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Review Article

Application of PRF and PRP in Periodontics and Implantology: A Review

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ABSTRACT:
Periodontal disease is characterized by the loss of attached connective tissue and other periodontal tissues. Growth factors secreted from platelets promote tissue formation and wound healing. Platelet concentrates (platelet-rich plasma and platelet-rich fibrin) are autologous bioactive substances that have found varied application in medical and dental fields, particularly in Periodontology. Platelets contain biologically active proteins that bind on to a developing fibrin mesh or to the extracellular matrix. The proteins thus create a chemotactic gradient for recruitment of stem cells. These stems cells undergo differentiation, and promote healing by regeneration. Hence, the use of autologous platelet concentrates opens a promising treatment option in the field of periodontal regeneration, especially in clinical situations demanding rapid healing. Hence the aim of present review of literature is to discuss application of PRF and PRP in Periodontics in detail.
Keywords: Platelet concentrates, PRF, PRP

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INTRODUCTION

Periodontal disease is characterized by the loss of attached connective tissue and other periodontal tissues. Growth factors secreted from platelets promote tissue formation and wound healing.[1] The use of platelets for regenerative medicine has increased in recent years. Platelets, which contain growth factors, play major roles in cell migration, proliferation, differentiation and angiogenesis and are associated with the tissue regeneration process. Autologous platelet concentrates (APCs) are produced by the centrifugation of venous blood at different speeds and the use or non-use of thrombin and anticoagulant. As a result of these processing protocols, a fibrin clot is formed that contains platelets and leukocytes.[2] The main generations of APCs are platelet-rich plasma (PRP), platelet-rich fibrin (PRF). The efficacy of platelet concentrates in promoting wound healing and tissue regeneration has been at the center of scientific interest over the past few decades.[3]

Platelets contain biologically active proteins that bind on to a developing fibrin mesh or to the extracellular matrix. The proteins thus create a chemotactic gradient for recruitment of stem cells. These stems cells undergo differentiation, and promote healing by regeneration. Hence, the use of autologous platelet concentrates opens a promising treatment option in the field of periodontal regeneration, especially in clinical situations demanding rapid healing. Hence the aim of present review of literature is to discuss application of PRF and PRP in Periodontics in detail.

EVOLUTION OF PLATELET CONCENTRATES

FIRST-GENERATION PLATELET CONCENTRATE-PLATELET-RICH PLASMA (PRP)

Platelet-rich plasma (PRP) was introduced by Marx *et al.* in 1988. PRP was developed to combine the fibrin sealant properties with growth factor effects of platelets, thereby providing an ideal growth factor delivery system at the site of injury. These growth factors exhibit chemotactic and mitogenic properties that promote and modulate cellular functions

involved in tissue healing, regeneration, and cell proliferation.[4,5]

METHOD OF PREPARATION

PRP is prepared by a process known as differential centrifugation. In differential centrifugation, acceleration force is adjusted to sediment certain cellular constituents based on different specific gravity.[7]

A volume of eight milliliters of venous blood is collected and subjected to centrifugation at 2400 rpm for 10 min. This results in formation of three fractions, plasma, buffy coat, and erythrocytes. The erythrocyte layer is discarded and then the remaining is subjected to second centrifugation cycle of 3600 rpm for 15 min. This results in formation of PRP and platelet-poor plasma (PPP). At the time of the application, the PRP is combined with an equal volume of a sterile saline solution containing 10% calcium chloride (a citrate inhibitor that allows the plasma to coagulate) and 100 U/mL of sterile bovine thrombin (an activator that allows polymerization of the fibrin into an insoluble gel, which causes the platelets to degranulate and release the indicated mediators and cytokines); the result is a sticky gel that is relatively easy to apply to the surgical defects.[8]

SECOND-GENERATION PLATELET CONCENTRATE-PLATELET-RICH FIBIRN (PRF)

Platelet-rich fibrin (PRF) was developed by Dohan et al. in 2001. Unlike the PRP, this technique does not require the addition of anticoagulants, bovine thrombin, or any other gelifying agent, thereby eliminating the risk associated with them.[9]

METHOD OF PREPARATION

The protocol tries to accumulate platelets and the released cytokines in a fibrin clot. PRF protocol requires only centrifuged blood without any addition of anticoagulant and bovine thrombin. Then, a blood sample is taken without anticoagulant in 10-mL tubes in a glass or glass-coated plastic tube, then immediately centrifuged at 3,000 rpm for 10 minutes.[10] The resultant product consists of the following three layers: Top most layer consisting of cellular plasma, PRF clot in the middle, Red corpuscle base at the bottom of tube.

