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REGENERATIVE POTENTIAL OF AUTOLOGOUS PLATELET CONCENTRATES IN OUTPATIENT SURGICAL DENTISTRY

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The abstract. This work systematizes modern scientific data on the use of platelet-enriched fibrin and its modifications in various fields of surgical dentistry and maxillofacial surgery. From my clinical experience, the use of PRF significantly accelerates wound healing, significantly reduces postoperative pain and edema, and significantly optimizes bone and soft tissue regeneration processes. The paper considers in detail various protocols for the production of platelet concentrates, their biological properties and indications for use. The research of our colleagues confirms the positive effect of PRF on the outcomes of surgical interventions.

Keywords: platelet-enriched fibrin, PRF, L-PRF, A-PRF, i-PRF, tissue regeneration, growth factors, wound healing, bone regeneration, platelet concentrates.

Autologous platelet concentrates are a dynamically developing group of biomaterials obtained by centrifugation of the patient's own venous blood and containing high concentrations of platelets, leukocytes, fibrin and related growth factors and cytokines. The history of the use of blood products in surgery dates back several decades, starting with the use of fibrin adhesives as hemostatic and adhesive agents. Platelet-enriched fibrin, developed by French anesthesiologist Joseph Choukroun in 2001, belongs to the second generation of platelet concentrates and differs fundamentally from previous drugs in the absence of the need to add exogenous anticoagulants, coagulation activators or any other additives. From my clinical experience, the ease of obtaining PRF directly in the dental chair within minutes makes it an affordable and cost-effective method of optimizing healing. The biological activity of platelet concentrates is determined by the growth factors contained in them, which are released from platelet alpha granules during their activation and degranulation. Key factors include platelet-derived growth factor (PDGF), transforming growth factor beta (TGF-beta), vascular endothelial growth factor (VEGF), epidermal growth factor (EGF), insulin-like growth factor (IGF), and fibroblast growth factor (FGF). These biologically active molecules play a key role in the regulation of cell proliferation and differentiation, angiogenesis, extracellular matrix synthesis, and tissue remodeling. The works of Russian authors clearly demonstrate that the concentration of growth factors in PRF significantly exceeds their physiological concentration in whole blood, which provides a pronounced stimulating effect on the repair processes. The process of obtaining classic PRF according to the Choukroun protocol involves sampling venous blood into glass or silica-coated plastic tubes without any additives and immediate centrifugation at a speed of about 3,000 revolutions per minute for 10-12 minutes. It is crucial to start centrifugation quickly, since the absence of an anticoagulant leads to immediate activation of the coagulation cascade upon contact of blood with the walls of the tube. As a result of centrifugation, a characteristic three-layer structure is formed: the upper layer of cell-free plasma, the middle layer of a dense fibrin clot with a high concentration of platelets and leukocytes, and the lower layer of red blood cells. The research of our colleagues confirms that the bulk of platelets is concentrated in the lower third of the fibrin clot, directly above the erythrocyte layer. Modifications to the centrifugation protocol have led to the development of various forms of PRF with optimized biological and mechanical properties for specific clinical applications. Leukocyte and platelet-enriched fibrin (L-PRF) are produced using standard centrifugation parameters and are characterized by a dense fibrin structure with a high content of leukocytes providing antibacterial and immunomodulatory activity. The improved PRF (A-PRF) is produced at a lower centrifugation rate of about 1,500 revolutions per minute for 14 minutes, which ensures a more uniform distribution of platelets and leukocytes throughout the fibrin matrix and a more prolonged release of growth factors. It follows from the research of my compatriots that A-PRF is characterized by a looser structure and a more pronounced regenerative potential. The injection form of PRF (i-PRF) is a liquid fraction obtained by very short centrifugation (2-3 minutes at low speed) until fibrin polymerization. This form is used for bioactivation of bone-plastic materials by mixing them with liquid i-PRF, which improves the manipulative properties of granular materials and ensures uniform distribution of growth factors throughout the entire volume of the graft. From my clinical experience, the combination of xenograft granules with i-PRF makes it possible to form a sticky bone-type plastic mass that easily adapts to the bone walls of the defect, does not migrate and provides optimal conditions for osteogenesis. In addition, i-PRF can be injected into soft tissues to accelerate healing. The clinical applications of PRF in surgical dentistry and maxillofacial surgery are extremely diverse and are constantly expanding as scientific evidence accumulates. The most studied is the use of PRF after tooth extraction, especially surgical removal of retinated third molars. From my experience, placing a PRF membrane or clot in the recess of a extracted tooth promotes the formation of a stable