



Efficacy of 532-nm Nd: YAG Fractional Picosecond Laser with 9 mm High Coverage Handpiece Micro Lens Array in the Treatment of Facial Partial Unilateral Lentiginosis: A Case Report

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Abstract

Introduction: Facial partial unilateral lentiginosis (PUL) is an infrequent skin pigmentation disorder characterized by multiple lentigines. Despite the availability of various treatment modalities, there is no standard treatment for PUL. This study reports a successful treatment of facial PUL in a female patient using a novel 532-nm Nd:YAG fractional picosecond laser (FPL)

Case Report: The patient underwent four treatment sessions at four-week intervals. The treatments were administered using a 9 mm high coverage handpiece micro lens array (MLA), with a fluence of 0.2–0.4 J/cm², a frequency of 2 Hz for 2–3 passes, and approximately 10% overlap. The treatment was well-tolerated by the patient, with significant improvement in pigmentation and no significant side effects observed. The outcomes confirmed the efficacy of the 532-nm Nd:YAG FPL in treating facial PUL.

Conclusion: The 532-nm Nd:YAG FPL appears to be an effective and well-tolerated treatment for facial PUL, offering significant improvement in pigmentation without notable side effects.

Keywords: Facial partial unilateral lentiginosis; Neodymium-Doped Yttrium Aluminum Garnet Picosecond Laser; Fractional picosecond laser; High coverage handpiece micro lens array

Introduction

Partial unilateral lentiginosis (PUL) is an uncommon disorder of normal skin pigmentation featured by multiple lentigines. Despite no necessity, many patients demand medical and cosmetic treatment for facial PUL¹. In the meantime, various modalities such as glycolic acid peeling, cryotherapy, and conventional ablative lasers have been reported for PUL standard treatments.^{1,2} However, inflammatory hyperpigmentation resulting from keratinocyte injury occurs after the treatment procedure, along with significant concerns of scarring, prolonged downtime, and pain.³ In particular, there have been few reports of potential laser treatments using a low-fluence 1,064-nm QS Nd:YAG laser,⁴ a copper bromide laser,⁵ and an alexandrite Q-switched laser⁶ for a cosmetic improvement in patients with PUL. Thus, we present a successful treatment for facial PUL by using the 532-nm Nd: YAG fractional picosecond laser (FPL) with a 9 mm high coverage handpiece micro lens array (MLA).

Case Report

A 30-year-old female patient presented with unilateral

hyperpigmented macules on the periorbital and right cheek area, which had been present since early childhood. She refused the history of pigmented-lesion or neurological disorders in the family. Multiple brown macules were measured at 1.5–2.5 mm in diameter, with aggregated lesions on physical examination. The dermoscopic analysis revealed an accentuated, brown-colored regular pseudo-reticular pigment network under both non-polarized and polarized light (Figure 1).

The clinical impression of her facial PUL showed a treatment using a 532/1,064-nm Nd: YAG picosecond laser domain of 532-nm wavelength Nd: YAG FPL with MLA and a spot size of 9 mm (DiscoveryPICO®; QuantaSystem, S.p.A., Samarate (VA), Italy).^{7,8} The parameters included a fluence of 0.2–0.4 J/cm² with a frequency of 2 Hz for 2–3 passes and approximately 10% overlap for 4 sessions at an interval of 4 weeks. The device featured a specialized high coverage handpiece MLA to fractionate the microbeam laser of 0.5 mm diameter and 1 mm distance between all microdots in the 9 mm circular diameter, covering 20% of the treatment spot for the 532 nm wavelength.⁷

The patient was asked to apply a topical anesthetic

of 2.5% lidocaine and 2.5% prilocaine cream (EMLA, AstraZeneca LP, Wilmington, DE) for 45 minutes prior to the treatment, with packs of ice placed on the face immediately after the treatment with the laser. The clinical endpoint was lighter pigmentation or mild erythema with no petechiae (Figure 2). The use of daily moisturizer and broad-spectrum sunscreen was also instructed.

Results

Photos were taken of the patient at baseline and 12 weeks following the last 4-session treatment (Figure 3). There was treatment efficacy in pigmentation improvement. The patient satisfaction yielded a score of 9 out of 10, with a pain score of 2 out of 10. She could tolerate well, with minimal side effects of treatment, such as scale, purpura,

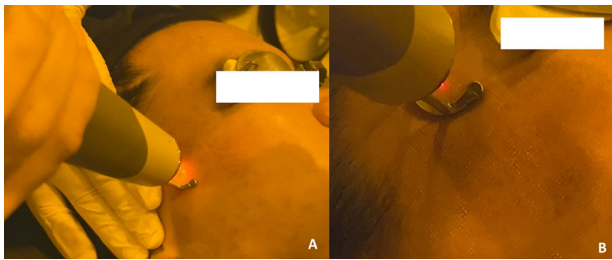


Figure 1. Fractional 532-nm Nd: YAG picosecond Laser with a 9 mm-Handpiece Micro Lens Array (A) and Clinical Endpoint of an Immediate Honeycomb Pattern Whitening of the Pigment or Mild Erythema Without Petechiae (B)

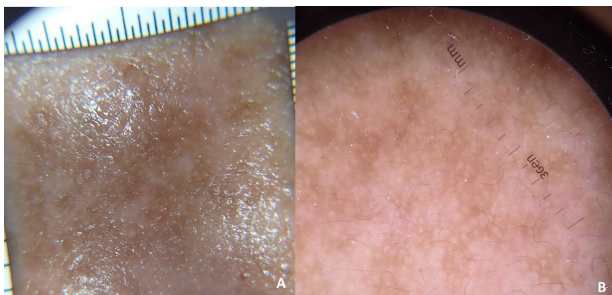


Figure 2. Dermoscopic Examination of Non-polarized and Polarized Light with Accentuated, Brown-Colored Regular Pseudo Reticular Pigmentation

