



SIMULTANEOUS IMPLANT PLACEMENT WITH BONE GRAFTING TO THE THIN BUCCAL PLATE OF BONE USING XENOGRAFT IN SITES OF INADEQUATE WIDTH IN POSTERIOR MANDIBLE

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ABSTRACT

Objective: The collapse of bone is considered to be a normal physiological change following the extraction if no measure of socket preservation was applied. This study was performed using pericardium collagen membrane and xenograft for horizontal width augmentation simultaneously with the placement of implant. To evaluate the amount of new bone gain cone beam computed tomography (CBCT) was used. **Subjects and methods:** Fifteen patients who met the inclusion criteria were selected from outpatient clinic in the Faculty of Dentistry, Al-Azhar University (boys- Cairo). All the patients showed narrow width in the lower posterior edentulous ridge that need to be restored by implant placement. All the cases had guided bone regeneration procedure using xenograft and pericardium membrane. The ridge width was measured preoperatively and 6 months post operatively using (CBCT) to evaluate the amount of bone gain. **Results:** The ridge width showed a significant increase from 4.51 ± 0.56 pre-operatively to 6.61 ± 0.44 immediately post-operative. This was followed by a decrease to 4.71 ± 0.6 after 6 months postoperatively. There was no significant difference between values recorded pre-operatively and after 6 months. **Conclusion:** The results of the current study do not support the use of bovine pericardium membrane with xenografts in horizontal bone augmentation simultaneously with implant placement.

KEYWORDS: Guided bone regeneration (G.B.R), xenograft, pericardium membrane, implant, bone loss, bone gain.

INTRODUCTION

The pattern of bone resorption in posterior mandible after tooth extraction is witnessed in the following sequence. The buccal plate of bone will collapse lingually at first, this occurs as the blood supply is being compromised and that is explained by the tearing of the periodontal ligaments which is containing the some of the vascular supply to the buccal bone⁽¹⁻³⁾.

After the collapse of the buccal bone, the vertical height of the alveolar ridge in the posterior mandible will decrease gradually and in some severe cases the alveolar ridge will completely resorb. The restoration of the horizontal width of the alveolar ridge became quiet challenging in some cases⁽⁴⁾.

A review including 1244 abstracts in addition to 106 of Cochrane papers stating that during the post extraction healing period the clinical loss in

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width is much greater than the loss in height. The results were found as the following, reduction in width of the alveolar ridges was 3.87 mm. The mean clinical mid-buccal height loss was 1.67 mm. The mean crestal height change as assessed on the radiographs was 1.53 mm. Socket fill in height as measured relative to the original socket floor was on an average 2.57 mm ⁽⁵⁾.

It is considered to be a great advantage for the patient if the clinical situation permits the placement the implant in the same time of the guided tissue regeneration. A decrease in the duration till receiving the final restoration and there will be no need for a second operation for implant placement ^(6,7).

Steigmann in his study attributed the success of the horizontal bone gain to the use of bovine pericardium membrane bovine pericardium (Tutodent membrane, Tutogen Medical GmbH) and the use of 2 different types of xenografts Navigraft Zimmer Dental, Carlsbad, CA) or Bio-Oss (Geistlich Pharma AG, Wolhusen, Switzerland). The results of his study showed huge gain in the horizontal width⁽⁸⁾.

Hämmerle et al ⁽⁹⁾, showed in their study of 12 patients a gain in the ridge width varying from 0mm to 6 mm with a mean value of 3.6 mm. In this study deproteinized bovine bone matrix "DBBM" (Bio-Oss®, Geistlich AG, Wolhusen, Switzerland) and a collagen membrane (Bio-Gide®, Geistlich AG) were used for the horizontal augmentation procedure. A healing period of nine months before the re-entry procedure and implant placement.

Therefore, the aim of this study was to evaluate the amount of bone gain in terms of ridge width using cone beam computed tomography pre-operatively and 6 months post-operatively.

SUBJECTS AND METHODS

In this study, 15 patients were selected from outpatient clinic in the Faculty of Dentistry, Al-Azhar University (boys- Cairo). Selection of patients was based on specific inclusion and exclusion criteria as the follow:

Inclusion criteria: Patients with narrow edentulous ridge measuring less than 4 mm in buccolingual dimension. Good general health condition without any systemic complications that may affect osseointegration.

