10.5005/jp-journals-10024-1299

ORIGINAL RESEARCH

Evaluation of Relative Efficacy of β-Tricalcium Phosphate with and without Type I Resorbable Collagen Membrane in Periodontal Infrabony Defects: A Clinical and Radiographic Study

D Trinath Kishore, Tushar Bandiwadekar, R Padma, Surangama Debunath, Profulla, Ajay Reddy

ABSTRACT

Background and objectives: To compare clinically and radiographically, the regenerative potential of a β-tricalcium phosphate bone graft, Cerasorb® with and without a bioresorbable type I collagen membrane, BioMend Extend™, in treating periodontal infrabony osseous defects.

Materials and methods: A total of 20 sites from 10 patients showing bilateral infrabony defects were selected and selected sites were randomly divided into experimental site A (Cerasorb®) and experimental site B (Cerasorb® and BioMend Extend™) by using split mouth design. The clinical parameters like plaque index, gingival index, probing pocket depth, clinical attachment level and gingival recession were recorded at baseline, 6 weeks, 3, 6 and 9 months. Radiographic evaluation (Linear CADIA) at 6 and 9 months; and intrasurgical measurements at baseline and 9 months were carried out to evaluate the defect fill, change in alveolar crest height and defect resolution.

Results: Significant reduction in all clinical parameters was observed in both the groups. On comparison no statistical significance was observed between the two groups. Radiographically, in site A there was significant defect fill of 78.4 and 97.2% at 6 and 9 months respectively. Whereas in site B reduction was 78.4 and 97.2% at 6 and 9 months respectively. After surgical re-entry, there was significant defect fill of 89.2 and 74% in both groups.

Interpretation and conclusion: Individually both the graft and membrane have shown promising results in the management of periodontal intrabony defects. But the added benefit by combining Cerasorb® with BioMend Extend™ was not observed statistically in both clinical radiographic findings.

Keywords: Periodontal regeneration, Bone graft, Type I collagen membrane, Linear CADIA, Surgical re-entry.

How to cite this article: Kishore DT, Bandiwadekar T, Padma R, Debunath S, Profulla, Reddy A. Evaluation of Relative Efficacy of β-Tricalcium Phosphate with and without Type I Resorbable Collagen Membrane in Periodontal Infrabony Defects: A Clinical and Radiographic Study. J Contemp Dent Pract 2013;14(2): 193-201.

Source of support: Nil

Conflict of interest: None declared

INTRODUCTION

In periodontal therapy, the nonsurgical procedures will prevent progression of periodontal destruction, but the anatomic changes that results from past disease activity often persist. Over the last three decades several different techniques have been developed to attain periodontal regeneration.[1-6] Some have been attempted with varying degrees of success. Among them, synthetic grafts or alloplastic materials have been of great interest in periodontal regeneration. The osteoconductive action of pure phase β-TCP (Cerasorb® Curasan, Germany) has been subjected to increased attention due to various factors, including its porous micromorphology, interconnecting pore structure and full resorbability, which is synchronous with bone remodeling.

Szabo et al (2000) stated that Cerasorb® is a satisfactory graft material even without autogenous bone for sinus lifting procedure.[7] Gera et al (2002) appreciated the regenerative potential of Cerasorb® in three wall intrabony defects by best radiographical results.[8]

The potential of collagen membrane for guided tissue regeneration (GTR) has been evaluated in animal studies. In humans, Mattson et al (1995),[9] Al-Arrayed et al (1995)[10] observed the reduction in probing pocket depth and also gain in clinical attachment level by using collagen membrane as a barrier. Currently, a new biomaterial BioMend Extend™ (Sulzer Dental, USA) is commercially available, which is mainly composed of type I collagen and has been used in surgical procedure when GTR is needed.

Clinical investigations suggest that, combination of an osteogenic bone graft along with GTR technique might

enhance both predictability of the procedure and the quality of bone repair.

Surgical re-entry gives three-dimensional (3D) view that provides substantial information regarding the efficacy of the therapeutic modalities aimed at regeneration of the periodontium. The procedure is quicker and less traumatic than the original surgery (Lynch 1992).[11] The combination of β-tricalcium phosphate (β-TCP) and type I collagen membrane with surgical re-entry has not been evaluated till date. Therefore, this study was undertaken to compare clinically and radiographically (Linear CADIA), the regenerative potential of a β-TCP bone graft, Cerasorb® with and without a bioresorbable type I collagen membrane, BioMend Extend™, in treating periodontal infrabony osseous defects and to evaluate the amount of bone regeneration at 9 months postoperatively, by surgical re-entry.

MATERIALS AND METHODS

The patients for this study were selected from the outpatient Department of Periodontics, Bapuji Dental College and Hospital, Davangere, Karnataka.

Inclusion Criteria

- Patients suffering from chronic periodontitis
- Patients with age group between 18 and 55 years of either sex
- Patients having good systemic health
- Having clinically at least two or more infrabony pockets of more than 5 mm, one on each quadrant or contralateral sides of the same arch, with radiographic evidence of vertical bone loss
- Patients who had not received any type of periodontal therapy for the past 6 months.

Exclusion Criteria

- Patients who are allergic to doxycycline/chlorhexidine/non steroidal anti-inflammatory drugs
- Patients who showed unacceptable oral hygiene during presurgical (phase I) period
- Patients who had taken antibiotics 1 month prior to the study
- Patients who were smokers
- Pregnant women and lactating mothers.

