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CLINICAL AND CONE BEAM COMPUTED TOMOGRAPHY EVALUATION OF INTRABONY DEFECTS TREATED WITH PLATELET RICH FIBRIN IN COMBINATION WITH DEMINERALIZED FREEZE DRIED BONE ALLOGRAFT AND PLATELET RICH FIBRIN ALONE

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ABSTRACT

Loss of alveolar bone is one of the cardinal signs of periodontal diseases and can be evaluated clinically and radiographically. Various treatment modalities are used for restoring the structures of the lost periodontium. The purpose of the study was to compare and evaluate the efficacy of Platelet Rich Fibrin (PRF) in combination with Demineralized Freeze Dried Bone Allograft (DFDBA) and Platelet Rich Fibrin alone in the treatment of periodontal intrabony defects. It was a randomized, split mouth study in which 10 sites of intrabony defects were treated with PRF in combination with DFDBA and 10 sites with PRF alone. Clinical parameter and radiographic measurements by Cone Beam Computed Tomography (CBCT) were recorded at baseline and at 6 months post-operatively. Results demonstrated statistically significant improvement in sites treated with PRF and DFDBA compared to PRF alone. Within limits of the study it was concluded that a combination of PRF with DFDBA showed better results in relative attachment level gain and increased bone fill as compared to PRF alone in the treatment of periodontal intrabony defects.

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INTRODUCTION

Periodontitis is a disease of the periodontium which is characterized by the irreversible loss of connective tissue attachment and supporting alveolar bone (Pihlstrom et al, 2005). The ultimate goal of periodontal therapy is to regenerate the lost periodontal tissues (Schallhorn 1977). Demineralized Freeze Dried Bone Allograft (DFDBA) has been used for periodontal regeneration as it has osteoconductive and osteoinductive properties (Urist et al, 1965; Urist et al, 1989).

Researchers are focusing on understanding periodontal disease at the cellular, molecular and clinical level for arresting periodontal disease progression (Foster et al, 2005). Human platelets contain a wide range of proteins and growth factors that can promote tissue repair and regeneration (Anitua et al, 2013; Crovetti et al, 2004; Albanese et al, 2013; Del et al, 2012; Simonpieri et al, 2012; Sanchez et al, 2007; Wroblewski et al, 2010; Muto et al, 2013; Redler et al, 2011; Anitua et al, 2007). Hence the use of growth factors for periodontal regeneration is gaining popularity. Choukroun's PRF, which is a second-generation platelet concentrate (Dohan et al, 2006), is

defined as an autologous leukocyte and PRF biomaterial (Dohan et al, 2009; Dohan et al, 2006 a,b). Choukroun et al, developed platelet rich fibrin (PRF) in 2001 at France (Choukroun et al, 2001). PRF has been proved to be rich in growth factors and has shown favorable effects on periodontal regeneration (Howell et al, 1997).

The aim of this study was to compare the efficacy of Platelet Rich Fibrin in combination with demineralized freeze dried bone allograft and platelet rich fibrin alone in the treatment of periodontal intrabony defects as evaluated by changes in relative attachment level, horizontal and vertical dimensions of the defects using Cone beam computed tomography (CBCT).

MATERIALS AND METHODS

It was a randomized, split-mouth, comparative, clinical study and evaluated twenty sites of intrabony defects in ten patients diagnosed with chronic periodontitis of age group 25 to 55 years. The inclusion criteria were the presence of intrabony defects in at least two quadrants of mouth as determined by radiographic observations and clinical probing depth of at least 6 mm after phase I therapy at the intrabony defects sites.

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Patients with any systemic diseases or who were on anticoagulation treatment, pregnant women, lactating mothers, smoker, alcoholic, unacceptable oral hygiene following phase I therapy or with presence of any soft tissue defect at the site of intrabony defects were excluded. Written informed consent from the patients were obtained.

