

ORIGINAL ARTICLE

Intense pulsed light in the treatment of non-aesthetic facial and neck vascular lesions: report of 85 cases

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Abstract

Background Intense pulsed light (IPL) treatment is one of the most effective procedures for patients with non-aesthetic vascular lesions in addition to signs of skin photoageing, and it has been reported as very successful in the treatment of telangiectasias, spider nevi, erythrosis, and above all, rosacea and poikiloderma. Its use is based on the principle of selective photothermolysis, which exploits the haemoglobin absorption peak among its range of wavelengths.

Objective The aim of this study is to assess the efficacy and safety of intense pulsed light in treating non-aesthetic vascular skin lesions, especially with regard to poikiloderma of Civatte and rosacea.

Methods A total of eighty-five patients, 64 women and 21 men, with 63 non-aesthetic vascular lesions (28 Poikiloderma of Civatte and 35 rosacea), 22 pigmented lesions (UV-related hyperpigmentation of solar lentigo-type) and four precancerous lesions (actinic keratosis, AKs), were treated repeatedly with IPL for 2 years. The patients received a mean of five treatments (range 4–6) at 3-weekly intervals. They were evaluated via clinical observations and professional photographs were taken before each treatment and after 2 weeks, 4 weeks, 3 months, 6 months and 12 months. The outcome of the IPL treatments was evaluated by four independent dermatologists, who were not informed about the study protocol, and who assessed the performance of IPL by dividing the results into four categories: no results, slight improvement, moderate improvement and marked improvement.

Results All the patients showed improvements in their overall lesions: 72 lesions (80.9%) achieved a marked improvement, 14 lesions (15.7%) achieved a moderate improvement and three lesions (3.4%) achieved a slight improvement. The results of the 63 non-aesthetic vascular lesions in Rosacea and Poikiloderma of Civatte were: 51 with a marked improvement, 10 with moderate improvement, whereas only two lesions achieved a slight improvement. The improvement of all four actinic keratoses was marked whereas the 22 pigmented lesions obtained a marked improvement in 17 cases, a moderate improvement in four cases and a slight improvement in one case. No undesirable effects were observed.

Conclusions Our study confirms how by minimizing side-effects, time and costs, IPL can be effective and safe for the treatment of non-aesthetic facial and neck vascular lesions.

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Keywords

intense pulsed light, poikiloderma of Civatte, rosacea, vascular lesions

Conflicts of interest

None declared.

Introduction

Intense pulsed light (IPL) that has proved effective in treating vascular lesions,¹ decreasing signs of photoageing and removing hair, was first presented in San Diego in 1992, but it was only recognized by the US Food and Drug Administration in 1995.² In Europe, it was initially used for treating leg telangiectasias by Wilder, Raulin and Schroeter,³ although its efficacy for this and other indications was demonstrated right from the start, the majority of

dermatologists considered it useless and even dangerous. Interestingly, it is now one of the most effective devices for patients with non-aesthetic vascular skin lesions in addition to signs of photoageing. Recently, IPL devices have witnessed a great proliferation.²

Intense pulsed light has been reported as very successful in the field of vascular lesions such as leg and face telangiectasias, spider nevi, rosacea, erythrosis, poikiloderma of Civatte,⁴ even though the new generations of Pulsed Dye Laser remain the gold standard

for port-wine stains, cherry angiomas and other vascular anomalies, thanks to their great selectivity. IPL is particularly suitable for the treatment of superficial poikiloderma of Civatte and extensive erythrosis due to its larger spot size. Its use is based on the fundamental principle of selective photothermolysis, which exploits the haemoglobin absorption peak among its range of wavelengths. A high concentration of this pigment is present in blood vessels as it is contained in the erythrocytes.

The process of selective photothermolysis induced by IPL in the treatment of vascular lesions is similar to that of lasers. Intense pulsed light consists of a non-coherent, polychromatic light in a broadband spectrum of 500 to 1200 nm. The greatest difference in comparison to lasers is that IPL simultaneously delivers multiple light wavelengths (500 to 1200 nm) at different intensities; for this reason, IPL has been considered a virtual application consisting of numerous lasers simultaneously emitting different wavelengths and radiant light exposures (J/cm^2).⁵ By selecting a cut-off filter, the physician is able to choose the wavelengths that will be emitted above that point, to match and destroy a specific target structure.

The aim of this study is to assess the efficacy of Intense Pulsed Light in treating non-aesthetic vascular lesions, especially with regard to Poikiloderma of Civatte and rosacea.

