## **Original Research Article**

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# A study on efficacy of high fluence Q-switched neodymium doped yttrium aluminium garnet laser in macular amyloidosis

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#### **ABSTRACT**

**Background:** Macular amyloidosis (MA) typically presents as small, dusky-brown or greyish pigmented macules, treatment of which remains challenging with topical and systemic therapies, however Q-switched neodymium-doped yttrium aluminium garnet (Nd:YAG) laser has proven to be an effective treatment modality to reduce hyperpigmentation. The aim of the study is to study the efficacy of Nd:YAG laser in the management of MA.

**Methods:** 30 female patients were treated with Q-switched Nd:YAG laser at 1064 nm with a spot size of 3 mm at a fluence of 6-7 J/cm<sup>2</sup>, frequency of 2 Hz, for 350-500 pulses. Total number of pulses decreased with each treatment session as the intensity of the hyperpigmentation decreased. The procedure was repeated at one-month intervals for a total of 6 treatment sessions.

**Results:** After completion of treatment sessions with Nd-YAG laser 36.66% patients showed >50% improvement in the pigmentation. 66.6% patients were satisfied with the laser treatment. 33.3% patients showed <25% improvement and unsatisfied with the treatment.

**Conclusion:** MA remains an enigma and a source of concern for the suffering patients and physicians. Q-switched Nd-YAG laser 1064 nm has shown positive response in the reduction of pigmentation in MA.

Keywords: Nd:YAG laser, Macular amyloidosis, Hyperpigmentation

#### INTRODUCTION

Macular amyloidosis (MA) most commonly presents as irregular, pigmented macules, which may or may not be itchy. It is typically distributed in a symmetric fashion on the upper back, limbs, and occasionally the chest and buttocks, and may have a rippled appearance. This disease is more prevalent in persons of South American, Asian, and Middle Eastern descent, with a female preponderance. Its etiology remains unknown and is most likely multifactorial, with genetics, sunlight, and friction playing a role. It has been proposed that mechanical damage to the skin leads to the apoptosis of basal layer keratinocytes and, thereafter, the release of keratin into the

dermis.<sup>3</sup> Histopathologic examination of the lesion on the back showed a slight enlargement of the dermal papillae containing a homogeneous, amorphous material.<sup>4</sup> Frustratingly, the hyperpigmentation associated with the disease remains difficult to treat systemically or topically. Recently, laser treatment, with Q-switched neodymium-doped yttrium aluminum garnet (Nd:YAG) 1064 nm has emerged as an effective treatment option since it selectively targets the melanin without damaging the surrounding tissue (selective photo thermolysis).<sup>5</sup> Hence the present study was conducted with the objective to evaluate the efficacy and side effects of Nd:YAG 1064 nm laser in the treatment of macular amyloidosis.

#### **METHODS**

This is a single centre (Sri Guru Ram Das Institute of Medical Sciences and Research, Amritsar, Punjab) prospective study done on 30 female patients between the age group 25-45 years consistent with the clinical diagnosis of MA. The recruitment period was from March 2018 to April 2019. Written informed consent from the patients and ethical committee clearance for the study was obtained from the institution. Pregnant, females on contraception, keloidal tendencies photosensitive dermatoses were excluded from the study. Complete history and physical examination to exclude any associated systemic disorder or drug usage leading to cutaneous pigmentation was obtained. The age of onset, skin type, duration, sites of involvement, pruritus, history of friction, sun exposure, personal and family history of MA were recorded. Dermoscopic and histological examination were done in doubtful cases. (Figure 1) Enrolled females were treated with Q-switched Nd:YAG laser at 1064 nm with a spot size of 3 mm at a fluence of 6-7 J/cm2, frequency of 2 Hz, for 350-500 pulses. Total number of pulses decreased with each treatment session as the intensity of the hyperpigmentation decreased. The procedure was repeated at one-month intervals for a total of 6 treatment sessions. Post procedure photoprotection with sunscreen was advised.



Figure 1: Dermoscopy shows brown clods and radiating brown lines described as "Hub and Spoke" pattern.

#### Outcome assessment parameters

Improvement after each session was assessed both by the treating dermatologist and the patient with the help of quartile grading scale which ranged from 1-4, 1 representing <25% improvement; 4 representing ≥75% improvement. Patient satisfaction score (PSS) was also used which ranged from 0-10, 10 representing maximum satisfaction after treatment. Results were evaluated using Statistical package for social sciences (SPSS) for windows software (SPSS Inc.,USA, version 24.0).

#### **RESULTS**

In present study total of 30 female patients were enrolled with mean duration of MA of 4.2±1.8 years. There was a wide variation in the duration of the disease ranging from 3 months to 10 years. The mean age of the patients was 32.4±5.19 years. Minimum age was 27 years and maximum age was 42 years at the time of inclusion. Most of the patients belonged to Fitzpatrick skin type IV (46.66%). The most common site of involvement of MA was upper back seen in 73.33% patients. 60% patients experienced pruritus of varying degrees. Family history of MA was present in 26.6% patients (table 1). After completion of treatment sessions with Nd:YAG laser 36.66% patients showed >50% improvement in the pigmentation. 66.6% patients were satisfied with the laser treatment. 33.3% patients showed <25% improvement and unsatisfied with the treatment. (Figure 2-4).



Figure 2: Before and after treatment with Nd:YAG laser picture of MA involving upper back (quartile grading >75% improvement, patient satisfaction score >7).

Table 1: Demographic profile of study population.

