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Clinical features, safety, and efficacy of combining Q-switched Nd:YAG laser and FOB[®] Tri-White Serum in melasma treatment

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Abstract

Melasma is a benign skin condition characterized by hyperpigmented patches, primarily affecting the face, and significantly reducing patients' quality of life. Treatment is challenging due to its recurrent nature, with no single modality proving universally effective. The combination of Q-switched Nd:YAG laser treatment and FOB® Tri-White Serum (Hong Nhung Cosmetics Co., Ltd., Can Tho, Vietnam) may represent a promising new therapeutic approach. This cross-sectional descriptive study involved 85 female patients with melasma treated at two dermatological centers between July 2023 and June 2024. Patients underwent four Q-switched Nd:YAG laser sessions (1064 nm, 1.5-1.7 J/cm²) at three-week intervals and applied FOB® Tri-White Serum twice or three times daily. Treatment effectiveness was assessed using the Melasma Area Severity Index (MASI) score and the Felix Von Luschan skin color chart. Data were analyzed using Stata 17.0 MP, with $p < 0.05$ considered statistically significant.

The mean MASI score improved significantly from 7.5 ± 4.7 to 4.9 ± 3.5 ($p < 0.05$), with a 69.4% response rate. Younger patients (< 45 years), individuals with a shorter disease duration (≤ 36 months), and cases of mild to moderate melasma exhibited more favorable outcomes. Adverse effects from both the laser and serum were mild and transient.

The combination of Q-switched Nd:YAG laser and FOB® Tri-White Serum is a safe and effective treatment for melasma, demonstrating significant improvement in pigmentation with minimal side effects. Further research is needed to validate these findings with larger sample sizes and control groups.

Introduction

Melasma is a benign skin condition characterized by brown, black, or dark brown spots or patches, predominantly localized on the face, especially on the cheeks. These spots or patches result from increased pigmentation (melanin).¹

The prevalence of melasma ranges from 10% to 50%, varying by gender, ethnicity, skin type, and level of sun exposure.² While melasma is not dangerous, its widespread and persistent progression can affect aesthetics, leading to significantly lower quality of life for affected individuals compared to those without the condition. Melasma is a common reason for patients to seek dermatological treatments.²

To date, the treatment of melasma remains challenging. Various treatment methods have been developed, but none have proven effective enough to become the gold standard. Therefore, combination treatments are often employed. These include topical depigmenting agents, laser treatments, skin-lightening cosmetics, and oral medications.^{2,3} Additionally, it is crucial for patients to avoid risk factors associated with the condition.²

Several types of lasers have been developed and used for melasma treatment. However, only two laser treatments have been approved by the U.S. Food and Drug Administration (FDA).³ The Q-switched Nd:YAG laser is recognized as an effective and safe method for treating moderate-to-severe and mixed-type melasma.³

Natural melanin in the skin plays a key role in pigmentation and is associated with melasma. Current melasma treatments often incorporate agents that reduce the melanin density in the epidermis, known as skin-lightening agents. Substances like hydroquinone and corticosteroids are effective at lightening skin but long-term exposure to these agents can lead to serious side effects, including uneven pigmentation, skin atrophy, carcinogenesis, and other local or systemic adverse effects.⁴

FOB® Tri-White Serum is a product combining three main ingredients: gluconolactone, arbutin, and vitamin E.⁵ Gluconolactone and arbutin are natural skin-lightening agents derived from plants and are considered safer alternatives to hydroquinone and other harmful depigmenting agents. These components have been demonstrated to be effective in the treatment of melasma.^{4,5} Combining laser treatments with FOB® Tri-White Serum may enhance the effectiveness of melasma treatment, which is the focus of our study.

Materials and Methods

This is a cross-sectional descriptive study. The study population consisted of all patients diagnosed with melasma who visited Can Tho University of Medicine and Pharmacy Hospital and FOB Can Tho Dermatology and Aesthetic Research Institute between July 2023 and June 2024.

