Variable Long-Pulse Nd:YAG Laser: A New Way To Treat Difficult Vascular Lesions

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Background and Objective:
The 1064 nm Nd:YAG laser has proved to be one of the most useful light sources for the treatment of deep vascular lesions. A deeper penetration and a lower absorption by haemoglobin makes this wavelength more useful for the treatment of deep or thick vascular lesions than the traditionally used shorter wavelengths (KTP, pulsed dye, IPL, diode) (Figure 1). However, problems with previously used Nd:YAG devices such as limited parameter combinations and pulse durations, non-optimal cooling systems, and uneven fluence distribution made them of limited value for the treatment of superficial or facial vascular lesions, as pain or risk of burning were common events. Since adequate absorption of this wavelength is achieved by haemoglobin, a system able to control depth of penetration through appropriate spot selection (Figure 2), with variable pulse duration to adjust to different vessel diameters, high fluences and optimal cooling systems to avoid pain or burning, should theoretically be able to treat any vascular lesion both superficial and deep or thick. An Nd:YAG laser with variable spot sizes (3, 5, 7 and 10 mm), highly-variable pulse duration (0.1-300 ms) and high fluences (up to 300 J/cm^2) (CoolGlide Vantage, Cutera) was evaluated for the treatment of a wide spectrum of vascular lesions.

Material and Methods:
From March 2003 to October 2004 about 135 patients with vascular conditions such as rosacea-couperosis, facial telangiectasia, poikiloderma of Civatte, haemangiomas of infancy, tuberous haemangiomas, flat and tuberous port wine stains (PWS), leg veins and arteriovenous malformations were treated. The 3 and 5 mm spot sizes were used for superficial lesions (telangiectasias, couperosis-rosacea, poikiloderma of Civatte, flat haemangiomas…) whereas the 5 or 7 mm spot sizes were selected for thicker or deeper ones (tuberous haemangiomas or PWS, leg veins…). Pulse durations were selected according to the estimated vessel size of each lesion: 0.3-5 ms for thin, 10-25 ms for medium and 25-55 ms for thick. Variable fluences (from 14 to 195 J/cm^2) were used. All the parameters were individually adjusted according to personal experience and immediate reaction (clearing or colour change on vessels, threshold effect on haemangiomas or PWS) on each treatment. Topical anaesthesia with 2% Lidocaine (EMLA®) 1 hour prior to treatment was used for larger haemangiomas or PWS.

Results:
A high response rate was obtained for all indications. Especially impressive were the results on rosacea, leg veins, tuberous or thick hemangiomas and PWS. No response was observed on few patients (patients with ulerythema ophryogenes, rosacea of the nasal ala, and arteriovenous malformation). Secondary effects were rare and transient and included mild superficial burns (3 patients), limited purpura (2 patients), transient hypopigmentation (1 patient) and transient facial pain and edema (2 patients). Moderate pain was reported on deeper or thicker lesions and decreased with longer or additional cooling with ice packs.

Conclusion:
The high penetration and sufficient, but not excessive, haemoglobin absorption of the 1064 nm Nd:YAG wavelength offers the possibility to treat deep or thick lesions that are not accessible with shorter wavelengths. The option to tailor the treatment for every patient according to the characteristics of their lesions is responsible for the high success rates on all lesions achieved in our experience. The lower absorption by melanin and the high efficiency of the cooling device of our equipment explains the low rate of secondary effects. A 1064 nm Nd:YAG laser with an optimal equipment design, as the one used in our study, permits us to treat any kind of vascular condition with high rates of success and safety.

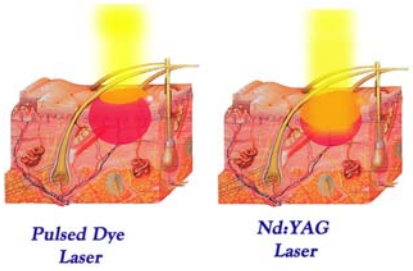

Figure 1

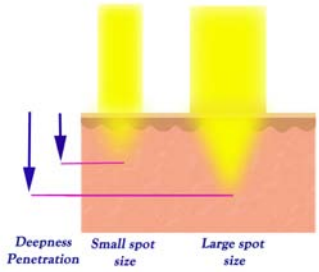

Figure 2

Case 1: Patient with fine telangiectasia on the nose before and 1 month after 1 treatment (3 mm, 8 ms, 165 J/cm^2)

Case 2: Patient with leg telangiectasia and veins before and 4 months after 1 treatment (3 mm, 10 ms, 175-195 J/cm^2; 5 mm, 15 ms, 155-165 J/cm^2; 7 mm, 25 ms, 135 J/cm^2)

Case 3: Patient with thick telangiectasia on the nose before and 1 month after 1 treatment (5 mm, 15 ms, 155-165 J/cm^2)

Case 4: Patient with leg telangiectasia and veins before and 2 months after 2 treatments (3 mm, 10 ms, 175-195 J/cm^2; 5 mm, 15 ms, 155-165 J/cm^2; 7 mm, 20 ms, 140 J/cm^2)

Case 5: Patient with leg telangiectasia and veins before and 2 months after 1 treatment (3 mm, 10-15 ms, 165-195 J/cm^2; 5 mm, 15-20 ms, 145-175 J/cm^2; 7 mm, 35 ms, 145-155 J/cm^2)

Case 6: Patient with congenital, rapidly growing and bleeding haemangioma on the forehead before and 1 month after 1 treatment (7 mm, 15 ms, 65-80 J/cm^2)

Case 7: Patient with tuberous haemangioma on the face before and 6 months after 4 treatments (7 mm, 30 ms, 65 J/cm^2; 5 mm, 10-20 ms, 70-80 J/cm^2; 3 mm, 3 ms, 95 J/cm^2)

Case 8: Patient with PWS before and after 5 treatments (7 mm, 20 ms, 65 J/cm^2; 5 mm, 5-15 ms, 75-95 J/cm^2)

Case 9: Patient with PWS before and after 4 treatments (7 mm, 10 ms, 65-75 J/cm^2; 5 mm, 5 ms, 80-95 J/cm^2; 5 mm, 0.3 ms, 18 J/cm^2)

Case 10: Patient with rosacea before and 3 months after 2 treatments (5 mm, 0.3 ms, 16 J/cm^2, 5000 shots, 5Hz)

Case 11: Patient with medium size telangiectasia on the face before and 2 months after 1 treatment (3 mm, 10 ms, 155-175 J/cm^2).

Case 12: Patient with poikiloderma of Civatte before and 6 months after 3 treatments
(5 mm, 10 ms, 85 J/cm^2;
5 mm, 5 ms, 95 J/cm^2;
5 mm, 0.6 ms, 34 J/cm^2)

Case 13: Patient with VHC hepatitis and spider haemangiomas on the chest before and 1 month after 1 treatment (3 mm, 8 ms, 165-175 J/cm^2;
5 mm, 10-15 ms, 120-165 J/cm^2;
5 mm, 0.3 ms, 16 J/cm^2).