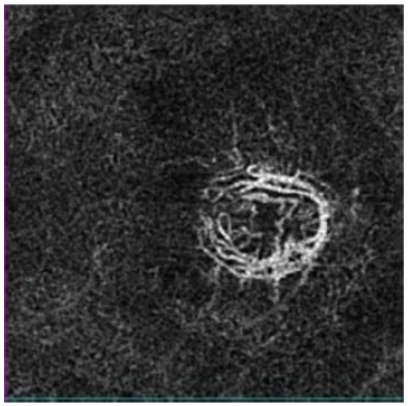
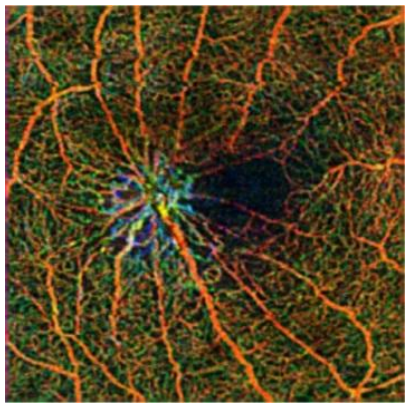
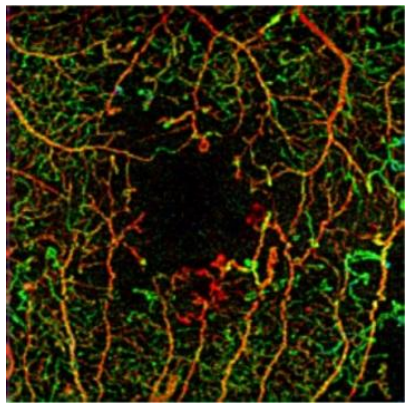
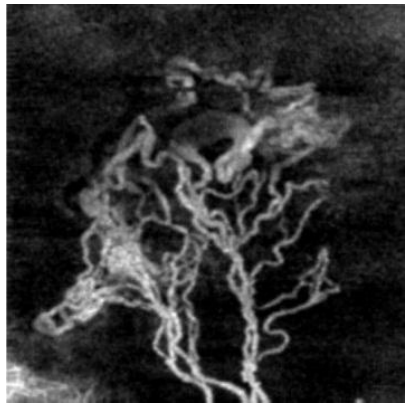
AngioPlex™ OCT Angiography

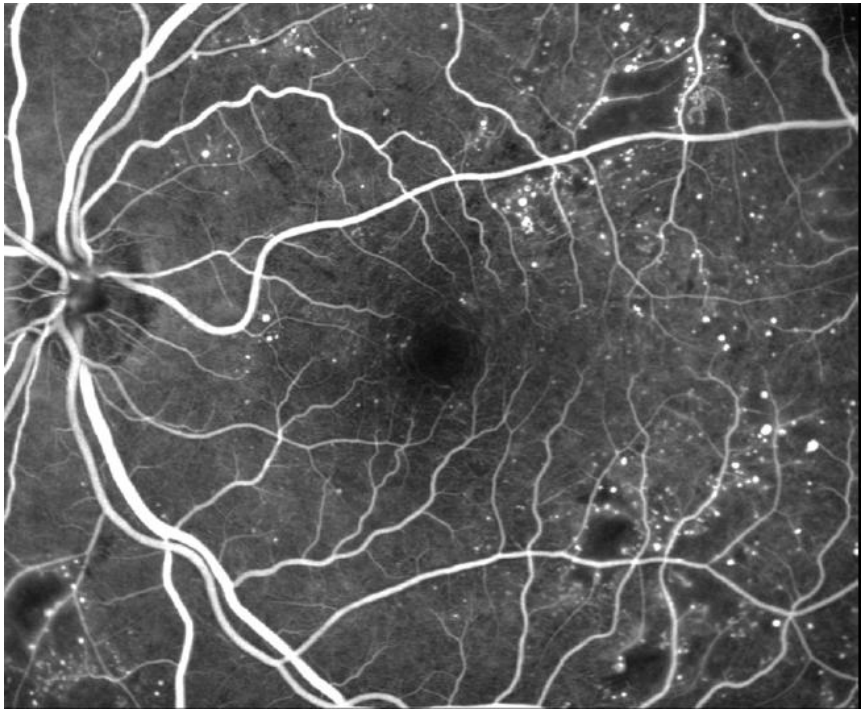
Optional module on CIRRUS 5000 that delivers fast, non-invasive 3D imaging of retinal vasculature without the need for dye:

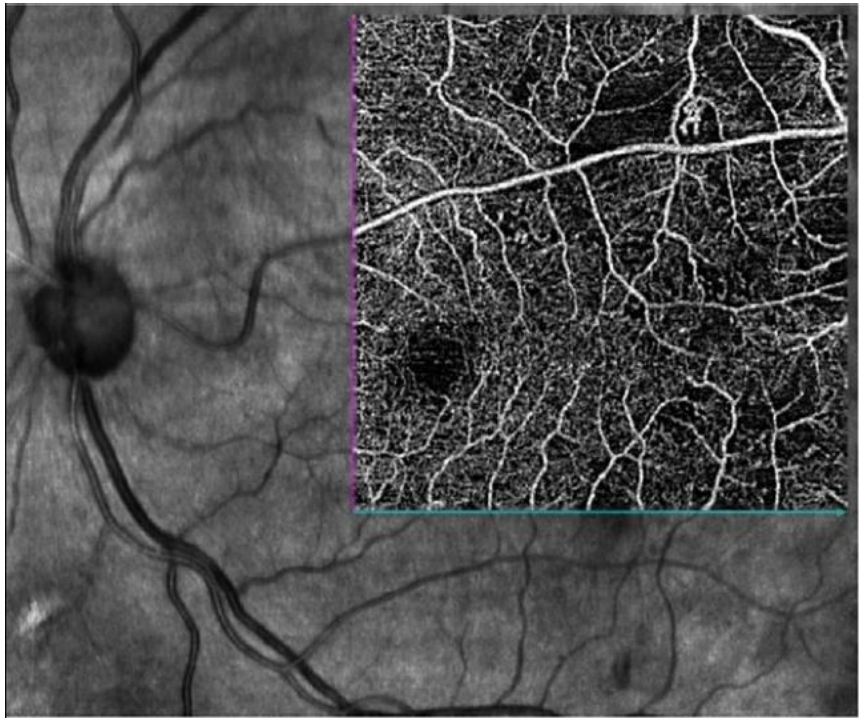
- 3 x 3 ,6 x 6 scans and 8 x 8 scan
- Clinical presets highlighting vasculature at multiple layers of interest
- Color-coded depth imaging

AngioPlex™ OCT Angiography
Comparison to Fluorescein Angiography

Visual detail from OCT Angiography correlates very well with traditional fluorescein angiography





Korobelnik J Fr Ophthalmol (2015)

AngioPlex Launch Messaging

New vascular information

- Ultra-clear 3D microvascular visualizations powered by **OMAG^{C}**
- OMAG^{C} – ZEISS' proprietary method to detect motion of red blood cells within sequential OCT B-scans performed repeatedly at the same location
- Depth of retinal vasculature color coded for ease of visual assessment

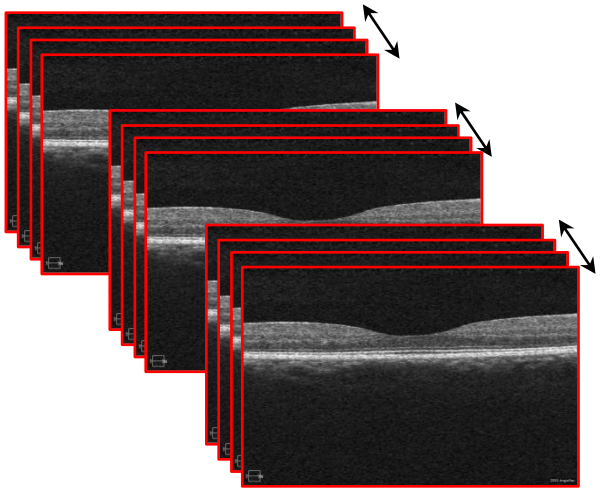
Enhanced workflow

- Ideal non-invasive, dye-free angiography
- **Single-Scan simplicity**: capture OCT angiography with just one scan in seconds
- Real-time tracking with **FastTrac™** ensures artifact-free scans and precise location identification during follow-up visits

AngioPlex Technology

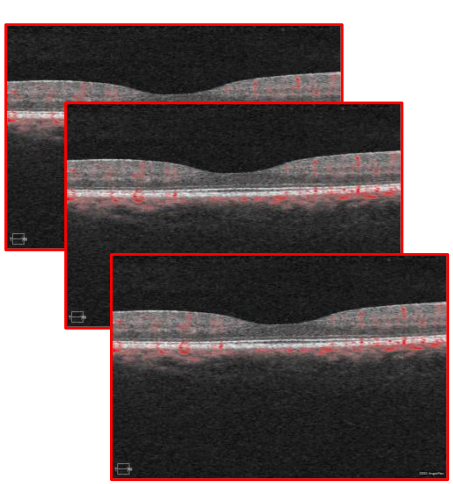
AngioPlex detects motion of scattering particles such as red-blood cells within sequential OCT B-scans performed repeatedly at the same location of the retina

Acquisition with FastTrac

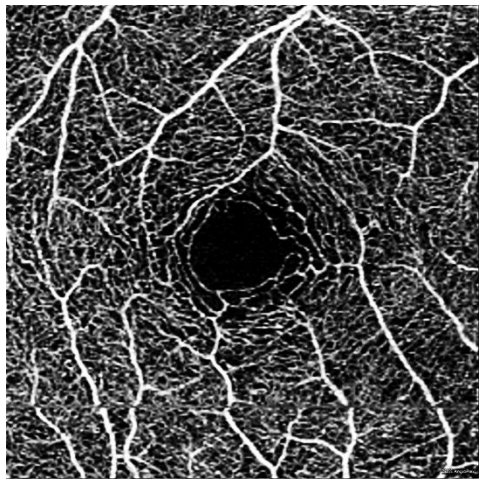


Clusters of OCT B-scans.
Each cluster is acquired in the same position on the retina

Data Processing powered by OMAG^{C}



Blood flow OCT B-scan.
Each cluster generates one Blood flow scan.



AngioPlex Map.
Reconstructed map of the perfused microvasculature within the retina and choroid.

