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Platelet Rich Plasma: A Boon to Periodontics

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Abstract

Platelet-rich plasma (PRP), a recently developed autologous cellular therapy, has the potential to perform new functions in an array of regenerative pharmacological treatment plans. Platelet growth factors (PGFs) promote the three stages of the wound recovery and repair cascade, which is the cornerstone of PRP therapy (inflammation, proliferation, remodelling). In vitro, in vivo, and animal experiments were used to test a wide range of PRP formulations. Yet, because it is difficult to apply the findings and technique recommendations from non-clinical studies to human clinical treatment protocols, recommendations from in vitro and animal research frequently result in various clinical manifestations. In this study, we addressed recent advancements in PRP production and composition, applications in periodontics, and PRP mechanisms relating to tissue inflammation and angiogenesis.

Keywords: Platelet Rich Plasma, Regeneration, Growth factors, Platelet concentrates.

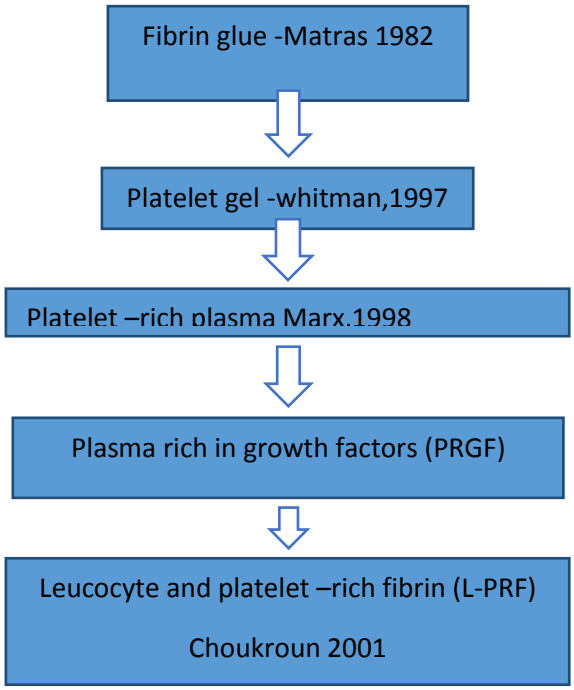
Introduction

Periodontal disease is defined as a complex, multifactorial disorder characterised by the loss of connective tissue attachment and the destruction of periodontal tissues. Periodontal therapy aims to stop the inflammatory process, stop the spread of periodontal disease, and restore damaged periodontal tissues. The expected healing process following periodontal therapy is revitalization or repair. This is dependent on the types of cells needed and whether or not the signals required to activate and use the cells are present. Clot formation starts the healing process, which is then followed by the proliferative and maturation stages. Growth factors facilitate the healing of wounds by stimulating the formation of new blood vessels, cell migration, and mitogenesis (angiogenesis).[1] There is evidence that growth factors and cytokines are present.In 1970, fibrin adhesives or fibrin sealants, which were created by polymerizing fibrinogen with thrombi and calcium, were initially used to treat wounds. Clinical uses for fibrin bonds included topical hemostasis, tissue sealing, and melting agents for replacement bone fragments. Less fibrinogen is present in plasma, and the fibrin adhesive's quality and stability were poor.[2,3] Depending on the generation of platelet concentrates being used, different sources of autologous growth factors are available. PRP, a first-generation concentrate, has been used both on its own and in association with grafting materials and barrier membranes to treat periodontal and surgical abnormalities. Nevertheless, there hasn't been much research on platelet-rich plasma's impact on bone repair. Platelet Rich Fibrin (PRF), a second-generation platelet concentrate (PRF), contains autologous leukocytes and platelet concentrates, both of which are effectively employed in a number of clinical domains of dentistry and medicine[4].

Platelet Concentrates

Platelets, which circulate in the blood for 8 to 10 days, are non-nucleated fractions of bone marrow megakaryocytes[5]. In the past, it was believed that platelets actively extruded many coagulation cascade initiators and contributed to the development of new blood vessels. Several mitogenic factors, including platelet-derived growth factor, vascular endothelial growth factor, and transforming growth factor, are found in the alpha molecules of platelets. It acts as a storehouse for growth factor proteins. Beginning the wound healing process is crucial. The platelet cell membrane is "triggered" to release these alpha granules upon contact with connective tissue, as happens during injury or surgery. As a result, active proteins are secreted, which bind to transmembrane receptors on the target cells to activate intracellular signalling proteins. As a result, a gene sequence that controls cellular growth, collagen synthesis, and osteoid product expression is effected[6].

