

Novabone Marvel: Transforming Intrabony Periodontal Defects Post Flap Surgery

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Abstract:

Background: The goal of periodontal therapy is regeneration of the lost periodontal tissues. Recent innovations have suggested a substantial role of Bioactive glass on bone regeneration. The objective of this study was to evaluate effect of OFD using Bioactive Glass (NovaBone dental bone graft Morsels).

Materials and Methods: The clinical parameters that were assessed at baseline and 9 months post-surgically were Plaque index, Gingival bleeding index, Pocket depth, Gingival margin position and Clinical attachment level. Radiographic parameters were calculated using IOPAs subjected to digital assessment and measurements. Statistical analysis was carried out to compare the results at baseline and 9 months post-surgically

Results: The results showed statistically significant reduction in PPD, gain in CAL and reduction in osseous defect depth after 9 months. On analysis, there was a statistically significant difference with respect to gain in CAL, reduction in osseous defect depth, amount of defect fill and percentage of original defect resolved.

Conclusion: In the present study, use of bioactive bone achieved better clinical and radiographic outcomes.

Key Word: bioactive glass; open-flap debridement; periodontal osseous defects; periodontal regeneration.

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I. Introduction

Periodontitis is characterized by inflammation and subsequent loss of the structures surrounding the tooth and root, which includes the bone, cementum, and attachment apparatus. The ideal goal of periodontal therapy is the regeneration of lost periodontal tissues. This has led to a renaissance of research in utilization of autogenous, allogenic, and alloplastic bone replacement materials in treatment of periodontal osseous defects. Autogenous grafts are truly osteogenic. Despite its potential, its use is limited due to surgical invasiveness, second donor site, limited amount of donor material and extended operating time for harvesting.^[1] On the other hand, Alloplastic bone grafts are synthetic, inorganic, biocompatible substitutes which offer advantages of unlimited quality, no additional surgical site and less operating time^[2]. Many studies have been done to resolve intrabony defects by using various grafts or minimally invasive techniques^[3]. Recent innovations have suggested a substantial role of a bio-active glass on bone regeneration in periodontal osseous defects. **Bioactive glass**, a biocompatible product, has a positive influence on osteoblast culture and inhibitory capacity on fibroblast proliferation and on the apical migration of junctional epithelium. The replacement of bioactive particles with new bone occurred not only due to an osteoconductive property, but also to an osteostimulatory capacity.^[4] One of the commercially available forms of Bioactive glass is NovaBone Dental Bone Graft Morsels. According to manufacturer NovaBone Morsels were developed to simulate the physical characteristics of xenografts and allografts. A combination of physical characteristics (macro porosity) and ionic release (osteostimulation) differentiates NovaBone Morsels from other products with similar appearance including allografts and xenografts. Being synthetic, NovaBone Morsels eliminates all concerns about disease transmission or immune responses. It is a crystalline composite composed of oxides of silicon, calcium, sodium, and phosphorous in a silica base.

II. Material And Methods

The subjects for this clinical study were selected from the outpatient department of Periodontics at the College of Dental Sciences in Davangere, Karnataka. The study protocol received approval from the local Ethical committee at the College of Dental Sciences in Davangere, Karnataka, India. The duration of the study spanned 1-1.5 years.

Patient selection criteria:

The patients were selected with the following inclusion and exclusion criteria from both the sexes.

INCLUSION CRITERIA:

- Patients with age group between 25-50 years.
- Patients suffering from mild to moderate periodontal pockets (5-7mm) clinically with radiographic evidence of bone loss.

EXCLUSION CRITERIA:

- Patients showing unacceptable oral hygiene during the pre-surgical (Phase-I) period.
- Patients who had medical problems like Cardiovascular diseases, Malignancy, Liver diseases, Bleeding disorders, Hormonal or Metabolic disorders that would contraindicate periodontal surgery.
- Smokers, Alcoholics, Pregnant and lactating women.
- Patients who had received any antibiotics and/or anti-inflammatory drugs for the past one month.

