Clinical, Cosmetic and Investigational Dermatology

Dovepress
Taylor & Francis Group

Open Access Full Text Article

CASE REPORT

Microneedling Combined with Photothermal-Biomodulated Autologous PRP to Enhance Exosome Release in Refractory Melasma: A Case Report

Luciana Leite Crivelin[1],*, Gabriela Tomasi-Batiston[2],*

[1]Aesthetics Department, Crivelin Medical Center, Saint Joseph of Rio Preto, Sao Paulo, Brazil; [2]Department of Dermatology, Base Hospital, Saint Joseph of Rio Preto School of Medicine, Saint Joseph of Rio Preto, São Paulo, Brazil

*These authors contributed equally to this work

Correspondence: Luciana Leite Crivelin, Aesthetics Department, Crivelin Medical Center, Saint Joseph of Rio Preto, Sao Paulo, Brazil, Tel +55 17 99657-7575, Email llcrivelin@hotmail.com

Abstract: Melasma is a challenging condition to treat, requiring multiple therapeutic approaches. Exosomes have been used as regenerative therapies in diverse contexts, including dermatological disorders. A 35-year-old male patient with Fitzpatrick skin phototype II and a longstanding diagnosis of facial melasma, who had undergone multiple prior treatments — including topical agents and laser therapy — with little to no improvement was treated with three monthly sessions of robotic microneedling without radiofrequency on the melasma-affected areas, followed by the injection of preconditioned autologous platelet-rich plasma. The preconditioning consisted of photothermal biomodulation using the Meta Cell Technology technique, applying blue light (467 nm), 1 J/cm^2, while maintaining the sample at 37°C for 10 minutes. Intradermal injections of 0.25 mL of the autologous product were administered at each demarcated point (1 × 1 cm). After treatment, the patient showed significant improvement in refractory melasma, with lightening of the malar and temporal regions and improved vascularization in the treated areas. This case suggests that intradermal administration of photothermal-biomodulated platelet-rich plasma combined with microneedling may represent a well-tolerated therapeutic alternative for selected patients with resistant melasma.

Keywords: exosomes, skin, regeneration, platelets, autologous platelet-rich plasma, skin regeneration

Introduction

Melasma is a chronic, recurrent hyperpigmentation disorder characterized by light-to-dark brown, reticulated, irregular patches, most commonly affecting the face. It develops gradually and is more prevalent in individuals with higher Fitzpatrick skin phototypes.[1] Its pathophysiology is multifactorial and not fully understood, involving pro-inflammatory cytokines, UV-related factors, oxidative stress, and altered paracrine signaling, with fibroblast dysfunction playing a critical role in pigmentation regulation.[2]

Treatment of melasma remains challenging, as conventional therapies, including topical lightening agents, chemical peels, laser therapy, and microdermabrasion, often provide only partial and temporary improvement, particularly in refractory cases.[3] Given the multifactorial pathogenesis and limitations of existing therapies, novel strategies targeting skin regeneration and intercellular communication are under investigation.

Exosomes have recently emerged as a promising tool in regenerative dermatology. These nanometer-sized extracellular vesicles, secreted by nearly all cell types, mediate intercellular signaling and modulate inflammatory and regenerative processes.[4]

https://doi.org/10.2147/CCID.S596645
Received: 16 January 2026
Accepted: 30 April 2026
Published: 18 May 2026

Given the regenerative and anti-inflammatory properties attributed to exosomes, together with the proposed effects of light and temperature, we report a case of refractory melasma successfully treated with microneedling and autologous photothermal-biomodulated (PTBM) platelet-rich plasma (PRP) (PTBM-PRP).

Case Presentation

A 35-year-old male patient with Fitzpatrick skin phototype II presented with refractory facial melasma affecting the malar and temporal regions. The condition was unresponsive to conventional treatments, including multiple topical therapies and laser interventions, with no significant improvement.

The treatment regimen for the affected areas consisted of three-monthly sessions of a robotic microneedling procedure followed by intradermal injections of autologous PTBM-PRP. The patient was considered a suitable candidate for this intervention because of the chronic and refractory nature of his melasma, the lack of meaningful improvement with previous conventional therapies, and the absence of reported contraindications to microneedling or autologous PRP application.

