AJDS LAZHAR *Al-Azhar Journal of Dental Science*
Vol. 26- No. 2- 195:200- April 2023
Print ISSN 1110-6751 | online ISSN 2682 - 3314
https://ajdsm.journals.ekb.eg
Oral Biology, Medicine & Surgical Sciences Issue *(Oral Biology, Oral Pathology, Oral Periodontology, Medicine, Oral & Maxillofacial Surgery)*

EFFECT OF MINERALIZED PLASMATIC MATRIX (MPM) PLATELET CONCENTRATE VERSUS PLATELET-RICH FIBRIN FOR SOCKET PRESERVATION: COMPARATIVE STUDY

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ABSTRACT

Objective: Adequate alveolar ridge is needed for a successful implant placement to attain predictable long-term functioning and an esthetic treatment outcome. Various bone graft materials such as platelet-rich fibrin (PRF) and mineralized plasmatic matrix (MPM) are widely used in oral and maxillofacial surgery to stimulate a new bone tissue formation and accelerate healing. This study was aimed to evaluate and compare the effect of (PRF) and (MPM) grafting materials in alveolar socket after extraction using cone beam computed tomography (CBCT) imaging to evaluated bone density, bone height and bone width. **Subjects and methods:** Twenty patients with permanent tooth indicated for extraction were collected from outpatient clinic in the Faculty of Dentistry, Al-Azhar University (boys- Cairo). The patients were divided randomly into two groups: study group, where ten patients' sockets were filled with mineralized plasmatic matrix (MPM) and control group where ten patients socket filled with platelet-rich fiber (PRF). **Results:** The results showed an increase in bone density in the study group, in comparison according to height and width, both groups showed statistically significant decrease in bone height and width, but the study group show lower decrease in bone height and width than the control group. **Conclusion:** The bone graft mixed with platelet has a superior biological effect on bone regeneration. Using MPM in socket preservation has a better radiological evidence to bone formation than PRF alone.

KEYWORDS: Platelet-rich fibrin, Mineralized plasmatic matrix, Bone graft, Bone loss.

INTRODUCTION

Bone loss due to periodontitis or trauma causes resorption of the edentulous or partially edentulous alveolar ridge. So, adequate alveolar ridge is needed for a successful implant placement to attain predictable long-term functioning and an esthetic treatment outcome [1].

Tooth extraction whether due to caries, trauma or advanced periodontal disease or serious of pathologic condition is a traumatic procedure often resulting in immediate destruction and loss of alveolar bone and surrounding soft tissues and affect healing pattern of extraction socket[2].

It is a mandatory to preserve the dimensions of the tooth socket after extraction, especially if an osseointegrated implant is planned. There are many studies that showed beneficial effects of using different grafts, membrane, and various growth

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DOI: *10.21608/ajdsm.2021.64620.1176*

factors to preserve the sockets compared to sockets which are left untreated[3].

It has been found that the use of platelet concentrate in combination with graft materials is increasingly recommended. Platelets are known to contain high quantities of growth factors, which stimulate cell proliferation and up regulate angiogenesis[4,5].

Marx et al[5,6], first introduced the technique of autologous platelet concentration in 1998 to create the first platelet-rich plasma (PRP) for application in dental surgery[5,7].

The second generation of platelet aggregation, platelet rich fibrin (PRF), was first introduced by Choukroun et al[8]. It is a strictly autologous fibrin-rich gel produced with fresh venous blood taken from a patient's vein. The (PRF) protocol is simple, predictable and does not need biochemical additives. So, (PRF) is free from the concern of cross-contamination[9].

The mineralized plasmatic matrix (MPM) is a modification of the (PRP) and the (PRF) presented by Perisse and Due[9](MPM) may serve as a third-generation platelet concentrate with potential applications in various fields. The advantage of the (MPM) is the integration of bone grafts particles inside the fibrin network that is not present in old autologous growth factors membranes[10].

Therefore, the aim of this study is to investigate and compare clinically and radiographically the ridge preservation in the extraction socket using (PRF) alone and mineralized plasmatic matrix (MPM).

SUBJECTS AND METHODS

In this study, 20 patients were collected from outpatient clinic in the Faculty of Dentistry, Al-Azhar University (boys- Cairo).

