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Research Article

Clinical efficacy and safety of ND-YAG laser in hair reduction

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Abstract

Background: Laser has become popular means of achieving hair reduction with improved quality of life. Meanwhile, different types of lasers show different clinical efficacy and safety according to the characteristic wavelength for each device and skin types of persons. Laser devices incorporating higher wavelengths have been developed to improve hair removal on dark skin, such as 1064 nm Neodymium-doped Yttrium Aluminum Garnet (Nd: YAG) laser. They not only provide deeper light penetration for targeting deeply located follicles but also allow for higher fluences to be used since absorption by melanin decreases when wavelength is increased and therefore the skin is heated less. This study aimed to assess the efficacy and safety of long-pulsed Nd: YAG laser on hair reduction. **Methods**: This study was carried out on 20 adult women who seek axillary hair reduction. These subjects were adjusted to receive 5 laser sessions with a 1- month interval. Clinical evaluation was done at 1 month after last session with detection of side effects of laser. **Results**: As regards Fitzpatrick skin type, 8 subjects (40 %) were skin type III and 12 subjects (60 %) were skin type IV. The hair count showed significant reduction (P<0.001) with hair reduction percentage of 64.3%. Regarding the side effects, there was significant pain during the procedure and encountered in 60% of cases. **Conclusion**: 1064-nm long pulsed Nd:YAG laser is safe and effective in hair reduction.

Keywords: Hair reduction, axillary hair, long-pulsed Nd-YAG laser.

Introduction

The presence of unwanted and excessive hair can be distressing to the affected individuals leading to emotional distress, lower quality of life, depression and sometimes social isolation due to embarrassment [1, 2]. So, effective removal of unwanted hair may thus be critical to alleviate its adverse psychological impact [3].

The current management lines for unwanted hair include medical management of any underlying clinical disorder and/or cosmetic treatment. The latter ranges from mechanical (e.g. shaving, plucking, threading and waxing) or chemical hair removal (such as creams and bleaching) to the destruction of hair follicles through electrolysis or light-based therapies[4,5]. However, mechanical stimulation should be discouraged because it leads to the conversion of vellus hairs to terminal hairs [6].

Laser hair reduction is one of the most common procedures performed by dermatologists all over the world. It is a quick, safe and effective method of hair reduction with virtually no downtime [7].

Functionally, laser hair-removal systems utilize the theory of selective photothermolysis, which involves targeting an area capable of absorbing light at a specific

wavelength (chromophore) [8, 9]. The commonest targeted chromophore is the melanin pigment, which is concentrated within the hair follicle only and thus enables targeted destruction of the follicle without nearby structure damage [10].

There are three common wavelengths in commercial use, corresponding to the three types of lasers on the market including; 755 nm alexandrite lasers, 810 nm diode lasers, and 1064 nm Neodymium-doped Yttrium Aluminum Garnet (Nd:YAG) lasers [11, 12].

Laser devices, incorporating higher wavelengths, have been developed to improve hair removal on dark skin, such as the 1064 nm Nd: YAG laser. They not only provide deeper light penetration for targeting deeply located follicles but also allow for higher fluences to be used since absorption by epidermal melanin decreases when wavelength is increased and therefore the skin is heated less. This makes the treatment safer for dark skin where abundant epidermal melanin may lead to excessive heating and burns [13-15].
The purpose of this study is to assess the efficacy and safety of long-pulsed Nd: YAG laser on hair reduction.

Patients and method

Patients

The present study included 20 healthy female volunteers, seeking for hair reduction. They were selected from the Dermatology Out-patient Clinic of Minia University Hospital. The study was approved by the Committee for Postgraduate Studies and Research of Faculty of Medicine, Minia University (approval number was 285: 9/2019). Informed consents were obtained from all patients.

This study included female persons of 17-40 years old, with dark black hairs. All females included in the study did not use topical or any other method for hair removal 2 months before starting the study. Also, lasers, light sources or electrolysis for hair reduction had not been performed on treated areas for over 1 year before starting the study. Pregnant and lactating females and patients with inflammatory skin diseases, collagen-vascular disease, androgen producing tumors, immunesuppression, active cutaneous infection within the treatment area or with history of hypertrophic scarring or keloid formation were excluded from the study. Moreover, this study excluded females with signs of hyperandrogenism (severe acne vulgaris, hirsutism and androgenetic alopecia) and individuals taking drug-induced hypertrichosis (minoxidil, phenytoin, diazoxide and corticosteroids).

Treatment protocol

Five treatment sessions were performed with Nd: YAG (Fotona XP Focus, Fotona, Solvenia), with 1-month interval. The choice of laser parameters was set according to the skin type and hair thickness as reported by the manufacturer as follows; fluence of 30-50 J/cm2, pulse duration of 40 ms and spot size of 6 mm and decreased with increasing fluence.

Clinical assessment

The clinical evaluation was done at baseline and at 1 month after the last session. The evaluation methods included hair counting/ cm^2 with measurement of hair reduction percentage. Side effects were encountered during and before each laser session and at 1 month after treatment.

Statistical analysis

The analysis of the data was carried out using the IBM SPSS 20.0 statistical package software (IBM; Armonk, New York, USA). Data were expressed as mean±SD, minimum and maximum of range for quantitative parametric measures in addition to both number and percentage for categorized data. The statistical methods for quantitative variables included independent Student *t*-test and paired sample t-test. The Chi-square *test was* used to compare qualitative variables. A p-value less than 0.05 was considered significant.

