

## The Effect of 3 Sessions of Q Switched Neodymium: Yttrium – Aluminum – Garnet Laser in the Treatment of Freckles

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### Abstract

**Background:** Freckles are common superficial pigmented lesions which can become cosmetic problems. Advances in laser technology have resulted in the ability to treat pigmented lesions with greater safety and efficacy.

**Objective:** The study aimed to evaluate the effectiveness of 1,064 nm Q-switched neodymium: yttrium–aluminum–garnet (Nd- YAG) laser in the treatment of freckles.

**Methods:** Fifty patients with freckles referring to the laser centers of Al-Azhar University hospital (Asyut) were enrolled in this open-label, monocentric study. All participants received 3 sessions of 1,064-nm Q switched Nd:YAG laser at 4-weeks intervals. The pigmentation area and severity index (PSI score) was calculated based on 3 parameters: Area, darkness, and density of the pigmented lesions.

**Results:** Fifty patients (4 males and 46 females) completed the study protocol. The age of the patients ranged from 6-43 years, the duration of freckles showed a wide range, (1 month-20 years) with a mean duration of  $5.13 \pm 4.72$  years. There was a statistical significant improvement in mean PSI after treatment of freckles with 1064 Q-Switched Nd-YAG.

Excellent improvement ( $\geq 75\%$ ) were occurred in 17 cases (34%), very good improvement (50-74%) in 14 cases (28%), good improvement ( $\geq 25$ -49%) in 16 cases (32%) and poor improvement ( $< 25\%$  lightening) in 3 cases (6%). The correlation between improvement and clinical parameters showed positive significant correlation with duration of disease and number of sessions. The reported side effects among this study were post-inflammatory hyperpigmentation in 2 cases (4%), hypopigmentation in 3 cases (6%) and erythema in 6 cases (12%).

**Conclusions:** 1064 Q-switched Nd- YAG laser is effective modality in the treatment of freckles especially in patients with long duration.

**Keywords:** Freckles; Q-Switched Nd- YAG laser; Pigmentation

**Abbreviations:** Nd- YAG: Neodymium-Yttrium Aluminum Garnet; PSI: Pigmentation Area and Severity Index; SD: Standard Deviations

### Introduction

Freckles are multiple pigmented spots or light-brown maculae become equally distributed and are relatively uniform in size and color. Freckles are genetically determined and most commonly located on nose, cheeks, shoulders and extensor aspects of the arms. Freckles appear in childhood, increase in number in adults and seem to regress during old age [1]. Histologically, freckles show an increased production of melanin pigment by a normal number of melanocytes [2].

Treatment of freckles is not usually necessary as they are asymptomatic and tend to fade during winter months, but cosmetically undesired lesions can be treated by different methods [3].

Different modalities of treatment may have reduced the occurrence and severity of freckles, but it is still with a relatively high rate of recurrence [4].

Laser treatment of pigmented lesions is based on the principle of selective photothermolysis, which states that a laser light must emit a wavelength that is specific and well absorbed by the particular chromophore being treated [5].

The aim of this study is to evaluate the effectiveness of 1,064 nm Q switched Nd-YAG laser in the treatment of freckles.

### Patients and Methods

We conducted a prospective monocentric randomized study with

Q switched Nd YAG laser (Synchro HP, DEKA, Florence, Italy). Fifty consecutive patients with freckles (4 males and 46 females), aged ranged from 6-43 years were included who were seen conducted at the laser unit in the Department of Dermatology, Al Azhar University hospital, Asyut, Egypt. The study was approved by the local institutional ethics committee of faculty of medicine, AL-Azhar University. All participants were informed about the nature of the study, and written informed consent was obtained. Patients classified according to Fitzpatrick classification into skin phototype II (n=14), III (n=29) and IV (n=7 patients). The duration of freckles showed a wide range, (1 month–20 years) with a mean duration of  $5.13 \pm 4.72$ .

Exclusion criteria were patients with pregnancy, personal history of skin cancer or radiotherapy on the area treated or other contraindications for phototherapy (photodermatosis, photosensitive treatments), topical or systemic retinoid treatment in the past 6 months.

### Treatment Protocols

All patients were instructed to stop using any make up, moisturizer, conditioner or spray 24 hours before the session as oils on the skin

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prevent transepidermal penetration. The patient and physician wear specific goggles to guard against harmful effects of laser on eyes. Treatment parameters are adjusted according to skin phototype where we use 41 J/cm<sup>2</sup> with skin phototype II and cm<sup>2</sup> J/cm<sup>2</sup> with skin phototype III and IV with spot size 2.5 mm. All the patients were asked to use sunscreens during daytime. Photograph of the patient using camera (Olympus c-420 digital SLR camera 10MP) were taken before treatment and after 3 sessions, PSI score was calculated according to the method described by Kimbrough et al. [6].

Assessment of treatment efficacy took place on the basis of clinical examination and photography evaluation in a blind manner at the baseline and final visit by two independent observers.

