CASE REPORT

Multi-Wavelength Laser Treatment for Nevus Spilus: A Promising Approach

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Abstract: Nevus spilus (NS), or speckled lentiginous nevus, is a pigmented skin lesion characterized by darker macules within a lighter brown patch. Managing NS is challenging due to its cosmetic impact, recurrence risk, and the need for selective pigment targeting without scarring. Among available treatment modalities, the Q-switched Nd:YAG laser (QSNYL) is considered an effective option, as it selectively targets melanin with minimal collateral tissue damage, offering favorable cosmetic outcomes. We report the case of a 37-year-old woman with NS presenting as hyperpigmentation on the preauricular region. The first two sessions of combination treatment with 660 nm and 1064 nm QSNYL resulted in post-inflammatory hyperpigmentation (PIH), which progressively worsened after the third and fourth sessions with 532 nm and 1064 nm QSNYL. Treatment was subsequently switched to the 1064 nm wavelength alone, which led to improvement of both the NS lesion and PIH, with no adverse effects. This case highlights the potential role of QSNYL in the management of NS.

Keywords: Nevus Spilus, Q-switched Nd:YAG 1064nm laser, Post-inflammatory hyperpigmentation

Introduction

Nevus spilus (NS), also referred to as speckled lentiginous nevus (SLN), is a relatively common dermatological finding characterized by numerous small, pigmented macules or papules scattered over a uniformly pigmented patch. It may be present at birth or develop later in life, although its underlying cause remains unclear [1]. Typically, NS lesions are small, with the background café-au-lait area measuring approximately 1–4 cm in diameter, while the superimposed darker macules range from 1–6 mm. However, in some cases, NS may present as a large unilateral patch or in a more extensive form involving broader areas of the body [2]. When the lesion exceeds 20 cm^2—referred to as the giant variant—it can cause significant cosmetic concerns and pose notable treatment challenges [3].

NS commonly presents at birth or within the first month of life and is therefore considered a congenital nevus, affecting both sexes equally [4-6]. Initially, it may appear as subtle tan macules during infancy or early childhood but gradually progresses into more prominent pigmented macules and papules over time, displaying black, brown, or reddish-brown hues.

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NS can occur anywhere on the body but most often affects the torso and extremities [7].

Various treatment modalities have been explored for NS, including conventional surgery, chemical peels, mechanical dermabrasion, and both ablative and non-ablative lasers, with varying degrees of success [8,9]. Among these, different types of ablative and non-ablative lasers, used either alone or in combination, have demonstrated promising results [2–4,8]. Q-switched Nd:YAG lasers (QSNYL) at 532 nm and 1064 nm have been reported to achieve clinical improvement in some NS cases [4]. However, these approaches may also lead to complications such as scarring (atrophic, hypertrophic, or keloid) and transient or persistent hypopigmentation or hyperpigmentation [4,10].

In this case report, we describe a patient with NS who developed post-inflammatory hyperpigmentation (PIH) following initial combination laser treatments using 660 nm and 1064 nm QSNYL, and subsequently 532 nm and 1064 nm QSNYL. Treatment was then switched to 1064 nm QSNYL alone, applied using two different settings, which resulted in notable clinical improvement with minimal adverse effects. This case underscores the importance of individualized wavelength selection in reducing the risk of PIH while optimizing therapeutic outcomes.

Case Presentation

A 37-year-old female, with no known medical illnesses (NKMI) and no known drug allergies (NKDA), who is single and employed as a human resources professional, presented with a hyperpigmented lesion on the right preauricular region that had been present for more than seven years. The patient reported that the lesion was longstanding but had not previously sought medical evaluation or treatment, as it remained asymptomatic.

On physical examination, there was a hyperpigmented patch with multiple darker pigmented macules and papules over the right preauricular region. Similar lesions were also observed on the back, chest, and right axilla. This multisite speckled presentation was consistent with the classic morphology of NS, supporting the diagnosis. The patient had a Fitzpatrick skin type III and reported no family history of similar lesions. Additionally, she denied frequent sun exposure and maintained only a basic skincare routine.

Management and Outcome

The patient underwent full-face laser treatments, performed by a single physician, after providing written informed consent. The treatment period spanned from August 2022 to January 2023. Standardized photographs were taken immediately before and after each session using an iPhone camera, positioned in a designated photo corner with consistent lighting to ensure reliable comparisons.

