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Muhsin A. Al-Dhalimi & Mohammad J. Kadhum

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REPORT

A split-face comparison of facial hair removal with the long-pulsed alexandrite laser and intense pulsed light system

MUHSIN A. AL-DHALIMI[1] & MOHAMMAD J. KADHUM[2]

[1]*Department of Dermatology, College of Medicine, University of Kufa, Najaf, Iraq and* [2]*Department of Dermatology,College of Medicine, University of AlQadisya, Al-Diwanya, Iraq*

Abstract

Background: Undesirable hair growth presents a significant problem for many patients. Photoepilation has become a very popular procedure in esthetic and cosmetic practice. Among the systems used are the long-pulsed alexandrite laser (755 nm) (ALX) and intense pulsed light (IPL). *Objective:* To compare the safety and efficacy of long-pulsed ALX and IPL for hair removal. *Patients and methods:* This comparative study was carried out in the outpatient Department of Dermatology and Venereology, Al-Sadir Teaching Hospital, Al Najaf City during the period from June 2009 to July 2010. Thirty-five patients were included; thirty of them completed the study. They received six treatment sessions with the ALX on the left side of the face and IPL on the right side of face with 4-week intervals between sessions. Response to treatment on both sides of the face was assessed at 1, 3, and 6 treatment sessions. Hair-free intervals and patient's satisfaction were recorded in each visit. *Results:* After six treatment sessions, IPL-treated sides showed longer median hair-free intervals compared with ALX-treated sides. Reduction in hair counts was significantly larger on the IPL compared with that on the ALX-treated sides at 1, 3, and 6 sessions. Three patients (10%) developed postinflammatory hyperpigmentation, one of them on the left side and the others on the right side. It was more severe on the right side and both the patients were of skin type IV. Slight stinging and burning sensation at time of the treatment were recorded in all patients. All reported side effects were transient and tolerated by the patients except postinflammatory hyperpigmentation which persisted and was decreasing gradually toward the end of the study. *Conclusions:* The results of this study suggested that IPL is more effective in reducing excessive facial hair growth, with longer hair-free intervals and greater patient satisfaction than the ALX.

Key Words: *hirsutism, IPL, long-pulsed alexandrite laser*

Introduction

Hirsutism (from Latin *hirsutus* = shaggy, hairy) is defined as "an excessive growth of terminal (coarse and medullated) hair in a female in a typically male distribution" (1). The affected androgen-dependent growth areas include the upper lip, cheeks, chin, central chest, breast, lower abdomen, and groin (2).

It may be the result of either excess androgen level or increased sensitivity of the hair follicles to normal levels of androgens. It affects around 5–10% of women (3). It is a common presenting complaint among patients who present to outpatient dermatology clinics for cosmetic reasons (4).

The frequency and distribution of female androgen-dependent hair growth also varies with age; terminal hair growth in the pubic and axillary regions declines with age, whereas facial hair growth increases. These difficulties in definition of hirsutism have led to the use of the patient-determined term "unwanted hair," to decide the need for therapeutic intervention (5).

Undesirable hair growth presents a significant problem for many patients. Several light- and laser-based photoepilation have rapidly become the treatment of choice for the removal of unwanted hair. The long-pulsed alexandrite laser (ALX) has a wavelength of 755 nm which allows a deeper penetration of the dermis with less absorption by epidermal melanin, thereby theoretically making adverse side effects less of a concern for dark-skinned patients (6). This laser

Correspondence: Prof. Muhsin A. Al-Dhalimi, MD, Department of Dermatology, College of Medicine, University of Kufa, Iraq-Najaf-Kufa, P.O. Box 18, Najaf 00964, Iraq. E-mail: muhsin.aldhalimi@uokufa.edu.iq

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system is compact and can be used in small rooms if adequate ventilation is available. Their flexible fiber optic arm is easy to manipulate and provides access to hard-to-reach body areas. The large spot sizes and frequency (1–5 Hz) improve the possibility of rapidly treating large body areas (7).

Intense pulsed light (IPL) systems are high-intensity pulsed light sources which emit polychromatic light in a broad wavelength spectrum of 400–1200 nm (8). The emitted wavelengths determine not only the absorption pattern of the emitted light, but also the depth penetration (8).

IPL devices use flashlamps and computer-controlled capacitor banks to pass the stored electrical energy through xenon gas within the gas-discharge lamp so that bright light is emitted; thus, electrical energy is converted into optical energy. With the aid of convertible cutoff filters, the polychromatic IPLs can be easily adapted to the desired wavelength range.

