Imaging of Macrophage-Like Cells in Eyes with Diabetic Retinopathy Using Clinical En Face OCT

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Purpose:
Retinal macrophages help regulate vasculature remodeling and inflammatory responses. Using a clinical OCT, we examined the distribution and morphology of the macrophage-like cells in healthy and diabetic eyes.

Methods:
13 patients with various stages of diabetic retinopathy and 17 controls were imaged using a clinical SD-OCT system (Avanti RTVue-XR; Optovue). Ten 3x3mm scans centered at 9° temporal to the fovea were obtained and averaged. A 3µm OCT-Reflectance (OCT-R) slab located above the ILM surface was used for macrophage-like cell density and nearest neighbor distance (NND) measurements (Fig. top row). In control eyes, measurements were performed on a 500x500µm ROI near the center of the OCT-R. In diabetic eyes, ROIs showed clustering of cell structures were measured. An OCT-Angiography (OCT-A) located between the ILM and 48µm below the ILM was overlaid with the respective OCT-R (Fig. bottom row). Axial length was obtained for ocular magnification correction of each eye.

Results:
Control eyes showed horizontally ramified macrophage-like cells distributed uniformly on the surface of the ILM (Fig. A1 & A2). Diabetic eyes demonstrated clustering of cell structures with plumper appearance (Fig. B1 & C1). These cells appeared to adhere to the surface of the larger blood vessels and gathered around the locations overlying retinal disruption (Fig. B2 & C2). Mean±SD cell densities in control eyes were 81±26 cells/mm² (range: 44-156 cells/mm²) with and NND ranging as 71.5±15.6 µm (range: 52.0-108.8 µm). In diabetic eyes, mean±SD cell densities and NND measured at the locations with clustered cell structures were 157±53 cells/mm² (range: 104-224 cells/mm²) and 53.2±10.8 µm (range: 45.2-69 µm), respectively.

Conclusions:
Macrophage-like cells seen in diabetic eyes were non-uniformly distributed with altered morphology. These cells appeared to have migrated towards locations with retinal damage. Clinical OCT imaging of these cells may become a useful new biomarker for retinal disease.