

Clinical Efficacy of Bioactive Glass in Combination with Platelet Rich Fibrin in Management of Gingival Recession Defects: A Prospective Comparative Study

Swarupa KB*, Tadepalli A, Parthasarathy H and Ponnaiyan D

Department of Periodontics, SRM Dental College and Hospital, Ramapuram, Chennai, India

Abstract

Background: Various biomaterials have been employed along with Coronally advanced flap (CAF) in root coverage procedures. The combined efficacy of bioactive glass and Platelet rich fibrin in management of gingival recession needs to be evaluated.

Aim: The aim of the present study was to clinically evaluate the efficacy of bioactive glass putty, platelet rich fibrin (PRF) and a combination of both in management of maxillary gingival recession defects.

Materials and methods: 31 patients with 60 Millers class I/II recession defects were treated with one of the following interventions; GROUP I: CAF alone, GROUP II, III and IV: CAF+Bioactive glass, CAF+PRF, CAF+ Bioactive glass+PRF respectively Clinical parameters such as recession height (RH), recession width (RW), probing pocket depth (PPD), clinical attachment level (CAL), width of attached gingiva (WAG), keratinized tissue height (KTH) were evaluated at baseline for 6 months. Mean root coverage (RC%), changes in biotype, RES and VAS aesthetic scores evaluated at the end of 6 months intervals.

Results: RH and RW showed statistically significant reduction from baseline to 6 months in all the groups ($p \leq 0.05$). At the end of 6 months, the mean RC% was $61.0\% \pm 34.3\%$, $75.5\% \pm 25.9\%$, $67.2\% \pm 32.8\%$ and $81.7\% \pm 28.6\%$ in Group I, II, III and IV respectively. Intergroup analysis showed no statistically significant difference of parameters between groups at any time point.

Conclusion: All the therapeutic interventions were effective in management of gingival recession defects. Though, group IV showed greater mRC% when compared to other groups, intergroup analysis failed to show any statistical significance.

Keywords: Bioactive glass; Coronally advanced flap; Gingival recession; Guided tissue regeneration; Platelet rich fibrin; Root coverage

Introduction

Gingival recession is a common periodontal condition, often leading to functional and aesthetic alterations due to soft and hard tissue loss. Frequently it is associated with dentinal hypersensitivity, aesthetic distress, root caries, cervical abrasion, besides an increase in the accumulation of dental plaque. The successful management of gingival recession depends on the selection of predictable technique in an appropriate class of defect [1-3].

Coronally advanced flap procedures have been considered as the most commonly employed surgical techniques for the management of maxillary gingival recession defects [4]. However, literature suggests that CAF when used alone, there will be a limited amount of gain in the apico-coronal dimension affecting long term success [5]. A surgical technique that can be combined with CAF in order to overcome its limitations is desirable for the management of gingival recession. Techniques like guided tissue regeneration beneath a coronally advanced flap ensure adequate periodontal regeneration as well as aesthetic correction. GTR based root coverage offers the additional potential benefit of new attachment formation.

A 21st century innovation in dentistry includes platelet rich fibrin (PRF), a second-generation platelet rich concentrate introduced by Choukran et al. [6]. PRF helps in slow polymerization of fibrinogen to fibrin which results in a favorable matrix for periodontal wound healing. This fibrin matrix acts like a barrier, thus preventing epithelial down growth and modulates the expression of growth factors and fibroblastic cells, facilitating their migration inside the wound [7]. PRF has many of the potentials that are required for an ideal matrix, to enhance soft and

hard tissue healing as well as regeneration of periodontal tissues [8].

However, maintaining space underneath the PRF membrane remains still a challenge, owing to its physical characteristics. Space is believed to provide a channel for the migration of progenitor cells toward and onto the root surface.

Unfortunately, the space maintenance in recession defects is often difficult to achieve, as the morphology of the defect results in collapse of the membrane against the root surface and there is a technical challenge in confinement of particulate nature of graft material. In recession management, there is a need of a material that can support the membrane and will stay in the same place for a considerable time period.

Recently bioactive glass, a next generation calcium phosphosilicate bone graft material has been introduced in the putty form (Novabone® putty) to improve handling characteristics and performance [9]. Bioactive glass has acquired interest because of two properties: osteo-conduction and osteo-promotion [10]. When bioactive glass is placed, the ions from the material leaches out in to the surrounding

*Corresponding author: Swarupa KB, Department of Periodontics, SRM Dental College and Hospital, Ramapuram, Chennai, India, Tel: +917823998434; E-mail: swarupakb1991@gmail.com

Received March 15, 2019; Accepted March 21, 2019; Published March 29, 2019

Citation: Swarupa KB, Tadepalli A, Parthasarathy H, Ponnaiyan D (2019) Clinical Efficacy of Bioactive Glass in Combination with Platelet Rich Fibrin in Management of Gingival Recession Defects: A Prospective Comparative Study. J Clin Case Rep 9: 1226. doi: 10.4172/2165-7920.10001226

Copyright: © 2019 Swarupa KB, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

environment of tissues, where the hydrogen ions from the tissue fluids exchange with the sodium ions in the glass. Following this process, calcium and phosphorous ions meet the tissue fluids, leaving a protective layer of silica gel [11]. The calcium phosphate-rich layer (Hydroxylcarbonate apatite: HCA layer) is thought to promote adsorption and concentration of osteoblast-derived proteins necessary for the mineralization of extracellular matrix [12]. The action is like the maturing mineral phase of bone and organic phase of collagen fibres [13]. The literature reports good confinement of Novabone putty material in various osseous defects resulting in significant gain of clinical attachment level and hard tissue fill [14-17]. A previous study by Bansal et al., suggested that novabone putty can be used for gingival recession management [18].

