



## EVALUATION OF RIDGE PRESERVATION USING BIO-OSS GRAFTING MATERIAL AND PRF MEMBRANE: A CLINICAL STUDY

Mohammed Omar Hegazy\*, Khaled Mohammed Ali \*\*, Atef Mohammed Hassanen \*\*\*

### ABSTRACT

**Objective:** The aim of present study was to evaluate effect of using two different biomaterials, Bio-oss graft and PRF membrane for ridge preservation after tooth extraction, clinically and radiographically. **Subjects & Methods:** This study was conducted on 20 patients indicated for extraction, from those attending the outpatient clinics of Oral and Maxillofacial Surgery, Faculty of Dental Medicine, Al-Azhar University Hospitals. Patients were divided into two groups: Group I: Extraction socket preservation with bio-oss graft and PRF membrane (10 patients). Group II: Extraction socket without grafting (10 patients). All patients were evaluated clinically after 24-hour, one week and two weeks for pain and edema. They were also evaluated immediately and after six months for bone gain in height and width using cone beam computed tomography. **Results:** The bone width between the two groups was found to be statistically significant where the bone height was not statistically significant between the study and control groups. **Conclusion:** Post extraction alveolar ridge resorption is an inevitable process. Bio-oss placed in extraction socket give better bone quality and quantity than empty socket. The PRF membrane is used effectively as a membrane to cover the bone graft.

**KEYWORDS:** Ridge Preservation, PRF, bone width.

### INTRODUCTION

The alveolar process is a tooth-dependent tissue, which develops along with the eruption of the teeth. Marked alteration in hard and soft tissue contours are expected after tooth extraction. Socket healing patterns following tooth removal resulted in more rapid bone resorption on the buccal than on the lingual/palatal aspects. Between 40-60% of the labial bone is lost during the first 3 years and this loss continue at an annual rate of 0.25-0.5 % which jeopardize the placement of dental implants<sup>(1)</sup>.

This phenomenon appears to be progressive and irreversible, resulting in myriad of prosthodontics, esthetic, and functional challenges during the replacement of missing teeth. Several human

studies evaluating the healing of extraction socket have confirmed that the alveolar process atrophies after the loss of single or multiple teeth<sup>(2)</sup>.

Socket grafting or ridge preservation involves grafting the extraction socket with biomaterial alone or in combination with barrier membrane and/or an advanced or rotated pedicle flap/connective tissue/free gingival graft<sup>(3)</sup>.

A variety of materials are available for post-extraction ridge preservation. For optimal results, all grafts require an adequate blood supply, a form of mechanical support, and osteogenic cells supplied by the host, graft material, or both. Several types of bone substitutes are commercially available, including allografts, xenografts, and alloplasts. Bone

\* MSc Student, Department of Oral Surgery, Faculty of Dental Medicine, Al-Azhar University, Cairo, Egypt.

\*\* Professor, Department of Oral surgery, Faculty of Dental Medicine Al-Azhar University, Cairo, Egypt

\*\*\* Assistant Professor, Department of Oral Surgery, Faculty Of Dental Medicine, Al-Azhar University, Cairo, Egypt

• **Corresponding author:** dr.dent7egazy@gmail.com

substitutes ideally should be able to form new bone and be biocompatible, completely resorbable, non-antigenic, non-carcinogenic, inexpensive, and pose no risk of disease transmission. They should also be space-maintaining, and have a similar composition, particle size, and resorption rate as human bone<sup>(4)</sup>.

Several trials and materials have been used to preserve the socket after extraction. Platelet rich fibrin PRF added to Bio-oss could be valuable in filling the socket and promote preservation of alveolar bone. A well-controlled study using (bio-oss and Platelet rich fibrin (PRF) membrane) is needed as a factor that initiates this study<sup>(5)</sup>.

## SUBJECTS AND METHODS

Twenty patients were participated in this study. They were selected from those attending the outpatient clinics of Oral and Maxillofacial Surgery, Department, Faculty of Dental Medicine, Al-Azhar University Hospitals.

