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A Novel Regenerative Approach for Acne Vulgaris Using Combined Umbilical Cord Mesenchymal Stem Cell-Derived Secretome and Platelet-Rich Plasma: A Case Report

Salsabillah Zamzam[1]*, Novi Kusumaningrum[2], Salindri Prawitasari[3], Dini Cahyani[3], Resanti Adityani[4]

*Correspondence:
salsabilazamzam@gmail.com

[1]Graduate Student of Biomedical Sciences, Faculty of Medicine, Universitas Sebelas Maret (UNS), Surakarta, 57126, Indonesia
[2]Departement of Dermatology and Venereology, Faculty of Medicine, Universitas Diponegoro, Semarang, 50275, Indonesia
[3]Lecturer, Biotechnology Undergraduate Program, Institut Karya Mulia Bangsa (IKMB), Semarang, 50223, Indonesia
[4]Student of Biotechnology Undergraduate Program, Institut Karya Mulia Bangsa (IKMB), Semarang, 50223, Indonesia

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ABSTRACT

Background: Acne vulgaris is a chronic inflammatory skin disorder that often leads to scarring and pigmentation. Conventional therapies may provide limited improvement and are frequently associated with adverse effects. Recent advances in regenerative medicine suggest that stem cell–derived secretome and platelet-rich plasma (PRP) may promote skin repair and rejuvenation through anti-inflammatory and regenerative pathways. **Case Presentation:** A 21-year-old male presented with persistent inflammatory acne and post-acne hyperpigmentation. The patient underwent two sessions of combined SH-MSCs-derived secretome and PRP therapy at two-week intervals. Facial assessments were performed using the Janus Skin Analyzer at baseline, day 14, and day 28. Quantitative analysis revealed significant improvement in multiple parameters, including reduction of pore size, pigmentation index, and sebum levels, accompanied by enhanced skin elasticity. Clinically, the patient exhibited visible improvement in overall skin texture, evenness, and clarity without any adverse reactions. **Results:** Marked clinical improvement was observed after the second session, with visible reduction in acne lesions, fading of post-acne marks, and overall improvement in skin radiance. Quantitative analysis demonstrated a 30% reduction in pore condition, 58% increase in elasticity, 35% decrease in pigmentation index, and 227% reduction in sebum levels compared to baseline. These findings indicate significant enhancement in skin texture, tone, and elasticity. **Conclusion:** Combination therapy using SH-MSCs-derived secretome and PRP demonstrated promising regenerative and aesthetic outcomes in this patient with acne vulgaris. Larger-scale clinical studies are warranted to validate efficacy and optimize treatment protocols.

Keywords: Acne vulgaris; Mesenchymal stem cell–derived secretome; Platelet-rich plasma (PRP); Regenerative therapy; Skin rejuvenation; Hyperpigmentation; Skin elasticity; Anti-inflammatory treatment.

INTRODUCTION

Acne vulgaris is a chronic inflammatory disorder of the pilosebaceous unit that affects individuals worldwide[1–3]. It is estimated to impact approximately 9.4% of the global population, ranking as the eighth most prevalent skin disease. Acne commonly affects about 85% of adolescents and may persist into adulthood[4]. Clinically, acne lesions are classified as non-inflammatory (open and closed comedones) or inflammatory (papules, pustules, nodules, and cysts), which may result in

scarring and post-inflammatory hyperpigmentation, often requiring long-term treatment.

The etiology of acne vulgaris is multifactorial, involving genetic, environmental, hormonal, psychological, bacterial, and cosmetic factors[5]. Pathophysiologically, chronic acne results from increased sebum secretion, endocrine factors such as androgens, abnormal follicular keratinization, bacterial proliferation, and inflammation. Elevated sebum production within hair follicles contributes significantly to acne development. Hormones such as testosterone and Insulin Growth Hormone-1 (IGH-1) stimulate sebum synthesis and secretion[6]. *Propionibacterium acnes* (currently *Cutibacterium acnes*) plays a pivotal role in the inflammatory process by inducing chemotactic factors that attract lymphocytes, neutrophils, and macrophages. This immune response causes follicular wall rupture and releases microbial components, fatty acids, and lipids into the dermis, leading to inflammatory lesions such as pustules, nodules, and cysts. In contrast, non-inflammatory lesions are smaller and contain minimal pus[7,8].

