Published in final edited form as:

Retina. 2013 January ; 33(1): . doi:10.1097/IAE.0b013e31826f5252.

Combined Depth Imaging using optical coherence tomography as a novel imaging technique to visualize vitreo-retino-choroidal structures

Giulio Barteselli, MD, Dirk-Uwe Bartsch, PhD, and William R Freeman, MD

Department of Ophthalmology, Jacobs Retina Center at Shiley Eye Center, University of California San Diego, La Jolla CA

Keywords

optical coherence tomography; enhanced depth imaging; combined depth imaging

Spectral-domain optical coherence tomography (SD-OCT) is a non-invasive technique to visualize cross-sectional images of vitreo-retinal structures. Image averaging during eyetracking increases the signal-to-noise ratio and improves image quality. The point of maximum sensitivity on SD-OCT (known as the “zero delay line”) is in the vitreous; with increasing depth, the signal is reduced and details of the choroid are reduced.¹

More recently, enhanced depth imaging on SD-OCT (EDI-OCT) has increased the ability to visualize the choroid, capturing images with the choroid close to the zero delay line.² However, with this modality details of the posterior vitreous are reduced. A healthy volunteer was scanned with a SD-OCT device (Spectralis HRA, Heidelberg Engineering). On the conventional SD-OCT B-scan of the macula, the preretinal vitreal pocket was clear. However, the outer choroidal border was not detected (Figure 1,A). The EDI-OCT scan increased the visibility of the choroid borders, but the preretinal vitreal pocket was not seen (Figure 2,B).

We devised an innovative imaging technique to visualize all posterior structures in a single image, combining the conventional SD-OCT B-scan with the EDI-OCT B-scan. The same volunteer was asked to fixate on the internal fixation centered on the fovea. A 100-frame averaged conventional linear SD-OCT scan in high-resolution mode was then performed. After reaching 50% of the averaging we manually changed to the EDI modality using the dedicated button, and the image was captured after obtaining a good enhancement of the choroid. This allowed the device to create a high-quality combined image of all depths. (Figure 3,C).

This manual technique of Combined Depth Imaging (CDI) on Spectralis HRA yielded a single comprehensive image of the posterior structures without using multiple acquisition modalities. Dedicated built-in software may be useful to achieve this imaging result automatically. Further studies will evaluate the applicability and limitations of this technique.

[§]Corresponding author and reprint requests: William R. Freeman, MD, University of California at San Diego, Shiley Eye Center, 0946, 9415 Campus Point Drive, La Jolla, CA 92037; freeman@eyecenter.ucsd.edu.

The authors have no proprietary, financial, or conflicts of interest to disclose.

Acknowledgments

Funding/Support: This study was supported by NIH grants R01EY007366 and R01EY018589 (WRF), R01EY016323 (DUB), and “RPB incorporated and unrestricted funds from Jacobs Retina Center”. The funding organizations had no role in the design or conduct of this research.

References

1. Regatieri CV, Branchini L, Fujimoto JG, Duker JS. Choroidal imaging using spectral-domain optical coherence tomography. *Retina*. 2012; 32:865–76. [PubMed: 22487582]
2. Spaide RF, Koizumi H, Pozzoni MC. Enhanced depth imaging spectral-domain optical coherence tomography. *Am J Ophthalmol*. 2008; 146:496–500. [PubMed: 18639219]

Fig. 1.

Multiple acquisition modalities on SD-OCT (Heidelberg Spectralis HRA). **A:** Conventional linear OCT B-scan allows good visualization of the preretinal vitreal pocket (asterisks) and retinal structures, but the outer choroidal boundary is not visible. **B:** Linear EDI-OCT B-scan increases visualization of the outer choroidal boundary (arrows), but decreases identification of the posterior vitreal structures. **C:** Combined conventional OCT and EDI-OCT B-scan yields a single comprehensive image of the posterior structures, including preretinal vitreal pocket (asterisks), retina, and choroid (arrows).