Autologous PRP Preconditioning

Twenty milliliters of whole blood were drawn (Figure 1A), collected in tubes containing 3.2% sodium citrate, and centrifuged to isolate the PRP fraction. PTBM was performed using the MCT System (Meta Cell Technology, Sant Cugat, Spain), a Class IIb medical device. The MCT System includes the MCT Unit and the MCT Kit (a Class IIa medical device). Ten milliliters of PRP were placed into a MCT kit which was introduced into the MCT Unit (Figure 1B).

The MCT Unit contains three specific PTBM-based presets for preconditioning autologous cells for regenerative purposes. For this case, the device's "Exosomes" preset was selected as an exploratory exosome-oriented preconditioning setting. Because evidence for melasma remains limited and no established disease-specific protocol exists for this indication, this parameter combination was used with the aim of promoting platelet-derived exosome release (Figure 1C). The preset applied blue light at 467 nm, with an energy of 1 J/cm^2, while maintaining the sample at 37°C for 10 minutes. After the PTBM cycle, the PTBM-PRP was collected from the MCT Kit to proceed to the injection (Figure 1D).

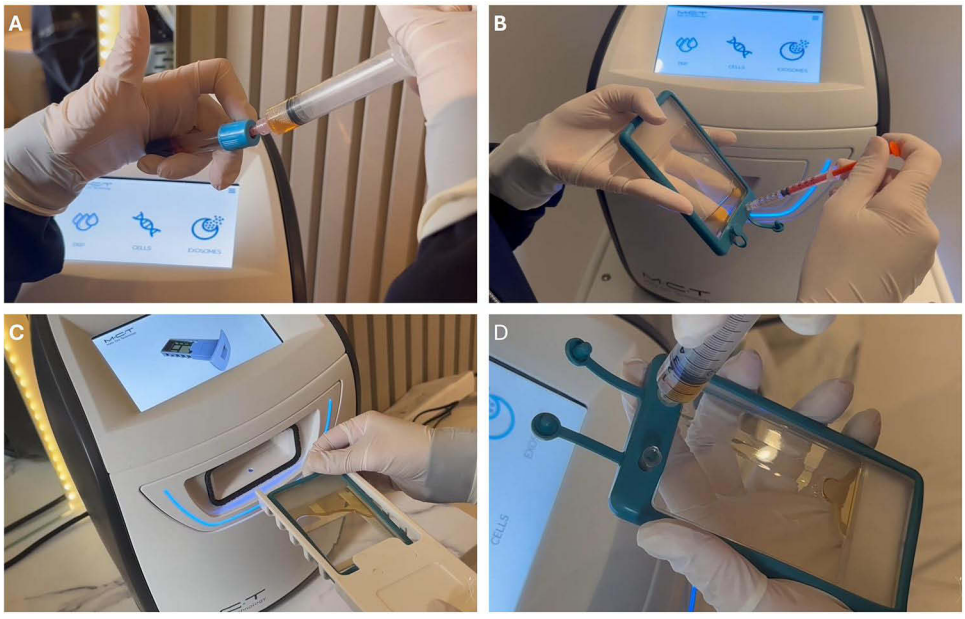

Figure 1 PRP processing: (**A**) Extraction of the PRP fraction; (**B**) Placement of the PRP sample into the MCT Kit; (**C**) Insertion of the MCT Kit into the MCT Unit to apply the "Exosomes" preset; (**D**) Collection of the preconditioned autologous PRP from the MCT Kit for injection into the patient.

Clinical Application Protocol

Before intradermal injection of autologous PTBM-PRP, the melasma region was mapped with equidistant points at 1×1 cm (Figure 2), and images of frontal and hemifacial views were taken with LifeViz (QuantifiCare, Valbonne, France), a compact stereophotogrammetric 3D imaging system. Following antisepsis with nonalcoholic chlorhexidine, robotic microneedling (without radiofrequency) was performed over the affected areas. Subsequently, 0.25 mL of preconditioned autologous PRP was injected intradermally at each marked point.