In IPL devices, similar to lasers, the basic principle is the absorption of photons by endogenous or exogenous chromophores within the skin and the transfer of energy to these chromophores. This transfer generates heat and subsequently destroys the target structure. The patient's skin type and the present skin condition determine the choice of suitable cutoff filters and therefore the spectrum of wavelengths to be emitted.

Advantages of IPL to lasers are the lower purchase price and the more robust technology (9). The large spot size is also a great advantage in terms of treatment duration, but a disadvantage in terms of handling and maneuverability. Another disadvantage of IPL devices is the heavy weight of the handpiece as it contains the lamp and the lamp-cooling device in some brands.

Although both IPL and ALX systems were recorded to be effective in treatment of unwanted hair in females, no previous split-face comparative study was done to compare their outcome and side effects in Iraqi population. Most of our people have skin color type III or IV. In this work, a split-face controlled trial was carried out to compare hair removal using long-pulsed 755-nm ALX and IPL system (peak of 650 nm) in women with hirsutism. The primary aim of the study was to establish whether there were any differences between the two systems in terms of outcomes and side effects.

Patients and methods

This study was carried out in the outpatient Department of Dermatology and Venereology, Al-Sadir Teaching Hospital, Al Najaf City, Iraq; during the period from June 2009 to July 2010. Thirty-five patients were enrolled in this study. The inclusion criteria were (1) facial hirsutism comprising brown or black hair, (2) Fitzpatrick skin type I–V, and (3) patients above the age of 16 years. Exclusion criteria included (1) non-facial hirsutism, (2) patients with blonde, red, gray, or white hair, (3) patients under the age of 16 years, (4) pregnancy, (5) use of photosensitizing medication, (6) diabetes mellitus, and (7) history of keloid formation. All included patients signed the informed consent form prior to the beginning of treatment. The study was approved by the Ethical Committee of the College of Medicine, University of Kufa.

Thirty-five female patients were recruited into the study; five of them were defaulted for different reasons. Thirty patients completed the treatment sessions and follow-up period of the study.

This study was a split-face controlled trial comparing 755-nm long-pulsed ALX (Quanta System, Italy) and IPL system (Quanta System, Italy) for the treatment of excessive facial hair. In both systems, the fluences used were within the recommended range by the manufacturing company and the commonly used parameters for facial hair removal. Patients initially received test spots using both systems and were assessed after 2 weeks for the response at the starting fluence and for any side effects.

Prior to treatment, all patients were instructed to avoid exposure to sun, mechanical epilation of hair in the treatment areas, and any other local treatment to the treated sites. At the day of treatment, the skin was prepped with soap and water and the treatment area was shaved.

All patients received a total of six treatments using ALX on left side of the face and IPL on right side of the face with 4-week intervals between treatment sessions. Response to treatment on both sides of the face was assessed at the first, third, and sixth sessions and 1 month after the last treatment session.

The IPL system (LIGHT A plus, LIGHT B plus, Quanta System, Italy) used in the study incorporated a 400–1200-nm filter on the flashlamp. Treatments were carried out using a cutoff filter, of 650 nm with a size of 48×13 mm quartz block. A thin film of colorless transparent chilled cooling gel was applied to the area being treated with the IPL system to protect the epidermis.

Patients with skin type I–III were treated using 11 J/cm^2 as a starting fluence increasing up to 15 J/cm^2 as tolerated, with double pulses and a 20-ms delay between pulses and pulse duration of 20 ms. The starting fluence for patients with skin type IV was 10 J/cm^2, increasing gradually to 13 J/cm^2 as tolerated.

The long-pulsed ALX (LIGHA, LIGHT A plus, LIGHT 4V, Quanta System, Italy) used has a wavelength of 755 nm and pulse duration of 30 ms. All patients were treated using 8-mm spot size, a repetition rate of 1 Hz, and accompanied with dynamic cooling device. Standard starting fluence of 20 J/cm^2 was used for skin type I–III, and gradually increased up to 25 J/cm^2 as tolerated. Patients with skin type IV

were treated at starting fluence of 10 J/cm^2 that was increased to 20–22 J/cm^2 as tolerated.

All patients were seen regularly every 4 weeks during the treatment period and at 1, 3, and 6 months after treatment cessation. At each visit, the response to treatment and any side effects were recorded; photographs were taken before the start of the treatment and at each visit.

