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Comparative Study Socket Preservation using PRF and MPM Platelets Concentrates

Abstract

The topical use of platelet concentrates is recent and its efficiency remains controversial. Several techniques for platelet concentrates are available; however, their applications have been confusing because each method leads to a different product with different biology and potential uses. Pure platelet-rich plasma PRP, Anitua's and Choukroun's PRF. Those are the common types of platelets concentrates. Latest evolution of platelets concentrates PRP and PRF is the mineralized plasmatic matrix which is prepared with different ways and has other names like sticky bone.

Key Words

Extraction; PRF; MPM; socket preservation

Dr Ahmed HalimAyoub[1], Dr Omneya R Ramadan[2]

[1]President of the Egyptian Society of Oral Implantology, President of International Group for Oral Rehabilitation, Alexandria, Egypt
[2]Lecturer, Department of Oral pathology. Faculty of Dentistry. Alexandria University, Alexandria, Egypt

INTRODUCTION

Platelet-rich fibrin (PRF) belongs to a new generation of platelet concentrates, with simplified processing and without biochemical blood handling, it is a strictly autologous fibrin matrix containing a large quantity of platelet and leukocyte cytokines.[1] The use of platelet gel to improve soft and hard tissue regeneration is a recent technique in implantology.[2] The mineralized plasmatic matrix MPM is a modification of the PRP and the PRF presented by Prof. Perisse and modified by Dr. El Moheb. 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. In fact the bone grafting materials are prepared and mixed with the autologous growth factors to produce the MPM. This offers the MPM the positional stability. This article focuses on comparing between the healing patterns of sockets after filling one of them with PRF and the other with MPM materials. Histologic evidence is reviewed to provide an in-depth understanding of the effect of 2 materials on accelerating the bone healing.

MATERIALS & METHODS

A healthy 46 years man presented with chief complain badly distracted lower right lateral incisor and canine and only remaining roots for both teeth (Fig. 1). He presented with Bad oral hygiene, history of periodontal disease, smoker and radiographic X-ray revealed vertical bone resorption. Upon clinical examination, there was good amount of buccal bone and a thin gingival biotype around the teeth. His recent dental history included placement of several implants.

Surgical Procedures

The aim of the surgery is to extract the remaining part of the teeth without damaging the surrounding bone. Extraction has been performed to those teeth using the periotome to preserve the socket size (Fig. 2). A very good socket debridement and curettage has been performed to eliminate remnants of periodontal fibers and necrotic tissues using a sharp curette. 28ml of blood has been collected from the patient without anticoagulant in 7ml tubes (4 tubes), 2 PRF tubes and 2 plain tubes. Then immediately centrifuged at 3000 rpm (approximately 400g according to Chokroun's calculations) for 10 minutes.[3]

MPM Preparation

After 10 minutes of centrifugation the 2 plain tubes present 2 layers , 1st layer is the RBC's in the button of the tube then in the upper portion an amount of clear yellow plasma rich in leukocytes , platelets, mesychimal stem cells and fibrinogen .This happens due to the difference in density between all blood components. The 2nd layer is then mixed with the bone grafting material (A mix of 30% HA and 70%

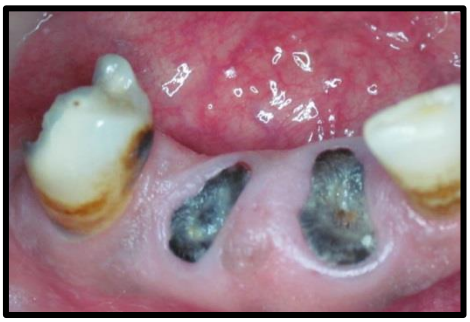
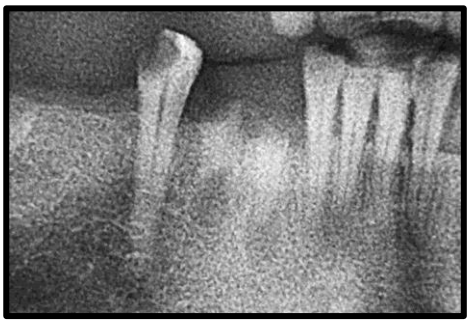


