Xenogenic Flexible Bone Lamina Graft: A Successful Alternative to the Autogenous Onlay Bone Block Graft in Alveolar Ridge Augmentation: A Clinical, Radiographic and Histological Evaluation

Amr AEH*, Abdel Ghaffar KA, Abuel-Ela HA and Abd Elhamid ES

Faculty of Dentistry/Department of Oral Medicine & Periodontology/Periodontology & Implantology, Ain Shams University, Abbasia, Cairo, Egypt

*Corresponding Author: Amr AEH, Faculty of Dentistry/Department of Oral Medicine & Periodontology/Periodontology & Implantology, Ain Shams University, Abbasia, Cairo, Egypt. Phone: +20 2- 24734617, 012 22243314. Email: amradehur@gmail.com


Received: November 06, 2017; Published: December 12, 2017

Introduction

Review of literature

Dental implant has become an important treatment option for the treatment of partial and complete edentulism [1]. Many studies showed that structural alterations of the alveolar ridges occur over time after tooth extraction which directly influence the possibility of the treatment with dental implants [2-4]. High failure rates have been associated with implants placed in resorbed ridges with insufficient alveolar bone structure [5]. Placement of implants in non-ideal positions as a result of bone deficiency may lead to the application of off-angle forces to the implant during function which significantly increases the force magnitude applied to the bone around the implant [6]. Thus, a sufficient volume of healthy alveolar bone should be available at the potential implant recipient site to ensure good prognosis of the treatment [7].

Abstract

Purpose of the study: compare autogenous onlay block bone graft versus xenogenic flexible bone lamina graft when used in horizontal alveolar ridge augmentation.

Materials and Methods: Fourteen patients were selected. All patients had a maxillary partially edentulous ridge which required horizontal ridge augmentation labiolyngually prior to implant placement. Two surgeries were carried out for each patient; the first was for alveolar ridge augmentation (bone grafting) while the second was for implant placement in a routine fashion. Patients were randomly divided into two equal groups. Alveolar ridge augmentation was performed in group 1 using intraoral autogenous onlay block bone graft while in group 2 using xenogenic flexible bone lamina. Clinical, radiographic and histologic/histomorphometric evaluations were performed.

Results: Clinically and radiographically through the whole study period, there was no statistically significant difference between mean % changes in BL ridge widths in the two groups. Histomorphometric analysis showed no statistically significant difference between mean bone surface areas in the two groups and no statistically significant difference between mean osteoblasts counts in the two groups.

Conclusion: Xenogenic flexible bone lamina graft can be used successfully in horizontal alveolar ridge augmentation as an alternative to the autogenous onlay block bone graft.

Keywords: Autogenous Bone Block; Alveolar Ridge Augmentation; Xenogenic Bone Lamina; Flexible Bone Graft; Dental Implant Site Development

Abbreviations: DO: Distraction Osteogenesis; GBR: Guided Bone Regeneration; CBCT: Cone Beam Computed Tomography; SD: Standard Deviation; BL: Bucco Lingual
Alveolar ridge augmentation is a surgical procedure performed to increase the dimensions of the alveolar ridge in order to produce sufficient bony structure which allow proper functional and esthetic placement of endosseous implants of suitable size and in correct axial inclination [8]. Targeting this goal, several surgical procedures for vertical and horizontal bone augmentation have been described. Guided Bone Regeneration (GBR), onlay block bone graft, Distraction Osteogenesis (DO) and ridge splitting have been successfully used widely in alveolar ridge augmentation [9-14]. Several materials have been used in the bone augmentation procedures including autogenous grafts, allogenic grafts, xenografts, titanium meshes and/or different barrier membranes [15-20]. The success rates of dental implants placed in augmented bone have been documented by many studies to be comparable to the success rate of implants placed in pristine bone [21-23].

According to the literature, Autogenous bone grafts is the “gold standard” among many bone augmentation techniques [30-32]. Better implant outcomes have been documented with intraoral autogenous grafts rather than extraoral calverial and hip bone grafts [29].

