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Original Research

Treatment of vascular abnormalities with a long-pulse diode at 980 nm

Jean Luc Levy & Christian Berwald

Authors:
Jean Luc Levy
Centre Laser Dermatologique, Marseille, France
Christian Berwald
Departement Chirurgie Plastique, Service Pr Magalon, University Hospital Marseille, France

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Background: Lasers have been used to treat a variety of vascular abnormalities for over 20 years. For minor vascular targets, a small and friendly diode laser with cooling handpiece appears to be a challenger to other systems. *Objective*: The purpose of this study was to compile treatment data and to examine the effectiveness of a longer pulse duration diode laser in the treatment of vascular pathologies such as facial telangiectasia, venous lakes, spider nevi, blue telangiectasia, leg veins and dermatological treatments. *Subjects and methods*: Thirty patients were treated with the diode laser with a pulse of 150 ms, energy densities of 300–500 J/cm^2 and wavelength at 980 nm. Patients were treated with a surface cooling device. Clinical evaluations were categorized into improvements of 0–25%, 25–50%, 50–75% and greater than 75%.
Results: 60% of the patients have up to 50% improvement. The maximum clearance was obtained with only one treatment. However even the cooling system is performed +5°C, pain was relatively high for a majority of patients.
Conclusions: The long-pulse diode laser at 980 nm is effective for treating a wide variety of small vascular abnormalities, for deep and thick vascular lesions and leg veins. The surface cooling device is useful for epidermal protection and pain-free treatment. *J Cosmet Laser Ther* 2004; **6**: 217–221

Introduction

A variety of continuous lasers have been used over the last 25 years, including the argon laser (488–514 nm), Nd:YAG laser (1064 nm)[1] and KTP laser (532 nm),[2] for vascular abnormalities. Face telangiectasia, spider nevi and venous lakes are common cosmetic blemishes and patients frequently seek medical therapies for their eradication. They vary markedly from patient to patient in their size, anatomical location, colour and pattern.

Telangiectasia of the legs occurs in as many as 41% of women with 15% in men in Europe. Although the leg veins in more than half of these patients are symptomatic, the most common reason patients seek treatment is because of their appearance.

The 980 nm long-pulse diode has been used for 1 year in our clinic by one physician to treat a wide variety of cutaneous vascular lesions. For the purpose of this study, only the results of facial vascular lesions and leg veins have been analyzed.

Correspondence: Jean Luc Levy, Centre Laser Dermatologique, 3 Bd Lord Duveen, 13008 Marseille, France. Fax: 33 4 96 20 34 49; Email: laserder@jeanluclevy.com

Materials and methods

Laser

The 980 nm diode VR1000^{TM} (INTERmedic, Barcelona, Spain) laser is a new medical laser for dermatological treatment. This is a semi-conductor laser system. The design of the laser cavity is simple, assuming high efficiency and good stability. It works in normal mode, delivering up to 2000 J/cm^2. It can work in either single shot mode or double pulse. The beam is delivered by an optic fibre and an aiming beam is provided by a red laser diode. Internal cooling avoids water connection and only a standard power outlet (10A) is required. The system is compact, monitored by a microprocessor assuming high reliability, and is compliant with all medical norms (CE marking).

For this study, the laser was tuned from 382 J/cm^2 to 509 J/cm^2.

Figure 1
A 1 mm handpiece and contact cooling.

Cooling system

The skin was cooled using a Cool Laser Optics, Inc (Westborough, Mass, USA). This is a cryo-sapphire-tip handpiece which is in direct contact with skin. Cooling is obtained by water. The cooling temperature was set at +5°C and the contact maintained at least for 2 seconds before firing the laser. During the protocol, a cooled handpiece with a 2 cm viewing window was used (Figure 1).

Patients

Thirty patients were included in this study. Patients were between 13 and 76 years of age (mean: 42 years). All phototypes were included in the study. Before treatment, the area to be treated was prepared with skin cleanser only. Treatment was performed without any kind of anaesthesia (EMLA® Cream (AstraZeneca) was not used.) The endpoint was a slight greying of photocoagulation observed on the face and legs. For both areas, a 1 mm spot handpiece was used connected to a cooling system. After treatment, patients applied Epitheliale® cream Ducray (Pierre Fabre Laboratory, Toulouse, France). The average crust duration was 5 days.

