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Efficacy and safety of triple diode laser in hair growth reduction

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ABSTRACT

BACKGROUND & OBJECTIVE: Laser treatment for hair removal is a very common procedure in dermatology. Ruby, diode, alexandrite, Nd:YAG, and intense pulse light are frequently used for hair reduction. For more effective results a combination of wavelengths is used. The purpose of this study is to determine the efficacy and safety of triple diode lasers in hair growth reduction.

METHODOLOGY: This interventional longitudinal study comprises of total 82 patients using a non-probability convenience sampling technique, the mean age of the patients was 28.73, the age range was between 17 to 56 years, and all patients in this study were female of skin phenotype between III to V. Each session was done one month apart for four months, and hair growth reduction was assessed by using GAIS (Global Aesthetic Improvement Scale Assessment) score
by two independent dermatologists in 4th session.

RESULTS: Hair growth reduction was observed in all the enrolled patients from the first session. Out of 82 patients, 63.4% of patients are of skin phenotype IV, 23.2% patients are of skin phenotype III whereas 13.4% are skin phenotype V. After four sessions 41 patients (50%) showed excellent results, and 41 patients (50%) showed good results. None of these patients experienced any long-term side effects.

CONCLUSION: Triple diode laser is a safe and effective modality in hair growth reduction at all body sites in skin phenotype III- V with minimal side effects.

KEYWORDS: Laser, Diode laser, Wavelength, Phenotype.

INTRODUCTION

Laser treatment for hair reduction is the most popular and demanding product in dermatology and aesthetic clinics. Different types of lasers are readily available nowadays such as ruby (694 nm), alexandrite lasers (755 nm), Nd: YAG (1064 nm), and diode lasers (800-810 nm) [1, 2].

Ruby and alexandrite laser is particularly used for lighter skin (Fitzpatrick's skin type I to III). All laser treatments required multiple sessions to achieve the desirable results. Different laser parameters can be adjusted according to patient skin type and hair thickness to get the maximum effects and to minimize the side effects. The wavelength, pulse duration, fluence, spot size, frequency, and number of treatment sessions are the laser parameters and the patients' related parameters are the color of the skin (Fitzpatrick skin type I-VI) and hair, hair diameter, treatment site and ethnicity [3, 4].

Laser treatment causes miniaturization of coarse terminal hair and converts the coarse terminal hair into vellus hair. Permanent hair reduction does not eliminate all hair in the treated area but it is a long-term steady reduction in the number of hair regrowing after several laser sessions [5]. The purpose of laser treatment is to reduce active and excessive hair growth by focusing the hair bulb during the active growth phase. The target chromophore is the melanin in the

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hair follicle and these lasers work by using precise photo thermolysis [6,7,8].

The ideal candidates for selective photo thermolysis are patients with Fitzpatrick's skin type I- IV and darkly pigmented hair [5,9]. Pigmented hair contains abundant melanin granules, which are more liable to laser and light source treatment [10]. Melanocytes degeneration will be present in grey hair while white hair shows loss of melanin. Therefore, lighter hair is less susceptible to laser and light source treatment. This point should be discussed with patients before starting the treatment that lighter hair will not respond to laser treatment [11].

Triple diode laser is a new technology for hair reduction; it is now one of the most frequent laser procedures in dermatology. It comprises three wavelengths 1064, 810, and 755 nm. Out of these three, 1064 and 810 nm have the capability for deep penetration and therefore focus on darker skin tones. 1064 nm wavelength is especially useful for pubic and axillary areas. For areas such as arms, legs, and cheeks 810 nm wavelength is mainly used, whereas for eyebrows and upper lip areas 755nm wavelength is useful [12]. It is the most effective and frequently used laser due to selective targeting of hair follicles and deep penetration; it is highly reliable and also very effective in skin types V and VI [13]. Histologically, hair follicles show degenerative changes, which were noted immediately after laser treatment and after one month, hair follicles show cystic changes and progressing to apoptotic cell death [14].

Only a few, mild and temporary side effects are reported after the laser treatment which includes erythema, skin irritation, edema, and pigmentation, and very rarely blister formation occurs. Avoidance of sun exposure before and after the treatment reduces the incidence of adverse effects. Severe complications with laser occur because of unintended contact between the laser beam and non-targeted tissues. Therefore, cooling of the skin during treatment and proper selection of the fluency according to the skin type are also the most important factors in reducing the adverse effects and tolerability [1]. The advantage of using a laser with triple wavelength is that it offers an integrated solution in a single device; the different wavelengths reach different depths within the hair follicles and hence provide better results in less time than with a wavelength laser. This laser is also painless due to efficient cooling in the device [4].

Triple diode laser is the best option for Asian Skin types due to their physical characteristics. The purpose of this study is to determine the efficacy and safety of triple diode laser in hair growth reduction in Asian skin.

METHODOLOGY

It is an interventional longitudinal study comprised of a total of 82 patients using a non-probability convenience sampling technique, conducted in the out-patient clinic of the Department of Dermatology at Dow University of Health Sciences, Karachi, after the approval from the Institutional Review Board of Dow University of Health Sciences (Ref:2537/DUHS/approval/2022/881). The sample size of at least 82 subjects was calculated using PASS version 15 software, based on a test for one sample proportion with 99% confidence of interval, 80% power of the test, 5% margin of error, excellent reduction in hirsutisim (95.5%) [2].

The duration of this study was six months from June 2022 to November 2022. Patients of hirsutism of either gender, male or female, age limit between 18 and 60 years were included in the study. Patients who were pregnant and lactating mothers, patients who were on oral contraceptive drugs; photosensitizing drugs; antibiotic therapy, and oral isotretinoin, patients who had taken laser treatments in the past 6 months, hair bleaching and threading or waxing during the last six weeks, patients with eczema, psoriasis, lichen planus and other dermatosis, history of photosensitivity; history of keloids and hypertrophic scars were excluded from the study.