STUDY DESIGN

A total of 20 sites from 10 patients were selected for the study, after completion of presurgical phase of treatment. According to the type of treatment rendered by using split mouth design selected sites were divided into experimental site A [10 sites treated with flap surgery followed by placement of a β-TCP bone graft material (Cerasorb®)] and experimental site B [where 10 sites treated with flap surgery followed by placement of β-TCP bone graft material (Cerasorb®) and a bioresorbable type I collagen membrane (BioMend Extend™)].

Clinical Parameters

All clinical parameters were recorded preoperatively at baseline. Plaque index[12] and gingival index[13] were recorded at 6 weeks, 3, 6 and 9 months, whereas the probing pocket depth,[14] clinical attachment level[14] and gingival recession[15] were recorded at 6 and 9 months postoperatively.

Radiographs were taken using long cone paralleling technique and the radiographic evaluation was made by using linear computer-assisted densitometric analysis (Linear CADIA) at baseline, 6 and 9 months postoperatively. Study was concluded with surgical re-entry at the end of 9th month.

Presurgical Procedure

Following initial examination and treatment planning, the selected patients underwent phase I therapy, occlusal adjustments were done in cases of traumatic occlusion. Detailed instructions regarding self-performed plaque control measures were given. Two weeks after phase I therapy, oral hygiene and tissue response were evaluated and informed consent was taken from each patient.

Surgical Procedure

After reflection of the flap and exposure of the osseous defect, thorough surgical debridement of both soft and hard tissues was done and then it was thoroughly irrigated with normal saline. Baseline intrasurgical parameters were recorded, i.e. from cementoenamel junction (CEJ) to base of the defect and CEJ to alveolar crest by using William's graduated periodontal probe.

Experimental site A (Fig. 1): The flap was partially presutured before the placement of the graft material. The required quantity of β-TCP bone graft material (Cerasorb®) was transferred to the dappen dish and hydrated with patient's own blood. When it changes to cohesive mass, it was delivered into osseous defect with light incremental pressure using scoop of a cumine scaler (Hu-Friedy, USA). In experimental site B (Fig. 2)

β-TCP bone graft (Cerasorb®) was placed in the osseous defect using the same procedures as mentioned for experimental site A and a type I collagen GTR membrane (BioMend Extend™) was placed over the graft material.

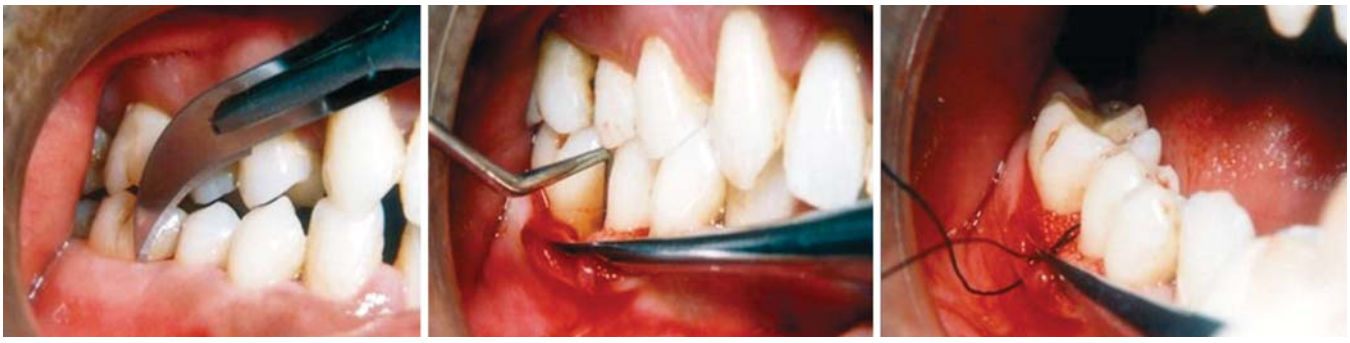

Fig. 1: Experimental site A: Cerasorb bone graft

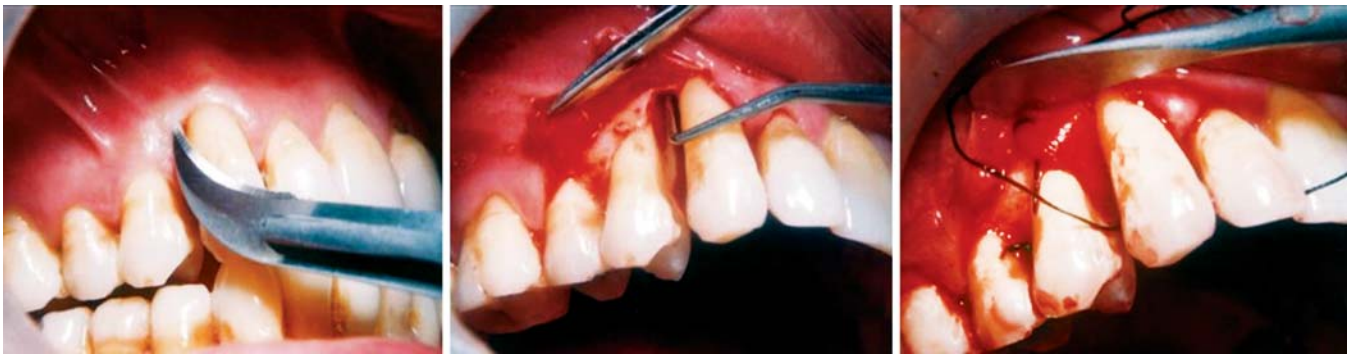

Fig. 2: Experimental site B: Cerasorb bone graft + BioMend Extend GTR

Preparation of the type I Collagen GTR membrane (BioMend Extend™)

