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Communication

Comparing Traditional and "In-Motion" Intense Pulsed Light Techniques for Hair Removal: A Split Study

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Abstract: Background and Objectives: Hair removal is a common aesthetic concern for patients referred to dermatologists and aesthetic physicians. Lasers and lights are one of the mainstays in the management of this condition. Among these devices, intense pulsed lights (IPLs) are broadly used in order to reduce the number and width of the hair present. Currently used techniques are associated with a high risk of side effects, such as hyper or hypopigmentation. Materials and Methods: Thirty patients seeking hair removal in one or more body areas with skin phototypes 1 to 4 were recruited to perform this study. All areas to be treated were divided into two equal regions; one side was treated with the standard IPL hair removal procedure, while the other was treated with a new "in-motion" IPL technology. Results and hair removal rates were evaluated six months after the last treatment. Results: Out of the 30 patients treated, all patients experienced hair reduction. No statistically significant difference in hair removal was noted among the two sides. A statistically significant reduction in pain during the procedure was observed in the side treated with the "in-motion" technique. Conclusions: Traditional and "in-motion" IPL techniques have similar results in hair removal; the "in-motion" technology seems to guarantee a better safety profile than the traditional technique, as well as maintains the same results over time and a faster treatment time. A more extensive clinical study will be necessary to confirm our study's results.

Keywords: hair removal; intense pulsed light; "in-motion" technology

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1. Introduction

Excessive hair growth is characterized by an increase of hair in various body areas, such as face, neck, chest, tummy, lower back, buttocks, or thighs. This condition may be idiopathic (not linked to any medical condition) or may be linked to various diseases, such as polycystic ovary syndrome, hormonal conditions (for example, Cushing syndrome, congenital adrenal hyperplasia), acromegaly, and the use of certain medicine and drugs (for example, anabolic steroids, minoxidil, danazol, etc.). Risk factors include obesity, family history, and geographical area (people with Mediterranean, Middle Eastern, and South Asian ancestry are more likely to have more body hair with no identifiable cause) [1–3].

Different treatments have been proposed to manage this condition, such as losing weight, hair shaving, waxing, plucking, using hair removal creams or bleaching, applying eflornithine-based creams for facial hirsutism, and in fertile women, taking contraceptive pills. Among currently available therapies, laser and light sources represent the mainstay in managing this condition [3–5]. Intense pulsed light (IPL) has been proposed to manage hair removal for more than 20 years [6,7]. IPL devices emit non-coherent, multichromatic, non-collimated light with a wavelength ranging between 400 and 1200 nm.

Various filters have been proposed to enhance light selectivity for specific targets, such as hemoglobin or melanin. Melanin is usually well absorbed at wavelengths between 650 and 800 nm [8]. Additionally, it is useful to avoid the emission of wavelengths beyond 950 nm as these frequencies are preferentially absorbed by water and for this reason are associated with an increment in epidermal heating and consequently with an increase in the risk of scarring [4–7].

Filters selecting light in this wavelength spectrum enhance hair removal effectiveness, as already reported in other studies. Specifically, wavelengths between 640 and 755 nm seem to guarantee higher efficacy [9]. In this work, we compare a new "in-motion" technology with the traditional IPL with an optimized filter for melanin at 755 nm in the management of hair removal.

2. Materials and Methods

Thirty patients with phototypes 1 to 4 presenting for hair removal were consecutively enrolled at the Unit of Dermatology of Magna Graecia University (Catanzaro, Italy) and at the Centro Medico Europa private practice (Florence, Italy). Patients reporting hypersensitivity to light or reporting using sulfonamides, sulfonylureas, phenothiazines, and contraceptives; being pregnant; breastfeeding; or having malignant tumors were excluded from the study. All patients signed informed consent forms regarding the risks of the procedure. The to-treat area was divided into two regions and the treatment was performed by an independent operator. The first region underwent traditional IPL therapy for hair removal with an optimized emission at 755 nm (Genus AX, DEKA M.E.L.A., Calenzano, Italy) (Fluence: 8–12 J/cm^2, Spot: 8.3 cm^2, 15 °C). Six treatments were performed with an interval between the sessions of 4–8 weeks according to the body areas (face, groin, legs, and trunk).

The second region was treated with the same IPL handpiece but with the "in-motion" technique (Genus AX, DEKA M.E.L.A., Calenzano, Italy) with the following parameters of fluences ranging from 2 to 3 J/cm^2, frequency ranging from 3 to 4 Hz, and 15 °C, according to the endpoint, which was considered as perifollicular erythema.

