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ORIGINAL ARTICLE

Treating melasma with the 1064 nm Nd:YAG laser with a 650-microsecond pulse duration: A clinical evaluation

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Abstract

Background: The effective treatment of melasma remains a challenge that necessitates a multifaceted approach that includes strict sun protection, bleaching creams, chemical peels, and laser therapy. The 1064 nm Nd:YAG laser with a 650-microsecond pulse duration provides a safe option for all skin types.

Methods: We treated 10 patients with the 1064 nm Nd:YAG laser with a 650-microsecond pulse duration. Treatments were performed every 2–4 weeks.

Results: Using a conservative treatment protocol, lightening of melasma occurred as early as 3 weeks post-treatment, with all subjects requiring several treatment sessions to achieve adequate resolution of their melasma. The majority of subjects experienced up to 25% improvement after two treatments, and an even more noticeable improvement after the 3rd treatment session. None reported any associated pain or discomfort.

Conclusions: Advantages of this laser modality include essentially no pain or downtime, lower risk of rebound, and the ability to safely treat all skin types with melasma. Therefore, the 1064 nm Nd:YAG laser with a 650-microsecond pulse duration serves as a treatment option for melasma.

KEYWORDS
laser, melasma, Nd:YAG, treatment

1 | INTRODUCTION

Melasma is a disorder of hyperpigmentation that is acquired and results from pigment deposition in the epidermis and/or dermis.[1,2] It typically affects women with darker skin types, especially those who are pregnant. Melasma has a chronic and relapsing course that requires a multimodal approach to treatment. While the gold standard treatment is topical bleaching cream, other common therapies include strict sun protection, chemical peels, and laser therapy.[1–3] Light and laser therapy, such as Q-switched lasers, intense pulsed light, ablative and non-ablative fractionated lasers, and picosecond lasers, have all been studied in the treatment of melasma with variable levels of efficacy.[1,2] Notably, many of these light and laser modalities, especially high energy lasers and intense pulsed light, may exacerbate melasma, resulting in higher rates of relapse and post-inflammatory hyperpigmentation.[1,2] Therefore, we aimed to explore the use of a low energy 1064 nm Nd:YAG laser with a 650-microsecond pulse duration in the treatment of melasma.

2 | MATERIALS AND METHODS

Ten subjects were recruited from a single academic cosmetic dermatology practice (University of California San Diego, Department of Dermatology), and informed consent was obtained. The 1064nm Nd:YAG laser with a 650-microsecond pulse duration was used to treat all affected areas on the face. Patients with skin types I, II, and III were started at energy mode 4, which corresponds to a fluence of 14 J/cm^2. Patients with skin types IV, V, and VI were started at the lower energy mode 3 (fluence 11 J/cm^2) for the first one to three

treatment sessions and then were increased to energy mode 4, based on their ability to tolerate this higher fluence without adverse effects. Three passes were performed over each affected area during each treatment session.

Patients were maintained on their current regimen to reflect a real-world scenario. Six subjects were not using any additional therapies, while four subjects were on additional therapies to treat their melasma. Those who were treating their melasma with additional topical and/or oral therapies had been stable on these treatments with no additional improvement of disease and were seeking additional therapies.

We used a 5-point scale to evaluate the clinical improvement of melasma when comparing baseline photographs with post-treatment photographs. A score of 0 meant that there was no improvement of melasma, 1 corresponded to up to 25% improvement of melasma, 2 represented 26–50% improvement of melasma, 3 corresponded to 51%–75% improvement of melasma, and 4 described 76%–100% improvement of melasma.

3 | RESULTS

Our subjects were all female and varied from skin types II-V (Table 1). Age ranged from 35 to 79 years, with a mean age of 49 years. Most subjects received 3–5 treatments with only two receiving 1 treatment.

All subjects reported improvement of melasma as early as 4 weeks after their first treatment and continued to see improvement with multiple treatments. Each subject received a score (0–5) based upon the amount of improvement seen in photographs taken at baseline and before each treatment session (Table 2). After the first treatment session, 8 subjects experienced improvement with a mean score of 1. Similarly, the majority of subjects had up to 25% improvement (score of 1) after their second treatment session (Figure 1), with 2 subjects experiencing up to a 75% improvement in response to the laser therapy.

The 1064 nm Nd:YAG laser with a 650-microsecond pulse duration showed a greater improvement of melasma in the majority of treated subjects after the third treatment session, with continued improvement for the subjects who received additional treatments (Figure 2).

Overall, the mean score across all subjects was two, which corresponds to a 26%–50% improvement of melasma. Two subjects reported temporary post-treatment darkening, which lasted 1–4 days after laser therapy. Subjects reported no associated pain or discomfort during or after the procedure.

