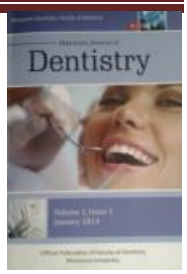

Mineralized Plasmatic Matrix With Versus Without Titanium Mesh For Ridge Augmentation Around Dental Implant In Anterior maxilla.

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Introduction

Different surgical techniques for anterior ridge augmentation (guided bone regeneration [GBR], bone splitting osteotomy, inlay and onlay grafting), different fixation devices (bone screws, pins, titanium mesh), different augmentation materials and different barrier membranes. GBR has been used successfully for regeneration of bone in conjunction with the placement of dental implants, augmentation of resorbed alveolar ridges and treatment of localized ridge deformities.[1] The introduction of protein therapy in regenerative procedure could overcome the use of barrier membranes in certain cases making grafting procedure easier. The mineralized Plasmatic Matrix (MPM) is an autologous blood product highly concentrated in platelets and fibrin in liquid state combined with a bone substitute.[2] The fibrin can become bound to bone particles. are stable and cannot move to secure the stability of the particles, the surgeon might use membranes, these membranes could be resorbable or not, reinforced with titanium or completely made of titanium such as titanium mesh.[3]

GBR has been used successfully for regeneration of bone in conjunction with the placement of dental implants, augmentation of resorbed alveolar ridges and treatment of localized ridge deformities. Recently the use of titanium micromesh has been advocated for GBR. The introduction of protein therapy in regenerative procedure could overcome the use of barrier membranes in certain cases making grafting procedure easier. The mineralized Plasmatic Matrix (MPM) is an autologous blood product highly concentrated in platelets and fibrin in liquid state combined with a bone substitute. The fibrin can become bound to bone particles. The filling material is easy to shape and a PRF- type membrane is also generated. Regarding the definition of the MPM, the use of particulate bone graft in implant dentistry has its limits. In fact, this kind of grafts is used in limited cases where the particulates are stable and cannot move to secure the stability of the particles, the surgeon might use membranes, these membranes could be resorbable or not, reinforced with titanium or completely made of titanium such as titanium mesh. Guided bone regeneration (GBR) using bone graft and barrier membrane is well-established technique for augmentation of atrophic ridges. For successful GBR, stability of bone graft, space maintenance, angiogensis and tension free, primary sutures are essential. However particulate bone graft is easily migrated when grafted on large horizontal/vertical bone defect. To reconstruct large one or two wall bony defect or for 3-dimensional ridge augmentation, bone tack on the collagen membrane or titanium mesh is required to contain bone graft during healing The MPM is a natural evolution of the platelet rich plasma. PRP is an autologous modification of fibrin glue and is used to deliver the growth factors in high concentration to the bone site. Platelet –derived growth factor(PDGF) and Transforming growth factor β (TGF- β) are the wound healing substance that have shown to play an important role in healing of bone. One of the highest concentration of PDGF and TGF-β in the body found within platelets.

MPM is prepared by a single spin using empty tubes without neither anticoagulant nor clot activator. At the end of the centrifugation the superior part of the tube will

contain the fibrinogen, platelets, and monocytes, this part stays in liquid, which permits the mixture with bone. This part of liquid will be collected and added to the bone graft or the bone substitute before its coagulate. Once this plasma is in contact with calcium of the bone graft, the activation will start and the transformation of the fibrinogen into fibrin will begin which is important because it allow us to obtain homogenous component, which contains the bone graft and fibrin, and the growth factors inside.

Patients and methods: 9 patients in whom 14 dental implants were placed who attended the outpatient's clinic of oral and maxillo-facial surgery department faculty of dentistry, Mansoura university divided into 2 groups.

Group 1: Included guided bone augmentation with MPM, this group included 5 patients receiving 7 dental implant to replace missed teeth in esthetic area.

Group 2: Included guided bone augmentation with MPM and titanium mesh, this group included 4 patients receiving 7 dental implant to replace missed teeth in esthetic area.

- Group 1:

MPM was used to augment bone defects around dental implant.

