SD-OCT Imaging in Eyes Implanted With a Miniature Telescope

Overcoming imaging challenges in eyes of AMD patients implanted with a telescope can result in high-quality images.

BY ANNA PAPPAS, BS, COA; MELANIE J. FORTIN, BS, COA; AND BRIAN C. JOONDEPH, MD, MPS

The implantable miniature telescope (IMT; VisionCare Ophthalmic Technologies) reduces the effect of a central scotoma in patients with end-stage age-related macular degeneration (AMD) by magnifying images in the field of view and projecting them onto unaffected perimacular retina.[1] The IMT is approved by the US Food and Drug Administration for eyes that have been diagnosed with end-stage atrophic AMD. The effect of a central blind spot is reduced because images through the IMT are magnified by a factor of 2.2 to 2.7, making it possible to see otherwise unrecognizable images in the central field of vision.[2] Figure 1 shows an image oriented toward the anterior segment of an IMT captured using spectral-domain optical coherence tomography (SD-OCT) technology with the Spectralis (Heidelberg Engineering). Ophthalmoscopy on eyes with the IMT can be challenging due to the severely minimized view through the telescope, making the OCT a valuable clinical resource in the management and treatment of AMD in telescope-implanted eyes.[3] We will review the challenges and solutions for imaging the macula in a telescope-implanted eye using the Spectralis SD-OCT system.

IMAGING CHALLENGES

There are several unique imaging challenges when performing diagnostic SD-OCT imaging of the retina through an implantable telescope. The first obstacle comes from the IMT itself; it is difficult to obtain a clear view of the macula through the telescope because it minimizes the view of the retina. Figure 2 shows an SD-OCT confocal scanning laser ophthalmoscopy (cSLO) image of the retina through an IMT. (Note that the view of the macula is not clear and the fundus is minimized.)

Another imaging challenge is caused by fixation loss. Eyes implanted with an IMT have difficulty focusing on a fixation target due to loss of central vision from end-stage AMD, which causes eyes with telescope implants to constantly move or scan. The TruTrack Active Eye Tracking feature of the Spectralis SD-OCT makes it easier to overcome motion artifacts due to the scanning effect from the IMT by focusing on anatomic features of the fundus.[4] For patients who have an IMT, these imaging obstacles may result in longer diagnostic imaging capture times and corneal exposure. Applying artificial tears and encouraging the patient to blink during the SD-OCT scan will prevent corneal dryness and increase the likelihood of capturing a high-quality image. Dilation is necessary only when performing anterior segment imaging.

PEARLS FOR SD-OCT IN EYES WITH AN IMT

In IMT-implanted eyes, high-resolution SD-OCT scanning can be used to monitor AMD progression and

At a Glance

- Imaging eyes with IMTs presents a unique set of challenges, requiring imagers and physicians to adjust their tactics.
- SD-OCT scans of telescope-implanted eyes can be performed by modifying certain features of the Spectralis SD-OCT device.

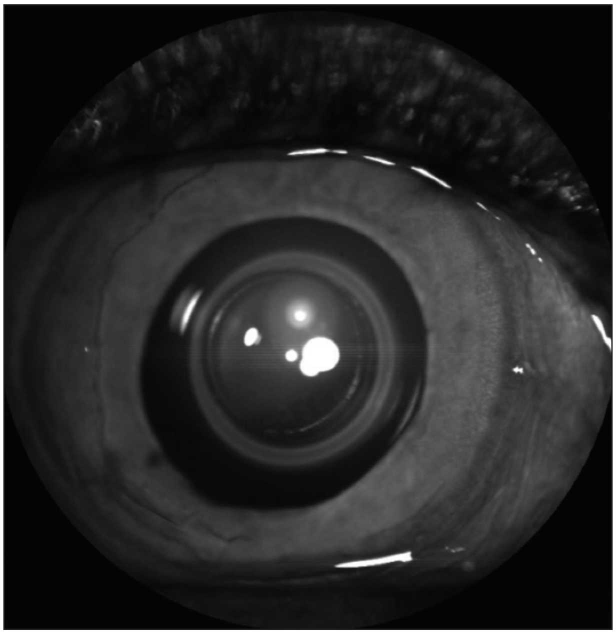

Figure 1. Image of an eye with an IMT taken with an anterior segment lens on the Spectralis SD-OCT (Heidelberg).

