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HUMAN RANDOMIZED CONTROLLED TRIAL

Clinical and radiographic evaluation and comparison of bioactive bone alloplast morsels when used alone and in combination with platelet-rich fibrin in the treatment of periodontal intrabony defects—A randomized controlled trial

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Abstract

Background: The present study aims to evaluate and compare the clinical and radiographic changes obtained through Bioactive Glass (BG) with and without autologous platelet-rich fibrin (PRF) in the treatment of intrabony defects in chronic periodontitis patients.

Methods: The present study was a split-mouth randomized controlled clinical trial comprising 20 chronic periodontitis patients (mean age: 35.9 years) having at least one pair of bilateral intrabony defect. Group 1 included 20 sites treated with a combination of BG and autologous PRF whereas 20 sites in Group 2 were treated with BG alone. Probing pocket depth (PPD), clinical attachment level (CAL) and gingival recession (GR) were evaluated at 3 and 6 months and bone fill at 6 months by using cone beam computed tomography (CBCT) analysis. Primary study outcomes were changes in PPD, CAL, GR, and bone fill.

Results: CAL gain was greater in Group 1 (5.05 ± 1.09 mm) when compared with Group 2 (4.2 ± 1.70 mm). Furthermore, a significantly greater bone fill was found in Group 1. At 6 months, statistically significant reduction in PPD in Group 1 and Group 2 was evident.

Conclusion: BG morsel when used in combination with PRF is found to be more effective in gain in CAL, reduction in PPD and achieving greater bone fill as compared with treatment with BG alone in periodontal intrabony defects and is indicative of enhanced periodontal regeneration.

KEYWORDS

bioactive glass, bone grafts, bony defects, cone beam computed tomography, periodontal regeneration

1 | INTRODUCTION

Chronic periodontitis is characterized by loss of clinical attachment caused by the destruction of the periodontal ligament and loss of the adjacent supporting bone.[1] The goals of periodontal therapy are to alter or eliminate the microbial etiology and the contributing risk factors, thereby preserving the dentition in a state of health, comfort, and function with appropriate esthetics. It also aims for regeneration of the lost periodontal attachment apparatus, whenever indicated.[1] Different bone grafts and their synthetic substitutes have been developed and tested for regeneration but only autogenous

bone grafts are considered to be truly osteogenic.[2] Despite laudable record, autografts have been questioned for surgical invasiveness, donor site morbidity, limited quantity of donor material and increased operating time for harvesting procedures.[3] Allografts like demineralized freeze-dried bone allograft (DFDBA) have been found to have efficacious benefits preferably when combination therapy [DFDBA + GTR(guided tissue regeneration)] has been used.[4] BG(45S5) is a glass ceramic crystalline composite material composed of oxides of silicon, sodium, calcium, and phosphorous in a silica base. In the presence of body fluids, BG (45S5) have shown the capability of bonding to both hard and soft tissues through cross-links with sites on the calcium phosphate (CaP) and Silica (Si) layer formed through a series of ion exchange reaction.[5,6] New generation bioglass (NovaBone® Dental Morsels, NovaBone Products, Alachua, FL) material is composed of minerals that occur naturally in the body (SiO_2, Ca. Na_2O, H and P) and the molecular proportions of the calcium and phosphorous oxides are similar those in the bones.

Polypeptide growth factors regulate cell proliferation, chemotaxis and differentiation along with a positive potential application in periodontal wound healing.[7] Second generation platelet concentrate, platelet-rich fibrin (PRF) introduced by Choukroun et al. has shown to concentrate almost all platelets and growth factors of the blood harvest.[8] The biologic activity of PRF as a scaffold for proliferation and differentiation of osteoblasts and gingival fibroblasts has been demonstrated.[9,10] Studies have shown the efficacious benefits of bioactive glass in the treatment of periodontal defects and the ability of PRF to have enhanced regeneration of compromised tissue with other bone substitutes.[11,12] Limited data exists about the efficacy of new generation of 45S5 BG morsels (NovaBone® Dental Morsels, NovaBone Products, Alachua, Fla) in terms of regenerative capacity for the treatment of intrabony defects and its potential effects in combination with PRF.[13,14] Evidence of reconstruction by Cone beam computed tomography (CBCT) is one of the latest methods of evaluation, which obviates the need for re-entry enabling comprehensive assessment of periodontal defects when compared with traditional radiography.[15] Currently, there are sparse studies in the literature that have used CBCT for evaluation of regeneration. The present study was planned for clinical and radiographic evaluation and comparison of BG alone and BG+PRF when used in the treatment of periodontal intrabony defects with respect to changes in scores of probing pocket depth (PPD), clinical attachment level (CAL), gingival recession (GR), and bone fill as seen on CBCT. The hypothesis being tested in the study was that PRF would induce and augment the regenerative effects BG in human intrabony defect.