Conventional acne treatments include topical, systemic, or oral medications such as anti-inflammatory and antibacterial agents. Physical modalities, including optical therapy, cryotherapy, comedone extraction, cryoslush therapy, and intralesional corticosteroid injections, are also used. However, combination therapy, typically integrating topical and systemic agents, has been shown to be more effective in addressing acne pathogenesis[9,10].

Mesenchymal stem cells (MSCs) exhibit regenerative and anti-inflammatory properties that have demonstrated potential in reducing atrophic and hypertrophic acne scars[11]. Among MSC-derived products, secretome contains a complex mixture of growth factors, cytokines, chemokines, and exosomes that promote angiogenesis, cellular proliferation, and migration of endothelial cells, keratinocytes, and fibroblasts, key processes in skin repair and re-epithelialization[12,13]. Likewise, platelet-rich plasma (PRP), an autologous platelet concentrate, is enriched with multiple growth factors such as PDGF, TGF-β, FGF, VEGF, and HGF[14]. These bioactive molecules regulate various cellular activities, including chemotaxis, angiogenesis, mitogenesis, differentiation, and metabolism, thereby facilitating tissue regeneration[15]. Given these complementary biological functions, this study aims to evaluate the effectiveness of secretome therapy, in combination with PRP, for the treatment of acne vulgaris.

CASE PRESENTATION

Patient

A 21-year-old male diagnosed with acne vulgaris presented with multiple inflammatory lesions on the face. The patient had no family history of acne-prone skin and had never undergone dermatologic treatments such as chemical peeling or topical acne therapy. Baseline skin analysis was performed using Janus Skin Analyzer, which revealed the following scores: pore size 20, elasticity 26, pigmentation 17, and sebum −93.

SH-MSCs and Platelet Rich Plasma Preparation

The secretome derived from hypoxia-induced mesenchymal stem cells (SH-MSCs) was obtained from the conditioned medium (CM) of umbilical cord-derived MSCs at passage 5. The CM was collected after hypoxic culture and centrifuged at 13,000 × g for 10 minutes at 4°C to remove cellular debris. The supernatant was then processed using a tangential flow filtration (TFF) system

(Formulatrix, MA, USA), following the methodology described in our previous study. Fractionation was performed with molecular weight cut-off (MWCO) filter cassettes ranging from 10–100 kDa**,** effectively enriching bioactive molecules in the SH-MSC fraction. The purified SH-MSCs were stored at −20°C until further use for subsequent experimental applications.

Whole blood samples were collected into tubes containing acid citrate dextrose (ACD) as an anticoagulant. The blood was processed through a two-step centrifugation protocol to obtain platelet-rich plasma (PRP). In the first centrifugation step, samples were spun at 300 × g for 10 minutes**,** allowing the separation of plasma and platelets from red and white blood cells. The resulting plasma layer, containing suspended platelets and part of the buffy coat, was carefully transferred to a new sterile tube and subjected to a second centrifugation at 800 × g for 10 minutes. This step separated the plasma into two fractions: platelet-poor plasma (PPP) in the upper layer and platelet-rich plasma (PRP) concentrated at the bottom. The PRP fraction was then collected and activated by the addition of calcium chloride ($CaCl_2$) before use in subsequent procedures.

Treatment Protocol

Prior to the main procedure, the patient underwent a preparatory facial treatment consisting of facial cleansing, comedone extraction, and an anti-acne mask. A topical anesthetic cream containing lidocaine was applied for 30 minutes to ensure comfort during the injection procedure. The therapeutic procedure involved intradermal injection of a combination of SH-MSCs and PRP (1:1) using an aqua injector device. Injection parameters were set at a depth of 1.0 mm**,** viscosity level 3**,** vacuum pressure 5, and dose of 10 µL per injection**,** with a total of 230 injection points distributed evenly across the entire facial surface.

