following the protocol developed by Choukroun *et al.*[11] Immediately before surgery, intravenous blood alone (without anticoagulant) was collected (by venipuncturing of the antecubital vein) in two sterile 10-ml tubes and centrifugation was carried out immediately at 2700 rpm (approximately 400 g) for 10 min. PRF the center layer was obtained after centrifugation and separated from the other two layers above (platelets poor plasma) and below (red blood cell layer preserving a small portion of the same).

To ensure adequate intra-examiner reproducibility, the examiner was calibrated before the beginning of the study. The examiners were considered calibrated once a statistically significant correlation and statistically non-significant difference between duplicate measurements were obtained (r = 0.91 for RAL)

Surgical procedure

About 0.12% chlorhexidine digluconate was used as pre-surgical rinse. Iodine solution swab was used to carry out an extraoral antisepsis. After the administration of lignocaine 1:2,00,000 adrenalin local anesthesia, buccal and lingual sulcular incisions were made, and mucoperiosteal flaps were reflected. Maximum

interproximal soft tissue was preserved. Root planning followed by debridement of the defect were carried out using ultrasonic instruments and currette. PRF of the required size was squeezed into the defects. Also, PRF of required size was used to cover the defect as a membrane. Repositioning of the mucoperiosteal flap was done and the flap was secured using a 3-0 non-absorbable silk suture (Ethicon), Interrupted sutures were placed. Post-operative instructions and suitable antibiotics and analgesics (Augmentin 625mg mg, thrice per day; and Diclofenac (Exudase DP) three times a day, for 5 days) were prescribed.

Post-operative care

Patients were advised to rinse with chlorhexidine gluconate mouthrinse (0.2%) twice daily for a period of 15 days. At 1 week postoperatively, sutures were removed. Povidine-iodine solution was used to rinse the surgical site and the patients were instructed for gentle brushing with a soft toothbrush (Stim ultrasoft brush). Each patient was [re-examined weekly up to 1 month and after 12 months, and oral hygiene instructions were reinforced at each recall visit. No subgingival instrumentation was attempted at any of these appointments.

Post-surgical measurements

Soft and hard tissue evaluation was performed 12 months after surgery. Soft tissue measurement was repeated with previously used acrylic stents. For hard tissue reevaluation, second IOPA of the same study site was carried out and IBD measurement was reassessed at 12 months.

Statistical analysis

The data were analyzed using statistical software SPSS (version 20.0) and Microsoft Excel (version 5.00)). Power calculations were performed before the study was initiated. To achieve 90% power and detect mean differences of the clinical parameters between groups. The results were averaged (mean standard deviation) for each clinical and radiographical parameter at baseline and 12 months.

III. Results

Soft tissues healed within normal limits, and no significant visual differences were noted between the treatment groups. Intra group and Inter group comparisons showed statistical significant reduction with RAL. Statistically significant improvements were seen with the mean defect fill (Alveolar crest to base of the defect [AC-BOD] (P = 0.003*) when intra group and inter group comparisons were made.

Tabulated depiction of clinical and radiographic parameters at baseline and 12 months.

		TEST GROUP	TEST GROUP	TEST GROUP	CONTROL GROUP	CONTROL GROUP	CONTROL GROUP
PARAMETERS	TIMING	Mean ±SD	t●	p	Mean ±SD	t●	p
RAL	BASELINE	7.87 ±34	37.32	<0.001°	6.13 ±2.11	0.61	<0.78
	12 MONTHS	4.56 ±1.74			5.66 ±1.65		
IBD	**BASELINE**	6.18 ±1.27	50.08		4.99 ±1.35	0.18	
	12 MONTHS	3.68 ±0.64		<0.001°	4.77 ±0.92		0.67

°Statistically significant at P ⟨0.05.

● paired t test.

Changes (mean ± SD) in Clinical and Radiographic Parameters Between Groups Over a 12-Month Period (one year of study)

PARAMETERS	TEST GROUP	CONTROL GROUP	t●	p
RAL	5.31 ±1.76	2.77 ±1.44	8.25	0.02143°
IBD DEPTH REDUCTION	−2.50 ±0.78	−0.09 ±0.11	16.18	⟨0.001°

●Paired t test.

°Statistically significant at P ⟨0.05.

