Trichoscopic changes in hair during treatment of hirsutism with 1064-nm neodymium:yttrium–aluminum–garnet laser

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Summary

Background Laser hair removal has become an accepted form of long-term hair reduction and is now one of the most common dermatologic procedures. Trichoscan is a validated method of assessing hair length, thickness, and density and growth rate using dermoscopy.

Objective The study aimed to evaluate the trichoscopic changes during treatment of hirsutism with 1064-nm neodymium:yttrium–aluminum–garnet laser.

Methods Seventy patients with idiopathic facial hirsutism referring to the laser centers of Al-Azhar University hospital (Asyut and Cairo) between December 2012 and October 2014 were enrolled in this open-label, multicentric study. All participants received six sessions of 1064-nm Nd:YAG laser at 4-week intervals. Mean hair density/cm², percentage of terminal/vellus hair ratio, and hair thickness (mm) were assessed at baseline and 1 month after each session for six sessions using trichoscan.

Results Seventy female patients completed the study protocol. At the final visit, mean hair density, terminal/vellus hair ratio, and hair thickness were significantly decreased from baseline (73.7 + 20.6, 72.5 + 14.7, 0.095 + 0.02, respectively) to $(19.4 + 5.6, 21.3 + 5.2, 0.02 \pm 0.007, respectively)$ (P < 0.05 for each).

Conclusion One thousand and sixty-four-nm Nd:YAG laser is an effective and safe method in the reduction of unwanted facial hair. Trichoscan is an easy and more accurate method in monitoring the treatment of hair disorders.

Keywords: hirsutism, Nd:YAG laser, dermoscopy, trichoscopy

Introduction

Hirsutism is defined as the presence of excessive terminal hair on androgen-dependent areas. It occurs as a result of increased androgen production or increased skin sensitivity to androgens or both. It affects 5-10% of females in reproductive age.¹

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Regardless of etiology, the presence of hirsutism is distressing to the women and causes significant psychological trauma and low self-esteem.²

There are several methods available to address unwanted hair growth. Commonly, these include tweezing, shaving, waxing, and bleaching, with around 20% of women using one of these temporary methods at least once a week.^{3,4}

Hair removal with laser and intense pulsed light has been a part of dermatological practice for the past 20 years and is today one of the most frequently performed cosmetic procedures.⁵

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Several professional high-power laser and IPL systems are available, and the clinical efficacy is substantially documented in the literature,⁶ although its effectiveness can be variable,⁷ with only 50–90% of hairs being permanently removed.^{8,9}

Trichoscan is a reliable, well-validated method of quantitatively assessing the biological parameters of hair growth. 10

The aim of this work was to evaluate the trichoscopic changes during treatment of hirsutism with 1064nm Nd:YAG laser.

Materials and methods

Study design and subjects

Participants in this study (n = 70) were female patients with idiopathic facial hirsutism, skin types III–IV, and dark brown or black terminal facial hair referred to the laser center of Al-Azhar University hospital (Asyut and Cairo) between December 2012 and October 2014, their mean ages were 25.2 ± 4.5 years and ranged 19-34 years were enrolled in this open-label multicentric study. The study was approved by the Ethical Committee of Al-Azhar University. Written and oral informed consent was obtained from all participants prior to enrollment.

The exclusion criteria were pregnant and lactating females, patients using medication such as isotretinoin and oral contraceptive, keloid tendency, history of skin malignancy, active herpes simplex infection, poly cystic ovaries and history of photosensitive disease or hormonal abnormalities. Before inclusion, all individuals were screened for causes of hirsutism by androgen status (total testosterone, free testosterone, sex hormone-binding globulin, androstenedione, dehydroepiandrosterone sulfate, dihydrotestosterone, and 17-hydroxyprogesterone level), patients deviated from normal were excluded.

Methods

Expected results and complications were discussed to all patients before laser procedure. Patients were instructed to avoid sun exposure and plucking for 1 month before the first treatment and during the study.

At the time of laser session, the patient was asked to remove any make up or powder. Topical anesthesia with 2.5% lidocaine and 2.5% prilocaine cream was applied on the treatment area 1 h before treatment in a few patients on request.

The treatment was performed six times at 1-month intervals, carried out with a 1064-nm Nd:YAG laser (Synchro HP, Deka, Florence, Italy), using a 15-mm

diameter spot with energy densities of from 30 to 40 J/cm² according to the patients skin phototype and a pulse width of from 10 to 20 ms. The long-pulsed Nd: YAG laser is accompanied by dynamic cooling device which can usually be tolerated by patients without anesthesia. When sufficient energy has been delivered and absorbed by the hair follicle, a perifollicular swelling and redness are usually visible within 3–5 min which are desired clinical endpoints. If this reaction does not occur, the fluence can be increased within a safe range for that skin type and the energy was increased or decreased in subsequent treatments depending on the patient's tolerance and the presence of side effects.

