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Combined Use of Sub-Ablative Er: YAG Laser and Exosomes for Facial Rejuvenation: A Preliminary Clinical Case Series

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ABSTRACT: Skin aging results from the interaction of intrinsic and extrinsic factors, leading to progressive loss of elasticity, surface irregularities, and wrinkle formation. Both Er:YAG laser irradiation and exosome-based therapies have individually demonstrated significant potential in facial rejuvenation; however, their combined application remains scarcely investigated. This preliminary case series aimed to assess the synergistic clinical effects of sub-ablative Er:YAG laser treatment followed by topical application of plant-derived exosomes for facial rejuvenation.
Three female participants (aged 45–55 years; Fitzpatrick phototypes III–IV) underwent three full-face Er:YAG laser sessions, each followed by standardized topical application of plant-derived exosomes. Skin texture, radiance, roughness, sagging, skin pigmentation spots, and volume were clinically assessed using a validated 4-point ordinal scale by a calibrated and blinded examiner. Progressive and cumulative improvement was observed in all parameters throughout treatment and follow-up. No adverse events were reported.
The combined use of sub-ablative Er:YAG laser and plant-derived exosomes demonstrated favorable safety and potential synergistic efficacy, suggesting a promising, minimally invasive biophotonic approach for facial rejuvenation and regenerative aesthetic dentistry.
KEYWORDS: Er:YAG Laser, Skin aging, Facial Rejuvenation, Exosome, Transdermal Drug Delivery.

I. INTRODUCTION

In Brazil, Orofacial Harmonization (HOF) is officially recognized as a dental specialty distinct from dermatology[1], [2]. Dentists trained in this field possess advanced anatomical knowledge of the face, enabling them to perform precise and safe aesthetic procedures using technologies such as lasers.

Among available systems, the Er:YAG laser (2940 nm) has been widely adopted not only for intraoral applications and snoring management[3] but also for facial rejuvenation, where it promotes collagen neogenesis, dermal remodelling, and texture improvement[4], [5].

Skin aging is a multifactorial process influenced by intrinsic and extrinsic factors such as ultraviolet radiation, smoking, alcohol, hormonal variations, and chronological aging, resulting in dermal collagen degradation, elastin disorganization, and surface irregularities[6]. Thus, non-invasive modalities capable of inducing dermal regeneration are of clinical significance.

In this context, exosomes have recently emerged as potent mediators of tissue regeneration. These nanosized extracellular vesicles (30–150 nm) carry proteins, lipids, and microRNAs that mediate intercellular communication[7], [8]. Derived from human, microbial, or plant sources, exosomes exhibit anti-inflammatory, angiogenic, and regenerative properties[8]. In aesthetic medicine, they enhance collagen synthesis, fibroblast proliferation, and skin rejuvenation[9].

Given that Er:YAG laser and exosome therapy act through complementary pathways, photothermal stimulation and biological signalling, their combination may yield synergistic regenerative effects. However, few studies have explored this approach. This pilot study aimed to evaluate the efficacy, safety, and potential synergy of sub-ablative Er:YAG laser therapy combined with topical application of plant-derived exosomes in improving skin quality and reducing signs of facial aging.

II. MATERIALS AND METHODS

Study Design and Ethics

This preliminary clinical case series was conducted following the Declaration of Helsinki guidelines. Informed consent was obtained from all participants prior to enrolment.

Participants

Three healthy female participants (aged 45–55 years; mean 49.7 ± 3.2; Fitzpatrick types III–IV) with mild-to-moderate facial aging were selected. Exclusion criteria included pregnancy, lactation, active skin disease, photosensitivity, keloid tendency, and recent aesthetic interventions.

Laser Protocol

Treatments were performed using an Er:YAG laser (2940 nm) (Light Instruments Ltd., Yokneam Illit, Israel) in sub-ablative "gentle treatment" mode. Standardized parameters were applied in all sessions. Each participant underwent three full-face laser treatments, spaced 30 days apart and 6 months follow-up. Linear, overlapping passes were performed to ensure homogeneous dermal heating while preserving epidermal integrity. Each session lasted approximately 8 minutes and included 3 to 5 consecutive passes per area to achieve uniform coverage of the treated surface. Skin temperature was continuously monitored throughout the procedure to ensure safety. Anesthesia was not required.

The treatment covered the entire facial area, including the upper, middle, and lower thirds. The laser was operated with an aesthetic handpiece with spray and a short spacer, using a 5 mm spot size. Parameters were set to 40 mJ, 20 Hz, 0.8 W, and 0.2 J/cm² fluence, with air and water levels set to 2[10].