AngioPlex™ OCT Angiography
Fundamentals

Technology

AngioPlex acquisition

- Laser scans the **same location of the retina up to 4 times** on a given scan capture
- **Real-time tracking** with FastTrac minimizes the presence of eye motion artifacts, reduces the need to rescan and allows for accurate follow-up over time

AngioPlex processing

- **OMAG^{C} algorithm** detects motion of scattering particles such as red-blood cells within sequential OCT B-scans by comparing frames acquired in the same location of the retina
- **OMAG^{C}** is an imaging technique which uses the **complete complex OCT** data signal including both **amplitude** and **phase**

AngioPlex Maps

- AngioPlex Map is a 2D representation of the retinal vasculature of a particular region of interest

Patient

Enhanced Workflow

- **Dye-free** vascular imaging
- **Single scan** capture in just a few seconds
- **FastTrac** increases scan success rate for subjects with poor fixation

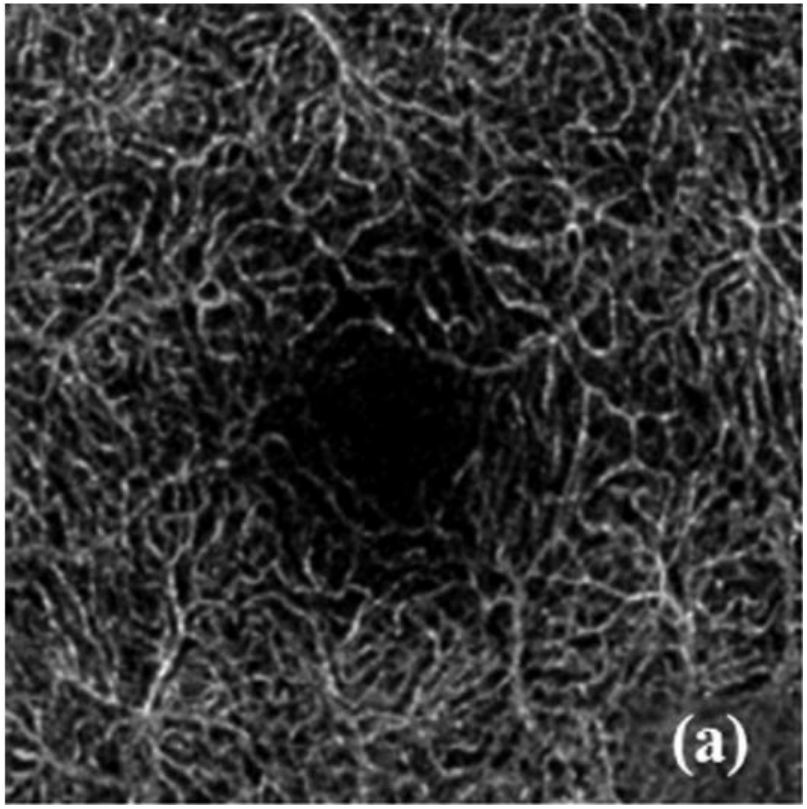
OMAG^{C}
Optical Micro-Angiography – Complex

- **OMAG^{C}** is an imaging technique which uses the **complete complex OCT** data signal including both **amplitude** and **phase**

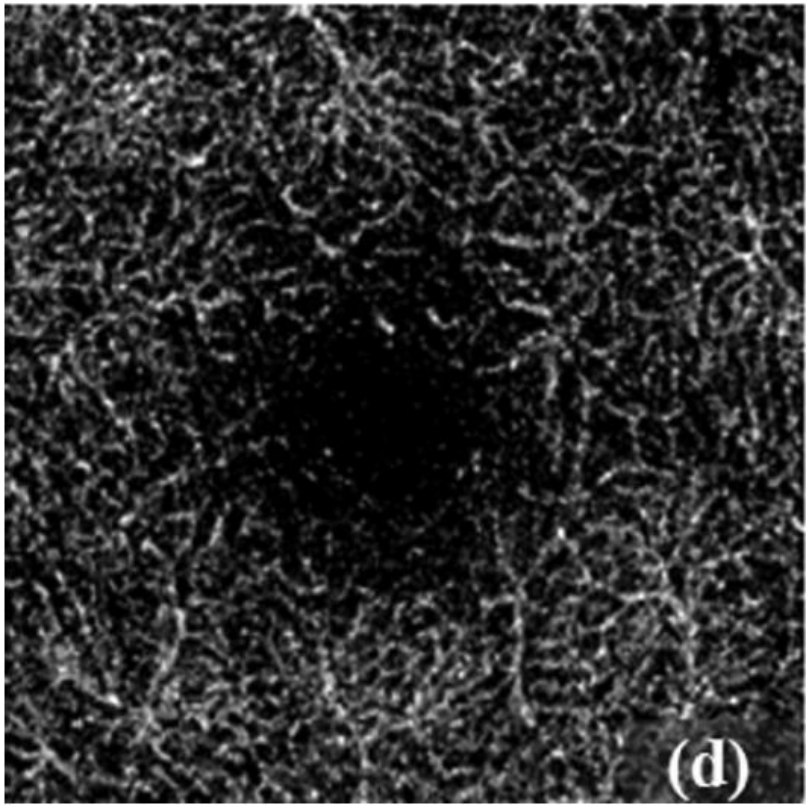
Complex signal = Amplitude + Phase

OMAG^{C}
Optical Micro-Angiography – Complex

OMAG^{C}: Amplitude and Phase



SSADA: Amplitude only



Zhang A, Zhang Q, Chen C, Wang RK; Methods and algorithms for optical coherence tomography-based angiography: a review and comparison. J. Biomed. Opt. 0001;20(10):100901.

AngioPlex™ OCT Angiography
Fundamentals

Disease applications

Age-related Retinal Anomalies

Retinal Anomalies and Coat's Disease

Macroaneurysms

Diabetic Retinopathy

CNV

AMD

Optic Disk Disorders/ Glaucoma (OCTA in general – not yet AngioPlex)

AngioPlex™ OCT Angiography
Fundamentals

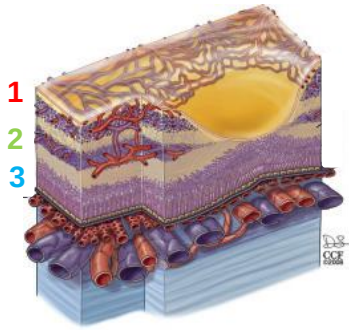
Clinical presets

AngioPlex offers the following clinical presets to visualize the vasculature:

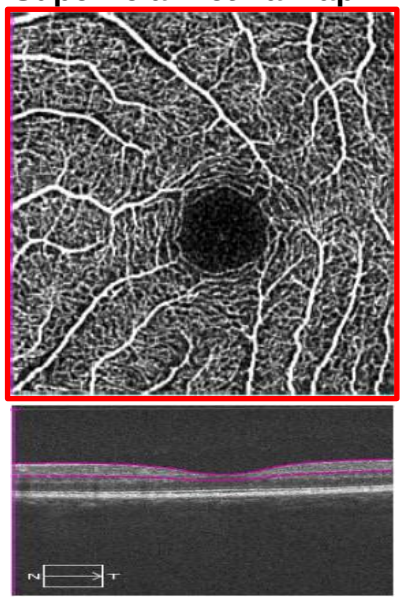
- Vitreo-Retinal Interface (VRI)
- Superficial Retina
- Deeper Retina
- Avascular Retina
- Choriocapillaris
- Choroid
- Whole Retina
- Whole Eye
- Retina Color Depth
- 2 Global Custom Presets (user-selectable top and bottom reference layers, including: ILM, IPL, OPL, RPE, and RPE Fit)

AngioPlex Maps

AngioPlex Maps consists of a 2D representation of the retinal vasculature of a particular region of interest

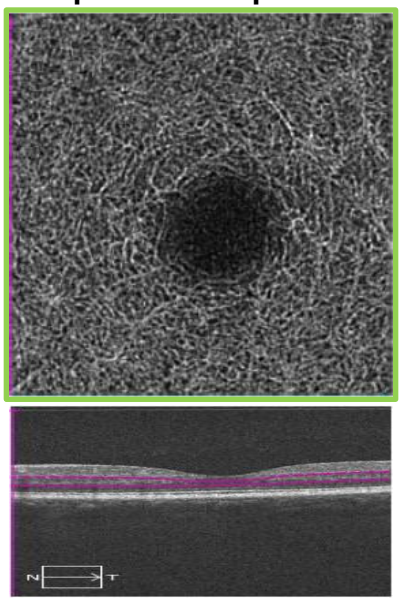


Superficial Retina Map



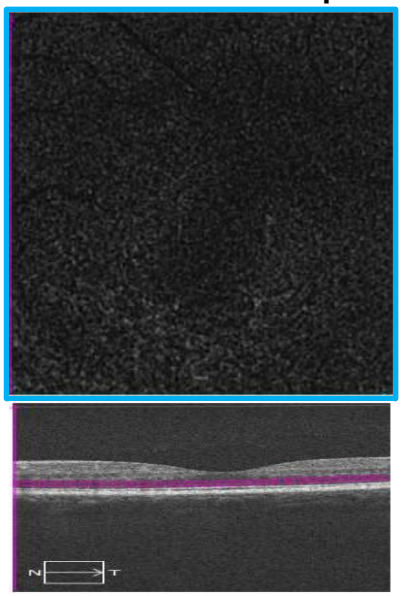
Visualization of blood flow in superficial retina

Deep Retina Map



Visualization of blood flow in deep retina

Avascular Retina Map

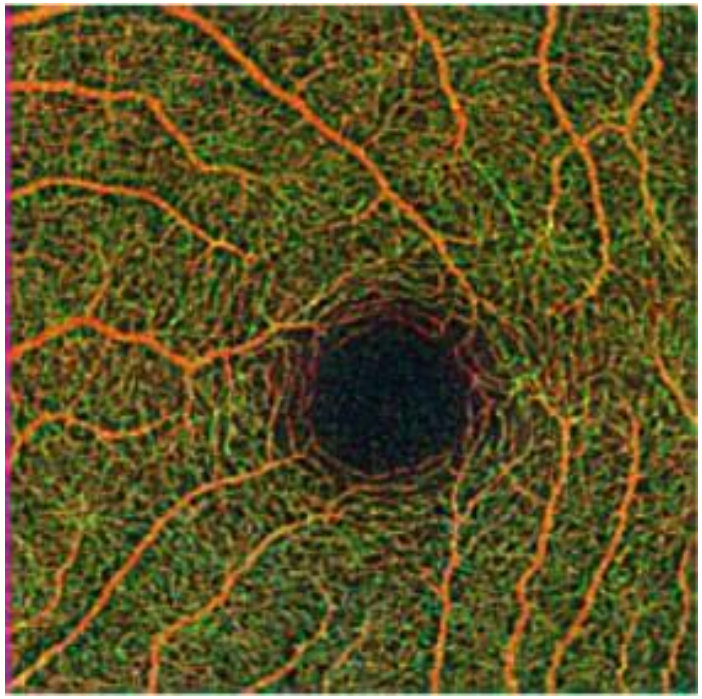


Avascular region of the retina in healthy eyes. Allows for detection of abnormal vascular growth