A moisturizer applied in circular motions can aid in decreasing the sun burn-like sensations. Sun exposure was avoided after the treatment and the patients instructed to use sunscreen with SPF >30 after each session.

All patients instructed to avoid facial hair removal during time of the study. Patients were subjected to dermoscopic examination as the patients lie in recumbent position and dermoscopy apply to fixed area of the face (the chin), and then, photos were taken before each session and 1 month after last session, first by 50 × lens and 200 × lenses. Standardized digital photographs were taken before the treatment and at every follow-up visit using identical camera settings (Olympus c-420 digital SLR Camera 10MP, Olympus, Tokyo, Japan).

All photos of patients were subjected to trichoscan software examination as: photo by $50 \times \text{lenses}$ examined for density of hair per cm² and terminal/vallus ratio and photo by $200 \times \text{lenses}$ for thickness of hair (Figs 1 and 2).

Statistical analysis

Data were analyzed and expressed in tables as mean values \pm standard deviations (SD). SPSS version 21 program (IBM Co., Armonk, NY, USA) was used for data processing. ANOVA test was used to compare between six sittings of density, hair thickness, and terminal hair/vellus hair ratio. Paired samples *t*-test used to compare between baseline and each sitting of density, hair width, vallus hair/terminal hair ratio. Correlations between variables were analyzed using spearman's rank correlation coefficient (*r*). *P*-values <0.05 were considered significant.

Results

The final study cohort was made up of 70 female patients with idiopathic facial hirsutism, with a mean age of 25.2 + 4.5 year (range 19-34). The mean



Figure 1 Clinical and trichoscan images at baseline (a,c) and 1 month after last session with 1,064-nm Nd:YAG laser (b,d), there is significant reduction in hair length, thickness and density.



Figure 2 Clinical and trichoscan images at baseline (a,b) and 1 month after last session with 1,064-nm Nd:YAG laser (c,d), there is significant reduction in hair length, thickness and density.

duration of hirsutism was 3.5 + 1.9 years (range 1– 9 years). Based on Fitzpatrick skin type, patients were classified as follows: 42 (60%) patients were grade III and 28 patients (40%) were grade IV. Family history was positive in 36 cases (51.4%) and negative in 34 cases (48.6%).

As shown in Table 1, in this study, the trichoscopic parameters of mean hair density (hairs/cm²), terminal/

	Hair density/cm ²		Terminal/vellus hair ratio (%)		Hair thickness (mm)	
	Mean \pm SD	(%)	Mean \pm SD	(%)	Mean \pm SD	(%)
Baseline	73.7 ± 20.6		72.5 ± 14.7		0.095 ± 0.02	
lst session	57.8 ± 10.9*	21.6	62.6 ± 13.9*	13.7	$0.08 \pm 0.2*$	15.8
2nd session	48.3 ± 11.8*	34.5	55.1 ± 12.3*	24	$0.07 \pm 0.1*$	26.3
3rd Session	41.1 ± 10.3*	44.2	47.2 ± 11.4*	35	$0.05 \pm 0.1*$	47.4
4th Session	33.9 ± 9.4*	53.5	38.04 ± 9.4*	47.5	$0.04 \pm 0.008*$	57.9
5th Session	27.1 ± 7.5*	63.2	31.8 ± 7.5*	56.1	$0.03 \pm 0.008*$	68.4
6th Session	19.4 ± 5.6*	73.6	$21.3 \pm 5.2*$	70.6	$0.02 \pm 0.007*$	78.9

Table 1 Mean trichoscopic changes in hair and percentage of reduction following treatment with 1064-nm Nd:YAG laser

ANOVA test was used to compare between six sittings densities. Paired samples *t*-test used to compare between baseline and each sitting density. The percentage of reduction in trichoscopic parameters was calculated from baseline to the last session. **P* value <0.05 is significant.

 Table 2 Correlation coefficient between percentage of improvement and clinical parameters

	Patient's age		Duration of hirsutism		Skin phototype	
	Р	r	P	r	Р	r
Hair density Terminal/vellus hair ratio Hair thickness	0.39 0.8 0.9	-0.1 -0.03 0.01	0.7 0.7 0.5	0.04 0.04 -0.07	0.6 0.9 0.3	0.1 -0.01 0.1

vellus hair ratio, and hair thickness of the included patients at one month after the final treatment were significantly lower than the baseline (73.6%, 70.6% and 78.9%, respectively).

