

Research Article

Combination of Pulsed Wave Radiofrequency (RF) Microneedling and a Glutathione-Based Mesotherapy Solution for the Treatment of Hyperpigmentation in Darker Skin Types: A Case Study

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Abstract

Background: Treating hyperpigmentation in patients with Fitzpatrick skin type V - VI presents significant challenges due to high melanin content and the risk of Post-Inflammatory Hyperpigmentation (PIH). Traditional energy-based treatments often carry increased risk in darker skin tones. Dual-wave Radiofrequency (RF) microneedling, particularly in pulsed mode, offers a safer alternative for pigment correction with minimal epidermal damage. Mesotherapy solutions containing antioxidants and bioactive compounds may enhance treatment efficacy.

Objective: To evaluate the safety and efficacy of combining pulsed wave RF microneedling (Sylfirm X) with a glutathione-based mesotherapy solution (Pink Glow, Koru Pharma) for hyperpigmentation in a patient with Fitzpatrick type VI.

Methods: A 48-year-old female with diffuse facial hyperpigmentation underwent three sessions of pulsed wave RF microneedling (Sylfirm X, PW2 mode, 0.3 mm depth) spaced 3 weeks apart. Pink Glow, containing glutathione, hyaluronic acid, peptides, amino acids, vitamins, coenzymes, and minerals, was applied topically after each session to enhance absorption via microchannels. Skin analysis with the Quantificare LifeViz Mini 3D system assessed melanin index, evenness, and skin tone uniformity. Global improvement was evaluated using Investigator and Patient Global Assessments (IGA/PGA).

Results: After three sessions, the melanin index decreased by ~31%, skin evenness improved by 67%, and tone uniformity increased by 58 percentage points. IGA and PGA scores improved from 4 to 2, indicating approximately 50% reduction in hyperpigmentation. No adverse effects, PIH, or irritation were observed.

Conclusion: The combination of pulsed wave RF microneedling and a glutathione-based mesotherapy solution demonstrated a moderate-to-marked improvement in hyperpigmentation with excellent tolerability in a Fitzpatrick VI patient. This minimally invasive protocol appears promising for darker skin types, though larger, controlled studies are required to validate these findings.

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Keywords: Post-Inflammatory Hyperpigmentation; Dual-wave Radiofrequency; Skin Types

Introduction

Hyperpigmentation is a common dermatologic concern, particularly in individuals with Fitzpatrick skin type V and VI, due to the high melanin content and increased reactivity of melanocytes [1]. Post-inflammatory hyperpigmentation (PIH), melasma, and other pigmentary disorders are more difficult to treat in darker skin because many conventional energy-based devices, including lasers and Intense Pulsed Light (IPL), carry a risk of pigment worsening or scarring if not carefully selected and parameterized [2,3].

Radiofrequency (RF) microneedling combines controlled mechanical injury from microneedles with RF thermal stimulation of the dermis, encouraging neocollagenesis and improving skin texture while minimizing epidermal disruption [4]. Devices such

as Sylfirm X use dual-wave RF modes: Continuous Wave (CW) mode induces uniform dermal heating and is primarily used for collagen remodeling and tightening, whereas Pulsed Wave (PW) mode selectively targets abnormal vasculature and pigmentation with lower epidermal energy, reducing the risk of PIH [5,6]. These characteristics make pulsed wave RF microneedling particularly suitable for skin of color, offering precision with minimal downtime.

Mesotherapy is a minimally invasive technique for delivering active ingredients directly into the dermis. Pink Glow (Koru Pharma) is a glutathione-based mesotherapy solution designed for skin brightening and rejuvenation. It contains glutathione, hyaluronic acid, peptides, amino acids, vitamins, coenzymes, and minerals. Glutathione is a potent antioxidant that inhibits tyrosinase and reduces oxidative stress in melanocytes [7]. Hyaluronic acid provides intense hydration, enhances skin plumpness, and improves penetration of other active ingredients. Peptides promote dermal repair, stimulate fibroblasts, and support extracellular matrix synthesis [8]. Amino acids serve as building blocks for proteins and assist in skin barrier recovery. Vitamins provide antioxidant activity, enhance cell renewal, and brighten skin tone. Coenzymes and minerals support cellular metabolism, enzymatic reactions, and overall skin health. When combined with RF microneedling, the microchannels created by the needles enhance the transdermal absorption of these agents, ensuring effective delivery to the epidermal-dermal junction the site of melanogenesis. This case study evaluates the clinical outcome of combining pulsed wave RF microneedling with a glutathione-based mesotherapy solution for treating hyperpigmentation in a Fitzpatrick VI patient.

Materials and Methods

Patient and Protocol

A 48-year-old female patient with Fitzpatrick type VI presented with diffuse facial hyperpigmentation. The patient underwent three sessions of pulsed wave RF microneedling at 3-week intervals. A glutathione-based mesotherapy solution was applied topically after each session of RF microneedling.

RF Microneedling Parameters

The treatment was performed using pulsed wave RF microneedling (Sylfirm X, PW2 setting) at a needle depth of 0.3 mm and energy level 6. The pulsed wave mode was chosen for its ability to treat pigmentary irregularities while minimizing epidermal heating. The 0.3 mm depth was selected to target the basal layer, where melanocytes reside, while avoiding unnecessary dermal injury. Two passes were performed across the entire face after cleansing with a hypochlorous acid solution (Clinisept).