2 | MATERIALS AND METHODS

Twenty Caucasian patients (9 females and 11 males) having chronic periodontitis as classified on the basis of the 1999 consensus classification of periodontal disease,[16] with a mean age of 35.9 years (range 27 to 45 years) were recruited from those visiting the Department of Periodontics and Implantology (Figure 1).[17] The study was conducted from February 2015 to September 2017. The study population included 20 pairs of intrabony defects in which 16 pairs of defects were from mandibular and 4 pairs from maxillary multirooted teeth. Intrabony defects in relation to multirooted teeth (molars only) were specifically selected in this clinical trial to maintain the similarity in defect morphology. The study was approved by the Institutional Ethics Committee of Vidya Shikshan Prasarak Mandal's Dental College & Research Centre (IEC/VSPMDCRC/19/2015) and was conducted in accordance with the Helsinki declaration of 1975, as revised in 2013. All patients received verbal information regarding participation and written informed consent was obtained for their participation in the study. (Clinical Trials Registry – India, CTRI/2017/02/007796)

2.1 | Sample size

The sample size to ensure adequate power for this study was calculated based on the results of the study by Zamet JS et al. (1997),[18] and Power analysis was performed. The data for the quantity of patients and defects resulted in an effect size of 0.7. A sample size of 20 patients was needed to achieve the stringent effect, with 90% power and 95% confidence level.

2.2 | Intraexaminer calibration

Single operator (AK) performed all the surgeries. Presurgically, single examiner (RK) evaluated 5 pairs of intrabony defect for clinical parameters and another single examiner (GB) evaluated 5 pairs of intrabony defect for radiographic parameters on CBCT twice, 48 hours apart. Both the examiners were blinded to the study groups. Intraexaminer calibration in the measurements of clinical and radiographic parameters was evaluated by Kappa value and significance test before and after treatment in the study groups. Calibration was accepted if $\geq$ 90% of the recordings could be reproduced within a one mm difference.

The inclusion criteria were the presence of at least one pair of similar bilateral intrabony defect that was $\geq$ 3 mm deep as identified on a diagnostic intraoral periapical radiograph [IOPA] along with an interproximal probing pocket depth (PPD) $\geq$5 mm after phase 1 therapy in an asymptomatic tooth and plaque score $\leq$ 1.[19] Osseous defects needed to have

