Intense pulsed light photoepilation turns out to be permanent at 5-9 years follow-up

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Background: Due to lack of really long follow-up periods for photoepilation, there has been an ongoing discussion if the obtained hair reduction is long lasting or permanent. To evaluate this, a follow-up period covering several hair cycles is needed.
Objectives: To perform a retrospective investigation of hair reduction based on hair count on clinical photographs taken before and after IPL photoepilation (with follow-up periods longer than four years) and to compare the results with data from the literature which reports results from follow-up periods longer than 6 months.
Methods and Materials: Clinical photographs taken before Ellipse I^{2}PL photoepilation of patients treated more than four years ago have been evaluated for recognizable landmarks and possibilities for performing hair counts. Out of 280 patients, 33 patients fulfilled these demands. Patients with an age higher than 60 years were rejected due to the fact that possible natural hair loss could lead to false positive conclusions of treatment efficacy. This reduced the group to 18 patients. Out of these we succeed in finding and evaluating nine patients with eleven treated anatomical sites.
Results: A significant hair reduction ($P<0.014$) was registered at the follow-up performed after an average period of 7.7 years (SD.:2.2 years). An average hair reduction of 53.3% (SD.: 21.4%) was obtained in 89.9% of the tested patients.
Conclusion: The present study shows that Ellipse I^{2}PL photoepilation is efficient and the registered efficacy is equivalent to what has been reported in 6 other articles with follow-up times of 8 to 18 months. Photoepilated facial hair reduction performed correctly has shown to be approximately 60% and unchanged after five to 15 full hair cycles, and thereby can be stated as permanent.

INTRODUCTION

Optical hair removal has been performed since 1996 with different kind of lasers and Intense Pulsed Light systems (IPLs). More than 600 articles have been published on the efficacy of the different systems since then, and generally the efficacy has been evaluated after a follow-up time of 3-6 months. This time span is much shorter than the hair cycle for most body areas (7 months - 6 years) and hence the degree of permanency of hair removal cannot be evaluated. Also, data based on hair counts after four or more treatments and follow-up times longer than 6 months, are very few.
One of the first published hair removal articles with a longer follow-up time was a bikini line study including ten Caucasian patients performed by Troilius et al[1] in 1999. Follow-up time corresponding to one full hair cycle for pubic hairs was used (Table 1). The obtained hair reduction was 80.2% (SD.:20.3%).
In 2003, a new epilation modality Electro-Optical Synergy (ELOS) was introduced, which is a combination of pulsed radiofrequency (RF) and IPL light energy (680-950 nm). Sadick et al[2] reported after treating forty patients in different body locations (Table1) an average hair reduction of 75% at the 18 month follow-up, with a time span covering 1-2 full hair cycles for the treated locations.
A comparative study between two different wavebands 600-950nm (Ellipse HR) and 645-950nm (Ellipse HR-D) was performed by Lee et al[3] in 2006. A total of 48 Asian patients with Fitzpatrick skin type III and IV completed this study.

Figure 1: Chin before and after photographs showing 63% hair reduction nine years after three IPL treatments.

It was possible to use higher fluences with the more restricted waveband (645-950nm), which also led to a higher hair reduction of 83.4% (SD.:10.9%) versus 52.8% (SD.:21.7%) at the 8-month follow-up (one full hair cycle).
In another study performed by Nahavandi et al [4] of 77 patients treated with IPL for facial hypertrichosis (mainly hirsutism), 88.3% obtained hair reductions of 50% or more by the one year follow-up. This is a nice result for a group of patients known to be difficult to treat, and especially as it was recorded after a time span covering from one to two full hair cycles (upper lip and chin respectively).
A comparison between the alexandrite and the Nd:YAG laser with follow-up time of 18 months after hair removal on the legs (twice the full hair cycle) was published in 2008 by Davoudi et al[5]. With a 12 mm spot size equal hair reductions were obtained by the alexandrite and Nd:YAG laser, 75.9% (SD.:19%) and 73.6% (SD.: 11.4%), respectively. A trend to higher efficacy was observed by increasing the spot size from 12mm to 18 mm (hair reduction 84.3%).
It has often been discussed if adding RF to IPL treatment really has an effect on the obtained efficacy as well as whether laser light should be superior to incoherent light treatment. In 2010 Sochor et al[6] published a three armed comparative study testing efficacy of IPL, IPL + RF and diode laser on the lower legs of 38 patients. The result at the nine month follow-up after two treatments showed that no statistical differences between the treatment modalities could be demonstrated.
The above data, as well as a hair removal review performed in a recently published article by Haedersdal et al[7], demonstrates the lack of long-term hair reduction data with several years follow-up time.