blood clot, accelerates epithelialization and granulation of the wound, and significantly reduces postoperative pain and edema. Systematic reviews and meta-analyses in recent years have convincingly demonstrated a statistically significant reduction in the incidence of alveolar osteitis with PRF compared with spontaneous healing. Maintaining the volume of the alveolar ridge after tooth extraction is a critical task when planning subsequent dental implantation. The work of our colleagues shows that filling the recess of a extracted tooth with a combination of bone-plastic material and a PRF membrane significantly reduces the degree of horizontal and vertical ridge resorption compared with spontaneous healing. The use of PRF as the only material for filling the hole also demonstrates positive results in terms of preserving soft tissues and accelerating the formation of bone regeneration. However, for the prevention of significant bone resorption, a combination of PRF with slow-resorbing xenograft is preferable. In the field of bone augmentation, PRF is used both independently as a barrier membrane and in combination with various osteoplastic materials for their bioactivation. A PRF membrane obtained by clot compression can be used instead of collagen membranes for targeted bone regeneration of small defects. The research of our colleagues shows that during sinus lifting operations, the addition of crushed PRF to xenograft promotes faster maturation of bone regeneration and improves the parameters of newly formed bone according to histomorphometric analysis. However, the use of PRF as the only material to fill the space under the Schneider membrane is not recommended due to its rapid resorption. The use of PRF in the treatment of odontogenic jaw cysts and periapical lesions is of particular interest to practicing surgeons. From my clinical experience, filling a bone defect after cystectomy with a combination of osteoplastic material and a PRF membrane provides radiologically proven bone regeneration in a significantly shorter time compared to the traditional approach without the use of biomaterials. The growth factors contained in PRF actively stimulate angiogenesis, which is critically important for the nutrition of emerging bone regeneration, and the attraction of mesenchymal stem cells to the area reparations. The works of Russian authors demonstrate that the average time for X-ray repair of a bone defect is reduced from 12-18 to 6-9 months. A promising and actively studied area is the use of PRF in the treatment of drug-associated osteonecrosis of the jaw, a severe complication of antiresorptive and antiangiogenic therapy. Traditional surgical treatment of this condition is associated with a high risk of progression. The work of our colleagues demonstrates that covering exposed necrotic bone with a PRF membrane after sequestrectomy promotes the formation of a soft tissue covering that isolates bone from the aggressive environment of the oral cavity, and significantly improves the quality of life of patients. The antibacterial properties of the leukocytes contained in PRF additionally contribute to infection control in the affected area. PRF is also used in periodontal surgery for the treatment of gum recessions and intraosseous defects. The use of a PRF membrane as an alternative to a subepithelial connective tissue graft when recessions are closed avoids the removal of tissue from the palate and the associated donor morbidity. Research by our colleagues shows that the results of recession closure using PRF are comparable to those using a connective tissue graft, although the long-term stability of the results requires further study. In the treatment of intraosseous defects, the combination of PRF with bone-plastic materials demonstrates improved regeneration rates. In conclusion, it should be noted that platelet-enriched fibrin is a safe, affordable and effective biomaterial with a proven positive effect on the healing and regeneration of oral tissues. The ease of obtaining it directly at the dental office, the absence of the risk of transmission of infections and immune reactions, and the low cost make PRF an attractive addition to the dental surgeon's arsenal. The works of Russian authors make a significant contribution to the study of optimal protocols for the use of PRF in various clinical situations. Further research is needed to standardize the protocols for obtaining and applying PRF, as well as to form clinical recommendations.

Conclusions:

Platelet-enriched fibrin is a safe, affordable and cost-effective autologous biomaterial obtained directly in the dental office from the patient's own venous blood without the use of additives. Modification of the centrifugation protocols makes it possible to obtain various forms of PRF L-PRF, A-PRF, i-PRF with optimized biological and mechanical properties for specific clinical situations. The use of PRF in dentoalveolar operations, including tooth extraction and especially removal of retinated third molars, significantly accelerates healing, reduces postoperative discomfort and reduces the incidence of complications. The combination of PRF with osteoplastic materials optimizes the bone regeneration process due to the bioactivation of the graft and the prolonged release of growth factors directly in the defect area. PRF is used in the treatment of odontogenic cysts, preservation of the alveolar ridge, bone augmentation, periodontal surgery, and treatment of drug-associated osteonecrosis of the jaw.

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