

Q-Switched 1064nm Nd:YAG Laser in Treating Axillary Hyperpigmentation in Filipino Women With Skin Types IV-V

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ABSTRACT

Background: Axillary post inflammatory hyperpigmentation (PIH) is one of the most common dermatological complaint in women with darker skin types. Standard of care include mainly topical bleaching agents either alone or combination with other treatments. Lately, laser-based treatments have emerged as potential therapeutic options for the treatment of PIH in patients with darker skin types.

Objective: To assess the safety and efficacy of a 1064nm Q-switched Nd:YAG laser in the treatment of axillary hyperpigmentation in Filipino women with Fitzpatrick skin types IV-V.

Materials and Methods: Nine women (18 axillae) ages 20-52 years old with axillary PIH were prospectively evaluated for treatment using a nanosecond 1064nm Q-switched Nd:YAG laser. Clinical evaluation included pigmentary changes of PIH lesion compared to non-affected regions and GIAS satisfaction assessment both by the treating physician and patients. Safety parameters included adverse events and pain visual analogue scale (VAS) scoring.

Results: All axillae responded to the laser treatment, exhibiting reduction in pigmentation in 85-100% of lesion area. GIAS satisfaction results exhibited 22-33% excellent improvement and 55% much improved scores. All patients' pigmentary improvements were maintained at the final follow-up visit, three months following final treatment. No adverse events were recorded throughout the trial. Treatment related pain was well tolerated, as exhibited by pain VAS scores recorded after each treatment.

Conclusion: Use of a low-fluence 1064nm Q-switched Nd:YAG laser in the treatment of axillary hyperpigmentation is safe and effective in patients with darker skin type.

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INTRODUCTION

Post inflammatory hyperpigmentation (PIH) is an acquired hyper-melanosis typically arising following inflammatory lesions. It is one of the most common dermatologic complaints, which may develop in all skin types, however, higher prevalence is seen in patients with Fitzpatrick skin types IV-VI. The etiology underlying PIH can either be an exogenous source (allergy, irritation, contact dermatitis, dermabrasion, laser therapy, or burns), an endogenous factor (primary inflammatory or bullous dermatosis) or even induced by an infectious agent such as herpes zoster virus infection. Morphologic pattern and degree of pigmentation vary depending on causative factors and melanin distribution in the epidermis, dermis, or both.^{1,2,3}

PIH typically manifests as macules or patches in the same distribution in previous areas of inflammation, which can be classified as two clinical forms: epidermal and/or dermal. In epidermal PIH, melanocytes are activated, and release melanin resulting in tan brown or dark brown appearance and may take months to years to resolve. Dermal PIH includes activation of basal keratinocytes, which also release melanin, and present as dark brown to blue-grey discoloration that may either be permanent or resolve over an extended period of time

if not treated. Differentiating between the two is difficult, and PIH is probably a result of the combination of both epidermal and dermal lesions.⁴ The degree of PIH varies depending on the etiological factors, skin type or "chromatic tendency" as well as exposure to UV light, certain medications, and cutaneous injuries (trauma or even shaving).^{1,2,5,6} The discoloration is determined by the distribution and depth of pigment within the skin layers.

The pathogenesis of PIH is often related to an increase in melanin synthesis and/or irregular pigment dispersion resulting from cutaneous inflammation. It is considered the end result of: melanocyte proliferation, melanin synthesis, and increased activation of tyrosinase coupled with transfer of melanosomes to neighboring keratinocytes. Although the exact mechanism is not yet fully understood, the rise in melanocyte activity and proliferation has been known to be stimulated by inflammatory mediators such as reactive oxygen species, prostaglandins, and leukotrienes.^{1,5}

PIH management is commonly addressed by prevention of the inflammatory dermatosis. A variety of medication and

procedures in addition to photoprotection have been shown to effectively treat PIH. Topical treatment with depigmenting agents such as hydroquinone, keratolytic agents, retinoids, or corticosteroids has been shown to be effective as a stand-alone treatment or in combination with other topicals, oral medication, or procedures mainly influencing epidermal PIH. Dermal PIH, which is characterized by deeper pigmentation does not respond well to these modalities.^{2,5,7} Laser and light-based therapies provide alternatives or adjuncts to topical therapy, especially in refractory cases. Typically, short wavelength lasers are efficiently absorbed by epidermal melanin while longer wavelengths penetrate deeper with more selective absorption by dermal chromophores enabling safer treatment options for patients with darker skin type.^{2,8} In recent years, a variety of lasers have been studied. Q-Switched Ruby (694nm), Alexandrite (755nm), and Neodymium:yttrium aluminum garnet (Nd:YAG) (1064nm), as well as fractional lasers (various wavelengths) have been clinically studied exhibiting statistically significant improvement in pigmentation up to complete clinical clearance in some cases.⁷ The Q-Switched (QS) Ruby and Alexandrite lasers have been reported to worsen lesions in dark-skinned patients and generally not recommended for this patient group. The QS Nd:YAG 1064nm laser was shown to be highly effective in darker skin type patients with various PIH etiologies.⁹ Picosecond lasers have also been reported in the treatment of pigmentation and PIH that proved difficult to treat with conventional QS lasers.¹⁰

