

## Original Research Article

# A comparative study of low-fluence Q-switched neodymium-doped: yttrium aluminum garnet laser versus 15% trichloroacetic acid peel in the treatment of melasma

Sridhar Venu, Sarath Chandran Balachandran, Kamalanathan Nallu\*, C. Lakshmanan

Department of Dermatology, Chengalpattu Medical College, Chengalpattu, Tamil Nadu, India

**Received:** 05 March 2019

**Revised:** 19 April 2019

**Accepted:** 30 April 2019

**\*Correspondence:**

Dr. Kamalanathan Nallu,

E-mail: [nkamalmd@gmail.com](mailto:nkamalmd@gmail.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

### ABSTRACT

**Background:** Melasma is an acquired, circumscribed, pigmentary disorder. It is characterized by more or less symmetrically distributed, dark brown macules with well-defined geographic borders and is often resistant to treatment. The aim of our study is to compare the therapeutic efficacy of low-fluence Q-switched neodymium-doped: yttrium aluminum garnet (Qs-Nd:YAG) laser versus 15% trichloroacetic acid (TCA) peel in the treatment of melasma.

**Methods:** Our study was an open, prospective, comparative study that included 50 melasma patients. They were then randomized into group 1 (n=25) and group 2 (n=25) by means of sequentially numbered list. Patients in group 1 were treated with 15% TCA. The procedure was repeated every two weeks for 6 times. Group 2 patients were treated with low influence Q-switched Nd:YAG laser. The treatment was given for four sittings at a gap of 3 weeks. Melasma area and severity index (MASI) was used to assess the response of therapy. Patients were followed up for 12 weeks after completing the study.

**Results:** The total percentage of reduction in mean MASI was 41.92% in group 1 and 27.88% in group 2 which was statistically significant (p=0.007). Post inflammatory hyper-pigmentation was the most common side effect in patients treated with Nd-YAG laser, particularly Fitzpatrick skin type V.

**Conclusions:** 15% TCA was better than Q switched Nd:YAG laser for the treatment of melasma. Qs-Nd:YAG laser is not an effective treatment option due to higher incidence of adverse effects.

**Keywords:** Melasma, Trichloroacetic acid, Q-switched Nd:YAG laser, Post inflammatory hyperpigmentation

### INTRODUCTION

Melasma is an acquired, circumscribed, pigmentary disorder. It is characterized by more or less symmetrically distributed, dark brown macules with well-defined geographic border. It has been reported to involve 8-10% of the general population and is more prevalent in women between 20-40 years of age when compared to men (9:1).<sup>1</sup> Melasma affects the sun exposed

areas, particularly forehead, cheeks, temples and upper lips. Its prevalence is also higher in intermediate phototypes (III, IV and V). In lighter skin phototypes (Fitzpatrick skin type II and III), it is usually influenced by the presence of family history, in contrast to a negative family history in Fitzpatrick's phototypes IV and V.<sup>2</sup> Historically the treatment of melasma has been challenging and various modalities of treatment include broad spectrum sunscreens, hypopigmenting agents (eg.,

hydroquinone, azelaic acid), tretinoin, chemical peeling agents like trichloroacetic acid, salicylic acid, glycolic acid and laser therapy including Q-switched ruby, Alexandrite, and Nd:YAG laser.<sup>3</sup> The Q-switched Nd:YAG laser is the laser of choice for pigmented lesions particularly in dark skin.<sup>4</sup> For the purpose of simplicity, melasma presentation in outpatient clinic can be graded as mild, moderate and severe, using the melasma severity scale (MSS). It rates melasma into four grades:

- 0- melasma lesions almost equivalent to the surrounding normal skin or with minimal residual pigmentation;
- 1- mild, slightly darker than the surrounding normal skin;
- 2- moderate, moderately darker than the surrounding normal skin;
- 3- severe, markedly darker than the surrounding normal skin.<sup>5</sup>

Other grading/scoring systems have been in use such as the melasma area and severity index (MASI) and modified MASI (mMASI).<sup>6,7</sup>

The melasma area and severity index (MASI) was developed by Kimbrough- Green et al in 1994. Probably this was the first scoring system used to measure the treatment response of melasma in a clinical trial by taking into account both the area involved, as well as the darkness of the skin.

