

# Assessing efficacy of energy-based devices in melasma: Q-switched Nd-YAG laser vs. Intense Pulsed Light

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## Abstract

**Background** Melasma is a common problem affecting many young females. Energy based devices are now used to treat melasma but there is fear of post-inflammatory hypo or hyperpigmentation, especially in Asian population. There is need to evaluate efficacy and safety of these devices in our population and find out what suits best in Asian skin. There is no study in the literature to the best of our knowledge which made comparison of Q switched Nd:YAG 1064nm laser and Intense Pulsed Light for treatment of melasma.

**Objective** To compare efficacy of Q-switched Nd:YAG 1,064nm laser and Intense Pulsed Light in the treatment of melasma in Asian females.

**Methods** A total of 60 patients (30 in each group) were included in this study. Group-A was treated with Q switched Nd:YAG 1064nm laser and group-B was treated with Intense Pulsed Light. 4 sessions 3 weekly were given to patients either of IPL or Q switch laser and efficacy was measured by mMASI score one week after completion of four sessions of treatment. All the collected data was entered and analyzed through SPSS version 21.

**Results** Mean age of the patients was  $31.4 \pm 4.4$  years (group-A) and  $34.2 \pm 5.4$  years (group-B). Mean baseline mMASI score was  $7.3 \pm 3.4$  and  $6.4 \pm 2.9$  in group A and B, respectively ( $p=0.335$ ); while post treatment mMASI score was  $3.6 \pm 2.1$  in group A and  $2.7 \pm 1.6$  in group B ( $p=0.074$ ). No side effects or long term complications were noted. Treatment was effective in 60% of patients in group A while in 80% patients in group B. Difference between two groups was statistically insignificant ( $p=0.091$ ).

**Conclusion** 1064-nm QS Nd: YAG laser and Intense Pulsed Light both were equally effective ( $p=0.09$ ) and safe for the treatment of melasma.

## Key words

Melasma, Q-Switched Nd:YAG laser 1064nm, Intense Pulsed Light.

## Introduction

Melasma is the most common skin disorder among young to middle aged Asian women and is defined as slowly developing symmetrical,

light to dark, irregular hyper melanosis of face.<sup>1</sup> It is most prevalent in South East Asia where the incidence is as high as 40% in females and 20% in males.<sup>2</sup> Risk factors include exposure to UV light, genetic predisposition, hormonal influences (Pregnancy, use of oral contraceptives) and phototoxic medication.<sup>3</sup> The condition is otherwise asymptomatic and there is no clear association with a systemic illness but melasma can be psychosocially detrimental to many patients.

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The treatment of melasma is difficult particularly in dark skinned patients. The challenge is to obtain decrease in melasma pigment without unacceptable hypopigmentation or post-inflammatory hyperpigmentation. Topical treatment with depigmenting agents like hydroquinone, azelaic acid, kojic acid etc are the mainstay of treatment but clearance is usually incomplete with frequent exacerbations.<sup>2</sup> Intense Pulsed Light (IPL) and laser devices have revolutionized the treatment of many dermatological conditions including pigmentary disorders.

IPL has been studied and applied in treating melasma during the last decade. It emits broad spectrum of light absorbable to all skin chromophores at 500nm to 1200nm with long pulse width.<sup>4</sup>

Q switched laser Nd:YAG 1,064nm (QS) laser has been in use for melasma treatment since 2008. It works on the principle of selective photothermolysis which deliver bursts of wavelength specific energy that can be absorbed by dermal melanosomes without producing inflammation or epidermal damage.<sup>4,5</sup>

Zhou et al. conducted study on efficacy and safety of QS 1064nm Nd:YAG laser in treatment of melasma, which showed a decrease in Modified MASI (mMASI) scores of 61.3% after therapy (from 10.6 to 4.1,  $p < .001$ ); 70% of patients had more than a 50% decrease in their MASI values.<sup>6</sup>

Zoccali et al. conducted a study in 2010 on 38 melasma patients treated with IPL; it showed good results (60-79% clearance) in 11 (28.95%), moderate (40-59%) in 5 cases (13.16%).<sup>7</sup>

Many studies have specified the clinical effectiveness of IPL and QS laser in treatment of melasma but we found no study which directly

compared both. Most of these studies were performed internationally. However the ethnic variations and skin phototypes are the major determinants for any pigmentary skin disorder. So, we did this study aiming to compare the effects of IPL and QS Nd:YAG laser in treatment of melasma in our local patients presenting to PAF Hospital Islamabad.

