OCT ANGIOGRAPHY: IMAGING MOTION

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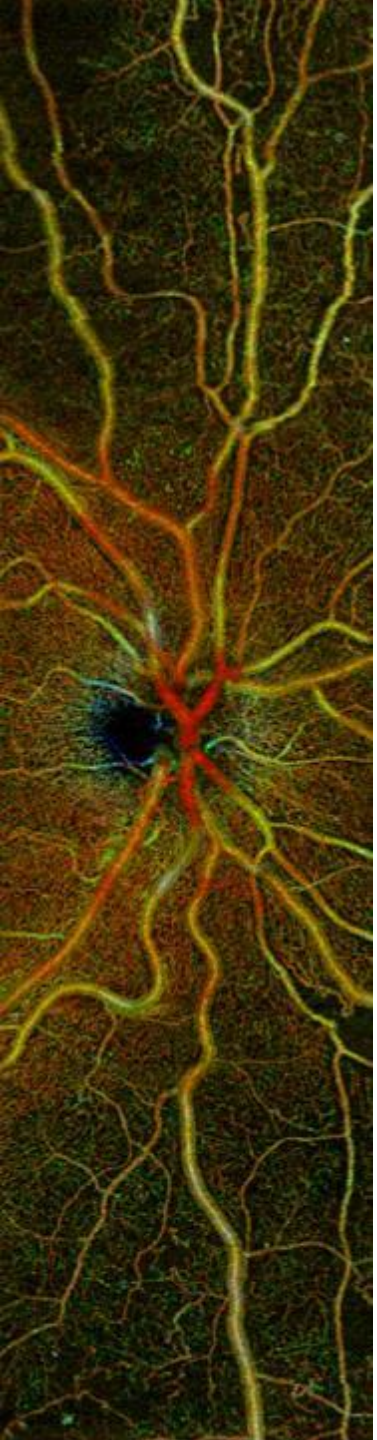
Rosenberg School of Optometry



ONLINE NOTES

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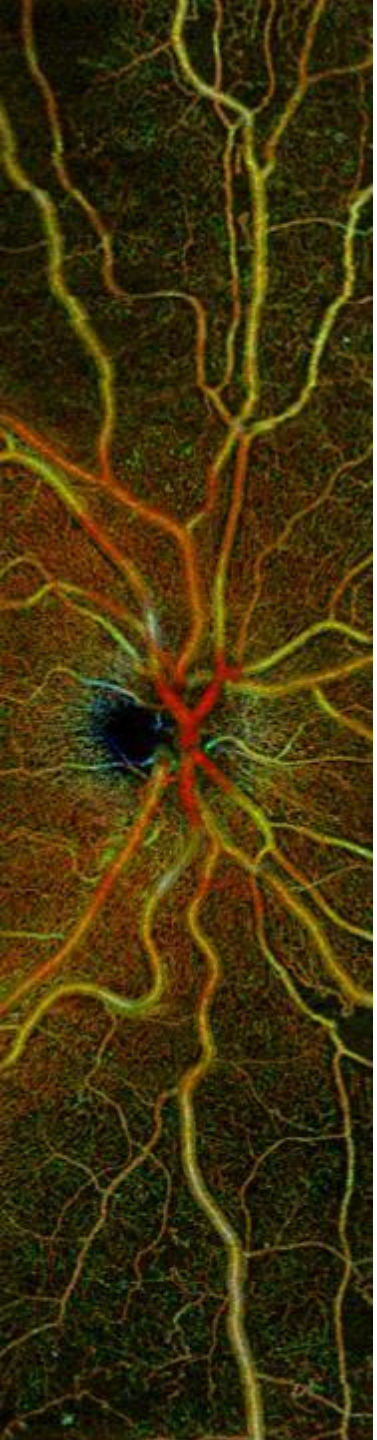
DISCLOSURES

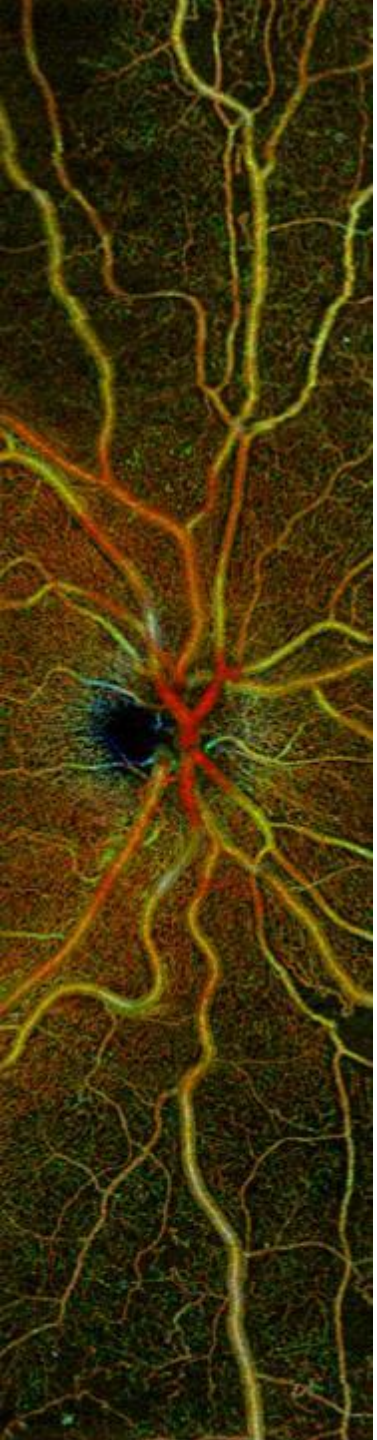
- No financial and/or proprietary conflicts of interest to disclose.

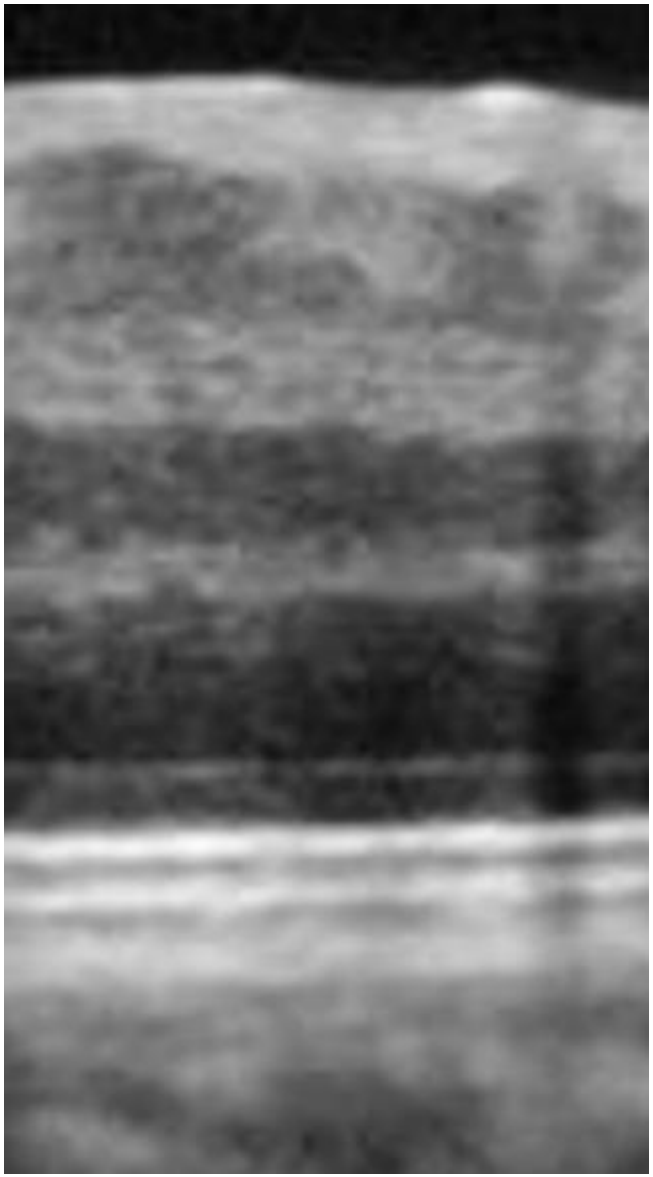


OVERVIEW

- Retinal blood supply
- Technology
- Principle (Motion contrast)
- Displays
- OCTA in disease
  - Diabetic retinopathy
  - Venous occlusion
  - AMD
  - Other causes of CNV
  - Glaucoma

RETINAL BLOOD SUPPLY

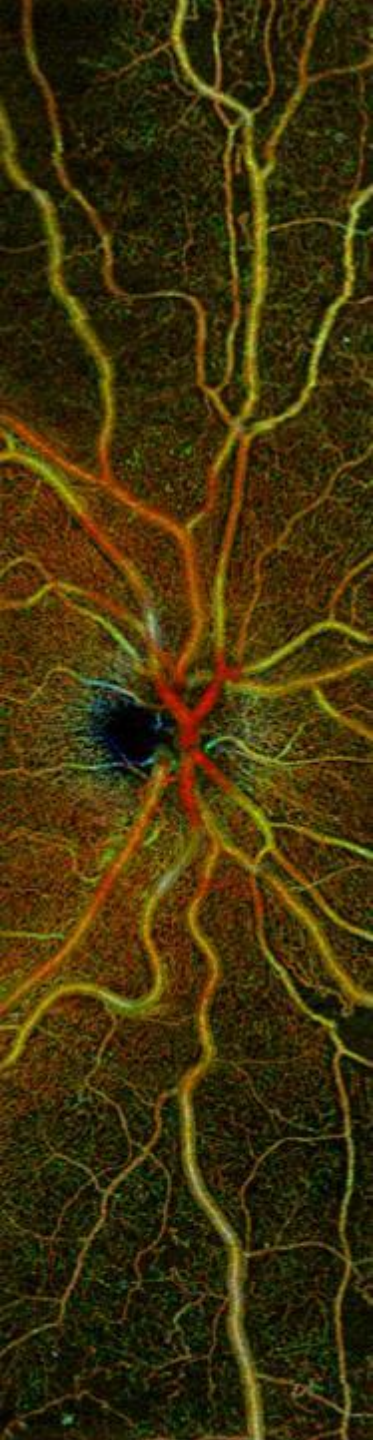




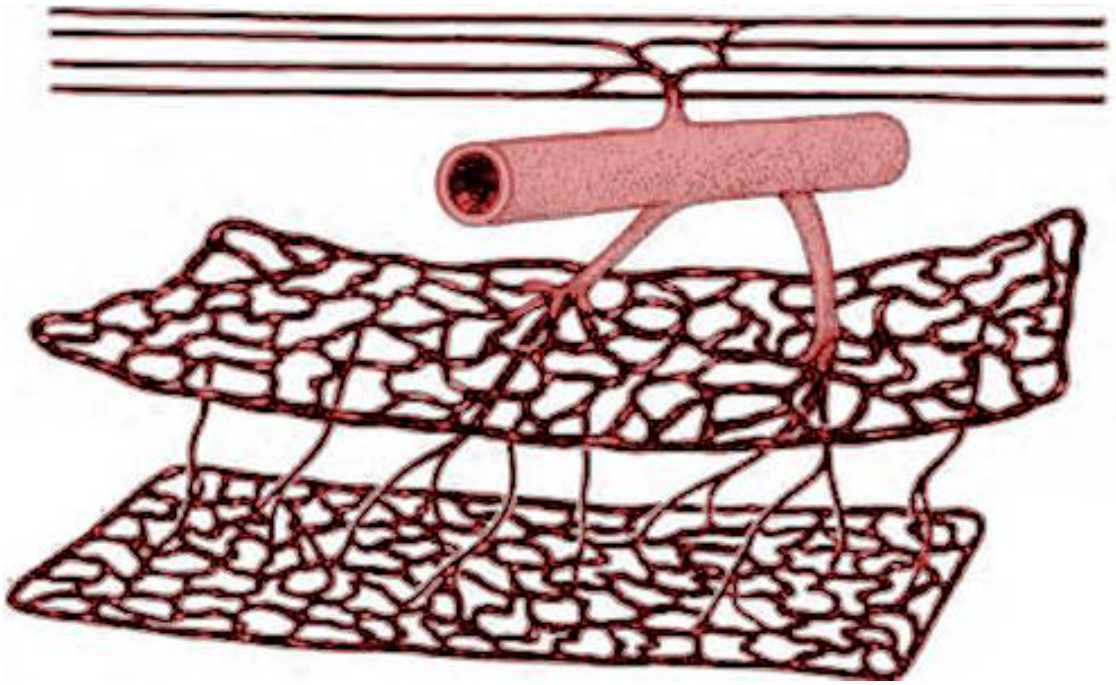
NFL
GCL
IPL
INL
OPL
ONL
PR

CRA

Choroid



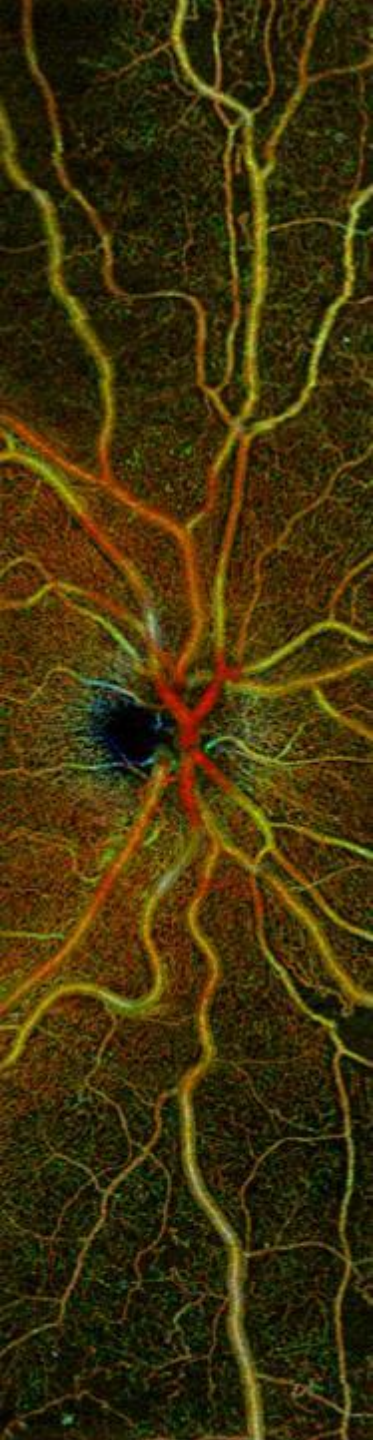
CENTRAL RETINAL ARTERY



Radial Peripapillary Capillaries

Superficial Capillary Plexus

Deep Capillary Plexus

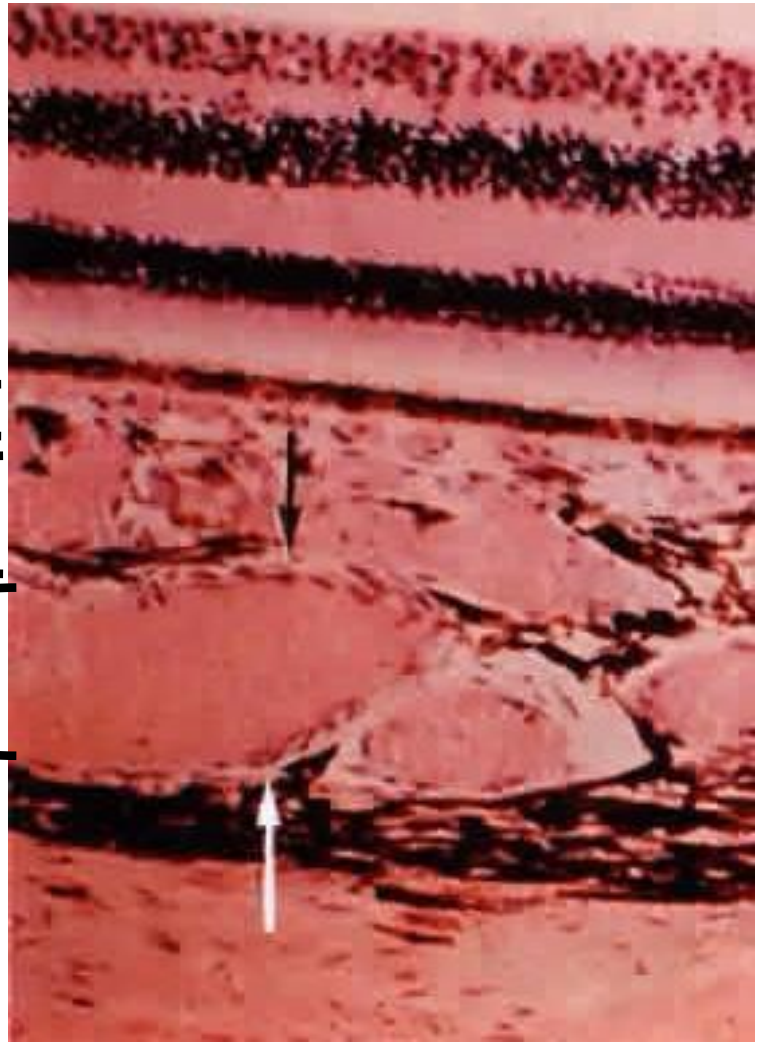


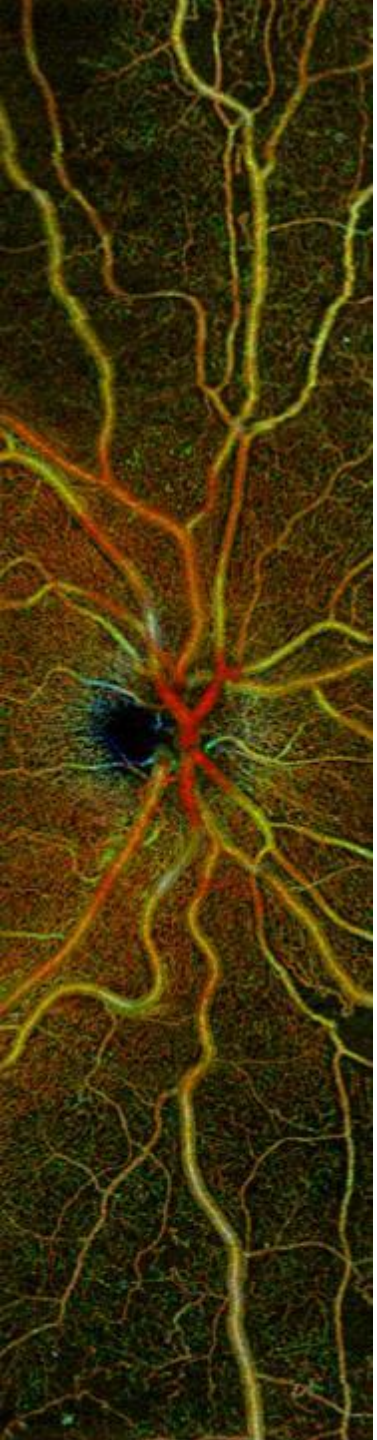
CHOROID

Choriocapillaris

Sattler's

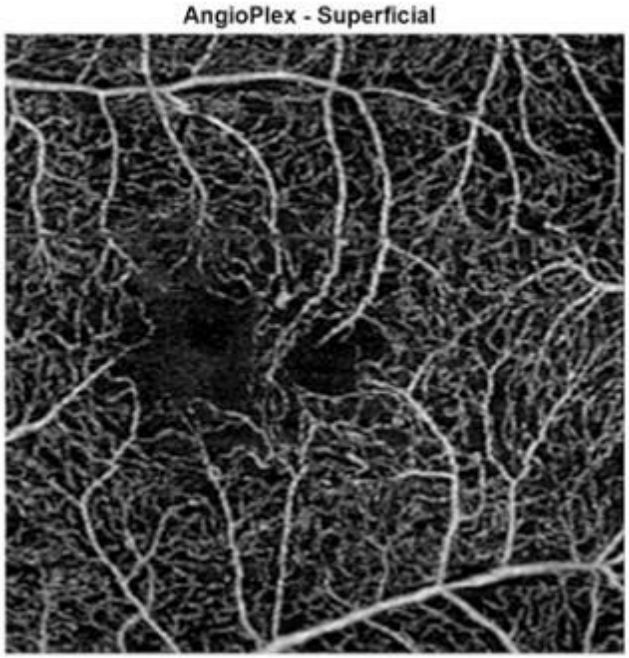
Haller's

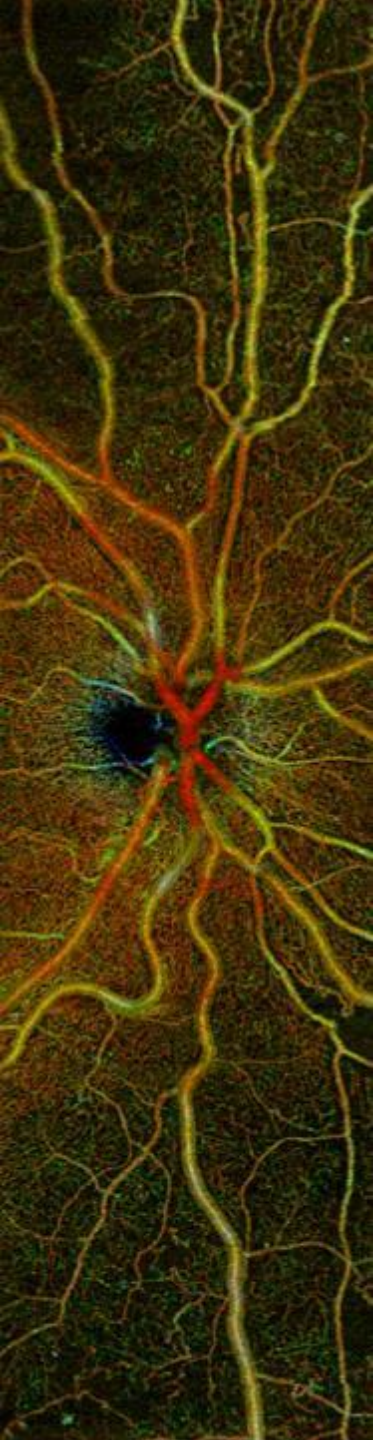




INTRODUCTION

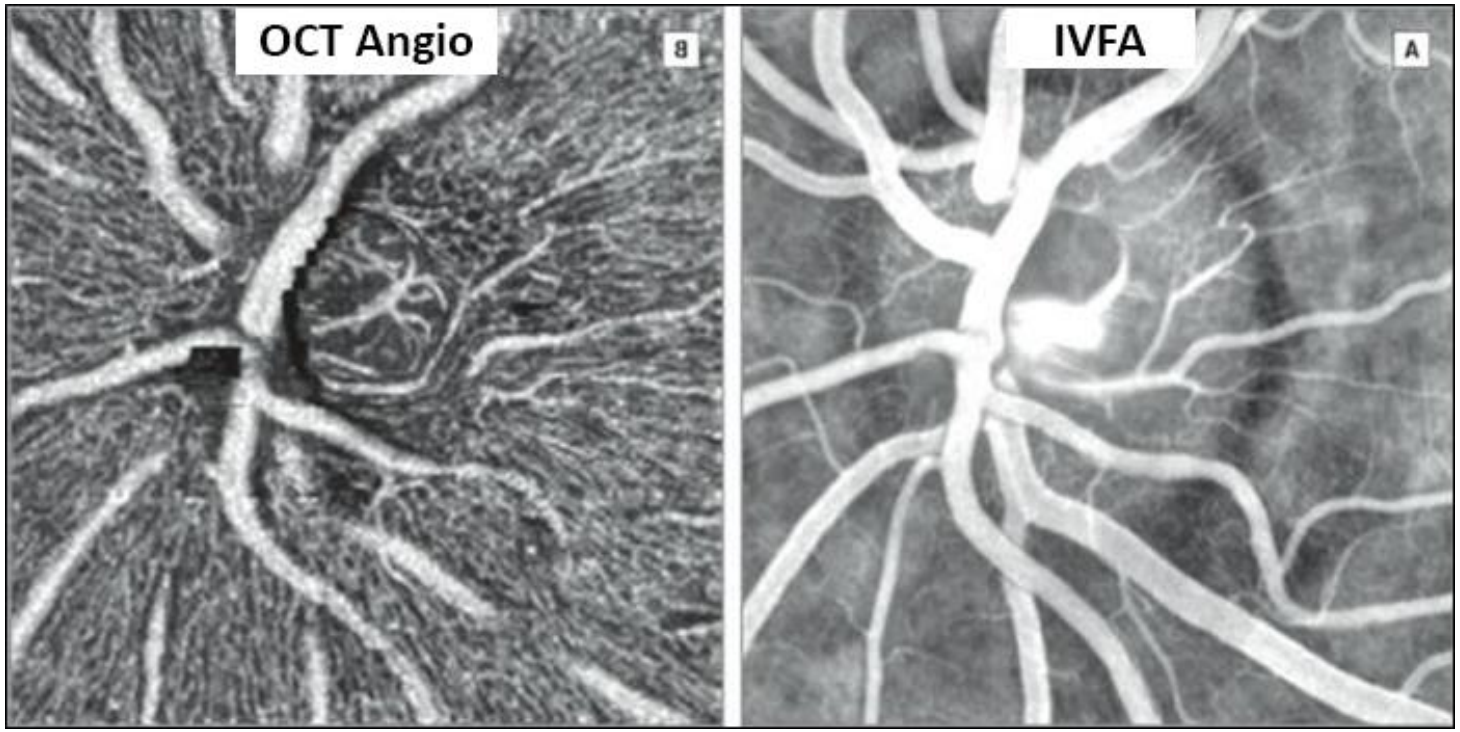
- Non-invasive “flow” imaging
- 3D volumetric data
- Simultaneous retinal and choroidal imaging
- Structure/ vasculature in tandem

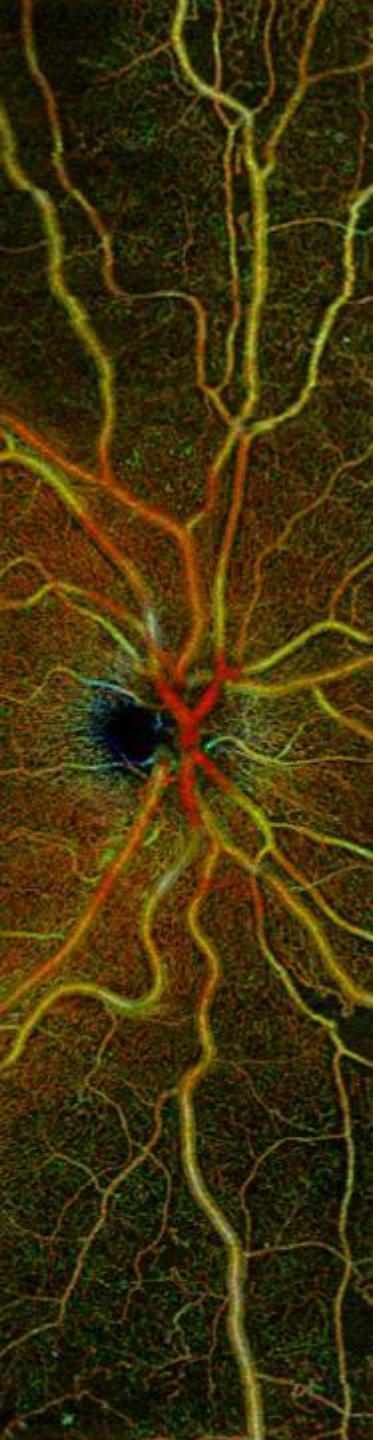




INTRODUCTION

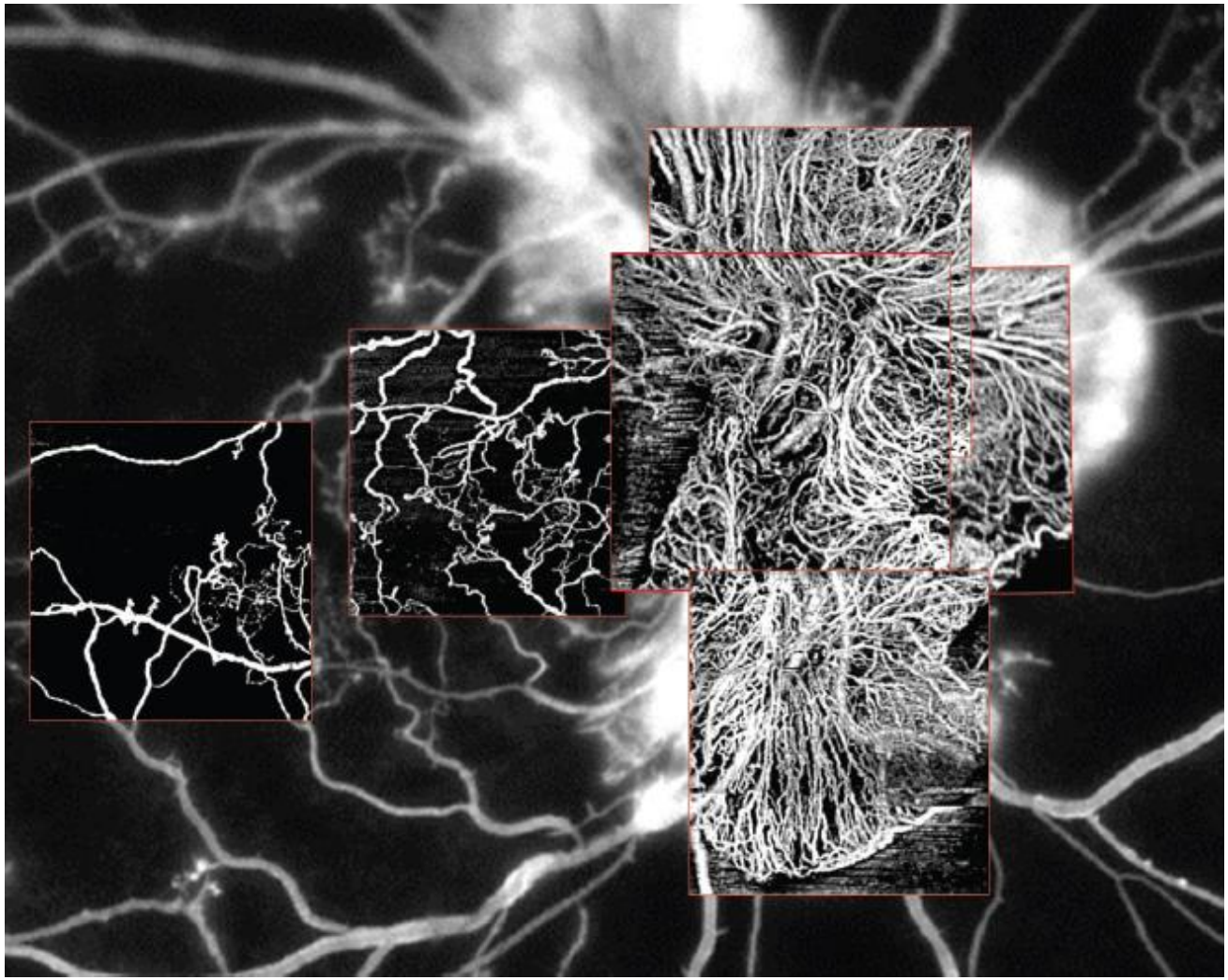
- Rapid acquisition
- Short term repeatability
- High microvascular resolution