The BioMend Extend™ GTR membrane was cut to the required size with the help of a template (which is available along with the membrane) and was hydrated in normal saline for few minutes. Later hydrated membrane was presutured and applied directly over the defect which was filled with graft and is stabilized by sling method using resorbable suture (Ethicon, 4-0).

The mucoperiosteal flaps were repositioned and secured in place by interrupted suture using the black braided (4-0) silk. The surgical area was protected and covered with noneugenol dressing (Coe-Pack, GC America Inc, USA). All patients were prescribed systemic doxycycline (Dox-T: 100 mg) 200 mg for first day followed by 100 mg/day for 4 days and combination of ibuprofen 400 mg and paracetamol 500 mg (Imol) twice daily for 3 days. Subsequent to postoperative instructions to the patient's postsurgical procedure followed after 24 hours to evaluate complications. At the end of the 9th month, patients were recalled for surgical re-entry procedure.

Radiographic Parameters

The following measurements were made at baseline and after 6 and 9 months postsurgery on all radiographs (Charlene BK et al 1987):[16]

A_0: Distance from CEJ to base of the defect (initial)

A_6: Distance from CEJ to base of the defect (6 months postsurgery)

A_9: Distance from CEJ to base of the defect (9 months postsurgery)

B_0: Distance from the CEJ to alveolar crest (initial)

B_6: Distance from the CEJ to alveolar crest (6 months postsurgery)

B_9: Distance from the CEJ to alveolar crest (9 months postsurgery).

Arithmetic Determinations

C_0: Initial distance from the alveolar crest to the base of the defect ($A_0 – B_0$)

C_6: 6 months postsurgery distance from the alveolar crest to the base of the defect ($A_6 – B_6$)

C_9: 9 months postsurgery distance from the alveolar crest to the base of the defect ($A_9 – B_9$)

D_6: Amount of defect fill = initial distance from the CEJ to base of the defect – 6 months postsurgery distance from CEJ to the base of the defect ($A_0 – A_6$)

D_9: Amount of defect fill = initial distance from the CEJ to base of the defect – 9 months postsurgery distance from CEJ to the base of the defect ($A_0 – A_9$)

E_6: Change in the alveolar crest height = initial distance from the CEJ to the alveolar crest – 6 months postsurgery distance from the CEJ to the alveolar crest ($B_0–B_6$)

E_9: Change in the alveolar crest height = initial distance from the CEJ to the alveolar crest – 9 months postsurgery distance from the CEJ to the alveolar crest (B_0–B_9).

The data of all clinical parameters were entered into the clinical study proforma. From the above measurements and arithmetic determinations, the following parameters were evaluated:

1. Amount of defect fill (mm) = D_6 (at 6 months) and D_9 (at 9 months)
2. Percentage of defect fill at 6 months = $D_6 \times 100/C_0$
3. Percentage of defect fill at 9 months = $D_9 \times 100/C_0$
4. Change in alveolar crest height (mm) = B_6 (at 6 months) and B_9 (at 9 months)
5. Percentage of change in alveolar crest height at 6 months = $E_6 \times 100/C_0$
6. Percentage of change in alveolar crest height at 9 months = $E_9 \times 100/C_0$
7. Percentage of defect resolution at 6 months = $C_0 - C_6 \times 100/C_0$
8. Percentage of defect resolution at 9 months = $C_0 - C_9 \times 100/C_0$

INTRASURGICAL MEASUREMENTS

The following measurements were made at baseline and after 9-month postoperatively by surgical re-entry (Charlene BK et al 1987):[16]

A: Distance from CEJ to the base of defect (initial)

A1: Distance from CEJ to the base of defect (9 months postoperative)

B: Distance from CEJ to crest of alveolar bone (initial)

B1: Distance from CEJ to crest of alveolar bone (9 months postoperative).

Arithmetic Determination

C: Distance from CEJ to the base of defect – CEJ to the crest of alveolar bone (initial) (A–B)

C1: Distance from CEJ to the base of defect – CEJ to the crest of alveolar bone (9 months postoperative) (A1–B1)

A-A1: Distance from CEJ to the base of defect (initial) – Distance from CEJ to the base of defect (9 months postoperative)

C-C1: CEJ to the crest of alveolar bone (initial) – CEJ to the crest of alveolar bone (9 months postoperative).

From the above measurements and arithmetic determination, the following parameters were evaluated:

1. Amount of defect fill = (A–A1)
2. Percentage of defect fill = (A–A1)/C × 100
3. Amount of change in alveolar crest height = (B–B1)
4. Percentage of change in the alveolar crest height = (B–B1) /C × 100
5. Amount of defect resolution = (C–C1)
6. Percentage of defect resolution = (C–C1)/C × 100.

