Clinical Study

Treatment of Leg Telangiectasia (Spider Veins) with Magma Long Pulse ND - Laser 1064 nm – Case Study

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1. Introduction

The superficial vascular lesions in aesthetic medicine practice include majorly hemangiomas, telangiectasias (face & lower limbs), spider nevus (spider angioma) and varicose leg veins. These lesions consist of dilated blood vessels with a linear or spider appearance. They usually measure between 0.5 and 1 mm and can be associated with a variety of conditions such as rosacea, scleroderma, dermatitis, chronic alcoholism, pregnancy, etc. Predisposing risk factors of spider angiomas and facial telangiectasis include bright skin phototypes (I – III), a history of significant sun exposure and longstanding rosacea. The distribution of spider angiomas is usually focal, with single lesions on the face, neck, chest or other sun exposed areas. A central feeder arteriole with branches leads to a “spider like” appearance of these lesions. The vessel diameter is around 0.1 – 0.5 mm. Leg veins anomalies arise from gravitational dilatation, reflux and incompetent venous valves. They include spider veins, reticular veins, perforators, tributaries and varicose veins arising within the system of greater and smaller saphenous vein. The treatments by laser technologies include the majority of patients who present these vascular lesions seen in cosmetic dermatologic surgery and aesthetic medicine. The most commonly used laser devices for these treatments include the 532 nm potassium titanyl phosphate (KTP), 595 nm pulsed dye laser (PDL) and the 1064 nm neodymium yttrium aluminum garnet laser (Nd:YAG). Their mechanism of action is based on the theory of selective photothermolysis. The selective absorption of the light energy by the target chromophore at specific wavelengths of light is converted into thermal energy, allowing for selective denaturation of hemoglobin with only minimal damage to the surrounding tissues. For an effective treatment the laser needs to penetrate to the depth of the target vessel. In addition, the laser exposure needs to be long enough to cause sufficient coagulation of the vessel. This allows a selective destruction of superficial vascular lesions with minimal scars formation.

The long pulse 1064 nm ND laser shows a significant deeper penetration in comparison to the above mentioned green light lasers with a discrete selectivity for hemoglobin. However, the prevalence of the scattering optical phenomenon over the absorption one confers the 1064 nm ND laser superior performance in the treatment of deep vessels and dark skin types.

2. Materials and methods

3 patients, two females and one male were treated in one single session with a long pulse ND 1064 nm laser (Magma – Formatk Systems, Israel). 3 lesions areas were chosen, all in lower limbs (lat. tight, lat. calf and inner knee). The treated vessels in the study measured between less than 1 mm to 2 mm of diameter size. Their color changed from red to purple – blue according to the variation of depth. 3 mm tip size was used in all cases. Fluence levels were set based on the vessel diameter and depth, starting at 200 J/cm^2 up to 360 J/cm^2. These fluence values were obtained by using a burst composed of two single pulses carrying each half of the set energy which added together gives the amount of the aforesaid energy. The pulse duration was set at the range of 40 ms – 80 ms. During the treatments an ice roller was used to cool down the skin surface in order to reduce the painful perception and eventual side effects to the epidermis. The study aimed to establish the rate of capillary clearance and to describe the onset of any adverse events. The clinical endpoint has varied during the treatments depending on the size and depth of the treated vessel. In some cases, an immediate bleaching was observed, especially in the smallest red capillary. In other cases a color transformation was observed from red to purple. In each treated lesion, a control of the vessel re-fill was performed by pressing with the thumb on the vessel immediately after the action of the laser. In case of an immediate re-filling of the vessel, some additional pulses were delivered to the lesion until obtaining the desired cauterization. One single treatment session was programmed for this study and a follow up check 4 weeks after the treatment.

The inclusion criteria were: leg telangiectasia (Spider Veins) having a diameter up to 2 mm, age between 18 – 60 Y.O, signing a proper informed consent. Exclusion criteria were: pregnancy, CVI, other professional treatments in the present or the past of the same vascular lesions (laser therapy, sclerotherapy, etc.), vessels dimensions > 2 mm, assumption of photosensitizers (i.e. Isoteretinoin). After the laser treatments, all patients were instructed to apply a lenitive cream (Biafin – Trolamine) and to avoid sun exposure or artificial tanning. Photographs were taken before the treatment and 4 weeks afterwards. Subjects were assessed for immediate side effects, including pain, erythema, edema, bruising, blistering, and crusting as well as long term side effects including pigmentary alteration and scarring. Pain was graded by the patients on a scale of 0 (least pain) to 10 (most pain). (Fig.1)

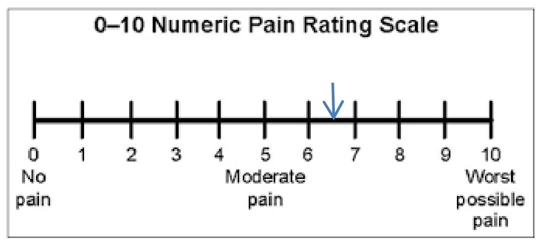

Fig. 1: VAS score used for the evaluation of pain level

The degree of improvement was assessed by comparing digital photographs B&A, which were rated on a quartile scoring system: 0 no change, 1 ≤ 25%, 2 ≤50%, 3 ≤ 75%, and 4 up to 100% clearance.

