

Near Infrared Pulsed Light for Permanent Hair Reduction in Fitzpatrick Skin Types IV and V

Pratik Thacker, Pramod Kumar

Department of Dermatology, Kasturba Medical College, Manipal University, Mangalore, Karnataka, India

Address for correspondence: Dr. Pratik Thacker, A/8 Shanti Mahal, Shastri Nagar, 148 S. V. Road, Borivali (West), Mumbai - 400 092, Maharashtra, India.
E-mail: pratikthacker@outlook.com

ABSTRACT

Background: Excessive hair on the face is a significant cause for distress amongst women. Permanent hair reduction methods including lasers and pulsed light devices are increasingly being used. **Aims:** The aim of this study is to evaluate the efficacy and safety of near infrared pulsed light source for permanent hair reduction in women seeking treatment for excessive hair growth on the upper lip and chin. **Settings and Design:** This was a prospective observational study done at a tertiary care hospital in South India. **Materials and Methods:** Women above 18 years of age were observed for six sittings of the treatment for excessive hair over the upper lip and chin using a near infrared intense pulsed light device. Efficacy was evaluated by measuring percentage hair reduction using digital photography. Further, efficacy amongst women with polycystic ovarian syndrome (PCOS) was compared with those without PCOS. Side effects were noted. **Statistical Analysis Used:** Student's unpaired *t*-test using the software SPSS version 16. **Results:** Percentage hair reduction at the end of 6 sittings in 24 women for the upper lip and chin was 52.87% and 73.81%, respectively. Out of the 24 women, 12 had PCOS and the difference in hair reduction in these women was statistically insignificant when compared to that observed in those without PCOS. Only two patients experienced side effects in the form of mild pain and discomfort. **Conclusions:** Intense pulsed light is a safe and efficacious tool for permanent hair reduction over the upper lip and chin, efficacy being similar in patients with or without PCOS.

KEYWORDS: Hair removal, intense pulsed light, permanent hair reduction

INTRODUCTION

The presence of excessive facial hair in women causes significant emotional distress and has a negative impact on their quality of life; so much so that in one study, women with polycystic ovarian syndrome (PCOS) rated excessive facial hair to have a larger impact on quality of life than other manifestations of PCOS such as infertility and menstrual problems.^[1-3] Since hypertrichosis is a cosmetic concern, the method used for hair removal must not only be practical but also cosmetically acceptable and has minimum side effects.

Temporary hair removal methods (shaving, waxing, depilatory creams, threading, etc.) are convenient and

inexpensive methods to control hair growth but require high maintenance. Bleaching with chemicals can lead to contact sensitisation and toxicity.^[4] This is why women have been constantly looking for better and newer options of hair removal, especially those that offer permanent hair reduction.

Permanent hair removal (i.e., permanent damage to the follicle) is achieved only by electrolysis which is a painful and very time-consuming procedure.^[5] It also

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Thacker P, Kumar P. Near infrared pulsed light for permanent hair reduction in Fitzpatrick skin types IV and V. *J Cutan Aesthet Surg* 2016;9:249-53.

Access this article online

Quick Response Code:



Website:
www.jcasonline.com

DOI:
10.4103/0974-2077.197078

leads to pigmentation and scarring.^[4] Hence, LASER and intense pulsed light (IPL) devices, found efficient and safe by many studies, have gained popularity in recent times.^[6-8] Commonly used LASER devices include ruby (694 nm), alexandrite (755 nm), neodymium-doped yttrium aluminium garnet (Nd: YAG) (1064 nm) and diode (800-810 nm).

In this prospective study, we assessed the efficacy and safety of super hair removal (SHR) module of pulsed light source using a near infrared wavelength of 810 nm. It is believed that it is more suited for Indian skin types, works on a low fluence (1-7 J/cm²), high pulse repetition rate (3 Hz) and a contact cooling system which minimises pain. Although studies have found this system to be safe and effective, most of these studies have been done on fairer skin types.^[6,7,9] Hence, we would like to do a study to evaluate the same in Fitzpatrick skin Types IV and V. Further, this study also aims to evaluate if there is a difference in response amongst those with PCOS and those without.

