A Novel Endovenous Laser Treatment of Great Saphenous Vein Reflux with a 1320 nm Nd:YAG Laser and a Pull-back Device

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Summary

A novel endovenous laser treatment system consisting of a 1320 nm Nd:YAG laser (CoolTouch CTEV™) and a motorized pull-back device was used for the treatment of varicose veins. Patients: 31 limbs in 29 patients with incompetent greater saphenous veins (GSV) were treated. Methods: The laser fiber was inserted into the GSV and connected to a pull back system. Pulsed laser energy was applied at 5 W while the fiber was retracted at a speed of 1 mm/sec. Results: Moderate bruising in the thigh was shown in two limbs and mild pain during walking in six patients. Occlusion of the treated GSV was seen in 29 of 31 limbs at 3 months. Conclusion: This endovenous laser system using a 1320 nm Nd:YAG laser is an effective, safe treatment for patients with varicose veins.

Introduction

Patients treated with an endovenous laser treatment frequently show posttreatment bruising and pain in the thigh [1]. These adverse effects are associated with a longer time for the patient to return to normal activity compared with RF treatment [2]. Either thermal damage to perivascular tissue or perforation of the venous wall associated with laser ablation may be responsible for the increase in symptoms. Use of conventional lasers at wavelengths of 810-1064 nm and uncontrolled pull-back of the catheter by hand are likely to cause overheating of the vessel wall and perforation [3,4].

Herein, we show a novel endovenous laser ablation system using a 1320

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nm Nd:YAG laser (CoolTouch CTEV™; CoolTouch Corp., Auburn, CA, USA) in combination with a motorized pull-back system (Track Back; CoolTouch Corp., Auburn, CA, USA) for the treatment of varicose veins. The 1320 nm laser can penetrate through the blood in the vein and be strongly absorbed in the vessel wall collagen. Moreover, the motorized pull-back system can precisely control the energy delivery to the vessel wall [5].

Patients

From May through December 2004 in our institution, endovenous laser treatment was performed in 27 patients (9 men and 18 women; mean age, 55 ± 12 years [32-83 years]) with primary varicose vein disease (31 legs). Based on the CEAP classification, 17 legs were C2, six legs were C3, six legs were C4, and two legs were C6. Preoperative assessments of deep-vein patency and mapping of GSV were done by using Duplex scanning. Patients were considered to be candidates for laser ablation when there was no tortuosity of the GSV at the thigh, which was assessed subjectively as unsuitable for catheterization with either a Duplex scan or when tortuosity was visible to the naked eye.

Materials and Methods

The Nd:YAG laser we used has a wavelength of 1320 nm, which can penetrate through a small amount of blood and is better absorbed by water than the 810 nm – 1064 nm waveband [6]. We used a relatively low laser power, at 5 W in pulsed mode at 50 Hz frequencies, in comparison with an 810 nm laser at 12 W. The automated pull-back device is illustrated in Fig. 1. The laser fiber is pulled back continuously at a constant rate of 1 mm/s or 0.5 mm/s using this device.

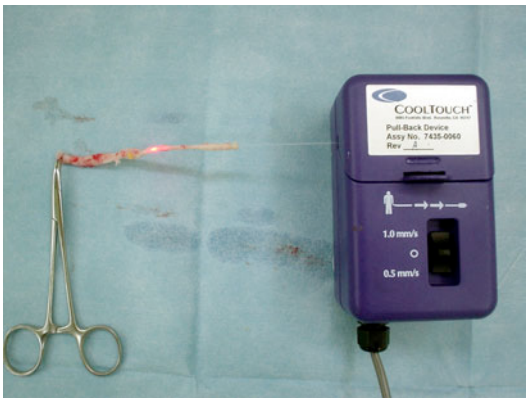

Figure 1. An automated fiber pull-back device can withdraw the laser fiber at a rate of 1 mm/s or 0.5 mm/s.