Inclusion criteria comprised patients clinically diagnosed with melasma. The diagnosis was based on the presence of light to dark brown patches or macules forming clusters with indistinct borders. Areas of normal skin could be observed between the hyperpigmented regions. The pigmentation ranged in color from yellowish-brown to dark brown, without signs of skin atrophy or pruritus. Lesions were commonly located on the face, typically distributed symmetrically on both sides. Affected areas included the forehead, periorbital regions, temples, cheeks, glabella, upper nasal bridge, and the arch above the eyebrows, often forming a crescent shape. The eyelids and chin were generally spared.

Exclusion criteria were: pregnant or breastfeeding women; patients with melasma secondary to endocrine disorders such as adrenal insufficiency, thyroid disease, or pituitary dysfunction; diffuse melasma due to genetic pigmentation disorders, metabolic diseases (*e.g.*, iron overload, Addison's disease), chronic malnutrition, or drug-induced photosensitivity (*e.g.*, from antimalarials, tetracycline, or minocycline); occupational melasma resulting from exposure to substances such as gasoline, tar, or arsenic, or in

individuals unable to avoid sun exposure due to work-related conditions; patients who had used hydroquinone, corticosteroids, or undergone laser treatments within six months prior to the study; patients with known allergies to anesthetics or topical components used in the study; and those with malignancies or severe systemic illnesses.

To assess patient satisfaction, a 5-point Likert scale ranging from 1 (very dissatisfied) to 5 (very satisfied) was used.⁶ We also evaluated adverse effects following laser treatment with Q-Switched Nd:YAG. These effects were assessed immediately after completing one laser session. To evaluate the adverse effects of FOB[®] Tri-White Serum, observations were conducted 24 hours after application. To differentiate between adverse effects caused by the Q-Switched Nd:YAG laser and those caused by FOB[®] Tri-White Serum, the serum was applied 48 hours after the laser session.

Treatment protocol

The melasma treatment involved four sessions, spaced three weeks apart. The Q-switched Nd:YAG laser parameters and techniques were as follows: wavelength 1064 nm, spot size 7 mm, energy level 1.5-1.7 J/cm², and two laser passes per session.

To examine the impact of FOB[®] Tri-White Serum application frequency on treatment outcomes, patients were assigned to two groups: one applied the serum twice daily, while the other applied it three times daily.

Treatment effectiveness

We evaluated treatment efficacy three weeks after the fourth session using the Felix Von Luschan skin color chart (range: 1-36) (Figure 1).⁷ Melasma severity was categorized into five levels:

- Level 1: Same color as normal skin.
- Level 2: Mild hyperpigmentation (19-24 on the color scale).
- Level 3: Moderate hyperpigmentation (25-27 on the color scale).
- Level 4: Dark hyperpigmentation (28-32 on the color scale).
- Level 5: Very dark hyperpigmentation (33-36 on the color scale).

Additionally, the Melasma Area and Severity Index (MASI) was used, following the guidelines of Kimbrough Green *et al.*⁸ The severity levels of melasma based on MASI were categorized as follows: mild ($MASI \leq 5.5$), moderate ($5.5 < MASI \leq 8.7$), severe ($8.7 < MASI \leq 13.1$), and very severe ($MASI > 13.1$).

Patients were considered to have responded to treatment if the MASI score at the end of four treatment sessions was lower than the MASI score before treatment.

Data analysis

Data were analyzed using Stata 17.0 MP software. Qualitative variables were presented as frequencies, percentages, and charts. Quantitative variables were expressed as mean \pm standard deviation. The χ^2 test was used for comparing proportions (adjusted with Fisher's exact test if expected values were less than 5). The *t*-test was applied to compare the mean values of two quantitative variables with normal distribution. A *p*-value <0.05 was considered statistically significant.

Results

A total of 85 female patients (median age: 44 years) participated. Mild and moderate melasma, based on MASI index, were most common (41.2% and 30.6%, respectively). The mean MASI score was 7.5 ± 4.7 , ranging from 1.2 to 27.0. Most patients had moderate lesions based on pigmentation and area (49.4%). The overall satisfaction rate with treatment was 76.5%. No patients reported being very satisfied or very dissatisfied.

Adverse effects from Q-switched Nd:YAG laser were common ($>90\%$) but mild (*e.g.*, stinging, redness, swelling). Rare effects such as scabbing and acneiform rash occurred in $<3\%$ of cases. FOB[®] Tri-White Serum caused mild itching/redness in $<3\%$ of patients, only at the first follow-up.

