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Comparison of photocoagulation with 450 and 980 nm diode lasers in vascular lesions of the lip

Comparación de la fotocoagulación con diodo láseres de 450 y 980 nm en lesiones vasculares del labio

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ABSTRACT

Objective: This paper presents a clinical comparison of a more conservative option for the treatment of localized vascular lesions on the lips with a high-intensity diode laser. **Material and methods:** The treatment of two patients with different wavelengths was reported, 450 nm diode at 2W, and a 980 nm diode laser at 2W, both pulsed. The application was performed in defocused mode, 1 to 2 mm away from the target tissue, in order to promote photocoagulation of the lesion. **Results:** In both patients we obtained the desired result regarding photocoagulation of the lesion, but with the 450 nm blue laser there was a faster healing response compared to the 980 nm infrared laser. **Conclusion:** Surgical laser photocoagulation is an excellent option in the conservative treatment of lesions with vascular malformation.

RESUMEN

Objetivo: Este trabajo presenta una comparación clínica de una opción más conservadora para el tratamiento de lesiones vasculares localizadas en los labios con un láser de diodo de alta intensidad. **Material y métodos:** Se reportó el tratamiento de dos pacientes con diferentes longitudes de onda, diodo de 450 nm a 2W, y un diodo láser de 980 nm a 2W, ambos pulsados. La aplicación se realizó en modo desenfocado, a una distancia de 1 a 2 mm del tejido objetivo, para favorecer la fotocoagulación de la lesión. **Resultados:** En ambos pacientes se obtuvo el resultado deseado en cuanto a la fotocoagulación de la lesión, pero con el láser azul de 450 nm hubo una respuesta de curación más rápida en comparación con el láser infrarrojo de 980 nm. **Conclusión:** La fotocoagulación quirúrgica con láser es una excelente opción en el tratamiento conservador de las lesiones con malformación vascular.

INTRODUCTION

Lip vascular malformation, also called venous lake is nothing more than a variceal or vascular ectasia. It can originate from a capillary aneurysm and has a predilection for sun-exposed areas, so it is often located on the lips and ears of elderly patients. The venous lake is characterized by compressible papules of a reddish-blue color.¹

This type of lesion, when located on the lips, generates the need for treatment without leaving aesthetic sequelae. However, in conventional treatments, this turns out to be somewhat challenging, as it usually culminates in local changes with visual flaws or poor visual outcomes with sensory impairment. The conventional options are surgical excision, cryosurgery, or application of sclerosing agents.

Another therapeutic option, and a more conservative one, is the high-power diode laser, in which the treatment occurs by vaporization or tissue photocoagulation, thus reducing the aesthetic inconvenience usually resulting from traditional treatments.¹

In these cases, the indicated are wavelength lasers with affinity for hemoglobin and oxyhemoglobin, being selective or not for these chromophores. The options are in the spectrum between 450 and 1,000 nm (Figure 1), but the visible lights are more effective in this type of procedure, having an absorption of up to 10 mm in the tissues, promoting coagulation of the vascular malformation.^{1,2}

The high power laser can be applied in focused or unfocused mode. In the focused mode, the application happens in contact with the tissue and



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perpendicular to it, causing a photo-thermolysis interaction, vaporizing the cells. In the defocused mode, the application is done without contact, with the laser slightly distant from the tissue. The energy absorption is lower, presenting other effects at the site, such as coagulation and protein denaturation.^{2,3}

In addition, the more peripheral areas where we have low energy concentration present an interaction of cellular photo-activation, causing tissue photobiomodulation. This interaction participates beneficially in controlling the postoperative inflammatory process, and also promotes local analgesia through the release of chemical mediators.^{2,4}

The most suitable wavelength for this type of treatment is 450 nm (blue), which has great affinity for hemoglobin and is at its absorption peak (Figure 1). With this, its action is more specific and thus provides less tissue damage in adjacent regions.

The literature is vast in studies that bring the advantages of the surgical technique with laser. According to Fornaini,⁵ both the 980 nm (infrared) and the blue have biomodulatory properties, having positive effects for the surgeon and the patient. Some of the benefits are: decreased amount of local anesthetic, decreased trans- and postoperative bleeding, and reduced overall

procedure time. In addition, in many cases there is no need to perform sutures and the patient reports greater comfort in the recovery period, with less pain and edema.^{4,6}

The aim of this paper is to present the report of two clinical cases of photocoagulation in vascular lesions in lip with the high-power diode laser, comparing two distinct wavelengths where in the blue wavelength 450 nm, and infrared (980 nm).

MATERIAL AND METHODS

For this case report, two patients presenting with vascular malformation lesions on the lower and upper lips were selected. The lesions had similar characteristics (flat, circular and purplish in color) and the largest did not exceed more than 10 mm in diameter. Patients M.A.B. and P.D. came to the clinic with mainly cosmetic complaints; however, they also reported discomfort due to swelling due to temperature variation, and when they did physical activity.

