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Perioglas® And Prf As Graft Materials in The Treatment of Intrabony Defects in Chronic Generalized Periodontitis: A Clinical And Radiological Evaluation

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Abstract:
Background: *Platelet-rich fibrin (PRF) is a platelet concentrate widely used to accelerate soft and hard tissue healing, whereas bioactive glass, an alloplastic bone graft, elicits a specific biological response, resulting in the formation of a bond between the tissues and graft thus facilitating bone healing. Thus, the purpose of this clinical study was to determine the efficacy of PRF and Perioglas®, as a regenerative material in the treatment of three wall vertical defects.*
Material and methods: *Twenty patients diagnosed with generalized chronic periodontitis having two or more, three wall vertical defects were selected for the study. Clinical parameters like Probing pocket depth (PPD) and relative attachment level (RAL), radiographic evaluation including the depth of the bone defect and the percentage of bone defect fill, were recorded for both the groups at baseline, three and six months. The sites were randomly treated either with PRF or Perioglas® after debridement.*
Results: *Evaluation of the PRF and Perioglas® sites from baseline to 6 months revealed that PPD reduced by 4.2 mm(72.4%) and 1.5 mm (21.74%) respectively; RAL reduced from 4.3 mm (32.58%) and 1.5 mm (11.9 %) , respectively; bone fill level from baseline to 6 months revealed a gain of 1.57±43 (25.5%) and 2.06 mm(33.1%), respectively.*
Conclusion: *At the end of six months PPD reduction and RAL gain were greater by PRF than Perioglas®. However, statistically significant difference in the bone fill of defects was not evidenced among the two groups.*
Keywords*: Infrabony Defects, Bioactive Glass, PRF, Perioglas®*

I. Introduction

Periodontal regeneration is a biological term defined histologically as reconstitution of the tooth's supporting tissues, including periodontal ligament, alveolar bone and cementum over a root surface deprived of the attachment apparatus [(1)].

Periodontal management is aimed at regaining the tooth supporting structures lost as a result of disease. The advent of regenerative approaches in contemporary periodontics has increased patient's treatment options and enhanced the long-term prognosis of teeth with advanced periodontal destruction [(2)]. Although to date the goal of predictable regeneration has not been attained, but there are evidences to suggest that current regenerative techniques which include the application of root conditioners, bone grafts, guided tissue regenerative membrane, growth factors and stem cell therapy, lead to significant amounts of regeneration [(2).]

Growth factors are a class of polypeptide hormones known to promote proliferation and migration of periodontal ligament cells, synthesis of extracellular matrix as well as differentiation of cementoblasts and osteoblasts. They present as potential aids, in attempts to regenerate the periodontium [(3)]. Growth factors that seem to play an important role in periodontal and bone wound healing are platelet derived growth factor (PDGF), insulin-like growth factor (IGF) and transforming growth factor- β (TGF-β).

A convenient and economic approach to obtain autologous PDGF and TGF-β is the use of platelet rich plasma (PRP). PRP is obtained by sequestering and concentrating platelets by gradient density centrifugation. The process of centrifugation concentrates PDGF and TGF -β within the fibrin matrix [(3, 4, 5)]. Placement of autologous platelets in periodontal wounds increases the local concentration of growth factors, which may enhance the healing outcomes [(6)].

Platelet-rich fibrin (PRF), developed by Choukroun et al., 2001, is a second generation platelet concentrate widely used to accelerate soft and hard tissue healing. Its advantages over the more extensively used platelet-rich plasma (PRP) include ease of preparation/application, minimal expense, and lack of biochemical modification (no bovine thrombin or anticoagulant is required). PRF is a strictly autologous fibrin matrix containing a large quantity of platelet and leukocyte cytokines [(7)]. PRF is capable of increasing osteoblast attachment, proliferation and simultaneously up regulating collagen-related protein production. These actions in combination would effectively promote bone regeneration [(8, 9).]

Various bone grafts and their synthetic substitutes have been used in an attempt to achieve this therapeutic endpoint. Currently autografts, allografts, xenografts and alloplasts are most widely used in periodontal therapies. Alloplasts offer the advantages of unlimited quantity, no additional surgical site and no potential for disease transmission, over other graft materials [(2).]Alloplastic bone substitutes that are used to treat periodontal defects include nonporous and porous hydroxyapatite, beta tricalcium phosphate, poly-methyl-methacrylate and hydroxyl-ethyl-methacrylate polymers, and bioactive glass [(10)].

