

Review Article

PRP in Periodontics

Sapanpuneet Kaur

National Dental College Derabassi, Mohali, Punjab India

ABSTRACT:

Platelet concentrates (PCs; platelet-rich plasma and platelet-rich fibrin) are autologous bioactive substances that have found varied application in medical and dental fields, particularly in oral and maxillofacial surgery, plastic surgery, and sports medicine. The rationale of these technologies is to extract all the elements from patient's own blood sample, which could be used to improve healing by promoting tissue regeneration.

Key words: Platelet concentrates, Platelet-rich fibrin, plastic surgery

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Corresponding author: Sapanpuneet Kaur, National Dental College Derabassi, Mohali, Punjab India

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INTRODUCTION

The lack of support for the impacted teeth, particularly for the periodontal ligament fibers and the bone they are embedded into, is a hallmark of periodontitis, an inflammatory disease of the periodontal tissues. The anticipated recovery after periodontal therapy is regeneration or repair. Two essential things must happen for this to happen: the required cell types must be available, and signals that are required to attract and activate the cells must exist or not. Any wound's healing cascade starts with the creation of the clot and progresses through the proliferative and maturative stages. Growth factors facilitate wound healing by encouraging cell division (mitogenesis), cell migration (chemotaxis), and the development of new blood vessels (angiogenesis).^{1,2}

When fibrin glues or fibrin sealants, which were created by polymerizing fibrinogen with thrombin and calcium, were first introduced in 1970, the use of blood-derived products to treat wounds officially began. Clinical uses for fibrin glue included soft tissues, topical hemostasis and tissue sealing, and melting agents for particle bone substitutes. The durability and quality of fibrin glue were reduced due to the lower concentration of fibrinogen in plasma. Its disadvantages include variations in its composition and properties, a reduced ability to withstand physical strain, high manufacturing costs, and a potential for viral transmission.³ Biologically active proteins found in platelets attach to the extracellular matrix or a

growing fibrin mesh. Thus, the proteins produce a chemotactic gradient that draws in stem cells. These stem cells differentiate and then regenerate to aid in healing. Therefore, the use of autologous platelet concentrates presents a promising avenue for treatment in the field of periodontal regeneration, particularly in circumstances where prompt healing is required in clinical settings.⁴

PLATELETS

Megakaryocytes, the precursor cells of bone marrow, are the source of enucleated hematopoietic components, or platelets. Its diameter is 2-3 μm , and its cell organelles consist of granules, a sparse number of mitochondria, and noticeable membrane features. When platelets are activated, its surface-connected canalicular system and well-stacked tubular system aid in the outflow of growth factors, particularly PDGF.⁵

The α granules are membrane-enclosed spherical or oval units containing cytoplasm. The granules' diameters vary from 200 to 500 nm. These macromolecules, which make up 15% of the total platelet volume, store proteins that are crucial for different phases of wound healing, including PDGF, TGF- β , and insulin-like growth factor (IGF-I). Together with TGF- β , PDGF stimulates the proliferative stage of wound healing and protein synthesis in osseous tissues. TGF- β induces the development of woven bone, inhibits osteoclasts, and

has chemotactic effects on endothelial and osteoblastic cells. For matrix synthesis, IGF-1 promotes osteoblast proliferation and upregulates

osteocalcin expression. IGF-1 and PDGF work together to monitor the speed and caliber of wound healing.⁶