Treatment Outcomes and Safety

After three monthly sessions, frontal and hemifacial images were captured with LifeViz. A marked clinical improvement was observed, with visible lightening of the malar and temporal regions on photographic and stereophotogrammetric comparison (Figure 3). Vascularization changes were also noted, correlating with a reduction in pigmentation intensity (Supplementary Video 1). The procedure was well tolerated, and no complications or adverse effects were reported.

Discussion

PTBM technology has been shown to prime platelets and enhance autologous PRP-derived exosome release, promoting intercellular communication and improving regenerative outcomes.[5] Autologous PRP-derived exosomes help to stimulate fibroblast proliferation, collagen deposition, and attenuation of chronic inflammation through downregulation of cyclooxygenase (COX)-1, COX-2, and membrane prostaglandin E synthase (mPGES) gene expressions.[6] Upon injection, platelets release a high concentration of pre-stored growth factors and proteins, further supporting tissue repair and regeneration.[7]

In this case report, treatment was associated with marked clinical improvement and substantial lightening of the malar and temporal regions. It was well tolerated and free of technical complications or adverse effects. Evidence from systematic reviews and case series suggests that cell-derived exosomes hold significant potential in melasma management.[8,9]

Exosomes may support melasma improvement through mechanisms that are biologically consistent with the current understanding of the disease. Melasma is driven not only by melanocyte hyperactivity, but also by chronic inflammation, oxidative

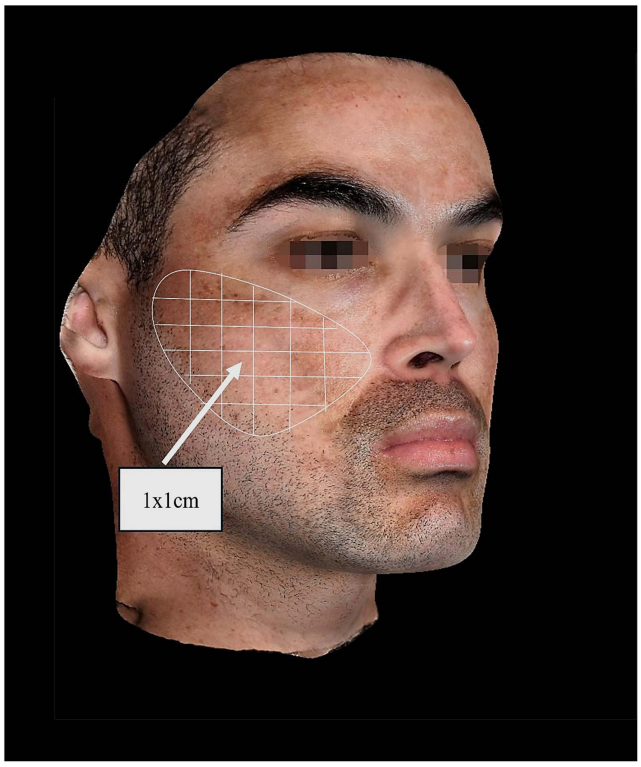

Figure 2 Oblique view of the right hemiface before treatment, marked with a 1×1 cm grid.