All the patients were evaluated objectively and subjectively regarding their response to the treatment. Objective evaluation was done by photographic assessment. Colored photographs for each patient were obtained at the baseline and at each visit during the follow-up period. Photographs of the front, right, and left side of face views were taken using Sony Digital, high sensitivity, 8 mega pixels, DSC W30 still camera, in the same place with fixed illumination and distance.

The percentage of hair reduction was determined by two blinded, independent dermatologists not involved in the study who assessed the photographs at the end of the study for degree of improvement.

Subjective assessment included patient's satisfaction and hair-free intervals (HFIs). Patient satisfaction questionnaire with laser treatment in terms of hair reduction was recorded on linear analog scale (LAS) from 0 to 10; 0, no satisfaction and 10, extremely satisfied. HFIs were recorded following each treatment. HFIs were defined as "the time to first hair re-growth," as measured by the patient, following each treatment.

Any incidence of immediate or delayed complications was assessed and recorded at each visit including erythema, pain, burning of skin hypo/hyperpigmentation, blistering, excoriation, crusting, and folliculitis.

Statistical analysis was done through descriptive and analytic statistics using scientific calculator and SPSS version 10 considering P value of ≤ 0.05 as significant. Paired t-test was used to compare the visual analog scales from photographical assessment before and after treatment.

Results

Thirty out of thirty-five patients completed this study. Their ages ranged from 17 to 42 years with mean ± standard deviation (SD) of 28.50 ± 6.74 years. The disease duration varied between 1 and 20 years with mean ± SD of 5.57 ± 5.328 years. The age of onset of the disease ranged from 15 to 38 years with a mean ± SD of 23.19 ± 6.31 years. According to Fitzpatrick classification for skin types, 7 (23%) patients were of skin type II, 21 (70%) patients were of skin type III, and 2 (7%) patients were of skin type IV.

The results of visual assessment for each patient before and after treatment sessions are shown in Figures 1 and 2. On the side of face that was treated with IPL, hair reduction at the first follow-up session was 33.97%, 72.69% at third session, and 79.67% at sixth session. The results remain static 1 month after the last session. On the side of face that was treated with ALX (755 nm) hair reduction at the first follow-up session was 18.50%, 38.83% at third session, and 42.83% at sixth session which remains the same at 1 month later.

All patients had significant reduction of hair growth on right side of face treated with IPL (650 nm) after the third and sixth sessions of treatment (Table I). At all follow-up points, the hair reduction on the right sides was statistically highly significant (P value = 0.0001), while hair reduction on ALX-treated sides was also significant but with less efficacy (P value = 0.0001).

The HFIs recorded for both the IPL and ALX systems after each treatment are displayed in Table II. HFIs were self-reported by the patients.

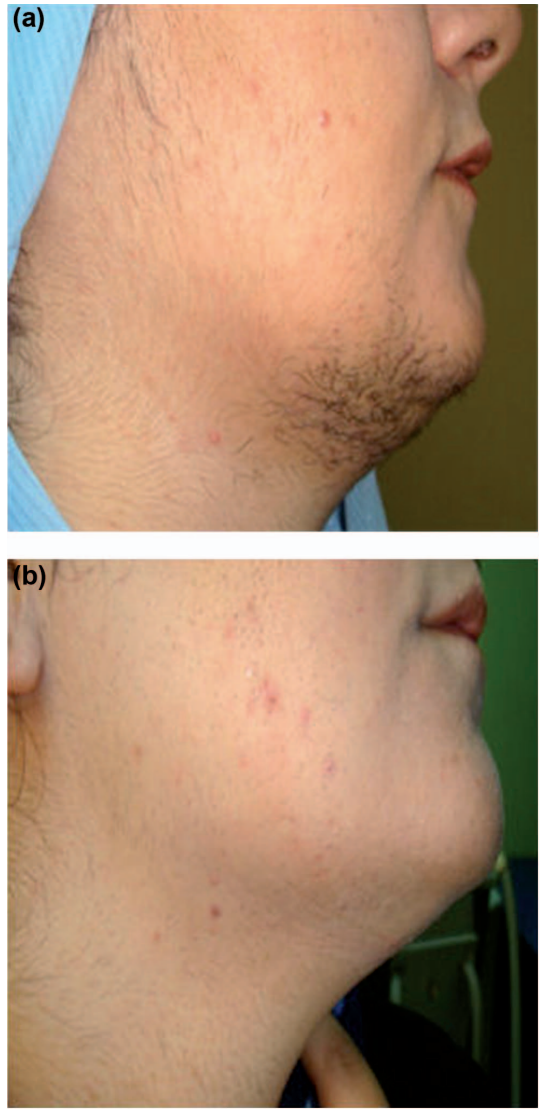

Figure 1. (a) Patient with IPL-treated side before treatment and (b) the same patient with IPL-treated side after 6 treatments.