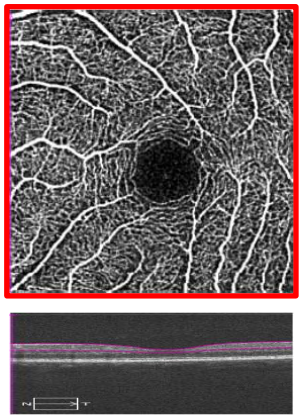
AngioPlex Color Depth Map

The color depth map combines superficial, deep and avascular retina maps and allows for depth visualization of retinal blood flow

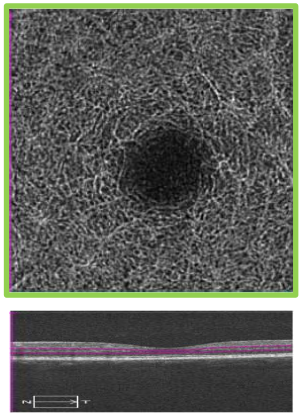
Color Depth Retina Map



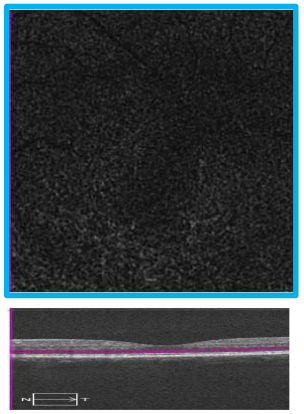
Superficial Retina



Deep Retina

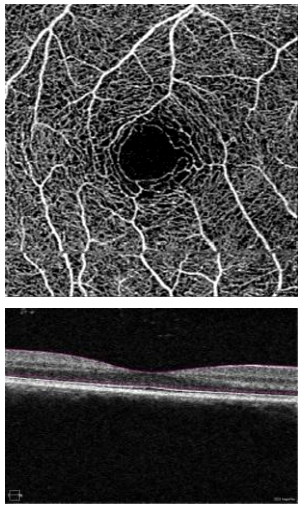


Avascular Retina

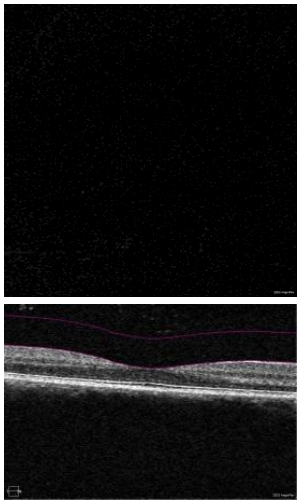


AngioPlex Maps - Normal Eye
Full breadth of Retina and Choroid Maps

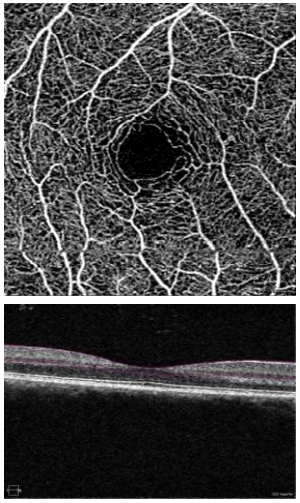
Retina Map



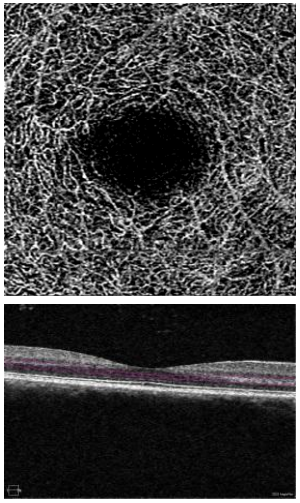
VRI Map



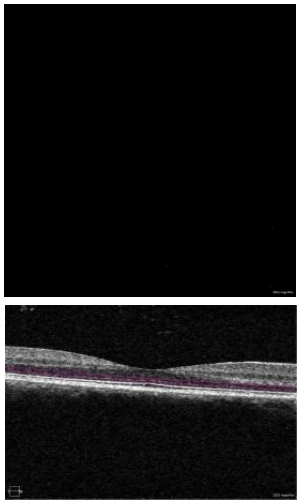
Superficial Retina



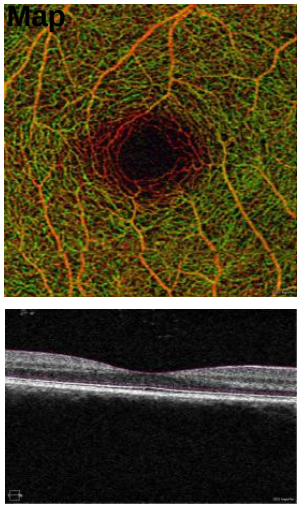
Deep Retina Map



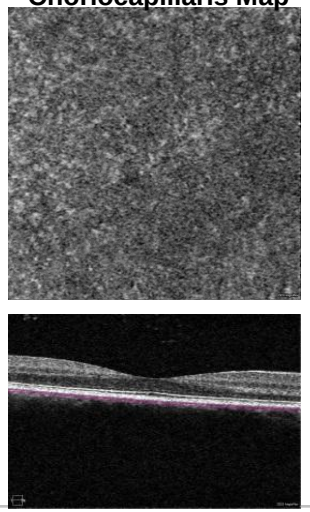
Avascular Retina



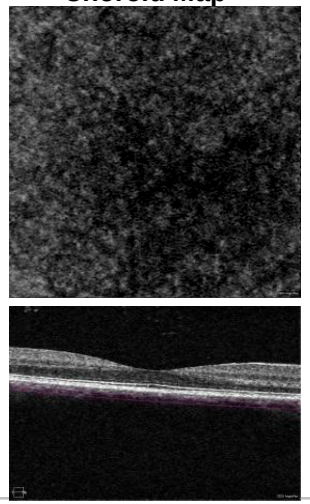
Color Depth Retina Map



Choriocapillaris Map



Choroid Map



AngioPlex Metrix™

More effective chronic disease management

New Vascular Metrics for Diabetic Retinopathy Management

Clinical Value

- Retinal vascular density is known to be affected by the presence of Diabetic Retinopathy (DR)..
- DR is also characterized by an irregular, large foveal avascular zone (FAZ)

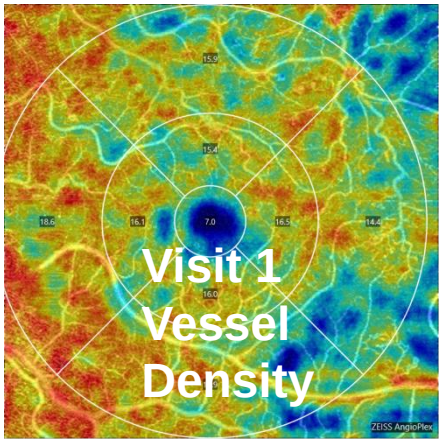
AngioPlex Metrix

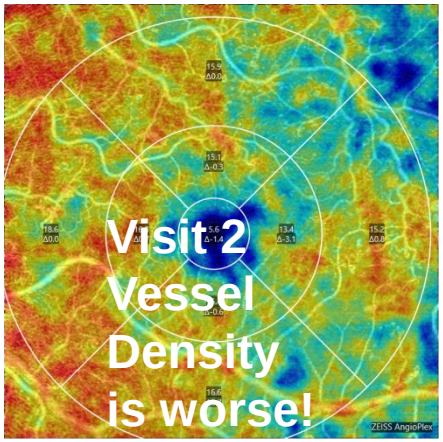
Objectively assess change over time

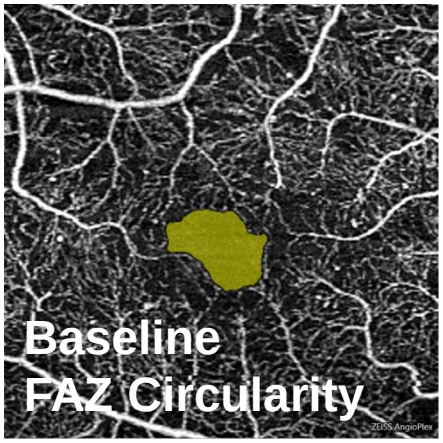
- Vascular density
- Perfusion density

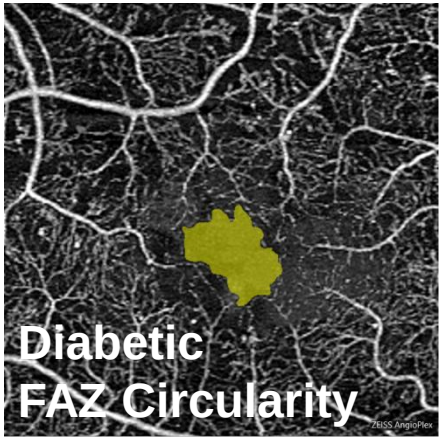
Help flag patients with early diabetic retinopathy changes.