IV. Discussion

The aim of periodontal therapy is to arrest and control the periodontal infection and ultimately to regenerate lost periodontal structures.[22] The complete regeneration of the periodontium after periodontal treatment modalities has been difficult to achieve because of differences in healing abilities among periodontal tissues.[23] The present study evaluates the clinical efficacy of PRF in the treatment of IBD in patients with chronic periodontitis and shows a significant improvement in clinical and radiographic parameters. The uneventful healing in patients was in agreement with our previous study, thus supporting the excellent properties of autologous PRF to enhance periodontal wound healing. Plaque infection and smoking are important factors that were shown to significantly influence the outcomes of regenerative periodontal surgery. [24,25] Because the present study excludes smokers and only includes patients who were able to maintain acceptable oral hygiene, it may be assumed that the careful patient selection was also responsible for the positive outcomes obtained in both groups. Only 2 or 3-wall IBDs were included because various wall defects have different potentials for regeneration. The number of remaining bony walls were found to be correlated positively with regeneration potential in grafting procedures. In addition, 2 or 3 wall defects provide the best spatial relationship for defect bridging by vascular and cellular elements from the periodontal ligament and adjacent osseous wall. Space maintenance is provided by the defect walls to minimize a membrane collapse and/or to provide the protection and retention of grafts. While monitoring changes in clinical and radiographic parameters, PRF showed a greater improvement in soft and hard tissue regeneration especially when compared to first-generation platelet concentrate (i.e., PRP). A mean RAL gain in PRF-treated sites (5.31 ± 1.76) was higher compared to OFD-treated sites (2.77 ±1.44 mm) . IBD change in test group (PRP treated sites) was from – 2.50±0.78 to – 0.09±0.11. Coronal movement of the marginal gingival in the test group depicts favourable results despite the expected recession because of the surgical intervention. This finding could have been due to the placement of the PRF membrane over the edge of the gingival collar as proposed by Del Corso et al., which, in turn, separated and stimulated the interface between the gingival tissue and the root surface on the entire height of the flap. In this application, PRF acted as a healing and interposition biomaterial. This could be explained because the fibrin matrix itself has mechanical adhesive properties and biologic functions like fibrin glue: it maintains the flap in a high and stable position, enhances neoangiogenesis, reduces the necrosis and shrinkage of the flap, and, thus, guarantees maximal root covering by remodeling and stabilization of the gingival flap in the highest possible covering position. The downgrowth of the junctional epithelium along the denuded root surface is one of the most important factors limiting the achievement of a predictable regeneration. PRF was used as a GTR membrane in the present study for the prevention of such a migration. One PRF clot and two PRF membranes were prepared for each test-group patient for the treatment of IBD referred by Del Corso et al. The PRF clot was placed directly into the IBD as a graft material for maintaining an adequate matrix volume. Because PRF membranes are inhomogeneous because leukocytes and platelet aggregates are concentrated within one end of the membrane, two PRF membranes (with the RBC end of both membranes facing toward the defect) were used to cover the IBD defect like GTR for providing a core material homogeneity.

V. Conclusion

This study is one of the prospective, randomized controlled clinical trial reported to date that assesses a putative periodontal healing potential. The study demonstrates that the use of autologous PRF is effective in the treatment of 2 or 3 IBDs. The treatment with autologous PRF stimulated a significant improvement in the RAL, and increase in bone fill compared to OFD at 12 months. However, a long-term, multicenter randomized controlled clinical trial with CBCT as diagnostic tool is needed to determine the clinical and radiographic effects of PRF on bone regeneration.

