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A comparative evaluation of Platelet Rich Fibrin and Platelet Rich Fibrin combined with Demineralized Freeze-Dried Bone Allograft (DFDBA) in the treatment of Intrabony Defects in Chronic Periodontitis patients: A Clinico-Radiographic Study

[1]Dr. Anju Vishwanath, MDS, Dept. of Periodontology, Rungta College of Dental Sciences and Research, Bhilai, Chhattisgarh, 490024.

[2]Dr. Aena Jain Pundir, MDS, Dept. of Periodontology, Rungta College of Dental Sciences and Research, Bhilai, Chhattisgarh, 490024.

[3]Dr. Siddharth Pundir, MDS, Dept. of Oral Pathology, Rungta College of Dental Sciences and Research, Bhilai, Chhattisgarh, 490024.

[4]Dr. Nikita Agrawal, MDS, Dept. of Periodontology, Rungta College of Dental Sciences and Research, Bhilai, Chhattisgarh, 490024.

Corresponding Author: Dr. Anju Vishwanath, MDS, Dept. of Periodontology, Rungta College of Dental Sciences and Research, Bhilai, Chhattisgarh, 490024.

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Abstract

Platelet-rich fibrin (PRF), a second-generation platelet concentrate has been used as a regenerative material for periodontal bony defects as its unique structure may act as a vehicle for carrying cells that are essential for tissue regeneration. The present study was carried out to compare the regenerative potential of PRF alone and PRF in combination with Demineralized freeze-dried bone allograft (DFDBA) in the treatment of periodontal intrabony defects both clinically and radiographically. A total of 60 sites from 30 patients with intrabony pockets more than 5 mm and radiographic evidence of vertical bone loss were selected from the Out Patient Department, Rungta College of Dental Sciences and Research, Bhilai, Chhattisgarh. The selected sites were randomly divided into Experimental site A (treated with PRF alone) and Experimental site B (treated with PRF and DFDBA). The clinical parameters i.e. Plaque Index (PI), Gingival Index (GI), Probing Pocket Depth (PPD), Relative Attachment Level (RAL) and Gingival Recession (GR) were evaluated at baseline, 3, 6 & 9 months. Radiographic parameters i.e. Defect Fill (DF)

and percentage of Defect Fill (%DF) were evaluated at 6 & 9 months. All clinical and radiographic data were subjected to statistical analysis for intra-group comparison and intergroup comparison. Platelet Rich Fibrin (PRF) in combination with Demineralized Freeze-Dried Bone Allograft (DFDBA) was found to be more effective in the treatment of periodontal intrabony defects when compared with Platelet Rich Fibrin (PRF) alone which shows that DFDBA enhances the regenerative capability of PRF when used together.

Summary: DFDBA enhances the regenerative capability of PRF when used in combination in periodontal bony defects.

Keywords: Regeneration, Intrabony defects, Platelet rich fibrin (PRF), Demineralized freeze-dried bone allograft (DFDBA).

Introduction

Destructive periodontal disease ultimately leads to formation of intrabony periodontal defects which worsen the long-term prognosis for teeth. The ideal therapeutic goal of periodontal therapy is regeneration. DFDBA, first used in dentistry in 1965 by Urist, stimulates the formation of new bone by osteoinduction. It provides a source of osteoinductive factors (bone morphogenic proteins (BMPs)) and it induces endochondral bone formation when implanted in tissues.[1] Platelets, on the other hand, elicit numerous growth factors comprising TGF-β, PDGF, IGF, and FGF which proceed as differential factors on regenerating periodontal tissues.[2] Platelet rich fibrin (PRF), which belongs to second generation platelet concentrates, was first developed in France by Choukroun et al.[3] Eventhough numerous studies have shown the role of PRF in bone regeneration, to our knowledge, till now no study has compared the effect of PRF versus PRF combined with an allograft. Hence this study was carried out to evaluate the ability of DFDBA in augmenting the regenerative effects exerted by PRF.

Materials and Methods

This study was approved by the human subjects' ethics board of RCDSR/IEC/MDS/2016/D10 and was conducted in accordance with the Helsinki Declaration of 1975, as revised in 2000. A total of thirty systemically healthy patients (60 sites) with moderate to advanced chronic periodontitis were selected for this study. Patient's verbal and written informed consent was obtained prior to commencement of the study. The selected sites were randomly divided into Experimental Site A (PRF) and B (PRF plus DFDBA) according to the type of treatment rendered to them by using split mouth design.[4]

The inclusion criteria included (a) 25-55 years age, (b) at least 2 or more intrabony pockets more than 5mm, one in each quadrant or contralateral sides of the same arch, (c) radiographic evidence of vertical bone loss and (d) non-tobacco users. The exclusion criteria included (a) one wall osseous defects and interdental craters, (b) those taking medications known to interfere with periodontal wound healing and (d) pregnant, lactating or uncooperative patients.

