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Hormonal Profile and Efficacy of Long Pulse Nd-YAG Laser in Treatment of Hirsutism

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ABSTRACT

Background: Hormones, particularly androgens play a vital role in hair growth, differentiation and distribution. Hirsutism is a common entity among Nepalese population with skin types III, IV and V. Long pulsed lasers are commonly used for hair removal.

Methods: This is a prospective analytical study done in Dhulikhel Hospital Kathmandu University Hospital, Kavre, Nepal from November 2010 to November 2011. Patients were first subjected to hormonal evaluation. Androgens, their tropic hormones, insulin resistance markers and endocrine components were measured and compared. Subjects were then categorized into two groups according to androgen levels: group A (n=30) with significantly high androgen (total testosterone and dehydroepiandrosterone sulfate) or elevated luteinizing hormone: follicle stimulating hormone ratio, consistent with Polycystic Ovarian Syndrome (PCOS) and group B (n=30). Adrenal tumour was ruled out in all patients. All patients received long pulse Nd-YAG laser (50J/cm^2; 50 msec pulse duration) therapy at four weeks interval to achieve at least 50% hair reduction.

Results: Among group A patients, average 8.1 treatment sessions were required for substantial hair reduction, whereas, average 5.7 sessions produced similar results in group B patients (p-value <0.05).

Conclusions: Patients with high androgen level and elevated LH: FSH ratio requires more treatment sessions for hair removal with long pulsed ND-YAG laser than patients with normal or low hormone level.

Keywords: hair removal; hormones; Nd-YAG laser; polycystic ovary syndrome.

INTRODUCTION

Hirsutism is androgen dependent hair growth while hypertrichosis refers to hair growth which is not androgen dependent.[1] Androgens play a pivotal role in the growth and maintenance of a hair follicle. Dark-haired individuals tend to be more hirsute than blonde or fair individuals.[2] Food and Drug Administration (FDA) approves long pulsed diode (810nm) and Nd-YAG (1064nm) for hair removal and both of them are suitable for darker skin types.[3] This study is thus conducted to evaluate and compare the efficacy of long pulsed Nd-YAG laser among patients with biochemically elevated androgens versus normal androgen level individuals.

METHODS

This is a prospective analytical study conducted in the department of dermatology, Dhulikhel Hospital Kathmandu University Hospital, Dhulikhel, Nepal. Prior consent was taken from the Institutional Review Committee for the initiation of the study. We studied a total of 60 female patients, 30 each having elevated hormones and normal hormones. Written informed consent was obtained from every patient before the start of study. Evaluation was done for facial hair removal from November 2010 to November 2011. Age of patients ranged from 14-50 years (mean age 27.9 ± 9.6 years). All patients had Fitzpatrick skin types III, IV

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and V and hair was terminal and black colored. Detailed history was taken including menstrual irregularity, fertility profile, diabetes and family history. Patient's height and weight was taken and Body Mass Index (BMI) was calculated. Patients with BMI of more than 24.9 Kg/m^2 were considered to be obese. Hormonal panel test was done first among all patients in the department of clinical biochemistry. It included Luteinizing Hormone (LH), Follicle Stimulating Hormone (FSH), Testosterone, Dehydroepiandrosterone Sulphate (DHEA-S), Sex Hormone Binding Globulin (SHBG), C-peptide, Thyroid Stimulating Hormone (TSH) and C-peptide. C-peptide was measured as a marker of insulin resistance as its half-life is quite longer than that of insulin and is relatively easy to quantify. ELISA technique was used to evaluate all hormones using ELISLAW, RFCL and diagnostic automation, USA reagents.

