

# Finding the most discriminative slab between healthy and diabetic eyes with OCTA



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Poster #3571061

## PURPOSE

There are many approaches to determining diabetic retinal changes. When using optical coherence tomography angiography (OCTA), observed changes to vessel density and perfusion density are common. This pilot study was conducted to explore the best en face slab to help differentiate between healthy and diseased eyes based on the detection of vascular differences.

## METHODS

- Eyes from healthy controls and eyes with diabetic retinopathy were imaged with PLEX® Elite 9000 (ZEISS, Dublin, CA) swept-source OCT using the Angio 6x6 mm scans centered on the fovea.
- Slabs of various thicknesses were extracted by shifting the common boundary between the superficial and deep layer in increments of 5 μm to create a set of 5 offset slabs (0, 5, 10, 15 and 20 μm). The superficial slab became thicker, and the deep slab became thinner, as the boundary moved posteriorly. See Figure 1.
- Vessel and perfusion density measurements were calculated for the 9 sectors of the standard ETDRS grid.
- The mean differences for these parameters were evaluated for a group of healthy and diseased eyes. Paired t-tests were performed on these differences and the area under receiver operator characteristic curve (AUC) values were computed. To account for multiple comparisons, the significance level was set at 0.05/90 = 0.00056.

## CONCLUSIONS

There appear to be more statistically significant differences in the superficial vessel density and perfusion measurements than in the deep layer for healthy and diseased eyes, and this is not changed by altering the boundary between them. This study would benefit from additional eyes.

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Disclosures: TC (E); LdS (E); WL (C); SK (E); J-FK (C); JC-V (C); MD (E); Carl Zeiss Meditec, Inc.

## RESULTS

Nine healthy and twelve eyes with non-proliferative diabetic retinopathy were evaluated. Statistically significant ( $p < 0.00056$ ) differences were found in the superficial perfusion and vessel density measurements between the healthy and diseased eyes, but only in the temporal sectors. Comparing the offset slabs, there did not appear to be an offset that was more effective than the default setting for the deep layer, although a thicker layer might improve discrimination in the superficial layer (see Table 1). The AUC curves provided similar findings (see Table 2).