Random allocation of the selected intrabony defect sites were done via a coin toss in front of an independent observer. Intrabony defect sites which were treated with PRF in combination with DFDBA were considered as group A and sites which were treated with PRF alone were considered as group B. Relative attachment level of the selected sites were recorded at baseline before surgery (Figure 1a. 2a) and at six months post-operatively (Figure 1d. 2d). Radiographic assessment of intrabony defect were recorded by Cone beam computed tomography (CBCT) images. The vertical defect were measured from the cemento-enamel junction of the tooth associated with intrabony defect to the apical extension of the defect wall and the horizontal defect were measured from the crest of the defect wall to the lateral surface of the tooth associated with intrabony defect. The measurements of CBCT images (in millimetres) were recorded in sagittal section views for vertical defect (Figure 3a. 4a.), for horizontal defect (Figure 3b. 4b.) and in coronal section view (Figure 5a. 6a.) at baseline before surgery and in sagittal section views for vertical defect (Figure 3c. 4c.), for horizontal defect (Figure 3d. 4d.) and coronal section view (Figure 5b. 6b.) at 6 months post-operatively.

The Modified Flap Operation (Kirkland 1931) was chosen as the flap of choice and a full thickness mucoperiosteal flap was reflected till the exposure of base of the osseous defect. Then a thorough surgical debridement and root planing was performed (Figure 1b. 2b.). The PRF was prepared by following the protocol developed by Choukroun et al (Choukroun et al, 2000). Platelet Rich Fibrin was mixed with DFDBA of particle size 500-1040micron (Tata memorial hospital tissue bank, Mumbai. To avoid any inter batch variation, required quantity of DFDBA for complete study was obtained from a single batch of preparation). This mixed mass was properly condensed into the defect site for group A (Figure 1c.). For group B, PRF alone was packed in the intrabony defect (Figure 2c.). Flaps were adapted back to their original position and suturing were done using 3-0 silk sutures. A periodontal dressing (Coe-pack) was applied to the surgical sites. Postsurgical instructions were given and patients were re-called after 8 days for removal of periodontal dressing and sutures. Relative attachment level and radiographic evaluation were recorded similar to baseline evaluation after 6 months postoperatively.

Statistical analysis

The statistical significance of difference of categorical variables across two study groups is tested using Chi-Square test. The statistical significance of inter-group difference of mean of continuous variables is tested using independent sample 't' (unpaired Student's 't' test) test. The underlying normality assumption was confirmed before subjecting the variables to t test for statistical comparison.

RESULTS

The mean post-operative percentage change in relative attachment level is significantly higher in group A compared to group B (Table 1).

The mean post-operative percentage change at mesial level, lingual or palatal level of defect are significantly reduced in group A compared to group B and at distal level, buccal level of defect did not differ significantly between group A and group B. The mean post-operative percentage change in CBCT measurement at the horizontal level of defect did not differ significantly between group A and group B at 6 months post-operatively. (Table 2).

Table 1 Inter-group comparison of Relative attachment level (n = 20)

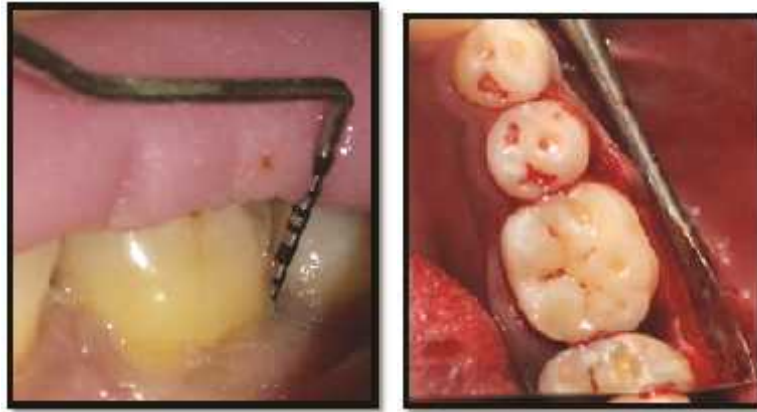
Relative attachment level (mm)	Group A [Site 1] (n=10)		Group B [Site 2] (n=10)		P-value [Inter-Group] (Group A vs Group B)
	Mean	SD	Mean	SD	
Baseline	12.90	1.29	12.80	1.62	0.880 (Non-Significant)
Post-operative	9.80	1.87	11.20	1.81	0.107 (Non-Significant)
% Change at Post-op	24.00%	--	12.58%	--	0.024 (Significant)

