International Journal of Dental Sciences and Research, 2018, Vol. 6, No. 1, 12-17
Available online at http://pubs.sciepub.com/ijdsr/6/1/3

DOI:10.12691/ijdsr-6-1-3

Management of Periodontal Infrabony Defects by Guided Tissue Regeneration alone or in Combination with Deproteinized Bovine Bone

Essam I. Elkhatat*

Preventive Dental Sciences Department, Al-Farabi Collage, Saudi Arabia
*Corresponding author: esamfrabi@yahoo.com

Abstract **Aim:** To compare the contribution of combined guided tissue regeneration and deproteinated bovine bone (EnterOss) and guided tissue regeneration alone to the outcomes of the treatment of infrabony defects. **Materials and Methods:** A total of sixteen patients of both sexes satisfying the criteria of chronic periodontitis and each of whom displayed one infrabony defect were randomly assigned to two groups, i.e. either treated with EnterOss and guided tissue regeneration (GTR) (group A) or with (GTR) alone (group B), in this parallel-arm study. The soft tissue and hard tissue measurements, including probing pocket depth (PD), clinical attachment level (CAL), and bone mineral density were recorded at baseline and 3,6 and 12 months after surgery. The differences with a $P < 0.05$ were considered significant. **Results:** Results showed that the combined group showed significant difference when compared with GTR alone, in relation to the degree of periodontal pocket, clinical attachment loss, and bone density. While in relation to Plaque and Gingival indices there is no significant difference between the two groups. **Conclusion:** The findings of this study suggest that, combination of deproteinated bovine bone and biocollagen membrane could be considered as an option in the treatment of infrabony defects. GTR alone gives acceptable clinical results in the treatment of infrabony defects. Combination of deproteinated bovine bone and biocollagen membrane resulted in significant clinical results in the treatment of infrabony defects.

Keywords: *Infrabony, GTR, EnterOss, periodontitis*

Cite This Article: Essam I. Elkhatat, Management of Periodontal Infrabony Defects by Guided Tissue Regeneration alone or in Combination with Deproteinized Bovine Bone." *International Journal of Dental Sciences and Research*, vol. 6, no. 1 (2018): 12-17. doi: 10.12691/ijdsr-6-1-3.

1. Introduction

Chronic periodontitis is the most common periodontal disease characterized by gingival inflammation followed by extension more deeply causing damage to the deeper periodontal tissues, alveolar bone destruction and finally tooth loss [1]. Periodontal diseases are a group of inflammatory diseases causing alveolar bone loss and eventually leading to loss of teeth. Periodontitis is caused by the cumulative effect of interactions between bacteria and the immune-inflammatory response of the host [2,3]. destruction of alveolar bone supporting the teeth results from the inflammatory process which caused by periodontal pathogens [4]. horizontal bone loss is usually found with suprabony pockets, while vertical bone loss is usually found with angular bony defects and infrabony pockets formation [5]. Chronic periodontitis may occur at any time with a slow progressive manner. Because of plaque accumulation and poor plaque control measures, interproximal areas destruction progress more rapidly. In molar area, bony destruction is generally characterized by periodontal probing depth up to 6 mm with clinical attachment loss up to 4 mm, should be present radiographically as bone loss [6]. Several periodontal treatment modalities may be mechanical debridement alone or in combination with bone grafts and GTR [7,8,9,10,11]. Non-surgical root planning of periodontal pockets results in subsiding of the inflammatory processes, small gain in the periodontal attachment, significant reduction in probing depth and formation of long junctional epithelium [12]. Essam et al 2015 concluded that, GTR provided acceptable results in prevention of junctional epithelium [13]. Bovine derived bone replacement grafts (xenografts) is one of these regenerative materials, manufactured by elimination of its organic part leaving a hydroxyapatite ‘‘skeleton" of a microporous structure of cortical and cancellous bone, mimic that of human being. It acts as an osteoconductive scaffold and enables bone growth with subsequent integration with host's bone [14,15]. InterOss (Geistlich-Pharma, CH-6110 Wolhusen, Switzerland) is one of the most well-known and commercially available product in this category and has been associated with the successful management of infrabony defects [16,17]. The action of GTR is based on either restitution or "healing by repair" [18]. Some authors have suggested that GTR results in healing characterized by "reparative" rather than regenerative activity [19,20]. Some studies concluded that the healing results obtained

