

## Quantification and comparison of retinal vascular features in optical coherence tomography angiography images using 3 different devices

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### Purpose

To compare the retinal vascular parameters in optical coherence tomography angiography (OCTA) images of 3 different devices

### Methods

12 eyes of 12 normal subjects were imaged (age 22-27, female/male = 6/6) with Swept-source optical coherence tomography (SS OCT) Angio (Topcon Systems, Tokyo, Japan), Spectral domain optical coherence tomography (SD OCT) AngioVue (Optovue Inc., Fremont, USA), and SD OCT AngioPlex (Carl Zeiss Meditec., Jena, Germany). Each subject eye was imaged thrice in each device. Local fractal analysis (Gadde et al., IOVS, 2016) was applied to 3 mm × 3 mm OCTA images of the superficial and deep retinal layers. Foveal avascular zone (FAZ in mm<sup>2</sup>) was calculated. Vessel density, spacing between large vessels and spacing between small vessels were quantified as percentage of the total area (9 mm<sup>2</sup>). Statistical analysis was performed to compare the vascular parameters in OCTA images of the 3 devices

### Results

SS OCT Angio, AngioVue and AngioPlex OCTA scans had a resolution of 320 × 320 pixels, 304 × 304 pixels and 245 × 245 pixels, respectively. The vascular parameters showed a good repeatability [Intra class coefficient (ICC) > 0.8] in all 3 devices. FAZ area was similar (p=0.3) in OCTA images of the 3 devices. In the superficial layer, vessel density was similar (p=0.8) among the 3 devices. In the deep layer, vessel density was significantly higher (p=0.02) in AngioVue OCTA images as compared to SS OCT Angio and AngioPlex. However, spacing between large vessels was significantly higher (p<0.05) and spacing between small vessels was significantly lower (p<0.05) in AngioPlex OCTA scans as compared to SS OCT Angio and AngioVue in both superficial and deep layers.

### Conclusion

In spite of different resolutions, vessel density showed good reproducibility among the 3 devices. SS OCT Angio and AngioVue had similar scan resolutions, which perhaps resulted in similar vascular features. Therefore, scan resolution is a critical parameter when comparing performance of different OCTA devices. Finally, local fractal technique is a useful tool in assessment of retinal vascular disorders, irrespective of device specifications.

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Vascular parameters	SS OCT Angio	AngioVue	AngioPlex	p-value
FAZ area (mm <sup>2</sup> )	0.36±0.06	0.31±0.04	0.35±0.05	0.27
Superficial layer				
Vessel density (%)	50.4±0.90	48.8±1.23	50.8±0.81	0.14
Spacing between large vessels (%)	16.0±0.38	14.1±0.70	25.6±0.81	<0.001*
Spacing between small vessels (%)	33.7±0.77	37.1±0.66	23.7±0.24	<0.001*
Deep layer				
Vessel density (%)	53.3±0.81	58.2±1.96	50.8±1.96	0.002*
Spacing between large vessels (%)	14.6±0.83	9.9±0.80	26.3±1.30	<0.001*
Spacing between small vessels (%)	32.1±0.56	31.9±1.23	23.1±0.34	<0.001*

Table : Mean ± SEM of retinal vascular parameters in the superficial and deep vascular plexus OCTA scans obtained using SS OCT Angio, AngioVue and AngioPlex, respectively. \* indicates statistical significance.

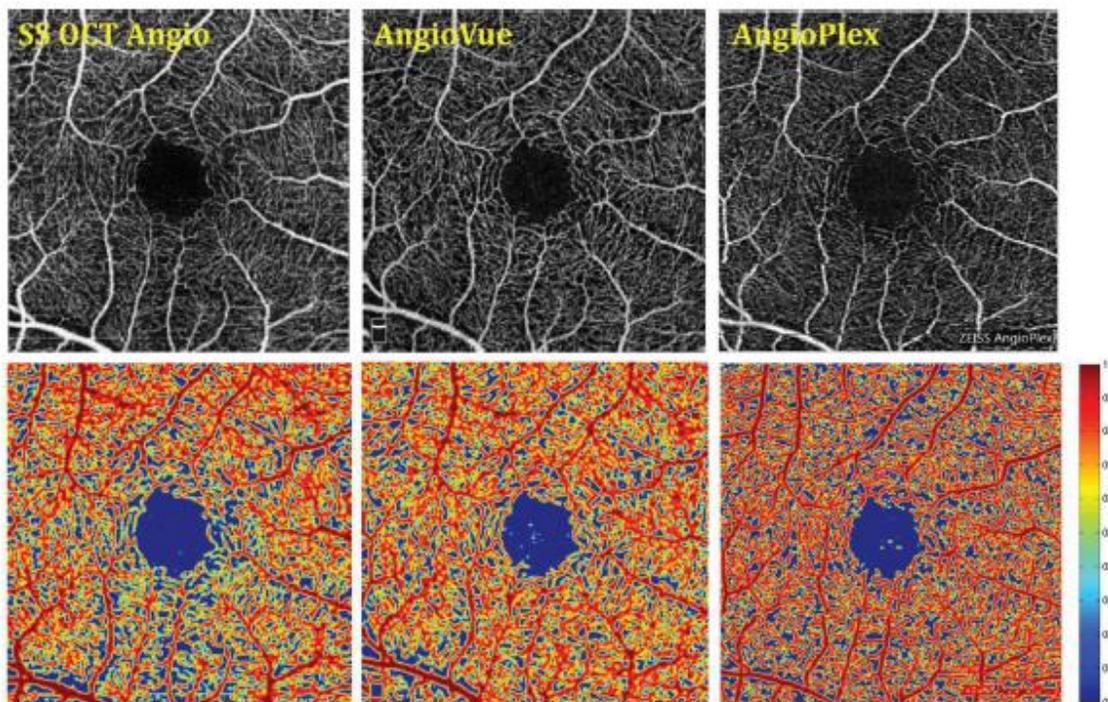


Figure : OCTA images of the superficial layer obtained using the 3 devices and their corresponding 'heat' contour maps developed using local fractal method showing probability index of presence of vessels. Index value closer to 1 indicates vessels and closer to 0 indicates non vessel.