Severe horizontal alveolar ridge defects have been reconstructed successfully with mandibular bone blocks [33-35]. To avoid the surgical procedure for harvesting the autogenous bone graft and its complications, several materials such as corticocancellous bovine/porcine bone have been introduced and used successfully by many authors in alveolar ridge augmentation [20,36,37].

Alveolar ridge augmentation is a surgical procedure performed to increase the dimensions of the alveolar ridge in order to produce sufficient bony structure which allow proper functional and esthetic placement of endosseous implants of suitable size and in correct axial inclination [8]. Targeting this goal, several surgical procedures for vertical and horizontal bone augmentation have been described. Guided Bone Regeneration (GBR), onlay block bone graft, Distraction Osteogenesis (DO) and ridge splitting have been successfully used widely in alveolar ridge augmentation [9-14]. Several materials have been used in the bone augmentation procedures including autogenous grafts, allogenic grafts, xenografts, titanium meshes and/or different barrier membranes [15-20]. The success rates of dental implants placed in augmented bone have been documented by many studies to be comparable to the success rate of implants placed in pristine bone [21-23].

According to the literature, Autogenous bone grafts is the “gold standard” among many bone augmentation techniques [30-32]. Better implant outcomes have been documented with intraoral autogenous grafts rather than extraoral calverial and hip bone grafts [29].

Severe horizontal alveolar ridge defects have been reconstructed successfully with mandibular bone blocks [33-35]. To avoid the surgical procedure for harvesting the autogenous bone graft and its complications, several materials such as corticocancellous bovine/porcine bone have been introduced and used successfully by many authors in alveolar ridge augmentation [20,36,37].

**Purpose of the Study**

Clinically, radiographically and histomorphometrically compare autogenous onlay block bone graft versus xenogenic flexible bone lamina graft when used in horizontal alveolar ridge augmentation, with the aim of introduction of a possible alternative to the use autogenous bone graft in alveolar ridge augmentation procedures.

**Materials and Methods**

**Patient selection**

Fourteen patients were selected from the clinic of the oral diagnosis, Faculty of Dentistry, Ain Shams University. All patients had a maxillary partially edentulous ridge which required horizontal width augmentation labiolingually prior to implant placement. All patients had healthy mandibular symphisis as bone donor site and no particular medical history (Medically free). Male or female with age range 20-40 years were included in the study.

Smokers, patients who showed residual infection in the edentulous area, patients with poor oral hygiene and vulnerable groups as pregnant females and decisionally impaired individuals were excluded from the study. The nature of the study was explained to each patient and a signed, written, informed detailed consent form was obtained from all patients prior to any study-related procedures.

Preoperative analysis included complete medical history, past dental history, clinical examination, clinical photographs and Cone beam computed tomography to evaluate edentulous alveolar ridge morphology and to measure height and width of the alveolar ridge.

**Surgical procedures**

Two surgeries were carried out for each patient; the first surgery was for alveolar ridge augmentation (bone grafting) while the second surgery was for implant placement in a routine fashion. The fourteen patients were randomly divided into two equal groups by the flip of a coin. Alveolar ridge augmentation was performed in group one (G1, 7 patients) using intraoral autogenous onlay block bone graft in addition to some particulate xenograft (Gen-Os; OsteoBiol®, Italy) to fill the discrepancies around the block. The intraoral autogenous block graft was harvested from the mandibular symphysis using piezoelectric surgery (VarioSurg.NSK). Alveolar ridge augmentation was performed in group two (G2, 7 patients) using xenogenic soft cortical bone lamina graft (Lamina; OsteoBiol®, Italy) in addition to particulate xenograft (Gen-Os; OsteoBiol®, Italy). Xenogenic OsteoBiol® Cortical Bone Lamina graft is made of cortical bone of heterologous origin produced with Tecnoss® process. The bone Lamina graft after hydration become flexible and can be adapted to the defect morphology. Patients of both groups were pre-medicated one hour before the ridge augmentation surgery with amoxycillin 875mg/ clavulanic acid 125 mg orally (Hibiotic 1gm tablets; Amoun pharmaceuticals) and Dexamethasone phosphate 8mg I.M. injection (Epidron ampoule 2ml; Eipico).