MASI total score =  $0.3 \times A$  (forehead)  $\times$  (D+H) (forehead) +  $0.3 \times A$  (left malar)  $\times$  (D+H) (left malar) +  $0.3 \times A$  (right malar)  $\times$  (D+H) (right malar) +  $0.1 \times A$  (chin)  $\times$  (D+H) (chin).

The MASI score range from 0 to 48, with 48 being the most severe. At first, the advantages of the MASI score is obvious as it takes into account both the area of involvement as well as the degree of pigmentation, two of the most important components that affects the patients adversely.

The mMASI was proposed by Pandya et al in 2011 with the removal of homogeneity component.

Modified MASI total score =  $0.3 \times A$  (forehead)  $\times$  D (forehead) +  $0.3 \times A$  (left malar)  $\times$  D (left malar) +  $0.3 \times A$  (right malar)  $\times$  D (right malar) +  $0.1 \times A$  (chin)  $\times$  D (chin).

Diagnostic tools include Wood's lamp, dermoscopy, reflectance confocal microscopy and biopsy.

## METHODS

The aim of our study is to compare the therapeutic efficacy of low fluence Q-switched Nd-YAG laser versus 15% trichloroacetic acid peel in the treatment of melasma. Randomized, open-label, prospective and

comparative study was conducted on melasma patients attending the dermatology outpatient department, Chengalpattu Medical College Hospital, Chengalpattu over a period of 1 year from June 2016 to May 2017 after obtaining Institutional ethical committee approval.

50 melasma patients were enrolled in the study with age group between 18 to 50 years of either sex. The patients who had not received any prior treatment and those who had received any kind of topical treatment for melasma, after a wash out period of 6 weeks were included in the study.

Patients with age group below 18 years, patients on oral contraceptives/hormone replacement therapy, Pregnant & Lactating women, with any systemic or endocrine disorders, hypersensitivity to the chemical peel/lasers and with active infections (eg. herpes simplex infections) were excluded from the study.

- Group 1 (n=25): Treated with 15% TCA peel.
- Group 2 (n=25): Treated with low fluence Q-switched Nd-yag laser.

A detailed dermatological assessment was carried out to assess clinical type and woods lamp examination was done to assess morphological type. Fitzpatrick skin types were noted. Relevant investigations were done. Estimation of affected area was carried out by using MASI score.

Group 1- Chemical peeling: First peel is done with 15% TCA peel applied for 1 min. Contact time is 2 and 3 min in the second and third sessions, respectively. But diffuse redness with or without light white frosting would be considered as the end point irrespective of the duration. This procedure was repeated every two weeks for 6 times and the patients were followed every fortnight.

Group 2- 1064-nm QSNYL: is administered at parameters like spot size 6-8 mm, frequency- 10 Hz, fluence- 0.5- 1 J/cm<sup>2</sup>, once in three weeks for a total of 12 weeks. Increment of 0.1-0.2 J/ 3 weeks is done till energy fluency of 1 J/cm<sup>2</sup> is attained and is continued at 1 J/cm<sup>2</sup> till 12th week. The treatment was given for four sittings at a gap of 3 weeks.

For better and sustained result, all patients were advised for strict photoprotection and were given the same sunscreen (of sun protection factor 50) for the entire study period.

Melasma area and severity index scores were calculated at the beginning and end of the therapy for all patients to assess the severity and to evaluate the response of treatment. Clinical photographs were taken during each visit. The overall clinical response was graded according to the percentage of improvement as: excellent (76%–100%; near-normal skin), good (51%–75%; marked

lightening), fair (26%–50%; moderate lightening), poor (0%–25%; no change to slight lightening).

All patients were followed up every month for 12 weeks after the end of treatment for possible recurrence/worsening of melasma. But the patients who had had any complications were followed up every fortnight.

The data of the collected sample was normally distributed, and the following tests were used for analysis of the results: Student t-test, paired t-test, chi-square test, and analysis of variance. All analyses were performed using SPSS/PC (17.0; SPSS, Chicago, IL).<sup>8</sup> A p-value < 0.05 was considered statistically significant and that <0.001 was considered highly significant.

**RESULTS**

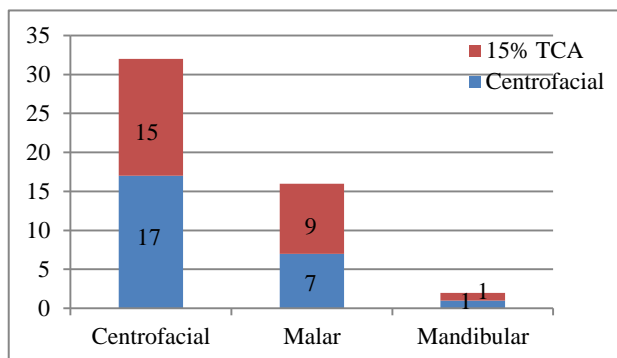
All 50 patients including 2 males completed the study. Table 1 shows the demographic data of our study.