- Group 2:

MPM with titanium mesh were used to augment bone defects around dental implant.

Materials:

Dental implants:

Two pieces, tapered screw-type dental implants * were used.

Bone graft:

Xenogeneic bone graft.

Titanium Mesh:

Titanium mesh was used to stabilize sticky bone.

Instruments and equipment's:

1. Dental implant surgical kit and dental implant motor.
2. **MPM KIT:**

Centrifuge machine

A table centrifuge machine was used to separate out blood components

Evacuated Tube System

Disposable 9ml PET (polyethylene terephalate) vacutest tubes with no additives were used. These tubes have predetermined vacuum to withdraw the exact amount of blood in each tube.

Surgical protocol:

- All patients received oral hygiene instructions, periodontal full mouth scaling and root planning before starting the procedure or during the treatment period whenever needed.
- For all patients, local anesthesia was administered.
- After successful nasopalatine nerve and anterior superior nerve blocks.
- A mid-crestal incision along the edentulous area followed by two oblique incisions given mesial and distal to the adjacent teeth using no.15 blade.
- A full thickness flap reflection was performed to expose the recipient site.
- Implant sites were then prepared so that the osteotomy was kept one millimeter narrower in diameter than the implant's diameter to be inserted to ensure good primary stability. Implants were positioned one millimeter sub-crestally whenever possible. finally cover screws were attached to implants to prevent inward growth of soft tissue or bone into implant platform.
- In both groups Mineralized Plasmatic Matrix(MPM) was prepared.
- Once the implant in place the preparation of the MPM was started; two tubes of 9 ml venous blood were filled from the patient own blood and placed in centrifuge at 2500 rpm (revolution per minute) for 15minutes. At the end of centrifugation, the blood in the tube will separated into two layers; one yellow and one red. The yellow part was withdrawn with a syringe to be mixed with xenogeneic bone graft, until the formation of a single homogenous mixture of fibrin network with integrated bone graft particles inside, which is rich in platelets, leukocytes, and mesenchymal cells.

All patients were assessed clinically and radiographically pre-operatively immediately, six month and one year post operatively to assess gained bone volume in both groups.