4 | DISCUSSION

Melasma is a common acquired disorder of hyperpigmentation that is also known as chloasma.[4] It most commonly affects middle-age females with darker skin types, who present with hyperpigmented macules and patches with irregular borders.[4–6] Common triggers include pregnancy, hormonal contraceptives, hypothyroidism, and sun exposure.[4]

The treatment of melasma is challenging and requires a multimodal approach, which includes sunscreen, bleaching creams, chemical peels, and laser therapy. Topical anti-melanogenesis agents include hydroquinone, glycolic acid, retinoic acid, kojic acid, and alpha albutin.[4,5] Tranexamic acid, in both topical and oral forms, has more recently been used to treat melasma.[4,6] Since oral tranexamic acid has anti-fibrinolytic properties, it should not be prescribed to those with clotting disorders, and caution is advised when initiating therapy in patients on oral contraceptives or other pro-coagulants.[4] Overall, due to the minimal treatment efficacy, side effects, and frequent relapse of melasma, these treatment modalities may be more successful and sustained in conjunction with laser therapy.

TABLE 1 Demographics and treatment characteristics

Subject	Age	Skin Type	Number of Treatments	Frequency of Treatments	Additional Therapies
1	35	2	3	q2wk	None
2	42	2	4	q2wk	None
3	45	3	3	q2wk	None
4	43	3	4	q4wk	Oral tranexamic acid 325mg BID; Hydroquinone 12%/kojic acid 6% cream qhs
5	49	3	2	q4wk	Oral tranexamic acid 325mg BID; Hydroquinone 12%/kojic acid 6% cream qhs
6	79	3	1	–	Hydroquinone 12%/kojic acid 6% cream qhs; 3 prior treatments with 1927nm laser (Clear and Brilliant, Solta Medical, Pleasanton, CA)
7	45	4	3	q4wk	Prior Hydroquinone 4% cream qhs for 1 month
8	63	4	5	q4wk	None
9	38	4	5	q2wk	None
10	52	5	1	–	None

TABLE 2 Treatment outcomes: Improvement of melasma

Subject	Score after 1st Tx	Score after 2nd Tx	Score after 3rd Tx	Score after 4th Tx	Score after 5th Tx	Overall score
1	0	1	1	–	–	1 (1%–25%)
2	1	1	2	2	–	2 (26%–50%)
3	1	1	2	–	–	2 (26%–50%)
4	1	2	3	4	–	4 (76%–100%)
5	2	3	–	–	–	3 (51%–75%)
6	1	–	–	–	–	1 (1%–25%)
7	1	1	2	–	–	2 (26%–50%)
8	0	1	2	3	4	4 (76%–100%)
9	1	1	1	2	2	2 (26%–50%)
10	1	–	–	–	–	1 (1%–25%)
Average Improvement	1 (1%–25%)	1 (1%–25%)	2 (26%–50%)	3 (51%–75%)	3 (51%–75%)	2 (26%–50%)

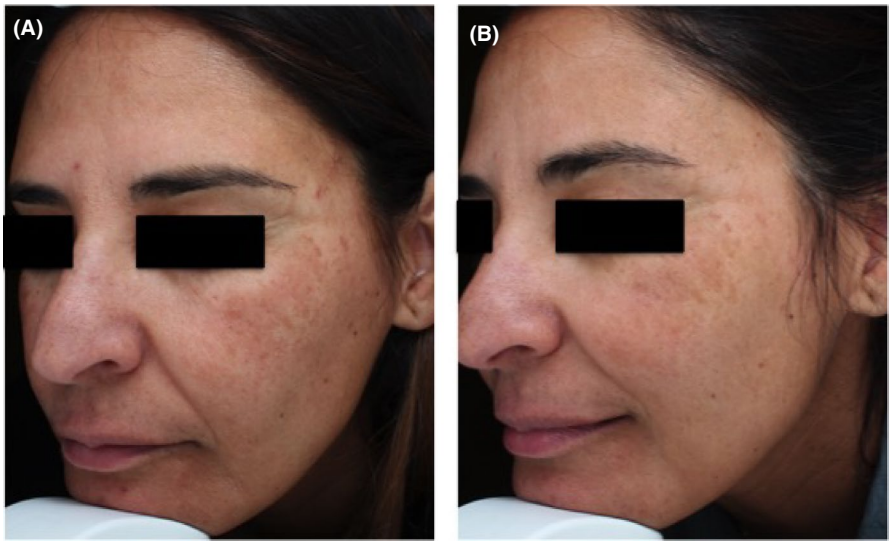

FIGURE 1 The appearance of melanoma prior to treatment with 1064 nm Nd:YAG laser with a 650-microsecond pulse duration (A) and after the completion of two treatment sessions (B). This patient's prior regimen of oral tranexamic acid and topical hydroquinone/kojic acid cream was maintained in addition to laser therapy