The patients were divided randomly into two groups: study group, where ten patients' sockets were filled with mineralized plasmatic matrix (MPM) and control group where ten patients socket filled with platelet-rich fiber (PRF). Ten patients ranged in age between 31.0 – 39.0 years with a mean age of 35.40 ± 3.03 years for MPM group and ten patients ranged in age between 32.0 – 39.0 years with a mean age 35.60 ± 2.55 years for PRF group.

Patient selection: selection of patients was based on specific inclusion and exclusion criteria as the follow:

- ***Inclusion criteria:*** Patients with permanent tooth indicated for extraction.
- ***Exclusion Criteria:*** Uncontrolled systemic disease which could affect the healing; local aggressive bone disease; presence of any local acute supportive infection or pathosis; patient on bisphosphonate and radiotherapy therapy; anticoagulant therapy that could impair platelet function.

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

A consent form was got for every patient after he/she has received detailed information about the study before starting 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 (CBCT) imaging was done to evaluate bone height and width and density.

Surgical procedure:

MPM preparation: is modified by Perisse[9], the two tubes were collected from the patient was immediately centrifuge in the centrifugation machine (LC-04R electric centrifuge. Wincom CO. China) at 3000 rpm for 10 minutes. Then, the 2 plain tubes showed 2 layers, the first layer is the RBC's

in the button of the tube and the upper portion an amount of clear yellowish plasma rich platelets.

Then the second layer was collected and mixed with the bone grafting material (A mix of 30% HA (Hydroxyapetite) and 70%Tri calcium phosphate small granules) and a drop of patient blood from the extraction socket was collected to provide the thrombin which will initiate the reaction of conversion of fibrinogen into fibrin and all mixed together and a drop from the Calcium gluconate (Calcionate) was added to the mix to stabilizing the fibrin and activation the reaction obtaining MPM.

PRF preparation: Choukroun et al[11], PRF protocol is a simple and free technique developed in France. After preparing the venipuncture at the area of cephalic vein at anticubital fossa and applied the tourniquet, ten millimeters of blood was collected from the patient in 2 plain tubes.

The tubes were immediately placed in the centrifuge with appropriate balance by putting the tubes opposite to each other. A centrifuge was adjusted at 3000 rpm for 10 minutes according to Choukroun et al [11].

After centrifugation three layers were formed: The first layer is RBC layer at the bottom of the tube, the second layer is a dense PRF clot forms at the intermediate layer, the third layer which liquid serum is called platelet-poor plasma (PPP) (figure1)

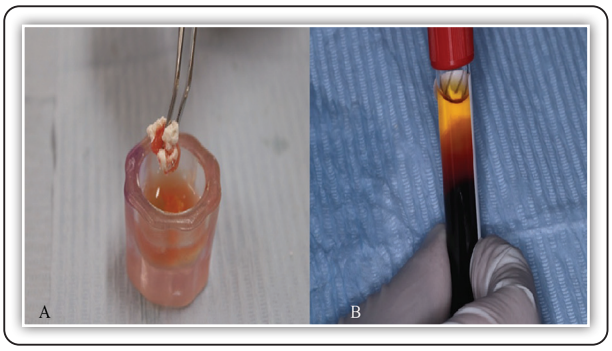

FIG (1) Clinical image of the MPM (A) and PRF (B)

Extraction procedure: extraction was carried out to the tooth (in the mandible posterior area molar tooth) using forceps without damaging the surrounding bone to preserve the socket size in all patients, socket debridement and gentle curettage was done to remove and eliminate the any periodontal ligament fibers using a sharp curette. And copious irrigation was done to the extraction socket. Then; the MPM mix and PRF which obtain was placed into the extraction socket in both groups

The socket was sutured with figure eight suture to prevent graft lost and approximate edges of extraction site using non-absorbable silk suture size 3/0.

Postoperative evaluation:

All patients of the 2 groups were evaluated at second, 5th, 7th, 10th, and 15th day's post-operative to evaluate: pain through visual analog scale (VAS), swelling through tap technique, soft tissue healing by monitoring the wound healing, infection noticed no pus discharge or swelling, and dehiscence by detected wound edges, graft lost by monitoring grafts stability and bleeding.

