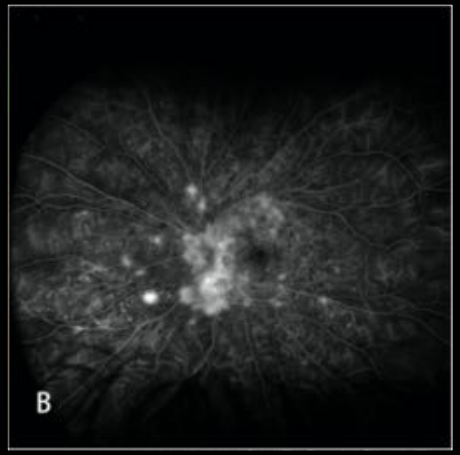
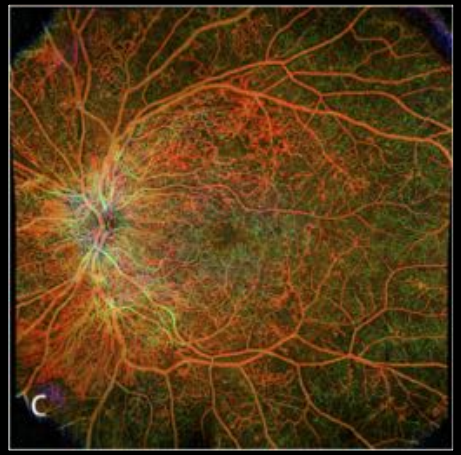
Wide-Field Swept Source OCT-A vs. Fluorescein Angiography for Detecting Diabetic Retinopathy





John B. Miller MD

Retina Society 2020

https://retinaimaginglab.com/

Disclosures

Consultant

- Zeiss
- Heidelberg

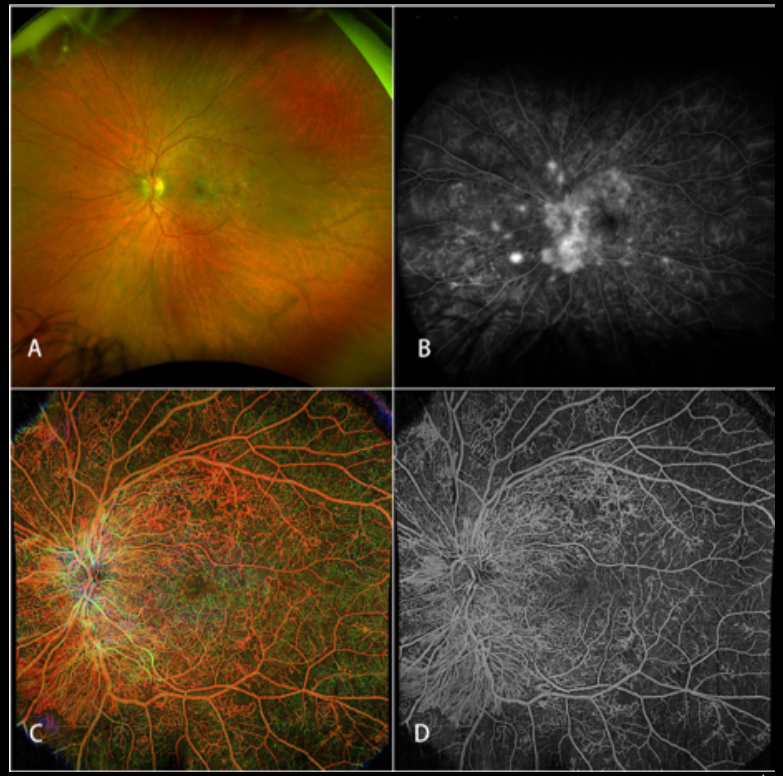
Support

- Lions International Equipment Fund with matching support from our MA Lions Club

Since 2015, Dr. John B. Miller's service at MEE has been subject to review, guidance, and management by an independent oversight committee. The committee is chaired by the President of MEE and has been approved by the Board of Directors of MEE and the Dean of HMS.