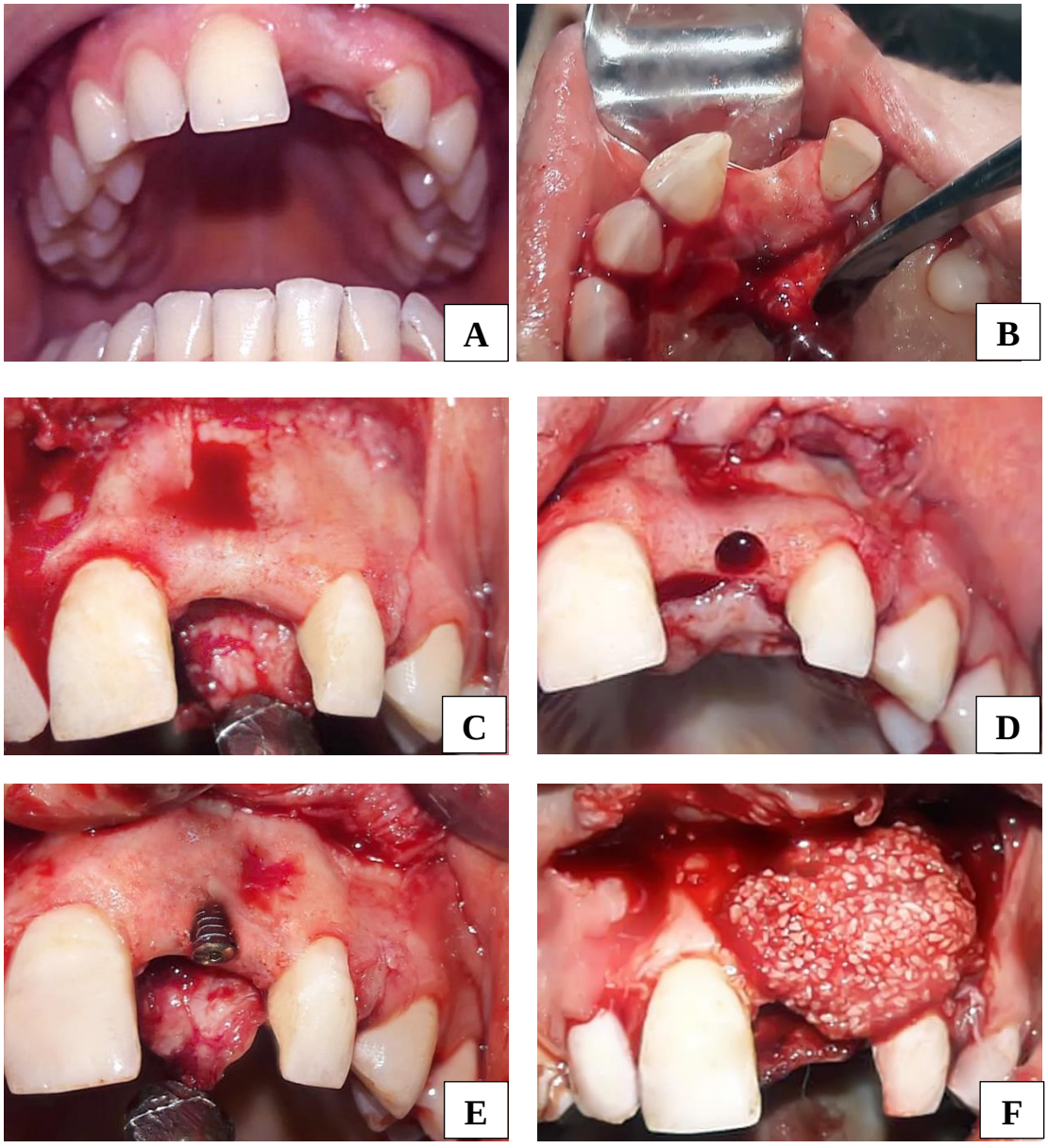

Figure (1):

(A) A preoperative intra oral clinical photograph showing missed left central incisor.
(B) Elevation of a full thickness mucoperiosteal triangular flap to expose the buccal aspect of anterior maxillary ridge.
(C) Elevation of a full thickness mucoperiosteal flap of palatal aspect of anterior maxillary ridge.
(D) The prepared implant osteotomy.
(E) Placement of the implants in the osteotomy sites in anterior maxillary

ridge.
(F) Mineralized plasmatic matrix with xenogeneic bone graft.
(G) Tension free flap closure.

Figure (2): A clinical photograph showing the final restoration.

Methods:

Pre-operative evaluation:

A. **Preoperative examination** included chief complaint, medical and dental histories.
B. **Study casts** were constructed as a pre-treatment record for all treated patients.
C. **Clinical examination:**
   i. A comprehensive intraoral examination was carried out.
   ii. Adequate oral hygiene was considered necessary for patient's selection also periodontal treatment was carried out whenever needed.
   iii. Extra oral examination was performed to detect the presence of any problems such as swelling and lymph node enlargement.
   iv. Horizontal and vertical jaw relations were accurately evaluated to estimate the occlusion and alignment of teeth.

D. photographic Records: Intraoral photographic records were taken for each patient.

E. Radiographic examination: CBCT images were taken to assess the bone volume pre-operatively, immediate post operatively, six month and one year post operatively.

Results: This study was conducted on nine patients, (six females and three males) in whom total number of 14 dental implants were placed.

The dental implants were divided randomly and equally into two groups of 7 implants each.

Group 1: included guided bone augmentation procedure with Mineralized Plasmatic Matrix (MPM), this group included 5 patients receiving 7 dental implant to replace missed teeth in esthetic area.

Group 2: included guided bone augmentation with titanium mesh and Mineralized Plasmatic Matrix (MPM), This group included 4 patients receiving 7 implants to replace missed teeth in esthetic area.

The implant diameter in all cases were 3.5 mm, while the lengths were 13mm (5 implants) ,11.5mm (8 implants) and10mm (1 implant).