CBCT scanning (Planmeca Proface. Finland) was performed after four months to measure the bone density, the bone height, and bone defect width.

RESULTS

All data were collected and statistically analyzed using statistical package of social science (SPSS) software package version 20.0.

Both groups showing the same decrease in pain, the difference was a statistically non-significant, and non-significant statistically difference in facial edema. There was no post-operative infection in both groups and no dehiscence, the grafting materials was stable (no expulsion) in both groups, and a good healing rate with non-significant statistically difference in both groups, so the both groups was statistically non-significant difference clinically.

In comparison according to CBCT after four months:

Bone density: At baseline, the difference was a statistically non-significant. MPM and PRF groups showing the same bone density.

At 4 months, the difference was a statistically a significant, MPM group showing a higher bone density than PRF group (Table1).

TABLE (1) Comparison between the two studied groups according to bone density

	MPM (n = 10)	**PRF (n = 10)**	**t**	**p**
Bone density				
Baseline	646.4 ± 99.15	570.2 ± 81.72	1.875	0.077
4 months	1023.4 ± 134.5	682.9 ± 89.73	6.660*	<0.001*
% Change (4 month – Baseline)	58.95 ± 8.28	19.99 ± 5.27	12.554*	<0.001*

Bone height: At baseline, the difference was a statistically non-significant. MPM and PRF groups showing the same bone height.

At 4 months, the difference was a statistically a significant, MPM group showing a lower decrease in bone height than PRF group (Table2).

TABLE (2) Comparison between the two studied groups according to bone height

	MPM (n = 10)	**PRF (n = 10)**	**t**	**p**
Bone height				
At baseline	10.80 ± 1.47	9.54 ± 2.13	1.541	0.141
4 months	9.96 ±1.21	6.71 ± 1.58	5.165*	<0.001*
% Change (4 month – Baseline)	-7.45 ± 5.35	-29.37 ± 9.32	6.452*	<0.001*

Bone Width: At baseline and at 4 months, the difference was a statistically non-significant. MPM and PRF groups showing the same bone width.

Regarding to Change (4 month – Baseline), the difference was a statistically a significant, MPM group showing a lower decrease in bone width than PRF group (Table3).

TABLE (3) Comparison between the two studied groups according to bone width

	MPM (n = 10)	**PRF (n = 10)**	**t**	**p**
Bone width				
Baseline	9.39 ± 1.08	8.80 ± 1.88	0.862	0.400
4 months	7.22 ± 1.14	5.87 ± 2.34	1.642	0.124
% Change (4 month – Baseline)	-23.27 ± 6.97	-34.94 ± 13.19	2.473*	0.024*

DISCUSSION

Alveolar ridge preservation is a surgical procedure which retains maximum bone and soft tissue after the extraction of tooth is done. The advantage of this procedure is that it maintains the original ridge morphology. Therefore, there will be minimal need for grafting the socket allowing the final restoration to be placed in an esthetic and functional position[12].

Mineralized Plasmatic Matrix (MPM) is a homogeneous product of mixing of two phases: the plasma phase and the mineral phase of bone graft that can be autogenic, allogeneic bone, or a bone substitute.

This study aimed to evaluate the efficacy of mineralized plasmatic matrix (MPM) on extracted socket and compare its efficacy clinically and radiographically with platelet rich fiber (PRF). Twenty patients who were need extraction of lower posterior teeth were divided randomly into two groups.

The pain was evaluated through visual analog scale VAS, the patients were evaluated for 15 days after the procedure and were prescribed an analgesic, in the study group the patients experienced slight to moderate pain which is agreed with Atia et al[12]. But in comparison between two groups there was statistically non-significant difference in mean VAS in both groups.

The soft tissue healing showing no statistically difference between both groups, but show an excellence healing which is coordinating with Cinar et al[13] .

The present study showed no infection and dehiscence in both groups and no inflammation signs in the patients which is agreed with Atia et al[12].

In comparison between both studied groups radiographically, all patients were evaluated after 4 months to determine bone height, bone width and bone density.

According to width both groups showing a statistically decrease in width after 4 months, which is disagreed with Amine et al[14],which informed in the case report study the MPM allowed better correction of the horizontal vestibular defect in the esthetic zone. But the PRF group showing decrease in width more than the MPM group.

