

ORIGINAL RESEARCH REPORT

## A comparative study of the effectiveness of intense pulsed light wavelengths (650 nm vs 590 nm) in the treatment of striae distensae

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### Abstract

**Background and objectives:** Striae distensae (SD) are a common skin condition that is a significant source of psychological distress. Intense pulsed light (IPL) may play a role in the management of the disease. The purpose of this study was to compare the effect of two wavelengths of IPL (650 nm vs 590 nm) in the treatment of SD. **Patients and methods:** Twenty patients with SD were included. Five sessions of IPL were carried out in each patient at 2-week intervals. Each side of the body was treated with a single wavelength. The response to the therapy was evaluated 2 months after the last session. Patients' satisfaction was also used in the assessment. **Results:** The reduction in the sum of lengths and maximum width on both sides was statistically highly significant ( $p < 0.0001$ ). The reduction in the degree of erythema was statistically significant only when the wavelength of 590 nm was used ( $p = 0.0157$ ). The patient satisfaction was better when the wavelength of 590 nm was used. All side effects were transient and well tolerated. **Conclusion:** The study showed that IPL is a good option for the treatment of SD and the wavelength of 590 nm was more effective than the wavelength of 650 nm.

**Key Words:** IPL, Iraqi patients, striae distensae

### Introduction

Striae distensae (SD, stretch marks) are commonly encountered in daily practice. They rarely cause any significant medical problem, but they are often a source of distress to the affected patients due to cosmetic disfigurement. They result from changes in the reticular collagen that are caused by rapid stretching of the skin (1). The exact etiology still remains controversial and this is partly due to the wide range of the clinical conditions associated with SD (2). They may result from mechanical stress, such as weight changes and weight lifting, or from hormonal factors, such as puberty, pregnancy, oral contraceptive use, and corticosteroid therapy or excess (3).

They readily develop in women at puberty or during pregnancy. Striae are usually multiple and typically symmetrically distributed along lines of cleavage in the involved areas (4). The commonest sites affected are the outer aspect of the thighs and the lumbosacral region in boys, and the thighs, buttocks, and breasts in girls. They are commonly irregularly linear, several centimeters long and 1–10 mm

wide. Early lesions may be raised and irritable, but they soon become flat, smooth and livid red or bluish in colour. Their surface may be finely wrinkled (5). After some years, they will fade partially and become less conspicuous (1).

Several treatments have been proposed with variable success regarding their therapeutic outcome (6). The use of topical agents has been tried including tretinoin cream (7), glycolic acid and trichloroacetic acid (8). The other approach of treatment involves removal of the superficial epidermis and dermis to induce collagen remodeling. This mode included microdermabrasion, chemical peel and ablative lasers like CO<sub>2</sub> laser and Er:YAG laser. Such methods commonly lead to postoperative complications such as oozing, bleeding, infections, and postinflammatory pigmentary changes, especially in dark-skin people (9). Nonablative laser and light sources has been used also such as pulsed-dye laser (10–13), excimer laser (14–16), copper-bromide laser, 1450-nm diode laser, 1064-nm Nd:YAG laser, fractional photothermolysis and radiofrequency devices

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(6). Recently, it has been reported that intense pulsed light (IPL) may offer some hope in improvement of SD. Yet the exact wavelength that is most effective for treatment of this condition is not well proved. There are only two published studies in the literature using this treatment for SD (17,18). They were using two different wavelengths, 645 nm and 590 nm.

IPL is a device that uses a flash lamp, which emits a high intensity, noncoherent and polychromatic broad-spectrum light (from 400 to > 1200 nm). The light is emitted in pulses with various pulse durations and intervals (7). The different cutoff filters deliver a variety of wavelengths. These filters are used to include or exclude certain wavelengths.

The present work was carried out to compare the effectiveness of two wavelengths of IPL (590 nm *vs* 650 nm) in the treatment of SD.

