

## Laser treatment in oral and maxillofacial vascular tumors and malformations

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### Summary

Vascular tumors and malformation in the facial and oral region are more frequently seen at youngest and oldest ages. These vascular lesions localized especially on exposed sites, disturb the physiognomical aspect and may cause significant psychological distress. The classification distinguishes tumors and vascular malformations as: telangiectasia, hemangioma, lymphangioma, arteriovenous malformations. With the advent of laser therapy in medicine, treatment of vascular tumors is performed using laser. A number of studies described the use of Argon laser, Nd-YAG laser or CO<sub>2</sub> laser for treatment of vascular tumors and malformations, with good results.

**Objective.** To evaluate the efficacy of 980 nm (Ga-Al-As) diode laser photocoagulation for treatment of oral and maxillofacial vascular tumors and malformations that had failed to respond to other therapies.

**Methods.** Eighteen consecutive patients with either tumors or vascular malformations of the head and neck were treated with laser photocoagulation.

A 980 nm (Ga-Al-As) diode laser type CERALAS D15 was used for the treatment, in continuous mode (cw). An interstitial technique was practiced in three stages, first stage after clinical diagnosis confirmed by Doppler sonography, second stage one month after and third stage two months after first treatment. Decrease in the area of the target lesion, amount of energy applied to achieve reduction in size was evaluated by clinical measures of the lesion, Doppler sonography and photographically in all stages of treatment comparatively.

**Results.** Long-term follow-up demonstrated regression of the lesion in all eighteen patients with good aesthetic results. The range of reduction in size was 40% to 80%. No re-expansion of the lesions was noted after a mean follow-up of 6 - 12 months.

**Conclusions.** Interstitial photocoagulation with diode laser of tumors and vascular malformations is an effective treatment for carefully selected patients. Photocoagulation properties of 980 nm diode laser have been confirmed to be an alternative to treat vascular tumors. When properly applied, this technique can achieve reduction in the size of these lesions without compromising cosmetics.

**Keywords:** 980 nm (Ga-Al-As) diode laser, vascular tumors, vascular malformations, interstitial photocoagulation.

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## Introduction

Vascular tumors in the facial and oral region are more frequently seen at youngest and oldest ages, as well. These vascular lesions localized especially on exposed sites, affect the physiognomical aspect and may cause significant psychological distress. The classification distinguishes vascular tumors as: telangiectasias, hemangiomas, lymphangiomas, arteriovenous malformations. In a careful clinical examination, hemangiomas are usually self-evident. In the oral cavity, they appear on the lips, oral mucosa, palate and other sites [1,2].

The exact diagnosis and extent of the tumor must be determined before any treatment, because the visible portion may represent only the tip of the lesion. For this purpose some authors used color-Doppler imaging, magnetic resonance (MR) imaging or color-coded duplex ultrasonography to detect the depth of the lesions [3,4,5].

Injection of sclerosing agents, solid embolizing materials followed by surgical excision are usually used for the treatment of vascular tumors and malformations. Cryotherapy was also used in the treatment of these vascular tumors with good results [6,7,8]. In the last few years, with the advent of laser therapy in medicine, treatment of vascular tumors was attempted with the Argon laser, Nd-YAG laser, CO<sub>2</sub> laser, 980 nm diode laser or KTP with good results [9,10,11,12].

The **aim** of this study is to evaluate the efficacy of interstitial 980 nm (Ga-Al-As) diode laser photocoagulation in the treatment of vascular tumors located on the oral and maxillofacial areas.

## Methods

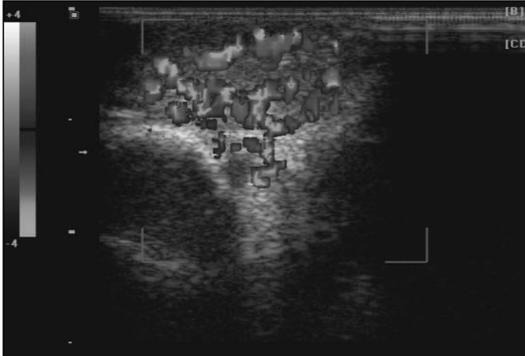
Eighteen patients (5 male and 13 female patients) with different type of vascular tumors of oral and maxillofacial regions were treated in our clinic between January

