

Journal Article Review

Microaneurysms visualization using five different optical coherence tomography angiography devices compared to fluorescein angiography

Based on:

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Background and Purpose

This study has evaluated the visualization of microaneurysms using five different optical coherence tomography angiography (OCTA) devices and compared them to SPECTRALIS® fluorescein angiography (FA). With the prevalence of diabetes being estimated to continuously increase over the next years, the visualization of microaneurysms, which are considered the first detectable pathologic sign in patients with diabetic retinopathy, could play a key role in the detection of the disease. Whilst FA is the gold standard modality for the evaluation of microaneurysms, OCTA has emerged as a non-invasive alternative for the evaluation of these patients. OCTA images provide detailed three-dimensional information of the different vascular layers, although it does not visualize leakage or pooling of blood.

Methods

Twenty eyes from fifteen patients with diabetic retinopathy were included. FA images were acquired using the SPECTRALIS HRA. Foveal 3x3 mm OCTA images were captured using five different devices including the SPECTRALIS OCTA Module (Heidelberg Engineering), the PlexElite prototype (Carl Zeiss Meditec), the Cirrus 5000 (Carl Zeiss Meditec), the RTVue VR Avanti (Optovue), and the DRI OCT Triton (Topcon). FA images served to evaluate both microaneurysms in the early phase (within one minute after dye injection) and leakage in the late phase (at least ten minutes after dye injection). Microaneurysms were evaluated in projection resolved OCTA images using the default automated segmentation boundaries of the superficial capillary plexus (SCP) and the deep capillary plexus (DCP).

Results

- In this study, FA counted the highest number of microaneurysms with significant difference compared to all OCTA devices ($p < 0.0001$).
- Considering both SCP and DCP, OCTA imaging performed with SPECTRALIS detected significantly more microaneurysms compared to the other devices used in the study ($p < 0.0001$).
- In the evaluation of microaneurysms as single units and when comparing each lesion within FA and OCTA images, SPECTRALIS OCTA images visualized a higher number of microaneurysms with significant difference to the other devices ($p < 0.0001$).
- Furthermore, SPECTRALIS showed a sensitivity of 43.3% (95%CI 39.1-47.5%) as well as specificity of 54.5% (95%CI 45.2-63.6%).
- Finally, the intergrader reliability analysis demonstrated a Cohen's kappa of 0.98 for FA, 0.95 for SPECTRALIS, 0.93 for PlexElite, 0.90 for AngioPlex, 0.98 for RTVue XR Avanti, and 0.99 for Triton.

Conclusions

FA remains the gold standard for microaneurysm detection, and most importantly identifies regions of focal leakage for targeted laser. However, OCTA could present a valuable alternative to FA when imaging microaneurysms. Within the scope of the current available devices used in this study, SPECTRALIS OCTA images detected a higher number of microaneurysms compared to the other OCTA devices. Variations in the OCTA method, resolution, and the number of repeated B-scans in the acquisition protocol may explain the different results. Furthermore, differences within the segmentation of the vascular plexus across OCTA platforms need to be taken into account when comparing images of different devices.