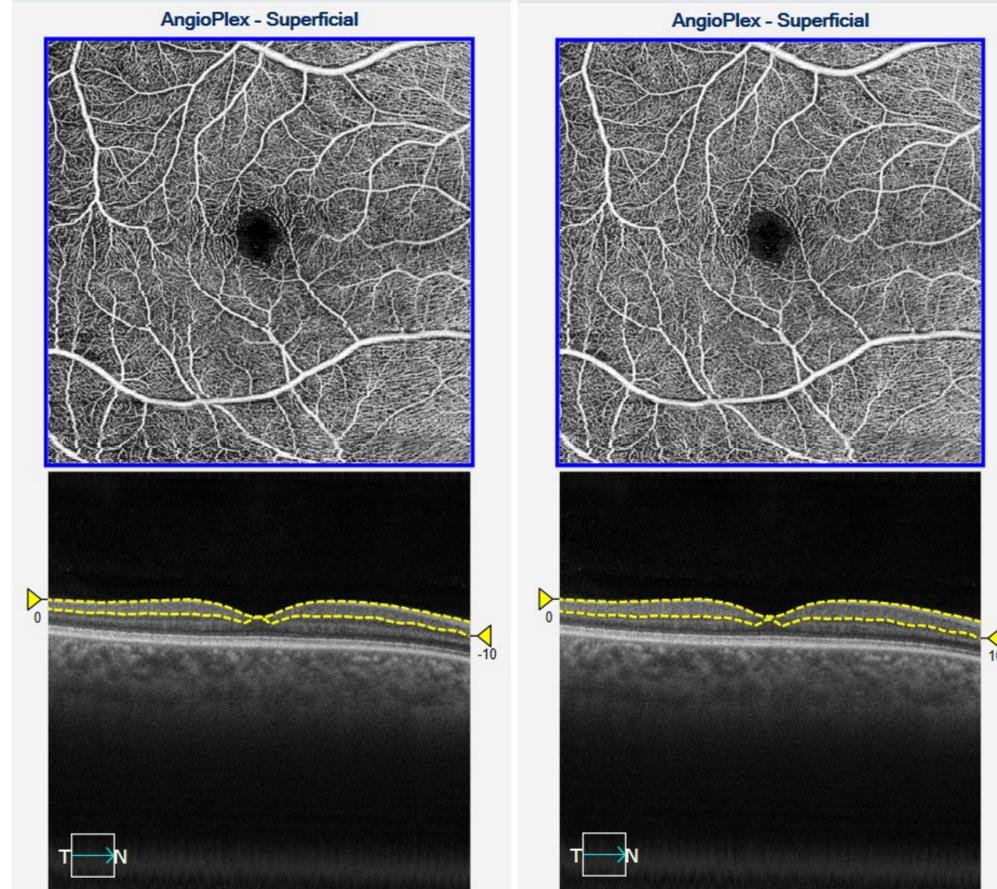


Figure 1: Superficial layer at normal thickness (left) and slab offset 20 μm thicker (right)

	Perfusion		Vessel Density		Perfusion		Vessel Density	
	Superficial	DEEP	Superficial	DEEP	Superficial	DEEP	Superficial	DEEP
CENTRAL	Central	Central	Central	Central	Central	Central	Central	Central
P-value offset0	0.0028	0.0498	0.0019	0.0456				
P-value offset5	0.0034	0.0455	0.0019	0.0426		p < 0.00056	significant	
P-value offset10	0.0061	0.0395	0.0036	0.0333				
P-value offset15	0.0084	0.0208	0.0057	0.0170				
P-value offset20	0.0096	0.0245	0.0061	0.0170				
NASAL	InnerNasal	InnerNasal	InnerNasal	InnerNasal	OuterNasal	OuterNasal	OuterNasal	OuterNasal
P-value offset0	0.0194	0.0632	0.0091	0.0475	0.0206	0.2375	0.0046	0.1778
P-value offset5	0.0192	0.1194	0.0093	0.0864	0.0342	0.3915	0.0074	0.3085
P-value offset10	0.0161	0.1225	0.0116	0.0969	0.0380	0.3939	0.0058	0.3164
P-value offset15	0.0131	0.0796	0.0071	0.0619	0.0349	0.2669	0.0054	0.2105
P-value offset20	0.0161	0.0644	0.0096	0.0562	0.0402	0.2118	0.0079	0.1655
SUPERIOR	InnerSup	InnerSup	InnerSup	InnerSup	OuterSup	OuterSup	OuterSup	OuterSup
P-value offset0	0.0155	0.0975	0.0142	0.0712	0.0162	0.1079	0.0080	0.1013
P-value offset5	0.0137	0.1735	0.0181	0.1325	0.0178	0.2043	0.0089	0.1936
P-value offset10	0.0113	0.2053	0.0163	0.1602	0.0186	0.1929	0.0096	0.1713
P-value offset15	0.0083	0.1745	0.0130	0.1344	0.0117	0.1572	0.0062	0.1363
P-value offset20	0.0096	0.1591	0.0109	0.1094	0.0141	0.1524	0.0072	0.1315
TEMPORAL	InnerTemp	InnerTemp	InnerTemp	InnerTemp	OuterTemp	OuterTemp	OuterTemp	OuterTemp
P-value offset0	0.0005	0.0259	0.0003	0.0153	0.0014	0.0115	0.0011	0.0067
P-value offset5	0.0003	0.0547	0.0002	0.0320	0.0010	0.0276	0.0007	0.0173
P-value offset10	0.0003	0.0852	0.0002	0.0510	0.0008	0.0608	0.0006	0.0379
P-value offset15	0.0002	0.0653	0.0002	0.0352	0.0005	0.0504	0.0003	0.0334
P-value offset20	0.0003	0.0871	0.0003	0.0460	0.0007	0.0502	0.0004	0.0326
INFERIOR	InnerInf	InnerInf	InnerInf	InnerInf	OuterInf	OuterInf	OuterInf	OuterInf
P-value offset0	0.0169	0.1384	0.0209	0.0997	0.0118	0.0933	0.0062	0.0665
P-value offset5	0.0251	0.1589	0.0245	0.1208	0.0157	0.1525	0.0082	0.1141
P-value offset10	0.0313	0.2577	0.0284	0.1878	0.0217	0.1928	0.0087	0.1437
P-value offset15	0.0398	0.1590	0.0385	0.1107	0.0181	0.1406	0.0053	0.1137
P-value offset20	0.0449	0.1329	0.0466	0.0943	0.0198	0.1152	0.0063	0.0897