following GTR are regenerative [21,22]. GTR are used clinically in periodontal surgical procedure more than 40 years ago [23,24]. The membranes utilized for GTR are either resorbable or non-resorbable. In case of non-resorbable membrane, it should be removed 4-6 weeks later. The placement of the GTR membrane would ensure that the detached root surface becomes repopulated with cells from the periodontal ligament and becomes capable of forming bone, periodontal ligament, and cementum by preventing epithelial tissue migration. It provides space for optimal wound stability that is necessary for periodontal regeneration [25,26]. GTR is characterized by clinical manageability, biocompatibility, cell occlusiveness, integration by host tissues and the space making functions [27]. Formation of abundantly vascularized connective tissue in the membrane-protected space is always preceded by the formation of new mineralized bone by GTR [28]. Bunyaratavej and Wang compared bioresorbable to non-resorbable membranes and proved that, non-resorbable membranes (ePTFE) resulted in more favorable bone formation compared to bioresorbable one [29]. The present study is designed to compare the effect of GTR alone or in combination with deproteinized bovine bone grafts on regenerative treatment of chronic periodontitis patients with infrabony defects.

2. Materials and Methods

Sixteen patients of both sex (10 males and 6 females). They were selected from those attending at the outpatient clinic, police hospitals. All subjects ranged in age from 35-42 years old. patients diagnosed as having a chronic periodontitis with infrabony defects, a complete examination was given to all patients participate in the study. Systemically healthy patients with adequate attached gingiva with the presence of infrabony pockets, probing depth of the selected cases should be > 6 mm were included in the study. Medically compromised patients, heavy smokers, pregnant and lactating patients and patients who previously underwent any surgical procedures in the same area were excluded from the study. Third molars, teeth affected by endodontic lesions and/or inadequate endodontic treatments, teeth showing restorations with overhanging margins, teeth with degree 3 mobility and in general all teeth with a hopeless prognosis at the combined clinical and radiographic evaluation were not included. All patients were informed about the study protocol and objectives before they signed an informed consent. The periodontal conditions were evaluated for each patient at different intervals pre-and post-operative for all subjects using the following clinical parameters: Plaque Index (PI) [30]. Gingival Index (GI) [31], Clinical attachment level [32]. and Probing pocket depth (PPD) using graduated periodontal probe [33]. Patients were divided into two groups through a computer-generated randomization. Group A-comprising of eight patients who underwent GTR combined with deproteinized bovine bone grafts procedure. Group B-comprising of eight patients who underwent GTR procedure. Prior to surgical procedure, patients received professional cleaning of their teeth and necessary oral hygiene instructions were given for proper maintenance of oral hygiene.

2.1. Surgical Procedures

The area around the teeth which were to undergo the procedure was sufficiently anesthetized with 2% lignocaine and 1:80,000 adrenalines. Full-thickness mucoperiosteal flaps were performed. The incisions were directed interdentally in an attempt to ensure maximum coverage of the graft after closure. Thorough debridement and root planning of the exposed root surfaces was performed by a combination of ultrasonic and Gracy curettes. For group A, the InterOss (deproteinized xenograft) mixed well with few drops of normal saline to make homogenous mix that placed into the infrabony defect and adapted well to provide complete filling of the defect, the membrane prepared properly to be sure that it covers the bony defect. Flaps were held in place by means of non-resorbable silk3-0 sutures. For group B, Biocollagen membrane used alone. Patients were given all the post-operative instructions and were prescribed antibiotic and analgesics. Adequate plaque control measures involving rinsing with 0.12% Chlorhexidine gluconate twice daily for about two weeks was advocated.

2.2. Radiographic Evaluation

All patients were exposed to standardized periapical radiographs were taken before and immediately after surgery and at intervals of 3, 6, 9, and 12 months post-operatively.

