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Mini Review

Application of L-PRF in the Field of Dental Surgery: A Brief Review

Cristyvro Marcondes de Castro Rodrigues [1]*, Izabella Sol [1], Vinicius Lima de Almeida [1], Claudia Jordro Silva [1]

[1] Department of Oral and Maxillofacial Surgery and Traumatology, Hospital das Clinicas, Federal University of Uberlandia, Uberlвndia, Minas Gerais, Brazil

*** Corresponding Author:** Cristyvro Marcondes de Castro Rodrigues, Department of Oral and Maxillofacial Surgery and Traumatology, Hospital das Clinicas, Federal University of Uberlandia, Uberlвndia, Minas Gerais, Brazil.

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Abstract

Fibrin-rich plasma is a material that is easy to make, requires only the patient's blood, thus nullifies the chances of contamination and reduces the risk of infection. Its aspects of hemostasis and support of the immune system contribute to its satisfactory result. L-PRF has wide applicability, from dentistry to medicine, with excellent results in short and medium terms. Several studies have shown safety in its use for maxillofacial application. This study aims to make a brief review of the literature in the last 15 years regarding the use of L-PRF and its applicability in dentistry in general.

Keywords: Platelet- Rich Fibrin, Surgery Oral, Bone, Bone Regeneration

Introduction

Currently, surgical procedures still face many challenges. After each intervention, surgeons are often faced with a complex phenomenon of tissue remodeling, the consequences of tissue healing and survival. In order to accelerate the healing physiological phenomenon, surgical additives have been studied, such as adhesive fibrin, platelet-rich plasma concentrate (cPRP) and fibrin rich in platelets and leukocytes (L-PRF).

The Platelet and Leukocyte Fibrin Concentrate (L-PRF) is an autologous biomaterial used for grafting, which incorporates into a fibrin matrix, leukocytes, platelets, leukocyte cytokines and growth factors, collected from a simple blood sample. The properties found in L-PRF have the ability to accelerate physiological healing, and when associated with bone grafts it speeds up the bone regeneration process.[1,2]

According to the study by Prakash and Thakur [3] (2011), fibrin glue was the first surgical additive to be used, commercially available in Europe at the end of 1970. An important property of fibrin glue is that it reproduces the final phase of the cascade of coagulation, acting independently from the internal coagulation mechanisms. Therefore, it will promote hemostasis of the wound regardless of coagulation defects. Fibrin glue is non-toxic, biodegradable, promotes local growth and tissue repair. Among its clinical applications, the treatment of intraosseous defects, enlargement of the alveolar crest, treatment of recession, bone regeneration involving dental implants, elevation of the sinus floor and treatment of extraction wounds can be mentioned. Its limitation is that it is less resistant to physical stresses than similar commercial glues.[1,3]

The platelet-rich plasma concentrate (cPRP), is based on the 1st generation of hemodynamic concentrates, scientifically based on the fact that they have growth factors, in English Growth Factors (GFs), are known to play a fundamental role repair mechanisms of hard and soft tissue, which exhibit properties that promote and modulate cellular functions involved in tissue healing, cell regeneration and proliferation.[3] Due to its property of accelerating the healing of soft tissues, the main clinical applications of cPRP can be highlighted, the procedures of sinus elevation, increase of bone crest, repair of the alveolar cleft palate, oral repair / nasal fistula, intra defects -bones, jaw reconstruction surgeries and soft tissue procedures, such as gingival and subepithelial grafts.[2,3]

Among the limitations of cPRP, it is relevant to mention the concern with the use of bovine thrombin, which can be associated with the development of antibodies to factors V, XI and thrombin, resulting in the risk of coagulopathies [4] (GUPTA 2011). Another important limitation of cPRP is the lack of uniformity

in the elaboration of its protocols, such as, for example, different concentrations of platelets with different storage times. In addition, according to LING (2009), the real effectiveness of cPRP in helping hard tissue healing is debated. Studies have suggested that it mediates only the first aspects of the bone repair process through an osteopromotion mechanism.[5]

According to Choukroun (2006),[6] Platelet and Leukocyte Rich Fibrin (L-PRF) belongs to a new generation of immune and platelet concentrate, with simplified processing and without biochemical manipulation of blood. The protocol for the derivation of this biomaterial is very simple and inexpensive: the blood is collected in a dry glass or a plastic tube lined with glass and is immediately centrifuged. All known clinical applications of L-PRF are structured in four fundamental healing events, namely angiogenesis, immunological control, use of circulating stem cells and wound covering by epithelium. These events play an accelerated tissue healing due to the effective development of neovascularization, accelerated wound closure with rapid remodeling of scar tissue and an almost total absence of infectious events. Although platelets and leukocyte cytokines play an important role in the biology of the biomaterial, the support of the fibrin matrix certainly constitutes the determining factor responsible for the therapeutic potential of L-PRF.[7,8]

The growth factors combined with the fibrin matrix were studied to accelerate the repair of bone tissue and allow the proliferation of fibroblasts, the favoring of tissue vascularization, the formation of collagen, the mitosis of mesenchymal stem cells and endothelial cells, as well as of osteoblasts, playing fundamental roles in the rate and extent of bone neoformation.[5,7,9]
Platelet-rich plasma (PRP) has proteins such as fibrin, fibronectin and vitronectin, which promote osteoconduction through their action on cell adhesion, in addition to the action of TGFβ and PDGF (Platelet-Derived Growth Factor) in stimulating osteoclasts, improving the quality of the results obtained in bone grafts.[1,5]

The literature has shown that the fibrin matrix is an excellent support for transplanted mesenchymal stem cells with the aim of regenerating bone defects, since bone marrow mesenchymal stem cells contribute to the regeneration of all types of bone cells and many other types of fabrics.

