THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
May 2024 Vol.4(5), 1756-1759

Popular Article

Therapeutic Potential of Platelet rich fibrin- A novel autologous platelet concentrate for regenerative veterinary medicine

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https://doi.org/10.5281/zenodo.11218373

Introduction:

Platelet-rich fibrin (PRF), a novel biomaterial designed for easier manufacturing without biochemical blood processing and resembling an autologous cicatricial matrix, is a member of the recent wave of platelet concentrates. Any surgical or regenerative procedure in animals ultimately aims to promote wound healing and tissue regeneration. This process's efficiency stems from the local and continuous supply of a diverse variety of growth factors and proteins, which replicate the requirements of physiological wound healing and reparative tissue processes. Clinical research suggests that this biomaterial promotes healing without causing excessive inflammation. Identifying potent homeostatic regulatory molecules in the PRF clot is crucial for limiting postoperative inflammation. In addition to platelet secretions, other blood constituents can release cytokines that can regulate inflammation.

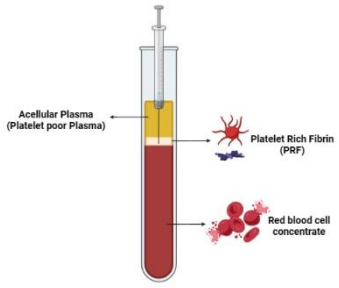

Figure 1 *Centrifugation stratification of whole blood*

Procedural harvesting of PRF:

Blood is collected in a glass based vacuum tubes without using an anticoagulant and promptly

centrifuged under low speed i.e. 1300-1500 rpm for 8-14 minutes to acquire advanced PRF (A-PRF) or advanced PRF-plus (A-PRF plus). A first centrifugation process separates the autologous blood into three distinct layers: red blood corpuscles (RBCs) at the bottom) in the supernatant platelet-poor plasma (PPP, and a 'buffy coat' layer in the middle, where platelets are concentrated (Figure 1). The next stage is to eliminate both the RBC and the PPP layers, leaving only the 'buffy coat' layer. Finally, using a syringe, the acquired platelet concentrate is administered to the area of interest, together with adjunct factors such as thrombin and/or calcium chloride (or similar factors), to activate platelets and polymerize fibrin.

Classification of PRF:

- **Pure Platelet-Rich Fibrin (P-PRF) or Leukocyte-Poor Platelet Rich Fibrin:** preparations that lack leukocytes and have a dense fibrin network.
- **Leukocyte and Platelet Rich Fibrin (L-PRF):** products contain leukocytes and a dense fibrin network.
- **Advanced Platelet-Rich Fibrin (A-PRF):** contains more viable cells than L-PRF.
- **Advanced Platelet Rich Fibrin Plus (A-PRF+):** A-PRF+ exhibits much higher levels of secreted growth factors (VEGF, TGF-β1, PDGF, IGF-I and EGF) than A-PRF and L-PRF.
- **Injectable-Platelet Rich Fibrin (I-PRF):** a liquid version of PRF.

Biological implications of PRF

PRF blends the clinical benefits of PRP with a fibrin scaffold that leads clot formation, supports tissue regeneration, and maintains growth factors and stem cells.

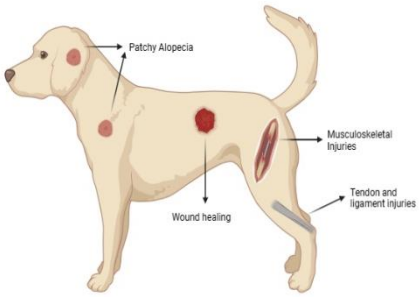

Figure 2: Biological uses of Platelet rich fibrin

1. Enhances wound healing:

Platelets are known to play crucial roles in homeostasis, blood clotting angiogenesis or neovascularization, inflammation tissue remodeling and regeneration. Various autologous platelet hemo-concentrates have been utilized as surgical adjuvants to improve wound healing, tissue remodeling and regeneration in modern veterinary regenerative medicine. Platelets isolated from venipuncture of peripheral blood vessels are source of over 1,500 bioactive molecules (immune mediators, growth factors, and enzymes) that are essential for tissue scaffolding, remodeling, regeneration and wound healing.

PRF membranes can simply be pulled out from a surgical or enhanced location. Being highly elastic in consistency, an applicant can pierce the membrane and drape it over the healing area.

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Published 19.05.2024

Concentrated platelets are capable of providing 6-8 times supraphysiological quantities of growth factors and is the fundamental mechanism that promotes wound healing. Platelet growth factors also promote the proliferation and differentiation of mesenchymal cell lines and other cells of interest involved in the healing process.

Musculoskeletal injuries:

PRF membranes are widely utilized in conjunction with bone graft to shorten healing time and stimulate bone regeneration. PRF is used with success in the therapeutic management of Intra-osseous periodontal defects. It can induce analgesia and alleviate post-operative swelling during tooth removal and in the treatment of tooth lesions and has shown promising results in the healing of osteonecrosis.

PRF has evolved as a viable non-operative treatment for muscle and cartilage injuries. The physiology of muscle recovery and the role of various growth factors in the healing process are extensively researched. PRF enhances muscle repair, regeneration and restoration by increasing the direct concentration of released growth factors at the site injury. For cartilaginous injuries, incorporating PRF into biodegradable fibrin (FB) serves as a scaffold, encouraging chondrocyte proliferation, differentiation and re-differentiation, with potential for cartilaginous tissue engineering. In healthy cartilage, chondrocytes are the sole cells, and they produce the cartilaginous matrix. PRF promotes the repair of knee cartilage lesions in animal models. Dysplastic conditions in the hind limbs of dogs following PRF implantation have often resulted in enhanced articular cartilage healing. In rabbits, PRF has been used to increase the survivability of sliced cartilage grafts, encouraging its usage as a suitable and biologically compatible casing material for cartilage grafting in treating cartilage defects.

Autologous PRF improves cell survival and electromechanical responsiveness in tendon injury and boosts the quality of repair.

Patchy Alopecia treatment:

PRP is thought to cure patchy alopecia by encouraging regrowth of hair via growth promotors or factors (GPs or GFs) present in thrombocyte alfa (α) granules. Various growth promotors, including EGF, b-FGF, IGF-1, TGF-β, PDGF, and VEGF, are implicated. These GFs affect dermal or cuticular papilla cells, increasing proliferation and differentiation while inhibiting cell death. Furthermore, these growth factors promote angiogenesis, collagen synthesis, and folliculogenesis of mesenchymal cells in the bulge area. These several pathways result in hair development.

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Pros of PRF (Platelet rich fibrin) over PRP (Platelet rich plasma)

- It is entirely an autologous product which is highly affordable and includes a simple method with only one centrifugation stage.
- Reduces hematological manipulation without biochemical handling.
- Polymerization happens naturally without incorporating bovine thrombin
- PRF-fibrin matrix contains growth promotors, leukocytes, immune mediators and cytokines that participate in the recovery process.
- It displays ensures sustained release of growth promotors compared to other degrees of platelet concentrates.
- PRF membrane is highly flexible and elastic.

Conclusions

Platelet-rich fibrin (PRF) is a new approach to platelet gel therapy. PRF is widely used in autologous blood concentrate therapy, serving as both a initial and auxiliary technique. Further research is likely to reveal additional benefits of PRF's bioavailability, autologous origin, and regenerative characteristics.

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Published 19.05.2024