Materials and methods

Patients

A total of eighty-five patients, 64 women and 21 men, mean age of 51.5 (range 28–75 years), Fitzpatrick skin types I–IV, mainly II–III, with 63 vascular lesions, 22 solar lentigines and four Actinic Keratoses, were treated with IPL for a maximum of 2 years. A detailed personal history of each patient considered life-style, skin type, clinical manifestations of the disease, health conditions and previous medication. Informed consent was also obtained from each patient. The vascular lesions, 28 Poikiloderma of Civatte lesions and 35 rosacea lesions, were located on the neck (20), cheeks (18), nose (10), forehead (7), cheekbone (5) and chin (3) (Table 1); solar lentigines were located on the hands (13) and face (9) (Table 1); actinic keratosis lesions were located on the face (4) (Table 1). Photographs of the lesions were taken with a Canon

digital camera and a polarized flash (Anthology system, DEKA-M.E.L.A., Calenzano, Italy), before and after each treatment. The use of non-conventional light sources may resolve the reflection effect of the skin and provide an image with specific skin features, depending on the wavelengths used.⁶

The patients received a mean of five treatments (range 4–6) at 3-weekly intervals. They were evaluated by means of clinical observations and anthology-system photographs taken before each treatment and after 2 weeks, 4 weeks, 3 months, 6 months and 12 months.

Intense pulsed light irradiation

We used Xe Pulsed Lamp technology as IPL's source (Minisilk FT, DEKAM.E.L.A.) (Table 2). A pulse time of 3–8 ms, with a double pulse and a pulse delay of 10 ms, and a fluence from 16 to 23 J/cm^2 were used. The cut-off filters used depend on the types of lesion and the patient's skin types. In the case of vascular lesions, we used a 500 nm cut-off filter for Fitzpatrick skin types I–II, a 520 nm cut-off filter for skin type III and a 550 nm cut-off filter for skin type IV. The choice of cut-off filters did not change for treating lesions with both vascular and pigmented components, whereas in the cases of pigmented lesions only, a 550 nm cut-off filter was selected for patients with Fitzpatrick skin types I–II–III, and a 600 nm cut-off filter was preferred for patients with skin type IV.

A transparent gel was applied to the area treated before emitting the light from the cooled handpiece used to reduce the thermal damage on the epidermis and spread the light uniformly.

Before starting, a spot test on the patient's pre-auricular area was carried out to adjust the parameters. This test starts with an energy fluence of 13 J/cm^2 for patients with Fitzpatrick skin type I–II, an energy fluence of 11 J/cm^2 for patients with Fitzpatrick skin type III, an energy fluence of 9 J/cm^2 for patients with Fitzpatrick skin type IV and two 4-ms pulses and a pulse delay of 10 ms. The initial parameters chosen are considered reliable, and the test is positive if post-treatment effects appear, including hyperpigmentation of the stains, mild or severe erythema for 2–8 days, mild oedema for 2 days and thin purpuric lesions along the lines of the telangiectasias. When these effects were not observed, the parameters were gradually increased, for instance by raising the energy fluence or reducing the pulse delay in a second test on a different skin area.

Results

In our study, a total of 85 subjects (64 women and 21 men) completed the treatment irradiations (range 4–6) over 2 years. The results assessed with anthology-system photographs and clinical observations immediately after the treatment, then at 2 weeks, 4 weeks, 3 months, 6 months and 12 months, were judged by four dermatologists who had not taken part in the treatments and who assessed the performance of IPL by dividing the results into four categories: no results (0%), slight improvement (1–40%),

Table 1 Eighty-nine lesions in 85 patients

Sites	63 vascular lesions	22 pigmented lesions	4 precancerous lesions (AKs)
Neck	20		
Cheeks	18		
Cheekbone	5		
Chin	3		
Nose	10		
Forehead	7		
Hands		13	
Face		9	4