A bioactive material is defined as "the one that elicits a specific biological response at the interface of the material which results in the formation of a bond between the tissues and materials". Upon contact with body fluids, there is an immediate exchange of ions which results in a physiochemical bond between the bioactive glass material, soft tissue and the bone. Also, it is having modulus of elasticity similar to that of bone. Researchers suggest hat bioactive glass is a potential bone replacement graft material. Thus it is an effective adjunct to conventional surgery in the treatment of periodontal infrabony defects [(11)].

Hence the present clinical study was aimed to evaluate the clinical and radiographic outcomes of PRF and Perioglas® in infrabony defects of chronic generalized periodontitis patients.

II. Materials And Methods

In the present prospective study twenty subjects in the age group ranging from 25 - 55 years, both males or females, with periodontal intrabony defects were recruited randomly from the dental OPD, Department of Periodontics and Implantology, Hitkarini Dental College and Hospital, Jabalpur (India).

The inclusion criteria were-:

1. Patients diagnosed of generalized chronic periodontitis with probing depth of ≥5 mm and radiographic evidence of vertical bone loss.

2. Patients with good general health, without any history of systemic disease.

The exclusion criteria were-:

1. Patients showing unacceptable oral hygiene during the presurgical (phase I) period

2. Pregnant women and lactating mothers

3. Smokers

The present study was approved by the ethical committee of Hitkarini Dental College and Hospital, Jabalpur (India). A written informed consent form explaining the nature of the study and surgical procedure was signed by all the participating patients. Phase I therapy was followed by maintenance phase. Patients were re-evaluated after 4 weeks of phase-I therapy.

2.1 Material used

Platelet-rich fibrin (PRF) represents a platelet gel therapeutic concept and attempts to accumulate platelets and release cytokines in a fibrin clot. Though platelets and leukocyte cytokines play an important part in the biology of this biomaterial, the fibrin matrix supporting them certainly constitutes the determining element responsible for the real therapeutic potential of PRF. The required quantity of blood is drawn into a 10-ml test tube without an anticoagulant and centrifuged immediately. Blood is centrifuged for 12 min at 2,700 rpm.

The resultant product consists of the following three layers:

- Topmost layer consisting of acellular PPP
- PRF clot in the middle
- RBCs at the bottom

Because of the absence of an anticoagulant, blood begins to coagulate as soon as it comes in contact with the glass surface. Therefore, for successful preparation of PRF, speedy blood collection and immediate centrifugation (before the clotting cascade is initiated) was absolutely essential. PRF was obtained in the form of a membrane by squeezing out the fluids in the fibrin clot [(8, 9)]. (Fig. 1).

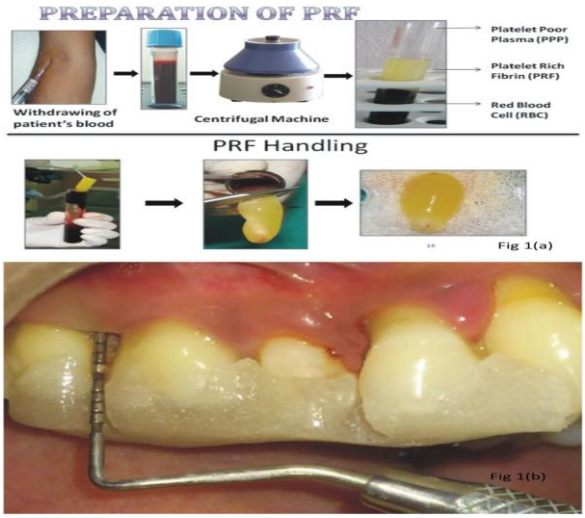

Figure: 1 (a)Preparation of PRF, (b) Measurement of pocket depth with occlusal stent using UNC-15 probe

Perioglas® though act as an osteoconductive scaffold but also interacts with the surrounding tissues and imparts an osteostimulatory effect. This phenomenon achieves faster bone regeneration than exhibited by osteoconduction, while simultaneously increasing the resorption rate of the implanted graft material [(11)].

2.2 Patient groups

Selected sites were randomly (toss of a coin) divided into two groups. In Group A, muco-periosteal flap elevation was followed by the placement of PRF in the intrabony defect, whereas in Group B, muco-periosteal flap elevation was followed by the placement of Perioglas®. Recall appointments were made at 7 days, 1, 3 and 6 months.

2.3 Clinical parameters:

Baseline recording of clinical parameters included Gingival Index, Probing pocket depth and clinical attachment loss, using a UNC-15 probe with an occlusal stent (Fig. 1).