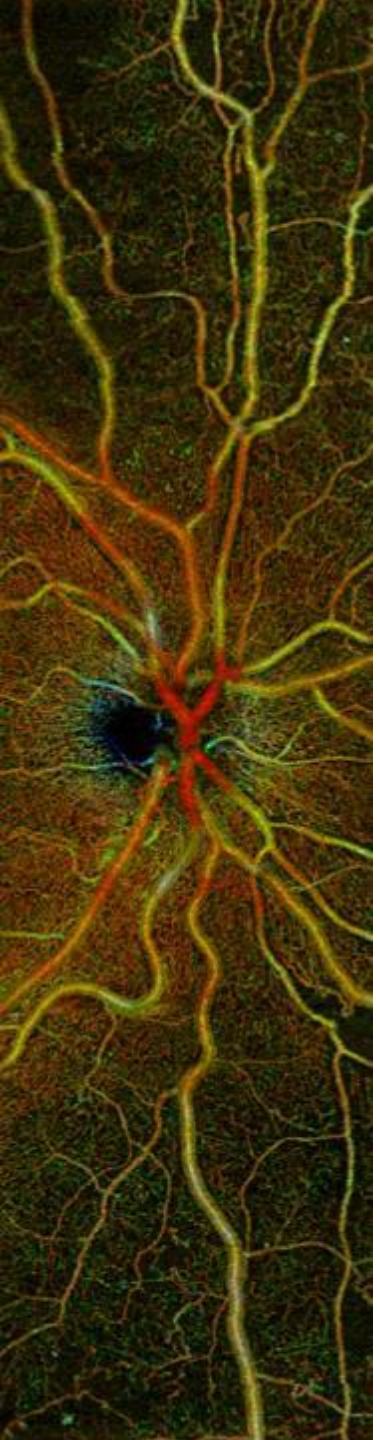




INTRODUCTION

- Precise delineation/measurement of neo





TECHNOLOGY

<u>FDA Cleared</u>

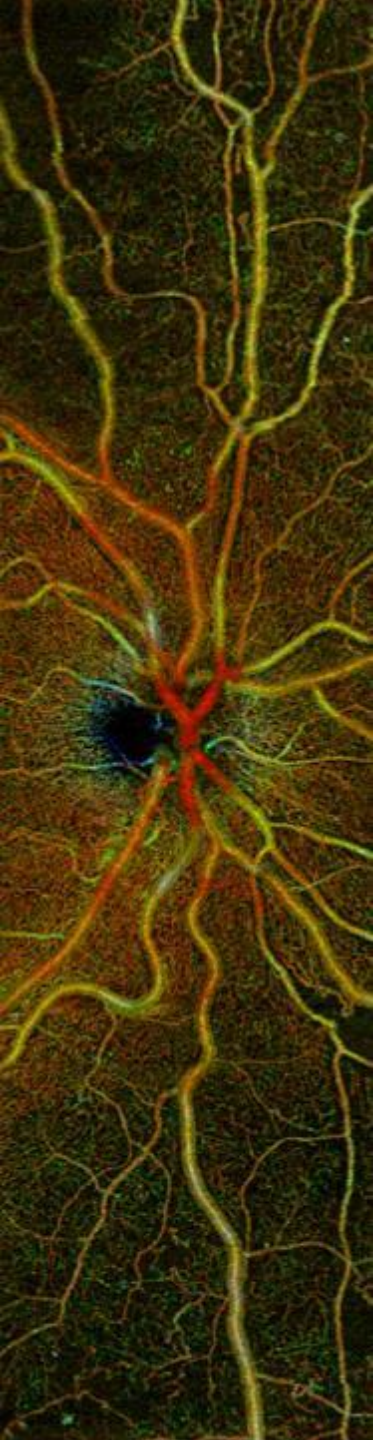
- **Zeiss AngioPlex™**
  - FDA approved in Sept 2015
  - Cirrus 5000 HD-OCT/Plex Elite 9000
  - Optical Microangiography (OMAG)

- **Optovue AngioVue™**
  - First commercially available OCT angiography system
  - FDA approved in Feb 2016
  - RTVue XR Avanti SD-OCT
  - Split-Spectrum Amplitude Decorrelation Angiography (SSADA)

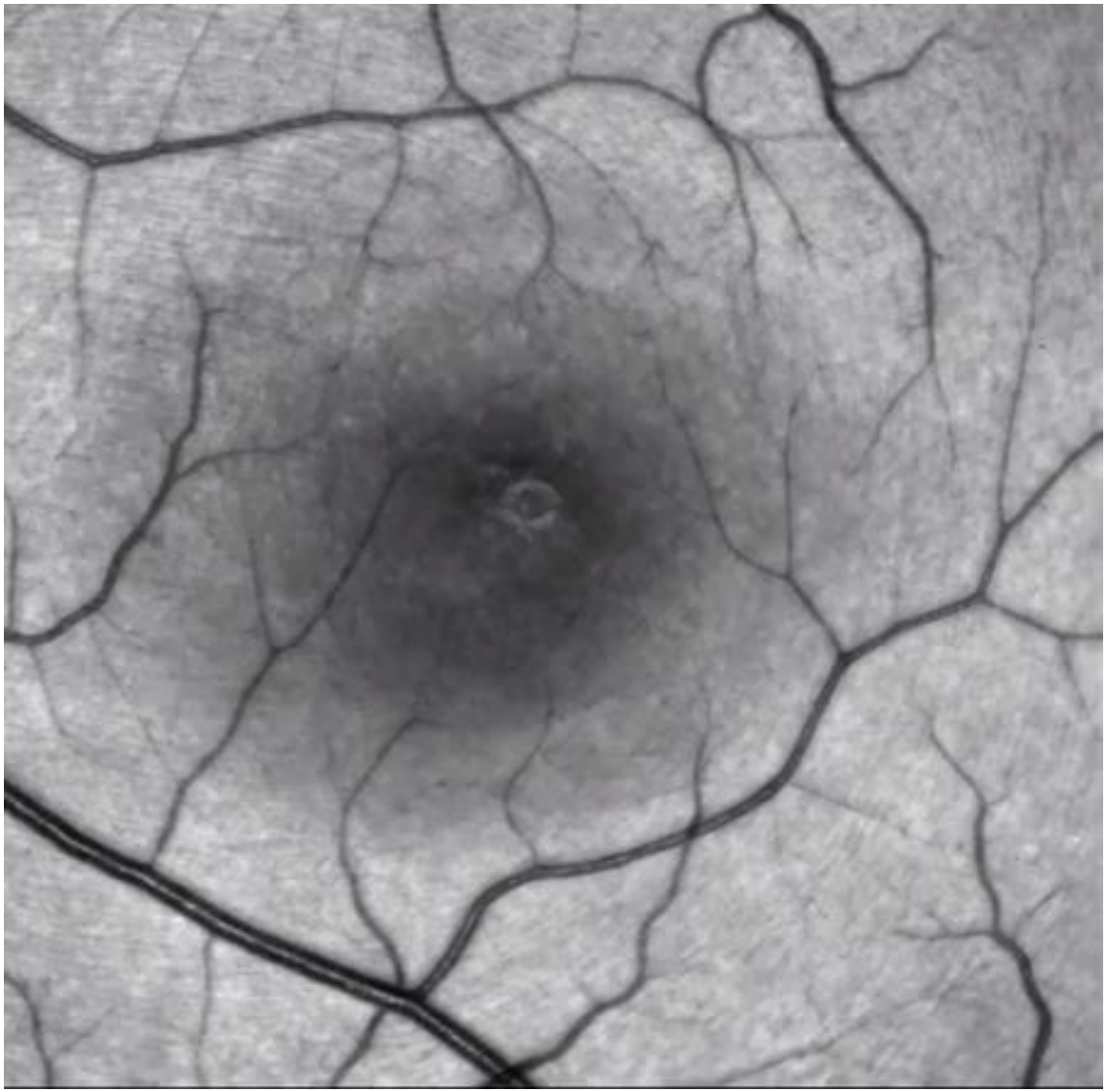
- **Heidelberg Spectralis (OCTA Module)**
  - FDA approved in Sept 2018

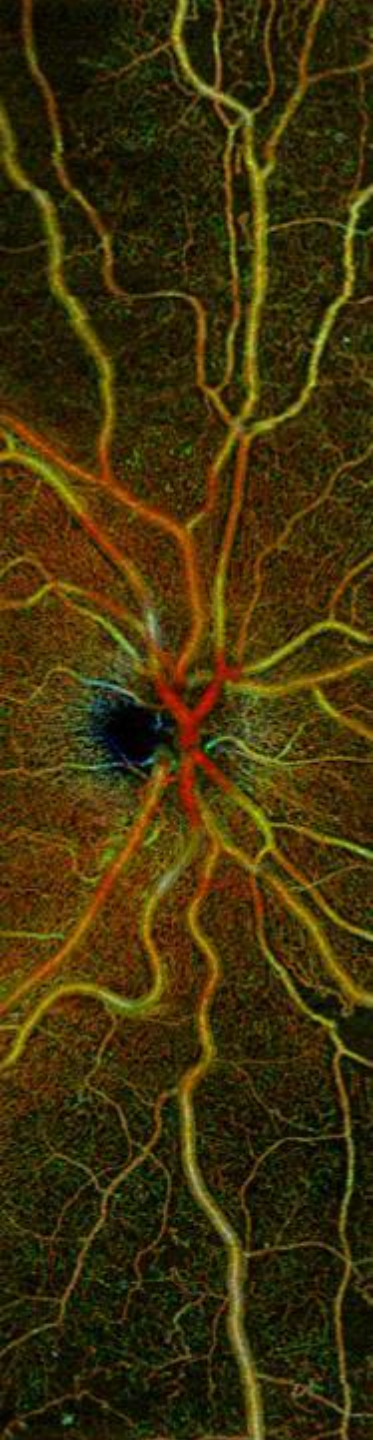
<u>Not FDA Cleared</u>

- Nidek AngioScan ™
- Topcon SS OCT Angio ™
- Canon



MOTION CONTRAST





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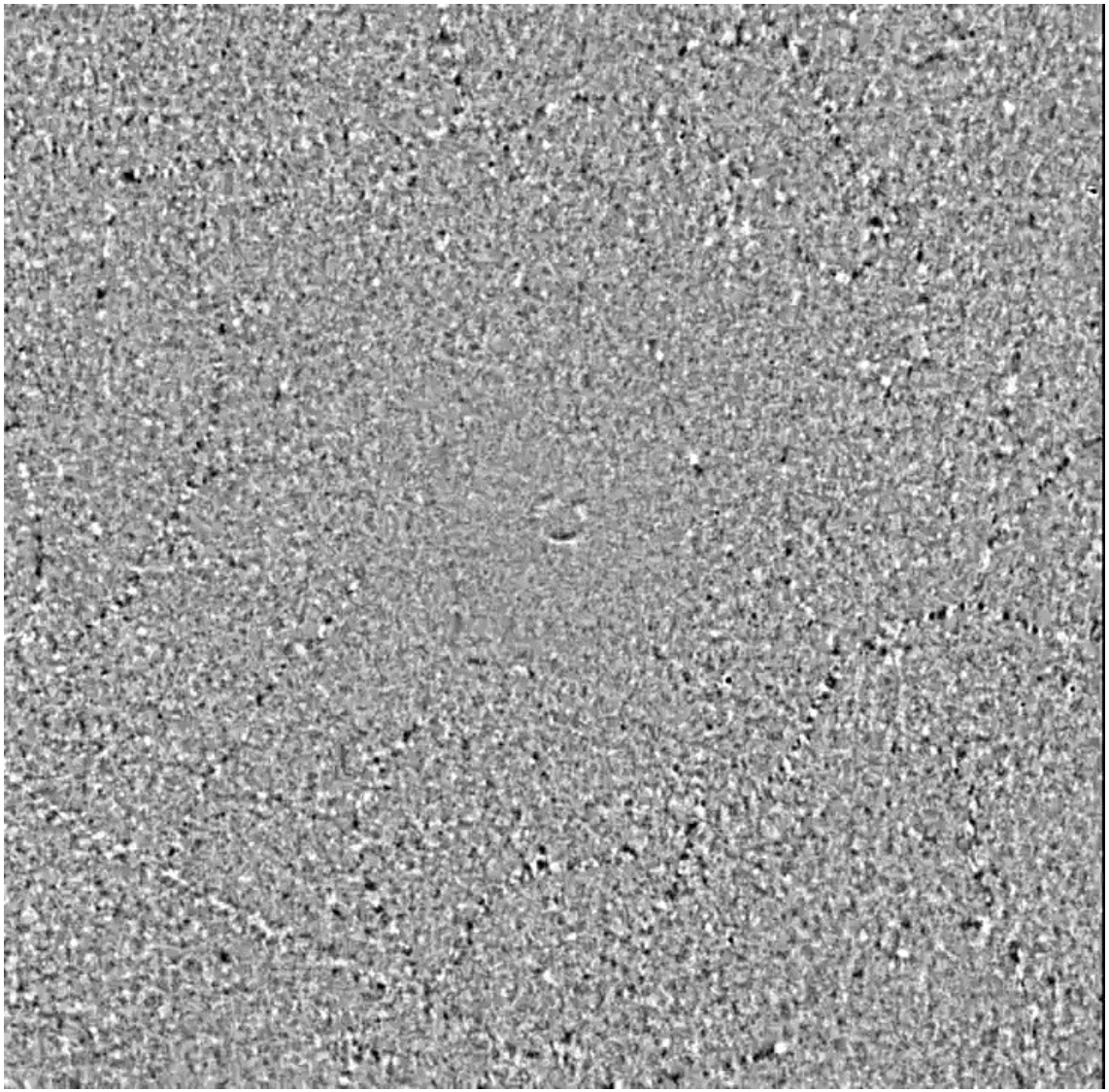

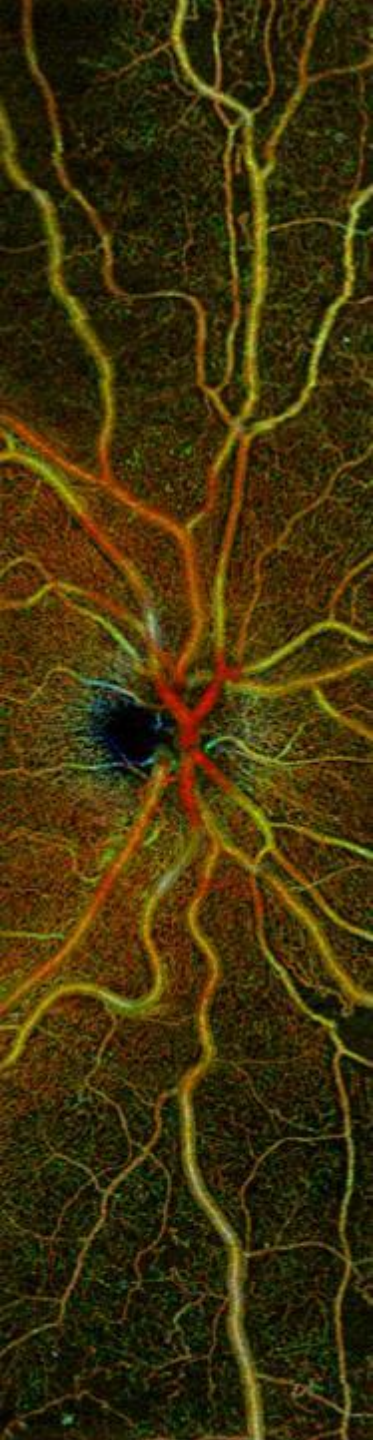

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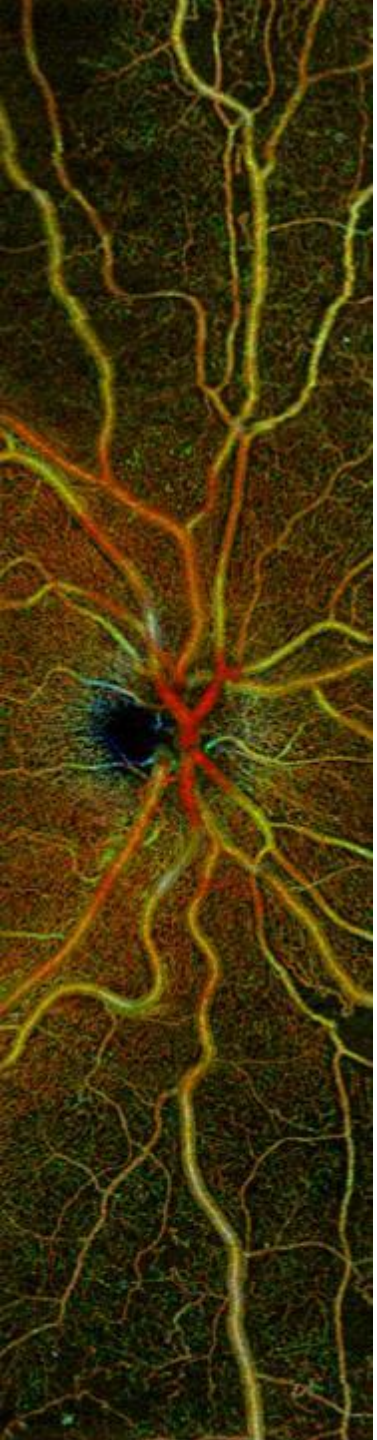
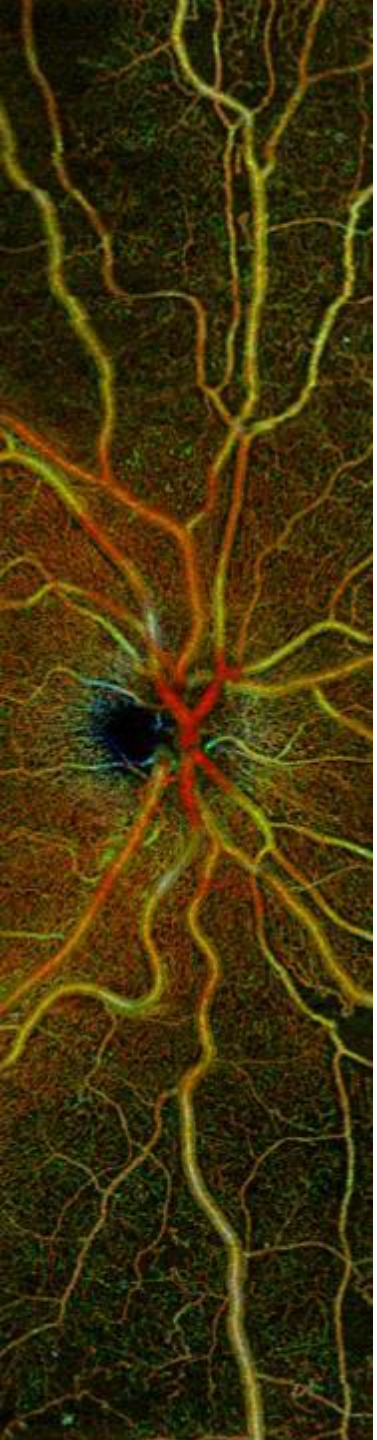


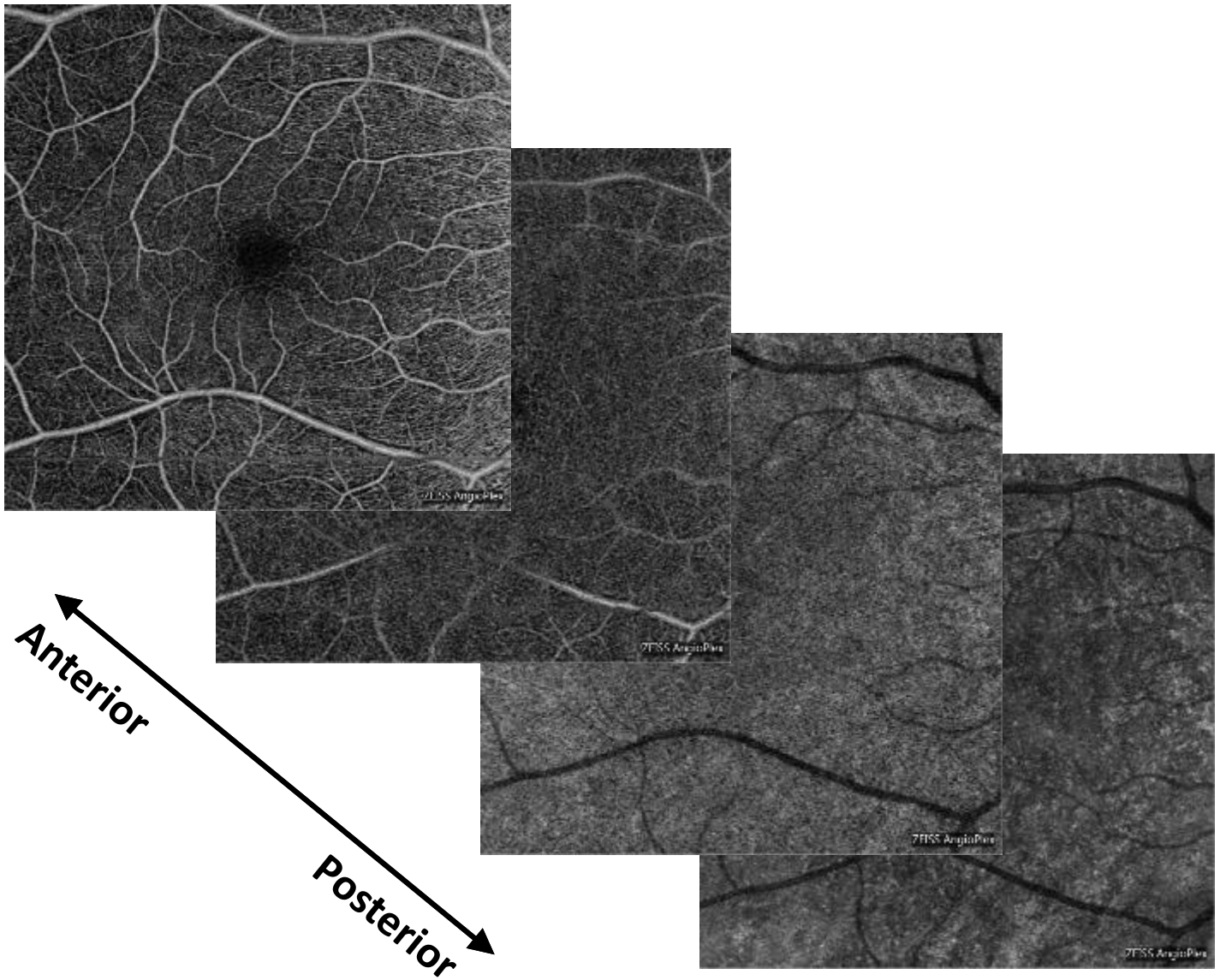
Billing

92134- OCT Retina

92499- other ophthalmological services and procedures????