Table 2 Inter-group comparison of CBCT Measurements (n = 20)

Bone Height Measurements (mm)	Site	Group A [Site 1] (n=10)		Group B [Site 2] (n=10)		P-value [Inter-Group] (Group A v Group B)
		Mean	SD	Mean	SD	
Mesial	Baseline	5.26	1.18	5.64	2.29	0.647 (Non-Significant)
	Post-op	4.58	0.99	5.39	2.29	0.317 (Non-Significant)
	% Change	12.14%	--	4.99%	--	0.041 (Significant)
Distal	Baseline	3.93	1.24	4.57	1.66	0.343 (Non-Significant)
	Post-op	3.47	1.26	3.95	1.96	0.522 (Non-Significant)
	% Change	11.78%	--	12.31%	--	0.952 (Non-Significant)
Buccal	Baseline	4.14	2.61	6.30	3.95	0.166 (Non-Significant)
	Post-op	3.78	2.50	5.15	3.55	0.334 (Non-Significant)
	% Change	9.38%	--	12.07%	--	0.752 (Non-Significant)
Lingual	Baseline	3.13	1.20	4.46	1.83	0.070 (Non-Significant)
	Post-op	2.74	1.08	4.34	1.89	0.033 (Significant)
	% Change	13.08%	--	3.84%	--	0.003 (Significant)
Horizontal	Baseline	2.30	1.02	2.71	0.62	0.291 (Non-Significant)
	Post-op	1.88	0.60	2.25	0.64	0.039 (Significant)
	% Change	18.97%	--	15.56%	--	0.593 (Non-Significant)

DISCUSSION

The aim of periodontal therapy is to arrest and control the periodontal infection and ultimately to regenerate lost periodontal structures (Wang et al, 2001). Regeneration of lost periodontal tissues has been a challenge and is a major area of interest in periodontal research. The goal of complete periodontal regeneration needs to be approached from a basic biological perspective (Polson, 1994). PRF is an autologous biomaterial (Dohan et al, 2009) which has high concentrations of growth factors. Growth factors are a class of natural biologic mediators which have potential to regulate cell proliferation, chemotaxis, differentiation, and matrix synthesis via binding to specific cell surface receptors during tissue regeneration (De Obarrio et al, 2000). It also acts as a scaffold where the progenitor/stem cells from neighboring tissues can be recruited in the site where periodontal regeneration is desired (Cochran et al, 1999).



a. Pre-operative Relative attachment level b. Debridement of site



c. Placement of PRF with DFDBA d. Post-operative Relative attachment level

Figure 1 Group A (Flap Surgery with placement of PRF with DFDBA)



a. Pre-operative Relative attachment level. b. Debridement of site



c. Placement of PRF d. Post-operative Relative attachment level.