Fig. 1



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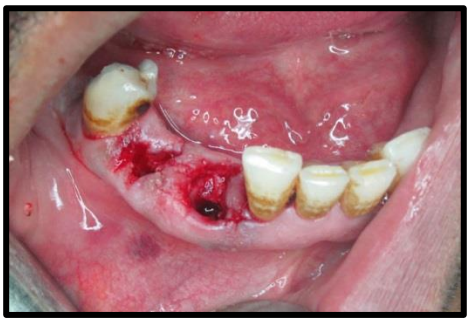

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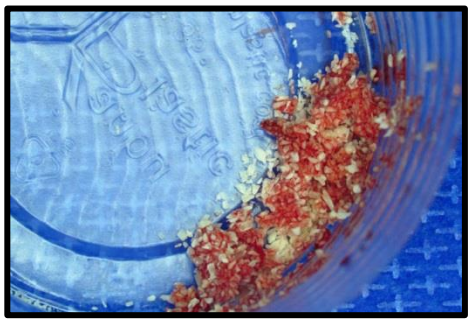

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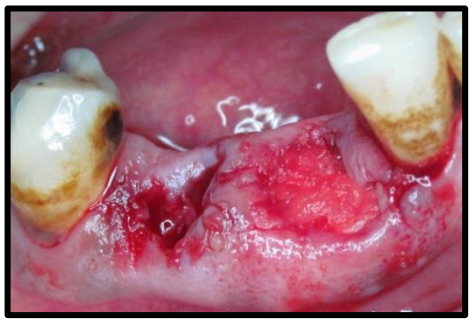

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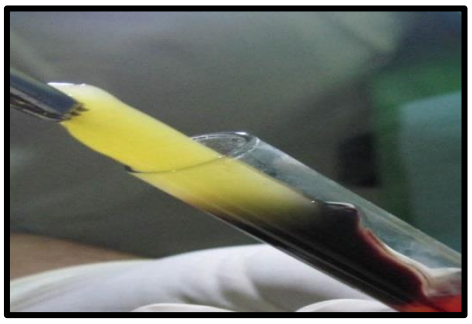
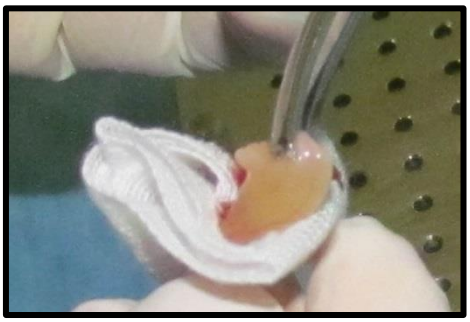


Fig. 8

Tri calcium phosphate small granules manufactured by POLYSTOM) and a drop of patient blood from the extraction socket to provide the thrombin which will initiate the conversion of insoluble fibrinogen into soluble fibrin and all mixed together in a sterile bowel. After a couple of minutes a homogenous mixture of fibrin network with integrated bone graft particles inside and the mixture is rich of platelets, leukocytes and mesynchimal cells (Fig. 3). The MPM, which has been obtained, is placed in the extraction socket of the lateral incisor.

PRF Preparation

Within a few minutes, the absence of anticoagulant allows activation of the majority of platelets contained in the sample to trigger a coagulation cascade. In the PRF tubes fibrinogen is at first concentrated in the upper part of the tube, until the effect of the circulating thrombin transforms it intoa fibrin network.[3] Fibrinogen is initially concentrated in the high part of the tube, before the circulating thrombin transforms it into fibrin. A fibrin clot is then obtained in the middle of the tube, just between the red corpuscles at the bottom and acellular



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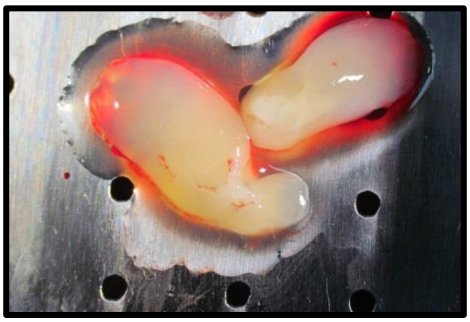