Evaluation methodology

Pain experience. We asked patients, after the treatment session, to grade the level of pain on a 4-point scale (none, mild, moderate, severe).

	0–25%	25–50%	50–75%	Over 75%
Red face telangiectasia	0	0	1	0
Blue face telangiectasia	0	5	2	0
Papular spider nevi/senile angiomas	0	1	8	3
Blue leg telangiectasia	3	2	2	3

Table I
Results according to location on the body.

Number of treatments	0–25%	25–50%	50–75%	Over 75%
1	3	3	9	2
2	0	1	6	1
⩾3	2	1	2	0

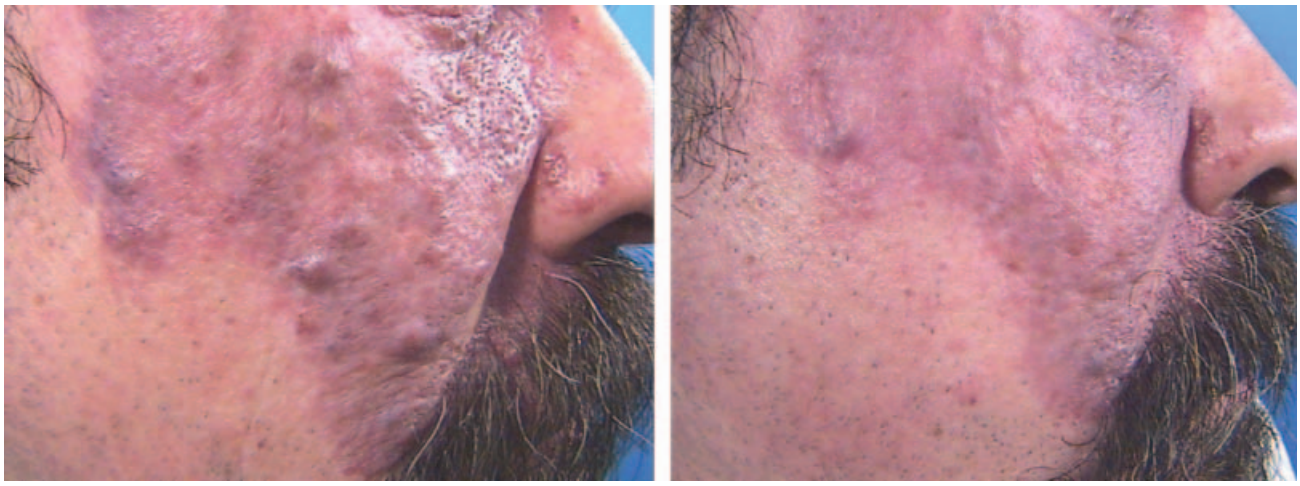
Table II
Results according to the number of treatments.

	Not painful at all	Mildly painful	Moderately painful	Severely painful
Face	0	0	6	6
Legs	4	6	4	4

Table III
Pain experienced without applying EMLA Cream before treatment according to the location on the body.

	Hypopigmentation	Hyperpigmentation	Matting	Textural changes
Face	1	0	0	2
Legs	1	0	1	0

Table IV
Side effects according to the location on the body.



(A) (B)

Figure 2
Before and 1 month after one session on PWS nodules.

Effectiveness of treatment. Photographs were obtained in standardized conditions (professional photographer/lighting/frame) at day 0, before treatment, and 1 or 2 months after the last treatment. They were evaluated in a randomized way with one independent observer from the study.

Adverse effects of treatment. Side effects were assessed 1 or 2 months after the last treatment.

Results

Table I shows the distribution of results according to the location and the type of lesion. A total of 60% of the patients have up to 50% improvement. In Table II, it is clearly seen that the maximum clearance is obtained with only one treatment (Figure 2, 3). However, even with the cooling system performed at $+5^{\circ}C$, pain is relatively high for a majority of patients (Table III). We complete local cooling by EMLA cream for pain reduction in bony zone (Figure 4).