Clinical Parameters:

The following clinical parameters were recorded at baseline, 3 months, 6 months and 9 months using a UNC 15 probe and an acrylic stent:

- A. Plaque index (Silness and Loe, 1964)
- B. Gingival Bleeding index (Ainamo and Bay, 1975)
- C. Probing pocket depth
- D. Gingival margin position
- E. Clinical attachment level

Radiographic parameters: Intraoral periapical (IOPA) radiographs of each defect site was exposed at baseline, 3months, 6months and 9 months using paralleling technique and subjected for the measurement of osseous defect. All radiographs were subjected to Digital assessment and measurements

Procedure methodology

MEASUREMENT OF OSSEOUS DEEFCTS:

IOPA of each site were digitalized using a flatbed scanner with a scanning resolution of 600 dpi (UMAX – ASTRA 1220S). The scanned images, stored in JPEG format were transferred to COREL DRAW 2020. The cemento-enamel junction, the base of defect and the crest of alveolar bone were located on the images. Using the ruler tool, a line was drawn from CEJ to the base of the defect. The length of the line was displayed in the property box of the software. The software then displayed the distance between these two points. The same procedure was then repeated to obtain the distance between CEJ and alveolar crest. Subtracting these two measurements, the depth of osseous defect was obtained. In the study, regenerative materials included Bioactive Glass, specifically NovaBone Dental Morsels Bone Graft manufactured by NovaBone Products in Alachua, FL, this material is a restorable bioactive glass with a particle size ranging from 500 μ to 1000 μ and a mean particle size of 750 μ . The pore size falls within the range of 50 μ to 100 μ , with a notable pore volume of approximately 60%. This regenerative material was a key component used in the study for its bioactive properties and suitability in promoting bone regeneration.

Surgical procedure: Following the baseline examination and comprehensive initial therapy involving scaling and root planing, the intrabony defects were taken for surgery. Patients, comfortably seated in the dental chair, underwent a mouth rinse with 10 ml of 0.2% chlorhexidine digluconate solution, and the extra-oral surfaces were swabbed with 0.5% Povidone iodine solution. Anesthesia was administered at the operative site using 0.2% Lignocaine HCl with adrenaline (1:80,000) through block and infiltration techniques.

Crevicular and interdental incisions were made using the Bard Parker handle with blades No.12 and No.15. A full-thickness mucoperiosteal flap was carefully reflected using a periosteal elevator, with attention to retaining interdental papillary tissue whenever possible. Subsequently, a meticulous surgical debridement of both soft and hard tissues was performed using area-specific Gracey curettes. Following the debridement, the surgical site was copiously irrigated with 0.9% normal saline and thoroughly inspected to ensure the completion of the

procedure. Pre-suturing was conducted through the buccal and lingual flaps before the placement of NovaBone Dental Morsels.

The mucoperiosteal flaps were repositioned and secured with 3/8 circle, reverse cutting needles, and 3-0 black braided silk sutures. Interrupted direct loop sutures were applied to achieve primary closure of the interdental papilla, and the treated area was safeguarded with a non-eugenol (Coe-pak) dressing.

All patients received a prescription for systemic Amoxicillin 500mg, Metronidazole 400mg thrice daily for 5 days, along with Aceclofenac 100mg + Paracetamol 325mg tablets thrice daily for 3 days, and 0.2% chlorhexidine digluconate (CHX) rinse twice daily for 2 weeks. Post-operative instructions were provided to all patients, including a requirement to visit the department 24 hours post-surgery and then again after 10 days.



Figure 1: Preparation of the acrylic stent for standardized measurements

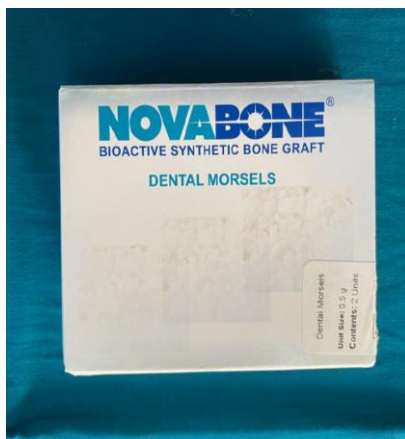


Figure 2: NovaBone Dental morsels graft (Bioactive Glass)



Figure 3: Baseline measurements using acrylic stent



Figure 4: Debridement and visualization of the defect (buccal view)



Figure 5: Debridement and visualization of the defect (palatal view)



Figure 6: Placement of graft into the defect



Figure 7: Suturing



Figure 8: Periodontal dressing

Statistical analysis

Results were expressed as Mean \pm SD and percentages. Changes in the clinical and radiographic parameters from baseline to nine months post-surgery in were analyzed using statistical software (SPSS version 22, IBM, NY).

