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PRP IN ORAL AND MAXILLOFACIAL SURGERY- A REVIEW

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ABSTRACT:
Platelets plays an important role in hemostasis by preventing blood loss at the site of vascular injury. The growth factors in platelets has been believed to have the potential to accelerate the healing process, promotes tissue repair and regeneration. The platelet rich growth factor promotes both hard (bone) and soft (skin and gingival) tissue healing. The PRP has a broad spectrum of applications in oral and maxillofacial surgery. This review article presents with various applications of PRP in maxillofacial surgery.

1. INTRODUCTION:

The success of maxillofacial reconstruction, dental implants, esthetic dental procedures depends on hard and soft tissue regeneration. PRGF an intrinsic growth factor released by activated platelets is a regenerative therapy that promotes tissue healing. Factors like ease of application, cost effectiveness, reduced degree of donor site morbidity[1] and decreased risk of disease transmission has made the clinicians opt for PRGF like PRF and PRP.

PRP is an autologous modification of fibrin gel introduced by Gibbe and Ness in the year 1990. PRP hastens and boosts up the body's wound healing mechanism by release of bio active substances like Platelet derived growth factor (PDGF), Transforming growth factor (TGF), insulin-like growth factor (IGF), and epidermal growth factor (EGF)[2] upon activation of platelets (by addition of thrombin)that constitute approximately 5% of the normal blood clot.

This review article is an effort to evaluate the various uses of PRP in oral and maxillofacial surgery and also to provide guidance for future research in the field.

2. PLATELET RICH PLASMA:

PRP is an autologous concentration of platelets in a pool of plasma that has been used in various surgical fields such as otolaryngology, head and neck surgery, neurosurgery, general surgery, oral and maxillofacial surgery, and periodontics[3].

3. PREPARATION:

The PRP preparation can be done from blood collected in the immediate preoperative period in a laboratory or in an operating/dental room. The technique used for PRP preparation is the Double centrifugation technique described by Whitman and colleagues[4]. The steps involved in the preparation are as follows:

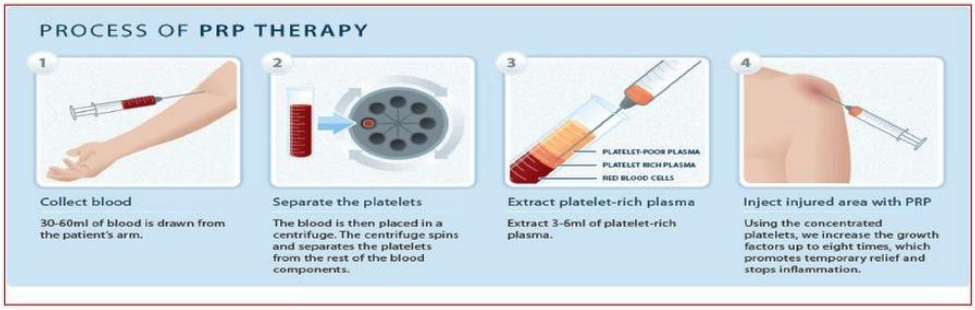
I. Approximately 450 mL of whole blood is collected in a standard collection bag containing citrate-phosphate-dextrose anticoagulant.
II. First centrifugation is done at 5600rpm/minute which separates the platelet-poor plasma from the erythrocytes, platelets and leukocytes[5].

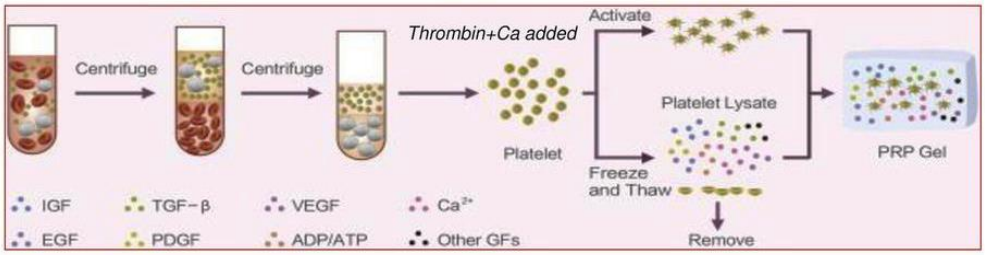
III. Second centrifugation is done at 2400rpm/minute to allow for further separation of the platelets and leukocytes from the red blood cell pack.

IV. The PRP thus produced is stored in room temperature to which is added a mixture of 10,000 units of bovine thrombin in powder form and 10 mL of 10 percent calcium chloride[6].

V. 7 mL of PRP and 2 mL of air are drawn into a 10-mL syringe. One mL of the thrombin/calcium-chloride mixture then is aspirated into the syringe and gently rocked to allow the air bubble to mix the components.

VI. Within 5 to 30 seconds, a gel is formed as a result of activation of fibrin polymerization by thrombin and degranulation of platelets. This gel is used in the surgical field as required.