Formation of hard tissue is important in long term management of gingival recession defects preventing relapse which usually occurs

with conventional techniques. Use of autologous materials like PRF and employing GTR principles may improve the long-term outcomes in root coverage procedures.

To our knowledge, there were no published prospective controlled clinical trials evaluating Novabone putty and PRF combination along with CAF in management of gingival recession. Hence the current study proposes to clinically evaluate the efficacy of bioactive glass, platelet rich fibrin and a combination of both in the management of gingival recession defects.

Materials and Methods

Study design and sample size calculation

This prospective comparative clinical investigation was approved by the institutional ethical committee and scientific review board

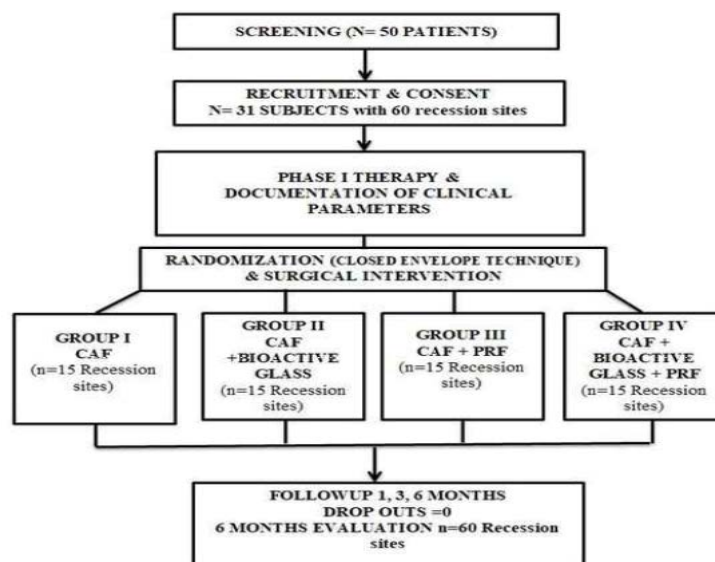


Figure 1: Flowchart showing the recruitment and therapeutic intervention.

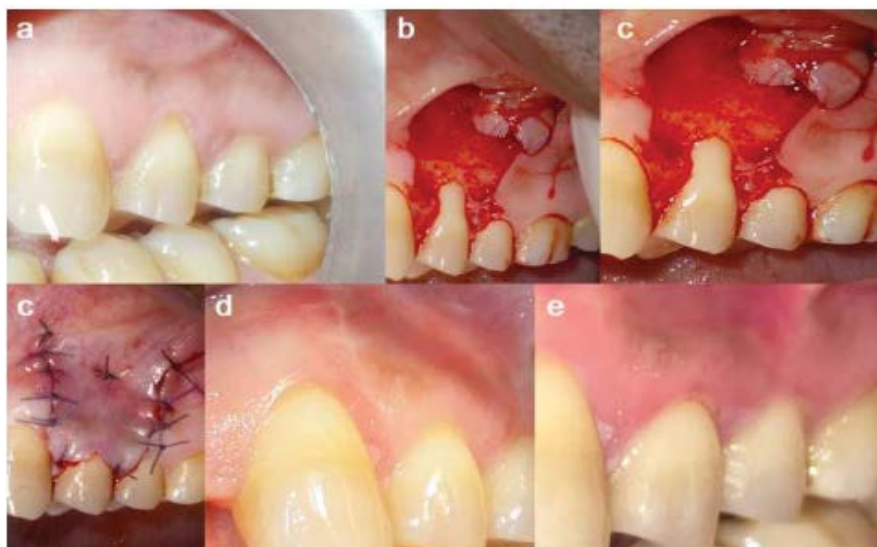


Figure 2: (a) Class I gingival recession-24, (b) Flap elevation with split full split approach, (c) After root surface debridement, (d) Flap advancement and suturing, (e) Review at 3 months, (f) Review at 6 months.

(SRMDC/IRB/2016/MDS/No.506) and was conducted in department of Periodontology, SRM Dental College, Chennai from January 2017 to August 2018.

The sample size was calculated based on the study results obtained by Sofia Aroca et al. [19]. In order to obtain a study power of 80% with alpha error set at 0.5%, a total number of 48 recession sites had to be included in the study. The study design consisted of 4 groups with different therapeutic interventions for gingival recession. Owing to the 20% drop outs which may occur during the follow up, a total number of 60 gingival recession defects in 31 subjects were recruited. Subjects were informed about the nature of the study and voluntary individuals were enrolled and duly signed consent forms were obtained (Figure 1).

Isolated/multiple adjoining (≤ 3) Millers class I and class II gingival recession defects in maxillary anterior and premolars were included. Sites with probing depth ≥ 4 mm/root caries, teeth with mobility and patients showing unacceptable oral hygiene compliance during/

after phase I therapy were excluded. Smokers/pregnant and lactating women and patients with systemic condition/disease/any medication having influence on course of periodontal disease and therapy were also exempted from enrolment.

The presurgical phase consisted of documentation of clinical parameters and phase I periodontal therapy. The following parameters were measured for evaluation & analysis: Gingival recession height (RH), recession width (RW), biotype, probing pocket depth (PPD), clinical attachment level (CAL), keratinized tissue height (KTH), Width of attached gingiva (WAG), Percentage of root coverage (RC%), VAS aesthetic score and RES aesthetic score. The clinical parameters were measured with the help of a reference groove on customized composite stent using UNC 15 periodontal probe and the measurements were rounded to the nearest mm.