Exosome Application

Immediately after each the second and third laser sessions, ASCE PLUS SRLV exosomes (ExoCoBio Inc., Seoul, South Korea) was applied topically and left in contact for 20 minutes. This post-laser window allowed enhanced dermal diffusion through transient microchannels.

Participants avoided makeup, exfoliation, and UV exposure for 48 hours. After 24 hours, participants were recommended to apply sunscreen with an SPF of 35 or higher every two hours[11].

Clinical Assessment

The clinical parameters: skin texture, radiance, roughness, sagging, skin pigmentation spots, and volume were evaluated at baseline, after each session, and 6 months post-treatment using a validated 4-point ordinal scale (0 = none; 1 = mild; 2 = moderate; 3 = marked improvement).

III. RESULTS

Clinical Outcomes

All participants completed treatment without complications. Progressive and cumulative improvement was observed across all assessed parameters (fig 1).

After two treatment sessions, scores for roughness and skin pigmentation improved from "severe" and "moderate" to "moderate" and "mild," with these improvements maintained at the 6-month follow-up. Skin firmness also improved, shifting from "severe sagging" to "mild sagging" over the course of the sessions and sustained during follow-up.

Radiance showed a gradual increase, with most participants progressing from "moderate" to "severe" scores after the treatment sessions, indicating a noticeable enhancement in skin brightness. Only the volume category remained unchanged throughout all evaluated timepoints.

Progressive improvements were visible after each session, especially in the malar, periorbital, and mandibular regions. Participants reported smoother, firmer, and more radiant skin (fig 2).

Safety and Tolerability

Transient erythema occurred in two participants, resolving within 24 hours. No edema, scarring, or hyperpigmentation was observed. No systemic or delayed adverse events were recorded.

IV. DISCUSSION

This study demonstrates that combining sub-ablative Er:YAG laser therapy with exosomes can enhance clinical outcomes in facial rejuvenation through a potential synergistic biophotonic mechanism.

The use of other medical devices, such as microneedling[12], [13], CO_2 lasers[14] and Nd:YAG[15] in combination with exosomes is well-documented in the literature for various aesthetic treatments. The goal of these techniques is to enhance collagen and elastin production, thereby improving facial rejuvenation effects.

Additionally, the Er:YAG laser can resurface the skin despite its superficial penetration and smaller thermal effect zone. When applied at fluences above 1.00 J/cm², residual damage does not exceed 20–50 µm[16]. Thus, the laser heats the dermis, safely forming Type I and Type III collagen[17]. Repeated laser pulses have demonstrated collagen denaturation and remodelling in the skin[18].

Histological evidence supports these biological effects. An ex vivo human skin study demonstrated that sub-ablative, non-fractional Er:YAG laser irradiation induces controlled epidermal microablation followed by complete re-epithelialization, increased fibroblast activity, and evidence of neocollagenesis and angiogenesis up to 30 days after treatment, without residual thermal damage or adverse inflammatory response. These findings provide histological support for the dermal remodelling and collagen-related clinical outcomes observed following sub-ablative Er:YAG laser protocols[10].

The effects achieved by the Er:YAG laser may have been amplified by the topical application of exosomes, known for their anti-aging, anti-inflammatory, regenerative, and low immunogenic properties[19]. These vesicles can promote collagen type I synthesis, stimulate fibroblast proliferation, and support extracellular matrix remodelling [7], [13], [20].

Given that topical exosomes have limited penetration when applied to intact skin achieving therapeutic effect requires delivery into the dermis[12], [21]. The sub-ablative Er:YAG laser was used in this protocol to create controlled microchannels, reducing the skin´s barrier function and enhancing transdermal absorption while preserving the epidermis[21], [22]. This combination may explain the observed improvements in texture, pigmentation, firmness and radiance.

The Fitzpatrick scale was classified skin color based on UV sensitivity into six levels[23], [24]. Darker skin types offer greater UV protection, delaying aging signs. However, their higher and more distributed melanosome concentration increases the risk of post-procedure hypo- or hyperpigmentation[23].

Patients in this study were classified as Fitzpatrick Types III and IV. In Fitzpatrick types IV–VI, melanin can act as a chromophore for lasers. However, the Er:YAG laser interacts with water and the use of the sub-ablative mode minimized the risks of pigmentation[25].

No adverse effects were reported. Transient side effects, similar to those in previous studies[13] resolved spontaneously. Patients exhibited high adherence to the treatment and reported satisfactory clinical and aesthetic outcomes.

Clinically, positive outcomes were observed, with high levels of patient satisfaction. Nevertheless, these preliminary findings should be validated through randomized, split-face, or controlled clinical trials incorporating objective outcome measures. Future studies should include advanced imaging modalities, such as optical coherence tomography (OCT) and ultrasound to objectively quantify changes in collagen and elastin and strengthen the clinical evidence.

