

Comparative Evaluation of Bioactive Glass in Treatment of Intra Osseous Periodontal Defects: A Clinical and Radiographic Study.

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ABSTRACT

Background: The present clinical trial was designed to evaluate the effects of bioactive glass in treatment of periodontal intra-bony defects. **Methods:** 25 patients 23-55 years of age with intra-bony defects completed 1 year study. After completion of initial therapy, defects were randomly assigned to either a test or control procedure. Following flap reflection root planning and removal of chronic inflammatory tissue in both groups test defects were restored with bioactive glass, while open flap debridement was done in control sites. Muco-periosteal flaps were replaced sutured and periodontal dressing was used. Follow up was carried out weekly, 3 months 9 months and 1 year post surgery. Plaque score, sulcus bleeding score probing pocket depth were recorded at baseline, 3 months and 1 year. Standardized radiographs using RVG was taken at baseline, immediately post operatively and at 1 year. **Results:** Radiographs showed a significant increase in radiographic density and volume between defects treated with bioglass when compared with open flap debridement alone. Probing pocket depth, probing attachment level showed improvement in test and control site with greater trend to improvement in test site. **Conclusion:** It was concluded that bioglass is effective as an adjunct to conventional surgery in treatment of intra-bony defects.

Keywords: Bioactive Glass, Intra Osseous Periodontal Defects, Periodontal Regeneration, Flap debridement, Grafting.

INTRODUCTION

Periodontal regeneration continues to be the ultimate goal of periodontal therapy. Surgical procedures incorporating autogeneous grafts, allografts, alloplasts and barrier membranes have been used for treatment of intra-bony defects with the goal of attaining periodontal regeneration.^[1] Traditionally the gold standard for osseous regeneration has been autogeneous bone, it is restorable and is non-allergenic but requirement of an additional surgery limits its use. The use of allografts has been questioned because of risk of viral disease transmission, hence alloplastic bone substitutes are being widely used in clinical practices for treatment of periodontal intra-bony defects.^[2] Among the various subgroups of alloplastic bone grafts bioactive glass is a kind of bioactive ceramic consisting of silicon oxide, calcium oxide, phosphorous pentoxide and sodium oxide.^[3]

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The term bioactive has been defined as a material that elicits a specific biologic response at the interphase of the material which results in formation of bond between the tissues and the material.^[4]

MATERIALS & METHODS

25 Patients 25-55 years of age presenting nonadjacent pockets in posterior segment with probing depth > 5mm and radiographic evidence of intra-osseous defect > 5mm were considered for present study. In control sites open flap debridement was done while in test sites perioglass was used as grafting material after open flap debridement [Figure 1-4].

Plaque was assessed according to Sillness and Loe 1964. Sulcus bleeding index was assessed according to Muhlemann 1975. Probing pocket depth and attachment level was recorded using Williams probe. Customised acrylic stent grooved in area of defect was used to provide a reproducible axis for probe and for assessing attachment level. Standardized radiographs using RVG was taken at baseline, immediately postoperatively and at 1 year [Figure 5]. Radiographs showed a significant increase in radiographic density and volume between defects treated with perioglass when compared to open flap debridement alone. Probing pocket depth and probing attachment level showed improvement in test and control site with greater trend to improvement in test

site. It was concluded that bioglass is effective as an adjunct to conventional surgery in treatment of intra-bony defects.

Statistical Analysis: The data i.e plaque index, sulcus bleeding index, probing depth, relative attachment level and radiographic fill of the defect at baseline and at one year after surgery was first collected. Following this the data was subjected to statistical analysis using Students paired t test & Students unpaired t test.

RESULTS

Table 1 shows the comparison of mean probing pocket depth reduction between Control group

(Group A) and Experimental Group (Group B). Statistically significant difference was recorded at 9 month interval in the means of the two groups. Test group showed highest difference. The results indicated reduction in probing pocket in both test and control site however more reduction in probing pocket depth was seen in test site as compared to control site when assessed at 9 months. There was an increase in radiographic bone fill in test as well as control site. In the test site the mean radiographic bone fill from baseline to one year was statistically significant. The increase in radiographic density in test site was attributed to the fact that bioglass leads to formation of an active hydrated calcium phosphate layer at the surface of glass particles.

Table 1: Comparison of Mean Probing pocket depth reduction between Control group (Group A) and Experimental Group (Group B).

Variables	Control group (Mean±SD)	Test group (Mean±SD)	Difference from baseline	t-value	P- value
Baseline	7.70±1.21	8.00±1.59	-0.3	2.1	0.1
3 Months	5.55±1.90	5.65±1.22	-0.1	-0.26	0.7
9 Months	3.75±1.16	2.75±.91	1.0	3.0	.004

Table 2: Comparison of Mean Plaque Index Reduction scores between Control group (Group A) and Experimental group (Group B).