2.4 Radiographic parameters

Intraoral periapical radiograph of each selected site using the long cone paralleling technique was exposed before treatment and at 6 months after treatment. Digitized images were displayed on the monitor at 5X magnification using Adobe Photoshop 7.0 computer software. A 0.5mm grid was made on the digitized images and all linear measurements were made using Auto-CAD 2010 software.

All the patients were subjected to routine blood examination that included hemoglobin %, bleeding time, clotting time, total leucocyte count, differential leucocyte count, and random blood sugar. An ELISA test for HIV and Hepatitis screening test were also recommended. All the sites were examined to record the clinical and radiographic parameters.

After adequate local anesthesia, crevicular incisions were made. The defect site was exposed by reflection of a full-thickness mucoperiosteal flap, followed by the debridement of the diseased granulation tissue, thorough root planing and irrigation with normal saline.

In Group A; the osseous defect was filled with PRF [Fig. 2(a, b), 3(a)] and the Group B; the osseous defect was filled with Perioglas® with the help of a cumine scaler. [Fig. 2(c,d 3(b)]. The material was placed from the base of the defect coronally to the approximate level of the crest of the remaining osseous walls.

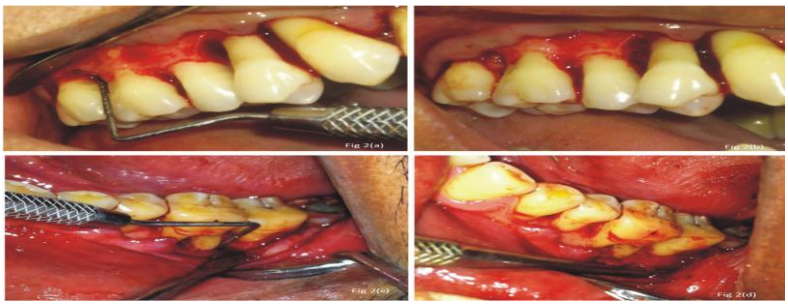

Figure: 2 (a) Measurement Of bone defect at PRF site Using UNC-15 Probe after Reflection In between 16, 17 ; (b) Defect Filled with PRF placed in Between 16, 17; (c) Measurement Of bone defect at Perioglas® site using UNC-15 Probe after reflection In between 36, 37 (d) Defect filled with Perioglas®

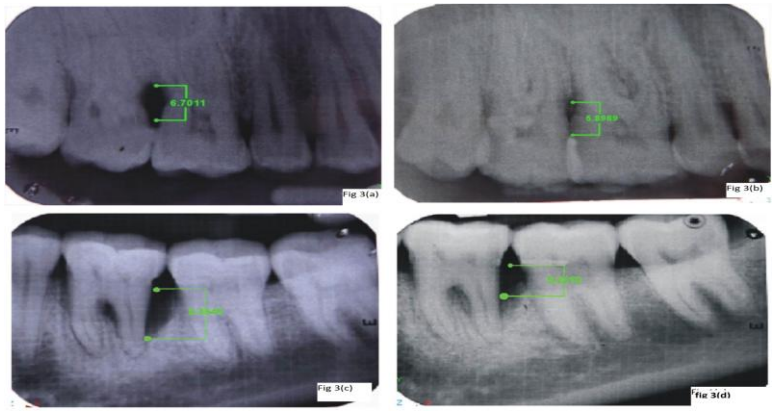

Figure: 3 (a) IOPA x-ray of PRF site at baseline; (b)IOPA x-ray of PRF site at 6 months; (c) IOPA x-ray of Perioglas® site at baseline; (d) IOPA x-ray of Perioglas® site at 6 months.

The mucoperiosteal flaps were repositioned and secured in place using black, braided (4-0), interrupted silk sutures to obtain primary closure of the interdental space, and protected with a noneugenol dressing. All patients were prescribed medications; an analgesic Diclofenac sodium 50 mg, twice a day; and an antibiotic Amoxycillin 500 mg thrice a day for five days.

After one week following surgery, the dressing and sutures were removed and the surgical site was irrigated thoroughly with saline. As healing was satisfactory and none of the patients experienced any untoward reaction, the recall appointments were made at 1, 3, 6 months post-operatively. At each visit, oral hygiene instructions were reinforced and the surgical sites were professionally irrigated with normal saline. At the end of six months post-therapy, patients were evaluated clinically and radiographically. Clinical parameters (Gingval Index, Probing pocket depth, Relative attachment level) and radiographic measurements were repeated for both the groups. [Fig. 3(c,d)].