Procedure

All the endovenous procedures were done on an outpatient basis. The patient was placed in the supine position with the affected leg in a slightly bent, frog-leg type position. The pathway of the GSV was marked with a marker pen under US guidance. 1% lidocaine was infused around the knee and at marked sites in the thigh for TLA infusion with a 20 G needle. A catheter was inserted into the vein through a small incision around the knee, and, before insertion of the laser fiber into the guide wire, the laser fiber was connected to the laser system and the transmission quality of the fiber was checked using the test mode incorporated into the laser system. The laser fiber was inserted into the catheter, and advanced until approximately 1-2 cm below the saphenofemoral junction (SFJ) under US observation. Alternatively, the position of the fiber tip could be confirmed by visualization of the red aiming beam through the skin.

Tumescent local anesthesia (TLA) solution consisting of 500 ml of 0.1% lidocaine with epinephrine (1:1,000,000) and 16 ml of 8.4% sodium bicarbonate was used [7]. The TLA solution was injected into the saphenous compartment exactly around the vein from the distal to proximal site of the thigh under ultrasound observation. A sterile strip was attached to the fiber for better visualization of the fiber movement. The laser treatment parameters and pullback speed were verified after the fiber had been inserted into the pull-back device, which was placed near the fiber entry point to the patient's leg. The laser system was then activated after the pull-back device was turned on. The laser fiber was retracted automatically by the pull-back system while fiber movement could be confirmed by the sterile strip attached to the fiber. When the fiber reached the opening into the vein, the laser system was stopped and the laser fiber was removed. Occlusion of the vein was checked by ultrasound observation. The procedure was completed with closure of the skin.

After the treatment, a compression bandage was applied over the lower leg and thigh with gauze following the course of the GSV.

Results (Fig. 2)

The mean follow-up range was 71.4 days. Initial endovenous occlusion of the GSV and continued closure of the occluded GSV at one month follow-up were noted in all limbs. Two GSVs were partially recanalized with reflux at 3 months.

Serious side effects, including deep vein thrombosis were not observed in any patient after laser treatment using the 1320 nm laser. Bruising outside the incision site was shown in two limbs although all bruising spontaneously and completely resolved before the 1 month follow-up. Mild pain during walking was shown in six patients. The pull-back device was temporarily stopped to treat an incompetent perforator in the thigh in two patients for a few seconds. In these two patients, one developed mild bruising and another developed erythema with mild pain in the same place. One patient in whom the saphenous nerve was accidentally hooked during surgery complained of mild paresthesia lasting for 3 months.

Posttreatment ultrasound examination showed thrombotic occlusion of the whole treated GSVs at 48 hours, one week and one month. The GSVs were

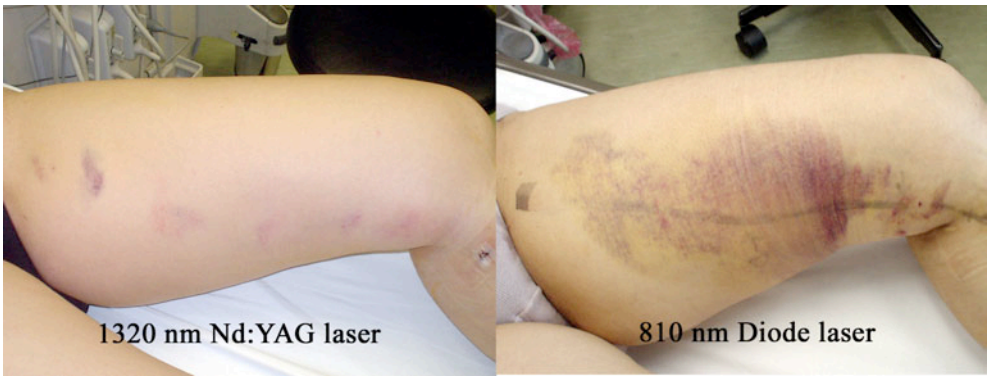

Figure 2. Appearance of the thigh 24-48 hours after endovenous laser treatments. (left: 1320 nm Nd:YAG laser, right: 810 nm diode laser)

simply occluded with a small amount of thrombus maintaining the vein wall structure without any change to the perivascular tissues.

Conclusions

Endovenous laser treatment using a 1320 nm Nd:YAG laser (CoolTouch CTEV™) in combination with a pull-back device could decrease the rates of posttreatment bruising and pain, which can delay the return of patients to normal activities. This procedure is an effective, safe and comfortable treatment for patients with varicose veins. It is much simpler to use and much safer than other wavelengths with manual pull-back, and the patient is much happier with the result.

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