Following the procedure, the patient was provided with a topical SH-MSCs–containing serum for home application to support healing and minimize downtime. Additionally, a daily skincare regimen containing salicylic acid and secretome was prescribed to enhance skin renewal and maintain post-treatment results. No adverse reactions were reported during or after the treatment. A follow-up evaluation was conducted two weeks post-procedure, during which the patient demonstrated noticeable clinical improvement. The same protocol was subsequently repeated during the second session using identical parameters.

RESULTS

Baseline facial assessment revealed dull skin tone with multiple active acne lesions on the forehead and bilateral temples, accompanied by post-acne scars on both cheeks (Figure 1a–d). Janus Skin Analyzer imaging confirmed the presence of inflammatory papules and pustules, along with hyperpigmented post-acne macules, predominantly on the forehead and left cheek (red arrows, Figure 2a). Following the initial intradermal administration of SH-MSCs (1.5 cc) combined with PRP (1:1) and daily skincare regimen containing salicylic acid and secretome, a visible reduction in inflammatory lesions was observed, characterized by lesion flattening and crust formation (Figure 1e–h). Subsequent imaging performed 14 days after the first treatment demonstrated progressive clinical improvement (Figure 2b), including enhanced skin brightness, resolution of forehead acne, and decreased pigmentation on the left cheek (blue arrows).

At day 28, further amelioration was evident, with reduced lesion count, improved skin texture, and attenuation of post-acne hyperpigmentation (Figure 1i–l, 2b). Only a few residual pustules were

observed on the left cheek and right temple, corresponding to sites of prior papular inflammation noted on day 14.