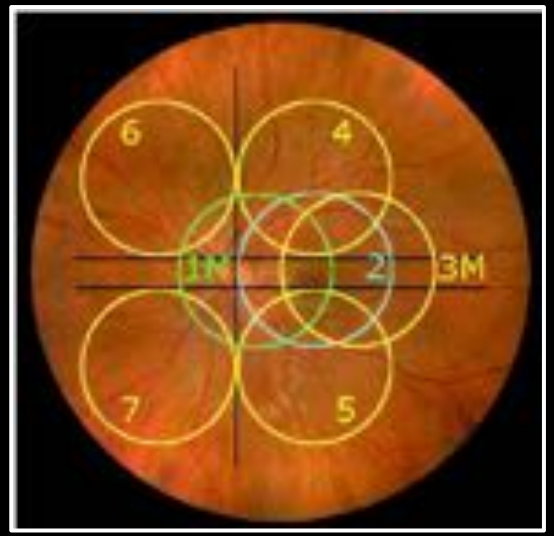
Summary

- WF SS-OCTA is clinically useful in detecting MA, IRMA and NVD/NVE, and NPAs
- WF SS-OCTA is comparable to UWFA for DR lesion detection
- When combined with UWF CFP, WF SS-OCTA showed identical detection rates to UWF FA
- WF SS-OCTA may offer a less invasive and more frequently testable alternative to FA for DR diagnosis, monitoring and screening.



Zhu Y, Cui Y, Wang JC, … Miller JB. Comparison of Widefield Swept-Source Optical Coherence Tomography Angiography with Ultra-Widefield Color Fundus Photography and Fluorescein Angiography for Detection of Lesions in Diabetic Retinopathy. British Journal of Ophthalmology. 2020 Jun 26;bjophthalmol-2020-316245.

Imaging Modalities in Diabetic Retinopathy



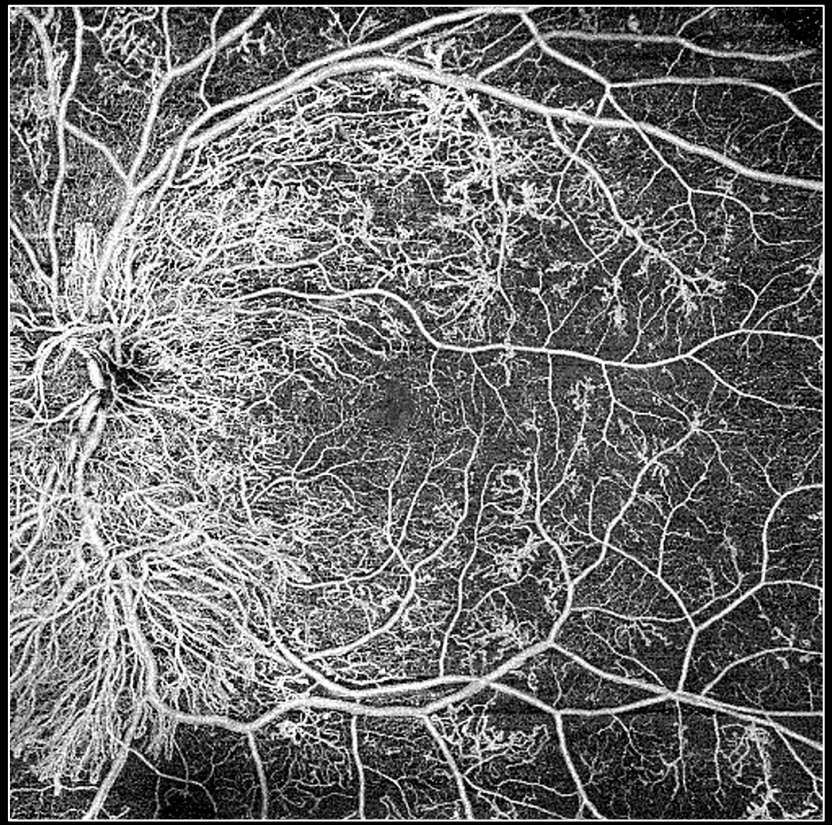
Gold Standard

Becoming More Widely Adopted

More Accurate But Invasive

1. Grading diabetic retinopathy from stereoscopic color fundus photographs--an extension of the modified Airlie House classification. ETDRS report number 10. Early Treatment Diabetic Retinopathy Study Research Group. Ophthalmology 1991;98(5 Suppl):786-806

Where OCT-A Fit In for DR?