Mesotherapy Solution Application

Immediately after each session, a mesotherapy solution (Pink Glow, Koru Pharma) containing glutathione, hyaluronic acid, peptides, amino acids, vitamins, coenzymes, and minerals was applied topically. The RF microneedling-induced microchannels facilitated enhanced transdermal penetration of these active ingredients.

Assessment Tools

Baseline and follow-up imaging (4 weeks post-final session) were performed using the Quantificare LifeViz Mini 3D camera, evaluating melanin index, skin tone evenness, and Investigator and Patient Global Assessments (IGA/PGA) on a 0-5 scale (0 = clear skin, 5 = severe pigmentation).

Results

The following quantitative improvements were observed after three sessions (Table 1, Fig. 1).

Parameter	Baseline	Post-3 sessions
Melanin index (a.u.)	185	128 (~31% improvement)
Evenness score (0-100)	42	70 (+67%)
Skin tone uniformity (%)	52%	82% (+58 pp)
IGA / PGA (0-5 scale)	4 / 4	2 / 2 (~50% reduction)

Table 1: Quantitative and qualitative improvements were evident, with no adverse effects such as PIH, irritation, or prolonged erythema.

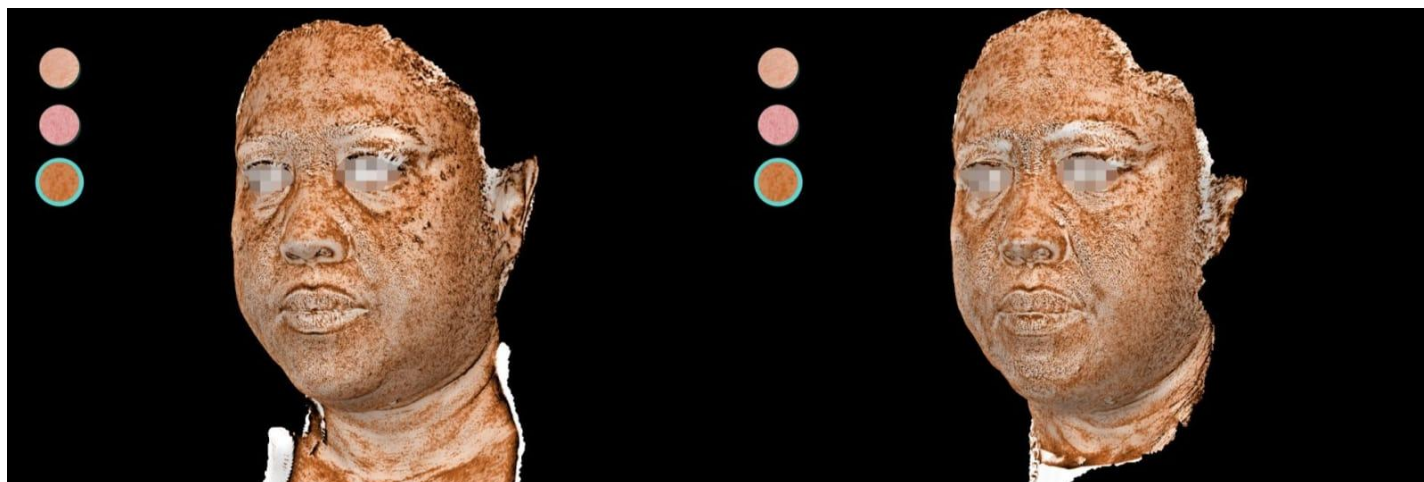


Figure 1: Changes to brown areas (pigments), before (left) and 4 weeks after 3 sessions of pulsed wave RF microneedling combined with glutathione-based mesotherapy solution (right). Images were taken and analyzed using Quantificare LifeViz Mini 3D camera.

Discussion

This case demonstrates that pulsed wave RF microneedling combined with a glutathione-based mesotherapy solution is effective and well tolerated in Fitzpatrick VI skin. The pulsed RF mode and shallow depth minimized the risk of epidermal damage while improving pigment distribution.

The active ingredients in Pink Glow each contribute to both skin recovery and brightening. Glutathione acts as a master antioxidant, reducing oxidative stress and suppressing melanin synthesis, which is essential for the reduction of hyperpigmentation. Hyaluronic acid improves skin hydration and elasticity, accelerating barrier recovery and creating a plump, luminous appearance. Peptides stimulate collagen synthesis and dermal repair, enhancing overall skin texture and light reflectivity. Amino acids replenish essential building blocks for protein synthesis, supporting barrier repair and cell turnover. Vitamins such as B-complex and C serve as antioxidants and cofactors for enzymatic processes that regulate pigmentation and promote a brighter complexion. Coenzymes and minerals facilitate energy metabolism and cellular repair, ensuring optimal skin regeneration and resilience.

RF microneedling has been shown to have a low incidence of PIH in skin of color due to its fractional, insulated energy delivery [4,5]. The enhanced absorption of these bioactive ingredients through the microchannels created by RF microneedling likely contributed to the observed improvement.

The limitations of this report include its single-patient design, lack of a control group, and short follow-up (4 weeks post-final session). Larger randomized studies with longer follow-up are needed to validate these findings and assess long-term pigment stability.

Conclusion

Three sessions of pulsed wave RF microneedling at 0.3 mm followed by glutathione-rich mesotherapy led to a moderate-to-marked (approximately 50%) improvement in hyperpigmentation in a Fitzpatrick VI patient, with no adverse events. This combination offers a promising treatment option for patients with darker skin types who are prone to pigmentary complications, but further studies are required to confirm these findings.

Conflicts of Interest

The authors declare no conflict of interest in this paper.

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