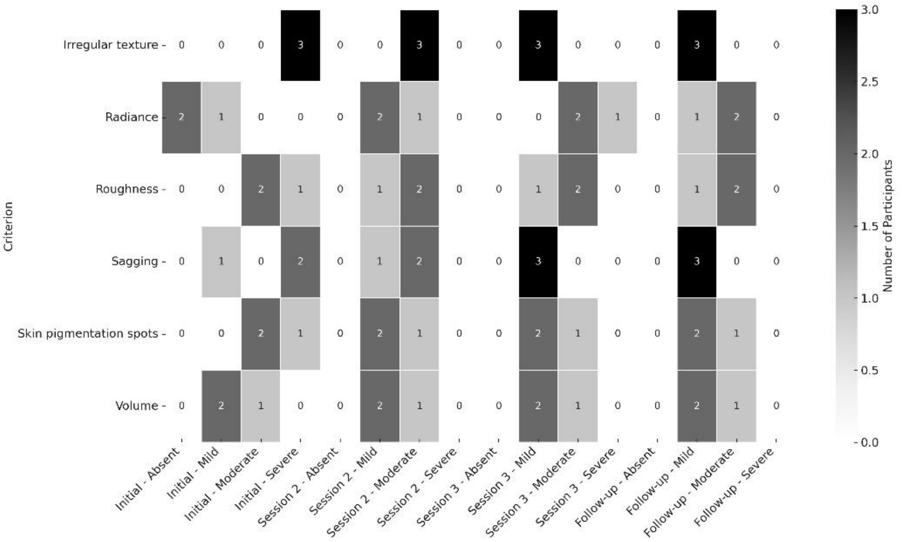

Figure 1. Heatmap demonstrating the number of participants and their clinical skin quality at four timepoints: initial, second session, third session and at six-month follow-up

Figure 2. (a) Participant, aged 55 years old before the treatment, (b) after the third session treatment

V. CONCLUSION

In the clinical case presented, the combined protocol of Er:YAG laser and exosomes demonstrated promising results, suggesting a potential synergistic effect for facial rejuvenation. Progressive clinical improvement was observed in texture, pigmentation, firmness, and radiance, maintained through a six-month follow-up and no adverse effects.

REFERENCES

[1] J. do Vale, *RESOLUÇÃO CFO-SEC-198, de 29 de janeiro de 2019*. Brazil, 2019, pp. 1–3. Accessed: Oct. 22, 2025. [Online]. Available: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://sistemas.cfo.org.br/visualizar/atos/RESOLU%C3%87%C3%83O/SEC/2019/198

[2] L. E. R. Volpato and J. do Vale, *RESOLUÇÃO CFO-SEC-230, de 14 de agosto de 2020*. Brazil, 2020, pp. 1–2. Accessed: Oct. 22, 2025. [Online]. Available: www.cfo.org.br

[3] H. S. Shiffman, J. Khorsandi, and N. M. Cauwels, "Minimally invasive combined Nd:YAG and Er:YAG laser-assisted uvulopalatoplasty for treatment of obstructive sleep apnea," *Photobiomodul Photomed Laser Surg*, vol. 39, no. 8, pp. 550–557, Aug. 2021, doi: 10.1089/photob.2020.4947.

[4] N. Q. Gaón and F. Binfa, "Efeito do laser não ablativo Erbium YAG 2940nm intraoral no rejuvenescimento do lábio superior: Estudo-piloto," *Surgical and Cosmetic Dermatology*, vol. 9, no. 1, pp. 56–58, 2017, doi: 10.5935/scd1984-8773.201791953.

[5] A. Pour Mohammad *et al.*, "A systematic review and meta-analysis of efficacy, safety, and satisfaction rates of laser combination treatments vs laser monotherapy in skin rejuvenation resurfacing," Dec. 01, 2023, *Springer Science and Business Media Deutschland GmbH*. doi: 10.1007/s10103-023-03856-5.

[6] D. J. Kim, S. S. Chang, and J. Lee, "Anti-aging potential of substance P-based hydrogel for human skin longevity," *Int J Mol Sci*, vol. 20, no. 18, Sep. 2019, doi: 10.3390/ijms20184453.

[7] A. Hajialiasgary Najafabadi, M. H. Soheilifar, and N. Masoudi-Khoram, "Exosomes in skin photoaging: biological functions and therapeutic opportunity," Dec. 01, 2024, *BioMed Central Ltd*. doi: 10.1186/s12964-023-01451-3.

[8] N. Mu *et al.*, "Plant-Derived Exosome-Like Nanovesicles: Current Progress and Prospects," *Int J Nanomedicine*, vol. 18, pp. 4987–5009, 2023, doi: 10.2147/IJN.S420748.