The clinical parameters i.e., Plaque index[5, 6], Gingival index[5, 6], probing pocket depth, relative attachment level and gingival recession were evaluated at baseline, 3, 6 and 9 months. Radiographic parameters i.e., Defect Fill and percentage of Defect Fill were evaluated during 6- and 9-months follow-up.

The PRF was prepared according to the process protocol developed by Choukroun et al. (2001). [7] The patient was prepared for the surgery and after achieving adequate anaesthesia, a full-thickness mucoperiosteal flap was raised. PRF was prepared which was then minced into pieces. In Experimental site A, PRF was placed in the

defect (Fig. 1) and in Experimental site B**,** PRF was combined with DFDBA in a proportion of 1:1,[8] and then placed in the defect (Fig. 2). 3-0 non-absorbable black silk surgical sutures were placed. The surgical area was protected and covered with a periodontal dressing. Analgesics, anti-inflammatory drugs and antibiotics were prescribed for 5 days post-operatively. Post-surgical instructions were given. Sutures were removed after one week and patients were recalled after 3, 6 and 9 months for re-evaluation.

Results

The data obtained was subjected to statistical analysis. The statistical software used was IBM SPSS 20.00 version (Statistical package for social science, Chicago, IL, USA) software. Paired 't' test and unpaired 't' test was used to compare the intra-group and inter-group post-treatment changes respectively. A probability P-value of 0.05 or less was considered as statistical significant. A confidence interval of 95% was set for comparison. Radiographic parameters were assessed using Image J 1.46 software. The results obtained were as depicted in the graphs (Graph 1-11) and tables (Table 1-6) with Experimental Site B showing comparatively significantly better results when compared to Site A in terms of PPD**,** RAL, gingival recession and defect fill. Fig. 3 and Fig. 4 show the clinical and radiographic pre and post measurements of both the sites respectively.

Discussion

The full mouth PI and GI scores increased slightly and statistically insignificantly ($p > 0.05$) which may be due to patient's ability to maintain desired level of oral hygiene throughout the period of study (Graph 1). A customized stent was used in this study to ensure consistency of inclination and angulation of the periodontal probe. The mean PPD in both the sites showed highly significant decrease from baseline to 9 months (Graph 2). Similar results were seen in studies done by Sharma et al (2011)[9], and Pradeep et al (2012)[10]. However, on comparing both the groups, a highly significant increase is seen in experimental site B when compared to A during the time interval of baseline to 6 and 9 months (Graph 3). However, the change from 6 to 9 months was insignificant.

The difference in changes in mean RAL when compared from baseline to 6 and 9 months showed highly significant increase in experimental site B than A (p value < 0.001) (Graph 4, 5). This is in accordance to the study where new attachment had been reported with DFDBA by Bowers et al (1989)[11] and Francis et al (1995)[12]. GR on the other hand was observed to have increased significantly following surgery in both the groups (Graph 6, 7) which is similar to the findings of previous studies on PRF (Thorat et al 2011[13], Pradeep et al 2012[10]). The increase in gingival recession following surgery can be attributed to shrinkage of supracrestal soft tissues. The increase in bone fill was statistically significant in both the groups when compared to baseline. However, on comparing the two groups, significant difference in mean DF & %DF was observed in favor of experimental site B (Graph 8-11).

The improvement in clinical parameters and better bone fill in the groups are suggestive of the effectiveness of PRF in regenerative periodontal therapy. These results may be attributed to the contents of the PRF clot namely fibrin, platelets, leukocytes, growth factors and cytokines. On the other hand, the osteoinductive properties of DFDBA have made it the grafting material of choice as compared to FDBA, xenografts, and alloplasts. Thus, regeneration of intrabony defects using PRF in combination with DFDBA gave better results when compared to PRF alone, as the addition of DFDBA could enhance the effects of PRF by maintaining the

space for tissue regeneration to occur, as well as by exerting an osteoinductive as well as osteoconductive effect in the intrabony defect area.

