Assessing the Relationship Between Cone Density and Foveal Morphology

A.M. Dubis1, A. S. Hansen1, R. F. Cooper2, B. R. Hansen1 & J. Carroll1,2

1Cell Biology, Neurobiology & Anatomy, 2Ophthalmology, Medical College of Wisconsin, Biomedical Engineering, Marquette University. CR: None

Summary

Previous work has shown that there is variability in foveal pit morphology, the foveal avascular zone (FAZ) size and cone photoreceptor topography. Computer modeling suggests that passive forces present in the developing eye link FAZ size to foveal pit morphology and cone photoreceptor topography. Another model of foveal development and maturation suggests that active forces, such as cell signaling and metabolic gradients, are at play. This model allows for different pathways directing foveal pit, FAZ and cone photoreceptor topography maturation, and potentially a lack of structural correlations between the three structures. Here we sought to quantify the relationship present between the FAZ, pit morphology and cone photoreceptor topography in vivo.

Quantifying FAZ and Foveal Morphology

The FAZ of subjects in this study was imaged with one or more of the following: (A) fluorescein angiography (FA), (B) an adaptive optics scanning light ophthalmoscope (AOSLO) or (C) Optical Imaging Retinal Function Imager (RFI). Scale bar is 250 µm. Previous work has shown all three devices to provide equivalent images of the FAZ. Foveal pit volume and area were quantified from macular OCT volumes using previously described methods.

Alignment of Multiple Foveal Features

The location of peak cone density (A) is aligned with the center of the FAZ (B). The center of the foveal pit is identified, and a Cirrus™ LSO (A) is aligned with the center of the FAZ (C).

Foveal Pit, FAZ and Cone Mosaic Data

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<th>Subject #</th>
<th>Eye</th>
<th>Age</th>
<th>Sex</th>
<th>Length</th>
<th>Area</th>
<th>FAZ</th>
<th>Cone Density</th>
<th>Deviation between FAZ center and pit center (um)</th>
<th>Deviation between FAZ center and peak cone density (um)</th>
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</table>

Conclusion

This study provides direct in vivo characterization of the relationship between the FAZ, foveal pit, and cone photoreceptor topography. It appears, while there is a strong correlation between the size of the FAZ and foveal pit, neither structure is correlated with the foveal cone mosaic. Interestingly, as the FAZ area decreases, the displacement between the centers of the FAZ, foveal pit, and center of peak cone density decreases.

References