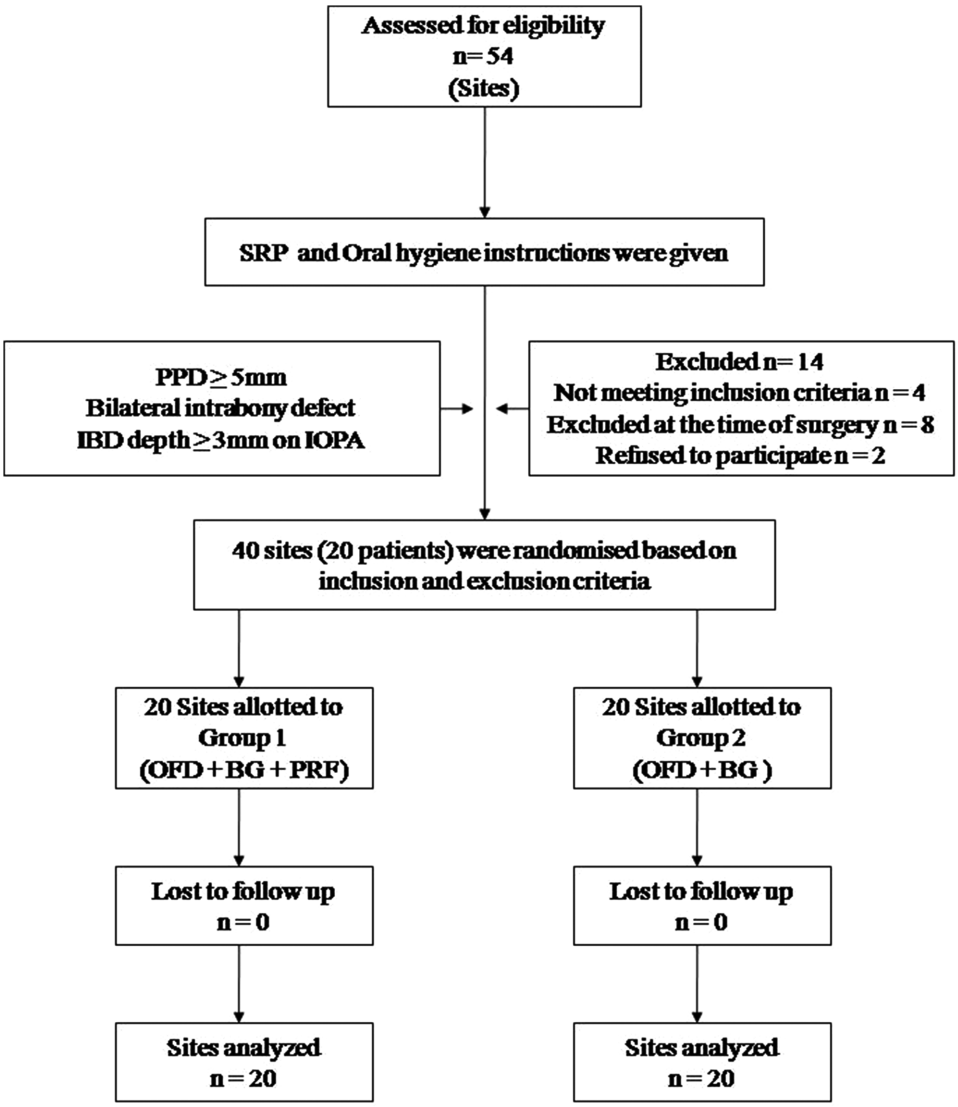

FIGURE 1 Consolidated Standards of Reporting Trials (CONSORT) flowchart

two or three walls; one wall defect and craters were excluded. Although all the defects included were interproximal intrabony defects in relation to multirooted teeth, there were some cases in which Grade I furcations or in some cases Grade II furcation defects were present in the patients. Patients with aggressive periodontitis with known systemic illness, allergies and taking any medications known to affect the outcomes of periodontal therapy, an insufficient platelet count ($< 200{,}000/mm^3$), pregnancy or lactation, and smokers were excluded from the study.

2.3 | Presurgical therapy

Each patient was subjected to presurgical hygiene therapy consisting of a session of oral hygiene instructions, full mouth supra and subgingival scaling, and root planing. Six weeks after phase 1 therapy the patients were re-evaluated to assess the plaque control and overall oral hygiene.

2.4 | Clinical and radiographic measurements

After the phase 1 therapy, for evaluation of oral hygiene and gingival health, Plaque index (PI)[19] and Gingival index (GI)[20] were obtained at baseline, 3 and 6 months. Soft tissue measurements were determined to the nearest millimeter mark by using periodontal probe (University of North Carolina 15, Hu-Friedy®, Chicago, IL) from the cementoenamel junction (CEJ) to free gingival margin (FGM) for gingival recession (GR) and from the CEJ to the base of periodontal pocket for clinical attachment level (CAL), from FGM to base of periodontal pocket for PPD. Custom made occlusal acrylic stents with grooves were used to standardize the probe angulation and position. The intrabony defect sites were investigated with CBCT (KODAK 9000C 3D Extraoral Imaging System, Carestream Health, Inc, France) at baseline and 6 months postoperatively. The CBCT analysis included the measurement of bone defect height [CEJ –BD (base of the defect)], level of

alveolar crest [CEJ –AC (alveolar crest)], bone defect depth (AC-BD) and the mesiodistal (MD) and buccolingual (BL) bone defect width. The landmark of the base of the defect was the lowest discontinuous point of the periodontal ligament. A line perpendicular from the AC to the root surface was drawn. The intersection point across the root surface was AC' (Figure 3I).

Intrabony defect (IBD) depth: The distance from the point AC' to the base of the defect (AC'-BD). MD width of the intrabony defect (AC-AC'): The distance from the point AC' to the alveolar crest (AC). BL width of the defect was measured, the innermost and the most coronal point for the buccal and lingual alveolar crest were chosen on the axial plane, and the horizontal distance of the two points was measured. 1.00 mm incremental slice thickness was used in the present investigation as smaller slices decreased the image resolution. In oblique view X, Y, and Z axes were sequentially analyzed to locate the most apical point of the BD or the most coronal aspect of the defect-associated AC. All clinical and radiographic measurements were made by single examiners (RK) and (GB) respectively.

2.5 | PRF preparation

The PRF was prepared following the protocol developed by Choukroun et al.[8] 10 ml venous blood was collected (by venipuncture of the antecubital vein) in sterile tubes without anticoagulant and immediately centrifuged in centrifugation machine (REMI® Laboratories, India) at 3000 rpm for 10 minutes, after which the following 3 layers were formed-top layer of straw-colored acellular plasma, middle layer of PRF and a bottom layer containing red blood cells (RBC). The PRF was easily separated from the red corpuscle base preserving a small red blood cell layer using sterile tweezers and scissors.

2.6 | Surgical procedure

The selected sites were assigned randomly (by flipping coin) to Group 1 or Group 2. The Group 1 sites on one side were treated with a combination of BG and autologous PRF after open flap debridement (OFD), whereas Group 2 sites on contralateral side were treated with BG alone after OFD. For intraoral asepsis, patients were asked to perform 0.12% chlorhexidine digluconate rinses. The surgical procedure involved placing sulcular incision in the periodontal pocket as close as possible to the tooth surface with the deepest point being the alveolar crest. Such an incision enabled repositioning of the gingival margin at the presurgical level. A parapapillary incision from the line angle of the concerned tooth to the line angle of the adjacent tooth on the lingual aspect without incising the interdental papilla was adopted. The parapapillary incision is aimed to retain the interdental papilla unlike the sulcular incision, where interdental papilla is dessected. The interdental papilla is retained which allowed the proper coverage and closure of the defect area. It provides a better healing and esthetics and is especially indicated in regenerative procedures. This incision design also helps in adequate coverage of interpositional PRF membrane.[21]