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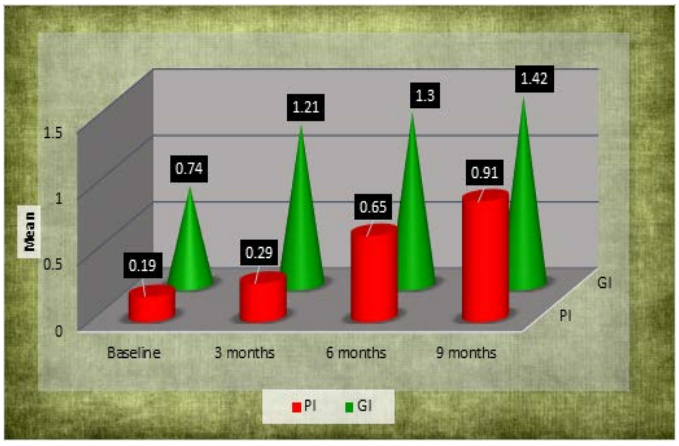
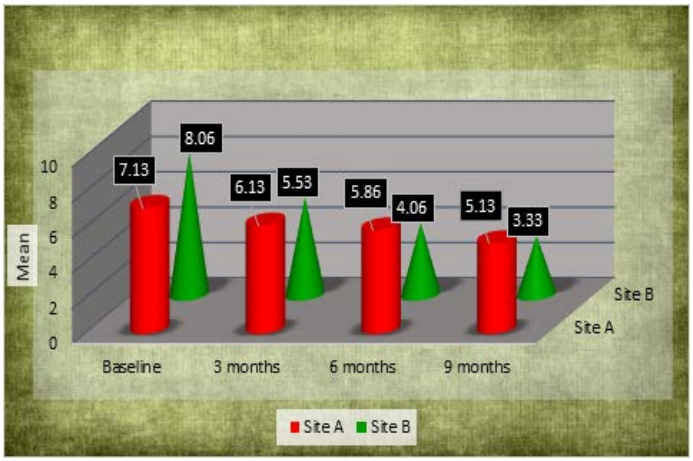
Legend Graph and Table

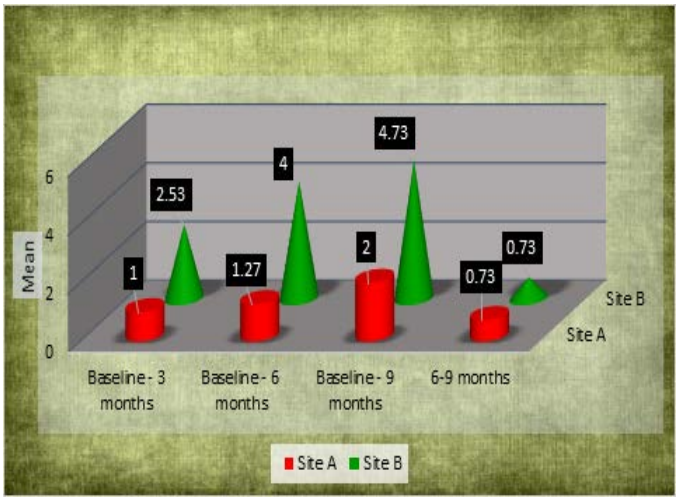
Graph 1: comparison of plaque index (pi) and gingival index (gi) at baseline, 3 months, 6 months and 9 months intervals.



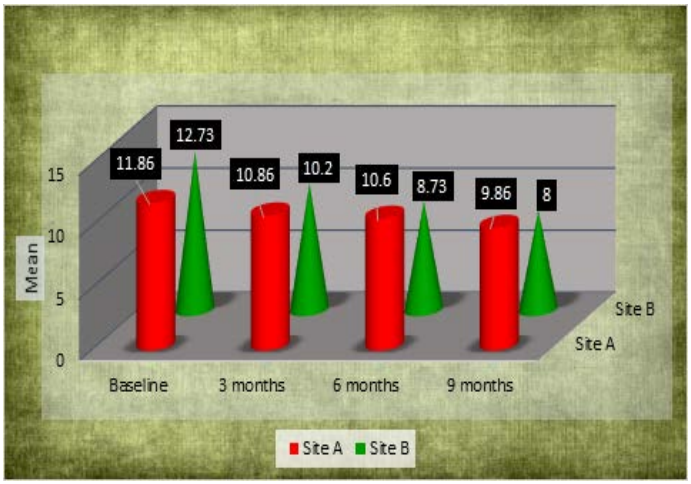
Graph 2: evaluation of ppd within experimental site a and experimental site b at different time intervals.



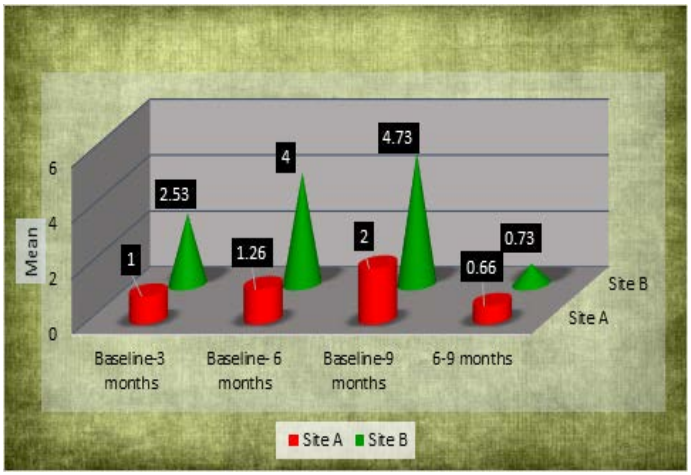
Graph 3: comparison of reduction in ppd between experimental site a and site b at different time intervals.