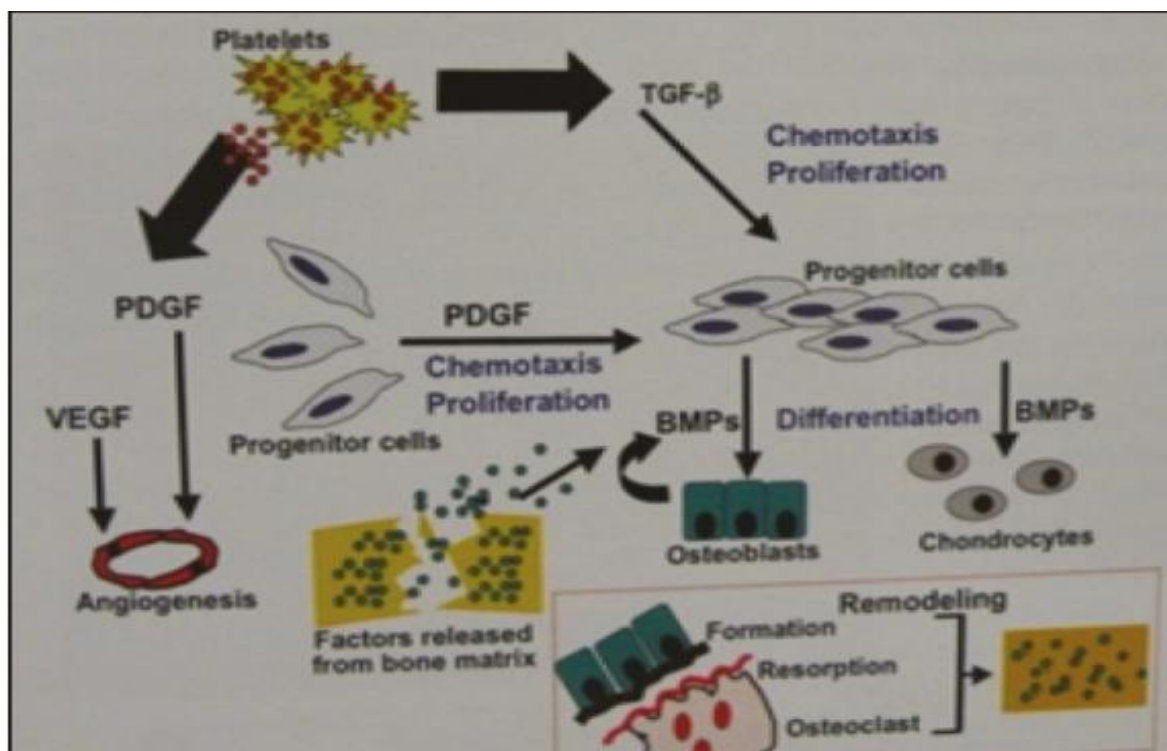


Fig- Growth factors released from α granules and their function

Classification of platelet concentrates

- Platelet-rich plasma (PRP), the first-generation platelet concentrates, showed positive results; however, its limitations included complex preparation protocol and the risk of cross infection from bovine thrombin.
- Platelet-rich fibrin (PRF) also called as Choukroun's platelet-rich fibrin named after its inventor.^{7,8}

PLATELET-RICH PLASMA

An autogenous living biomaterial, developed in France by Choukroun et al⁹, is a second-generation platelet concentrate. It has gained popularity as it accelerates soft- and hard-tissue healing. Its advantages over PRP are ease of preparation/application, minimal expense, and lack of biochemical modification (no bovine thrombin or anticoagulant is required). A major advantage of PRF is that it has a simple preparation protocol. The difference between natural blood clot and PRF is that the latter is more homogeneous and stable and easy to handle and place.

Application of platelet concentrates in periodontology

Treatment of furcation involvement

A systematic review and meta-analysis of randomized controlled trials with at least six months of follow-up examined the role of PC in grade II or III furcation

defects as an adjuvant to open flap debridement (OFD) and bone grafts with OFD alone. Only one study—out of the ten that were included—had a significant risk of bias.¹⁰ The findings indicated that using PC in addition to OFD produced better results in terms of clinical attachment level (CAL) and vertical and horizontal furcation depths. Improvements were only shown in horizontal CAL when used in conjunction with bone transplants. PRP and PRF both produced positive outcomes. However, there is little information available about the use of PC in conjunction with guided tissue regeneration (GTR) and bone grafts.¹¹

Alveolar Ridge Preservation Procedures (ARP)