- Automatic detection of FAZ Area and Circularity



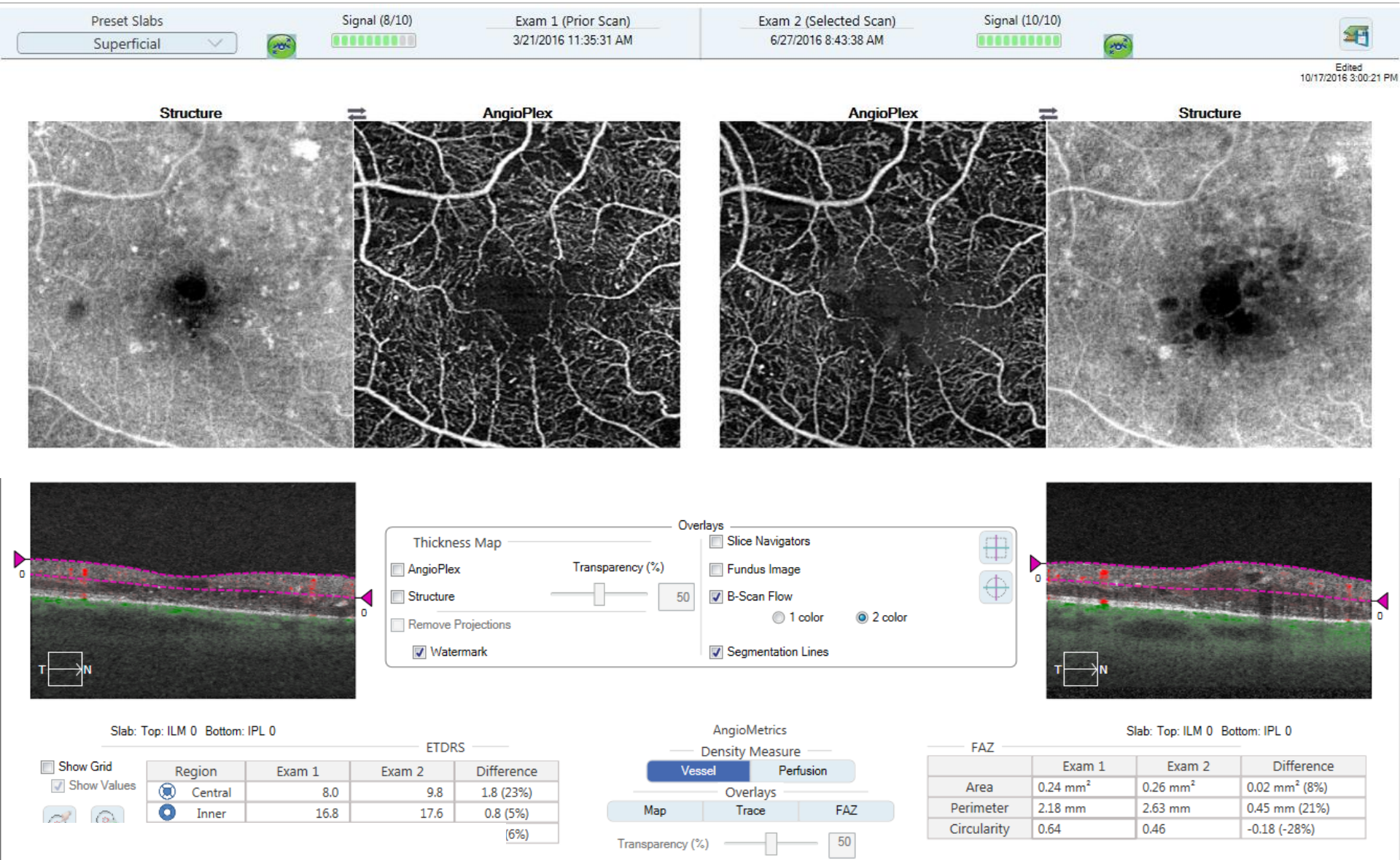






Angiography Change Analysis with AngioPlex Metrix

Clinical Value: Track changes across visits to monitor disease progression and the efficacy of treatment

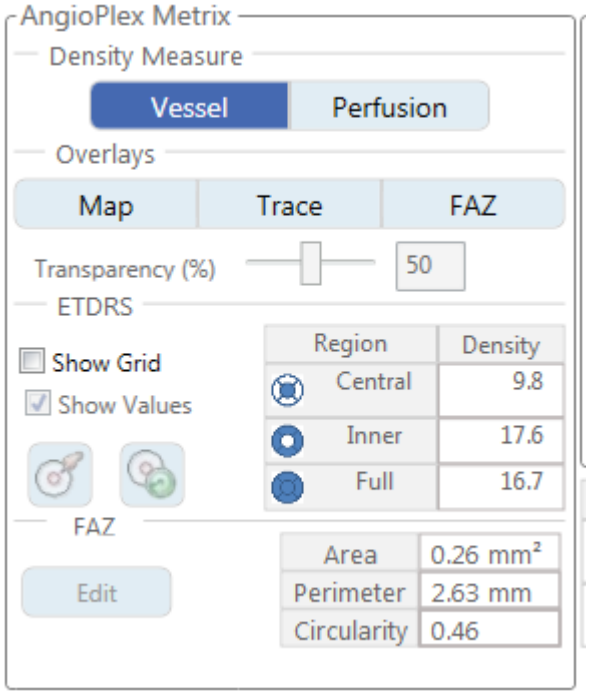


AngioPlex Metrix™ Parameters

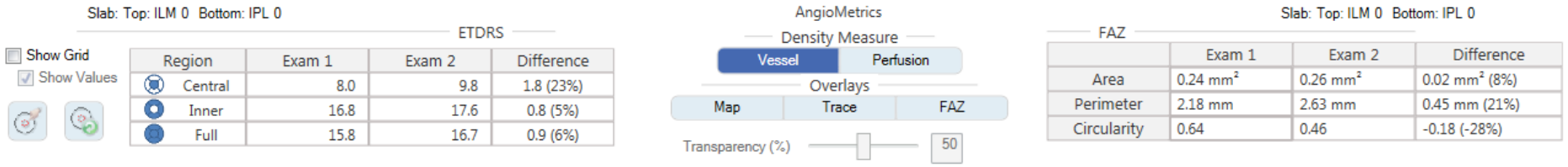
FAZ Parameters
- Area (mm^2)
- Perimeter (mm)
- Circularity (unit less)

Density Parameters (ETDRS Grid based)
- Vessel Density (mm^{-1})
- Perfusion Density (unit less)

- Absolute and percentage change over time for all the above parameters is available in Angiography Change Analysis



Angiography Analysis Screen

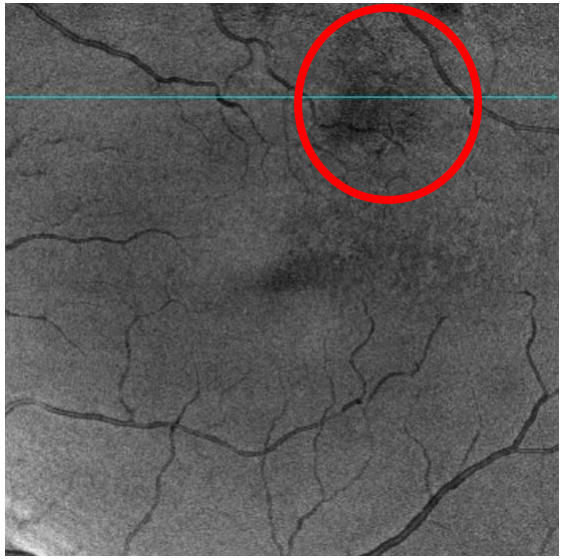


Angiography Change Analysis Screen

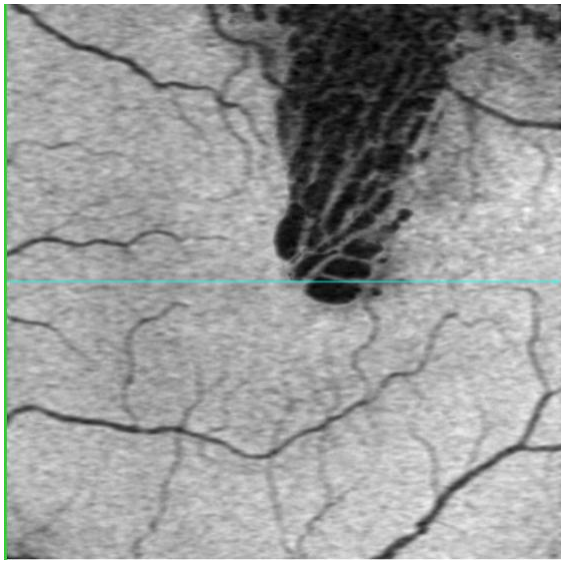
Min-IP
Minimum intensity projection

Value Proposition:

- Fluid build-up in retina or disruptions in outer retina may generally be presented as hypodense regions.
- Going through all the cube b-scans to look for these regions is cumbersome
- Min-IP provides a quick and easy visualization of minimum intensity (hypodense) regions



Summed Intensity



Minimum Intensity

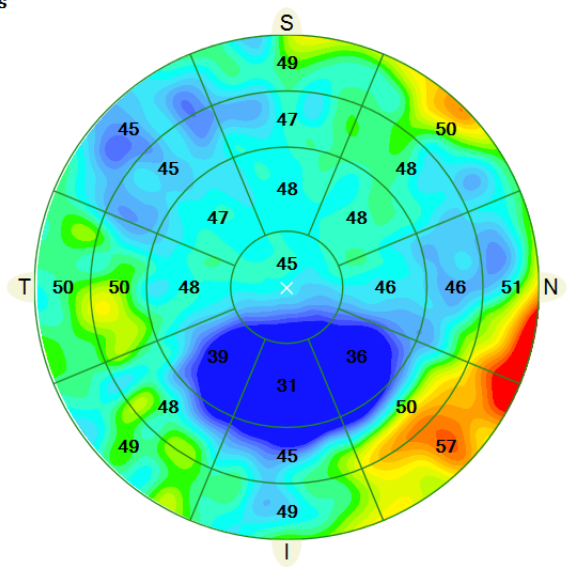
Epithelial Thickness Mapping (ETM)

Available with Anterior Segment Premium Module

Value Proposition:

- Epithelial layer thinning may be associated with early keratoconus.
- The new Epithelial thickness map provides visualization and measurement of the Epithelial cell layer for up to 9 mm scan region

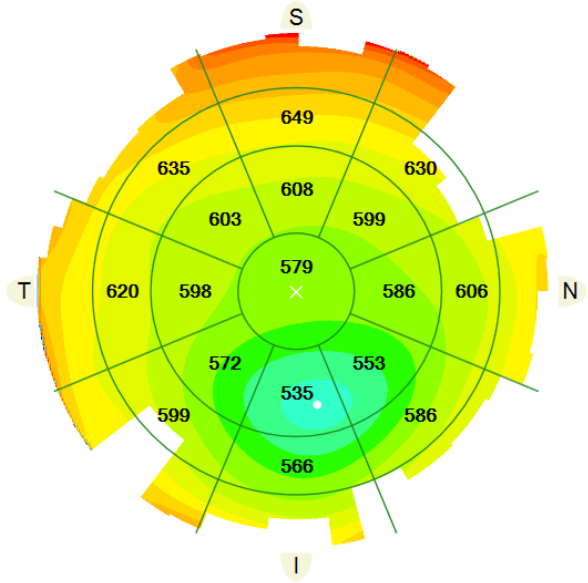
Epithelial Thickness



Range (mm)	Min. (µm)	Avg. (µm)	Max. (µm)	S-I (µm)	SN-IT (µm)
0.0-2.0	35	45	49	-	-
2.0-5.0	28	43	50	17	9
5.0-7.0	33	47	59	2	0
7.0-9.0	42	50	65	0	1

Minimum Thickness (µm)	28	Y Min (mm)	-1.9
Epithelial Min-Median (µm)	-16	Central Epithelial Thickness (µm)	47

