Evaluation of the Lyra Nd:YAG 1064nm wavelength for the treatment of leg vessels up to 4mm in diameter

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Background

Superficial leg veins present a cosmetic problem for a large segment of the female population. They vary in size, color and nature. Red superficial telangiectatic (up to 1.5 mm) vessels are routinely treated with long pulse KTP/532 nm and flash lamp pulsed dye lasers.

Recently a new generation of long pulse Nd:YAG lasers have been introduced for the treatment of larger and deeper leg vessels. With an appropriate combination of pulse duration, energy and spot sizes, this wavelength can be used effectively on deeper vessels between 1.5 mm and 4 mm in diameter.

Objective

The purpose of this study was to evaluate the effectiveness and any side effects in the treatment of red, purple and blue vessels between 1.5 mm and 4 mm in diameter in 20 patients with the Laserscope Lyra™ Nd:YAG laser with EDP (Extended Duration Pulse).

Materials and Methods

Twenty patients were treated with the Lyra Nd:YAG 1064 nm laser with EDP. Red, purple and blue vessels with sizes ranging between 1.5 mm and 4 mm varied in depth. The location of vessels on legs was not predetermined. A 3 mm treatment beam was used in the evaluation. Fluences were varied between 175 J/cm^2 and 220 J/cm^2 with the pulse duration set at 50 msec for all treatments. All treatments were performed with the company's proprietary cooling device, CoolSpot™, which cools the tissue to about 12°C. Patients were treated either one or two times where applicable, with a 6-week interval between the procedures. All patients were followed up to 2 months post the last treatment.

Results

At two months following the final treatment, 15% of patients showed moderate improvement, 25% of patients showed good improvement and 60% exhibited excellent improvement.

Introduction

The use of lasers for vascular applications is based on the Theory of Selective Photo-thermolysis developed by Drs. R. Anderson and J. Parrish in 1983. This theory states that the combination of the laser light properties, the energy levels and exposure duration must be optimized to achieve desirable clinical results. Various wavelengths have been used for the treatment of leg telangiectasia. These include pulsed dye lasers which emit light in the range of 577 nm to 595 nm, and KTP lasers, which emit 532 nm wavelength. Additionally, there are light sources, which provide wavelength between 500 nm and 1100 nm, that are utilized for various vascular applications. Due to the absorption characteristics, however, there are limitations to the size and depth of the vessels that can be treated with these lasers and light sources. Both pulsed dye and KTP lasers are very highly absorbed in oxyhemoglobin, thus limiting their penetration to very shallow layers of skin and very superficial vessels. Additionally, pulsed dye lasers emit at very short pulse durations (0.45 msec and 1.5 msec), which cause immediate coagulation of blood, exhibiting itself in unsightly purpura. The KTP laser, while providing the ideal pulse duration (between 1 and 50 msec) is highly absorbed in skin pigment, limiting the use of the laser to certain lighter skin tones.

Sclerotherapy – non-laser method – although delivering clinically satisfactory results, is known to create inflammatory effects, as well as hyper-pigmentary changes and ulceration. Additionally, it is not unusual to run across 'needlephobia' in some patients.

Finding a solution for vessels up to 4mm in diameter with the location anywhere between 0.2 mm and 1.5 mm in depth (red, purple and blue in color) has been a long-standing challenge. Lasers used for this application should have a great depth of penetration, low absorption in melanin and relatively high absorption in oxyhemoglobin.

The 1064 nm wavelength has been long used for various vascular and pigment applications. Q-switched (10 nsec) pulses have proven to be a clinical standard for dark ink tattoo removal. Continuous lasers are used successfully for hemangiomas and other deep vascular deformities.

Recent introduction of long pulse Nd:YAG lasers (10-50 msec) has given us the opportunity to extend the application of this wavelength to the removal of lower extremities vessels. The great penetration of the Nd:YAG wavelength, due to its low scattering combined with the pulse duration matching the thermal relaxation time of targeted vessels, could potentially allow the treatment of these vessels. The equation involves two more parameters – spot size to approximate the vessel size and the appropriate energy to create enough thermal effect to seal vessels.