2.3. Imaging Analysis: (Bioquant)

It is image analysis software that is used for different analysis applications (histo-morphometric as well as densitometric analysis). In this software the area to be measured which called Regions of Interest (ROI) was selected (color density selection). Bioquant was used for calculation of the average density of the crystal bone.

3. Results

During the period of the study no abnormal reactions, no complications were observed post-operatively. The results showed no significance difference between both the groups in relation to changes in plaque and gingival indices, however there are significant difference when comparing the results in each group in relation to the baseline. In relation to changes in PD, the range between minimum, maximum readings, the mean values ± SD of illustrated in (Table 1 & Figure 1). Unpaired t-test showing means, standard deviations, t-values and p-values within each group at different intervals representing ***high*** significant difference in both groups at the different intervals when compared to the baseline. Paired t-test for comparing Means, Standard deviations, t-values and p-values among the two groups at different intervals representing significant difference when group A compared with group B at 9, 12 months of the surgery.

Table 1. Comparison between the deference of PD for both groups at different intervals

	Group A X±SD	Group B X±SD	Independent samples t-test (p value)
Base line (T0)	6.67±0.21	6.81±0.24	0.32
3 months (T3)	5.82±0.23	5.68±0.43	0.01
T 6	4.94±0.22	5.01±0.33	0.45
T 9	4.31±0.21	4.81±0.21	0.003*
T 12	3.27±0.22	4.33±0.28	0.001*
Paired sample t-test (p value)	0.03*	0.05*	

X; mean. SD; standard deviation. * Significant difference at 0.05.

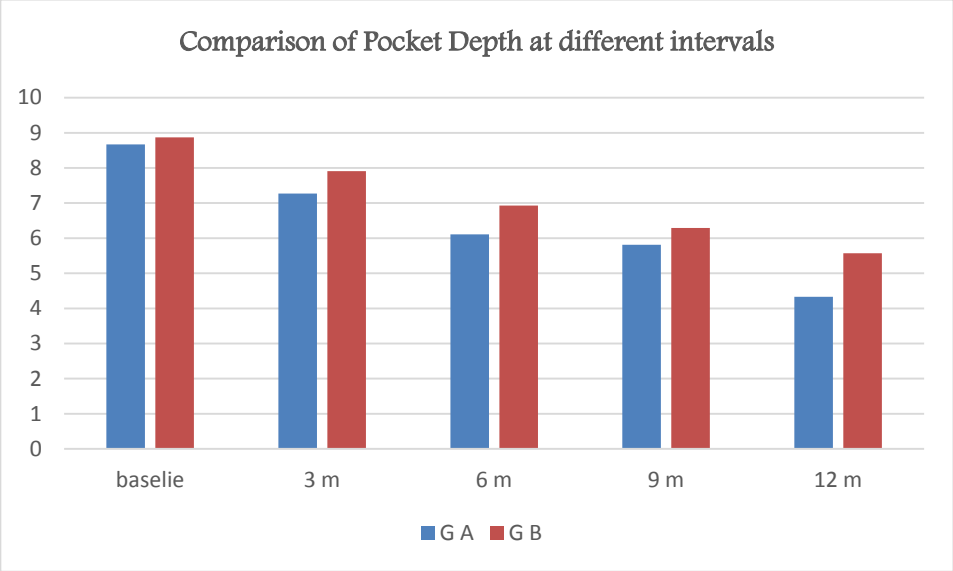

Figure 1. Histogram of the deferent PD for both groups at different intervals

Table 2. Comparison between the deference of CAL for both groups at different intervals

	Group A X±SD	Group B X±SD	Independent samples t-test (p value)
Base line (T0)	8.67±0.32	8.87±0.22	0.32
3 months (T3)	7.27±0.21	7.91±0.22	0.01
T 6	6.11±0.33	6.93±0.21	0.45
T 9	5.81±0.21	6.29±0.22	0.003*
T 12	4.33±0.28	5.57±0.35	0.001*
Paired sample t-test (p value)	0.03*	0.05*	

X; mean. SD; standard deviation. * Significant difference at 0.05.