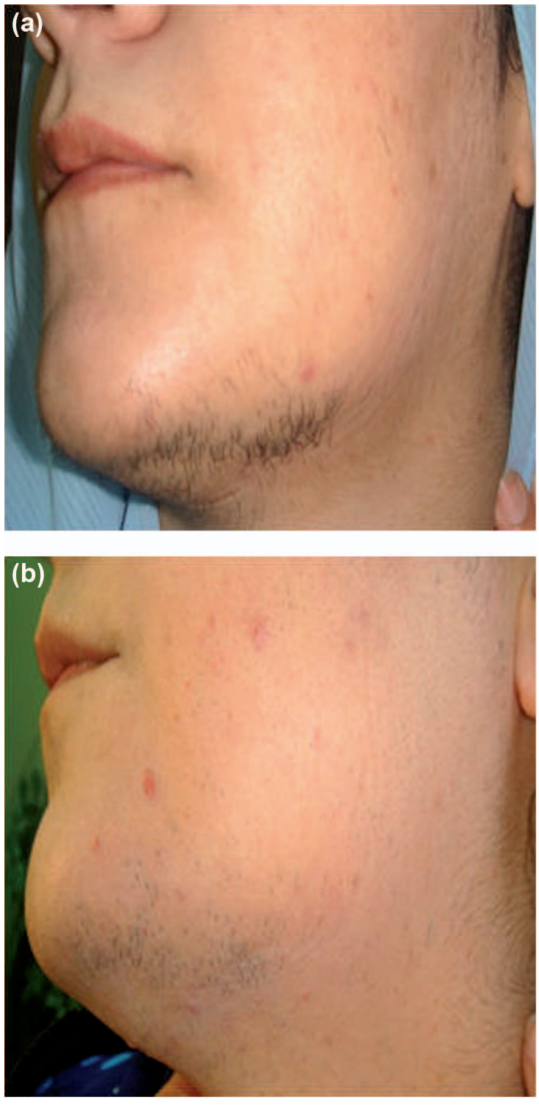

Figure 2. (a) The same patient in Figure 1 with ALX-treated side before treatment and (b) the same patient with ALX-treated side after 6 treatments.

Since these recordings are to an extent subjective, HFI results are presented as medians.

On the right side of the face which was treated with the IPL, there was marked increase in median HFI with treatment, with the longest HFI of 5 weeks recorded after the sixth treatment. This was significantly longer than those recorded in the first 5 months ($p = 0.0001$). In contrast, the median HFIs on the left side of the face which was treated with the ALX only had a maximal HFI of 2.5 weeks. This was also noted after the sixth treatment. Therefore, the median HFIs were longer on the IPL-treated side, when compared with the ALX, after all six treatments. This finding reached statistical significance from the third treatment session onward (P value = 0.0001).

Table I. Percentage of hair reduction, p value, and t test result of both systems after 1, 3, and 6 treatments.

Treatment session	Hair reduction (%)	*T*-test	*P* value
IPL after 1 session	33.97	25.37	0.000
IPL after 3 session	72.67	37.76	0.000
IPL after 6 session	79.67	53.25	0.000
ALX after 1 session	18.50	15.09	0.001
ALX after 3 session	38.83	25.39	0.000
ALX after 6 session	42.84	25.87	0.000

Table II. HFIs (Median) are displayed for both the ALX and IPL systems after each treatment.

	HFI (weeks)	
Treatment	IPL	ALX
1	2	1
2	2	1.5
3	4	1
4	4	2
5	4	2
6	5	2.5

At 1 month after IPL treatment on right side, median satisfaction was 5.6 (range: 0–7). At the third month, patient satisfaction score was increased and the median was 7.5 (range: 5–10). At the end of follow-up period, patients' satisfaction was increased to median of 8.3 (range: 6–10) (Table III).

In contrast, on left side treated with ALX median satisfaction at 1 month was 2.3 (range: 0–4). At the third month, patient satisfaction score was increased to median of 2.5 (range: 0–5). At the end of follow-up period, patient satisfaction was 2.5 (range: 0–6), showing p value of 0.305 which is not statistically significant.

