Anatomical changes evidenced by Ocular Coherence Tomography (OCT) in dry AMD following Photobiomodulation treatment.

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Disclosures:
1,2 *Co founders of Lumithera Inc. Data and patents are subject to licensing agreements with Lumithera Inc. which has provided funding in part for this study.*
3 *Reports relationship as consultant to Photospectra Health Sciences and Lumithera Inc.*

Introduction:

Photobiomodulation (PBM) is the use of low intensity, non-thermal laser or LED light sources to reduce oxidative stress, improve mitochondrial function, inhibit inflammation and prevent apoptosis in cells that are treated. PBM provides a non-invasive approach to address many of the proposed affected cellular mechanisms in patients with dry age-related macular degeneration (AMD).

PBM was evaluated previously in patients with dry AMD, wherein statistically significant clinical improvements in outcome measures that included visual acuity and contrast sensitivity were observed (Merry G, Dotson R, Devenyi R, Markowitz S, Reyes S (2012) Photobiomodulation as a New Treatment for Dry Age Related Macular Degeneration. Results from the Toronto and Oak Ridge Photobiomodulation Study in AMD (TORPA), ARVO Meeting Abstracts 2012 53: 2049.)

This is an investigation of OCT changes in an interventional case series of patients who underwent PBM therapy for dry AMD.

Study materials and patients:

Patients with dry AMD (determined to have no neovascular lesions on retinal inspection, fundus photography, OCT assessment and IVFA (in some)) that underwent PBM therapy and were evaluated with SD-OCT before and after treatment have been included in this case series. The SPECTRALIS SD-OCT system combines high-speed image acquisition with custom TruTrack technology to actively track the eye during imaging. Tracking eye movement with simultaneous dual-beam imaging minimizes motion artifact, enables noise reduction and allows the instrument to precisely track change over time. The result is point-to-point correlation between fundus and OCT scans which enables accurate and repeatable alignment of OCT and fundus images, greater image detail and clarity, and more confident assessment of small changes.

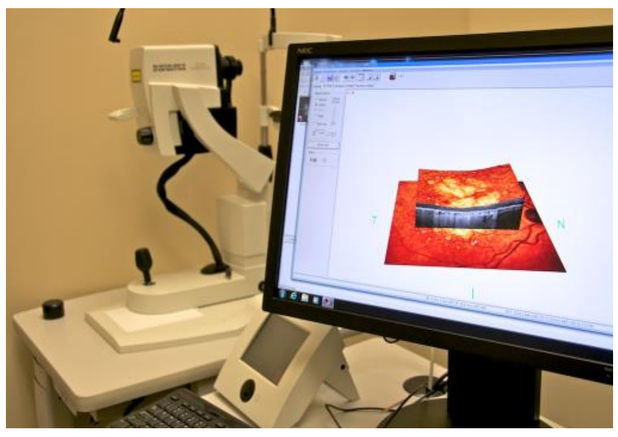
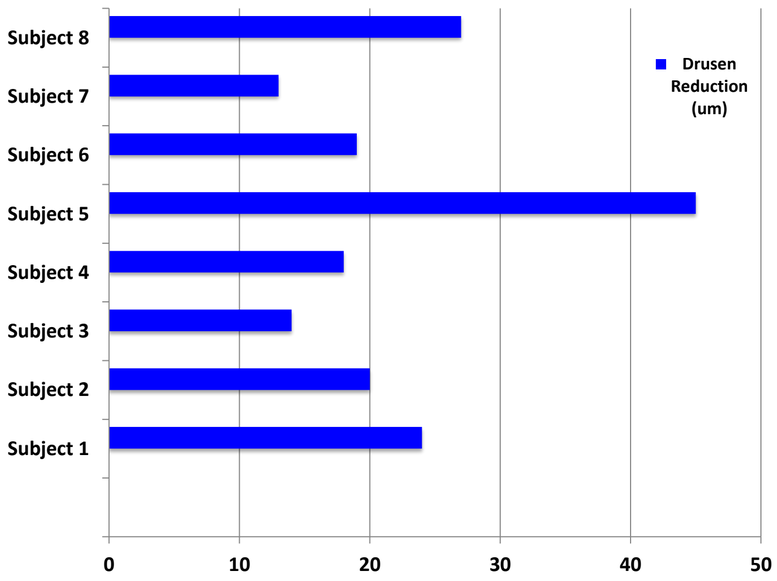


Fig 1: Photograph of the Spectralis SD-OCT device used to obtain OCT images in the study patients

Patients were treated three times a week for three weeks; a total of nine sessions where they received the same total dose of PBM as the TORPA trial patients but in a condensed shorter treatment time (to facilitate patient compliance and travel arrangements).
Two devices were used at each treatment session delivering multiple wavelengths of light energy.
The intervention consisted of using PBM in the yellow, far red and near-IR range using low-energy delivery with the Warp10 (Quantum Devices) and the Gentlewaves (Light Bioscience) instruments. The instruments are commercially available and have been approved for use in other conditions by the FDA and Health Canada.
The treatment parameters followed for the Warp10 delivery system were 670 nm +/- 15 nm at 50-80 mW/cm2, 4-7.68 J/cm2, for 88 +/- 8 seconds.
The treatment parameters followed for the Gentlewaves delivery system were 590 nm +/- 8 nm at 4 mW/cm2, 790nm +/- 60 nm at 0.6 mW/cm2, for 35 seconds, pulsed at 2.5 Hz (250 milliseconds on, 150 milliseconds off) while delivering 0.1 J/cm2/treatment.
All subjects were treated with the two devices used sequentially at each treatment visit and then repeated in the same session.