Pachymetry



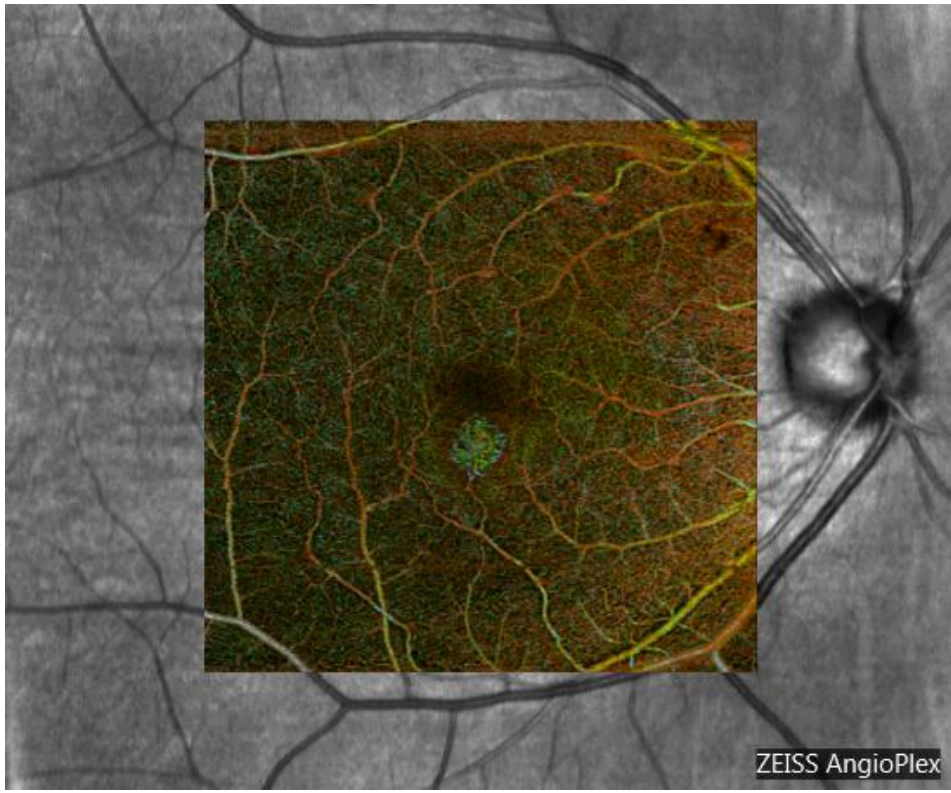
Range (mm)	Min. (µm)	Avg. (µm)	Max. (µm)	S-I (µm)	SN-IT (µm)
0.0-2.0	552	579	589	-	-
2.0-5.0	522	582	628	73	27
5.0-7.0	534	611	677	83	31

Minimum Thickness (µm)	522	Y Min (µm)	-1949
Pachy Min-Median (µm)	-59	Central Corneal Thickness (µm)	581

AngioPlex Case 004, PED with CNV

6x6 mm AngioPlex Scan

00:14 FA

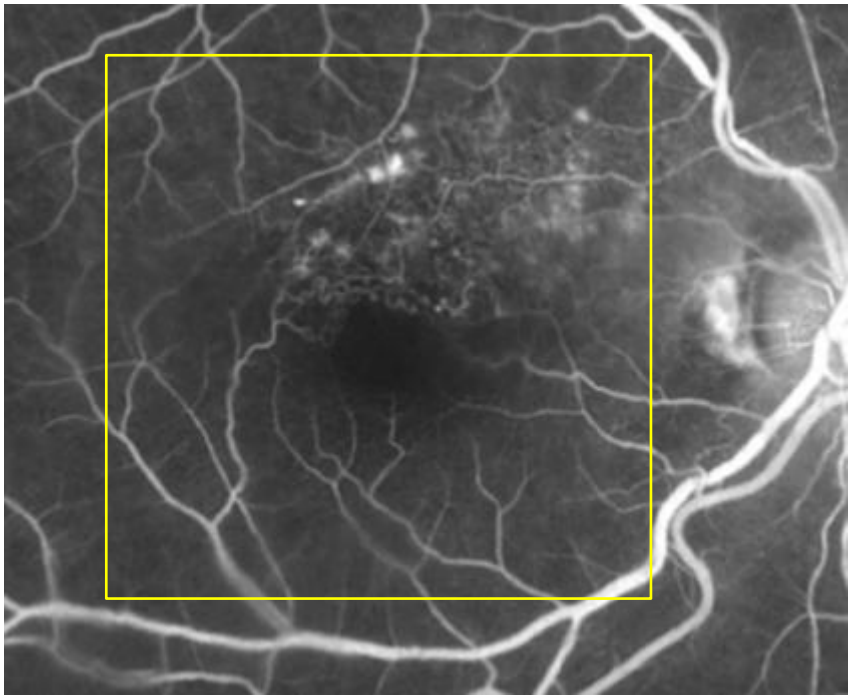


AngioPlex – Retina Color Depth Map

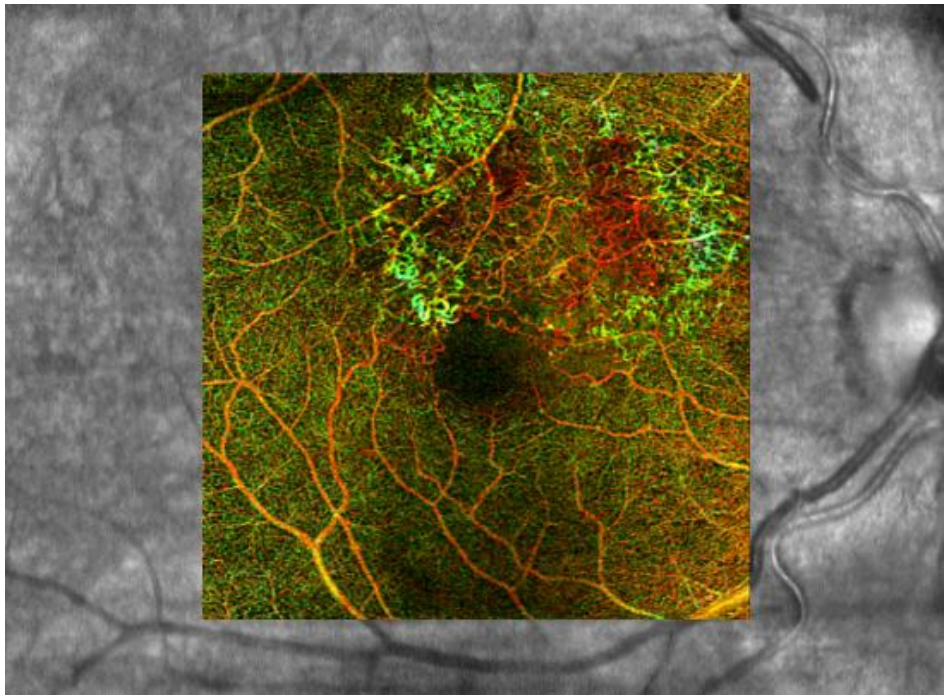
Courtesy of S. Feldon, Flaum Eye Institute, University of Rochester, Rochester, NY, USA