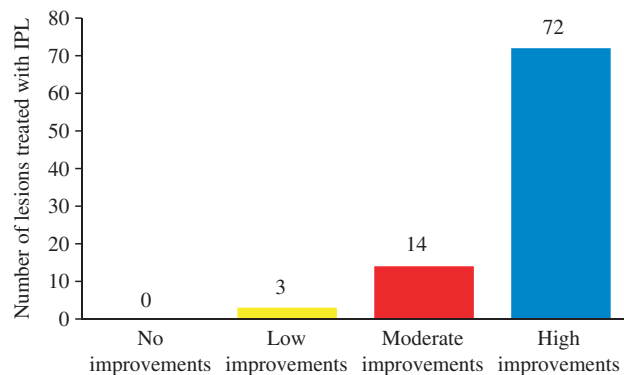
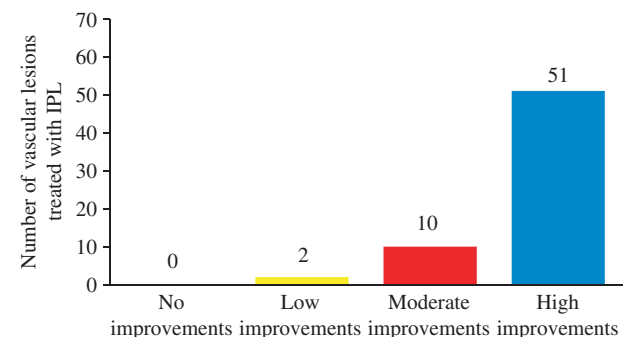
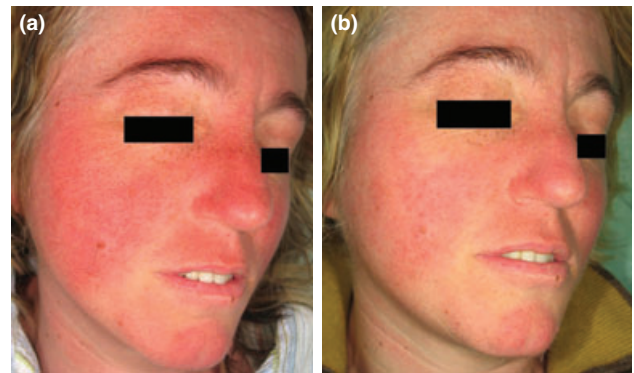
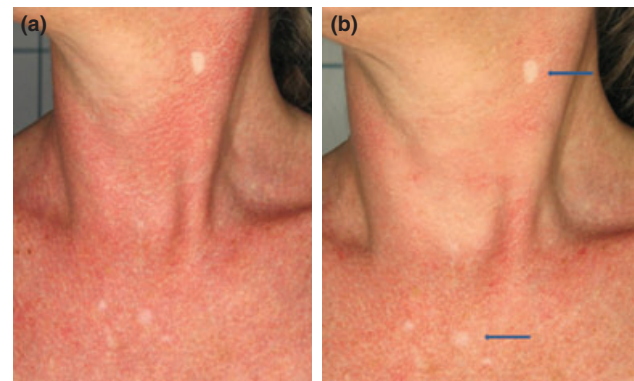
Table 2 Intense pulsed light system, (Minisilk FT, DEKA-M.E.L.A.)

Output	Cut-off filters	Number of pulses	Pulse time	Pulse delay	Fluence	Handpiece spot-size dimensions
500 to 1200 nm	500 nm	Single	3–24 ms	5–50 ms	Up to 25 J/cm ²	6.2 cm ²
	520 nm					
	550 nm	Double				
	600 nm					
	650 nm	Triple				

moderate improvement (40–70%) and marked improvement (70–100%). The evaluations of these four dermatologists were made by quantifying the clearance of the erythema, the telangiectasias and the other vascular lesions, the pigment abnormalities and the atrophy. All the patients observed global improvements (Fig. 1) in their lesions: 72 lesions (80.9%) achieved a marked improvement, 14 lesions (15.7%) achieved a moderate improvement, and three lesions (3.4%) only achieved a slight improvement. The results of the 63 vascular lesions (Fig. 2) were: 51 with a marked improvement (81%) (Figs 3a,b and 4a,b), 10 with moderate improvement (15.9%) and two lesions with a slight improvement (3.1%). All the actinic keratoses had a marked improvement, whereas in the

22 high-pigmented lesions, there was a marked improvement for 17 lesions, a moderate improvement for four lesions and in one case only a slight improvement.

The treatments were carried out at 3-week intervals to obtain the treatment related end-point side-effects, indicative of the effectiveness of the procedure. Naturally, the number of sessions required varied according to the type of lesion: in our experience,

**Figure 1** Improvements of all the lesions.**Figure 2** Improvements in vascular lesions assessed by independent physicians.**Figure 3** (a) Rosacea, before treatment (polarized image, Anthology, DEKA-Florence). (b) After four sessions of IPL (polarized image, Anthology, DEKA-Florence).**Figure 4** (a) Poikiloderma of Civatte before treatment (polarized image, Anthology, DEKA-Florence). (b) After six sessions of IPL. The hypochromic stains, indicated with the arrows, are due to previous treatments with CO₂ super-pulsed laser (polarized image, Anthology, DEKA-Florence).

we have found that four IPL treatments are sufficient for solving cases of pigmented lesions such as solar lentigos, whereas as many as six are necessary in cases of complex vascular lesions such as rosacea or poikiloderma of Civatte; in the latter, we first treated the pigmented and then the vascular component of the lesion.

