Local variations in rod function and subretinal drusenoid deposits (SDD) in patients with reticular pseudodrusen (RPD)

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Introduction

- Reduced rod sensitivity and slowed dark-adaptation are common in age-related macular degeneration, especially in those patients with reticular pseudodrusen (RPD).
- The unique fundus appearance in RPD is thought to be caused by subretinal drusenoid deposits (SDDs).
- In this prospective study, we evaluate the relationship between local variations in rod function and local variations in SDD thickness

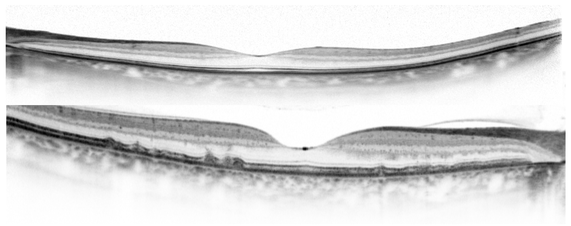


Figure 1. Top: HD OCT line scan from a normal subject. Bottom: HD OCT line scan from a patient with RPD. RPD is characterized by SDD on OCT imaging.

Methods

Subjects

- 6 subjects with RPD (best corrected visual acuity ≥ 20/32)
- 6 age-similar normal controls
- Eyes with better VA dilated and dark adapted for 40 minutes

Procedure- Scotopic Microperimetry

- 56 point macular scotopic sensitivity map generated using short-wavelength, spot size 3 on a Nidek MP-1S fundus perimeter
- SLO infrared images and SD-OCT volume scans (96 lines, 20*20 degrees acquired using a Heidelberg Spectralis imaging platform
- Volume scans segmented with manual adjustment used to delineate the combined thickness of the RPE and SDD
- Segmentation results processed by a MATLAB routine to obtain the average RPE+SDD thickness of the 1 degree local area centered at each test location

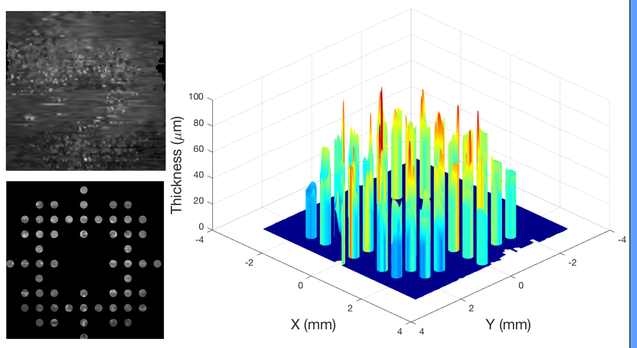


Figure 2: Matlab processing utilized to measure RPE+SDD thickness at test points locations

Scotopic Sensitivity

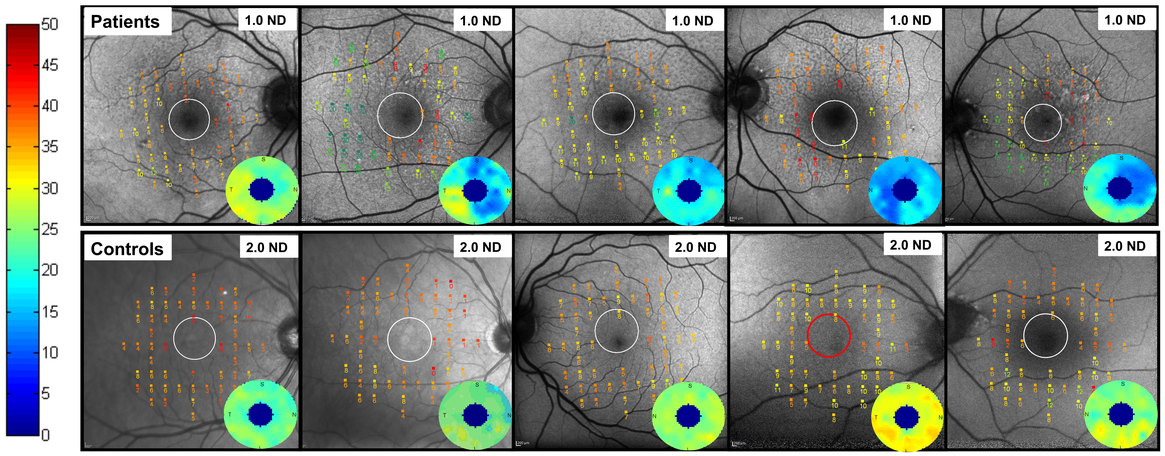


Figure 3: MP-1 56 point scotopic sensitivity map, with numbers representing sensitivity (dB) at each test point projected onto fundus autofluorescence. Shown in the upper right corner of each panel is the neutral density (ND) filter that was used. Superimposed in lower corner is heat map adjusted for filter density, showing true sensitivity. Patients (top row) display considerable regional variation in rod function relative to controls (bottom row).

