

## MODULE 7.5

## The Future of Detection

Ophthalmologists have benefited from continual developments in posterior segment imaging technologies.<sup>1</sup> Time-domain optical coherence tomography (TD-OCT) was an important advance for retinal specialists but was soon eclipsed by spectral-domain OCT (SD-OCT), which offers higher resolution (1-3  $\mu$ m axial resolution with SD-OCT vs 10  $\mu$ m with TD-OCT) and 3D imaging capability.

Swept-source OCT (SS-OCT) is a recent advance in retinal and choroidal imaging.<sup>1</sup> To overcome light scattering by the retinal pigment epithelium, which prevented visualization of deeper structures by SD-OCT, a longer wavelength was adopted for SS-OCT (1050 nm vs 840 nm in SD-OCT), and photodetectors, instead of charge-couple device (CCD) cameras, provide a further improvement in resolution (1  $\mu$ m). The scan speed in SS-OCT is approximately twice that in SD-OCT, enabling faster acquisition of B-scans, thus allowing widefield B-scans and more accurate 3D imaging. The optic nerve and macula can be visualized on the same widefield scan, and simultaneous high-quality visualization of the vitreous, retina, and choroid is now possible. Choroidal layers that were hardly discernable using conventional SD-OCT are visible on SS-OCT.

SS-OCT has been used to confirm histologic data: the structure of the choroid consists of multiple layers going from the innermost Bruch membrane to the choriocapillaris, Sattler layer (layer of medium diameter blood vessels), Haller layer (outermost layer of the choroid consisting of

larger diameter blood vessels), and lamina suprachoroidea.<sup>3</sup> Usually behind the lamina suprachoroidea - a hyperreflective line indicating the choroidoscleral boundary - sclera of diminishing reflectivity can be visualized. Arteries and vessels running through the sclera may also be visualized. Additionally, in some eyes, a hyperreflective linear structure between the lamina suprachoroidea and sclera has been observed and judged to be the suprachoroidal space.<sup>4</sup> Although this hypothetical space had not previously been visualized by conventional techniques (except in eyes with choroidal effusion), new surgical and pharmacologic techniques are currently being developed to introduce drugs into this space. Visualization will be an important factor in identifying the effects of these interventions.

The information provided by SS-OCT and other recent imaging advances holds promise for the study of diabetic eye disease because altered morphology in the choroid has been observed in eyes with diabetic retinopathy (DR).<sup>5</sup> Further studies may provide insights into the significance of choroidal angiopathy and its effect on disease progression in DR. However, for the time being, some of these technologies are not yet widely disseminated, and access may be limited to certain tertiary or academic centers.

## References

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