## Materials and Methods

This randomized controlled trial was conducted at Department of Dermatology, Pakistan Air Force Hospital, Islamabad from 05-07-2017 to 04-01-2018. Sample size was calculated by WHO sample size calculator. 30 patients were taken in each group. Patients were all females from 18 to 50 years of age suffering from melasma. Females who have received any topical or laser therapies or chemical peels on face at least 3 months before treatment, pregnant females, females with eczema or recurrent herpes simplex on face, females on photosensitizing drugs were excluded from the study.

Study was conducted after taking permission from Ethical committee of PAF hospital Islamabad and after taking informed consent from patients.

**Table 1** Determination of modified MASI Score

Location of Melasma	Scoring
Forehead	(0.3)(A) (D) Forehead mMASI
Left Malar	(0.3)(A) (D) Score + Left Malar
Right Malar	(0.3)(A) (D) mMASI Score + Right
Chin	(0.1)(A) (D) Malar mMASI Score + Chin mMASI Score = Total mMASI Score

Abbreviation: MASI, Melasma Area And Severity Index.  
Scoring system: A, Area of involvement rated 0 to 6:0 indicates absent; 1, <10%; 2, 10% to 29%; 3, 30% to 49%; 4, 50% to 69%; 5, 70% to 89%; 6, 90 to 100%.  
Darkness rated 0 to 4: 0 indicates absent; 1, slight; 2, mild; 3, marked; 4, severe  
Total mMASI score range is 0 to 24 and is calculated by adding scores of 4 areas of the face

Patients were randomized using computer generated sequence of random numbers to either of the two treatment arms QS or IPL. Each group received 4 sessions at 3 weeks interval of either QS Nd:YAG laser or IPL. Patients in QS Nd:YAG 1064nm laser group were treated with fluence 3.0-4.0 J/cm<sup>2</sup>, spot size 6mm and frequency of 10 Hz. Patients in IPL group were treated with cut off filters of 510 nm, pulse of 5-10ms, pulse delay of 10-20 ms and fluence of 10-12 J/cm<sup>2</sup>. Digital photographs were taken before and one week after completion of treatment. mMASI score was calculated before and after one week of treatment (**Table 1**).<sup>8</sup> Also level of improvement was subjectively evaluated by investigators by comparing before and after photographs of patients as poor (1-24% improvement), fair (25-49%), good (50-74%) and excellent (75-100% improvement). If mMASI score decreased more than 50% from baseline one week after completion of treatment, it was considered effective. Any temporary or long-term side effects were also asked and noted at each visit.

All data were entered and analyzed using SPSS version 10. Descriptive statistics was used to calculate quantitative and qualitative data. Baseline and one week post 4 sessions mMASI

score±standard deviation was calculated and compared. Chi-square test was used for comparison for efficacy between two groups. P value ≤0.05 was considered statistically significant.

## Results

A total of 60 patients (30 in each group) were included in this study. Group-A was treated with Q switched Nd:YAG 1064 nm laser and group-B was treated with IPL.

Mean age of the patients was 31.4±4.4 years (group-A) and 34.2±5.4 years (group-B). Baseline mMASI score was determined in all patients (**Table 2**). In group-A, treatment was effective in 60% of patients while in group-B, 80% of the patients. Difference between two groups was statistically insignificant (p=0.091). Mean baseline mMASI score was 7.3±3.4 and 6.4±2.9 in group-A and B, respectively (p=0.335), while after one week of therapy mMASI score was 3.6±2.1 in group-A and 2.7±1.6 in group-B (p=0.074) (**Table 3**). In majority of patients good improvement was observed in both groups.

**Table 2** Distribution of patients by baseline mMASI score

Score	Group-A		Group-B	
	Q switched Nd:YAG 1064nm laser		Intense Pulsed Light	
	No.	%	No.	%
0-10	22	73.3	27	90.0
> 10	08	26.7	03	10.0
Total	30	100.0	30	100.0

Chi Square=2.857 P value=0.091

**Table 3** Comparison of mMASI score at baseline and after one week

Variables	Group-A		Group-B	
	Q switched Nd:YAG 1064nm laser		Intense Pulsed Light	
	Mean	SD	Mean	SD
m MASI (at baseline)	7.30	3.41	6.49	2.97
P value	P=0.335			
m MASI (after 1 week)	3.68	2.11	2.79	1.64
P value	P=0.074			

There were no major side effects. Majority patients belonging to both groups experienced transient pain and erythema immediately which settled with icing and topical steroids. There were no patients with post inflammatory hypo or hyper pigmentation.

