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Current Perspectives on the Use of Platelet Rich Fibrin: Review

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Abstract

PRF is one of the most common and popular biocompatible materials today. Due to its ease of application and production and its cost-effectiveness, an increasing number of studies are carried out on it. PRF, which is applied in various fields in other branches of medicine, can be used in almost every field of dentistry.

Keywords: Platelet Rich Fibrin (PRF); Chemotaxis; Mitogenesis; Periodontology; Xenografts

Introduction

Tissue engineering has tried to develop new biomaterials to improve wound healing and biocompatibility after surgery. One of these materials, which are cost-effective, easy to manufacture and applicable, is Platelet Rich Fibrin (PRF) applications [1]. It is frequently preferred today because of its biocompatibility, reliable, low cost, and rapid recovery potential.

When conducting studies, a comparison of the PRF material versus a control group is often made. Today, a standard PRF protocol is still not available, but all the protocols applied show great promise in the field of maxillofacial surgery.

The first platelet concentration method applied in regenerative dentistry is platelet rich plasma. The application period of PRP is long and the anticoagulant added to it affects tissue healing. For this reason, different regenerative methods were sought and PRF applications were developed [2].

PDGF and TGF-B contained in PRF increase the number of defense cells in the region by supporting mitogenesis and chemotaxis. In this way, the bone density in the region increases significantly [3].

There may be silica micro-particles in the structure of the glass or plastic tubes used while preparing the PRF membrane. Silica particles in the tubes can interfere with the structure of the PRF membranes and cause inflammation by creating a potential toxic effect [4].

Literature review

The basic concept in all PRF materials is the centrifugation of venous blood from the patient at different RPM/RCF values and times. Centrifugation time and tour may vary depending on the purpose of application; it can be prepared with a more liquid consistency or denser.

Miron, et al. In their L-PRF and A-PRF applications, they observed higher concentrations, more evenly distributed platelets, and high levels of growth factors for 10 days in blood samples centrifuged at slower speeds and forces. However, they have seen that the centrifuge tube used can be effective on the concentration and distribution obtained [5].

In a study by Mudalal, et al. on fibroblast proliferation, L-PRF preparations were fixed and applied, and they observed that growth factors were formed in the first 3 hours and continued for 10 days [6].

PRF preparation protocol

Depending on the size of the area to be used, 10 cc-100 cc of venous blood is taken from the patient.

Plastic or glass tubes can be preferred according to the protocol to be applied. As soon as the blood is taken, it is placed in the centrifuge. Transport times longer than 60 seconds cause clotting. Centrifugation is done in accordance with the desired protocol.

After the centrifugation period is over, the upper coagulated layer is removed. Solid PRF can be cut and pressed according to the defect, but i-PRF should be injected as soon as coagulation occurs (Table 1) [7].

Current PRF protocols

Table 1: Current general PRF protocols.

L-PRF	**3000 RPM 10 minutes**
i-PRF	700 RPM 3 minutes
A-PRF	1500 RPM 14 minutes
A-PRF+	1500 RPM 8 minutes
T-PRF	Inside Titanium tubes 2800 RPM 12 minutes
C-PRF	3000 RPM 10 minutes

PRF application areas

Endodontics

- In pulp base perforations with MTA,
- As a revascularization agent for scaffolding in teeth with immature necrosis.
- In apexification treatments with MTA,
- It can be applied instead of calcium hydroxide in traumatized immature teeth to increase tooth vitality and durability.
- Youssef, et al. two different study groups in which he performed regenerative endodontic with blood clots and PRF were followed up at 6 and 12 months periods and after 12 months, peri-radicular improvement and increased tooth sensitivity were observed in both groups [8].

PRF material can be used as a bone graft or membrane with high success in implant operations that require sinus lifting. Some studies show that in addition to the use with graft, even PRF applications alone can be effective in sinus augmentation. Compared with xenografts, it has been seen that PRF grafts and membranes can be an alternative in sinus lifting applications.

In a split mouth study conducted by Erdur, et al. i-PRF was applied to class 2 division 1 patients and it was observed that canine distalization developed more rapidly in the applied area. Farshidfar, et al. stated in their systemic study that orthodontic tooth movement can be accelerated, especially in canine teeth, by applying i-PRF.

A-PRF applications to the impacted third molar tooth sockets were found to be effective in reducing post-operative symptoms such as pain, swelling, and trismus, and in increasing the rate of recovery. 10 times less osteomyelitis cases were observed by applying PRF into the socket after the third molar tooth extraction [9].

Discussion

In a study by Miron, et al., PRF was found to be more successful than the coronally shift flap. When PRF+coronal shift was applied, better covering and keratinized mucosa were obtained, but no difference was found in attachment level and probing. PRF was found to be more successful in postoperative comfort and pain.