2.5 Statistical analysis

The data was compiled and entered in spreadsheet computer program (Microsoft Excel 2007) and then exposed to software SPSS, version 20 (SPSS Inc, Chicago, Illinois, USA). The data was normal and quantitative hence, parametric tests were applied. Student't' test was applied for comparison between PRF and Perioglass® groups. Repeated measure ANOVA, for comparison between different time intervals followed by Mann Whitney U test for intra-group comparison was applied for comparison within different time intervals. P value of under 0.05 was considered statistically significant.

III. Results

In the present clinical study both the treatment modalities showed a statistically significant reduction of the mean GI, PPD, reduction in CAL and increased bone fill which continued up to the 6 month evaluation.

3.1 Gingival index

The mean gingival index on PRF Perioglas® reduction at baseline was 1.49 ± 0.33 and 1.42 ± 0.19 respectively, which was reduced to 0.88 ± 0.33 (40.93%) and0.880 ± 0.26 (38.02%) respectively, at 3months. These values further reduced to 0.78 ± 0.14 (47.65%) and 0.80 ± 0.023 (43.66%) respectively at 6 months. On comparing both the groups no significant difference was observed. **(GRAPH- 1)**

3.2 Probing pocket depth

The mean reduction in probing pocket depth of PRF and Perioglas® at baseline was 5.8 ±1.13 and 6.90 ±0.87 respectively; which reduced to 2.50 ± 0.70 (56.9%) and 5.70 ±1.25 (17.4%) respectively at 3 months. At 6 months value further reduced to 1.60± 0.51 (72.4%) and 5.40 ± 0.51 (21.74%) respectively. On comparing both the groups statistically significant reduction in pocket probing depth was observed in PRF as compared to perioglas® with a P value of 0.001. **(TABLE-1, 4: GRAPH- 1)**

Table :1 Mean pocket probing depth

Probing pocket depth	Group A (PRF)		Group B (PG)		
	Mean ± SD	% Change from baseline	Mean ± SD	% Change from baseline	
Baseline	5.80 ± 1.135	-	6.90 ±0.876	-	t-1/2=1.08;p>0.05
3 months	2.50 ± 0.707	56.9%	5.70 ±1.252	17.4%	t-1/2=3.25;p<0.01
6 months	1.60 ± 0.516	72.4%	5.40 ±0.516	21.74%	t-1/2=0.70;p<0.0001
PPD (Difference between Baseline and 6 months	4.20 ± 0.619		1.50 ±0.527		

3.3 Clinical attachment loss

The mean clinical attachment loss in PRF and Perioglass® group at baseline was 13.20 ± 1.93 and 12.60 ± 2.27 which is reduced to 9.80 ± 1.54 (25.76 %) and 11.40 ± 2.67 (9.5%) respectively, at 3months. At 6 months values further reduced to 8.90 ± 1.66 (32.58%) and 11.10 ± 2.02 (11.9 %) respectively. On comparision PRF sites showed statistically significant gain in clinical attachment level than Perioglas® with the p value of 0.016. **(TABLE. 2, 4: GRAPH- 1)**

Table 2: Mean relative attachment level

Relative Attachment Level	Group A (PRF)		Group B (PG)		P value
	Mean ± SD	% Change from baseline	Mean ± SD	% Change from baseline	
Baseline	13.20 ± 1.932	-	12.60 ±2.271	-	t-1/2=0.69;p>0.05
3 months	9.80 ± 1.549	25.76%	11.40 ±2.675	9.5%	t-1/2=1.25;p>0.05
6 months	8.90 ± 1.663	32.58%	11.10 ±2.025	11.9%	t-1/2=0.28;p>0.05
RAL Difference between Baseline and 6 months	4.30 ± 0.949		1.50 ±0.527		

3.4 Bone Density fill

The mean bone fill level (depth of defect) in PRF and Perioglas® group at baseline was 6.11± 0.4 and 6.23± 0.66 respectively, at 3 months. At 6 months depth of defect was reduced to 4.54 ± 0.59 (25.5%) and 4.17 ± 0.58 (33.1 %) respectively. On comparision Perioglas® showed better bone fill than PRF. However, with the p value of 0.513, the difference in bone fill was not satistically significant. **(TABLE-3, 4: GRAPH- 1)**

Table 3: Mean radiographic defect fill

Depth of the defect	Group A (PRF)		Group B (PG)		
	Mean ± SD	% Change from baseline	Mean ± SD	% Change from baseline	
Baseline	6.114 ± 0.4	-	6.234 ±0.661	-	t-1/2=0.80;p>0.05
6 months	4.544 ± 0.595	25.5%	4.174 ±0.582	33.1%	t-1/2=3.12;p<0.05
BD-CEJ Difference between Baseline and 6 months	1.570 ±0.431		2.059 ±0.576		

Table 4: Percent difference of all parameters after 6 months.