Graph 4: evaluation of ral within experimental site a and experimental site b at different time intervals.

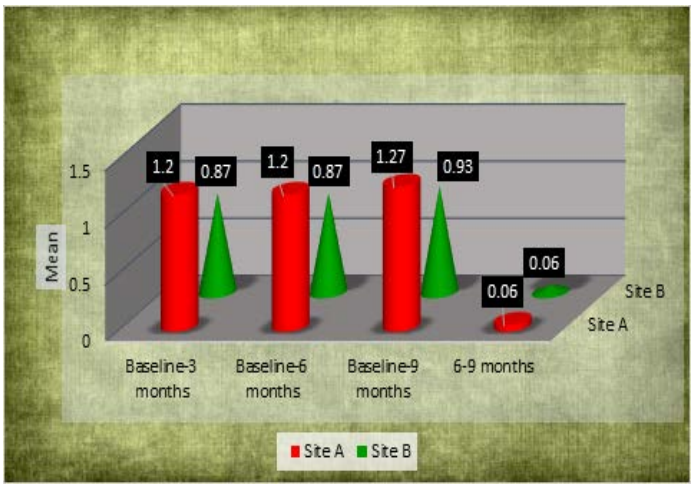


Graph 5: comparison of difference in ral between experimental site a and experimental site b at different time intervals.

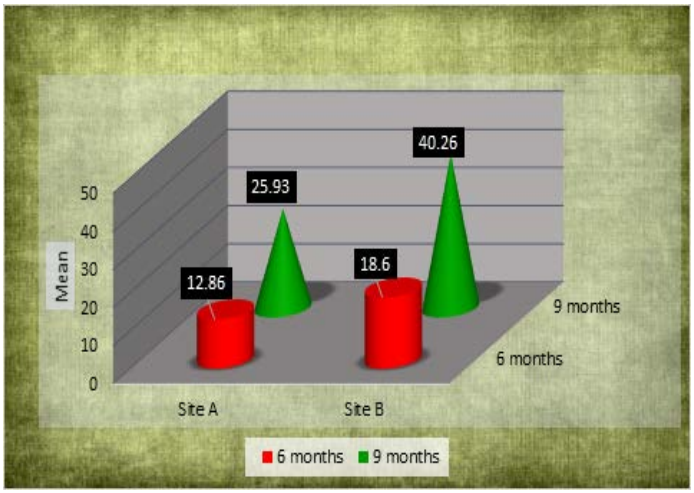


Graph 6: evaluation of gr within experimental site a and experimental site b at different time intervals.

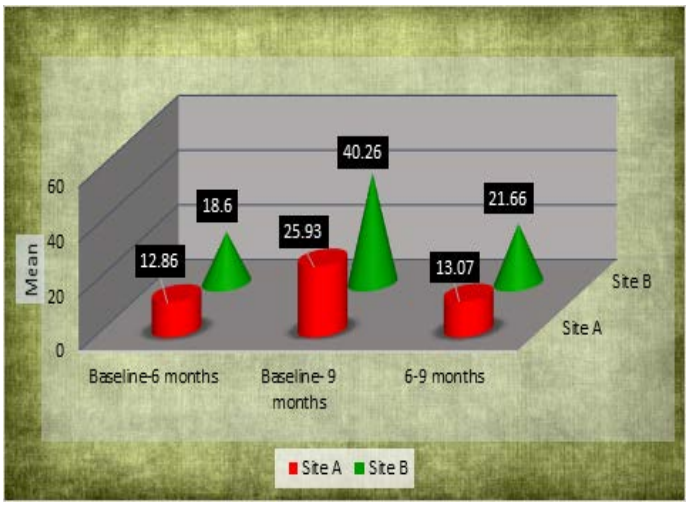
Graph 7: comparison of difference in mean gr between experimental site a and site b at different time intervals.