Exclusion Criteria: Uncontrolled systemic disease which could affect the osseointegration of the implant and wound healing. Local aggressive bone disease. Presence of any local acute suppurative infection or pathosis. Bisphosphonate therapy and Radiotherapy patient.

Ethical Considerations: All patients were informed about the surgical procedure, complications and post-operative follow-up period.

Each patient was signed an informed consent form after he/she has received detailed information about the study before stating the study.

Preoperative evaluation: complete dental, medical and drug history as well as patient's data (name, gender, and age) were collected. All patients were free from any systemic diseases. Then, Clinical and radiographic examination through cone beam computed tomography where in vivo software was used to evaluate bone width.

Surgical procedure

All the patients were treated under local anesthesia using Articaine hydrochloride 4% with epinephrine 1:100,000. Para crestal and mesial or distal releasing incision were made "open book flap" for proper accessibility and fixation of the membrane ^(10,11). Then, mucoperiosteal elevator was used to reflect full thickness buccal and lingual flaps were reflected to expose the site of implant placement and obtain access and visibility to the subperiosteal surgical site.

Identification of implant position, once the bone had accessed. As a rule, for treatment option, all implants (Dura-Vit EV Implant, B and B Dental, Italy) were submerged 1-2 mm subcrestally; the implant dimeters ranging from 4 to 5 mm. The implant

drillings with its various diameters was initiated under copious isotonic saline irrigation till reach to the final drill followed by implant insertion. The torque should reach 40 Newtons to increase the chance of osteointegration ⁽¹²⁾, then decortication was done in the buccal cortex to ensure bleeding occurs for proper blood supply for the graft.

The bovine pericardium membrane (Tutopatch, Tutogen Medical GmbH, Neunkirchen, Germany) was placed on the buccal wall either to treat the dehiscence found on the wall or to increase its thickness, then the membrane was trimmed and adapted to the site of augmentation. Two self-tapping screws “micro screws diameter 1.2 and length 4mm”, were used for the fixation of the membrane, one was placed mesial and the other screw placed distally.

The xenograft (Tutobone, Tutogen Medical GmbH, Neunkirchen, Germany) was prepared by mixing it with saline. The amount of xenograft needed to be used was evaluated according to the

present defect, then the graft was packed using the convex side of a micro mucoperiosteal elevator along the buccal defect. Adaptation of the membrane was done, then it was pulled to the lingual side to ensure complete coverage of the graft. The coronal portion of the membrane was fixated by using the covering screw of the implant, or by placing screw on the crestal part of the lingual cortical wall. Sharp dissection was done in the periosteum of the buccal flap by using scalpel no.15, in order to approximate the edges of the wound and to achieve passive closure.

Addison forceps was used to approximate the edges of the wound to ensure tension free closure. Suturing was done using polypropylene suture 4/0, a key suture was done at the crestal portion of the releasing for reorientation of the flap, and then multiple simple interrupted sutures was done to ensure the complete closure of the wound. The stitches were left in place from seven to ten days.

