Bio-oss in Treatment of Furcation Class II Defects and Comparison with Coronally Positioned Flap

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Statement of Problem: Among periodontal defects, the furcation involvement represents one of the most challenging scenarios due to the difficulty of achieving a predictable improvement regardless of the type of periodontal therapy. Moreover, the presence of furcation involvement has been demonstrated to considerably affect tooth prognosis. Thus, treatment of furcation defects is a challenge in clinical periodontics. The aim of periodontal treatment is not only to control infection but also to regenerate periodontal tissues lost as a consequence of periodontal disease.

Purpose: The purpose of this study was to compare Bio-oss (Bo), an anorganic bovine bone Xenograft, in combination with coronally positioned flap to open flap debridment surgery with coronally positioned flap alone in human mandibular class II furcation defects.

Materials and Methods: In this clinical trial and interventional study 24 furcations, which provided 12 pairs of similar periodontal defects were evaluated. Each defect was randomly assigned to treatment with Bio-Oss in combination coronally positioned flap or open flap debridment and coronally positioned flap alone. Following basic therapy, baseline measurements were recorded including probing depth (PDD), clinical attachment level (CAL), gingival recession (REC), keratinized gingiva (KG) and closed horizontal probing depth (CHPD). After 6 months, all sites were re-entered and hard tissue measurements were recorded. Hard tissue measurements were performed during surgery to determine open horizontal probing depth (OHPD) and open vertical probing depth (OVPD). The data was analyzed using t-test paired sample.

Results: Vertical probing depth reduction of 3.17±1.32 mm and horizontal probing depth reduction of 4.42±1.02 mm were noted for the BO group, with 2.87±0.83 mm and 2.31±0.49 mm reductions, respectively, noted for CPF alone. Both surgical procedures resulted in statistically significant probing depth reduction and gain clinical attachment levels, with no significant difference between groups. Recession didn't have significant differences between groups. Hard tissue measurements (after Re-entry) showed 4.17±1.66 mm of vertical furcation bone fill (OVPD) for test group (BO) and 0.83±0.72 mm for CPF alone. The test (BO) group had 3.87±0.88mm of horizontal furcation bone fill (OHPD), and the CPF group had 1.21±0.8mm.

Conclusion: There was a statistically significant difference between test (BO) group and CPF group in all soft and hard tissue measurements with the exception of attachment level, recession, and keratinized gingiva. The use of Bio-oss improved horizontal and vertical defect resolution in mandibular class II furcation defects.

Key words: Furcation defects; Bio-oss; Coronally positioned flap; Furcation treatment

Journal of Dentistry, Tehran University of Medical Sciences, Tehran, Iran (2004; Vol: 1, No. 3)
Furcation involvement in multiple root teeth is one of the important and serious problems in periodontal therapy. These teeth have a less favorable prognosis due to their morphology that limits hygiene care for the patients and interfere with accessibility for adequate subgingival scaling. These defects have different treatments like Conservative, Resective, and Regenerative methods. The main aim of periodontal treatment is the regeneration of damaged supportive structures like alveolar bone, cementum, and periodontal ligament. Regenerative treatments of furcation may be difficult because of complicated anatomy, inaccessibility of patient to the area, small size of furca foramen and accumulation of microbial plaque.

There are different methods of regenerative treatments like GTR (Guided Tissue Regeneration) technique, using bone graft and synthetic materials, and combination methods. Auto graft, Allograft and Xenograft bone and Aplastic materials have been used in periodontal defects. However, there is no material for complete regeneration until now. The main reasons of using this material are improvement of bone regeneration and accessibility for patients, to remove microbial plaque, prevention of disease progress and losing tooth. Many researches have performed successful results using Bio-Oss (BO) in periodontal defects. Some of these researches are Houser et al in histological evaluation of BO in human periodontal lesion, Mellonig in relation to BO with absorbable membrane in furcation defects, Yamada et al in the effect of BO with collagen membrane in forming new bone and cementum in experimental dogs defects.

The aim of this study was the application of BO (one type of Bovine Bone Xenograft) and clinical evaluation in regeneration of molar mandibular class II furcation defects. Also, the results of material effect on improving new attachment and regeneration of coronally flap were compared with the procedure of open flap debridment using coronally flap technique.