### Patient and methods

This prospective study was done in the laser research unit in the College of Medicine, University of Kufa, Iraq, during the period from Dec 2010 to Nov 2011. Twenty patients with SD and Fitzpatrick skin types III-IV were enrolled in the study. There were 15 females and 5 males. The age of the patients ranged from 15 to 32 years with a mean of 21.2 years. The patients have bilateral, symmetrical striae rubra. They had not had any previous treatment prior to the study. Exclusion criteria were history of systemic and/or topical corticosteroid therapy, anabolics intake, systemic retinoid therapy, Cushing's syndrome or polycystic ovary syndrome based on history, physical examination and/or investigations, pregnancy and lactation. Informed consent for treatment and photography was obtained from all patients. This study was approved by the local ethics committee.

Five sessions of IPL were carried out for each patient at 2-week intervals. The patients were informed to remove the hair overlying the treated site by shaving. The eyes of the patients and the operator were covered with specific protective eye goggles supplied with the device. Enough quantities of a refrigerated cooling, colorless and inert gel were applied onto the area, forming a layer of 3–5 mm thickness between the skin and the cutoff filter. The spot size was 10 mm × 50 mm. The shots were made one after the other, with 1–2 mm overlap. Any form of local anesthesia was not used, as the subjective pain is a determining indicator for fluence adjustment. The device used was Eterna Giovinezza, Category class IIb (Quanta System SPA, Italy).

Two cutoff filters were used, 590 nm on the left side and 650 nm on the right side of the body in symmetrical areas. The treatment began with a fluence of 13 J/cm<sup>2</sup> and increased gradually up to 15.5 J/cm<sup>2</sup> according to Fitzpatrick skin type, patient tolerance and the appearance of side effects. Lower

fluencies were used in the treatment with the wavelength 590 nm (up to 14.5 J/cm<sup>2</sup>) compared with that used in the treatment with the wavelength 650 nm (up to 15.5 J/cm<sup>2</sup>) in order to reduce or avoid the side effects. Each shot consisted of two pulses (6 ms and 6 ms) separated by interval of 20 ms.

Clinical photographs were taken by Sonny digital, high sensitivity, 10.1 mega pixels, DSC-T700 still-camera in the same space and illumination before and after each visit and at 2 months after the last treatment. Any side effect was recorded. All the patients were evaluated objectively and subjectively regarding their response to the treatment by following methods:

Objective methods, which include determining the changes of the total number, the sum of the lengths and maximum width of striae in the treated area. A visual analogue scale (VAS) from 0–10 was made to assess the degree of erythema of the lesions by a computer view of their photographs before and 2 months after the last treatment session. The evaluation was done by two independent board qualified dermatologists who were not members of the research team. The results were as follows: 0–1 white striae, > 1–4 mild erythema, > 4–7 moderate erythema, > 7–10 severe erythema.

Subjective methods, which include the patient's satisfaction as follows: weak, partial, very good on both sides. Statistical analyses were done through descriptive and analytic statistics by using scientific calculator and SPSS version 17, paired t-test and Chi square considering *p* value of ≤ 0.05 as significant.

### Results

All patients completed the periods of the treatment and follow-up. The duration of striae ranged from 2–36 months (average duration: 9.5 months). Two months after the final treatment, there was reduction in all assessed parameters on both sides.

The total number of striae on the right side (treated with a wavelength of 650 nm) was decreased from 256 to 240 with a mean ± SD of 12.8 ± 4.25 to 12 ± 3.755, and by application of the t-test for statistical analysis, the reduction was significant (*p* = 0.001) (Table I). It also decreased on the left side from 251 to 228 with a mean ± SD of 12.55 ± 4.11 to 11.4 ± 3.789. The reduction was statistically highly significant (*p* < 0.0001) (Table II). The reduction in the number of striae was more significant when the wavelength 590 nm was used.