For the "in-motion" technique, the user continuously moved the handpiece in a slow linear/circular motion, creating an area of 5 × 5 cm and executing multiple back-and-forth passes up to a defined accumulated energy (typically 8–10 passes) (see Figure 1).

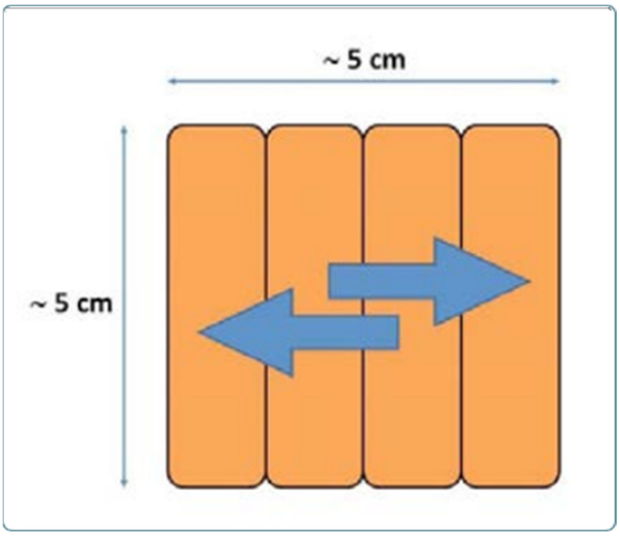

Figure 1. Graphical representation of the "in-motion" technique. Courtesy of DEKA M.E.L.A company.

The interested areas were shaved 48 h before each treatment. Before every treatment session, all patients were evaluated by a physician (S.N.). A sample hair count was performed in a 1.5 × 1.5 cm^2 square template, which was carefully placed in the same location at each visit, and was used to calculate the percentage of hair reduction. Hair reduction rate (R%) was quantified utilizing the following formula: [(the hair quantity before the first laser treatment—the hair quantity after the current laser treatment)/the hair quantity before the first laser treatment] × 100. Response to both treatments was assessed six months after the last treatment session. Right after each laser session, the same physician evaluated side effects, using a five-point scale to evaluate erythema and the presence of first, second, or third grade burns. A visual analog scale from 0 to 10 at the end of each treatment was administered to the patients to evaluate pain. At the end of the treatment, a visual analog scale about the treatment's satisfaction (from 1 to 8) was administered to the subjects for each side. A Student's t test for paired data was used to compare the results obtained between the groups. Statistica14.0 (TIBCO Software, Palo Alto, CA, USA) software was used for data analysis (mean, standard deviations, and rate calculations) (Figures 2 and 3).

Figure 2. Patient 1 left side treated with traditional technique.

Figure 3. Patient 1's right side treated with the new "in-motion" technique. No difference is noted in the results when compared to that of the standard technique.

3. Results

Thirty patients were recruited, consisting of 25 females and 5 males (mean age: 26.97 ± 6.22 years). Three patients had Fitzpatrick skin phototype 1, nine patients had phototype 2, fourteen participants had phototype 3, and four had phototype 4. The principal investigator reported a hair reduction of almost 75% (74.6% ± 5.7%) for the traditional IPL and 70% (70.2% ± 4.5% for group 2) for the "in-motion" technique ($p < 0.005$). Both techniques generated an intermediate degree of redness after the IPL treatments (2.33 ± 0.76 in the traditional IPL and 2.03 ± 0.81 with the "in-motion" technique) with no statistical difference (p: 0.16). Patients reported a high degree of satisfaction for both techniques (5.37 ± 1.10 for the standard IPL and 6.33 ± 0.80 for the "in-motion" technique), preferring the "in-motion" technique (p: < 0.001). The standard technique side was reported to undergo a higher level of pain during the procedures (5.43 ± 1.14 vs. 3.70 ± 0.88). This result was statistically significant ($p < 0.001$). No severe side effects were reported, and no burns were experienced in both techniques. Perifollicular erythema and edema were the most common immediate responses but they were transient and disappeared within 24 h.

Patients' characteristics are reported in Table 1.

Table 1. Patients' characteristics.