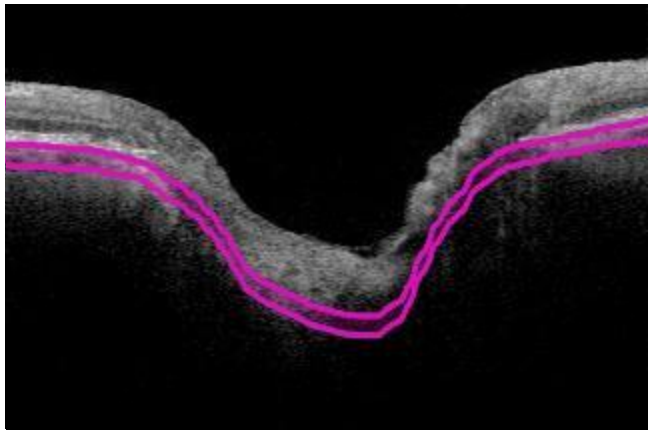


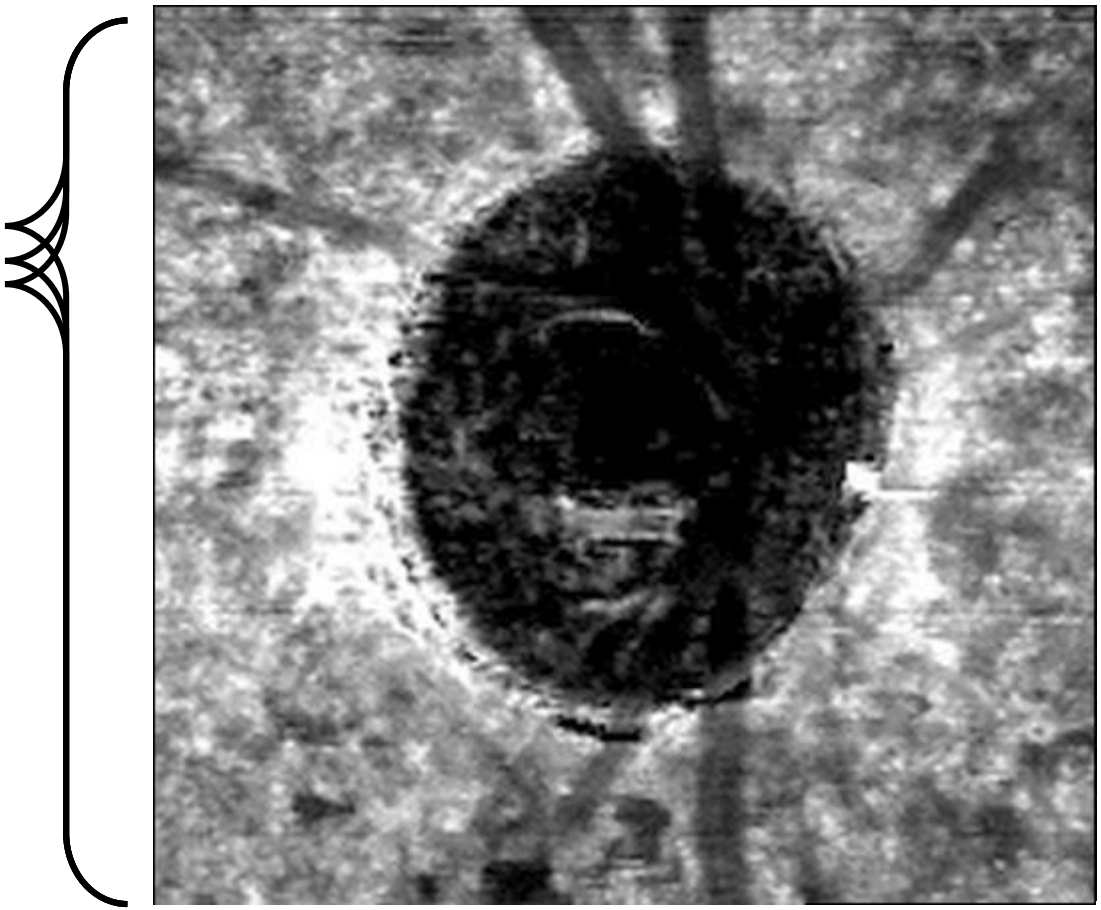
DISPLAY- En Face



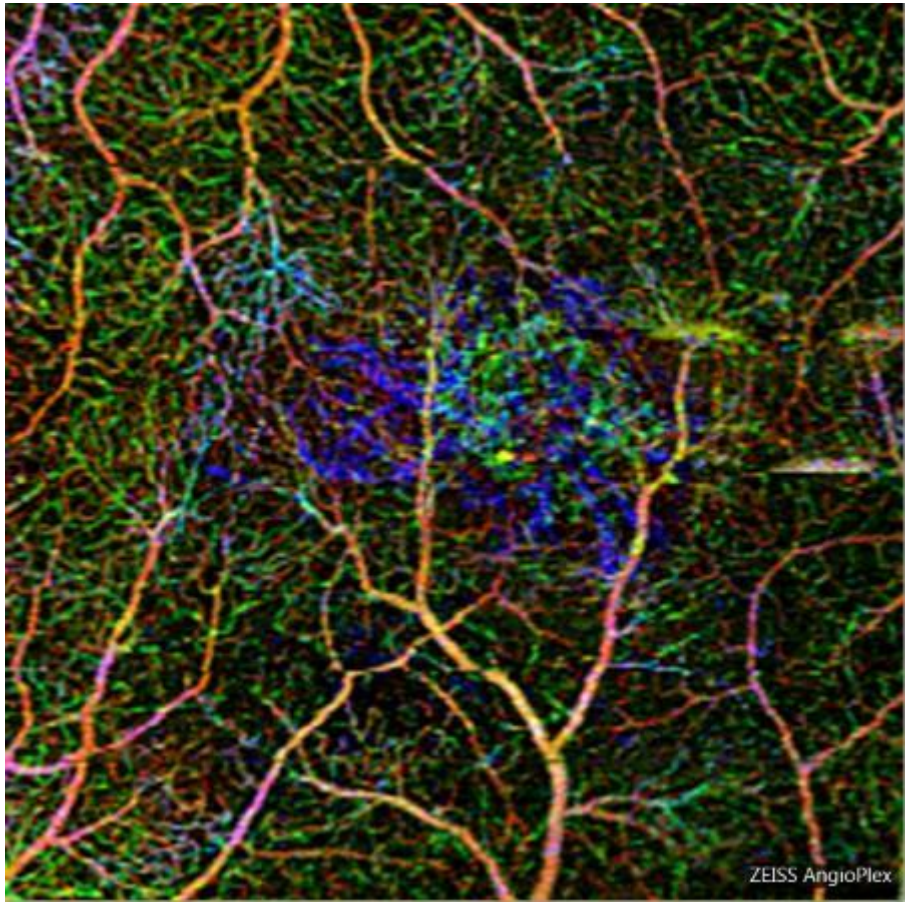
DISPLAY- Optic Nerve En Face

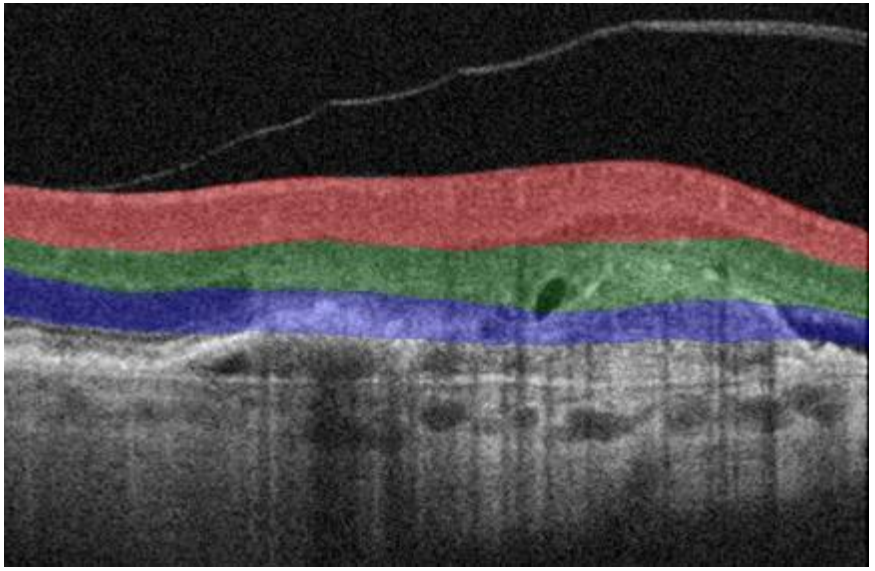
Radial Peripapillary Choroid

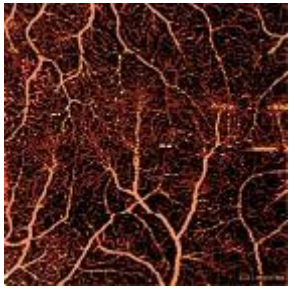


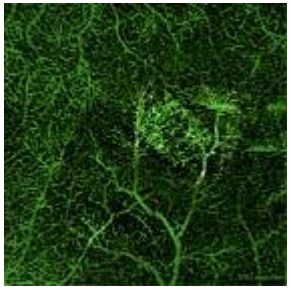


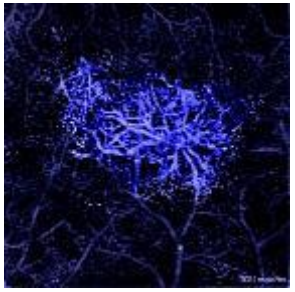
DISPLAY- Color En Face

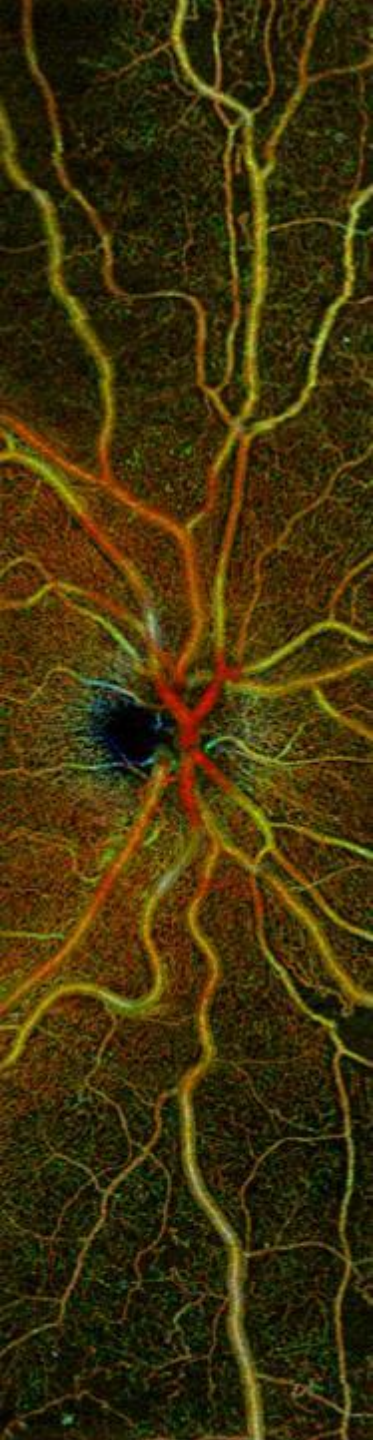




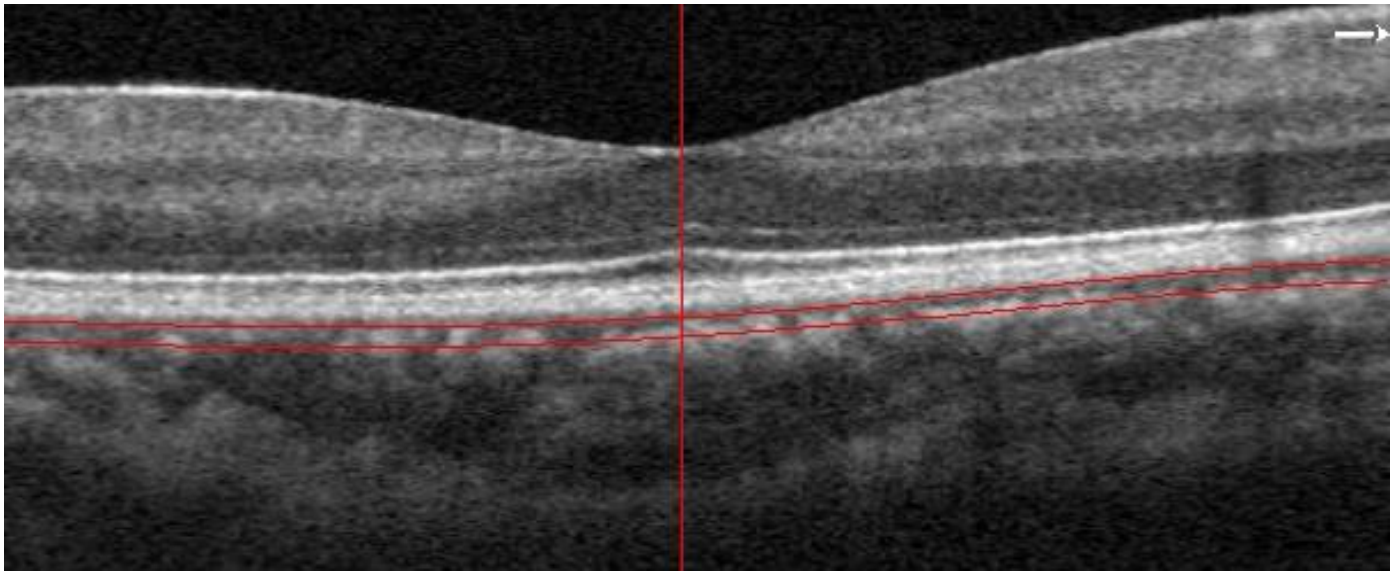


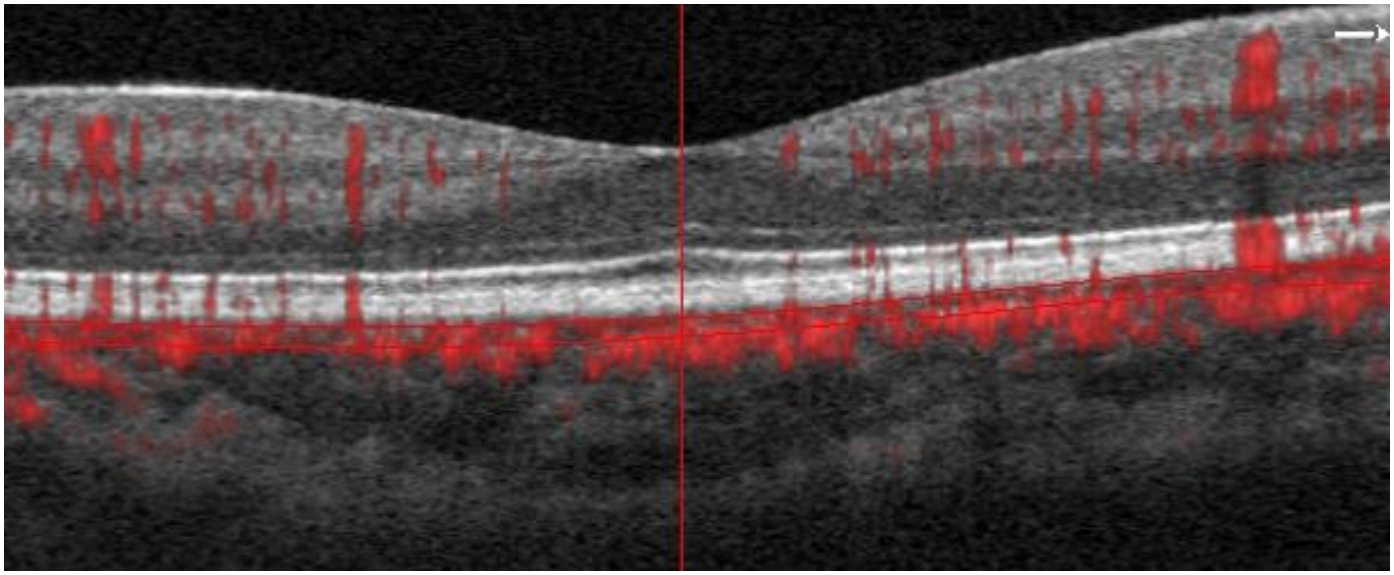


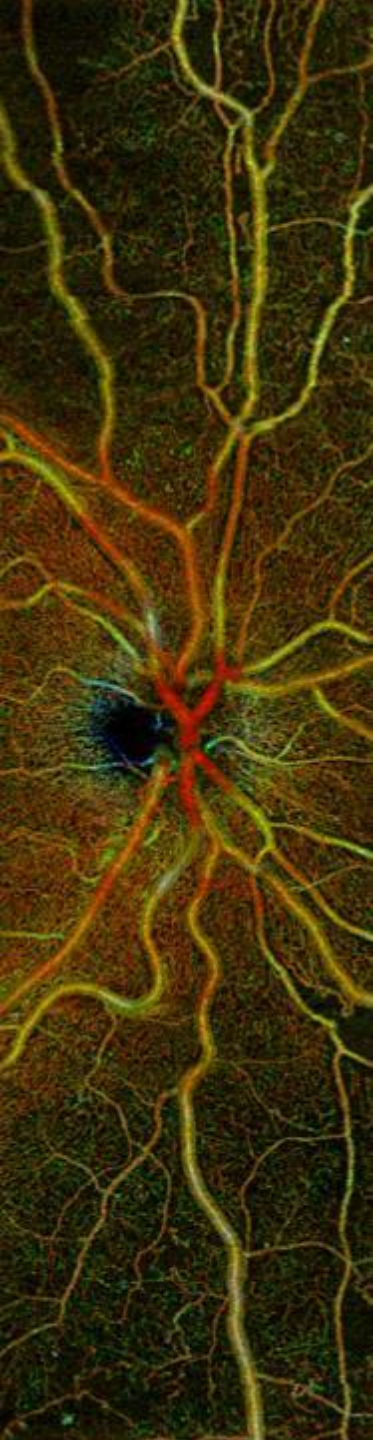




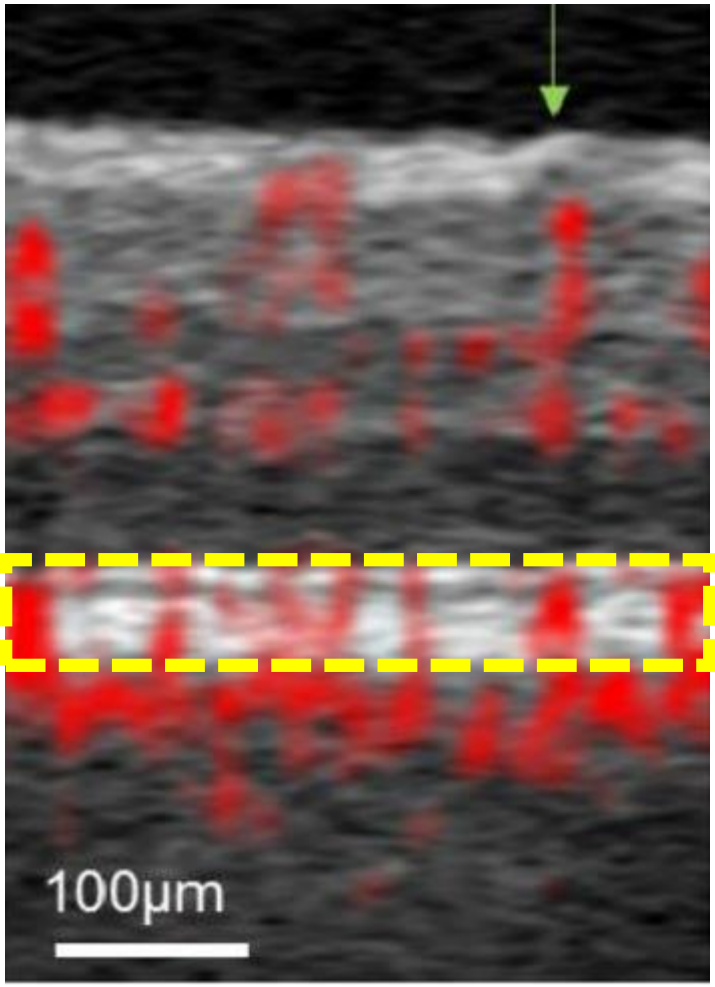
DISPLAY- B Scan Overlay



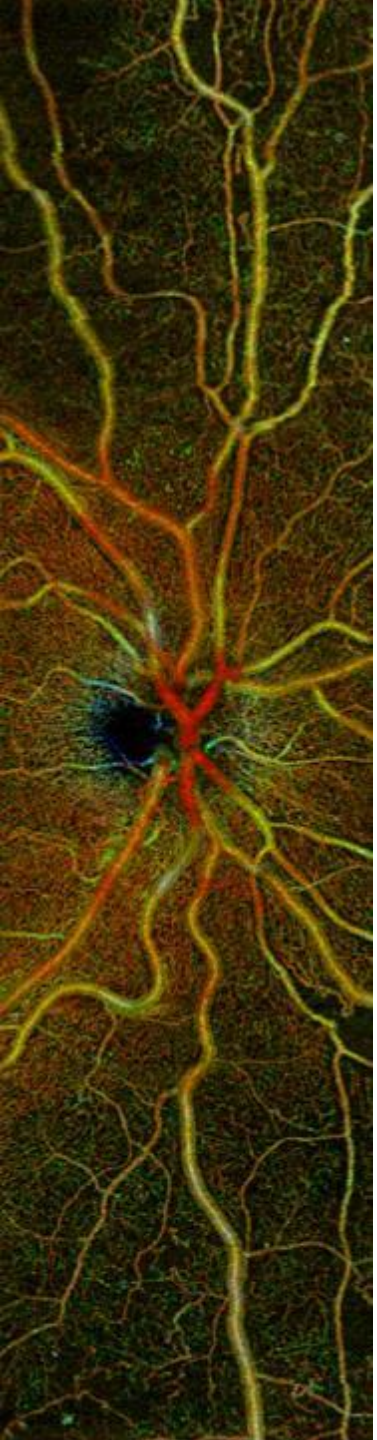




ARTIFACTS- Projection



Spaide R, et al. Image Artifacts in OCTA. Retina. 35(11):2163-2180.



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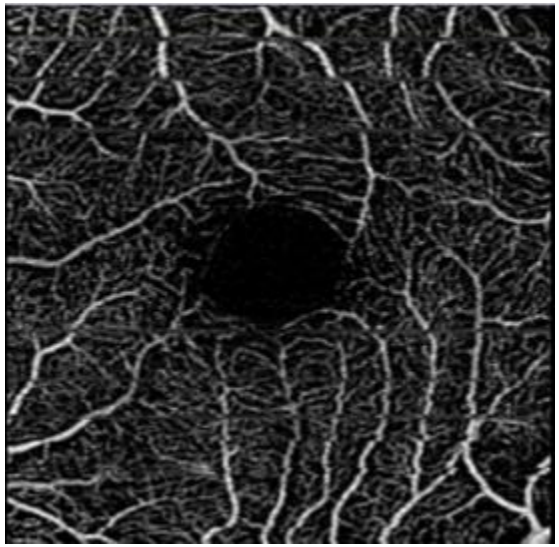
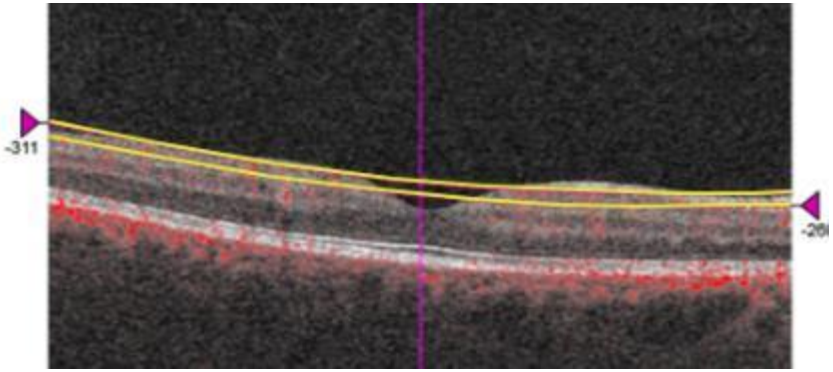
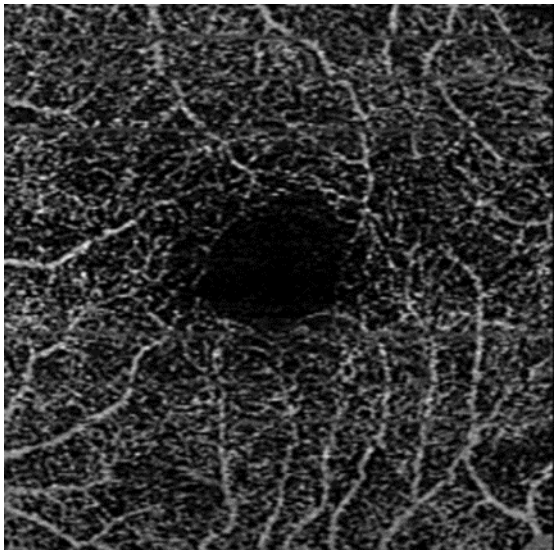
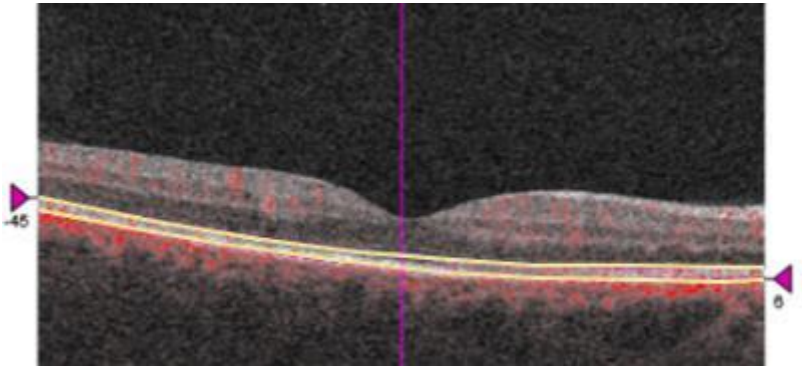


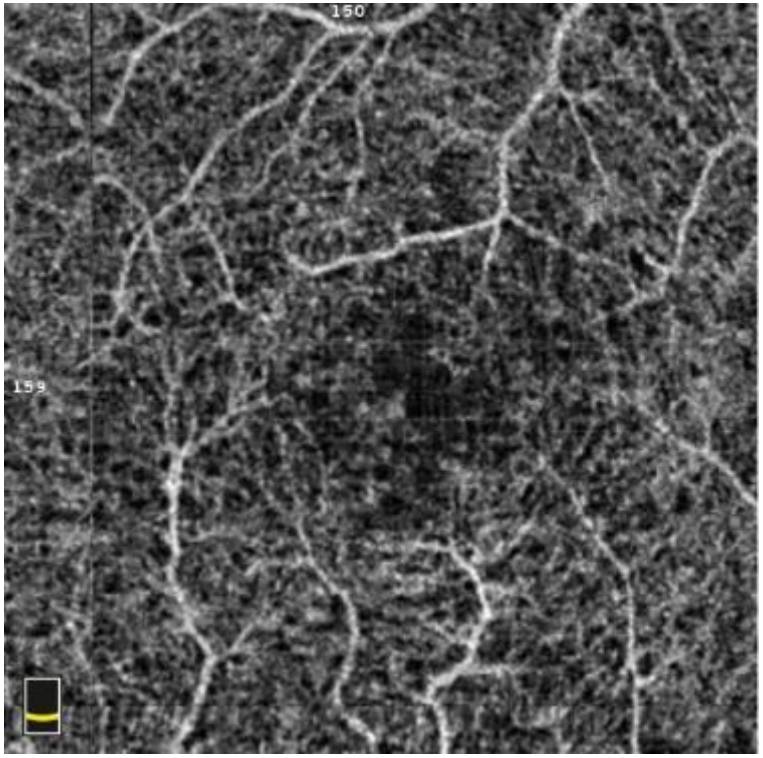




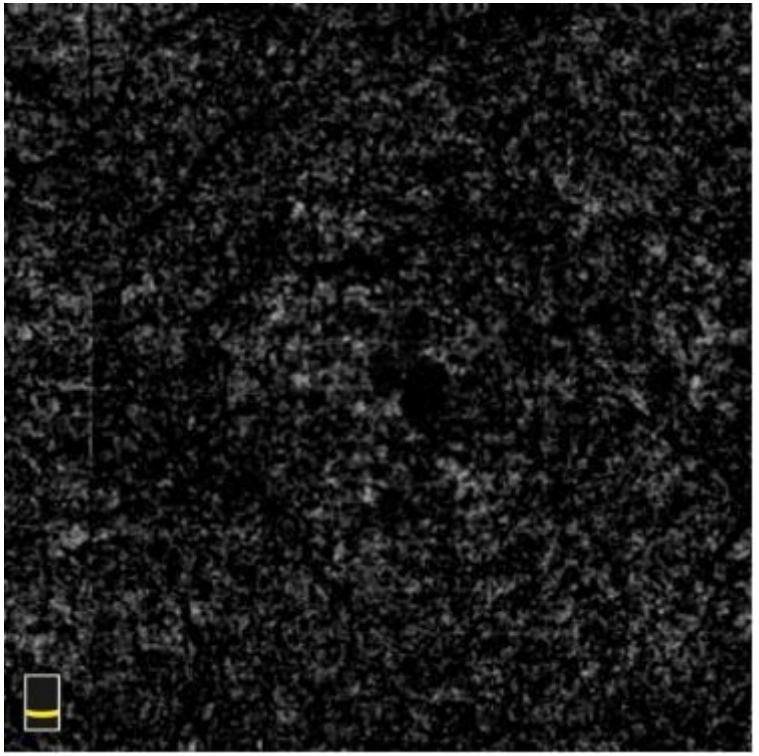


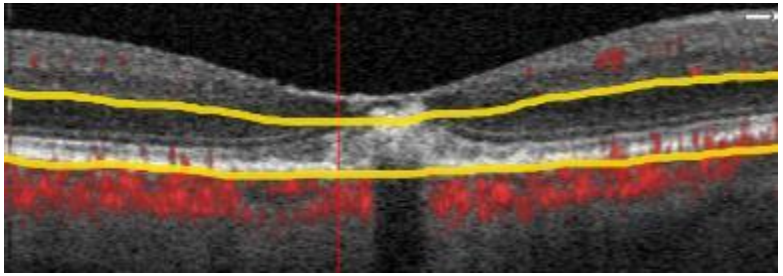
ARTIFACTS- Projection

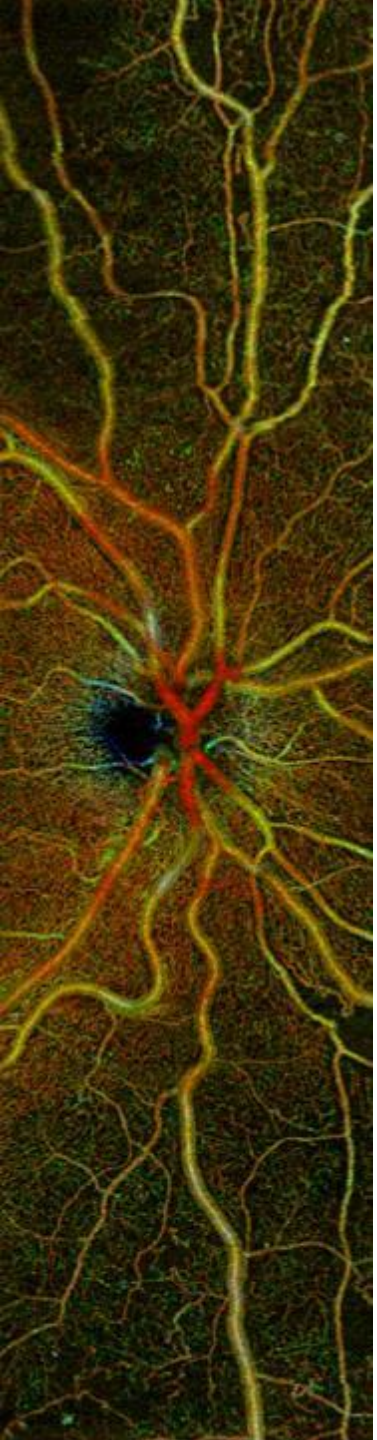
Without projection artifact removal



With projection artifact removal



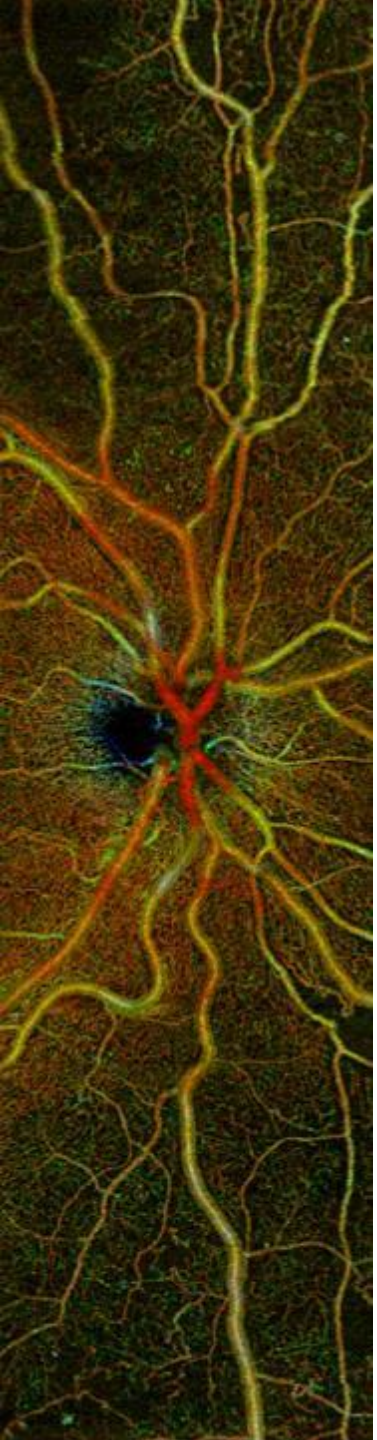




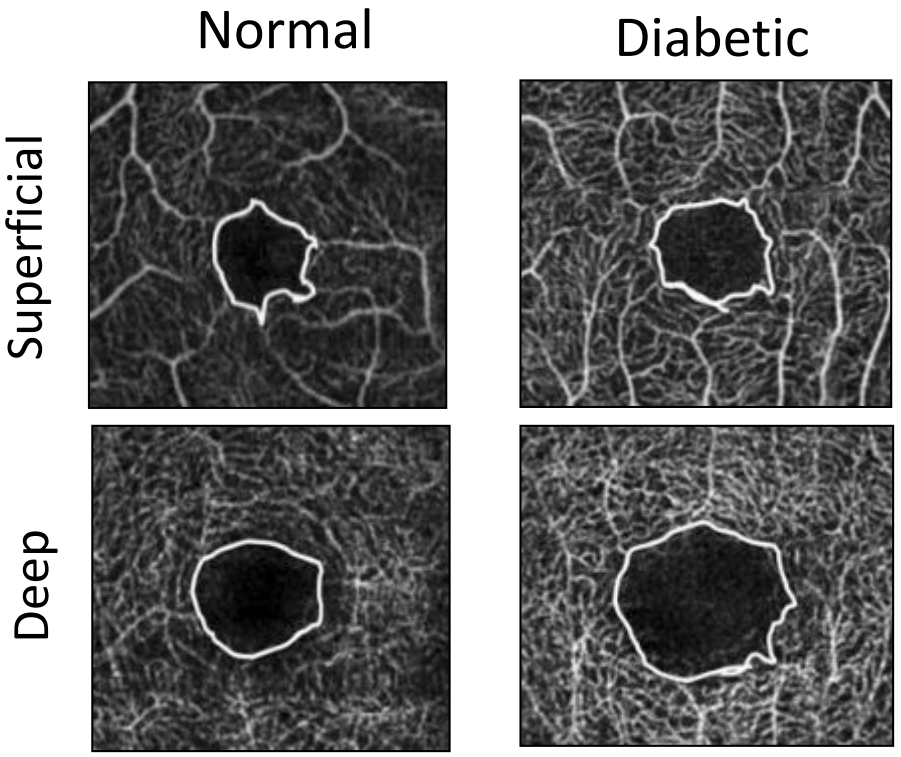
DIABETIC RETINOPATHY

OCTA Clinical Applications

- Sub-clinical diabetic retinopathy detection
- Highlight and localize vascular abnormalities (IRMA, vascular loops, etc.)
- Detection and localization of non-perfusion
- Detailed evaluation of FAZ
- Visualize vascular abnormalities within the deep plexus
- Differentiate IRMA from early NVE
- Localization of microaneurysms
- Early detection of PDR
- Precise definition of PDR
- Follow response to treatment



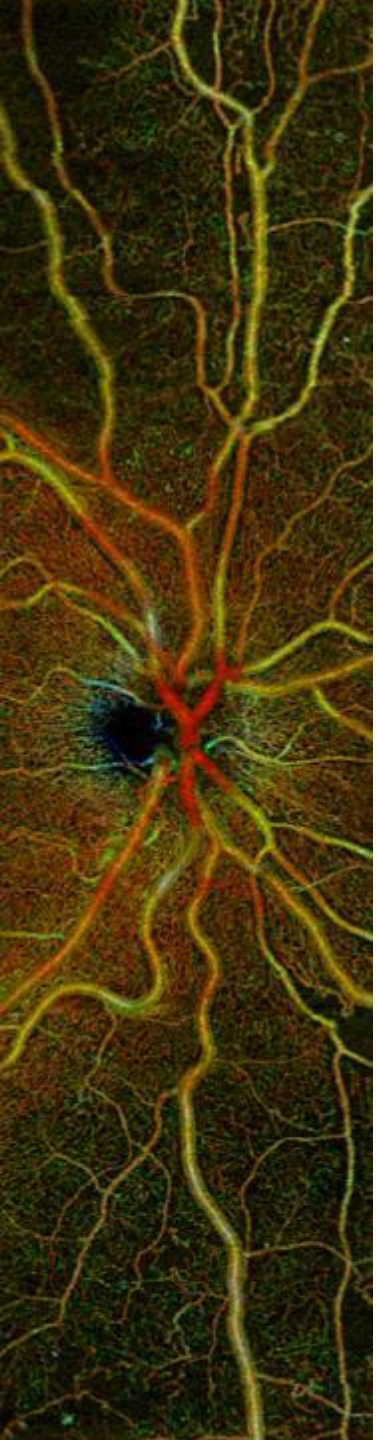
DIABETIC RETINOPATHY



	Control	Diabetics Without DR	Diabetic Retinopathy
Mean FAZ area in the superficial plexus (mm2)	0.25	0.37 (p<0.01*)	0.38 (p<0.01*)
Mean FAZ area in the deep plexus (mm2)	0.38	0.54 (p<0.01*)	0.56 (p<0.01*)

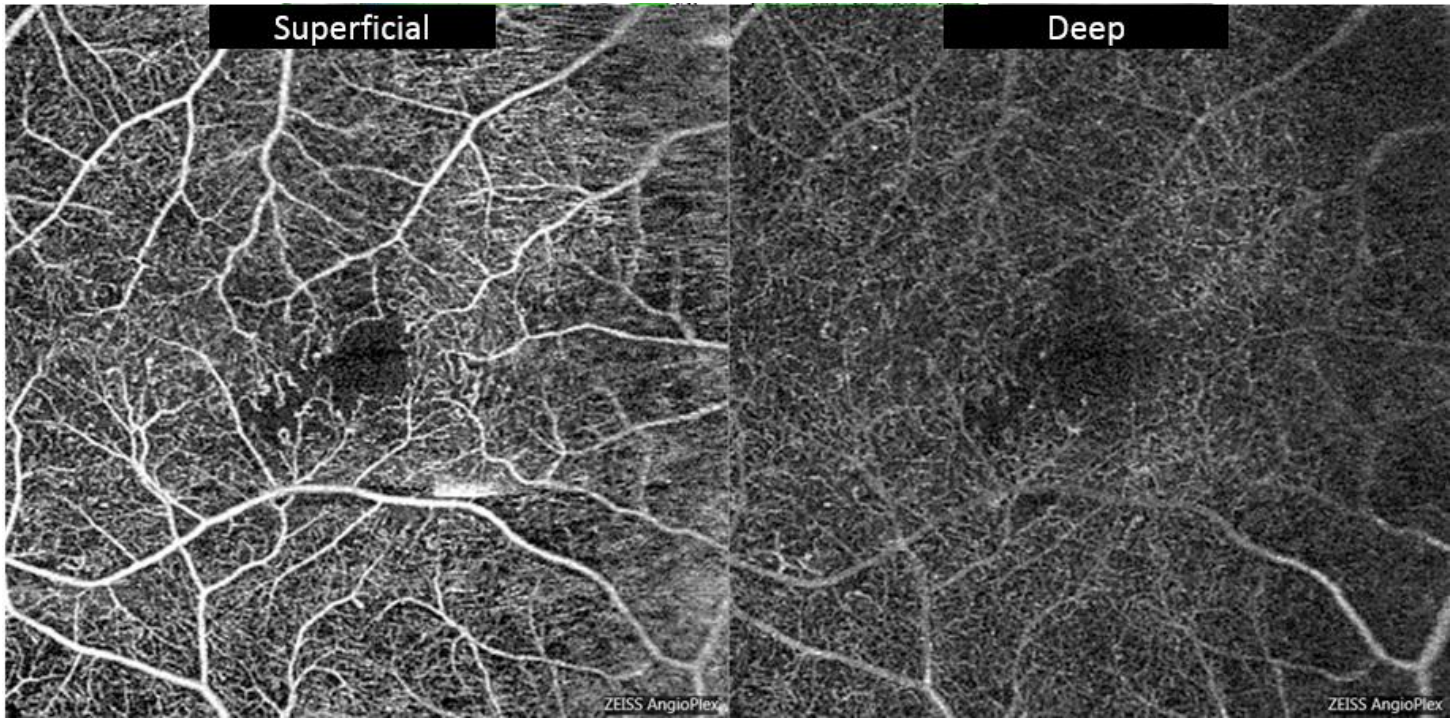
*compared to controls (no sig diff between diabetic grps)

Takase N, et al. Enlargement of FAZ in Diabetic eyes evaluated by En Face OCTA. Retina 2015. 35(11):2377-2383.