For Group 1, BG morsels were mixed with few drops of top layer of straw colored acellular plasma from the test tube and placed in small increments in the defect site. Care was taken not to overfill and avoid excessive condensation of the graft material. PRF was placed in the defect site after graft placement. Immediately after placing PRF the reflected flap was then positioned back to the original level and sutured. Primary closure was accomplished at the surgical site using 3-0 silk (3-0 Mersilk suture, Alsilk, Aalay Surgicals Pvt. Ltd., India) with interrupted loop sutures and periodontal dressing (COE-PAK™, GC) was placed (Figures 2A through 2E). For Group 2, the sites received the same treatment without placement of the PRF (Figures 2F through 2I). Postoperatively, the patients were prescribed with nonsteroidal anti-inflammatory medication and systemic antibiotics. Sutures were removed after 7 days. Soft-tissue evaluations were performed with acrylic stents after 3 and 6 months post surgery. For the hard tissue re-evaluation, a second CBCT of the same study site was carried out, and the intrabony defect measurement was reassessed after 6 months.

2.7 | Statistical analyses

Statistical software STATA version 14.0 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP) was used for statistical analysis. All clinical parameters were presented as Mean ± standard deviation. Pl, GI, PPD and CAL were compared at different time interval by performing one-way repeated measure analysis of variance (ANOVA). Multiple comparison test (Bonferroni test) was performed to compare mean difference between 2 time intervals. Change in these clinical parameters at 3 months and 6 months from baseline between 2 groups were compared by performing Wilcoxon rank sum test for non-normalized data. Comparison of CEJ-BD, CEJ-AC, AC-BD, MD and BL by CBCT between baseline and 6 months was done by performing paired t-test for normalized data. Mean change at 6 months from baseline between 2 groups were compared by performing Wilcoxon rank sum test. All the test were two- sided. $P < 0.05$ was considered as statistical significance.

3 | RESULTS

Primary outcome variables were bone fill and changes in CAL. During the course of the study, wound healing was uneventful in both groups, without any signs of infections

