Author(s)
Principal: Joel Schuman
Presenting: Joel Schuman, M.D.
Contributing: Gadi Wollstein, MD
Hiroshi Ishikawa, MD
Lawrence Kagemann, MS
Maciej Wojtkowski, PhD
James G. Fujimoto, PhD

Abstract Title:
High-Speed, Ultra-High Resolution Optical Coherence Tomography in Glaucoma

Purpose:
Optical coherence tomography (OCT) is an established ocular imaging technology that may be used for glaucoma evaluation. We compared conventional OCT with a new generation of OCT research technology which provides high-speed and ultra-high resolution images by measuring echo time delay of light using Fourier (spectral) domain detection.

Design:
Case Series

Participants:
Healthy subjects and glaucoma patients seen at the UPMC Eye Center Glaucoma Service

Main Outcome Measures:
Retinal structure and function

Methods:
Healthy subjects and glaucoma patients in various stages of disease were scanned at the same visit with commercially available OCT (Stratus OCT) and a prototype high-speed, ultra-high resolution OCT (HS UHR-OCT). The HS UHR-OCT used superluminescent diodes (SLDs) as the light source with a wavelength of 840+/-50 μm. The axial resolution of the HS UHR-OCT was 3-4μm (2-3 times greater than Stratus OCT) and the tissue sampling rate was 28,000 Hz (70 times faster than Stratus OCT). The fast acquisition rate enabled

acquisition of three dimensional data sets consisting of raster scans of the macula and optic nerve head regions. Each 3D data set had 180 consecutive OCT images with 500 axial scans each, for a total of 90,000 transverse points on the retina.

Results:
Marked enhancement of tissue visualization was noted with the HS UHR-OCT which allowed improved discrimination of structural features. Structures such as the retinal ganglion cell layer could be clearly observed. The fast scanning and the enhanced registration properties of HS UHR-OCT provided detailed maps of the scanned regions. In addition, these features allowed us to obtain structural data in arbitrary orientations in the scanned area including the circumpapillary region, thus minimizing a major cause for interscan variability, image registration problems, as observed with Stratus OCT.

Conclusion:
HS UHR-OCT provided detailed structural information which might improve the clinical utility of this technology for disease detection and longitudinal follow-up of patients with glaucoma. The enhanced properties of this new technology open new avenues for data acquisition and analysis.