MATERIALS AND METHODS

Study design

This was a prospective observational study done at a dermatology outpatient department (OPD) of a tertiary care hospital in South India, between the period of October 2013 and August 2015 after obtaining due approval from the Institutional Ethics Committee. Twenty-four women older than 18 years of age with Fitzpatrick skin Types IV and V, who attended the dermatology OPD for treatment of perceived excessive hair on the upper lip and chin, were included in the study after informed consent. Women who have undergone laser hair removal or other permanent hair reduction treatment previously, those with photosensitivity, any active skin disease over the face, pregnant and lactating women and those on any photosensitising medication were excluded from the study.

Patients were evaluated by a detailed history and clinical examination followed by relevant laboratory investigations and ultrasonography (USG) of the abdomino-pelvis to rule out any underlying hormonal abnormality. Hair on the upper lip and chin was trimmed close to the skin surface. Hair count was done by taking digital photographs of the right upper lip, left upper lip, right chin and left chin separately. Hair thickness was graded before the first and after the last sitting. The hair density and thickness was graded as follows:

- 1 = Brown, thin, low/medium/high density
- 2 = Dark, thin, low/medium/high density
- 3 = Dark, coarse, low density
- 4 = Dark, coarse, high density.

Patients were treated for excessive hair on the upper lip and chin using a near infrared pulsed light source (SHR module of the Harmony XL device, Alma Lasers Ltd., USA). No anaesthesia was used since the cooling sapphire tip of the handpiece facilitated relatively pain free hair removal. Settings used were as follows:

- Wavelength: 810 nm
- Pulse repetition rate: 3 Hz
- Timer: 30 s
- Fluence 4-6 J/cm² depending on the skin type
- Total energy approximately 2 KJ/20 cm² depending on the fluence used.

Patients underwent six sittings of treatment at intervals of about 4 weeks. Patients were allowed to use only those hair removal methods during this period which do not uproot the hair, e.g., shaving, epilation creams. The use of threading, plucking, lasers or electrolysis was not permitted. Any adverse effect arising due to the treatment was noted.

Patients answered a patient satisfaction questionnaire, wherein they graded their satisfaction with the treatment on a numerical scale of 1-10.

Statistical analysis was done using the software SPSS version 16 (IBM) using the Student's unpaired *t*-test. *P* < 0.05 was considered significant.

RESULTS

Twenty-four patients were included in this study out of which 12 were diagnosed to have PCOS based on USG and hormonal evaluation. Age of the patients ranged from 18 years to 34 years. Eleven of these patients had Fitzpatrick skin type IV, and thirteen had skin type V. All patients completed six sittings.

Hair reduction for the upper lip in our patients ranged from 33.15% to 74.39% with an average reduction of 52.87%. The average reduction seen in patients with PCOS was 50.98% and in those without PCOS was 54.77%. This difference was found to be insignificant by unpaired *t*-test (*P* = 0.376).

For chin, the average hair reduction was 73.81% ranging from 50.33% to 91.37%. Average reduction in those without PCOS was 74.37% while that in those with PCOS was 73.25%. The difference between the two groups was found to be insignificant by unpaired *t*-test (*P* = 0.828) [Table 1].

Out of 24 patients, 22 did not complain of any side effect. One patient complained of burning sensation in 2 of the 6 sittings, and one patient complained of pain during the procedure in one sitting over the upper lip. There was no post-inflammatory pigmentation/scarring/burn in any patient.

Out of 24 patients, 19 showed reduction in hair thickness and density by two grades, whereas one and four patients showed reduction by one and three grades, respectively.

Patient satisfaction score ranged from 4 to 9; the average being seven for both with or without PCOS [Figures 1-4].