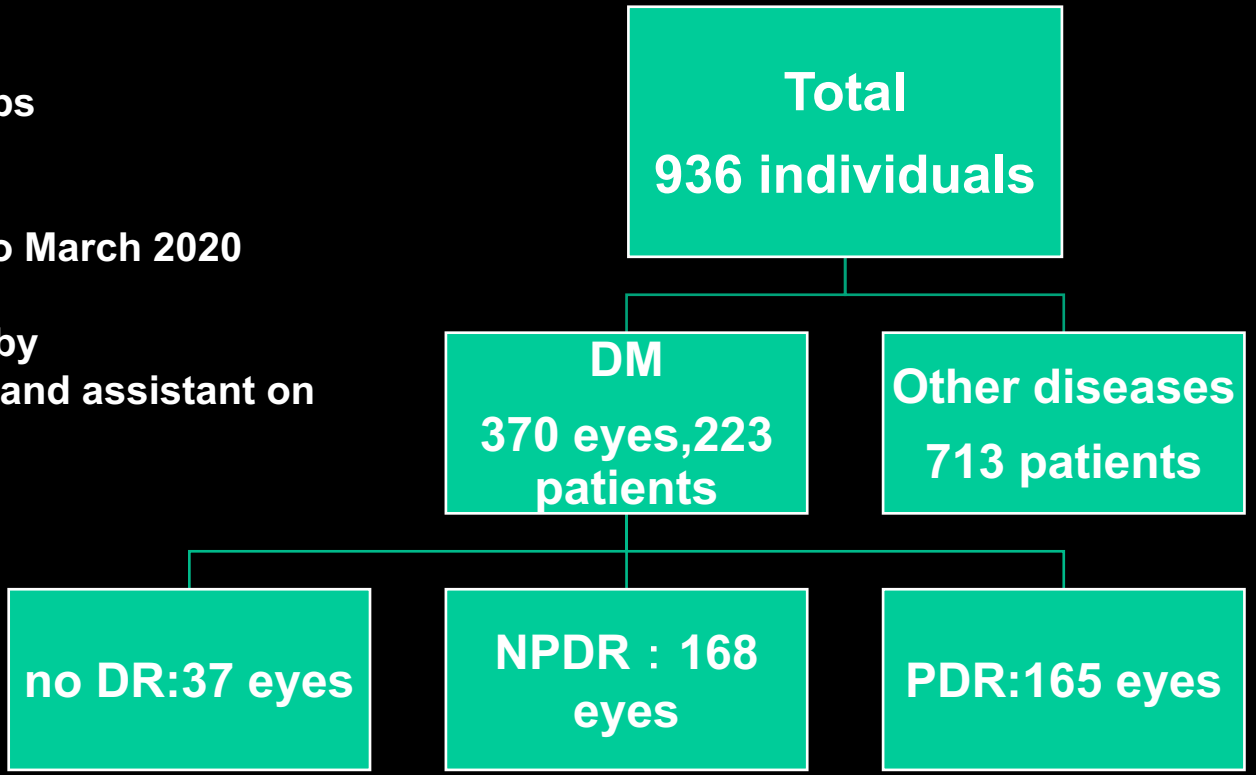


Widefield SS-OCTA at Mass Eye and Ear

Multiple follow-ups in some patients

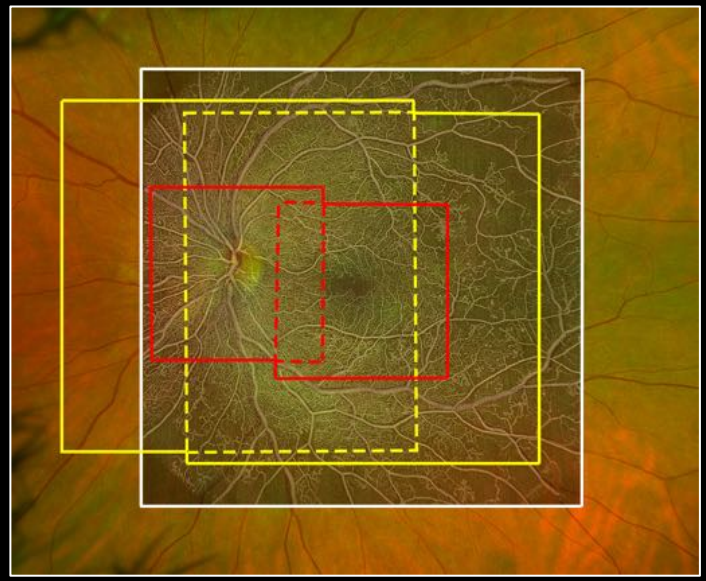
From Nov 2018 to March 2020

All images done by research fellows and assistant on Zeiss Plex Elite



What scan protocol should we use for DR detection?