2005 and December 2005. The age of the treated patients varied between 1 year and 75 years, the mean age was 38 years. Color Doppler ultrasonography was used for an accurate diagnosis, in order to acquire additional information about the vascularization of these tumors, as well as the size of the tumours (*Figure 1*). An interstitial technique of laser therapy was applied using an 980 nm (Ga-Al-As) diode laser type CERALAS D15, in continuous mode (cw), power was P = 10-12 W and energy varied with the volume (1000 J/cm<sup>3</sup>). Under local or general anesthesia, a flexible laser fiber with diameter of 320 μm was introduced into the lesion via a 22-gauge needle, and the laser fiber was advanced in radial direction as photocoagulation proceeded within the tissue (*Figure 2*). The interstitial technique was performed in three stages with one laser irradiation on each stage, first stage after clinical diagnosis confirmed by color Doppler ultrasonography, second stage one month after and third stage two months after first treatment. The decrease in the size of the target lesion and the amount of energy applied to achieve reduction in size was evaluated by clinical measurements of the lesion, color-Doppler ultrasonography measurements and photometry comparison in all stages of treatment.

## Results

After interstitial laser therapy we obtained a reduction of treated vascular tumors in all 18 patients with good cosmetic results (*Figure 3, Figure 4*). The volume regression of vascular tumors varied between 40% and 80% (*Figure 5, Figure 6*). The age groups were very different in our study, 8 patients between 1-9 years, 6 patients between 20-50 years and 4 patients over than 60 years. The color-Doppler ultrasonography showed a significant difference before and after treatment, with a reduction of vascular signal in these tumors (*Figure 7*).

**Figure 1.** Color-Doppler ultrasonographical aspect of the internal orbital angle hemangioma before treatment



**Figure 2.** Laser photocoagulation of an oral soft tissue hemangioma (intrasurgery aspect)



**Figure 3.** Intraoral view of a hemangioma on the tongue before treatment



**Figure 4.** Same patient as in Figure 3 after two months of laser therapy



**Figure 5.** Intraoral view of a cavernous hemangioma on the oral mucosa before treatment



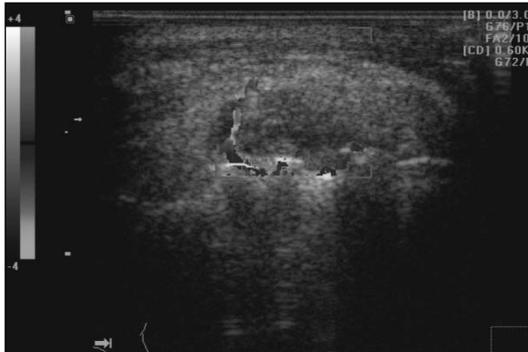
**Figure 6.** Same patient as in Figure 5 after one month of interstitial laser therapy



The healing process after each stage of laser treatment evolved without any scars or other complications. After a mean follow-up of 6 to 12 months no reexpansion was noted clinically and in ultrasonography (*Figure 8*). The patients had no complaint about pain or

functional discomfort in the treated areas during and after laser treatment. All patients were satisfied with the laser treatment and agreed to continue the treatment if necessary.

**Figure 7.** Color-Doppler ultrasonographical aspect of the internal orbital angle hemangioma, with a reduction of vascular signal after treatment (same patient as in Figure 1)



## Discussion

This study represents our preliminary clinical experience with the application of 980 nm (Ga-Al-As) diode laser in the treatment of vascular tumors and malformations in the oral and maxillofacial field.

The 980 nm wavelength produced by the (Ga-Al-As) diode laser has similar effects in tissue coagulation with the Nd:YAG laser, confirmed by other authors [13]. By using this type of laser, reduction of vascular tumors could be obtained with interstitial laser therapy.

This interstitial laser photocoagulation technique is similar to other interstitial techniques used in different parts of the body for the treatment of hemangioma or other vascular malformations [14]. Our results show that application of the interstitial diode laser photocoagulation causes regression in hemangiomas, similar with the results of other studies using interstitial Nd:YAG laser treatment [15,16]. We obtained a healing process with no scars and no reexpansion of the hemangiomas, as reported by other studies using the diode laser (980 nm) [17].

The results of this study with the interstitial 980 nm (Ga-Al-As) diode laser therapy of vascular tumors demonstrate a high effectiveness of this novel therapy modality. For this reason we might continue the study for a long-term follow-up.

**Figure 8.** Ultrasonographical aspect at the same patient as in Figure 1 at 6 months after laser treatment with no reexpansion of hemangioma



The color-Doppler ultrasonography represents an important instrument for diagnosis and postoperative evaluation of results. This imaging technique should be recommended for routine preoperative and postoperative application in hemangiomas [3,5].

As a difference, we used a different wavelength (980 nm), a different type of laser (diode laser), energy density, power and a different procedure of photocoagulation. In our study we treated patients of various age groups.