PRF membrane can be obtained by squeezing out the liquids present in the fibrin clot. Liquid removal from the PRF fraction can be done through mechanical pressure between gauze layers resulting in a fairly solid, gel-like material that can be used in various clinical applications as a filling material or as a suturing membrane. PRF membrane can also be prepared by compressing PRF clot in special tools like “PRF Box” resulting in standardized membranes of constant thickness and size along with PRF exudates.[11]

Table no 1: Difference between PRP and PRF[12]

	PRP	PRF
Generation	First generation	Second generation
Based on processing technique	Use of bovine thrombin and calcium chloride (anticoagulants)	No anticoagulant used
Based on architecture	Sudden fibrin polymerization depending on the amount of surgical additives (thrombin and calcium chloride)	Slow natural polymerization on contact with glass particles of the test tube results in physiologic thrombin concentration
Based on biological property	There is immediate release of growth factors	Growth factors are released slowly over a period of 7 or more days
Based on therapeutic concern	Concern over the use of bovine thrombin, bovine factor Va may be a contaminant in certain bovine thrombin commercial preparations, antibodies to bovine factor Va may cross react with human factor Va and may produce coagulopathies and rare bleeding episodes	No coagulopathies and no bleeding episodes An *in vitro* study showed that PRF is superior to PRP, considering the expression of alkaline phosphatase and induction of mineralization, caused markedly by release of TGF-β, and PDGF-AB

APPLICATION OF PRF AND PRP IN PERIODONTICS

The cementum, gingiva, periodontal ligament (PDL) and alveolar bone serve as the tooth supporting tissues (periodontium). Periodontitis is a chronic multifactorial inflammatory disease which is primarily characterized by the destruction of alveolar bone and tooth supporting connective tissue, which is

manifested by a loss of clinical attachment, presence of periodontal pocketing and bleeding on probing. Lack of treatment may lead to tooth loss.[13]

Platelet concentrate, shows compelling data in various *in vitro* and clinical studies. It can be utilized in various procedures such as management of intrabony defects, gingival recession, furcation defects, extraction socket preservation, and accelerated healing of wound.

Table no. 2 Clinical Application

PRF	PRP
• Treatment of intrabony defects Sinus augmentation procedure with simultaneous implant placement • Treatment of grade II periodontal furcation defects • Coverage of gingival recession • Peri-implant regeneration procedures • Facial rejuvenation	• Treatment of periodontal intrabony defects • Maxillary sinus augmentation procedure Treatment of grade II periodontal furcation defects • Facial rejuvenation

APPLICATION OF PRF A CASE REPORT

A 25 year old patient reported in Department of Periodontology, Chandra Dental College with chef complaint of tooth mobility and pus discharge the upper front tooth since 2 months. On history, patient revealed root canal treatment for the same tooth 2 years ago.

Clinical and radiographic analysis of complained tooth revealed grade 1 mobility with draining sinus at periapical area and circumscribed radiolucency around apex of 22, suggestive of periapical cyst. (Figure no. 1 and 2) Clinical decision was taken to extract the tooth and simultaneous implant placement.

Periotome assisted atraumatic extraction was performed and flap was raised with vertical incisions as labial plate was missing. Complete debridement was done by removal of granulation tissue and betadine irrigation & disinfected by clindamycin thus making sure no residual granulation tissue persists. (Figure 3) After complete debridement implant of D 4.2/L 12 mm in length was placed, achieving primary stability of 35N cm, by palatal placement of implant (Figure 4). Implant was completely covered with bone graft and resorbable membrane (Figure 5 and 6). Flap was passively sutured and primary closure was achieved. (Figure 7 and 8) After 4 months, final prosthesis was delivered with periodontally healthy issue. (Figure 9 and 10) 1 year follow up showed satisfactory outcome. (Figure 11 and 12)

