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Case Report

Intense pulsed light treatment of hirsutism: case reports of skin phototypes V and VI

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Removal of unwanted hair is a commom cosmetic concern. For hirsute women, treatment often requires drug therapy and various methods to physically remove the hair. Traditional methods of hair removal include shaving, waxing, tweezing, depilatory creams and electrolysis. Hair removal methods based on light technology, such as lasers and intense pulsed light systems, are alternative methods for longer-term hair removal. Intense pulsed light has been used in our clinic during the past 2 years to treat light-to-dark skinned patients, including skin types V and VI. We present here the treatment, using an intense pulsed light source, of three dark skinned patients with hirsutism. Patients were treated during multiple sessions (five to seven) for unwanted facial hair. Sessions were conducted monthly and patients were evaluated at follow-up sessions 2-7 months after the final treatment. Successful clearance of unwanted hair was achieved in all three patients with no pigmentary changes observed during the final follow-up sessions. Folliculitis and hyperpigmentation from tweezing were also treated by the intense pulsed light source. These results suggest that intense pulsed light is an effective source for hair removal and may, with proper parameter selection, be useful in the treatment of very dark skin types.
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Introduction

Hirsutism is a medical condition characterized by an excessive hair growth in women. Hair growth occurs in a male pattern distribution, primarily in facial regions such as the upper lip and chin. Medical intervention with drugs that block androgen receptor binding provides only partial treatment for the condition, since the treatment is only effective while the drug is being taken. Furthermore the drugs will not affect unwanted hairs that are not androgen-dependent.[1]

Temporary hair removal methods include shaving, waxing, depilatory creams and tweezing. These are convenient and inexpensive methods to control hair growth, but require high maintenance and can result in skin irritations and folliculitis. Permanent treatment by electrolysis is a painful and time-consuming approach with scarring as a potential side-effect. Laser hair removal is a relatively new approach to long-term epilation of unwanted hair. Permanent hair removal in some cases and prolonged growth delay with sustained reduction in hair counts have been reported.[2-4] Laser

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treatment of dark-skinned patients (Fitzpatrick skin types IV - VI) is limited owing to the risk of epidermal blistering and pigmentary changes.[1]

The use of lasers and intense pulsed light (IPL) sources for hair removal is based on the theory of selective photothermolysis.[4] A wavelength is chosen that will be maximally absorbed by a target chromophore to bring about the eventual destruction of the target structure with minimal damage to the surrounding tissue. With light-based hair removal, the target chromophore is presumably the melanin produced by melanocytes in the hair matrix.[5] Melanin is also present in the epidermis, so that a wavelength must be chosen that will be maximally absorbed by the hair follicle. While melanin absorption is maximal at shorter wavelengths, longer wavelengths are necessary to penetrate hair residing deeper in the dermis. Additionally, the absorption coefficients of eumelanin (contained in brown and black hair) and phaeomelanin (contained in blonde and red hair) vary (i.e. at 694 nm, the absorbance of phaeomelanin is 30 times lower than that of eumelanin).[5] Therefore, in order to optimize the results of hair removal for different body sites (where hair is located at various depths in the dermis) and different hair colors, both shorter and longer wavelengths (in the range of 600 to 1000 nm) may be necessary. An intense pulsed light source (EpiLight®, ESC Sharplan, Yokneam, Israel) that generates 590-1200 nm non-coherent light pulses can be used with various cut-off filters to tailor treatment to the skin type and hair color of the patient. For treatment of dark-skinned individuals, higher cut-off filters can be used to omit light at lower wavelengths, where absorption of light in epidermal melanin is greatest. Longer pulse duration and longer wavelengths are available to target deeper structures, while protecting the epidermis. Additional protection of epidermal melanin is achieved by the use of multiple synchronized pulses separated by controlled delay times. Reports in the literature have demonstrated the safety of IPL hair removal treatment of various body sites for skin types I-V.[5,7-9] Furthermore, large spot sizes allow many hair follicles to be targeted with each light pulse, thereby permitting quick treatment for large body areas.

Three case reports are presented here of IPL hair removal treatment in female patients with skin types V and VI. The results of a multiple treatment protocol were evaluated during 2-7 month intervals following treatment.