**Table 1: Demographic data of the study.**

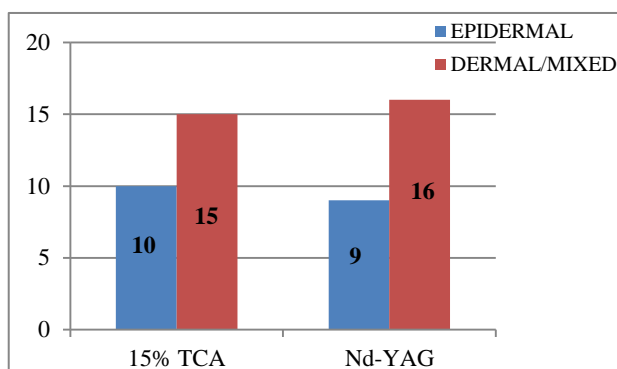
Variable	Result
<b>Age (years)</b>	
Mean±SD	31.2±8.9
Range	21 to 50
<b>Sex, N (%)</b>	
Female	48 (96)
Male	2 (4)
<b>Occupation, N (%)</b>	
Working	20 (40)
Not working	30 (60)
<b>Melasma-clinical type, N (%)</b>	
Centrofacial	32 (64)
Malar	16 (32)
Mandibular	2 (4)
<b>Melasma-histologic type by wood lamp, N (%)</b>	
Epidermal	19 (38)
Dermal/mixed	31 (62)
<b>Fitzpatrick skin type, N (%)</b>	
Type III	4 (8)
Type IV	14 (28)
Type V	32 (64)

The mean age of the patients in the study population was 31.2 years (SD= ±8.9; t-1.409). 32 (64%) patients were belonging to centrofacial distribution and 31 (62%) patients had dermal/mixed pattern of melasma (Figure 1 and 2). All the patients belonged to Fitzpatrick type from 3 to 5 and type 5 was the most common among all. Out of 50 patients, 8 (32%) and 2 (8%) patients have shown good response (>51% improvement) in TCA and laser groups respectively. 11 (44%) patients in laser group have shown poor response (<25% improvement). We observed that none of either group has shown excellent response. In our study, we obtained better response in

patients with epidermal type in both groups than those with dermal/mixed types of melasma.



**Figure 1: Melasma clinical type with its patients' distribution.**



**Figure 2: Melasma morphological types with its patients' distribution.**

**Table 2: Side effects distribution.**

Side effects	15% TCA	Nd-YAG	Total
No side effects	21	13	34
Acneform eruption	1	0	1
Erythema	2	3	5
Post inflammatory hyperpigmentation	1	8	9
Spotty hypopigmentation	0	1	1

Post inflammatory hyperpigmentation (PIH) was the most common side effect in patients treated with Nd-YAG laser, particularly Fitzpatrick skin type V. 12 (48%) out of 25 patients in laser group had side effects like PIH, spotty hypopigmentation and erythema. 4 (16%) patients in TCA group had erythema, PIH and acneform eruption. Table 2 shows that patients treated with Nd-YAG laser had more side effects than patients treated with 15% TCA.

All the patients were followed up for another 12 weeks after the study period. Among all improved patients, we observed recurrence rate of 40% during follow up period.

Figure 3 and 4 show the clinical response before and after 15% TCA and Nd-YAG laser treatment respectively.



**Figure 3 (A, B): Clinical response before and after 15% TCA.**



**Figure 4 (A, B): Clinical response before and after Nd-YAG laser.**

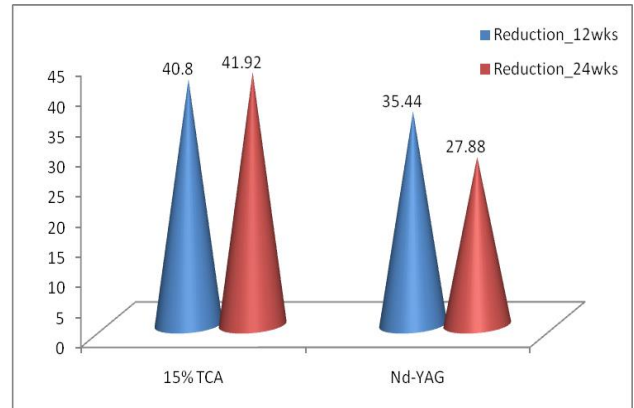


**Figure 5 (A, B): Post inflammatory hyperpigmentation in a patient after Nd-YAG laser treatment.**

Figure 5 shows worsening of melasma with post inflammatory hyperpigmentation in a patient, after 3 sessions of Nd-YAG laser treatment.