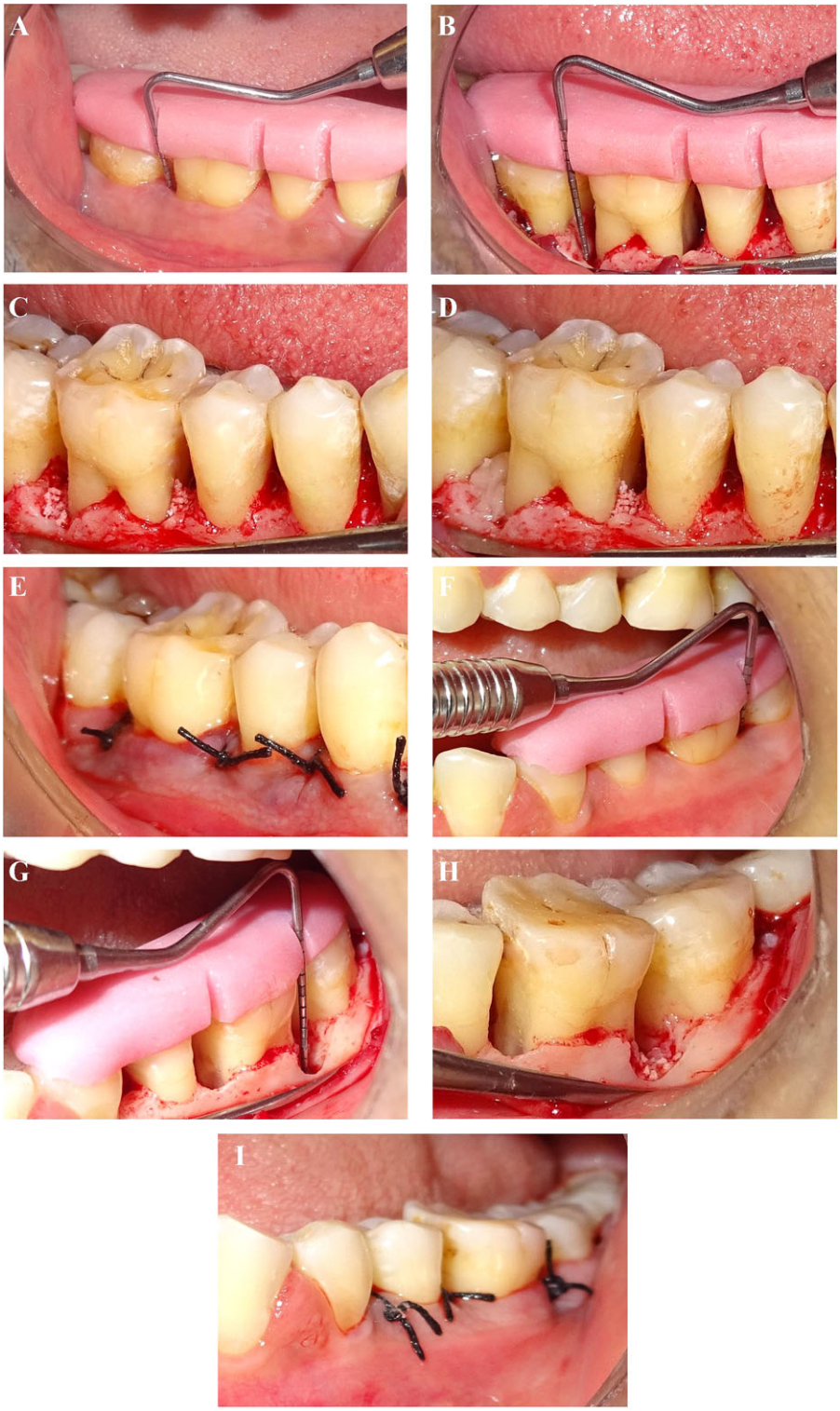

FIGURE 2 Clinical pictures of Group 1- **A**. Vertical probing pocket depth presurgically. **B**. Vertical probing of intrabony defect after flap reflection. **C**. Placement of BG morsels. **D**. Placement of PRF after BG morsels. **E**. Flap sutured back. Clinical pictures of Group 2 – **F**. Vertical probing pocket depth presurgically. **G**. Vertical probing of intrabony defect after flap reflection. **H**. Placement of BG morsels. **I**. Flap sutured back

or complications. For intra-examiner calibration intraobserver agreement of 1 was seen which indicates perfect agreement at both intervals. At 6 months, the mean PPD reduction was 5.75 ± 1.16 mm for Group 1 and 5.65 ± 1.66 mm for Group 2. There was a statistically significant reduction in PPD for both the groups at 6 months when compared with baseline. The mean CAL gain at 6 months in Group 1 was 5.05 ± 1.09 mm and in Group 2 was 4.2 ± 1.70 mm. There was statistically

TABLE 1 Intra-group comparison of measurements of clinical parameters (mean value ± SD) at baseline 3 months and 6 months (in mm)

	Group 1		Group 2	
Parameters	**Mean ± SD**	***p* value**	**Mean ± SD**	***p* value**
PPD (in mm)				
Baseline	8.75 ± 1.44	<0.001[a]	9.05 ± 1.76	<0.001[a]
3 months	3.5 ± 0.60		4.1 ± 0.55	
Baseline	8.75 ± 1.44	<0.001[a]	9.05 ± 1.76	<0.001[a]
6 Months	3.0 ± 0.56		3.4 ± 0.50	
CAL (in mm)				
Baseline	9.25 ± 1.37	<0.001[a]	9.95 ± 2.30	<0.001[a]
3 months	4.6 ± 0.94		6.15 ± 1.42	
Baseline	9.25 ± 1.37	<0.001[a]	9.95 ± 2.30	<0.001[a]
6 Months	4.2 ± 0.76		5.75 ± 1.16	
GR (in mm)				
Baseline	0.45 ± 0.51	0.004[a]	0.90 ± 1.16	0.0032[a]
3 months	1.1 ± 0.55		2.05 ± 1.14	
Baseline	0.45 ± 0.51	<0.001[a]	0.90 ± 1.16	0.002[a]
6 Months	1.2 ± 0.52		2.35 ± 1.03	

[a]Statistically significant difference at $p < 0.05$.

significant CAL gain for Group 1 and Group 2 at 6 months when compared with baseline and a statistically significant CAL gain at 3 months and 6 months in Group 1 when compared with Group 2. At 6 months the mean increase of gingival recession in Group 1 was 0.80 ± 0.61 mm and in Group 2 was 1.95 ± 1.09 mm which was statistically significant when compared with baseline. There was a statistically significant increase in gingival recession in Group 2 at 6 months when compared with Group 1 (Tables 1 and 3).

3.1 | CBCT analysis of intrabony defect parameters

3.1.1 | Intrabony defect depth (AC-BD)

The difference in the measurement values of AC-BD at baseline and 6 months denotes the reduction in IBD depth. There was a highly significant defect depth reduction of 3.51 ± 1.17 mm and 2.56 ± 0.95 mm for Group 1 and Group 2 respectively. When compared between the two groups it was significantly higher in Group 1 as compared with Group 2 (Tables 2 and 3) (Figures 3A, 3B, 3E, 3F)

3.1.2 | Mesiodistal width (MD)

There was a highly significant MD dimension reduction of bone defect in both the groups. When the reduction at 6 months was compared between the two groups it was significantly higher in Group 1 as compared with Group 2 (Tables 2 and 3) (Figures 3A, 3B, 3E, 3F).

3.1.3 | Buccolingual width (BL)

There was a highly significant BL dimension reduction of bone defect in both the groups. When the reduction at 6 months was compared between the two groups it was significantly higher in Group 1 as compared with Group 2 (Tables 2 and 3) (Figures 3C, 3D, 3G, 3H).

3.1.4 | Height of intrabony defect (CEJ-BD)

The difference in the measurement values of CEJ–BD at baseline and 6 months denotes the bone fill. At 6 months the mean CEJ–BD exhibited a reduction indicating a bone fill of 3.30 ± 1.10 mm and 2.49 ± 0.99 mm for Group 1 and Group 2 respectively. Bone fill was significantly higher for Group 1 when compared with Group 2 (Tables 2 and 3) (Figures 3A, 3B, 3E, 3F).