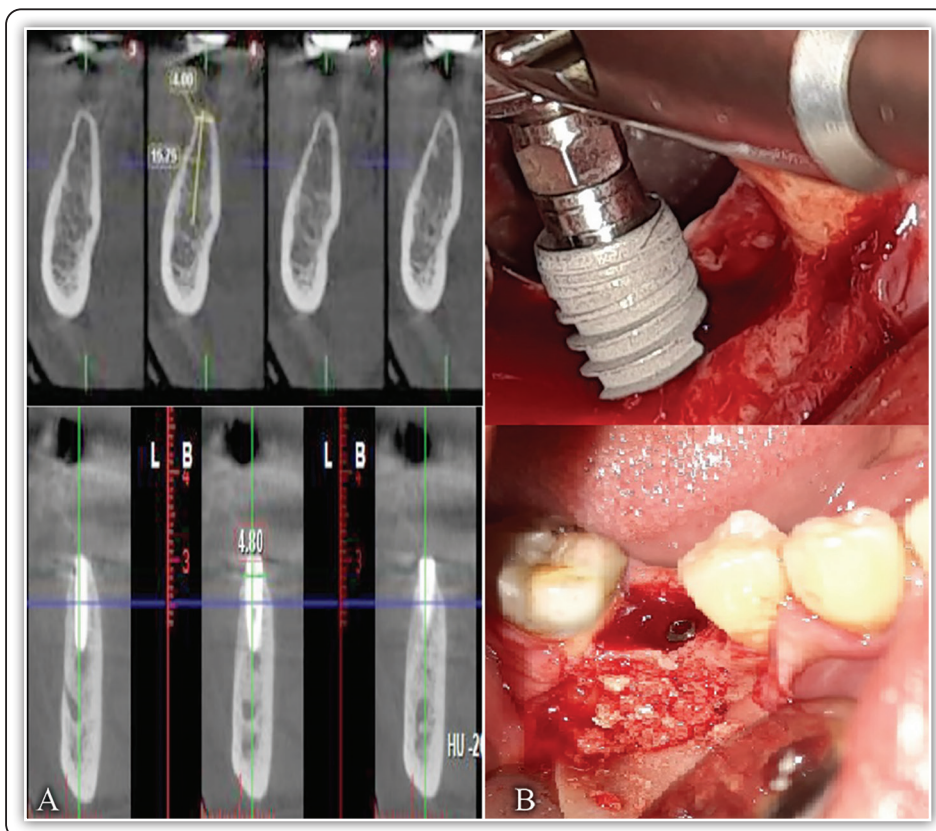


FIG (1) Pre-operative and 6 months post-operative radiograph (A); and clinical image of implant placement and G.B.R (B).

Postoperative evaluation:

All the patients were evaluated 10 days post-operatively for suture removal and evaluation of the wound healing. We have examined the healing of soft tissue mucosa, presence of swelling, signs of infection and sharp bony edges. Clinical evaluation was done to observe any pain, swelling signs of infection exposure of the implant.

CBCT was performed 6 months post-operatively to compare the ridge width pre-operative and 6 months post-operative as well as the marginal bone loss.

RESULTS

The study included 15 patients: 12 females (80%), 3 males (20%). Their ages ranged from 20 to 40 years with the mean age of patients was 43.6±9.8 years. All the patients showed normal healing pattern no wound dehiscence, signs of infection, persistent inflammation, foul odour or any discharge was reported.

Probing depth showed a significant increase from a mean 4.87±0.44 immediately post-operative to a mean 5.82±1.02 after 6 months. Paired t test revealed a statistically significant difference by time (p=0.00). The mean difference between

observations was 0.95±1.04 and the percent change recorded a median = 30 (range -16.67 to 55.56).

Gingival index showed a no significant increase from a median 1.5 (1; 2) immediately post-operative to a median 1.5 (0.5; 2.5) after 6 months. Wilcoxon signed rank test revealed a non-significant difference by time (p=0.448). The mean difference between observations was 0.10±0.54 and the percent change recorded a median =0.00 (range -50 to 66.67).

Papillary bleeding index showed a significant increase from a mean 1.67±0.31 immediately post-operative to a mean 2±0.06 after 6 months. Paired t test revealed a non-significant difference by time (p=0.07). The mean difference between observations was 0.33±0.65 and the percent change recorded a median = 25 (range -50 to 100).

According to the CBCT performed after 6 months:

Ridge width:

The ridge width showed a significant increase from 4.51±0.56 pre-operatively to 6.61±0.44 immediately post-operative. This was followed by a decrease to 4.71±0.6 after 6 months postoperatively. Repeated measures ANOVA revealed a statistically significant difference by time (p=0.00) (Table 1).

TABLE (1) Descriptive statistics and comparison of ridge width (mm) (repeated measures ANOVA test)

	Bone loss	Median (range)	Mean	Std. Dev	F	P
Value	Pre-operative	4.40 (3.7; 5.7)	4.51 ^b	0.56	70.22	0.00*
	Immediate	6.7 (6; 7.5)	6.61 ^a	0.44		
	6 months	4.5 (4; 5.6)	4.71 ^b	0.6		
Percent change	From pre-operative to immediate post-operative	48.89 (31.58; 62.16)	47.54	9.27		
	From immediate to 6 months	-30.77 (-38.6; -19.12)	-28.84	6.49		
	From pre-operative to after 6 months	8.11 (-12.28; 18.42)	4.77	9.17		

Significance level p≤0.05, *significant

Marginal bone loss:

Marginal bone loss showed a significant increase from a median 0 (0; 3.5) immediately post-operative to a median 2 (0; 4) after 6 months.

