PRF in modern dentistry: An innovative approach to oro-dental tissue regeneration

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Abstract

In this study we will follow the use of PRF membranes in modern dentistry and implantology. We will explore the role, importance and specific techniques of using PRF membranes in various implant surgery procedures. This work was based on a study of 30 patients of both sexes who underwent treatment using PRF membranes for the first time. Prior to this, patients were informed about treatment plam and intervention process. The first objective analyzed was the presence of post-operative pain. On the first day after the intervention, more then 60% of patients did not experience pain, and of those who experienced pain, 20% experienced mild pain and only 10% of patients experienced moderate pain. No patient described the pain as intense. The second day after the intervention 93% of patients had no pain at all, and 7% had mild pain. On the third day after the intervention, all patients confirmed the total absence of pain. The second objective analyzed was the presence of post-operative edema. On the first day after the intervention, 83% of patients had edema present. The second day after the intervention the number of patients with edema decreased by more than half, reaching 33%. On the third day, only 10%/ of patients still had edema. The last objective analyzed was the presence of post-operative infection, in order to prove the capacity of PRF membranes to form a protective barrier against infection. Post-operative infections were present in only 6% of the participants. The use of PRF membranes plays a crucial role in maintaining the structure of the alveolar ridge it also helps the preservation of the integrity and stability of the alveolar bone. By restoring gingival tissues, PRF membranes contribute on improving the overall oral health of the patients. The use of PRF membranes reduces the risk of peri-implantitis and peri-implant mucositis. The PRF membranes stimulate the healing process of periodontal defects, favoring the regeneration of the affected tissues. The use of PRF membranes reduces patients discomfort in the initial phase of the healing process, contributing to the absence of pain and offering a fast recovery.

Keywords: PRF, implantology, surgery, osseointegration

INTRODUCTION

The field of dentistry is in a continuous dynamic, constantly making significant progress in terms of the innovative approach to the techniques used in the regeneration of oro-dental tissues. One of these approaches that has received considerable attention is the use of platelet-rich fibrin (PRF) preparations. This study aims to explore the role of PRF membranes in the healing and tissue regeneration process, as well as their potential as an innovative approach in oral implantology. Many important medical discoveries were made by chance. A suitable example of this is osseointegration, which marked the beginning of a modern era of dental implantology. When Per-Ingvar Brånemark (1929-2014) discovered osseointegration, he was investigating something completely different: the microcirculation of blood in the bone marrow. For this study, conducted on rabbits, he developed a system consisting of a titanium cylinder with a small optical camera that, inserted into the rabbit's femur, helped him observe blood circulation in the bone. After a few months, once the study was completed, Brånemark wanted to recover the micro-camera to reuse it in another project, but when he tried to remove it, he had a surprise: he couldn't detach it because it was attached to the bone. Brånemark called this process of integration between titanium and bone "osseointegration". Similarly, platelet-rich plasma (PRP/platelet-rich fibrin - PRF) was discovered by chance by observing a more accelerated and complete healing process in patients who developed hematomas. From that simple observation in the 1980s, the key components of the blood clot responsible for advanced healing were later determined: active growth factors in platelet alpha granules, various molecules responsible for cell adhesion, and specific clot guidance signals of fibrin. [1]

Aim and objectives

In this study we will follow the use of PRF membranes in modern dentistry and implantology. we will explore the role, importance and specific techniques of using PRF membranes in various implant surgery procedures.

MATERIAL AND METHODS

This work was based on a study of 30 patients of both sexes that underwent treatment using PRF membranes for the first time. Prior to this, patients were informed about the treatment and intervention process.

Patient preparation:

Before collecting the blood for the production of PRF membranes, the patient must be properly prepared. This involves a prior medical assessment, the patient's medical history and checking for contraindications to the procedure. It is important to obtain the patient's informed consent and to consider any medications or conditions that may influence the clotting process.

Blood collection:

Blood is collected by phlebotomy at the level of the antecubital fossa of the arm. The amount of blood collected may vary depending on the specific protocol, usually 2-6 tubes, respectively 20-60 ml of blood, are collected. Depending on the type of membrane we want to produce, harvesting is done in glass tubes with a red cap, for solid PRF or in PET plastic tubes with a white or blue cap (orange for some manufacturers).

Blood centrifugation:

The collected tubes of blood are placed in a centrifuge machine and undergo a controlled centrifugation process. This process causes blood components to separate into

distinct layers based on their density. Centrifugation results in obtaining the platelet-rich fibrin (PRF) layer at the top and the red blood cell layer at the bottom of the tube, separated by the so-called buffer zone, which contains the highest concentration of platelets, leukocytes but also erythrocytes.