Case reports

Patients were instructed to stop all methods of removing hair before undergoing treatment, to allow the hair growth cycle to return to normal. Medical histories were taken prior to treatment and treatment parameters were determined according to the patients' skin type, hair color and hair texture (Tables 1, 2). Hair was then trimmed and a refrigerated water-based gel was applied to the skin to serve as a heat sink and to ensure uniform light distribution. In contrast to the treatment of light-skinned patients, there was no immediate post-therapy clinical endpoint of treatment. An immediate post-treatment reaction in dark skin indicates skin injury. There was a delayed reaction to treatment and the hair was observed to fall out in 1-2 weeks following treatment. Multiple treatments were conducted at monthly intervals. The clinical endpoint of treatment was removal of all unwanted hair and improvement of any existing folliculitis. Photographs were taken of the patient prior to beginning treatment and at follow-up visits, and were assessed by th physician and attending medical assistant for percentage clearance.

Patient (gender/ age)	Skin type	Hair color	Hair texture	No. of treatments	Average interval between treatments	% clearance at follow-ups 2-7 months after final treatment (9-12 months after initial treatment)
1 (F/40)	VI	Black	Coarse/thick	5	1 month	85%
2 (F/30)	VI	Black	Coarse/thick	6	1.2 months	100%
3 (F/38)	V	Black	Fine/very fine	7	1 month	95%

Table 1
Summary of patient information for facial hair removal treatment on dark skin

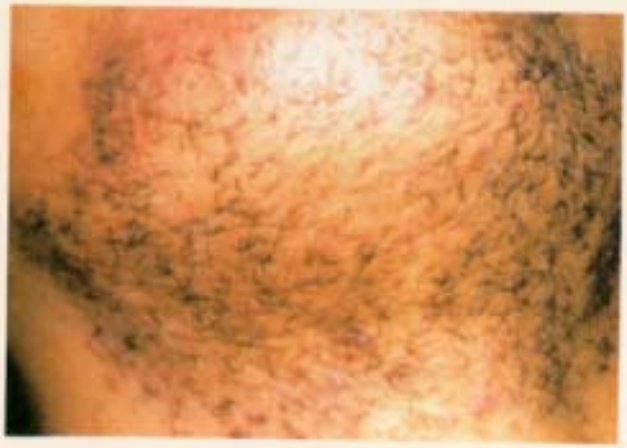
Patient	Energy range (J/cm²)	Filters (nm)	Pulse modality	Pulse duration (ms)	Pulse delay (ms)
1	34-45	695	Triple pulses	3.6	110, 120 or 130
2	28-34	645, 695, 755	Double and triple pulses	3.6, 5 or 5.5	80 or 90
3	28-45	695	Double and triple pulses	3.6 or 5.5	80 or 85

Table 2
Summary of treatment parameters used.

Patient 1

A 40-year-old African-American female (skin type VI) suffered from hirsutism since the age of 20 (Figure 1A). Hair growth was managed with daily shaving, tweezing and occasional waxing and electrolysis. The patient presented for initial treatment with 11-day growth of coarse black hair on the chin and neck. Evidence of extensive folliculitis, ingrown hairs and hyperpigmentation, resulting from tweezing, was observed. The patient underwent five treatment sessions, conducted at monthly intervals with the following treatment parameters: fluence range of 34-45 J/cm^2, 695 nm cut-off filter, and triple pulses with duration of 3.6 ms and 110, 120 or 130 ms delay between pulses.

The first treatment session resulted in the disappearance of ingrown hairs, while successive treatments reduced the number of hairs and decreased the folliculitis. After three monthly treatments, noticeable improvement was observed with 66% of the hairs removed. A follow-up session at 7 months after the final treatment (1 year after initial treatment) revealed sustained hair reduction with 85% clearance of all the thick hairs and only some fine hairs left (Figure 1B). No adverse reactions to the treatment were observed.