Patient Number	Skin Type	Sex	Body Location	Age	Level of Erythema (0–4)		Satisfaction with Treatment (1–8)		Hair Reduction (%)		Level of Pain (0–10)	
					Std.	Mot.	Std.	Mot.	Std.	Mot.	Std.	Mot.
1	2	F	Trunk	23	3	3	5	5	77	73	6	4
2	3	F	Groins	27	3	2	4	6	73	70	8	5
3	4	M	Legs	22	4	1	5	6	71	68	6	4
4	3	F	Legs	19	2	2	6	6	73	74	6	5
5	3	F	Face	32	2	2	6	7	77	78	6	3
6	1	F	Legs	24	2	3	6	8	78	69	5	3
7	2	F	Face	36	3	3	5	6	64	68	6	4
8	3	M	Groins	34	2	2	6	6	87	79	7	4
9	4	F	Legs	37	3	1	5	6	73	78	5	4
10	2	F	Face	32	2	2	4	6	68	68	6	5
11	3	F	Trunk	19	2	3	5	5	73	70	5	3
12	1	F	Legs	21	3	3	7	7	78	72	5	3
13	2	M	Legs	27	3	2	8	7	82	68	5	4
14	3	F	Face	25	2	1	6	7	79	69	4	4
15	3	F	Groins	28	3	2	5	7	60	62	4	3
16	3	F	Trunk	34	2	2	6	6	78	76	4	3
17	4	F	Legs	38	3	1	4	7	77	64	7	3
18	3	M	Groins	18	3	2	5	7	76	72	4	2
19	3	F	Legs	19	2	3	6	6	70	64	5	4
20	2	F	Trunk	22	1	1	6	7	76	68	4	2
21	2	F	Legs	25	1	2	5	7	74	72	5	5
22	3	F	Trunk	24	2	2	4	6	63	61	7	3
23	4	M	Legs	31	3	1	2	5	78	68	8	3
24	2	F	Groins	35	2	4	5	5	79	73	5	3
25	2	F	Trunk	25	1	2	6	6	73	66	5	4
26	2	F	Face	19	2	1	6	7	78	69	6	4
27	3	F	Legs	22	3	3	6	7	81	72	5	5
28	3	F	Trunk	24	2	2	5	7	77	68	5	5
29	3	F	Legs	32	3	2	6	7	76	73	4	4
30	1	F	Legs	35	1	1	6	5	69	64	5	3

Std., by standard technique. Mot., by in motion technique.

4. Discussion

IPLs are different from lasers as they are characterized by minimal coherence and high and monochromatic power density using a polychromatic broadband flashlamp with filters to generate non-coherent light in the visible and infrared spectrum (400–1200 nm). Based on the applied filter, the light generated by the IPL can selectively target various molecules, such as water, hemoglobin, or melanin in the case of hair removal [10–12]. When targeting hemoglobin or water, IPL may be used to manage vascular lesions and aging [13]. In these cases, cut-off filters used are usually in the 500 nm spectra, such as 515 nm, 550 nm, 570 nm, and 590 nm. The different IPL filter settings should include a wider selection of band-focusing for different vessels in the vascular system. As a general rule, the longer the wavelength, the deeper the light can penetrate and shed energy. For this reason, darker (for example, blue) vessels that are usually deeper and of bigger caliber are better treated with longer wavelength cut-off filters. The longer wavelength emitted by this system can penetrate deeply into the tissues, theoretically improving the clinical effectiveness. Advantages of IPL are the low cost of the device as well as the bigger handpiece that usually covers more extensive areas; because of the very quick divergence of the light beam associated with this technique, the hand piece should touch the skin to achieve satisfactory results. The immediate inducible perifollicular edema and erythema seen with lasers are less frequently encountered with IPL, which makes it challenging to place the pulses adjacent to each other accurately and may inadvertently leave areas untreated or overtreated [14]. For this reason, it is usually useful to leave a 10% area of overlap, in order to reduce the risk of leaving untreated areas and to minimize the risk of inflammatory side effects more frequently present in cases of big overlap areas. The variable fluence of IPL makes these devices a harder-to-use tool, with only properly trained physicians able to obtain good results with low to no risk of side effects [15]. Other disadvantages in daily practice are the requirement of gel application and the direct skin contact with the handpiece [16].