Axillary hyperpigmentation is a frequent dermatological complaint, characterized by dermal and epidermal PIH mainly associated with women of darker skin types. Etiological theory associates axillary hyperpigmentation of a form of post inflammatory hyperpigmentation due to continuous irritation due to hair removal, cleansing, tight cloths, or innate darkening from genetic related factors.¹¹ The purpose of this case study was to evaluate the efficacy of a 1064nm nanosecond QS Nd:YAG laser in the treatment of axillary PIH in Filipino women with Fitzpatrick skin types IV-V.

MATERIALS AND METHODS

Study Design

Nine (9) female patients, aged 20 to 52 years (mean age, 39 ± 10 years), with skin types IV-V and bi-lateral underarm hyperpigmentation (18 axillae) were included in this prospective study. Verbal and written informed consent were obtained. The patients were in good health and were not treated with concomitant whitening or depigmenting agents.

All 18 axillae were treated with a QS Nd:YAG (1064nm) laser (Alma Q, Alma Lasers GmbH, Nürnberg, Germany). Treatment was carried out according to the following treatment protocol: four (4) passes over the treatment area with a focused handpiece, 7 mm spot size, fluence of 2.6mJ/cm² until total energy accumulation reached 800kJ. Case study design included

a 10-week treatment protocol, which consisted of 4 treatment sessions at 2 weeks intervals and a follow-up visit at one and three months following the fourth treatment.

Clinical Evaluation

Primary end point of the study was reduction in axillary hyperpigmentation. Pigmentary changes were assessed by calculating the L* (luminosity) according to the Von Luschan's Chromatic classification scale (Figure 1). Improvement was assessed by comparing the difference (L*Δ) between target treatment area of the axilla and a non PIH affected area (L*Δ= axilla-periaxilla), at baseline and at the final follow-up visits. Assessment was carried out by the treating physician and by two other objective evaluators. Clinical improvement was assessed by the GIAS score (stages of improvement scoring: 1= very much improved, 2= much improved, 3= improved, 4= no change, or 5= worse outcomes) both by the treating physician and the patients throughout the study. Safety parameters included treatment related adverse events and pain, scored on a 10-point visual assessment scale (VAS scale), recorded after each treatment.

FIGURE 1. Von Luschan's Chromatic classification scale.

	1	10			19	28	
	2	11			20	29	
	3	12			21	30	
	4	13			22	31	
	5	14			23	32	
	6	15			24	33	
	7	16			25	34	
	8	17			26	35	
	9	18			27	36	

FIGURE 2.

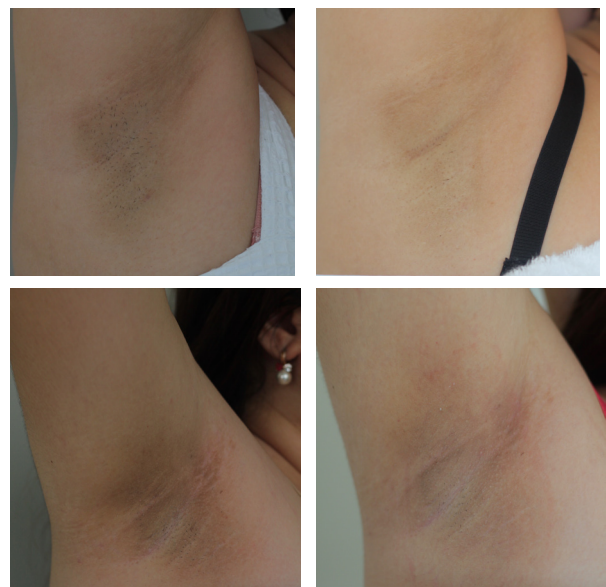


TABLE 1.

Axillary Pigmentary Changes (L*Δ) Following Q-Switched Laser Treatment								
Von Luschan's Chromatic Classification of Skin Color Scale Score								
	Axillary		Periaxillary		Baseline (L*Δ) (Axillary-Periaxillary)		1 Month (L*Δ) (Axillary-Periaxillary)	
Patient #	Right	Left	Right	Left	Right	Left	Right	Left
1	28	27	25	25	3	2	0	1
2	29	27	24	24	5	3	1	0
3	31	29	26	26	5	3	1	1
4	28	28	25	25	3	3	0	0
5	31	31	25	25	6	6	0	0
6	28	30	25	25	3	5	0	1
7	27	27	25	25	2	2	0	0
8	26	27	25	25	1	2	0	0
9	29	29	24	24	5	5	1	1
Mean	28.6 ± 0.6	28.3 ± 0.5	24.9 ± 0.6	24.9 ± 0.2	3.7 ± 0.6	3.4 ± 0.5	0.3 ± 0.2	0.4 ± 0.2

Note: Data are expressed as color scale score by Von Luschan's chromatic scale and summarized as mean ± standard error of mean.

