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Efficacy of Palatal Connective Tissue Graft as a Membrane in the Treatment of Intrabony Defects

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Abstract

Background and aims. The aim of this study was to compare clinical effects of two different membranes (palatal connective tissue and collagen) in combination with Bio-Oss in the treatment of intrabony defects.

Materials and methods. Fifteen patients who had at least a pair of intrabony defects with an attachment loss of ≥5 mm and an initial osseous defect depth of ≥3 mm participated in this study. Probing pocket depth, clinical attachment level, position of gingival margin, bony defect depth and position of alveolar crest were measured before surgery and in re-entry procedure 9 months after treatment.

Results. The results of this study showed that both techniques were effective in the treatment of intra-bony defects and both treatment modalities resulted in significant differences in all the parameters before and after surgery ($P<0.05$).

Conclusion. It was shown that, after treatment, considering all the variables in each group, there were significant improvements, but there were not any statistical differences in any of the variables between the two groups.

Key words: **Bio-Oss, collagen membrane, intrabony defects, palatal connective tissue.**

Introduction

As a result of the high prevalence of intrabony defects[1] and possibility of tooth loss with the progression of these lesions,[2,3] different techniques have been proposed for the treatment of intra-bony lesions, including resective osseous surgery,[4] pocket elimination and debridement,[5] regenerative therapy with the use of membranes[6-9] and bone materials.[10,11] In order to reconstruct the lost periodontal tissues different kinds of graft materials have been used, including autografts,[12,13] allografts[14] and xenografts[15-17] and also PRP in combination with guided tissue regeneration (GTR).[18-24] GTR is based on the use of a membrane as a barrier to prevent the migration of epithelial and connective tissue cells to the wound site during the healing period, which provides a chance for periodontal ligament cells to accumulate; these cells are considered the principle cells in periodontal regeneration.[25-27] Due to the disadvantage of non-bio-absorbable mem-

branes, which is the necessity for their removal during a second surgery, there is an increased tendency for the use of bio-absorbable membranes. In addition, because of the cost and possibility of immunologic reactions,[28,29] the use of autogenous membranes seems to be justified.[28-30] Palatal connective tissue graft is one of the autogenous membranes which has shown successful results in different studies.[30-34] In addition, it has been shown that connective tissue graft has mesanchymal cells which are osteogenic.[35] In a comparison of periosteal pedicle graft (experimental) and open flap debridement (control) in intrabony defects, more bone fill has been shown in the experimental group. In addition, it has been shown that combination of connective tissue graft as a membrane with hydroxyapatite results in more gain in clinical attachment level and bone fill than connective tissue graft alone.[33] On the other hand, Moghaddas et al[33] showed no differences in resolution of the defect when they compared connective tissue graft and open flap debridement procedures. Paolantonio[37] showed more clinical attachment level gain and bone fill with the use of collagen membrane and Bio-Oss than collagen membrane alone. In a study by Sculean et al,[38] the use of collagen membrane in combination with Bio-Oss was compared with open flap debridement and better results were achieved in pocket depth reduction. On the other hand, Nevins et al[39] showed no differences between the combination of collagen membrane and Bio-Oss and Bio-Oss alone according to clinical attachment level gain, pocket probing depth and bone fill.[40] To our knowledge the benefits of palatal connective tissue graft as a membrane in comparison with collagen membranes have not been tested. Therefore, the purpose of this study was to compare the efficacy of using palatal connective tissue graft and collagen as a membrane with Bio-Oss in the treatment of intrabony defects.

Materials and Methods

Study population

Fifteen patients with a mean age of 39 ± 2.75 (8 females and 7 males) participated in this study. Patients were selected from the patient pool at Shahid Beheshti University of Medical Sciences. All the patients suffered from generalized severe periodontitis. Chronic periodontitis was classified as more than 30 percent of sites with clinical attachment loss of more than 5 mm.

Study design

This study was a randomized, split-mouth, single-blinded controlled clinical trial, which compared periodontal outcomes of the use of connective tissue graft plus Bio-Oss (particle size 0.25–1.0 mm, Bio-Oss, Geistlich, Wolhusen, Switzerland) (experimental group) with bioresorbable collagen membrane of porcine origin (BioGide Perios, Geistlich,Wolhusen, Switzerland) plus Bio-Oss (control group) in the treatment of intrabony defects. The subjects were informed of the purpose of the study and an informed consent was signed by each patient. The study was performed in accordance with the Helsinki Declaration of 1975, as revised in 2000. The study protocol was reviewed and approved by the Ethics Board at Shahid Beheshti University of Medical Sciences. All the patients were treated at the Department of Periodontology, Shahid Beheshti University of Medical Sciences, by one experienced periodontist.