Evolution Of Platelet Concentrates



Platelet Rich Plasma

Platelet rich plasma(PRP) is defined as a portion of the plasma fragment of autologous blood having a platelet concentration above baseline.[7] PRP is getting a authentically popular curative for a variety of conditions including degenerative and musculoskeletal conditions. The balance between degeneration and rejuvenation is restored in favor of renewal with the help of PRP[8].

A PRP clot contains

- 5% Red blood cells
- 94% Platelets
- 1% White blood cells.

Components Of Platelet Rich Plasma

1. Growth Factors
2. WBC & phagocytic cells
3. Native fibrogen concentration

4. Vasoactive and chemotactic agents
5. Increased concentration of platelets

Principle Behind The Use Of Platelet Rich Plasma

Platelet rich plasma mimics like terminal stage of coagulation cascade, that is the conformation of fibrin clot. The beneficial effects of PRP are mainly due to the release of certain growth factors through α molecule. Platelet Rich Plasma promotes collagen synthesis and angiogenesis and also increase the wound strength. These peptide acts both locally and systemically in a self regulatory feedback system. It's proven that PRP " jump starts " the regenerative cascade after trauma leading to quality tissue rehabilitation and patient care. The antimicrobial effect is attributed to high leukocyte concentration. These growth factors releases for the period of 7 days. The early woundhealing is based on the platelet count in the clot at injured site[9].

Mechanism Of Action

PRP work through the degranulation of the α granules in platelets, which contain the synthesized andpre-packed growth factors. The active release of growth factors is initiated by the clotting process of blood and begins within 10 minutes after clotting. further than 95% of the presynthesized growth factors are secreted within 1 hour. PRP must be developed in anticoagulated state and should be used on the graft, flap, or wound, within 10 minutes of clot inauguration[10]. The concealed growth factors instantaneously bind to the external surface of cell membranes of cells in the graft, flap, or wound via transmembrane receptors. These transmembrane receptors in turn induce an activation of an endogenous internal signal protein, which causes the expression of a normal gene sequence of the cell similar as cellular proliferation, matrix conformation, osteoid product, collagen formation etc. PRP growth factors acts by stimulating the wound recovery as much faster[11]. The main significance of PRP growth factors are never enter into the cell or its nucleus, they aren't mutagenic. PRP has no ability to induce malignancy production

Indications[12]

1. Joint pains (chronic arthritis)
2. Chronic tendinopathies
3. Ligament sprains
4. Muscles strains
5. Intervertebral discs
6. Nerve injuries

Contraindications[12]

1. Regular use of nonsteroidal anti inflammatory medications within 48 h of procedure
2. Corticosteroid injection at treatment site within 1 month
3. Systemic application of corticosteroids within 2 weeks
4. Tobacco use
5. Recent fever or sickness

6. Cancer particularly hematopoietic or of bone
7. Haemoglobin(HGB)

Preparation Of PRP

PRP is procured from a sample of patient's blood rendered at the time of treatment. A 30 cc venous blood draw will yield 3- 5 cc of PRP depending on the baseline platelet count of an individual, the device used, and the methodology employed. PRP is prepared by a procedure known as differential centrifugation. In differential centrifugation, acceleration force is acclimated to grounding certain cellular ingredients.It is grounded based on different specific gravity .

- Procure blood by venipuncture in acid citrate dextrose(ACD) tubes
- Don't refrigerate the blood at any moment before or during platelet fractionalization.
- Centrifuge the blood utilizing a ' soft ' spin.
- Transfer the supernatant plasma holding platelets into another sterile tube(without anticoagulant).
- Centrifuge the tube at a progressive speed(a hard spin) to gain a platelet concentrate.
- The lower 1/ 3rd is PRP and upper 2/ 3rd is platelet poor plasma(PPP). At the bottom of the tube, platelet pellets are sedimented.
- Remove PPP and suspend the platelet pellets in a minimal volume of plasma(2- 4 mL) by gently shaking the tube. Figure:1[13].