Their values were compared and patients were categorized among two groups depending upon androgen level and ratio. Group A (n=30) had high androgen (total testosterone and dehydroepiandrosterone sulfate) or elevated LH: FSH ratio consistent with PCOS and group B (n=30) who had normal hormone level. LH: FSH ratio of more than 2:1 was considered abnormal. Every patient underwent abdomino-pelvic ultrasound to meet the diagnosis of PCOS using Rotterdam's Criteria and adrenal tumor was ruled out among all.[1] After shaving the concerned part all patients received 1064nm longpulse Nd-YAG laser with 50 J/cm^2 energy and 50 msec pulse duration. Laser therapy was repeated every four weeks and number of settings was noted for substantial hair reduction. More than 50% reduction in hair count was considered a success. Efficacy of laser was evaluated on the basis of serial hair count. Microsoft Excel was used for data entry and SPSS version 16 was used for data analysis. Using mean settings required, student's t-test was applied and results were compared. Satisfaction of patient was also evaluated as patient satisfaction score on a four point Likert scale which included: poor, satisfactory, good and excellent.

RESULTS

Age group 15-25 years was the most common age group (53%) presenting for hair removal. Likewise age group 26-35 years had 18% and 36-50 years had 29% patients. 69% patients were obese (BMI>25) and 37% patients had positive family history of hirsutism/hypertrichosis. None of the female patients had features of virilization. Abnormal TSH was seen among 5 (3 hypothyroid and 2 hyperthyroidism) patients. C-peptide was high among 9 patients and all of them belonged to group A (28.1%).

Among group A patients, mean number (mean ±S.D.) of treatment sessions required for substantial hair reduction was 8.1±1.28, whereas, average 5.7±1.01 sessions produced similar results in group B patients (Table 1). This finding was found to be statistically significant (*p*-value <0.05). The result of patient satisfaction score was illustrated using Likert scale (Figure 1). The most common treated site was face-upper lip (67.7%). All the complications were transient and mild hyperpigmentation was the most frequent complication (5%). There was an improvement of hirsutism in a PCOS patient following long pulse Nd: Yag laser (Figure 2).

Table 1. Number of settings (with mean setting required) for 2 groups.

Group	Mean Setting	Standard Deviation	p-value
Group A (n=30)	8.1	1.28	< 0.05
Group B (n=30)	5.7	1.01	

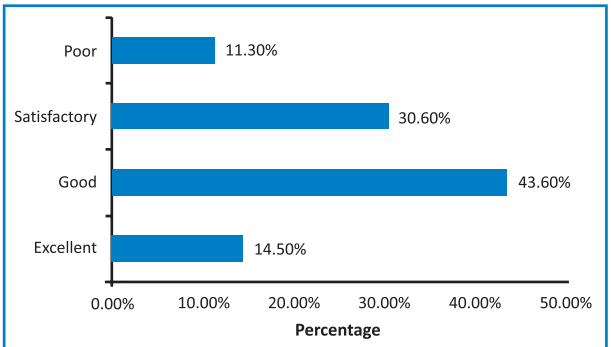

Figure 1. Patient satisfaction score for hair removal.

Figure 2. Hirsutism of a PCOS patient before and after long pulse Nd: YAG laser.

Abbreviations and Symbols

PCOS: Polycystic Ovarian Syndrome

Nd: YAG: Neodymium-Doped Yttrium Aluminum Garnet

LH: Luteinizing Hormone

FSH: Follicle Stimulating Hormone

TSH: Thyroid Stimulating Hormone

DISCUSSION

Prevalence of hirsutism is around 15% among general population.[4] PCOS is considered to be the commonest cause of hirsutism. Apart from androgen disorder hirsutism may be a normal variant of hair growth. Race and ethnicity also play a major role in body hair distribution. Unwanted hair may be distressing. Many methods have been used in the past with varying results but most of them are temporary and are associated with pain, pigmentation, irritation, and distortion of hair follicles or scarring. Electrolysis and thermolysis offers permanent hair removal but both are impractical for larger areas.[7] Lasers offer easy advancements of hair removal with minimal adverse effects.

