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OBM Transplantation

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Case Report

Use of Plasma-Rich in Growth Factors (PRGF) in the Treatment of Acne

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Academic Editor: Khan Sharun

Special Issue: Prospects of Platelet Rich Plasma in Regenerative Medicine

OBM Transplantation
2024, volume 8, issue 4
doi:10.21926/obm.transplant.2404225

Received: April 26, 2024
Accepted: September 26, 2024
Published: October 03, 2024

Abstract

Acne is a chronic inflammatory condition affecting the pilosebaceous units of the skin, characterized by the formation of papules, cysts, comedones, pustules, nodules, and scars. These lesions are typically located on the face and shoulders, although they can extend to the trunk, arms, and legs. In regenerative medicine, biomolecules are fundamental to tissue regeneration. The use of growth factors from autologous platelet-rich plasma emerges as a promising alternative in the treatment of acne and scars. This study aimed to describe the case of a patient with moderate papulopustular acne treated with autologous plasma-rich growth factors (PRGF). The patient received three applications of the treatment at one-month intervals, improving the appearance of scars and active acne lesions. Proteins released from platelets help regulate inflammation, inhibit bacterial growth (*Cutibacterium acnes*), and restore collagen. PRGF is emerging as a therapeutic alternative in dermatology and aesthetic medicine.

Keywords
Platelet-rich plasma; acne; growth factors

1. Introduction

Acne is a chronic inflammatory disease. The initial phase in the pathogenesis of acne is follicular plugging, expressed as commonly produced by abnormal desquamation of the keratinocytes in the follicular ostium (follicular dyskeratosis). In the next phase, this obstruction contributes to the proliferation of anaerobic bacteria such as *Cutibacterium acnes*, which is part of the normal microbiota of the skin. This low-growing non-spurulent gram-positive bacillus can trigger inflammation and the formation of comedones by decomposing sebum and releasing by-products that irritate the skin [1]. The presence of this bacterium reinforces the production of inflammatory cytokines, metalloproteinases, and the development of comedones [2].

In addition, adrenarche, which marks the beginning of puberty between 7 and 8 years of age, is responsible for an increase in sebum production. In this phase, androgens will be responsible for maintaining this situation and additionally producing an increase in the size of the sebaceous gland, a large amount of free fatty acids are produced, which, together with keratin, will contribute to the inflammatory process. The clinical expression of the disease is polymorphic with papules, pustules, nodules, and cysts. Acne is an inflammatory process on the face, neck, upper arms, chest, and back [3].

The pathophysiology of scars caused by acne is also associated with the loss or overproduction of collagen because there is an imbalance in the reorganization phase of the tissue architecture, in which fibroblasts and keratinocytes produce enzymes such as metalloproteinases, which are responsible for remodeling damaged tissue [4].

Alterations in the stages of wound healing can induce the formation of scars. These can remain throughout life and are often related to problems ranging from functional and aesthetic to psychological and social, affecting quality of life of a person who suffers from them [5].

There are a variety of treatments that adapt to the multifactorial origin of acne. Systemic treatments include a combination of oral antibiotics and hormonal therapies with anti-androgenic effects, such as cyproterone or spironolactone [6], which are effective for treating inflammation and sebum production. However, the widespread use of systemic antibiotics has induced bacterial resistance, until now, the Food and Drug Administration (FDA) has not approved the dermatological use of spironolactone. Other systemic therapies include vitamin A derivatives such as isotretinoin and tretinoin, which reduce the size of the sebaceous glands but have side effects such as itching and dry skin [5].

Topical treatments include benzoyl peroxide alone or in combination with adapalene, a retinoid analog with a comedolytic and anti-inflammatory action that reduces scarring. Therapies such as hyaluronic acid, laser therapy, and chemical peels are also used in treating acne and scars [7].

In emerging therapies, the line of biological and probiotic products are used to modulate the skin microbiome and inflammatory responses. The natural products line includes curcumin and berberine [8].