Treatment response was observed in 69.4% of patients, with a significant reduction in MASI score from 7.5 ± 4.7 to 4.9 ± 3.5 ($p < 0.05$). Improvement was significant across Fitzpatrick skin types 3-5 and among patients with moderate to very severe melasma.

Two factors were significantly associated with better outcomes: i) melasma duration ≤ 36 months (odds ratio [OR]=2.96; 95% confidence interval [CI]: 1.03-8.80; $p=0.025$); and ii) mild-to-moderate baseline MASI severity (OR=4.27; 95% CI: 1.38-13.22; $p=0.004$)

Discussion

The median age of 44 years in our study aligns with global findings that melasma most commonly affects women in their 30s to 40s. Hay *et al.*, Gokalp *et al.*, Kim *et al.*, and Jang *et al.* reported similar mean ages ranging from 39 to 45 years in melasma cohorts.⁹⁻¹² This age group is often concerned with aesthetics and has the financial means to seek treatment, especially for visible skin conditions such as melasma.

Regarding safety, our study found no serious adverse events associated with Q-switched Nd:YAG laser therapy or FOB® Tri-White serum. Mild reactions, such as stinging, redness, and swelling, were common but resolved without intervention. These observations are consistent with other reports showing that the Q-switched Nd:YAG laser, when used with appropriate parameters, is safe.^{3,10,13-15} Gokalp *et al.* used 2.58 J/cm² and Choi *et al.* applied energy levels ranging from 1.2 to 2.0 J/cm² without significant complications.^{3,10}

Treatment efficacy in our study was notable, with a significant decrease in mean MASI scores from 7.5 to 4.9 and a 69.4% response rate. Similar reductions were reported by Gokalp *et al.* (6.7 to 3.2), Cheng *et al.* (8.71 to 6.91), Choi *et al.* (3.19 to 1.46), and Guo *et al.* (7.09 to 4.4).^{3,10,16,17} This supports the use of laser therapy as a core modality for melasma management.

Our subgroup analysis found that shorter melasma duration (≤ 36 months) was significantly associated with better outcomes (OR=2.96, $p=0.025$). This finding aligns with those of Ibrahim *et al.*, who demonstrated a correlation between treatment efficacy and shorter disease duration.¹⁸ Patients with mild-to-moderate melasma also responded better than those with more severe forms (OR=4.27, $p=0.004$), highlighting the importance of early intervention. While epidermal melasma showed the highest response rate compared to mixed and dermal types, the difference was not statistically significant, possibly due to sample size limitations. However, this trend is consistent with prior studies such as that by Ibrahim *et al.*, which found that epidermal melasma responded more favorably to laser therapy.¹⁸

FOB® Tri-White Serum, containing ingredients such as arbutin, gluconolactone, vitamin E, and glycerin, may enhance treatment through its antioxidant effects, inhibition of melanogenesis, and improved skin penetration. The frequency of application (three times vs. two times daily) did not yield a statistically significant difference in our study, although a higher frequency showed a trend toward better improvement. This aligns with Le Minh Hoai's findings, which showed improved outcomes with two or three applications daily compared to once daily.¹⁹ These results suggest that compliance with recommended usage is important for optimizing treatment response.

Our study has limitations. The relatively small sample size may have reduced the statistical power to detect subtle subgroup differences. The absence of a control group limits our ability to isolate the effects of the combined therapy *versus* monotherapy with either laser or serum. Additionally, the short follow-up period may not fully reflect long-term efficacy or recurrence, which are key issues in managing chronic relapsing conditions like melasma.

Conclusions

In conclusion, our study demonstrates that the combination of Q-switched Nd:YAG laser and FOB[®] Tri-White Serum is a safe and effective treatment for melasma, showing significant improvement in MASI scores with a high response rate. The treatment was well-tolerated, with no severe adverse effects reported. Despite the study's limitations, the promising results underscore the potential of this combination therapy and highlight the need for further research with larger sample sizes and control groups to validate these findings.

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Figure 1. Treatment efficacy: A, C) before treatment; B, D) 3 weeks after the fourth treatment session.