Inclusion criteria

1. plaque score of 20% or less before surgery;
2. tooth mobility less than Miller Class III;[40]
3. vital teeth;
4. no systemic disease;
5. compliance with the maintenance program.

Defect characteristics

For qualified patients to participate in the study, clinical and radiographic examinations were needed to find paired matching defects. If they were not found, paired defects were accepted in the same quadrants but not in the adjacent interproximal spaces. In addition, the defects were expected to have the following criteria: (1) attachment loss ≥5 mm; (2) radiographic vertical bony component ≥3 mm (INTRA); (3) two or three walls; (4) no furcation involvement; and (5) no intrabony defects extending into the furcation area.

Exclusion criteria

1. pregnancy;
2. smoking;
3. aggressive periodontitis;
4. use of antibiotics in the last 3 months
5. no history of periodontal surgery in the last 6 months.

Randomization

Using randomized cross-over approach the defects were randomly selected in each patient by the flip of a coin. The distance from the alveolar bone crest to the bottom of the defect (INTRA), CAL, and the distance of the alveolar crest to an acrylic stent were used to decrease outcome variability.[24] The INTRA was estimated before surgery based on radiographs and transgingival bone sounding recordings by the same calibrated investigator who also performed all the other

clinical measurements.

Intraexaminer reproducibility

Three patients, each with at least 5 teeth (single or multi-rooted) with PD ≥5mm on at least two aspects of each tooth, were used to calibrate the examiner. The examiner evaluated the patients on two separate occasions, 72 hours apart. Calibration was accepted if >90% of the measures could be reproduced within 1.0-mm difference.

Clinical procedures and periodontal measurements

All the patients completed a hygienic phase of scaling and root planing one month before the baseline examination. Teeth with Miller Class II mobility were adjusted. An acrylic stent was made for measurements of the defined parameters before and during surgery and also during re-entry phase. The following variables were measured at baseline: (1) probing pocket depth from the base of the stent to the depth of the pocket; (2) clinical attachment level which was calculated from two measurements of depth of the pocket and distance from the base of the stent to cemento-enamel junction; (3) gingival margin position, from the base of the stent to the gingival margin. For all the measurements, a UNC-15 periodontal probe was used in the direction of a groove which was made on the acrylic stent and used as a guide.

The defects were randomly assigned to one of the following treatment modalities at the time of surgery: (1) connective tissue graft + Bio-Oss; (2) collagen membrane + Bio-Oss. Randomization was performed immediately following defect debridement by the flip of a coin. Surgical sites were anesthetized using 2% lidocaine (epinephrine 1:80000). In both groups, the following measurements were made during the surgery after reflecting a mucoperiosteal flap and debridement of the lesion and root planing (Figure 1 & 2): the distance from the base of the stent to the bottom of the defect (stent-BD); the distance from the base of the stent to the most coronal extension of the alveolar bone crest (stent-BC). The INTRA of the defects was defined as the difference between stent-BD and stent-BC. Bio-Oss granules (bovine-derived mineralized matrix) were used to fill the defect (Figure 3 & 4). In the experimental group palatal connective tissue graft was used to cover the defect. In the palate, within the distance from the first premolar to the first molar, a horizontal incision was made 3 mm away from the gingival margin with a depth of 1 mm and two vertical incisions at two ends of the first incision. Superficial tissue layer was reflected and the connective tissue graft was excised with a thickness of 1 mm with no periosteal elevation. The graft was obtained in a size to cover the defect and 3 mm of the bone around it. Horizontal cross mattress sutures were used to fix the graft (penetrating the needle from the mesiobuccal papilla, passing the interdental space at the distoplalatal or distolingual aspect in a cross-wise manner, horizontally crossing the palatal or lingual flap and then, penetrating from mesiopalatal or mesiolingual aspect of the flap at the distobuccal papilla). In the control group collagen membrane was used to cover the defect in the same manner (Figures 5 & 6). Periodontal dressing was placed over the area and antibiotics (Amoxicillin 500 mg, every 8 hours for 7 days; 0.12% chlorhexidine mouthrinse, every 12 hours for 14 days) and oral analgesics (Ibuprofen 400 mg, every 4 hours as necessary) were prescribed.

