

Lyophilized Growth Factors in Dermatology: A Promising Approach for Skin Regeneration and Acne Scar Treatment

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Abstract:

Background: Platelet-rich plasma (PRP) has been increasingly used in regenerative medicine and dermatology because of its ability to provide growth factors that promote tissue repair and regeneration. However, conventional PRP has several limitations, including variability in platelet concentration and donor-dependent quality. Lyophilized growth factors (L-GF) have emerged as a standardized alternative derived from allogenic pathogen-free platelets with controlled platelet counts. The lyophilization process preserves biologically active growth factors while providing improved stability, reproducibility, and practicality for storage and clinical use. L-GF contains several bioactive mediators, including platelet-derived growth factor, transforming growth factor- β , epidermal growth factor, vascular endothelial growth factor, and insulin-like growth factor, which promote cellular migration and proliferation, extracellular matrix synthesis, and angiogenesis. In dermatology, these regenerative properties have supported the application of L-GF in chronic ulcers, skin rejuvenation, acne scarring, burns, and reconstructive procedures. Furthermore, L-GF may be used alone or combined with procedures such as microneedling and fractional laser therapy, where enhanced delivery of growth factors into deeper dermal layers may promote collagen deposition, dermal regeneration, scar remodeling, and improved cosmetic outcomes.

Keywords: Lyophilized growth factors; Platelet-rich plasma; Growth factors; Skin regeneration; Acne scarring; Microneedling; Wound healing; Dermatology.

Introduction:

Acne vulgaris is a chronic inflammatory disorder of the pilosebaceous follicles that affects populations worldwide. It is estimated to impact 9.4% of the global population, ranking eighth among skin diseases, and occurs in more than 85% of adolescents, often persisting into adulthood—particularly in females, who account for two-thirds of dermatology consultations. Clinically, acne lesions are classified as non-inflammatory (open and closed comedones) or inflammatory (papules, pustules, nodules, cysts), which may progress to scarring and pigmentation requiring prolonged therapy (1).

Platelet-rich plasma therapy has gained widespread attention in regenerative medicine and dermatology due to its ability to deliver autologous growth factors that stimulate tissue repair and regeneration. However, conventional PRP is limited by variability in platelet concentration, donor-dependent quality, and potential pathogen transmission. To overcome these challenges, lyophilized growth factors (L-GF) have been developed as a standardized, pathogen-free alternative (2).

Lyophilized growth factors are a refined modification of PRP therapy. Instead of relying on autologous platelets, L-GF utilizes allogenic pathogen-free platelets with a standardized platelet count. These platelets are

processed through lyophilization, a freeze-drying technique that preserves bioactive growth factors while ensuring long-term stability and reproducibility. This approach eliminates donor variability and enhances safety by using pathogen-screened platelet sources (3).

I. Mechanism of action

Allogeneic platelet-derived growth factor injections contain a range of bioactive mediators, including platelet-derived growth factor (PDGF), transforming growth factor- β (TGF- β), epidermal growth factor (EGF), vascular endothelial growth factor (VEGF), and insulin-like growth factor. Together, these factors enhance wound, bone, and tendon repair by stimulating cellular migration, proliferation, differentiation, extracellular matrix synthesis, and angiogenesis (4).

II. Advantages

The use of standardized platelet counts ensures reproducible concentrations of these growth factors across different treatments, thereby enhancing consistency in clinical outcomes. Moreover, the reliance on allogenic pathogen-free platelet sources improves safety by minimizing the risk of contamination and reducing immune reactions compared with autologous preparations. Importantly, the lyophilization process confers long-term stability, allowing storage and transport without significant loss of bioactivity, which makes this approach more practical and reliable for widespread clinical application (5).

III. Dermatological applications

- Chronic ulcers: L-GF foams have been successfully used in the management of diabetic foot ulcers and pressure sores. They accelerate healing by stimulating angiogenesis, fibroblast proliferation, and extracellular matrix synthesis (6).
- Skin rejuvenation and acne scarring: By enhancing collagen deposition and neovascularization, L-GF improves dermal texture and scar remodeling. (7).
- Burns and reconstructive surgery: L-GF supports epithelialization and reduces healing time in complex wounds (8).

For instance, human recombinant epidermal growth factor (rhEGF) has also shown clinical benefit in the management of pressure sores, second-degree burns, and chronic, non-healing traumatic wounds, as evidenced by small case series and limited clinical trials, including direct clinical experiences (Figure 1) (9).

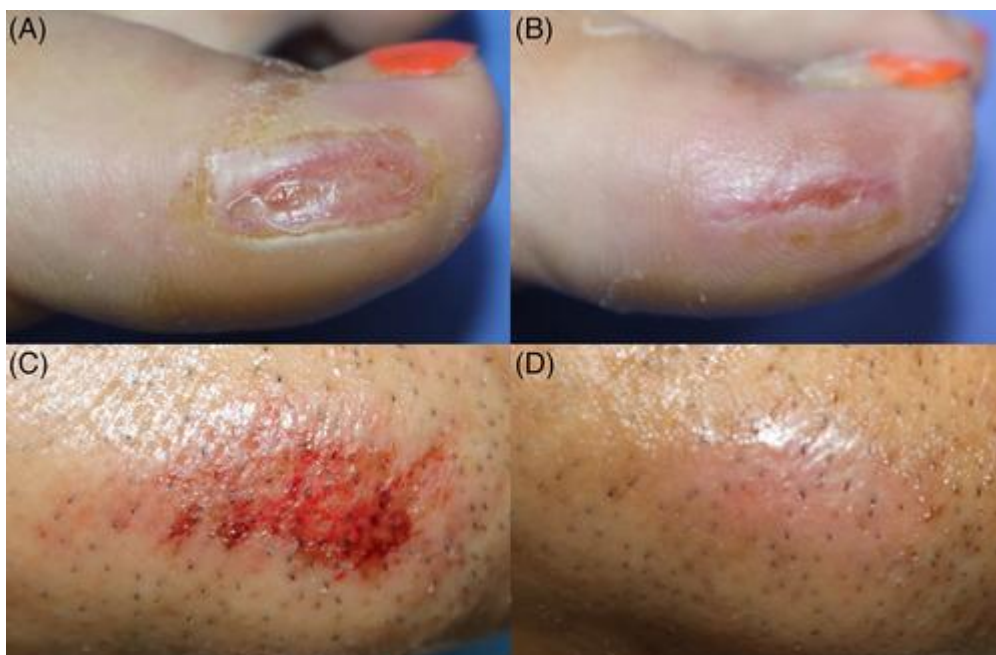


Figure (1): (A) Clinical photographs of a chronic and recalcitrant traumatic wound in a 35-year-old female before, and (B) after two weeks of treatment with rhEGF ointment. (C) Clinical photographs of a traumatic abrasion wound in a 62-year-old male before, and (D) after three days of treatment with rhEGF ointment (9).

Clinical applications have demonstrated that L-GF can be used as a standalone therapy or as an adjunct to established dermatological procedures. When administered alone, L-GF injections stimulate scar remodeling and improve cosmetic outcomes by accelerating collagen deposition and dermal regeneration. In combination with microneedling, L-GF enhances the penetration of growth factors into deeper dermal layers, synergistically promoting tissue repair. Similarly, pairing L-GF with fractional laser therapy augments the regenerative response by combining controlled dermal injury with growth factor-mediated healing. When used alongside dermal fillers, L-GF not only improves scar volume correction but also supports long-term remodeling by stimulating endogenous tissue repair mechanisms. (10).

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