No significant correlation between improvement in hair density/mm², terminal/vellus hair ratio, and hair thickness with patients age, duration of hirsutism or skin photo type (P > 0.05 for each). (Table 2).

Side effects were limited to mild to moderate treatment pain in 100% of the treatment sites, short-term erythema in 16 patients (22.9), perfollicular edema in eight patients (11.4) of the patients. In our study, we have not noticed any pigmentary alterations or blistering. Only one patient refused to continue after 1st session due to erythema and the downtime of a week and was replaced by another.

Discussion

About 5-10% of all women of childbearing age and one-third of all postmenopausal women display some degree of hirsutism. Increased hair growth (unwanted hair growth) has strong negative psychological effect on the well-being of the women. For this reason, various methods of hair removal have been practiced.¹¹

Longer wavelength lasers penetrate up to 7 mm in dermis, thus causing less epidermal absorption and

sufficient hair follicle damage. So, long-pulsed Nd:YAG is safer in darker skin types. This is because the longer wavelength of Nd:YAG minimizes epidermal melanin absorption and maximizes wavelength penetration to the dermal hair follicular unit.¹²

In our study, monthly session of 1064-nm Nd:YAG laser for 6 months significantly reduced the growth of unwanted facial hair, as measured by trichoscan. The application of 1064- nm Nd:YAG laser resulted in significant reduction in hair density, hair thickness, and terminal/vellus hair ratio with improvement starting to be seen with trichoscan after the first session and continue with the following sessions.

These results support the findings of previous studies that have demonstrated the efficacy and safety of Nd: YAG laser in treatment of hirsutism. Mittal *et al.*¹³ treated 59 adult women with skin phototypes IV and V with a long-pulsed Nd:YAG laser for six consecutive treatment sessions at 4- to 6-week intervals, and they revealed an overall 56% hair reduction after a series of six treatment sessions with follow-up at 6 weeks.

Tanzi and Alster¹⁴ showed a reduction in terminal hair varying from 41% to 46% after three sessions at six months with a long-pulsed Nd:YAG laser. Galadari showed a reduction in terminal hair about 35% after six sessions with a long-pulsed Nd:YAG laser at 12 months follow-up.

Alster *et al.* showed a hair reduction varying from 70% to 90% after series of 3 long-pulsed 1064-nm Nd: YAG laser treatments at 12-month follow-up after the final laser treatment.

Multiple sessions undoubtedly yield more effective results because lasers can only target the anagen or active phase of the hair growth cycle. At any given time, only 50-65% of facial hair is in the anagen phase for the duration of 3-4 weeks. Therefore, even if 100% of all anagen hairs are destroyed after each treatment, only a percentage of the total hair would be eliminated. $^{\rm 15}$

The difference between our study and previous results may be related to the use of trichoscan in our study which is an objective and more accurate method for monitoring the treatment efficacy than other subjective methods.

Trichoscopy is a method of hair image analysis based on dermoscopy or videodermoscopy of the hair. It allows the visualization of hair at high magnification and the measurement of relevant trichologic structures.¹⁶

In our study, all patients were subjected to trichoscan which is an objective and more accurate method for monitoring the treatment efficacy than other subjective methods.

In our study, trichoscan was shown to be a highly useful tool for evaluating the effectiveness of Nd YAG laser in the treatment of women with idiopathic facial hirsutism. Unlike other methods trichoscan has been well validated and its reliability is investigator independent suggesting that it may be a more quantifiable method of evaluating hair growth. Furthermore, trichoscan is relatively simple and quick to perform, unlike other techniques that can be tedious and time consuming. In addition, the amount of equipment needed is small.¹⁰

The corresponding data reported in our study appear to be lower or higher than some of the above-mentioned data. This difference may be related to assessment types conducted by different investigators using different grading and counting techniques making varied results. Up to the present time, hair counting is the most commonly used technique for assessing hair reduction, which unfortunately could not be performed accurately as in dermoscopic examination.

The laser sessions were generally well tolerated with minimal and transient side effects in our study consistent with previous studies on the Nd:YAG laser, while Bouzari *et al.*¹⁷ reported blistering rated to be 18% and the second most common side effect after pain.

In conclusion, 1064- nm Nd:YAG laser was shown to be an effective therapy for the management of hirsutism in women. Trichoscan was shown to be a highly useful tool for evaluating the effectiveness of 1064- nm Nd:YAG in the treatment of women with facial hirsutism.

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