STATISTICAL ANALYSIS

1. For intragroup variations, paired 't' tests were performed.
2. For comparison between the two groups/intergroup variations two sample rank test (Mann-Whitney 'U' test) a nonparametric test was performed.

RESULTS

The mean values of plaque and gingival index score at different intervals was statistically highly significant ($p < 0.001$). The mean values of periodontal pocket and attachment loss at different intervals was statistically highly significant ($p < 0.001$). On comparison, between the two groups at 6 and 9 months revealed a difference of 0.3 and 0.2 mm respectively, which were statistically not significant. For the mean gain in clinical attachment level between the two groups, revealed a difference of 0.2 mm at 6 months and 0.1 mm at 9 months, which was also not statistically significant.

Radiographic mean defect fill at experimental site A for 6 months was reduced to 5.6 ± 1.4 mm with a defect fill of 3.6 ± 2.4 mm (78.4%), which was statistically significant ($p < 0.01$). At 9 months, it further reduced to 4.4 ± 1.5 mm, with defect fill of 4.4 ± 2.6 mm (97.2%) which was statistically highly significant ($p < 0.001$). On the other hand at site B at 6 months it was reduced to 5.1 ± 1.3 mm by the, with a defect fill of 3.9 ± 1.7 mm (86.6%), which was highly statistically significant ($p < 0.001$). At 9 months, it further reduced to 4.4 ± 1.3 mm, with a defect fill of 4.2 ± 1.7 mm (97.4%), which was statistically highly significant ($p < 0.001$). On comparison between the two groups revealed a difference of 0.3, 0.2, 0.3 mm at 6, 9 and 6 to 9 months respectively, which were statistically not significant.

In the intrasurgical measurements mean defect fill at 9 months, it was reduced to 5.6 ± 1.8 mm, with a defect fill of 3.6 ± 1.5 mm (89.2%) at site A (Fig. 3) and 4.30 ± 0.9 mm, with a defect fill of 3.0 ± 0.9 mm (74%) at site B (Fig. 4) which were statistically highly significant ($p < 0.001$). However, on comparison between the two groups at 9 months, revealed a difference of 0.6 mm respectively, which was statistically not significant.

DISCUSSION

The eventual goal of periodontal regenerative therapy is to replace bone, cementum and periodontal ligament on previously diseased root surface. β-TCP a synthetic graft