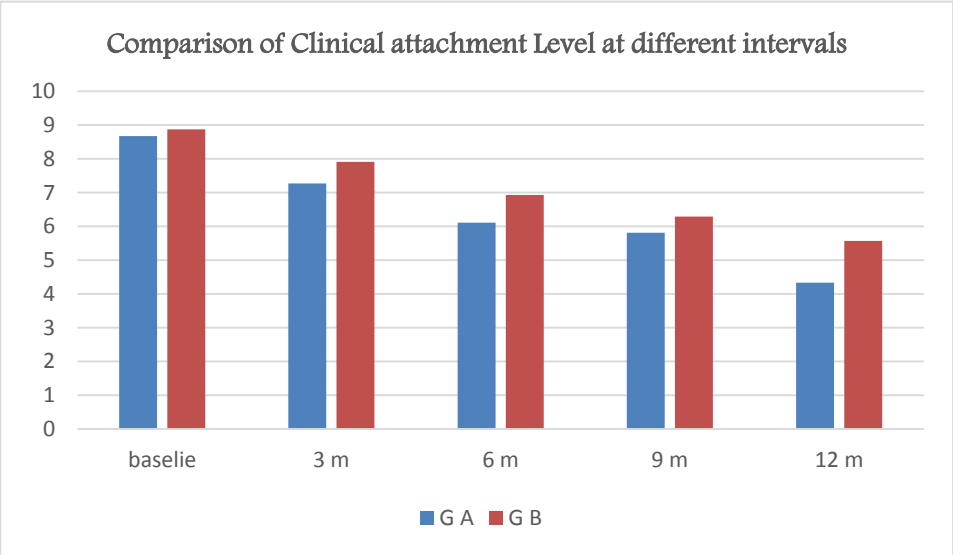

Figure 2. Histogram of the deferent CAL for both groups at different intervals

In relation to the changes in CAL, the range between minimum and maximum readings and the mean values ± SD of CAL illustrated in (Table 2 & Figure 2).

Unpaired t-test showing ***high*** significant difference in both groups at the different intervals. The mean value of CAL in group A before the periodontal surgery was 8.67±0.32 that reduced to 4.33±0.28 after 12 months of the surgery. The mean value of CAL in group B before the periodontal surgery was 8.87±0.22 that reduced to 5.57±0.35 after 12 months of the surgery. representing high significant difference when the group A compared with group B at 9,12 months of the surgery.

3.1. Changes in Bone Density

The changes in average of Bone Density (in pixels) scored during the observation periods of the present study using image analysis software illustrated in (Table 3 & Figure 3) for both groups. Unpaired t-test showing means, standard deviations, t-values and p-values within each group at different intervals representing ***high*** significant difference in both when compared to the baseline. The mean value of Bone Density in group A before the periodontal surgery was 87.47±0.34 compared to 133.57±4.68 after 12 months of the surgery (the end of the present study). The mean value of Bone Density in group B before the periodontal surgery was 90.28±4.92 compared to 126.71±3.59 after 12 months of the surgery. Paired t-test for comparing Means, Standard deviations, t-values and p-values among the both groups at different intervals representing significant difference when group A compared with group B at 9 months and showed ***high*** significant difference at 12 months of the surgery.

Figure 4, Figure 5 showing bone high before and after the study.

Table 3. Comparison between the deference of bone density for both groups at different intervals

	Group A X±SD	Group B X±SD	Independent samples t-test (p value)
Base line (T0)	87.47±0.34	90.28±4.92	0.32
3 months (T3)	96.33±0.41	93.42±5.47	0.01
T 6	107.47±0.32	101.42±7.42	0.45
T 9	115.55±0.21	111.0±6.73	0.001*
T 12	133.57±4.68	126.71±3.59	0.001*
Paired sample t-test (p value)	0.03*	0.05*	

X; mean. SD; standard deviation. * Significant difference at 0.05.

