Research Paper

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Assessment of Certain Properties of a Graft Material as Relevant to Periodontal Osseous Defect

Medical Science

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ABSTRACT

This study evaluated the efficacy of a recently introduced bone graft material (Bone Medik) in the treatment of intrabony periodontal osseous defect. 20 defects in 14 patients, 25-50 years of age of both sexes received Bone Medik in the defect site following mucoperiosteal flap reflection, root planing and curettage of defect site. Clinical and radiographic parameters were recorded prior to surgery and 6 months postsurgery. A statistically significant improvement in clinical and radiographic parameters was observed after 6 months. Bone fill of 62.76% was recorded at the end of the study.

Introduction

Treatment approaches for the restoration of lost periodontal structures include the use of different types of bone replacement grafts, such as autografts, allografts, xenografts, and alloplastic materials, guided tissue regeneration and enamel matrix derivatives.[1-4]

In the past few years, periodontists have used various alloplastic materials in an attempt to regenerate bone lost due to periodontal disease. There has been much controversy regarding the efficacy of such materials and techniques.[5]

Among alloplastic graft materials, bioactive ceramics is a group of osteoconductive materials including Hydroxyapatite, Flouroapatite, Bioactive glass and Tricalcium phosphate.[6] Bioactive glass is a ceramic composed principally of SiO2. The original composition of bioactive glass approved by FDA, designated 45S5 was, 45 mol% of SiO2, 26.9 mol% CaO, 24.4 mol% Na2O, 2.5 mol% P2O5. This material can bond to bone through development of a surface layer of carbonated hydroxyapatite, *in situ*.[7]

The present study was an attempt to evaluate the efficacy of a newly introduced bioactive glass (Bone Medik) in the treatment of periodontal osseous defects.

Materials and Method

Material

Commercially available bioactive glass (Bone Medik) was used as the material for study. According to manufacturer's claims Bone Medik is a composite of bioactive calcium-phospho-silicate particulate which is composed solely of elements that exist naturally in normal bone (Ca, P, Na, Si, O). The material can be mixed with saline or distilled water for its easy manipulation in the defect site.

Study method

Patient selection

14 systemically healthy subjects suffering from moderate to severe chronic periodontitis, aging between 25 to 50 years, having radiographic evidence of one or more vertical defects (two or three walled) and probing pocket depth of 6 mm or more at the experimental site were enrolled. Patients who had any medical condition or were on therapeutic regimen that could decrease the probability of soft tissue or bone healing, pregnant or lactating women, teeth with furcation involvement, non vital or endodontically treated teeth, third molars, one walled defects, patients with parafunctional habits i.e., bruxism and who had periodontal surgery in last 6 months, allergic to tetracycline, chlorhexidine were excluded.

Clinical parameters

The clinical parameters i.e., Probing pocket depth, Clinical attachment level, Plaque index, and Radiographic parameters (radiographic depth of intrabony defect) were recorded by a single investigator just before surgery as baseline data, and then were re-evaluated at 6 months post surgery.

Probing pocket depth was measured as the distance from the gingival margin to the base of the pocket using University of North Carolina probe. Clinical attachment level with same periodontal probe from cementoenamel junction to base of periodontal pocket on a vacuum formed acrylic stent was measured. Vertical grooves were made in the stent for proper alignment of the probe and to ensure reliability and reproducibility for future comparisons.

To facilitate serial radiographic comparisons, intraoral periapical radiographs with attached X-ray grid, standardized by means of paralleling technique were utilized.

Study protocol

After completing oral prophylaxis, subjects were re-evaluated after 4 weeks. The subjects showing acceptable oral hygiene were selected for the study and signed written consents were obtained from the patients.

Surgical protocol

Surgical procedure was performed under local anesthesia. It included intrasulcular incisions, full thickness flap elevation, meticulous debridement and root planing, endosseous defect filling with bioactive glass, flap repositioning.

Suturing was done with interrupted 3-0 silk sutures. Periodontal dressing was placed. Routine postoperative instructions were given to all the subjects. Antibiotics Doxycycline hyclate (100 mg every 12 hours on the day of surgery and every 24

hours for subsequent 7 days) were prescribed and Chlorhexidine mouth rinse (0.12%) twice daily for 14 days. Subjects were recalled after 7 days for suture removal. Clinical and radiographic parameters were re-evaluated 6 months post surgery.

Statistical analysis

The statistical analysis was carried out using Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, version 15.0 for Windows). All quantitative variables were estimated using measures of central location (mean) and measures of dispersion (standard deviation and standard error). For time related comparison Paired *t*-test was applied. All statistical tests were two-sided and performed at a significance level of α=0.05.

Results & Observations

Fourteen patients in age group 25-50 years had participated in this study. Twenty intrabony defects were treated with Bone Medik. All the treated sites resulted in uneventful healing. No complications such as allergic reaction, abscesses, or infections were observed throughout the study period, in any of the patients.

Statistically significant mean radiographic osseous defect fill of 64.76% (2.49 mm) was observed from baseline to 6 months. [Table 1, 2]

A statistically significant reduction of 1.75± 1.59 mm in probing pocket depth was recorded after 6 months. A gain of 0.4± 0.5 mm in clinical attachment level was recorded which was statistically significant [Table 1,2].