Materials and Methods
This study was an interventional clinical trial. Eleven patients (with 24 mandible class II furcation defect) with moderate to advanced chronic periodontitis (7 females and 4 males; mean age 43 years) participated in this study. Patients were screened for the following inclusion criteria: 1) at least 2 bilateral mandibular molars with class II furcation involvement as determined by clinical evaluation and standard radiographs using the extension cone paralleling technique and aiming devices; 2) no contributory medical history; 3) non-smokers; 4) at least 5 mm depth of horizontal pocket; 5) ability to control oral hygiene; 6) good cooperation. Informed consent was obtained after explanation of the procedure, its associated risks and benefits to the patient, and the need for increased documentation and re-entry surgery.

Basic periodontal therapy was performed with detailed instructions in self-performed plaque control measures, full-mouth scaling and root planning and occlusal adjustment. Baseline examination was performed 4 weeks after completion of the basic therapy and achievement of low plaque index (under 15%). Molar tooth of one side as experimental group and other tooth in other side as control group were considered. The treatments for experimental and control groups were coronal flap (CPF) with and without BO, respectively. Soft tissue measurements were recorded before surgery, 3 and 6 months after surgery. But, hard tissue measurements were obtained at the time of surgery and 6 months after Re-entry surgery. Soft tissue measurements included: 1- Probing pocket depth (PPD): the distance from the free gingival margin to the base of the pocket. In each tooth, probing was applied in 3 areas and the highest deep in the furcation was registered.
2- Clinical attachment level (CAL): the distance from CEJ to the base of the pocket.
3- Gingival Recession: gingival margin position to the CEJ in 3 points of each surface of the tooth.
4- Keratinized gingival: the distance from Mucogingival Junction to free gingival margin. It was measured in 3 areas at each surface of the tooth.
5- Closed horizontal probing depth (CHPD): the distance from deepest area of probe penetration vertically to buccal or lingual surfaces to connection line of hight of contour of mesial and distal roots.

The measurements at the time of first surgery and Re-entry surgery:
6- Open horizontal probing depth (OHPD): the distance from deepest area of probing to the connecting line of the height of contour of mesial and distal roots. This line was created with a probe lying horizontally on the buccal or lingual surfaces of the mesial and distal roots. The measurements were according to the internal surface of this probe.
7- Open vertical probing depth (OVPD): these measurements were from inter furcation area. The distance from deepest area to furcation furnix was registered.

Following administration of local anesthesia, intrasulcular incision was performed and full thickness flap was reflected. The inner aspect of the flap was curetted and complete debridement of the osseous defects and thorough scaling and root planning using hand curets and ultrasonic scalers were performed. BO was impacted in the furcation area. The flaps were subsequently adjusted coronally and retained with interproximal sutures.

For each surgical procedure, 500 mg amoxicillin was prescribed every 8 hours for one week, followed by 400 mg ibuprofen in case of pain. Patients were instructed to use a solution of 0.2% chlorhexidine topically twice a day. Patients returned for flap suture removal one week later.

Six months after re-entry surgery, the soft tissue changes were evaluated at the same presurgical midline reference points using the same technique. All measurements were recorded by the same examiner previously calibrated with 95% reproducibility. All data were processed through paired sample t-test.

**Results**

The mean of PPD in test group was reduced to 3.62±1.32 and 3.67±1.32 mm after 3 and 6 months respectively. The amount of this reduction in control group was 2.96±0.99 and 2.87±0.83mm after 3 and 6 months respectively. So, using BO caused more reduction compare to control group (0.67±1.17 mm after 3 months and 0.79±1.57 mm after 6 months). There was no significant difference in the mean of PPD before and 3 months after surgery (P>0.05). But, it had significant difference after 6 months (P<0.05) (Fig 1).

The amount of CAL after 3 and 6 months in test group was 3.40±1.45 and 3.35±1.43mm respectively. It was reduced in control group to 2.67±1.07 and 2.56±1.00mm. The analysis showed that there was no significant difference in change of means before, 3 and 6 months after surgery (P>0.05) (Fig 2).

There was an increase in REC in test group after 3 and 6 months (0.23±0.56 and 0.31±0.51 mm respectively). But, in control group it didn’t have any increase (0.29±0.62 and 0.48±0.66 mm). So, BO caused less REC after 3 and 6 months (0.06±0.99 and 0.17±0.96 mm). But, it wasn’t significant (P>0.05) (Fig 3).

