

## ORIGINAL ARTICLE, MEDICINE

# Minimal Invasive Approach for Lips Venous Lake Treatment by 980 nm Diode Laser with Emphasis on the Aesthetic Results. A Clinical Series

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**Introduction:** A venous lake (VL) is a vascular lesion with common occurrence in many patients, manifested as a dark blue-to-violet compressible papule, caused by dilation of venules. The main reasons for the treatment of VL are aesthetic. The haemorrhaging episodes or impairment of oral normal functions are also under considerations. Treatment of lip VL includes surgical excision, selective photocoagulation, cryotherapy, sclerotherapy and electrodesiccation. The high-intensity diode laser is an option. The 980 nm diode laser is selectively absorbed by haemoglobin and selectively destroys blood vessels, minimising injury to the surrounding healthy skin.

**Aim:** The purpose of this study was to evaluate the effectiveness of diode laser in the treatment of VL lesions with the accent on the postoperative defects and aesthetic results.

**Methods:** 35 patients aged 37 to 71 were included in this study. A 980 nm diode laser was used in noncontact mode, under local anaesthesia in continuous wave (2-3W, for 20-60s). All patients received only one procedure.

**Results:** Healing process was completed within 2 to 4 weeks after treatment with no scarring. None of the typical adverse effects were observed in the process of healing.

**Conclusions:** Selective photocoagulation is an effective method for treatment of VL. Lower morbidity, minimal patient discomfort and satisfactory functional and aesthetic results are favourable for patients. To optimise the results and to reduce the adverse effects, basic knowledge on lasers and laser-tissue interactions is requisite.

## INTRODUCTION

A venous lake (VL) is a vascular lesion with common occurrence in many patients, manifested as a dark blue-to-violet compressible lesion, caused by dilation of venules. In 1956 Bean and Walsh described how these lesions can be easily compressed and their tendency to occur on the sun-exposed skin, especially in elderly patients.<sup>1</sup> From a biological standpoint, VLs are considered benign vascular lesions, but in the clinic, they resemble some malignant lesions, such as melanoma, sarcoma and pigmented basal cell carcinoma.

Two main hypotheses regarding the development of VL have been put forward. The first is long-term solar damage injuries that can affect the vascular adventitia, permitting dilatation of super-

ficial venous structures.<sup>2</sup> The second hypothesis proposed that the vascular thrombosis may play a role because it is commonly present in this type of lesions. There is no clear evidence whether thrombosis is a primary or a secondary event in the development of these lesions.

VLs have no tendency to spontaneous involution. Once they have formed VL persists throughout life. The prognosis for VLs is excellent. Although VLs do not resolve on their own, patients can be reassured that VL do not evolve into a skin cancer. It is important to consider differential diagnosis to ensure proper treatment planning. Clinically the VL is typically presented as a slow-growing asymptomatic lesion. Bleeding can occur once if the lesion has been traumatised. The exact incidence of

VL is unknown. Bean and Walsh reported that 95% of VL were observed in males at the mean age of 65 years.<sup>1</sup> They suggest that the disproportionately large distribution in males may be related to occupational exposure to the harmful environmental factors. In other two moderate-size studies women comprised the majority of treated patients.<sup>3,4</sup> This may be related to increased concern among women regarding the cosmetic appearance of VL rather than with true incidence.

Physical examination usually reveals a soft, compressible, purple coloured lesion (slightly elevated), approximately 10 mm in diameter or greater. The lesions usually are well demarcated with a smooth surface, and the compression often causes an emptying of the blood content. Lesions typically are distributed on the sun-exposed surfaces of the face, neck and the ear. Vermilion border of the lower lip is also commonly affected. Sometimes, several lesions are found on the same person, and the surrounding skin reveals actinic damage.

The main reasons for the treatment of VL are aesthetic because they are acquired defects commonly affecting the facial appearance. The haemorrhaging episodes or impairment of oral normal functions are also under considerations. Treatment modalities of lip VL include surgical excision, selective photothermolysis<sup>8,9,11,12</sup>, cryotherapy<sup>3</sup>, sclerotherapy<sup>10</sup>, and electrodesiccation. Although all of these approaches are economical, multiple treatments may be necessary. Treatment of VL may be complicated by prolonged bleeding, swelling, pain, textural changes in treated areas, and scarring.

