

## THERMAL AND NON-THERMAL LASER-TRABECULAR MESHWORK INTERACTION IN HUMAN AND NON-HUMAN PRIMATES EYES.

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**Purpose:** To evaluate the thermomechanical effect of different trabeculoplasty lasers.

**Methods:** Laser trabeculoplasty was performed on cadaver eyes with a commercially available quasi-CW high frequency Diode pumped Q-switched frequency-doubled Nd:YAG laser (532nm, 0.1s pulse duration, 50 $\mu$ m spot, Coherent Novus Verdi), a frequency-doubled Q switched-Nd:YAG laser (Coherent Selecta 7000, 532nm, 3ns pulse duration, 400 $\mu$ m spot), as well as an experimental short-pulse Titanium:Sapphire (Ti:Al<sub>2</sub>O<sub>3</sub>) laser (790nm, 7 $\mu$ s pulse duration (200ns spike train), 175 $\mu$ m spot, SOLX-I). One fresh human donor-eye, 2 fresh Rhesus (*Macaca mulatta*) and 2 Cynomologous (*Macaca fascicularis*) eyes were sectioned into 8 equal parts. The iris was sutured to the sclera to expose the trabecular meshwork (TM). The tissue was placed in a custom rotating holder affixed to the slit lamp chin-rest. A single laser shot was applied in the center of each tissue sample. Treatment parameters were: 400, 600 and 800mW for the Novus Verdi laser, 1.1 to 2.4mJ for the Selecta SLT laser, and 10 to 130mJ for the Ti:Al<sub>2</sub>O<sub>3</sub> laser. All events were video-recorded. The tissues were fixed in 2% paraformalin/2.5% Glutaraldehyde, dehydrated, critical point dried then gold coated and were systematically photographed on an JSM-35 SEM at x39, x100 or x200 and x1000 or x2000.

**Results:** Clinical: Treatment thresholds were determined as a de-pigmentation in the area of the laser spot which were obtained at ~400mW for the Novus Verdi, ~1.5mJ for the Selecta, and ~15mJ for the Ti:Al<sub>2</sub>O<sub>3</sub>. When used above treatment threshold, all lasers produced gas bubbles. SEM: The diode laser produced shrinkage and thermal damage at all power levels that included contraction of the corneal collagen as well as of the TM's framework. The SLT produced a tissue density increase in the region of the spot at all energies but no observable TM structural damage. With the Ti:Al<sub>2</sub>O<sub>3</sub>, no damage was detected until >80mJ where the TM lifted from its scleral wall anchors. At 135mJ, the iris separated.

**Conclusion:** When used at threshold energy levels, the Ti:Al<sub>2</sub>O<sub>3</sub> laser did not produce thermal or structural damage to the TM and, as with the SLT, treatment may therefore be repeated.

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