**Recipient site preparation for both groups:** Following local anaesthesia, crestal incision and two divergent vertical incisions were made labially adjacent to the neighboring teeth. Mucoperiosteal flaps were elevated at the buccal and
palatal aspects of the edentulous alveolar ridge. The cortical bone on labial aspect was perforated at multiple sites with a small round surgical bur (Aesculap, Germany) under copious irrigation to form communications with the marrow spaces and to increase bleeding in order to facilitate vascularization of the graft [38]. The bony defect was evaluated to ensure the size and shape of the needed bone graft.

Bone graft harvesting and fixation at the recipient site in G1: (Figure 1) Surgical procedure was performed as described by Misch et al., 1992 [9]. Following local anaesthesia of the donor site (mandibular symphysis), labial sub-marginal attached gingiva incision and two vertical releasing incisions were made between the lower premolar regions at the mandibular symphysis reflecting a mucoperiosteal flap on the facial aspect of the ridge. The ultrasonic piezoelectric device was used to harvest the bone block. Once the block graft was separated from the donor site, the graft was placed in sterile cold saline; minimal time elapsed before placement of the bone block at the recipient site to preserve the cell viability and the osteogenic power of the autogenous bone. The harvested bone block was then trimmed, adjusted and any sharp angles were removed so that it could fit at the recipient bed; close as much as possible to the recipient bone and to avoid perforation of the overlying flap. The onlay block bone graft was then positioned over the recipient site with the spongy bone side of the graft facing the recipient bed cortical bone. To ensure graft immobilization, the block graft was firmly secured to the recipient site by titanium fixation micro-screws. Small amount of particulate bone graft was used to fill gaps between the block bone graft and the recipient bed. Moreover, some particulate bone graft was used to cover the surface of the block with the aim of delaying the resorption rate of the autogenous bone. Periosteal releasing incisions were made at the base of the recipient site facial flap to allow stretching of the mucosa, tension-free adaptation of the wound margins, wound stability and primary intention closure of the surgical flap which are of primary importance for the prognosis of the regenerative procedures [39]. The facial flap at the recipient site was then sutured to the palatal flap without any tension using interrupted sutures (4-0 polypropylene, blue monofilament, Assut Sutures). Closure of the donor site with interrupted sutures was then completed.

Figure 1: Ridge Augmentation Surgery steps. Autogenous Block Onlay Bone Graft
Bone graft preparation and application in G2: (Figure 2) Gen-Os® particulate bone graft (250-1000 microns granulometry) was hydrated and mixed with few drops of sterile saline in a sterile dish for 5-10 minutes. The Cortical Bone Lamina graft (30×30×2-4mm) was first trimmed with a sterile scissor to the desired size and shape then placed in a sterile dish of saline for 5-10 minutes for hydration and to acquire the desired plasticity. The lamina was then fixed with fixation screws to the recipient site with some particulate graft (thin layer about 2mm thickness) placed underneath the lamina. Care was taken to ensure that the drills penetrated enough in the bony cortex of the recipient site to reach the spongy bone. The recipient site was then sutured in the same manner as in group one patients.

Post-surgical care for both groups: Oral antibiotic (amoxycillin 875mg/clavulanic acid 125 mg) and oral non-steroidal anti-inflammatory were prescribed for 1 week. Postoperative antibiotics following bone regenerative techniques were recommended by several authors [38,40,41]. Patients were also instructed to use Chlorhexidine mouth wash (Antiseptol. Cairo pharmaceuticals) three times daily for 2 weeks starting the second day following the surgery to reduce the risk of infection. The sutures were removed ten days following the surgery. Then the patients returned for follow-up every two weeks for the first month, then once a month until re-entry surgery for the implant placement. Patients were instructed not to wear any removable prosthesis for four weeks after the surgery. After this period, the prosthesis was lined and patients were instructed to wear the removable provisional prosthesis only for esthetic reasons for the whole period of healing (6 months).
Failure of ridge augmentation occurred in 2 cases only; one case in **G1** and one case in **G2**. Failure of the case in **G1** was due to smoking following the ridge augmentation surgery although the patient denied that he is a smoker at the beginning of the study, wound infection and suppuration 2 weeks following the surgery necessitates graft removal. In the case of **G2**, wound dehiscence occurred 5 days following the surgery. Wound irrigation with antiseptic mouth rinse and re-suturing was performed, but wound infection, suppuration and loosening of the bone graft occurred after 1 week. Thus, Removal of the bone lamina, wound debridement and suturing was performed with antibiotic prescription. The patient was treated with a fixed bridge later on.