Treatment with high-energy lasers is an option.<sup>4</sup> When the proper wavelength is carefully chosen the selective laser photothermolysis can be used. The 810 to 980 nm diode laser beam is selectively absorbed by haemoglobin (the penetration depth vary from 4 to 5 mm) and selectively destroys vascular components (photocoagulation), minimising injury to the surrounding healthy tissue.

High-intensity diode lasers have been increasingly used over the past decades in the treatment of vascular lesions.<sup>13,14</sup> Accordingly, the purpose of this study was to evaluate the effectiveness of diode laser in the treatment of VL lesions putting the emphasis on the postoperative defects and aesthetic results.

## PATIENTS AND METHODS

In this clinical series, a total of 35 patients with VL were managed. Informed consent was obtained

before treatment. A 980-nm diode laser (LiteMedics®, Italy) was used in a non-contact mode, under topical or local infiltrative anaesthesia. Irradiation was delivered using a flexible non-activated fiber 300 µm in diameter. The laser tip was held 2 to 3 mm away from the target area, circling around the lesion several times in continuous wave mode (2-3W, for an average irradiation time of 20-60 s deepening on the lesion size). The energy density was 224J/cm<sup>2</sup> (for 2W and 20 s irradiation time) and 344J/cm<sup>2</sup> (for 3W and 60 s irradiation time). The endpoint of treatment was blanching and visible shrinkage of the lesion. The patients were instructed to raise a hand if they feel any discomfort during the procedure. All patients reported that they were comfortable during the procedure (**Figs 1, 2**). All cases were photographically documented at different stages of treatment.

Statistical analysis was performed using SPSS v. 17.0. Descriptive statistics, analyses of proportions, Spearman's rho correlation coefficient and one-way ANOVA were applied. As a level of significance  $P < 0.05$  was accepted. All P-values were two-tailed.

## RESULTS

In this study, 28 men and 7 women aged 37 to 71 years were included (mean  $\pm$  SD  $56 \pm 9.09$ ) (**Fig. 3**).

All VL lesions were located on the lips (3 on the upper lip, 26 on the lower lip and 6 on oral commissures) (**Table 1**).

The diagnosis was made on a clinical basis and the vitropression technique. The lesions were from 5 to 15 mm in diameter.

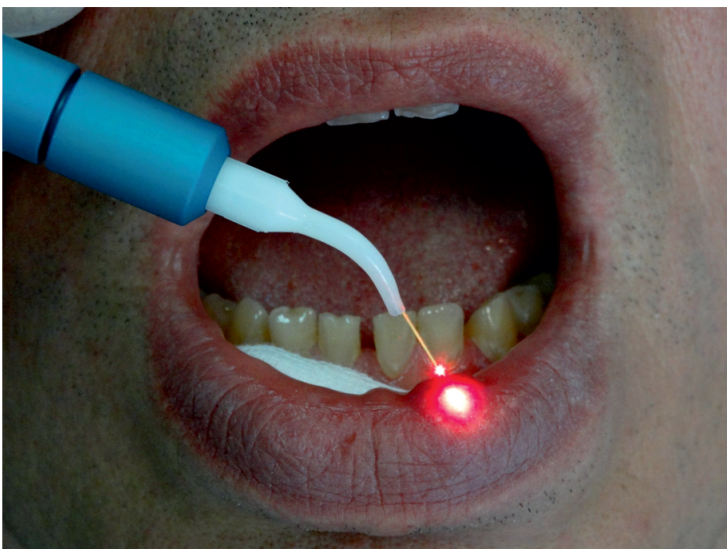
The present study confirmed that the frequency of VL in males is greater than that in women (80% men and 20% women).

All patients received only one procedure. Postoperative pain was minimal in most patients. Only one patient reported scanty bleeding after the secondary trauma of the wound (**Table 2**).

