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USE OF PLATELET-RICH PLASMA FOR DERMATOLOGICAL WOUND HEALING: A LITERATURE REVIEW

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Abstract: This article discusses the use of platelet-rich plasma (PRP) as a promising tool in dermatology to accelerate the healing of skin wounds. PRP is a blood derivative that contains high concentrations of platelets and growth factors, which play a crucial role in tissue regeneration. It stimulates angiogenesis, fibroblast proliferation and collagen synthesis, significantly accelerating the healing process. The article also highlights the effectiveness of PRP in chronic wounds, which are often slow to heal, emphasizing its relevance as an innovative treatment in the aesthetic field.
Keywords: Platelet-rich plasma. Wound healing. Chronic wounds.

INTRODUCTION

The term platelet-rich plasma is used generically to describe a suspension of plasma obtained from whole blood, prepared in such a way as to contain higher concentrations of platelets than those normally found in circulating blood (Monteiro, 2013).

PRP is a product derived from the laboratory processing of autogenous blood, rich in growth factors originating from alpha-platelet granules. It is an organic, non-toxic and non-immunoreactive product that has been used to accelerate wound repair, based on the various growth factors that stimulate angiogenesis, promoting vascular growth and fibroblast proliferation, which in turn leads to an increase in collagen synthesis, enabling faster healing (Vendramin *et al*., 2006; Melo *et al*., 2021).

The properties of platelets make PRP a product with great potential for improving the integration of grafts, be they bone, skin, cartilage or fat. These properties can be used to improve the treatment of lower limb wounds, which tend to heal more slowly and have a higher incidence of local flap complications than other parts of the body (Vendramin *et al*., 2006).

METHODOLOGY

For this review, searches were carried out in the electronic databases PubMed, SciELO and Google Scholar. For the search, the terms used were: skin wounds, platelet-rich plasma, PRP applied to dermatology, exploratory reading of books, dissertations, articles and theses was carried out. Works published between 2004 and 2024 were included (except for laws, resolutions, ordinances and decrees), in English, Spanish and Portuguese.

For inclusion purposes, we selected studies dealing specifically with platelet-rich plasma applied to dermatology published within a 20-year period, with the exception of laws, ordinances and decrees, which are older. The following criteria were used for exclusion: I) papers published in languages other than those selected for the review, II) repeated content and III) publication outside the stipulated period. The criteria were applied in the following order: a) investigative reading, b) eliminatory reading and c) determination of the papers with a theme suitable for the research. With the investigative search, around 20 files were found, of which 12 were analyzed in full and eight were selected for this review.

RESULTS AND DISCUSSION

It is important to mention how skin wounds heal. The process is based on a series of cellular, molecular and biochemical events that work together to regenerate tissue. As soon as tissue damage occurs, blood elements come into contact with collagen, inducing platelet degranulation and activating the coagulation cascade. In this way, vasoactive and chemotactic mediators are released, leading to the healing process and attracting inflammatory cells to the wound site (Campos *et al*., 2011).

According to surgeon and biologist Alexis Carrel, the healing process takes place in a sequence of three elements: the inflammatory

phase, the proliferation or granulation phase and the remodeling or maturation phase (Campos *et al*., 2011). These events are mediated and modulated by cytokines and growth factors, which stimulate and modulate these cellular activities. Platelet-rich plasma (PRP) has been shown to be effective for treating wounds, as it secretes various growth factors related to skin regeneration (Pinto; Pizani, 2013).

Chronic wounds are distinguished by the fact that they do not follow the dynamic and physiological process of healing, resulting in a multi-sequential mismatch, which disrupts the recovery of anatomical and functional integrity within the normal timeframe of six weeks (Laureano; Rodrigues, 2011).

It is known that platelet-rich plasma contains different concentrations of white and red cells and that this can have an impact on the outcome of the proposed treatment. Protocols differ in the number, time and speed of centrifugation to which the whole blood is subjected. The volume of the initial blood sample and the types of collection tubes and anticoagulants used are also different for each method (Monteiro, 2013).

Platelet concentrates are considered PRP if they are an autologous blood product (the patient's own blood). PRP is obtained by collecting blood and centrifuging it to obtain a concentration approximately five times higher than that found in normal blood (Nascimento *et al*., 2024).

