OCT angiography (OCTA) has been inspiring groundbreaking questions and providing new answers about retinal vascular disease, and it’s doing the same in glaucoma.

In my referral practice at the University of Texas Southwestern Medical Center, I obtain OCTA scans on all patients the first day I see them. Alongside the OCT-generated measurements I had already been assessing - retinal nerve fiber layer (RNFL) thickness, ganglion cell complex thickness and focal loss volume percentage, optic nerve rim and disc area - I have added the OCTA-generated measurement of vessel density. OCTA provides vessel density values for the macula as well as the optic disc and the radial peripapillary capillaries. It has been established that optic disc and peripapillary vascular abnormalities detected by OCTA are seen in eyes with glaucoma.\(^1\) It has also been shown that macular and peripapillary areas of reduced vessel density in eyes with glaucoma correlate with the location of visual field damage.\(^2\) Furthermore, as expertly outlined in a recent editorial from researchers at the University of California - San Diego Hamilton Glaucoma Center, some evidence suggests that vascular changes may occur prior to RNFL thickness changes, OCTA may provide information about disease progression that is additive to RNFL thickness, and OCTA may be a more reliable way to measure change in advanced disease.\(^3\)

While many questions about OCTA’s ultimate role in glaucoma care still need to be answered with certainty, taking OCTA measurements into account improves my confidence in determining whether a patient needs immediate treatment and where to place him or her in my treatment protocols. For example, a highly myopic patient referred to me recently had normal IOP but suspicious-looking optic discs. Her visual field test results were nonspecific. OCT and OCTA, however, showed normal RNFL values and normal vessel density. Given this palette of information, I’m comfortable observing her rather than recommending medication, and the associated burden and cost, at this time.

With a different set of information, for example, a mild visual field defect but OCTA vessel density values indicating moderate damage (Figure 1), I’m likely to be more aggressive in categorizing the patient’s status and need for treatment. My current follow-up strategy for most patients, after baseline OCTA and visual field testing, includes alternating between OCTA and a visual field test every 6 months. For patients unable to perform a visual field test, I replace it with OCTA.

Figure 1. Association of visual field testing, nerve fiber layer thickness and vessel density around the optic nerve and macula in a 62-year-old patient with a strong family history of glaucoma and unilateral (OD) moderate glaucomatous damage. Visual field testing (A) reveals a dense superior arcuate defect (MD -8.65, PSD +8.23), and OCT scanning of the optic disc (B) shows marked thinning of nerve fibers in the inferior hemisphere (80:52 ratio of thickness between upper and lower hemispheres; normal >90 µm). OCTA vessel density (%) mapping of the optic disc and macula correspond with the nerve fiber layer thinning. Optic disc vessel density (C) is markedly reduced in both hemispheres (28:43 inferior:superior ratio; normal >50%). Macular vessel density (D) is also markedly reduced in the superficial and deep vascular complexes in both hemispheres (31:35 inferior:superior ratio; normal >45%).
From a research perspective, my colleagues and I have been collecting normative data and analyzing OCTA vessel density measurements and OCT structural measurements in controls, glaucoma suspects and patients with mild, moderate and severe glaucoma. We’ve found that both OCT structural properties and OCTA vessel densities have been effective in determining glaucoma stage based on visual field damage. One aspect we’ll watch as we continue to collect and analyze our data is the lack of vessel density change compared to controls that we’ve seen in some glaucoma suspects who exhibit change in OCT structural properties.

Working with OCTA has been an exciting addition to my practice, and I look forward to its expanding foothold in glaucoma care as it nudges the field toward a broader and deeper understanding of the disease and hence improved care and less burdensome testing for patients.

References