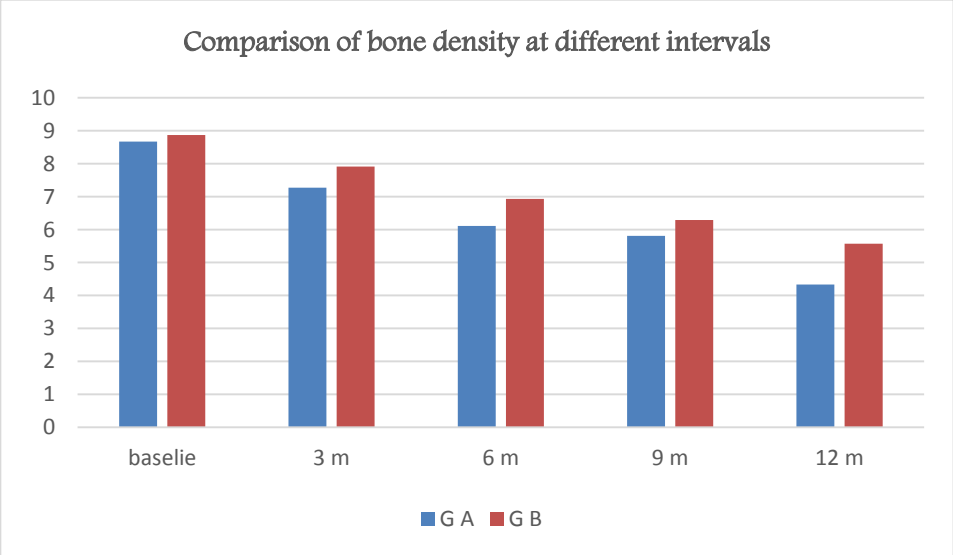

Figure 3. Histogram of the deferent Bone Density for both groups at different intervals