Table (1): Showing implant dimensions:

implant	length	Diameter
5	13mm	All of them with the same diameter 3.5
8	11.5mm	
1	10mm	

Table (2): Showing edentulous areas to be resorted:

Teeth	no
Central incisor	9
Lateral incisor	4
Canine	1
Total	14

Clinical evaluation:

Post*-operative *healing:

The post-operative healing was accepted nearly in all cases uneventful in all patients.

The titanium meshes appeared to adhere tightly to underlying regenerated tissues, and after their removal it was possible to observe that the space under them was filled by bone, only two cases showed soft tissue dehiscence of the covering mucosa.

Clinically, a significant increase in the width of the alveolar ridge in buccal direction was found.

Using Landry healing index, the gingiva healing was scored by, we modify Landry index by adding score 1 to titanium mesh dehiscence.

Radiographic evaluation:

Cone Beam CT was done pre-operative, immediate and one year post operatively to assess gained bone volume in both groups.

Average bone volume at baseline (immediately post-operative):

Relative bone volume was measured immediately post-operative at mesial, distal and middle of each dental implant, the mean value at baseline was 12.3mm^2 in group 1 and was 6.2mm^2 in group 2.

A significant difference was observed between the two groups (P=0.003mm^2) Table (2).

Average bone volume at one year:

Relative bone volume was measured one year post-operative at mesial, distal and middle of each dental implant, the mean value of bone volume for each group at one year was 23.8mm^2 in group 1 and 25.2mm^2 in group 2.

Gained bone volume after one year:

Bone gain was measured by subtract the average bone volume after one year and that at baseline which was 11.45mm^2 in group 1 while was18.97 mm^2 in group 2 with P value =0.049 mm^2 was just statistically significantly higher in group 2 vs group 1.

Table (2) showing Relative bone volume at baseline:

Statistic	Group 1	Group 2	t value	P value
Mean	12.3	6.2	3.742	**0.003**
95% CI	8.77 – 15.87	4.36 – 8.05		
SD	3.8	1.99		
SEM	1.45	0.75		

SD= Standard deviation. SEM= Standard error of the mean. CI=Confidence interval. P value: By Independent-Samples t-test.

This table shows that average bone volume at baseline was statistically significantly higher in group 1 vs group 2.

Figure (1) :showing relative bone volume at baseline.

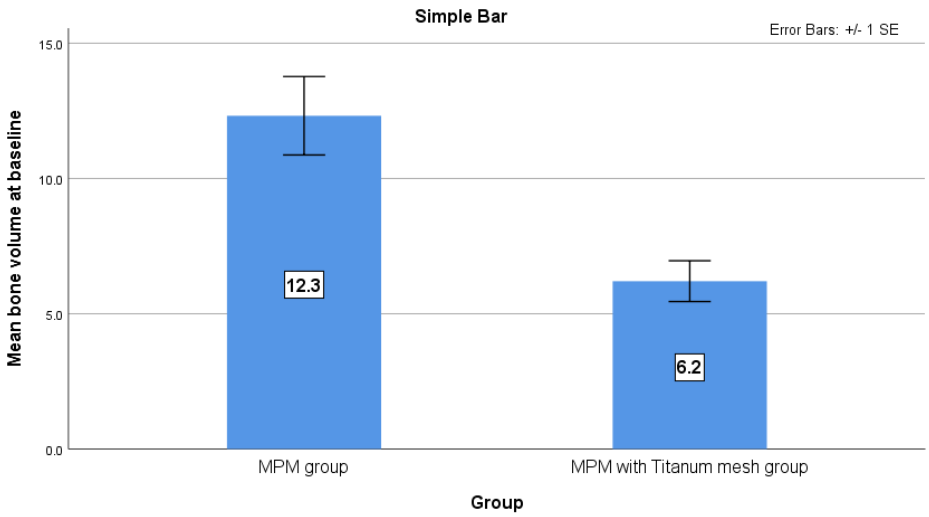

Table (3) showing Relative bone volume at one-year:

Statistic	Group 1	Group 2	t value	P value
Mean	23.77	25.17	-0.452	0.659
95% CI	18.4 – 29.1	19.8 – 30.6		
SD	5.77	5.86		
SEM	2.18	2.21		

SD= Standard deviation. SEM= Standard error of the mean. CI=Confidence interval. P value: By Independent-Samples t-test.