**Implant placement surgery:** The surgery for implant placement was performed six months after the ridge augmentation surgery. Paracrestal incision and full thickness mucoperiosteal flap was elevated labially and palatally. The fixation screws were removed using the proper screw driver. A trephine bur of 2 mm inner diameter (*Hu-Friedy, USA*) was used to obtain bone biopsy at the implant site before preparation of the implant recipient bed. The implant site preparation was then performed in routine fashion. All implants in both groups were placed with adequate primary stability (≥35) N.cm. Then the cover screws were placed and the flaps were closed using interrupted sutures for 7-10 days. A total of twelve implants were used, one in each patient (*Replant system, Implant Direst, Sybron Dental Specialities*). The implant diameter used was 3.5 mm in all patients while the implant length used was 11.5 mm in three cases and 13 mm in nine cases. Patients were instructed not to wear any removable prosthesis for four weeks after the surgery. After this period, the prostheses were lined and the patient was instructed to wear it only for esthetic reasons for the whole period of healing (3 months). The patient returned for follow-up every 2 weeks for the first month then once a month until starting the prosthetic steps. During the follow-up visits, examination of the surgery site for soft tissue healing was performed.

**Prosthetic procedures**

Three months after placement of the implant, prosthetic procedures were performed as follows. Using the soft tissue punch, cover screw of the implant was exposed and then removed without flap reflection. The gingival former was then connected to the implant. Rubber base impression was taken two weeks later using the suitable impression post. The final fixed prosthesis (crown restoration) was cemented with a temporary cement two weeks later to be able to remove the crown during CBCT at month 12 in order to minimize the image distortion as much as possible.

**Clinical and radiographic evaluations**

The alveolar ridge labiolingual horizontal width was measured before and after the augmentation procedures using the bone caliper (*Com Dent, UK*) and the Cone Beam Computed Tomography (CBCT). Bone caliper measurements of the alveolar ridge were carried out at five occasions during the study; during the first surgery for ridge augmentation before and after the bone graft placement, during re-entry surgery for implant placement, during the prosthetic procedures and the end of the study (12 months following ridge augmentation). The CBCT measurements of the alveolar ridge were carried out at three occasions; one week before the ridge augmentation surgery (month zero), one week before the implant placement surgery and at the end of the study period (month 12). Cone Beam Computed Tomographic images were taken with an I-CAT cone beam 3D dental imaging system (Imaging Sciences International, Hatfield, Pa) at 120 KVP, 5mA, exposure time 3-4 sec, slice thickness 0.3mm and field of view 60-70 mm.

It was decided by the authors that choosing a single point at the edentulous area to be measured before and after the ridge augmentation as a representative of the labiolingual ridge width will neither be accurate nor easily applicable since different points in the same edentulous area may show different degrees of changes in the ridge width following augmentation as the changes in ridge width was not suspected to be uniform throughout the whole edentulous area. Therefore, each edentulous area representing one missing tooth was measured at six different points and a mean value for the labiolingual width for each edentulous area was calculated.

To determine the points where measurements were carried out, the single tooth edentulous area was divided mesiodistally and apicoocclusally by two vertical and three horizontal imaginary lines respectively. The points of intersection between the imaginary lines are the six points where we measured the clinical labiolingual width of the ridge (Figure 3).