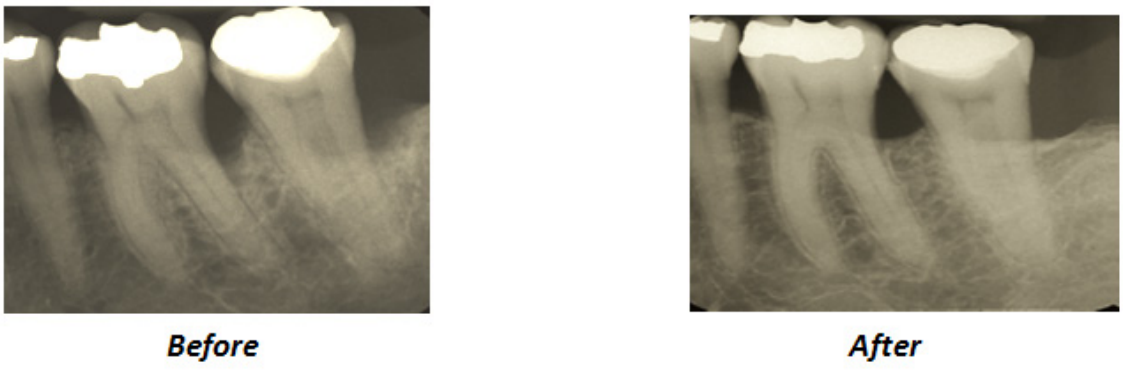

Figure 4. Showing bone level before and after 12 months in Group A

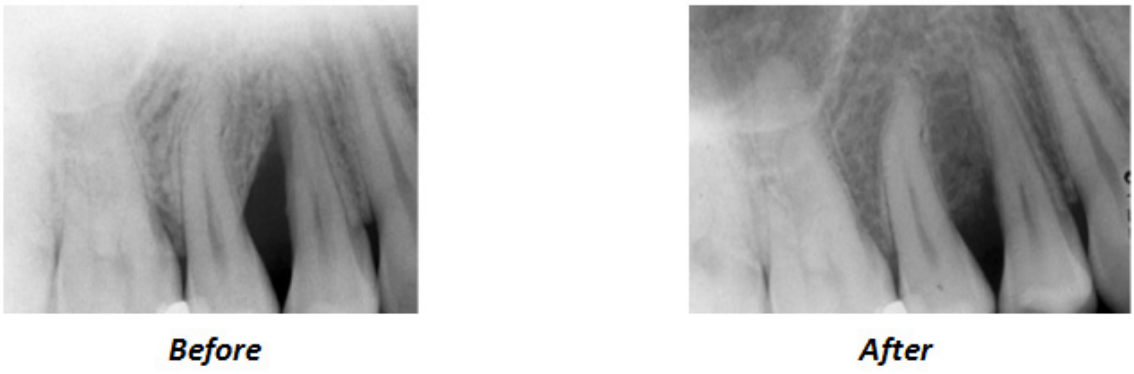

Figure 5. Showing bone level before and after 12 months in Group A

4. Discussion

Our present clinical study was to evaluate both clinically and radiographically the effectiveness of a GTR combined with InterOss bovine graft compared to GTR alone for a regenerative treatment of periodontal infrabony pockets. It was stated that reattachment is reunion of connective tissues and epithelium with the root surface on which viable periodontal tissue is found without new cementum formation, while repopulation of periodontally diseased root surfaces by periodontal ligament cells results in new connective tissue attachment. This can be achieved by means of a biodegradable material which act as barrier between the gingival tissue and the dental surface [34]. So, we used a collagen membrane which promotes the selective repopulation of Periodontal Ligament (PDL) cells. Regarding plaque and gingival index scores, the present study showed a significant reduction prior to surgery and remained among the study period, which attributed to the patient cooperation and effective phase I therapy. Patrick et al. concluded that, good oral hygiene plays an important role in the management of infrabony defects before surgery in agreement with our study [35]. This finding of PI and GI which recorded during this study indicated that, oral hygienic status of the patients and their cooperation are essential for periodontal regeneration. These are in accordance with the findings of Cobb and Machtei et. al who stated that plaque control plays a major role in the regenerative process using GTR [36,37]. The present study used flap surgery in both groups for the management of infrabony defects, this is in accordance with Fleischer et al. They concluded that, open root planning left the affected area freer from calculus depositions, as compared to the closed debridement technique [38]. In addition, it facilitates infrabony defect accessibility, as Schmitt et al. who reported in their study that it was difficult to reach the base of the vertical defect by an ordinary periodontal instrument [39]. The results showed statistically significant reduction in PD as well as gain of CAL and bone density in the group treated with combined modality. These results supported the findings of Lekovic et al, who reported that a combined treatment with bone graft and membrane resulted in a significant increase in bone and clinical attachment gain [40]. Regarding the outcome of periodontal regeneration for the cases of the present study, we attribute the enhancement of regeneration process in the combined group to application of biocollagen membrane, which facilitates periodontal ligament cells to repopulate the root surface and the action of the bone graft. A similar opinion was given by Karring et al. [41].

The present study was also mainly designed to evaluate the efficacy of a Biocollagen membrane alone in the treatment of infrabony defects. The results showed that there was a statistically significant reduction in PD as well as gain of CAL and bone densities, as well as more bone fill in the group treated with Biocollagen when compared with the baseline. These results agree with the results obtained in a study by Joly et al. who had performed a similar study comparing GTR alone with an open flap surgery in the treatment of infrabony defects [42].

Our results are also in accordance with the findings of a study by Trejo et al., who compared the regenerative potential obtained on using GTR in combination with demineralized freeze-dried bone allograft (DFDBA) to GTR alone in management of human periodontal bony defects [43]. In addition to clinical parameters that included PD and CAL, image analysis of average bone density is used in the evaluation of this study. We used a period of a twelve months for evaluation in the present study; this is in accordance with the report of Rabelais et al. who stated that a six months period was not enough to evaluate the results of periodontal therapy with regenerative technique [44].

5. Conclusion

The regenerative process of periodontal defects not only depend on the materials used to fill or scaffold the defect but also depend on a multitude of factors such as patient's oral hygiene, smoking, defect depth, width, recall maintenance. Our choice to use the enterOss and resorbable biocollagen barrier in infrabony defects management of yielded positive outcomes. So, within the limitations of the present study, the combined group showed a significant difference in reduction in PD and gain in CAL and mineral density, compared to GTR group.

References

[1] Consensus Report on Periodontal Diseases: Epidemiology and Diagnosis. Ann Periodontol 1996; 1: 216-222.

[2] Garett S: Periodontal regeneration around natural teeth. In: proceedings of the 1996 world workshop in periodontology. Ann. Peridontol; 1996, 7: 621.

