GOVERNMENT DENTAL COLLEGE AND HOSPITAL, KADAPA.

DEPARTMRNT OF PERIODONTOLOGY AND IMPLANTOLOGY.

LIBRARY DISSERTATION

TITLE: “PRF IN PERIODONTOLOGY AND IMPLANTOLOGY.”

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INTRODUCTION:

Wound healing is a complex biological process where many cellular events taking place simultaneously leading to the repair or regeneration of damaged tissues. Many attempts have been made in the field of tissue regeneration with the aim of predictably repairing, regenerating, or restoring damaged and diseased tissues. These include strategies with foreign materials often derived from allografts, xenografts, or synthetically produced alloplasts to regenerate host tissues.[1,2] While many of these materials have shown promise in various aspects of regenerative medicine, it is important to note that all create a "foreign body reaction," where by a foreign material is introduced into human host tissues.[3]

The potential role of platelets in inflammation and wound healing is due to the presence of several growth factors and cytokines and some of them play an important role in osteoblast activity, modulating their response in improving bone healing. Moreover, fibrin, fibronectin, and vitronectin in platelets provide connective tissue, a matrix, and thereby facilitate cell migration.[4] They form an intracellular storage pool proteins vital to wound healing, including platelet-derived growth factor(PDGF), transforming growth factor(TGF-β), and insulin like growth factor(IGF-I). Biologic action of PDGF is stimulation of DNA and protein synthesis in osseous tissues; mitogenic effect on mesenchymal cells; angiogenic effect on endothelial cells. TGF-β stimulates angiogenesis and matrix synthesis; enhanced woven bone formation; chemotaxis and bone formation by inhibitory effects on osteoclasts. IGF-1 stimulates proliferation of osteoblasts and matrixproteins such as osteocalcin; in combination with PDGF it enhances the rate and quality of wound healing.[5]

Regenerative potential of platelets was introduced in 1974, and Ross et al. were amongst the pioneers who first described a growth factor from platelets. Growth factors released after activation from platelets trapped within fibrin matrix, and have been shown to stimulate the mitogenic response in the periosteum for bone repair during normal wound healing.[6]

Whitman et al, in 1997, were the first to introduce the use of platelet-rich plasma in oral surgical procedures, reporting great advantages because it enhances osteoprogenitor cells in the host bone and bone graft. However, using it also presents risk because bovine thrombin, which is used to handle PRP, may generate antibodies to factor 5,11 thrombin that could cause coagulopathies that may endanger life.[7]

On the other hand, PRF was first used in 2001 by Choukroun et al. specifically in oral and maxillofacial surgery, and is currently considered as a new generation of platelet concentrate. It consists of a matrix of autologous fibrin and has several advantages over PRP, including easier preparation and not requiring chemical manipulation of the blood, which makes it strictly an autologous preparation.[7]

PRF is an autologous fibrin-based (membrane, matrix, or scaffold), living biomaterial, derived from human blood, also referred to as an optimized blood clot. In essence, PRF is a natural (autologous) composite biomaterial, consisting of fibrin, platelets, growth factors, and various cell types including leukocytes and stem cells. The blood concentrate which is obtained after centrifugation has three distinct layers: a red blood cell (RBC) base at the bottom, a PRF clot in the middle, and an acellular plasma (platelet-poor plasma [PPP]) supernatant layer at the top. The PRF clot is composed of two main parts observable with the naked eye: a fibrin yellow portion, constituting the main body, and a red portion located at the end of the clot (full of

RBCs). Between these two areas, a whitish layer ‘‘buffy coat’’ can be observed with the naked eye. PRF can be used directly as a clot, or after compression, as a membrane or plug. Alternatively, the supernatant can be aspirated from the vacutainer (i-PRF) and used in injectable form.[8]

The purpose of PRF technology is to extract essential elements from patients’ blood samples, that could be used to improve healing, promote tissue regeneration, and to prepare it in a clinically usable form as a membrane (APRF, L-PRF or CGF) or injectable liquid (i-PRF). The key elements are the fibrin (serving as a supporting matrix), the platelets (rich in growth factors), and cells (mostly the various populations of leukocytes, and stem cells for their antibacterial, neo-vascularization and regenerative properties). The three-dimensional fibrin membrane creates the scaffold for cells to function optimally during healing and regeneration. The fibrin matrix contains the platelets, leukocytes, growth factors and stem cells that act in synergy to stimulate, improve and accelerate tissue healing and to regenerate soft or bone tissue, including cell proliferation and differentiation, extracellular matrix synthesis, chemotaxis, and angiogenesis. The purpose of the PRF membrane is to connect the various elements within the fibrin matrix with local tissues (bone and soft tissue), to accelerate neo-angiogenesis thereby enhancing healing and regeneration.[8]

PRF is a powerful healing biomaterial with inherent regenerative capacity and can be used in various procedures such as periodontal intrabony defects, treatment of furcation, sinus lift procedures and as application in the field of tissue engineering, it can be used as a scaffold for human periosteal cells in vitro. Eren and Atilla in 2012 treated bilateral gingival recession with (CAF) coronally advanced flap and (SCTG) subepithelial connective tissue graft on one side and

CAF with PRF on other side. They found improvement in all parameters with both the techniques.[9]

According to Chang et al. the expression of phosphorylated extracellular signal-regulated protein kinase are promoted by PRF. Moreover, it stimulates the production of osteoprotegerin(OPG) which in turn causes proliferation of osteoblasts. Another study by Huang et al. reported that PRF stimulates the osteogenic differentiation of the human dental pulp cells by up-regulating OPG and alkaline phosphatize expression.[10]

PRF by Choukroun's technique is a simple and inexpensive derivative for the successful regeneration of periodontal tissues. The main advantage is that PRF preparation utilizes the patient's own blood reducing or eliminating disease transmission through blood. The use of PRF as an adjunct in wound healing, during periodontal regeneration has been successful for the correction of osseous defects in periodontics, oral and maxillofacial surgery and implant dentistry.[11]

Thus, PRF has emerged as one of the promising regenerative materials in the field of periodontics. The aim of this library dissertation is to review the platelet concentrate (PRF), its preparation, biological mechanisms for enhanced wound healing properties of PRF additives and the advancement in the PRF technology since its inception, emphasizing the clinical applications and benefits.[8,12]

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