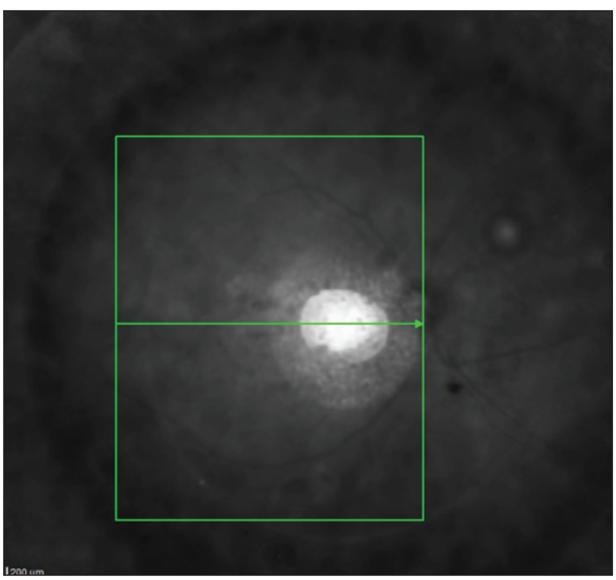

Figure 2. Spectralis SD-OCT cSLO image of a retina through an IMT. This example depicts the difficulty of trying to obtain a clear view of the macula through an IMT.

treatment response to anti-VEGF therapy. The unique imaging challenges presented by the IMT, however, require those operating SD-OCT devices to consider different approaches to imaging. For example, when performing diagnostic SD-OCT using the Spectralis, several parameter adjustments can be used to counteract the minimized and indistinct view of the macula. To start, all retinal

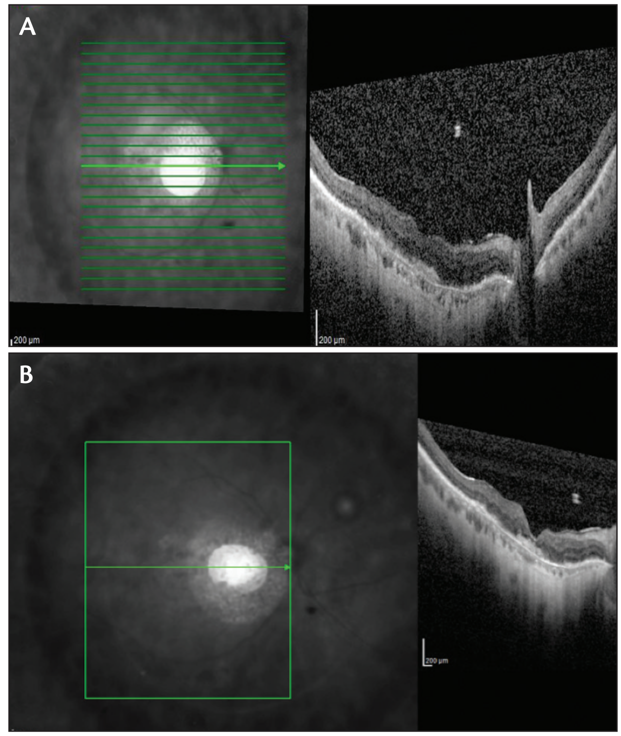

Figure 3. Spectralis SD-OCT images of a retina in an eye with an IMT. Using the preset volume scan pattern results in a scan of the retinal layers farther from the fovea, including the optic nerve (A). Decreasing volume scan area results in enhanced details of the macular region (B). Reducing the area of the volume scan improves the quality of the scan.

scans should use the 20° lens and the fast preset volume scan pattern.

To overcome the minimization effect of the macula from the IMT, the first adjustment to the SD-OCT scan pattern is to condense the area of the preset volume scan pattern. This modification will decrease the area of the retina scanned to display just the macular region. Otherwise, approximately 100° of the retina will be viewed in the cSLO acquisition window. Therefore, decreasing the area of the retina that will be scanned results in improved visualization of the macular region. (Note that the standard fast preset volume scan pattern also works well if a view farther from the macula is desired.)