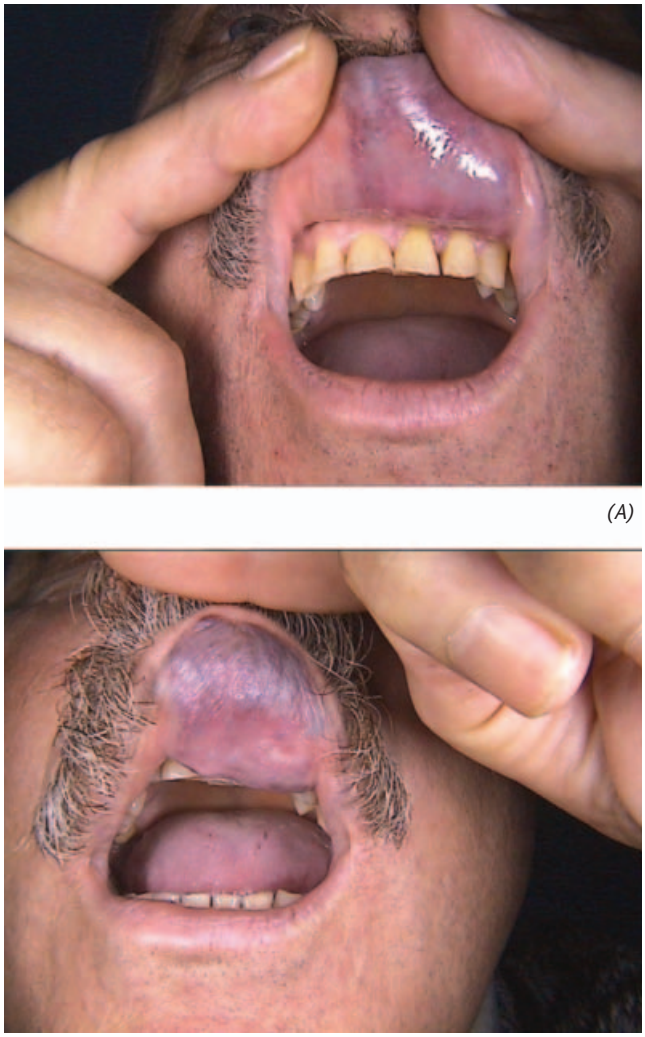
Few side effects were observed as hypopigmentation in 2/30 patients and textural changes in 2/30 patients with large nodules of port wine stain (Table IV) (Figure 5).

Discussion

As far as the authors are aware, this is the first study published in the literature using a new long-pulse diode at 980 nm for vascular treatment.

There are many different vascular lesions on the body according to their depth, geometry, blood flow and thickness. For superficial telangiectasia of the face, a lot of choice of wavelengths are effective from 532 nm to 1064 nm. For thick telangiectasia of the face and legs, proliferating capillary haemangioma, papular spider veins, venous lakes, nodules of port wine stain and pyogenic granulomas, this infrared wavelength is very appropriate to this treatment.

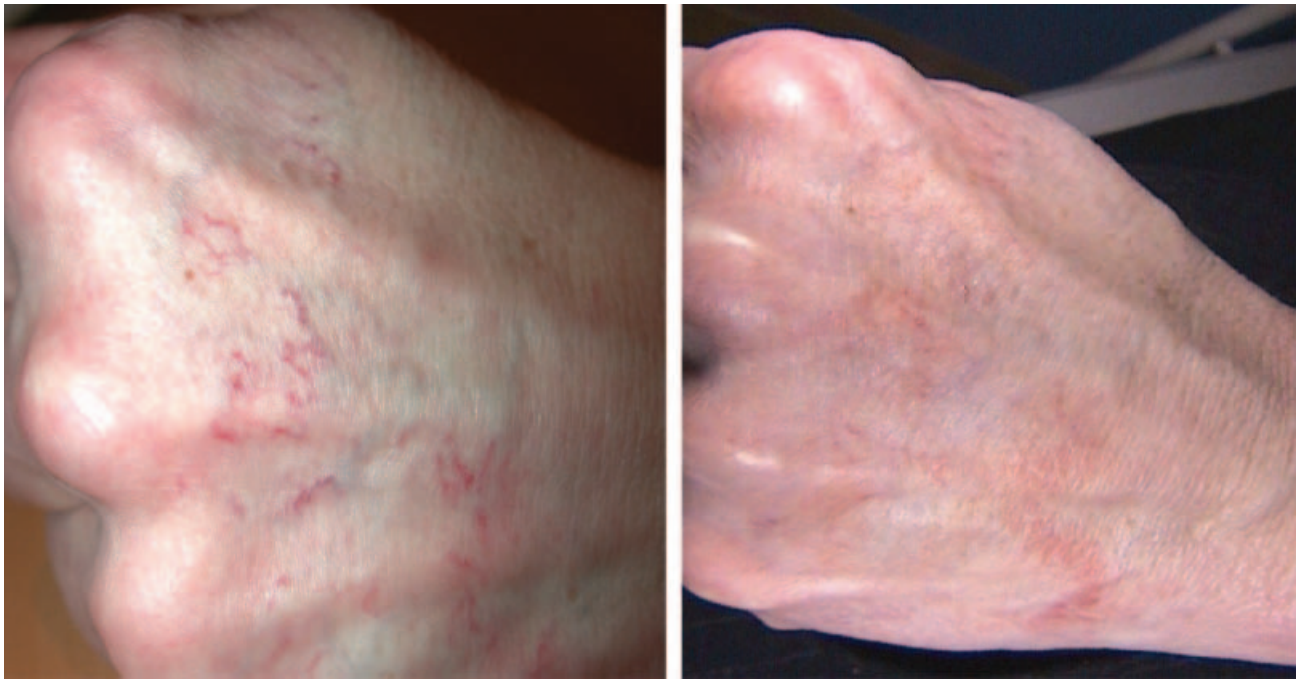
The fact that the clinical endpoint used in laser treatments was disappearance of the vessel with residual epidermal greying correlates well with the almost non-existence of side