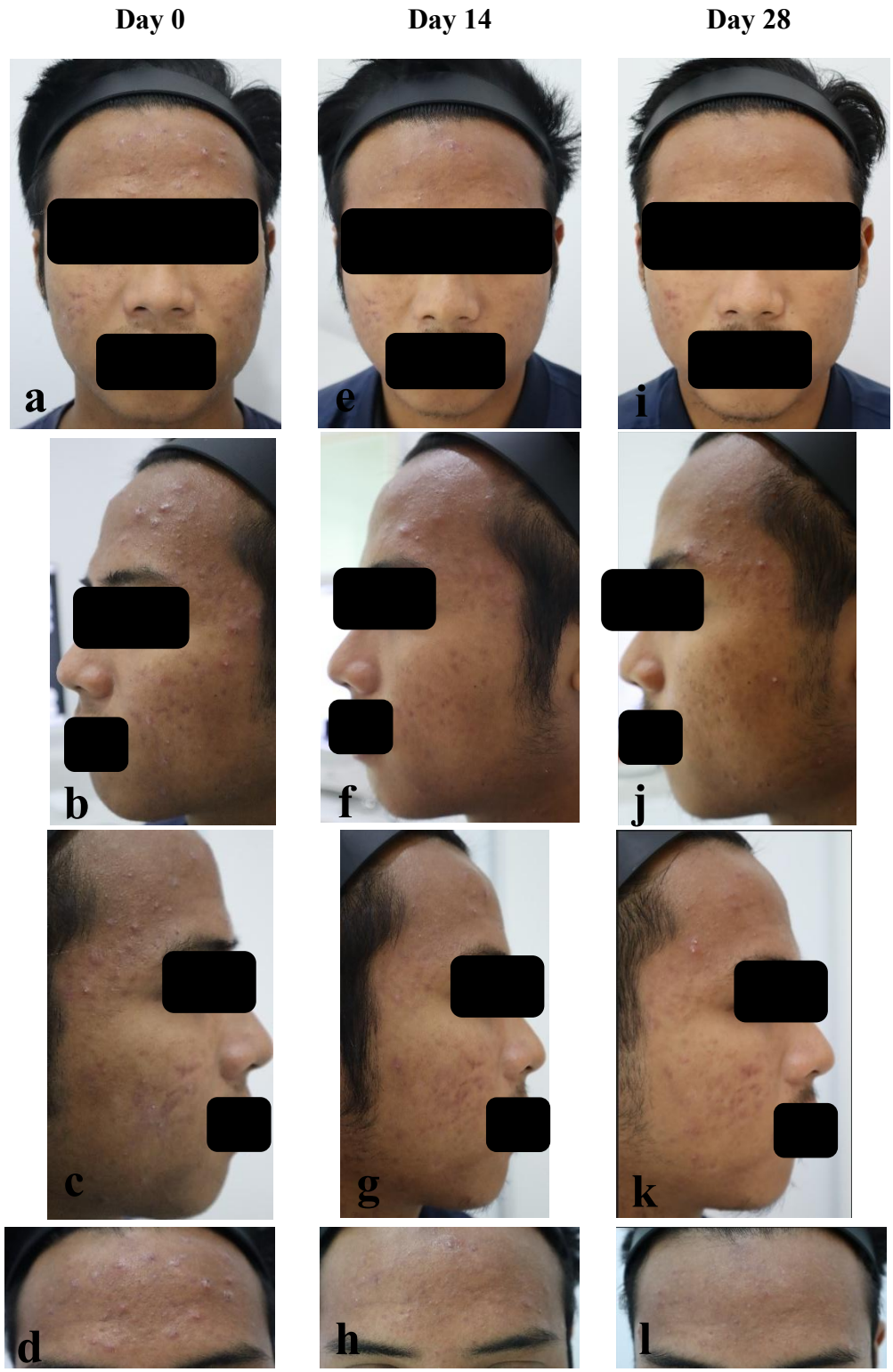

Figure 1. Representative photographs showing the patient's facial condition before (a–d), after the first (e–h), and second (i-l) treatment. (a, e, i) Frontal view; (b, f, j) left profile; (c, g, k) right profile; (d, h, l) forehead area.

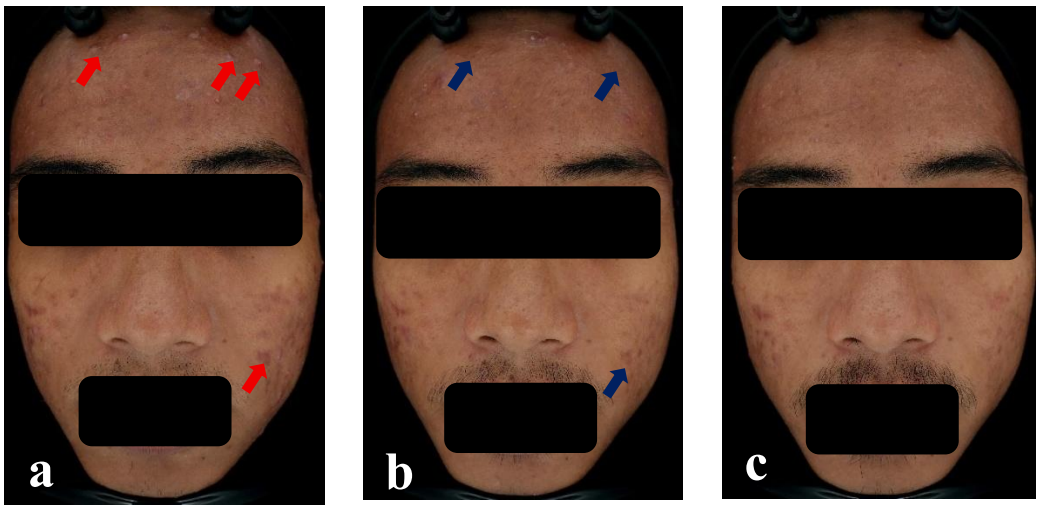

Figure 2. Facial skin condition of the patient before and after treatment, captured using the Janus Skin Analyzer. (a) Baseline condition prior to treatment; (b) two weeks after the initial treatment; and (c) four weeks after the initial treatment.

Quantitative evaluation using the Janus Skin Analyzer (Table 1) demonstrated marked improvements across multiple skin condition parameters following SH-MSCs and PRP combination therapy. Between baseline (day 0) and post-treatment evaluations (days 14 and 28), progressive enhancement was observed in skin pore size, elasticity, pigmentation index, and sebum levels. The most prominent improvement was noted in skin elasticity, which increased by 15 points (58%) after two treatment sessions, suggesting enhanced dermal structural integrity and collagen remodeling. Pore condition also showed notable improvement, decreasing by 6 points (30%), indicating reduced follicular obstruction and refinement of overall skin texture.