From a historical perspective, in the 1980s, platelet-rich plasma (PRP) in regenerative medicine with various medical applications began to be studied. Active platelets release bioactive molecules from their alpha granules, which induce various biological responses in hemostasis and tissue regeneration. PRP is a fraction of blood subjected to centrifugation to concentrate platelets (above the basal concentration of 150,000-350,000 pl/uL). Among the biomolecules released by platelets, we find growth factors such as transforming growth factor beta (TGF-β), fibroblast growth factor (b-FGF), subtypes of platelet-derived growth factor (PDGF-AA, PDGF-AB, PDGF-BB), insulin-like growth factor type 1 (IGF-1), epidermal growth factor (EGF) and liver growth factor (HGF) [9].

PRP has antibacterial activity since it expresses and stores proteins called platelet microbicidal proteins (PMP), enhancing antibiotic-induced killing of *S. aureus* and increasing the post-antibiotic effect duration in *S. aureus* [10].

PRP also contains proteins that act at the level of cell adhesion (fibrin, fibronectin, and vitronectin), which provide the necessary structural support for cell migration, proliferation, and three-dimensional growth of the tissues on which they act. It shows direct effects on target cells through growth factors and extracellular matrix production to stimulate tissue repair [11].

PRP is an autologous product, eliminating the possibility of treatment rejection, the need for a donor, or any transmissible infection. However, there are some contraindications, such as cancer, chemotherapy, platelet dysfunction syndrome, critical thrombocytopenia, and the use of anticoagulants. Side effects of this treatment include pain during application, bruising, and skin dyschromia, which usually disappears after application [12].

This study aimed to describe the case of a patient with nodulocystic acne and acne scars grades 1 and 2 treated with autologous plasma rich in growth factors and to determine the effectiveness of the treatment.

2. Materials and Methods

The patient is an 18-year-old woman with acne classified as moderate papulopustular. At the start of the treatment, she had grade 1 erythematous scars on her face and neck and grade 2 atrophic scars on her face, according to the Goodman and Baron scale. Additionally, she had papules, pustules, and inflammatory cysts for four years. The patient had not received other treatments before or during the PRGF application and lives in the city of Bogotá (average temperature 14°C with cold and dry weather during most of the year), where she is attending university without changes in her place of residence in the three months before the start of therapy.

2.1 Preparation of PRP

The patient's blood was collected in a hospital environment (Medical Research Center, Clínica Universidad de La Sabana) according to the protocol previously standardized by the researchers: 49.5 ml of blood were taken from the cephalic vein in sterile tubes containing 0.5 ml of citrate. sodium (Vacutainer® Ref 369714; BD Biosciences) [13].

One of the tubes was reserved for baseline platelet count (Table 1) in the clinical laboratory of Clínica Universidad de La Sabana. The 11 tubes of blood remained were transferred to a 50 ml Falcon-type tube inside a biological safety cabinet and centrifuged for 10 minutes at 240 g at 20°C using a Thermoscientific Sorvall ST16 centrifuge and obtaining 8 ml of platelet-rich plasma [13], 10%

calcium gluconate was added to this platelet concentrate (50 ul for each milliliter of PRP) (Ropsohn Therapeutics) to activate platelets. In this way, the patient received plasma rich in growth factors.

Table 1 Patient's blood count at the time of starting treatment.

HEMATICAL TABLE (HEMOGRAM)	RESULT	RESULT REFERENCE VALUES	UNIT
Leukocytes	5350	4500-11000 x 10^3	mm^3
Polymorphonuclear Neutrophils	56.4	40-70%	%
Lymphocytes	34.2	20-45	%
Monocytes	7.5	2-8	%
Polymorphonuclear Eosinophils	1.3	0-6	%
Polynuclear Basophils	0.6	0-1	%
Hematies (In millions)	4.59	3.9-5.4 x 10^6	mm^3
Hemoglobin	14.2	12-16	g/dL
Hematocrit	42.8	38-47	%
Mean Corpuscular Volume	93.2	82-98	fl
Mean Corpuscular Hemoglobin	30.9	27-31	pg
Mean Corpuscular HB Concentration	33.2	33-37	g/dL
Erythrocyte Distribution Width	12.9	11.5-15.1	%
Platelet Count (In thousands)	248	150-450 x 10^3	mm^3

