CLINICO-RADIOGRAPHIC EVALUATION OF GUIDED TISSUE REGENERATION USING COLLAGEN MEMBRANE AND BIPHASIC CALCIUM PHOSPHATE IN TREATMENT OF INTRABONY PERIODONTAL DEFECTS

Simant Lamichhane¹*, Manoj Humagain¹, Asmita Dawadi¹, Prakriti Rupakhety²
¹Department of Periodontics, Kathmandu University School of Medical Sciences, Dhulikhel, Nepal
²Chandragiri Dental Home and Implant Center Pvt. Ltd., Bhaktapur

ABSTRACT

Background: The ideal result of successful periodontal therapy is periodontal regeneration. Guided tissue regeneration is considered currently as gold standard for periodontal regeneration. Poor mechanical properties, biomaterials instability and lack of biocompatibility of regenerative membrane alone led to direct use of bioactive materials in defect area. So, this study was intended towards evaluation of effectiveness of resorbable membrane with bioactive molecule containing biphasic calcium phosphate determined by amount of bone fill both clinically and radiographically.

Methods: A total of 20 intrabony defects from sixteen patients were selected. The study designed was Quasi experiment, a quantitative non randomized experimental trial. The clinical parameters like Plaque index, Gingival index, Pocket probing depth, Amount of Gingival recession and relative attachment level were recorded at baseline and after 6 months by using acrylic surgical stent following periodontal access flap surgery along with use of collagen membrane and alloplast bone graft. Radiographic parameters were taken using Orthopantomograph for measuring the radiographic bone fill at baseline and after 6 months. Data were analyzed using paired t-test and Wilcoxon sign rank test.

Results: All the parameters post operatively were statistically significant. Clinically, gain in attachment was 2.1±1.25mm and pocket reduction was 3.35±1.39mm whereas linear radiographic bone fill was found to be 2.81±1.43mm. However, gingival recession was found to be increased post-operatively.

Conclusions: The current study showed combination of bone alloplast and regenerative membrane yields promising results in treatment of human intrabony periodontal defects.

INTRODUCTION

There are various features of periodontal diseases like dull aching pain, halitosis, dentinal hypersensitivity, bleeding gums, tooth mobility, etc. However, the ultimate consequence is loss of supporting bone.¹ The alveolar bone loss is higher in interproximal areas with a destruction rate around 0.3mm/year.² The common patterns of bone loss in periodontal disease are horizontal and vertical. Among the two, vertical bone loss has a greater regenerative potential.³

Regeneration of lost periodontium is the most desired periodontal treatment outcome which employs graft associated and non-graft associated techniques. The history of graft associated periodontal regeneration started with the use of autogenous bone graft to reconstruct the lost alveolar bone.⁴ Guided tissue regeneration (GTR) is the most commonly used non-graft associated method of periodontal regeneration. Single use of GTR has certain shortcomings like lack of rigidity and stability. Combining both bone graft substitutes (a rigid unit) and GTR membrane has shown superiority over conventional periodontal flap surgery, use of bone graft and GTR alone.⁵

OSTEON™ III, a next generation bone graft material is a successor of Osteon II which has been tested clinically in human subjects successfully.⁶ It is a biphasic calcium phosphate and comes with chemical composition of 60% Hydroxyapatite (HA) and 40% beta tricalcium phosphate (β-TCP). Being a combination product, it has advantage of both slow resorbing HA crystal and fast resorbing β-TCP. Genoss is a type I bovine derived collagen membrane for guided tissue regeneration. The aim of this study was to evaluate the efficacy of using both biomaterials in intrabony vertical defects.

METHODS

The study was conducted after obtaining ethical clearance from Kathmandu University School of Medical Sciences with institutional review committee designated number- 74/19. The study designed was Quasi experiment which is a quantitative experimental research method and non-randomized clinical trial.

Samling method employed for the current study was
convenience, purposive sampling. Sample size calculated was 20 after adding the attrition rate of 10% using a standard formula. Patients between 20-55 years of age with no habit of smoking, probing pocket depth ≥5mm and intrabony defect of ≥ 4mm deep were included for the study whereas patients who have undergone periodontal regeneration therapy within 6 months, patients with systemic disease influencing the periodontium, patient who have undergone antibiotic therapy in past 6 months, un-cooperative patients and lactating mothers were excluded from the current study.

A total of twenty sites from sixteen patients were prepared for regenerative periodontal surgery using GTR and bone alloplast. Informed written consent was obtained from all the study participants. All patients received at least two sessions of non-surgical periodontal therapy before surgical periodontal therapy.

All surgical procedures were performed under completely aseptic conditions. Open flap debridement of the selected cases was done followed by placement of regenerative materials (Figure 2). The elevated flaps were sutured back into their original position with interrupted sutures using 4-0 silk suture. The surgical sites were protected from use of non-eugenol periodontal dressings (Coe-pack ™, GC America Inc.) (Figure 3). Patients were asked to refrain from toothbrushing and chewing hard foodstuffs for 1 week on the surgical site. Chlorhexidine mouthrinse along with antibiotics and analgesics was prescribed to the patients depending upon the clinical scenario. Patients were recalled after a week for periodontal dressing and suture removal.

