The Use of Growth Factors Fibrin Network to Enhance Architecture, Mechanical and Biological Aspect of the Graft Particles

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Abstract

Dental implants are the best choice to replace a missing tooth. But to Dr EL Moheb Mohamad 1 place the implant, a certain quantity of bone surrounding the implant is needed. Sometime the height or the thickness of the natural bone where an implant should be placed is not sufficient. So in these cases bone France grafting is recommended. In order to succeed the bone grafting, it is necessary to achieve a good stability of the graft, a good vascularisation and a good tension free closure of the flap. The use of screwed bone block may solve the stability problem. But it is hard to shape it, time consuming and it oblige the surgeon to open a second site to harvest the bone. Till today, the used of particles for the bone grafting is recommended for minor defects, because the particles are not stable and it is hard to keep it in place under the chewing forces and movements. The Mineralized Plasmatic Matrix solve this problem, and open a new age for the use of particles grafting, because by using the fibrin network, it link all the particles together and offers a very good stability for the graft.

Key Words

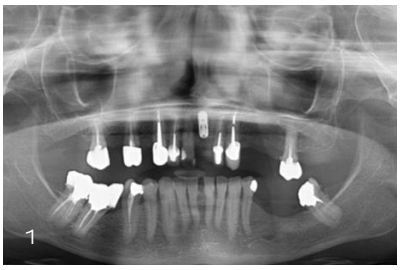
BPM; platelets; growth factors; fibrin; monocytes

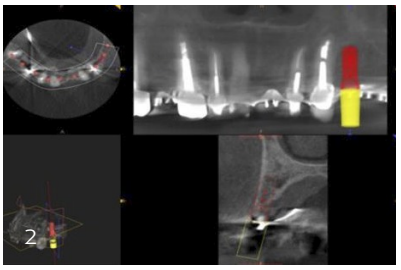
Introduction

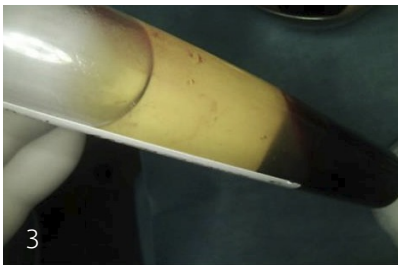
Based on Tayaponsak protocol, Platelet Rich Plasma (PRP) and Platelet Rich Fibrin (PRF) has been developed.[1] These techniques are based on the idea of concentration of platelets for reuse as a drug in some serious diseases.[2] This is why it is called platelets concentration. The platelet concentration is obtained by centrifuging the blood. The centrifuge is a device that allows you to settle various suspended particles in a liquid solution. These particles, due to their difference in size and in mass are deposited at different distances to the bottom of the tube and will therefore be separated at the end of the operation function to their differences. [2] Since platelets are enucleate and the smaller blood elements,[3] they will therefore be in the intermediate portion (between the physiological saline and red blood cells) of the tube, and the red blood cells and will precipitate in the bottom of the tube. In fact at the end of the centrifugation, the content of the tube can be divided into three parts:

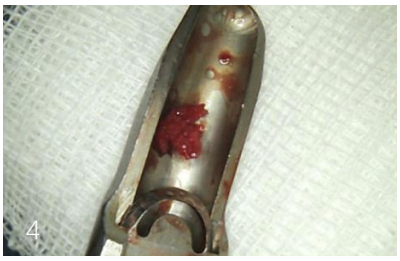
- The upper part which is poor in cells and element
- The middle part will be platelet-rich
- And the lower part which is rich in red blood cells.

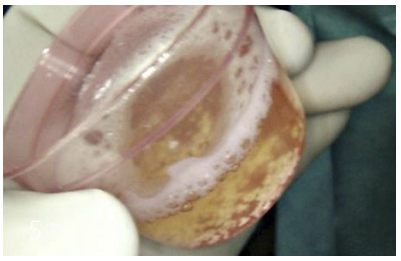
We seek to isolate platelets or to concentrate the platelets of the patient because platelets are a natural source of growth factors.[4] These growth factors can be very interesting for use in accelerating post-surgical healing. Plasma Mineralized Matrix (MPM) is a product of mixing of two phases: the mineral phase and the plasma phase. After centrifugation, the white blood cells are recovered and mixed with the mineral phase of bone graft that can be autogenic, allogeneic bone, or a bone substitute like Xenogeneic Bone Synthetic. The result of this mixture is a homogeneous singlcomponent, compact and stable, containing the graft, a dense fibrin network, and promoting healing.[5]