Table 1: Showing Mean Probing pocket depth, Clinical attachment level and radiographic osseous defect depth at baseline and 6 months postsurgery.

Parameter	Baseline	6 months postsurgery
PPD	4.8 ±0.99	2.75±1.02
CAL	2.25 ±1.71	1.85±1.71
RD	4.00 ±1.24	1.57±1.22

PPD: Probing pocket depth, CAL: Clinical attachment level, RD: Radiographic defect depth.

Table 2: Showing mean differences and significance of parameters.

Parameter	MD	SD	P Value	Significance
Clinical PPD1-PPD2 CAL1-CAL2	 1.75 0.4	 1.59 0.5	 <0.001 <0.01	 HS S
Radiographic RD1-RD2	 2.49	 0.51	 <0.001	 HS

PPD1-PPD2- Reduction in probing pocket depth after 6 months.

CAL1-CAL2- Clinical attachment level gain after 6 months.

RD1-RD2- Reduction in defect depth after 6 months.

Discussion

This study evaluated the efficacy of a new bioactive glass material (Bone Medik) in the treatment of intrabony periodontal defects. Statistically significant reduction in probing pocket depth, gain in clinical attachment level and radiographic osseous defect fill was recorded.

For some years, so called bioactive glass products have been available for the treatment of intrabony defects.[8] Bioactive glass has a good manageability, hemostatic and osteoconductive properties and it may also act as a barrier retarding epithelial down growth.[9-14] Wide spread use, popularity among the clinicians and manufacturer's claims made us interested to study this particular material. The present study has evaluated the efficacy of bioactive synthetic graft material (Bone Medik) in the treatment of intrabony periodontal osseous defects.

The amount of mean radiographic osseous defect fill was measured to be 64.76% (2.49 mm) after 6 months, which was statistically significant (P<0.001). These findings are inaccordance with studies of Mengel, *et al.*,[15] Froum, *et al.*[16] and Lovelace, *et al.*[17] who showed a mean bone fill of 65.0%, 62.0% and 61.8% respectively in the bioactive glass treated sites.

A statistically significant mean probing pocket depth reduction of 1.75±1.59 mm was observed from baseline to 6 months. This reduction in probing pocket depth can be attributed to soft and hard tissue improvements following resolution of inflammation and to the osteogenic potential of the bone graft material used in the study. Our results are in agreement to the previous studies of Froum, *et al.*[16] Lovelace, *et al.*[17] and Mengel, *et al.*[8] who have also demonstrated statistically significant reductions in probing pocket depth over a period of 6 months in bioactive glass treated sites.

Clinical attachment level gain of 0.41±0.5 mm was statistically significant from baseline to 6 months. This gain in attachment level can be attributed to periodontal regeneration, long junctional epithelium formation and/or soft tissue healing at the base of the pocket. These findings are in accordance to the studies of Lovelace, *et al.*[17] , Froum, *et al.*[16] who reported approximately similar mean attachment level gains. Park, *et al.*[18] also reported that the sites treated with bioactive glass have shown statistically significant gain of attachment levels 6 months post surgery.

Plaque index was monitored throughout the study period and a non significant change was observed. This variable is totally dependent on the patient's compliance and his/her efficacy to maintain oral hygiene. As the subjects were on continuous periodic recall, constant motivation, education and oral hygiene instructions revision have led to almost similar plaque scores at all the periods of observation, which have negated the possibility of the elucidation of effect of this variable on regeneration. Similarly non significant changes in plaque scores have also been reported in previous studies.[19-20]

The results of this study demonstrate that treatment of intrabony periodontal osseous defects with Bone Medik (A bioactive glass synthetic graft) has led to clinically and statistically significant probing depth reduction, clinical attachment level gain and radiographic osseous defect fill.

CONCLUSION

Bone Medik resulted in statistically significant improvements in radiographic osseous defect measurements and clinical parameters. It was very well tolerated by the subjects. No adverse effects such as periodontal abscess, inflammation and/or allergic reaction in the treated surgical site was reported.

Photographs:

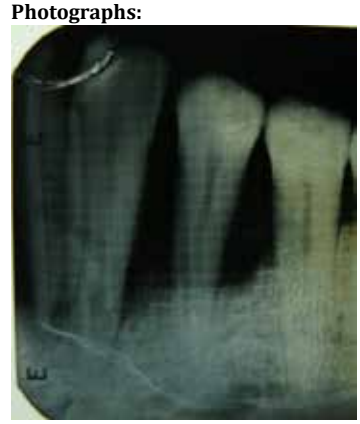

Figure 1: Pre-operative radiograph

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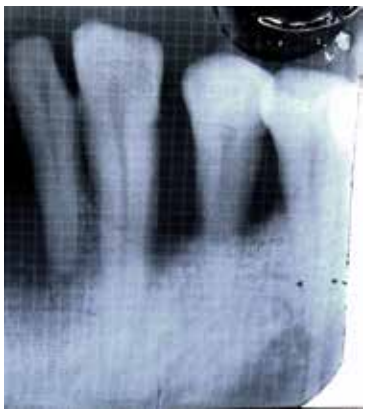

Figure 2: After 6 months

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