Separation of blood components:

After the centrifugation process, the blood components are separated. Typically, the layer of PRP is carefully collected using a pipette or similar device and transferred to a separate container. The PRP layer contains the blood platelets, growth factors and other beneficial components that will be used in the tissue regeneration process.

Formation of PRF membranes

The remaining fibrin layer in the centrifuge tube is retrieved and shaped to form the PRF membranes. This is a manual process where the fibrin layer is pushed and compressed to create a solid or semi-solid form. Sometimes, specially designed tools are used to shape the membranes according to the specific needs of the medical or dental procedure.

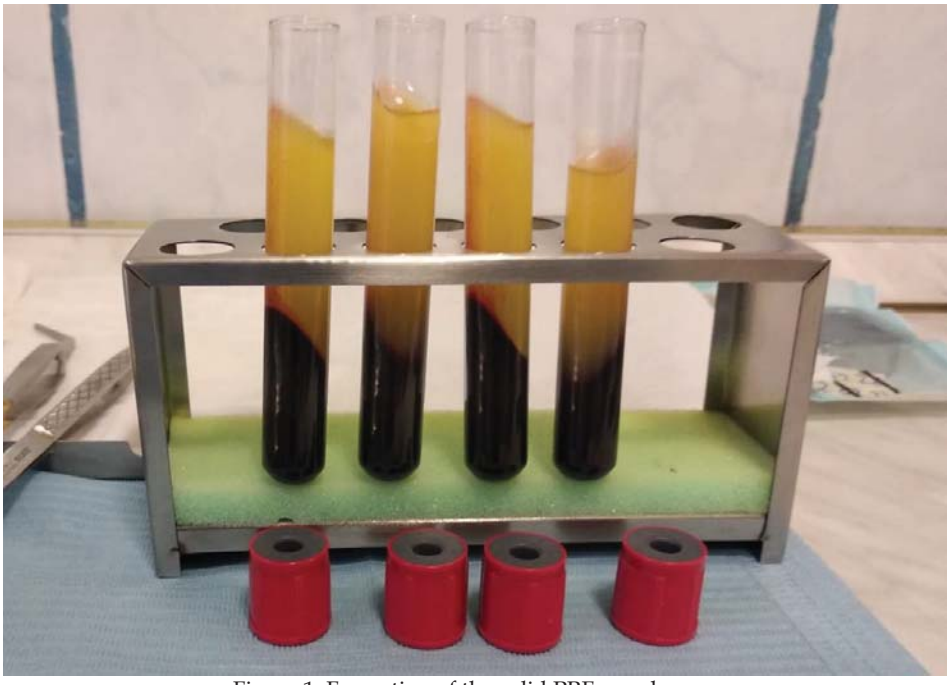

Figure 1. Formation of the solid PRF membranes

Processing and final preparation:

The PRF membranes obtained after modeling the fibrin layer are subjected to a final processing and preparation stage. This step may involve further compression of the membranes to remove excess fluid and to strengthen them. The goal is to obtain well-defined and structured PRF membranes that can be easily manipulated and applied during medical procedures.

Cutting and sizing membranes:

PRF membranes can be cut and sized according to the specific needs of the procedure. Using sterile surgical instruments, the membranes can be tailored to fit the area where they will be applied. This step allows a precise and efficient use of PRF membranes in tissue regeneration.

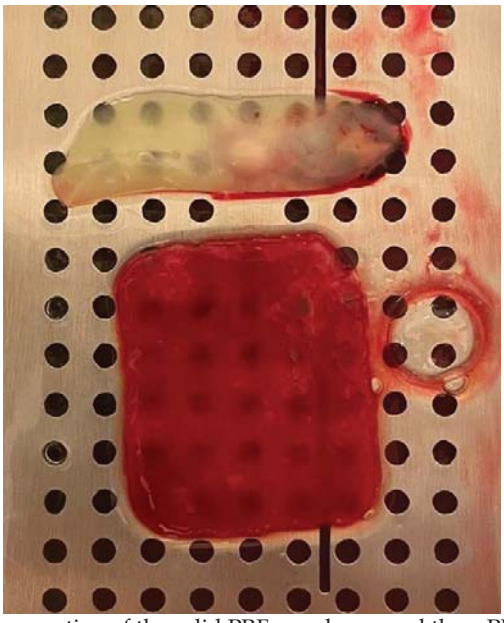

Figure 2. The separation of the solid PRF membrane and the e-PRF membrane

Storage and use:

PRF membranes are kept under appropriate storage conditions, usually in a sterile, sealed container, to maintain their integrity and biological properties. Before use, membranes can be rehydrated in specific solutions or combined with other tissue regeneration materials, depending on the needs of the medical procedure. PRF membranes are applied in areas where it is necessary to stimulate and accelerate the healing and tissue regeneration process.