Post-operative care

The dressings and sutures were removed 10 days postoperatively. The patients were instructed to brush surgery sites gently and avoid flossing surgery sites for 4 weeks. The patients were examined every 2 weeks during the first month, at which scaling was performed if

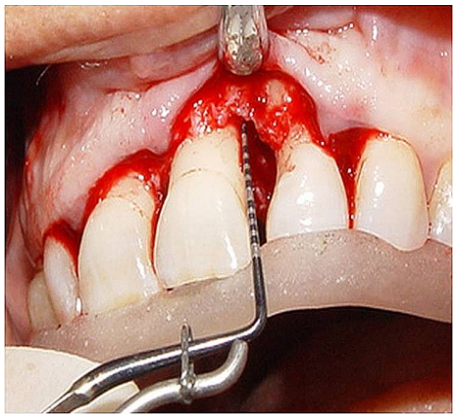

Figure 1. Intrabony defect in the distal aspect of upper left central incisor (baseline for the connective tissue group).

Figure 2. Intrabony defect in the distal aspect of lower left canine (baseline for the collagen group).

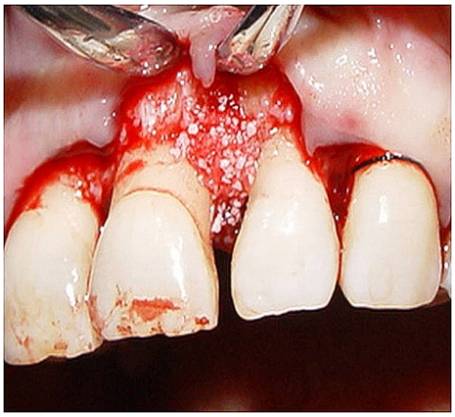

Figure 3. The bony defect is filled with Bio-Oss in the experimental group.

Figure 4. The bony defect is filled with Bio-Oss in the control group.

needed and oral hygiene was monitored. Then evaluation continued monthly until the final evaluation for re-entry surgery after 9 months. Defect resolution was calculated by comparing the measurements of defect depth at baseline and re-entry procedure (Figures 7 & 8).

Statistical analysis

Statistical analysis was performed using a commercially available software (SPSS 11).

For statistical evaluation of the changes from baseline to the 9-month interval in each treatment group, Student's paired *t*-test with a confidence interval of 95% was used. For the comparisons between the groups, *t-test* was used. Statistical significance was defines at $\alpha = 0.05$. The power of the study, given ≥ 1 mm as a significant difference between the groups, was calculated to be 0.80.

Results

The results of this study showed that both techniques were effective in the treatment of intrabony defects and both treatment modalities resulted in significant

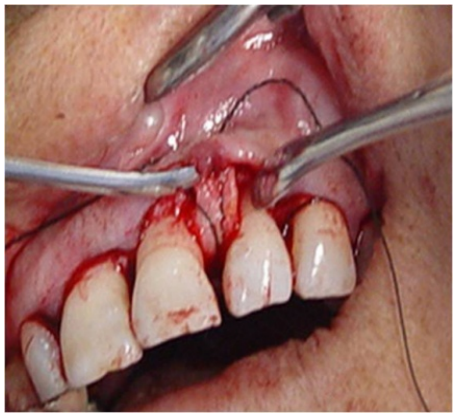

Figure 5. Covering the defect with connective tissue graft in the experimental group.

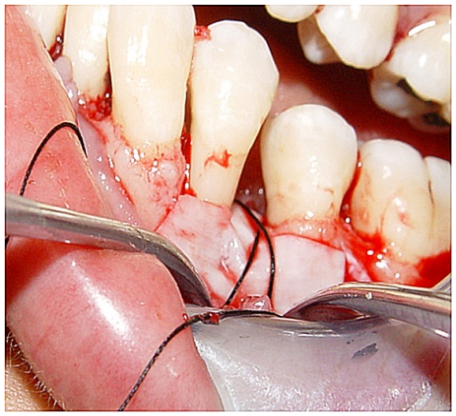

Figure 6. Covering the defect with collagen membrane in the control group.

differences in all the parameters before and after surgery ($P < 0.05$) (Tables 1 to 5). In addition, concerning the resolution of the defects, differences between the two groups were not significant (connective tissue 71.6%, collagen membrane 68.3%). In both groups a significant positive correlation was observed between the initial depth of the lesion and defect resolution.