DISCUSSION

IPL devices are non-laser high-intensity light sources using a high-output flash lamp to emit non-coherent light of broad wavelength, usually in the 500–1200 nm range.^[10] This technology was first used in 1996, to treat

a cohort of eighty patients with treatment-resistant facial port wine stains in Germany.^[11] Today, it is used for the treatment of various vascular and pigmented lesions as well as for permanent hair reduction.^[12] Its use in hair removal is based on the principle of selective photothermolysis, target chromophore being melanin at the hair bulb causing relatively selective destruction of the hair bulb at suitable wavelengths.^[13] It has been proposed that damage to the isthmus and upper stem interferes with the interactions between dermal and epidermal germinative cells, inhibiting or altering the normal hair cycle.^[14]

Our study found this method to be efficacious with an average reduction of 52.87% over the upper lip and 73.81% over the chin in six sittings. This corresponded with a study by El Bedewi who found 70% reduction in facial hair for skin Types IV and V.^[15] There were a few studies that showed a higher reduction in hair, but a higher fluence was used in all these studies and the number of sittings and the body part varied.^[16,17] Furthermore, we noted that the hair reduction was more

Table 1: Results

	NPCOS	YPCOS	Total
<i>n</i>	12	12	24
%REDn upper lip	54.77	50.98	52.87
%REDn chin	74.36	73.25	73.81

n: Number of participants, PCOS: Polycystic ovarian syndrome, NPCOS: Participants without PCOS, YPCOS: Participants with PCOS, %REDn: Percentage reduction in hair counts



Figure 1: Upper lip, before 1st sitting



Figure 2: Upper lip, after 6 sittings



Figure 3: Chin, before 1st sitting



Figure 4: Chin, after 6 sittings

over the chin than the upper lip. This is contradictory to the view of Kolinko and Littler who proposed that areas with thick skin such as the chin respond less favourably as compared to areas with relatively thin skin.^[18] A higher fluence can be tried for the upper lip area as compared to the chin area to get similar results. This, however, must be weighed against the possibility of higher side effects considering that the skin over the upper lip is thinner than the chin.

On comparing with other lasers, IPL was found to be more efficacious than long-pulsed Nd: YAG laser in one study. A another non-comparative study using long-pulsed Nd: YAG showed greater hair reduction than that observed in our study.^[8] Hair reduction with alexandrite laser has been found to be more in two studies.^[2,19] Of these, the study by McGill *et al.* was a split-face study in a single patient with PCOS, and their conclusion was limited to those with PCOS only. Another study by El-Badawi *et al.* showed comparable hair reduction with both lasers. As compared to diode laser, Klein *et al.* found IPL to be less effective.^[6] However, it must be noted that most of these studies were done on fairer skin types and on varying body parts. Table 2 gives a brief summary of some studies comparing IPL devices with other devices [Table 2].

Patients with PCOS did not show any difference in efficacy or safety profile in our study in terms of hair reduction and reduction in grade of thickness and hair density.

Side effects reported by IPL hair reduction have been infrequent and transient, including erythema, isolated vesicles, minimal scarring, pain, burning, pigmentary

Table 2: Some studies comparing intense pulsed light with other devices for permanent hair reduction

Authors	Devices compared	Conclusions and comments
Purj ^[20]	Diode, Nd: YAG, IPL	Efficacy: Diode >Nd: YAG >IPL Safety: IPL >Nd: YAG >diode Study performed on darker skin types
Karaca <i>et al.</i> ^[19]	Alexandrite, Nd: YAG, IPL	Efficacy: Alexandrite >IPL >Nd: YAG
Ismail ^[21]	Nd: YAG, IPL	3 sittings in skin Types I to IV Nd: YAG was more efficacious than IPL but IPL had lower pain scores Skin Types IV and V, axillary hair
Sochor <i>et al.</i> ^[22]	Diode, IPL, IPL+RF	Efficacy: Diode=(IPL+RF) > IPL Pain scores: Least for IPL, highest for diode
McGill <i>et al.</i> ^[2]	Alexandrite, IPL	Fairer skin types Alexandrite was more efficacious than IPL Skin Types I to IV