Randomization of Study Sites

Patient was asked to withdraw a slip from a container labelled with

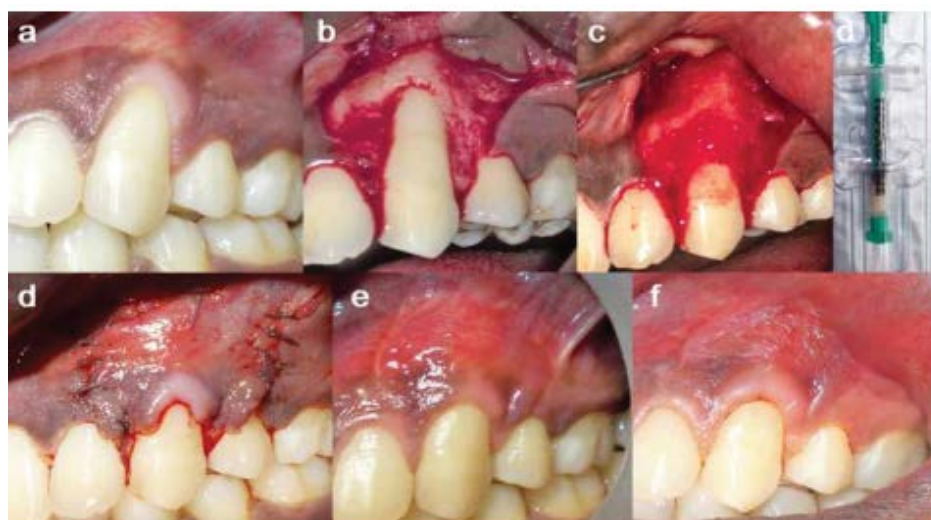


Figure 3: (a) Class I gingival recession-23, (b) Flap elevation with split full split approach, (c) Root surface debridement and placement of bioactive glass putty (d) Flap advancement and suturing, (e) Review at 3 months, (f) Review at 6 months.



Figure 4: (a) Class I gingival recession-23, (b) Flap elevation with split full split approach, (c and d) Procurement of platelet rich fibrin, (e) Root surface debridement and placement of platelet rich fibrin, (f) Flap advancement and suturing, (g) Review at 3 months, (h) Review at 6 months.

4 therapeutic interventions and the recession site was subsequently treated with the respective surgical protocol.

Group I: Recession sites were treated with coronally advanced flap alone.

Group II: Recession sites were treated with coronally advanced flap along with bioactive glass putty material.

Group III: Recession sites were treated with coronally advanced flap along with platelet rich fibrin.

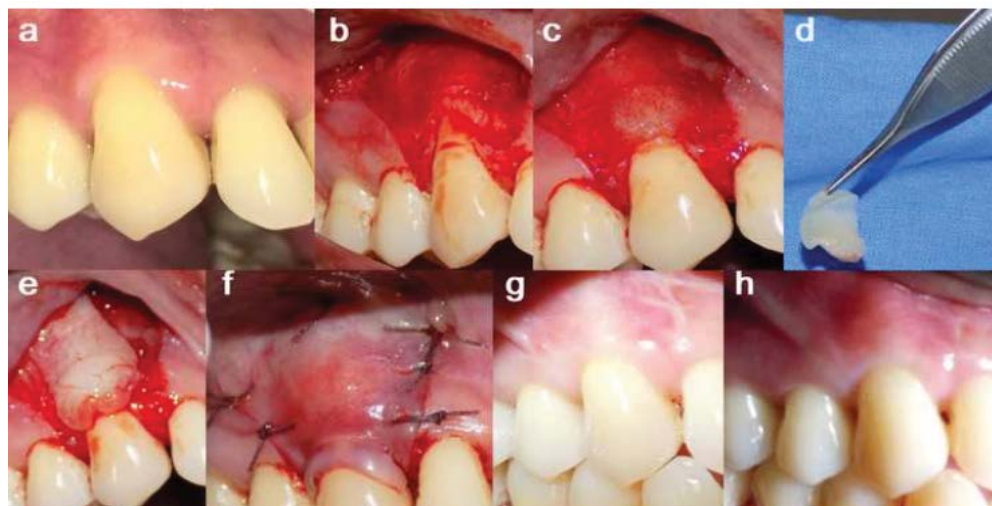


Figure 5: (a) Class II gingival recession-13, (b) Flap elevation with split full split approach, (c) After root surface debridement, placement of bioactive glass putty, (d) Procurement of platelet rich fibrin, (e) Placement of platelet rich fibrin, (f) Flap advancement and suturing, (g) Review at 3 months, (h) Review at 6 months.

