

CLINICAL UTILITY OF OCT ANGIOGRAPHY FOR RETINAL AND CHOROIDAL VASCULAR DISEASES



In Part 2 of this two-part series, the authors continue to explore the pluses and minuses of OCTA.

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In Part 1 of this two-part series, we summarized the clinical utility of OCT angiography (OCTA) in exudative and nonexudative AMD. In this report, we examine the usefulness of OCTA for other retinal and choroidal vascular diseases.

DIABETIC RETINOPATHY

OCTA can play a significant role in diagnosis and monitoring of diabetic retinopathy (DR; Figure 1). It can visualize microaneurysms and show reduced macular vessel density where detailed fundus examination fails to detect any signs of DR.¹ Nevertheless, only about half of the microaneurysms seen on fluorescein angiography (FA) are detected by OCTA, perhaps because of the limited ability of the latter modality to detect slow flow.²

FA, because of light scattering and limitations inherent to the technology, is unable to capture changes in the deep capillary plexus where some of the earliest changes of DR may occur.³ The depth resolution of OCTA, however, enables visualization of the capillary plexus. Additionally, OCTA can detect nonperfused areas and enlargement of the foveal avascular zone (FAZ; Figure 2).⁴

OCTA may also be useful for precisely detecting retinal neovascularization (NV) without obscuring the margins by leakage, as occurs with FA. The area of NV can be monitored as it changes in size after laser treatment or anti-VEGF therapy.³ However, the smaller field of view on OCTA compared with FA may limit its ability to investigate peripheral NV or nonperfusion in DR. To address this limi-

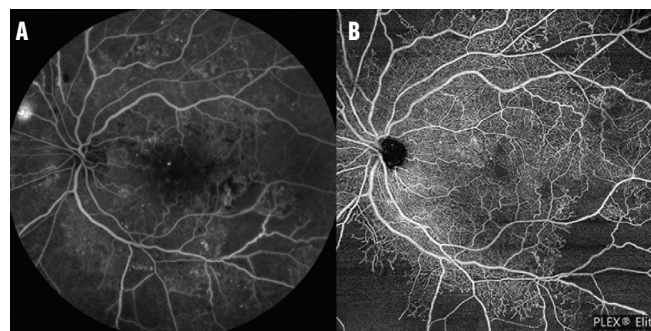


Figure 1. These are the FA (A) and the corresponding 6 x 6 mm OCTA en face images of the full retinal thickness slab (B) of an eye with proliferative diabetic retinopathy (PDR). Areas of nonperfusion can be seen with both technologies, but in greater detail on the OCTA image. FAZ margins are also better visualized with OCTA than with FA. The superonasal area of dye leakage captured on FA was not captured on the OCTA frame.

tation, it is possible to create widefield images by mounting multiple images.³ Some high-speed OCTA devices are capable of scanning larger areas. Although widefield OCTA offers a smaller field of view than that captured by ultra-widefield FA, OCTA provides more detailed visualization of vascular changes in a fast, noninvasive manner.^{1,4,5}

RETINAL VASCULAR OCCLUSION

Retinal vascular occlusions are common retinal disorders causing vision loss.⁶ Traditionally, FA has been used for the evaluation of disease severity, degree of ischemia, and extent of NV.⁷ Recently, widefield OCTA has been useful in evaluating the retinal vasculature with high sensitivity



Figure 2. The widefield en face OCTA (12 x 12 mm montage) of the superficial capillary plexus in a patient with PDR shows extensive areas of nonperfusion, irregular FAZ, and multiple areas of NV elsewhere (red arrows).

for early detection of nonperfusion and vasculature abnormalities (Figure 3).⁸⁻¹¹

CENTRAL SEROUS CHORIORETINOPATHY

Choroidal NV is a known complication of central serous chorioretinopathy (CSCR) and can be a major cause of visual impairment.¹² Forming a definitive diagnosis of macular NV in this condition is often challenging using traditional imaging; late hyperfluorescence in FA is not easy to differentiate from window defects of the retinal pigment epithelium (RPE) and the ill-defined leaking points of CSCR.¹³ Recent studies report that OCTA is more sensitive in the detection of macular NV secondary to CSCR and can enhance diagnosis compared with dye-based angiography (Figure 4).¹⁴⁻¹⁶

UVEITIS

OCTA findings in patients with uveitis may have significant implications, documenting potential biomarkers of retinal or choroidal inflammatory activity and response to treatment in a noninvasive manner.¹⁷ If OCTA is unable to detect dye leakage in uveitis, however, it may still assist in evaluating vascular density changes in the superficial and/or deep retinal capillary plexus; these are significantly lower in eyes with vasculitis than in healthy eyes.