This table shows that average bone volume at one-year was NOT statistically significantly different between the two groups.

Figure (3): showing relative bone volume at one year.

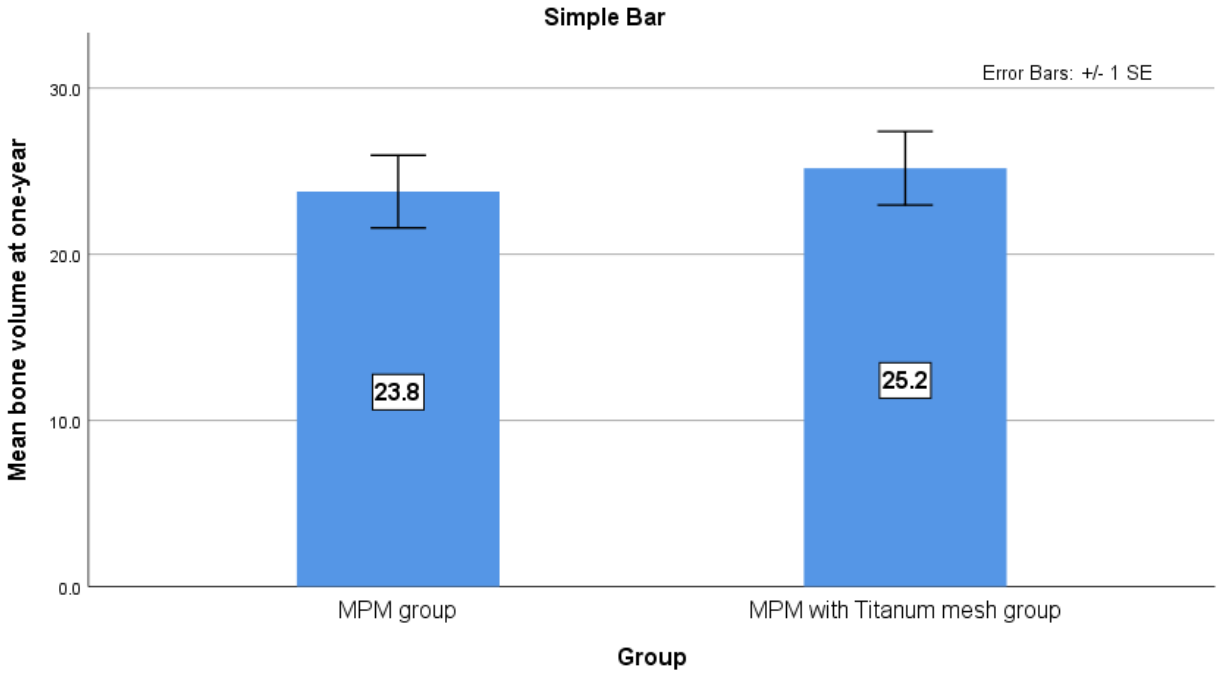

Table (4): Relative gained bone after one-year.

Statistic	Group 1	Group 2	t value	P value
N	7	7		
Mean	11.45	18.97	-2.195	0.049
Mean difference	-7.52			
SD	6.08	6.72		
SEM	2.3	2.5		

SD= Standard deviation. SEM= Standard error of the mean. CI=Confidence interval. P value: By Independent-Samples t-test.

This table shows that bone gain after one-year was just statistically significantly higher in group 2 vs. group 1.

Figure (4): showing relative gained at one year.