3.1.5 | Level of alveolar crest (CEJ-AC)

The difference in the measurement values of CEJ–AC at baseline and 6 months denotes the change in the level of alveolar crest. Mean values at 6 months showed a statistically significant increase of 0.13 ± 0.22 mm and 0.33 ± 0.37 mm for Group 1 and Group 2 respectively compared with baseline, exhibiting the alveolar crest resorption (Table 2 and 3) (Figures 3A, 3B, 3E, 3F).

4 | DISCUSSION

Periodontal regeneration can be defined as the complete restoration of lost tissues to their original architecture and

TABLE 2 Intragroup comparison of measurements of radiographic parameters (mean value ± SD) at baseline and 6 months (in mm)

	Group 1		Group 2	
Parameters	**Mean ± SD**	***p* Value**	**Mean ± SD**	***p* Value**
CEJ-BD (in mm)				
Baseline	10.09 ± 2.16	<0.001[a]	11.16 ± 2.39	<0.001[a]
6 Months	6.79 ± 1.92		8.66 ± 2.23	
CEJ-AC (in mm)				
Baseline	4.24 ± 1.32	0.0179[a]	4.49 ± 1.44	<0.0001[a]
6 Months	4.37 ± 1.37		4.83 ±1.38	
AC-BD (in mm)				
Baseline	5.85 ± 1.64	<0.0001[a]	6.66 ± 1.71	<0.0001[a]
6 Months	2.34 ± 0.99		4.1 ± 1.65	
MD (in mm)				
Baseline	2.69 ± 0.81	<0.0001[a]	2.91 ± 0.80	<0.0001[a]
6 Months	1.99 ± 0.68		2.45 ± 0.77	
BL (in mm)				
Baseline	5.95 ± 1.48	<0.0001[a]	4.87 ± 1.63	<0.0001[a]
6 Months	4.34 ± 1.42		3.53 ± 1.66	

[a]Statistically significant difference at $p < 0.05$.

TABLE 3 Intergroup comparison of measurements of clinical and radiographic parameters (mean values ± SD) at 6 months (in mm)

	Group 1	Group 2	
Parameters	**Mean ± SD**	**Mean ± SD**	***p* Value**
Clinical parameters			
Mean PPD reduction (in mm)	5.75 ± 1.16	5.65 ± 1.66	0.8268[b]
Mean CAL gain (in mm)	5.05 ± 1.09	4.2 ± 1.70	0.0282[a]
Mean increase in gingival recession (in mm)	0.80 ± 0.61	1.95 ± 1.09	0.0003[a]
Radiographic parameters			
Mean change in CEJ-BD (in mm)	3.30 ± 1.10	2.49 ± 0.99	0.0196[a]
Mean change in CEJ-AC (in mm)	0.13 ± 0.22	0.33 ± 0.37	0.2705[b]
Mean change in AC-BD (in mm)	3.51 ± 1.17	2.56 ± 0.95	0.0077[a]
Mean change in MD (in mm)	0.70 ± 0.68	0.45 ± 0.18	0.0047[a]
Mean change in BL (in mm)	1.60 ± 0.27	1.33 ± 0.44	0.0319[a]

[a]Statistically significant difference at $p < 0.05$.
[b]Statistically not significant at $p > 0.05$.

function by recapitulating the crucial wound healing events associated with their development.[22] The present study was a split-mouth randomized controlled trial which evaluated the clinical efficacy of new generation BG morsels and its combination with PRF in the treatment of periodontal intrabony defects in patients with chronic periodontitis and showed a significant improvement in clinical and radiographic parameters. No clinical evidences of undesirable local and systemic responses were detected and these findings were in agreement with those of Ashawan et al.[23] and Grover et al.[24] It indicates that not only the two materials but also their combination, were well tolerated. Plaque is known to influence the outcomes of periodontal treatment[25] but each participant in the present study showed good oral hygiene throughout the duration of the study. The decrease in PI, GI was statistically significant at the end of 6 months which is assumed to be the result of repeated oral hygiene instructions given to the patients, which is in accordance with the finding of Froum et al.,[26] and Thorat et al.[27] In the present study which was conducted in an institutional setting, the suture material used was 3-0 silk (3-0 Mersilk suture, Alsilk, Aalay Surgicals Pvt. Ltd., India), which has been reported to have a tendency towards plaque accumulation.[28] So there is a possibility that the accumulated plaque would have influenced the amount of regeneration within the tissues. This should be considered as one of the limitations of the study. At 6 months, the mean PPD reduction for the Group 1 and Group 2 was statistically significant, but the non-significant difference when intergroup comparisons were done. The results were similar to Demir B et al.,[29] where authors compared the effect of BG with and