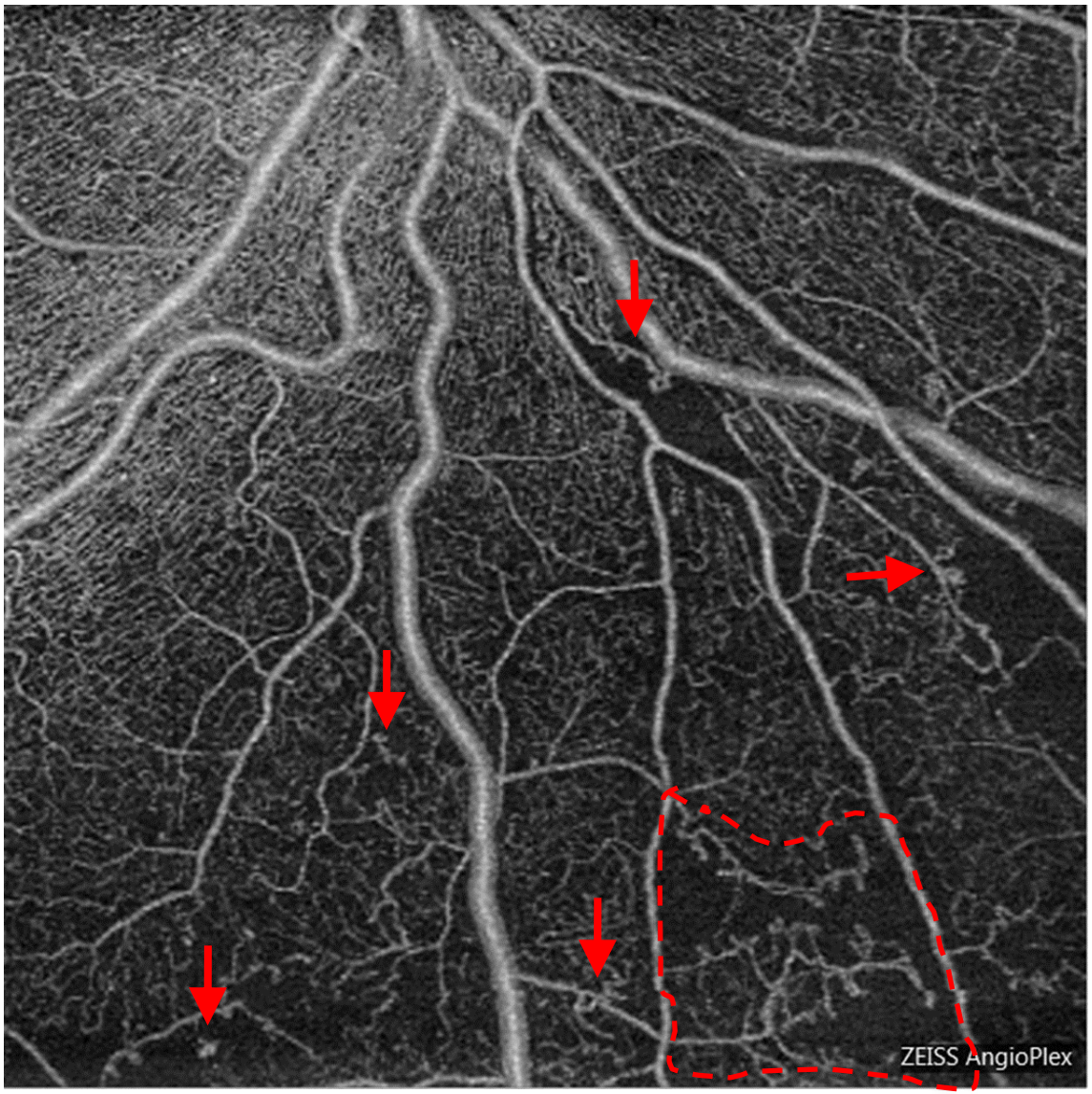
DIABETIC RETINOPATHY

Mild NPDR with reduction in BCVA



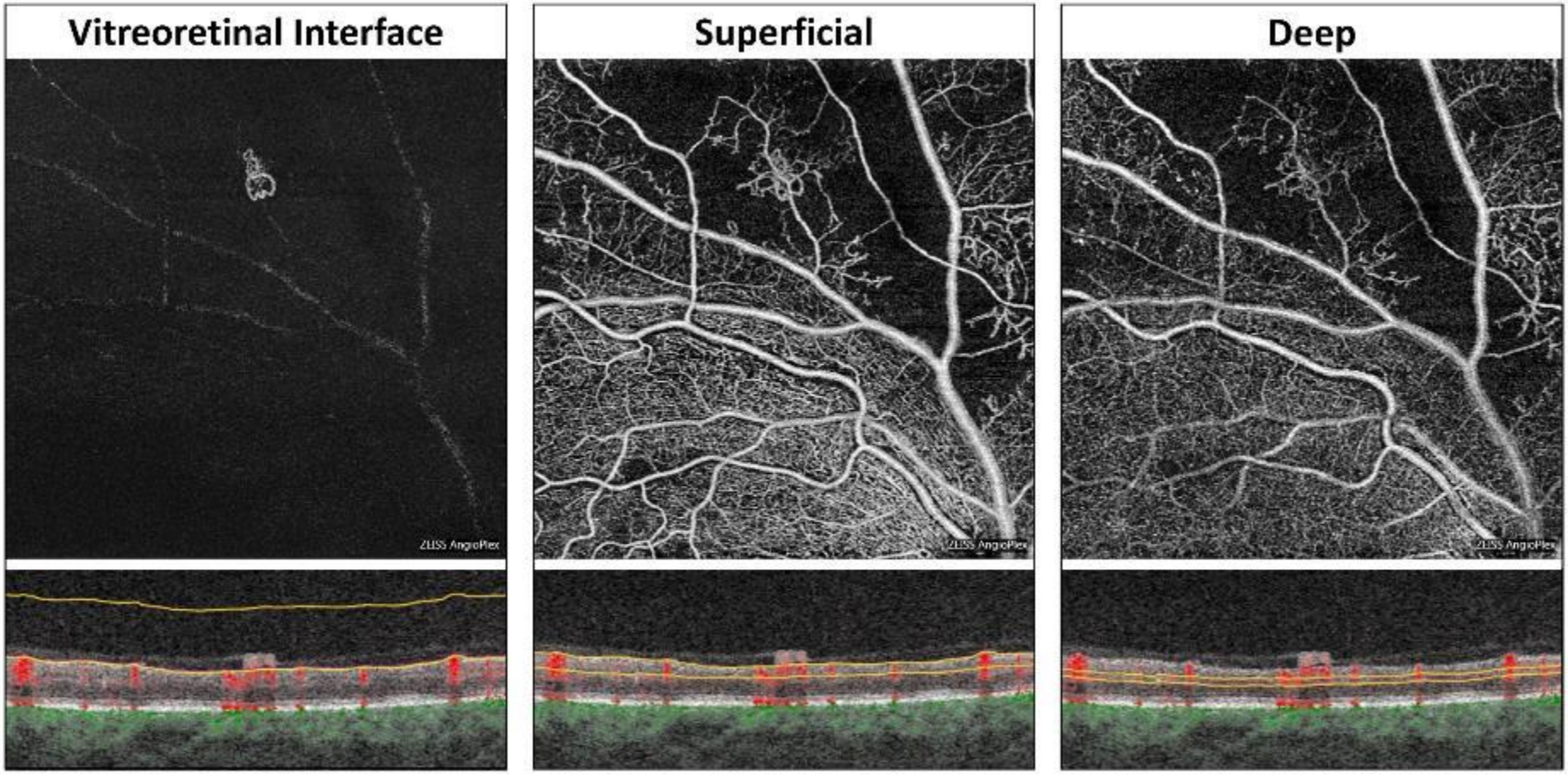
DIABETIC RETINOPATHY

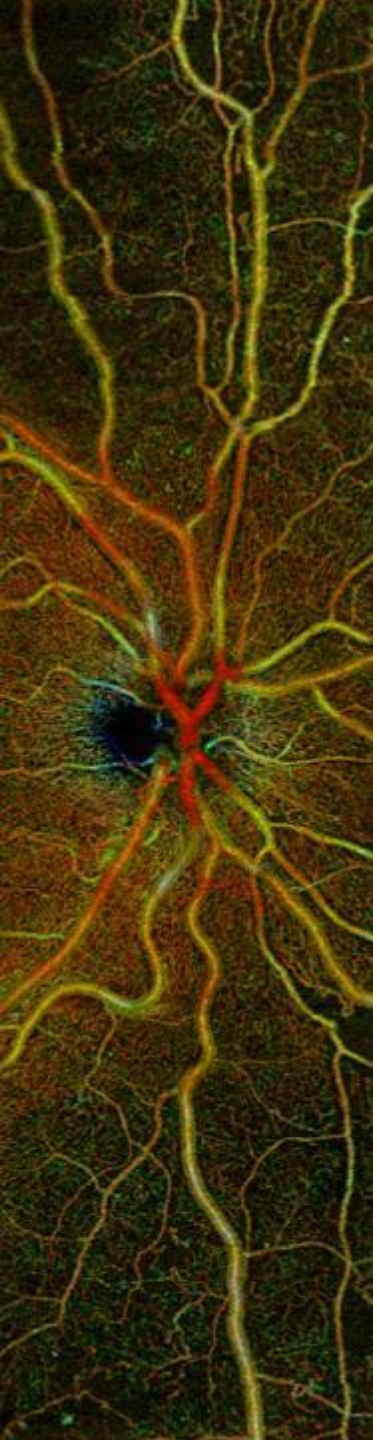
Intraretinal microvascular abnormalities (IRMA)



DIABETIC RETINOPATHY

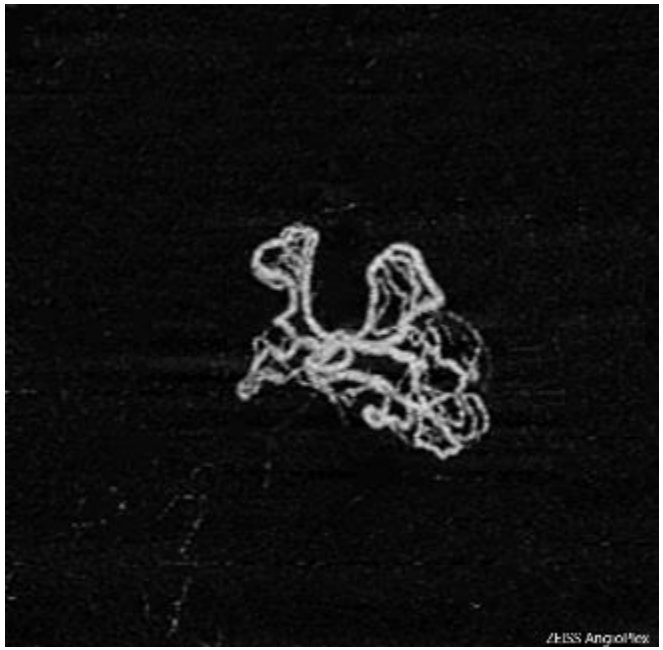
IRMA or early NVE???

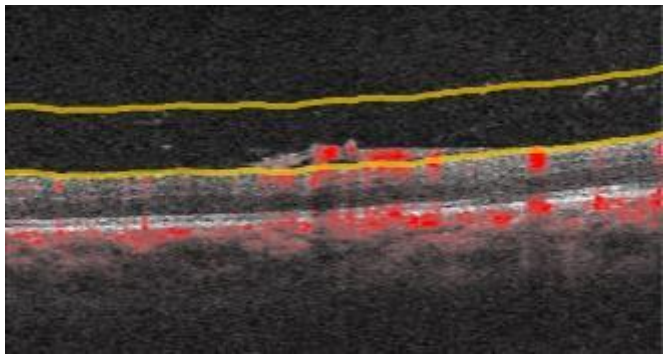




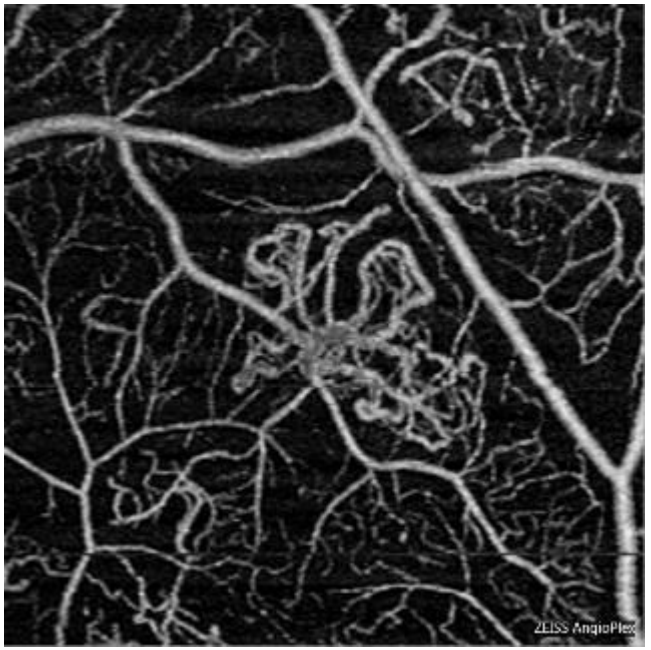
DIABETIC RETINOPATHY

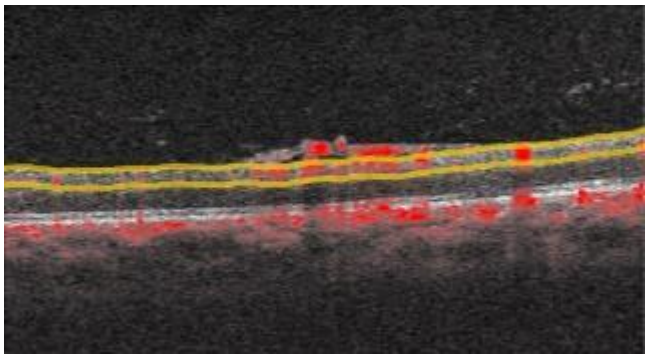
VRI

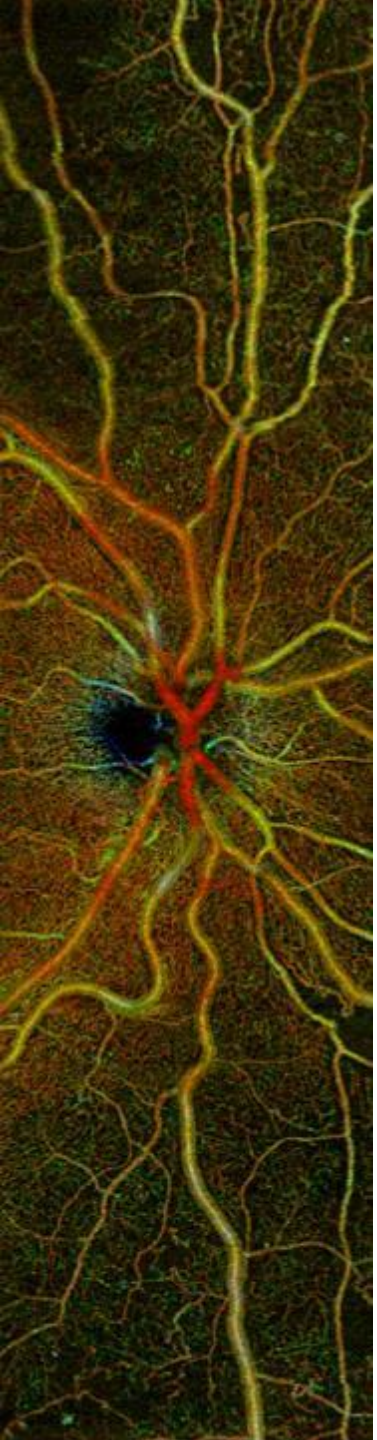




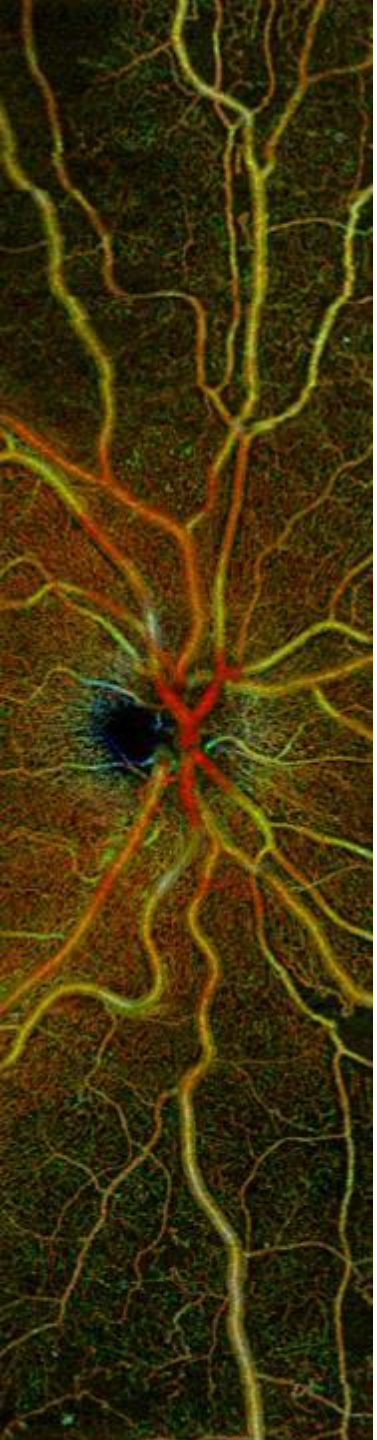
Superficial







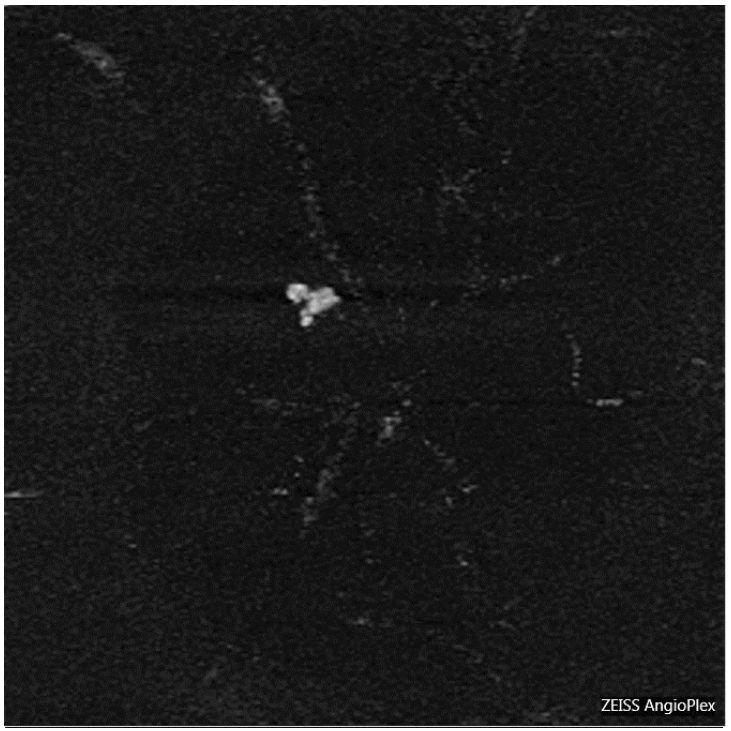
DIABETIC RETINOPATHY

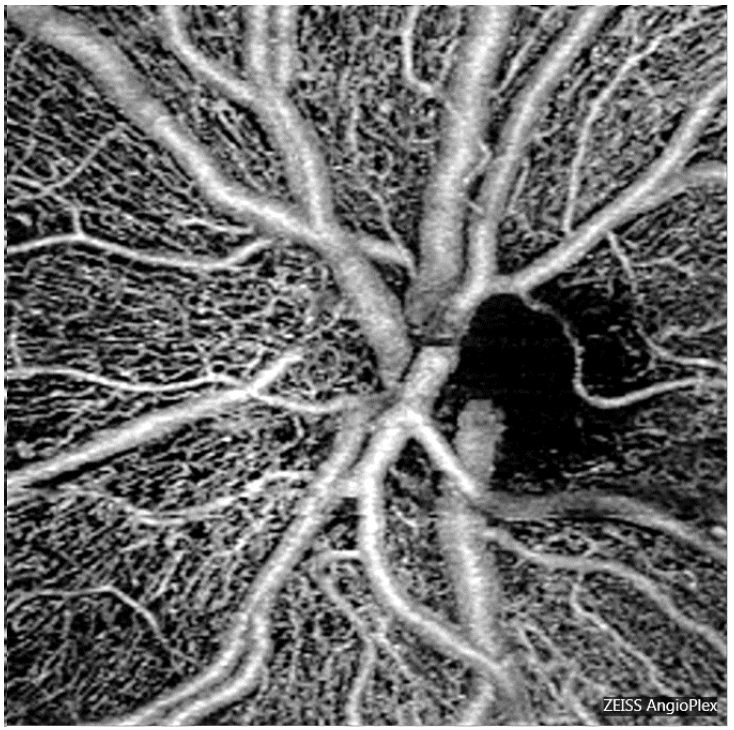


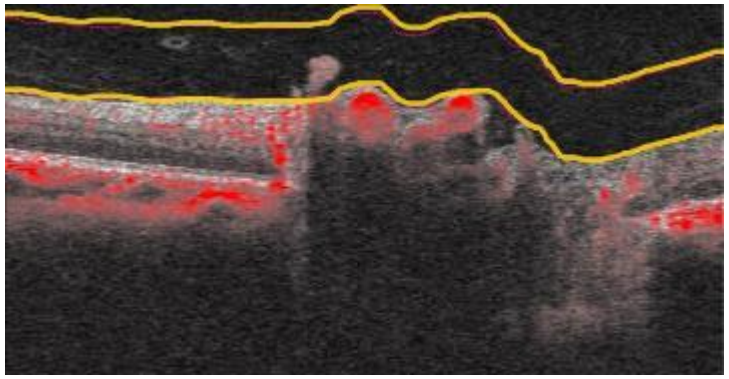
DIABETIC RETINOPATHY

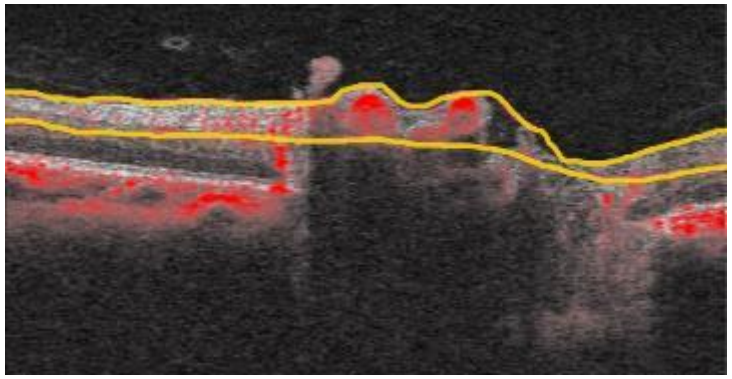
VRI

Superficial









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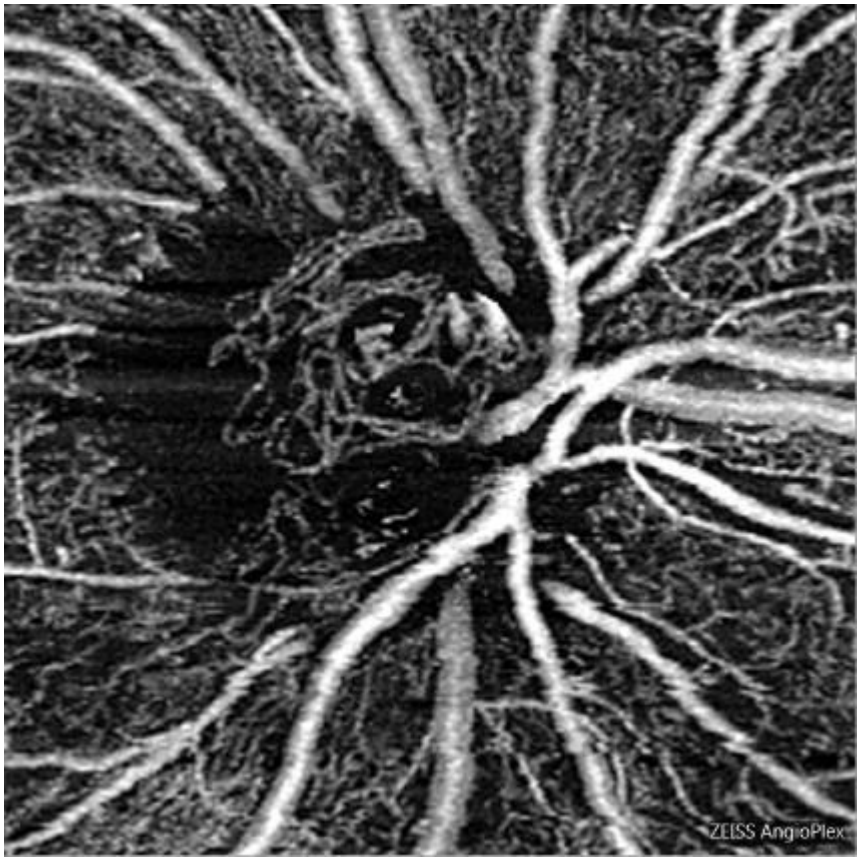