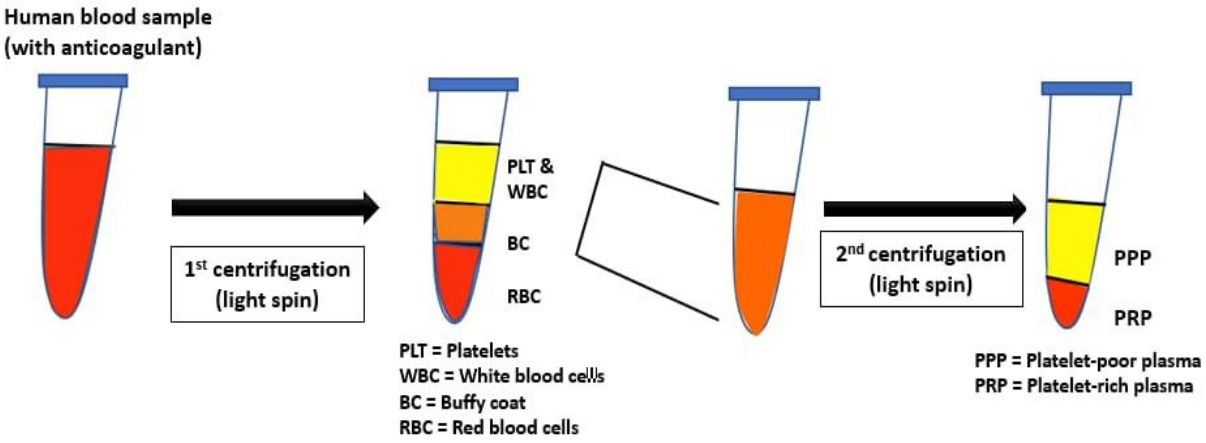


Figure1: Preparation Of Platelet Rich Plasma

Use Of Platelet Rich Plasma In Periodontal Surgery

Growth factors in PRP have the capacity to induce a fibrin clot, increase fibroblast proliferation, and up-regulate collagen synthesis in the extracellular matrix[14]. The application of PRP to wounded areas may be appropriate to encourage wound healing and rejuvenation of periodontal soft tissues. Infrabony abnormalities may benefit from the way these factors can speed up bone healing by increasing osteoblast mitosis and tissue vascularity. PRP's therapeutic effectiveness in periodontal therapy is still debatable.

Impact on Implants

PRP has a crucial role in improving the result of the initial chain of events that lead to the effective osseointegration of an implant[15].

Preservation of Alveolar Ridge

PRP can be used with particulate bone transplant for rapid implant implantation. The delivery of the graft material is made easier as a result. PRP is added to release growth factors in the grafting site and the socket walls after the graft has condensed. Inside the graft, it forms a fibrin-like mesh that disintegrates within a short period of time[16].

DISCUSSION

Wojtowicz et al.[17]compared the outcomes of autologous bone marrow and PRP transplants on osteogenesis of the alveolar bone. According to the findings of this study, PRP caused newly created bone to grow faster. PRP has also been used in sinus lift procedures, with positive outcomes. Maxillary sinus augmentation produced positive results, according to Poeschl et al[18]. The PRP preparation adheres to the metal when it is applied to an implant surface, possibly creating a new dynamic face that could release growth factors.

Anitua et al[19]found that coating the implant surface improved osseointergation in their 2006 report. PRP works well to regenerate bone and heal soft tissue. PRP is utilised to regenerate bone after fracture augmentation, and reconstruction following jaw procedures has demonstrated a significant impact of PRP on a variety of treatment methods. In terms of sinus lifting, the combination of PRP application with other biomaterials appears promising, but the outcomes vary according on the substance used. PRP alone has shown promising outcomes when used as a coating material in implant surgery.

CONCLUSION

Mesenchymal stem cells from bone marrow, osteoblasts, gingival fibroblasts, and periodontal ligament cells have all been shown to respond favourably to platelet-rich plasma as a mitogenic factor[20]. The majority of this beneficial effect depends on the concentration, and higher concentrations don't always result in the best outcomes for promoting tissue renewal. Current research on platelet rich plasma's impact on bone tissue development has revealed that this platelet concentrate may even reduce osteoconductivity in vivo[21]. Which platelet rich plasma concentrations work best for accelerating wound healing is still debatable.

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