Open Access Research Article

The effectiveness of intense pulsed light (home use) device in facial hair reduction

DOI: https://doi.org/10.32007/jfacmedbagdad.2127.

Russul A. Dawood* **BSc student**
Rzan A. Al- Battat ** **FICMS**
Mawada M. Funjan* **PhD**

J Fac Med Baghdad
2023; Vol.65, No. 2
Received: May, 2023
Accepted: June. 2023
Published: July 2023

Abstract:

Background: Intense pulsed light (IPL) devices produce polychromatic incoherent high-intensity pulsed light with a specified wavelength spectrum, fluence, and pulse duration through the use of flashlamps and bandpass filters. Similar to lasers, IPL devices operate on the selective photothermolysis principle, with melanin acting as the chromophore. Despite this similarity, they are constructed differently and produce different amounts of light

Aim of the study: To investigate the efficacy of IPL home-use device in hair reduction technique for women with unwanted facial hair.

Subjects and methods: The study was conducted in Baghdad on forty-five female subjects with Fitzpatrick skin phototype (II to IV) and black, brown hair in a period of eight months with five sessions. The treatment area (1 cm^2 of chin) photographs and the density of hair (hair count) after each session were compared to the pretreatment.

Results: After five sessions a percentage average of hair reduction reached 70.9% (P-value ≤0.01) from the pretreatment density of hairs. Also, the physician's GAIS (global esthetic improvement scale) score was used in order to evaluate hair reduction. After five sessions, it was found that 40% of the subjects had excellent response, 56.6% had good responses and 3.33% had average responses (p-value ≤0.01)

Conclusion: The current study shows that the IPL technique used for hair reduction is effective and safe to use for the subject's Fitzpatrick skin phototypes (II to IV) facial hair.

Keywords: Hair reduction, IPL home use device, Facial hair removal

Introduction:

The use of lasers and other light-based technologies, such as the intense pulsed light (IPL) source, to permanently remove facial and body unwanted hair is currently one of the most prevalent cosmetic surgical procedures done by dermatologists and laser specialists across the world (1,2). To understand the interaction between light and biological tissues, the physical parameters of the biological tissue must be related to the parameters of the light (3,4). The extent of the effect depends on the characteristics of the tissue, which are determined by the structure and composition of the tissue, such as absorption, reflection, scattering, heat capacity, thermal conductivity, and density, as well as on the parameters of the intense light, namely its power density, wavelength and energy (5,6). In light-based hair removal, pigmented targets preferentially absorb optical energy pulses, inducing localized thermodynamic heating of hair follicle (HF) compartments. (7). Selective photothermolysis facilitates HF photothermal destruction. Selective photothermolysis damages pigmented target structures by delivering a specific wavelength at a certain fluence level for a duration equal to or less than the target's thermal relaxation time (8). IPL hair removal needs melanin in the hair shaft to absorb the energy at certain wavelengths and produces spatially limited thermal damage to melanin-containing structures when pulse durations match thermal relaxation times. Light-based hair removal damages stem cells in the bulge region of the outer root sheath by diffusing heat from melanin in the hair shaft (9). IPL devices produce light at a variety of wavelengths (500-1200 nm) that is regulated by a cutoff filter. A flash-lamp emits polychromatic, non-coherent light; different filters enable the emitted wavelength range to be narrowed. IPL is similar to lasers in that it uses selective photothermolysis, but it is polychromatic and incoherent while lasers are monochromatic and coherent (10). The miniaturization of optomechanical components supported the trend toward personal home-use therapy. Lasers/IPL devices have been considerably scaled down from high-powered, large, and costly professional systems meant for expert professionals to smaller, portable, accessible, efficient, and safe consumer equipment (11). Home–use lasers and IPL devices were developed between 2003 and 2006. Today, energy-based optical devices

*Corresponding Author: Dept. of physiology, College of Medicine, University of Baghdad anwer.russul@gmail.com mawadamousa4@gmail.com
** Dept. of Medicine, College of Medicine, University of Baghdad rzan.a@comed.uobaghdad.edu.iq

that consumers use at home to get rid of hair have become major market playeruse home–use devices for hair removal might grow more if the very important questions of safety and effectiveness are answered and clearly communicated to both consumers and providers (12). IPL is preferable to lasers because it can be used on darker skin, it can cover larger areas because the spot size is bigger, and it costs less than a real laser. However, the handpiece of some IPL devices is heavy because it contains the lamp and the device for cooling the lamp (10).
With all of this in mind, the objective of the study was to find out how well home-use IPL devices work at reducing hair in women with unwanted facial hair.