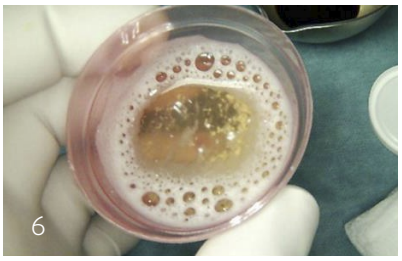


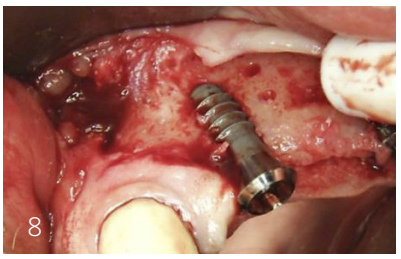


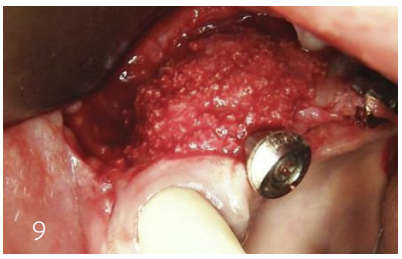


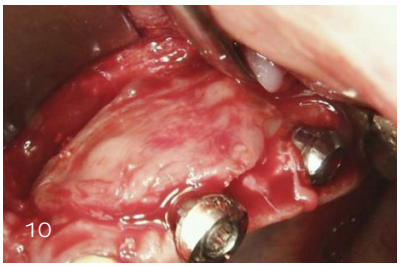


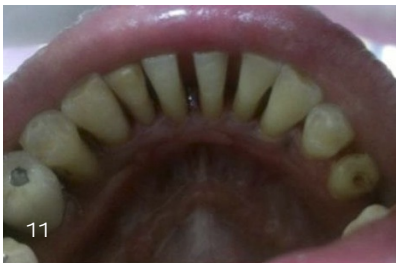


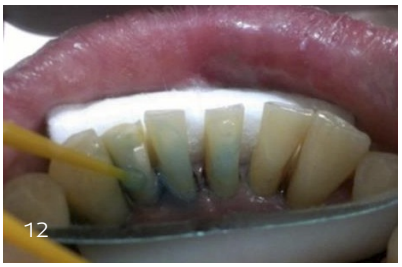


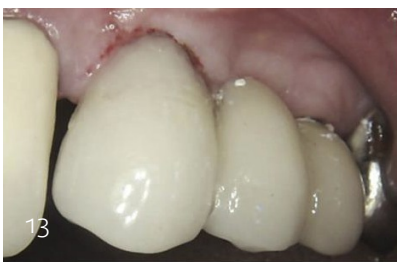


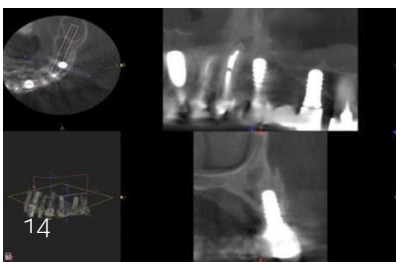












Case report

Ms. "G" was referred to our clinic to replace the removable partial denture by fixed prosthesis. After a medical examination, exo, endo-oral and radiographic (Panoramic and Cone beam), an implant treatment plan was proposed to the patient (Fig. 1). (Fig. 2). The residual bone thickness was not sufficient; a graft with MPM was decided. Based on Dr. Davarpanah, implants must be surrounded by at least 1mm bone around..[6] A less thickness of 1 mm on the day of implant placement may lead to a higher bone resorption. The MPM was chosen for its facility of use and the ability to place the implant and graft in the same session. The preparation of the MPM started before surgery, 4 tubes of 9 ml of venous blood were taken from the patient and placed in a centrifuge at 2500 rpm / min for 15 min. At the end of the centrifugation, the blood in the tube was separated into two compartments; one yellow and one red (Fig. 3). The yellow part was withdrawn with a syringe to be mixed with alloplastic bone substitute; (TCP and Beta Hydroxy apatite : Bone Ceramic from straumann). During surgery using a "scraper" a small amount of autogenous bone was removed from the patient (Fig. 4). This autogenous bone was added to the mixture plasma Bone Ceramic (Fig. 5). The whole was mixed using a probe, until the formation of a single homogeneous component, called the MPM. The implant chosen was a Straumann Tissue level implant 4.1mm/ RN/ SP/ SLA 10 mm in length. After drilling, the implant has been placed with a buccal surface completely uncovered by bone (fenestration). The graft site receiver was prepared by perforating the lateral cortical bone to improve the vascularization and facilitate cell migration (Fig. 7). The MPM was placed to cover the labial defect of the bone (Fig. 8) and the whole was covered by MPM membrane (Fig. 9). Sutures were performed. (Fig. 10). The sutures were taken out one week later (Fig. 11). Two months later an impression was taken to achieve a transitional prosthesis that lasted a year (Fig. 12). One year later a Cone Beam exam was done to control and monitor bone level implants before moving to the final prosthesis (Fig. 13).
The Cone Beam result shows that the implant was completely covered by a large thickness having the same image as that of bone on the Cone Beam. This radiography also showed periapical reaction on the 23 and the temporary bridge was unsealed posterior. Apical resection will be attempted on the 23 and the final prosthesis will be placed.

Discussion

The "MPM" is a homogeneous product that contains important elements for bone formation. It contains the mineral phase which is the scaffold for bone cells necessary for bone formation. It also contains the fibrin network which is the extracellular matrix necessary for migration of specific cells in the tissue regeneration or repair. And it also contains growth factors necessary for the stimulation of differentiation or migration of cells. The fibrin network is obtained by the activation of fibrinogen which is a soluble dimer found in the blood. The network is a dense fibrin network that forms the extracellular matrix during the repair process. This extracellular matrix is important for cell migration.[7] It containes also Platelets are the smallest elements anucleate circulating in blood vessels. Platelets are borne in the bone marrow, by fragmentation of megakaryocytes.[8] They have a duration of life of 5 to 9 days. Conventionally, platelet activation will release granules, which represent several interests. These are the platelet factors and cytokines such as TGF, PDGFs and IGFs plays an important role in the healing process. The platelet release of cytokines can stimulate the colonization and proliferation of other cells needed for the reparation or regeneration process.[1] The "MPM" also contains a very important element for bone formation. Indeed Dr. Perissé in its histological studies revealed the presence of monocytes inside the MPM biopsies.[9] However, the monocytes are very important in bone formation as they allow a regulation of production of BMPs which are highly important proteins in the induction of bone production.[10]

Conclusion

Clinically using the "MPM" whenever a bone graft is necessary whatever the biomaterials used becomes very important, because the "MPM" facilitates the use and application of the graft, provides stability to the transplant due to its fibrin network and allows improved cell penetration into the graft. Its preparation is very simple, natural without any chemical additives. And it allows the use of all biomaterials.

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