

532-nm diode laser targets facial problems

Richmond, Va. — Early laser treatments of facial telangiectasias were performed with continuous wave carbon dioxide (10,600 nm), and argon (488-nm and 514-nm) lasers as well as neodymium Nd:YAG (10,600) systems, noted Joseph Niamtu, D.D.S., oral and maxillofacial surgeon specializing in cosmetic surgery.

"The major drawback of these lasers was the fact that they successfully destroyed the ectatic vascular tissue as well as the overlying epidermis in a nonselective fashion," said Dr. Niamtu, a fellow with the American Academy of Cosmetic Surgeons. "This nonselective heat dissipation resulted in a high incidence of scarring and hypo- or hyperpigmentation. These lasers were in effect sophisticated forms of electrocautery."

Dr. Niamtu noted that, in 1982, Anderson and Parrish revolutionized laser surgery in a classic paper describing the concept of selective photothermolysis.

They hypothesized that selective thermolysis could be predicted by choosing the appropriate wavelength, pulse duration, and pulse energy for a particular chromophore target. The two key conclusions, Dr. Niamtu added, were that the wavelength of the laser light must be absorbed by the target in order to have a treatment effect, and that the laser energy must be confined to the intended target to spare the surrounding tissue from damage.

Vasoactive mediators have been implicated in vascular neogenesis in the formation of telangiectasia

The 585-nm flashlamp pumped-pulsed dye laser has become the gold standard for which other vascular lasers are judged, he noted. Clinical drawbacks of the pulsed dye laser include purpura, costly field service for tube or dye replacements, mirror collimation, and overheating of the machine and the treatment room, he explained.

Just as transistors made vacuum tubes obsolete, semiconductor diode-pumped lasers are replacing vacuum tube and flash-

lamp-pumped lasers, Dr. Niamtu reported.

He said the Diolite 532-nm diode laser (Iridex, Inc. Mountain View, Calif.) is a lightweight, portable laser about the size of a VCR. The laser weighs 15 pounds (6.8 kg) and requires a standard wall outlet.

The 532-wavelength is a green light and is obtained by a process known as frequency doubling.

Diodes are commonly used in many devices such as bar code readers and CD players. A high-powered diode laser at 808 nm is used to optically pump a Nd:YAG (neodymium:yttrium-aluminum-garnet) crystal that produces 1064 nm of light. This light is then focused onto a KTP (potassium titanyl phosphate) crystal to double its frequency, which halves the wavelength, producing a 532-nm wavelength. A red diode-aiming beam is added to target the 532-nm beam.

The diode-pumped, frequency-doubled Nd:YAG laser is referred to as the DP FD Nd:YAG laser a diode laser, millisecond, or a "KTP" laser.

According to Dr. Niamtu, in private practice in Midlothian, Va., the absorption of green light at 532 nm by oxyhemoglobin is very high; the wavelength is also absorbed by melanin.

"This is an advantage as the 532-nm diode laser may be used to treat selected vascular pigmented lesions," he said.

Pulsed dye lasers produce pulses of 450-μsec to 1.5-ms duration.

"These pulse durations produce selective treatment of vascular lesions; however, the 585-nm flashlamp pumped pulsed-dye laser causes violent vaporization of blood within the vessel," Dr. Niamtu said.

"The very short pulses of 450 μsec (0.45 ms) heat the oxyhemoglobin so rapidly that it creates a steam bubble and bursts holes in the vessels. This destruction of the vessel with resultant extravasation of red blood cells gives rise to clinical purpura."

In contrast, Dr. Niamtu noted, the 532-nm diode laser delivers pulse durations from 1 ms to 100 ms, which provide selective photothermolysis without purpura.

Typically used between 1025 ms, the 532-nm diode laser uses moderate pulses targeting the abnormal vascular structures while sparing the normal capillaries, hence producing no purpura, he explained.

"The much longer pulse duration of 1 ms to 100 ms seems to be well matched to the thermal relaxation time of most facial

vessels. It is the longer pulse of the 532-nm diode laser that spares gross vessel damage."

Those with 532-nm diode laser experience are familiar with the immediate disappearance of the ectatic vessel after laser light exposure, Dr. Niamtu noted.