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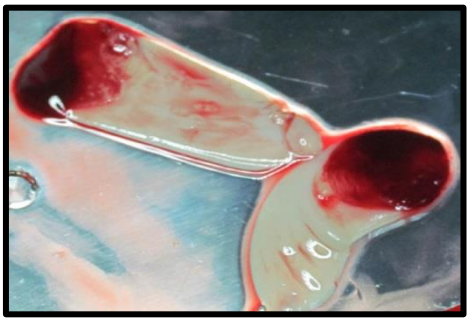

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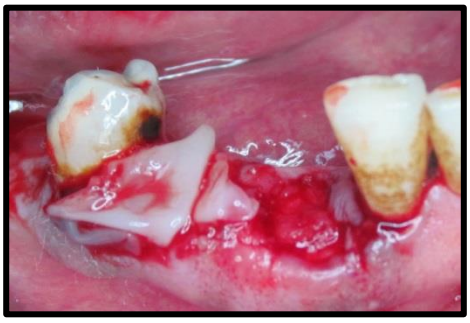

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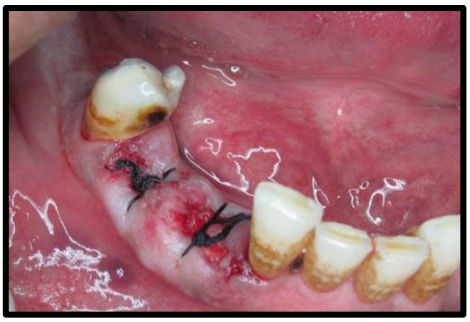

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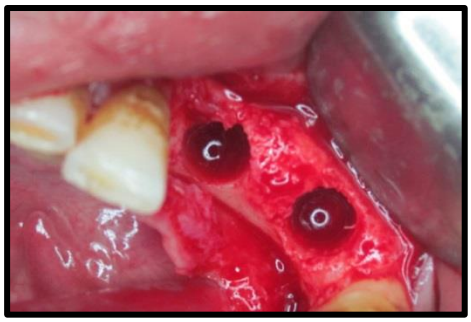

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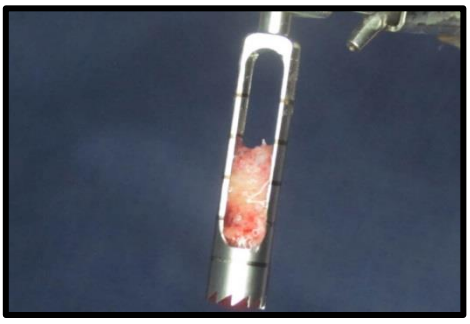
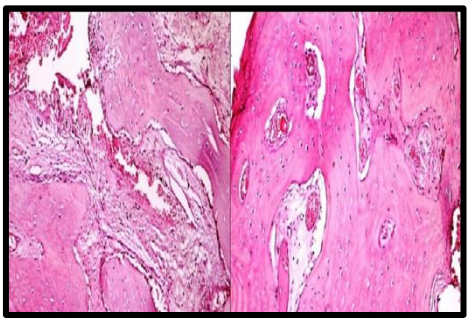


Fig. 15

plasma at the top (Fig. 8). Platelets are theoretically trapped massively in the fibrin meshes. The clot is removed from the tube and the attached red blood cells scraped off and discarded. The PRF clot is then placed on the grid in the PRF Box and covered with the compressor and lid. This produces an inexpensive autologous fibrin membrane in approximately one minute. The PRF Box was devised to produce membranes of constant thickness that remain Hydrated for several hours and to recover the serum exudate expressed from the fibrin clots which is rich in the proteins vitronectin and fibronectin. The exudate collected at the bottom of the box may be used to store autologous grafts.[2] After removing the cover of PRF box 2 membranes obtained from 2 PRF clots (Fig. 4). With a specific tweezers the PRF was inserted in the canine socket. Edges of the mucosa were approximated to each other and sutured using 3-0 Monocrylsutures. Healing was uneventful, and the patient was followed up for 4 months postoperatively, making sure to enforce oral hygiene and rinsing with chlorhexidine 0.12%. 4 months later bone was harvested from the 2 sockets using a 3.2mm trephine drill and 2 implants microdent GN3512 was inserted. The specimen was sent to histological evaluation.

