Combined Depth Imaging Using Optical Coherence Tomography as a Novel Imaging Technique to Visualize Vitreoretinal Choroidal Structures

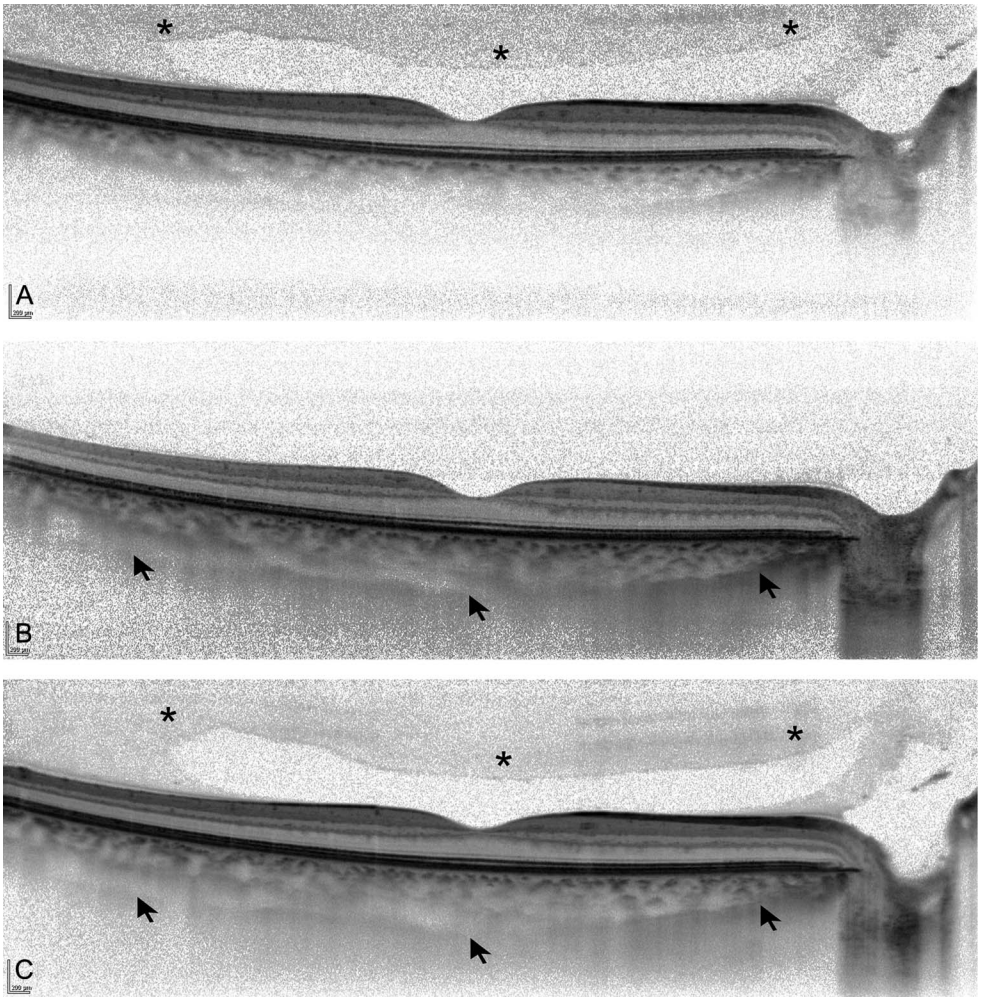

Fig. 1. Multiple acquisition modalities on SD-OCT (Heidelberg Spectralis HRA). **A.** Conventional linear OCT B-scan allows good visualization of the preretinal vitreal pocket (asterisks) and retinal structures, but the outer choroidal boundary is not visible. **B.** Linear EDI-OCT B-scan increases visualization 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). EDI-OCT, enhanced depth imaging on spectral domain optical coherence tomography.

Spectral domain optical coherence tomography (SD-OCT) is a noninvasive technique to visualize cross-sectional images of vitreoretinal structures. Image averaging during eye tracking 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 spectral domain optical coherence tomography 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 an SD-OCT device (Spectralis HRA; Heidelberg Engineering, Carlsbad, CA). 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 1A). The enhanced depth imaging on spectral domain optical coherence tomography scan increased the visibility of the choroid borders, but the preretinal vitreal pocket was not seen (Figure 1B).

We devised an innovative imaging technique to visualize all posterior structures in a single image, combining the conventional SD-OCT B-scan with the enhanced depth imaging on spectral domain optical coherence tomography 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 enhanced depth imaging 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 1C).

This manual technique of combined depth imaging on Spectralis HRA yielded a single comprehensive image of the posterior structures without using multiple acquisition modalities. A dedicated built-in software may be useful to achieve this imaging result automatically. Further studies will evaluate the applicability and limitations of this technique.

Key words: optical coherence tomography, enhanced depth imaging, combined depth imaging.

GIULIO BARTESELLI, MD
DIRK-UWE BARTSCH, PHD
WILLIAM R. FREEMAN, MD

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

Supported by NIH grants R01EY007366 and R01EY018589 (W.R.F.), R01EY016323 (D.-U.B.), and "RPB incorporated and unrestricted funds from Jacobs Retina Center."

The authors declare no conflict of interest.

Reprint requests: William R. Freeman, MD, Department of Ophthalmology, Jacobs Retina Center at Shiley Eye Center, University of California San Diego, 9415 Campus Point Drive, La Jolla, CA 92037; e-mail: freeman@eyecenter.ucsd.edu