All treatment sessions were performed using a Q-switched Nd:YAG laser (Spectra XT™, Lutronic Corporation, Goyang, Korea) at different wavelengths **(Table 1)**. The initial two sessions were carried out using QSNYL with a combination of 660 nm and 1064 nm wavelengths. The 660 nm QSNYL was set to a 3 mm spot size, 1 Hz frequency, and a fluence range of 0.75–1.4 J/cm², achieving endpoint frosting. The 1064 nm QSNYL was set to a fluence of 1.0 J/cm², 10 Hz frequency, and an 8 mm spot size, with three passes per session. However, after these two combined sessions, the patient developed PIH **(Figure 1)**. She was then prescribed topical hydrocortisone 1%, applied once daily (OD) and continued until the third treatment session to manage the pigmentation.

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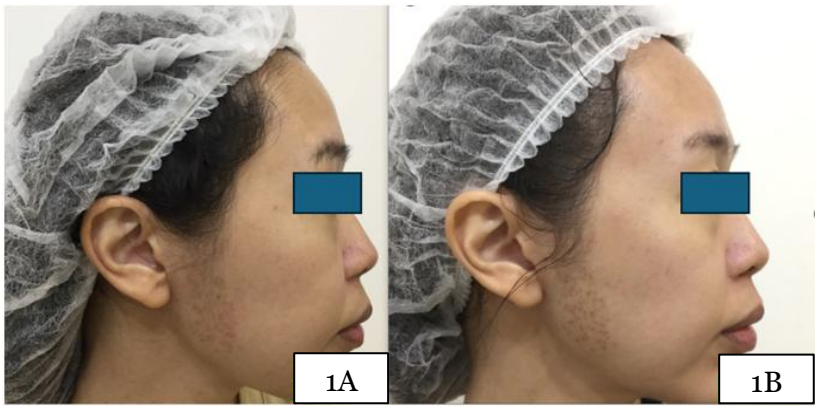

Figure 1. Comparison of the NS lesion between the first session **(A)** and second session **(B)** combination treatment with 660 nm and 1064 nm QSNYL, showing the development of PIH.

Figure 2. Comparison of the NS lesion between the third session **(A)** and fourth session **(B)** of combination treatment with 532 nm and 1064 nm QSNYL, demonstrating the development and worsening of PIH over the NS lesion following the change in treatment protocol.

Subsequently, the treatment protocol was modified to a combination of 532 nm QSNYL and 1064 nm QSNYL for the next two sessions. The 532 nm QSNYL was set to a 3 mm spot size, 1 Hz frequency, and a fluence of 1.4 J/cm², achieving endpoint frosting, while the 1064 nm QSNYL parameters remained unchanged. However, the patient developed worsening PIH following these sessions **(Figure 2)**.

During the fifth session, the treatment approach was adjusted to 1064 nm QSNYL alone using the same initial settings. An additional step was then introduced with a pulse rate of 5 Hz, 4 mm spot size, and a fluence of 4.0 J/cm², applying a pulse stacking technique for 5 to 8 seconds without activating the Pulse-to-Pulse (PTP) mode. After two sessions with this modified protocol, the PIH gradually began to fade **(Figure 3)**. All treatment sessions were conducted at one- to three-month intervals, with close monitoring of skin responses to optimize outcomes and minimize adverse events. The patient was instructed to apply sunscreen daily, avoid direct sun exposure, and maintain adequate skin hydration using moisturizing masks. Over the course of 18 sessions, each lasting approximately 30 minutes, there was a remarkable cosmetic improvement. The NS lesions showed significant lightening, and the PIH progressively improved **(Figure 4)**. Apart from this, the patient experienced no significant adverse effects, such as scarring or hypopigmentation.

Discussion

NS is a pigmented skin lesion typically presenting as a patch containing multiple darker macules or papules [1]. Beyond surgical excision, various laser and light-based modalities have been explored for its management, with treatment outcomes depending largely on lesion characteristics and patient-related factors. Among these, pigment-targeting devices such as

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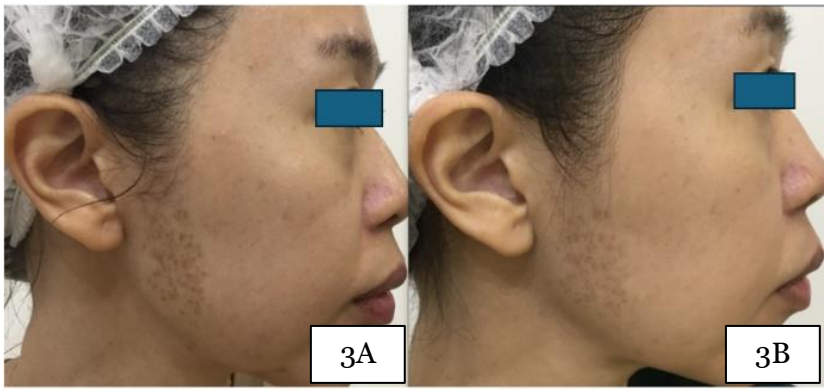

Figure 3. Comparison of the NS lesion between the fifth session **(A)** and seventh session **(B)** of treatment with 1064 nm QSNYL alone, showing progressive fading of PIH after two sessions of treatment.