RESULTS

1st socket MPM histological study showed decalcified section shows a mass of cancellous bone with areas of diverse degrees of maturation. Numerous large lacunae containing osteocytes are a prominent feature. The bony trabeculae are lined by numerous osteoblasts with the bony interface



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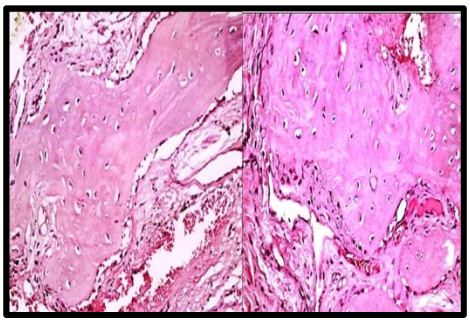

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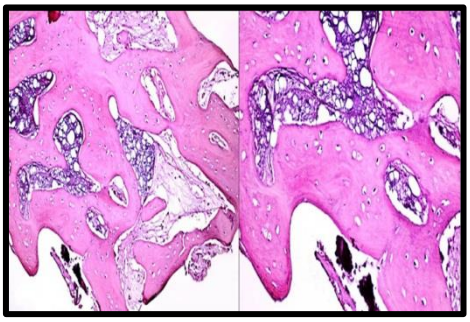

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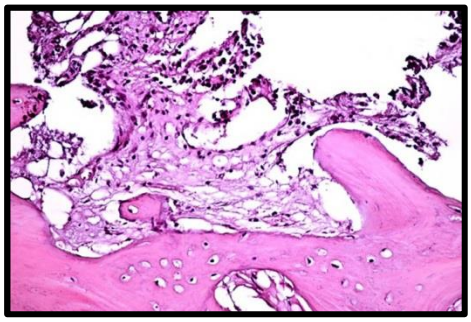

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showing areas of active deposition of woven bone. Resting lines are seen in some areas. The bone marrow contains multiple capillaries and lymphatic vessels with mild inflammatory infiltrate (Fig. 5).

2nd socket PRF histological study showed PRF:

Decalcified section shows a mass of mature cancellous bone with prominent resting lines. The bony trabeculae demonstrate multiple osteocytes in large lacunae. Few viable osteoblasts are seen lining the bony trabeculae. The bone marrow is clearly fibrotic with little vascularity and almost no chronic inflammatory cells infiltrating (Fig. 6).

DISCUSSION

In MPM specimen the ostoeblastic activity is more prominent and active deposition of woven bone while in PRF less osteoblastic activity and the bone marrow is fibrotic with little vascularity. The plasma obtained after a single spin, is rich in platelets, fibrinogen and monocytes. The fibrinogen is necessary for the formation of the MPM. The Fibrinogen will be transformed into fibrin network under than action thrombin coming from patient's wound,[4] the platelets that will offer the growth factors and the monocytes once activated by the interleukine can enhance the production of BMP-2.

The BMP-2 is a bone morphogentique protein that induces the bone formation. It is a high inductive protein.[5] The fibrin network that is produced in the MPM, will link all bone particles together, and also the platelets and monocytes. This fibrin network is the scaffold needed by the bone to regenerate, and also it is the pathway need by the cells to migrate to heal or to repair the wound. This fibrin network or the extracellular matrix allows the elasticity of the MPM, permit the shaping and the remodeling of the MPM and facilitate the cells migrating inside the MPM between the particles.

CONCLUSION

From this study, the use of bone filler combined with fibrin, platelets and leukocytes in the form of MPM has shown a better histologic evidence of bone formation after 4 months than the use of PRF as sole filling material for the extraction socket.

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