Comparison of microaneurysm detectability between MHz WF-OCTA and kHz WF-OCTA in advanced diabetic retinopathy

Kim Lien Huber[1], Heiko Stino[1], Thomas Schlegl[2], Michael Niederleithner[2], Wolfgang Drexler[2], Rainer A. Leitgeb[2], Ursula Schmidt-Erfurth[1], Tilman Schmoll[2,3], Andreas Pollreisz[1]

[1]Department of Ophthalmology, Medical University of Vienna, Austria; [2]Center for Medical Physics and Biomedical Engineering, Medical University Vienna, Austria; [3]Carl Zeiss Meditec, Inc., Dublin, CA

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PURPOSE

- To compare the difference in diabetic microaneurysm (MA) detection between an ultrafast megahertz (MHz) widefield optical coherence tomography angiography (WF-OCTA) device and a commercially available kilohertz (kHz) WF-OCTA device.
- Improvements of OCTA imaging have led to an increased usage of OCTA in diabetic retinopathy (DR) diagnosis, pathing the way for a wider applicability.

METHODS

- Diabetic patients with DR were recruited from the Department of Ophthalmology at the Medical University of Vienna.
- MHz WF-OCTA 3D data were acquired with a custom-built swept-source (SS) OCT prototype: A-scan rate 1.7 MHz; FOV 18mm in diameter; 1060nm central wave length and lateral resolution of 20 µm. Data was further processed with deep learning (DL) based 3D denoising.
- Corresponding images were obtained with PLEX® Elite 9000 (ZEISS, Dublin, CA; A-scan rate 200 kHz; FOV 12x12mm) and Optos® California (Optos; ultrawide-field fluorescence angiography (FA) and color fundus (CF) imaging).
- Microaneurysms (MAs) were manually evaluated on en face OCTA/FA/CF images within an extended ETDRS grid consisting of a central 1 mm diameter disc, inner (0.5–1.5mm), outer (1.5–3.0mm) and extended ring (3.0-6.0mm).

CONCLUSIONS

- MHz WF-OCTA in combination with DL-based image denoising techniques outperformed kHz WF-OCTA in the detection of diabetic MAs, which was pronounced in the extra-macular and peripheral regions of an extended ETDRS grid.

Email: kim.huber@meduniwien.ac.at

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RESULTS

Thirty-four eyes of 34 patients with severe non-proliferative DR (n= 11) and proliferative DR (n=23) were included in this study. A mean number of 160±45 (± standard deviation) MAs per eye were detected from the gold standard FA images. MHz WF-OCTA and kHz WF-OCTA detected 55% and 44% of MAs, respectively. Significantly more MAs in total were detected on MHz WF-OCTA compared to kHz WF-OCTA (p=0.007). MHz WF-OCTA outperformed kHz WF-OCTA in MA detection in the outer (p=0.006) and extended ETDRS ring (p=0.031). CF showed the lowest detection rate with 34% of MAs. Details of MA numbers in specific ETDRS rings are shown in Table 1.

Table 1: Number of MAs detected per modified ETDRS grid

	MHz WF-OCTA	kHz WF-OCTA	FA	CF
Central disc	28	25	54	15
Inner ring	199	174	346	129
Outer ring	839	641	1359	475
Extended ring	1954	1538	3685	1227
Total	3020	2378	5444	1846

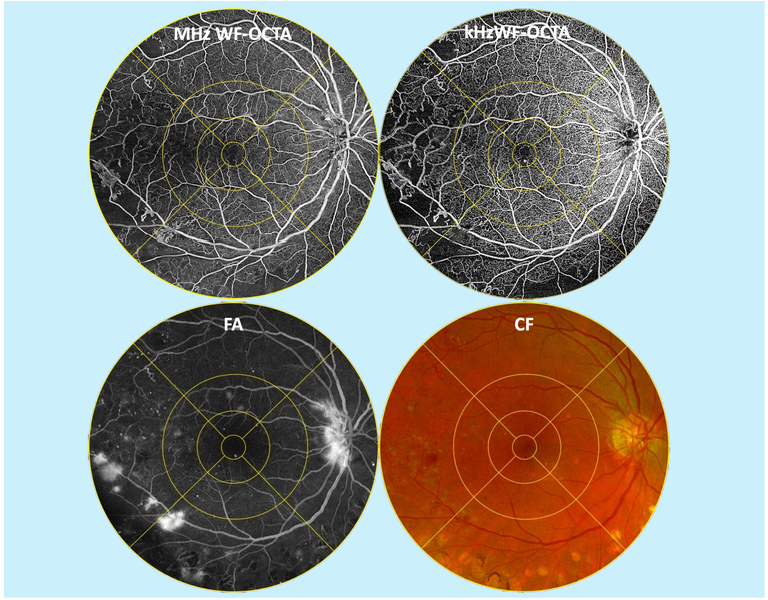

Figure 1: 57-year-old patient with proliferative DR, MAs, IRMAs and NVs visible on MHz-WF-OCTA, WF-OCTA, FA and CF imaging

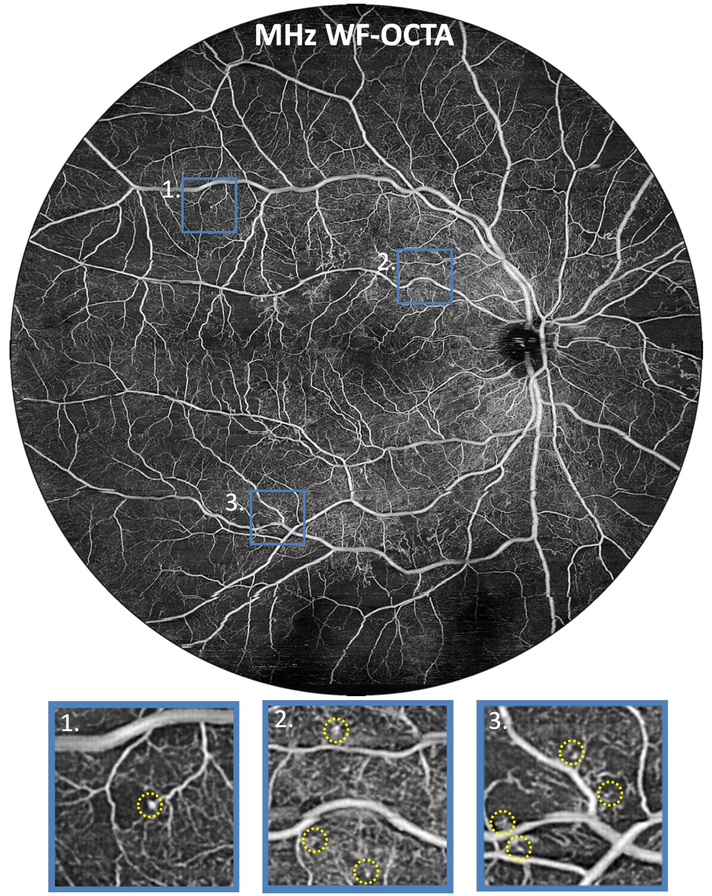

Figure 2: MHz-WF OCTA of a 55-year-old with severe non-proliferative DR, Images 1.-3. show examples of MAs on OCTA en face images