(A)

(B)

Figure 1

*A 40-year-old female (skin type VI) with coarse, black hair, extensive folliculitis, and hyperpigmentation as a result of tweezing (**A**) before and (**B**) 7 months following the final treatment (1 year after initial treatment). Significant clearance of the thick hairs (85%) and clearing of the folliculitis can be observed with no adverse pigmentation present.*

(A)

(B)

Figure 2

*A 30-year-old female (skin type VI) with coarse, black hair, and hyperpigmentation, as a result of tweezing, on the chin and neck (**A**) before and (**B**) 2 months following the final treatment (10 months after initial treatment). Total clearance of the unwanted hairs and clearing of the hyperpigmentation can be observed.*

Patient 2

A 30-year-old African-American female (skin type VI) suffered from hirsutism since the age of 16 (Figure 2A). Hair growth was controlled with daily tweezing. The patient presented for initial treatment with 10-day growth of coarse black hair primarily on the chin and neck. The patient underwent six treatment sessions, conducted at monthly intervals (2 months between the second and third sessions). The following treatment parameters were used: fluence range of 28-34 J/cm^2, 645, 695 and 755 nm cut-off filters, double and triple pulses with duration of 3.6, 5 or 5.5 ms and 80 or 90 ms delay between pulses.

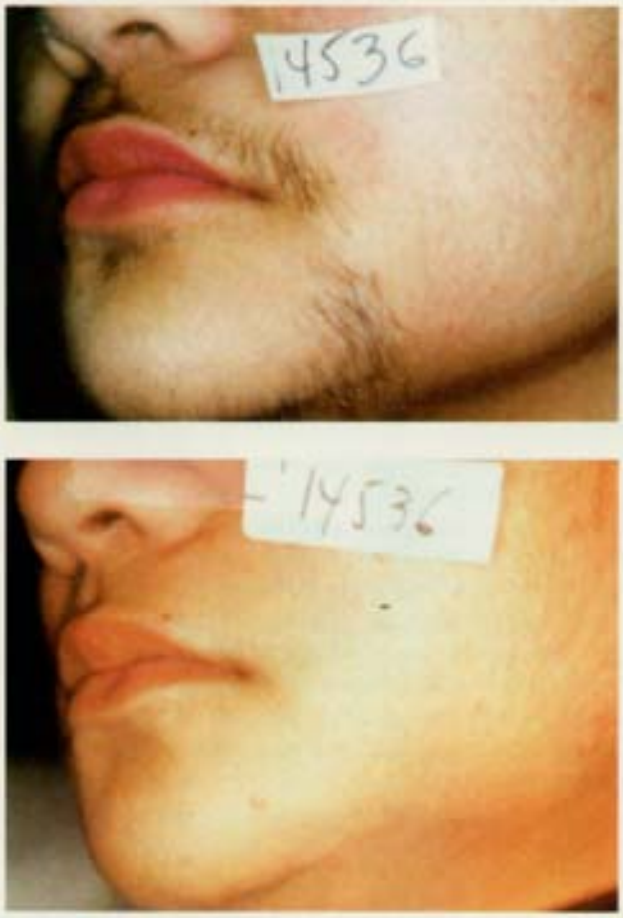


Figure 3
*A 38-year-old female (skin type V) with fine black hairs on the upper lip and chin and very fine hairs on the face (**A**) before and (**B**) 2 months following the final treatment (9 months after initial treatment). Nearly total clearance (95%) of hairs on the upper lip and chin has been achieved (very fine hairs on the face were not treated per the patient's request). Normal skin color with no adverse pigmentation can be observed.*

Six sessions, conducted at average 1.2-month intervals, resulted in 100% clearance of all the unwanted hairs, observed at a follow-up session at 2 months after the final treatment (10 months after initial treatment) (Figure 2B). Hyperpigmentation, resulting from routine tweezing prior to treatment had cleared by the follow-up session. No pigmentary changes or other adverse effects occurred as a result of treatment.

Patient 3

This 38-year-old Indian female (skin type V) had hirsutism since the age of 14 (Figure 3A). Hair growth was controlled by tweezing and bleaching. The patient presented for initial treatment with fine, black hairs on the upper lip and chin and very fine black hairs on the face. The patient underwent seven treatment sessions, conducted at monthly intervals, to treat hair on the upper lip and chin only. The following treatment parameters were used: fluence range of 28-45 J/cm^2; 695 nm cut-off filter, double and triple pulses with duration of 3.6 or 5.5 ms and 80 or 85 ms delay between pulses.