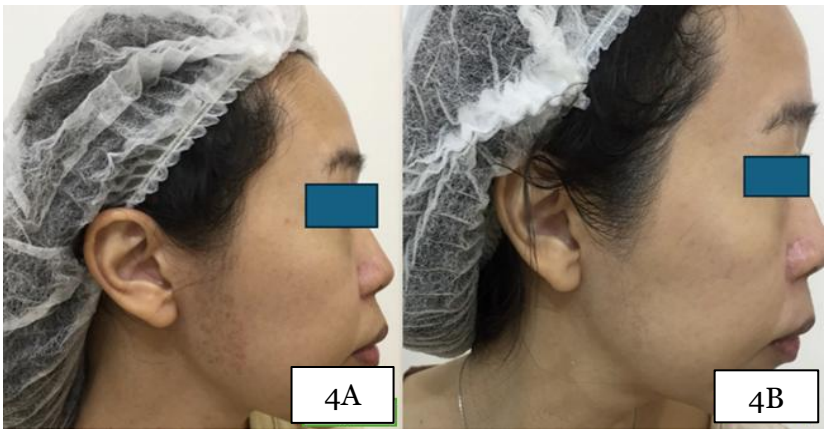

Figure 4. Comparison of the NS lesion prior to treatment **(A)** and after 18 sessions **(B)** with QSNYL, demonstrating significant cosmetic improvement and resolution of PIH.

Table 1. Laser parameters of QSNYL used in the treatment of NS.

Session(s)	Wavelength	Spot Size (mm)	Fluence (J/cm²)	Frequency (Hz)
1–2	QS Nd:YAG 660 nm	3	0.75	1
	QS Nd:YAG 1064 nm	8	1	10
3–4	QS Nd:YAG 532 nm	3	1.4	1
	QS Nd:YAG 1064 nm	8	1	10
5–18	QS Nd:YAG 1064 nm	8	1	10
	QS Nd:YAG 1064 nm	4	4	5

Q-switched ruby, alexandrite, and QSNYL at 532 nm and 1064 nm have demonstrated consistently favorable results [11].

Previous studies have documented successful clearance of NS lesions with QSNYL [4]. The QSNYL is commonly utilized in various dermatological treatments due to its ability to effectively target dermal pigments, including tattoo ink and benign pigmented skin lesions. Its action is based on the principle of selective photothermolysis, which enables precise pigment destruction while minimizing damage to the surrounding tissues [12].

The wavelength used plays a critical role in treatment success. Longer laser wavelengths are generally more effective for treating dermal lesions due to their greater penetration depth and reduced absorption by the epidermis. Conversely, superficial epidermal pigmented lesions respond better to shorter wavelengths [12]. For example, the QSNYL utilizes a 532 nm wavelength for targeting superficial

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pigmentation and a 1064 nm wavelength for treating deeper dermal pigments, as well as for improving skin texture and resurfacing [13]. Because NS may involve pigment deposition in both the dermis and epidermis, using different wavelengths can be beneficial.

In our patient, since the pigment in the portion of NS containing the small nevi was located in both the epidermis and superficial dermis, initial combination treatments with 660 nm and 1064 nm QSNYL, followed by 532 nm and 1064 nm QSNYL, were performed. However, this led to the development of PIH. PIH is one of the most frequent adverse effects associated with pigment-targeting laser therapies, especially in individuals with darker skin tones. PIH is typically more persistent and severe in individuals with darker skin tones, particularly those with Fitzpatrick skin types III to VI, due to higher melanin production and increased melanocyte activity [14]. In this case, the patient had Fitzpatrick skin type III, placing them at elevated risk of PIH after QSNYL treatment.

After switching to a protocol using 1064 nm QSNYL alone, applied with two different energy settings, the patient achieved notable clinical improvement with minimal adverse effects. This positive outcome underscores the importance of individualized wavelength selection and careful parameter optimization based on patient-specific factors such as skin type, lesion depth, and pigment density.

Conclusion

This case highlights the potential effectiveness of the QSNYL, particularly the 1064 nm wavelength, in managing NS. Since NS may involve pigment in both the epidermis and dermis, appropriate wavelength selection and parameter adjustment are essential to optimize outcomes while minimizing PIH. Individualized laser protocols tailored to patient-specific factors such as skin type, lesion depth, and pigment distribution can enhance treatment efficacy and safety. Further studies with larger cohorts are needed to establish standardized protocols for NS management.

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Potential Conflict of Interest

The authors declare no potential conflicts of interest.

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