## Conclusions

Photocoagulation through laser therapy is a new kind of treatment for the vascular tumors and malformations. In some cases it is the only alternative for the treatment. The advantages of this method consist in the real comfort during and after the surgery, both for the doctor and the patient.

With this method we can reduce the risks during and after the surgery because of the minimal bleeding during the procedure and also because of the rapid healing, without any complications.

In cases of correctly selected patients the method turns out to be an advantageous alternative. If the laser therapy is correctly applied, it triggers complete or partial reduction of the vascular tumors and malformations. The aesthetical results are very good in most of treated patients.

## References

1. Wood NK, Goaz PW. *Differential Diagnosis of Oral and Maxillofacial Lesions*. Fifth Edition. Mosby, 1997: 49-355.
2. Regezi JA, Sciubba J. *Oral pathology. Clinical-Pathologic Correlations*. Second Edition. W.B. Saunders Company, 1993: 136-585.
3. Offergeld C, Schellong S, Hackert I, Schmidt A, Huttenbrink KB. Interstitial Nd:YAG laser therapy. Color-Doppler imaging (CDI)-guided laser therapy of hemangiomas and vascular malformations. *HNO* 2003; **51**(1): 46-51.
4. Wacker FK, Cholewa D, Roggan A, Schilling A, Waldschmidt J, Wolf KJ. Vascular lesions in children: percutaneous MR imaging-guided interstitial Nd:YAG laser therapy – preliminary experience. *Radiology* 1998; **208**(3): 789-794.
5. Offergeld C, Schellong SM, Daniel WG, Huttenbrink KB. Value of color-coded duplex ultrasound in interstitial laser therapy of hemangiomas and vascular malformations. *Laryngorhinootologie* 1998; **77**(6): 342-346.
6. Bauman NM, Burke DK, Smith RJ. Treatment of massive or life-threatening hemangiomas with recombinant alpha(2a)-interferon. *Otolaryngology Head and Neck Surgery* 1997; **117**(1): 99-110.
7. Van Doorne L, De Maeseneer M, Stricker C, Vanrensbergen R, Stricker M. Diagnosis and treatment of vascular lesions of the lip. *British Journal of Oral and Maxillofacial Surgery* 2002; **40**(6): 497-503.
8. Vazquez-Doval FJ, Vicente FJ. Treatment of oral vascular anomalies by transfixion technique. *Dermatology Surgery* 1998; **24**(10): 1087-1091.
9. Parkin JL, Dixon JA. Argon laser treatment of head and neck vascular lesions. *Otolaryngology Head and Neck Surgery* 1985; **93**(2): 211-216.
10. Gosepath K, Pfeiffer N, Mann WJ. Treatment of cavernous hemangiomas with the neodymium:YAG laser. *Laryngorhinootologie* 1997; **76**(5): 284-288.
11. Lambrecht JT, Stubinger S, Hodel Y. Treatment of intraoral hemangiomas with the CO2 laser. *Schweiz Monatsschr Zahnmed* 2004; **114**(4): 348-359.
12. Clark C, Cameron H, Moseley H, Ferguson J, Ibbotson SH. Treatment of superficial cutaneous vascular lesions: experience with the KTP 532 nm laser. *Lasers in Medical Science* 2004; **19**(1): 1-5.
13. Rastegar S, Jacques SL, Motamedi M, Kim B-M. Theoretical analysis of equivalency of high-power diode laser (810nm) and Nd: YAG Laser (1064nm) for coagulation of tissue: Predictions for prostate coagulation. *SPIE Vol. i646 Laser-Tissue Interactions* 1992; 150-160.
14. Clymer MA, Fortune DS, Reinisch L, Toriumi DM, Werkhaven JA, Ries WR. Interstitial Nd:YAG photocoagulation for vascular malformations and hemangiomas in childhood. *Arch Otolaryngology Head and Neck Surgery* 1998; **124**(4): 431-436.
15. Werner JA, Lippert BM, Gottschlich S, Folz BJ, Fleiner B, Hoefl S, Rudert H. Ultrasound-guided interstitial Nd: YAG laser treatment of voluminous hemangiomas and vascular malformations in 92 patients. *Laryngoscope* 1998; **108**(4): 463-470.
16. Vesnaver A, Dovsak DA Treatment of vascular lesions in the head and neck using Nd:YAG laser. *Journal of Cranio-Maxillofacial Surgery* 2006; **34**(1): 17-24.
17. Romanos G, Nentwig GH. Diode laser (980 nm) in oral and maxillofacial surgical procedures: clinical observations based on clinical applications. *Journal of Clinical Laser Medicine and Surgery* 1999; **17**(5): 193-197.

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