https://doi.org/10.2147/CCID.S596645

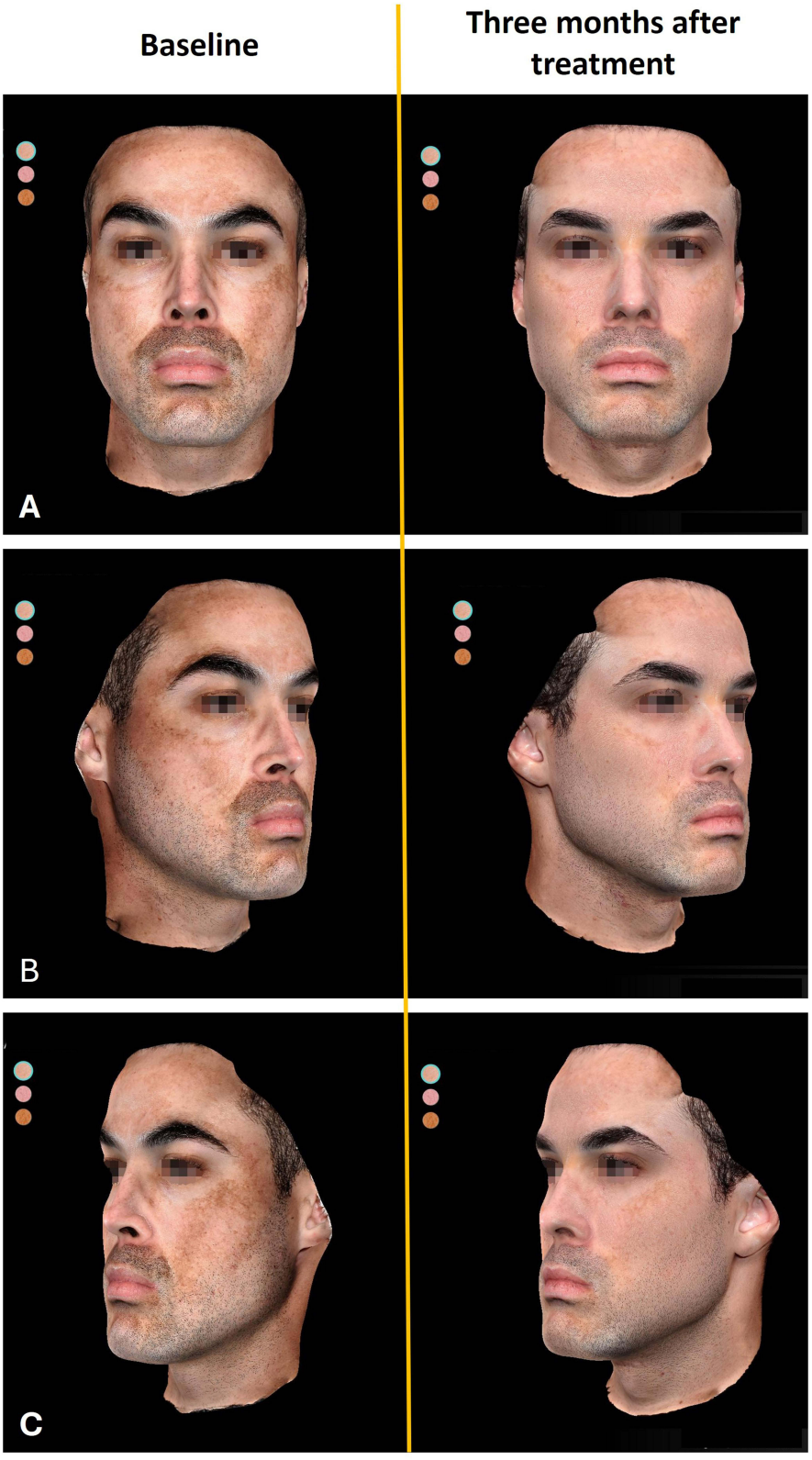

Figure 3 Clinical views of the treated areas before and three months after treatment: (**A**) Frontal views; (**B**) Oblique right views; (**C**) Oblique left views.

https://doi.org/10.2147/CCID.S596645

stress, and abnormal dermal–epidermal crosstalk.[2,4] In this context, PRP-derived exosomes may help reduce inflammatory signaling and improve the dermal microenvironment through fibroblast activation and tissue remodeling.[4,6] These effects may contribute to reducing persistent melanogenesis and support the clinical improvement observed in this case.[2,4,6]

Other regenerative or adjunctive strategies have also been explored for melasma and related pigmentary disorders, including standard PRP, microneedling-based drug delivery, stem cell-derived extracellular vesicles, and combination protocols with energy-based devices.[3,4,8,9] However, the evidence remains heterogeneous, and no consensus currently exists regarding the optimal regenerative approach, the most appropriate candidate profile, or the durability of response.[3,8,9]

Outcome assessment in this case was primarily qualitative and based on clinical photography and stereophotogrammetric comparison. The absence of a validated quantitative score such as Melasma Area and Severity Index (MASI) or modified MASI is a limitation of this report. Interpretation of the outcome should also consider potential confounding factors known to influence melasma severity and recurrence, including phototype/skin tone, baseline chronicity, UV exposure, skincare routine, treatment adherence, and hormonal influences.[1–3] Although some factors may be less relevant in the present male patient, they remain important when considering the broader applicability of this approach.