**Table 3: Comparison of percentage of reduction in mean MASI between two groups.**

Student t test	Group	N	Mean (%)	SD (%)	T	P
% of reduction	15% TCA	25	41.92	12.69	2.8	0.007
	Nd-YAG	25	27.88	21.62		



**Figure 6: Percentage of reduction in mean MASI between two groups at 12 and 24 weeks.**

Table 3 shows the final outcome of treatment results between 15% TCA group and Nd-YAG laser group. In this study, the total percentage of reduction in mean MASI was 41.92% in 15% TCA treated group and 27.88% in Nd-YAG laser treated group (Figure 6) [t=2.8, p=0.007 (<0.05)]. Thus 15% TCA group showed significantly better response as compared to the Nd-YAG laser group.

**DISCUSSION**

Melasma is an acquired, circumscribed, pigmentedary disorder that causes significant social and emotional stress to the patients. Although many treatment modalities are available, its management remains a challenge due to its recurrent and refractory nature.

Chemical peeling with TCA, Alpha and Beta hydroxy acids have been shown to be beneficial for the treatment of melasma and other pigmentedary disorders. Trichloroacetic acid at the concentration of 10%-30% can be used for superficial peels which causes exfoliation of the stratum corneum without epidermal necrosis.<sup>9</sup> Like Nd-YAG laser, Q switched ruby and Alexandrite lasers can also be used in the treatment of melasma with variable results.<sup>10</sup>

In our study, 15% TCA peeling was found to be more effective than laser therapy in the treatment of melasma with rare side effects. Whereas, Nd-YAG laser group was associated with complications such as post inflammatory hyperpigmentation.

About 96% of our study population was females. Centrofacial pattern (64%) was the most common pattern of melasma observed in our study. Bansal et al also observed that centrofacial pattern was the commonest followed by malar and mandibular types.<sup>11</sup>

In a similar study, Moubasher et al compared Qs-Nd:YAG laser and TCA of various strength (20%, 25% and 30%) in the treatment of melasma among Egyptian patients.<sup>12</sup> In this study most of the patients belong to Fitzpatrick skin type IV (89.2%) while our patients belong to Fitzpatrick skin type V (64%). Moubasher et al concluded that 25% TCA was more effective with 64.7% of reduction in mean MASI ( $p < 0.001$ ) and no excellent or good response in the laser group. In our study, the total percentage of reduction in mean MASI were 41.92% and 27.88% in 15% TCA group and Nd-YAG laser group respectively ( $p = 0.007$ ). Thus we have obtained promising results with lower concentrations of TCA.

Moubasher et al also reported that adverse effects like post inflammatory hyperpigmentation (53.3%) and rate of recurrence (32%) were more among Nd:YAG laser treated patients. These results were in the agreement with ours.

Some studies have also shown that the rate of recurrence was higher even up to 81%, after completing the procedure with Nd-YAG laser.<sup>13</sup>

Recent reviews on the treatment of melasma with lasers in pigmented skin suggest that it should not be used as a first line treatment but only to be considered when other treatments have failed.<sup>14</sup>

Few other studies compared TCA with other peeling agents or topical treatment. They reported that TCA was either superior or equally effective like other agents in the treatment of melasma.<sup>15,16</sup>

Combination of TCA peel with an adjuvant treatment has also been recommended by some, thus improving the results and minimizing post inflammatory hyperpigmentation.<sup>17,18</sup>

Hence chemical peels still remain more popular for the treatment of pigmentation disorders like melasma and aesthetic improvement

## CONCLUSION

Our study shows that 15% TCA is more efficacious and safer than Nd:YAG laser in the treatment for melasma. Higher incidence of side effects like Post inflammatory hyperpigmentation with Q-switched Nd:YAG laser, particularly in dark skinned people limits its use in melasma as first line of management. Avoidance of sun exposure, regular usage of broad spectrum sunscreens and discontinuation of medicines like hormonal pills would enhance therapeutic outcome in melasma.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the institutional ethics committee*