Variables	Control group (Group A) Mean±SD	Experimental group (Group B) Mean±SD	Difference between the groups	t- value	P value
Baseline	1.85±.27	1.83±.18	0.02	2.89	0.4
3months	1.48±.19	1.30±.12	0.18	3.52	0.001
9months	1.23±.11	0.84±.27	0.39	5.78	<.001

Table 3: Comparison of Sulcus-Bleeding Index between Control group (Group A) and Experimental group (Group B).

Variables	Control group mean±SD	Test group mean±SD	Difference from baseline	t value	P value
Baseline	1.95±.88	1.60±.75	0.35	1.34	.18
3 months	1.35±.48	0.65±.58	0.70	4.0	.004
9 months	0.75±.44	0.10±.44	0.65	4.6	>.001

Table 2 shows comparison of Mean Plaque Index Reduction scores between Control group (Group A) and Experimental group (Group B). A significant difference was recorded at both 3 months and 9 months in both the groups. Lowest plaque was recorded in experimental group at 9 months. Plaque and sulcus bleeding indices of test sites showed an improvement against the control sites at both three months and one year.

Comparison of Sulcus-Bleeding Index between Control group (Group A) and Experimental group (Group B) is shown in table 3. Statistically significant difference was recorded in Control group (Group A) and Experimental group (Group B) at 3 months and 9 months with highest difference at 9 months. Test

group showed the lowest mean sulcus bleeding scores at 9 months (0.10 ± 0.44).

DISCUSSION

The treatment modalities for intra bony defects include autografts, allografts growth factors, guided tissue regeneration and combination of these techniques.^[5] Among the various subgroups of alloplastic bone grafts bioactive glass is a kind of bioactive ceramic that binds to bone without an intervening fibrous connective tissue interface.^[6] In a histologic study, Schepers reported that narrow size bioglass (300-350µm) has osteo-stimulatory effect besides osteo-conductive properties.^[7] The study

showed significantly greater improvement at the test defect site treated with bioglass compared to control site. It has been shown that the formation of an active hydrated calcium phosphate layer at the surface of glass particles is important for the formation of bone/graft bond. Plaque and sulcus bleeding indices of test sites showed an improvement against the control sites at both three months and one year. The results indicated reduction in probing pocket depth in both test and control site however more reduction in probing pocket depth was seen in test site as compared to control site when assessed at one year.

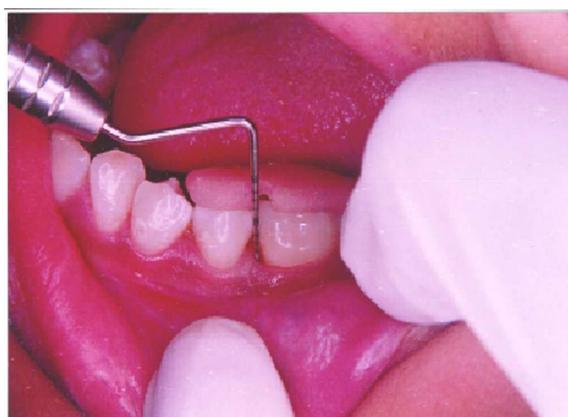


Figure 1: Preoperative pocket depth from a fixed reference point on customized acrylic stent



Figure 2: Osseous defect after debridement.

Although Helnch stated that alloplastic materials can be osteo-inductive a study by Wilson and Loe^[8] using a bioactive ceramic reported a more rapid repair of surgically created periodontal defects in monkeys when compared to other alloplastic materials. As defined by Wilson et al⁹ the process of osteo-production involves colonization of bioactive surface by migrating differentiating osteogenic stem cells into the surgically treated environment. As such

bioactive glass has the ability to promote both intra and extracellular responses at the particle /bone interface. Bioglass has been successfully used as a solid implant material to replace damaged ossicles of middle ear Merwin.^[10] The results of the present study indicate reduction in plaque index scores from baseline to 9 months in both control and experimental group.



Figure 3: Perioglass filled in the defect.



Figure 4: Pre & postoperative radiograph showing defect infill.

However more reduction in plaque index scores from baseline to 9 months was seen in experimental group as compared to control group. The findings of this study are consistent with findings of studies conducted by Jan Lindhe and Sture Nyman 1985.^[11] This reduction in plaque index score could be attributed to professional tooth cleaning at regular time intervals. Also bioglass has been shown to have an antibacterial effect on supra/sub gingival plaque. This study indicates reduction in sulcus bleeding

index in both control and experimental group. However more reduction in sulcus bleeding index was seen in experimental group as compared to control group. The findings of this study are consistent with the findings of study conducted by Anderegg et al.^[12] An increase in radiographic bone fill was seen in experimental group as compared to control group. The findings of this study are consistent with the findings of Froum,^[13] Borghetti,^[14] and Yukna^[1] which concluded that mean defect fill with grafted site was greater than non-grafted defects. Moreover, an increase in calcium content around glass particles accounts for increase in radiographic density Bragger et al.^[15]

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