Subjects and Methods:
This study was conducted at the dermatology outpatient clinic in Baghdad, Under the supervision of a dermatology specialist, during the period from September 2022 to April 2023. Forty-five women were included in this study, but only thirty women completed all the follow-up visits. Informed written consent and consent for photography was taken prior to treatment in all subjects. Skin type is often categorized according to the Fitzpatrick skin phototype scale which has six different levels ranging from very fair (skin type I) to very dark (skin type VI). Inclusion criteria include all the subjects who have skin types II-IV based on Fitzpatrick scale, brown or black hair, and18–40 years-old. subjects with blond, white, or gray hair, pregnant women, under 18 years old, and photosensitizer users were excluded.
A controlled trial used IPL to treat unwanted facial hair. Before treatment, subjects were advised to avoid sun exposure, mechanical hair removal, and other local therapies to the treated areas. Shaving and soaping were performed the day before the treatment day. Subjects received five treatment sessions. Response to treatment on the face was assessed after each session and one month after the last treatment session. Each subject had one test site, measured $1cm^2$on their face at the chin. Prior to the first treatment and at each follow-up appointment, standard pictures of the test locations were taken using an iPhone 7 Plus with a 12-megapixel camera. Each picture is used to determine the density of hair (number of hairs) in the treatment area. Chilled ultrasonography gel was used to improve the movement of the handpiece and cool the top layer of the skin these areas were exposed to a novel low-fluence IPL source generated by Philips co. produce fluence (1.8 – 4.9 J/cm^2) via flash lamp. Pulse of light with range of wavelengths between 500 nm and 1200 nm, pulse width (0.9-2s), irradiated area $3cm^2$, strong cooling 5°c with five adjustable energy gear refers to the energy intensities the choosing of the right energy depends on the skin type of the subject and the energy intensity they feel comfortable with. All subjects had five such sessions, with treatment intervals determined by hair regrowth. Hair reduction response was evaluated using the physician GAIS (global esthetic improvement scale) score:100% for excellent response, 75% for good response, 50% for average response, 25% for poor response, and 0%for no response. Photographs of the pretreatment and final follow-up visit were evaluated based on the physician's GAIS score (scale ranging from 0% to 100%). Hair counts at pretreatment and after five sessions were measured (Figure 1), and the average hair reduction response after each session is represented by (Figure 2). Finally Monitoring for any adverse events both during and after treatment was done in order to assess the safety.

Statistical Analysis
The Statistical Analysis System- SAS (2018) software was used to determine the impact that various factors had on the research parameters. In this particular research, a statistical technique known as the Least Significant Difference –LSD test (Analysis of Variation –ANOVA) was used to make meaningful comparisons between the various means. (P <0.05) was the limit for considering differences to be significant (13).

Results
Thirty subjects completed all study visits. Including five sessions and up to eight months follow up. Table 1 and figure 1 demonstrate density (hair count in 1 cm^2) for the treatment area (square area of $1cm^2$ from the chin clamped for all subjects) at the pretreatment stage (before the first session) and after the final session. The average hair count was 18.27 at pretreatment and 5.3 after the last session, which was a highly significant difference (p-value ≤0.01**) indicating an average hair count reduction of 70.9% at six months after the last treatment session.

Table 1: Hair density (number of hairs in $1cm^2$) before the first and after the last session

Mean ± SD	Pretreatment No = 30	After five sessions No = 30	Reduction %
Hair count in 1 cm^2	18.27 ±7.29	5.3 ±4.29	70.9 %
	** (P≤0.01)		

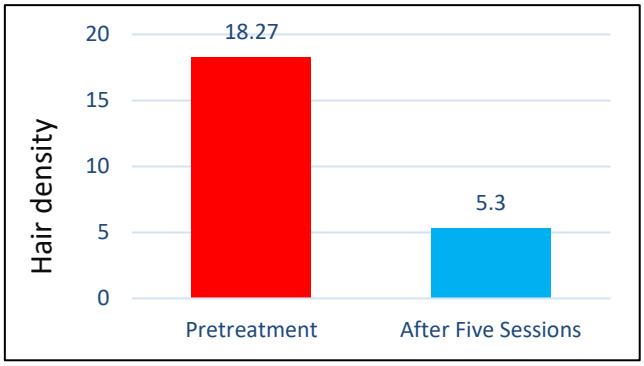

Figure 1. Mean hair density (number of hairs in $1cm^2$) before the first and after the last session