- Angio 6- × 6mm centered on fovea
- Angio 6- × 6mm centered on optic disc
- Angio 12- × 12mm centered on fovea
- Angio 12- × 12mm centered on optic disc
- Montage 15- × 15mm (2- Angio 15- × 9mm scan composite)



Zhu Y, Cui Y, Wang JC, … Miller JB. Different Swept-Source Optical Coherence Tomography Angiography scan protocols for detection of diabetic retinopathy lesions. American Journal of Ophthalmology. 2020 Jul; 215:72-80. doi: 10.1016/j.ajo.2020.03.004.

Conventional OCTA vs. Widefield SS-OCTA

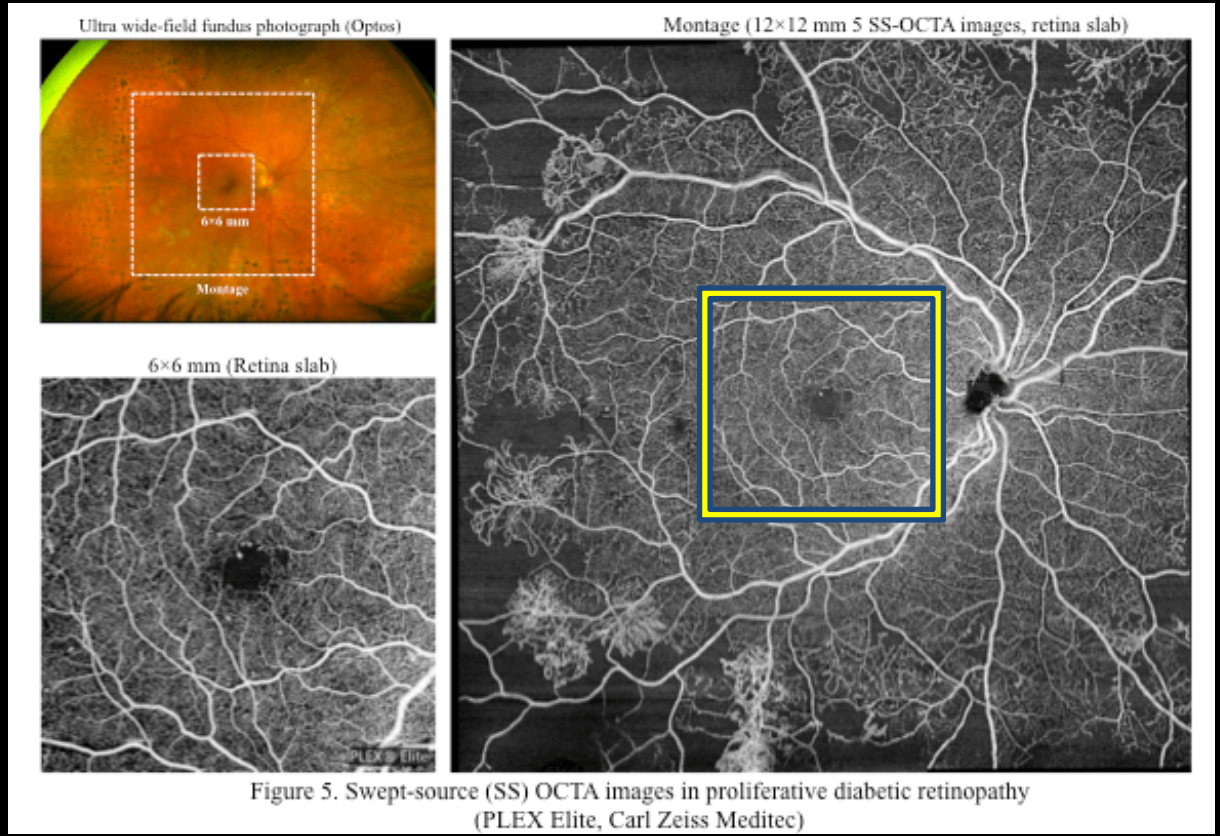


Figure 5. Swept-source (SS) OCTA images in proliferative diabetic retinopathy (PLEX Elite, Carl Zeiss Meditec)