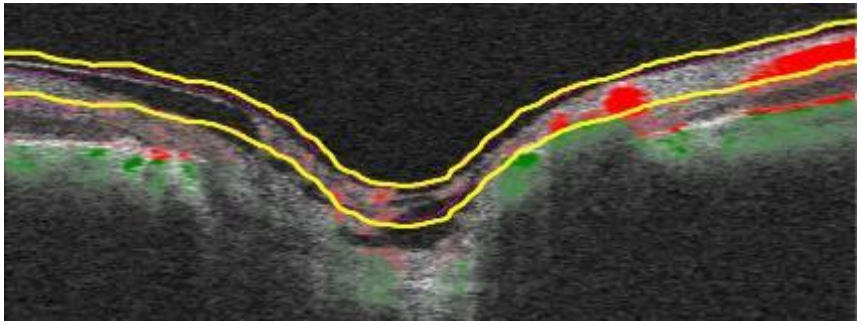

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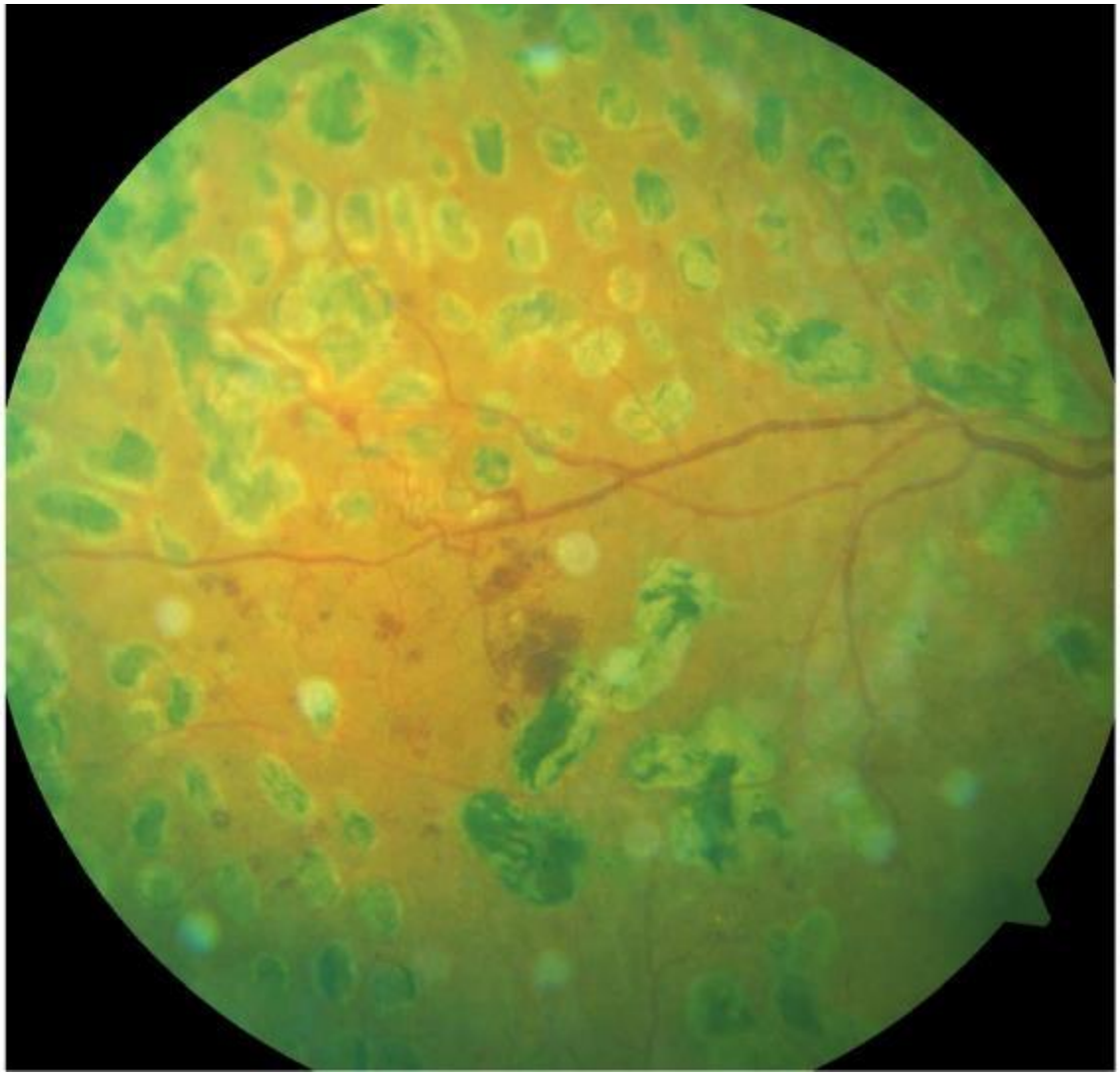
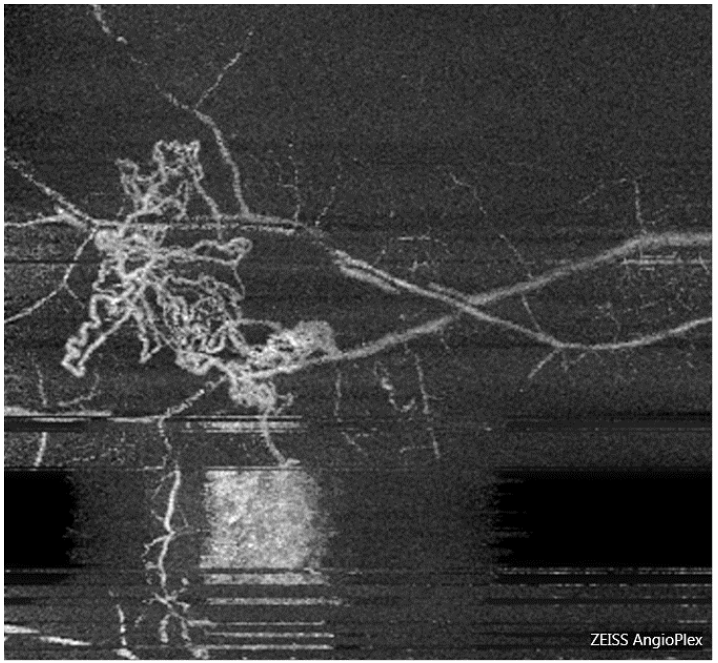
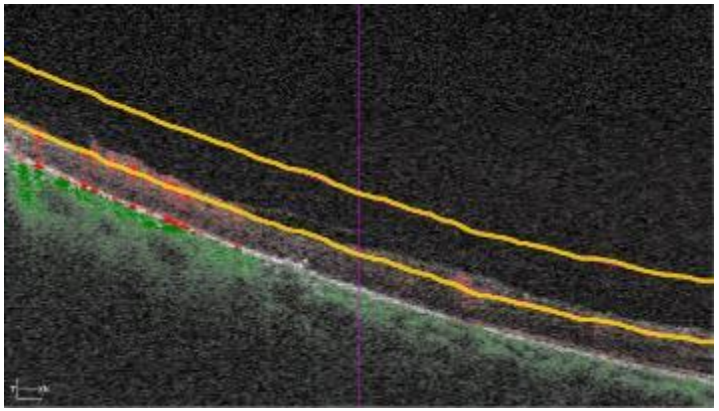
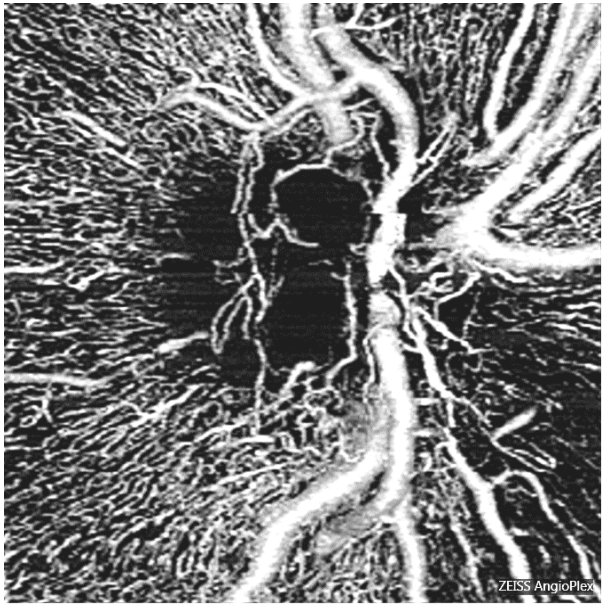






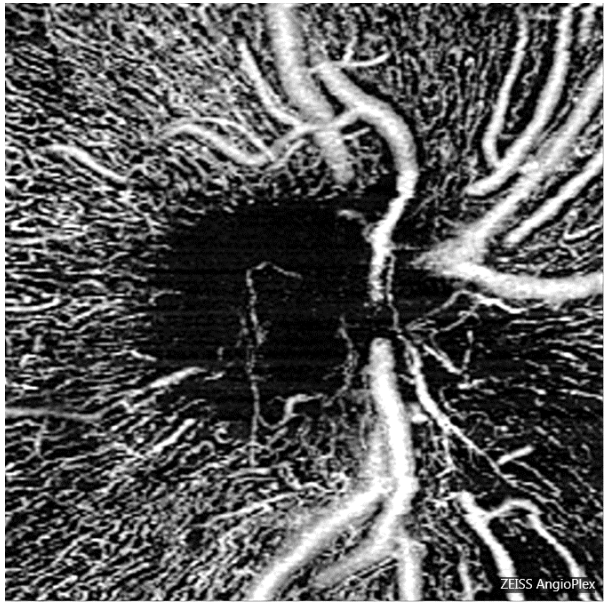
DIABETIC RETINOPATHY

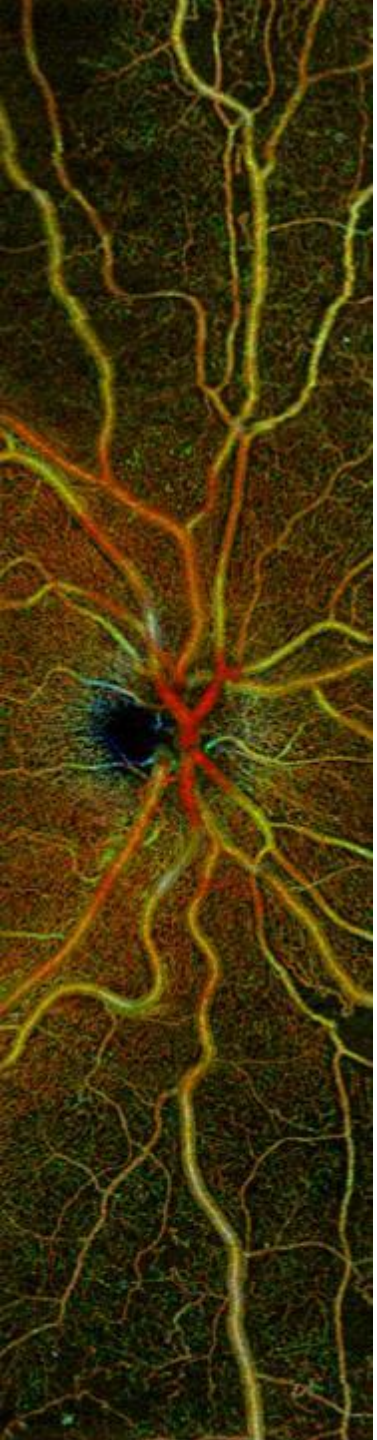
Baseline



1 week S/P PRP

3 months S/P PRP

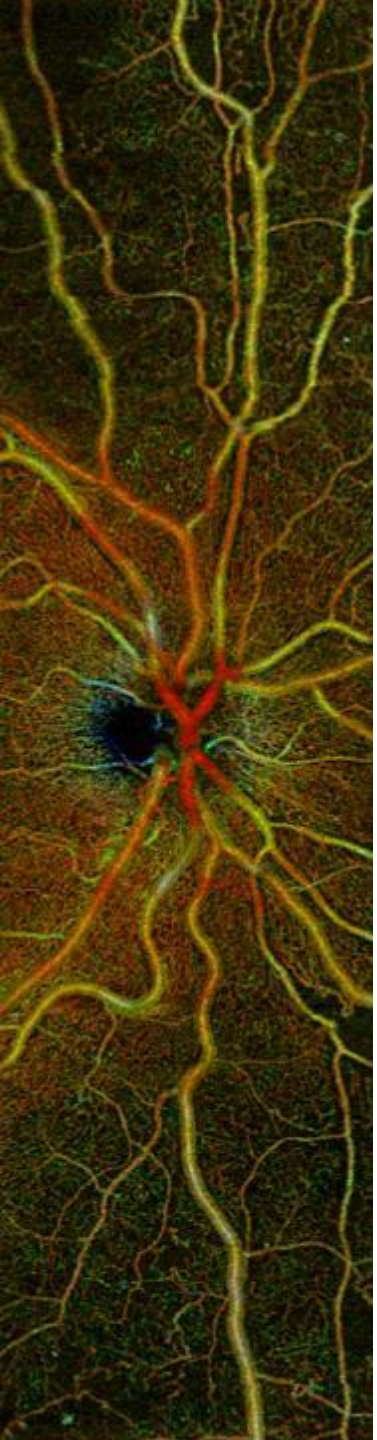




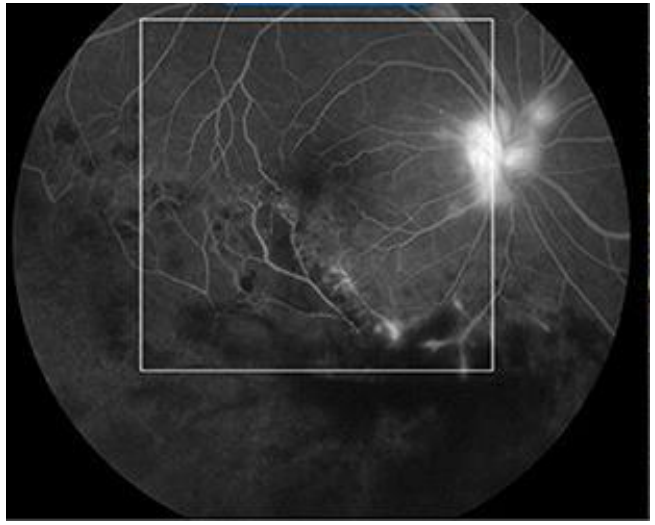
VENOUS OCCLUSION

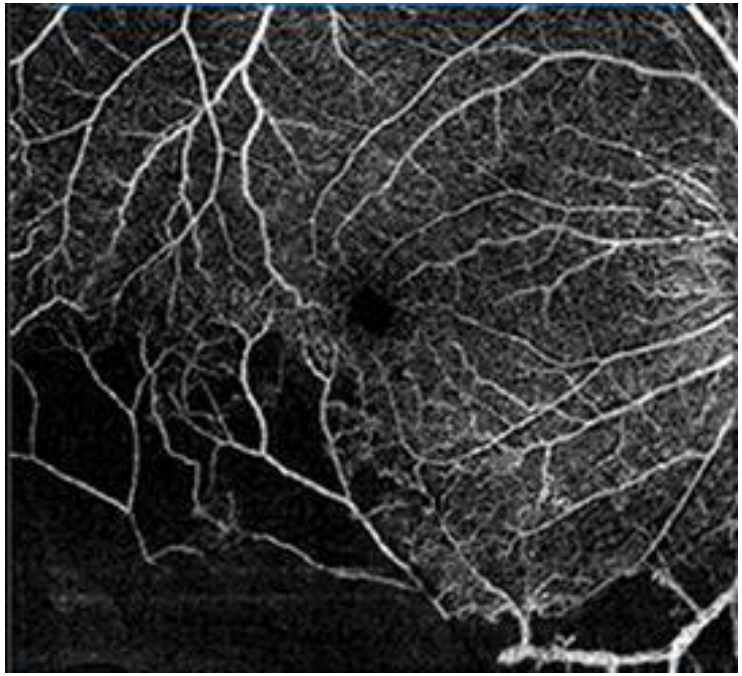
OCTA Clinical Applications

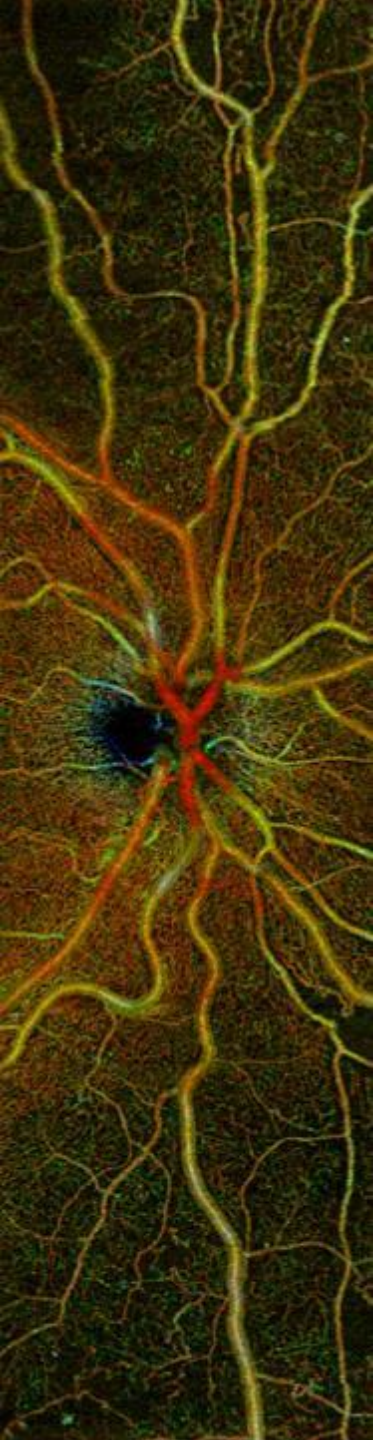
- Delineation and quantification of non-perfusion
  - Ischemic vs non-ischemic?
  - BRVO: Risk of post segment neo and vitreous/pre-retinal hemorrhage?
  - CRVO: Risk of ant segment neo and NVG?
  - Identify convertors
- Visualization of macular ischemia
- Improved visualization of collaterals
- Depth localization of abnormalities
- Visualization of deep capillary telangiectasias
- Earlier detection of posterior segment neo



BRVO - Ischemic

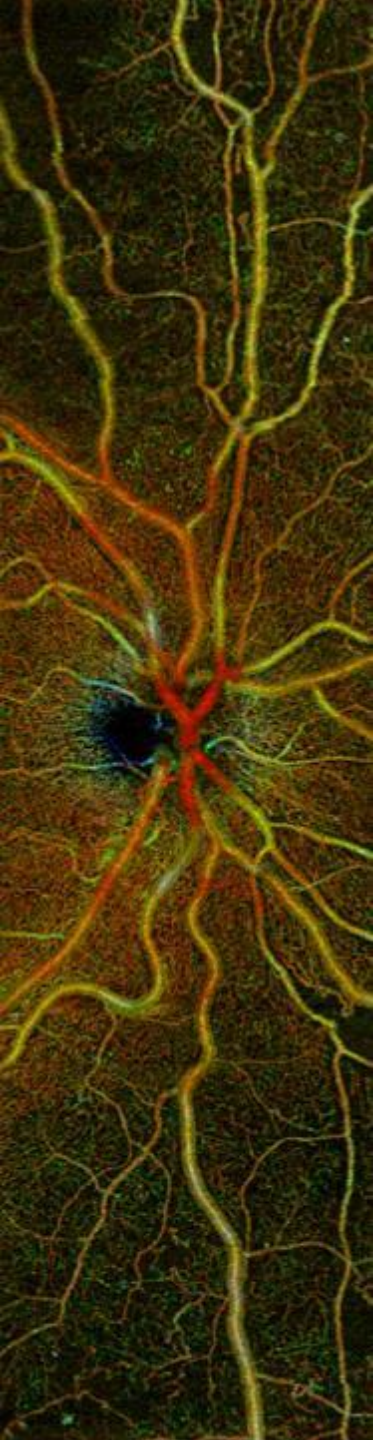


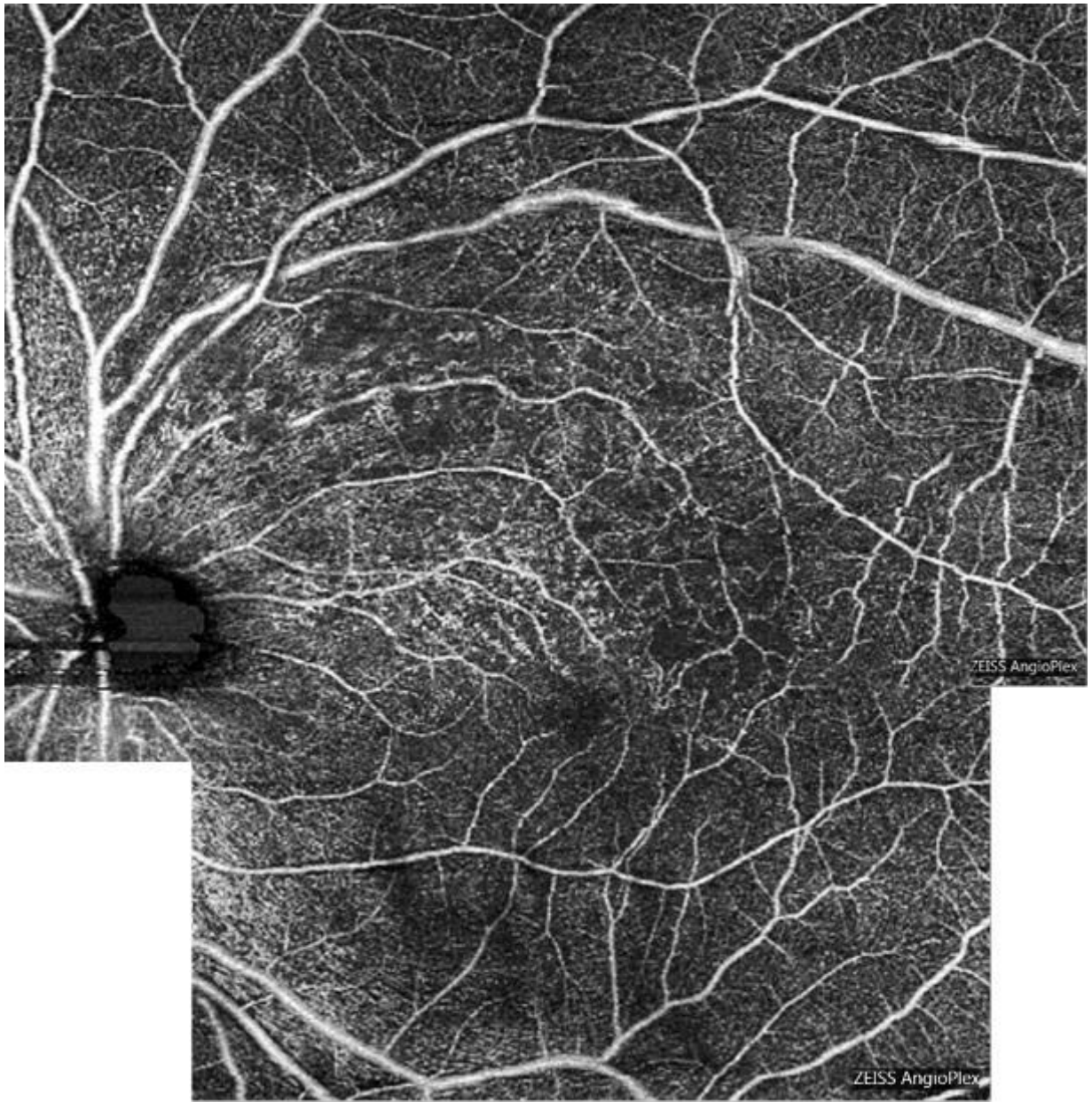


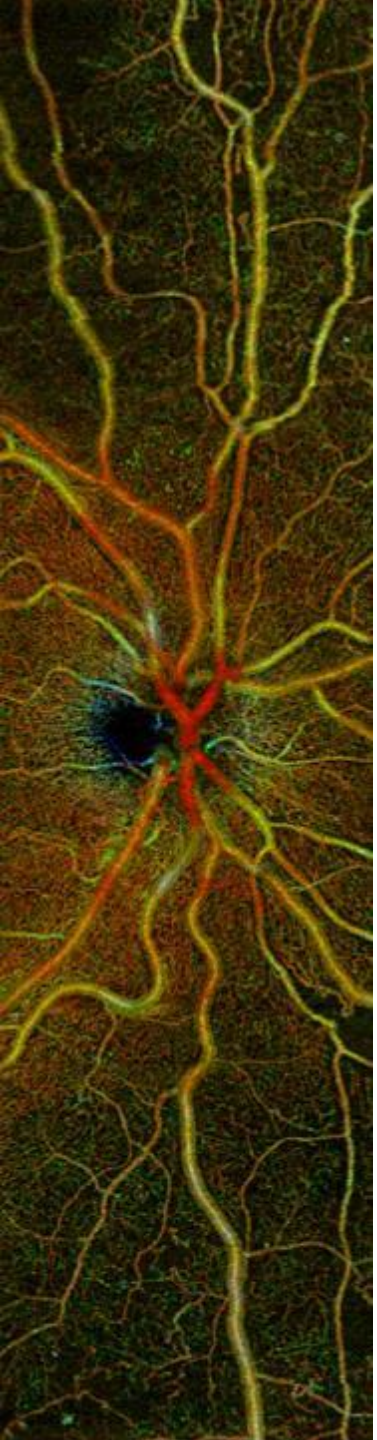


BRVO – Nonischemic

BRVO – Nonischemic







Retinal Vein Occlusion

CASE REPORT

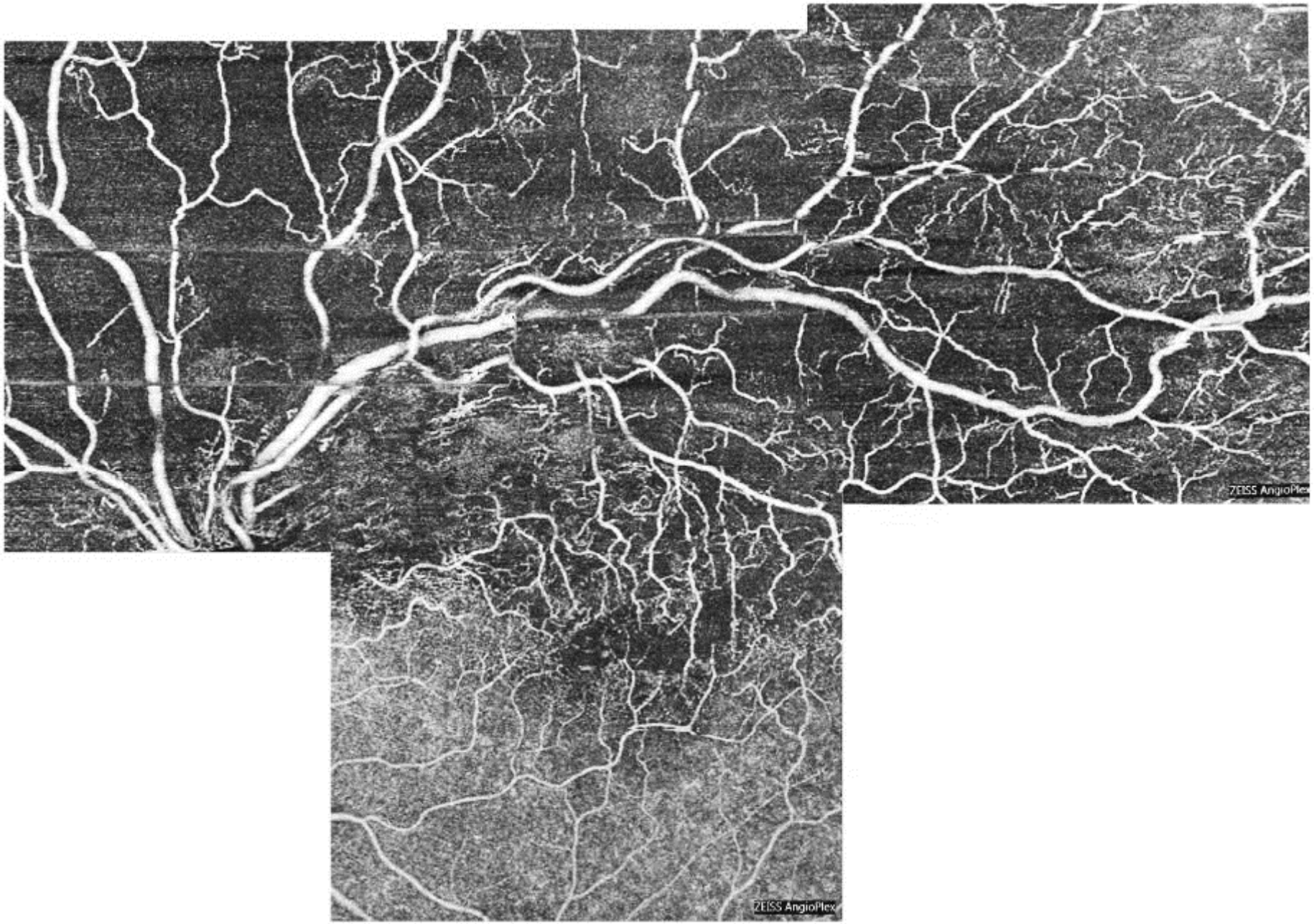
52yo HM

- Referred to our retinal service for evaluation of RVO OS
- Pt c/o blur OS x 5 days – getting worse

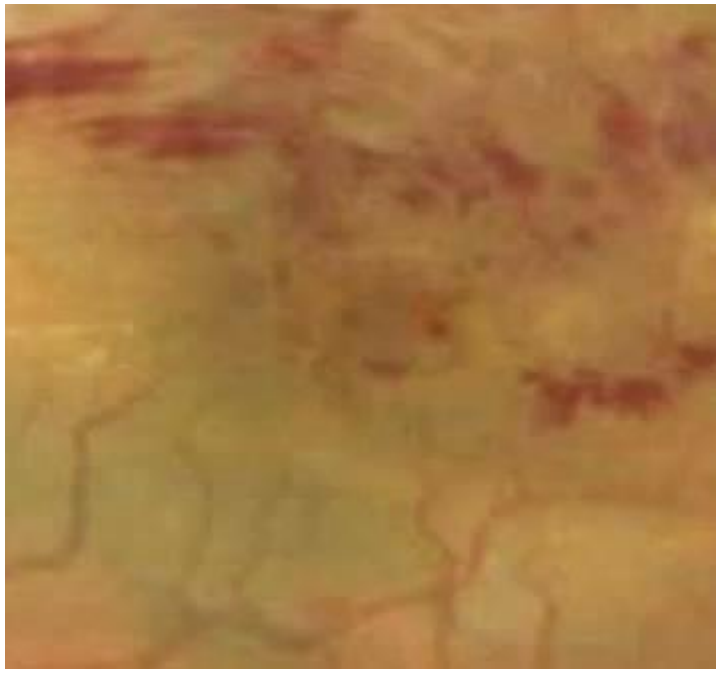
- BCVA: 20/25 OD, 20/200 OS
- Ta 19/14
- SLE: WNL OU, No NVI