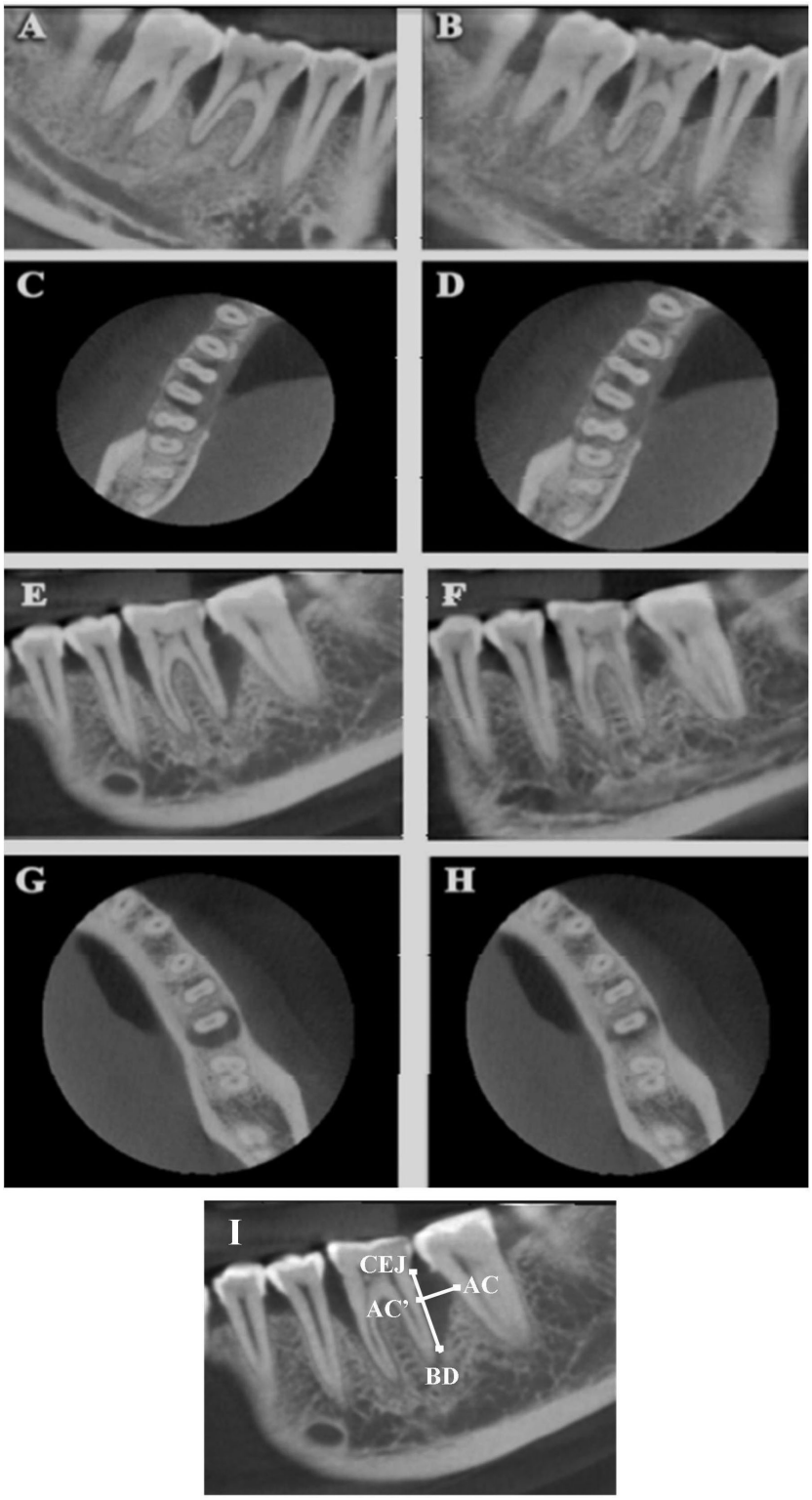

FIGURE 3 Comparison of baseline and 6 months CBCT images of Group 1 and Group 2 A. Intrabony defect in Sagittal view in Group 1 at baseline. **B**. Reduction in Intrabony defect in Sagittal view in Group 1 at 6 months. **C**. Intrabony defect in Transverse view in Group 1 at baseline. **D**. Reduction in Intrabony defect in Transverse view in Group 1 at 6 months. **E**. Intrabony defect in Sagittal view in Group 2 at baseline. **F**. Reduction in Intrabony defect in Sagittal view in Group 2 at 6 months. **G**. Intrabony defect in Transverse view in Group 2 at baseline. **H**. Reduction in Intrabony defect in Transverse view in Group 2 at 6 months. **I**. Schematic of reference points for measurement of CBCT parameters

without PRP and reported PPD reduction of 3.60 ± 0.51 mm for BG+PRP group and 3.28 ± 0.45 mm for BG group which was significant when compared with baseline but intergroup comparison at 6 months showed non-significant results. Sculean et al. compared the treatment of deep intrabony defects with a combination of an enamel matrix protein derivative (EMD) and a bioactive glass (BG) to BG alone and found a PPD reduction of 4.15 ± 0.41 mm and 4.22 ± 0.66 mm respectively.[30] In our study mean PPD reduction was 5.75 ± 1.16 mm for Group 1 and 5.65 ± 1.66 mm for the Group 2 which is on a higher side when compared the above mentioned trials. These findings can be explained on the basis of observation of Lindhe et al. where the authors opined that all surgical procedures result in a decrease in probing