In the CBCT, measurements of the edentulous area at a single occasion were made on two sagittal views. The two vertical imaginary lines mostly represent the sections where the sagittal views to be used for measurements were chosen. At each sagittal view, measurements were made at three different levels of the ridge occlusoapically. Thus six measures for the ridge labiolingual width for each patient were made at a single occasion then the mean labiolingual width was calculated (Figure 4).
Distances from the vertical lines to the proximal surfaces of the teeth bounding the edentulous area were recorded and distances of the three horizontal lines from the imaginary plane connecting the neighboring teeth cervical lines were recorded, thus for each case the six points where measurements were done were reproduced as much as possible at different occasions during the study period.

**Histological evaluation**

After obtaining the Bony specimens, they were then quickly removed from the trephine bur and fixed in 10% neutral buffered formalin solution. The specimens were then rinsed with distilled water and then decalcified. The specimens were dehydrated through an ascending ethanol series. After decalcification, the bony specimens were embedded in paraffin wax. Serial sections (5μ in thickness) were cut through each specimen using a microtome and then they were stained with Hematoxylin and Eosin (H&E) and examined using a light research microscope (BX60, Olympus, Japan) for standard histologic analysis.

**Histomorphometric Analysis**

After image acquisition at original magnification of x200 for the H&E stained sections via a digital camera (5060,
Olympus, Japan) mounted on light research microscope (BX60, Olympus, Japan) by C mount, the digital images were saved as JPEG images. Images of the H&E stained sections were analyzed by image analysis software (Image J, 1.49b, NIH, USA) to calculate the newly formed bone total surface area and the osteoblasts count. Using the image analysis software, images were automatically corrected for brightness and contrast. The corrected images were converted to gray scale images and then they were automatically thresholded, which allows the operator to automatically select the total surface area of newly formed bone or the osteoblasts count. For every specimen, two sections were obtained with four randomly selected fields within each section making a total of eight measurements for every specimen with their mean value representing the final value for this specimen used in statistical analysis.

**Statistical analysis**

Numerical data were presented as mean and Standard Deviation (SD) values. Data were explored for normality by checking the data distribution, calculating the mean and median values and using Kolmogorov-Smirnov and Shapiro-Wilk tests. BL ridge width data showed parametric distribution, bone surface area, osteoblasts counts as well as % changes in BL width data showed non-parametric distribution. For parametric data, repeated measures ANOVA test was used to study the changes by time within each group. Bonferroni’s test was used for pair-wise comparisons when ANOVA test is significant. Student’s t-test was used to compare between the two groups. For non-parametric data, Mann-Whitney U test was used to compare between the two groups. The significance level was set at P ≤ 0.05. Statistical analysis was performed with IBM (IBM Corporation, NY, USA.), SPSS Statistics Version 20 for Window.

**Results**

**Clinical Assessment of Bucco Lingual (BL) Ridge Width**

In autogenous bone graft as well as bone lamina groups; there was a statistically significant increase in BL ridge width immediately after graft placement. Then a statistically significant decrease in mean BL ridge width was observed after 6 months. From 6 months to 9 months as well as from 9 months to 12 months; there was no statistically significant change in mean BL ridge width. Six, nine as well as twelve months periods showed statistically significantly higher mean clinical BL ridge width than baseline measurement (Table 1, Figure 5).

### Table 1: Mean, standard deviation (SD) values and results of comparison between clinical measurements of BL ridge width during the study period within each group

<table>
<thead>
<tr>
<th>Period Group</th>
<th>Baseline (SD)</th>
<th>Immediately After Graft (SD)</th>
<th>6 months (SD)</th>
<th>9 months (SD)</th>
<th>12 months (SD)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autogenous bone graft</td>
<td>6.9 (1.4) a</td>
<td>12.3 (1.4) a</td>
<td>9.8 (2.4) b</td>
<td>9.8 (2.3) b</td>
<td>9.7 (2.3) b</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Bone lamina</td>
<td>6.0 (0.8) a</td>
<td>11.3 (0.8) a</td>
<td>8.7 (0.9) b</td>
<td>8.5 (0.9) b</td>
<td>8.6 (0.9) b</td>
<td>&lt;0.001*</td>
</tr>
</tbody>
</table>

*: Significant at P ≤ 0.05, Different superscripts in the same row are statistically significantly different

Through the whole study period, there was no statistically significant difference between mean BL ridge widths in the two groups (Table 2, Figure 6). Through the whole study period, there was no statistically significant difference between mean % changes in BL ridge widths in the two groups (Table 3, Figure 7).
In autogenous bone graft as well as bone lamina groups; there was a statistically significant increase in BL ridge width at P ≤ 0.05.