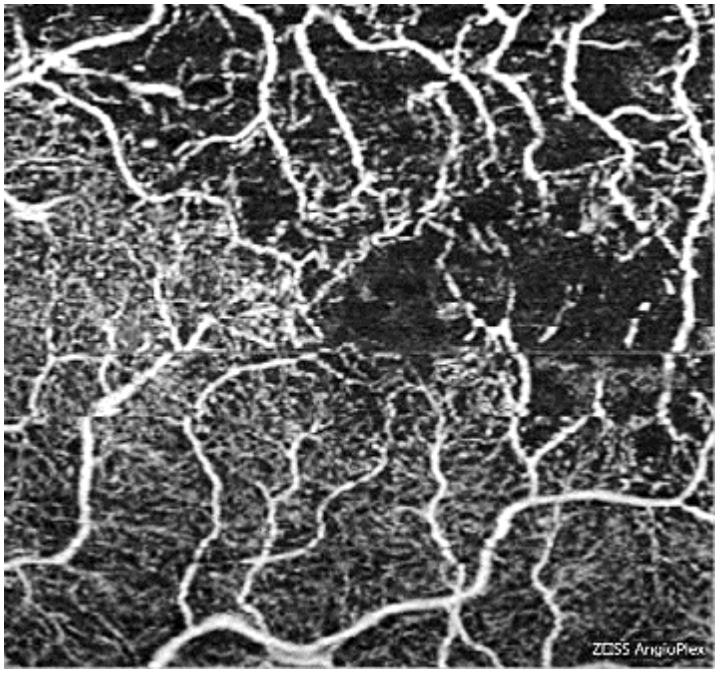
Hemicentral Vein Occlusion

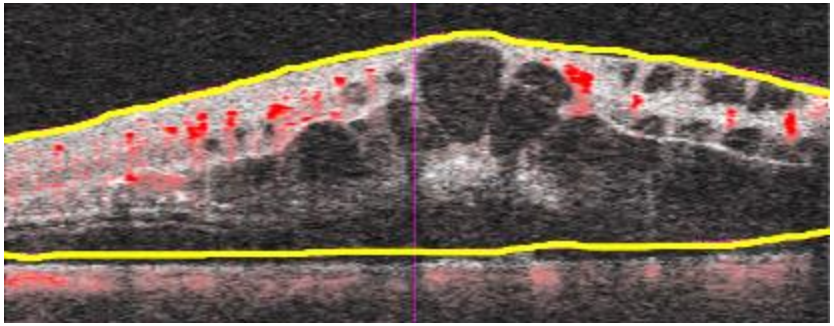
Hemicentral Vein Occlusion



Hemicentral Vein Occlusion

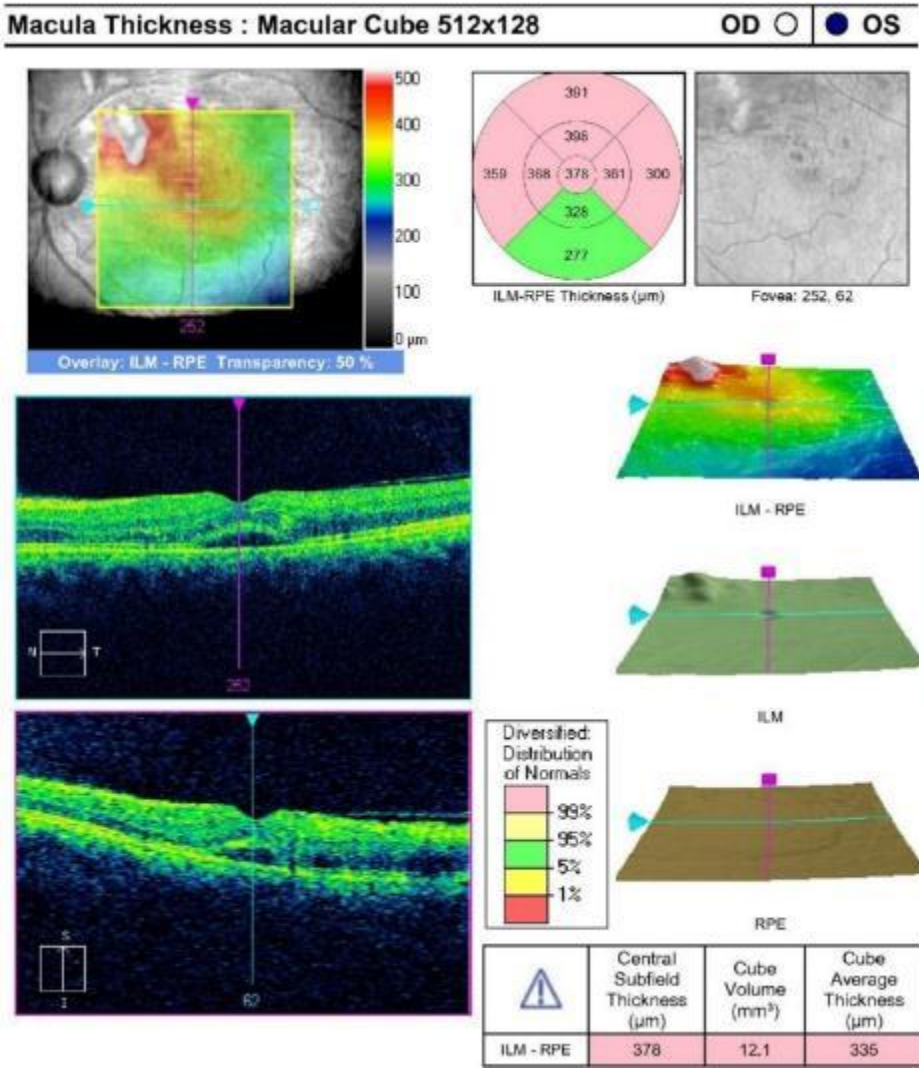




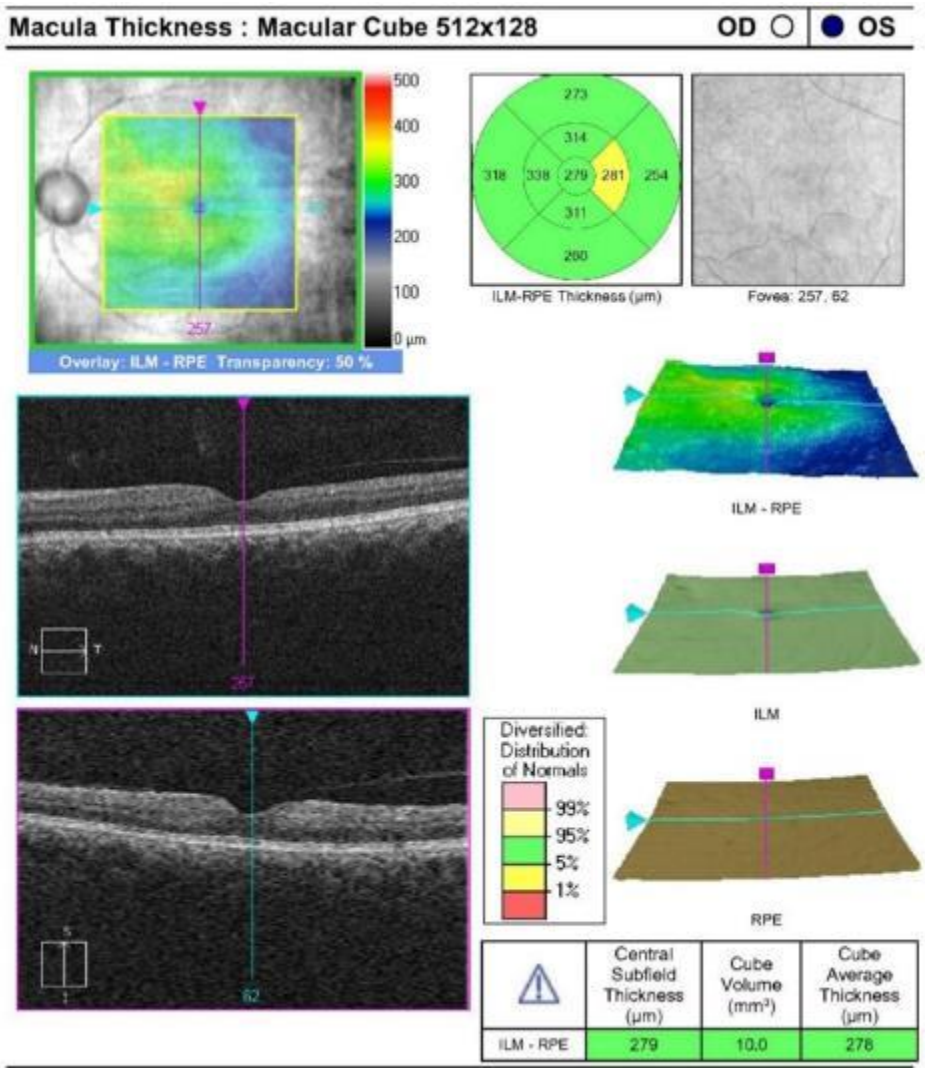


Hemicentral Vein Occlusion

S/P IVB x 1

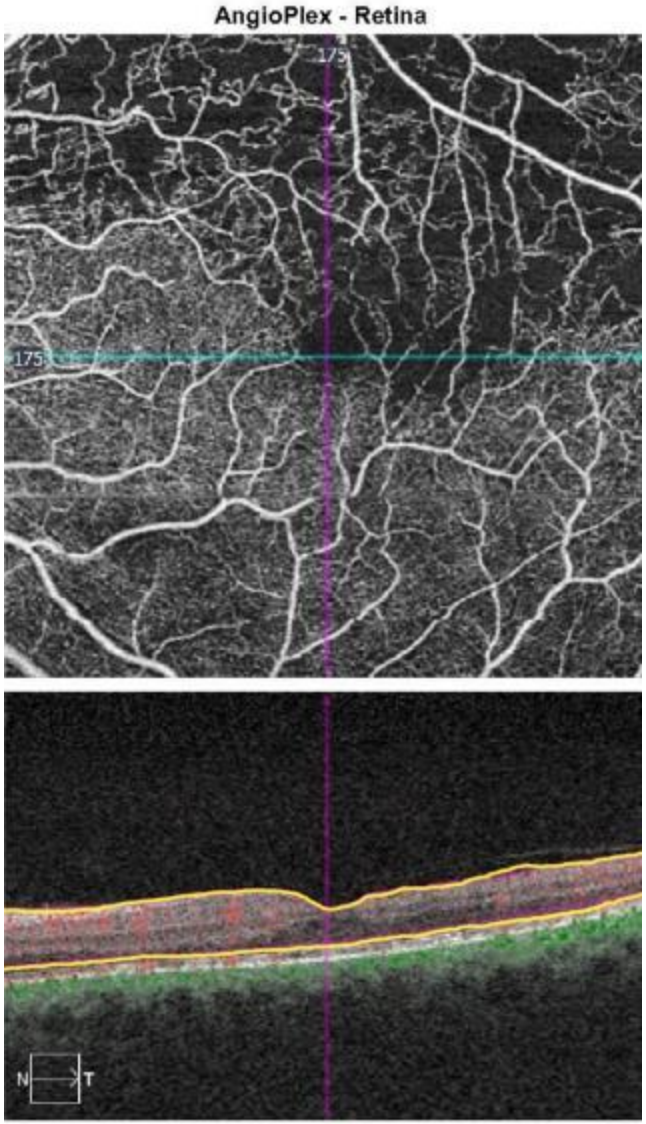


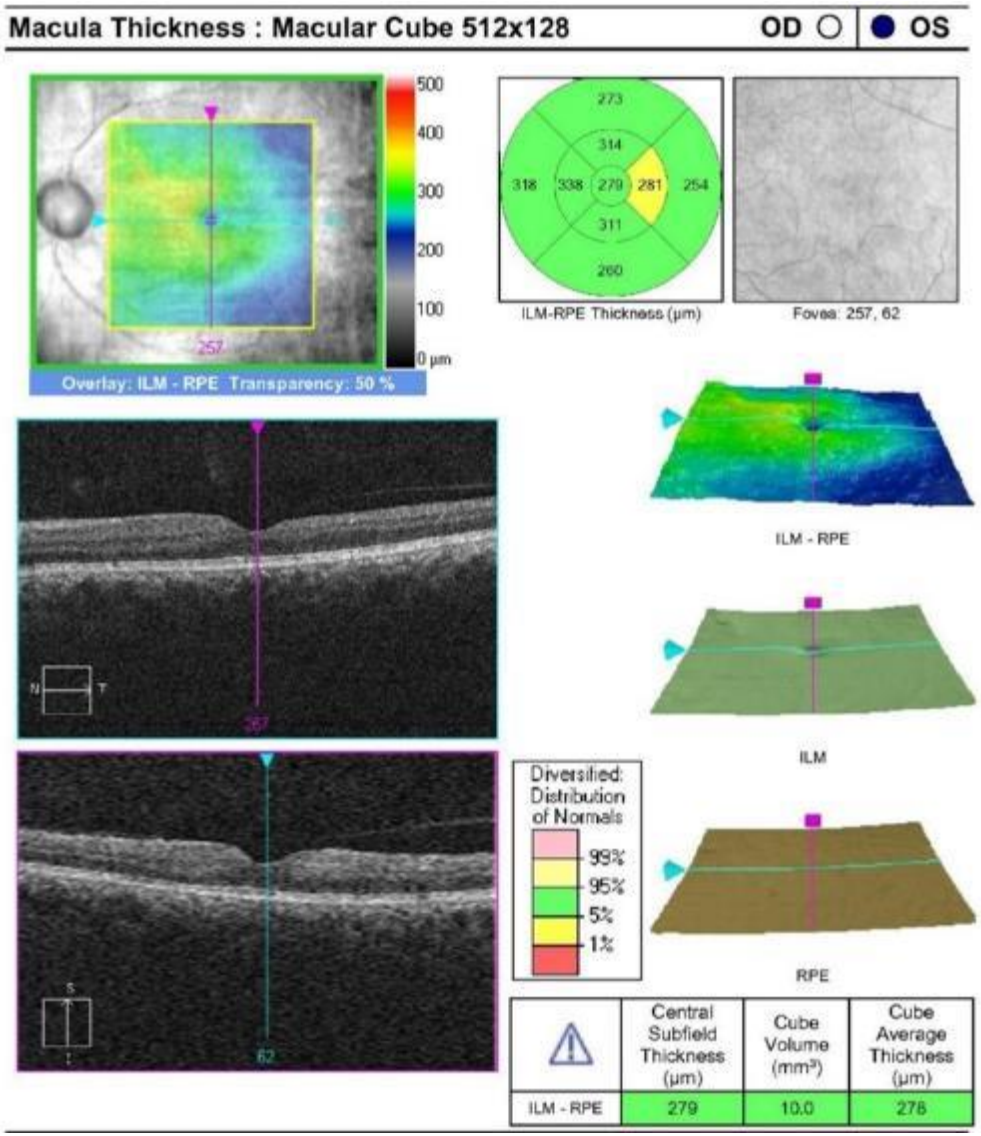
S/P IVB x 3 (5 mos after presentation)



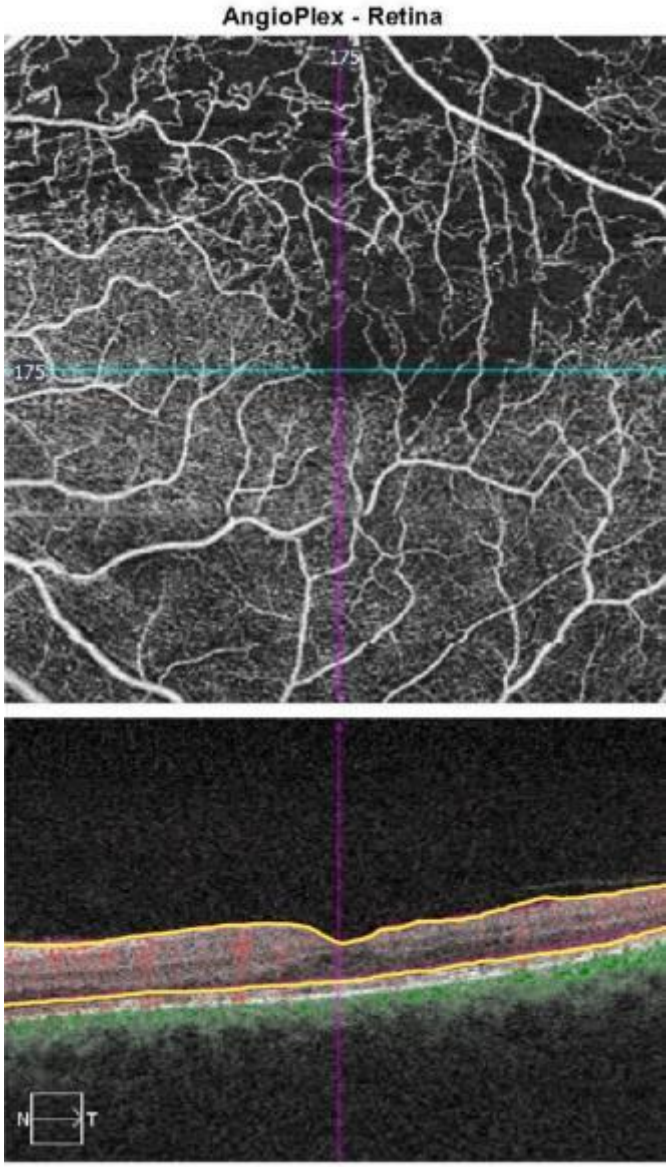
Hemicentral Vein Occlusion

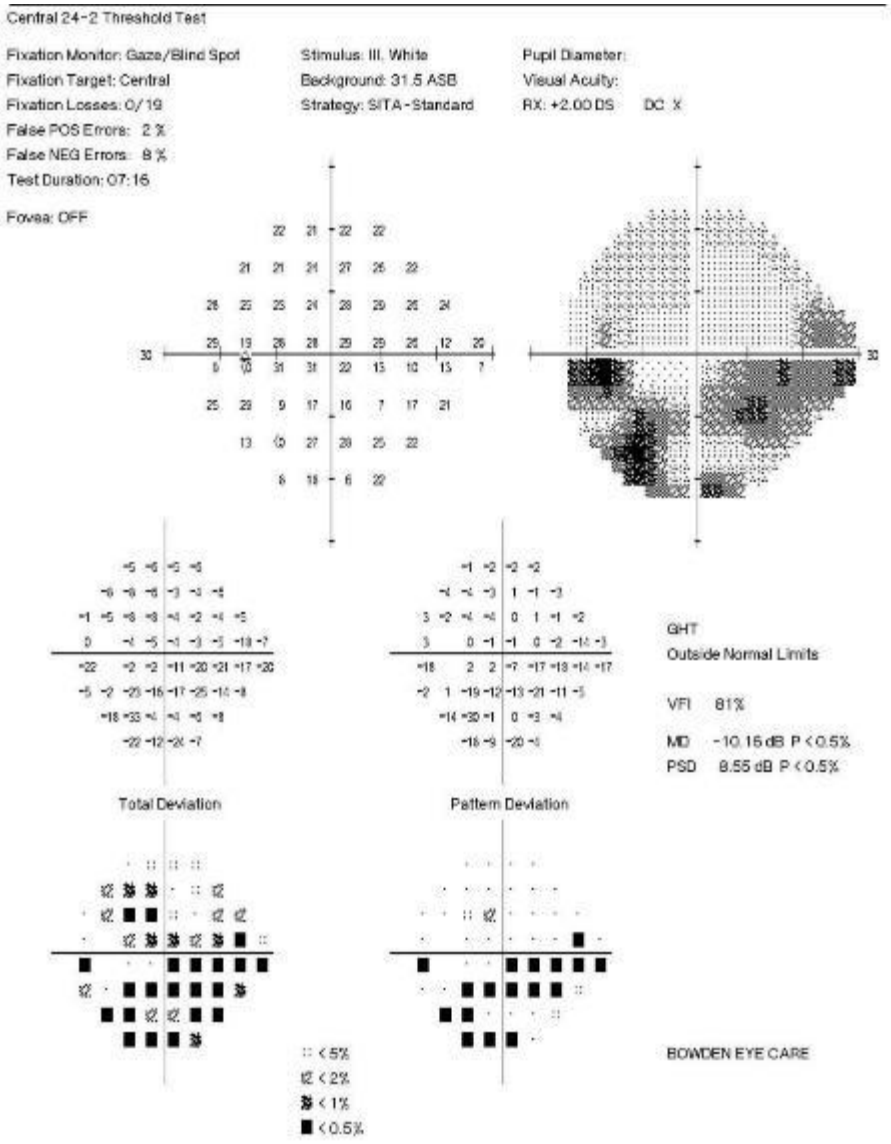
BCVA 20/40

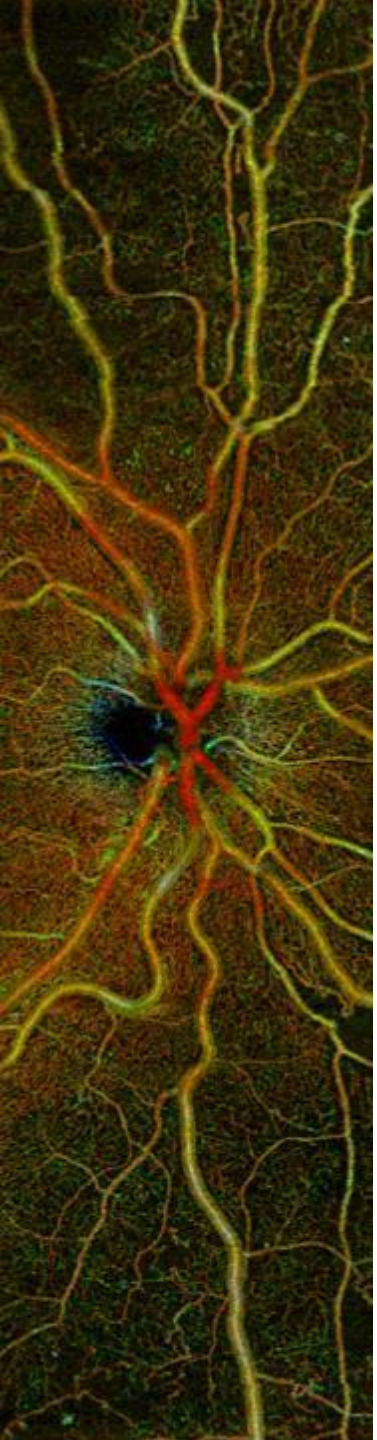




Hemicentral Vein Occlusion



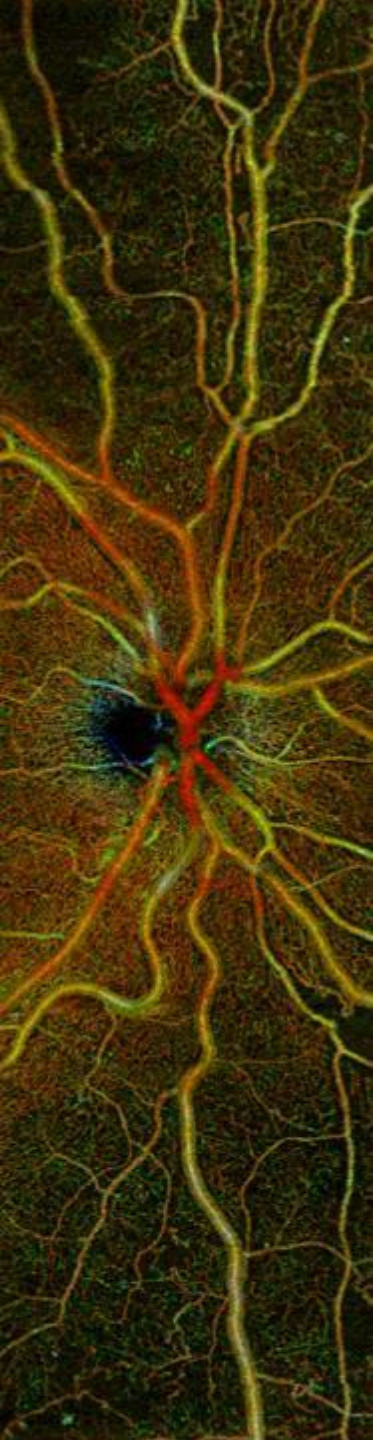




Retinal Vein Occlusion

KEY POINTS

- Vision loss from RVO may be a consequence of macular ischemia and/or edema
- More extensive retinal ischemia increases the risk of neovascular complications
- OCTA is an excellent tool for evaluating retinal perfusion and detecting preretinal neovascularization following RVO

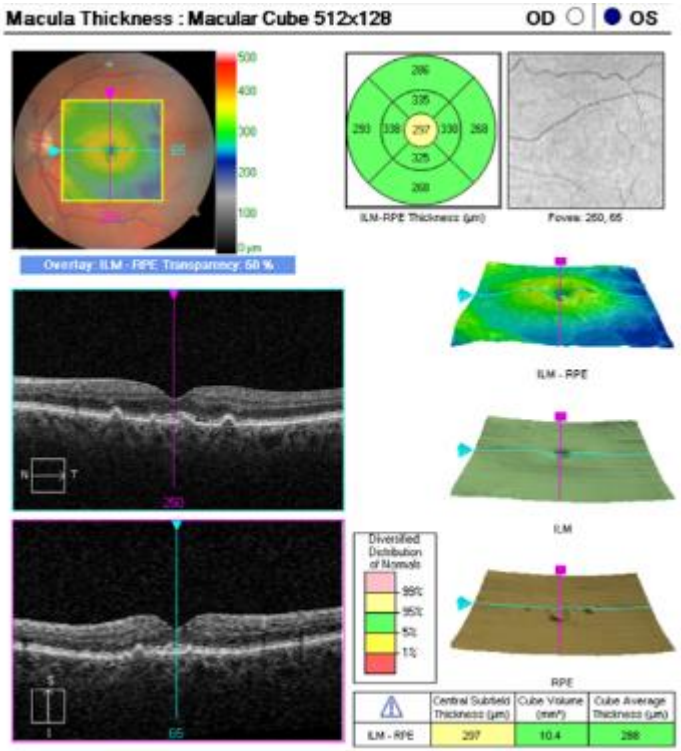


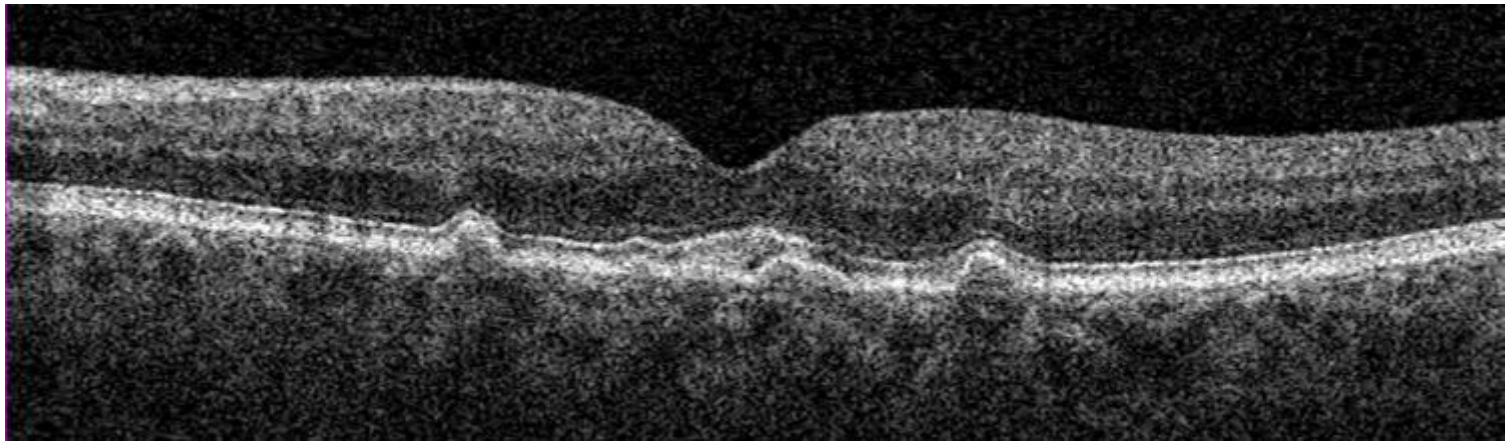
AMD & OTHER CAUSES OF CNV

OCTA Clinical Applications

- Choroidal ischemia detection/quantification
- CNV detection, area quantification, and classification
- Quantify responsiveness to treatment
- Assess need for retreatment
- Detect quiescent (inactive) CNV membranes

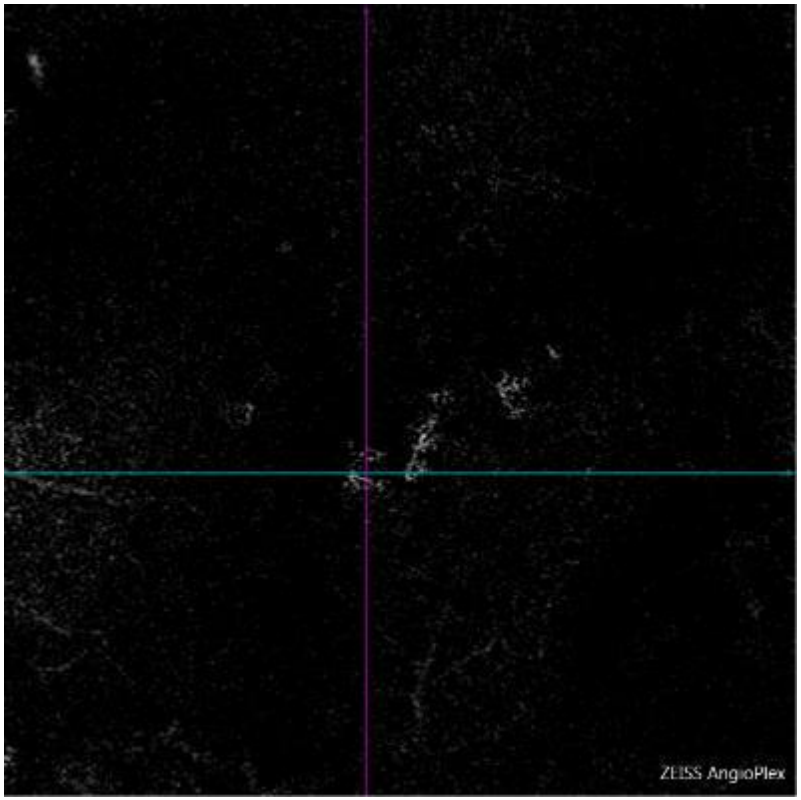
AMD


Macula Thickness : Macular Cube 512x128
OD
OS
Overlay: ILM - RPE Transparency: 50 %
ILM-RPE Thickness (µm)
Fovea: 260, 65
ILM - RPE
ILM
RPE
Diversified Distribution of Normals
99%
95%
5%
1%
Central Subfield Thickness (µm)
Cube Volume (mm³)
Cube Average Thickness (µm)
ILM - RPE
297
10.4
288