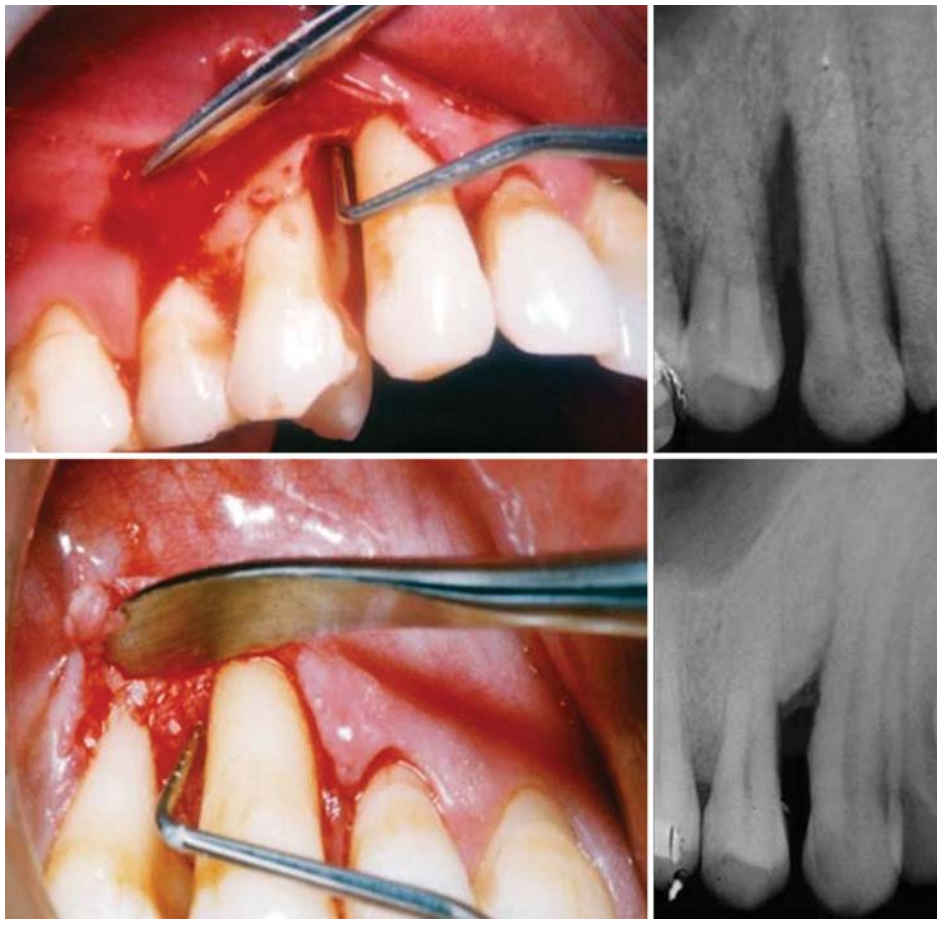

Fig. 3: Experimental site A: Defect fill by surgical re-entry

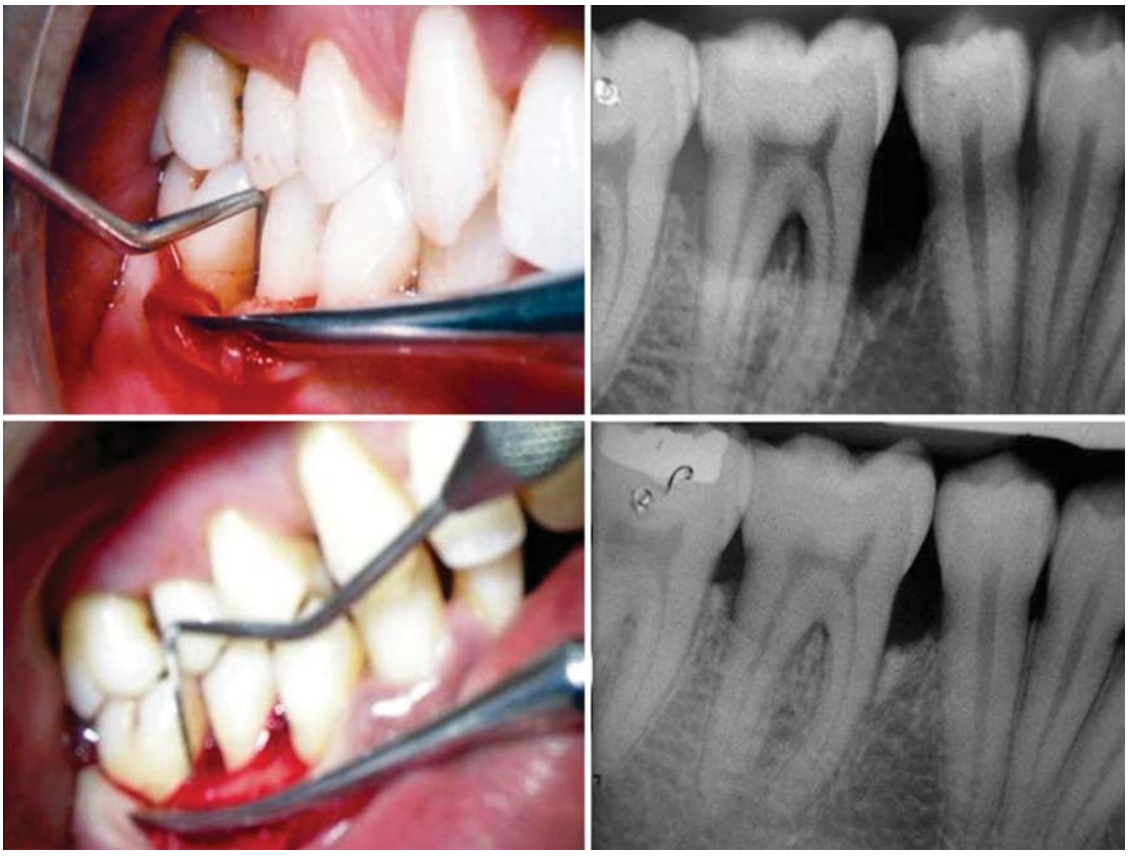

Fig. 4: Experimental site B: Defect fill by surgical re-entry

material, has been associated with repair of lost periodontium. There is also evidence that it possesses the potential to inhibit osseous resorption. It is well tolerated by the tissues and when placed in periodontal osseous defects, has been found to resorb within 12 to 18 months, depending upon particle size. A 1 year re-entry study in humans by Strub et al (1979)[17] compared TCP with allograft. They reported a measurable bone fill of 1.2 mm with TCP, but allograft showed a better result with 1.5 mm of bone fill.

GTR which excludes epithelial exclusion and selective repopulation of the root surface by multipotential cells has become an accepted mode of therapy in periodontics. In recent years studies have demonstrated that treating osseous defects with bioresorbable membrane (Guidor®) produced significant reduction in probing depth, while the incidence of gingival recession and membrane exposure is low (Gottlow and Nyman 1996).[18]

The use of various graft materials in combination with collagen membranes seems to improve clinical outcomes for periodontal osseous defects. Neil M Blumenthal (1988)[19] combined TCP with microfibrillar collagen in conjunction to flap surgery for maintaining postsurgical soft tissue levels. They reported 16.74% less soft tissue recession when compared to the controls.

A total of 20 sites from 10 patients were randomly selected by using a split mouth design. This excludes the influence of patient's specific characteristics (Hujoel and DeRuen, 1992) and facilitated the interpretation of trials by minimizing the effects of interpatient variability. The selection of the Intraosseous defects were done by clinical and radiographical methods (Baldock WT et al 1985)[20] and were randomly divided into experimental site A and experimental site B.

Oral hygiene status was assessed by taking the plaque and gingival index which were statistically significant. The mean PPD (Table 1) at experimental site A, at baseline was 7.1 ± 2.0 mm which was decreased to 4.0 ± 1.4 mm (44%) and 2.7 ± 0.8 mm (62%) at 6 and 9 months, respectively, which were statistically highly significant ($p < 0.001$). These findings were in accordance with those of Nery EB and Lynch L (1978) and Snyder AJ et al (1984). In experimental site B, the mean PPD at baseline was 6.8 ± 1.3 mm which was decreased to 2.5 ± 0.7 mm (36%) and 4.3 ± 1.3 (63%) at 6 and 9 months, respectively, which were statistically highly significant ($p < 0.001$). Thus, these results are in consistent with those of Blumenthal NM (1988), Mattson JS et al (1999) and Ratka Kruger P (2000).