III. Results

All patients showed good clinical compliance and the healing period was uneventful for both the treated groups, without showing any signs of infection or complications.

Plaque index: The mean baseline values for plaque index were 0.58 ± 0.18 and at 9 month post-surgically it was 0.57 ± 0.17 . The mean reduction in Plaque index at baseline and 9 months was 0.01 (1.7%) which was non-significant (p- value=0.49).

Gingival Bleeding Index: The mean baseline values for gingival bleeding index were 37.41 ± 7.79 and at 9 month post-surgically it was 27.24 ± 10.33 . The mean reduction in gingival bleeding index at baseline and 9 months was 10.18 (27.2%) which was significant (p- value<0.001).

Probing Pocket Depth: The mean baseline values for PPD were 5.76 ± 0.83 and at 9 month post-surgically it was 3.24 ± 1.68 . The mean reduction in PPD at baseline and 9 months was 2.53 (44.0%) which was significant (p- value=0.001).

Gingival Margin Position: The mean baseline values for GMP were -1.24 ± 1.30 and at 9 month post-surgically it was -1.00 ± 1.77 . The mean reduction in GMP at baseline and 9 months was 0.24 which was non-significant (p- value=0.47).

Clinical attachment level: The mean baseline values for CAL were 7.00 ± 1.58 and at 9 month post-surgically it was 4.24 ± 2.22 . The mean reduction in CAL at baseline and 9 months was 2.76(39.4%) which was significant (p- value<0.001).

Table no 1 Shows mean difference in plaque index, gingival bleeding index, probing pocket depth, gingival margin position, clinical attachment level of subjects at baseline and 9 months post-surgery.

Table no 1: Shows clinical parameters before and 9 months post-surgery.

Clinical parameter	Time interval	Mean ± sd	Difference from baseline	% difference	P-value
Plaque index	Baseline	0.58 ± 0.18	-	-	-
	9 MONTHS	0.57 ± 0.17	0.01	1.7%	0.49 (NS)
Gingival bleeding index	Baseline	37.41 ± 7.79	-	-	-
	9 MONTHS	27.24 ± 10.33	10.18	27.2%	<0.001 (S)
Probing pocket depth	Baseline	5.76 ± 0.83	-	-	-
	9 MONTHS	3.24 ± 1.68	2.53	44.0%	0.001 (S)
Gingival margin position	Baseline	-1.24 ± 1.30	-	-	-
	9 MONTHS	-1.00 ± 1.77	0.24	-24%	0.47 (NS)
Clinical attachment level	Baseline	7.00 ± 1.58	-	-	-
	9 MONTHS	4.24 ± 2.22	2.76	39.4%	<0.001 (S)

p-value ≤ 0.05 – Significant; p-value > 0.05 – Non significant

Radiographic parameters

The results for the radiographic parameters are as follows:

Defect depth: The mean baseline values for defect depth were 3.32 ± 1.03 and at 9 month post-surgically it was 1.98 ± 0.77 . The mean reduction in defect depth at baseline and 9 months was 1.34 (40.3%) which was significant (p-value < 0.001).

Amount of defect fill: The mean defect fill of the original defect at 9 months post-surgically was 1.34 ± 0.64 .

Percentage defect fill: The mean percentage defect fill of the original defect at 9 months post-surgically was 39.86 ± 15.30 .

Percentage of original defect resolved: The mean percentage of original defect resolved at 9 months post-surgically was 37.83 ± 16.01 .

Table no 2: Comparison of radiographic changes of subjects at baseline and 9 months post-surgery.

Table no2: Records the Percent Change in Lipids profile after treatment given.