(A)

(B)

Figure 3
Before and 1 month after one session on a venous malformation.



(A) (B)

Figure 4
Before and 1 month after three sessions on telangiectasia of the hand.

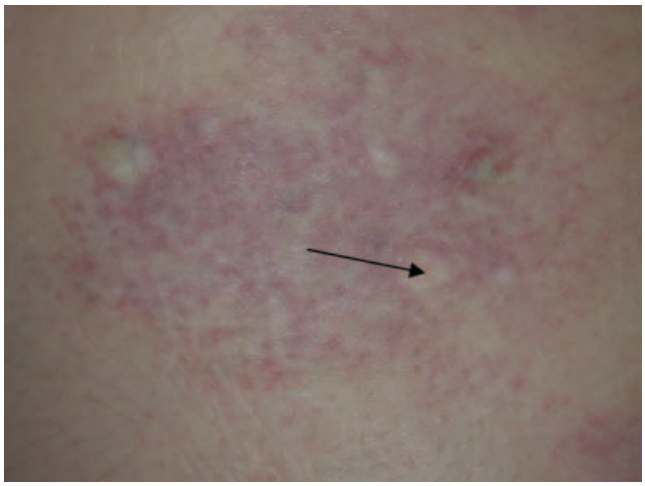


Figure 5
Hypochromia after photocoagulation of nodules on the leg: after one session.

effects. The most common observations during the learning phase were evidence of over-treatment due to non-optimal contact cooling. To increase optimal contact cooling, the sapphire window must always be in contact with the skin.

No histology was performed but this clinical evaluation has clearly demonstrated that the VR1000 treats leg veins with efficiency if optimal parameters are used with good contact cooling. Moreover, the pain is higher in cases of non-contact cooling. Pain control with EMLA Cream could be useful.

The VR1000 efficiently treats small leg veins, and its wavelength, at 980 nm, is not far from Nd:YAG 1064 nm laser treatment, which logically treats these application concerning the treatment of blue leg veins telangiectasia between 1 and 2 mm.[3,4] The use of the non-uniform pulse mode[5] compared with one pulse allows the delivery of high energy while preserving the surrounding tissue and leads to rapid vessel clearance with reduced pain and few side effects.

Other diode lasers have been used for leg veins at 940 nm[6] with good results and treats in a similar way the blue leg veins telangiectasia between 1 and 2 mm.[3,4] They also need pain control and lead to photocoagulation in several weeks. Definitive results occur only after prolonged follow-up; they are considerably better than the short-term results.

Conclusion

Our study confirmed the efficacy of the 980 nm wavelength combined with contact cooling for deep and thick vascular lesions, and leg veins. The study clearly demonstrates that when the pulse duration is longer than the current long-pulse Nd:YAG, the results are similar. Cooling is essential to protect the epidermis on large areas and provides pain control and efficacy.

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