## **Discussion**

In our study, the mean age of presentation was  $31.4 \pm 4.4$  and  $34.2 \pm 5.4$  years in group-A and B, respectively. These findings are consistent with an earlier study conducted in Indian patients reporting a mean age of  $37.2 \pm 9.3$  years in patients presenting with melasma.<sup>9</sup>

Our study has demonstrated that both modalities of light therapies are effective for treatment of melasma. The efficacy of 1064-nm Q-switched Nd: YAG laser was 60% which is similar to the efficacy of Q switch laser demonstrated in melasma by other studies, including the one carried out by Longo who supported the efficacy of QS laser through confocal microscopy.<sup>10</sup> Young et al. studied the combined effects of IPL followed by QS in same patients and found a combination of both to be effective in all 20 patients with 60% decrease in MASI in their patients.<sup>11</sup>

In a review of many articles on lasers and IPL used, Mostafa mentioned that selective photothermolysis caused by IPL induces rapid differentiation of keratinocytes resulting in an upward transfer of melanosomes along with necrotic keratinocytes and their elimination as micro crusts. Surrounding tissues are spared potentially reducing nonspecific, widespread thermal injury. Thus, the effect of IPL treatment on pigmentation is cumulative and repeat treatments (typically 3-6) every 3-4 weeks are generally necessary for complete clearance. Therefore, we also used 4 sessions and checked results after a week. Our findings were

consistent with their findings where QS and IPL both were found individually effective in melasma.<sup>12</sup>

Polnikorn found that more than 60% of the patients had good (>50% clearing, 30% had complete clearing) result after 10-20 weekly treatments. The complications were mild and transient including pain, erythema, rash, urticaria and exacerbation of acne. Less than 10% had rebound melasma, recurrence of melasma was found in 30%. Hypopigmentation was found in 5%.<sup>13</sup> Our findings were similar but we concluded the study after 4 sessions and did not follow up patients for recurrence. We also faced temporary side effects such as erythema, pain etc. There were no long term complications making both devices safe for treatment of melasma.

Wang *et al.* compared the effect of application of a 4%-hydroquinone cream versus 4% hydroquinone plus IPL (4 sessions in 16 weeks) in a prospective randomized control trial and found IPL to be a great adjuvant therapy.<sup>14</sup> Similar study was done in Pakistan by Shakeeb et al. who compared the efficacy of IPL and triple combination cream versus IPL and triple combination cream alone in epidermal melasma treatment. They found out combination of IPL and triple creams to be superior to creams alone.<sup>15</sup>

Polnikorn, in a review article in 2014 claimed that IPL, in Asians, is minimally effective for melasma as high energy fluence often resulted in epidermal burn followed by hypopigmentation or hyperpigmentation while lower energy fluence was not enough to reduce follicular melanocytes.<sup>13</sup> Contrary to this, our results with IPL were effective as well as safe for melasma in Asian people. Probably we, being Asians, understand our skin better and are able to choose right settings.

Wajieha *et al.* demonstrated no efficacy of IPL in melasma in 2014 in 50 patients in Pakistan. These findings are contrary to ours as well as too many past papers. They thought use of substandard cosmetics, poverty, poor nutritional status of the patients, illiteracy and non-adherence to the regular use of sunscreen could be factors for poor response to IPL.<sup>16</sup> Either their settings were not ideal or their patients (90% females) might be having iron deficiency which is an independent risk factor for melasma.<sup>17</sup> So, although we did not screen for confounding variables, but these confounding variables must be taken into account while performing study on effectiveness of any treatment.

Trivedi<sup>4</sup> too, was of the opinion that IPL has an advantage over laser therapy that it uses a spectrum of wavelengths allowing penetration of various levels of the skin and thus targets both epidermal and dermal melasma simultaneously. The pulse duration of IPL being in the millisecond range provides greater thermal diffusion and a reduced chance of thermal-related post inflammatory pigmentation. The size of the IPL head is larger than most laser spot sizes, which allows for the rapid treatment of large areas.<sup>4</sup> This makes IPL cheaper and lesser time consuming without compromising on safety or efficacy. The main purpose of our study was also to compare the safety and efficacy of this underestimated cheaper machine with the expensive QS Laser. The findings of our study emphasizes on utility of IPL. IPL should be used more often for melasma. There is no study in the literature to the best of our knowledge which made comparison of Q switched Nd:YAG laser and IPL for treatment of melasma, so we consider our study to be among the pioneer ones, especially in Pakistan.

## **Conclusion**

In conclusion, the 1,064-nm QS Nd:YAG laser and Intense Pulsed Light both were effective ( $p=0.09$ ) and safe treatment for melasma.

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