Studies have shown that PRF applications in alveolar clefts accelerate the wound healing process together with new bone formation in the treatment. When used together with anterior iliac graft in maxillary unilateral clefts, a significant increase in bone amount was detected [10].

PRF can be preferred as a soft tissue graft to reduce secondary healing areas, especially in vestibuloplasty procedures applied to increase the retention of removable dentures.

PRFs can be used as fully osteoinductive autogenously bone grafts in implantology. However, it can also be used as a membrane in guided bone regeneration and sinus lifting applications.

PRF accelerates the formation of new vessels and the wound healing process by affecting angiogenesis in bone osteonecrosis. Steller, et al. applied zoledronic acid on osteoblasts and observed a decrease in the proliferation and differentiation functions of osteoblasts. Then, by applying PRF and PRP to the medium, he saw an increase in the viability of the cells. This showed that PRF and PRP could benefit therapeutically in bisphosphonate associated osteonecrosis [11].

When used alone or in combination with allogeneic/autogenous grafts, PRF can be successfully used for bone repair in cavities formed after enucleation and curettage of cysts in the jaw. Studies in which successful results were obtained with the application of PRF in the treatment of paradental cysts and traumatic bone cysts are available in the literature.

PRF membranes can be used alone or with buccal fat pad, palatal flap, etc. to close the oroantral relationship. It can be used together with other methods and shows successful results. Salgado, et al. stated in their study that PRF alone would be sufficient for openings smaller than 5 mm, and bi/trilaminar techniques were recommended for larger openings.

Barbu, et al. showed that in patients with insufficient amount of sub antral bone, full recovery can be achieved because of PRF application in patients with high perforation of the sinus membrane by placing more than one implant at the same time [12].

Studies show that PRF membrane applications have anti-inflammatory properties by supporting M_1-M_2 conversion in murine macrophages. In this way, it is thought that the development of inflammation after surgical procedures can be reduced. It will be beneficial in preventing various inflammatory conditions, especially peri-implantitis. In a study comparing PRF, PRP and i-PRF, it was seen that i-PRF had more antibacterial effects than others.

When L-PRF was injected into the upper joint space and retrodiscal tissues in case of pain and dysfunction, a decrease in

pain and dysfunction and an increase in mouth opening were observed [13].

In periodontology, it has been observed that the amount of bone in the region increases when applied to intraosseous defects. In a study conducted by Ustaoglu, et al. bone graft and PRF were compared after open flap debridement in intraosseous defects, and it was seen that PRF could yield successful results as a graft. The extra application of PRF alongside the graft increased the regenerative capacity [14].

There are studies supporting that higher success can be achieved by applying the PRF and the "sticky bone" concept together as a graft material to accelerate bone regeneration. In order to shorten the application process, new tools are currently being developed to produce 'sticky bones' [15]. Recently, along with the concept of "sticky bone", the concept of "sticky tooth" has also emerged. In studies based on socket preservation in the concept based on the combination of autogenous dentin graft and i-PRF, van Orten, et al. have achieved successful results. As a result of their studies, they observed that bone was formed in direct contact with dentin granules with cancellous content [16].

In a study on dogs, PRF was applied to one side after bilateral extraction. When the dry replanted teeth were replanted after 60 minutes, when examined 8 weeks later, no difference was found other than decreased inflammatory root resorption in the sockets, which made its use in replantation a question mark.

In a study conducted by Pitzura, et al. L-PRF and A-PRF+ groups versus control groups, they observed that wound healing and cell migration occurred faster in PRF groups, and that A-PRF + groups had a positive effect on migration, proliferation, and healing [17].

Liu, et al. applied A-PRF to the right region after bilateral premolar extraction in the upper and lower jaws on dogs and examined it immunohistochemically and under laser Doppler [18]. They concluded that A-PRF may be beneficial in gingival regeneration due to the presence of blood vessel formation and growth factors around the gingiva from the first day.

In their split mouth study on 24 patients diagnosed with bilateral erosive lichen planus, Saglam, et al. applied i-PRF to one of the bilateral lesions and methylprednisolone acetate to the other area. As a result of 6 months controls, a decrease in pain and lesion size was observed in both groups [19,20].

Conclusion

PRF is one of the most common and popular biocompatible materials today. Due to its ease of application and production and its cost-effectiveness, an increasing number of studies are carried out on it. PRF, which is applied in various fields in other branches of medicine, can be used in almost every field of dentistry. Thanks to the new protocols that are constantly emerging in tissue engineering, it has become a more effective and efficient method of application day by day. Thanks to the completely autologous content of PRF, it can often be preferred instead of various allografts. Thanks to its ease of application, it can be applied by many physicians, from surgeons to general practitioners.

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