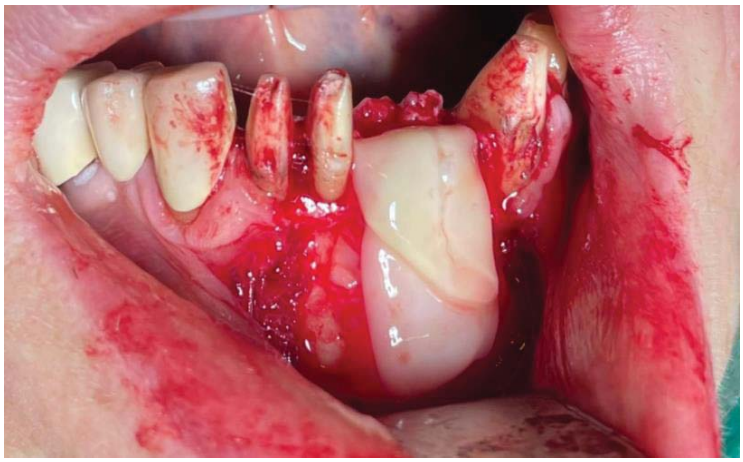

Figure 3. Covering of a post-extractional alveola with a solid PRF membrane in order to obtain a better healing and tissue regeneration

RESULTS

The statistical survey was carried out on the basis of 30 patients of both sexes, with age between 18 and 71 years. They underwent surgical interventions where tissue augmentation was performed with PRF membranes. All currently selected patients were individually and clearly informed about the possible risks and the treatment plan. The objectives pursued in this study were the presence of pain, the presence of edema and the presence of post-operative infections after the use of PRF membranes in the first 3 days after surgery.

Table 1. The gender distribution of the patients

Sex	Number of patients	Percentage
Male	12	40%
Female	18	60%

Table 2. The age distribution of the patients

Age	Number of patients	Percentage
18-25	5	16.6%
25-40	8	26.6%
40-60	7	23.4%
60+	10	33.4%

Table 3. The presence of post-operative pain in the first 3 days after surgery

The presence of pain	Day 1	Day 2	Day 3
Absent	21	28	30
Light	9	2	-
Medium	1	-	-
Intense	-	-	-

Table 4. The presence of post-operative edema in the first 3 days after surgery

The presence of edema	Day 1	Day 2	Day 3
Prezent	25	10	3
Absent	5	20	27

Table 5. Refers to the presence of post-operative infection in the first 3 days after surgery

The presence of inffection	Number of patients	Percentage
PRESENT	2	6.6%
ABSENT	28	93.4%

DISCUSSIONS

PRF membranes are as natural as the host tissue and present zero risk of infection or immunological reaction, as they are extracted from the patient's blood. At the same time, the membrane cannot be rejected by the patient's tissue. [2]

The use of PRF increases the healing rate of the grafted bone during surgical treatment.

PRF represents a much more cost-effective option compared to synthetic materials, bringing significant benefits to the economy of dental treatments.

The use of PRF membranes reduces patients discomfort in the initial phase of the healing process, contributing to the absence of pain and ensuring a fast recovery.

The PRF membranes stimulate the healing process of periodontal defects, favoring the regeneration and reparation of the affected tissues. [3]

PRF membranes play a crucial role in maintaining the structure of the alveolar ridge, helping in preserving the integrity and stability of the alveolar bone;

By restoring gingival tissues, PRF membranes contribute on improving the oral health of the patients;

The use of these membranes reduces the risk of peri-implantitis and peri-implant mucositis;

Treatment with PRF membranes is relatively simple and can be performed by most dentists;

Using horizontal centrifugation more cells and more growth factors can be obtained than using fixed angle centrifugation. [4]

It was observed that the formation of PRF depends not only on the centrifugal preparation method, but also on the composition of the cells in the patient's peripheral blood. There is a strong correlation between the patient's hematocrit levels and the sizes of the PRF membranes. Patients with lower hematocrit levels (females and elderly patients) were shown to have significantly larger membranes (30%-40%) compared to patients with higher hematocrit levels (younger males). [5]

CONCLUSIONS

The first objective analyzed was the presence of postoperative pain. On the first day after the intervention, more than 60% of patients did not experience pain, and of those who experienced pain, 20% experienced mild pain and only 10% of patients experienced moderate pain. No patient described the pain as intense. The day after the intervention, 93% of patients had no pain at all, and 7% had mild pain. On the third day after the intervention, all patients confirmed the total absence of pain. The second objective analyzed was the presence of postoperative edema. On the first day after the intervention, 83% of participants had edema present. The day after the intervention, the number of patients with edema decreased by more than half, reaching 33%. On the third day, only 10% of patients still had edema. The last objective analyzed was the presence of post-operative infection, thus proving the capacity of PRF membranes as a protective barrier against infections, which were present in only 6% of the participants.

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