On analysing the results obtained, we noted several differences in the IPL responses according to the Fitzpatrick skin type of the patients (Table 3). In fact, on examining all the lesion responses,

Table 3 Responses to IPL in patients with different Fitzpatrick skin types

63 vascular lesions			
Fitzpatrick skin type I	1	1	12
Fitzpatrick skin type II	0	4	21
Fitzpatrick skin type III	0	3	11
Fitzpatrick skin type IV	1	2	7
	2 Slight improvement	10 Moderate improvement	51 Marked improvement
22 pigmented lesions			
Fitzpatrick skin type I	0	0	2
Fitzpatrick skin type II	0	1	6
Fitzpatrick skin type III	1	3	4
Fitzpatrick skin type IV	0	0	5
	1 Slight improvement	4 Moderate improvement	17 Marked improvement
4 actinic keratoses			
Fitzpatrick skin type I	0	0	0
Fitzpatrick skin type II	0	0	2
Fitzpatrick skin type III	0	0	1
Fitzpatrick skin type IV	0	0	1
	0 Slight improvement	0 Moderate improvement	4 Marked improvement
All 89 lesions treated			
Fitzpatrick skin type I	1	1	14 (87.5%)
Fitzpatrick skin type II	0	5	29 (85.3%)
Fitzpatrick skin type III	1	6	16 (69.6%)
Fitzpatrick skin type IV	1	2	13 (81.2%)
	3 Slight improvement	14 Moderate improvement	72 Marked improvement

we can see that the Fitzpatrick skin type I and type II patients have had higher percentages of marked improvement, respectively 87.5% and 85.3%; the same result can also be observed considering the vascular lesions only. As regards the age of the patients, there is no significant correlation between age and response to IPL (Table 4). Besides, we noted that some areas, such as the neck, are difficult to resolve and often require an increased number of applications.

The patients were asked for a subjective evaluation of the results by means of the following score: 0 (unsatisfied), 1 (not very satisfied), 2 (satisfied), 3 (very satisfied). Sixty-nine patients (81.2%) were very satisfied, 14 (16.5%) were satisfied and 2 (2.3%) were not very satisfied with the results, whereas no patients were unsatisfied (Table 5).

The post-treatment phase was very important for preventing adverse effects; in fact, the patient had to cooperate by applying cool compresses and emollient creams to the treated skin for at least 8 days, and should always use sunscreens to maintain the results.

Table 4 Responses to IPL in patients of different ages

63 vascular lesions			
20–39 years	1	2	14
40–59 years	0	4	22
60–79 years	1	4	15
	2 Slight improvement	10 Moderate improvement	51 Marked improvement
22 pigmented lesions			
20–39 years	0	1	4
40–59 years	1	2	6
60–79 years	0	1	7
	1 Slight improvement	4 Moderate improvement	17 Marked improvement
4 actinic keratoses			
20–39 years	0	0	0
40–59 years	0	0	1
60–79 years	0	0	3
	0 Slight improvement	0 Moderate improvement	4 Marked improvement
All 89 lesions treated			
20–39 years	1	3	18 (81.8%)
40–59 years	1	6	29 (80.5%)
60–79 years	1	5	25 (80.7%)
	3 Slight improvement	14 Moderate improvement	72 Marked improvement

Table 5 Subjective evaluations show that the vast majority of subjects is very satisfied or satisfied

Unsatisfied	Not very satisfied	Satisfied	Very satisfied
0	2 (2.3%)	14 (16.5%)	69 (81.2%)

Despite a few predictable side-effects (Table 6) like erythema, oedema, swelling, mild purpura and pain, the majority of patients were very satisfied, especially in view of the clinical outcome achieved.

One year after the last treatment, there has only been a recurrence of the lesion in one patient, who presented isolated telangiectasias.

Conclusions

The intense pulsed light technology offers numerous therapeutic options in the field of cutaneous conditions (Table 7). It is considered as a complex technique not yet totally standardized, yet and therefore it calls for great experience and the publication of further independent studies in the future.

Intense pulsed light can be applied for hair removal, melasma, lentigines, ephelides, postburn hyperpigmentation and photo-induced skin ageing⁷ where the result of photodamage of chronic ultraviolet (UV) light exposure involves more than just rhytides, with other visible signs such as skin thinning or coarse texture, hyperpigmentation and telangiectasias.

