

Efficacy and Safety of Long Pulsed Neodymium-Doped Yttrium Aluminium Garnet Laser for Hair Reduction in Patients of Skin of Colour

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ABSTRACT

Introduction: Many different laser systems are available for permanent reduction of unwanted hairs; however, no single laser has been shown to be superior in providing safe and effective hair removal in all skin types. The objective of the study was to evaluate the efficacy and safety of long-pulsed Neodymium-doped Yttrium Aluminium Garnet (Nd:YAG) 1064-nm laser along with cooling device for hair removal in darker skin types.

Materials and methods: A total of 85 female patients of Fitzpatrick skin types IV and V with terminal facial and/or non-facial hairs were treated with a long pulsed Nd:YAG laser 1064-nm, (6mm spot size, fluence of 60-100J/cm² with pulse width of 40 or 60msec and 10-mm spot size, fluence of 36-45 J/cm² with pulse duration of 15msec. 6 or more consecutive laser treatments were delivered to 160 skin sites at an interval of 6 to 8 weeks. Both the outcome and the adverse events were noted down.

Results: There was a significant hair reduction of 60-80% after 6 treatment sessions. Non facial sites like axillae and chest responded slightly better than facial sites. Amongst the facial hairs, side burn showed more reduction than chin and upper lip. Adverse reactions were minimal and included mild pain, transient erythema, perifollicular edema and rarely post inflammatory hyperpigmentation without scarring.

Conclusion: The long-pulsed 1064-nm Nd:YAG laser is a safe and effective method of hair reduction in patients of dark skin types. It may require more than 6 sittings to have permanent hair reduction. Side effects were limited and transient.

Keywords: Dark skin type, Laser hair reduction, Nd:YAG Laser,

with longer pulse duration and adequate epidermal cooling minimize the epidermal injury in skin of color.² In this study we discuss about outcome of laser hair removal in dark skin patients using long pulsed Nd:YAG 1064-nm laser including procedure details, its safety and efficacy, precautions and contra-indications.

Aim of the study was to assess the outcome of laser hair removal in the different body sites and to look for the most common adverse events.

MATERIAL AND METHODS

This was an observational study conducted at a tertiary care teaching hospital from 2009 to 2013 for a period of five years. Institutional ethical committee clearance as well as informed consent from the patients were obtained before starting the study. All the patients who fulfilled the inclusion criteria were included and only those who had completed 6 sittings were analyzed for the treatment outcome. A total of 85 patients with 160 skin sites having terminal facial or non-facial hairs were included in the study. Initial evaluation was done for growth and density of hairs (Black hairs: Brown hairs: Light brown hairs and coarse/medium/fine). Patients with features suggestive of hirsutism were evaluated clinically and biochemically. A detailed clinical history was taken in each patient especially regarding herpes, photosensitivity, keloidal tendency or any drug intake.

Inclusion Criteria: a) Patients of skin type Fitzpatrick IV and V having terminal facial and non-facial hairs b) Informed Consent signed by patient or guardian.

Exclusion Criteria: a) Waxing, threading or bleaching within one month, b) patients on Isotretinoin in past 3 months, c) patients suffering from photosensitivity disorders, d) history of keloid formation, e) pregnancy and epilepsy.

The patients were advised not to undergo threading, waxing, plucking or bleaching and excessive sun tanning at least 3-4 weeks prior to start of treatment and in between the treatment sessions.

INTRODUCTION

The laser assisted hair removal has come a long way from its inception. Over the last decade there have been tremendous advances in Laser technology for hair removal. Light based system evolved from the earlier version of IPL (Intense pulsed light) based technology to AFT (Advanced Fluorescent Technology) with contact cooling. Lasers have moved from the days of Ruby laser 694-nm and Alexandrite Laser 755-nm to Long pulsed Nd:YAG laser 1064-nm and Diode laser of 810-nm in-motion technology. Longer wave length laser such as Nd:YAG 1064-nm have been shown to be best for patients with darker skin shades.¹ The advantage of this wavelength is reduced scatter and deeper penetration of the laser. The decreased absorption of the 1064-nm Nd:YAG laser by melanin containing structure is an advantage in terms of epidermal heating and damage, it follows that hair also is less effectively heated. Use of longer wave length laser

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After marking the treatment area with white marker, hairs were shaved close to skin and site was cleaned properly. Topical anesthetic cream was not used routinely. All the patients were treated with a long pulsed Nd:YAG laser (Harmony Laser XL from Alma Lasers, Ltd.) 1064-nm with precooling of the skin with Cryo5 Zimmer. For apprehensive patients and with darker shade of skin, a test patch was done with 6mm spot size with fluence of 60 and 70J/cm². The patients were reassessed after 48 hours and further treatment was given.

