

# Efficacy of Q-switch 532 nm Nd:YAG Laser in acquired melanocytic nevi

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## Abstract

**Introduction** Acquired melanocytic naevi are benign pigmented skin lesions characterized by asymptomatic, small macules, papules and nodules. These consist of clusters of melanocytic nevus cells distributed in epidermis, dermis and subcutaneous tissue. In the past ablative lasers like CO<sub>2</sub> and Erbium:Yag lasers were used to treat them. However due to their adverse effects of scarring and depigmentation they have been replaced by new lasers.

**Objective** To determine efficacy of Q-switched 532nm Nd:YAG laser in treating acquired melanocytic nevi.

**Methods** Total 77 patients meeting inclusion criteria were taken from outpatient Dermatology Department, Jinnah Hospital, Lahore. After informed consent, name, age, gender, duration, site, size and color of nevi were noted. All patients underwent treatment with 532nm Q-Switched Nd:YAG laser, repetition rate 1Hz, pulse width 10 nanoseconds, spot size: 2 to 6mm and fluence 0.17-2.12 J/cm<sup>2</sup>, Improvement was assessed according to operational definition between pre and post treatment photographs.

**Results** The mean age of patients was 31.12 ± 9.62 years (16-46years). There were 23(29.9%) male and 54(70.1%) females, with female to male ratio as 2.35:1. Efficacy of treatment was achieved in 65(84.4%) while efficacy was not achieved in 12(15.6%) cases.

**Conclusion** It is concluded that efficacy was achieved in 84.4% cases with Q-switched 532nm Nd YAG laser in treating acquired melanocytic nevi. Hence in future we can use Q-switched 532nmNd: YAG laser in treatment of acquired melanocytic nevi.

## Key words

Q switch Nd Yag laser; Melanocytic naevi; Benign pigmented.

## Introduction

Melanocytic nevi are benign proliferation of normal pigment producing cells in the skin characterized by diverse range of clinical spectrum and histological pattern.<sup>1</sup> Genetic control plays an important role in the emergence

of nevi, whereas mean number of nevi depends on environmental exposure.<sup>2</sup> The most predominant environmental risk factor for nevus development is amount of sun exposure.<sup>3</sup> Regular use of sunscreen decreases the formation of new nevi on photo-exposed skin especially in children having freckles.<sup>4</sup> Experimentally it has been shown that UV radiation stimulates melanocytes to increase melanin synthesis.<sup>5</sup> Melanocytic nevi have been reported as the most frequent pigmented lesion in a study (74.3%).<sup>6</sup> Furthermore, it can be classified as congenital or acquired. Acquired

**Manuscript:** Received on: September 29, 2024

Accepted on: December 10, 2024

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melanocytic nevi often referred as moles are small asymptomatic pigmented lesions characterized by small macules, papules or nodules. These lesions are comprised of clusters of melanocytic nevus cells located in epidermis, dermis and subcutaneous tissue.<sup>7</sup> Treatment of acquired melanocytic nevi is a common concern. Therapeutic options include surgical excision, shave excision, electro cautery and laser therapy. Until recent times, ablative lasers such as CO<sub>2</sub> and Erbium: YAG lasers were used but due to reported adverse effects of scarring, depigmentation and persistent erythema, newer pigment lasers have replaced these ablative lasers.<sup>8</sup> Different pigment specific lasers have proven to be effective in treating nevi.<sup>9</sup> Q-switched Nd:YAG laser characterized as a pigment laser, emits infrared light at 1,064 nm. The primary cause of scarring is increased depth of penetration which increases with increased wavelength.<sup>10</sup> Passing of laser light through potassium titanyl phosphate(KTP) crystal allows for the doubling of its frequency and halving its wavelength, resulting in emission at 532nm.<sup>11</sup> The shorter wavelength of 532nm allows the laser to penetrate the skin less deeply. This allows more controlled removal of the melanocytic nevi from the surface with minimal effects on the underlying tissue and thus minimizing any undue damage to the surrounding skin.<sup>12</sup>

532 nm laser appears to be safe and effective modality for removal of pigmented nevi with no long-term side effects.<sup>13</sup> A study was carried out in Yemen, to determine the efficacy and safety of 532 nm Nd:YAG laser. In this study total 350 patients were treated with a single treatment session and 84.9% of cases showed good to excellent results (more than 50% improvement).<sup>12</sup>

Currently there is lack of local studies available to assess the effectiveness of Qswitched 532nm Nd:YAG laser in treating acquired melanocytic

nevi. Rationale behind this study is to enhance our knowledge about safety and efficacy of Q-switched Nd:YAG laser with wavelength of 532nm, in treating acquired melanocytic nevi in local population.