The PRP thus obtained contains platelet count ranging from 0.5 million to 1 million which is four to five folds the normal platelet count (150,000 to 350,000 /mL). Ideally PRP should contain over 1 million cells per millilitre for the best possible surgical outcome[7].

4. GROWTH FACTORS IN PRP

Multiple growth factors that are released upon activation are responsible for regulating cellular processes such as mitogenesis, chemotaxis, differentiation, and metabolism. The natural growth factors are insulin-like growth factor (IGF) and hepatocyte growth factor (HGF) and those growth factors that are derived upon activation are platelet-derived growth factor (PDGF), transforming growth factor (TGF-β), vascular endothelial growth factor (VEGF), and epidermal growth factor (EGF).

Platelet derived growth factor:

It is a dimeric glycoprotein that was first found in alpha granules of platelets with a molecular weight of 30kd. It can also be found in macrophages, endothelial cells, monocytes, fibroblasts and bone matrix[8]. PDGF comprises of 5 isoforms-2 homodimeric "A"subunits (PDGF-AA), 2 homodimeric "B" subunits (PDGF-BB) and one heterodimeric subunit (PDGF-AB) of which the PDGF-BB and PDGF-AB plays an important role in regeneration and repair by promoting angiogenesis and collagen synthesis thereby enhancing wound healing.

Transforming growth factor B :

It is a multifunctional protein with a molecular weight of 25kd secreted by macrophages. It exists in 3 isoforms B1,2and 3. This protein family includes inhibin, activin, antimullerian hormone, bone morphogenetic protein, decapentaplegic, and Vg1 all of which contributes an important role in chemotaxis, proliferation, activation of immune cells and regulation of inflammatory process. This family of peptide

when applied topically enhances the collagen and fibronectin production aids in cell differentiation and proliferation of cells in the periosteum by stimulating the mesenchymal precursor cells.

Vascular endothelial growth factor :
VEGF is a signalling protein with a molecular weight of 27kd and is mainly involved in vasculogenesis [9]and angiogenesis by inducing chemotaxis and cell differentiation . VEGF family has five members VEGFA, VEGFB, VEGFC, VEGFD and PGF of which VEGFA plays an important role in angiogenesis and PGF in wound healing.

Epidermal growth factor :
It is a transmembrane protein with a molecular weight of 6kd. It plays an important role in TGFB dependent fibroblast differentiation to myofibroblast and ii also acts as a stimulator for the formation of granulation tissue.

5. PRP AND ITS APPLICATIONS IN OMF SURGERY

PRP has various clinical applications in the field of OMF surgery including healing of sockets post extraction, dental implants , BRONJ surgery etc
Exodontia is one of the very common procedure which involves removal of teeth that re periodontally compromised, grossly decayed, non restorable or impacted however these are often accompanied by significant pain post operatively especially during the removal of third molars. Recently PRP has been widely used post extraction because of its high concentration of growth factors that promotes tissue healing and regeneration thereby improving the quality of healing. According to Alissa et al. (2010), there was a significant improvement in soft tissue healing in patients treated with PRP and much lesser post operative pain compared to those untrated with PRP. According to Ogundipe et al. (2011)there was a significant improvement in post operative oedema and a good interincisal mouth opening in patients who underwent impaction removal followed by the placement of PRP. According to Celio-Mariano et al (2012) there was a greater radiographic bone density in patients treated with PRP and a significant improvement in bone healing following impaction surgery.

Initial study on applications of PRP for bone healing was carried out by Alissa et al on 23 patients who were followed up for a period of 12 weeks post operatively. The author observed that there was a significant improvement in soft and hard tissue healing and a significant reduction of complication and pain post operatively[10].

De Obarrio, Ozdemir et al. and others combined PRP with bone substitutes and GTR for the treatment of intrabony defects and observed a significant improvement in CAL.
In a prospective study carried out by anitua et al for augmentation of sinus floor and implant placement it was found that there was a significant improvement in implant prognosis.
In a study conducted by daif et al for the application of PRP for mandibular fractures concluded that the application of autologous PRP enhances the bone regeneration.
A study carried out by Curi et al. in 2011 for treatment of BRONJ surgically with wide resection and application of PRP found the combination therapy to be effective with fast mucosal healing and a significant reduction of pain and tissue vascularization.

In addition to the bone healing PRP also plays a significant role in nerve regeneration by activating the progenitor cells for neuronal regeneration.
Although the literature suggests the use of PRP improves soft tissue healing there are much less evidence to support the role of PRP in bone regeneration.

6. CONCLUSION:

The beneficial effects like uneventful wound healing, bone healing and regeneration are the important factors that determining the use of the autologous PRP. Ease of preparation and application attracts the clinician for

its usage in several procedures, however the efficacy and efficiency are still questionable which might require extensive clinical trails in the field to provide with a strong evidence that supports PRP to be used as an adjunct to oral and dental surgical procedures.

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