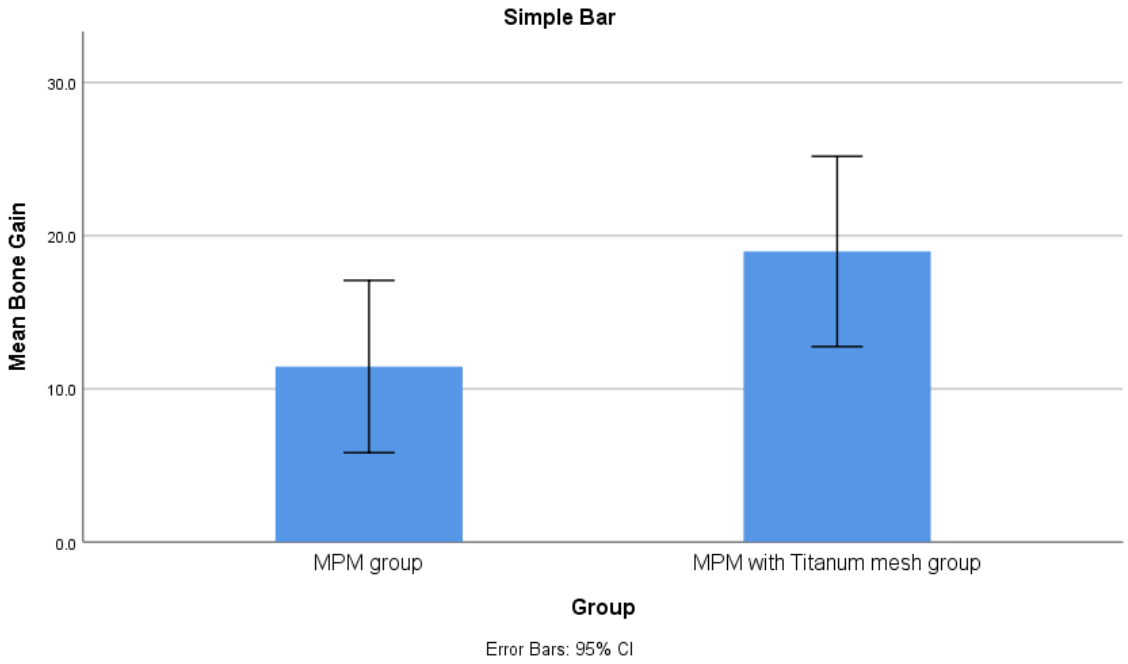

Table (4): showing intragroup comparisons before and after bone formation

Group	Before	After	t value	P value
MPM	12.3 ± 3.8	23.8 ± 5.8	-4.982	0.002
MPM with Titanum mesh	6.2 ± 2	25.2 ± 5.9	-7.471	<0.001

Data expression (Test of Significance): Mean ± SD (Paired-Samples t-test).

This table showed a statistically significant increase in average bone volume after bone formation which was more in group with Titanium mesh.

Figure (5) :showing before and after bone formation in MPM group.