In the present retrospective study, 280 patients treated more than 4 years before were included in order to obtain long-term follow-up data on the efficacy of Ellipse I^{2}PL intense pulsed light hair removal treatment.

MATERIALS AND METHODS

Treatment Devices

All treatments were performed with an Ellipse Flex I^{2}PL (Ellipse A/S, Hoersholm, Denmark), which is a second-generation, multi-purpose IPL system which is - among other applications - optimized for long-term depilation. The spot size on the skin surface is 10 x 48 mm. The pulse duration is adjustable between 2 ms and 127 ms. All patients were treated with an Ellipse HR applicator containing two types of optical filters: First a liquid filter containing water which absorbs the light energy at wavelengths which would otherwise lead to non-specific heating of the tissue water in the skin. Water absorption starts at 950nm and increases with longer wavelengths. A second filter absorbs wavelengths shorter than 600nm.

Patients

Clinical photographs taken before treatment from patients, who were epilated more than four years ago, were evaluated for presence of recognizable landmarks and possibilities for performing hair counts. Out of 280 patients, 33 patients met

Author	Equipment used	# patients # treatments	Treated sites #	Hair reduction % (SD)	Hair cycle in months	Follow-up time in months
Troilius et al[1] 1999	Ellipse HR 600-950 nm	10 4 xT	Bikini line	80.2 (20.3)	7	8
Sadick et al [2] 2004	Aurora Syneron 680-980nm + RF	40 4xT	Facial 10, Bikini line 7, Axillae 7, Legs 8, Trunk 8	65 75 85 85 65	5-22 7 7 9 -	all 18
Lee et al[3] 2006	Ellipse HR 600-950nm	24 4 xT	Axillae	52.8 (21.7)	7	8
	Ellipse HR-D 645-950nm	24 4xT		83.4 (10,9)		
Nahavandi et al[4] 2007	Energist VPL 610-950 nm	77 Mean 6.9 xT	Facial	88.3% patients obtained > 50% 68.2%	5-22	12.7 ±2.87
Davoudi et al[5] 2008	GentleLase Alexand.: 755nm	15 4xT	Leg	Ø12 spot: 75.9 (19.0) Ø18 spot: 84.3 (12.4)	7	all 18
	GentleYag Nd:YAG:1064	15 4xT		Ø12 spot: 73.6 (11.4)		
Sochor[6] 2010	Aurora 680-980 nm	Comparative study 38 2 xT	Leg 30 J/cm^2 + RF 5 J/cm^2	39.16	7	9
	Aurora 680-980 nm + RF		Leg 30 J/cm^2 + RF 20 J/cm^2	47.15		
	Mediostar XT diode 810nm		Leg 32 J/cm^2	49.9		
Bjerring et al Present study	Ellipse HR 600-950 nm	19 4.5 ±1.5 xT	Back 1 Bikini line 1 Chin 4 Upper lip 4	14 38 58 (15) 62 (19)	- 7 22 5	68 109 106±12 78±32

Table 1: Overview over published hair removal studies with follow-up times longer than 6 months

these demands. Patients with an age higher than 60 years were rejected, due to the possibility that any natural hair loss could lead to false positive conclusions of treatment efficacy. This reduced the group to 18 patients. Out of these we succeeded in finding and evaluating nine patients with a total of eleven treated areas. These patients had no further hair removal treatments performed after the original treatments.
The average age by the follow-up was 49.6 years (SD.:4.2 years). The follow-up times were between 4.4 and 9.1 years and the treated locations were back, bikini line, chin or upper lip (Table 1).