AngioPlex Case 006, BRVO

6x6 mm AngioPlex Scan



Late Phase FA



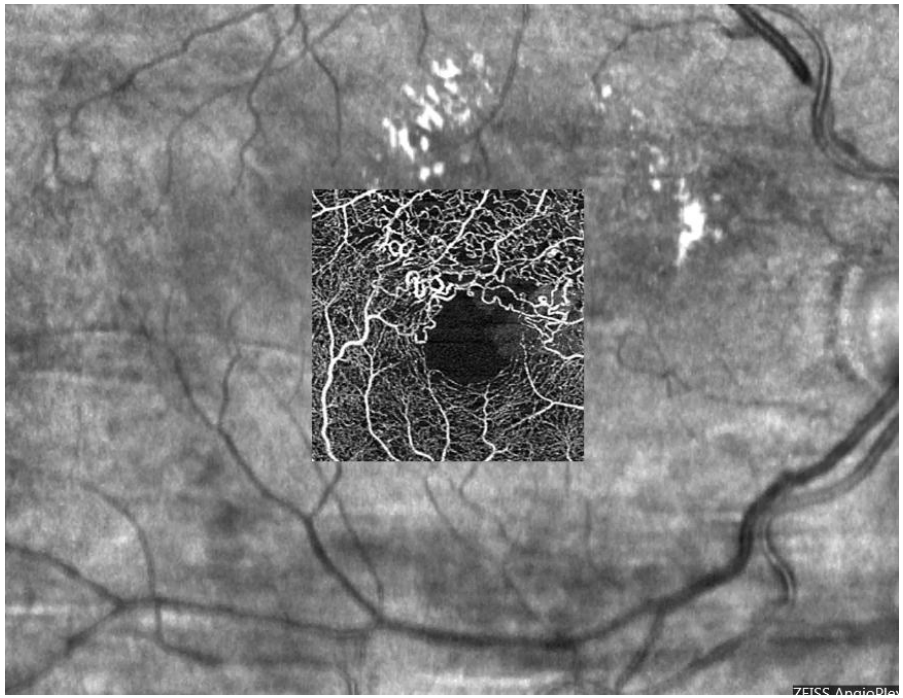
AngioPlex – Retina Color Depth Map

Courtesy of S. Lee, East Bay Retina Consultants, Oakland, California, USA

AngioPlex Case 006, BRVO

3x3 mm AngioPlex Scan

Late Phase FA

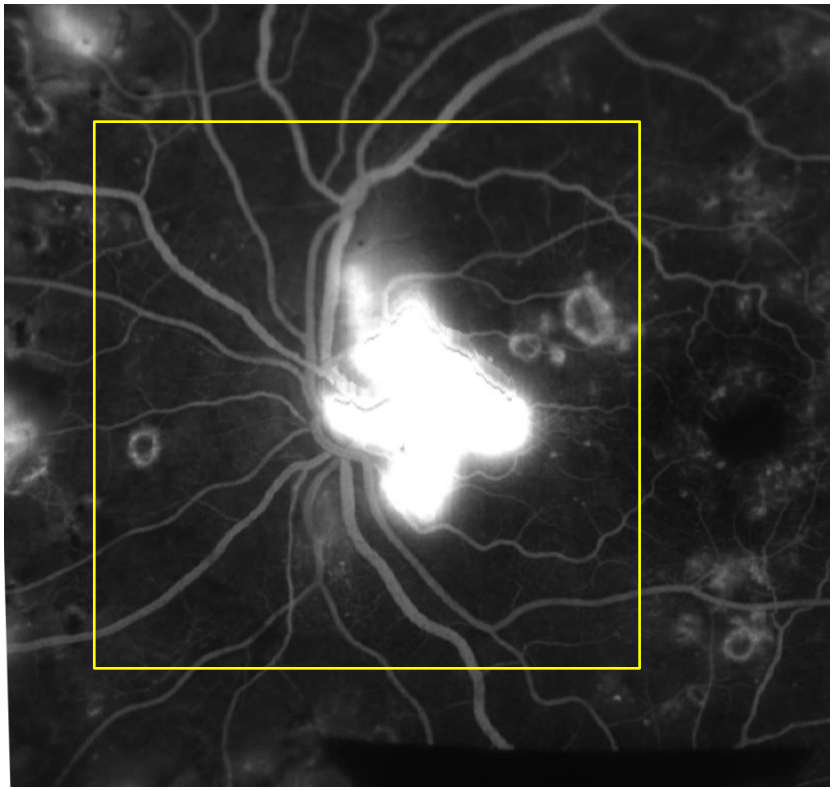


AngioPlex – Retina Map

Courtesy of S. Lee, East Bay Retina Consultants, Oakland, California, USA

AngioPlex Case 010, Proliferative DR w/NVD

6x6 mm AngioPlex Scan



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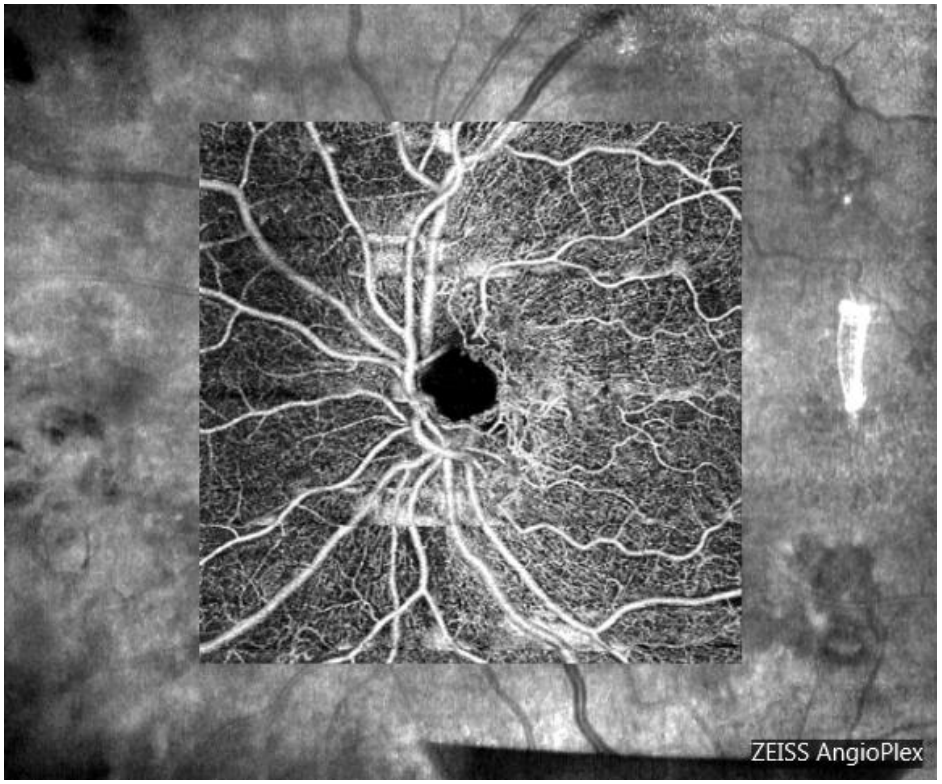
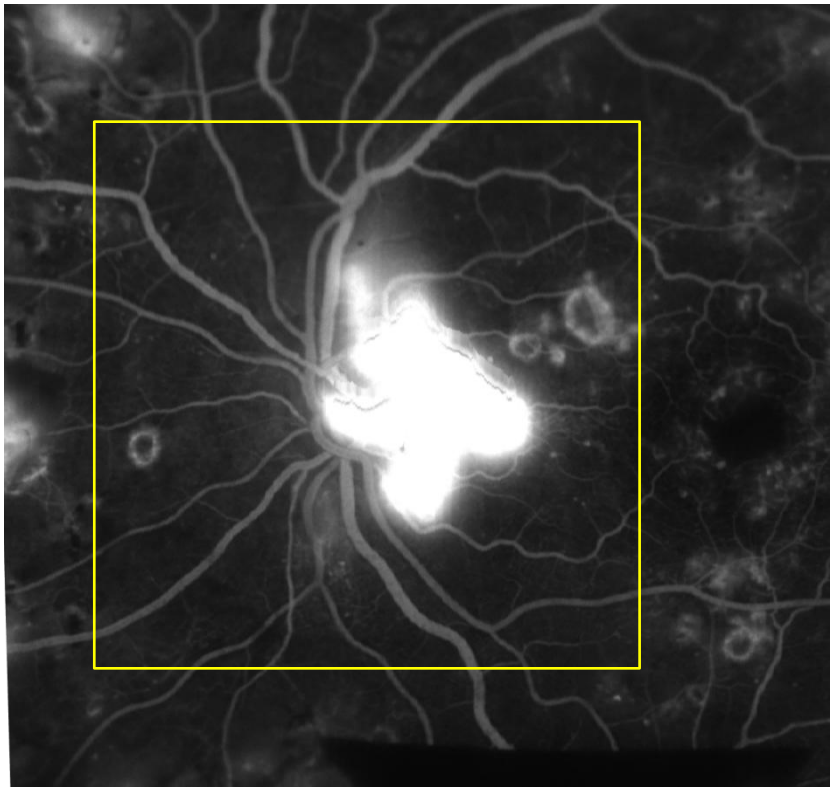


AngioPlex – Retina Map

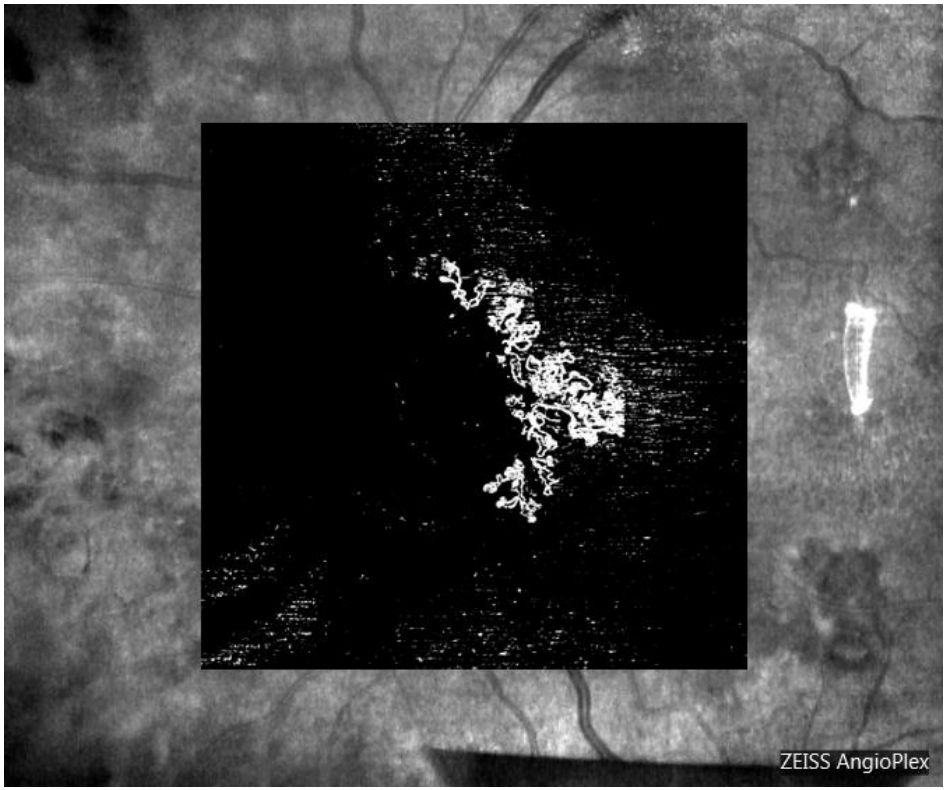
Courtesy of S. Lee, East Bay Retina Consultants, Oakland, California, USA

AngioPlex Case 010, Proliferative DR w/NVD

6x6 mm AngioPlex Scan



1:48 FA



AngioPlex – Vitreo-Retinal Interface Map

Courtesy of S. Lee, East Bay Retina Consultants, Oakland, California, USA

Positive Feedback from 12 Global Validation Sites (US, Germany, Italy)

- **Very positive reception to CIRRUS AngioPlex:**
  - *"Seems to be easier and faster in acquisition for patient with low fixation compared to Optovue. Image quality for those patients seems to be better than Optovue"* - ***Prof. Staurenghi***
  - *"Easy, intuitive (more than Optovue) and good images"* - ***Prof. Querques***
  - *"After the loan time I'll have to buy it. There is no way back."* - ***Prof. Lang***

- **Early users excited about possibilities with AngioPlex:**
  - *"Valid tool, in some patients it can replace fluorescein angiography"*
  - *"it is a useful examination and it gives comparable results compared to FA"*
  - *"shows micro changes that are not visible during exam or on photos"*

- **Most will add it to their standard imaging protocol**
  - *"We consider it as a part of our standard imaging protocol"*
  - *"We are doing it in most of our patients"*
  - *"Will probably get it along with standard macula OCT with AMD patients"*

Which Test, What Disease?