Hair may be vellus or terminal.[8] Pubertal androgens and hair follicle's intrinsic characteristics determines the quality of hair. Hairs of eyebrows, eyelashes and vellus hair are androgen insensitive. Excess androgen in ladies causes hair growth except in the scalp, where hair loss occurs because androgens here shorten the period of anagen phase. Ovaries, adrenal glands and peripheral fats are the sites of androgens in our body. Androgen particularly testosterone is converted into potent Dihydrotesosterone (DHT) by type 1-5α-reductase in the pilosebaceous unit, which enhances androgen receptor binding and exerts end-organ effects.[9] Insulin has also shown relationship with androgen to regulate pilosebaceous unit development.

Hirsutism is the most common cutaneous manifestation of PCOS (65-73%) and usually has high testosterone level.[2,4-6] Idiopathic hirsutism on the other hand has normal testosterone level. Acne, seborrhea, androgenic alopecia and acanthosis nigricans are other dermatological signs of PCOS.

Wavelength ranging from 630 to 1100 nm can irradiate hair follicles of anagen phase.[10,11] Within this range problems are faced with lower wavelength lasers while treating darker individuals because in these melanin in the epidermis competes as a chromophore for the laser light. Also, there is high incidence of epidermal side effects in darker individuals. The absorption spectrum of melanin ranges from 250–1200 nm and the absorption decreases as wavelength increases. Longer wavelength lasers penetrate 5 to 7 mm in dermis thus causing less epidermal absorption and sufficient follicle injury. Hence, Long pulsed diode and Nd-YAG are best used in darker skin types. Though diode lasers are considered more efficacious than Nd-YAG, Nd-YAG lasers are considered safer in treating darker skin types.[10,11] This is because the longer wavelength of Nd-YAG minimizes epidermal melanin absorption and maximizes wavelength penetration to the dermal hair follicular unit. Also studies recommend multiple treatment sessions rather than a single setting. Lorenz S. et al. followed patients for one year treated with multiple sessions with long pulsed Nd-YAG laser and concluded that greater than 50% hair reduction remained in patients treated with five treatment sessions.[12] Mittal R et. al. conducted similar study on our skin type and concluded that 56% patients were successful to achieve fine vellus hair after six treatment sessions.[3]

C peptide is a known marker of insulin resistance and is also used to monitor its progress.[13] Insulin resistance is a known feature of PCOS, which stimulates ovarian androgen secretion and suppresses SHBG production, thus increasing free testosterone level.[14,15] Studies have shown to have significantly high C peptide among patients with hirsutism.[16] This was also seen in our study where 28.1% of patients had high c peptide level. Among ladies diagnosed PCOS, 10% develop diabetes mellitus in the third or fourth decade, 40% have impaired glucose tolerance and 40% are obese.[17] Also studies have shown that PCOS and hirsutism are associated with insulin resistance independent of obesity.[18]

Saleh et al, conducted a similar study to this study where after comparing hormonal parameters efficacy of hair removal was compared between diode (800nm), ruby (694nm) and long pulsed alexandrite (755nm) lasers.[19] They found no significant statistical difference between patients with or without hormonal disturbance, PCOS, family history or antiandrogen therapy during treatment sessions. These results contrasts our findings which might be because of the fact that the former study only included beard area for the study and the longer wavelength of Nd-YAG laser might have produced significant result in our study. The former study also concluded that age is an important factor to enhance the efficacy of laser. They found that patients less than 30 years responded better than those more than 30 years regardless of associated clinical factors or type of laser used.

Limited sample size and limited studies of this nature were the major limitations of our study which demands a similar study with ample number of cases. Hence we recommend having a hormonal profile test in patients with hirsutism before the start of therapy. Patients with hormonal parameters indicating PCOS are expected to have higher treatment sessions with long pulsed Nd-YAG laser.

CONCLUSIONS

Patients with high androgen level or elevated LH: FSH ratio requires higher number of setting for unwanted hair removal using long pulse Nd-YAG laser as compared to patients with normal hormone level. Also, long pulse

Nd-YAG laser is efficacious in removing hair in skin types III, IV and V.

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