The patients were submitted to anamnesis, and then diagnosed with a vascular malformation lesion on the lip, with a suggested intervention to solve the case. The patients were then informed about the treatment through an informed consent form, and they consented to the treatment, as well as to the disclosure of the case.

Initially the patients were anesthetized with infiltrations of 2% lidocaine with vasoconstrictor (Alphacaine 100 - DFL - Rio de Janeiro/RJ 660 - Brazil) being administered in the region below the lesion. In each area an average of 0.3 mL of the anesthetic tube was applied.

After anesthesia the surgical technique of photocoagulation was performed with high power diode laser for the blue wavelength (Medlaser - DMC - São Carlos/SP - Brazil, 450 nm, 600 µm diameter fiber, 2W, pulsed mode, 20 us pulse) and infrared (Thera Laser Surgery - DMC - São Carlos/SP - Brazil, 980 nm, 600 µm fiber diameter, 2W, pulsed mode, 20 us pulse), being applied in a blur mode, without contact, maintaining a distance between 1 to 2 mm from the lesion and making continuous sweeping movements in a circular direction. Once it was verified the visual alteration of the lesion forming an ischemia, the treatment was finished. The average laser application time was 15 seconds. After the procedure the postoperative recommendation was only the use of topical triamcinolone acetone ointment (Oncilon A - orabase - Aspen Pharma - Serra / ES - Brazil).

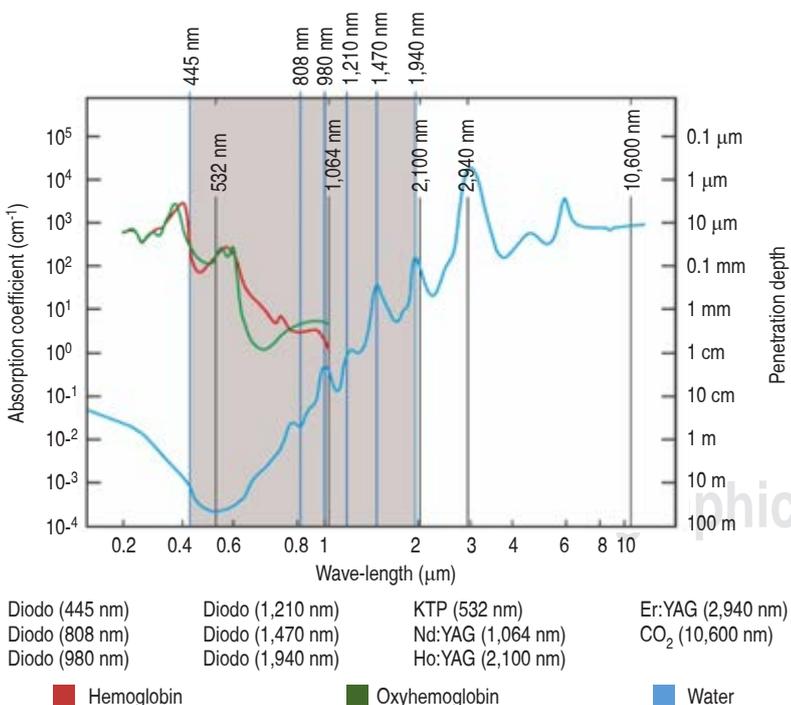


Figure 1: Absorption spectrum of the main chromophores present in biological tissues.

In the first case report, a male patient, M.A.D., with two lesions on the lower lip (Figure 2), the 980 nm laser was used as previously described. In case two, male patient, P.D., with three lesions on the lower lip, the 450 nm laser was used (Figure 3).

Further evaluation was done through clinical visualization and comparative photography, taking into consideration the general appearance of the area, the regression of varicose veins, the repair time, and the color of the region. In addition, the patient's clinical report was also described in the comparative photocoagulation method.

RESULTS

We obtained in both patients an excellent functional and aesthetic result. All lesions were photo-coagulated with the same technique.

The lesions treated with the 450 nm laser were better delimited, and did not present much damage to the adjacent tissues.

The clinical follow-up after surgery was immediate, 14 days, and 90 days; with stability and success in the proposed treatment in both cases. The complete healing happened in a similar way in both cases, and the complaint was solved. It is worth pointing out that the vascular malformation was not removed, only coagulated and atrophied. Thus, visually there will still be a tissue abnormality in the area, but it is completely acceptable from the aesthetic point of view, because there is no more blood leakage.

DISCUSSION

Different treatment options are proposed and effective for vascular malformation on the lips, but the one with the diode laser presents interesting advantages over conventional techniques, such as procedure without bleeding, healing by second intention, faster postoperative, less possibility of aesthetic compromise.

Cryotherapy, for example, can result in aesthetic scars when applied to more specific lesions. The application of sclerosing agents causes fibrosis with hardening of the region. Likewise, surgical removal by complete or partial excision of the lesion will result in loss of soft tissue, with traction of the edges and an apparent scar, besides being a more invasive procedure and with risk of bleeding.