The healing process was completed within 2 to 4 weeks after treatment with no scarring. In most of the patients (65.6%) this period was 2 weeks. Statistical significance was found using correlation analysis between lesions' diameter and its postoperative healing period ( $r = 0.617$ ,  $P < 0.0001$ ) (**Table 3**). None of the typical adverse effects (significant scars, hyper- or hypopigmentation, atrophy, or wrinkled texture) were observed after complete healing (**Figs 3, 4 and 5**).



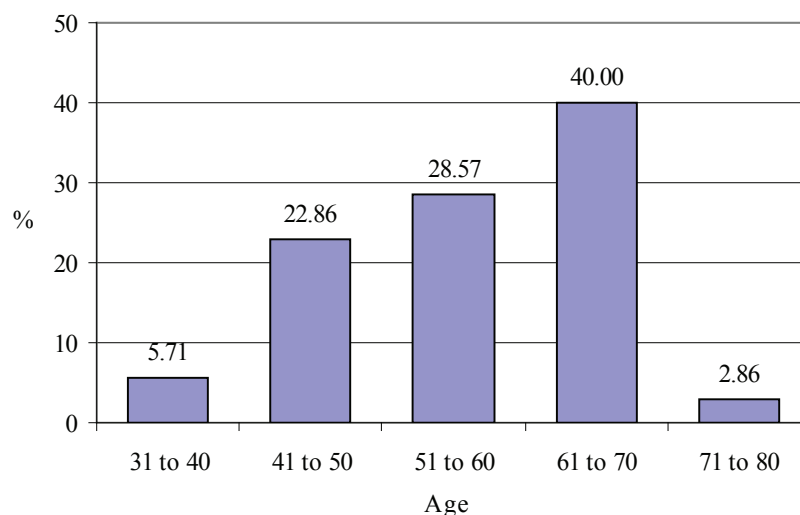
**Figure 1.** 65-year-old male presented with a lesion, approximately 10 mm in diameter, on the left side of his lower lip (vermillion – mucosa border). The lesion appeared blue in colour and was pronouncedly raised.



**Figure 2.** The laser tip was held in noncontact mode, circling constantly around the lesion (3W, continuous wave for 20s).

**Table 1.** Characteristics of VL lesions

Characteristics		N	%
Possible causes based on medical history	Post-traumatic	19	54.3
	Senile	16	45.7
Localization on the lips (vermillion and vermillion - mucosa border)	upper lip	3	8.6
	lower lip	26	74.3
	left angle	2	5.7
	right angle	4	11.4
	elevated	20	57.1
Lesion type	flat	15	42.9
Persisting period (presence of the lesion)	1 year	8	22.9
	more than 1 year	27	77.1
VL size (mm)			
Range		5-15	
Mean $\pm$ SD		7.14 $\pm$ 2.54	



**Figure 3.** Patients' distribution in age groups.

**Table 2.** Early results after VL laser photothermolysis

Characteristics		N	%
Complications	None	32	54.3
	Ulceration	1	45.7
Healing period	14 days	21	65.6
	21 days	9	28.1
	28 days	2	6.3
Postoperative results assessed by the patients	Good	3	9.4
	Very good	29	90.6
Subjective patients' evaluation of the procedure	Acceptable	13	37.1
	Felt Nothing	22	62.9

\*There are missing values because of patients lost to follow-up.

**Table 3.** Mean VL diameter according to the duration of the postoperative healing period

Healing period	N	VL diameter (mm) mean $\pm$ SD	F	P
14 days	21	6.00 $\pm$ 1.18	23.316	< 0.0001
21 days	9	8.78 $\pm$ 2.48		
28 days	2	13.50 $\pm$ 2.12		

## DISCUSSION

Vascular lesion treatment, especially on the face, is based on two major rules: radical elimination and obtaining good functional and aesthetic postoperative results. The main reasons for the treatment of VL are aesthetic considerations or haemorrhaging episodes. It was mentioned that nowadays various

therapeutic modalities are available for VL treatment. Laser treatment such as Nd:YAG laser<sup>6</sup>, CO<sub>2</sub> laser<sup>7</sup>, and diode lasers<sup>5,13,14</sup> have been found to be safe and effective.