The sum of the lengths of striae on the right side, treated with the wavelength 650 nm, was decreased from 935 cm to 830 cm with a mean ± SD of 46.75 ± 18.679 cm to 41.5 ± 16.797 cm. The reduction was statistically highly significant (*p* < 0.0001) (Table I). This sum of the lengths decreased on the left side from 948 cm to 803 cm with a mean ± SD of 47.4 ± 18.61 cm to 40.15 ± 16.683 cm. The reduction was statistically highly significant (*p* < 0.0001)

Table I. The changes in the number, the sum of lengths and the maximum widths of striae before and after treatment with a wavelength of 650 nm.

Patient no.	No. of striae before and after treatment		Sum of lengths before and after treatment (cm)		Maximum width before and after treatment (mm)	
	Before	After	Before	After	Before	After
1	16	14	33	25	4	3
2	11	10	57	50	25	22
3	10	10	49	44	4	4
4	21	19	30	27	5	4
5	8	8	28	25	6	6
6	11	11	53	49	11	9
7	10	10	52	47	3	3
8	8	8	37	34	7	6
9	13	13	60	55	5	4
10	19	18	74	62	17	15
11	6	6	17	17	3	3
12	15	14	75	69	6	5
13	10	8	29	24	7	5
14	14	14	73	66	4	3
15	15	13	24	21	7	5
16	10	10	43	40	14	12
17	12	10	23	18	5	3
18	22	20	69	58	12	10
19	13	12	65	58	5	5
20	12	12	44	41	9	8
Sum	256	240	935	830	159	135
mean $\pm$ SD	12.8 $\pm$ 4.25	12 $\pm$ 3.755	46.75 $\pm$ 18.679	41.5 $\pm$ 16.797	7.95 $\pm$ 5.51	6.75 $\pm$ 4.876
t & p value	t = 4, p = 0.001		t = 8.2, p < 0.0001		t = 6, p < 0.0001	

(Table II). The wavelength 590 nm was more effective depending on the t value, which was greater (9.244) than when the wavelength 650 nm was used (8.2).

The sum of the maximum widths of striae on the right side, treated with the wavelength 650 nm,

decreased from 159 to 135 mm with a mean  $\pm$  SD of 7.95  $\pm$  5.510 mm to 6.75  $\pm$  4.876 mm. The reduction was statistically highly significant (p < 0.0001) (Table I). This parameter decreased on the other side from 151 mm to 122 mm with a mean  $\pm$  SD of 7.55  $\pm$  5.072

Table II. The changes in the number, the sum of lengths and the maximum widths of striae before and after treatment with a wavelength of 590 nm.

Patient no.	No. of striae before and after treatment		Sum of lengths before and after treatment (cm)		Maximum width before and after treatment (mm)	
	Before	After	Before	After	Before	After
1	15	13	25	17	4	2
2	7	6	64	55	23	20
3	14	14	44	37	4	3
4	19	17	35	30	6	5
5	9	7	27	22	5	5
6	12	12	65	60	9	7
7	10	10	53	46	3	3
8	9	8	47	41	6	5
9	12	12	59	50	5	4
10	15	13	70	55	15	13
11	13	13	49	48	3	3
12	11	10	58	51	5	4
13	5	4	22	17	6	4
14	18	17	67	58	4	2
15	16	12	22	15	11	7
16	14	14	49	44	15	13
17	16	14	27	20	7	5
18	18	16	82	66	10	8
19	13	11	61	52	5	5
20	5	5	22	19	5	4
Sum	251	228	948	803	151	122
mean $\pm$ SD	12.55 $\pm$ 4.11	11.4 $\pm$ 3.789	47.4 $\pm$ 18.610	40.15 $\pm$ 16.683	7.55 $\pm$ 5.072	6.1 $\pm$ 4.47
t & p value	t = 4.721, p < 0.0001		t = 9.244, p < 0.0001		t = 6.175, p < 0.0001	