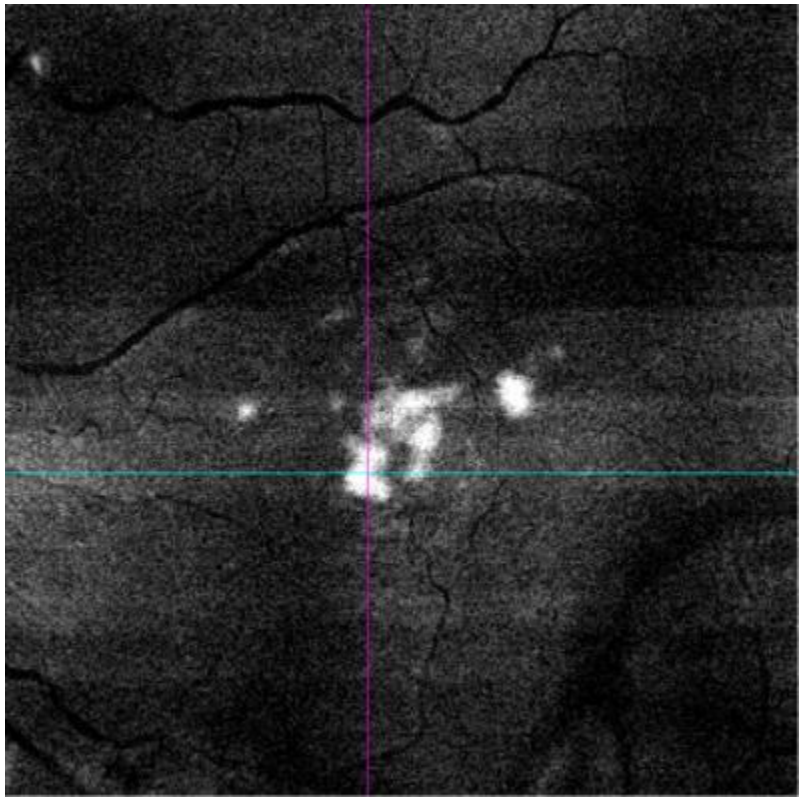


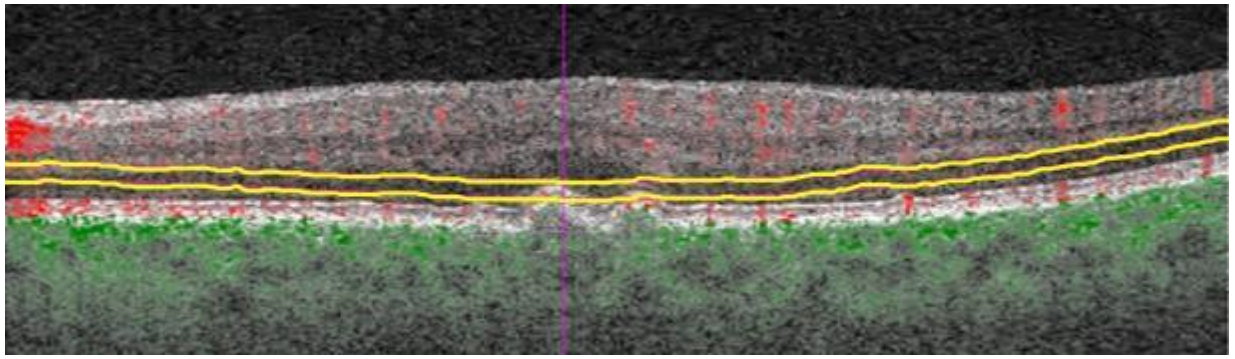
AMD

Avascular Angio



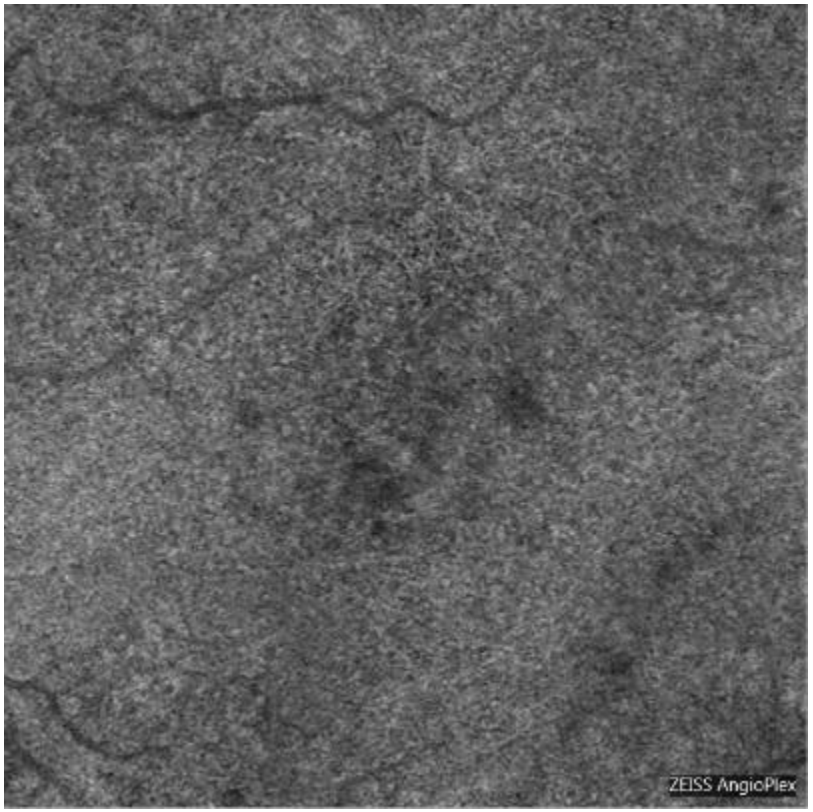
Avascular Structural



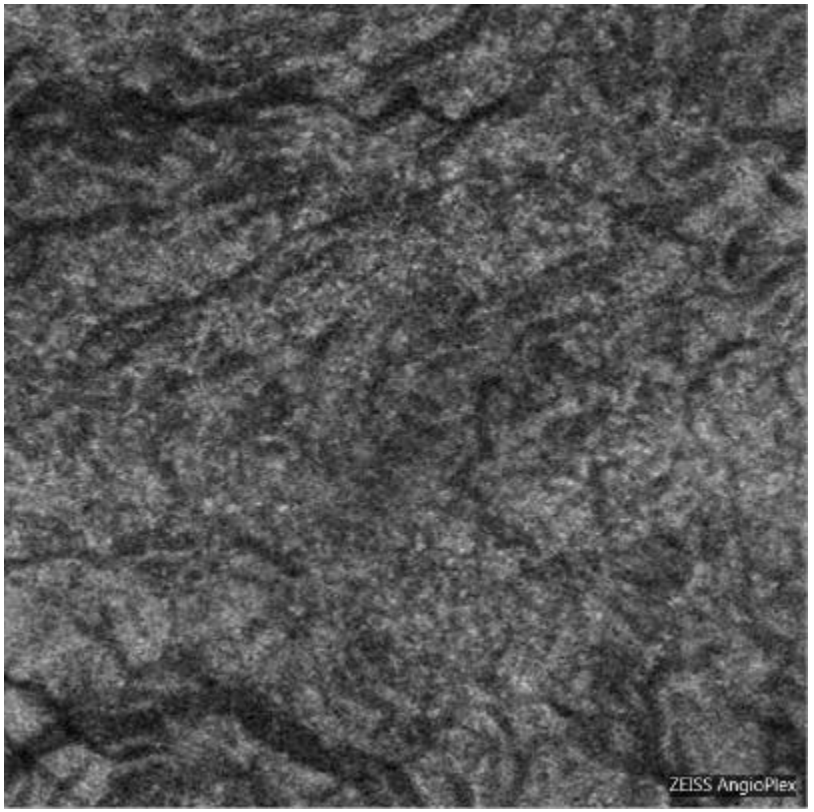


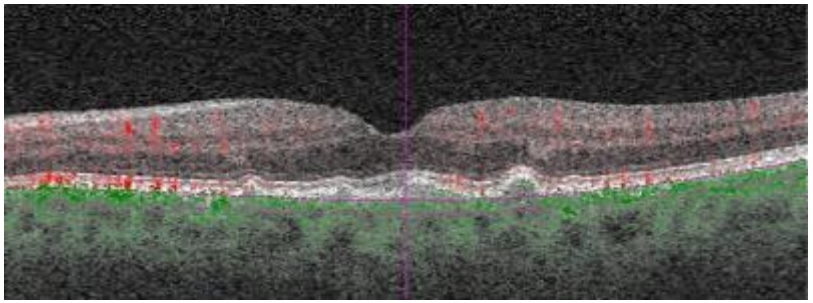
AMD

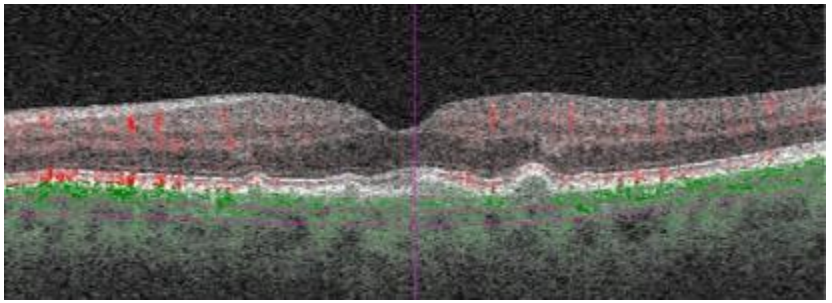
Choriocapillaris

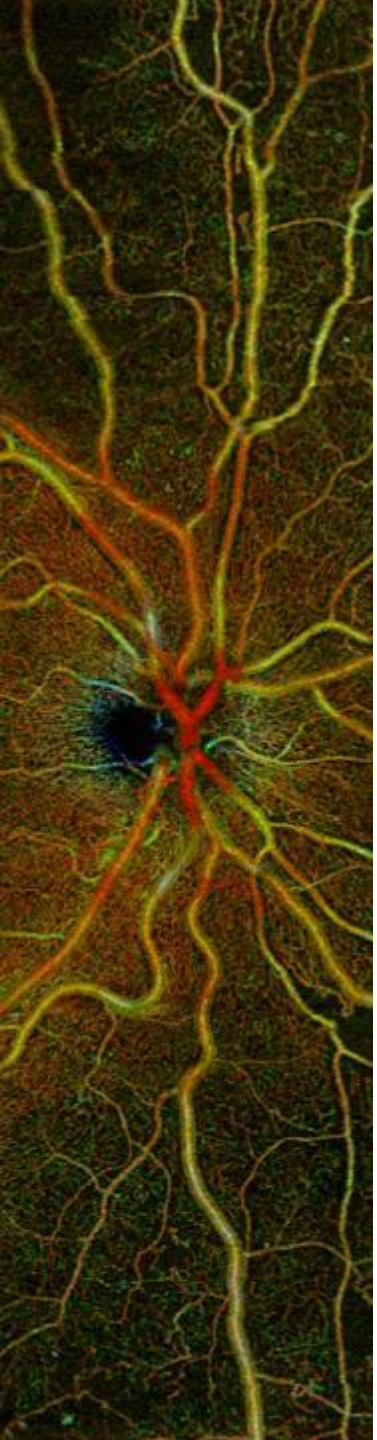


Choroid



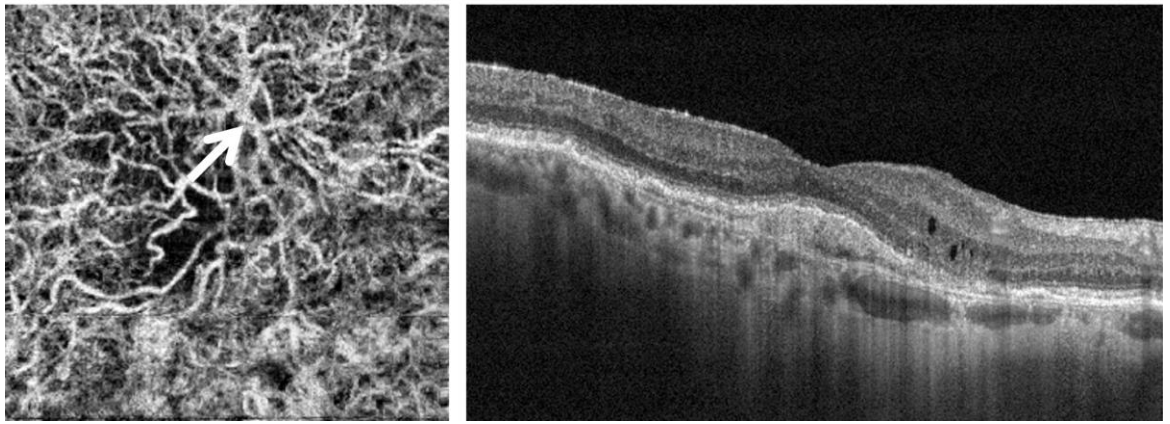




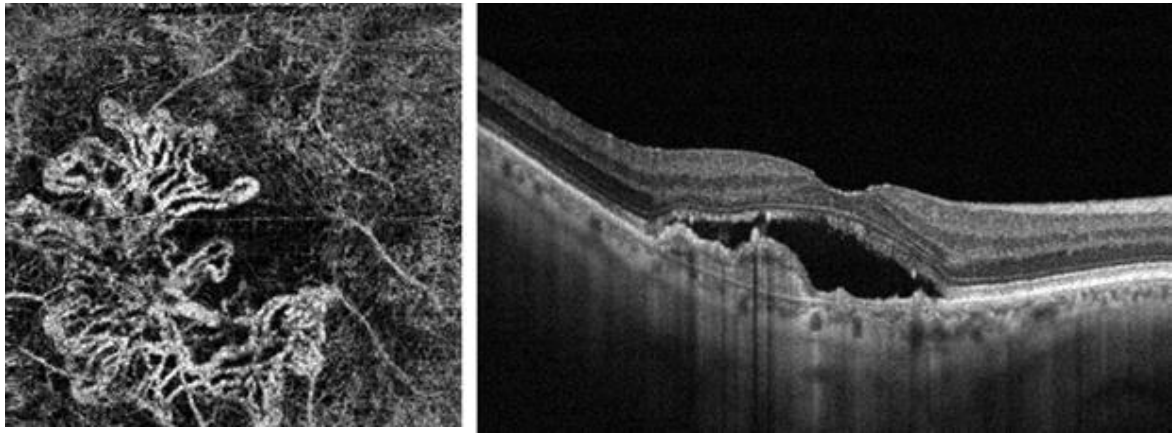


AMD- Exudative

Medusa Pattern



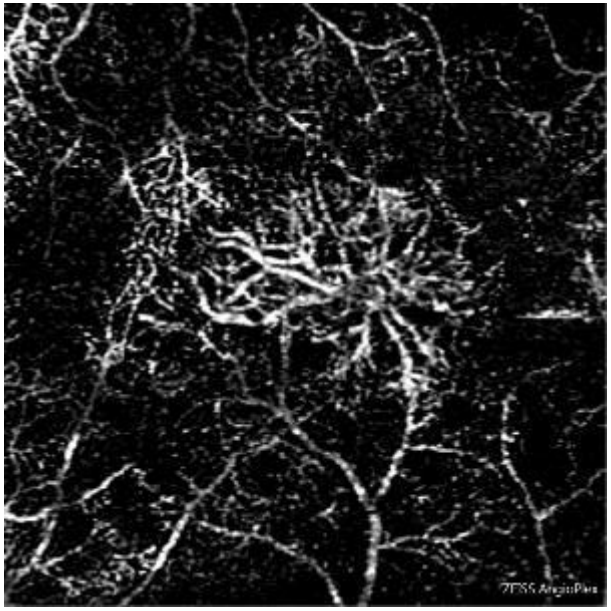
Seafan Pattern



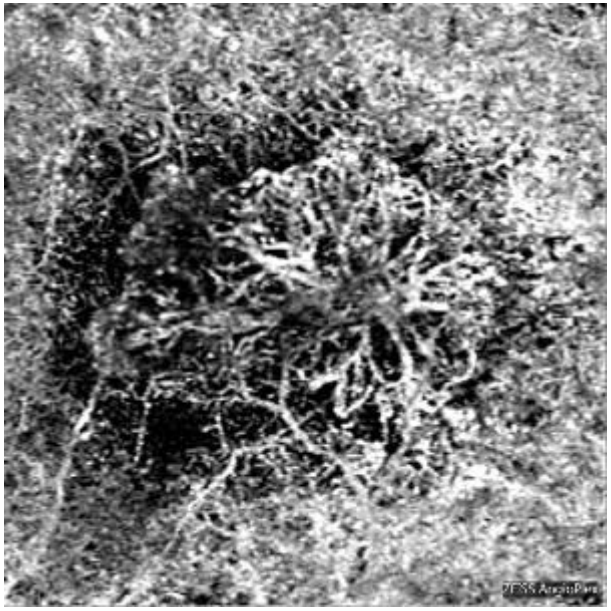
Kuehlewein L et al. OCTA of Type 1 Neovascularization in ARMD. Am J Ophthalmol. 2015 Oct;160(4):739-48.e2.

AMD- Exudative

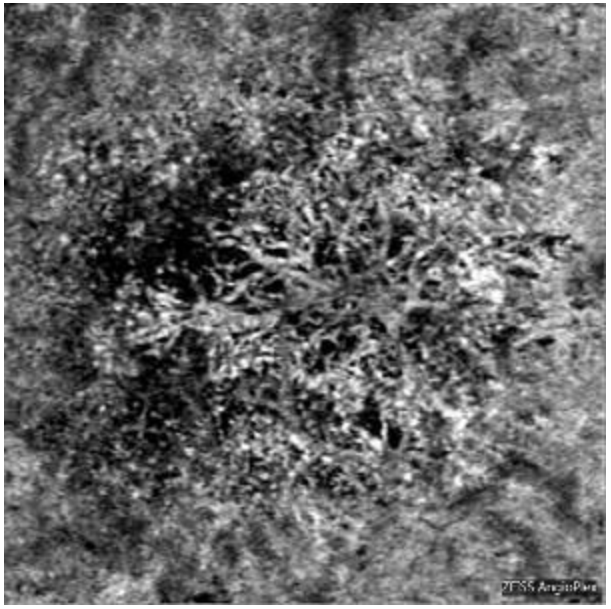
Avascular

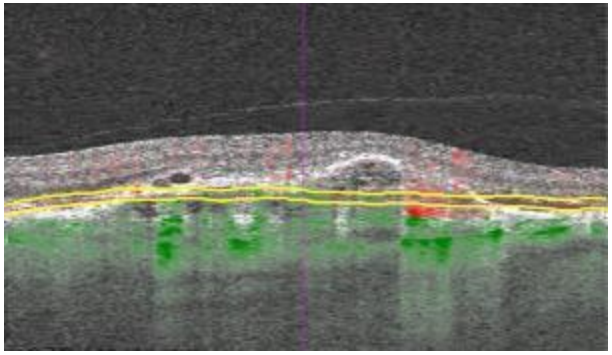


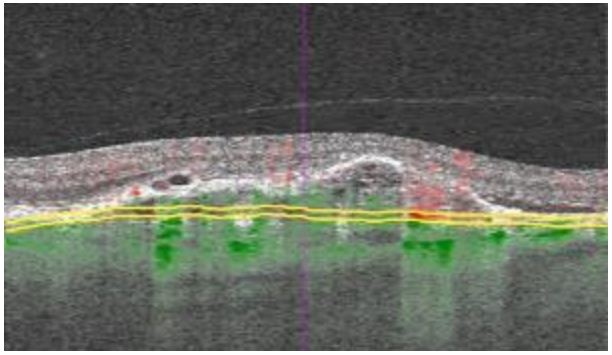
Choriocapillaris

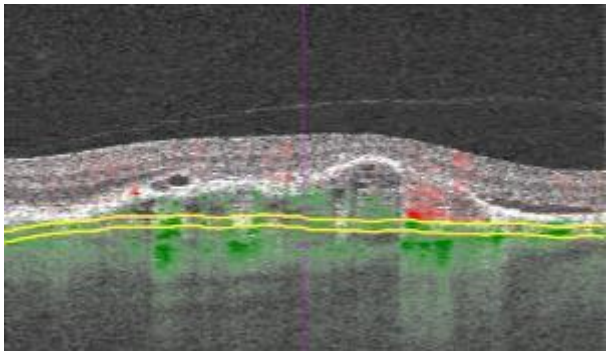


Choroid

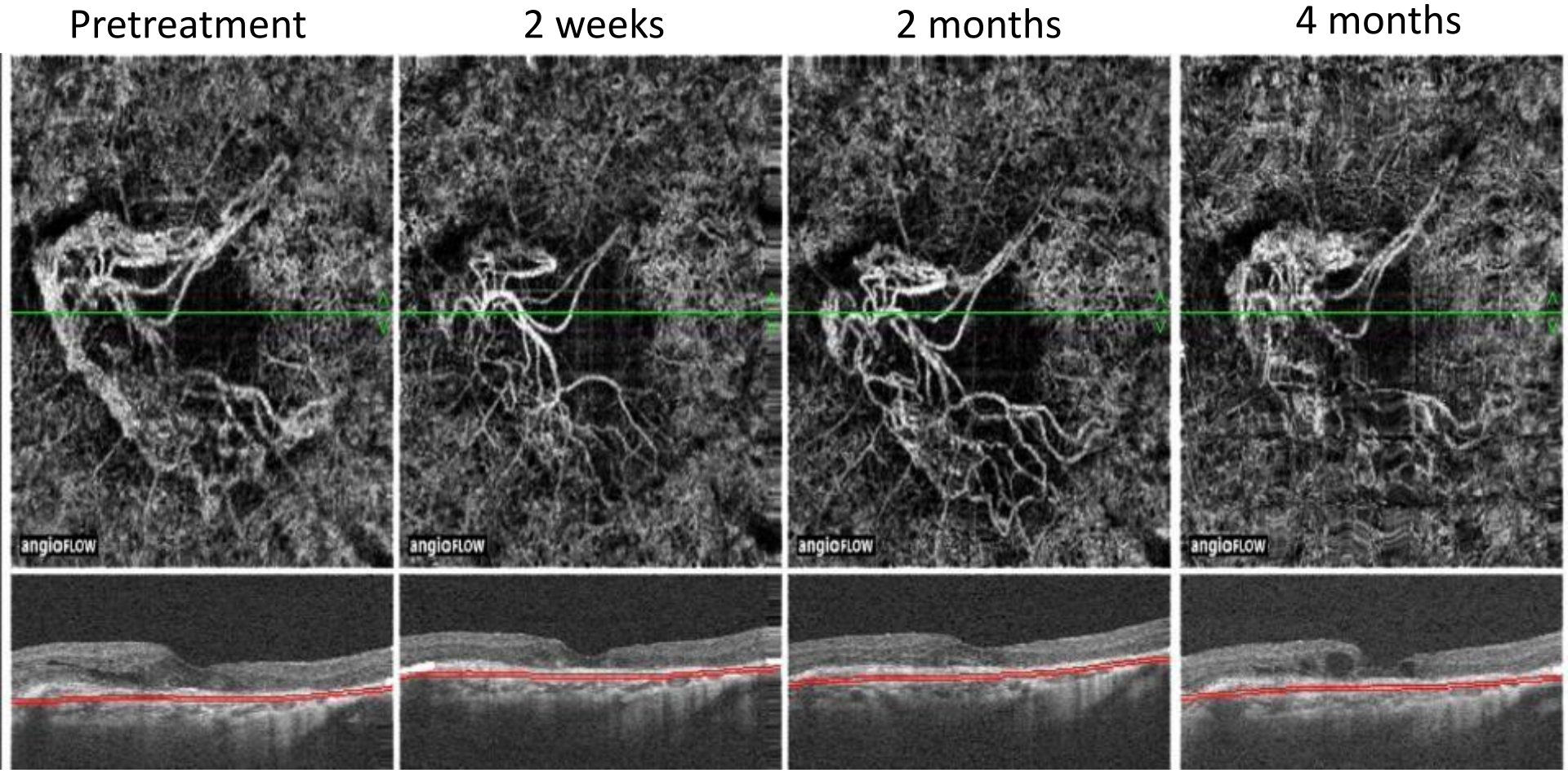


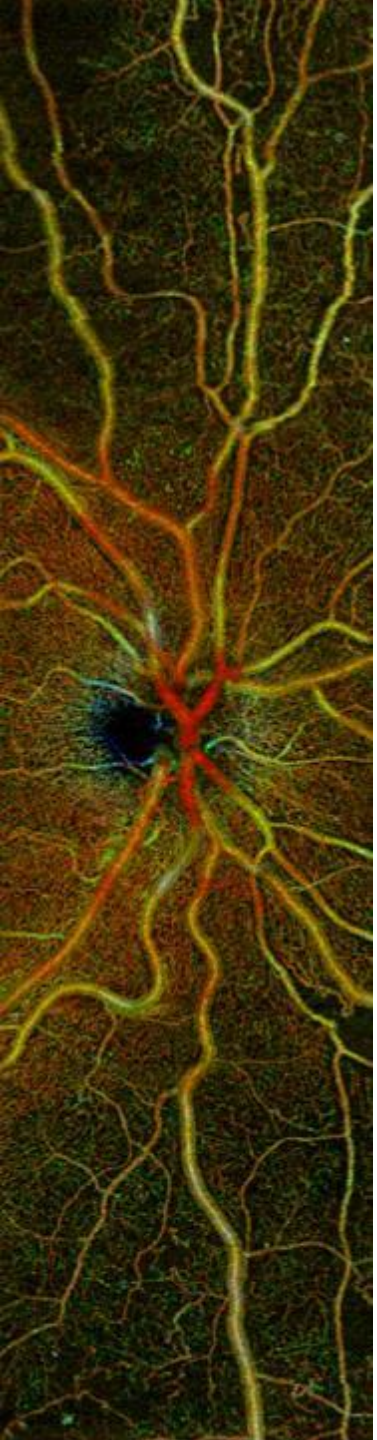






AMD- Exudative





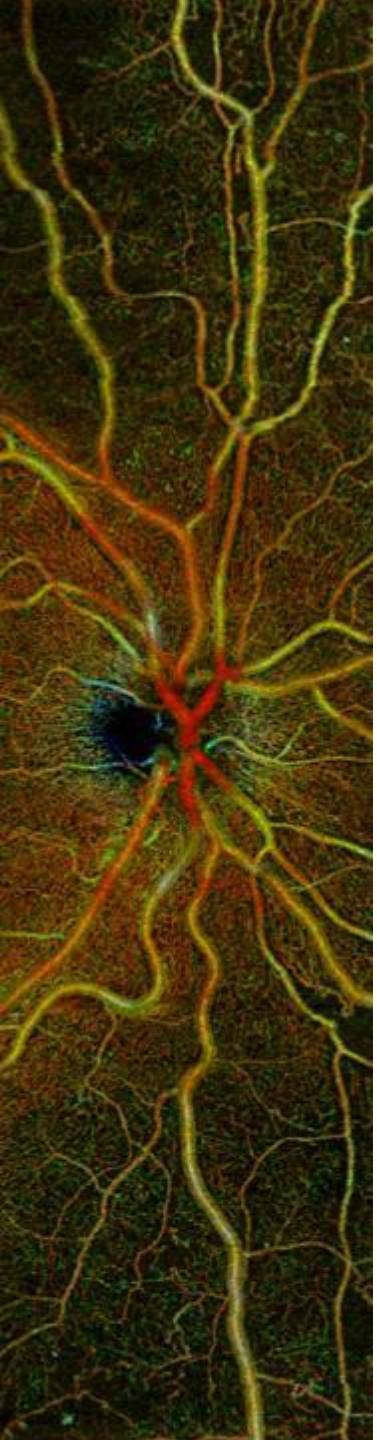
Macular Telangiectasia Type 2

WHAT IS IT?

MacTel type 2 is an idiopathic bilateral neurodegenerative disease with characteristic alterations of the macular capillary network and neurosensory atrophy

CLINICAL FEATURES INCLUDE:

- Loss of macular pigment
- Retinal hyporeflective cavities on OCT
- Telangiectatic capillaries (early)
- Retinal pigment plaques, foveal atrophy, and subretinal neovascularization (late)



Macular Telangiectasia Type 2

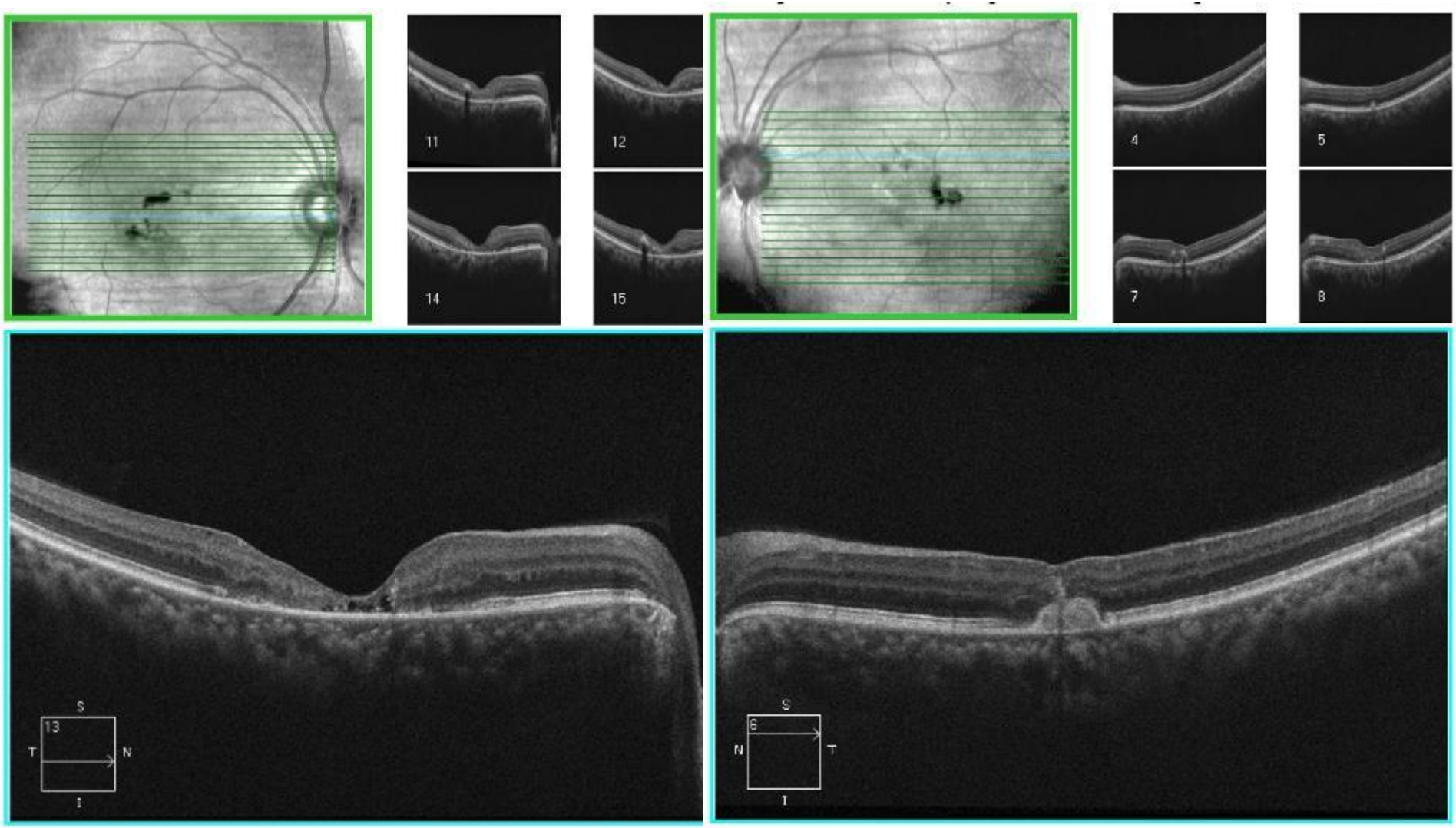
CASE REPORT

56yo HF

- Consultation for evaluation of maculopathy OU
- C/O bilateral progressive decrease in vision x 2 yrs
- MH: Good health. No meds
- POH: Unremarkable
- BCVA: 20/100 OD, 20/200 OS
- Ta 25/25 @ 2pm
- SLE: WNL OU