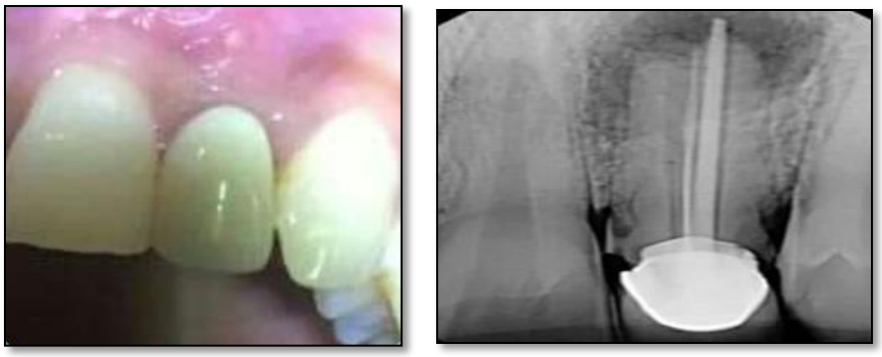

Figure no. 1 and 2: Preoperative clinical and Radiographic view

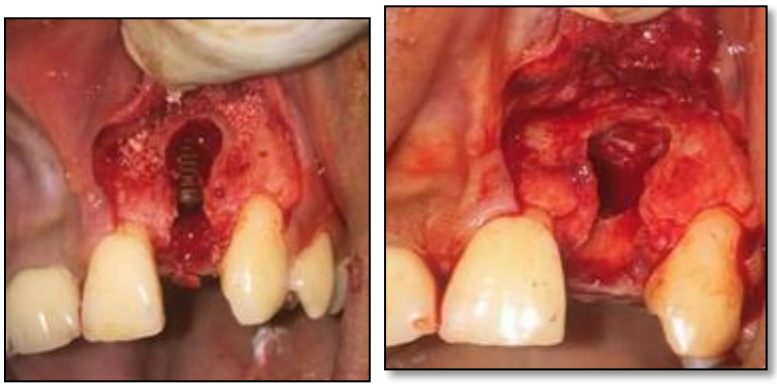

Figure no. 3 and 4: Intra-operative photograph (Complete debridement of lesion and placement of Implant)

Figure no. 5 and 6: Sticky bone graft prepared with PRF and placed at operative site

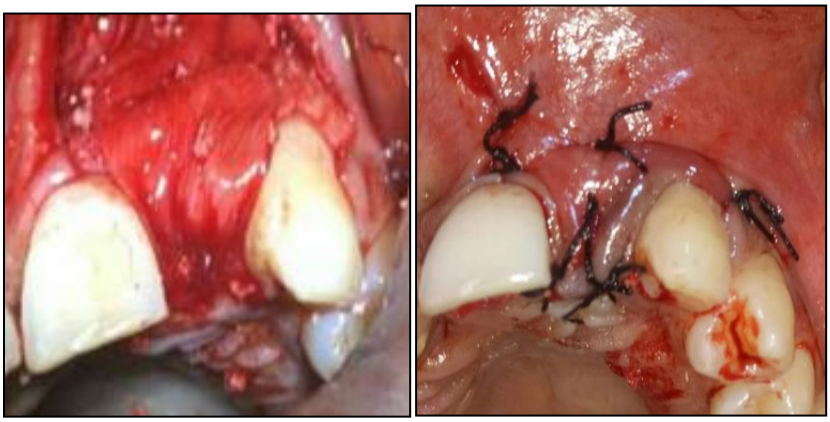

Figure no. 7 and 8: Membrane placement and primary closure

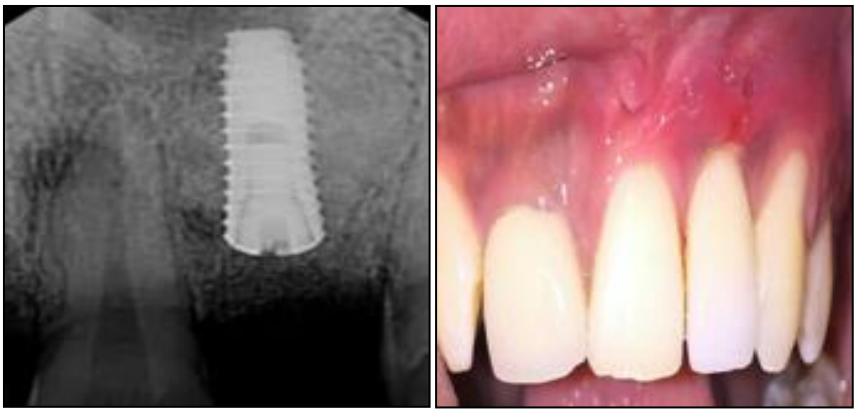

Figure no. 9 and 10: Post-operative view

Figure no. 11 and 12: 4 month and 12 month follow-up

CONCLUSION

The application of autologous platelet concentrate could present new possibilities for enhanced healing and regeneration. Overall, platelet-rich plasma is mainly used in cases of hard and soft tissue procedures, while platelet-rich fibrin is used in gingival recession and treatment of furcation and intrabony defects; concentrated growth factor is mainly used in bone regeneration.

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