Table 1: Offset P-values for each sector of the ETDRS grid

	Perfusion		Vessel Density		Perfusion		Vessel Density	
	Superficial	DEEP	Superficial	DEEP	Superficial	DEEP	Superficial	DEEP
CENTRAL	Central	Central	Central	Central	Central	Central	Central	Central
AUC offset0	0.84	0.73	0.87	0.74				
AUC offset5	0.85	0.72	0.90	0.72				
AUC offset10	0.85	0.74	0.88	0.75				
AUC offset15	0.83	0.77	0.88	0.78				
AUC offset20	0.83	0.76	0.86	0.77				
NASAL	InnerNasal	InnerNasal	InnerNasal	InnerNasal	OuterNasal	OuterNasal	OuterNasal	OuterNasal
AUC offset0	0.82	0.73	0.84	0.76	0.82	0.63	0.88	0.64
AUC offset5	0.82	0.71	0.85	0.72	0.76	0.58	0.86	0.61
AUC offset10	0.84	0.69	0.85	0.71	0.76	0.56	0.87	0.58
AUC offset15	0.85	0.72	0.87	0.73	0.80	0.65	0.87	0.65
AUC offset20	0.84	0.72	0.86	0.74	0.75	0.66	0.82	0.68
SUPERIOR	InnerSup	InnerSup	InnerSup	InnerSup	OuterSup	OuterSup	OuterSup	OuterSup
AUC offset0	0.86	0.72	0.82	0.72	0.86	0.73	0.86	0.74
AUC offset5	0.86	0.69	0.82	0.73	0.87	0.69	0.87	0.70
AUC offset10	0.87	0.68	0.83	0.72	0.88	0.69	0.88	0.69
AUC offset15	0.88	0.69	0.83	0.72	0.88	0.68	0.88	0.71
AUC offset20	0.88	0.71	0.87	0.74	0.88	0.68	0.88	0.69
TEMPORAL	InnerTemp	InnerTemp	InnerTemp	InnerTemp	OuterTemp	OuterTemp	OuterTemp	OuterTemp
AUC offset0	0.94	0.75	0.95	0.78	0.89	0.81	0.88	0.83
AUC offset5	0.93	0.71	0.96	0.74	0.90	0.77	0.90	0.79
AUC offset10	0.93	0.70	0.97	0.72	0.93	0.74	0.92	0.77
AUC offset15	0.94	0.71	0.98	0.73	0.93	0.76	0.94	0.78
AUC offset20	0.93	0.69	0.95	0.73	0.94	0.71	0.94	0.72
INFERIOR	InnerInf	InnerInf	InnerInf	InnerInf	OuterInf	OuterInf	OuterInf	OuterInf
AUC offset0	0.88	0.72	0.87	0.74	0.83	0.67	0.88	0.69
AUC offset5	0.88	0.69	0.87	0.71	0.82	0.66	0.88	0.68
AUC offset10	0.88	0.65	0.88	0.67	0.80	0.64	0.88	0.66
AUC offset15	0.87	0.66	0.87	0.69	0.83	0.68	0.88	0.70
AUC offset20	0.87	0.68	0.87	0.71	0.82	0.66	0.88	0.69

Table 2: AUC values for each sector of the ETDRS grid