Materials and Methods

Twenty female patients with Fitzpatrick skin type II through V were treated with the Lyra Nd:YAG 1064 nm laser with EDP (Extended Duration Pulse). Leg vessels treated in this study varied between 1.5 mm and 4 mm in size. The depth of vessel location was determined by the color changing from red to purple to blue. Vessel locations on the legs were random.

4.0 mm vessels on the popliteal fossa before the treatment

6 weeks post one treatment

Patients were treated with a 3 mm spot size handpiece chosen based on the vessel sizes between 1.5 mm and 4 mm. The energy levels were set based on the vessel depth and size. At the 3 mm spot size, the fluence was changed from 175 J/cm^2 to 225 J/cm^2 with lower levels for shallower vessels. Based on the thermal relaxation time of the treated vessels, pulse duration was set at 50 msec throughout all treatments. The company's proprietary cooling device – CoolSpot – was used in each treatment to cool down the skin surface. The CoolSpot provides about 12°C temperature at the skin surface, decreasing any non-specific thermal effects to the epidermis and underlying layers. Prior to each treatment, the area was covered with UltraSound Jelly, which served as an index matching medium.

The clinical trial objectives were to determine the extent of vein clearance and to describe the occurrence of any adverse effects. The clinical end-point during treatment varied with the size and the depth of the vessels. Immediate blanching was seen with some vessels and more prolonged (up to 5 minutes) clinical reaction occurred with other vessels. Generally, small- and medium- sized red and purple vessels blanched with each consecutive pulse. Larger blue vessels did not exhibit an immediate reaction, but turned pinkish-red with blurred outline within 2-5 minutes of the treatment. After the treatment, each vessel was depressed with the finger and observed for blood refill. If no abnormalities were noted, treatment was repeated. No treatment was repeated more than two consecutive times over the same vessel.

In this evaluation patients were treated at 1pps (pulse per second), which allowed for a uniform tracing of vessels with minimal overlap. Any increase in pulse rate induced discomfort to the patients.

Patients were treated one or two times with six weeks between each treatment. The number of treatments was based on the severity of vessel formation. No pre-operative regime was prescribed to the patients. Post-operative treatment included complete avoidance of exercise for three days and avoidance of blood thinning medications.

2.5 mm vessels on the popliteal fossa before the treatment

6 weeks post one treatment

All patients were photographed before each treatment, after each treatment and two months after the last treatment. Results were graded as poor (25% clearance), moderate (25-50%) clearance), good (50-75% clearance) and excellent (75-100% clearance).

Patients were observed for pain, hypo- or hyperpigmentation, as well as any other side effects.

Results

Two months following the last treatment with the Lyra Nd:YAG laser, 3 patients showed moderate improvement, 5 patients showed good improvement and 12 exhibited excellent improvement. Out of 20 patients, 5 patients were treated once and 15 patients required a second treatment.

Reddening and inflammatory reaction was clearly seen in patients with over-treatment, i.e. those patients whose vessels were treated twice consecutively within the same treatment at excessive fluences. However, no side effects resulted from these treatments in any of the patients, including the patients with dark skin. Improvement usually occurred on or before the sixth week post treatment.

All patients complained about deep pain during the treatment, which is explainable with the depth of vessel location and wavelength penetration. Pain, however, resolved immediately after the laser energy was deactivated. Sensitive patients were offered topical anesthetic.

Conclusion

The above evaluation was conducted using the Laserscope Lyra Nd:YAG 1064 nm laser with long pulse. We have found the evaluation to be quite successful and believe that long pulse 1064nm wavelength can be effectively used for the treatment of deeper red, purple and blue leg vessels of up to 4 mm in size.

References:

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