### Table 2:

<table>
<thead>
<tr>
<th>Group Period</th>
<th>Autogenous Bone Graft</th>
<th>Bone Lamina</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>6.9 (1.4)</td>
<td>6.0 (0.8)</td>
<td>0.197</td>
</tr>
<tr>
<td>Immediately after graft</td>
<td>12.3 (1.4)</td>
<td>11.3 (0.8)</td>
<td>0.155</td>
</tr>
<tr>
<td>6 months</td>
<td>9.8 (2.4)</td>
<td>8.7 (0.9)</td>
<td>0.331</td>
</tr>
<tr>
<td>9 months</td>
<td>9.8 (2.3)</td>
<td>8.5 (0.9)</td>
<td>0.242</td>
</tr>
<tr>
<td>12 months</td>
<td>9.7 (2.3)</td>
<td>8.6 (0.9)</td>
<td>0.340</td>
</tr>
</tbody>
</table>

*: Significant at P ≤ 0.05

### Table 3:

<table>
<thead>
<tr>
<th>Group Period</th>
<th>Autogenous bone graft</th>
<th>Bone Lamina</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline - Immediately after graft</td>
<td>82.0 (21.8)</td>
<td>90.5 (15.6)</td>
<td>0.359</td>
</tr>
<tr>
<td>Baseline - 6 months</td>
<td>39.9 (8.4)</td>
<td>46.0 (18.8)</td>
<td>0.575</td>
</tr>
<tr>
<td>Baseline - 9 months</td>
<td>40.2 (7.3)</td>
<td>43.4 (21.0)</td>
<td>0.810</td>
</tr>
<tr>
<td>Baseline - 12 months</td>
<td>38.7 (9.7)</td>
<td>44.7 (20.5)</td>
<td>0.573</td>
</tr>
</tbody>
</table>

*: Significant at P ≤ 0.05

### Figure 6:

Bar chart representing mean BL ridge widths in the two groups.

### Figure 7:

Bar chart representing mean % changes in BL ridge widths in the two groups.

**Radiographic Assessment of Bucco Lingual (BL) Ridge Width**

In autogenous bone graft as well as bone lamina groups; there was a statistically significant increase in BL ridge width.
There was no statistically significant difference between mean bone surface areas in the two groups and there was no statistically significant difference between mean osteoblasts counts in the two groups.

**Histomorphometric Assessment**

There was no statistically significant difference between mean bone surface areas in the two groups and there was no statistically significant difference between mean osteoblasts counts in the two groups.

**Histological Assessment**

On histological examination of the augmented sites in group one (G1), newly formed bone, both woven and more mature lamellar bone were observed in all sites. Woven bone showed prominent osteoblastic rimming indicating the active bone formation process. Reversal lines were seen indicating bone remodeling. Also, prominent abundant osteocytes were observed entrapped in the lamellar bone which showed haversian systems (bony osteons). Some deeply stained small areas were noticed representing the remnants of bone graft particles which were incompletely resorbed. They were seen integrated and in continuity with the newly formed bone. The medullary spaces were seen also in continuity with the newly formed bone and filled with well vascularized connective tissue with prominent capillaries and abundant fibroblasts. Few inflammatory cell infiltrate was noticed in the medullary spaces. (Figure 8,9).