## **Material and methods**

This study is descriptive case series, carried over a period of 6 months from October 2020 to April 2021. Total of 77 patients with Fitzpatrick's skin type 3 and 4, of either gender and in between age of 16-75 with at least 5 years' history of static lesion were included in the study. After informed consent, demographic details like name, age, gender, duration, site, size and colour of nevi were noted. Baseline photograph was taken before 1<sup>st</sup> session. One mole which was most pigmented and big was selected as a target lesion. Other moles were treated simultaneously but were not included in the study. All patients underwent treatment with Q-Switched Nd: YAG laser of 532 nm wavelength, with fixed parameters of repetition rate of 1 Hz, pulse width of 10 nanoseconds, average spot size ranging from 2 to 6 mm and fluence of 0.17-2.12 J/cm<sup>2</sup> (minimal to achieve end point of ash-grey color change). Patients were advised to apply antibacterial skin ointment for 7 days three times a day. They were also advised to do strict sunlight protection and to use sunblock (SPF 60). A total of 3 sessions were done with interval of 4 weeks in between each session. Patients were evaluated 4 weeks after the last session and photograph was also taken. Improvement was assessed by comparing post treatment photograph with the pre-treatment photograph. All the information was entered in a structured proforma.

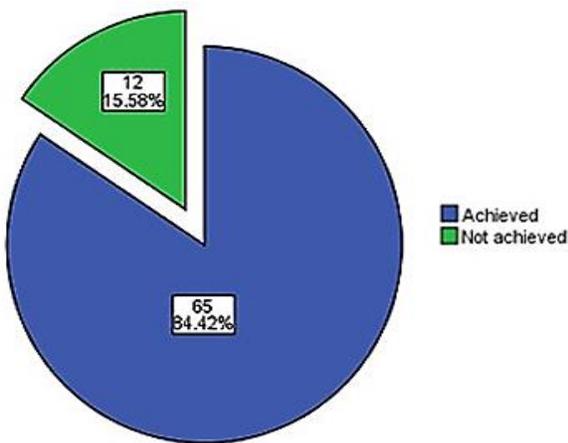
## **Results**

The mean age of patient was 31.12±9.62 years with minimum age of 16years and maximum age of 46 years. 44 (57.1%) subjects were in the age

group of 16-34 and 33 (42.9%) subjects were in the age group of 35-50years. 23 patients (29.9%) were male and 54 (70.1%) were female and female to male ratio was 2.35:1. The mean size of the lesion was  $4.02 \pm 1.19$  (mm) with minimum size of 2.10mm and maximum size of 6mm. 38 (49.4%) patients had lesion size of 2.1-4mm and 39(50.6%) had size as 4.1-6mm. The mean duration of lesion was  $7.78 \pm 1.56$  years. Majority of patients (26) had lesion on nose, 20 patients had on cheeks, 16 had on chin and 15 had it on forehead. Treatment proved to be effective in 65(84.4%) while in 12 patient's efficacy was not achieved (**Figure 1**). Comparison of frequency of efficacy with respect to duration of years, gender, size of lesion and age group was insignificant ( $p$  value $>0.05$ ).

**Discussion**

Melanocytic nevi are a clusters of abnormal melanocytes known as nevus cells. They can appear in various shapes, sizes and colours such as flat brown macules to raised skin-coloured or hyper pigmented papules. Normal melanocytes maintain uniform cell density but any alteration in this density regulation results in the clustering of proliferating melanocytes in to benign nevi and the radial and vertical growth phases of melanoma.<sup>14</sup> Acquired melanocytic nevi is a



**Figure 1** Descriptive statistics of efficacy.

**Table 1** Comparison of frequency of Efficacy with respect to lesion size (mm).

Lesion size (mm)	Efficacy		Total
	Achieved	Not achieved	
2.1-4	32(84.2%)	6(15.8%)	38(100%)
4.1-6	33(84.6%)	6(15.4%)	39(100%)
Total	65(84.4%)	12(15.6%)	77(100%)

Chi-square=0.002; P-value = 0.961(Insignificant).

**Table 2** Comparison of frequency of Efficacy with respect to site of lesion.

Site	Efficacy		Total
	Achieved	Not achieved	
Forehead	11(73.3%)	4(26.7%)	15(100%)
Cheeks	17(85%)	3(15%)	20(100%)
Nose	23(88.5%)	3(11.5%)	26(100%)
Chin	14(87.5%)	2(12.5%)	16(100%)

Chi-square = 1.845 P-value = 0.605 (Insignificant).

cause of cosmetic concern, especially in young female patients. There is an increased relative risk of developing melanoma in those who have 50 or more number of melanocytic nevi.<sup>15,16</sup>

Conventional methods such as excision, dermabrasion, and chemical peels are not preferred now due to increased risk of scarring. Ablative lasers, such as the CO2 and erbium: YAG lasers have been used in the past for the treatment of melanocytic nevi. The erbium: YAG laser (2490nm wavelength) was introduced as an alternate to CO2 laser due to its ability to give more precise ablation with lesser risk of complications.<sup>17</sup> Both normal and Q-switched mode of new pigment specific lasers as Ruby, Alexandrite , Diode and Nd:YAG have also been used to target the pigment in melanocytic nevi.<sup>18</sup> These lasers deliver high energy in nano second or picosecond range with specific targeting of melanin chromophores and spares adjacent tissue.<sup>19-22</sup> In a Q-switched laser, mechanism primarily relies on a photomechanical effect and minimal photothermal effect.<sup>23-25</sup> The 532-nm Nd:YAG laser has become popular due to its efficacy in treating pigmentary disorders and Hori's nevus.<sup>26</sup> Safety profile of Q-switch lasers is good with only few side effects.<sup>27</sup> Hyperpigmentation,

hypopigmentation and thermal damage are common adverse effect of Q-switch lasers.<sup>28,29</sup>