Comparison between the two groups revealed that, the amount of PPD reduction at 6 and 9 months is 0.3 and 0.2 mm respectively which was statistically not significant.

The reduction in probing pocket depth after treatment can be attributed to the reduction in inflammation and shrinkage of the pocket wall due to the placement graft material into a defect which may modify the gingival tissue consistency and thereby impede penetration of periodontal probe (Lekovic 2003).[21]

The mean CAL (Table 2) at experimental site A, at baseline was 15 ± 3.5 mm which was decreased to 12 ± 2.8 (20%) and 11.1 ± 2.5 mm (27%) at 6 and 9 months, respectively, which were statistically highly significant ($p < 0.001$). These findings were in accordance with those of WT Baldock (1985), SS Stahl and S Froum (1986) and Snyder AJ et al (1984). In experimental site B the mean CAL at baseline was 14.9 ± 2.7 mm which was decreased to 3.2 ± 1.3 mm (21%) and 4.1 ± 1.1 mm (28%) at 6 and 9 months, respectively, which were statistically highly significant ($p < 0.001$). Thus, these findings were in accordance with those of Blumenthal NM (1988), Mattson JS et al (1999) and Eraldo L Batista et al (1998). Comparison between the two groups revealed that the amount of CAL reduction at 6 and 9 months is reduced to 0.2 and 0.1 mm respectively which was statistically not significant.

The gain in the clinical attachment level was attributed to resolution of tissue inflammation, reformation of collagen fibers and new attachment to the root surface and bone fill (Fowler et al 1982).[22]

Table 1: Mean difference in probing pocket depth of experimental site A and B and its comparison (A *vs* B) at different intervals

Time interval	*Experimental site A*				*Experimental site B*				*A vs B*	
	Mean PD ± SD	*Difference from baseline*	*%*	*p-value**	*Mean PD ± SD*	*Difference from baseline*	*%*	*p-value**	*Mean significance*	*Difference (p-value**)*
Baseline	7.1 ± 2.0	–	–	–	6.8 ± 1.3	–	–	–	–	–
6 months	4.0 ± 1.4	3.1 ± 1.3	44	t = 7.6 p < 0.001 HS	4.3 ± 1.3	2.5 ± 0.7	36	t = 11.2 p < 0.001 HS	0.3	0.94 NS
9 months	2.7 ± 0.8	4.4 ± 1.3	62	t = 10.3 p < 0.001 HS	2.5 ± 0.7	4.3 ± 1.3	63	t = 10.2 p < 0.001 HS	0.2	0.73 NS

*Intragroup; **Intergroup; HS: Highly significant; NS: Nonsignificant

Table 2: Mean difference in clinical attachment level of experimental site A and B at different intervals

Time interval	*Experimental site A*				*Experimental site B*				*A vs B*	
	Mean PD ± SD	*Difference from baseline*	*%*	*p-value**	*Mean PD ± SD*	*Difference from baseline*	*%*	*p-value**	*Mean significance*	*Difference (p-value**)*
Baseline	15 ± 3.5	–	–	–	14.9 ± 2.7	–	–	–	–	–
6 months	12 ± 2.8	3 ± 1.4	20	t = 6.4 p < 0.001 HS	11.7 ± 2.4	3.2 ± 1.3	21	t = 7.2 p < 0.001 HS	0.2	0.97 NS
9 months	11.1 ± 2.5	4 ± 1.4	27	t = 8.3 p < 0.001 HS	10.8 ± 2.4	4.1 ± 1.1	28	t = 11.6 p < 0.001 HS	0.1	0.43 NS

*Intragroup; **Intergroup; HS: Highly significant; NS: Nonsignificant

Radiographic evaluation for the changes in alveolar bone was done as per the methodology explained by Charlene BK et al 1987. Defect fill is a desirable outcome of any periodontal regenerative therapy. At experimental site A, the mean defect fill (Table 3) was 5.6 ± 1.4 mm (78.4%), and 4.4 ± 1.5 mm (97.2%) at 6 and 9 months respectively, which were statistically highly significant ($p < 0.001$). These findings were in accordance with those of WT Baldock et al (1985), EB Nery (1978) and Gera I et al (2002). At experimental site B, the mean defect fill was 5.1 ± 1.3 mm (86.6%) and 5.1 ± 1.3 mm (97.4%) at the end of 6 and 9 months respectively, which were statistically highly significant ($p < 0.001$). These results concur with those of Chen CC (1995), Lundgren D et al (1999) and Minabe M et al (2002).

Both experimental site A and experimental site B individually showed statistically highly significant ($p < 0.001$) defect fill on radiographic analysis. However, on intergroup comparison, the difference in defect fill was statistically not significant.

The direct linear measurement is the primary and outstanding outcome variable of all regenerative procedures which can be achieved by intrasurgical method. It provides a direct visualization of the osseous defect changes and visualization of supracrestal root surface, surgical re-entry was done at 9 months after initial surgery. These measurements were taken as per the methodology explained by Charlene BK et al 1987.