1. Ishibazawa A, Waheed NK. Which OCTA Machine Should You Get? RETINA ROUNDUP. Jan 28, 2019.

Angio 6×6 mm centered on fovea vs. Montage 15- ×15mm

DR lesions	Eyes with DR lesions present in different scan protocols (eyes, %)		
	Angio 6- × 6mm centered on the fovea	Montage 15- × 15mm	*P* value
MAs	126/153 (82.4%)	117/153 (76.5%)	0.012*
IRMA	92/153 (60.1%)	100/153 (65.4%)	0.057
NVE	27/153 (17.6%)	51/153 (33.3%)	<0.001*
NVE+NVD	27/153 (17.6%)	53/153 (34.6%)	<0.001*
NPAs	60/153 (39.2%)	97/153 (63.4%)	<0.001*
Looping/beading	27/153 (17.6%)	37/153 (24.2%)	0.041*
Hard Exudates	77/153 (50.3%)	74/153 (48.4%)	0.453

Detection rate of neovascularization on Angio 6mm×6mm centered on fovea was about half of that on Montage 15mm×15mm (P<0.05). Only for MAs, was 6x6 better than Montage.

Angio 12-×12mm centered on the fovea and optic disc vs. Montage 15-×15mm

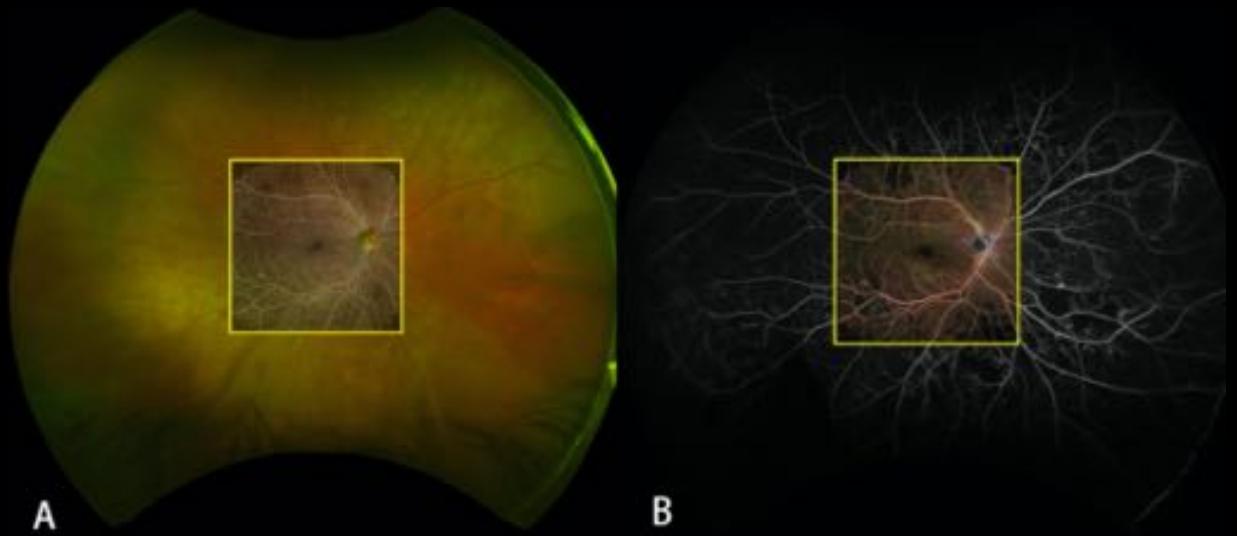
DR lesions	Eyes with DR lesions present in different scan protocols (eyes, %)		
	Angio 12-×12mm centered on the fovea and optic disc	Montage 15- × 15mm	*P* Value
MAs	41/50 (82.0%)	40/50 (80.0%)	1.000
IRMA	37/50 (74.0%)	37/50 (74.0%)	1.000
NVE	21/50 (42.0%)	21/50 (42.0%)	1.000
NVE+NVD	21/50 (42.0%)	21/50 (42.0%)	1.000
NPAs	35/50 (70.0%)	36/50 (72.0%)	1.000
Looping/beading	17/50 (34.0%)	17/50 (34.0%)	1.000
Hard Exudates	31/50 (62.0%)	29/50 (58.0%)	0.500