Parameters	Group I	Group II	Group III	Group IV	p Value
Age (yrs)	40.53 ± 6.70	31.93 ± 3.93	39.47 ± 6.69	29.67 ± 6.93	0.0005** (Oneway ANOVA)
Gender	Male	80%	53.3%	100%	0.025* (Pearson Chi Square)
	Female	20%	46.7%	0%	
Baseline Miller's Class of Recession	Class I	8 (53.3%)	60%	73.3%	0.007** (Pearson Chi Square)
	Class II	7 (46.7%)	40%	26.7%	
RH (mm)	2.40 ± 0.73	2.60 ± 0.63	2.53 ± 0.74	2.67 ± 1.17	0.7 (Kruskal Wallis)
RW (mm)	3.40 ± 0.50	3.20 ± 0.67	3.40 ± 0.63	3.40 ± 1.35	0.8 (Kruskal Wallis)
PPD (mm)	2.13 ± 0.51	2.00 ± 0.75	1.60 ± 0.63	2.13 ± 0.35	0.04* (Kruskal Wallis)
CAL (mm)	4.53 ± 0.99	4.60 ± 1.12	4.13 ± 1.12	4.80 ± 1.20	0.24 (Kruskal Wallis)
WAG (mm)	1.33 ± 0.61	1.40 ± 0.50	1.60 ± 0.73	1.27 ± 0.45	0.5 (Kruskal Wallis)
KTH (mm)	3.47 ± 0.74	3.40 ± 0.73	3.20 ± 0.67	3.40 ± 0.50	0.7 (Kruskal Wallis)
Gingival Biotype	Thick	5 (33.3%)	4 (26.7%)	1 (6.7%)	0.104 (Pearson Chi Square)
	Thin	10 (66.7%)	11 (73.3%)	14 (93.3%)	

*Significant at 0.01 < p ≤ 0.050, **Highly Significant at p ≤ 0.01, #No Significant at p > 0.050

Table 1: The mean descriptive parameters among the study groups at baseline.

Kruskal Wallis Test	3 Months					6 Months					
	Group I	Group II	Group III	Group IV	p Value	Group I	Group II	Group III	Group IV	P Value	
RH (Mm)	0.73 ± 0.59	0.53 ± 0.64	0.87 ± 0.83	0.33 ± 0.48	0.1	0.73 ± 0.59	0.67 ± 0.72	0.87 ± 0.83	0.40 ± 0.50	0.3	
RW (Mm)	1.47 ± 1.12	1.00 ± 1.13	1.40 ± 1.24	0.73 ± 1.10	0.2	1.47 ± 1.12	1.13 ± 1.12	1.40 ± 1.24	0.87 ± 1.12	0.4	
Rc%	61.0 ± 34.3	81.0 ± 22.6	67.2 ± 32.8	83.8 ± 28.6	0.1	61.1 ± 34.3	75.5 ± 25.9	67.2 ± 32.8	81.7 ± 28.6	0.2	
PPD (Mm)	1.60 ± 0.50	1.27 ± 0.45	1.07 ± 0.25	1.13 ± 0.35	.00*	1.53 ± 0.51	1.20 ± 0.41	1.07 ± 0.25	1.13 ± 0.35	0.01	
CAL (Mm)	2.33 ± 1.04	1.80 ± 1.01	1.93 ± 0.96	1.40 ± 0.63	.08	2.27 ± 1.03	1.87 ± 0.99	1.93 ± 0.96	1.53 ± 0.64	0.24	
WAG (Mm)	2.13 ± 1.12	2.87 ± 0.83	2.53 ± 0.64	2.67 ± 0.72	0.2	2.27 ± 1.22	2.93 ± 0.79	2.60 ± 0.50	2.67 ± 0.72	0.3	
KTH (Mm)	3.73 ± 0.88	4.13 ± 0.64	3.67 ± 0.48	3.80 ± 0.41	0.1	3.80 ± 0.94	4.13 ± 0.64	3.67 ± 0.48	3.80 ± 0.41	0.2	
Gingival Biotype	Thick	Na					12 (80%)	15 (100%)	12 (80%)	15 (100%)	0.083
	Thin	Na					3 (20%)	0 (0%)	3 (20%)	0 (0%)	
Res Aesthetic Scores						8.27 ± 1.71	8.53 ± 2.20	8.27 ± 1.43	9.20 ± 1.37	0.2	
Vas Aesthetic Scores (E)						7.93 ± 0.79	8.67 ± 0.48	8.67 ± 0.90	8.53 ± 1.06	0.02	

*Significant at 0.01 < p ≤ .050, **Highly Significant at p ≤ 0.01, #No Significant at p > 0.050

Table 2: The mean descriptive parameters among the study groups at 3 and 6 months.

Group IV: Recession sites were treated with coronally advanced flap along with platelet rich fibrin and bioactive glass putty material.

Surgical procedure

The surgical protocol remained constant in all the treatment groups. Under local anesthesia (2% Lignocaine, 1:80,000 adrenaline), a split full split thickness flap was elevated as recommended by Zucchelli 2007 [20]. Root surface debridement was done using area specific currettes. In group I sites the flap was advanced slightly coronal to CEJ and secured with resorbable 4.0 sutures. In group II sites, following flap elevation and root surface debridement, bioactive glass material was placed according to manufacturer’s instructions covering the entire defect and the flaps were repositioned at the level or slightly coronal to CEJ. For group III & IV interventions, L-PRF membrane was obtained following the guidelines given by Choukran 2000 [6]. In group III sites after root surface debridement, the L-PRF membrane was adapted over the exposed root surface just coronal or at the level of CEJ. The flap was

advanced and secured using resorbable sutures. In group IV sites, after elevation of flap and root surface debridement, bioactive glass putty material was adapted over the defect and L-PRF membrane was placed to cover the graft material and flap was coronally advanced (Figures 2-5).

In all the four therapeutic interventions flap was advanced coronally and secured using 4-0 vicryl interrupted loop sutures. Periosteal anchoring sutures were placed at the base of the flap. The sites were covered with periodontal dressing and patients were prescribed with antibiotics and analgesics for 5 days. Patients were instructed to refrain from brushing in the surgical sites for 4 weeks and were advised 0.12% Chlorhexidine mouthwash twice daily. Patients were enrolled in a stringent post-operative supportive care regimen with 1,3 and 6 months review.