Improvement from baseline was rated on a four- point scale, excellent improvement ≥ 75%, very good improvement 50–74%, Good improvement 25–49% and poor < 25%.

### Statistical Analysis

Data were analyzed and expressed in tables as mean values ± standard deviations (SD). SPSS version 21 program was used for data processing. Paired samples t-test used to compare between variables. Correlations between variables were analyzed using spearman’s rank correlation coefficient (r). P-values less than 0.05 were considered significant.

### Results

There was a statistical significant decrease in mean PSI score after treatment of freckles with 1064 Q-Switched Nd-YAG (p<0.05) as shown in Table 1. There was excellent improvement (≥ 75%) in 17 cases (34%), very good improvement (50-74%) in 14 cases (28%), good improvement (≥ 25-49%) in 16 cases (32%) and poor improvement (<25% lightening) in 3 cases (6%) as shown in Figure 1.

There was a statistical positive significant correlation between improvement with duration of disease and number of sessions and no significant correlation with patient’s ages or skin photo type.

The reported side effects in this study were post-inflammatory hyper pigmentation in 2 cases (4%), hypo pigmentation in 3 cases (6%) and erythema in 6 cases (12%).

### Discussion

Owing to the broad absorption spectrum of melanin, which ranges from 351 nm to 1064 nm, several lasers can effectively treat cutaneous pigmented lesions with minimal complications [7].

Extremely short pulse, Q-switched laser systems can successfully lighten or eradicate a variety of pigmented lesions include freckles [8].

The effectiveness of Q-switched Nd-YAG laser in the treatment of benign pigmented lesions, including freckles was previously studied with variable percentage [4,8-10], Moreover, there are no data on a Egyptian skin and it has not been documented in large samples before our study.

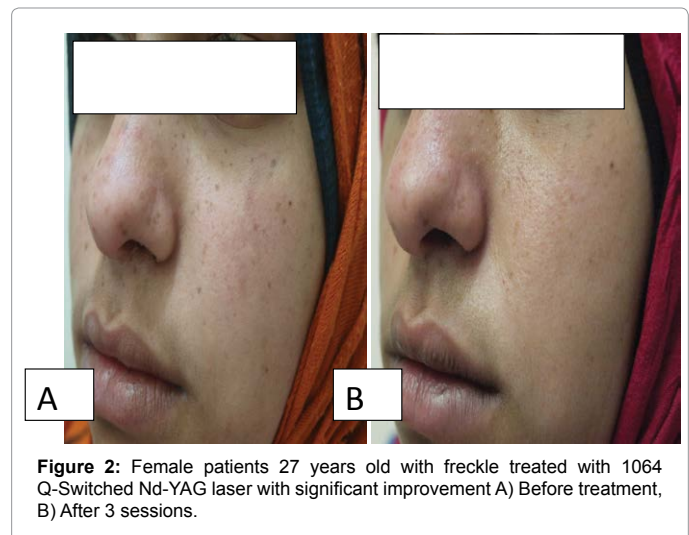
	Pre treatment	Post treatment
Area	2.88 ± 1.33	2.10 ± 1.3*
Density	2.22 ± 0.86	1.38 ± 0.85*
Darkness	2.68 ± 0.77	1.36 ± 0.63*
PSI	9.99 ± 14.98	6.82 ± 6.75*

\*Significant: p<0.05 9.99 ± 14.98

**Table 1:** Mean ± SD of area, density, darkness and PSI before and after treatment of freckles with 1064 Q-switched Nd-YAG.



**Figure 1:** Improvement of freckles after treatment with 1064 Q-Switched Nd-YAG.



**Figure 2:** Female patients 27 years old with freckle treated with 1064 Q-Switched Nd-YAG laser with significant improvement A) Before treatment, B) After 3 sessions.

According to our results, there is better improvement and significant lightening of freckles among patients treated with 1064 Q-Switched Nd-YAG laser. There is significant lightening of freckles (>50%) in 62% of patients.

The improvement of freckles in this study correlate positively with duration of freckles, patients with early age of onset and long duration of disease showed better improvement. Also, the present study showed that there is no significantly correlation between the improvements of freckles treated with 1064 Q switched Nd-YAG laser and skin phototype.

This finding may be due to the fact that freckles are associated with painful sunburns in young patients, but not with chronic life time sun exposure which is reported by Bastiaens et al.

This means that older patients and patients have not been exposed to painful sunburns much like younger patients, so have less freckles and better improvement [11].

The most common side effects occurred in the present study were post-inflammatory hyperpigmentation, hypopigmentation and transient erythema. Several studies [12,13] reported that all Q-switched laser systems, include Nd-YAG, have been reported to cause both hypopigmentation and, rarely hyperpigmentation. Salem et al. reported

that transient post inflammatory hyperpigmentation and erythema were common in darker skin types V and VI. With using of the Q-switched Nd-YAG laser for the treatment of pigmentary disorders.

These findings indicate that 1064 Q-Switched Nd YAG laser is effective treatment of freckles in Egyptian patients (Figure 2). The limitation of our study is lack of long term follow up to access the rate of recurrence.

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