Recent advances in widefield OCTA imaging may enhance the detection of peripheral nonperfusion. Additionally, quantitative evaluation of the vasculature can be used to assess disease progression.^{18,19}



Figure 3. En face 12 x 12 mm OCTA scan of the superficial capillary plexus demonstrates an area of nonperfusion due to a left superotemporal ischemic branch retinal vein occlusion.

OTHER APPLICATIONS

OCTA can be used to evaluate choroidal ischemia corresponding to areas of hypofluorescence on indocyanine green angiography in placoid lesions such as acute posterior multifocal placoid pigment epitheliopathy and serpiginous choroiditis.^{20,21} In contrast, OCTA demonstrated normal choriocapillaris flow in the areas with corresponding hypofluorescence in patients with multiple evanescent white dot syndrome, suggesting shadowing rather than ischemia.²²

In multifocal choroiditis or punctate inner choroidopathy, OCTA is useful in distinguishing inflammatory macular NV from avascular inflammatory lesions that are poorly identified using other imaging modalities (Figure 5).²³⁻²⁵

CONCLUSION

OCTA is a rapid, noninvasive imaging tool with clinical applications in a wide range of ophthalmic diseases. However, limitations such as artifacts and segmentation errors can challenge scan interpretation.²⁶

The inability of OCTA to detect leakage is a shortcoming in comparison to FA, limiting its clinical utility. However, the higher resolution and the depth-resolved imaging capability of OCTA add to the clinical assessment of many conditions.³

Along with future technical improvements, more studies are needed to elucidate the clinical utility of OCTA in the diagnosis and monitoring of many common ophthalmic pathologies. ■

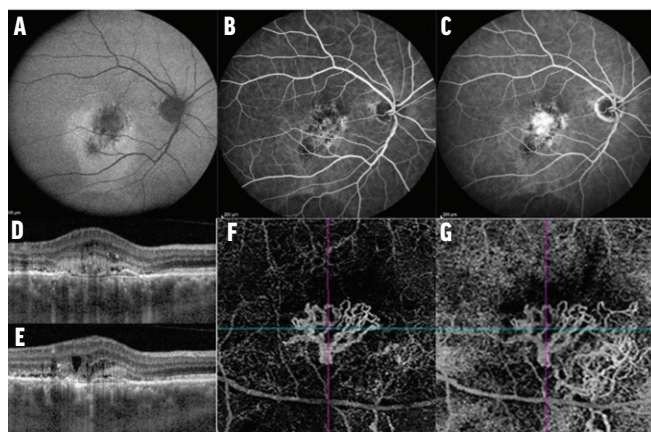


Figure 4. In this patient with choroidal NV secondary to CSCR, fundus autofluorescence shows RPE mottling and track sign of hyperautofluorescence (A). FA shows early hyperfluorescence (B) and late leakage (C). OCT B-scans (D, E) show a thickened choroid, subretinal fluid, intraretinal fluid, subretinal hyperreflective material, and a flat irregular pigment epithelial detachment. OCTA en face scans at the level of the outer retina (F) and choriocapillaris (G) show a choroidal neovascular membrane.

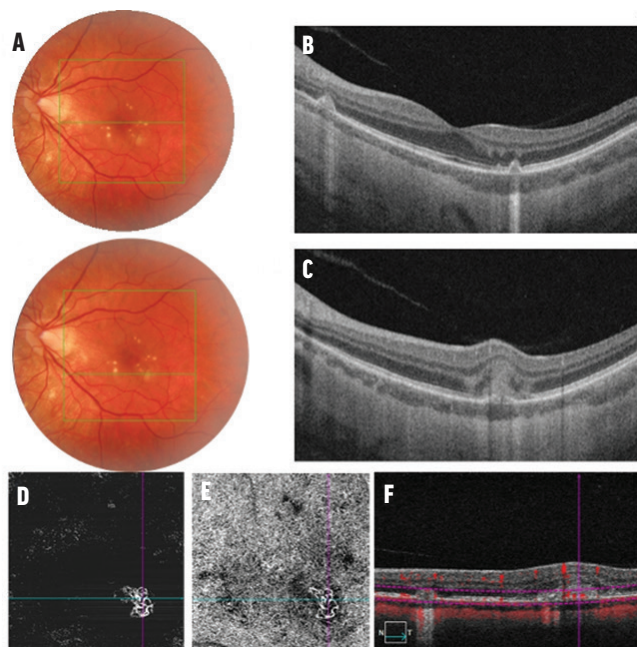


Figure 5. In this patient with uveitis and secondary macular NV, the color fundus photograph (A) and corresponding OCT B-scan (B) show punctate inner choroidopathy lesions. Lower OCT B-scan (C) shows a lesion that is suspicious for secondary type 2 macular NV. OCTA en face images at the level of the outer retina (D) and outer retina-choriocapillary complex (E) show an abnormal vascular network, and the corresponding OCTA B-scan (F) shows flow signals confirming the diagnosis of secondary type 2 macular NV.

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