

# Transcleral laser, ciliary muscle shortening & outflow pathway reorganization.

Murray A Johnstone; Steven Padilla; Kimika Wen

+ Author Affiliations & Notes

Investigative Ophthalmology & Visual Science June 2017, Vol.58, 3468. doi:

## Abstract

**Purpose :** Aqueous outflow system configuration (OSC) determines aqueous flow and IOP that becomes abnormal in glaucoma. We describe a pilot study with an *ex vivo* system using visually guided positioning and real time observation of OSC changes ( $\Delta$ s) in response to transcleral  $\mu$ P laser (Iridex™) pulses.

**Methods :** *M. fasc.* primates A (PrA) & B (PrB). PrA: microscope, video recordings, calibration micrometer, 1 mm thick radial limbal segments from 4 quadrants (Q), micromanipulator, single pulse of 810 nm  $\mu$ P laser, duty cycle 31.3%. Paired parameters of stepwise power; range: 500-3000 mw, stepwise duration; range: 125-3,000 msec. Energy range: 0.08-2.35 joules. Clinically,  $\sim$ 1.59 J (CEJ) is applied per single location. Video capture during pulse. PrA: Motion quantitated from still frames with ImageJ. PrB: H&E & trichrome in 4 Q after Rx with CEJ.

**Results :** PrA - Visible  $\mu$ P effects were confined to longitudinal ciliary muscle (CM) near sclera (Fig. 1) Shortening/Contraction (ShCo) & relaxation was detected at  $\geq$  0.08 J in the IN & SN Q and at  $\geq$  0.16 J in the IT and ST Q. The CM facing the AC transiently moved inward & posteriorly at  $\geq$  0.75 Joules in all Q. A pilocarpine-like  $\Delta$  (PL $\Delta$ ) in Schlemm's canal shape occurred when the scleral spur (SS), and trabecular meshwork (TM) moved posteriorly (Fig. 1); ([www.youtube.com/user/ibmurray](http://www.youtube.com/user/ibmurray)). CM bundles recovered/relaxed to near pre- $\mu$ P configuration at low energies with progressive reduction in the recovery response as energy increased (Fig. 2). CM bundles experienced ShCo & turned white at 2.35 J ( $\sim$  48% > than CEJ) with a persistent  $\Delta$  in CB, SS & TM configuration. Ciliary epithelial damage was absent with direct observation (PrA & B) & histology (PrB).

**Conclusions** : Transcleral  $\mu$ P laser induces contraction of the CM, a well-characterized muscle response to uP lasers. CM shortening caused posterior and inward movement of the SS & TM. Our pilot study reports CM, SS, TM & SC PLAs following transcleral 810 nm  $\mu$ P laser Rx. Clinically used  $\mu$ P parameters induce OSC  $\Delta$ s generally associated with improved aqueous flow. Our preparation permits systematic assessment of effects of probe location, power vs. duration relationships, total energy and focal depth. Systematic lab studies to determine optimized parameters may improve success rates, reduce morbidity and ideally achieve lasting improvement in aqueous flow & IOP.

This is an abstract that was submitted for the 2017 ARVO Annual Meeting, held in Baltimore, MD, May 7-11, 2017.

- [View Original](#) [Download Slide](#)

Fig. 1

- [View Original](#) [Download Slide](#)

Fig. 2

This work is licensed under a [Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License](https://creativecommons.org/licenses/by-nc-nd/4.0/).