Various international studies have been carried out to know about the efficacy of Q-switched Nd:YAG laser ( both with 532nm and 1064nm wavelength) in acquired melanocytic nevi. Although the efficacy of Q-switched 1064nm Nd:YAG laser in acquired melanocytic nevi has been proved in many studies, the effect of long pulsed 532nm Nd:YAG laser was demonstrated only in 1 study carried out in Yemen in 2012.<sup>12</sup> Local data is also limited, so it was important to conduct a study to determine the efficacy and safety of 532nm Q-switched Nd:YAG laser in treating melanocytic nevi.

In a study conducted in Korea by Kim *et al.* the mean age of the patients was 28.3 years with a range of 18-56 years, which is comparable to our study in which mean age was 31.2 years.<sup>10</sup> Mean age of patients in another study on indian population was 25.27 years with a range of 8-48 years, which is again comparable to our study.<sup>7</sup>

In our study 70.13% of subjects were females whereas 29.87% were males and this is comparable to the study conducted by Alshami *et al.* in which majority of patients were also females i.e. 88.2% and only 11.7% were males.<sup>12</sup> Similarly male to female ratio of 4:15 in another study conducted in India by Parasramani *et al.* is comparable to our study.<sup>7</sup> Male to female ratio in a study conducted by Kim *et al.* showed a higher percentage of female patients (98.6%) and only 1.35% male patients. Higher cosmetic concerns of female patients force them to seek treatment earlier and maybe the reason of this high percentage of female patients.

Efficacy, which in this study was defined as more than 75% improvement in size and colour of nevi with Q-switched Nd-YAG laser was achieved in 84% of the subjects. Excellent

results were also shown in 84.9% of the patients in study conducted by Alshami *et al.* and this is comparable to our study.<sup>12</sup> However excellent efficacy was achieved in only 70% of patients in the study conducted by Kim *et al.* to know the efficacy of 1064 Nd:YAG laser in acquired melanocytic naevi.<sup>10</sup> This difference is probably due to use of different wavelength of Nd:YAG laser i.e.1064nm and also because of racial differences in their study population and ours. Parasramani *et al.* also conducted a study in which Q-switched Nd:YAG laser of 1064 nm wavelength showed excellent response (i.e. more than 80% improvement in size and color of nevi) in 44% of Indian subjects.<sup>7</sup> Stricter criteria of more than 80% improvement in color and size is the reason of difference in results from our study. Generally according to results efficacy of 532nm Q-switched Nd:YAG laser is more than 1064nm Q-switched Nd:YAG laser in treating acquired melanocytic nevi.

In comparing subjective improvement of lesions at different anatomical sites, our study found that the rate of excellent improvement (defined as >75% improvement in both color and size of the lesion) was highest for lesions on the nose (88.5%), followed closely by cheeks (85%), chin (87.5%), and forehead (73.3%). This contrasts with the findings from Kim *et al.*, who reported lower rates of subjective improvement for nose (54.35%) and chin (61.1%) lesions compared to forehead (84.9%) and cheeks (85.4%) lesions and this may be attributed to different wavelength of Nd:YAG laser used in the study i.e. 1064 nm.

When data was stratified according to age, gender, size of lesion, duration of lesion and site of the lesion, no statistically significant difference was found in these subgroups.

Treatment was tolerated very well in most of our patients, only side effect noted was mild

transient erythema around the lesion after each session, for which patients were advised to use sunscreen to avoid pigmentation after the treatment.

Small sample size, absence of control group and lack of follow-up after treatment for delayed side effects and recurrence of nevi were limitations of our study.

This study shows that treatment of acquired melanocytic nevi with 532 nm Nd:YAG laser is a safe and effective treatment modality in our population. This will help in improving the quality of life of the patients and will also address their cosmetic issues. Hence 532 nm Nd:YAG laser is a useful addition in treatment of acquired melanocytic nevi in future.

### Conclusion

It is concluded that Q-switched 532nmNd: YAG laser achieved efficacy in 84.4% cases in treating acquired melanocytic nevi. Hence in future we can use Q-switched 532nmNd: YAG laser in treatment of acquired melanocytic nevi.

**Declaration of patient consent** The authors certify that they have obtained all appropriate patient consent.

**Financial support and sponsorship** None.

**Conflict of interest** Authors declared no conflict of interest.

### Authors' contribution

**MS,KM,BB,WN:** Substantial contributions to study design, acquisition of data, manuscript writing, has given final approval of the version to be published.

**HS,LMM:** Substantial contributions to analysis and interpretation of data, critical review of the manuscript, has given final approval of the version to be published.

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