Treatment

The actual fluences used for the individual patients were selected according to the clinical reaction to test shots, and fluences selected for treatment were the lowest fluence which resulted in perifollicular erythema or oedema visible within 5 min of the treatment. Fluences in the range of 14–22 J/cm^2 were used in combination with pulse durations selected according to the diameter of the hairs: 15 ms, 20ms and 40ms for thin, medium and thick hairs respectively. A transparent optical index-matching gel was applied to the skin, and the treatments were performed with an overlapping of 10 % and with a moderate pressure on the skin in order to empty the cutaneous blood vessels.
No cooling or any other post-treatment regime was utilised.
Patients were treated between three and seven times (avg. 4.5; SD.:1.5) and the treatments were performed between 1999 and 2005.

Clinical evaluation

The clinical outcome was evaluated based on hair counts on pre-treatment clinical photos and on follow-up photos. Counting of the hair follicles was performed with a computer imaging system on areas which could be localized on both before and after photos with respect to well defined anatomical landmarks. The hair count was performed by one of the two authors, who had not performed the original treatment. The hair removal was calculated as a percentage of the number of hairs present, compared with the baseline (pre-treatment) count. Two to five days prior to treatment and follow-up, the hairs of the area to be evaluated were shaved, enabling both effective hair treatment and efficient counting procedure.

Statistical

Statistical analysis was carried out as a paired Student's t-test. Significance was assumed at a P-level less than 0.05.

Result

A significant hair reduction ($P<0.014$) was registered at the follow-up performed after an average period of 7.7 years (SD.:2.2 years). An average hair reduction of 53.3% (SD.:21.4%) was obtained by 89.9% of the patients. The actual distribution of hair reduction can be seen in figure 2.
The average hair reduction for the eight facial treated sites was 60.2% (SD.:15.7). Figure 3 shows the hair reductions with respect to treated location. One female patient was a non-responder and showed increased number of hairs by the follow-up (patient no. 4, figure 2).

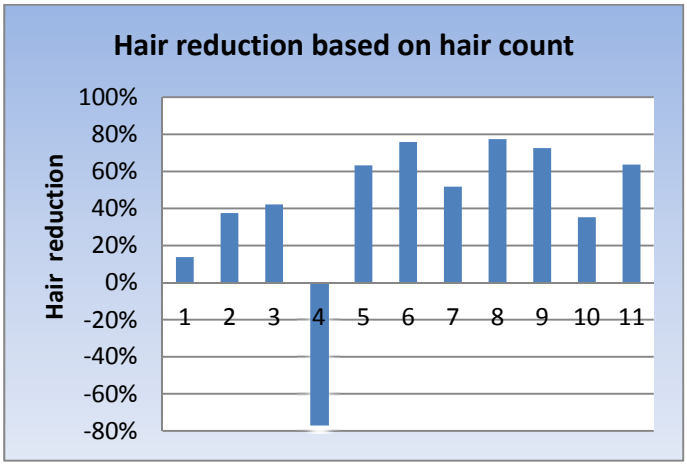

Figure 2: Distribution of hair reduction for the 11 IPL-treated areas performed in nine patients at the follow-up after an average of 7.7 years.

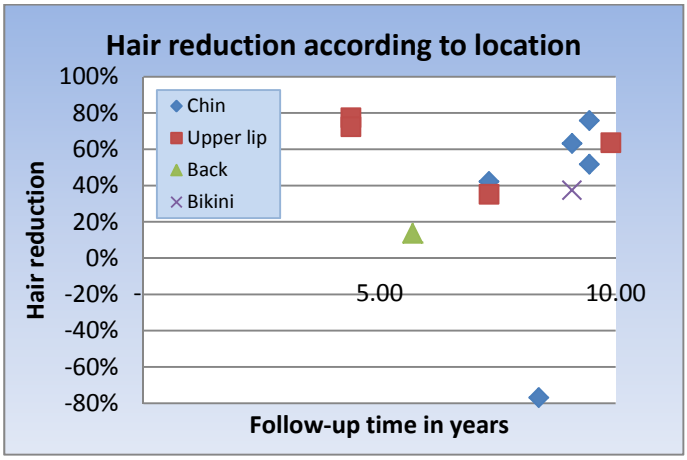

Figure 3: Distribution of hair reduction for the 11 IPL-treated areas with respect to treated area at the follow-up after an average of 7.7 years