The amount of KG in using BO had more reduction in 3 months after surgery (0.10 ±0.29 mm) compare to control group. But, it had less reduction after 6 months (0.04±0.14 mm). There was no significant difference in both of them (P>0.05) (Fig 4).

CHPD in test group was 1.50±1.04 and 2.10±1.00 mm after 3 and 6 months respectively. They showed more reduction
compare to control group. According to analysis of data, the difference between two groups was significant (P<0.05) (Fig 5).

The mean of OHPD was 3.87±0.88 mm in test group in 6 months after Re-entry surgery. It was 1.21±0.8 mm in control group. The effect of BO technique was the reduction of OHPD (2.67±1.42 mm) in compare to control group and the difference was significant (P<0.001) (Fig 6)

The amount of OVPD after 6 months of Re-entry surgery was reduced in test group (4.17±1.66 mm). That was 0.83±0.72mm in control group. So, test group had 3.33±1.40 mm more reduction of OVPD compare to control group. This difference was significant (P<0.001) (Fig 7).

Discussion

The results of this study suggest that a combination of anorganic bovine bone xenograft and CPF in the treatment of mandibular class II furcation defects may improve clinical results when compared to OFD and CPF.

The results of measuring PPD were approximately the same as Trejo et al (2000). They reported 3.8 mm reduction of packet depth after Decalcified Freeze-Dried Bone Allograft (DFDBA) with membranes in periodontal disease after 6 months. Trejo et al and Camelo et al (2000) reported the mean of packet depth of 5.55±2.93mm in the treatment of class II mandibular molar furcation defects after autogenus graft with ePTFE membranes. (8,9)
The results of this study indicated more reduction of PPD in comparison with Luepke et al (1997), who obtained 2.29±0.73mm in non-smokers following treatment of mandibular molar furcation with DFDBA membranes and without membrane after 6 months. Houser et al (2001) showed 2.0±1.7 mm reduction after Anorganic bovine bone xenograft using absorptive membranes. The amount of CAL showed 2.77±0.85 mm in test group after 6 months, which was similar to that reported by Leonardis et al, who mentioned an improvement of 2.4 mm, following treatment with DFDBA accompanied with absorbing membrane. In this research, it was shown that the quantity of gingival recession is comparable to that measured by Houser et al.

This amount is also less than that reported by Leonardis et al. In this study, the obtained reduction of CHPD relative to the baseline is statistically significant (P<0.001). The quantity of this reduction is greater than that obtained in studies of Houser et al and Leonardis et al. The improvement of CHPD indicates the resistance of the treated defect to the probe penetration. For a better diagnosis of bone regeneration and defect repair, other methods are needed among which, Re-entry is the best, since it investigates furcation directly.

In this study, 6 months after original treatment, Re-entry surgery was applied to evaluate bone fill. The results show the reduction of OHPD in test group after 6 months following Re-entry surgery compare to baseline (3.87±0.88 mm) which the change was significant (P<0/001). This amount in a research by Martin et al and Houser et al which used DFFBA in treatment of furcation was 3.0±1.6 and 3.0±1.9 mm respectively.

OVPD reduced in test group after 6 months following surgery that is significant in compare to baseline (P<0.001). This reduction in the researches of Martin et al and Houser et al was 2.4±1.9 and 3.0±1.3 mm respectively. Some factors affecting more reduction in this research are furcation vertical depth, defect shape and anatomical form of furcation.
Recent reports in the literature have demonstrated that anorganic bovine bone xenograft in combination with BO may support periodontal regeneration in vertical human periodontal defects. In a 1998 publication, Camelo et al.\(^{(13)}\) histologically demonstrated new cementum, periodontal ligament, and bone formation in human periodontal defects with the use of BO. BO can be a favorable graft material replacing bone because of its biocompatibility and osteoconductive properties, its chemical composition, and crystalline structure and porosity morphology similar to human bone. According to the results, BO showed improvement in reducing PPD, CAL, CHPD and also reduction of depth of OVPD and OHPD after treating of furcation defects. In comparison between test and control groups, there was a great improvement in CHPD, OHPD and OVPD parameters in test group.

**References:**


