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Laser Treatment of Erythema and Telangiectasia Associated with Rosacea

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Abstract. The response of rosacea-associated erythema and telangiectasia to treatment with the pulsed tunable dye laser (PDL) was evaluated in 12 patients. Improvements in erythema, telangiectasia, flushing, the physician's and the patient's perception of overall severity, treatment tolerability, and the adverse side effects were examined. With the sole exception of the patient's assessment of overall severity we have found highly significant improvements in all other parameters evaluated, with excellent tolerance of treatment. We therefore conclude that the PDL is a safe and effective treatment for the erythemato-telangiectatic component of rosacea.

Keywords: Erythema; Pulsed tunable dye laser; Rosacea; Telangiectasia

INTRODUCTION

Rosacea is a common disorder characterised by intermittent flushing and with time the gradual development of persistent erythema and telangiectasia, often punctuated by episodes of inflammatory papules, pustules, and swelling [1]. The exact aetiology of rosacea is unclear but it is likely to be due to a combination of factors. Climatic and/or photodamage resulting in vessel wall abnormalities probably play a role [2,3]. The mite *Demodex folliculorum* may also be involved [4,5]. In view of the possible role of weathering and sun exposure, the increasing incidence of photodamage is likely to mean an increase rather than decrease in the frequency of rosacea, and therefore increasing requirements for treatment.

Although the papulo-pustular element usually responds well to medium or long-term antibiotic therapy the vascular elements are frequently persistent [6], and their severity can result in considerable cosmetic embarrassment for the patient concerned. Management for many patients often includes advice to avoid popular foods and alcohol, and cosmetic camouflage which can be expensive and time consuming.

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More recently there have been a number of studies reporting the use of lasers for rosacea and facial telangiectasias [7–13]. Though these studies suggest good clearance of the vascular elements of rosacea with laser therapy, in general they have been uncontrolled and lacking in objective measures of improvement. Many relate to the use of the pulsed tunable dye laser (PDL) which has become the treatment of choice for a number of conditions with cutaneous vascular ectasia [14], in particular port wine stains (PWS) [15,16], and telangiectasias, including spider naevi [17,18]. The PDL laser produces selective photothermolysis of cutaneous blood vessels with a significantly reduced incidence of adverse cutaneous reactions [19,20].

The aim of this study was to perform a prospective analysis of the treatment of the erythema and telangiectasia associated with rosacea with the PDL. Specific evaluation was made of the overall clinical improvement, and in addition controlled objective assessment of changes in the severity of erythema, telangiectasia, flushing, change in inflammatory lesion counts, and the number of treatments required for clearance of the vascular element.

PATIENTS AND METHODS

Ethical approval was obtained from the District Ethics Committee. Twelve patients

with rosacea were recruited over a one-year period. Patients with markedly active papulopustular disease, those who had received oral retinoids within 12 months, and pregnant women were excluded from the study. All were assessed prior to treatment.

A 2×2 cm test area was treated with the pulsed dye laser (SPLT-1b; Candela Corp, Wayland, MA, USA) at 585 nm with a 450 μs pulse duration at energy fluences of 5.5, 6.0, and 6.5 J/cm^{-2} with a 5 mm spot to assess the most appropriate starting dose for future treatments, and to judge treatment tolerability. Thereafter patients were reviewed and treated 8 weekly with the PDL using contiguous non-overlapping spots. Laser treatment was carried out to all areas, with the exception of one cheek left untreated to act as a within patient control. Where possible treatment was carried out to the entire cosmetic unit involved to improve the uniformity of paling. If improvement was seen the energy fluence was kept constant with each treatment. If no improvement occurred the fluence was increased by 0.5 J/cm^{-2} per treatment as tolerated. If the spot size was increased from 5 mm to 7 mm the energy fluence per treatment was reduced by 0.5–1.0 J/cm^{-2}. If necessary, local anaesthetic cream (EMLA®) was applied prior to treatment.

Assessments

Prior to treatment and at each visit the following parameters were assessed.

1. Erythema was measured using a hand held reflectance spectrophotometric erythema meter [21]. Three readings were taken from the specified area, and a mean value was calculated. To take into account fluctuation in vasodilation with environmental changes, a mean control reading taken from an uninvolved area of the pre-auricular area was subtracted from this value to give an overall score, i.e. erythema score = mean erythema reading of the involved area − mean erythema reading of the control area.
2. The extent of telangiectasia was estimated using a visual analogue scale meter (VAS) (measurements from 0 to 100).
3. The severity of flushing was estimated by the patients using a 0–3 scale (none, mild, moderate or severe).
4. Overall severity was assessed using VAS by both the doctor and patient.
5. Inflammatory lesion counts were taken from all involved areas.
6. Any adverse events were documented.

A single observer (SMC) carried out all measurements. Statistical analysis of the comparative results from both cheeks was carried out using the Wilcoxon Signed Rank test.

RESULTS

Four men and eight women with an age range of 31–63 (mean 48) years were treated. The duration of rosacea ranged from 2 to 20 (mean 8) years. All patients had relatively symmetrical involvement of both cheeks, 11 (92%) also had involvement of the nose, 10 patients (83%) involvement of the forehead, and 10 the chin. Six of the patients were on antibiotic therapy (four on oral, one on topical, and one on both oral and topical treatment) prior to laser treatment. The duration of antibiotic therapy prior to PDL treatment ranged from 6 weeks to 6 years (mean 2.5 years). In all of these patients the antibiotics were maintained for the duration of the study. The other four patients had all previously received antibiotics orally for their rosacea. These had been discontinued from 1 week to 10 months (mean 4 months) prior to the study. None of the patients were using topical steroids on their skin.

The treatment was well tolerated by all patients. Treatment energies ranged from 5.5 to 7.5 J/cm^{-2}. In 11 of the 12 patients a mean of three treatments (range 2 to 6) with the PDL were required for unequivocal improvement (Fig. 1). One patient (patient 1) opted not to continue in the trial after the first treatment because she felt that there had not been any perceptible improvement (see below). Figures 2(a,b) and 3(a,b) show some of the clinical results following PDL therapy.

Changes in Erythema, Telangiectasia and Flushing

The results for erythema, telangiectasia, and flushing in the treated and control sides are shown in Table 1. After laser treatment there was a reduction in telangiectasia score in all patients, and in both severity of erythema and flushing scores in 11 of the 12 patients (all but patient 10). Highly significant improvements were seen with respect to all three parameters

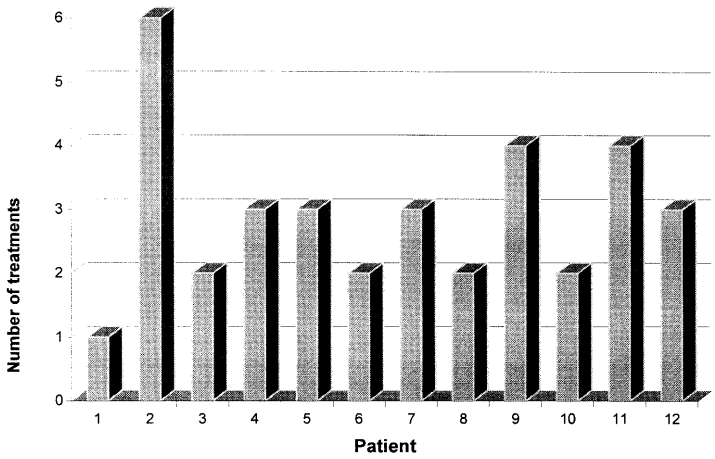


Fig. 1. Number of PDL treatments received.

in the treated side ($p<0.01$). After a mean of three treatments there was a 50% reduction in erythema, a 55% reduction in flushing, and a 75% reduction in telangiectasia scores. Two of the patients felt that there was also a reduction in flushing on the untreated control side, though this was much less marked.

There were no obvious indicators as to which patients showed the most significant improvement following PDL treatment. We have noted that in the two patients (2 and 11) with the most vivid persistent erythema some erythematous areas failed to blanche or show the immediate bruising expected with treatment, whilst at the same time developing a marked surrounding hyperaemia. These patients have taken longer to clear, and the results were slightly more patchy.

Changes in Overall Disease Severity

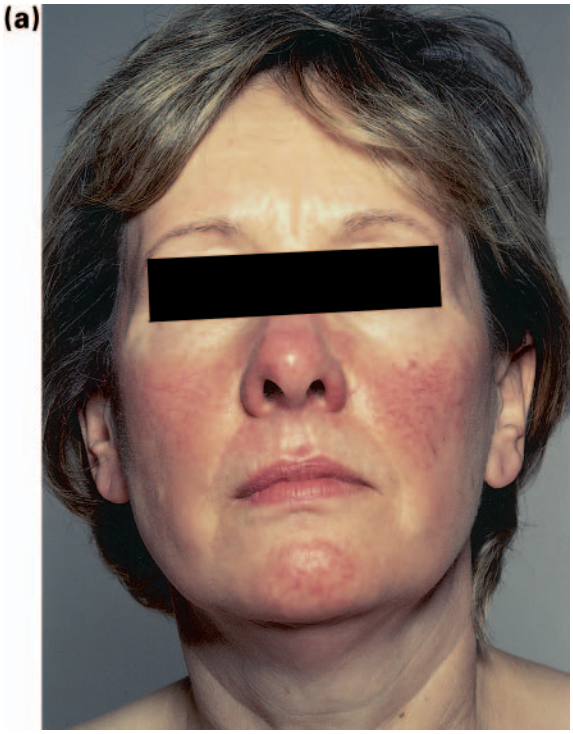
The results of the assessments of overall disease severity pre- and post-treatment are shown in Table 2, and Figs 4 and 5. In 9 of the 12 patients the overall severity score assessed by both the physician and patient fell after PDL treatment. Severity scores as assessed by the physician fell significantly from a mean of 49.3 pretreatment to a mean of 33.1 after PDL treatment ($p=0.004$). The reduction in patient assessed severity just failed to reach statistical significance ($p=0.055$). This is likely to relate to the fact that the untreated side was included in the overall assessment.

Two of the twelve patients (patients 1 and 7) scored their overall disease severity at the end of treatment as worse than pretreatment. Patient 7, a 49-year-old lady with a 2-year history of rosacea, was the only patient to show deterioration in overall severity score as assessed by both the physician and patient following PDL treatment. Her erythema and telangiectasia scores fell significantly from 7 to -2 and 36 to 9.1, respectively on the treated side. Her flushing score also improved from severe pretreatment to mild post treatment. However, her total lesion count increased from 28 pretreatment to 52 following PDL treatment despite continued use of topical and oral antibiotics. Patient 1, a 47-year-old lady with a 4-year history of rosacea, withdrew from the trial after one treatment because she felt that there had been no perceptible improvement in her condition. Her telangiectasia score fell from 24.1 to 16, and flushing score from moderate to mild on the treated side. Her erythema score remained virtually unchanged.

The overall severity score of patient 10 showed no change following PDL treatment. Her severe flushing present pretreatment was persistent. Her erythema score showed no change, though her telangiectasia score fell from 47.8 to 17.4 on the treated side, and her total lesion count fell from 13 pretreatment to 0 following treatment.

Changes in Inflammatory Lesion Counts

Eleven of the 12 patients had inflammatory lesions associated with the erythema and telangiectatic changes pretreatment. Six of the 12 patients were maintained on previously commenced topical or oral antibiotic therapy for their rosacea throughout the study. After PDL treatment 9 of the 11 patients had lower counts, however the reduction in lesion counts



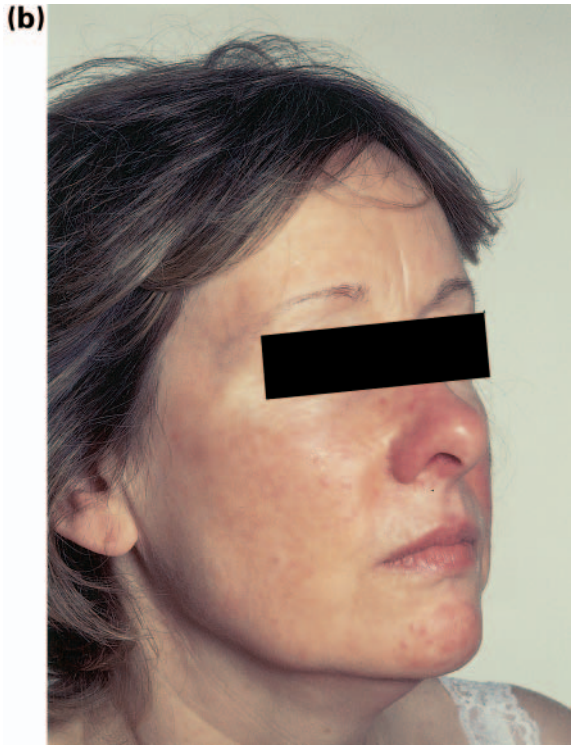


Fig. 2. Patient 2: (a) pretreatment; (b) treated cheek after PDL treatment.

failed to reach statistical significance. Lesion count in the treated cheek pretreatment ranged from 0 to 40 (mean 6.25), and post treatment from 0 to 20 (mean 3.5). In the control cheek pretreatment lesion counts

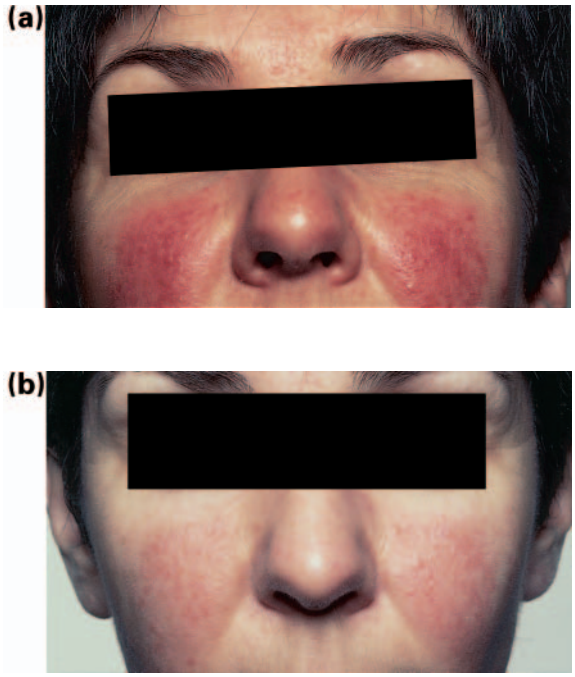


Fig. 3. Patient 7: (a) pretreatment; (b) after PDL treatment.

ranged from 0 to 24 (mean 5.1), and post-treatment from 0 to 13 (mean 3.1). Of the two patients with increasing lesion counts, one patient had been taking oral oxytetracycline, and the other topical metronidazole throughout the study period.

Side Effects

Side effects documented are shown in Table 3, and are compared to the results published by Seukeran et al. [20] for PDL treatment of PWSs. As expected bruising occurred in all patients, but in virtually all cases settled within 7 to 10 days. Postinflammatory hyperpigmentation was common, occurring in over half the patients, usually affecting the cheeks. This improved with time in all patients and has resolved within three months in all but one of the female patients who has a previous history of chloasma. Severe crusting occurred in two (17%) patients. Both were of skin type I, treated with the 5 mm spot diameter at 6.0 J/cm^2 and 6.5 J/cm^2, respectively. Macular atrophic scars were noted in two patients both on the central cheek area (one patient with a history of severe crusting). Both were solitary, small, and unnoticed by the patients themselves who were keen to continue with further treatments. Brief local skin irritation post treatment in occurred in two patients, and one

Table 1. Results of the assessment of telangiectasia, erythema and flushing scores pre- and post-laser treatment

Measurement	Treated side					Control side				
	Pre-PDL		Post-PDL		Significance of change	Pre-PDL		Post-PDL		Significance of change
	Mean	Range	Mean	Range		Mean	Range	Mean	Range	
Erythema	10.8	3–23	5.4	− 2–17	$p<0.01$	10.2	2–24	10.1	1–21	NS
Telangiectasia	40.8	24.1–61.1	10.6	0–21.2	$p<0.01$	42.3	25.6–65.0	37.0	13.7–70.7	NS
Flushing	2.7	2–3	1.2	0–3	$p<0.01$	2.7	2–3	2.6	2–3	NS

Table 2. Results of the assessment of overall severity of rosacea pre- and post-laser treatment

Overall severity assessment	Treated side				Significance of change
	Pre-PDL		Post-PDL		
	Mean	Range	Mean	Range	
Physician	49.3	27.5–76.9	33.1	6.6–47.9	$p=0.004$
Patient	56.2	8.3–77.4	41.1	7.3–84.8	$p=0.055$

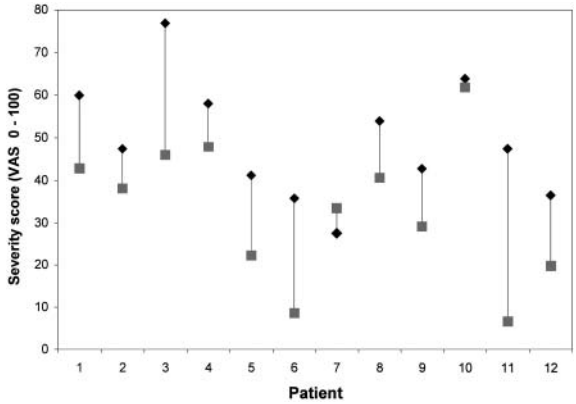


Fig. 4. Medical assessment of overall severity of rosacea. ◆, Pre-PDL; ■, post-PDL.

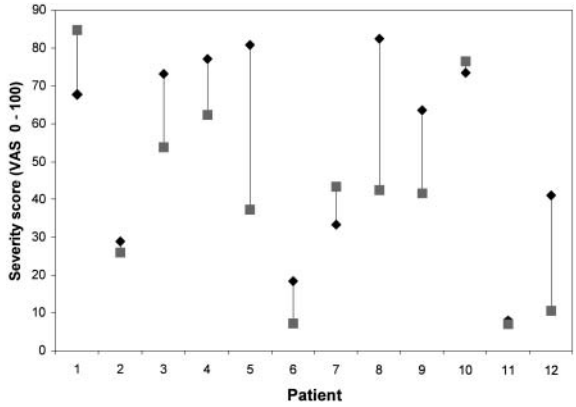


Fig. 5. Patient assessment of overall disease severity. ◆, Pre-PDL; ■, post-PDL.

patient complained of transient occipital headache in the 24 h period following each treatment. No other problems have occurred.

DISCUSSION

We have shown that the PDL can significantly reduce both the erythema and telangiectasia of rosacea. An average of three treatments was required for significant clearance of the vascular elements. The reduction in telangiectatic scores was dramatic often after only one or two treatment sessions. Prominent vessels on the nasal tip and nasal alae tended to take the longest to clear. A similar finding was also described by McCoy in the treatment of facial telangiectasia with the copper bromide laser [11,12].

No major side effects occurred. Postinflammatory hyperpigmentation was common, though in most patients this cleared within three months. The incidence of postinflammatory hyperpigmentation was higher than seen with PDL treatment of PWS [20]. The reason for this is unclear, but may relate to the fact that rosacea is a more inflammatory condition, to the older age of the patients, or to sun exposure during the summer months. No patient was treated if they were significantly tanned at the time.

The telangiectatic element showed the greatest clearance after PDL laser treatment. We found no other obvious indicators to predict which patients would obtain the greatest benefit from treatment, however in a small number of patients some areas of florid erythema failed to blanche/bruise as deeply as others immediately after PDL treatment. This was associated with a pronounced surrounding hyperaemia, and at follow up in more patchy clearance of the erythema. Troilius et al. [22], in attempting to assess why some patients with PWS showed poor response, demonstrated that there was a good correlation between the degree of blanching and the therapeutic result, i.e. the greater the blanching the better the result. They suggest that this can be used as a guide to monitor and predict the outcome of PDL treatment and our experience would support this.

The reasons for vascular ectasia in rosacea are not clearly defined. Histologically in addition to widely dilated vessels, the skin shows disruption of the dermal connective

Table 3. Incidence of side effects

Side effect	Number of patients	Percentage of patients	Incidence in the treatment of PWS (%) [20]
Hyperpigmentation	7	58	9.1
Hypopigmentation	0	0	1.4
Severe crusting	2	17	0.7
Transient skin irritation	2	17	Not reported
Atrophic scarring	2	17	4.3
Hypertropic scarring	0	0	0.7
Headaches	1	8.5	Not reported

tissue with elastosis, and there is no doubt that in many patients photo, climatic and/or steroid damage are contributing factors. Previous studies suggest that there may be a genetic predisposition to vasodilation. An increased incidence of migraine, reported in up to 45% of female rosacea patients suggests the possibility of vascular hyper-responsiveness [23]. Exaggerated flushing after thermally hot foods or liquids may also play a role. A variety of inflammatory mediator blockers have been variably effective in reducing vasodilatation in rosacea patients. Whatever the cause repeated bouts of vasodilation gradually increases vascular ectasia.

The mechanism by which the vascular and papulo-pustular elements are linked either directly or indirectly is also unclear. Increased cutaneous blood flow and 'leaky' dilated blood vessels may as a result of secondary dermal oedema induce local inflammatory mediators. It has been suggested that vascular abnormalities play a role in the pathophysiology of other cutaneous inflammatory disorders including psoriasis, and that a reduction in the vascular skin supply following PDL treatment results in improvement or clearance of the inflammation. This was demonstrated in studies by Katugampola et al. [24] and Ros et al. [25] who treated patients with plaque psoriasis with the PDL. After therapy 60% of the patients experienced a beneficial clinical effect. If a similar role of the skin vasculature occurs in rosacea, as has been previously proposed, then a reduction in the cutaneous vasculature should result in a reduction in the local inflammatory component. A study by Lowe et al. reported a reduction in lesion count following PDL treatment of rosacea [26]. Our evaluation of inflammatory lesion counts pre- and post-laser treatment have shown a trend towards a reduction post-PDL treatment, however this failed to reach significance. It may be that early treatment of the erythemato-telangiectatic element may not only improve the flushing and vascular prominence, but may reduce the inflammation seen in this disease.

In conclusion, the PDL is a safe and effective modality for the treatment of the erythemato-telangiectatic component of rosacea. More intense erythema giving rise to local discomfort or itching, and prominent telangiectatic vessels on the nose may be more difficult to clear. Follow-up of the patients in this study is planned to assess the persistence of the improvements achieved.

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