**Inclusion criteria:** Patients indicated for tooth extraction in lower posterior area (lower premolars and lower molars). The age of patients was between 20 and 60 years old.

**Exclusion criteria:** Teeth with severe marginal bone loss (bone level  $\geq 3$  mm from the cemento-enamel junction) and/or exhibited acute periapical lesions were not included in the study. Patients suffering from systemic disease that influencing bone healing. Presence of any pathologic lesion in extraction region i.e. tumor or cyst; and history of chemotherapy or radiotherapy.

Patients were divided into two groups: Group I: Extraction socket preservation with bio-oss graft and PRF membrane (10 patients). Group II: Extraction socket without grafting (10 patients). All patients were evaluated clinically after 24-hour, one week and two weeks for pain and edema. They were also evaluated immediately and after six months for bone gain in height and width using cone beam computed tomography (CBCT).

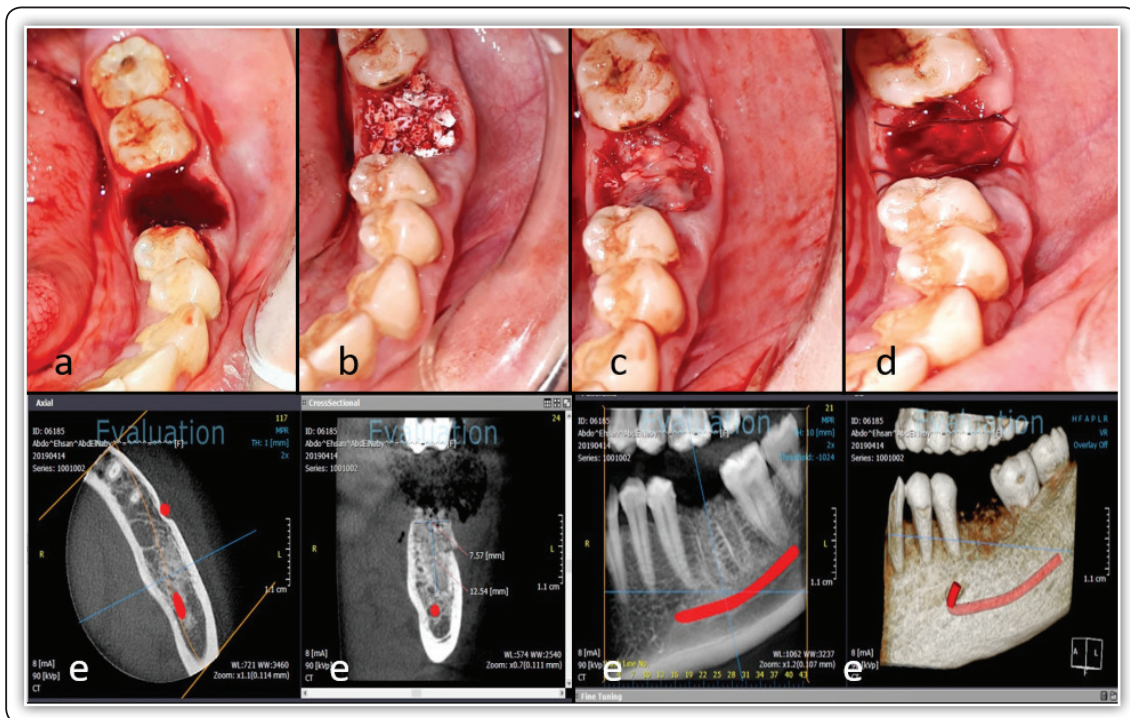


FIG (1) **a;** Socket after extraction, **b;** Bio-Oss in place, **c;** PRF membrane cover Bio-Oss, **d;** PRF membrane covering the graft and secured with sutures, **e;** CBCT immediately post-operative

**RESULTS**

All patients were free from any systemic disease that can compromise the bone healing. A total of twenty patients were gone through dental extraction in the lower posterior area. Ten of them received Bio-oss and PRF membrane after extraction and the other ten just extracted the tooth without any grafting. All patients were up for 6 months, and results were registered as regards clinical and radiographic evaluation.