In experimental site A, 4 cases, the graft material was seen attached to the granulation tissue. Similar findings were seen in reports of WT Baldock et al 1984 and Froum et al, 1982 when examined histologically the TCP particles were walled off by the fibrous connective tissue. Stahl S and Froum (1987)[23] histologically evaluated the healing response of TCP particles at 13 to 18 months. They could not determine the specific reason for limited presence of particles, which may reflect exfoliation of these particles with subsequent replacement by dense connective tissue.

In experimental site B, none of the cases showed exposure of the graft. These findings were consistent with Sugaya (1990),[24] where the TCP particles with collagen showed tighter filling of granules than the TCP group. The defect fill (Table 4) in experimental site A and experimental site B was recorded as 3.6 ± 1.5 mm (89.2%) and 3.0 ± 0.9 mm (74%) respectively, which were statistically highly significant. However, on intergroup comparison, the difference in defect fill was not significant. These findings were in accordance with those of Alvin Synder (1984), Eraldo et al (1998) and Brion et al (1995).

Table 3: Mean difference in defect fill of experimental site A and B and its comparison (A *vs* B) at different intervals

Time interval	*Experimental site A*				*Experimental site B*				*A vs B*	
	Mean PD ± SD	*Mean defect fill D_M*	*% defect fill $D_M/B_0 \times 100$*	*p-value**	*Mean PD ± SD*	*Mean defect fill D_M*	*% defect fill $D_M/B_0 \times 100$*	*p-value**	*Mean significance*	*Difference (p-value**)*
Baseline	9.1 ± 3.1	–	–	–	9 ± 2.7	–	–	–	–	–
6 months	5.6 ± 1.4	3.6 ± 2.4	78.4	t = 4.5 p < 0.01 (S)	5.1 ± 1.3	3.9 ± 1.7	86.6	t = 7.1 p < 0.001 HS	0.3	0.41 NS
9 months	4.4 ± 1.5	4.4 ± 2.6	97.2	t = 5.6 p < 0.001 (HS)	4.4 ± 1.3	4.2 ± 1.7	97.4	t = 1.96 p < 0.001 HS	0.2	0.85 NS
6-9 months	–	1.2 ± 0.7	23.7	t = 4.3 p < 0.01 (S)	–	0.9 ± 11.9	18.8	t = 1.96 p < 0.01 S	0.3	0.36 NS

*Intragroup; **Intergroup; S: Significant; HS: Highly significant; NS: Nonsignificant

Table 4: Mean difference in defect resolution of experimental site A and B and its comparison (A *vs* B) at different intervals

Time interval	*Experimental site A*				*Experimental site B*				*A vs B*	
	Mean PD ± SD	*Mean defect resolution ($C-C_1$)*	*% resolution of the defect $C-C_1/AB\times100$*	*p-value**	*Mean PD ± SD*	*Mean defect resolution ($C-C_1$)*	*% resolution of the defect $C-C_1/A-B\times100$*	*p-value**	*Mean Significance*	*Difference (p-value**)*
Baseline	4.3 ± 1.4	–	–	–	4.2 ± 0.6	–	–	–	–	–
9 months	1.9 ± 1.2	2.4 ± 1.7	54.8	t = 4.4 p < 0.01 S	1 ± 0.9	3.2 ± 0.9	83.7	t = 11 p < 0.001 HS	0.8	<0.01 S

*Intragroup; **Intergroup; S: Significant; HS: Highly significant

The defect resolution at 9 month re-entry was 54.8% for experimental site A and 86.6% for the experimental site B which was statistically highly significant. The findings of experimental site B were comparable with Eraldo et al (1998).[25]

In the present study, favorable response was observed in all the clinical, radiological and surgical re-entry parameters recorded at both experimental site A and experimental site B. They individually showed statistically highly significant reduction in probing pocket depth and gain in clinical attachment level; defect fill, defect resolution and increase in alveolar crest height both radiographically and on surgical re-entry. However, when the defect resolution at 9 months surgical re-entry revealed a difference of 0.8 mm respectively, which was statistically significant ($p < 0.01$). This may be attributed to:

1. Improvements in graft stability in the defects due to adhesive nature of collagen.
2. Acceleration of bone regeneration due to promotion of osteoconductive nature of graft and collagen.

No postoperative complications other than those considered normal, following any surgical procedure were noticed. Also no antigenic reactions were observed in any of the patients thereby, indicating the safety of Cerasorb® as a bone graft material and BioMend Extend™ as bioresorbable membrane representing a novel approach toward periodontal regeneration.

CONCLUSION

Both Cerasorb® and BioMend Extend™ were safe to use, without causing any immunologic/antigenic reactions in any of the treated patients. The use of both the materials resulted in a mean probing depth reduction, gain in attachment and defect fill. The limited number of patients in the present study may have contributed to the lack of any detectable significance between the two treatment modalities. Future clinical study is recommended to study the efficiency of these materials with autologous blood products, such as platelet rich plasma in treating human periodontal infrabony defects.