Discussion

All the participants completed the procedures well. No complications were observed at any treated site. In the present study comparison between the two treatment modalities showed no significant differences ($P > 0.05$). Pocket depth changes in the experimental group (2.6 ± 1.7 mm) were almost consistent with results reported by Lekovic et al[32] (2.6 mm) and Moghaddas et al[33] (2.9 mm). In the control group, decrease in pocket depth (3.2 ± 1.9 mm) was less than those reported by Paolantonio et al[37] (5.7 mm) , Sculean et al[38] (6.7 mm) and Nevins et al[39] (6 mm). Clinical attachment gains in both groups post-operatively (experimental: 11.2 ± 2.1, control: 11.4 ± 2.1) were more

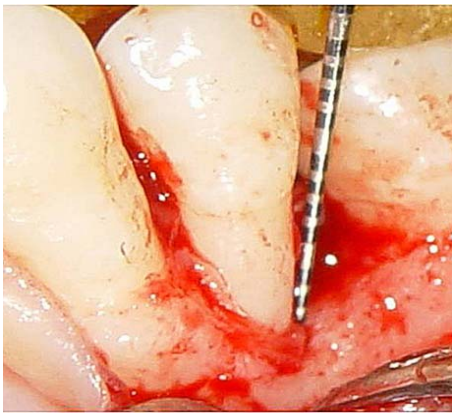

Figure 7. Defect's bone fill at 9-month re-entry in the experimental group.

Figure 8. Defect's bone fill at 9-month re-entry in the control group.

than pre-operative measurements (experimental: 12.7 ± 2.5, control: 13.3 ± 3.5) (P <0.05). However, the differences between the groups were not significant (P = 0.68). Clinical attachment level gains in both the experimental (1.5 mm) and control (1.9 mm) groups were less than those in other studies. In the experimental group the amount of gingival recession (0.9 ± 1.4 mm) was more than that reported by Lekovic et al[30] (0.3 mm), and Moghaddas et al[33] (0.5 mm). In the control group, in comparison with the results reported by Paolantonio et al[37] (0.8 mm) and Sculean et al[38] (1 mm) more gingival recession was observed (1.3 ± 1.7 mm). These differences in the variables evaluated (pocket depth, clinical attachment level and gingival recession) between this study and the other studies might be attributed to the following reasons: (1) differences in the materials and methods; (2) differences in the tools used for measuring the parameters; (3) operator variability and skills. Amount of bone fill in the experimental group (3.4 mm) was the same as that reported by Moghaddas et al[33] (3.3 mm) but less than that reported by Lekovic et al[30] (1.8 mm). On the other hand, bone fill in the control group (3.9 mm) was almost the same as that reported by Mattson et al[41] (3.2 mm). In the group in which connective tissue was used as a membrane, crestal bone loss was 0.1 mm but Lekovic et al[30] reported an increase of 0.08 mm in crestal bone. In addition, in the control group (BioGide) an increase of 0.5 mm was seen in crestal bone, with no significant difference from the baseline; however, all the other studies have reported crestal bone loss.[20-22] Defect resolution in the experimental group (71.6%) was less than that reported by Moghaddas et al[33] (82.9%); in the control group (3.6 mm), it was less than that reported by Paolantonio et al[37] (5.8 mm).

Table 1. Comparison of PD values between the baseline and the 9-month interval in the treatment group

Group/site	Baseline	9 months	P value
Connective tissue graft /Bio-Oss (N=8)	7.1±2	4.5±1.5	<0.001
Collagen membrane /Bio-Oss (N=7)	7.6±1.9	4.4±1.1	<0.001

Table 2. Comparison of CAL values between the baseline and the 9-month interval in the treatment group

Group/site	Baseline	9 months	P value
Connective tissue graft /Bio-Oss (N=8)	12.7±2.5	11.2±2.1	<0.0001
Collagen membrane /Bio-Oss (N=7)	13.3±3.5	11.4±2.1	<0.05

Table 3. Comparison of gingival margin-to-stent values between the baseline and the 9-month interval in the treatment group

Group/site	Baseline	9 months	P value
Connective tissue graft /Bio-Oss (N=8)	5.5±2.2	6.3±2.6	P<0.01
Collagen membrane /Bio-Oss (N=7)	6.2±1.6	7.3±2.4	P<0.001

Table 4. Comparison of depth of intrabony defect values between the baseline and the 9-month interval in the treatment group

Group/site	Baseline	9 months	P value
Connective tissue graft /Bio-Oss (N=8)	15±2.9	11.2±1.8	<0.001
Collagen membrane /Bio-Oss (N=7)	16.2±3.3	12.1±1.8	<0.001

Table 5. Comparison of alveolar crest location values between the baseline and the 9-month interval in the treatment group

Group/site	Baseline	9 months	P value
Connective tissue graft /Bio-Oss (N=8)	9.7±2.5	9.8±2.2	NS
Collagen membrane /Bio-Oss (N=7)	10.9±2.8	10.2±2	NS

Conclusion

Within the limitations of this study it can be concluded

that clinical efficacy of palatal connective tissue and collagen, as a membrane in combination with Bio-Oss in the treatment of intrabony defects of the alveolar bone, is the same and according to the operator's skill, costs and preferences each treatment modality may be chosen.

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