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2.2 PRGF Application Procedure

The PRGF application was a subdermal mesotherapy. Considering that this processing can cause pain, the patient received topical anesthetic (Roxicaina® 2% lidocaine hydrochloride, Ropsohn, Therapeutics), and its application was done 1 hour before PRGF injection, repeating it approximately every 20 minutes. Then, we perform a gentle cleaning with distilled water.

The patient had a average blood count (Table 1), with a platelet count of 248,000 pl/ul, and after the platelet concentration protocol, we obtained 728,000 pl/ul. Subsequently, we activated the PRP with calcium gluconate. When we had the PRFC, we did multiple subdermal injections on the face and neck, leaving 1 cm gaps and applying approximately 0.25 ml of autologous PRGF in each infusion.

We observed minimal erythema and edema up to three hours after treatment. The patient was asked not to apply makeup, painkillers, or ice on the day of treatment, to use sunscreen, and to

avoid direct exposure to the sun. The patient received three applications of PRGF at one-month intervals.

Before applying for PRP, the patient signed an informed consent form approved by the University of La Sabana Ethics Committee.

3. Results

After the treatment's third application, the papules, pustules, and comedones decreased in appearance and size, going from a moderate to a mild degree. Finding grade O erythematous scars on the face, grade 1 on the neck, and grade 1 atrophic scars on the face. The appearance of the skin and scars improved concerning depth and dimensions; one week after the first application, an improvement in the appearance of the skin was observed. At the end of three months, after the last PRGF application, the skin looked fresher, softer, and uniform both in appearance and on palpation (Figure 1). The patient was satisfied with the results and did not report any adverse effects, only mentioning that the injections from each PRGF application were uncomfortable.

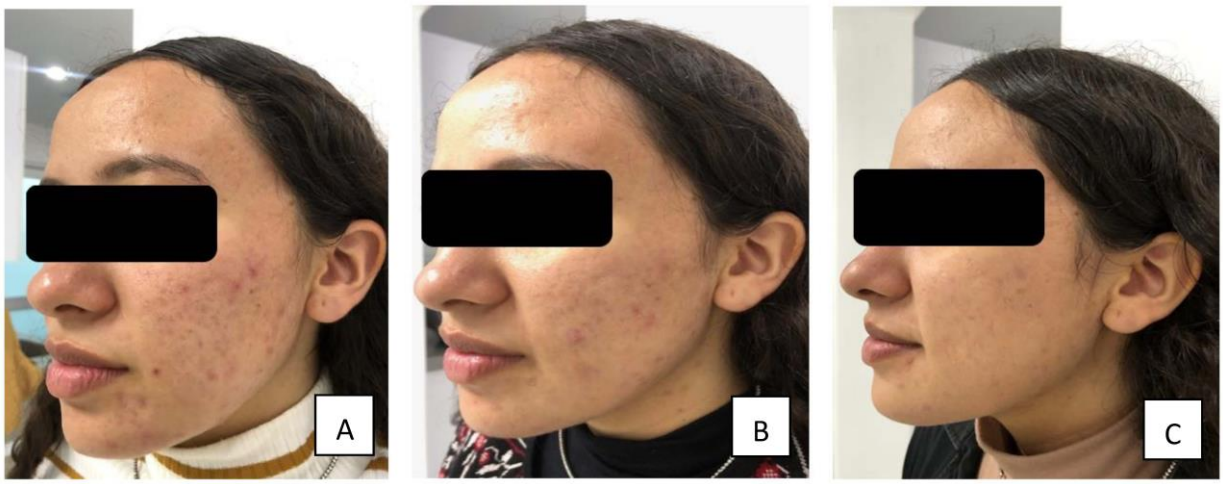

Figure 1 Photographic follow-up of the patient with papulonodular acne before and during PRGF treatment. A. image taken before the first application. B. image obtained one week after the second application. C. Image taken one week after the third application.