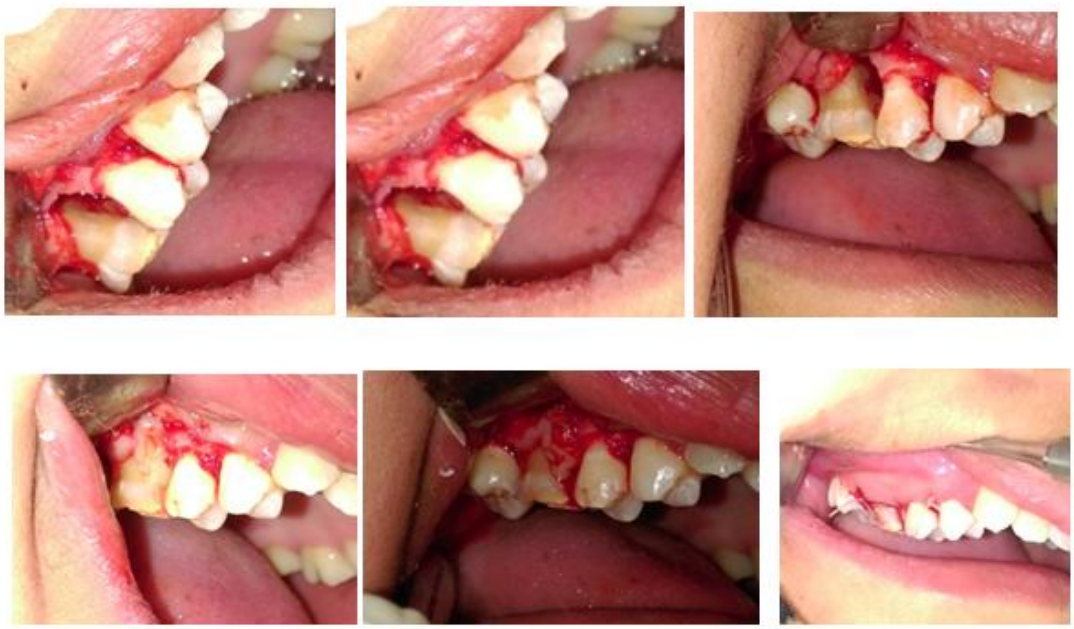
Bibliography

[1]. Karring T, Lindhe J, Cortellini P. Regenerative periodontal therapy. In: Lindhe J, Karring T, Lang NP, editors. Clinical Periodontology, and Implant Dentistry. Copenhagen: Blackwell Munksgaard; 2003. pp. 650–704.
[2]. Polimeni G, Xiropaidis AV, Wikesjö UM. Biology and principles of periodontal wound healing/regeneration. Periodontol 2000. 2006;41:30–47. [PubMed]
[3]. Zander HA, Polson AM, Heijl LC. Goals of periodontal therapy. J Periodontol. 1976;47(5):261–6. [PubMed]
[4]. Pradeep AR, Shetty SK, Garg G, Pai S. Clinical effectiveness of autologous platelet-rich plasma and platelet-rich fibrin in intrabony defect treatment. J Periodontol. 2009;80:62–71.[PubMed]
[5]. Siciliano VI, Andreuccetti G, Siciliano AI, Blasi A, Sculean A, Salvi GE. Clinical outcomes after treatment of non-contained intrabony defects with enamel matrix derivative or guided tissue regeneration: A 12-month randomized controlled clinical trial. J Periodontol. 2011;82(1):62–71. [PubMed]
[6]. Wu SY, Chen YT, Chen CW, Chi LY, Hsu NY, Hung SL, et al. Comparison of clinical outcomes following guided tissue regeneration treatment with a polylactic acid barrier or a collagen membrane. Int J Periodontics Restorative Dent. 2010;30(2):173–9. [PubMed]
[7]. Yukna RA, Krauser JT, Callan DP, Evans GH, Cruz R, Martin M. Multi-center clinical comparison of combination anorganic bovine-derived hydroxyapatite matrix (ABM)/cell binding peptide (P-15) and ABM in human periodontal osseous defects 6-month results. J Periodontol. 2000;71(11):1671–9. [PubMed]