In comparison to controls, the effect of PCs in alveolar ridge preservation alone or in conjunction with bone grafts was assessed in a systematic review that included five research. Two of the five included studies had a high bias risk. According to the findings, L-PRF reduced both the vertical and horizontal dimensions of alveolar ridge resorption in ARP, whether or not bone grafts were used. Conversely, PRP may have no effect at all. Evidence suggests that PC improves patients' quality of life and comfort just after the ARP by reducing postoperative pain, edema, trismus, and inflammation. Nonetheless, there is still conflicting data on the impact on the percentage of newly formed critical bone. Furthermore, a small body of research indicates that platelet concentrates

enhance the production of new bone and bone density.¹²

Similar results (better soft tissue healing and fewer postoperative symptoms) were found in another systematic review that included seven controlled trials (320 extractions in 190 patients). However, this review also highlighted the heterogeneity in the existing research when it came to standardizing variables like socket type and location, computed tomography (CT) assessment of baseline alveolar bone levels, reason for extraction, and minimally traumatic extraction techniques. Additionally, there is insufficient data to support the use of PC in maintaining the alveolar ridge, which calls for studies with sufficient control groups.¹³

Gingival recession

The effect of autologous platelet concentrations as an adjunct to coronally advanced flap in the treatment of Millers Class I or II recessions was assessed in systematic review and meta-analysis of randomized trials. The study included 8 RCT involving 328 sites in 170 patients.¹⁴ The results show better clinical outcomes in root coverage for PRF, while PRP did not affect much. PRF had favourable outcomes in terms of RC, RD, CAL and Gingival thickness. However, though platelet concentrates could achieve root coverage, their effect on keratinized tissue width is minimal. Besides, they did not have any significant effect in combination with connective tissue grafts. The study results should be interpreted with caution as the included studies exhibited high risk of bias.¹⁵

Surgical treatment of periodontal diseases and periodontal regeneration

Regardless of the method of treatment utilized in addition to OFD to correct infra-bony deficiencies, PC shown a positive effect on CAL increase. Furthermore, when PC (PRP) was administered in conjunction with directed tissue regeneration, it produced notable short-term results. Long-term data, however, points to the GTR membrane's superiority. However, the thick fibrin network of PRF membranes can function as a barrier membrane given the high cost, procedure sensitivity, and patient acceptance for GTR membranes. One of the disadvantages is that they can resorb in as little as 21 days.^{16,17}

In terms of Pocket depth (PD) decrease, CAL gain, and radiographic bone filling compared to OFD alone, PC as an adjuvant to OFD is superior, according to a Cochrane systematic review that examined 38 randomized controlled trials. Platelet concentrates have been shown to significantly improve PD, CAL, and radiographic bone fill when used as an adjuvant to OFD and bone grafts, as opposed to OFD + bone grafts. Furthermore, PC showed little benefit when used in conjunction with enamel matrix derivative (EMD) to cure furcation. Nevertheless, the authors presented poor quality evidence in relation to the data they analyzed.¹⁸

Clinical applications of I-PRF and A-PRF

Less than a decade ago, these two new formulations were proposed (A-PRF, 2014, i-PRF, 2016), and currently their biological basis is being understood. The research regarding their clinical application is still in nascent stages, and only time will prove their application in various clinical scenarios. However, few clinical studies and case reports show their application in Gingival recession, treatment of deep periodontal pockets, periodontal regeneration, enhancing gingival phenotype, orthodontic tooth movement and various oral regenerative procedures. However, the evidence is weak to conclude their application in areas as mentioned above.¹⁹

CONCLUSION

A significant step in regenerative periodontal treatment, PRF is a new type of platelet concentrate that requires no biochemical modification and simpler processing. In addition to dentistry, PRF is employed in orthopedics and plastic surgery, among other medical specialties. While a number of systematic reviews and meta-analyses have validated the benefits and drawbacks of PRF, more prospective studies remain to be investigated.

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