Figure 3 is a comparison of Spectralis SD-OCT scans of an eye with an implanted telescope showing the use of the preset volume scan pattern and the modified decreased volume scan pattern to cover a reduced area of the retina. One disadvantage of decreasing the area of the preset volume scan pattern is that the imager may miss a small pocket of extrafoveal subretinal fluid, especially if the fluid is not centrally located. However, if a pocket of subretinal fluid is too far from the central macula

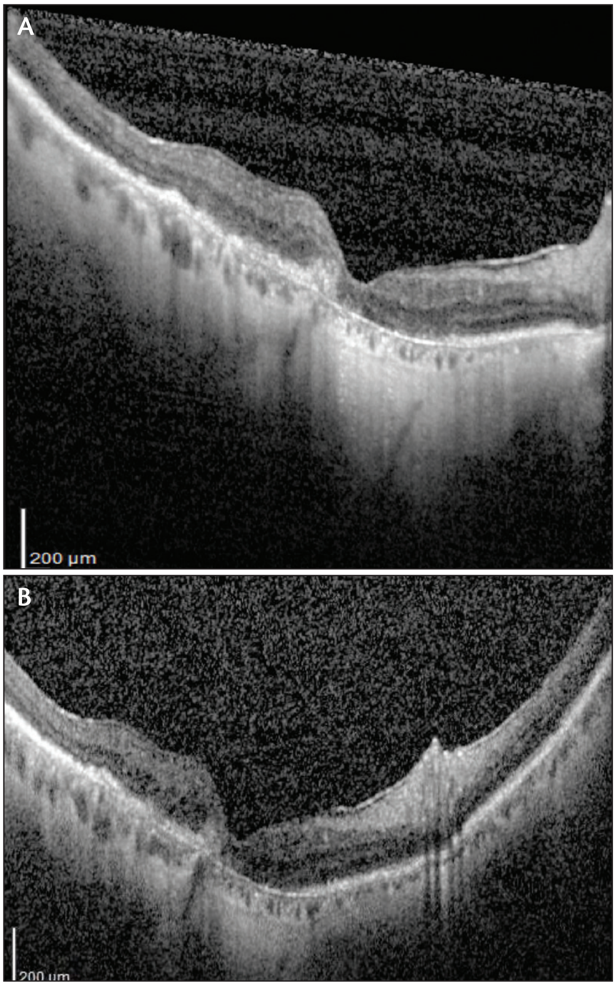

Figure 4. Spectralis SD-OCT images of a retina using ART 30 and 193 sections (A). ART 9 with 23 sections of the same eye (B). Increasing the ART and number of sections results in an image with a higher resolution.

to be visualized, it is not likely to be clinically significant.

Two additional modifications can aid in achieving a higher-resolution SD-OCT scan. The number of sections of the fast preset volume scan pattern should be increased from the standard setting of 23 sections to 193 sections in order to achieve greater anatomic detail of the fovea. Also, the standard definition setting of automatic real tracking (ART) 9 should be increased to ART 30. Figure 4 shows SD-OCT scans of an eye with the IMT using ART 30 (with 193 sections) and ART 9 (with 23 sections), illustrating the differences in resolution between the two modes. With these setting changes, it took an imaging technician approximately 2 minutes to acquire the scans in this figure. It is possible to further increase the ART and the number of sections with the Spectralis SD-OCT, but this consequently increases imaging capture times.

"Despite the imaging challenges presented by the IMT, SD-OCT scans can be obtained by modifying certain features of the Spectralis SD-OCT."

CONCLUSION

Despite the imaging challenges presented by the IMT, SD-OCT scans can be obtained by modifying certain features of the Spectralis SD-OCT. Decreasing the preset volume scan area overcomes the minimization effect of the telescope to focus on the macular region and improves the quality of the image. Changing the number of sections from 23 to 193 while also increasing ART 9 to ART 30 in turn increases the scan resolution to provide enhanced anatomic details of the retina. Together, these modifications increase the likelihood of detecting retinal fluid in eyes with the IMT. Furthermore, they improve the diagnosis and management of telescope-implanted patients with AMD. ■

Melanie J. Fortin, BS, COA, is an ophthalmic technician and trainer with Colorado Retina Associates in Denver, Colorado. Ms. Fortin may be reached at mfortin.email@gmail.com.

Brian C. Joondeph, MD, MPS, is a partner at Colorado Retina Associates and a clinical professor of ophthalmology at Rocky Vista University College of Osteopathic Medicine in Parker, Colorado. Dr. Joondeph may be followed at @retinaldoctor and reached at bjoondeph@retinacolorado.com.

Anna Pappas, BS, COA, is an ophthalmic imager and technician with Colorado Retina Associates in Denver, Colorado. Ms. Pappas may be reached at apappas@retinacolorado.com.

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