Wilcoxon signed rank test revealed a statistically significant difference by time (p=0.014). The mean difference between observations was 1.25±1.52 and the percent change recorded a median =400 (range -100 to 700) (Table 2).

TABLE (2) Descriptive statistics and comparison of marginal bone loss (mm) (Wilcoxon-signed rank test)

Bone loss	Median (range)	Mean	Std. Dev	Difference				Z	P
				Mean	Std. Dev	C.I. lower	C.I. upper		
Immediate	0 (0; 3.5)	.57	.98	1.25	1.52	0.41	2.09	-2.45	.014*
6 months	2 (0; 4)	1.81	1.35						
Percent change after 6 months	400 (-100; 700)	277.3	298.4						

Significance level $p \leq 0.05$, *significant.

DISCUSSION

Reduction in the duration of the treatment plan and to provide the best modality of treatment without any risks and to be cost effective is paramount. Decision was taken to use xenograft instead of autogenous bone or allografts to avoid the use of another operation site to harvest autogenous bone and expose the patient to many complications such as nerve injury, hematoma formation and donor site morbidity. The xenograft is considered to be much cheaper than the allograft so it is considered to be a good alternative ⁽¹³⁾.

The main objective in our study is to evaluate the amount of bone gain and to compare the change in bone width in various durations of the study. Marginal bone loss, probing depth, gingival index and papillary bleeding index were involved in the current study.

The upper one third of the implant threads was exposed and not covered by any buccal bone in some cases of the study, this that may affect the

primary stability of the implant. It was intentional not to reach the final drill and to stop the osteotomy at the drill before the final one in order to achieve proper primary stability and engagement between the implant surface and the surrounding bone as stated by Campos et al ⁽¹⁴⁾. The implant was placed in the osteotomy site in order to act as a bone expander and push the buccal plate of bone laterally. The immediate post-operative increase in the ridge width is attributed to the action of the implant on the buccal bone and the amount of bone graft packed buccally to the implant. High primary stability was achieved in all of the cases approximately from 50 to 60 Ncm.

In the current study, the ridge width showed a significant increase from 4.51±0.56 pre-operatively to 6.61±0.44 immediately post-operative. This was followed by a decrease to 4.71±0.6 after 6 months postoperatively, 4 cases only showed vertical dehiscence on the implant surface. There was no significant difference between values recorded pre-operatively and after 6 months.

There was contrast in results by Steigmann⁽⁸⁾, who showed gain in the ridge width varied from 0.2 mm to 5 mm with a mean value of 3.1714 mm measured clinically in a group of 7 patients who needed immediate implant placement with guided bone regeneration to increase the horizontal dimension of the ridge. Hämmerle et al⁽¹⁵⁾, showed in their study including 12 patients a gain in the ridge width varying from 0 mm to 6 mm with a mean value of 3.6 mm.

This controversy about the results between our study and Steigman⁽⁸⁾ study may be attributed to the type of the xenograft used in both studies. In the latter study, 2 different types of xenografts were used Navigraft (Zimmer Dental, Carlsbad, CA) or Bio-Oss (Geistlich AG, Wolhusen, Switzerland). While in the current study Tutobone (Tutogen Medical GmbH, Neunkirchen, Germany) was used as a bone graft.

While Hämmerle et al⁽¹⁵⁾ used different type of bone graft, pericardium membrane and longer healing period. He used Bio-Oss and a collagen membrane (Bio-Gide[®], Geistlich AG) were used for the horizontal augmentation procedure. A healing period of nine months before the re-entry procedure and implant placement.

The results concluded by Van Steenberghe et al⁽¹⁶⁾, were similar to the results of the current study in terms of ridge width. They stated that 10 sites were completely and 9 partially filled at re-entry after 6 months. Two sites showed loss of the graft material and an increased defect 2.4 and 4.8 mm respectively. For the partial fills, the mean remaining defect height was 1.6 mm (range: 0.6–3.0 mm).

CONCLUSION

The results of the current study do not support the use of bovine pericardium membrane with xenografts in horizontal bone augmentation simultaneously with implant placement.

We recommend more Randomized Clinical Trials “RCT” to compare between different manufacturers of xenografts and bovine pericardium membranes in order to exclude the difference that might be caused due to the surgical technique or human error.

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