TABLE 2.

Clinical Improvement by GIAS Scale		
Clinical Improvement (GAIS) 1 Month		
Patient #	Physician	Patient
1	Much improved	Much improved
2	Much improved	Much improved
3	Much improved	Improved
4	Much improved	Much improved
5	Very much improved	Very much improved
6	Much improved	Improved
7	Improved	Much improved
8	Very much improved	Much improved
9	Very much improved	Very much improved

RESULTS

Reduction in hyperpigmentation of the axillae was apparent in all patients, affecting 85-100% of pigmented lesion. At the one-month follow-up visit, the mean L*Δ values were 0.4±0.05 compared to 3.5±1.58 at baseline, presenting major pigmentary improvement following laser treatment (Table 1). At the three months follow-up visit, all patients maintained their improved state in PIH reduction. Clinical improvement by GIAS scores rated laser treatment for axillary PIH by the physician and the patients as excellent in 33.3% and 22.2%, very much improved in 55.5% (by both physician and patients), and improved in 22.2% and 11%, respectively (Table 2).

The VAS pain rating was scored after each treatment and reported as 3.8, 2.7, 1.4, and 1, respectively. No adverse events were reported during the trial or at the follow-up visits.

DISCUSSION

Post inflammatory hyperpigmentation (PIH) is a common acquired pigmentary disorder. Melanocytes of darker skin types are hyperactive and thus release more melanin, which may account for the high frequency of PIH in Fitzpatrick skin types IV-VI populations.² Recently, laser-based treatments have emerged as safe and effective therapeutic options for PIH, specifically targeting melanin. The Q-Switched photoacoustic effect promotes chromophore shattering with subsequent evacuation by immunologic associated cells. These treatments have produced variable results when treating PIH.

Near-infrared lasers such as 1064nm QS Nd:YAG laser are less absorbed by melanin compared with the green and red light lasers thus are considered safer for the treatment of patient with darker skin types. This is due to the fact that the 1064nm wavelength targets not only melanin but also hemoglobin and water. In addition, the 1064nm wavelength is known for its deeper penetration into the skin and thus can effectively target dermal pigmented lesions.^{8,12} A study using low-fluence 1064nm QS Nd:YAG laser was shown to be a safe and effective treatment for PIH as a single or combined therapy, however, with recurrence after several weeks.⁷ To date there are limited studies on the 1064nm QS Nd:YAG laser for PIH treatment, with most clinical data collected from melasma studies.¹²

Recently, the efficacy of low-fluence 1064nm- QS Nd:YAG laser was evaluated for the treatment of the axillary hyperpigmentation with satisfactory results. This was the first observational study clinically testing axillary PIH treatment using laser, which exhibited good-to-excellent improvement after a minimum of 3 treatments with lasting results for at least 6 months.⁴ Our study followed a similar treatment protocol and laser to be done on Filipino women with skin types IV-V.

Since axillary hyperpigmentation is considered a common disorder associated mainly with darker skin types and poses a major influence on quality of life, we focused on Filipino women with skin types IV-V with axillary hyperpigmentation. Objective analysis of pigmentation showed a marked reduction in after 4 laser treatments. Paired clinical improvement scoring both by the treating physician and patients proved that following 4 treatments, all lesions reported pigment reduction compared to baseline. Previous studies have shown that pigments treated with QS Nd:YAG exhibited recurrence of pigment after a few months or even cases in which the laser treatment itself produced PIH.⁷ We found that the low-fluence treatment protocol spaced 2 weeks apart did not induce additional PIH in any of the patients and that reduction in pigmentation was sustained for at least 3 months after the final treatment session. Furthermore, none of the major adverse events of traditional laser treatments such as pain, burning, or edema were noted. Pain scored throughout the trial was tolerable as shown by the consistent reduction in VAS scores after each treatment session.

CONCLUSION

Axillary hyperpigmentation is a common and problematic aesthetic condition that has not been extensively studied, although presenting high prevalence among females of dark skin types. Our study supports previous preliminary data that showed a minimum 3 laser treatments for PIH in the axillary area. We found that low fluence QS 1064nm Nd:YAG nanosecond laser treatment is a safe and effective treatment option for PIH associated axillary pigmentation. Our data show marked improvement in pigmentation, which was sustained for as long as three months after the final treatment with no related adverse events or treatment related PIH.

Further investigation and large-scale clinical studies are necessary to substantiate clinical significance of low fluence QS 1064nm Nd:YAG laser in the treatment of PIH.

DISCLOSURES

The author has no conflicts of interest to declare.

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