According to Azevedo, the technique with electrocautery is effective, and the equipment is low cost, but it can cause burns on the lip border, and thus provide an esthetic problem.¹

The literature shows that the use of the diode laser is a safe option with fewer risks or sequelae than the others shown.¹ In the great majority of cases, only one irradiation is needed to obtain coagulation of the lesion. In addition, the patient reports less discomfort and little or no cosmetic complaints.¹⁻³ In the case of larger lesions as in our case report, the use of the blue laser (450 nm) is more indicated because it has a higher absorption in hemoglobin than the infrared laser (980 nm). Thus, for deeper lesions and with larger areas a suggestion is the indication of the 450 nm laser.^{1,2,5}



Figure 2: A) Initial clinical case 1 showing the vascular lesion on the lip. B) Application of the blue laser (450 nm). C) Immediate postoperative period. Evidence of photocoagulation with characteristic of tissue denaturation. D) 14 days postoperative. E) 90 days postoperative.

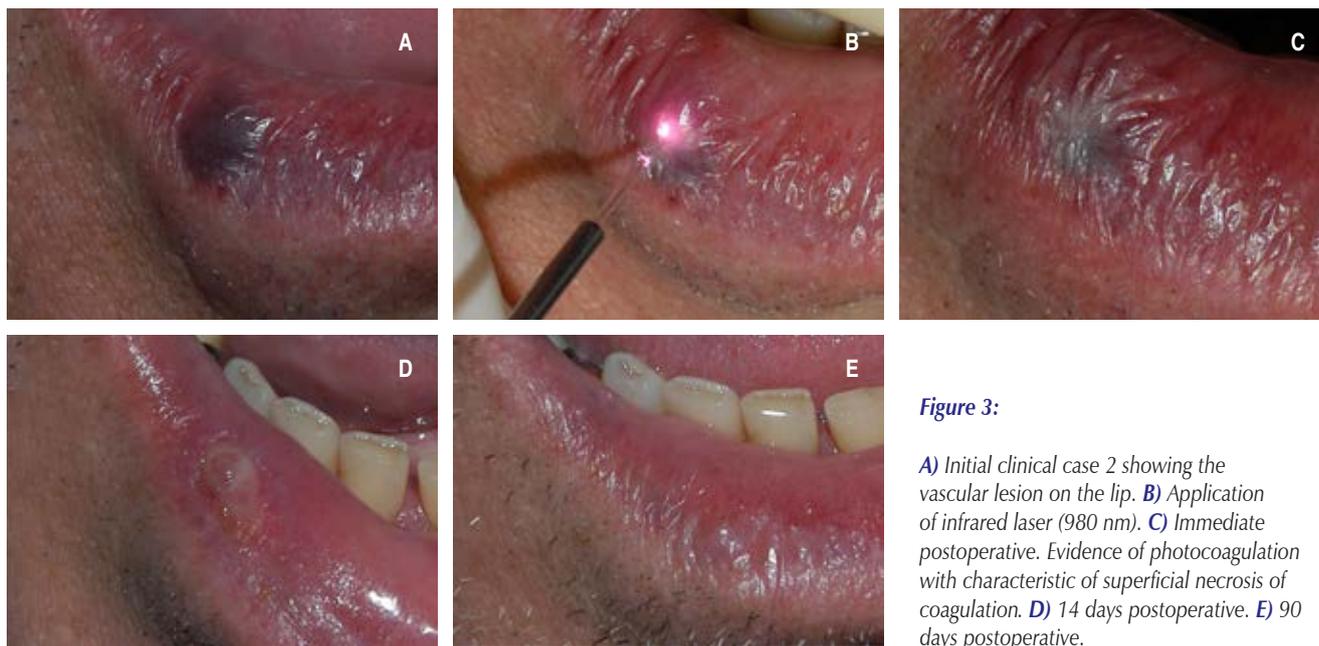


Figure 3:

A) Initial clinical case 2 showing the vascular lesion on the lip. **B)** Application of infrared laser (980 nm). **C)** Immediate postoperative. Evidence of photocoagulation with characteristic of superficial necrosis of coagulation. **D)** 14 days postoperative. **E)** 90 days postoperative.

The diode laser also has advantages over other high-intensity laser equipment such as neodymium, erbium, CO₂, because its cost is much lower, it allows portability without de-calibration of the laser emitter or the mirrors present in some equipment, and it is more compact and simple to operate.^{3,4}

In relation to the conventional techniques, the laser has a higher cost, both because of the need to acquire the equipment, as well as the wear on the optical fiber, in which after each treatment a portion of the fiber is discarded.

The photocoagulation with the surgical diode laser is the technique that has shown more benefits and safety, and is more acceptable to the patients. Because there is no cutting, no bleeding, no need for suture, it is performed with little anesthetic infiltration, and presents a more physiological tissue repair, without aesthetic or sensory damage to the patient. Besides causing little or no postoperative pain.¹

CONCLUSION

The photocoagulation of vascular lesions on the lip is a simple and safe technique, being indicated with success in the proposed treatment.

The two wavelengths were effective, but the blue laser 450 nm for presenting greater absorption for hemoglobin, presented itself more selective and presents a more precise and biological indication, avoiding damage to healthy tissues.

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