![Figure 8](image1.png)

*Figure 8:* Photomicrograph from Group 1 showing newly formed bone in continuity with the medullary spaces rich in capillaries and the remnants of the bone graft. Note the reversal lines* and bony osteons* (Hematoxylin and Eosin (H&E), magnification: x 200)

![Figure 9](image2.png)

*Figure 9:* Photomicrograph from Group 1 showing newly formed bone and medullary spaces. Note the osteoblastic rimming* (H&E x 100)
On histological examination of the augmented sites in group two (G2), newly formed bone, both woven and more mature lamellar types were observed in all sites. Active ongoing bone remodeling and new bone formation were indicated by the presence of abundant reversal lines and osteoblastic rimming. Many bony osteons were also noticed in the lamellar bone. Deeply stained areas were noticed representing incompletely resorbed residuals of the bone graft and in complete continuity with the newly formed bone. Medullary spaces showed abundant connective tissue rich in fibroblasts and blood capillaries. Few inflammatory cell infiltrate was noticed in the medullary spaces. (Figure 10,11)

**Figure 10:** Photomicrograph from Group 2 (Bone lamina) showing newly formed lamellar bone*, woven bone and medullary spaces rich in capillaries and fibroblasts. Note the reversal lines (H&E x 100)

**Figure 11:** Photomicrograph from Group 2 showing newly formed lamellar bone with prominent reversal lines* (H&E x 200)

**Discussion**

The use of dental implants has become a routine treatment modality in contemporary dentistry. However, alveolar bone deficiency as a result of bone resorption following tooth extraction often reduces the possibility of correct three dimensional implant placements [42,43]. To avoid many complications associated with autogenous grafts, the use of other bone substitutes as allografts or xenografts has been proposed. Corticocancellous bone of bovine/porcine/equine origin has been used for many years as a biomaterial for bone augmentation and showed good osteoconductive properties [17,36,37]. To the best of our knowledge, no previous studies compared this relatively new form of bone graft “xenogenic flexible lamina” to the gold standard autogenous bone in horizontal alveolar ridge augmentation.

All the patients in our study were showing partially edentulous anterior area, which is a relatively common site for early tooth loss and patient’s major concern. Many risks of complications associated with autogenous bone graft
harvesting in group one were minimized using the piezoelectric surgery [44,45]. In both groups; the clinical mean BL ridge width showed a statistically significant increase immediately after graft placement then a statistically significant decrease after 6 months which could be related to some resorption of the grafted alveolar bone. This is in accordance to many previous studies that proved that grafted alveolar bone show some resorption by time [46,47]. No statistically significant change in clinical mean BL ridge width was observed from 6 months to 9 months as well as from 9 to 12 month in both groups. This is in accordance with previous studies which showed that the resorption of the grafted bone after augmentation is not a uniform process but most pronounced during the first six months following the augmentation surgery [48-50].

When measuring the clinical BL ridge width at 6, 9 as well as 12 months periods in both groups, statistically significantly higher clinical mean BL ridge width was found at each occasion when compared to the base line measurement; thus allowed placement of dental implants. This is in accordance with many previous studies that showed that different ridge augmentation techniques such as GBR and Onlay bone grafting have been successfully used to increase alveolar ridge width and allow positioning of dental implants in atrophic ridges which otherwise would not be possible [11-13]. Through the whole study period, clinically and radio graphically there was no statistically significant difference between mean % changes in BL ridge widths in both groups. To the best of our knowledge no previous studies have compared autogenous bone to bone lamina. But a previous study by Felice et al. comparing autogenous bone to another form of deproteinized bovine bone in bone augmentation demonstrated no significant differences between grafts in terms of bone gain [51].

In both groups; the CBCT at 12 months period showed statistically significantly higher mean BL ridge width than the base line CBCT measurement which was in accordance with many previous studies [18,50,52,53]. From 6 months to 12 months; there was no statistically significant radiographic change in mean BL ridge width. This was the same as the clinical results and was in accordance with previous studies [49,54]. There was no statistically significant difference between mean bone surface area in the two groups and no statistically significant difference between mean osteoblastic counts in the two groups. A study by Barone et al [55], comparing the use of 100% autogenous bone versus a combination of autogenous bone and xenograft for maxillary sinus augmentation showed by histomorphometric analysis very similar bone volume tissue percentages for the two groups [55].

Conclusion

The Xenogenic flexible bone lamina graft can be used successfully in horizontal alveolar ridge augmentation as an alternative to the autogenous block onlay bone graft. We recommend further studies testing the same material in vertical alveolar ridge augmentation.

References