The baseline data for PPD, RAL, REC, PI (Silness and Loe)⁹ and GI (Loe and Silness)¹⁰ were measured. For uniformity, customized acrylic stent with reference groove was used for measurement of PPD, RAL and recession at baseline (Figure 1) and after 6 months of follow up (Figure 4). All clinical parameters were measured using University of North Carolina (UNC)- 15 probe (Hu-Friedy Mfg. Co., Chicago, USA).

RESULTS

A total of 20 sites from sixteen patients were included under study. The Table 1 displays the baseline data pre-operative, post-operative data after six months of follow-up and changes from the baseline to the complete evaluation after six months'
All the parameters post operatively were statistically significant (p-value <0.05). Both plaque and gingival index were found to be improved post-operatively. GI and PI yielded a positive change of 0.13±0.17 and 0.16±0.17 post-operatively (Table 1).

**DISCUSSION**

Loss of attachment is the key feature of periodontal disease.\(^\text{12}\) Regeneration of the lost periodontium is the ideal goal of periodontal therapy.\(^\text{10}\) Periodontal regenerative therapy is the preferred choice over traditional pocket reduction/elimination techniques. Traditionally it was believed that complete debridement of the pocket would result in periodontal regeneration but in reality, there was more of the healing by formation of long junctional epithelium rather than bone remodeling or formation of periodontal ligament.\(^\text{14}\)

Periodontal regeneration in general comprises of graft associated and non-graft associated regeneration. Sculean et al.\(^\text{4}\) (2008) in a systematic review found that combining both graft and non-graft associated products resulted in superior periodontal regeneration rather than single use of them. Guided tissue regeneration using membranes is considered as gold standard for periodontal regeneration. But the search for the appropriate bone graft materials is continuous because of requirement of second surgical site for autograft- a gold standard in bone graft material.\(^\text{15}\) Combination product of β-TCP and HA has been tried to use as a bone graft material in many animal and human studies.\(^\text{11,16,17}\) HA crystals alone can result in formation of bone in early stages but as it is resistant to resorption, residual particles of HA may contribute to resorption of newly formed bone and cementum. On the other hand, β-TCP gets resorbed faster which is also not desirable in many cases. So, a bio-resorbable material i.e. β-TCP is mixed with HA to obtain better clinical results.\(^\text{13}\) The present study was done therefore to evaluate the results obtained from combination of bone alloplast and GTR membrane in treatment of human intrabony periodontal defect. The study participants revealed no post-operative complications and allergic reactions to Osteon III bone graft material and Genoss collagen membrane.

Clinically, CAL gain was 2.1±1.25mm and PPD reduction was 3.35±1.39mm whereas linear radiographic bone fill was found to be 2.81±1.43mm. There was a significant amount of defect fill as well with a mean change of 2.81±1.43mm which was evident radiographically. However, gingival recession was found to be increased post-operatively.

**Table 1: Mean and standard deviation of periodontal status, soft and hard tissue parameters**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Baseline pre-operative</th>
<th>Six months post operative</th>
<th>Change in six months’ time</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GI</td>
<td>1.08±0.14</td>
<td>0.95±0.12</td>
<td>0.13±0.17</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>PI</td>
<td>1.00±0.16</td>
<td>0.84±0.15</td>
<td>0.16±0.17</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>PPD</td>
<td>7.15±1.09</td>
<td>3.80±1.4</td>
<td>3.35±1.39</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>RAL</td>
<td>11.35±1.39</td>
<td>9.05±2.01</td>
<td>2.10±1.25</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>REC</td>
<td>0.55±0.83</td>
<td>1.55±1.25</td>
<td>1±0.92</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CEJ-AC</td>
<td>3.81±1.20</td>
<td>2.79±1.22</td>
<td>1.02±0.87</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CEJ-BD</td>
<td>7.75±1.66</td>
<td>4.94±1.93</td>
<td>2.81±1.43</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>AC-BD</td>
<td>3.95±1.69</td>
<td>2.15±1.78</td>
<td>1.79±1.29</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

The radiographic improvements were evident by bone fill of 2.81±1.43mm in the periodontal defect area. The defect fill was 3.43 ± 1.25mm in a clinical study done by Bansal et al.\(^\text{11}\) (2014) which is similar to our study. The radiographic defect fill was also evident in several other studies.\(^\text{20,21}\) Overall, the results of the present study demonstrated improvements in both clinical and radiological parameters. The treatment threshold of periodontal therapy in a successfully treated periodontitis patient as suggested by World Workshop for classification of periodontal and peri-implant diseases was PPD ≤ 4mm which was achieved in this present study (post-op 6 months PPD was 3.8 ± 1.4mm).\(^\text{24}\)

The study had certain limitations. One of the major drawbacks was the unavailability of comparison group as same group was compared at two different study time in this study. Furthermore, it would have been of more diverse and valuable if the study could have been conducted at multiple centers.
CONCLUSION

OSTEON™ III and Genoss collagen membrane are safe to use and exerts a positive effect in terms of pocket depth reduction, gain in clinical attachment level and radiographic bone fill. Thus, these materials could be used successfully as a predictable regenerative material in human intrabony periodontal defects.

ACKNOWLEDGEMENT

We would like to acknowledge oral medicine and radiology department and all supporting staffs of Kathmandu University School of Medical Sciences for their constant support during this research work. We would like to express our heartfelt thanks to Dr. Sirjana Dahal, currently in Department of Community Dentistry in Institute of Medicine, Kathmandu for helping us in biostatistical analysis.

CONFLICT OF INTEREST: None

FINANCIAL DISCLOSURE: None

REFERENCES:


