Successful Treatment of Lower Extremity Telangiectasias Using 585-nm Pulsed-Dye Laser at Low Fluence Combined With Optical Coherence Tomography: A Case Report

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ABSTRACT

Background: Significant advances have been made in using lasers and intense pulse light sources to treat common vascular lesions such as telangiectasias. However, the treatment of leg telangiectasia, specifically, is more challenging because it involves the clearing of smaller veins as well as the larger feeding veins. The latest guidelines recommend use of short wavelength pulse-dyed lasers (PDL) as an option to treat telangiectasia cases that are unresponsive to sclerotherapy.
Methods: A 29-year-old white woman presented with persistent telangiectasia, with multiple telangiectasias ranging from 1 cm to 20 cm in size involving the dorsal feet and both ankles and legs, which developed 10 years prior, associated with paresthesia. Test spots were treated with a 585-nm pulsed dye laser with various energy settings, and treatment was performed at 5.5 J/cm^2 with spot size 10 mm and 0.5ms pulse duration.
Results: Near complete clearance was achieved 1 month after the single treatment without adverse effects. Optical coherence tomography (OCT) imaging demonstrated a reduction of cutaneous blood flow after treatment.
Discussion: We report successful treatment despite using settings that were previously reported to lack efficacy. This treatment resulted in considerable improvement in aesthetics and symptomatology. Also, OCT confirmed decreased vascular flow and bulging.
Conclusion: Our results suggest there is still much to learn about the use of PDL in treating telangiectasias of the lower extremities, and that the ideal parameters warrant further investigation. Moreover, the novel use of OCT in auxiliary imaging for identification of treatment spots, as well as monitoring response at a microvascular level, holds great potential for wider application.

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INTRODUCTION

Telangiectasias of the lower extremities are common. Sclerotherapy is the first-line treatment for telangiectasias, but significant advances have been made in using lasers to treat these vascular lesions,[1,2] including use of pulsed dye laser (PDL), potassium-titanyl-phosphate (KTP)-lasers, and longer wavelength lasers such as alexandrite lasers, diode lasers (800 nm – 900 nm), and millisecond Nd:YAG lasers (1064 nm). Among these, short wavelength PDL has been viewed as a subpar treatment option for telangiectasia. There is also a perhaps unfounded consensus that longer wavelength PDL with higher fluences is better suited for treating vascular lesions of the lower extremities due to the vessels' deeper location and larger diameter, respectively.[3]

In this report, we investigate the use of short wavelength PDL with low fluence levels in treating a patient with telangiectasia of the lower extremities that did not respond favorably to sclerotherapy. Additionally, we employed optical coherence tomography (OCT) imaging to identify the treatment area and monitor treatment response at the microvascular level. We report successful treatment of lower extremity telangiectasia with a single session of 585-nm PDL therapy at low fluences in combination with OCT monitoring, which resulted in considerable improvement in aesthetics and symptomatology.

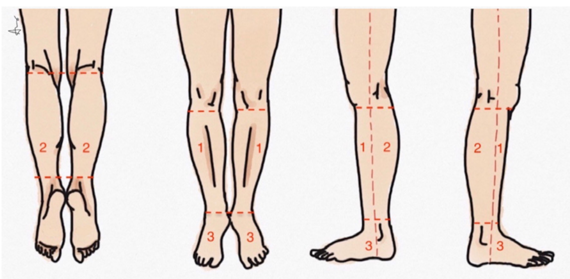
Case Presentation

A 29-year-old Caucasian woman (Fitzpatrick skin type I) presented with multiple telangiectasias ranging from 1 cm to 20 cm in size, involving the dorsal feet and both dorsal and ventral ankles and legs, which developed 10 years prior, associated with paresthesia. Two biopsies favored the diagnosis of essential telangiectasia. The patient had been previously treated with sclerotherapy, along with gabapentin 200mg nightly for paresthesias of the affected areas; but both provided only limited improvement. She had noted frequent nosebleeds since childhood, but otherwise had no history of weight loss, fatigue, gastrointestinal bleeding, or neurological symptoms. No family history of similar symptoms was reported.

Three spots on the dorsum of the right foot were considered as test spots. Each spot measured approximately 1 cm x 1 cm. These spots were imaged using dynamic OCT to identify dilated vessels and visualize blood flow at different skin depths. The sites were then treated with a 585-nanometer PDL with the energy set to 3.5 J/cm^2, 4.5 J/cm^2, and 5.5 J/cm^2, respectively. A spot size of 10 mm was used due to the large size of the lesions, with a 0.5 ms pulse duration. The patient tolerated the procedure well. Post treatment instructions included sun avoidance and sunscreen use (SPF >30) on the treated areas. The use of gabapentin was unaltered. The patient returned for evaluation 4 weeks later. OCT demonstrated the most substantial decrease in blood flow and number of dilated vessels on the test spot treated with a fluence of 5.5 J/cm^2. This result was also evident on visual inspection when comparing the 3 test spots.

The patient returned for the treatment of 3 additional area. Each area was treated once, each 1 month apart (Figure 1).

FIGURE 1. Laser treatment areas. Session 1: anterior right & left shins. Session 2: posterior right and left shins. Session 3: dorsum of feet.



Fluence levels ranged from 4.5 J/cm^2 to 5.5 J/cm^2 depending on the location of the lesion, with a spot size of 10 mm and pulse duration of 0.5 ms. The results were documented photographically both before and at 1 month follow-up. As seen in Figures 2a and 2b, near 100% clearance was achieved 1 month after the single treatment with no adverse effects reported. OCT imaging was also employed to compare blood flow of the lesion both before and one month after treatment, as shown in Figure 3. Blood flow data from OCT confirmed effective clearance. An evident drop in blood flow was seen at all measured depths after laser therapy. The highest blood flow was seen at a depth of 0.35 mm both before and after treatment. These data are reported in Figure 4.

FIGURE 2. Blood flow data from OCT supports the effective clearance: drop in blood flow after treatment, particularly at 0.35mm in depth, where most blood vessels reside.

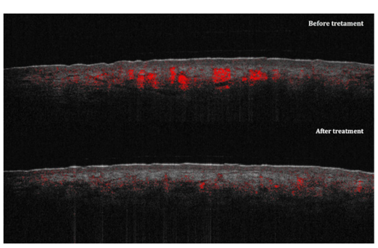


FIGURE 3. Near 100% clearance was achieved 1 month after the single treatment at that location, and no adverse effects were reported. OCT en face view shows decreased blood flow after 1 month.

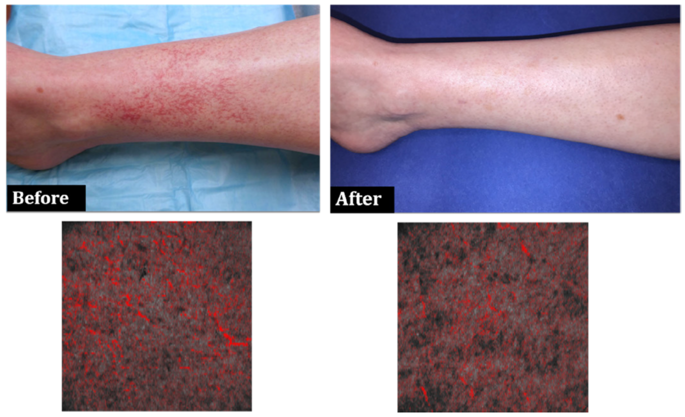
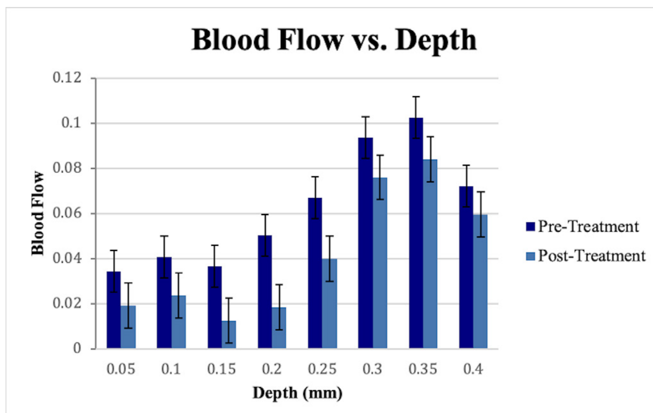


FIGURE 4. Drop in blood flow after treatment, particularly at 0.35 mm in depth, where most blood vessels reside.



DISCUSSION

Although sclerotherapy remains the first-line treatment for leg telangiectasias, laser treatment is a promising alternative for those with contraindications, inadequate response, or intolerable side effects such as purpura and hyperpigmentation.[4] The use of PDL on lower extremity telangiectasias dates was originally reported in the 1990s; and some consensus had been reached based on previous studies and reports. For example, a shorter wavelength PDL of <600 nm has been recognized to yield the best results for facial telangiectasia because it is more efficacious in treating superficial vessels of small caliber, with diameters no larger than 1.0 mm.[4-6] Treatment of telangiectasia of the lower extremities, however, involves vessels that are often larger in size and deeper beneath the thicker adventitial tissues and basal lamina, in addition to smaller more superficial vessels, thus making treatment with a single laser difficult.[4,6] Shorter wavelength (<600 nm) modalities such as KTP and LPDL have been reported to be most effective for narrow veins (<1 mm), while longer wavelength modalities such as alexandrite, diode, and Nd:YAG have been recognized to be most effective for deeper veins.[4]

In terms of PDL, the 595-nm laser has traditionally been viewed as superior in treating leg veins than the original 585-nm laser.[3] Studies also suggest a preference for treatments with longer pulse durations (typically 10 ms-100 ms) to target larger vessels and avoid common side effects, such as purpura, post-inflammatory hyperpigmentation, and hemosiderin deposition (Meesters et al).[7] Additionally, most studies with PDL used fluences in the 10 J/cm^2 to 20 J/cm^2 range, and demonstrated that higher fluences are associated with an increased incidence of hyperpigmentation.[8]

This case is unique in that, despite using the previously discredited lower wavelength PDL (585-nm) with a short pulse duration (0.5 ms) and a relatively low energy density (5.5 J/cm^2), near 100% clearance was achieved with only a single treatment. In fact, the results prove to be more efficacious compared with previous reports that are more in line with the existing parameter consensus. The study by Garden reported perhaps the most favorable outcome, with 585-nm PDL at 1.5 ms and 16-20 J/cm^2, having achieved 69±8% clearance after a single treatment.[9] In comparison, our case achieved a higher clearance (nearly 100%) at a lower fluence (5.5 J/cm^2).

Positive reports using the 595-nm PDL date back to 1997, when Hsia et al reported achievement of over 75% clearance in 64.7% of sites treated at 18 J/cm^2 and in 52.9% of sites treated at 15 J/cm^2 after a single treatment with the 595-nm PDL with a pulse duration of 1.5 ms.[6] Buscher et al reported similar results with an average 67.5% clearance rate using the same laser and pulse duration with fluences of 20 J/cm^2 and 24 J/cm^2; but with 2 treatments needed to achieve this level of clearance.[10] In 2003, Tanghetti reported even better results, with over 75% clearance in 80% of treated lesions at 16 J/cm^2 with a 40 ms pulse duration after a single treatment.[11] However, there was an increase in the incidence of temporary purpura, likely secondary to the use of higher fluences. Compared with the collective results using the 595-nm PDL, our case was able to achieve a greater clearance rate with a much lower fluence and pulse duration, with no notable side effects.

Another unique aspect of this case is the employment of OCT. The use of OCT in dermatology is still novel but has already shown great promise. Recent studies have recommended OCT-based microangiography as a modality to provide high-resolution vascular maps, as well as direct visualization and quantitation of in vivo microvascular changes.[12] Particularly in the treatment of telangiectasia, OCT has been reported to provide visualization of coagulation following intense pulsed light treatment, making OCT an attractive adjunct tool both before and after treatment.[13] In this case, OCT imaging was useful in identifying treatment spots as well as monitoring changes with treatment. OCT was also helpful in identifying small interconnecting vessels surrounding the treatment spots that were otherwise invisible to the naked eye and dermoscopy. Identification and treatment of these accessory vessels are speculated to have greatly reduced the need for multiple treatment sessions.

Our results suggest there is still much to learn about the use of PDL in treating telangiectasias of the lower extremities, and that the ideal parameters warrant further investigation. The excellent outcome achieved in this case was beyond expectation and, as such, necessitates more research in the application of low fluence, shorter wavelength PDL in the treatment of telangiectasia. Furthermore, the novel use of OCT in auxiliary imaging for identification of treatment spots as well as monitoring response at a microvascular level holds great potential for wider application.

DISCLOSURE

The authors have no conflicts of interest.

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