[3] Savage A, Eaton KA, Moles DR, Needleman I. A systematic review of definitions of periodontitis and methods that have been used to identify this disease. J Clin Periodontol 2009; 36: 458-67.

[4] Cochran D; Inflammation and bone loss in periodontal disease. J. Periodontol, 2008. 79, 1569-1576

[5] American Academy of Periodontology: Parameters on chronic peridontotitis with slight to moderate loss of periodontal support. (Position Paper). J. Peridontol, 2000a; 71: 853-855.

[6] Thomas E. Van Dyke, D & Sheilesh Dave: J. Int Acad Periodont. 2005 Jan; 7(1): 3-7.

[7] Albandar J, Streckfus C, Adesanya M& Winn D: Cigar, pipe and cigarette smoking as risk factors for periodontal disease and tooth loss. J. Periodontol 2000; 71:1874-1881.

[8] Hujoel P: Endpoints in periodontal trials: the need for an evidence-based research approach. Periodontol 2000, 2004; 36, 196-2004.

[9] Becker W, Becker B, Berg L & Samsam C: Clinical and volumetric analysis of three-wall intrabony defects following open flap debridement. J. Periodontol, 1986b.57: 277.

[10] Gantes B, Garrett S & Egelberg J: Treatment of periodontal furcation defects (II). Bone regeneration in mandibular class II defects. J. Clin. Periodontol, 1988; 15: 232-239.

[11] Cortellini P, Pini Prato G & Tonetti M: Periodontal regeneration of human intrabony defects. Clinical measures. J. of Periodontol 1993a; 64, 254-260.

[12] Herrera D, Sanz M, Jepsen S, Needleman I & Roldan S: A systematic review on the effect of systemic antimicrobials as an adjunct to scaling and root planning in periodontitis patients. J. Clin Periodontol. 29(Supply 3)2002: 139-159.

[13] Essam et al; Clinical and radiographic evaluation of periodontal intrabony defects by open flap surgery alone or in combination with Biocollagen membrane. 2015, Volume 5, Issue: 3: 190-198.

[14] Karring T, Lindhe J, Cortellini P. Regenerative periodontal therapy. In: Lindhe J, Lang NP, Karring T, editors. Clinical Periodontology and Implant Dentistry. Copenhagen: Munksgaard; 2007. p. 597-646

[15] David S.H. Lee, Y. Pai, Steve Chang; Physicochemical characterization of InterOss_ and Bio-Oss_ anorganic bovine bone grafting material for oral surgery Materials Chemistry and Physics 146 (2014) 99-104.

[16] Richardson C, Mellonig C, Brunsvold J, McDonnell M, Cochran H. Clinical evaluation of Bio-Oss: a bovinederived xenograft for the treatment of periodontal osseous defects in humans. J. Clin. Periodontol. 1999; 26, 421-428.

[17] Taheri M, Molla, R., Radvar, M, Sohrabi, K., Najafi, M; An evaluation of bovine derived xenograft with and without a bioabsorbable collagen membrane in the treatment of mandibular class II furcation defects. Aust. Dent. J. 2009; 54, 220-227.

[18] Egelberg J; Regeneration and repair of periodontal tissues. J Periodontol Res 1987; 22:233-42.

[19] Karring T, Nyman S, Gottlow J, Laurell L. Development of the biological concept of guided tissue regeneration--animal and human studies. Periodontol 2000 1993; 1: 26-35.

[20] Araújo MG, Berglundh T, Lindhe J. GTR treatment of degree III Furcation defects with 2 different resorbable barriers. An experimental study in dogs. J Clin Periodontol 1998; 25: 253-9.

[21] Schüpbach P, Gaberthüel T, Lutz F, Guggenheim B. Periodontal repair or regeneration: Structures of different types of new attachment. J Periodontol Res 1993; 28: 281-93.

[22] Graziani L, Laurell L, Tonetti M, Gottlow J, Berglundh T. Periodontal wound healing following GTR therapy of dehiscence-type defects in the monkey: Short-, medium-and long-term healing. J Clin Periodontol 2005; 32: 905-14.

[23] Nyman S, Lindhe J, Karring T, Rylander H. New attachment following surgical treatment of human periodontal disease. J Clin Periodontol 1982; 9:290-6.

[24] Garrett S. Periodontal regeneration around natural teeth. Ann Periodontol 1996; 1: 621-66.

[25] Eickholz P, Pretzl B, Holle R, Kim TS. Long-term results of guided tissue regeneration therapy with non-resorbable and bioabsorbable barriers. III. Class II furcations after 10 years. JPeriodontol2006; 77: 88-94.

[26] Karring T, Nyman S, Gottlow J, Laurell L, Hardwick R, Scantlebury T, *et al*. Development of the biological concept of guided tissue regeneration--animal and human studies. Periodontol 2000 1993; 1: 26-35.

[27] Hardwick R, Scantlebury T, Sanchez R, Whitley N, Ambruster J. Membrane design criteria for guided bone regeneration of the alveolar ridge. In: Buser D, Dahlin C, Schenk RK, editors. Guided Bone Regeneration in Implant Dentistry. Chicago: Quintessence; 1994. p. 101-36.

[28] Gottlow J. Guided tissue regeneration using bioresorbable and non-resorbable devices: Initial healing and long-term results. J Periodontol 1993; 64(Suppl):1157-65.

[29] Bunyaratavej P, Wang HL. Collagen membranes: A review. J Periodontol 2001; 72: 215-29.

[30] Loe H: The gingival index, plaque index and the retention index systems J. periodontol. 1967; 38: 610 (supplement).

[31] Abramson J: The cornell medical index as an epidemiological tool. AMJ, puplic health1966, 56: 287-298.

[32] Ramfjord S: The periodontal index, J. periodontol.1967; 38; 604-610.

[33] Polson M, Yeaple R& Zande H: Histologic determination of probe tip penetration into gingival sulcus of human using an electronic pressure, sensitive probe; J. Clin. periodontol; 7; 479-488.

[34] Scantlebury TV. 1982-1992: A decade of technology development for guided tissue regeneration. J Periodontol 1993; 64(Suppl): 1129-37.

[35] Adriaens PA, Adriaens LM. Effect of nonsurgical periodontal therapy on hard and soft tissues. Periodontol 2000 2004; 36: 121-45.

[36] Cobb CM. Non-surgical pocket therapy: Mechanical. Ann Periodontol 1996; 1:443-90.

[37] Machtei EE, Dunford R, Grossi SG, Genco RJ. Cumulative of periodontal attachment loss. J Periodontal Res 1994; 29:361-4.

[38] Fleicher HC, Mellonig JT, Brayer WK, Gray JL, Barnett JD. Scaling and root planing efficacy in multirooted teeth. J Periodontol 1989; 60: 402-9.

[39] Schmitt SM, Brown FH. Management of root-amputated maxillary molar teeth: Periodontal and prosthetic considerations. J Prosthet Dent 1989; 61: 648-52.

[40] Lekovic V, Camargo PM, Weinlaender M, Nedic M, Aleksic Z, Kenney EB. A comparison between enamel matrix proteins used alone or in combination with bovine porous bone mineral in the treatment of intrabony periodontal defects in humans. J Periodontol 2000; 71: 1110-6.

[41] Karring T, Nyman S, Gottlow J, Laurell L, Hardwick R, Scantlebury T, *et al*. Development of the biological concept of guided tissue regeneration--animal and human studies. Periodontol 20001993; 1: 26-35.

[42] Joly JC, Palioto DB, de Lima AF, Mota LF, Caffesse R. Clinical and radiographic evaluation of periodontal intrabony defects treated with guided tissue regeneration. A pilot study. J Periodontol 2002; 73: 353-9.

[43] Trejo P, Weltman R, Caffesse R; Treatment of intraosseous defects with bioabsorbable barriers alone or in combination with decalcified freeze-dried bone allograft: A randomized clinical trial. J Periodontol 2000; 71: 1852-61.

[44] Rabalaise M, Yukna R, Mayer E; Evaluation of durapatite ceramic as an alloplastic implant in periodontal osseous defects. I. Initial six-month results. J Periodontol 1981; 52: 680-9.