This report is also limited by its single-subject design and the absence of a control group, which limits the generalizability of the findings. Comparable studies investigating preconditioned autologous PRP to prime platelets and enhance exosome release for melasma treatment are lacking. Longer follow-up is needed to assess the durability of response and recurrence risk.

Future studies should evaluate this approach in larger, more diverse populations, particularly among patients with Fitzpatrick phototypes IV–VI, who remain underrepresented in melasma research despite the substantial clinical burden of the condition.

Conclusion

Intradermal administration of autologous PTBM-PRP combined with microneedling was associated with marked clinical improvement in this case of refractory melasma. Although this approach may represent a promising therapeutic alternative in selected patients who have not responded adequately to conventional treatments, the findings should be interpreted cautiously given the single-case design. Further controlled studies with standardized outcome measures are needed to confirm efficacy, safety, and durability of response.

Ethics Statement

The patient signed a written consent form authorizing the publication of his photographs and medical information in print and online, with the understanding that this information may be publicly available and discoverable via search engines. IRB Approval was not required.

Acknowledgments

We thank the entire Supremamed team for their trust and support in developing the regenerative protocols related to this case report.

Funding

Meta Cell Technology paid for the Article Processing Charges.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Ogbechie-Godec OA, Elbuluk N. Melasma: an up-to-date comprehensive review. *Dermatol Ther*. 2017;7(3):305–318. doi:10.1007/s13555-017-0194-1
2. Espósito ACC, Brianezi G, de Souza NP, Miot LDB, Marques MEA, Miot HA. Exploring pathways for sustained melanogenesis in facial melasma: an immunofluorescence study. *Int J Cosmet Sci*. 2018;40(4):420–424. doi:10.1111/ics.12468

3. Yao H, Shen S, Gao X, Feng J, Song X, Xiang W. Definition of refractory melasma and its treatment: a review. *Lasers Med Sci*. 2024;39(1):118. doi:10.1007/s10103-024-04066-3
4. Tienda-Vázquez MA, Hanel JM, Márquez-Arteaga EM, et al. Exosomes: a promising strategy for repair, regeneration and treatment of skin disorders. *Cells*. 2023;12(12):1625. doi:10.3390/cells12121625
5. Cordero L, Domingo JC, Sánchez-Vizcaíno Mengual E, Pinto H. Autologous platelet-rich plasma exosome quantification after two thermo-photobiomodulation protocols with different fluences. *J Photochem Photobiol*. 2025;29:100267. doi:10.1016/j.jpap.2025.100267
6. Guo SC, Tao SC, Yin WJ, Qi X, Yuan T, Zhang CQ. Exosomes derived from platelet-rich plasma promote the re-epithelization of chronic cutaneous wounds via activation of YAP in a diabetic rat model. *Theranostics*. 2017;7(1):81–96. doi:10.7150/thno.16803
7. Tian Y, Zong Y, Pang Y, et al. Platelets and diseases: signal transduction and advances in targeted therapy. *Signal Transduct Target Ther*. 2025;10(1):159. doi:10.1038/s41392-025-02198-8
8. Majewska L, Dorosz K, Kijowski J. Efficacy of rose stem cell-derived exosomes (RSCEs) in skin treatment: from healing to hyperpigmentation management: case series and review. *J Cosmet Dermatol*. 2025;24(1). doi:10.1111/jocd.16776
9. Dairov A, Issabekova A, Ogay V. Mesenchymal stem cell-derived exosomes in the treatment of skin and subcutaneous tissue diseases: a review. *Curr Stem Cell Res Ther*. 2025. doi:10.2174/011574888X393159250704132425