Group		RAL % DIFF	PPD % DIFF	GI % DIFF	BD % DIFF
PG	Mean	11.9	21.3	44.2	32.9
PRF	Mean	32.6	72.4	41.0	25.8
Total	Mean	22.25	46.8	42.6	29.35

IV. Discussion

The primary goal of periodontal therapy is to arrest the progression of periodontal disease and maintain the natural dentition for esthetics and function. If periodontal disease results into a loss of the attachment apparatus, attempts are made to regenerate the periodontium to a pre-diseased state [(12)]. Though periodontal regeneration continues to be the ultimate goal of periodontal therapy, outcome is dependent on multiple factors.

In the quest to restore lost attachment, a variety of implant materials have been investigated. Numerous studies have shown varying degrees of success through the implantation of different forms of bone substitutes, guided tissue regeneration and growth factors. Although autogenous bone grafts are being considered as gold standard for grafting procedures but difficulty in procurement and need for an additional surgical site limits their use.

Bioactive glasses are alloplastic materials and act by osteoconduction and/or osteopromotion. 45S5 Bioglass particulate exhibits enhanced new bone formation which was many times faster as compared to hydroxyapatite. Bioactive glass and its composite are found to be better, compared to HA and open flap debridement alone for the reconstruction of infrabony defects [(13)].

The growth factors act as signaling molecules which stimulate the receptors on the external surface of the target cells in order to stimulate an expression of normal gene. Since these are not mutagens, therefore do not pose a risk of neoplasia or hyperplasia. The growth factors also contain pleotropic effect which are angiogenesis, mitogenesis, and differentiation and up regulation of normal cellular functions [(14)].

The biologic scaffolds for the growth factors are the exposed collagen and the cell adhesion molecules, fibrin and fibronectin from plasma, and vitronectin secreted by platelets. PRF used as fibrin bandage serves as a matrix to accelerate the healing of wound edges [(15)].

In this study the efficacy assessment of PRF and Perioglas® included measurement of both hard and soft tissue parameters. The clinical parameters of gingival index, probing pocket depth and clinical attachment level were recorded at the baseline, 3 and 6 months follow-up period. In an attempt to assess the amount of bone fill, IOPA x-rays of osseous defects were obtained at baseline and at six months post-surgically. A follow-up period of 6 months was designated based on the concept that the dimensional alterations of the periodontal tissues resulting from active therapy occurs within the first 6 months.

Although, the most reliable outcome for assessing the periodontal regeneration is human histologic investigation, however the morbidity associated with this technique and the practical and ethical restrains precludes this.

Various parallel design, prospective, randomized control trials compare sites with PRF or novabone putty, respectively with sites treated by flap surgery alone as ‘controls’. These studies suggest, statistically significant improvement in clinical and radiographic parameters in osseous defects filled with either of theses regenerative materials as compared to osseous defects treated with surgical debridement alone [(16.17,18)]. Therefore in the present study, there is lack of a group with no treatment, and labeled as ‘controls’.

Evaluation of the PRF and Perioglas® sites from baseline to 6 months revealed that probing pocket depth reduced by 4.2 mm(72.4%) and 1.5 mm (21.74%) respectively; Relative attachment level reduced from 4.3 mm (32.58%) and 1.5 mm (11.9 %) , respectively; bone fill level from baseline to 6 months revealed a gain of 1.57±43 (25.5%) and 2.06 mm(33.1%), respectively.

Current study demonstrated a statistically significant reduction in the probing pocket depth and gain in clinical attachment level; additionally bone augmentation was also statistically significant in both the groups, from baseline to six months, postoperatively. This improvement in soft tissue parameters was more for PRF sites as compared to Perioglas®. Though, after six months, Perioglas® sites revealed slightly better bone fill among the two groups, the P value were not evidenced to be statistically significant.

Further studies with a larger sample size and for a longer duration would further explore the role of PRF and Perioglas® in the management of intrabony defects.

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