The first treatment session resulted in minimal changes to the hairs and some burn pigmentation. At the second treatment session, it was observed that the skin had healed. Some hairs disappeared or became fine after initial treatments. After the fifth treatment, a noticeable reduction in the number of hairs were observed, and by the final seventh treatment 95% of the unwanted hairs on the chin and upper lip were removed. A follow-up session at 2 months after the final treatment (9 months after initial session) revealed sustained clearance of all the undesired hairs and normal intact skin without pigmentary changes (Figure 3B).

Discussion

Hirsutism can represent a severe cosmetic disturbance and cause great social embarrassment. Traditional methods of hair removal can be painful, result in adverse effects and require considerable efforts to mantain satisfying results.Patients have often spent decades attempting to rid themselves of excess hair to no avail. Lasers and intense pulsed light appear to offer an alternative modality for more lasting results.

In this study, the intense pulsed light system provided the flexibility to select parameters according to the individual patient and consequently to produce excellent results after multiple treatments. Various parameters such as cut-off filters and pulse duration were taken into consideration during the treatment of the three cases presented here. Energy for treatment was selected automatically, according to pre-sets in the computer software of the systems, after the necessary patient data (skin type, hair density, hair color) had been entered. These pre-sets represented the most conservative settings, since there is a particular need with dark-skinned individuals to proceed cautiously to avoid skin damage. The parameters were then refined as reactions to treatment were assessed; fluence was increased and delay times lowered if the initial treatment did not result in significant hair removal and if there were no adverse reactions. If the initial energy chosen resulted in pigmentary changes or did not produce any effect, then the energy was changed accordingly for the next treatment session. Since significantly more melanin absorption occurs with dark-skinned individuals, the risk of epidermal damage in the patients presented here was a concern. Generally the 695 nm cut-off filter was selected since this would allow only wavelengths longer than this value (695-1200nm) to be emitted. Wavelengths in this range are less absorbed by epidermal melanin, thereby decreasing the risk of epidermal damage.[3] Despite this, patient 3 was observed to have some burn pigmentation after the first treatment. An-

increase in pulse duration for the second treatment appeared to prevent further epidermal damage. In order to spare the epidermis further in the three patients presented here, a longer pulse duration and delay were selected. Double and triple pulses were utilized in order to divide the energy over the sequential pulses. This allowed the hair follicle to heat up to a critical temperature for damage in a step-wise fashion, while allowing ample time for the epidermis to cool.[10] Since the thermal relaxation time of the epidermis is in the order of 3-10 ms and that of a hair follicle (200 to 300μm in diameter) is 40-100 ms, an optimal pulse duration would be of an intermediate value.[3] A pulse duration of longer than 3 ms (total pulse width of 7.2-16.5 ms) and delay times in the order of 80-130 ms were utilized to allow the epidermis to cool while the follicle heated up during the sequential double and triple pulses.

The time interval between treatments was selected on a clinical and practical basis rather than in precise regard to the physiological aspects of the hair growth cycle. Since it is necessary to target hair in the active cycle of growth (anagen cycle), the resting (telogen) phase for hair growth on different anatomical sides should be taken into consideration. The telogen duration for the upper lip has been reported to be approximately 6 weeks.[11] Though the time for regrowth is patient dependent, we have found in our clinical experience that 1 month generally allows ample time for sufficient regrowth of facial hair to serve as a light absorbing target. This also influences patient satisfaction, since patients are eager to receive further treatment once they see initial hairs disappearing.

Although only three cases are presented here, they are quite representative of the dark-skinned population treated in our clinic (over 500 dark-skinned patients have been treated in our clinic). A large-scale study is currently underway to report the methodology for treatment of skin types I-VI. In the case reports presented here significant hair reduction was achieved after multiple treatments. Of interest is the fact that although two fo the patients had returned for follow-up (at the time the study was initiated) only 2 months after the final treatment, the patients have been examined recently and no hair regrowth was observed at 14 months following the final treatment. Furthermore, hyperpigmentation from tweezing, wich was at times presented for up to a year after tweezing had been terminated, was cleared after intense pulsed light treatment.

These cases represent a group of patients that are often contraindicated for laser hair removal owing to the risk of hyper- and hypopigmentation during treatment of dark-skinned patients. With the use of carefully-selected parameters such as cut-off filters that filter out shorter wavelengths, longer pulse duration, and long pulse delays that allow the epidermis to cool sufficiently, the authors feel that IPL may be safely and effectively used to treat even skin type V and VI patients.

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