Statistical analysis

Site level data was analysed using IBM.SPSS statistics software 23.0

Wilcoxon Signed Rank Test	Baseline Vs. 3months								Baseline Vs. 6 Months							
	Group I		Group II		Group III		Group IV		Group I		Group II		Group III		Group IV	
	Z Value	p Value	Z Value	p Value	Z Value	p Value	Z Value	p Value	Z Value	p Value	Z Value	p Value	Z Value	p Value	Z Value	p Value
RH	-3.22	0.001**	-3.47	0.001**	-3.34	0.001**	-3.32	0.001**	-3.22	0.001**	-3.45	0.001**	-3.34	0.00**	-3.32	0.001**
RW	-3.20	0.001**	-3.44	0.001**	-3.22	0.001**	-3.44	0.001**	-3.20	0.001**	-3.44	0.001**	-3.22	0.001**	-3.43	0.001**
PPD	-2.53	0.011*	-3.31	0.001**	-2.82	0.005**	-3.41	0.001**	-2.71	0.007**	-3.20	0.001**	-2.82	0.005**	-3.41	0.001**
CAL	-3.20	0.001**	-3.45	0.001**	-3.45	0.001**	-3.43	0.001**	-3.20	0.001**	-3.44	0.001**	-3.45	0.001**	-3.45	0.001**
WAG	-2.37	0.017*	-3.57	0.000**	-2.88	0.004*	-3.28	0.001**	-2.58	0.010*	-3.53	0.000**	-3.03	0.002**	-3.28	0.001**
KTH	-1.41	0.157#	-2.42	0.015*	-2.07	0.038*	-2.44	0.014*	-1.66	0.096#	-2.42	0.015*	-2.07	0.038*	-2.44	0.014*

*Significant at 0.01<p ≤ 0.050, **Highly Significant at p ≤ 0.01, #No Significant at p >0.050

Table 3: Intra group variation of clinical parameters in the study groups across the time intervals.

ANOVA with Post Hoc Tukey Hsd Analysis		Baseline						6 Months					
Parameters		I and II	I and III	I and IV	II and III	II and IV	III and IV	I and II	I and III	I and IV	II and III	II and IV	III and IV
RH	Mean Difference	-0.200	-0.133	-0.267	0.067	-0.067	-0.133	0.067	-0.133	0.333	-0.200	0.267	0.467
	p value	0.917	0.973	0.825	0.996	0.996	0.973	0.993	0.949	0.535	0.849	0.703	0.244
RW	Mean Difference	0.200	0.000	0.000	-0.200	-0.200	0.000	0.333	0.067	0.600	-0.267	0.267	0.533
	p value	0.919	1.000	1.000	0.919	0.919	1.000	0.859	0.999	0.491	0.921	0.921	0.589
PPD	Mean Difference	0.133	0.533	0.00	0.400	-0.133	-0.533	0.333	0.467	0.400	0.133	0.067	-0.067
	p value	0.923	0.070	1.00	0.249	0.923	0.070	0.110	0.011*	0.038*	0.794	0.967	0.967
CAL	Mean Difference	-0.067	0.400	-0.267	0.467	-0.200	-0.667	0.400	0.333	0.733	-0.067	0.333	0.400
	p value	0.998	0.759	0.913	0.662	0.961	0.365	0.635	0.754	0.140	0.997	0.754	0.635
WAG	Mean Difference	-0.067	-0.267	0.067	-0.200	0.133	0.333	-0.667	-0.333	-0.400	0.333	0.267	-0.067
	p value	0.990	0.605	0.990	0.789	0.925	0.416	0.153	0.709	0.577	0.709	0.827	0.997
KTH	Mean Difference	0.067	0.267	0.067	0.200	0.000	-0.200	-0.333	0.133	0.000	0.467	0.333	-0.133
	p value	0.993	0.700	0.993	0.847	1.000	0.847	0.506	0.944	1.000	0.216	0.506	0.944
RC%	Mean Difference							-14.4	-6.1	-20.5	8.3	-6.1	-14.4
	p value							0.5	0.95	0.2	0.8	0.9	0.5
Res Aesthetic Scores	Mean Difference							-0.267	0.00	-0.933	0.267	-0.667	-0.933
	p value							0.974	1.00	0.448	0.974	0.711	0.448
Vas Aesthetic Scores (E)	Mean Difference							-0.733	-0.733	-0.600	0.0	0.133	0.133
	p value							0.089	0.089	0.215	1.00	0.972	0.972

*Significant at 0.01<p ≤ 0.050, **Highly Significant at p ≤ 0.01, #No Significant at p>0.050

Table 4: Pairwise analysis of parameters between the study groups at various intervals.

version. RH, RW, PPD, CAL, WAG and KTH were recorded at baseline, 3 and 6-months intervals. VAS-E and RES scores were evaluated at the end of the study period. Normality of the data was assessed using Kolmogorov Smirnov and Shapiro Wilks tests. Data followed non parametric distribution. To describe the descriptive statistics, mean and SD were used. To find the significant difference in the multivariate analysis Kruskal Walli's test followed by Mann Whitney U test was used. For repeated measures Friedman test followed by Wilcoxon signed rank test was used. To find the significance in categorical data Chi-Square test was used. In all the above statistical tools the probability value (P) ≤ 0.05 is considered as significant level.