Ehrenfest *et al*. (2009) classified the different platelet concentrates into four categories, depending on the fibrin density, leukocyte content and degree of standardization of the procedure: pure platelet-rich plasma (P-PRP), leukocyte-rich plasma and platelets (L-PRP), pure platelet-rich plasma and fibrin-rich (P-PRF) and platelet-rich, leukocyte-rich and fibrin-rich (L-PRF) (Schneider; Silva, 2020).

Platelets are anucleated fragments of megakaryocytes produced in the bone marrow. They have granules inside, the contents of which are made up of various substances that are released at the moment of platelet activation. Among the main substances released are growth factors, cytokines, adhesion molecules, integrins and coagulation proteins. The number of white cells present in PRP has a major influence on the release of growth factors from this product (Monteiro, 2013).

Platelets are the most important component when it comes to modulating tissue healing, due to the platelet's alpha granules, which release numerous growth factors that act by binding to cell receptors located on the cell membrane and transmitting a signal into the cell (Pinto; Pizani, 2013).

They have many biologically active molecules contained in their numerous granules, which are of three types: alpha granules, as mentioned above, dense granules and lysosomes, containing various proteins and bioactive substances. Alpha granules are the most abundant, making up approximately 10% of platelet volume. They contain bioactive molecules such as adhesive proteins (fibrinogen and von Willebrand factor), coagulation factors (V, XI, XIII and prothrombin), fibrinolytic factors (antithrombin, plasmin and plasminogen), integrins (α2b, α6, β3), platelet endothelial cell adhesion molecule (PECAM) and growth factors: platelet-derived growth factor (PDGF), transforming growth factor beta 1 (TGF- β1), vascular endothelial growth factor (VEGF), basic fibroblast growth factor (bFGF), hepatocyte growth factor (HGF) and epidermal growth factor. (Schneider; Silva, 2020).

These bioactive substances help initiate and accelerate tissue repair and regeneration. They can suppress the release of cytokines and limit

inflammation, interacting with macrophages to improve healing. Platelet activation can occur by endogenous or exogenous molecules (Schneider; Silva, 2020).

TGF activates fibroblasts to form protocolagen, which results in collagen deposition and wound healing. PDGF, associated or not with TGF, increases tissue vascularization, promotes fibroblast proliferation, increases the amount of collagen, stimulates granulation tissue production and improves osteogenesis. VEGF stimulates angiogenesis, mitogenesis and vascular permeability and EGF induces the growth of epithelial tissue, also promoting angiogenesis. These substances make healing faster and more efficient, favoring the integration of grafts, be they bone, skin, cartilage or fat cells (Vendramin *et al*., 2006).

Platelet-derived growth factor (PDGF) is the main factor contained in platelets, as it is the first to be present in the wound and guides revascularization. Collagen synthesis and tissue repair are produced in megakaryocytes and stored in the alpha granules of platelets (Pinto; Pizani, 2013).

Plasma is the yellow liquid component of blood in which cells are suspended. Plasma is also an active part of PRP. Its composition includes proteins, electrolytes such as calcium and chloride, hormones and other substances that participate in PRP's mechanism of action, such as signaling molecules and platelet activation (Schneider; Silva, 2020).

Leukocytes can be classified into five major groups: neutrophils, eosinophils, basophils, lymphocytes and monocytes (or macrophages). Neutrophils and macrophages are phagocytic cells and are essential to the healing process. After hemostasis and coagulation, neutrophils and macrophages migrate to the wound. The work of neutrophils is crucial in the first few days after injury, as their ability to phagocytose and secrete protease eliminates local bacteria and helps to degrade necrotic tissue (Schneider; Silva, 2020).

Once applied to the wound, platelet-rich plasma stimulates the growth of new blood vessels, helps maintain the extracellular matrix and promotes the multiplication and migration of the cells responsible for healing (Nascimento *et al*., 2024).

FINAL CONSIDERATIONS

This article highlights the importance of platelet-rich plasma (PRP) as a promising treatment in the field of dermatology, especially for accelerating the healing of skin wounds. Throughout this review, we have observed that PRP, with its high concentration of platelets and growth factors, is effective in promoting tissue regeneration.

PRP's ability to stimulate angiogenesis, proliferate fibroblasts and increase collagen synthesis has been demonstrated, which contributes significantly to accelerating the healing process.

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