**Radiographic evaluation**

Bone height in both groups represented in (Table 1) display the bone height. In the study group, the mean bone height in the socket was 13.48 mm ±1.52 immediately post-operative. Six months later, the mean bone height decreased significantly reaching 13.09 mm ±1.22 (p=0.04). Similarly, in the control group, the mean bone height was 12.61 mm ±1.98 immediately post-operative with significant reduction after six months of 11.79 mm ±2.05 ((p<0.0001).After 6 months (figure 2), mean difference in bone height was statistically lower in the study (-0.39±0.54 mm) as against the controls (-0.83±0.31mm). (p=0.04)A reduction in bone height was observed in both groups 6 months later with less mean percent reduction in bone height of 2.64% among the study group compared to 6.80% in their controls. The mean reduction in bone height between both groups was statistically significant (p=0.01).

Bone width in both groups represented in (Table 1). In the study group, the mean bone width in the socket was 6.34 mm ±1.82 immediately post-operative. Six months later, the mean bone width increased significantly to 7.16±1.52 mm. (p=0.02). On contrary, in the control group, the mean bone width was 5.66±0.77 mm immediately

post-operative and decreased significantly after six months till 4.51 mm ±0.69. (p=0.005). Mean difference of bone width differed significantly with higher bone width loss among controls after 6 months (figure 2). (p<0.0001)Bone width was increased in the study group with mean percent of 15.73±16.70 percent. However, a bone width reduction of 20.27±5.83 percent in their controls was observed. The differences in mean percent change of bone width was statistically significant between both groups. (p<0.0001)

**TABLE (1):** Comparison between the two groups according to Bone Height in mm, and Bone width in mm.

	Study (n=10)	Control (n=10)	P value
<b>Bone Height in mm</b>			
Immediately PO	13.48±1.52	12.61±1.98	0.28 <sup>a</sup>
After 6 months	13.09±1.22	11.79±2.05	0.10 <sup>a</sup>
P value	0.04*	<0.0001*	
Mean difference	-0.39±0.54	-0.83±0.31	0.04* <sup>a</sup>
% Reduction	2.64±4.35	6.80±2.88	0.01* <sup>b</sup>
<b>Bone width in mm</b>			
Immediately PO	6.34±1.82	5.66±0.77	0.45 <sup>a</sup>
After 6 months	7.16±1.52	4.51±0.69	<0.001* <sup>a</sup>
P value	0.02*	0.005*	
Mean difference	0.83±0.96	-1.15±0.36	<0.001* <sup>a</sup>
% Change	15.73±16.70	-20.27±5.83	<0.0001* <sup>b</sup>