Results

Healing was uneventful in all the groups without any post-operative complications. Table 1 shows the mean descriptive values of parameters in study groups at baseline. The mean age of study population ranged from 29.67 ± 6.93 to 40.53 ± 6.70 yrs. There was a statistically significant difference observed among study population with respect to age and gender distribution. There was a significant difference in dissemination of class of gingival recessions among the study groups. Overall and pairwise analysis showed no statistically significant difference ($p > 0.05$) between the groups about clinical parameters except for PPD at baseline, 3 and 6 months (Tables 1-4). By end of 6 months, the mean gingival recession height and width showed a considerable reduction with a mean root coverage percentage of 61.1 ± 34.3 , 75.5 ± 25.9 , 67.2 ± 32.8 , 81.7 ± 28.6 in group I, II, III and IV respectively. At the end of 6 months, 12 out of 15 study sites showed thick gingival biotype in group I and III whereas group II and IV sites exhibited 100% thick biotype. At 6 months, the mean RES & VAS aesthetic scores were 8.27 ± 1.71 and 7.93 ± 0.79 in group I, 8.53 ± 2.20 and 8.67 ± 0.48 in group II, 8.27 ± 1.43 and 8.67 ± 0.90 in group III, 9.20 ± 1.37 and 8.53 ± 1.06 in group IV respectively. All the interventions resulted in statistically significant improvement in all clinical parameters (p value ≤ 0.05) from baseline to 6 months except for KTH in group I (Table 3).

Discussion

To accomplish the objectives of aesthetics and functional demands, coronally advanced flap procedures (CAF) combined with other graft materials have been widely used in treatment of gingival recessions in maxilla. Rationale of adding biomaterials along with CAF is to promote new attachment, in order to achieve long term stable results [21-26].

To our knowledge this is the first prospective comparative study evaluating the efficacy of coronally advanced flap with a combination of bioactive glass putty and PRF in treatment of Millers Class I and Class II recession defects.

The primary objectives of our study were to assess changes in recession height and recession width. Post operatively, intragroup analysis showed a statistically significant reduction in RH, RW from baseline to 6 months in all groups respectively ($p \leq 0.05$).

Group I sites showed a mean root coverage percentage of 61% at 6 months, this is in accordance with the mean root coverage percentage achieved in recent studies done by ranging from 35-86% [5-31]. The mean root coverage in group II sites was 75% at the end of 6 months. Bansal et al. achieved a mean root coverage of 74% in the CAF + bioactive glass putty sites [18]. A mean root coverage percentage of 63-87% was obtained with other bone grafts that have been attempted in

treatment of gingival recession such as demineralized freeze dried bone allograft [32-34], beta tricalcium phosphate [35,36], hydroxyapatite [37,38]. In group III sites, the mean root coverage percentage was 67.2%. Similar results were quoted in Meta-analysis [39-41] and in randomized control trials [42-45]. In group IV sites, the mean root coverage percentage was 81% at the end of 6 months. So far, there is limited literature evidences using combination of PRF+Novabone for root coverage. In a study conducted by Kumar et al. [46]. The author obtained a mean recession coverage of $94.17 \pm 8.42\%$ at the end of 18 months. This discrepancy in results can be attributed to the use of minimally invasive technique like VISTA and additionally use of collagen membrane.

Addition of growth factors/bone grafts beneath CAF tends to create a potential space, helps in new connective tissue attachment as well as prevent epithelial migration. Significant gain in KTH in GROUP II, III and IV may be attributed to the benefits of addition of biomaterials to CAF as previously quoted by Cairo et al. However, long term studies are required to prove this statement [47].

Adequate zone of attached gingiva has been considered critical for the healthy maintenance of periodontium. WAG also showed a significant gain in all the 4 groups at all-time points. Gingival biotype/phenotype is a vital factor that has a significant impact on periodontal therapy. At the end of 6 months, all sites transformed to thick biotype in group II and group IV.

Obtaining complete root coverage is no longer enough, for a successful outcome, the aesthetic integration of tissues with adjacent area is equally important. In the present study to evaluate the optimal integration, RES given by Cairo et al. was used [48]. The mean RES obtained in the present study in group I and II at the end of 6 months respectively were accordance with the study conducted by Amrita Bansal et al. [18], Piniprato et al. Though the combination group showed greater mean RES score at 6 months, statistically there were no significant difference between the groups [49].

Overall intergroup and pair wise analysis showed no statistically significant differences ($p > 0.05$) between the groups about the clinical parameters at all-time intervals except for PPD. This may be due to the statistically significant differences noted in mean PPD values among the groups at baseline which would have continued in the follow up.

Though there were no statistically significant differences in inter group analysis of the sites, the combination therapy (group IV) (81.1%) resulted in a greater mean root coverage percentage, more reduction in RH and RW than other groups. Further Group I (61%) sites showed least improvement followed by group III (67.2%). The greater root coverage percentage in group II and IV may be attributed to the addition of bioactive glass putty which could have promoted bone remodelling.

Conclusion

The limitations of the current study included, discrepancy in miller's class I/II site distribution which may be attributed to the randomization technique being followed. Further, inclusion of multiple adjoining defects and shorter follow up period could also have influenced the study results.

Based on the observations of study it can be concluded that, the combination of PRF and Novabone along with CAF has shown to be effective in treatment of gingival recession defects. The benefit of this combination over individual treatment needs to be investigated in future studies, with larger sample size and longer follow up period.