Similarly, pigmentation levels decreased by 6 points (35%), reflecting attenuation of post-inflammatory hyperpigmentation and improved skin tone uniformity. Furthermore, sebum production exhibited a remarkable reduction of 211 points (227%) compared to baseline, signifying better sebaceous gland regulation and reduced oiliness, factors closely associated with acne vulgaris severity. These findings collectively suggest that the combined administration of SH-MSCs and PRP exerts a synergistic regenerative effect, promoting restoration of epidermal homeostasis, improved elasticity, and balanced sebum secretion. The observed outcomes support the therapeutic potential of SH-MSCs–PRP combination therapy as an effective modality for enhancing skin quality and accelerating recovery in acne-affected individuals.

Table 1. Facial skin condition analysis assessed using the Janus Analyzer.

Day	Score			
	Pores	**Elasticity**	**Pigmentation**	**Sebum**
0	20	26	17	-93
14	16	15	14	-207
28	14	11	11	-304

DISCUSSION

The clinical observation in this case showed noticeable improvement in the patient's facial condition after two sessions of SH-MSCs and PRP combination therapy and daily skincare regimen containing salicylic acid and secretome. Before treatment, the patient presented with a dull complexion, active acne on the forehead and temples, and post-acne scars on both cheeks. Following the second treatment, the patient's skin appeared brighter, with a marked reduction in active acne and fading of acne scars. These improvements can be attributed to the stimulation of new tissue growth and collagen formation promoted by the bioactive factors contained within the injected secretome.

The SH-MSCs contains various growth factors such as Epidermal Growth Factor (EGF), Transforming Growth Factor-beta (TGF-β), Interleukin-10 (IL-10), and Hepatocyte Growth Factor (HGF), which play important roles in skin regeneration and inflammation control. The bioactive molecules in the secretome; including growth factors, cytokines, and proteins; support tissue regeneration and accelerate wound healing in acne-damaged skin. Specifically, EGF and TGF-β promote keratinocyte and fibroblast proliferation, facilitating tissue repair and reducing acne scars. Meanwhile, IL-10 and HGF act as anti-inflammatory cytokines that help alleviate local inflammation[16].

Post-acne scarring results from extracellular matrix (ECM) disruption, including excessive and irregular collagen production[17,18]. SH-MSCs contributes to ECM remodeling by regulating matrix metalloproteinases (MMPs) and tissue inhibitors of metalloproteinases (TIMPs), restoring balance and enabling regeneration of new skin tissue while reducing scar formation[16,17]. Moreover, the anti-inflammatory and antifibrotic properties of the SH-MSCs promote wound healing and reduce post-inflammatory fibrosis, leading to improved skin texture and appearance[16].

In addition to the effects of the secretome, PRP also plays a crucial role in accelerating tissue repair and wound healing. Platelets release a range of growth factors, such as HGF, TGF, PDGF, FGF, and VEGF, that contribute to cellular chemotaxis, angiogenesis, and metabolic regulation[14,15]. These growth factors promote ECM remodeling, enhance dermal regeneration, and restore skin luminosity by forming new, healthy skin tissue. Furthermore, PRP exerts anti-inflammatory effects by suppressing the NF-κB signaling pathway, a central mediator of inflammation. The anti-inflammatory action of TGF-β inhibits monocyte chemotaxis by blocking TNF-α–induced chemokine transactivation[19], while HGF reduces inflammatory mediator production through modulation of cyclooxygenase enzymes (COX-1 and COX-2) and prostaglandin E2 (PGE2) synthesis[20].

Overall, the combined application of SH-MSCs-derived secretome and PRP demonstrates synergistic regenerative and anti-inflammatory effects that contribute to the restoration of skin homeostasis, reduction of acne lesions, and improvement in post-acne scarring.

CONCLUSION

This case highlights the potential benefits of combining SH-MSCs and PRP in the management of acne vulgaris. The patient showed marked improvement in skin tone, reduction of inflammatory lesions, and fading of post-acne scars after two treatment sessions. The synergistic regenerative and anti-inflammatory effects of SH-MSCs and PRP may enhance tissue repair and collagen remodeling. Further clinical studies are needed to confirm these findings and establish standardized treatment protocols.

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Competing Interests

The authors declare that there is no conflict of interest.

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