At all stages of follow-up, patient satisfaction with IPL-treated side had statistically highly significant P value of 0.0001.

Slight stinging and burning sensation at the time of treatment was recorded in all patients on both sides. Erythema was seen on both the treated sides in all cases, which lasted from a couple of hours up to 2 days after the session on both sides. Three patients (10%) all were of skin type IV developed postinflammatory hyperpigmentation, one on the left side and the other two on the right side which was more severe. Leukotrichia was detected in 2 patients (7%) on IPL-treated side, particularly in those who already had whitish hair on their scalp.

All the side effects were transient and tolerated by the patients except postinflammatory hyperpigmentation which persist to the end of the study but in a decreasing manner.

Table III. LASs are displayed for both the ALX and IPL systems after treatment.

	Satisfaction in terms of hair removal (median LAS score)	
Treatment	IPL	ALX
1	5.6	2.3
3	7.5	2.5
6	8.3	2.5

Discussion

Unwanted pigmented hair is a common presenting complaint, which may affect 5–10% of those who present to outpatient dermatology clinics for cosmetic reasons (1). It affects the upper lip, cheeks, chin, central chest, breast, and lower abdomen in an androgen-dependent fashion (2).

It may be the result of either excess androgen level or increased sensitivity of the hair follicles to normal levels of androgens. Unwanted hair growth remains a therapeutic challenge and there is a need for an effective, safe, and non-invasive treatment modality capable of removing hairs on a long-term basis.

However, hair removal treatments are for a large part performed for cosmetic reasons to people with normal hair pattern, and considerable amounts of time and financial resources are spent to achieve hair-free appearances.

Several traditional treatments are offered for hair removal including shaving, plucking, bleaching, waxing, chemical depilatories, and electrolysis (10,11). None of these treatments are ideal as their efficacy is limited, they are painful and tedious, and there may be a risk of side effects such as skin irritation, infection, allergic and irritant dermatitis, as well as scarring. Most of these methods have poor long-term effect. Even electrolysis, which has potential long-term action when compared with laser epilation, was much less effective and time consuming, requiring more sessions and was more painful.

Laser and IPL sources have, over the recent years, become increasingly propagated. The available lasers and light sources operate in the red or near-infrared wavelength regions: ruby laser (694 nm), ALX (755 nm), diode laser (800–810 nm), Nd:YAG or neodymium:yttrium aluminum garnet laser (1064 nm), and non-coherent IPL (590–1200 nm) (12,13). Still there is a controversy over which is the best light system for hair removal. The mechanisms by which these devices induce selective damage to hair follicles are based on the concepts of selective photothermolysis (14).

The red and near-infrared wavelengths allow for selective absorption by melanin combined with deep penetration into the dermis and pulse durations shorter than or equal to the thermal relaxation time of the hair follicles (about 10–50 ms) confine the thermal damage to the hair follicles.

In 2007, McGill et al. conducted a randomized split-face comparison of facial hair removal with an ALX (GentleLase, Candela, Wayland, MA; spot size: 15 mm, fluence: 10–30 J/cm^2; and pulse duration: 3 ms) and an IPL device (Lumina, Lynton Lasers, Cheshire, UK; wavelength: 650–1100 nm; fluence: 16–42 J/cm^2; three pulses of 55 ms; and delay: 20 ms) in women (n¼38) with polycystic ovary syndrome (15).

The authors reported that ALX treatment resulted in longer median HFIs than IPL therapy. Decrease in hair counts was significantly higher after ALX treatment than that after IPL therapy at 1, 3, and 6 months (52%, 43%, and 46% vs. 21%, 21%, and 27%, $P < 0.001$). Patient satisfaction scores were significantly higher for the ALX ($P = 0.002$). This is due to the specific wavelength, short pulse duration, large spot size, and single pulse delivery of the GentleLase ALX, resulting in more follicular destruction than IPL-treated side.

In another study, Amin and Goldberg (9) compared hair removal from the back or thigh using a GentleLase ALX, a Palomar Starlux IPL (incorporating two different filter settings), and a Lumenis Lightsheer diode laser, and found that there were no significant differences between hair count reduction between the systems.

In the present study, we conducted a split-face comparison of facial hair removal with a Quanta ALX (LIGHA, LIGHT A plus, LIGHT 4V, ITALIA; wavelength: 755 nm; spot size: 8 mm; fluence: 10–25 J/cm^2; and pulse duration: 30 ms) and an Quanta IPL System (LIGHT A plus, LIGHT B plus, Italy; wavelength: 650–1200 nm; fluence: 10–15 J/cm^2; double pulses of 20 ms; and delay: 20 ms) in women with hirsutism.