## REFERENCES

- Handel AC, Miot LDB, Miot HA. Melasma: a clinical and epidemiological review. *An Bras Dermatol.* 2014;89:771–82.
- Melasma: a monography. 1st edition. New Delhi, Philadelphia: Jaypee Brothers Medical Publishers (P) Ltd; 2015: 86.
- Rendon M, Berneburg M, Arellano I, Picardo M. Treatment of Melasma. *J Am Acad Dermatol.* 2006;54(2):272-81.
- Barlow RJ, Hruza GJ. Lasers and light tissue interactions. In: Goldberg DJ, Dover JS, Alam M (eds). *Procedures in cosmetic dermatology: lasers and Lights.* 1st edition. Volume 1. Philadelphia: Elsevier; 2005: 1-11.
- Pandya A, Berneburg M, Ortonne JP, Picardo M. Guidelines for clinical trials in melasma. *Br J Dermatol.* 2007;156(S1):21–8.
- Kimbrough-Green CK, Griffiths CE, Finkel LJ, Hamilton TA, Bulengo-Ransby SM, Ellis CN. Topical retinoic acid (tretinoin) for melasma in black patients. A vehicle-controlled clinical trial. *Arch Dermatol.* 1994;130:727-33.
- Pandya AG, Hynan LS, Bhore R, Riley FC. Reliability assessment and validation of the Melasma Area and Severity Index (MASI) and a new modified MASI scoring method. *J Am Acad Dermatol.* 2011;64:78–83.
- SPSS. Statistical package for social science. Version 17. Standard version. Chicago, IL: SPSS Inc.; 2008.
- Tsai T, Bowman P, Jee S, Maibach H. Effects of glycolic acid on light induced skin pigmentation in Asian and Caucasian subjects. *J Am Acad Dermatol.* 2000;43:238–43.
- Rendon MI. Utilizing combination therapy to optimize melasma outcomes. *J Drugs Dermatol.* 2004;3:27.
- Bansal C, Naik H, Kar HK, Chauhan A. A comparison of low fluence 1064nm Q switched Nd:Yag Laser with topical 20% azelaic acid cream and their combination in melasma in Indian patients. *J Cutan Aesthet Surg.* 2012;5:266-72.
- Moubasher AE, Youssef EM, Abou-Taleb DA. Q-switched Nd: YAG laser versus trichloroacetic acid peeling in the treatment of melasma among Egyptian patients. *American society of Dermatol Surg.* 2014;40(8):874-82.
- Houfbauer Parra CA, Careta MF, Valente NY, de Sanches Osorio NE, Torezan LA. Clinical and histopathologic assessment of facial melasma after low-fluence Q-switched Nd-YAG laser. *Dermatol Surg.* 2016;42:507-12.

14. Halachimi S, Haedersdal M, Lapidoth M. Melasma and Laser Treatment: An evidence based analysis. *Lasers Med Sci.* 2014;29:589-98.
15. Azzam OA, Leheta TM, Nagui NA, Shaarawy E. Different therapeutic modalities for treatment of melasma. *J Cosmet Dermatol.* 2009;8:275–81.
16. Dogra A, Gupta S, Gupta S. Comparative efficacy of 20% trichloroacetic acid and 50% glycolic acid peels in treatment of recalcitrant melasma. *J Pak Assoc Derma.* 2006;16:79–85.
17. Soliman MM, Ramadan SA, Bassiouny DA, Abdelmalek M. Combined trichloroacetic acid peel and topical ascorbic acid versus trichloroacetic acid peel alone in the treatment of melasma: a comparative study. *J Cosmet Dermatol.* 2007;6:89–94.
18. Safoury OS, Zaki NM, El Nabrawy EA, Farag EA. A study comparing chemical peeling using modified jessner's solution and 15% trichloroacetic acid versus 15% trichloroacetic acid in the treatment of melasma. *Indian J Dermatol.* 2009;54:41–5.

**Cite this article as:** Venu S, Balachandran SC, Nallu K, Lakshmanan C. A comparative study of low-fluence Q-switched neodymium-doped: yttrium aluminum garnet laser versus 15% trichloroacetic acid peel in the treatment of melasma. *Int J Res Dermatol* 2019;5:446-51.