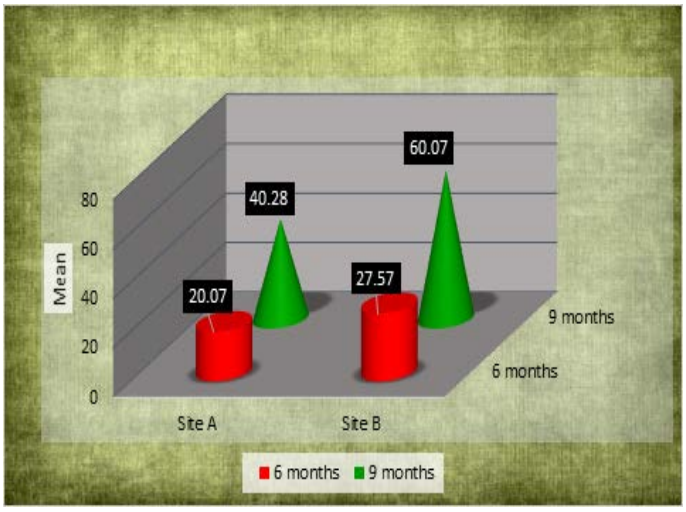
Graph 8: evaluation of df within experimental site a and experimental site b at different time intervals.



Graph 9: comparison of df between experimental site a and experimental site b at different time intervals.



Graph 10: evaluation of %df within experimental site a and experimental site b at different time intervals.



Graph 11: comparison of %df between experimental site a and experimental site b at different time intervals.

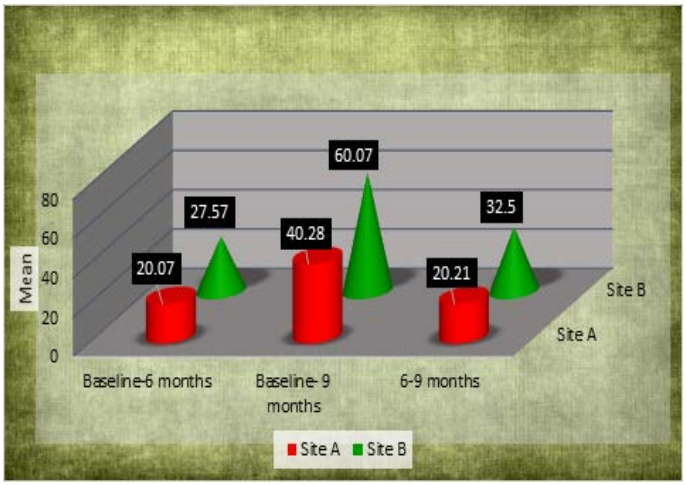


Table 1: comparison of plaque index (pi) and gingival index (gi) at baseline, 3 months, 6 months and 9 months intervals.

Parameter	Baseline	3 months	Mean difference	6 Months	Mean difference	9 months	Mean difference
PI	0.19 ± 0.09	0.29 ± 0.12	0.1 ± 0.03 (0.362, NS)	0.65 ± 0.27	0.46 ± 0.18 (0.569, NS)	0.91 ± 0.29	0.72 ± 0.2 (0.298, NS)
GI	0.74 ± 0.33	1.21 ± 0.22	0.47 ± 0.11 (0.576, NS)	1.30 ± 0.16	0.56 ± 0.17 (0.637, NS)	1.42 ± 0.19	0.68 ± 0.14 (0.354, NS)

Table 2: comparison of reduction in ppd between experimental site a and site b at different time intervals.

Time interval	Site	Mean ± Std. Deviation	Std. Error Mean	t-value	p value
Baseline – 3 months	Site A	1.00 ± 0.28	0.29	1.46	0.015 (S)
	Site B	2.53 ± 0.41	0.29		
Baseline – 6 months	Site A	1.27 ± 0.16	0.32	4.56	0.000 (HS)
	Site B	4.00 ± 0.65	0.22		
Baseline – 9 months	Site A	2.00 ± 0.28	0.29	5.43	0.000 (HS)
	Site B	4.73 ± 0.92	0.15		
6 months – 9 months	Site A	0.73 ± 0.45	0.12	0.00	1.00 (NS)
	Site B	0.73 ± 0.45	0.12		

Table 3: comparison of difference in ral between experimental site a and site b at different time intervals.

Time interval	Site	Mean ± Std. Deviation	Std. Error Mean	t-value	p value
Baseline – 3 months	Site A	1.00 ± 0.17	0.30	1.31	0.027 (S)
	Site B	2.53 ± 0.34	0.40		
Baseline – 6 months	Site A	1.26 ± 0.17	0.30	4.05	0.000 (HS)
	Site B	4.00 ± 0.57	0.34		
Baseline – 9 months	Site A	2.00 ± 0.17	0.30	4.40	0.000 (HS)
	Site B	4.73 ± 0.77	0.29		
6 months – 9 months	Site A	0.66 ± 0.48	0.12	-0.38	0.448 (NS)
	Site B	0.73 ± 0.45	0.11		

Table 4: comparison of difference of mean gr between experimental site a and site b at different time intervals