4. Discussion

PRGF therapies promote wound healing and tissue regeneration due to the content of multiple growth factors released from platelets, such as VEGF, PDGF, TGF-β, FGF, and EGF. For example, PDGF and FGF attract and proliferate fibroblasts to the injury site. FGF and TGF-β are involved in the synthesis of extracellular matrix proteins, especially collagens, promoting the repair of damaged skin and reducing acne scars [14-17].

TGF-β also acts as a regulator of cell growth and differentiation. At the same time, EGF accelerates re-epithelialization by promoting keratinocyte proliferation and migration, contributing to the rapid healing of active acne lesions [14]. Finally, TGF-β and HGF may help regulate melanogenesis and reduce post-inflammatory hyperpigmentation (PIH) associated with acne [15].

PRGF contains anti-inflammatory molecules like IL-1RA and HGF, which can modulate the immune response, contributing to the resolution of inflammatory acne and preventing post-inflammatory hyperpigmentation and scarring. Additionally, HGF and VEGF promote angiogenesis, contributing to tissue repair [15, 16].

PRGF contains proteins called defensins that activate the immune system and defend the host from microorganisms such as *Cutibacterium acnes*. Platelet microbicidal proteins (PMPs) can inhibit bacterial growth, reducing the risk of infection and inflammation in cutaneous lesions [14]. Additionally, insulin-like growth factor (IGF) present in PRGF may modulate IGF signaling for balanced sebum production [17].

The growth factors and other bioactive molecules present in PRGF are responsible for its multiple mechanisms of action and therapeutic potential. Therefore, obtaining autologous plasma using a standardized and sterile methodology could be a safe and effective alternative for treating skin disorders.

In our case, the patient had not received any therapy since the onset of acne, leading us to believe that using his own PRGF was responsible for the significant decrease in the size and number of bumps and the improvement in the appearance of his scarring skin. This is only one case with positive results in treating papulopustular acne using autologous PRGF; however, controlled studies are necessary to further evaluate the efficacy and safety of PRGF in managing acne and acne scars.

5. Conclusion

The treatment of papulopustular acne includes topical and oral treatments with antimicrobials, anti-inflammatories, and hormonal regulators, which present adverse effects such as erythema, desquamation, sun sensitivity, skin dryness, increased antibiotic resistance, chemical gastritis, pseudomembranous colitis, and hormonal alterations. On the other hand, treatment with PRGF is an autologous and minimally invasive therapy without risks of infections and with minimal discomfort during its application.

This patient had not received any previous conventional treatment, and the application of PRGF showed decreased acute inflammation and cutaneous erythema and reduced scarring without adverse effects.

PRGF benefits acne and acne scars through wound healing promotion, anti-inflammatory action, collagen synthesis stimulation, sebum regulation, antimicrobial effects, skin rejuvenation, and pigmentation reduction. These mechanisms are mediated by the growth factors and bioactive molecules present in PRGF, making it a promising therapeutic alternative in dermatology and aesthetic medicine.

Author Contributions

The authors confirm their contribution to the paper as follows: Elga J. Vargas: Study conception and design; data collection, patient follow-up, analysis and interpretation of results, draft manuscript preparation. Julio C. Martinez: Study conception and design, data collection, patient follow-up, analysis and interpretation of results, draft manuscript preparation. Lina A. Gómez: Study conception and design, data collection, patient follow-up, application of treatment to the patient, analysis, and interpretation of results, draft manuscript preparation. All authors reviewed the results and approved the final version of the manuscript.

Funding

The authors thank the Universidad de La Sabana for the financial support through project number MED-247-2018.

Competing Interests

The authors have no conflicts of interest.

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