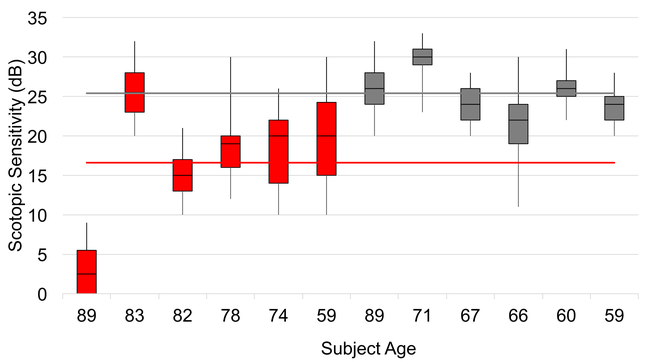


Figure 4: Patient data, in red, is distributed over a wider range than control data. Patients shows lower average scotopic sensitivity (16.6 dB, shown as red line) than controls (25.4 dB, gray line) (p<0.0001).

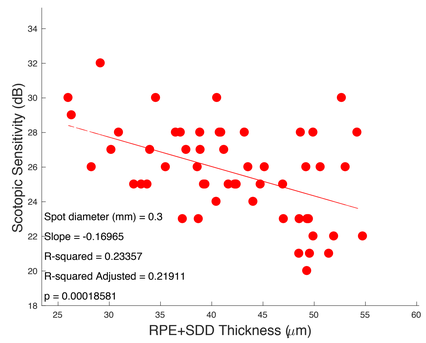
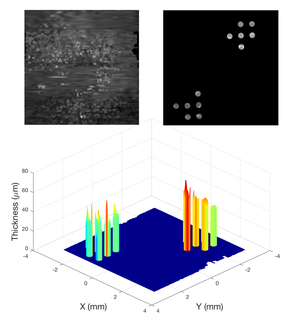


Figure 5: Example of scotopic sensitivity vs RPE+SDD thickness obtained from one patient. Scotopic sensitivity is correlated with RPE+SDD thickness (R^2=0.21911, p=0.000186) in 56 point test.

Time Course of Dark Adaptation

Procedure- Time Course of Dark Adaptation

- 8-12 test points selected to represent areas of high and low scotopic sensitivity
- Points located 4-8 degrees from the fovea, roughly equidistant
- Subjects exposed to a bright light for 3 minutes (80% bleach)
- Points tested every 5-10 minutes for 1-2 hours, until rod plateau phase reached
- Values are presented as log threshold elevation relative to the dimmest setting (50 dB) on the Nidek MP-1S. Thus maximum threshold elevation is 5 log units.



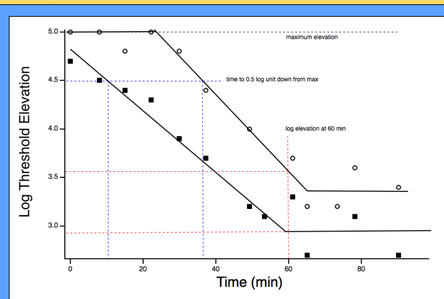


Figure 6: Representative time course functions from two locations in one patient

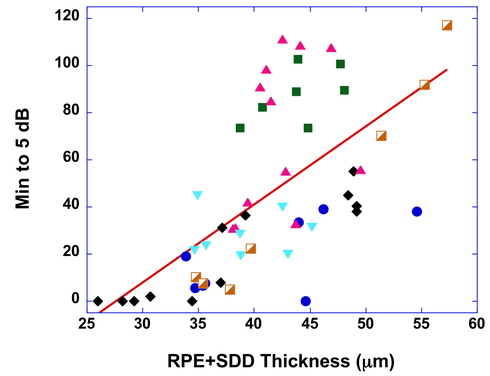


Figure 7: Minutes to detect stimulus 5 dB dimmer than brightest setting (recovery time) is correlated (R^2=0.38135, p<0.0001) with RPE+SDD thickness of a 1 degree area around the test point. Different symbols represent different patients. Mean recovery time is significantly higher (p<0.0001) for patients (mean=44.8 minutes, SD=35.4) than for controls (mean=3.6 minutes, SD=5.8).

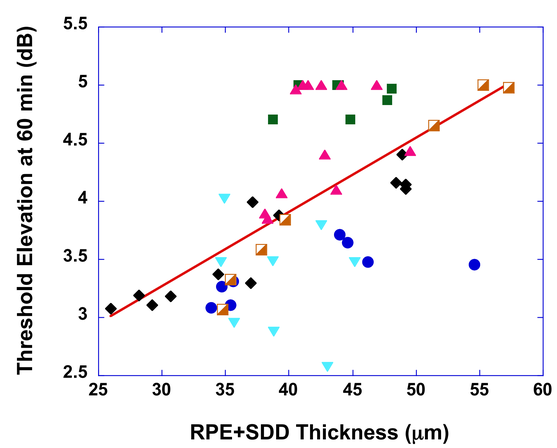


Figure 8: Scotopic sensitivity of a point at 60 minutes is correlated (R^2=0.30742, p<0.0001) with the RPE+SDD thickness of a 1 degree area around the test point.

Conclusions

Our results suggest that there are two consequences of SDD: one is to reduce dark-adapted sensitivity and the other is to substantially delay recovery from a bleaching light.

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