In contrast with other studies, the result from this study showed that IPL treatment resulted in longer median HFIs than ALX therapy (5 weeks vs. 2.5 weeks; $P < 0.001$). Decrease in hair counts was also significantly higher after IPL treatment than that after ALX therapy at 1, 3, and 6 sessions (33%, 72%, and 79% vs. 18%, 42%, and 47%; $P < 0.0001$). Patient satisfaction scores were significantly higher for the IPL treatment than ALX-treated side at 1, 3, and 6 sessions, median LAS score (7, range: 0–10 vs. 2, range: 0–5), P value = 0.0001 (highly significant).

The reduction in hair growth on the IPL-treated side was higher than that on the alexandrite side at all follow-up points. This is despite using lower fluences on the IPL side than those on the alexandrite side: mean fluences of 15 and 25 J/cm^2, respectively. We anticipate that the results from used ALX with small spot size (8 mm) and pulse duration of 30 ms in comparison with previous study result in less penetration and less follicular destruction.

Previous studies have found hair reductions using IPL systems to vary between 33% and 80.2%, with the improvement lasting up to 30 months following treatment (16,17).

The present study showed that Quanta IPL resulted in mean hair count reductions of 33% at the first session and 72.69% and 79.67% at the third and sixth session's follow-up, respectively.

In a split-face study, Bjerring and Christiansen compared the effectiveness of an IPL device (Ellipse Relax Light 1000, Danish Dermatologic Development, Hoersholm, Denmark; lem¼600–950 nm; spot size: 10mm_48mm; and 18.5 J/cm^2) to a normal-mode ruby laser (EpiTouch, ESC Sharplan, Tel Aviv, Israel; lem¼694 nm, spot size: 5 mm, and

pulse duration: 0.9 ms) for hair removal in 31 patients (three treatments) (17).

The authors reported an average hair count reduction of 49.3% (IPL) versus 21.3% (ruby laser) after three treatments and concluded that IPL treatment was 3.94 times more effective for hair removal than ruby laser therapy.

Some very recent articles focused on the safety of IPLs in hair removal. Feng et al. investigated the short-term efficacy and side effects of an IPL device (Lumenis One, Lumenis, Inc., Santa Clara, CA; lem¼550–1,200 nm) for epilation in Chinese patients (n¼18) with Fitzpatrick skin types III–V and black hair (16). Patients were treated four times at 4–6-week intervals on the axillae (n¼13) and the upper lip (n¼5) with 14–22 J/cm^2.

The authors reported an average hair reduction of 49.9% for all sites after one session, 58.6% after two sessions, 79.3% after three sessions, and 83.8% after four sessions (P¼0.001). No significant complications or adverse events were reported.

Radmanesh et al. investigated the side effects of IPL (Lumina, Lynton Lasers, London, UK) for hair removal among 1,000 female hirsute patients (14). They were treated every 4–6 weeks for eight sessions or more (fluence: 16–30 J/cm^2, according to Fitzpatrick skin types and tolerance) and follow-up lasted up to 20 months. The authors documented burning as a frequent side effect, followed by postinflammatory hyperpigmentation (n¼75), bulla and erosion (n¼64), leukotrichia (n¼40), folliculitis (n¼35), postinflammatory hypopigmentation (n¼10), and finally scar formation (n¼1).

In the present study, slight stinging and burning sensation at time of the treatment was recorded in all patients. Erythema was seen on both the treated sides in all cases, which lasted from hours to 2 days after session. Two patients (7%) only developed leukotrichia on IPL-treated side, which is felt to be due to thermal damage to the melanocytes that is seen more in older patients and in those who already have few white hairs in other areas such as the scalp.

Conclusion

The results of this study suggest that the Quanta IPL is more effective at reducing facial hirsutism than the Quanta ALX. Still the IPL did result in a significant reduction in hair growth and most of patients were satisfied with treatment.

Since the IPL can be used to treat a wide variety of other conditions simply by changing the filter used, and is significantly less expensive than the ALX, it may be an excellent choice for treatment of unwanted facial hair. In addition, it offers flexibility in allowing a wide range of settings that caters to individual patient characteristics, particularly where one system is required to treat a variety of different conditions.

Declaration of interest: The authors report no declarations of interest. The authors alone are responsible for the content and writing of the paper.

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