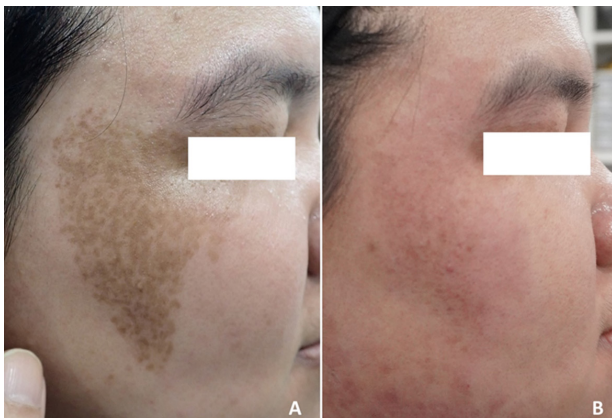


Figure 3. Response to Treatment and Clinical Manifestations Prior to Treatment (A) and 12 Weeks After the Completion of 4 Laser Treatments (B)

post-inflammatory hyperpigmentation (PIH) or scars. Only mild erythema and transient burning sensation were noted after the treatment with the laser but none after 1 hour. Additionally, redness resolved within 3-5 days.

Discussion

PUL is an uncommon disorder of normal skin pigmentation featured by multiple lentigines with a distinct demarcation at the midline.³ Typically presenting from birth or childhood, the lesions darken and expand over time. Various cutaneous and systemic disorders, such as neurofibromatosis, can be related to PUL, though generally benign. Also, lentiginous epidermal melanocyte proliferation, resembling simple lentigines, histologically exhibits considerable aesthetic alterations.^{1,3}

The current review of the literature showed better treatment with the low-fluence 1064-nm QS Nd:YAG laser,⁴ 511 nm and 578 nm copper bromide lasers,⁵ and alexandrite Q-switched laser.⁶ Our study reported the treatment of PUL by using a novel 532 nm FPL with high coverage handpieces, of which the FPL created numerous microbeams with very high- and low-fluence emissions. Thus, it could preserve the nearby skin and minimize burning injury in comparison to the laser with a full beam,⁹ which theoretically would result in less downtime and complication like PIH.¹⁰

The principal mechanism of the FPL to rejuvenate the skin is based on laser-induced optical breakdown (LIOB). The immediate tissue reaction after the 532-nm FPL demonstrates focal intraepidermal vacuoles with a larger size and higher fluences. Despite a predominant location in the lower epidermis, there are a few vacuoles in the upper epidermis of darker skin phototypes without obvious dermal vacuoles.¹¹ Following a high-energy laser beam with intraepidermal LIOB formation, the absorption of energy is mostly from nearby plasma, with little energy into the dermis.^{12,13}

A clinical study comparing the efficacy of 532-nm and 1064-nm Nd: YAG FPLs showed a similar improvement in the texture and pores of the skin. The 532-nm picosecond laser yielded better treatment efficacy for dyspigmentation, including solar lentigo, due to its higher absorption coefficient for melanin and lower absorption coefficient for hemosiderin compared to the 1,064-nm picosecond laser wavelength.¹⁴ However, a limitation was noted for 532-nm lasers due to short wavelengths which led to more side effects, such as dyspigmentation and scarring.¹⁵ Nonetheless, there was a report of hyperpigmentation after the treatment with the 532-nm FPL in a darker skin type.¹⁶

In contrast to the previous treatment, there was an improvement of pigmentary lesions by using the low-fluence 1064-nm QS Nd:YAG laser in PUL, as postulated from the subcellular selective photo thermolysis.¹⁷ Thus, the fragmentation of melanin granules was observed

with cytoplasm dispersion with no cellular destruction and melanocyte apoptosis replacement.¹⁸ However, the mottled hypopigmentation occurred after various treatment sessions of the low-fluence 1,064-nm QS Nd:YAG laser for melasma, leading to the disadvantage of this laser technique.¹⁹

Conclusion

The 532-nm Nd: YAG FPL with 9 mm high-coverage handpiece MLA is promising and safe for the treatment of facial PUL, offering a balance for its efficacy with low side effects. Nonetheless, further studies should be recommended with a higher number of samples and longer follow-up time to warrant and consolidate these findings and optimize treatment protocols.

Authors' Contribution

Conceptualization: Suparuj Lueangarun, Therdpong Tempark.

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Formal analysis: Suparuj Lueangarun, Therdpong Tempark.

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Methodology: Suparuj Lueangarun.

Project administration: Suparuj Lueangarun.

Resources: Suparuj Lueangarun, Therdpong Tempark.

Software: Suparuj Lueangarun.

Supervision: Suparuj Lueangarun, Therdpong Tempark.

Validation: Suparuj Lueangarun, Therdpong Tempark.

Visualization: Suparuj Lueangarun.

Writing—original draft: Suparuj Lueangarun, Therdpong Tempark.

Writing—review & editing: Suparuj Lueangarun, Therdpong Tempark.

Competing Interests

The authors report no conflict of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethical Approval

All procedures related to this case was performed in accordance with the ethical standards of the 1964 Helsinki Declaration, including its later amendments or relevant ethical was given by the participant.

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Patient Consent

The patient signed the informed consent form after understanding the nature of the case report.

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