Program Number: 4936 **Poster Board Number:** A0296
Presentation Time: 11:00 AM–12:45 PM

Differences in retinal cone morphology between subjects with dry AMD and healthy participants observed with OCT and narrow-angle Heidelberg Retinal Angiograph 2

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Purpose: We used a multimodal imaging approach to uncover differences in outer retinal layer and cone mosaic morphology between patients with dry age related macular degeneration (AMD) and age matched normal controls.

Methods: Five subjects with early to intermediate dry AMD (69 ± 5 years) and five age matched controls with healthy eyes (66 ± 5 years) underwent Spectralis 30° infrared reflectance imaging, optical coherence tomography (OCT) and cone photoreceptor imaging using a narrow-angle Heidelberg Retinal Angiograph 2 (HRA2). OCT images were analyzed manually using the manufacturer's software and callipers to measure outer retinal (outer plexiform layer to retinal pigment epithelium) and outer segment (ellipsoid zone to retinal pigment epithelium) thickness. The HRA2 was modified in order to visualise parafoveal cone photoreceptors through a reduction in the scan angle from 30° to 3° and a subsequent increase in the system resolution. The internal fixation target was set at 9°. Images of two pairs of adjacent regions of interest were acquired for each subject and photoreceptor densities were determined with a manual counting algorithm. Photoreceptor densities of adjacent pairs were compared to OCT layer thicknesses at the same locations.

Results: AMD patients had on average fewer visible cones than normal controls (3131 vs. 3994 cones/mm^2). In addition to the global reduction of detectable cones, there was also variable loss in photoreceptor density with the adjacent regions of interest varying by 9.0% for the normal controls and 22.2% in the AMD patients ($p=0.001$). Interestingly, there was no significant difference in outer retinal thickness between normal controls and AMD subjects at the locations of imaging ($p=0.23$), however, there was a significant reduction in outer segment thickness in the AMD group ($p=0.011$).

Conclusions: While our data is limited, it suggests that the 'lost' photoreceptor cells may still be present in subjects with AMD, however their outer segment morphology may be altered.

Commercial Relationships: Marketa Cilkova, None; **Adam M. Dubis**, None; **Esther Papamichael**, None; **Padraig J. Mulholland**, None; **Andrew Rider**, None; **Steven Dakin**, None; **Adnan Tufail**, Novartis (F), Roche (C), Novartis, Heidelberg Engineering (C), Genetech (C), Bayer (C), Allergan (C); **Gary S. Rubin**, None; **Roger S. Anderson**, None
Support: Fight for Sight Clinical Fellowship Award

Program Number: 4937 **Poster Board Number:** A0297
Presentation Time: 11:00 AM–12:45 PM

Comparison of 3D Computer-automated Threshold Amsler Grid Testing and Microperimetry in Wet AMD Patients

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Purpose: Comparative analysis of examination results from 3D Computer-automated Threshold Amsler Grid test (3D-CTAG; Fink & Sadun, JBO 2004) and microperimetry in wet AMD patients.

Methods: *Group #1:* Wet AMD patients (n=35, 43 eyes). *Group #2 (Control):* Healthy patients (n=25, 50 eyes). All patients underwent 3D-CTAG testing and microperimetry. *3D-CTAG:* Subjects in a dark room were placed on a chin-head-rest in front of an iPad III wearing optical corrections for presbyopia. *Indices for 3D-CTAG analysis:* Number of scotomas per eye (ND), lowest perceivable contrast level (CL), absolute hill-of-vision volume lost (AVL), and relative volume lost (VLRH). *Microperimetry, MAYA, CenterVue, Italy:* Tested visual field 20°×20°, 68 points. *Indices for microperimetry analysis:* Average threshold (AT) in dB, average threshold in choroidal neovascularization (ATCNV) in dB, and percentages of fixation points located within 1° (P1). The following non-parametric statistical methods were used: Shapiro-Wilk test, Mann-Whitney U-test, and Spearman's rank correlation coefficient.

Results: Result format: Median(25%-quartile;75%-quartile). *Group #1:* ND=1(1;2), CL=17(11;25)%, AVL=4711(2932.5;6968)%deg^2, and VLRH=6.8(4.24;10.06)%. AT=19.1(11.45;22.7)dB, ATCNV=15.9(7.61;18.86)dB, and P1=34(27.5;54.5)%. *Group #2:* ND=0(0;0), AVL=0(0;0), and VLRH=0(0;0). AT=29.1(28.8;30.8) dB and P1=95(93;99)%. A medium correlation between AT and AVL (ρ=-0.69, $p=0.00001$) and a strong correlation between ATCNV and AVL (ρ=-0.85, $p=0.00001$) were determined, i.e., the visual field depressions detected by both methods coincide. The fixation stability (P1) also has a negative correlation with AVL (ρ=-0.65, $p=0.00095$).

Conclusions: Both 3D-CTAG and microperimetry demonstrate functional disorders of the macular area in wet AMD. The average threshold reduction in the CNV area correlates well with the AVL in 3D-CTAG. It seems preferable to use 3D-CTAG in patients with low visual acuity (<6/30) compared to microperimetry because of a more stable fixation. 3D-CTAG testing appears to be less tedious for patients because it takes only 4-5 min. per eye compared to 10-15 min. for microperimetry.