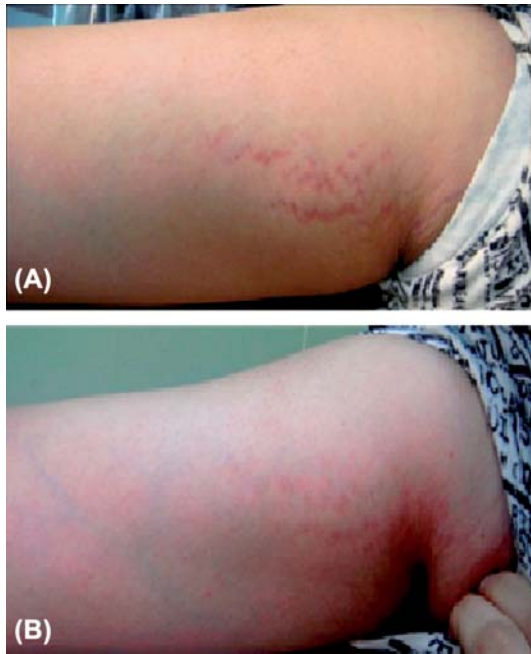


Figure 1. A patient with SD on the right arm before treatment (A) and two weeks after fifth session of treatment (B) with wavelength 650 nm of IPL.

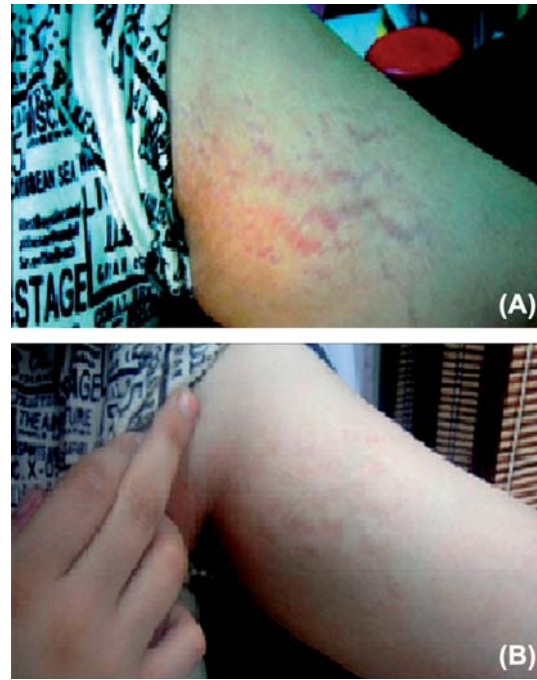


Figure 2. A patient with SD on the left arm before treatment (A) and two weeks after fifth session of treatment (B) with wavelength 590 nm of IPL.

mm to  $6.1 \pm 4.47$  mm. The reduction was statistically highly significant ( $p < 0.0001$ ) (Table II). The reduction was greater on the side treated with the wavelength 590 nm using *t* value, which was greater (6.175) than when the wavelength 650 nm was used (6).

According to visual assessment of photographs; at the start of the study 6 patients (30%) presented with severe erythema, 7 patients (35%) presented with moderate erythema and 7 patients (35%) presented with mild erythema. Two months after the last session of treatment with wavelength 650 nm, 2 patients (10%) had severe erythema, 5 patients (25%) had moderate erythema and 13 patients (65%) had mild erythema (Figure 1). The reduction in the degree of erythema had occurred in 8 patients. Applying of the Chi square test for statistical analysis, the change was not significant ( $p = 0.127$ ). The results of the assessment on the left side were: 2 patients (10%) had severe erythema, 2 patients (10%) had moderate erythema, 16 patients (80%) had mild erythema (Figure 2). The reduction in the degree of erythema had occurred in ten patients. The change was statistically significant ( $p = 0.0157$ ).

The evaluation of patient's satisfaction showed that 10 patients (50%) had more satisfaction in the area treated by the wavelength 590 nm, 4 patients (20%) had more satisfaction when the wavelength 650 nm was used, 2 patients (10%) were equally satisfied with both types of treatment and 4 patients (20%) had no satisfaction with either type.