REFERENCES

1. Mann W. Autogenous transplant in treatment of an infrabony pocket. Periodontics 1964;2:205-08.
2. Schall Horn RG. The use of autogenous hip marrow biopsy implants for bony crater defects. J Periodontology 1968;39: 145-47.
3. Goldberg VM, Stevenson S. The natural history of autografts and allografts. Clin Orthoped 1987;225:7-16.
4. Scott Metsger D, Driskell TD, Paulsrud JR. Tricalcium phosphate ceramic – a resorbable bone implant: Review and current status. JADA 1982;105:1035-38.
5. Nielsen IM, Ellegaard B, Karring T. Kielbone® in new attachment attempts in humans. J Periodontol 1981;52:723-28.
6. Nyman S, Lindhe J, Karring T, Rylander H. New attachment following surgical treatment of human periodontal disease. J Clin Periodontol 1982;9:290-96.
7. Szabo G, Suba Z, Hrabak K, Barabas J, Nemeth Z. Autogenous bone verse beta-tricalcium phosphate alone for bilateral sinus elevation (2- and 3-dimensional computed tomographic, histologic and histomorphometic evaluation): Preliminary results. Int J Oral Maxillofac Implants 2001;16:681-92.
8. Gera I, Dori F, Keglevich T. Experience with the clinical use of beta-tricalcium phosphate ceramic (Cerasorb®) as a bone replacement graft materials in human periodontal osseous defects. Fogorv Sz 2002;95:143-47.
9. Mattson JS, Galagher SJ, Mansoor HJ. The use of 2 bioabsorbable barrier membranes in the treatment of interproximal intrabony periodontal defects. J Periodontol 1999;70:510-17.
10. Al-Arrayed F, Asam S, Moran J, Dowell P. Clinical trail of cross-linked human type I collagen as a barrier material in surgical periodontal treatment. J Clin Periodontol 1995;22:371-79.
11. Lynch SE. Methods for evaluation of regenerative procedures. J Periodontol 1992;63:1085-92.
12. Levin MP, Gether L, Adrian J, Cutright DF. Healing of periodontal defects with ceramic implants. J Clin Periodontol 1974;1:197-205.
13. Caton J, Nyman S, Zander H. Histometric evaluation of periodontal surgery. II connective tissues attachment levels after four regenerative procedures. J Clin Periodontol 1980;7:224.
14. Ramfjord SP. The Periodontal index. J Periodontol 1962;38: 604-10.
15. Becker W, Becker BE, Berg L, Prichard J, Caffese RG, Rosenberg E. New attachment after treatment with root isolation procedure: Report for treated class III and class II furcations and vertical osseous defects. Int J Periodontics Restorative Dent 1988;8:9-22.

16. Krejic CB, Bissada NF, Farah C, Greenwell H. Clinical evaluation of porous and nonporous hydroxyapatite in the treatment of human intrabony defects. J Periodontol 1987;58:521-28.
17. Strub JR, Gaberthuel TW, Firestone AR. Comparison of tricalcium phosphate and frozen allogenic bone implant mass. J Periodontol 1979;50:624-29.
18. Gottlow J, Nyman S, Lindhe J, et al. New attachment formation in human's periodontium by guided tissues regeneration. J Clin Periodontol 1986;13:604-16.
19. Blumenthal NM. The use of collagen membranes to guide regeneration of new connective tissue attachments in dogs. J Periodontol 1988;59:830-36.
20. Baldock WT, Hutchens LH, Mcfalls WT, Simpson DM. Evaluation of tricalcium phosphate material in human periodontal osseous defects. J Periodontol 1985;56:1-7.
21. Lekovic V, Camargo PM, Weinlaender M, et al. Effectiveness of a combination of platelet-rich plasma, bovine porous bone mineral and guided tissue regeneration in the treatment of mandibular grade II molar furcations in humans. J Clin Periodontol 2003;30:746-51.
22. Fowler C, Garret S, Crigger M, et al. Histologic probe position in treated and untreated human periodontal tissues. J Clin Periodontol 1982;9:373-85.
23. Stahl SS, Forum S. Histological evaluation of human intraosseous healing responses to the placement of tricalcium phosphate ceramic implants. Three to eight months. J Periodontol 1986;57:21.
24. Sugaya A, Minable M, Hori T. Effect on wound healing of tricalcium phosphate collagen complex implants in periodontal osseous defects in the dog. J Periodontol Res 1990;25:60-63.
25. Batista EL Jr, Novaes AB Jr, Simonpietri JJ, Batista FC. Use of bovine-derived anorganic bone associated with guided tissues regeneration in intrabony defects: 6-month result after re-entry. J Periodontol 1999;70:226 (Academy Report).

ABOUT THE AUTHORS

D Trinath Kishore (Corresponding Author)

Reader, Department of Periodontics, GITAM Dental College and Hospital, Visakhapatnam, Andhra Pradesh, India, Phone: 9949109930 08912840395, e-mail: dentalcys@gmail.com

Tushar Bandiwadekar

Senior Lecturer, Department of Oral Surgery, Maratha Mandal Dental College, Belgaum, Karnataka, India

R Padma

Professor and Head, Department of Periodontics, Coorg Institute of Dental Sciences, Virajpet, Karnataka, India

Surangama Debunath

Professor and Head, Department of Periodontics, Navodaya Dental College and Hospital, Raichur, Karnataka, India

Profulla

Reader, Department of Periodontics, Navodaya Dental College and Hospital, Raichur, Karnataka, India

Ajay Reddy

Senior Lecturer, Department of Periodontics, Army College of Dental Sciences, Secunderabad, Andhra Pradesh, India