[8]. Kwon DH, Bennett W, Herberg S, Bastone P, Pippig S, Rodriguez NA, et al. Evaluation of an injectable rhGDF-5/PLGA construct for minimally invasive periodontal regenerative procedures: A histological study in the dog. J Clin Periodontol. 2010;37(4):390–7. [PubMed]
[9]. Shirakata Y, Taniyama K, Yoshimoto T, Miyamoto M, Takeuchi N, Matsuyama T, et al. Regenerative effect of basic fibroblast growth factor on periodontal healing in two-wall intrabony defects in dogs. J Clin Periodontol. 2010;37(4):374–81. [PubMed]
[10]. Sharma A, Pradeep AR. Treatment of 3-wall intrabony defects in patients with chronic periodontitis with autologous platelet-rich fibrin: A randomized controlled clinical trial. J Periodontol. 2011;82(12):1705–12. [PubMed]
[11]. Choukroun J, Adda F, Schoeffler C, Vervelle A. An opportunite' in paro-implantology: The PRF (in French) Implantodontie. 2000;42:55–62.
[12]. Brown LF, Lanir N, McDonagh J, Tognazzi K, Dvorak AM, Dvorak HF. Fibroblast migration in fibrin gel matrices. Am J Pathol. 1993;142(1):273–83. [PMC free article][PubMed]
[13]. Dohan Ehrenfest DM, Del Corso M, Diss A, Mouhyi J, Charrier JB. Three-dimensional architecture and cell composition of a Choukroun's platelet-rich fibrin clot and membrane. J Periodontol. 2010;81(4):546–55. [PubMed]
[14]. Dohan Ehrenfest DM, Bielecki T, Jimbo R, Barbé G, Del Corso M, Inchingolo F, et al. Do the fibrin architecture and leukocyte content influence the growth factor release of platelet concentrates? An evidence-based answer comparing a pure platelet-rich plasma (P-PRP) gel and a leukocyte- and platelet-rich fibrin (L-PRF) Curr Pharm Biotechnol. 2012;13(7):1145–52.[PubMed]
[15]. Dohan Ehrenfest DM, de Peppo GM, Doglioli P, Sammartino G. Slow release of growth factors and thrombospondin-1 in Choukroun's platelet-rich fibrin (PRF): A gold standard to achieve for all surgical platelet concentrates technologies. Growth Factors. 2009;27(1):63–9.[PubMed]
[16]. Zumstein MA, Berger S, Schober M, Boileau P, Nyffeler RW, Horn M, et al. Leukocyte- and platelet-rich fibrin (L-PRF) for long-term delivery of growth factor in rotator cuff repair: Review, preliminary results and future directions. Curr Pharm Biotechnol. 2012;13(7):1196–206. [PubMed]
[17]. Ozdemir H, Ezirganli S, Isa Kara M, Mihmanli A, Baris E. Effects of platelet rich fibrin alone used with rigid titanium barrier. Arch Oral Biol. 2013;58(5):537–44. [PubMed]
[18]. Charrier JB, Monteil JP, Albert S, Collon S, Bobin S, Dohan Ehrenfest DM. Relevance of Choukroun's platelet-rich fibrin (PRF) and SMAS flap in primary reconstruction after superficial or subtotal parotidectomy in patients with focal pleiomorphic adenoma: A new technique. Rev Laryngol Otol Rhinol (Bord) 2008;129(4-5):313–8. [PubMed]
[19]. Mazor Z, Horowitz RA, Del Corso M, Prasad HS, Rohrer MD, Dohan Ehrenfest DM. Sinus floor augmentation with simultaneous implant placement using Choukroun's platelet-rich fibrin as the sole grafting material: A radiologic and histologic study at 6 months. J Periodontol. 2009;80(12):2056–64. [PubMed]
[20]. Aroca S, Keglevich T, Barbieri B, Gera I, Etienne D. Clinical evaluation of a modified coronally advanced flap alone or in combination with a platelet-rich fibrin membrane for the treatment of adjacent multiple gingival recessions: A 6-month study. J Periodontol. 2009;80:244–52. [PubMed]
[21]. Gassling V, Douglas T, Warnke PH, Açil Y, Wiltfang J, Becker ST. Platelet-rich fibrin membranes as scaffolds for periosteal tissue engineering. Clin Oral Implants Res. 2010;21(5):543–9. [PubMed]
[22]. Wang HL, Greenwell H. Surgical periodontal therapy. Periodontol 2000 2001;25:89-99.
[23]. Cho MI, Lin WL, Genco RJ. Platelet-derived growth factor-modulated guided tissue regenerative therapy. J Periodontol 1995;66:522-530.
[24]. Trombelli L, Kim CK, Zimmerman GJ, Wikesjo¨ UM. Retrospective analysis of factors related to clinical outcome of guided tissue regeneration procedures in intrabony defects. J Clin Periodontol 1997;24:366- 371.
[25]. Tonetti MS, Prato GP, Cortellini P. Factors affecting the healing response of intrabony defects following guided tissue regeneration and access flap surgery. J Clin Periodontol 1996;23:548-556.

IMAGES

PICTOGRAPHIC REPRESENTATION OF SURGICAL PROCEDURE OF A PATIENT



Dr Gazanfer Ali Shah. "Comparative Evaluation of Platelet-Rich Fibrin Biomaterial and Open Flap Debridement in the Treatment of Intrabony Defects."." IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 17, no. 12, 2018, pp 47-52.