It has earlier been reported that vellus hairs can turn into terminal hairs, which might account for the non-responding patient showing actual increased hair count at the follow-up

DISCUSSION

The average total hair reduction after 7.7 years of 53.3% obtained by 89.9% of the patients in the present study is equivalent to result obtained by Nahavandi[4] with more than 50% hair reduction in 88.3% of the patients in only 12 months follow-up time. Both treatments were performed with IPL systems emitting equivalent bands of wavelengths 600 or 610-950nm and using a similar range of pulse durations 10 - 50ms. Furthermore no statistical significance is found between average hair reduction in the present study for chin and upper lips of 60.2% - (with a follow-up time of 106 and 78 months, respectively) and the average facial hair reduction obtained by Nahavandi of 68.2% by the 12 month follow-up.

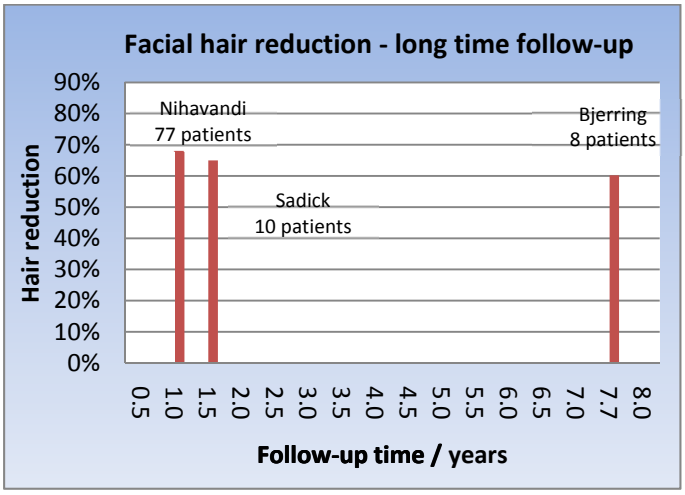

Figure 4: No statistical difference in obtained hair reduction at 1, 1½ and 7.7 years follow-up in three independent IPL facial photoepilation studies proves the IPL hair reduction can be stated as permanent.

Also, the reported 18 month follow-up data showing 65% facial hair reduction in the Sadick study[2] with the combination of IPL and RF in ten patients corresponds very well to the 60.2% hair reduction obtained in the same areas in the present study. At the same time this comparison supports the conclusion of Sochor's study[6] that no statistical differences can be registered by adding RF to IPL treatments.

The long-time efficacy from facial photoepilation performed in three independent IPL studies is shown in figure 4. No statistical significance difference in obtained hair reduction of 68.2%, 65% and 60.2% by 1, 1½ and 7.7 years follow-up could be registered. Extending the follow-up period from 1-2 full to 5-15 full hair cycles did not lead hair to regrowth.

Treatment with either different lasers, IPLs or IPL+ RF do not, - in this investigation dealing with seven studies with long and very long follow up times - show any difference in efficacy when identical anatomical areas are compared.

CONCLUSION

The hair reduction demonstrated in the present study after an average follow-up time as long as 92 month is statistically significant compared to baseline ($P < 0.014$) and the registered efficacy is equivalent to what has been reported in 6 other articles with follow-up times of 8 to 18 months. In conclusion facial hair reduction performed correctly (using correct pulse durations and light fluencies being in accordance to hair follicle thermal damage times) has shown to be approximate 60% and unchanged after five to 15 full hair cycles, and thereby can be stated as permanent.

Figure 5: Before and after photographs showing 64% hair reduction 9.9 years after three IPL treatments.

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