Scan Protocol Recommendations

- Wide-field SS-OCTA better than conventional 6x6 macular scans for detecting DR lesions
- The Angio 12- × 12mm centered on fovea and optic disc might be a good alternative to Montage 15- × 15mm in a busy clinical practice
  - Comparable DR lesion detection rates
  - Shorter acquisition time
  - Less imaging artifacts

Zhu Y, Cui Y, Wang JC, … Miller JB. Different Swept-Source Optical Coherence Tomography Angiography scan protocols for detection of diabetic retinopathy lesions. American Journal of Ophthalmology. 2020 Jul; 215:72-80. doi: 10.1016/j.ajo.2020.03.004.

How does WF SS-OCTA compare to UWF CFP and FA?



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Study Population

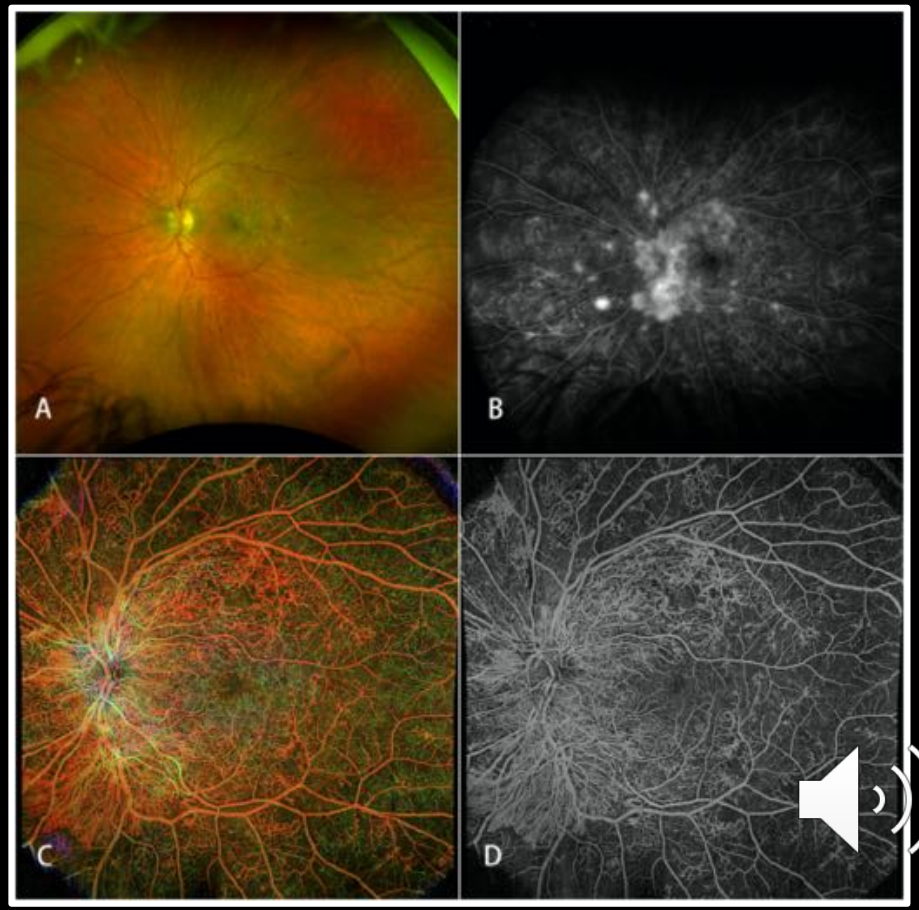
Participants (eyes)	101(152)
Age (years)	54.26±13.40
Sex:Male	46 (30.3%)
Female	55 (36.2%)
Type of diabetes (Participants)*	
Type 1 diabetes mellitus	23 (29.5%)
Type 2 diabetes mellitus	78 (77.2%)
Duration of diabetes (years)*	17.81±10.93
HbA1c (%)*	8.22±1.86
Involved eye: Right/left	88/64
DME (eyes, %)	80 (52.6%)
Treatment naive (eyes)	81 (53.3%)

Groups (severity of DR, eyes)	101(152)
No DR in DM patients	20 (13.2%)
Mild NPDR	28 (18.4%)
Moderate NPDR	23 (15.1%)
Severe NPDR	6 (3.9%)
PDR	75 (49.3%)