These patients were treated with 6mm spot size, fluence of 60 to 70J/cm² with pulse width of 40 to 60 msec. Depending upon patient's response fluence was increased by 10J/cm² on subsequent sitting up to 100J/cm² and pulse width reduced from 60 to 40 msec. Usually 1-2 passes were given. Non facial sites like axilla and chest were treated with 10-mm spot size, fluence of 36-45J/cm² with pulse duration of 15msec. For the initial 2-3 sessions, patients were called after 4 to 6 weeks and subsequent intervals were based on regrowth of hairs which was approximately 8 weeks. Global clinical evaluation of hair reduction using photographs of skin sites were obtained at baseline and at the end of 6 treatment sessions. Hair reduction was graded as poor for less than 25% reduction, fair for 25% to 50% reduction, good for 51% to 75% reduction, and excellent for more than 76% reduction. Outcome and adverse events, if any were recorded after each sitting. Each patient underwent at least 6 or more consecutive laser treatments.

Post treatment instructions were given to the patient like not to rub the treatment areas for next 2-3 days and regular use of sunscreens. Patient who developed marked peri-follicular edema and erythema were advised fluticasone and fucidic acid ointment for 3-5 days to prevent post inflammatory pigmentation.

STATISTICAL ANALYSIS

Microsoft excel was used to generate tables. Results of the study are based on Descriptive statistics.

RESULTS

A total of 85 patients with 160 skin sites were included in the study (Table-1). Out of 70 patients undergoing laser treatment for chin, 20 (28.5%) patients showed excellent results, 44 (62.9%) patients showed good results and 6 (8.5%) patients showed fair results. Out of 40 patients who were treated for upper lip area, 10 (25.0%) showed excellent results, 24 (60.0%) showed good results and 6(15.0%) showed less than 50% improvement. Of the 35 patients who were treated for side burn, 17 (48.5%) patients showed excellent results and 18 patients (51.4%) showed good results.

All the patients (n=10) treated for axillae (Figure-1a and Figure-1b) and chest (n=5) showed excellent results.

Adverse reactions included mild pain and burning sensation in almost all patients especially while treating the upper lip area which reduced after extra cooling with the Zimmer chiller. Immediate erythema was noticed in all the treated areas. Perifollicular edema (Figure-2) was noticed especially where coarse hairs were present except over the central area of upper lip and axillae. In 6 cases there was unusual response to cold in the form of urticaria which subsided after

| Site | No. of sites | Improvement | | |
|-----------|--------------|-----------------|--------------|--------------|
| | | Excellent > 76% | Good 51%-75% | Fair 25%-50% |
| Chin | 70 | 20 | 44 | 6 |
| Upper lip | 40 | 10 | 24 | 6 |
| Side burn | 35 | 17 | 18 | |
| Axillae | 10 | 10 | | |
| Chest | 5 | 5 | | |

Table-1: Table showing overall results after 6 sessions of laser treatment.



Figure-1: (a and b) Before and after treatment photographs of axilla in a patient showing excellent results.



Figure-2: Perifollicular edema

several hours. Mild crusting and post inflammatory hyperpigmentation was noticed in 10 patients which was transient and subsided within a week except in 3 patients for whom prolonged intervention was required in the form of chemical peeling and skin lightening creams.

DISCUSSION

With advances in the laser technology, wide ranges of laser machines are available for laser assisted hair reduction in all the skin types. In spite of all these advances, there is no single laser system which is effective in all skin shades and hair type. This is evident from the change in terminology of earlier claims of permanent hair removal to hair reduction and from the concept of thermal relaxation time (TRT) to thermal damage time (TDT). All hair removal lasers work on the principle of selective photothermolysis with the melanin in the hair follicle as the chromophore. Absorption spectrum of melanin is between 600-nm and 1100-nm. At this range laser is absorbed poorly by competing chromophore like hemoglobin and water and hence penetrate deeply in to the dermis.^{3,4} The use of higher fluence and the larger spot sizes can compensate for the reduced melanin absorption capacity by taking the advantage of reduced scatter of the energy as it passes through the epidermis. Safety and efficacy of laser hair removal is well documented in fairer skin types in several studies.^{5,6} There are few studies which are designed to evaluate laser hair reduction in Fitzpatrick's skin type IV and V.⁷⁻⁹ Study conducted by Alster TS *et al.*, on women with skin type IV through VI showed prolonged hair reduction of 70% - 90% at the end of 12 months. They observed that axillary hairs are substantially more responsive than hairs on face and legs. In our study overall hair reduction was 60% - 80% at the end of 6 sittings. Hair of the axillae and chest responded better than face. In their study, Nanda S and Bansal S reported improvement of 89.69% for chin and 59% for upper lip. In our study good to excellent result was seen in 91.4% for chin and 85.0% for upper lip. It is observed that as the number of sittings progresses hairs become light brown, thinner and much longer than the original. It may require few more sessions with reduced pulse width and higher fluence to counter these changes.

Side effects are minimal and temporary without any permanent damage to the color or texture of skin. This is the observation in most of the studies which concluded that Long pulsed Nd:YAG laser is a safe and effective method of long term hair reduction in patients with dark pigmented skin.^{10,11}

Limitation

As the majority of the patients included in the study were of type V skin and only few were of type IV skin, hence, statistically significant differences in response could not be evaluated between the groups.

CONCLUSION

Hair reduction with long pulsed Nd:YAG laser 1064-nm is safe and effective technique in darker skin types when it is used along with the cooling device. However, to achieve permanent hair reduction it may require more than 6-8 sittings. Side effects are seen only in a few patients and are transient without any permanent sequelae.

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