Figure 2 Group B (Flap Surgery with placement of PRF alone)

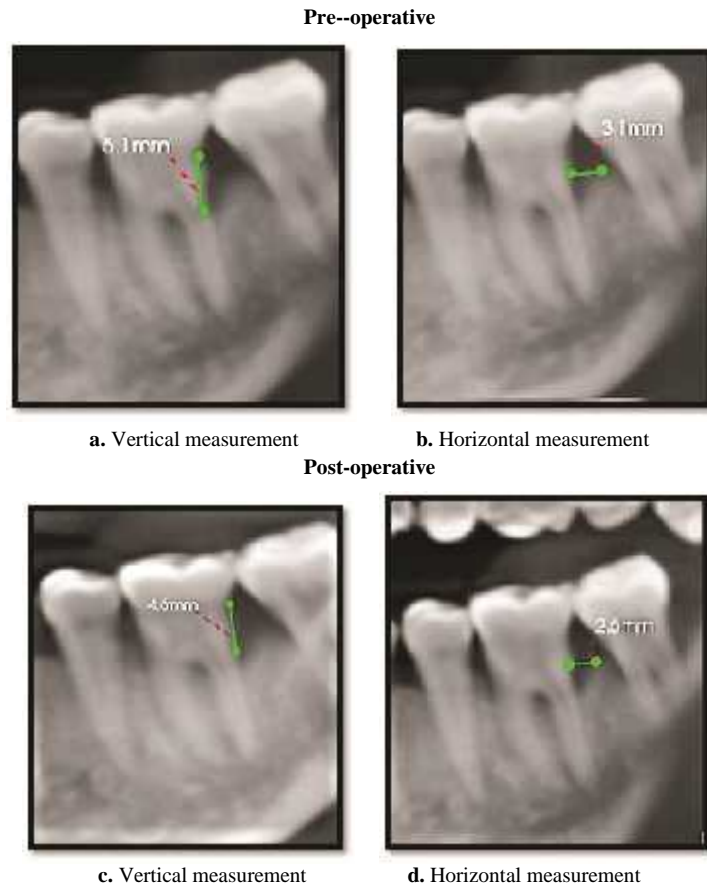


Figure 3 CBCT measurements of Sagittal section views of Group A

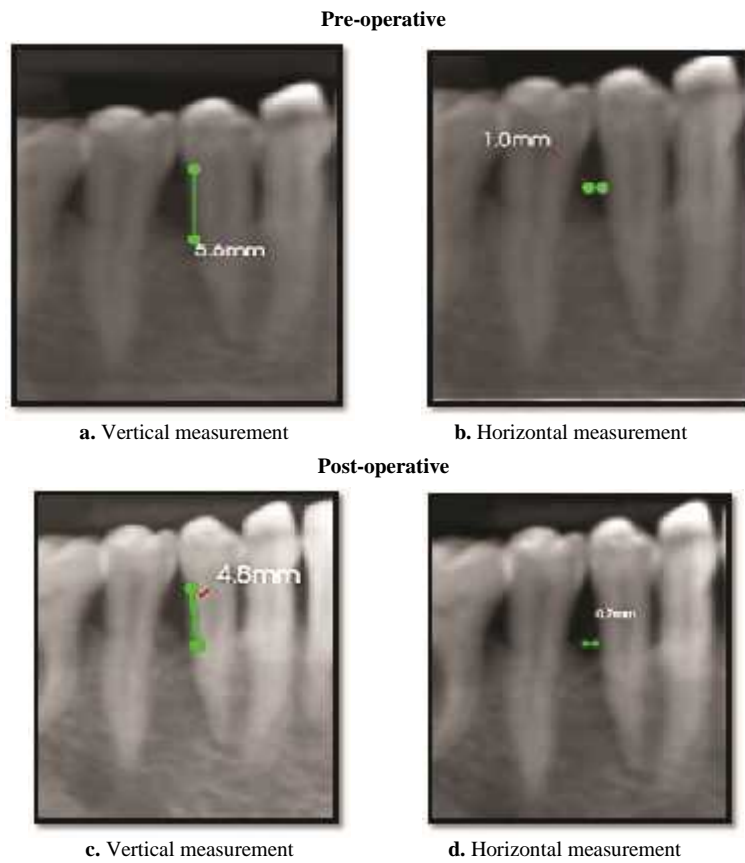


Figure 4 CBCT measurements of Sagittal section views of Group B

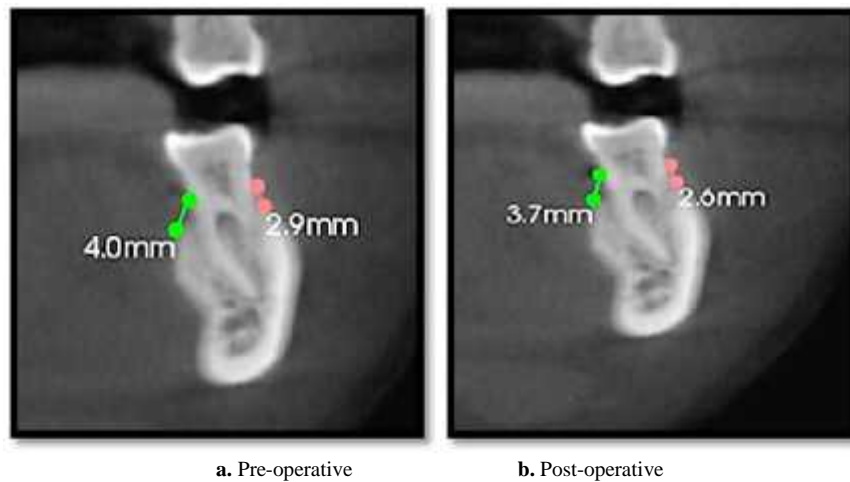


Figure 5 CBCT measurements of Coronal section views of Group A

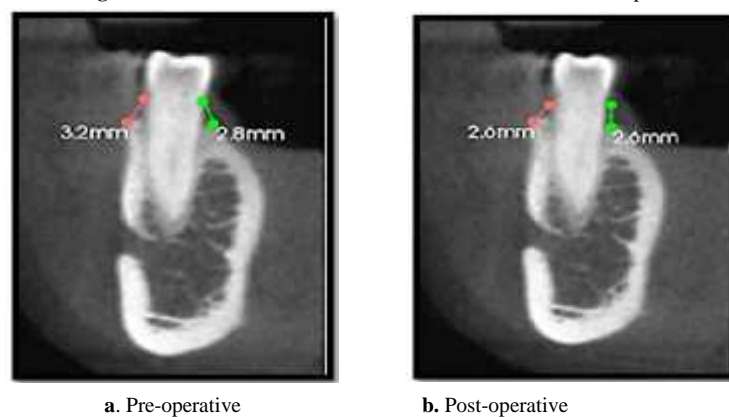


Figure 6 CBCT measurements of Coronal section views of Group B

PRF has also been shown to stimulate the growth of osteoblasts and periodontal ligament cells, both of which are significant for the regeneration of periodontal defects (Thorat *et al*, 2011). DFDBA induces the host undifferentiated mesenchymal cells to differentiate into osteoblasts resulting in the new bone formation (Mellonig *et al*, 1981; Kanakamedala *et al*, 2009).

In the present study, PRF with DFDBA demonstrated statistically significant gain in relative attachment level compared to PRF alone in the treatment of periodontal intrabony defects. Various studies that have also shown a beneficial effect of PRF with DFDBA (Pradeep *et al*, 2012; Yo-chao *et al*, 2011; Reynolds 2003). In this study to determine the topography of intrabony defects an advanced diagnostic imaging technique, CBCT was used. In the CBCT images, there was improved results with defect fill in PRF with DFDBA group compared to PRF alone group at six months postoperatively. This may be attributed to the combined effects of DFDBA and PRF. Within the limitations of the study it can be concluded that the combination of DFDBA with PRF demonstrated better results in treatment of intrabony defects as compared to use of PRF alone. However, further studies with larger sample sizes, longer follow up periods need to be conducted with histological evaluation of new attachment to derive to conclusive evidence.

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