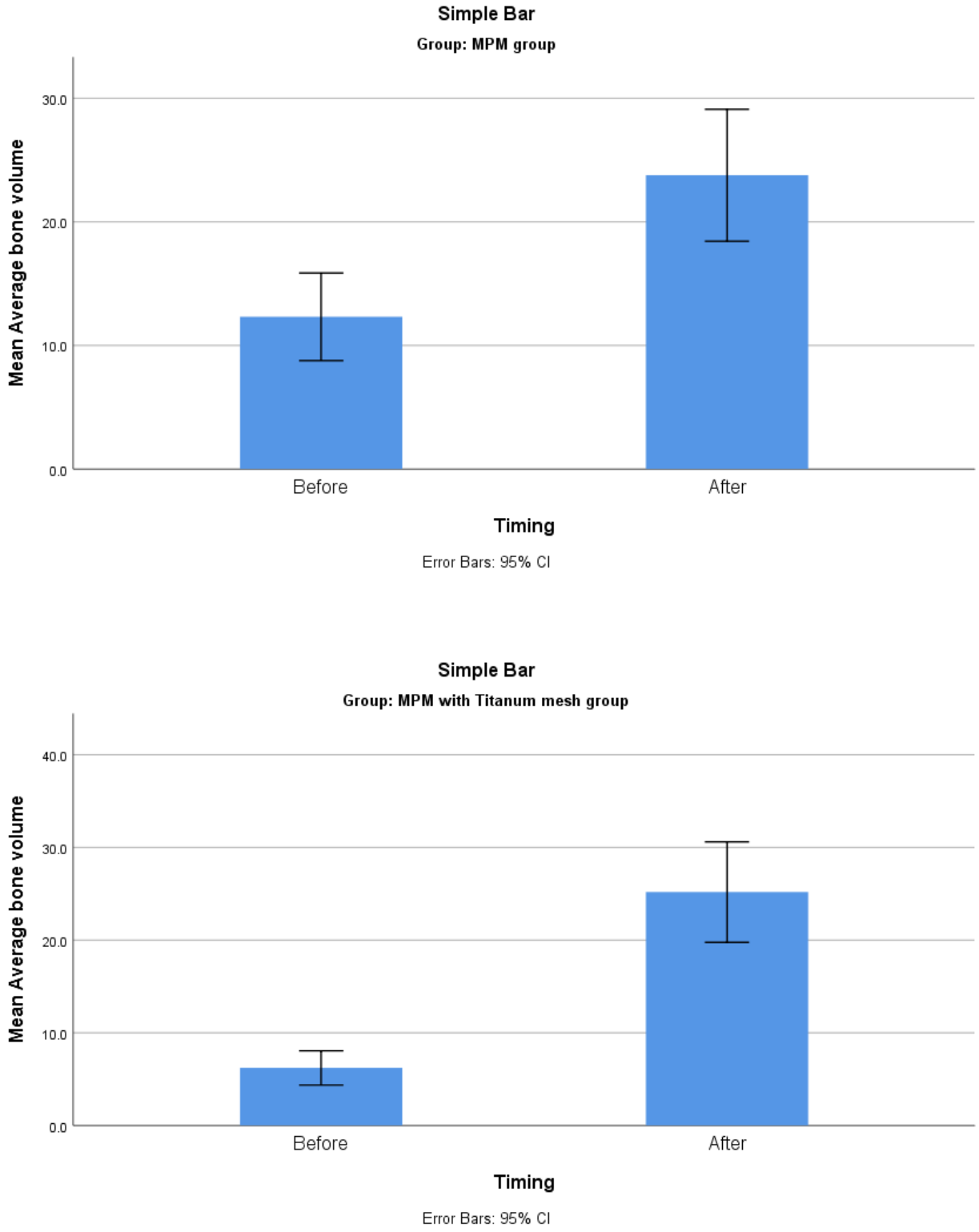

Figure (6): showing before and after bone formation in MPM and Titanium mesh group

Discussion: During GBR procedure, it is important to create a space that is properly isolated from the soft tissues and can be maintained for an appropriate period to ensure osteogenesis. In addition to space maintenance, the membrane plays a role in clot stabilization while simultaneously preventing migration of non -osteogenic tissues into area.

Non-resorbable membrane barriers, when exposed, result in infection that can jeopardize the results (Buser et al. 1996). On the contrary, exposure of the Ti-Mesh did not appear to

affect final outcome as the ridge was augmented to receive the implants needed in the desired position. This is in accordance with von Arx et al. (1996), Bahat & Fontanessi (2001c), Proussaefs et al. (2003), and Roccuzzo et al. (2004).

The sticky bone is a homogenous product that contains important elements for bone formation. It contains the mineral scaffold bone cells necessary for bone formation. And it also contains growth factors necessary for stimulation of differentiation or migration of cells. During manipulation, the retention in the fibrous mesh of the bone fragments or the grafting material conserves its cohesion and avoids its departure away from the recipient bed.[4]

Conclusion: the use of MPM as grafting material offer superior graft handling and stability. It also reduced the overall cost of the treatment which makes it a suitable alternative compared to conventional technique. [5]

Sticky bone is a simple procedure, a cost-effective source of growth factors and is easy to prepare. It is effective, its preparation is very simple, natural without any chemical additives. And it allows the use of all biomaterials.

MPM eliminates the need for barrier membranes when a guided bone regeneration procedure is considered.

The use of MPM reduces the cost of the guided bone regeneration procedures.

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