Results

The present study included 20 healthy female volunteers. As regards Fitzpatrick skin type, 8 subjects (40 %) were skin type

III and 12 subjects (60 %) were skin type IV. The hair count showed significant reduction (P< 0.001) at 1 month after last session, as it ranged from 3 to 6.8 with a mean±SD of 4.3±1.1 compared to baseline, that ranged from 9-16 /cm2 with a mean± SD of 12.6±2. Hair reduction percentage was 64.3%.

Regarding the side effects, there was significant pain during the procedure and encountered in 60% of cases. However, there were no reported burning, scaling, hyperpigmentation, pruritus or blistering even in dark skin types.

Table (1): Summary of the clinical data of the subjects

Basic characters	
Age (years)	17-40 26.6±5.1
Fitzpatrick skin type III IV	 8 (40%) 12 (60%)

Table (2): Comparison of hair count of the axillae among the studied subjects at baseline and 1 month after last session

	ND:YAG		**P value**
	Pre MeanSD	**Post Mean±SD**	
Hair count (/cm$^{3)}$	12.6±2.4	4.3±1.1	0.0001
Percentage of reduction of hair count	64.3±13.7		

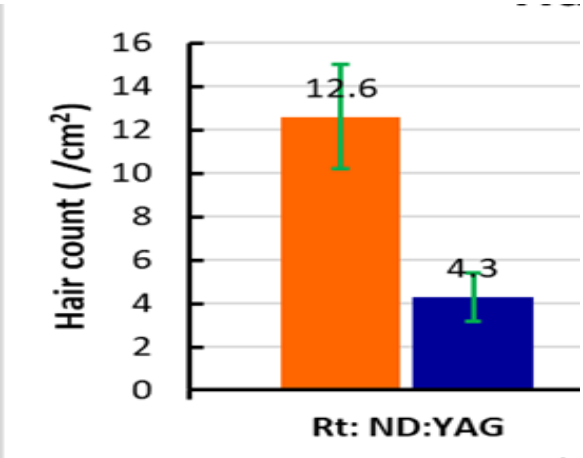

Fig. (1): The mean percentage of reduction of hair count before and after 1 month after treatment.

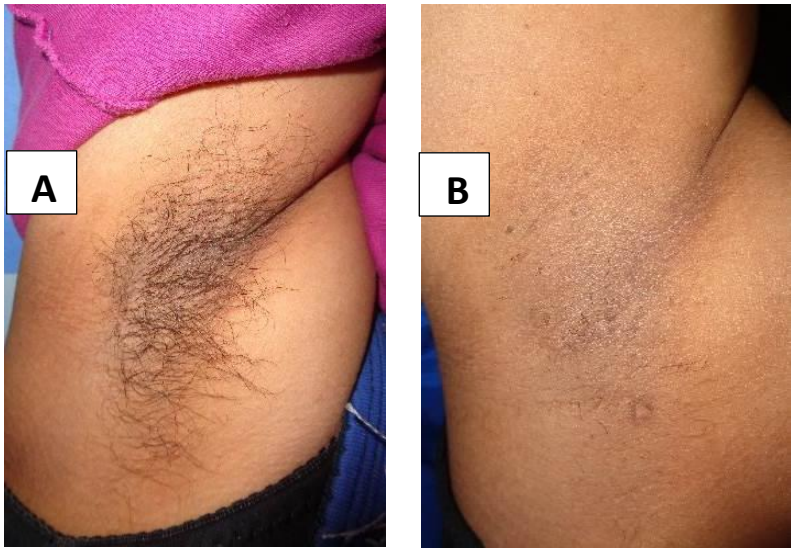

Fig. (2): right axilla in female subject: (a) At baseline, (b) At 1 month after last session.

Discussion

The presence of excessive hair can be a source of distress that can lead to such psychological problems as anxiety, depression and reduced quality of life. Laser hair removal permits satisfactory treatment of large areas of unwanted excess hair with less discomfort and fewer complications than electrolysis [16].

Patients with darker skin tones (Fitzpatrick skin phototypes IV–VI) should only receive laser treatment with either lower fluences of alexandrite and diode laser wavelengths or with a long pulsed Nd:YAG laser which can safely deliver its longer 1064 nm wavelength to avoid unwanted postoperative skin dyspigmentation [17]. However, the use of lower fluence may compromise the efficacy of laser-assisted hair removal in dark-skin patients and may be complicated with paradoxical hypertrichosis [18].

In the present study the mean hair count at 1 month after last session was significantly decreased when compared to baseline. Also, the percentage of hair reduction was 64.3%. This agrees with the study of Galadari [19] that showed reduction of 70% after 6 sessions of ND: YAG and with the study of Moftah et al.,[20] that showed reduction of hair density at 1 month after the 5th laser session in both long-pulsed Nd: YAG laser as well as Multipass Alex laser compared to the baseline.

Regarding the side effects, there was significant pain during the procedure and encountered in 60% of cases. However, there were no reported burning, scaling, hyperpigmentation, pruritus or blistering. This is similar to Akinturk and Eroglu [21], who reported that Nd:YAG 1064-nm laser hair removal is a painful procedure

Conclusion,

1064-nm long pulsed Nd: YAG laser is a safe and effective method in hair reduction.

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