Figure 2: An example of treatment before the first session and after completing the last session

The response to IPL hair reduction is shown in (figure 3). The degree of hair elimination was evaluated using the GAIS score developed by the treating physician; the following categories were considered: Excellent 75%-100%, good 50%-75%, average 25%-50%, poor 0%-25% and no result 0% for hair reduction.

About 80% of the subjects in this study had a poor - average result after the first session, about 40% had a poor - average response after the second session, 83% had a good response after the third and fourth session and 40% of the subjects had an excellent response after the fifth session (p-value ≤0.01). This study reveals a hair count reduction in the range of 70% after five sessions in the period of 8 months.

Figure 3 shows that

- In the first session 13.3% of the subjects had an average response and 3.33% of the subjects had a good response (P≤0.01).
- In the second session 56.6% of the subjects had an average response and 3.33% of the subjects have a good response (P≤0.01).
- In the third session 56.6% of the subjects had an average response and 20% of the subjects had a good response (P≤0.01)
- In the fourth session 63.3% of the subjects had a good response and 6.6% of the subjects had an excellent response (P≤0.01)
- In the last session 65.6% of the subjects had a good response and 40% of the subjects had an excellent response (P≤0.01)

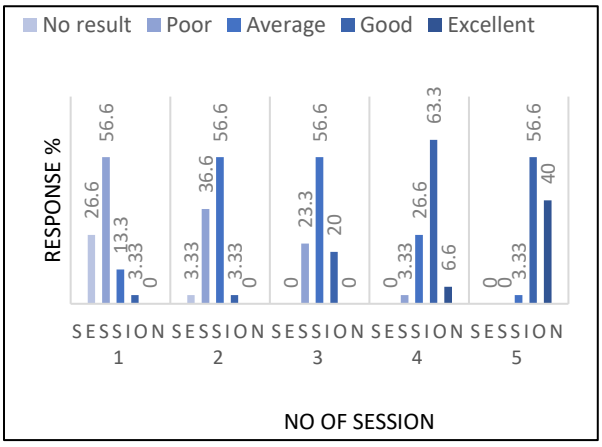

Figure 3: Comparison between different sessions in % response according to (GAIS) score

Discussion

It is hard to decide which method of hair reduction will give the best results because treatments must be tailored to each person. This study looked at how well IPL devices work, since they are one of the most popular ways to get rid of hair right now. The results of our study show that IPL hair removal with wavelength (500 – 1200 nm), fluence (1.8 – 4.9 J/cm^2), pulse width (0.9 – 2s) is effective for the Fitzpatrick skin phototype (II to IV) while the effective of IPL for Fitzpatrick skin phototype (I to III) approved by atta-motte et al (14). Even so, it is not appropriate for darker Fitzpatrick skin type since it has been shown that darker skin types are able to handle a smaller rise in temperature, According to Fodor et al, light-skinned patients (types II and III) reported greater levels of satisfaction after treatment, whereas patients with darker skin had a greater number of complications. (15)

when we want to compare IPL device to another laser device like diode, alexandrite and Nd: YAG laser, Chen, J et al (16) reported that low-power diode laser and IPL devices produced comparable outcomes. Dorgham et al (17) found that long pulsed Nd: YAG laser and diode laser had the same effect on hair count and overall satisfaction as IPL. However, alexandrite laser had a much bigger effect on hair count than IPL, but it took more sessions with the IPL device to get a good result.

Overall, the findings in this study show that IPL may provide satisfactory to majority excellent and good outcomes of subjects, with less side effects in individuals with lighter skin. So that, this therapy may be regarded as safe since the only adverse effects noted in this research were one case of pain. Treatment settings should be modified before each session based on the skin's reaction to the prior one.

IPL home-use hair removal devices are gaining popularity because they are safe, effective, and simple to use in the privacy of one's own home. Apart from the small sample size and low cost, we believe that greater spot sizes provide superior results. They cover greater areas, leaving less gaps between the spots. They also smooth out the light geometry.