pocket depths with greater reduction occurring at initially deeper sites.[31] In our study, Group 1 showed more reduction in PPD probably showing the additive effect of PRF but the difference fails to reach the level of statistical significance when compared with Group 2. There was no significant difference in probing depth between the Group 2 and Group 1 in our study and is in accordance with the findings from studies by Kim et al., indicating that in deep periodontal defects, the bone graft material, although not osteoinductive, acts as a space-making material, inhibiting apical migration of the junctional epithelium, and thus facilitating periodontal regeneration.[32] At 6 months, the mean CAL gain for Group 1 was 5.05± 1.09 mm and for Group 2 was 4.2 ± 1.70 mm and this difference between the groups was statistically significant. Also, there was a statistically significant difference in CAL in both the groups at 6 months compared with baseline. Similar results have been reported by Cortellini and Tonetti, who concluded that in deeper defects (4 mm or more), a greater CAL gain is achieved.[33] Findings of the present study are in contrary to results of Ashawan et al.,[23] wherein those authors reported statistically non-significant difference in CAL for sites treated with BG+PRF and BG alone. The difference can be attributed to the selection geometry of the defects and method of evaluation for regeneration. Ashawan et al.,[23] evaluated regeneration on digital radiographs, which being a two-dimensional evaluation imaging technique, have several limitations. In our study, the evaluation was carried out by the technique of CBCT analysis, which is known to be more precise in such evaluations.[34] Statistically significant CAL gain in Group 1 compared with Group 2 might have been the result of true periodontal regeneration via new attachment in the case of PRF. The reason why PRF could improve periodontal osseous defects healing may be explained on the basis that PRF has been found to suppress osteoclastogenesis, promoting the secretion of osteoprotegerin in osteoblasts cultures and can also upregulate phosphorylated extracellular signal-regulated protein kinase expression.[35] Recently, studies have demonstrated that the PRF has a very significant slow-sustained release of key growth factors for at least 7 days and up to 28 days.[36] In the present clinical trial, first graft material is placed in the defect and then PRF is placed over it as an interposition membrane after driving out serum.[37,38] Such a protocol offers an improved space making effect of the barrier, which is conducive to cell events leading to periodontal regeneration. An increase in gingival recession may be attributed to the shrinkage of gingival tissues with the resolution of inflammation and the results are in accordance with the results of Thorat et al.[27] There is a possibility of inferior healing response in few of the test sites having Grade I and Grade II defect in adjacent teeth influencing the study results.[39] In our study, there is a significantly higher recession in Group 2 than Group 1 when compared after 6 months. This finding could have been because of the placement of the PRF over the graft which in turn, separated and stimulated the interface between the gingival tissue and the root surface preventing epithelial migration. This helps to maintain the flap in a high and stable position, enhances neoangiogenesis and reduces the necrosis and shrinkage of the flap, thus providing maximal root coverage.[40–43] These findings explain the biologic rationale for the use of a combination of BG and PRF. Where, besides its potential osteoinductive and osteoconductive properties, graft also provides a scaffold for the clot and granulation tissue maturation, wound stabilization and supports PRF which act as interpositional material. PRF promotes osteoblastogenesis and enhanced wound healing through the release of growth factors reflected through significant study results in the test group.

Westfelt et al.,[44] reported that most histologic changes occurred in the first 6 months after surgery. A healing period of 6 months was allowed before the results of surgical procedures were evaluated. After 6 months, CBCT were taken and radiographic measurements were compared with the baseline CBCT data. Statistically significant reduction in MD and BL measurements were seen for Group 1 which showed favorable results of combination therapy when evaluated by CBCT. de Faria Vasconcelos et al. compared periapical radiographs with CBCT imaging in detecting and localizing alveolar bone loss.[45] The authors concluded that CBCT offers improved visualization of the morphology of the defect. In the present split-mouth study design, it is considered that the study design could have helped to reduce this bias. However, this study has the following limitations a) It is practically difficult to have a pair of morphologically similar defects with equal mesiodistal and buccolingual dimensions. To have control on these variables when dealing with in vivo trial is difficult. Though we tried to include similar geometry of the defects on bilateral sides there is a remote possibility of minor differences in the defects. b) The presence of Grade I and Grade II furcation defects adjacent to the treated defect site might have influenced the regenerative outcome of the treatment. Strict exclusion of furcation defect, though difficult in deep intrabony defect should be followed. c) Hawthorne effect in terms of oral hygiene could have influenced the study results limiting its validity.

5 | CONCLUSION

Within the limitation of the study it can be stated that new generation BG morsels in combination with autologous PRF was effective in obtaining improved treatment outcomes in periodontal intrabony defects with an uneventful healing of treated sites, greater CAL gain and osseous defect fill. The treatment of intrabony defects with combination therapy of new generation BG and autologous PRF facilitated greater

resolution of the defect compared with BG morsels alone thus, substantiating the adjunctive effect of use of PRF. These preliminary results need to be further evaluated on a longitudinal basis and greater sample size so as to ascertain the possibility of use of this combination as a substitute for autografts and allografts as they have their inherent limitations.

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CONFLICT OF INTEREST

None

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