"With the longer 532-nm diode pulses, the blood is more gently heated, and damages the endothelial cells, but does not burst the vessel. It is theorized that the laser energy creates a small steam bubble that expands along the axis of the vessel, clearing the lumen and pushing a column of hot blood along the vessel. As the vessel cools during its thermal relaxation time, the vapor bubble condenses, collapsing the vessel wall. Thermal coagulation of the blood, now ejected well beyond the actual exposure site, creates an intravascular 'plug,' leaving an empty, thermally damaged lumen at and around the site of the laser exposure."

Multiple studies have shown the 532-nm diode laser to be effective in treating facial telangiectasias, Dr. Niamtu pointed out.

Telangiectasias occur in up to 48 percent of healthy children and 15 percent of normal adults and may arise from various intrinsic and extrinsic factors.

Intrinsic factors include inherited genetic disorders, such as hereditary hemorrhagic telangiectasis, congenital factors, primary cutaneous disorders (Rosacea), systemic disease (collagen vascular disease, Cushing's disease, meta-static carcinoma), pregnancy, and venous incompetence.

Extrinsic factors may be drug-induced (estrogen, chronic corticosteroid usage) actinic and radiation dermatitis, postsurgical (rhinoplasty, wound closure under tension), radiotherapy, and trauma.

Vasoactive mediators have been implicated in vascular neogenesis in the formation of telangiectasia. The new vessels occur as a response to anoxia, alcohol, chemicals, hormones, direct trauma, sinus infection, and other physical factors that result in angiogenesis, Dr. Niamtu said. CST

For more information

■ Cassuto DA, Ancona DM, Emanuelli G. Treatment of facial telangiectasias with a diode-pumped Nd:YAG laser at 532 nm. *J Cutaneous Laser Therapy* 2000;2.

■ Goldberg DJ, Meine JG. A comparison of four frequency-doubled Nd:YAG (532 nm) lasers for treatment of facial telangiectasias. *Dermatol Surg* 1999;25:463-467.

■ West TB, Alster TB. Comparison of the long-pulse dye (590-595 nm) and KTP (532 nm) lasers in the treatment of facial and leg telangiectasias. *Dermatol Surg* 1999;24:221-226.

■ McCann DP, Spoor TC. Clinical effects of the 532-nm diode laser for treating a variety of vascular and pigmented skin lesions. *Cos Derm* 2000;13:725-28.



Dr. Niamtu uses the Iridex 532 diode laser and accessories.

Anesthesia for laser Tx of facial telangiectasias

Although most surgeons use no type of anesthesia for laser procedures, this is not necessarily in the best interest of the patient.

Treatment pain is similar to botulinum toxin-A (Botox) injection and most patients can tolerate the smaller spot sizes with no anesthetic; however, some patients

react or are uncomfortable during treatment, according to Joseph Niamtu, D.D.S., oral and maxillofacial surgeon specializing in cosmetic surgery.

When using the 532-nm diode laser, single laser pulses are activated by tapping the foot switch intermittently and cause a minor, slightly delayed pain that feels like a rubber band snap.

Holding down the foot switch will cause a continuous, but adjustable, repeat rate. Slower repetition rates (4 Hz to 7 Hz) usually result in less discomfort. Using the 15-Hz repeat provides faster treatment, but is also considerably more uncomfortable for the patient. The use of a thin layer of refrigerated, water-based gel, such as aloe vera, will provide a thermal sink for the skin and will result in greater comfort and reduce the risks of epidermal injury.

However, when treating very sensitive areas such as the nasal alae, upper lip, or periorbital areas, use local anesthetic infraorbital nerve blocks, Dr. Niamtu advised.

On the larger facial areas, some vessels may require several passes and the skin should be allowed to cool between passes. A moderate energy density such as 16J/cm² is initially used, increasing the energy density until vessel collapse is observed. Excessive thermal energy can cause linear hypopigmentation, hyperpigmentation, and possibly atrophic scarring, he cautioned. CST



Dr. Niamtu



According to Dr. Niamtu, this photograph shows typical posttreatment purpura after using a 585-pulsed dye laser.



Portwine stain shown pre- and immediately posttreatment after using an Iridex 532-nm diode laser. (Photographs courtesy of Joseph Niamtu, D.D.S.)