a. Student's t test

b. Mann Whitney U test

\*Statistically significant at p value ≤0.05

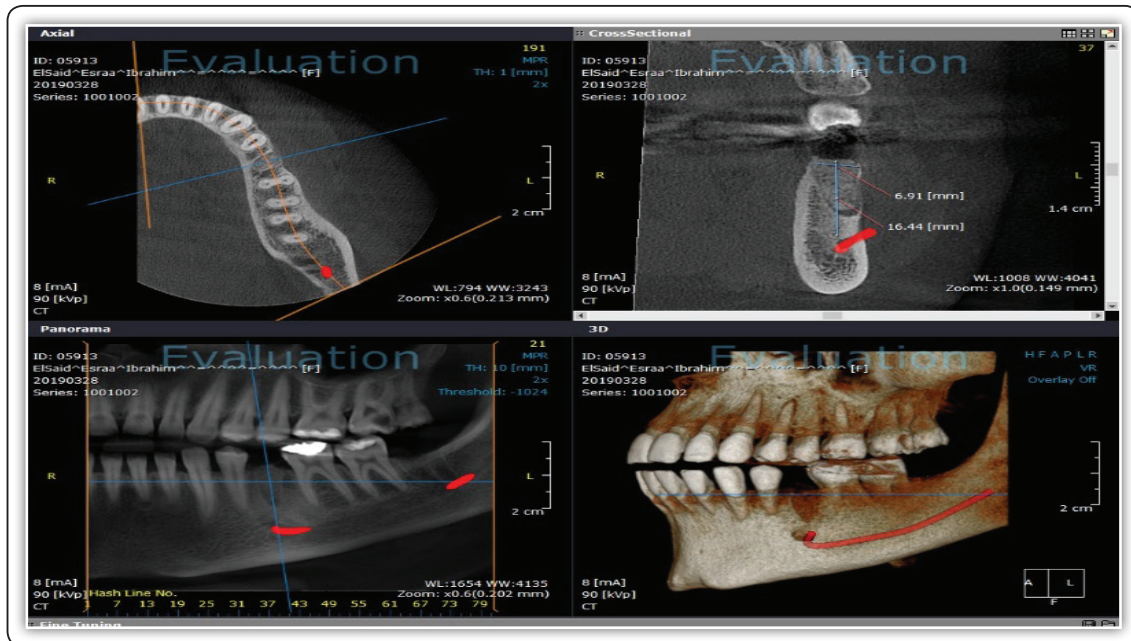


FIG (2) CBCT after 6 months.

## DISCUSSION

The objective of this study was to evaluate the ridge preservation using Bio-oss bone graft covered with a PRF membrane. Following extraction of one or more teeth, a significant reduction in vertical height and buccolingual width of the alveolar ridge takes place. The amount of the morphological changes is dependent on several patient related factors and a great variation among individuals is seen.

From the results of the present study, it has been found that the reduction of bone height in the control group was about 6.80 % compared to 2.64 % in the test group and there is no significant difference in bone height between the two groups. Whereas bone width is preserved when Bio-oss is used for grafting the socket after extraction. There is a significant difference between the test and control group regarding the bone width.

In agreement with a study conducted by Schropp et al<sup>(6)</sup> including 46 molar or premolar extraction sites, it was demonstrated that minor vertical changes occurred following single-tooth extraction while the buccolingual width of the ridge was reduced by

approximately 50% during an observation period of 1 year. The finding that approximately two thirds of this reduction occurred within the first 3 months after tooth extraction also corresponds to earlier findings.<sup>(99, 100)</sup> When analyzing the extraction sites separately according to region and jaw, there was no major diversity between the sites.

This disagrees with other studies<sup>(8, 9)</sup> which, although demonstrating a greater width than height reduction of the alveolar process, reported a height reduction of 2.0 to 4.5 mm. This disagreement may be explained by the fact that those studies involved multiple extractions. Furthermore, the few patients (n = 3) examined in one study<sup>(9)</sup> received an immediate removable partial denture after extraction of the teeth. Unlike Schropp et al study, 44 of 46 patients wore no prosthesis in the healing period like in the present study where all twenty patients wore no prosthesis during the 6-month healing period.

Bio-Oss is a deproteinized bovine bone mineral, has been used to graft bone defects and extraction sockets in the mandibles of dogs and stated that the



bio-material acted as a scaffold for new bone formation<sup>(10)</sup>. Artzi et al<sup>(11)</sup> placed Bio-Oss in fresh extraction sockets in 15 patients and performed a histological examination of the grafted sites 9 months later. After 9 months of healing, biopsies of the grafted sites were retrieved and examined. It was observed that the tissue was comprised on average of 23% connective tissue, 30% graft particles and 64% bone tissue. They concluded that Bio-Oss particles are an appropriate biocompatible bone derivative in fresh extraction sockets for ridge preservation.

In contrast, Becker et al<sup>(12)</sup> reported that Bio-Oss particles placed in extraction sockets were, 3–7 months later, mainly surrounded by connective tissue. In a study conducted by Carmagnola et al<sup>(13)</sup> There were three treatment groups. In group A, the extraction sockets were covered with a Bio-Gide membrane (Geistlich Pharma AG) and in group B the extraction sockets were filled with BioOss. The extraction sockets in group C were left to heal spontaneously. Clinically, the quantity and quality of the grafted tissue in group B allowed for implant placement at all sites. Nevertheless, the histological examination revealed that the central portion of the augmented bone was mainly occupied by connective tissue and Bio-Oss particles. These findings are in agreement with results from other studies. Skoglund et al<sup>(14)</sup> used Bio-Oss mixed with a fibrin sealant to augment the edentulous maxilla in humans 6-44months prior to implant installation. The histological examination of biopsies collected at the time of implant installation revealed that Bio-Oss particles were surrounded by newly formed bone tissue or a ‘cellular rich, loose connective tissue.