3. Results

Lesion N.	Clearance %	Score
1	90	4
2	80	4
3	60	3

Fig. 2: Clearance evaluation in percentage & scoring of treated capillary 4 weeks post treatment.

As can be seen in Fig. 2, all 3 lesions obtained a remarkable improvement after one single treatment, 60% - 90% of clearance (average score 3.66). Erythema and edema occurred in all subjects immediately after treatment and lasted up to 4 days. There was no occurrence of blistering, crusting, pigmentary alteration, or scarring. The evaluation of pain level during the treatments shows a range of perception that varies from 5 to 7 (moderate to intense) with an average of 6.30 (Fig. 3)

Patient N.	VAS score
1	5
2	7
3	7

Fig. 3: Evaluation of pain perception using a VAS 1-10 score

Case 1 (Inner Knee): Before

Case 1 (Inner Knee): After

Case 2 (Lat. Tight): Before

Case 2 (Lat.Tight): After

Case 3 (Lat. Calf): Before

Case 3 (Lat. Calf): After

4. Discussion

The ND: YAG long pulse laser, which shows greater tissue penetration and a certain selectivity for hemoglobin, found in recent years increasing use of the deep and superficial vascular lesions. Thickness and depth of the vessels causes often a slight responsiveness to traditional green beam lasers treatments. The 1064 nm wavelength has the deepest penetration capacity of optical energy in the tissue among all other lasers (Fig. 4). It has a clear predominance of diffusion (Scattering) as optical interaction phenomenon with the tissue, over absorption which occurs in minor way in hemoglobin and negligibly in melanin. When the radiation passes through the tissue, the collimated component is converted almost completely into diffused light; consequently the thermal propagation is relatively deep in comparison to other wavelengths that allow greater absorption in the chromophores.

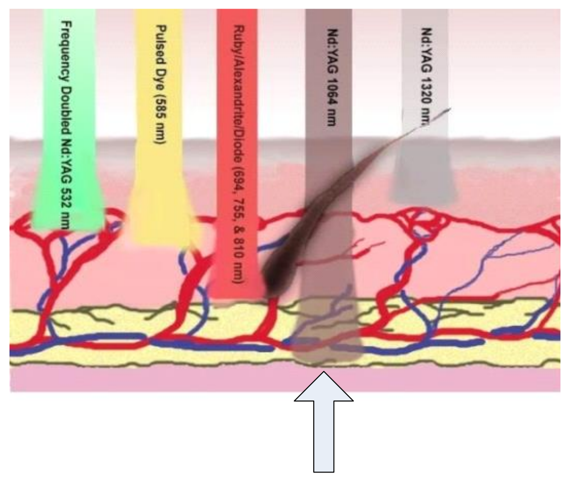

Fig. 4: penetration of 1064 nm Nd:YAG in the tissue

According to theory of selective photothermolysis the setting of electro-physical parameters such as, energy levels and exposure duration must be optimized to achieve desirable clinical results. It is shown that smaller spot sizes with moderate fluences (100–400 J/cm2) and longer pulse durations (10–100 ms) were most effective and most tolerable to patients. Finding a solution for small vessels up to 1.5 mm in depth with light red, purple or blue and violet color has been a longstanding challenge. Nd:YAG lasers have a great depth of penetration, low absorption in *melanin and relatively higher absorption in oxyhemoglobin. Black and Barton showed that the laser photothermal coagulation of blood in vitro is a complicated process involving time and temperature dependent changes in both optical and structural properties. Mordon claimed that met-Hb should account for observations in the treatment of lower-extremity telangiectases using Nd:YAG lasers at 1064 nm. One possible explanation for this is the abrupt increase in absorption at 1064 nm resulting from the met-Hb conversion. Black and Barton gave evidence of an Hb absorption spectrum shift, red blood cells shape changes and coagulation on both molecular and macroscopic scales. Furthermore, due to heat generation in the bulk tissue, a phenomenon of protein denaturation may occur. Some studies show evidence of decrease of absorption intensity by red blood cells after 70 seconds of Nd:YAG 1064 nm, laser irradiation, due to protein denaturation. Blood vessels with a 0.1 mm diameter have a thermal relaxation time (TRT) of about 5 ms, while a 0.3 mm vessel has a 40 ms TRT, and increasing the diameter to 1 mm brings its TRT up to 500 ms. Generally higher fluences and shorter pulse durations are required to blanch smaller and redder vessels. Side effects were minimal and included erythema and edema immediately after treatment. Subjects described discomfort as moderate to intense. The pain sensation faded once the laser ceased .Improvement usually occurred shortly after the treatment and was clearly visible 4 weeks post treatment at the follow up control. These results were seen in the treatment of violet, bluish and red leg telangiectases. The use of the Magma ND applicator in this study, allowed for vast variations in the chosen fluence and pulse duration. This makes possible the adaptation of the parameters according to individual needs in terms of vascular characteristics such as diameter and depth of the vessels.*

5. Conclusions

The Magma long pulse 1064 nm ND has demonstrated effectiveness and safety in the treatment of leg telangiectasia red, purple and bluish up to 2 mm diameter in one single treatment. The ability to adjust fluence and pulse duration independently was particularly useful to the achievement of desired end point in each treatment. An extended follow-up up to one year would be useful to test the long-lasting effect. It would also be a dutiful in the future to conduct a comprehensive study by increasing the number of variables, subjects, treatments and follow-up time.

6. References

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