The high-intensity diode laser is preferable for VL treatment because of its deeper penetration compared to the other lasers, and selective absorption





**Figure 4.** Clinical view immediately after the procedure and 10 days after treatment.



**Figure 5.** Four weeks postoperative view. The lip is completely healed with the excellent aesthetic outcome, no evidence of scarring or disturbed function.

that minimises injury to the surrounding healthy tissue. In addition, the high-intensity diode laser does not generate textural or pigmentary changes, which are commonly seen when using CO<sub>2</sub> lasers.

The cryosurgery, as an alternative treatment for VL, may result in aesthetic scarring or pyogenic granuloma as a complication, mainly in lesions located on the vermilion border of the lips.<sup>3,15</sup>

Electrocautery could also be used (acting by means of coagulation); it may cause severe scarring due to its non-selective interactions with the tissue.

In this clinical series, the diode laser photocoagulation technique was effective in the treatment of VL, requiring only one session. The postoperative problems resulting from this minimally invasive and bloodless technique were limited to minimal discomfort. This therapeutic approach is also practical because the diode lasers are portable

and have a significantly lower cost than other high-power lasers.

## CONCLUSION

Selective photocoagulation via diode laser is an effective method for treatment of VL. Inpatient care is not required for venous lakes, which are superficial vascular anomalies. Lower morbidity, minimal patient discomfort and satisfactory functional and aesthetic results are favourable for patients. However, clinicians should be careful when using high-intensity diode lasers because they can generate excessive tissue coagulation, leading to severe thermal injury of the surround healthy tissues. Therefore, to optimise the results and to reduce the risks and the adverse effects, basic knowledge of lasers and laser-tissue interactions is requisite.

With continuing advances in the laser techno-

logy and intense pulsed light sources, the clinicians can rely on predictable results with minimal pain, minimal postoperative care, reduced scarring and reduced costs to increase patient satisfaction.

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## Минимальный инвазивный подход при лечении венозного озера с помощью 980 nm лазерного диода с акцентированием на эстетических результатах. Клиническая серия.

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**Введение:** Венозное озеро (VL) представляет собой повреждение сосудов, которое часто встречается у множества пациентов и проявляется в виде возвышающейся папулы от темно-синего до фиолетового цвета, возникшей вследствие расширения венул. Основные причины лечения VL имеют эстетический характер. Геморрагические эпизоды или ухудшение нормальных функций ротовой полости тоже имеют значение. Лечение VL на губах включает хирургическую эксцизию (иссечение), селективную фотокоагуляцию, криотерапию, склеротерапию и электродесикацию. Дополнительной возможностью является использование высокочастотного лазера. Лазерный диод 980 nm diode селективно поглощается гемоглобином и селективно разрушает кровеносные сосуды, доводя до минимума повреждение примыкающих здоровых тканей.

**Ключевые слова:**

венозное озеро, лазерный диод, фотокоагуляция, приобретенные дефекты лица, минимальный инвазивный подход

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**Цель:** Целью настоящего исследования является оценка эффективности лазерного диода при лечении VL повреждений с обращением внимания на послеоперационные дефекты и эстетические результаты.

**Методы:** В данном исследовании приняли участие 35 пациентов в возрасте от 37 лет до 71 года. В неконтактном режиме был использован 980 nm лазерный диод, под местным наркозом, с непрерывной волной (2-3W, в течение 10 s). Со всеми пациентами была проведена одна процедура.

**Результаты:** Процесс восстановления был завершен в течение от 2 до 4 недель после лечения, без рубцов. В рамках процесса восстановления не наблюдались характерные неблагоприятные эффекты.

**Заключение:** Селективная фотокоагуляция представляет собой эффективный метод лечения VL. Благоприятное воздействие на пациентов оказывают низкая степень болезненности, минимальный дискомфорт и удовлетворяющие функциональные и эстетические результаты. В целях оптимизации результатов и сокращения неблагоприятных последствий обязательным условием являются базовые знания в области лазерной техники и взаимодействия лазера с тканями.