Methods

- WF SS-OCTA (PLEX ELITE 9000,Carl Zeiss Meditec, Inc) Montage 15mm × 15mm

- Ultrawide field color fundus photo (UWF CFP) and fluorescein angiography (UWF FA) (California®; Optos, Dunfermline, United Kingdom)



WF SS-OCTA superior to UWF CFP for IRMAs and NVE/NVD

DR lesions	Eyes with DR Features present (eyes,%) in Montage 15- ×15mm, compared with UWF CFP			
	Montage 15- × 15mm centered on the fovea	UWF CFP	Kappa value (Cohen's Kappa)	P value
MAs	122/152 (80.3%)	134/152 (88.2%)	0.608	0.004*
IRMA	105/152 (69.1%)	67/152 (44.1%)	0.377	0.000*
NVE	57/152 (37.5%)	44/152 (28.9%)	0.627	0.015*
NVE+NVD	60/152 (39.5%)	46/152 (30.3%)	0.654	0.007*

WF SS-OCTA (Montage 15×15) showed non-inferiority to UWF FA for all DR lesions

DR lesions	Eyes with DR Features present (eyes,%) in Montage 15- ×15mm, compared with FA			
	Montage 15- × 15mm centered on the fovea	FA	Kappa value (Cohen's Kappa)	P value
MAs	44/48 (91.7%)	47/48 (97.9%)	0.372	0.250
IRMA	40/48 (83.3%)	42/48 (87.5%)	0.667	0.625
NVE	26/48 (54.2%)	27/48 (56.3%)	0.789	1.000
NVE+NVD	29/48 (60.4%)	29/48 (60.4%)	0.913	1.000
NPAs	38/48 (79.2%)	36/48 (75.0%)	0.647	0.687

The detection rate of MA, IRMAs, NVE/NVD and NPAs in WF SS-OCTA were comparable with UWF FA images

Detection of NV(NVE and NVD) by SS-OCTA (Montage 15- × 15mm) VS. FA

	UWFFA,NV(+)	UWFFA,NV(-)
OCTA(Montage 15- × 15mm) ,NV(+)	28 eyes	1 eye
OCTA(Montage 15- × 15mm) ,NV(-)	1 eyes	18 eyes

The combination of UWF photo with the WF SSOCTA identified both areas of NV and all DR lesions seen by the UWF FA

WF SS-OCTA Plus UWF CFP equivalent to UWF FA for all DR lesions

DR lesions	Eyes with DR Features present (eyes,%) in Montage 15- ×15mm, compared with FA			
	Montage 15- × 15mm centered on the fovea + UWF CFP	FA	Kappa value (Cohen's Kappa)	P value
MAs	47/48 (97.9%)	47/48 (97.9%)	1.000	1.000
IRMA	42/48 (87.5%)	42/48 (87.5%)	1.000	1.000
NVE	27/48 (56.3%)	27/48 (56.3%)	1.000	1.000
NVE+NVD	29/48 (60.4%)	29/48 (60.4%)	1.000	1.000
NPAs	36/48 (75.0%)	36/48 (75.0%)	1.000	1.000

Limitations

- Not all patients had UWF FA images
  - Because it's an invasive test, UWF FA is not routinely performed in all clinic DR patients
- This study investigated the binary presence or absence of lesions, but not statistically comparing the number of lesions detected by different imaging modalities.

Conclusion

- WF SS-OCTA is clinically useful in detecting MA, IRMA and NVD/NVE, and NPAs
- WF SS-OCTA is comparable to UWFA for DR lesion detection
- When combined with UWF CFP, WF SS-OCTA showed identical detection rates to UWF FA
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Thank you

Harvard Retinal Imaging Lab

- Ying Cui
- Ying Zhu
- Ines Lains
- Jay Wang
- Raviv Katz
- Grace Le
- Yifan Lu
- Rebecca Zeng
- Megan Kasetty
- Archana Nigalye
- Itika Garg
- Filippos Vingopoulos
- Vivian Douglas
- Konstantinos Douglas
- Chibby Uwakwe
- Ash Kras
- Neal Patel
- Karen Wai
- Noam Rudnick
- Ned Lu
- Jade Moon
- Chloe Li

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