In comparison according to height, both groups show statistically significant decrease in bone height, but the MPM group show lower decrease in bone height than PRF group. This disagreed with Ayoub AH and Belal SM[15], which informed that the MPM which there placed in anterior esthetic zone showed an increase in bone height.

This study showed the platelet concentrates have no effect on bone dimension (height and width) which is agreed with Anwar et al[16], which concluded in a histological split mouth design in an experimental study the MPM and PRF showed a good quality of bone but better in MPM.

In comparison between the two groups according to density, the both groups show a statistically significant difference in mean density, but MPM group showing a higher bone density than PRF group. Which is agreed with Jean Périssé[9] in his histological study and Anwar et al[16].

CONCLUSION

Form this study's finding, platelet concentrates have a good biological effect and the bone graft mixed with platelet have a superior biological effect on bone regeneration, therefore the MPM is an excellent choice for socket preservation. Using MPM in socket preservation has a better radiological evidence to bone formation after 4 months than PRF alone.

REFERENCES

1. Buser, D., W. Martin, and U.C. Belser, Optimizing esthetics for implant restorations in the anterior maxilla: anatomic and surgical considerations. International Journal of Oral & Maxillofacial Implants, 2004. 19(7).
2. Caplanis, N., J.L. Lozada, and J.Y. Kan, Extraction defect assessment, classification, and management. Cda Journal, 2005. 33(11).
3. Chan, H.-L., et al., Alterations in bone quality after socket preservation with grafting materials: a systematic review. International Journal of Oral & Maxillofacial Implants, 2013. 28(3).
4. Rosenkranz, S. and A. Kazlauskas, Evidence for distinct signaling properties and biological responses induced by the PDGF receptor α and β subtypes. Growth Factors, 1999. 16(3): p. 201-216.
5. Birang, R., et al., Effect of plasma-rich in platelet-derived growth factors on peri-implant bone healing: An experimental study in canines. Dental Research Journal, 2012. 9(1): p. 93.
6. Marx, R.E., Platelet-rich plasma: evidence to support its use. Journal of oral and maxillofacial surgery, 2004. 62(4): p. 489-496.
7. Marx, R.E., et al., Platelet-rich plasma: growth factor enhancement for bone grafts. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology, 1998. 85(6): p. 638-646.

8. Choukroun, J., et al., Une opportunité en paro-implantologie: le PRF. Implantodontie, 2001. 42(55): p. e62.
9. Périssé, J., Du PRF vers les matrices plasmatiques minéralisées en implantologie. 59ème Congrès de la SFMB-CB, 2012: p. 02010.
10. Ayoub, A., O. Ramadan, and M. Agbor, Tissue engineering, platelets concentrates and its role in dental implant treatment. EC Dental Science, 2016. 5(1): p. 969-980.
11. Choukroun, J., et al., Platelet-rich fibrin (PRF): a second-generation platelet concentrate. Part IV: clinical effects on tissue healing. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology, 2006. 101(3): p. e56-e60.
12. Avila-Ortiz, G., et al., Effect of alveolar ridge preservation after tooth extraction: a systematic review and meta-analysis. Journal of dental research, 2014. 93(10): p. 950-958.
13. Cinar, I.C., et al., Histologic, Histomorphometric, and Clinical Analysis of the Effects of Growth Factors in a Fibrin Network Used in Maxillary Sinus Augmentation. 2020. 17(6): p. 1918.
14. Amine, K., et al., Effect of Bone Regeneration with Mineralized Plasmatic Matrix for Implant Placement in Aesthetic Zone. Case Reports in Dentistry, 2017. 2017.
15. Ayoub, A.H. and S.M. Belal, Clinical and Radiographic Evaluation of Socket Preservation Using Autolo-gous Concentrated Growth Factors Enriched Bone Graft Matrix (Sticky Bone): A Case Report. EC Dental Science, 2016. 5: p. 1128-1135.
16. Anwar, S.K., et al., Efficacy of Using Platelet Concentrates in The Management of Horizontal Ridge Defects (Experimental Study). Alexandria Dental Journal, 2018. 43(1): P. 99-104.