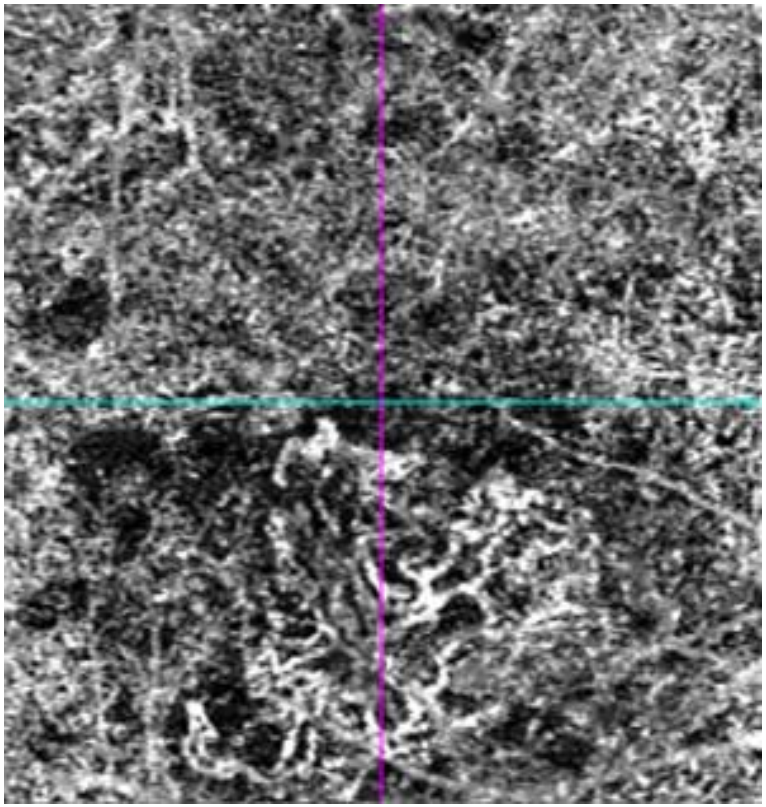
AngioPlex
(Macular Zones)

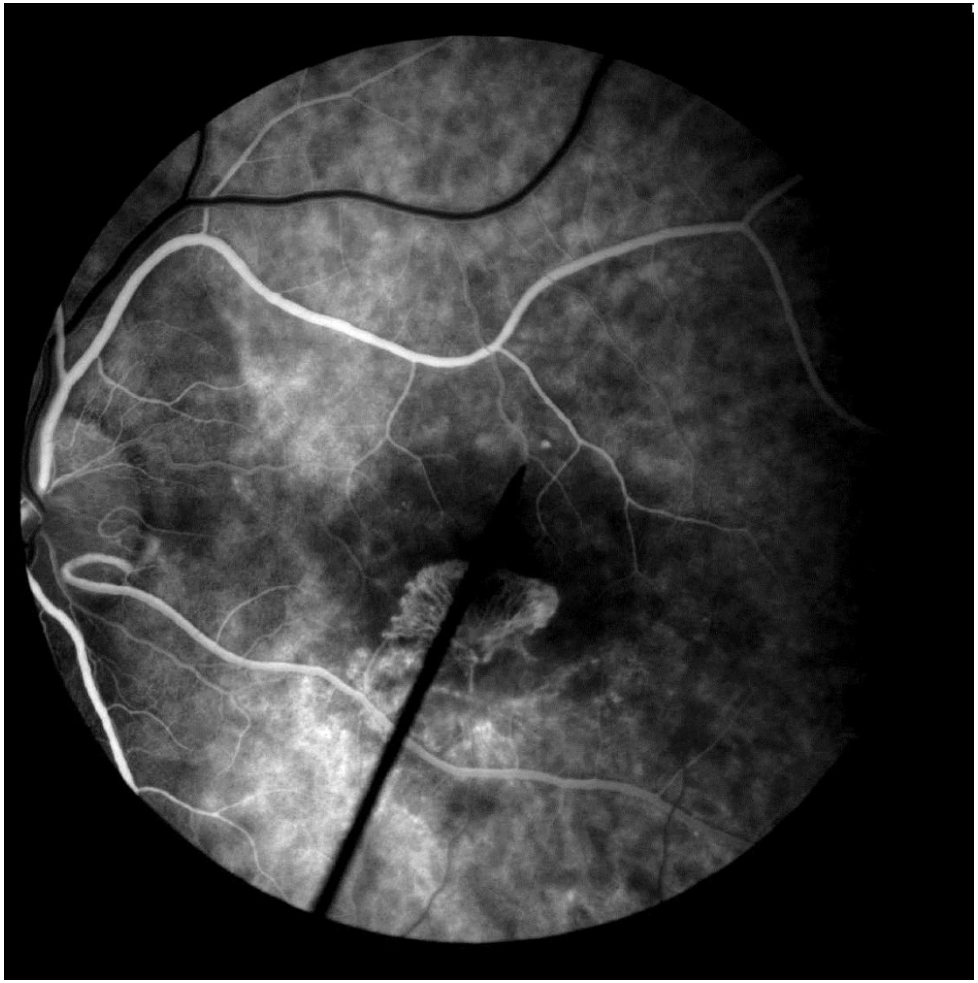
AMD - Age Related Macular Degeneration
Wet, Dry, Drusen, PED, RAP Lesion, ORT
MacTel – Macular Telangectasia
Myopic Degeneration
ERM – Epi Retinal Membrane
Macular Hole
PolyPoidal Vasculopathy
CME – Cystoid Macular Edema
DME – Diabetic Macular Edema
CSR – Central Serous ChorioRetinopathy

FA/ICG
(Macular Zones and Beyond)

BDR – Background Diabetic Retinopathy
PDR – Proliferative Diabetic Retinopathy
Tumors -
Occlusions – “Strokes in the Eye”
BRVO – Branch Ret Vein Occ
CRVO – Central Ret Vein Occ
BRAO – Branch Ret Artery Occ
CRAO – Central Ret Artery Occ.

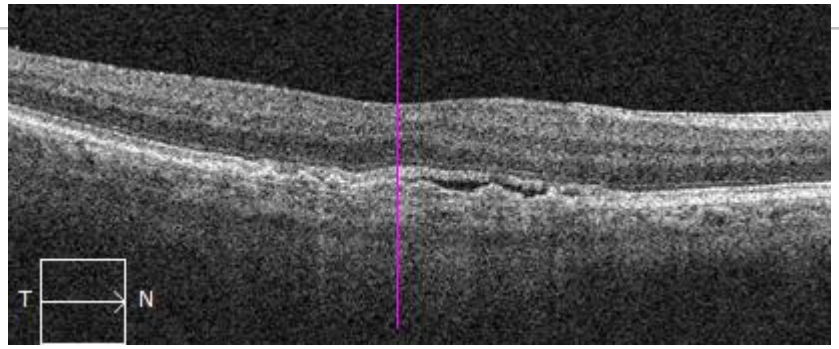
5 Seconds vs. 10 Minutes
AngioPlex (l) vs Early Stage FA (r)
Choroidal Neovascularization (CNV)

