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View Abstract

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Study Group: (none)

ABSTRACT

TITLE: Real-Time Optical Coherence Tomography Controlled Microsecond Laser Retinal Microsurgery: First In-vivo Results

ABSTRACT BODY:

Purpose: Reliable mild photocoagulation and selective retina therapy (SRT) selectively damaging the retinal pigment epithelium (RPE) while sparing the neuroretina, the photoreceptors as well as the choroid are highly demanded. However, due to the inter- and intraindividual variability of RPE and choroidal absorption, optical microsurgery requires reliable real-time laser dosing to prevent unwanted overexposure and extended damage of the neuroretina. In this experiment optical coherence tomography (OCT) was implemented to detect minimal damage, and a laser feedback control algorithm was used for real-time dosing. For the first time in-vivo experiments on rabbits were performed with microsecond laser pulses of varying duration.

Methods: Pigment rabbit eyes (n=6) were exposed to laser pulses of 4, 8, 12, and 20 µs in duration (wavelength, 532 nm; ramp-mode, maximum 15 pulses; repetition rate, 100 Hz). Therefore, a system with a scanning laser ophthalmoscope and spectral-domain OCT (Heidelberg Engineering) extended with a prototype laser (Meridian Medical) was used. For each laser lesion, the increasing ramp's end energy was individually controlled in real-time using OCT dosimetry (central wavelength, 870 nm; scan rate, 80 kHz). Within 1 hour after irradiation, retinal changes were assessed with fluorescein angiography (FA), indocyanine green angiography (ICGA), color fundus photography (CFP) and OCT.

Results: OCT dosimetry utilizing the control algorithm can interrupt the ramp-mode in real-time for each lesion individually. The preconditioned algorithm enabled treatment with a clearly visible breakdown of the blood-retinal barrier (BRB) according to FA and ICGA imaging and barely visible treatment lesions according to CFP. OCT B-scans through the treated areas provided a first indication of the morphological tissue impact. Preliminary evaluation shows that the algorithm stopped the laser at 4 µs at a ramp end energy of 53 µJ

(corresponds to 13/15 pulses), at 8 µs at 68 µJ (5/15 pulses), at 12 µs at 74 µJ (7/15 pulses), and at 20 µs at 100 µJ (1/15 pulses).

Conclusions: The novel system with OCT based laser dosing proved to induce minimal visible damage and BRB breakdown in a wide range of pulse durations. The new irradiation scheme and algorithm are being optimized an tested in multiple subjects to further limit unwanted damage and enable pure RPE selective laser microsurgery in real-time.

(No Image Selected)

Layman Abstract (optional): Provide a 50-200 word description of your work that non-scientists can understand. Describe the big picture and the implications of your findings, not the study itself and the associated details.: The results of these experiments suggest that OCT can be used to control laser treatment of the retina in real-time. Laser treatment with real-time dosimetry control could allow gentler photocoagulation and, at best, selective RPE removal for retinal rejuvenation.

DETAILS

PRESENTATION TYPE: Poster Only
CURRENT REVIEWING CODE: 2630 Laser - RE
CURRENT SECTION: Retina
Clinical Trial Registration (Abstract): No
Other Registry Site (Abstract): (none)
Registration Number (Abstract): (none)
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Date Trial Began (MM/DD/YYYY) (Abstract): (none)
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