Measurements	Mean±sd	P-value
Baseline defect depth	3.32 ± 1.03	-
9-month post-surgical defect depth	1.98 ± 0.77	<0.001 (s)
Amount of defect fill	1.34 ± 0.64	-
Percentage defect fill	39.86 ± 15.30	-
Change in alveolar crest	0.06 ± 0.40	-
Percentage change in alveolar crest	2.03 ± 12.30	-
Percentage original defect resolved	37.83 ± 16.01	-

p-value ≤ 0.05 – Significant; p-value > 0.05 – Non significant

IV. Discussion

Periodontal therapy primarily aims to reduce or eliminate tissue inflammation induced by bacterial plaque and its by-products, correct defects or anatomic issues, and regenerate lost periodontium due to the disease process. Bone replacement grafts play a crucial role in facilitating and promoting periodontal regeneration⁽⁵⁾.

Although conventional surgical approaches, like open flap debridement, offer critical access to assess and detoxify root surfaces, these techniques have limited potential in regenerating periodontal tissue. Periodontal regeneration has been reported when surgical therapy incorporates osseous grafting techniques. Presently, bone replacement grafts, including autografts, allografts, xenografts, and alloplasts, stand as widely used treatments for regenerating periodontal supporting tissues lost due to periodontitis⁽⁶⁾. NovaBone dental morsels bone graft is a crystalline composite of silicon, calcium, sodium and phosphorus in a silica base. The pore size of the material ranges from $50\mu - 100\mu$ with a pore volume of about 60%. It offers a combination of physical characteristics (macro porosity) and ionic release (osteostimulation). This differentiates NovaBone Dental

Morsels from other products with similar appearance, including allografts and xenografts. Being synthetic, it eliminates all concerns about disease transmission or immune responses. It not only acts as an osteoconductive scaffold, but also imparts an osteostimulatory effect.

The graft was easy to use and manipulate during placement and filled the defect completely. A non-graft control was excluded from the study as numerous studies have already demonstrated significant results favoring use of bone grafts when compared to a non-grafted site. (Hanes et al 2007)⁽⁶⁾

There was a significant reduction in gingival bleeding index (GBI) from baseline to 9 months post-surgery, indicating a decrease in gingival inflammation. Additionally, all sites showed statistically significant reductions in pocket depth (PPD) over the same period. The study revealed a statistically significant gain in clinical attachment level from baseline to 9 months post-surgery. Utilizing radiographic bone measurements as a non-invasive, cost-effective, and painless alternative to direct measurements was observed. While conventional radiography has limited sensitivity and potential geometric distortion, standardized radiographs were taken to establish reproducible source tooth film geometry, minimizing errors. Image processing techniques facilitated the detection of minute osseous changes following periodontal therapy.

The study also showed that only flap surgery might not suffice for complete resolution of the defect that is significant. Additional agents along with the bone graft can be considered as adjunct for regenerative flap surgery. Several studies have been done on herbs and synthetic agents which have proved to show antibacterial and antimicrobial properties when either used as LDD or as an adjunct to flap surgery^(7,8,9,10,11)

It is noteworthy that most alveolar bone changes post-regenerative treatment of intrabony defects occur within the intrabony component, with minimal crestal bone apposition. In some cases, net crestal resorption may occur. Referring to studies by Becker et al. (1993) and Machtei (1997)⁽¹²⁾, measuring periodontal intrabony defects from a fixed reference point to the base of the alveolar defect holds value for monitoring osseous changes post-regenerative treatment. The percentage of original defect resolved in the control group, after 9 months post-surgically, was 37.83% ± 16.01%.

V. Conclusion

The use of NovaBone Dental Morsels Bone Graft in this study has demonstrated promising results post-periodontal regenerative surgery. The observed positive outcomes, including a statistically significant gain in clinical attachment level and a greater percentage of original defect resolution in the subjects underscore the potential efficacy of NovaBone as a regenerative material.

While the findings are encouraging, it is essential to note the need for further comprehensive studies to strengthen the evidence base. Future research endeavors should focus on comparing NovaBone with other regenerative materials, possibly incorporating additive materials to assess their combined effects. This would contribute to a deeper understanding of the material's effectiveness, paving the way for more informed and optimized approaches in periodontal regenerative surgery. Such comparative studies could provide valuable insights into the relative advantages and limitations of NovaBone and guide its optimal utilization in clinical practice.

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