References

1. Chambrone L, Chambrone D, Pustigliani FE, Chambrone LA, Lima LA (2008) Can subepithelial connective tissue grafts be considered the gold standard procedure in the treatment of Miller Class I and II recession-type defects. *Int J Dent Oral Health* 36: 659-671.
2. Oates TW, Robinson M, Gunsolley JC (2003) Surgical therapies for the treatment of gingival recession: A systematic review. *Ann Periodontol* 8: 303-320.
3. Rocuzzo M, Bunino M, Needleman I, Sanz M (2002) Periodontal plastic surgery for treatment of localized gingival recessions: A systematic review. *J Clin Periodontol* 29: 178-194.
4. Cairo F, Nieri M, Pagliaro U (2014) Efficacy of periodontal plastic surgery procedures in the treatment of localized facial gingival recessions: A systematic review. *J Clin Periodontol* 41: 44-62.
5. McGuire MK, Nunn M (2003) Evaluation of human recession defects treated with coronally advanced flaps and either enamel matrix derivative or connective tissue. Part 1: Comparison of clinical parameters. *J Periodontol* 74: 1110-1125.
6. Choukroun J, Diss A, Simonpieri A (2006) Platelet-rich fibrin (PRF): A second-generation platelet concentrate. Part IV: Clinical effects on tissue healing. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 101: 56-60.
7. Corso MD, Sammartino G, Fest DEDM (2009) Letter to the Editor: Re: "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* 80: 1694.
8. AL Jasser R, AlKudmani H, Andreana S (2017) Platelet-rich fibrin as a new approach in treating gingival recession: Systematic review and meta-analysis. *J Dent Oral Disord Ther* 5: 1-12.
9. Allon I, Anavi Y, Allon DM (2014) Topical simvastatin improves the pro-angiogenic and pro-osteogenic properties of bioactive glass putty in the rat calvaria critical-size model. *J Oral Implantol* 40: 251-258.
10. Chan C, Thompson I, Robinson P, Wilson J, Hench L (2002) Evaluation of Bioglass/dextran composite as a bone graft substitute. *Int J Oral Maxillofac Surg* 31: 73-77.
11. Reynolds MA, Aichelmann-Reidy ME, Branch-Mays GL (2010) Regeneration of periodontal tissue: Bone replacement grafts. *Dent Clin* 54: 55-71.
12. Froum SJ, Weinberg MA, Tarnow D (1998) Comparison of bioactive glass synthetic bone graft particles and open debridement in the treatment of human periodontal defects: A clinical study. *J Periodontol* 69: 698-709.
13. Hench LL (2013) Chronology of bioactive glass development and clinical applications. *New J Glass Ceramics* 3: 67.
14. Katuri KK, Kumar PJ, Swarna C, Swamy DN, Arun KV (2013) Evaluation of bioactive glass and demineralized freeze dried bone allograft in the treatment of periodontal intraosseous defects: A comparative clinico-radiographic study. *J Ind Soc Periodontol* 17: 367.
15. Naqvi A, Gopalakrishnan D, Bhasin MT, Sharma N, Haider K, et al. (2017) Comparative evaluation of bioactive glass putty and platelet rich fibrin in the treatment of human periodontal intrabony defects: A randomized control trial. *JCDR* 11: 9.
16. Agrawal I, Chandran S, Nadig P (2017) Comparative evaluation of the efficacy of platelet-rich fibrin and calcium phosphosilicate putty alone and in combination in the treatment of intrabony defects: A randomized clinical and radiographic study. *Contemp Clin Dentist* 8: 205.
17. Biswas S, Sambashivaiah S, Kulal R, Bilichodmath S, Kurtzman GM (2016) Comparative evaluation of bioactive glass (Putty) and platelet rich fibrin in treating furcation defects. *J Oral Implantol* 42: 411-415.
18. Bansal A, Kulloli A, Kathariya R, Shetty S, Jain H, et al. (2016) Comparative evaluation of coronally advanced flap with and without bioactive glass putty in the management of gingival recession defects: A randomized controlled clinical trial. *J Int Acad Periodontol* 18: 7-15.
19. Aroca S, Keglevich T, Barbieri B, Gera I, Etienne D (2009) 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* 80: 244-252.
20. De-Sanctis M, Zucchelli G (2007) Coronally advanced flap: A modified surgical approach for isolated recession-type defects: Three-year results. *J Clin Periodontol* 34: 262-268.
21. Greenwell H, Bissada NF, Henderson RD, Dodge JR (2000) The deceptive nature of root coverage results. *J Periodontol* 71: 1327-1337.
22. Gottlow J, Nyman S, Karring T, Lindhe J (1986) Treatment of localized gingival recessions with coronally displaced flaps and citric acid: An experimental study in the dog. *J Clin Periodontol* 13: 57-63.
23. Tinti C, Vincenzi GP, Cocchetto R (1993) Guided tissue regeneration in mucogingival surgery. *J Periodontol* 64: 1184-1191.
24. Tinti C, Vincenzi GP, Cortellini P, Pini-Prato G, Clauser C (1992) Guided tissue regeneration in the treatment of human facial recession: A case report. *J Periodontol* 63: 554-560.
25. Cortellini P, Clauser C, Prato GPP (1993) Histologic assessment of new attachment following the treatment of a human buccal recession by means of guided tissue regeneration procedure. *J Periodontol* 64: 387-391.
26. Meng HW, Chien HH (2016) Therapeutic outcomes for gingival recession defects in the esthetic zone: A systematic review. *Periodon Prosthodon* 2: 1.
27. Silva RC, Joly JC, De-Lima AF, Tatakis DN (2004) Root coverage using the coronally positioned flap with or without a subepithelial connective tissue graft. *J Periodontol* 75: 413-419.
28. Zucchelli G, De-Sanctis M (2000) Treatment of multiple recession-type defects in patients with esthetic demands. *J periodontol* 71: 1506-1514.
29. Lins LH, de Lima AF, Sallum AW (2003) Root coverage: Comparison of coronally positioned flap with and without titanium-reinforced barrier membrane. *J periodontol* 74: 168-174.
30. Cairo F, Pagliaro U, Nieri M (2008) Treatment of gingival recession with coronally advanced flap procedures: A systematic review. *J Clin Periodontol* 35: 136-162.
31. Huang LH, Neiva RE, Wang HL (2005) Factors affecting the outcomes of coronally advanced flap root coverage procedure. *J periodontol* 76: 1729-1734.
32. Kimble KM, Eber RM, Soehren S, Shyr Y, Wang HL (2004) Treatment of gingival recession using a collagen membrane with or without the use of demineralized freeze-dried bone allograft for space maintenance. *J periodontol* 75: 210-220.
33. Duval BT, Maynard JG, Gunsolley JC, Waldrop TC (2000) Treatment of human mucogingival defects utilizing a bioabsorbable membrane with and without a demineralized freeze-dried bone allograft. *J Periodontol* 71: 1687-1692.
34. Dodge JR, Greenwell H, Drisko C, Wittwer JW, Yancey J, et al. (2000) Improved bone regeneration and root coverage using a resorbable membrane with physically assisted cell migration and DFDBA. *Int J Periodontics Restorative Dent* p: 20.
35. McGuire MK, Scheyer ET (2006) Comparison of recombinant human platelet-derived growth factor-BB plus beta tricalcium phosphate and a collagen membrane to subepithelial connective tissue grafting for the treatment of recession defects: A case series. *Int J Periodontics Restorative Dent* p: 26.
36. Singh P, Suresh DK (2012) Clinical evaluation of GEM 21S® and a collagen membrane with a coronally advanced flap as a root coverage procedure in the treatment of gingival recession defects: A comparative study. *J Indian Soc Periodontol* 16: 577.
37. Nazareth CA, Cury PR (2011) Use of anorganic bovine-derived hydroxyapatite matrix/cell-binding peptide (P-15) in the treatment isolated Class I gingival recession of defects: A pilot study. *J Periodontol* 82: 700-707.
38. Pilloni A, Schmidlin PR, Sahrman P, Sculean A, Rojas MA (2018) Effectiveness of adjunctive hyaluronic acid application in coronally advanced flap in Miller class I single gingival recession sites: A randomized controlled clinical trial. *Clin Oral Invest* 30: 1-9.
39. Culhaoglu R, Taner L, Guler B (2018) Evaluation of the effect of dose-dependent platelet-rich fibrin membrane on treatment of gingival recession: A randomized, controlled clinical trial. *J Appl Oral Sci* p: 26.
40. Jose KP, Rajan P, Malagi S (2018) Combination of coronally advanced flap and platelet rich fibrin in the treatment of miller's class I and II gingival recessions: A Systematic Review. *Natl J Integr Res Med* 8: 135-144.
41. Moraschini V, Barboza ED (2016) Use of platelet-rich fibrin membrane in the treatment of gingival recession: A systematic review and meta-analysis. *J Periodontol* 87: 281-290.
42. Jankovic S, Aleksic Z, Klokkevold P, Lekovic V, Dimitrijevic B, et al. (2012) Use of platelet-rich fibrin membrane following treatment of gingival recession: A randomized clinical trial. *Int J Periodontics Restorative Dent* 32: 165.