Eight patients (40%) developed side effects and in 7 of them, side effects were more on the left side (treated with the wavelength 590 nm) and 1 patient had equal side effects in both types of treatment. The side effects

ranged from slight erythema and pain in 4 patients (20%) to intense erythema and burning of skin in 2 patients (10%). Two patients (10%) developed postinflammatory pigmentation, one of them got it only on the left side and the other on both sides but it was slight on the right side and more severe on the left side and both of them were skin type IV. All side effects were transient and tolerated by the patients except postinflammatory pigmentation, which persisted to the end of the study but in a decreasing manner.

## Discussion

SD is still a frequently encountered, difficult to treat skin condition with mainly cosmetic impact on the patient. Topical agents give inconsistent results and ablative laser and surgical treatment may be associated with more injury to the treated site (3,4). Nonablative light sources have been used to induce dermal collagen remodeling without epidermal injury. The effects of these lasers were due to generation of thermal injury in the papillary and upper reticular dermis. Various nonablative lasers were proved to be useful in patients with scarring or atrophy (6). The first nonablative laser used in treatment of SD was the pulsed dye laser with variable results. While some studies showed good results in patients with striae rubra, no effect was seen in those with striae alba (10–13). Moreover, postinflammatory pigmentation is a significant side effect after treatment with the pulsed dye laser in the melanin-rich skin types IV–VI as melanin acts a competing chromophore with hemoglobin for the light energy (10,11).



There are only two studies in the literature using IPL for treatment of SD (17,18). The exact mechanism of action of IPL in the treatment of SD is unknown, but, it is probably by inducing controlled wounds on the skin. This will prompt the skin to heal itself by creating new cells, so the amount and activity of fibroblasts increased and more collagen fibers were synthesized or rearranged within the stroma (19). This effect is utilized in using IPL for rejuvenation (20,21), facial rhytides (22) and poikiloderma of Civatte (23). Pérez et al. showed that SD improved clinically and microscopically after IPL with minimal side effects. The cutoff filter most commonly used in this study was the one of 645 nm (18). Almost similar results were found by Hassan and Solaiman. They used IPL that delivers pulsed light of 590-nm wavelength (17).

In the present work we have tried to compare the effects of both wavelengths on SD. To the best of our knowledge, no previous study for treatment of striae by IPL was tried in Iraq. The patients enrolled in this study have striae rubra, unlike all other studies when the patients were in the late stage, i.e., striae alba. The present work showed that both of the wavelengths (650 nm and 590 nm) were effective in the treatment of striae distensae and both of them resulted in statistically significant reduction in the number, the sum of lengths and the maximum widths of striae, and in all of these assessed parameters the wavelength 590 nm was more effective. These results were comparable with that obtained in the study done by Pérez et al. (18) and Hassan and Solaiman (17).

According to VAS assessment, the reduction in the degree of erythema was more conspicuous and statistically significant in area treated with the wavelength 590 nm. In the previous studies (17,18), No VAS was done and the improvement was assessed roughly on the general appearance of the striae as assessed by the treating physician and by the patient himself. The involvement of dermatologists that are not members of the work gives it more support and probably more accuracy in the assessment.

The patients' satisfaction was more when using the wavelength 590 nm in spite the occurrence of more side effects on the side treated with this wavelength. All the side effects were transient and well tolerated by the patients. No severe side effect was encountered in any patient that led to inconvenience, lack of compliance or discontinuation of treatment. These results were also comparable with the previous published articles (17,18), apart from less incidence of postinflammatory pigmentation in our patients who have skin types III and IV. The other difference is the absence of defaulting patients, which may reflect the low incidence and mild severity of side effects and good satisfaction of the patients.

In conclusion, IPL appears to be a good option for the treatment of SD. All the clinical parameters assessed showed variable improvement. Both wavelengths of IPL (650 nm and 590 nm) are promising

alternatives for treatment of SD with mild, transient and well-tolerated side effects. The wavelength 590 nm was more effective than the wavelength 650 nm in all of the assessed clinical parameters but with more occurrences of side effects, which can be reduced or avoided by using lower fluencies.

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