Conclusion

IPL home-use hair reduction treatment with wavelengths between (500-1200 nm) is effective and safe for facial hair reduction of subjects with Fitzpatrick skin phototypes (II to IV).

Authors' declaration:
Conflicts of Interest: None. -We hereby confirm that all the Figures and Tables in the manuscript are mine/ ours. Besides, the Figures and images, which are not mine /ours, have been given permission for re-publication attached to the manuscript. -Authors sign on ethical consideration's Approval-Ethical Clearance: The project was approved by the local ethical committee at the Department of Physiology, College of Medicine, university of Baghdad. According to the code number (91.1.6.2023).

Authors` contribution:
MMF contributes to the concept and design of the study, Drafting the article or revising it critically for important intellectual content; and Final approval of the version to be published and submissions.RAA contributes to the acquisition of data or analysis and interpretation of data; Drafting the article or revising it critically for important intellectual content; and Final approval of the version to be published. RA contributes to the design of the study, Drafting the article for important intellectual content and collect the data or analysis and interpretation of data.

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How to cite this Article:

Anwer Russul, Al-Battat RA, Funjan MM. The effectiveness of intense pulsed light (home use) device in facial hair reduction. J Fac MedBaghdad [Internet]. 2023 Jul. 1 [cited 2023 Jul. 7];65(2). Available from: https://iqjmc.uobaghdad.edu.iq/index.php/19JFacMedBaghdad36/article/view/2127

فعالية جهاز الضوء النبضي المكثف (الإستخدام المنزلي) في تقليل شعر الوجه

رسل أنور داود / **فرع الفيزيولوجي / كلية الطب / جامعة بغداد**
د. رزان عبد الحسن البطاط / **فرع الطب كلية الطب / جامعة بغداد**
ا.م.د. مودة موسى فنجان / **فرع الفيزيولوجي كلية الطب / جامعة بغداد**

الخلاصة:
خلفية البحث: تنتج أجهزة (الضوء النبضي المكثف) ضوءا نابضا عالي الكثافة غير مترابط متعدد الألوان مع طيف طول موجي محدد، وطلاقة، ومدة النبضة من خلال استخدام المصابيح الكهربائية ومرشحات تمرير النطاق الترددي. بطريقة مشابهه لليزر، تعمل أجهزة (الضوء النبضي المكثف) على مبدأ التحلل الضوئي الإنتقائي، حيث يعمل الميلانين ككرموفور. على الرغم من هذا التشابه، يتم تشكيل أجهزة (الضوء النبضي المكثف) بشكل مختلف وتنتج كميات مختلفة من الضوء.
الأهداف: الهدف من هذه الدراسة هو التحقق من فعالية جهاز (الضوء النبضي المكثف) للإستخدام المنزلي في تقنية تقليل الشعر.
المنهجية: أجريت الدراسة في بغداد على 45 مريضة من نوع البشرة (II إلى IV) والشعر الأسود والبني في فترة ثمانية أشهر وعلى خمس جلسات. وكانت منطقة العلاج ($1\ cm^2$) من الذقن، تم اخذ صورة فوتوغرافية للمنطقة المستهدفة وتم حساب كثافة الشعر (عدد الشعرات) بعد كل جلسة مقارنة بكثافة الشعر قبل الجلسة الاولى.
النتائج: بعد خمس جلسات، يصل متوسط النسبة المئوية لنقصان الشعر إلى (70.9 %) ($p \leq 0.01$) من كثافة الشعر قبل المعالجة. أيضا، تم استخدام مقياس GAIS من أجل تقييم إزالة الشعر. بعد خمس جلسات وجد أن (40 %) من المرضى لديهم إستجابة ممتازة، و(56.6%) لديهم إستجابة جيدة و (3.33%) لديهم إستجابة متوسطة ($p \leq 0.01$).
الإستنتاجات: تظهر الدراسة الحالية أن تقنية (الضوء النبضي المكثف) المستخدمة لتقليل الشعر فعالة وآمنة للإستخدام لأنواع البشرة من الثاني إلى الرابع (II الى IV) لشعر الوجه.
مفتاح الكلمات: تقليل الشعر، تقنية الضوء النبضي المكثف، أجهزة الاستخدام المنزلي لتقليل الشعر