Other studies reported a decrease in hair count from 40 to 60%, but this result variability may be associated with the researchers' experience and a variable number of treatments [17]. Some studies reported a reduction in hair up to 80%, especially on the face [18]. Indeed, the results depend on hair type, skin type, number of treatments, and treatment parameters [19]. Our study also confirmed good results in managing phototypes three and four, traditionally treated with other light devices, showing overall good results. Pain was patients' most referred concern, but it was bearable during all the procedures when using the new "in-motion" technology, whose efficacy and safety have already been investigated and demonstrated in the recent study by Nisticò et al. in 2022 [20] and other published studies [21,22]. When applied to Nd:YAG laser, the "in-motion" technology reduced the rate of side effects, while not reducing the overall treatment effect. These same results were confirmed when using IPL devices, with a lower side effect rate and consistent efficacy. Comparing the studies, overall, IPL devices with a 755-nm wavelength tend to achieve better results in lower phototypes (1–2), while Nd:YAG laser achieves better results in phototypes three or higher. Of course, a direct comparison between the two techniques for darker and lighter phototypes would statistically confirm the results obtained in current available studies. Perifollicular erythema and edema were the most common immediate responses and were present in almost all our patients. No significant side effects were reported in our study, although burns, crusts, and pigmentary alterations are the frequent side effects [23,24]. Yellow discoloration of the terminal hairs was reported by Radmanesh [25] and is caused by the destruction of melanocytes within the hair follicles without the destruction of germinative cells. The containment of the side effects and the pain can be explained through the particular emission mode of the "in-motion" technique. The "in-motion" technique leads to a less painful treatment for the patient due to the use of a lower fluence (minimal energy emission) than the standard one. This results in a longer treatment time, but it has the advantage of giving the operator more control over the technique, thus providing a safety advantage.

The technique, by also having a cooled handpiece, indeed, uses a minimal energy emission to reduce the pain sensation. The physician continuously moves the handpiece in a slow linear/circular motion and executes multiple back-and-forth passes up to a defined follicular heat endpoint. This method allows the induction of a progressive increase of the target temperature, while monitoring the cutaneous reactions and being able to interrupt or modify the treatment at any time, thus minimizing the side effects typical of the traditional method, as already proposed for other typologies of lasers and lights in hair removal [26]. Of course, a physician trained adequately in using IPL is necessary to improve effectiveness and reduce the rate of side effects [27–30].

Our findings demonstrate that both techniques are effective; however, the new technique ("in-motion") appears to have more safety than the standard one, thanks to its treatment protocol that uses less energy emission compared with that of the standard procedure, decreasing the patient's perception of pain. Furthermore, the longer treatment duration of the new technique, due to the multiple scanning passes on the treated area (which ultimately leads to a greater accumulated energy compared to the standard technique) permits the operator to have greater control and safety throughout the entire treatment period, resulting in the achievement and monitoring of energy emission. As a result, the patient experiences less discomfort and may choose to continue receiving treatment over time.

Finally, since it is an aesthetic treatment, it is preferable to use less energy with more steps to achieve the same result, even if it is achieved in a longer time to avoid unwanted effects and ensure less pain for the patient.

The superior feature of the "in-motion" technique is represented by the possibility to have a multi-pass technique which can limit side effects (attributable to the possibility of using less energy than the standard procedure), ensuring a greater monitoring of the treatment.

The multi-pass ("in-motion") technique can limit side effects, ensuring homogeneity in the treatment, ensuring a better safety profile compared with that of the traditional technique.

5. Conclusions

Standard IPL with an optimized emission at 755 nm with a filter and with the "in-motion" emission have proven to be effective and safe technologies capable of achieving long-standing results in body hair removal in Fitzpatrick's skin type 1 to 4. Hair removal with lasers and IPL sources are generally regarded as safe treatment procedures when performed by properly educated and trained operators. It is fundamental that the physician should be properly trained in order to reduce the risk of scarring as well as other side effects for the patients, such as discomfort/pain, redness, swelling around the treatment area, edema, bullae, hematoma, scarring, keloid formation, crusting, hyperpigmentation, hypopigmentation, leukotrichia, and infection. Longer pulse durations, higher fluences, and darker or thinner skin may increase the risk of side effects. Most of these adverse events, fortunately usually last between 2 and 48 h posttreatment and often depend on the fluence, pulse duration, and specific treatment area. For these reasons, it may be beneficial to avoid treatment in subjects with recent sunburns, during pregnancy or breastfeeding, as well as in those taking prophylactic antiviral therapy (oral acyclovir, valacyclovir, or famciclovir) one day before starting IPL and for the following week to reduce the risk of reactivation of the herpes simplex virus [31]. Various devices and techniques are being studied to reduce the risk of complications, such as cooling devices in order to reduce post-operative inflammation and erythema and new technologies to reduce the amount of heat directed to the skin instead of hair follicles. In our study, however, this new "in-motion" technology, while being equally effective, has proven to be associated with less erythema, side effects, and patient's perceived minor pain than those in the traditional technique. This new technique, given the reduced risk of complications, may in the future become the standard technique of treatment, especially for beginners and not very experienced physicians. Of course, further studies with a larger number of enrolled subjects will be necessary to confirm our study results and to better quantify the difference in the side effects' rates between these techniques.

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