[9] Y. Zhong *et al.*, "Therapeutic role of exosomes and conditioned medium in keloid and hypertrophic scar and possible mechanisms," 2023, *Frontiers Media SA*. doi: 10.3389/fphys.2023.1247734.

[10] G. Tomov, P. Voynov, and S. Bachurska, "Ex vivo histological study on the effects of non-fractional ER:YAG laser for wrinkle therapy."

[11] M. El-Domyati *et al.*, "Fractional versus ablative erbium:yttrium-Aluminum-garnet laser resurfacing for facial rejuvenation: An objective evaluation," *J Am Acad Dermatol*, vol. 68, no. 1, pp. 103–112, Jan. 2013, doi: 10.1016/j.jaad.2012.09.014.

[12] S. Hu *et al.*, "Needle-Free Injection of Exosomes Derived from Human Dermal Fibroblast Spheroids Ameliorates Skin Photoaging," *ACS Nano*, vol. 13, no. 10, pp. 11273–11282, Oct. 2019, doi: 10.1021/acsnano.9b04384.

[13] G. H. Park *et al.*, "Efficacy of combined treatment with human adipose tissue stem cell-derived exosome-containing solution and microneedling for facial skin aging: A 12-week prospective, randomized, split-face study," *J Cosmet Dermatol*, vol. 22, no. 12, pp. 3418–3426, Dec. 2023, doi: 10.1111/jocd.15872.

[14] H. H. Kwon *et al.*, "Combination treatment with human adipose tissue stem cellderived exosomes and fractional co2 laser for acne scars: A 12-week prospective, double-blind, randomized, split-face study," *Acta Derm Venereol*, vol. 100, no. 18, pp. 1–8, 2020, doi: 10.2340/00015555-3666.

[15] S. Lueangarun, B. S. Cho, and T. Tempark, "Hair repigmentation of poliosis circumscripta in androgenetic alopecia patient treated with exosomes and fractional picosecond laser," Jun. 01, 2024, *John Wiley and Sons Inc*. doi: 10.1111/jocd.16261.

[16] B. Drnovš Ek-Olup and B. Vedlin, "Use of Er:YAG Laser for Benign Skin Disorders," 1997.

[17] M. El-Domyati, T. Abd-El-Raheem, W. Medhat, H. Abdel-Wahab, and M. Al Anwer, "Multiple fractional erbium: yttrium-aluminum-garnet laser sessions for upper facial rejuvenation: clinical and histological implications and expectations," 2014.

[18] B. Drnovšek-Olup, M. Beltram, and J. Pižem, "Repetitive Er:YAG laser irradiation of human skin: A histological evaluation," *Lasers Surg Med*, vol. 35, no. 2, pp. 146–151, 2004, doi: 10.1002/lsm.20080.

[19] J. Han *et al.*, "Exosome-like nanovesicles derived from Phellinus linteus inhibit Mical2 expression through cross-kingdom regulation and inhibit ultraviolet-induced skin aging," *J Nanobiotechnology*, vol. 20, no. 1, Dec. 2022, doi: 10.1186/s12951-022-01657-6.

[20] B. Zhang *et al.*, "Exosomes based advancements for application in medical aesthetics," Dec. 20, 2022, *Frontiers Media S.A.* doi: 10.3389/fbioe.2022.1083640.

[21] K. W. Ng, "Penetration enhancement of topical formulations," Jun. 01, 2018, *MDPI AG*. doi: 10.3390/pharmaceutics10020051.

[22] K. Kunzi-Rapp, C. C. Dierickx, B. Cambier, and M. Drosner, "Minimally invasive skin rejuvenation with erbium: YAG laser used in thermal mode," *Lasers Surg Med*, vol. 38, no. 10, pp. 899–907, Dec. 2006, doi: 10.1002/lsm.20380.

[23] Ajay N. Sharma and Bhupendra C. Patel, "Laser Fitzpatrick Skin Type Recommendations," *StatPearls*, Mar. 2023.

[24] T. B. Fitzpatrick, "The validity and practicality of sun-reactive skin types I through VI.," *Arch Dermatol*, vol. 124, no. 6, pp. 869–71, Jun. 1988, doi: 10.1001/archderm.124.6.869.

[25] A. M. Alajlan and S. N. Alsuwaidan, "Acne scars in ethnic skin treated with both non-ablative fractional 1,550nm and ablative fractional CO 2 lasers: Comparative retrospective analysis with recommended guidelines," *Lasers Surg Med*, vol. 43, no. 8, pp. 787–791, Sep. 2011, doi: 10.1002/lsm.21092.