In the present study, the bone graft is covered with PRF membrane. Simonpieri et al<sup>(15)</sup> found that PRF membranes can be cut into small pieces and added to graft material, functioning as a “biological matrix” which may promote the migration of osteoprogenitor cells to the center of the graft and induce neoangiogenesis. The study concluded that the L-PRF block consists of deproteinized bovine

bone mineral particles surrounded by platelets and leukocytes, embedded in a fibrin network that releases growth factors up to 14 days.

## ACKNOWLEDGEMENTS

The authors thank Dr. Khalid Mohammed Ali for his assistance. This study was partially supported by the Faculty of dentistry, Al-Azhar University, Egypt. The authors report no conflicts of interest related to this study.

## REFERENCES

1. Trombelli L, Farina R, Marzola A, Bozzi L, Liljenberg B, Lindhe J. Modeling and remodeling of human extraction sockets. *J Clin Periodontol* 2008;35:630-9.
2. Nahles S, Nack C, Gratecap K, Lage H, Nelson JJ, Nelson K. Bone physiology in human grafted and non-grafted extraction sockets--an immunohistochemical study. *Clin Oral Implants Res* 2013;24:812-9.
3. Laney WR, Broggini N, Cirelli JA. *Glossary of Oral and Maxillofacial Implants*. Chicago: Quintessence; 2007.
4. Darby I. Periodontal materials. *Aust Dent J* 2011;56 Suppl 1:107-18.
5. Shue L, Yufeng Z, Mony U. Biomaterials for periodontal regeneration: a review of ceramics and polymers. *Biomater* 2012;2:271-7.
6. Schropp L, Wenzel A, Kostopoulos L, Karring T. Bone healing and soft tissue contour changes following single-tooth extraction: a clinical and radiographic 12-month prospective study. *International Journal of Periodontics & Restorative Dentistry* 2003;23.
7. Pietrokovski J, Massler M. Alveolar ridge resorption following tooth extraction. *Journal of Prosthetic Dentistry* 1967;17:21-7.
8. Johnson K. A study of the dimensional changes occurring in the maxilla following tooth extraction. *Australian Dental Journal* 1969;14:241-4.
9. Lam RV. Contour changes of the alveolar processes following extractions. *The Journal of prosthetic dentistry* 1960;10:25-32.
10. Araújo M, Carmagnola D, Berglundh T, Thilander B, Lindhe J. Orthodontic movement in bone defects augmented with Bio-Oss®: An experimental study in dogs. *Journal of clinical periodontology* 2001;28:73-80.

11. Artzi Z, Tal H, Dayan D. Porous bovine bone mineral in healing of human extraction sockets. Part 1: histomorphometric evaluations at 9 months. *Journal of periodontology* 2000;71:1015-23.
12. Becker W, Clokie C, Sennerby L, Urist MR, Becker BE. Histologic findings after implantation and evaluation of different grafting materials and titanium microscrews into extraction sockets. *Journal of Periodontology* 1998;69:414-21.
13. Carmagnola D, Adriaens P, Berglundh T. Healing of human extraction sockets filled with Bio-Oss®. *Clinical oral implants research* 2003;14:137-43.
14. Skoglund A, Hising P, Young C. A clinical and histologic examination in humans of the osseous response to implanted natural bone mineral. *International Journal of Oral & Maxillofacial Implants* 1997;12.
15. Simonpieri A, Del Corso M, Sammartino G, Ehrenfest DMD. The relevance of Choukroun's platelet-rich fibrin and metronidazole during complex maxillary rehabilitations using bone allograft. Part I: a new grafting protocol. *Implant dentistry* 2009;18:102-11.