Method for artificially degrading the signal from Optical Coherence Tomography cube to assess variability in retinal pigment epithelium elevation.

Sophie Kubach, MS[1]; Luis de Sisternes,PhD[1]; Warren Lewis, MS[2], Gregory Giovanni ,PhD[3]

[1]Carl Zeiss Meditec, Inc., Dublin, CA; [2]Bayside Photonics, Inc., Yellow Spring, OH; [3]Bascom Palmer Eye Institute, Miami FL

Poster# PB0175

PURPOSE

Measurement of retinal pigment epithelium detachment volume (RPED) is an important characteristic to be able to measure when designing the needed signal in an OCT system. In this study we assess the variability in the RPED volume in dry AMD eyes with signal-to-noise reduction by artificially degrading the OCT signal.

METHODS

- Repeated 6x6mm angio scans from 5 dry AMD eyes imaged on the PLEX® Elite 9000 swept-source OCT (ZEISS, Dublin, CA) were artificially corrupted to simulate different reduction in signal
- The method to reduce the OCT signal is the following:
  - Data from an 8-bit OCT cube are unlogged after determining the pixels value above and below the noise level.
  - The noise is then subtracted from the signal and the signal is scaled by a factor $10^{\left(\frac{deltadB}{10}\right)}$ where *deltadB* is the signal reduction factor.
  - The noise is then added back to the signal and the log is taken to produce an 8-bit OCT cube.
  - After segmentation of the RPE, volume RPE elevation is computed on the original cubes and on the cubes with different reduction in signal.

RESULTS

- Table 1 shows for each eye, the mean and standard deviation for volume RPE elevation within a 5mm radius circle centered at the fovea when considering the original dataset (i.e. no signal reduction) and the same dataset degraded by 1.5 dB, 3 dB and 4.5 dB.
- The sensitivity of the RPE volume elevation with OCT signal degradation varies from eye to eye (Figures 1a, 1b).
- The change in volume of the RPE elevation with signal degradation is small, less than half the standard deviation for all eyes except for eye #2 where the change in RPE volume is statistically significant, with a volume reduction of 5 sigma at 4.5 dB from baseline (Figure 2).

CONCLUSION

The described method for artificially degrading the OCT signal can be used to assess the sensitivity of the RPE metric independently from any system-to-system variations. This model can also be expanded to other algorithms to define an acceptable range of SNR for the device.

Email: sophie.kubach@zeiss.com

Disclosures: SK (E), LdS (E), WL (C), GG (C) : Carl Zeiss Meditec ,Inc

	Eye 1 Volume RPE elevation		Eye 2 Volume RPE elevation		Eye 3 Volume RPE elevation		Eye 4 Volume RPE elevation		Eye 5 Volume RPE elevation	
Signal reduction	Mean (mmm3)	Stddev (mm3)	Mean (mmm3)	Stddev (mm3)	Mean (mmm3)	Stddev (mm3)	Mean (mmm3)	Stddev (mm3)	Mean (mmm3)	Stddev (mm3)
0 dB	0.0426	0.0008	0.0316	0.0011	0.0427	0.0107	0.0547	0.0053	0.0004	0.0005
-1.5dB	0.0425	0.0009	0.0277	0.0021	0.0431	0.0096	0.0556	0.0055	0.0009	0.0015
-3dB	0.0425	0.0007	0.0273	0.0015	0.0422	0.0095	0.0543	0.0027	0.0009	0.0014
-4.5dB	0.0427	0.0006	0.0274	0.0004	0.0384	0.0121	0.0558	0.0057	0.0006	0.0010

Table 1: Volume of RPE elevation for each eye over a 5 mm circle centered on the retina For each the mean and 1 standard deviation from 4 repeated scans are reported

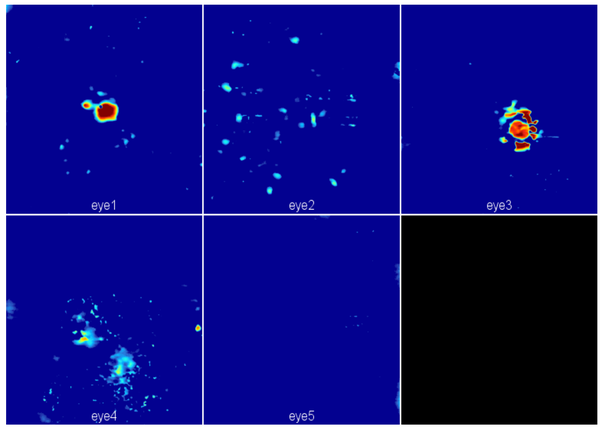

Figure 1-a: Baseline RPE elevation map for all 5 eyes

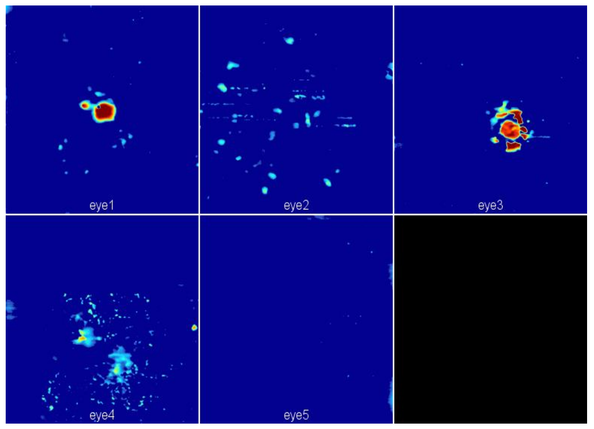

Figure 1-b: RPE elevation map for all 5 eyes at 4.5 dB signal degradation

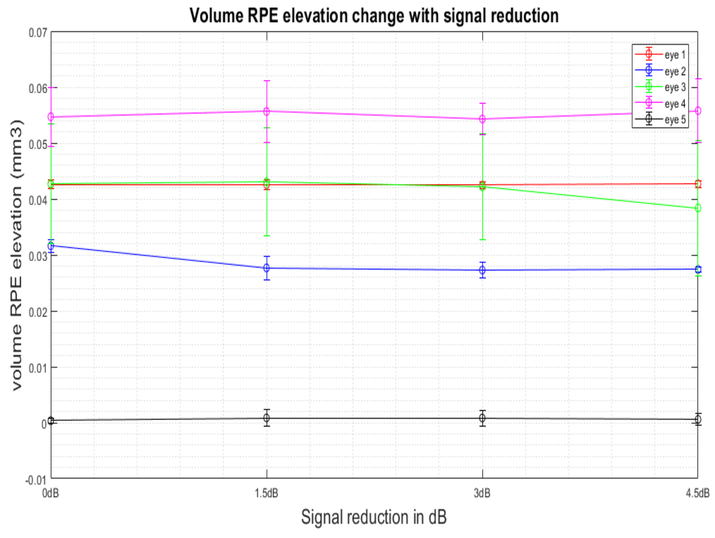

Figure 2: RPE volume elevation as a function of OCT signal degradation for each 5 eyes