

ROLE OF PLATELET RICH FIBRIN IN ORAL AND MAXILLO-FACIAL SURGERY - A REVIEW

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Abstract: The oral maxillofacial structures are the most frequent sites of predilection for trauma, tumors, inflammation, and congenital abnormalities. The injuries caused to the oral and maxillofacial bone by bone removal during tumor surgery, periapical bone destruction induced by periapical periodontitis, alveolar bone atrophy following extraction of teeth, and alveolar cleft, causes severe changes to the physical and mental health of the patient. Oral and maxillofacial bone reconstruction has employed numerous bone graft substances, including autologous, allogeneic, and synthetic bone graft substances. PRP can be defined as a fraction of the volume of plasma with a higher concentration of platelets than in peripheral blood and also three or four times higher growth factors than peripheral blood. This review aims to assess the role of PRF and its benefits in the field of Oral & Maxillofacial Surgery (OMFS).

Keywords: Platelet rich fibrin; maxilla-facial surgery

INTRODUCTION

The oral maxillofacial structures are the most frequent sites of predilection for trauma, tumors, inflammation, and congenital abnormalities. The injuries caused to the oral and maxillofacial bone by bone removal during tumor surgery, periapical bone destruction induced by periapical periodontitis, alveolar bone atrophy following extraction of teeth, and alveolar cleft, causes severe changes to the physical and mental health of the patient. Oral and maxillofacial bone reconstruction has employed numerous bone graft substances, including autologous, allogeneic, and synthetic bone graft substances. The use of autogenous bone transplantation, regarded as the gold standard, was contained in bone regeneration due to limited donor supply, a second surgery, chronic pain, and complications at the donor site [1]. Furthermore, allografts may spread disease while synthetic graft agents require the property of osteogenic induction [2, 3].

The usage of blood-derived products to wound healing commenced in 1970 when fibrin glues or fibrin sealants, which were produced by polymerizing fibrinogen with thrombin and calcium, were introduced. Fibrin glue had clinical administrations such as topical hemostasis and tissue sealing. As the concentration of fibrinogen in plasma is more limited, the stability and quality of fibrin glue were low. [4, 5] Change in its technique and characteristics, lower immunity to physical tensions, high-priced processing, and correlation by a hazard of viral transmission are its drawbacks.

PRP can be defined as a fraction of the volume of plasma with a higher concentration of platelets than in peripheral blood and also three or four times higher growth factors than peripheral blood. [6] Regenerative medicine is an addition or replacement of infected or wounded cells. [7] This review aims to assess the role of PRF and its benefits in the field of Oral & Maxillofacial Surgery (OMFS).

PLATELET-RICH FIBRIN

A second-generation platelet concentrate was developed in France by Choukroun et al. [8] (2001) which was an autogenous living biomaterial. It has obtained demand as it hastens soft- and hard-tissue healing. Its advantages over PRP are ease of preparation and application, least investment, and decrease of biochemical modification (as no bovine thrombin or anticoagulant is required). [8] A major advantage of PRF is that it has a simple preparation protocol. The variation amidst a natural blood clot and PRF is that the end is more homogeneous and firm with the ease to manage and fix.

PREPARATION OF PRF

The protocol tries to collect platelets and the released cytokines in a fibrin clot. The completion of this procedure depends entirely on the time gap from the blood collection to its shift for centrifuging, and it should be done in less time.

The centrifuged blood without any enhancement of anticoagulant and bovine thrombin is needed.

The blood sample is obtained without anticoagulant in 10-mL tubes in a glass or glass-coated plastic tube and immediately centrifuged at 3000 rpm for 10 minutes.

The resultant output consists of the following three layers: a top-most layer of an acellular plasma, a middle layer of PRF clot, and a bottom layer of red corpuscle.

The upper straw-colored layer is removed and the middle portion is concentrated, 2 mm below the lower dividing line, which is the PRF.

Mazor et al. [9] recommended that on condensation between two sterile gauzes or in a specific PRF tool, the clot could be changed into a membrane. The communication of blood with a silica surface stimulates the clot polymerization method; this activation diminishes the risk of cytotoxicity compared with the use of bovine thrombin used for PRP preparation. [10] Compared to PRP, structurally it has equilateral junctions (connected trimolecular), fine and flexible fibrin network that support cytokines enmeshment and cellular migration. This three-dimensional structure provides elasticity, flexibility, and strength to the PRF membrane.

ROLE OF PLATELET RICH FIBRIN IN ORAL AND MAXILLO-FACIAL SURGERY PLATELET RICH FIBRIN IN POST EXTRACTION

PRF has been explicated to play a vital role in tissue healing with the releasing growth factors from alpha granules, regulate cellular events such as cell adhesion, migration, proliferation, differentiation, and extracellular matrix deposition. Major variations occurred within the first year following an extraction, but most of the bone resorption takes place only within 3 months. [11, 12]

Platelet concentrates have been used to hasten bone generation and promote healing by delivering growth factors such as transforming growth factors β_1 and β_2 , platelet-derived growth factor, and vascular endothelial growth factor, which can provoke angiogenesis and activate cell proliferation.