IPL: Intense pulsed light, RF: Radio frequency,
Nd: YAG: Neodymium-doped yttrium aluminium garnet

changes, crusting and perifollicular oedema.^[23] All studies have found IPL to be safe.^[9,10,12,15,16,23-25] In our study, one patient each experienced mild transient pain and discomfort, both over the upper lip. Apart from a study by Karaca *et al.* who found that pain experienced during the procedure was less with alexandrite laser as compared to IPL, most studies have found IPL to be more tolerable and have less side effects than alexandrite, diode and long-pulsed Nd: YAG lasers.^[2,6,8,19,26] This could be due to the fact that in other lasers, the temperature can rise to 700°C and cause burns and pigmentation if not used with extreme caution. Deeper penetration of such high temperatures can cause alterations in the dermis and pain.^[26] Contrary to this, IPL systems use a controlled IPL source as its source of energy operating at approximately 50°C and a cooling system which minimises pain. Different IPL systems use different cooling systems such as forced refrigerated air, contact cooling tips (used in our machine) and cryogen spray.^[27]

One of the notable findings in our study was that even though all patients had reduced hair counts at the end of six sittings, three patients showed a slight increase in counts in intermediary sittings. This could be explained by the phenomenon of paradoxical hypertrichosis. It is the paradoxical increase in hair counts due to subtherapeutic thermal injury causing induction of hair cycle and activation of surrounding dormant follicles. This is most likely due to use of suboptimal fluence.^[14,28] The hair grown as a result of this is usually fine and dark.^[14] Studies have shown that the incidence of this side effect is up to 10%, and face is a common site.^[28]

The major limitation of our study is relatively small sample size. We recommend further studies in this field on Indian skin types and those that give results individually for different body areas. Furthermore, based on the fact that transient paradoxical hypertrichosis was seen in three patients and the incidence of side effects was low in our study, treatment with higher fluence may be tried to see if better reduction can be obtained with minimal side effects. This is supported by higher hair reduction in other studies with greater fluence used.^[8,16]

