Clinical and Histologic Characterization of a Nd:YAG Dual-Wavelength Laser with Unique Sub-Pulse Format

Keywords: vascular lesions; Nd:YAG; cryogen cooling

l Background : A new vascular Nd:YAG laser with both 532 and 1064nm wavelengths and pulse durations ranging from microseconds to milliseconds has been developed. PDL devices have been the gold standard due to overall safety and efficacy in treating vascular lesions compared to previous iterations of Nd:YAG lasers.

l Objective : The goal of this study was to evaluate the effects of the Nd:YAG laser on normal skin by observing the overall skin response and evaluation histology to observe the effects of laser on blood vessels at various depths.

l Methods : The Nd:YAG laser was evaluated at a wavelength of 532nm, pulse durations ranging from 300 microseconds to 40 milliseconds, and energies up to 16J/cm^2. Initially we evaluated the skin response and histological effects with H&E staining at different fluences and pulse formats. Afterwards we evaluated the impact of pre and post-laser pulse cooling for immediate post-treatment skin response.

l Results : At 40ms pulse duration, the purpuric threshold for the skin was found to be approximately 13, 16, and 11J/cm2 for the single, sub-millisecond, and sub-microsecond pulse formats respectively. Histology revealed significant vascular damage and hemorrhaging at multiple depths. Clinical use has shown post-pulse cooling can significantly lower overall treatment pain with significant improvement seen after a single treatment.

l Conclusions : We demonstrated that the Nd:YAG device at 532nm wavelength yields similar skin response to PDL and is capable of damaging a wide variety of vessels at multiple depths by adjusting pulse duration, pulse structure, fluence, and our cooling configuration.