Patients meeting the inclusion criteria were included after informed consent. 82 patients with hirsutism were included in the study. A total of 4 sessions of triple diode laser were done at monthly intervals. Before starting the laser, the target area was shaved and ultrasonic gel was applied over the treatment area. The head of the laser was placed in contact with the skin while exerting slight pressure. The head emitted laser light through the cold sapphire-crystal window. Hair reduction was assessed via the Global Aesthetic Improvement Scale (GAIS) by two independent dermatologists at the second session and the fourth session. The Global Aesthetic Improvement Scale (GAIS) is a 5-point global aesthetic improvement scale in appearance, after the treatment or procedure, as concluded by the doctors. It includes no result, poor, average, good, and excellent. No result is 0% reduction, poor 0 to 25% reduction, average is 25 to 50% reduction, good is 50 to 75% reduction while excellent is 75 to 100% reduction.

Data was analyzed by using SPSS version 21. For patient characteristics (age group, area, type of skin, static score group) frequency and percentage were reported. Pearson's chi-square test was applied to see the association of the GAIS score group with patient characteristics (age group, area, and skin type. P-value<0.05 was considered as significant.

RESULTS

This study comprised of total 82 patients, the age range was between 17 to 56 years, the mean age was 28.73 and all patients in this study were female of skin type between III to V. Skin type III comprises 19 patients, skin type IV comprises of 52 patients while skin type V comprises of 11 patients (table 1). A total of 4 sessions were done one month apart and hair growth reduction was assessed by using GAIS score at 2nd and 4th sessions (table 1). After four sessions 41 patients (50%) showed excellent results and 41 patients (50%) showed good results. The most common site of treatment was faced (by 68 patients) out of which 97.6% achieved a good score on GAIS score and 68.3% achieved excellent response with p<0.001 (table 2). It concluded that all 82 patients' achieved more than 50% response in just 4 sessions. None of these patients experienced any long-term

side effects apart from transient erythema which resolved within an hour.

Table-I: Distribution of clinical characteristics (n=82)

Variables	Categories	n (%)
Age group	≤30 years	52 (63.4)
	>30 years	30 (36.6)
Area	Face	68 (82.9)
	Axilla	6 (7.3)
	Limbs (Upper & Lower)	8 (9.8)
Skin type	III & IV	71 (86.6)
	V	11 (13.4)
Static score group (What is this static score? Please explain in the results)	Good	41 (50.0)
	Excellent	41 (50.0)

Table-II: Distribution of patient characteristics according to static score group

Characteristics		Good (n=41)	Excellent (n=41)	χ^2/ value	p-value*
		n (%)	n (%)		
Age group	≤30 years	25 (61.0)	27 (65.9)	0.21	0.647
	>30 years	16 (39.0)	14 (34.1)		
Area	Face	40 (97.6)	28 (68.3)	12.403	<0.001
	Axilla & Limbs	1 (2.4)	13 (31.7)		
Skin type	III & IV	33 (80.5)	38 (92.7)	2.62	0.105
	V	8 (19.5)	3 (7.3)		

DISCUSSION

Excessive hair growth and undesired hair on any part of the body are the most popular concerns presented to aesthetic clinics [15]. In this study only female participants were included of Fitzpatrick skin type III-VI and face was the most targeted area. The youngest patient in this study was 17 years and the oldest was 56 years old. All patients had idiopathic hirsutism and were taken triple diode laser session 4 weekly and after 4 sessions 50% of the patients showed excellent response with no side effects.

A similar study was conducted in Germany by Kirit et al. which also showed excellent hair reduction in 95.5% areas [10]. Another similar study conducted in Israel by Lehavit et al also concluded that triple diode laser gives effective hair reduction and high patient satisfaction without significant side effects [16]. One study conducted by Gold MH et al, in which mainly the axillary and bikini area was treated reported a mean result of 4 out of 5 with minimal and transient side effects [17]. These studies and the current study indicated that triple diode laser is efficacious for hair reduction.

The comparative study conducted by Khoury JG et al shows that the diode laser was less efficacious at 59.7% as compared to the alexandrite laser which shows a 70.3% reduction [18,], this showed that the alexandrite laser is superior to the diode laser but studies conducted with triple diode laser showed effective results without significant adverse effects, especially in darker skin types.Laser and light base technology best worked on dark hair and relatively fair skin and concluded that the average clearance rate of hair is around 15-75% after 1-6 months of follow-up [19-21].

The study also conducted in Tehran by Ayatollahi A. et al concluded that a 755 nm diode laser is as effective and safe as the 755 nm alexandrite laser in skin types III-IV [22].Triple diode laser for hair growth reduction is a recent advancement in the optical device as this technology has three combined wavelengths and gives better results, especially in skin of color population [23].

This current study showed excellent results especially in skin types III to VI without significant adverse effects.

LIMITATION: The limitation of this study is that only females were included and mainly face was treated in this study. Further study should be conducted with different body parts that must be treated and long-term follow-up are needed to determine the achievement of permanent hair growth reduction.

CONCLUSION

To conclude, the triple diode laser is an attractive and effective tool that is a combination of three different wavelengths in a single pulse which provide satisfactory results and with no or minimal adverse effects.

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Authors' Contribution:

Tayyaba Iqbal: Substantial contributions to the conception and design of the work.
Sadaf Ahmed Asim : Final approval of the version to be published
Syeda Shahmoona Tirmizi : Reviewing it critically for important intellectual content.
Nadia Farooq: Analysis and interpretation of data for the work.
Madiha Sajid: Drafting the work.
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