CONCLUSION

The efficacy of IPL device in permanent hair reduction is comparable to the popular laser devices used today, with superior safety profile compared to other devices.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Rabinowitz S, Cohen R, Le Roith D. Anxiety and hirsutism. *Psychol Rep* 1983;53 (3 Pt 1):827-30.
2. McGill DJ, Hutchison C, McKenzie E, McSherry E, Mackay IR. A randomised, split-face comparison of facial hair removal with the alexandrite laser and intense pulsed light system. *Lasers Surg Med* 2007;39:767-72.
3. Guyatt G, Weaver B, Cronin L, Dooley JA, Azziz R. Health-related quality of life in women with polycystic ovary syndrome, a self-administered questionnaire, was validated. *J Clin Epidemiol* 2004;57:1279-87.
4. Wagner RF Jr. Physical methods for the management of hirsutism. *Cutis* 1990;45:319-21, 325-6.
5. Sun TT, Cotsarelis G, Lavker RM. Hair follicular stem cells: The bulge-activation hypothesis. *J Invest Dermatol* 1991;96:77S-8S.
6. Klein A, Steinert S, Baeumler W, Landthaler M, Babilas P. Photoepilation with a diode laser vs. intense pulsed light: A randomized, inpatient left-to-right trial. *Br J Dermatol* 2013;168:1287-93.
7. Haak CS, Nymann P, Pedersen AT, Clausen HV, Feldt Rasmussen U, Rasmussen AK, *et al.* Hair removal in hirsute women with normal testosterone levels: A randomized controlled trial of long-pulsed diode laser vs. intense pulsed light. *Br J Dermatol* 2010;163:1007-13.
8. Nanda S, Bansal S. Long pulsed Nd: YAG laser with inbuilt cool sapphire tip for long term hair reduction on type- IV and V skin: A prospective analysis of 200 patients. *Indian J Dermatol Venereol Leprol* 2010;76:677-81.
9. Tse Y. Hair removal using a pulsed-intense light source. *Dermatol Clin* 1999;17:373-85, ix.
10. Raulin C, Greve B, Grema H. IPL technology: A review. *Lasers Surg Med* 2003;32:78-87.
11. Raulin C, Hellwig S, Schönermark MP. Treatment of a nonresponding port-wine stain with a new pulsed light source (PhotoDerm VL). *Lasers Surg Med* 1997;21:203-8.
12. Goldberg DJ. Current trends in intense pulsed light. *J Clin Aesthet Dermatol* 2012;5:45-53.
13. Anderson RR, Parrish JA. Selective photothermolysis: Precise microsurgery by selective absorption of pulsed radiation. *Science* 1983;220:524-7.
14. Lolis MS, Marmur ES. Paradoxical effects of hair removal systems: A review. *J Cosmet Dermatol* 2006;5:274-6.
15. El Bedewi AF. Hair removal with intense pulsed light. *Lasers Med Sci* 2004;19:48-51.
16. Schroeter CA, Groenewegen JS, Reineke T, Neumann HA. Hair reduction using intense pulsed light source. *Dermatol Surg* 2004;30 (2 Pt 1):168-73.
17. Khodaeyani E, Amirnia M, Babaye-Nazhad S, Alikhah H, Brufeh B. Efficacy of intense pulsed light in hirsutism. *Pak J Biol Sci* 2010;13:635-41.
18. Kolinko V, Littler CM. Mathematical modeling for the prediction and optimization of laser hair removal. *Lasers Surg Med* 2000;26:164-76.
19. Karaca S, Kaçar SD, Ozuguz P. Comparison of SHR mode IPL system with alexandrite and Nd: YAG lasers for leg hair reduction. *Balkan Med J* 2012;29:401-5.
20. Puri N. Comparative study of diode laser versus neodymium-yttrium aluminum: Garnet laser versus intense pulsed light for the treatment of hirsutism. *J Cutan Aesthet Surg* 2015;8:97-101.
21. Ismail SA. Long-pulsed Nd: YAG laser vs. intense pulsed light for hair removal in dark skin: A randomized controlled trial. *Br J Dermatol* 2012;166:317-21.
22. Sochor M, Curkova AK, Schwarczova Z, Sochorova R, Simaljakova M, Buchvald J. Comparison of hair reduction with three lasers and light sources: Prospective, blinded and controlled study. *J Cosmet Laser Ther* 2011;13:210-5.
23. Moreno-Arias GA, Castelo-Branco C, Ferrando J. Side-effects after IPL photodepilation. *Dermatol Surg* 2002;28:1131-4.
24. Raulin C, Werner S, Hartschuh W, Schönermark MP. Effective treatment of hypertrichosis with pulsed light: A report of two cases. *Ann Plast Surg* 1997;39:169-73.
25. Weiss RA, Weiss MA, Marwaha S, Harrington AC. Hair removal with a non-coherent filtered flashlamp intense pulsed light source. *Lasers Surg Med* 1999;24:128-32.
26. El-Badawi AS, Shaheen MA, Maher HM. A comparative study between alexandrite laser and intense pulsed light in axillary hair removal. *J Plast Reconstr Surg* 2004;28:125-32.
27. Weiss RA, Sadick NS. Epidermal cooling crystal collar device for improved results and reduced side effects on leg telangiectasias using intense pulsed light. *Dermatol Surg* 2000;26:1015-8.
28. Desai S, Mahmoud BH, Bhatia AC, Hamzavi IH. Paradoxical hypertrichosis after laser therapy: A review. *Dermatol Surg* 2010;36:291-8.