Results:



Subject	Drusen Reduction (μm)	Visual Acuity (letter increase)	Contrast Sensitivity (log unit increase)
1	24	8	0.3
2	20	5	0.3
3	14	3	0.3
4	18	4	0.16
5	45	5	0.9
6	19	5	0.18
7	13	4	0.3
8	27	2	0
Mean	22.5	4.5	0.305
STD DEV	10.21	1.77	0.26
SEM	3.61	0.63	0.09

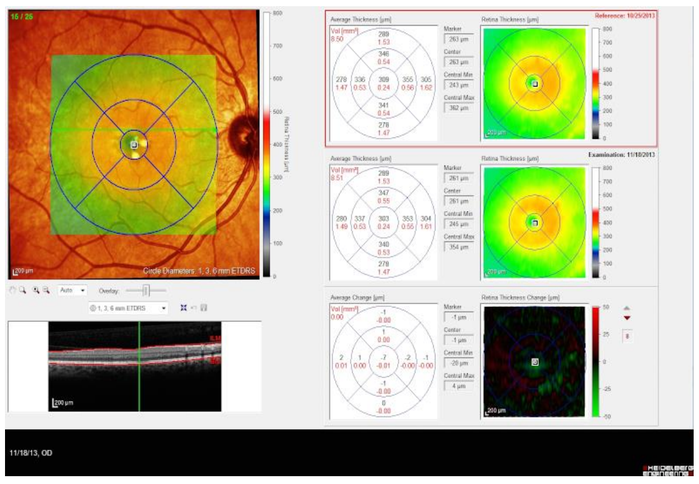


Fig 2: Subject 4: OCT thickness subtraction map showing retinal thickness change over the macular area evidenced by the green colour coded areas at the bottom right.

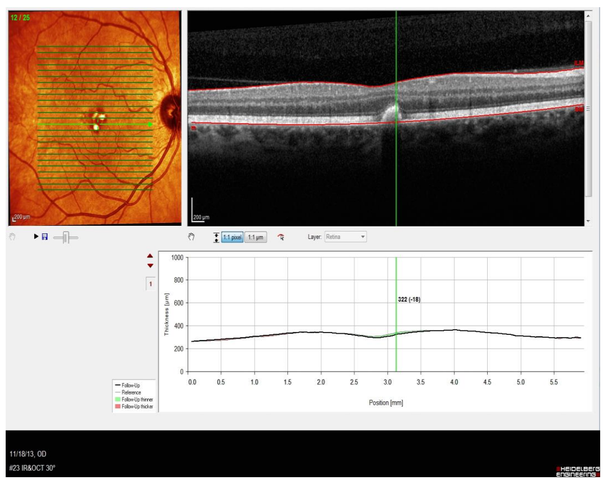


Fig 3: Same subject as fig 2 showing reduction over central druse shown in this detailed cross section cut through the central macula. The green area represents the difference in retinal height in this section.

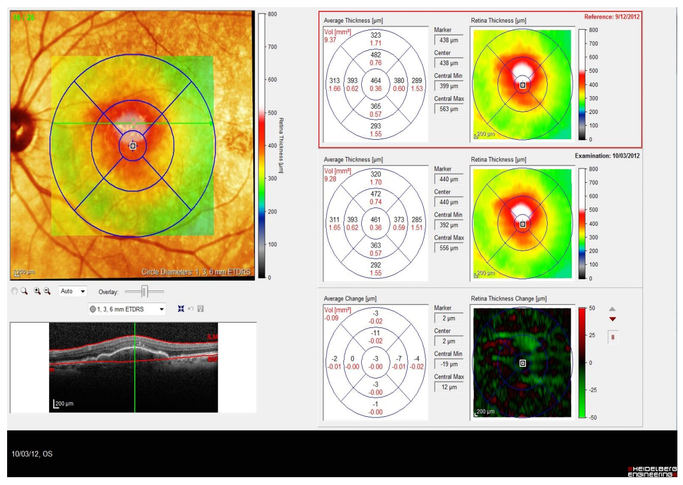


Fig 4: Subject 6: showing thickness decrease on the subtraction map evidenced by the green areas in the bottom right panel.

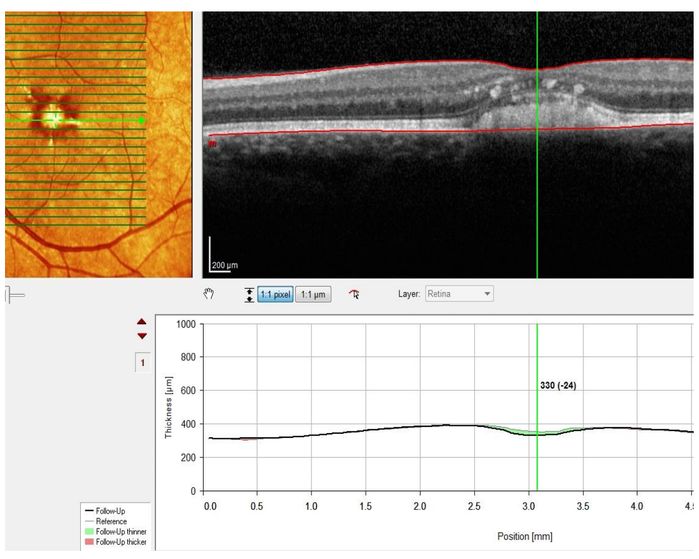


Fig 8: Subject 1: showing a 24 micron decrease after PBM Rx. in this cross sectional cut.

This evidence of objective change in retinal anatomy following PBM therapy and correlating with improved subjective parameters (ETDRS VA and CS), albeit with small numbers and a non-randomized case series, deserves consideration for a prospective multi-center evaluation of PBM as a useful, non-invasive treatment for dry AMD.