Demographic data	N
Number of patients	30
Mean age of study participants	32.4±6.79 years
Mean duration of MA	4.2±1.8 years
Fitzpatrick skin type	
III	12 (40%)
IV	14 (46.66%)
V	4 (13.33%)
Site of Macular amyloidosis	
Upper Back	22 (73.33%)
Extensor aspect of arms	5 (16.66%)
Extensor aspect of legs	3 (10%)
History of pruritus	
Present	18 (60%)
Absent	12 (40%)
Family history of MA	
Present	8 (26.6%)
Absent	22 (73.33%)

Table 2: Results of Nd:YAG 1024 nm laser in MA.

Variables	N (%)
Quartile grading scale	•
1≤25% improvement	10 (33.3)
2=26-50% improvement	9 (30)
3=51-75% improvement	8 (26.66)
4≥75% improvement	3 (10)
Patient satisfaction score	
0-3 (unsatisfied)	10 (33.3)
4-6 (satisfied)	14 (46.6)
7-10 (highly satisfied)	6 (20)



Figure 3: Before and after treatment with Nd:YAG laser picture of MA involving upper back (quartile grading >75% improvement, patient satisfaction score >7).



Figure 4: Before and after treatment with Nd:YAG laser picture of MA involving upper back (quartile grading <25% improvement, patient satisfaction score 3).

#### DISCUSSION

Amyloidosis is a group of disorders characterized by the accumulation of fibrillar material (amyloid) in the tissues.

MA believed to result from localized trauma in the form of continuous friction, scratching or the use of sponges, brushes etc., during bath. It has been proposed that mechanical damage to the skin leads to the apoptosis of basal layer keratinocytes and thereafter, the release of keratin into the dermis. Keratin phagocytosed by macrophages undergoes structural transformation from previously  $\alpha$ -structure into  $\beta$ -pattern proteins (the hallmark of amyloid proteins), which resist physiological degradation.6 Though various treatment options such as topical steroids, vitamin D3 analogues, calcineurin inhibitors. narrow band Ultraviolet B (UVB), dermabrasion, cryotherapy, oral drugs like acitretin, cyclophosphamide, cyclosporine, colchicine etc have been tried but with limited results. Recently laser therapy has emerged as boon for treating hyperpigmentation, decreasing thickness and relieving pruritus in MA patients. Lasers work on the principal of selective photo thermolysis with melanin (absorption spectra 400-1100 nm) as target chromophore.8 In a study by Ostovari et al., 90% of patients with MA demonstrated more than 50% reduction in pigmentation with Q-switched Nd-YAG laser.9

In present study, of 30 female patients were enrolled with wide variation in the duration of the disease ranging from 3 months to 10 years (mean±SD, 4.2±1.8 years). In a study by Bandhlish et al age of onset of MA for all patients ranged between 16 and 59 years with mean age of onset was 34.6±10.5 years. In our study mean age of the patients was 32.4±5.19 years. <sup>10</sup> Minimum age was 27 years and maximum age was 42 years at the time of inclusion. Rasi et al reported eighty one percent of patients were between 21 and 50 years of age. <sup>11</sup> Most of patients in our study belonged to Fitzpatrick skin type IV (46.66%) followed by Fitzpatrick skin type III (40%) and V (13.33%) where as in study by Bandhlish et al 78% patients had skin phototype III; the rest were of skin phototype IV. <sup>10</sup>

Epidemiologically, MA is prevalent in populations which generally have a high skin phototype IV and V. The most common site of involvement of MA was upper back seen in 73.33% patients followed by extensor aspect of arms (16.66%) and legs (10%). Similar sites of involved were reported in other studies like Bandhlish et al delineated interscapular involvement in 80% patients followed by extensor aspect of arms and legs extensor aspect of legs, biphasic pattern comprising both macular and lichen amyloidosis was seen in three (6%) patients. <sup>10</sup> None of the patients had biphasic pattern in current study. History of pruritus was present in 60% of our patients whereas in a study by Bandhlish et al 44% patients complained of itching. In a study by Ratrout and Satti, six of the 10 patients complained of mild to moderate pruritus. 12 Family history was present in 26.6% patients in our study similar findings are reported in other study. 10 In our study after treatment with high fluence Q-switched Nd:YAG laser, 33.3% patients showed <25% improvement after completion of total 6 sessions, one month apart. 30% patients reported improvement in the range of 26-50%

whereas 11 patients reported >50% improvement after completion of sessions. Most of the patients (46.6%) were satisfied with the treatment whereas 33.3% patients were unsatisfied after treatment. 6 patients were highly satisfied with the treatment since there was decrease in pigmentation and itching after treatment with Nd:YAG laser. This laser works on the principle of selective photo thermolysis targeting area of hyperpigmentation without much damage to surrounding tissue. There are very few studies done so far to assess the role of Nd-YAG laser in MA. 13,14 Similar successful results with lasers have been shown by Barsky et al, in which recalcitrant macular amyloidosis was treated with 3 treatment sessions of pulse dye laser at 2 weeks interval. 15 Esmat et al, when compared efficacy of different modes of fractional carbon dioxide laser in treatment of primary cutaneous amyloidosis, demonstrated that both superficial and deep mode showed comparable efficacy whereas superficial mode is better tolerated by patients.16

#### Limitations

Our study lacks the objective improvement assessment parameters, had smaller sample size and shorter follow up to assess the long-term results and recurrence after treatment with laser. Though we concluded that high fluence Q-switched Nd:YAG laser is an effective treatment modality for the management of MA more number of studies are required in future to compare the outcomes.

#### **CONCLUSION**

Q-switched Nd-YAG laser 1064 nm has shown positive response in the reduction of pigmentation in MA, also it decreases potential side effects associated with the use systemic therapy in the management of MA.

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Ethical approval: The study was approved by the

institutional ethics committee

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