Table 6 Reactions after IPL treatment in 85 patients studied

Long-lasting erythema	19
Purpura	8
Uncomfortable pain	6
Oedema	0
Hyperpigmentation	1
Blisters	0
Footprints	0
None	55

Compared to other treatments capable of improving telangiectasias in rosacea such as pulsed dye laser, IPL offers numerous advantages: first, there are fewer local or systemic adverse effects (lack of postoperative purpura), due to the pulse delays during which the skin can be cooled. The 'purpura effect', especially of the older dye laser, is caused by a rapid rise in blood temperature, which disrupts the small dermal vessels. The second advantage is a larger spot size, ideal for treating more extensive areas of the face, enabling a reduction in treatment times and patient discomfort. It also prevents the honeycomb aspect caused by the smaller spot sizes of the pulsed dye laser. Lastly, by using IPL's longer wavelengths, there is deeper penetration into the skin compared with the other shorter IPL wavelengths available, enabling treatment of much deeper lesions.

Over recent years, lasers have been competing with non-laser IPL in the cosmetic arena. Initially, the IPL approach was cumbersome and only accepted by a minority of experts. Now it is widely accepted, and combination treatments (i.e. ALA-PDT with IPL, Photodynamic therapy with topical 5-aminolevulinic acid using IPL as a light source) are described for a variety of dermatological disorders.

ALA-PDT with IPL¹³⁻¹⁵ appears to be useful in the treatment of facial photodamage and associated Actinic Keratoses: in fact, by using photosensitizers as ALA or MAL, IPL is able to destroy the dysplasia found in these potential precancerous lesions. In our opinion, IPL used alone for Actinic Keratoses is not the best tool for treating these lesions, as it improves erythema but not epidermal dysplasia; the safest way to remove AKs consists of surgery, nevertheless IPL is a possible alternative to the traditional treatment for some selected cases. The cases we speak about are those patients who have numerous large, superficial Actinic Keratoses,

Table 7 Facial and neck vascular lesions

Port-wine stains	Vascular birthmarks caused by an ectasia of papillary and upper reticular dermal vessels	Often located on the face	The best results are achieved with Flash-Lamp-Pulse Dye Laser (FPDL). ^{8,9} Not as positive results with IPL.
Poikiloderma of Civatte	A lesion consisting of a combination of atrophy, telangiectasias and pigment changes	Symmetrically on the sun-exposed areas of the neck, cheeks and upper chest	IPL can guarantee positive results. ^{10,11} Pulsed Dye Laser gives good results but the side-effects limit its use. Electrosurgery, cryotherapy, Argon laser and Potassium titanyl phosphate are unsatisfactory.
Telangiectasias	Derive from the dilatation of arterioles, venules or capillaries; these can be: Arborizing Linear Spider Punctiform	Usually found on the forehead, nose, cheeks, chin and legs	IPL has proved highly effective in removing these lesions.
Rosacea	A common skin disorder accompanied by facial flushing, erythema, oedema, papules, pustules and in some cases also rhinophyma and ocular involvement.	On the face and especially on the cheeks, chin, forehead, nose; ocular involvement is also possible.	IPL treats this disease in a safe, effective manner. ^{4,12} Several therapeutic options are applied in an attempt to heal the vascular elements of rosacea: excision, electrosurgery and numerous lasers including Argon, Neodymium:yttrium-aluminium-garnet (Nd:YAG), Carbon dioxide, Krypton, Pulsed Dye laser.

or patients who are not eligible for surgery due to their age, health conditions (heart patients, pacemaker users) or anticoagulant therapies. Our results are encouraging and the clinical outcomes are positive, especially in the scalp area even though these patients must observe a strict follow-up.

To conclude, our study confirms the efficacy of the IPL source using five different cut-off filters (500, 520, 550, 600 and 650 nm), enabling the emission of light with a wavelength band between 500 to 650 and 1200 nm. For vascular treatment, the best results are achieved when working on phototypes I-II, with 500–520 nm wavelength filters and a pulse time up to 8 ms, choosing double pulses, changing the pulse delay depending on the cases and delivering higher fluences. Different IPL models exploit different parameters which make results user-dependent and difficult to reproduce with other machines, especially because the devices, and in particular the handpieces, differ in the various types of IPL.

Although long-term efficacy has not been studied and a maintenance treatment may be necessary to control the vascular effects, IPL can be considered as a safe technique for resolving poikiloderma, rosacea and other vascular lesions, while minimizing side-effects, time and costs.

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