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The Revolution in Noninvasive Retinal and Choroidal Vascular Imaging: Optical Coherence Tomography Angiography (OCTA)

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COLUMN ARTICLE

Optical coherence tomography (OCT) is a noninvasive and very useful imaging method for the diagnosis and the evaluation of the treatment of the various macular diseases. However, it fails to detect the leakage and ischemia in the retina, and it cannot directly to show the neovascularization in retina and choroid as well as fluorescein angiography (FA) or indocyanine green angiography (ICGA), respectively. These angiography methods need the intravenous administration of a contrast dye for the imaging of pathological lesions in the posterior segment. The injections of dyes such as fluorescein or indocyanine green can rarely cause nausea and vomiting. So, both angiography methods are invasive. They have also serious adverse effects such as anaphylaxis or anaphylactic reactions even if these are very rare. Additionally, conventional fundus angiography with the usage of dye has not been preferred in the patients with kidney or liver failure and cardiovascular disease. The patients required fundus angiographies are also usually older persons having systemic vascular diseases such as diabetes mellitus and arterial hypertension. In the other hand, FA can detect micro-aneurysms, venous beading, intraretinal microvascular abnormalities (IRMA), retinal ischemia and neovascularization. However, FA fails separately reveal the intraretinal major capillary networks, because the superficial and deep capillaries in the retina overlap at two-dimensioned imaging.

OCTA provides the detailed and in-depth assessment of the retinal and choroidal vasculature in high-resolution, the accurate size and localization by detecting motions of the red blood cells and visualizing the blood flow using serial OCT B-scans. OCTA does not need the injection of a contrast dye [1-5] (Figure 1).

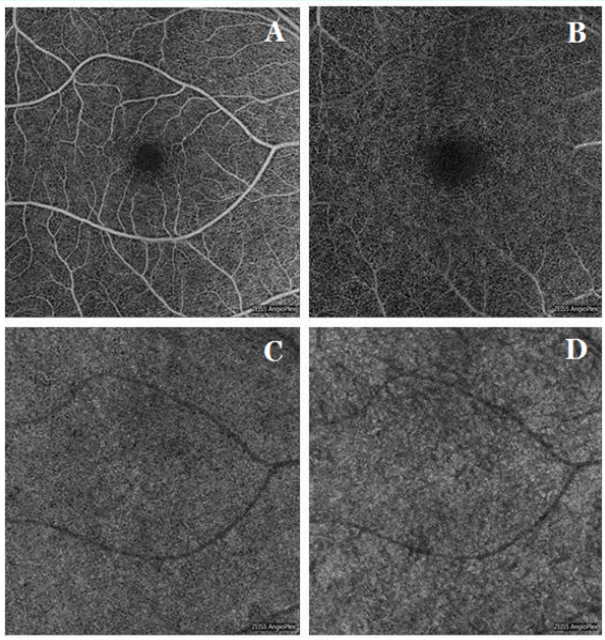

Figure 1: The imaging of superficial (A) and depth (B) retinal vasculature, choriocapillaris (C), and choroid (D) by optical coherence tomography angiography (ZEISS Angioplex) belonging the author's own.

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Advantages of OCTA [1-6].	Disadvantages of OCTA [1-6].
Detailedand in-depthassessment in theaccurate size and localization of the retinal and choroidal vasculature	The artifacts due to blinking, motion or vessel ghosting
The quantitative measuring in neovascular vessels	The fade out of the flow signal in OCTA in large vessels due to very fast blood
To visualize both superficial and depth vascular plexus in retina	A limited field of view (about 3 × 3–6 × 6 mm)
No necessary the injection of a contrast dye and so, no adverse reactions	The failure to show the leakage and to assess the vascular permeability
Providing microaneurysms, retinalischemia, andneovascularization	Necessary some algorithms such as SSADA or OMAG for providing the detailed OCTA images with high-quality

Table 1: The current advantages and disadvantages of OCTA.

The OCTA imaging can be improved by the split-spectrum amplitude-decorrelation angiography (SSADA) or Optical Micro Angiography (OMAG) algorithms and the OCTA images with high-quality and quick can be provided [1-5]. OCTA has important advantages and some disadvantages (Table 1) [1-6]. However, the failure in the revealing of leakage can be also considered as an advantage because the images gained by OCTA are not obscured by the leakage and the involved vessels can be clearly observed.

In a newly publication, it has been demonstrated that OCTA provides clear visualization of the micro-aneurysms beside the retinal non-perfused areas and detailed observation of each layer of the retinal capillaries and quantitative measuring in neovascular vessels [6]. It seems that OCTA will replace to conventional fundus angiography as a non-invasive angiography in next years if the disadvantages of OCTA could be eliminated.

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