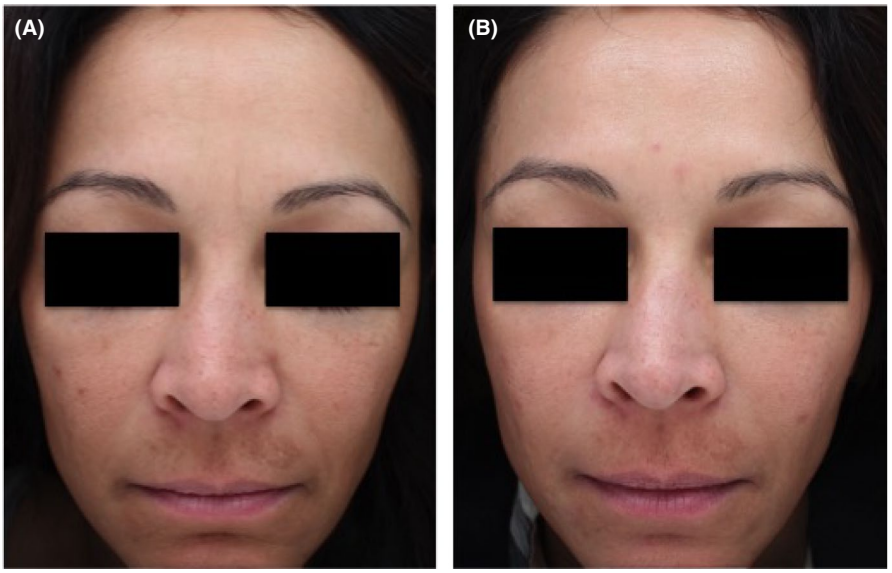

FIGURE 2 The appearance of melanoma prior to treatment with 1064 nm Nd:YAG laser with a 650-microsecond pulse duration (A) and after the completion of four treatment sessions (B). Laser therapy was added to this patient's prior regimen of oral tranexamic acid and topical hydroquinone/kojic acid cream

When laser therapy is used in the treatment of melasma, the goal is to transmit photo-thermal energy into the skin, in order to break melanin into smaller particles that can be removed by macrophages.[5] In general, caution is advised with higher energy lasers, which may exacerbate melasma or lead to rebound.[1,3] Therefore, we investigated the use of the 1064 Nd:YAG laser with a 650-microsecond pulse duration (LightPod Neo, Aerolase Corp.) in the treatment of melasma.

This 1064 Nd:YAG laser with a 650-microsecond pulse duration is a shorter pulsed laser that allows for the safe treatment of melasma in all skin types. Since the 1064 nm wavelength bypasses the epidermal melanin and treats the deeper dermal melanin, which is key to improving melasma while also avoiding hyperpigmentation, it is ideal for darker skin types.[7] In addition, the 1064 Nd:YAG laser with a 650-microsecond pulse duration is unique to other conventional 1064nm lasers, due to is shorter pulse duration. The 650-microsecond pulse duration, which is shorter than the 700-microsecond thermal relaxation time of skin tissue, allows for a well-tolerated, comfortable procedure without the need for cooling or anesthetic.[8,9] This allows for results to be achieved with lower fluences that minimize the thermal damage to surrounding structures and the risk of scarring.[5] The 1064 Nd:YAG laser with a 650-microsecond pulse duration delivers energy in a collimated beam, which allows for treatment at variable distances from the skin's surface without altering the fluence.[8]

Overall, we found that 1064 Nd:YAG laser with a 650-microsecond pulse duration is a useful tool to use in conjunction with other therapies for the treatment of melasma. Our patients required several treatments to see improvement of their melasma, with most reporting more noticeable results after the third treatment session. Several patients underwent laser therapy only, but those who combined this laser modality with hydroquinone, kojic acid, and oral tranexamic acid experienced a greater improvement of melasma after the first and second treatment sessions when compared to those receiving monotherapy.

All subjects tolerated the 1064 Nd:YAG laser with a 650-microsecond pulse duration well, and none reported any pain or sequelae requiring downtime. In addition, several patients reported improvement of unrelated facial erythema and overall texture of their skin as an added benefit. Subjects were followed for 4–6 months after their final laser treatment session, and none experienced rebound of disease. Higher fluences with additional passes may result in higher clearance rates, but further investigation is required to optimize treatment settings.

DISCLOSURES

Laser equipment was provided by Aerolase. Dr. Arisa Ortiz is a member of the Medical Advisory Board of Aerolase.

ETHICAL APPROVAL

The authors confirm that the ethical policies of the journal, as noted on the journal's author guidelines page, have been adhered to.

DATA AVAILABILITY STATEMENT

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

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