The clinical experience of Choukroun (2006) [6] confirms that the PRF can be considered as a healing biomaterial, having all the necessary parameters to allow an ideal cure and to accelerate the physiological healing process.[10]

Conducting L-PRF Therapy in the Area of Dental Surgery

L-PRF applicability in outpatient surgeries such as 3rd molar extraction included / impacted, maxillary sinus lifting and implant dentistry.

L-PRF applicability in hospital surgeries, such as maxillomandibular reconstructions with autogenous grafts (iliac crest / hubcap), trauma surgery (fractures and gunshot wounds) in order to promote covering of the surgical area, for better tissue healing process, decreasing infection rates of surgical wounds and optimizing osteogenic induction factors.

Discussion

Clinicians want materials that offer simplicity and predictability for a wide variety of defects, minimizing the potential for risk of complications. Currently, studies have focused on the clinical use of L-PRF, a material rich in autologous platelets and growth factors, which provides an osteoconductive framework and stimulates the patient's own cells towards a regenerative response.

L-PRF is basically a concentrate of growth factors and other agents that promote wound healing and tissue regeneration. It is used in several dental disciplines to repair different types of injuries and regenerate dental and oral tissues.[11]

Khiste and Tari (2013) [12] listed the oral clinical applications of PRF in maxillary sinus elevation in combination with bone grafts, in order to accelerate healing, protection and stabilization of graft materials in crest augmentation procedures, alveolar preservation after extraction or avulsion, covering the roots of one or more teeth with recession, treatment of bone defect of three walls and filling the cystic cavity.

The systematic use of PRF during breast lift, with or without bone substitute, seems to be a very interesting and beneficial option, especially for the mechanical and biological protection of the sinus membrane, and can replace the commonly used collagen membranes. In addition, its use in the sinus membrane can potentially improve membrane healing, induce stimulation of the periosteum and stabilize a new bone volume at the implant tip.[8,13]

In periodontics, the PRF membrane has been used to

treat gingival recessions, intraosseous defects and periapical injuries. Some studies point to the use of PRF gel and PRF membrane in combination with a bone graft for the treatment of a tooth with a combined periodontal endodontic lesion.[1,6] The use of PRF aiming at covering the root may decrease the need to acquire tissue local conjunctive that leaves the donation site with morbidity. The free gingival graft is one of the most used techniques when it is intended to increase the dimensions of the keratinized tissues, however they leave donor sites to heal by the second intention, which requires a longer recovery time (from two to four weeks), being more uncomfortable for the patient.[14]

In the case of complete maxillary cystic ablation, where the cavity quickly fills with blood, a blood clot, a physiological version of L-PRF, is formed acting as a trap for circulating stem cells, resulting in a physiological healing time of six months to one year. However, when filling the cavity with L-PRF, the physiological phenomenon of healing is accelerated, since the fibrin matrix of the PRF, being better organized, is able to make more effective use of stem cells, reducing the healing time for two months only.[6]

In studies by Agrawal (2014)[11], L-PRF has been presented as a filling material for the extraction cavities, which acts as a stable blood clot for neovascularization and accelerated tissue regeneration. Thanks to the initial neovascularization, stem cells are taken to the wound site and are trapped by the fibrin mesh, becoming a secretory phenotype that induces vascular and tissue restoration, which is important for bone neoformation. Maintaining bone volume at post-avulsion or extraction sites is a dilemma, as the volume loss that occurs hinders aesthetics and implantation.[6] The L-PRF can also be used as a membrane for guided bone regeneration, where the strong and elastic three-dimensional architecture acts as a suturable mesh that will cover and stabilize the grafted material, protecting the material and the wound itself, allowing the approach of the gingival edges and, consequently, favoring their re-epithelialization. Thus, the acceleration of the healing process makes the surgical site less sensitive to aggressions, reducing postoperative sensitivity and acting in favor of aesthetics.[15,16,17]

Final Considerations

Fibrin-rich plasma is a material that is easy to make, requires only the patient's blood, thus nullifies the chances of contamination and reduces the risk of infection. Its aspects of hemostasis and support of the immune system contribute to its satisfactory result. L-PRF has wide applicability, from dentistry to medicine, with excellent results in short and medium terms. Several studies have shown the safety in its use for maxillofacial applications.

It is extremely important to adopt the guided tissue regeneration technique, and greater predictability in the surgical results performed on patients treated at the outpatient and hospital levels, improving clinical and surgical conditions that are provided to populations that seek and need oral maxillofacial surgical care, as based on the current literature regarding the benefits of L-PRF.

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