43. Thamaraiselvan M, Elavarasu S, Thangakumaran S, Gadagi JS, Arthie T (2015) Comparative clinical evaluation of coronally advanced flap with or without platelet rich fibrin membrane in the treatment of isolated gingival recession. *J Ind Soc Periodontol* 19: 66.
44. Tunalı M, Özdemir H, Arabacı T, Gürbüzler B, Pıkdöken ML, et al. (2015) Clinical evaluation of autologous platelet-rich fibrin (L-PRF) in the treatment of multiple adjacent gingival recession defects: A 12-month study. *Int J Periodontics Restorative Dent* 35: 105-114.
45. Padma R, Shilpa A, Kumar PA, Nagasri M, Kumar C, et al. (2013) A split mouth randomized controlled study to evaluate the adjunctive effect of platelet-rich fibrin to coronally advanced flap in Miller's class-I and II recession defects. *J Indian Soc Periodontol* 17: 631.
46. Kumar TA, Gowda TM, Mehta DS, Kumar A (2018) Management of multiple gingival recessions with the VISTA technique: An 18-month clinical case series. *Int J Periodontics Restorative Dent* p: 38.
47. Cairo F, Cortellini P, Tonetti M, Nieri M, Mervelt J, et al. (2012) Coronally advanced flap with and without connective tissue graft for the treatment of single maxillary gingival recession with loss of inter-dental attachment. A randomized controlled clinical trial. *J Clin Periodontol* 39: 760-768.
48. Cairo F, Rotundo R, Miller PD, Prato GPP (2009) Root coverage esthetic score: A system to evaluate the esthetic outcome of the treatment of gingival recession through evaluation of clinical cases. *J Periodontol* 80: 705-710.
49. Prato PG, Rotundo R, Franceschi D, Cairo F, Cortellini P, et al. (2011) Fourteen-year outcomes of coronally advanced flap for root coverage: Follow-up from a randomized trial. *J Clin Periodontol* 38: 715-720.