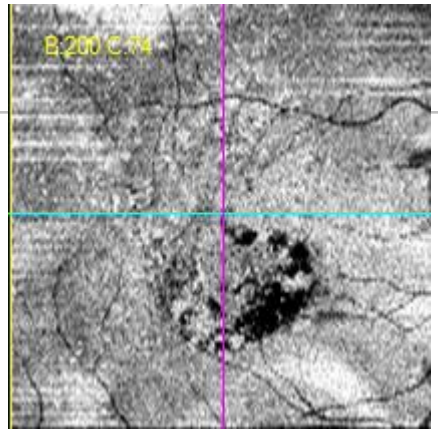


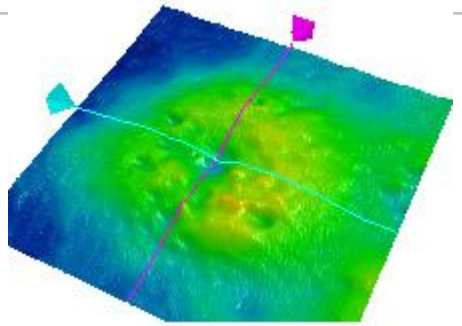


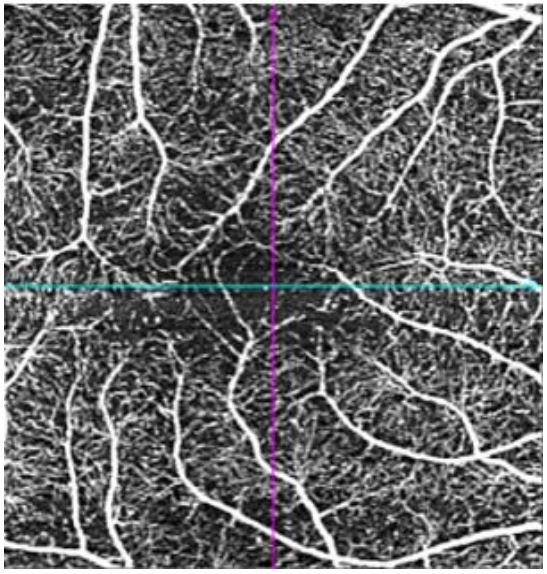
Hoffmeyer AngioPlex Case #1

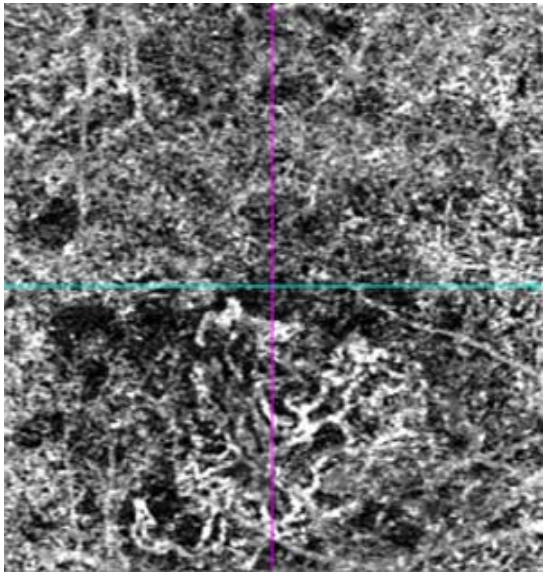
Lucky Shot…

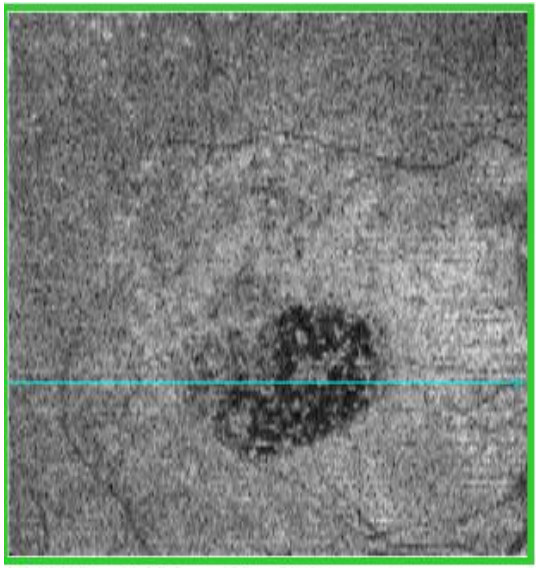






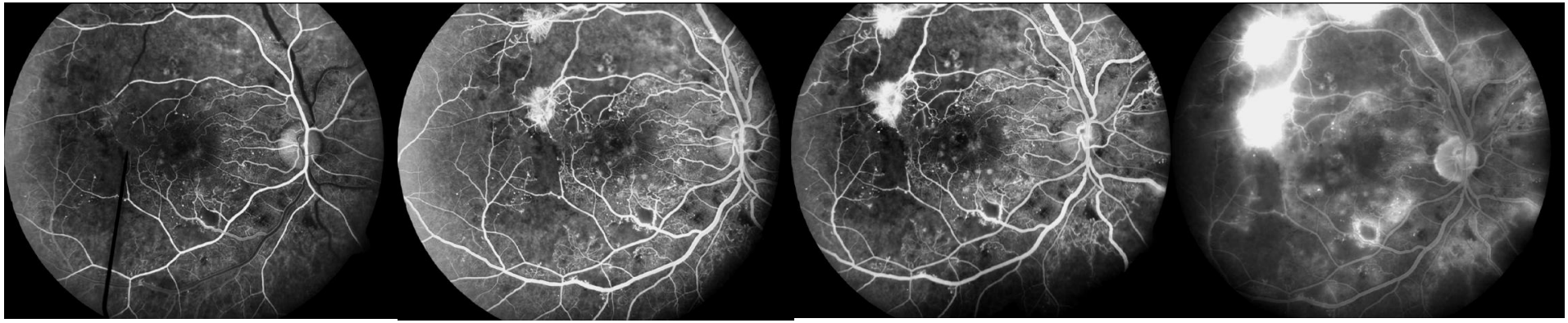






IS/OS-Ellipsoid: Offset = -29 µm Thickness = 0 µm

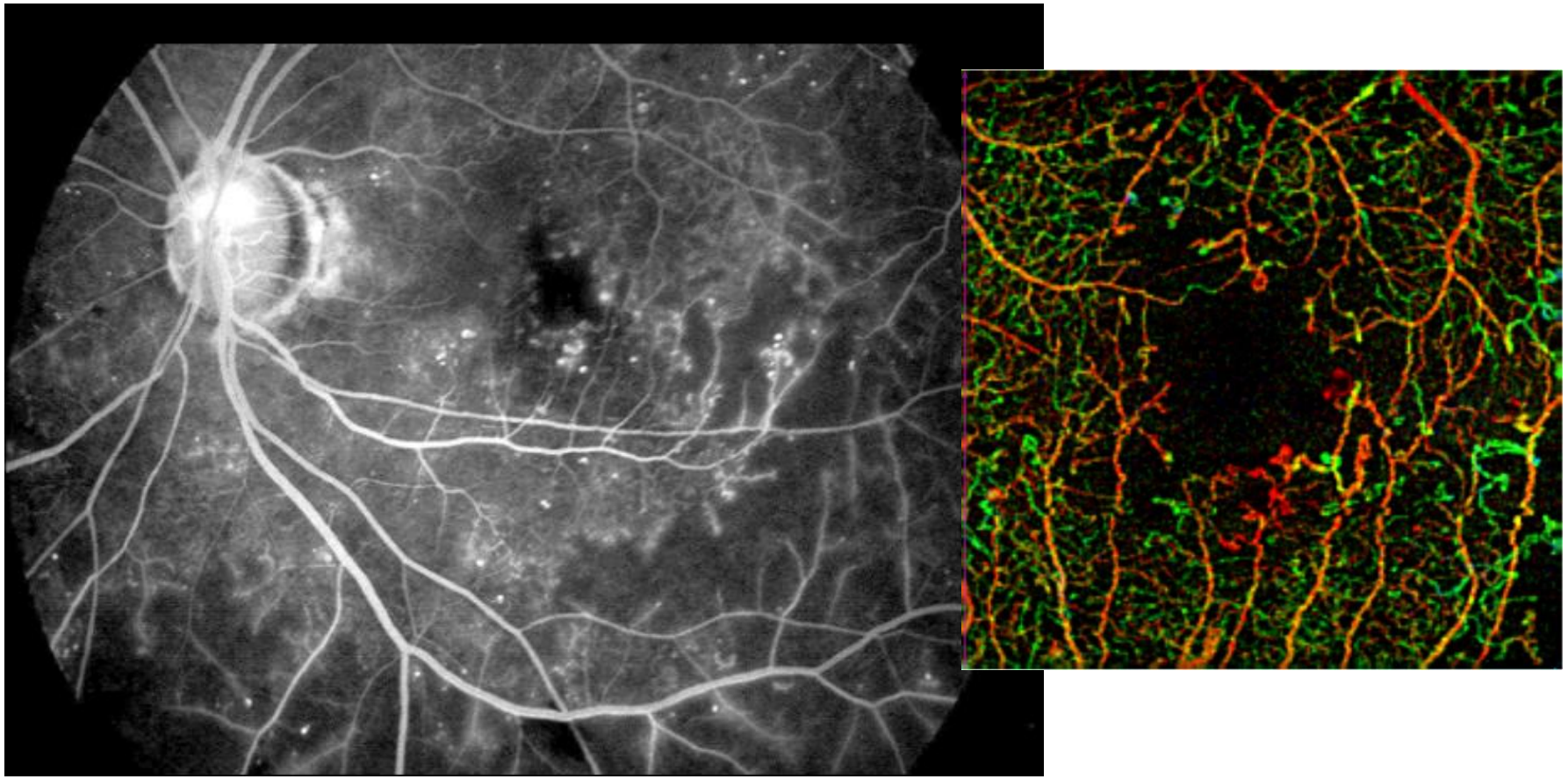
Every Question Answered



PDR – Proliferative Diabetic Retinopathy

Clinical case : PDR
57y Male

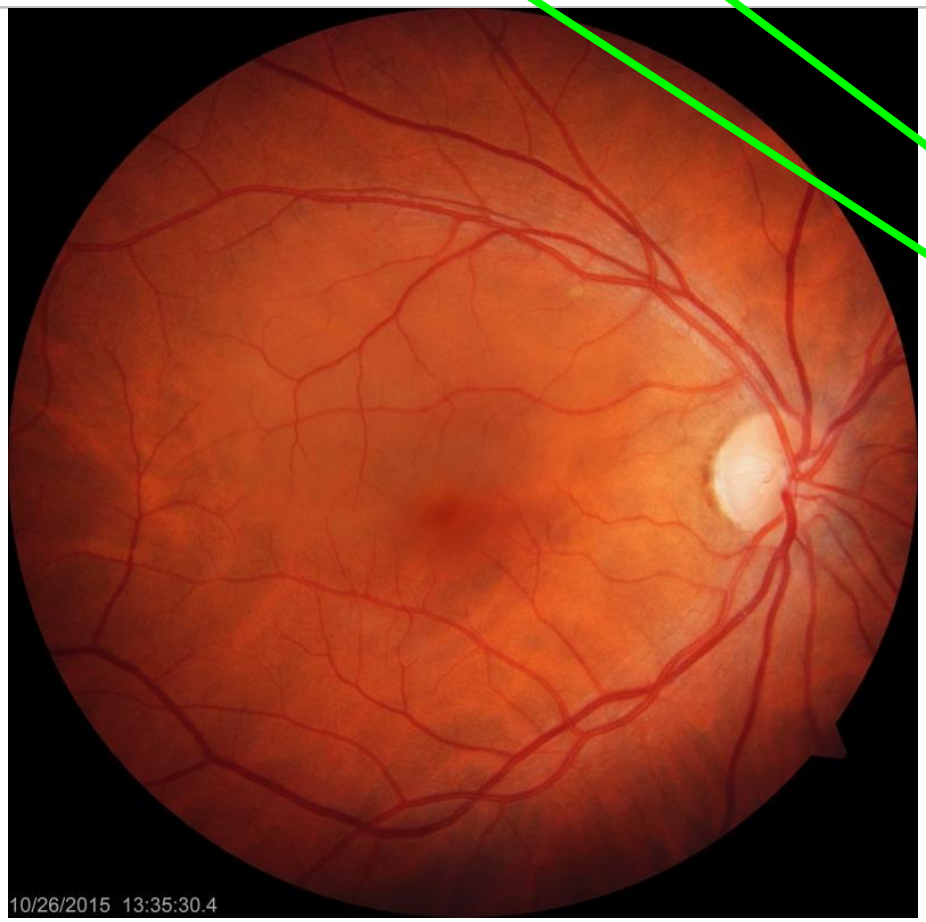
Fluorescein Angiogram : Mid phase

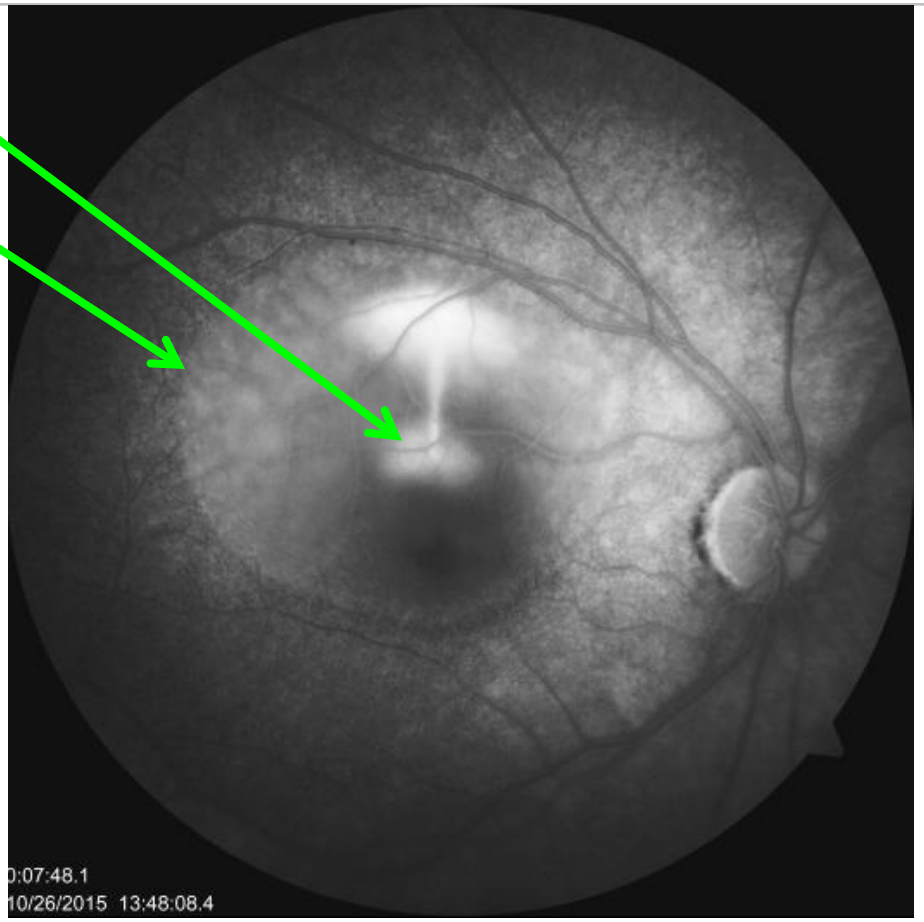


Courtesy of Dr. Scott Lee, East Bay Retina Consultants, Oakland, CA

CSR – FA Pooling/Leakage

VisuCam 524





CSR "*OCT Leakage and Pooling*"