Time interval	Site	Mean ± Std. Deviation	Std. Error Mean	t-value	p value
Baseline – 3 months	Site A	1.2 ± 0.05	0.27	-0.745	0.67 (NS)
	Site B	0.87 ± 0.12	0.23		
Baseline – 6 months	Site A	1.2 ± 0.05	0.27	-0.557	0.79 (NS)
	Site B	0.87 ± 0.12	0.23		
Baseline – 9 months	Site A	1.27 ± 0.06	0.27	-0.745	0.56 (NS)
	Site B	0.93 ± 0.14	0.23		
6 months – 9 months	Site A	0.06 ± 0.25	0.06	0.00	1.00 (NS)
	Site B	0.06 ± 0.25	0.06		

Table 5: comparison of df between experimental site a and site b at different time intervals.

Time interval	Site	Mean ± Std. Deviation	Std. Error Mean	t-value	p value
Baseline – 6 months	Site A	12.86 ± 5.92	1.53	-2.50	0.018 (S)
	Site B	18.60 ± 6.57	1.69		
Baseline – 9 months	Site A	25.93 ± 12.01	3.10	-3.07	0.005 (S)
	Site B	40.26 ± 13.46	3.47		
6 months – 9 months	Site A	13.07 ± 6.09	1.58	-3.20	0.003 (S)
	Site B	21.66 ± 6.89	1.79		

Table 6: comparison of %df between experimental site a and site b at different time intervals

Time interval	Site	Mean ± Std. Deviation	Std. Error Mean	t-value	p value
Baseline – 6 months	Site A	20.07 ± 6.49	1.67	-3.55	0.001 (S)
	Site B	27.57 ± 4.97	1.28		
Baseline – 9 months	Site A	40.28 ± 11.65	3.00	-5.19	0.000 (HS)
	Site B	60.07 ± 9.03	2.33		
6 months – 9 months	Site A	20.21 ± 5.16	1.68	-4.986	0.000 (HS)
	Site B	32.50 ± 4.06	1.57		

S – Significant ($p < 0.05$)

NS – Non-significant ($p > 0.05$) HS – Highly significant ($p < 0.001$)

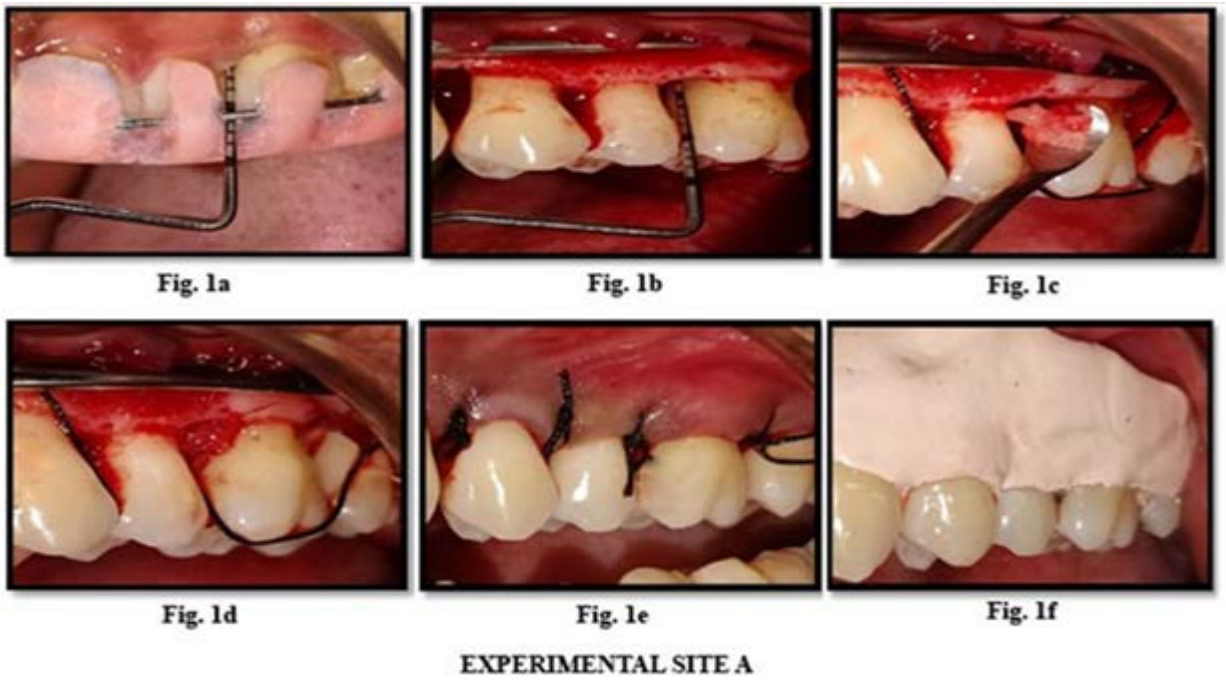


Fig. 1: experimental site a:

Fig. 1a- pre-operative measurement of PPD & RAL

Fig. 1b- Intrasurgical measurement

Fig. 1c- PRF being carried to the defect

Fig. 1d- PRF placed into the defect

Fig. 1e- Sutures placed

Fig. 1f- Coe-pak placed

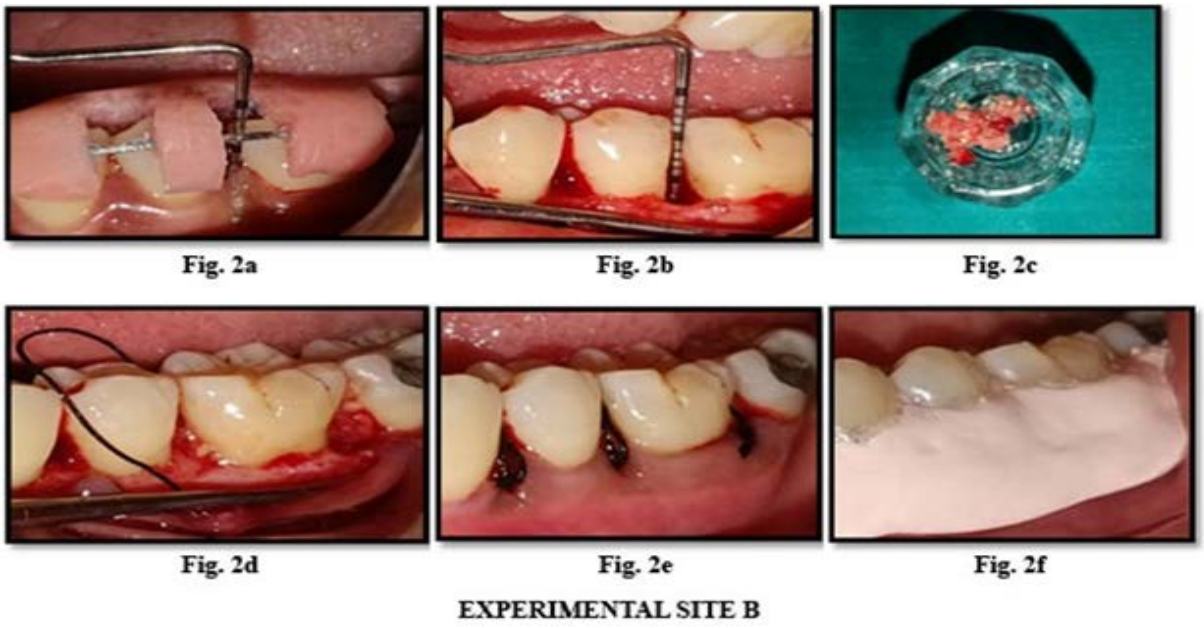


Fig. 2a Fig. 2b Fig. 2c

Fig. 2d Fig. 2e Fig. 2f

EXPERIMENTAL SITE B

Fig. 2: experimental site b:

Fig. 2a- pre-operative measurement of PPD and RAL

Fig. 2b- Intrasurgical measurement

Fig. 2c- PRF mixed with DFDBA

Fig. 2d- PRF plus DFDBA placed into the defect

Fig. 2e- Sutures placed

Fig. 2f- Coe-pak placed

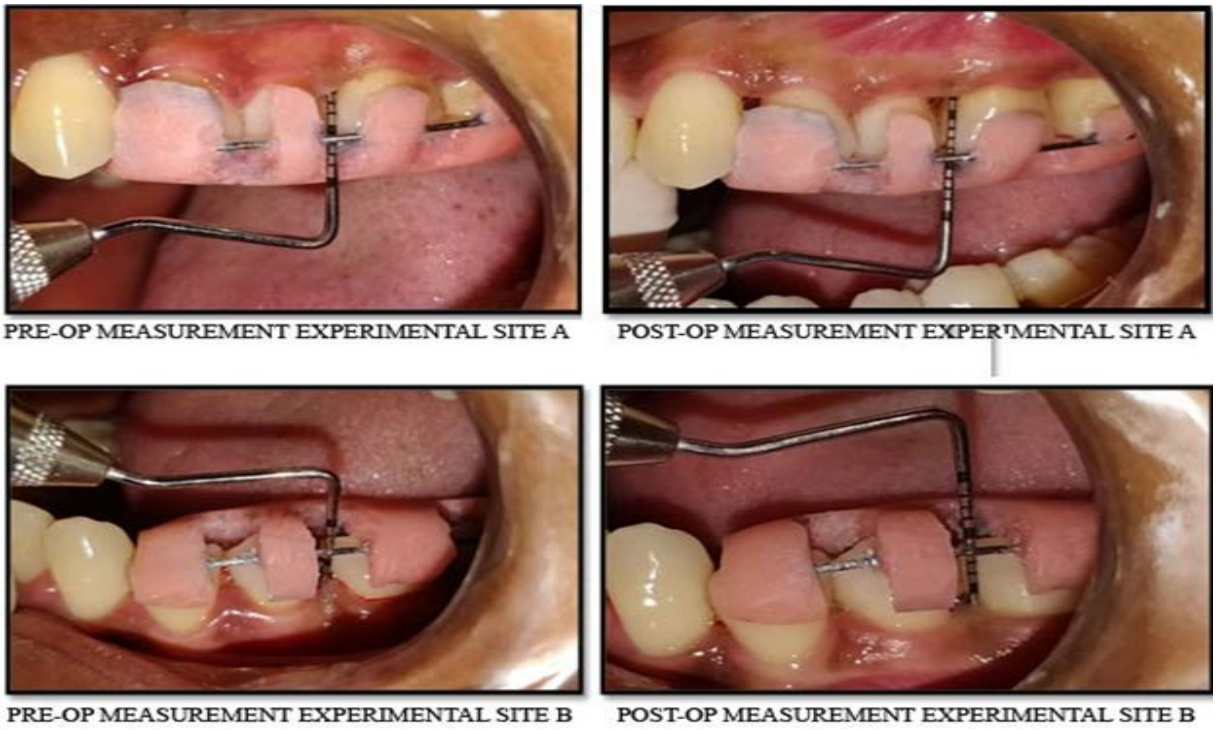


Fig. 3: Pre- & Post- measurements of Experimental Sites A & B.

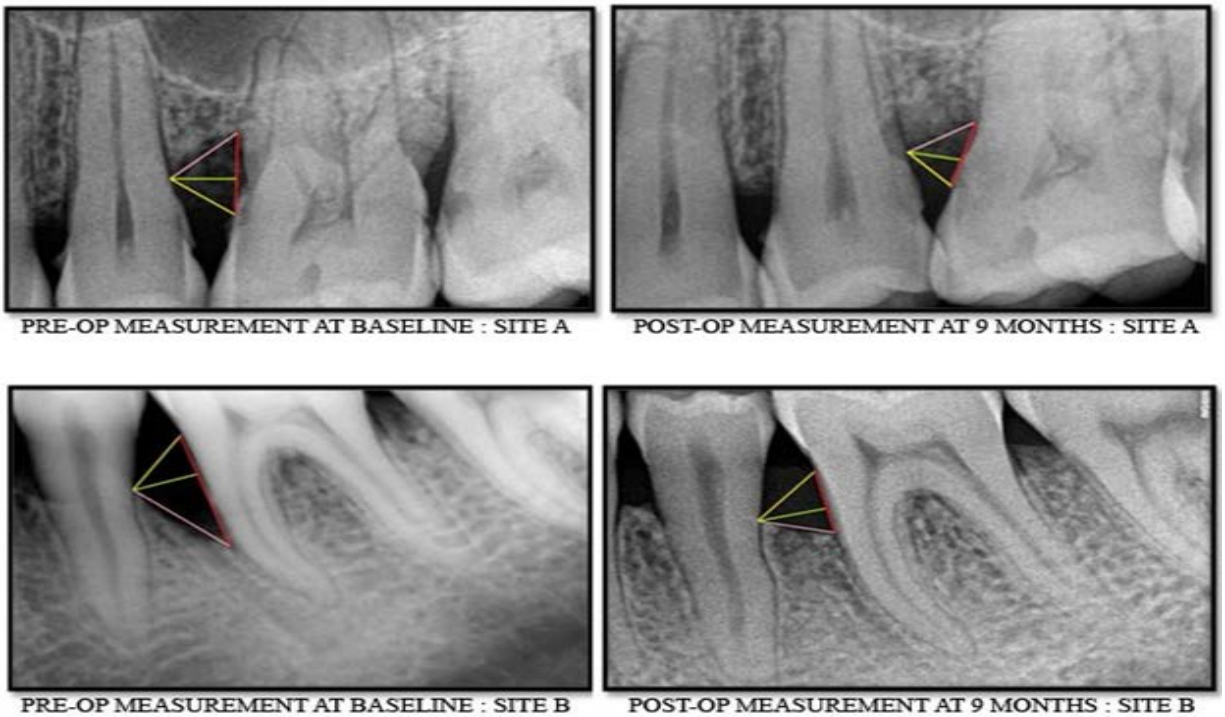


Fig. 4: Radiographic Pre- & Post- measurements of Experimental Sites A & B.