On the other cards, the role of PRF in soft tissue healing has been shown at well-designed meta-analyses. There exist no notable variations in alveolar osteitis, acute inflammation, or alveolar infection following tooth extraction. New bone gain and bone remodeling topics are also contradictory. However, it was concluded that PRF is good at decreasing swelling, edema, pain, and trismus following tooth extraction [11, 12, and 13]

PRF FOR MAINTAINING SWELLING, EDEMA AND PAIN

Advanced studies on clinical research have explained that PRF intends to improve not only the benefit of the treatments but also patient relief. In this respect, the use of autologous products is profitable such as high acceptability, low risk of disease transfer, low morbidity, and low cost. PRF plays a vital role in tissue repair. Their alpha granules incorporate many substances, plenty of growth factors with significant influences on the inflammatory and proliferative resident cells at the site of injury, like mesenchymal stem cells, fibroblasts, chondrocytes, and osteoblasts. This potential may be enhanced by the concentration of the platelets. Certain in-vitro and in-vivo studies have shown that the use of PRF is significantly beneficial in terms of cell migration. Most clinical studies observed the use of PRF accurately at wound healing. The outcomes of clinical investigations showed the application of PRF renders an improvement in soft tissue healing, reducing swelling and trismus, and improving patient comfort. Nevertheless, pieces of evidence on managing pain are limited and pain usually adheres to the early formation of soft tissue healing. [14]

PRF IN SINUS LIFT

Maxillary sinus floor elevation is regarded as one of the most thriving methods that can be done using different grafting materials, such as autogenous, xenograft, allograft, alloplastic, and PRF materials [15, 16].

The bone graft materials display a reduction of osteogenic and osteoinductive potential with distinguished osteogenic capacity and bone formation. Furthermore, some limitations, mainly linked to limited availability, prolonged healing time, and influence on host responses can develop when using these bone substitutes. To subdue these difficulties, different materials with osteoinductive properties, such as platelet-rich fibrin (PRF) was recently proposed as a replacement or additional materials in sinus augmentation procedures [17].

The biologic arbitrators have osteoinductive properties and are considered to expedite the production of new bone and to lessen the time interval. The intensities of PRF come from improving the vascularization of bone tissue, diminishing tissue inflammation, developing scaffold mechanics, and hastening new bone formation [17]. Lately, researchers have paid more inclusive observance to the benefit of PRF administration in maxillary sinus lifting procedures, but no unison has arrived. Some researchers have listed the positive effects of PRF application in sinus augmentation procedures.

PRF IN OROANTRAL FISTULA

Oroantral fistula (OAF) constitution is defined as a pathological way between the maxillary sinus and oral cavity. It is an abnormal epithelial connection filled by granulation tissue or polypoid extension of the sinus membrane. It can either come into existence automatically following a large maxillary cyst or tumor or as iatrogenic subsequent tooth extraction or dental implant surgery.

There are a plethora of methods to manage OAF. PRF is one of them which is introduced recently. The technique is as following; PRF clots collected by centrifugation should be isolated from PPP (Platelet Poor Plasma) and red blood cells, made as thin membranes and applied perforated area layer by layer. The researchers about PRF in OAF closure infer that wound healing is faster and there was an improvement in soft tissue thickness during healing. Due to its natural ingredients, there is no need to use additional materials, thus there is a decrease in the donor site morbidity that occurs.

PRF IN CYSTS

The application of PRF in cyst depends on the equivalent rationale with the augmentation of soft and hard tissue healing. Studies associated with this issue assume that using PRF as a graft material is advantageous for reducing healing time and increasing bone mineral density.

Considering it has been determined the synergetic impact of PRF in healing enrichment of covering oral mucosa, these platelet derivatives became even more remarkable. PRF involves cytokines, chemokines, and antimicrobial derivatives including growth factors such as VEGF, which are essential to support hard and soft tissue in order to heal.

CONCLUSION

PRF, a distinct generation of platelet concentrate, is an innovative inception in regenerative periodontal and surgical treatment with interpreted processing and outwardly biochemical modification. Aside from its application in dentistry, PRF is also been used in various medical fields: orthopedic and plastic surgery. Although the virtues and faults of PRF have been confirmed by various systematic reviews and meta-analyses, copious prospective investigations are yet to be explored. Clinical examinations in cooperating PRF for multiple approaches are quite reassuring; though, further studies are required to promote its common use in conventional dental training with high clinical potency and long-term establishment.

AUTHOR CONTRIBUTIONS

First author (Jitesh.S) performed the analysis, interpretation and wrote the manuscript. Second author (Dr.Madhulaxmi) contributed to conception, analysis, and interpretation and critically revised the manuscript. The two authors have discussed the results and contributed to the final manuscript.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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