Macular Telangiectasia Type 2

Macular Telangiectasia Type 2

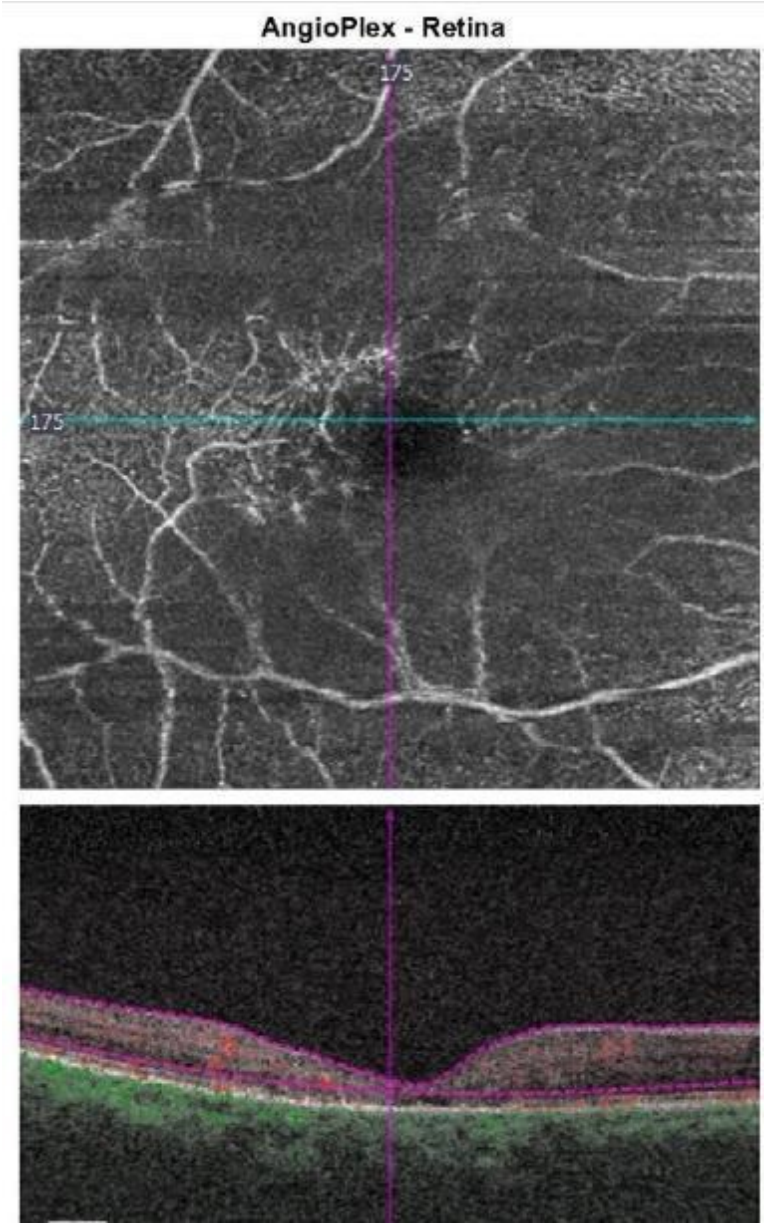


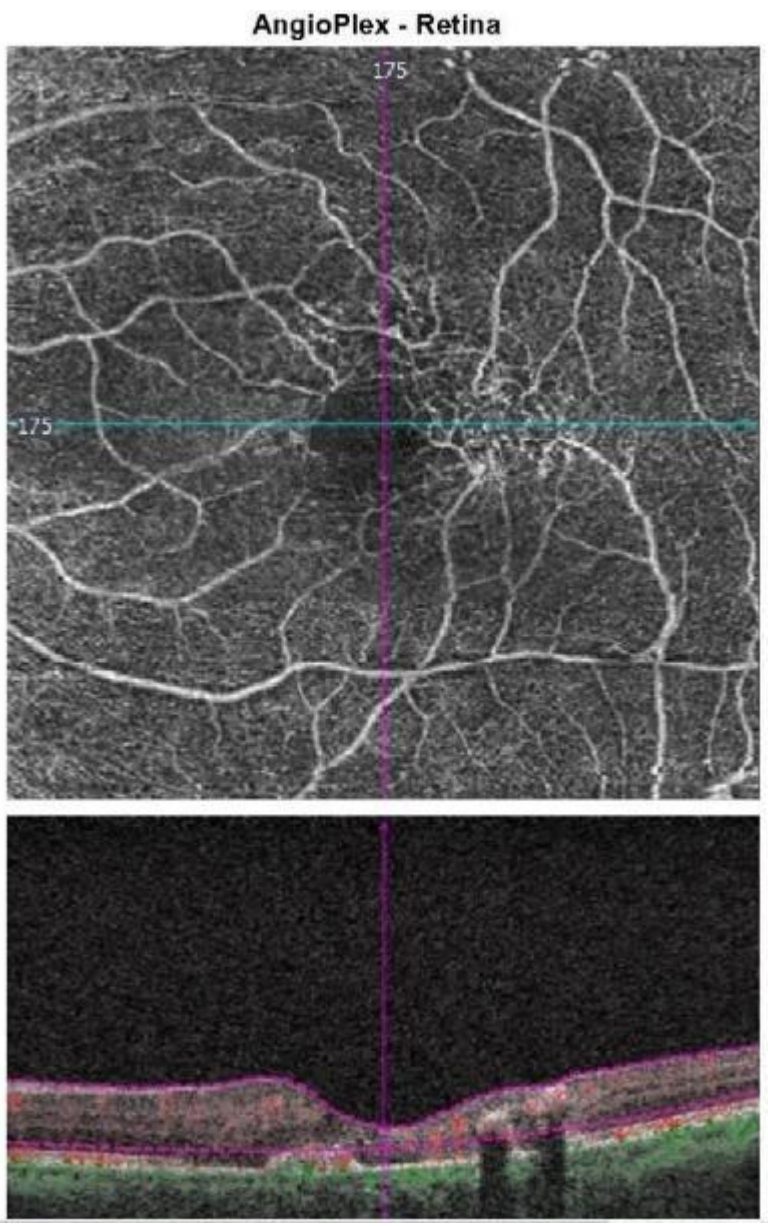
OD

OS

Macular Telangiectasia Type 2

OD

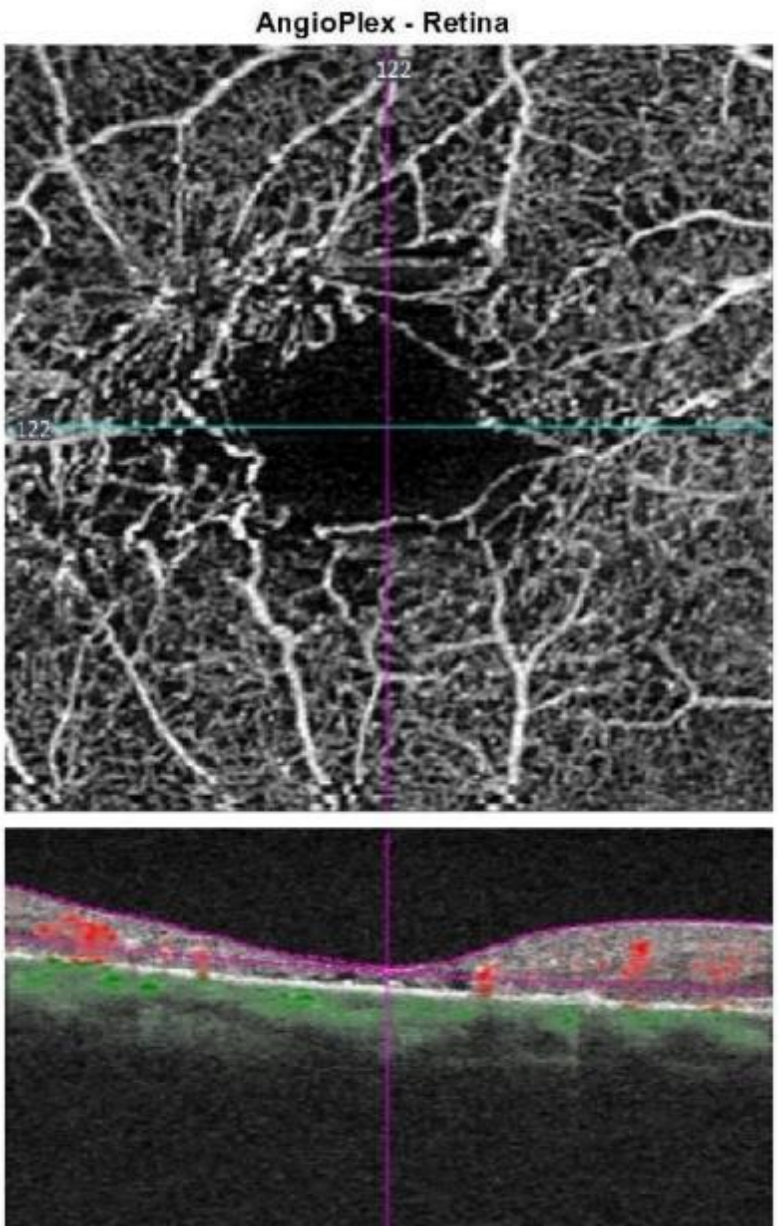


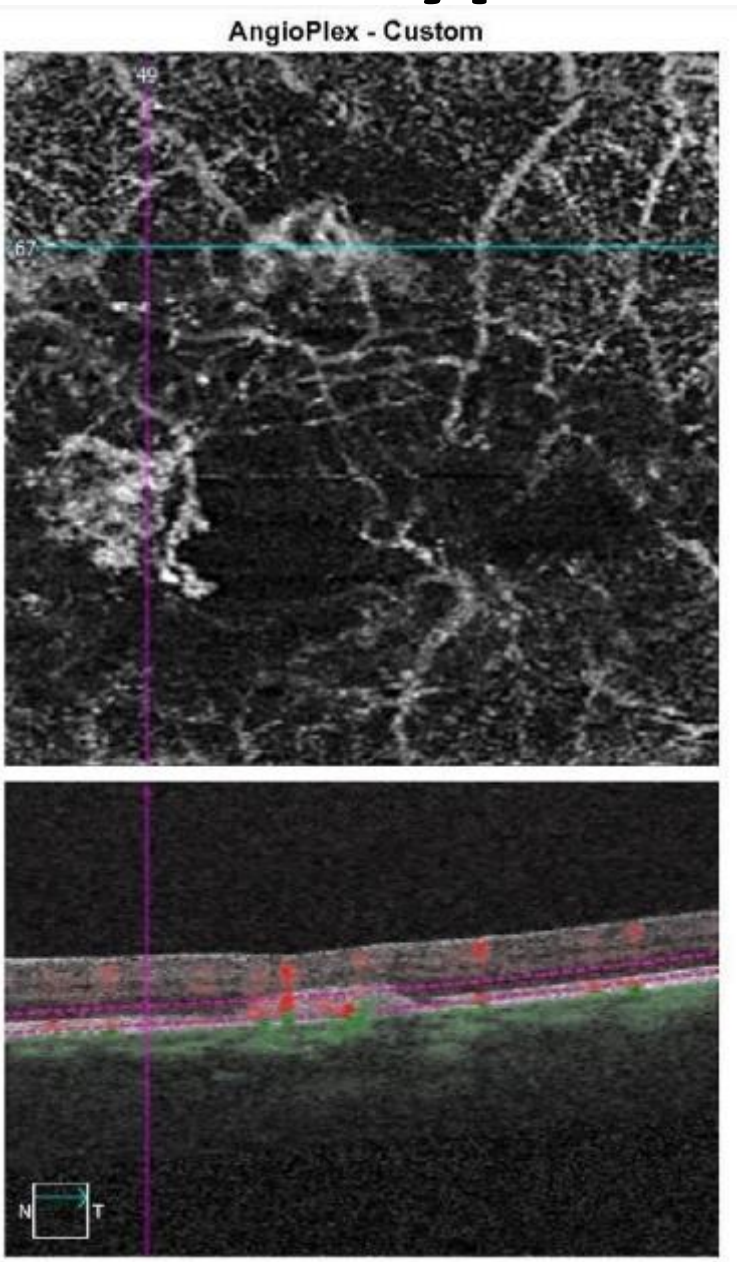


OS

Macular Telangiectasia Type 2

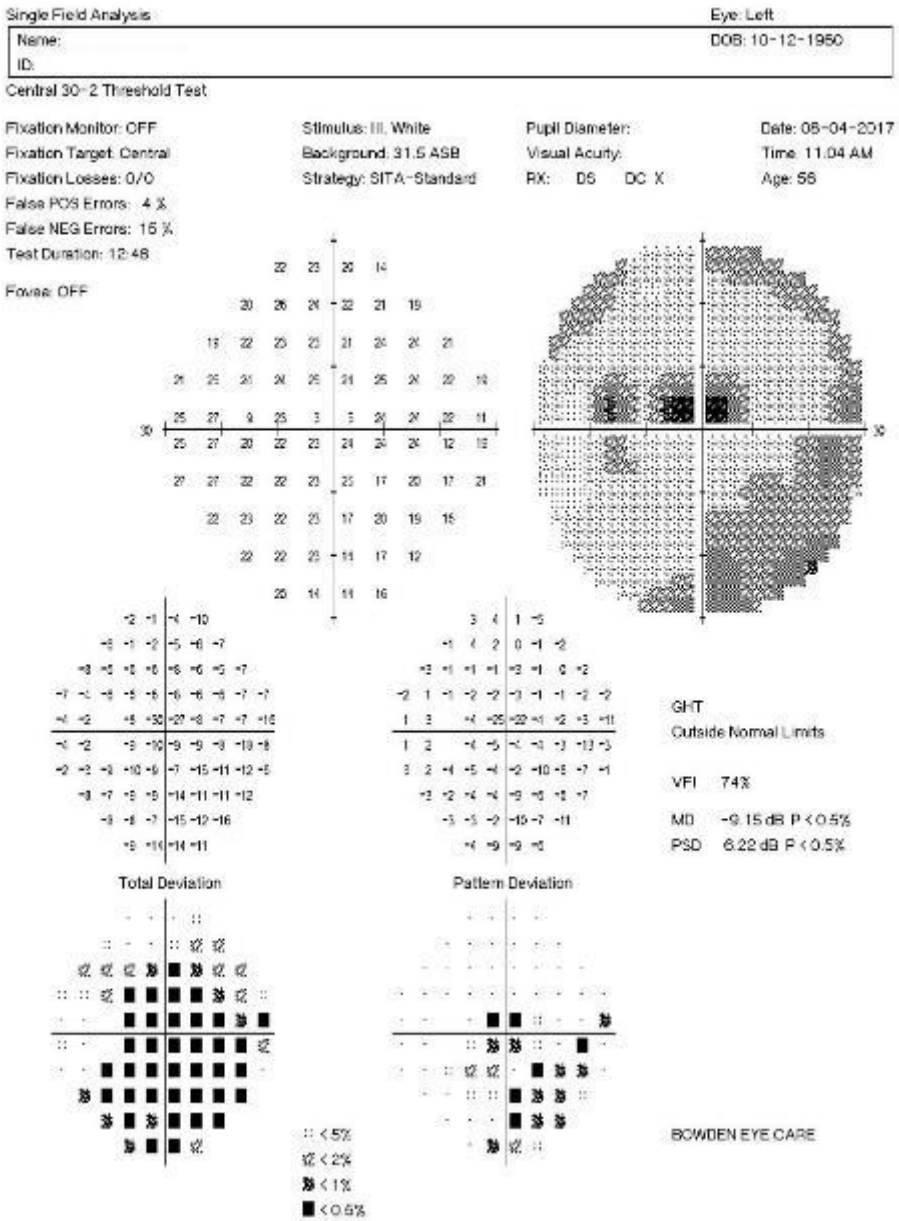
OD

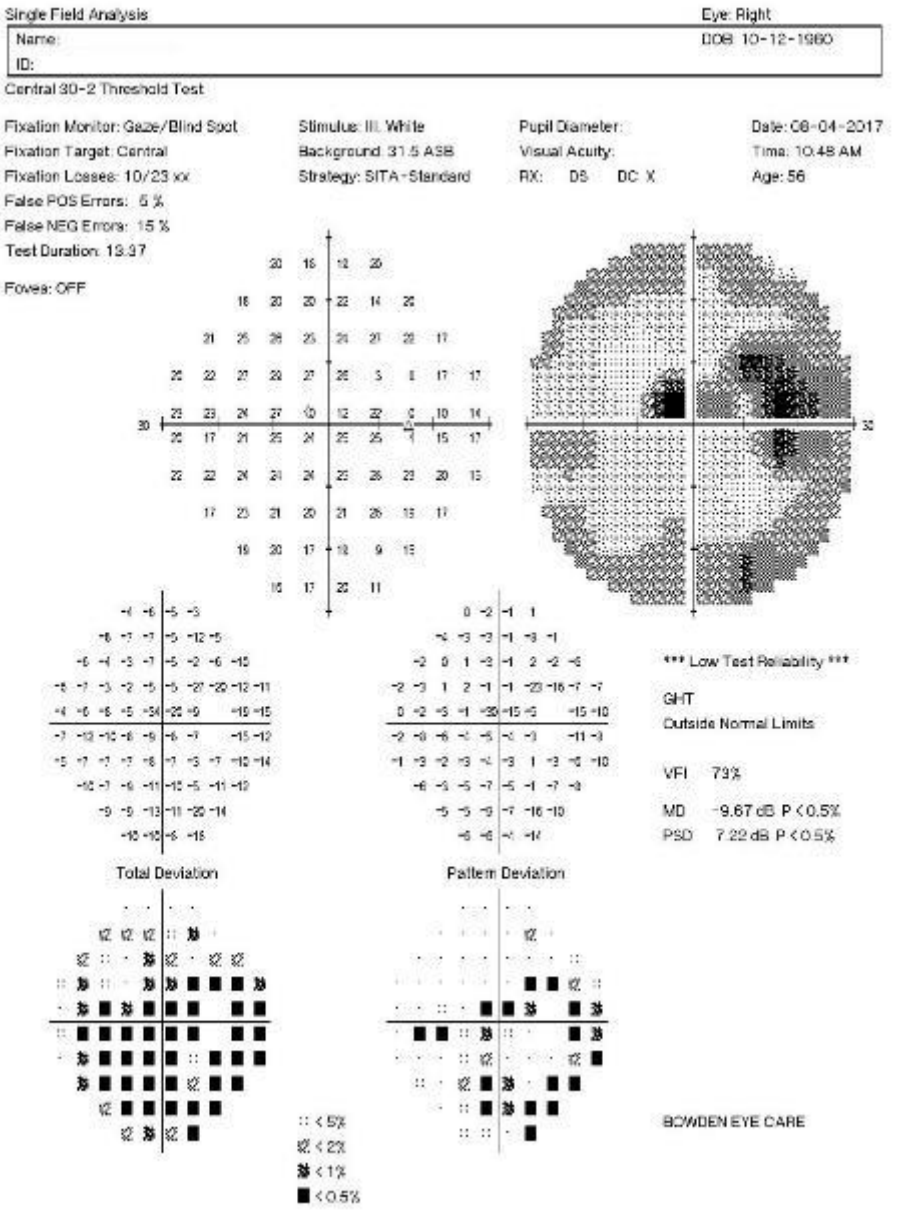




OS

Macular Telangiectasia Type 2





Macular Telangiectasia Type 2

OUR PLAN:

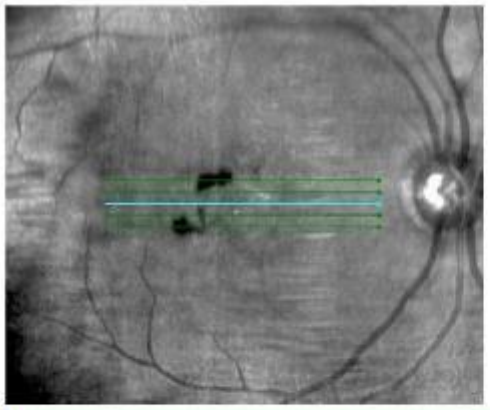
(1) IVB OS, (2) Glaucoma eval, (3) Low vision

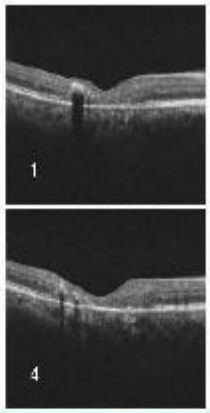
PATIENT'S PLAN:

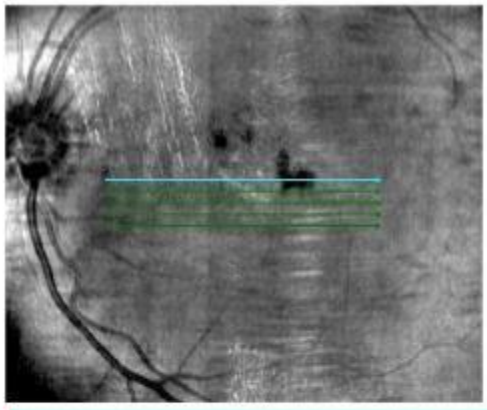
- Return 8 mos later

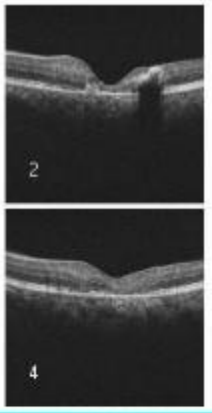
- C/O vision getting worse OS.
- BCVA: 20/100 OU
- Ta 24/24 @ 4pm
- SLE: WNL OU

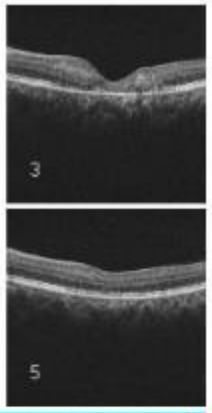
Macular Telangiectasia Type 2







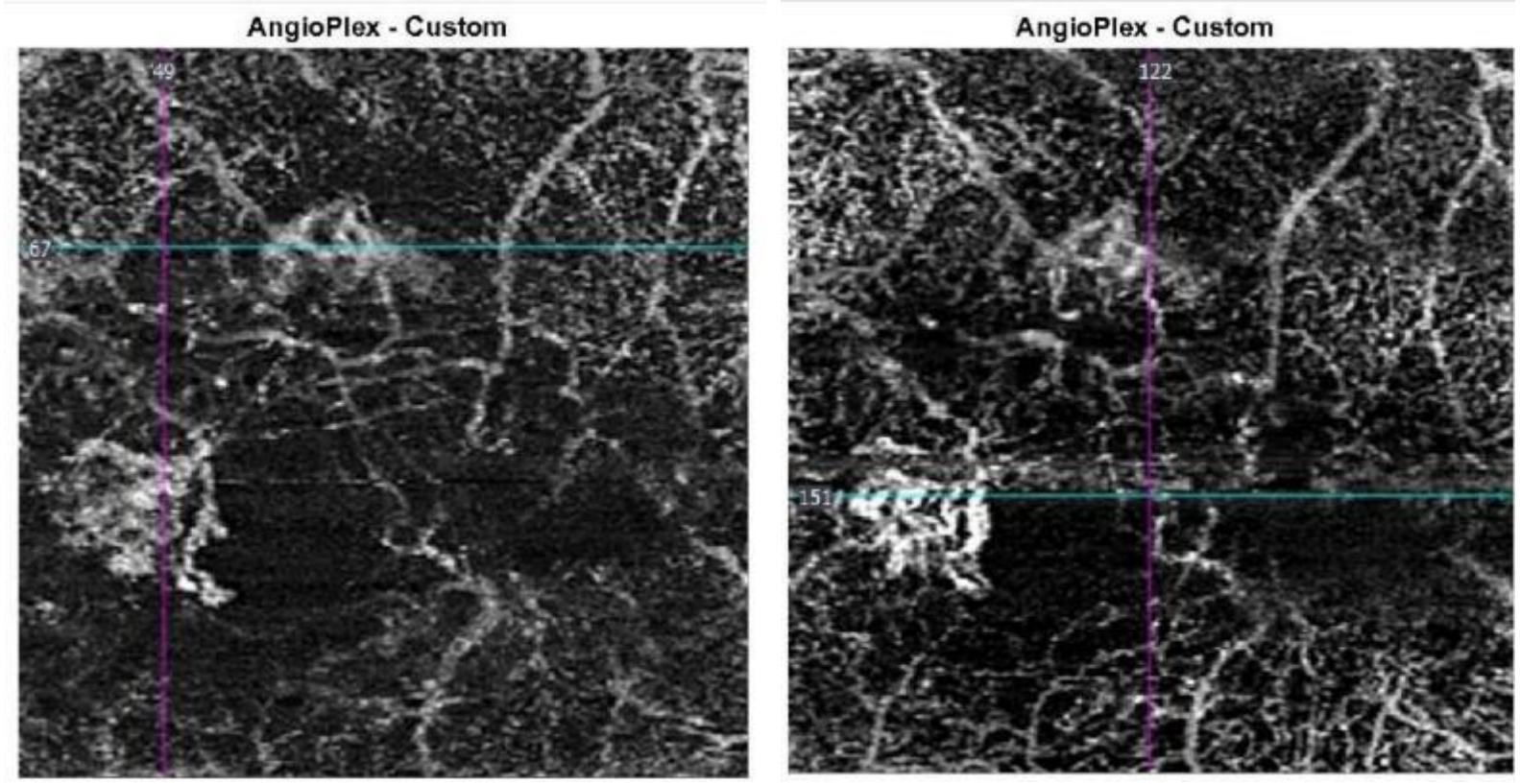




OD

OS

Macular Telangiectasia Type 2



2017 2018

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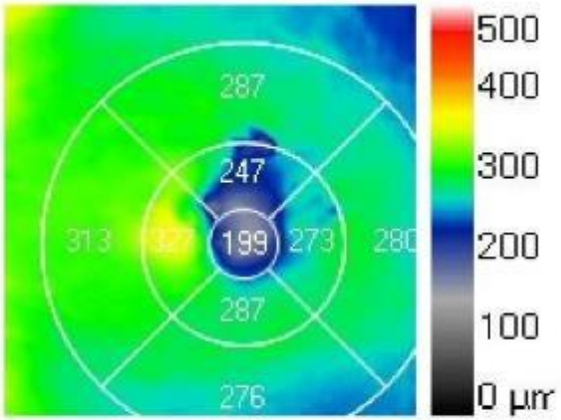
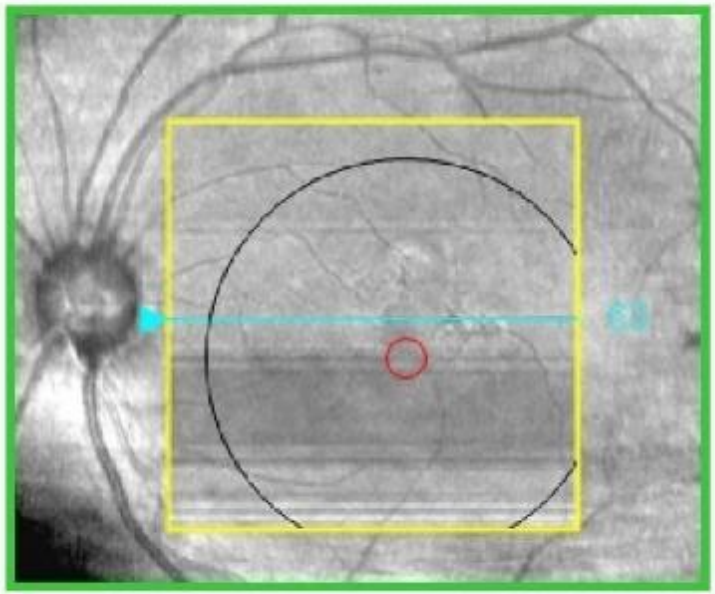
Exam from 8/4/2017 1:02:18 PM

Fovea: 297, 75

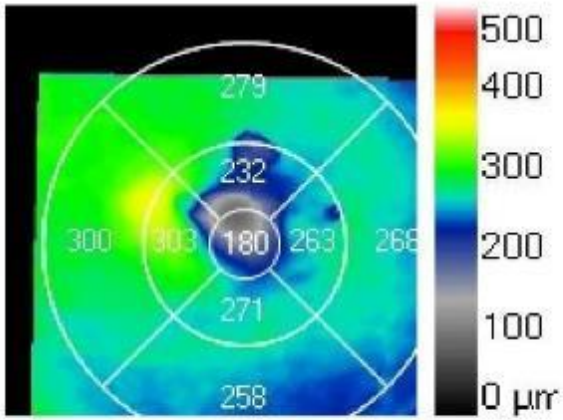


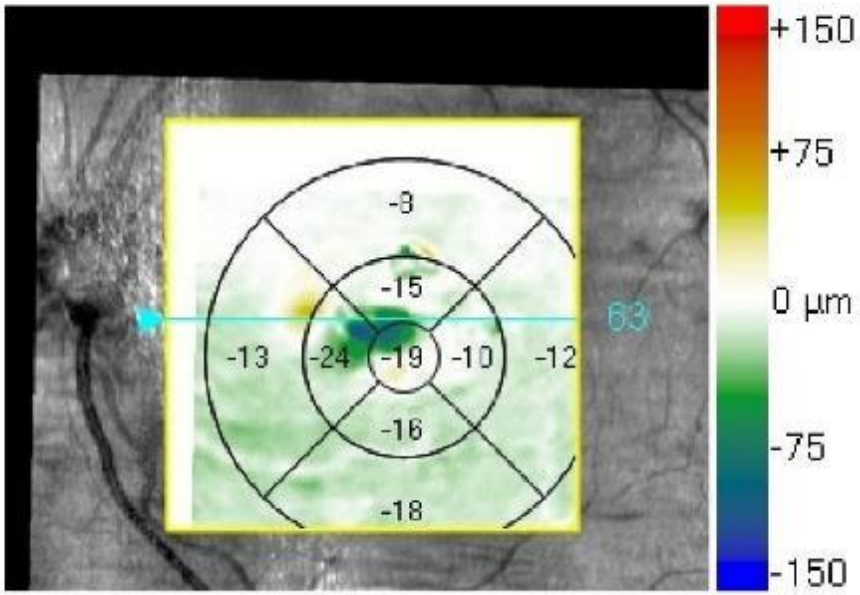


Overlay: OCT Fundus Transparency: 0 %

Exam from 4/13/2018 4:21:07 PM

Fovea: 297, 75



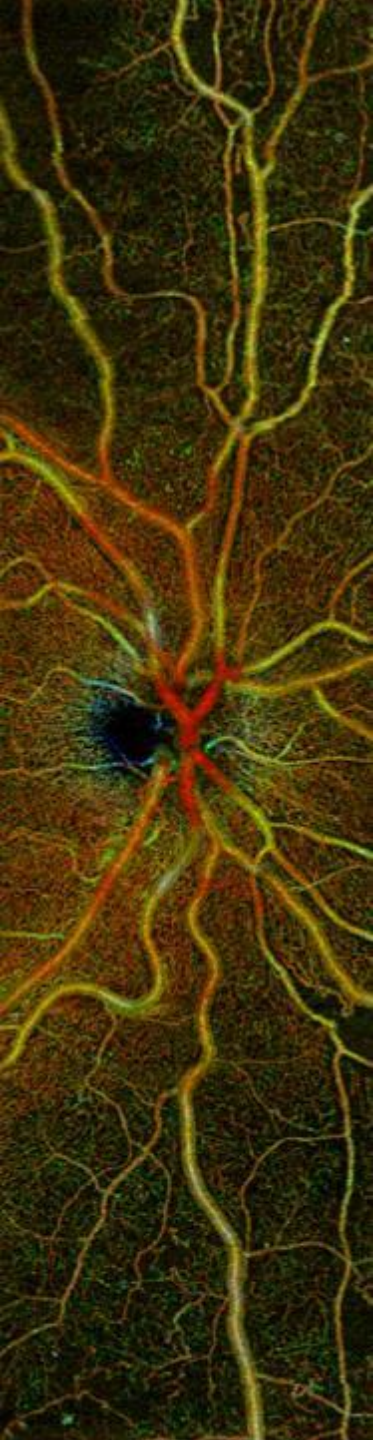


Overlay: ILM-RPE Difference Transparency: 0 %

Macular Telangiectasia Type 2

KEY POINTS

- No effective treatment for nonproliferative disease (macular atrophy)
- Treatment of subretinal neovascularization can prevent vision loss
- OCTA is well suited to visualizing the retinal vascular abnormalities associated with MacTel2, particularly with monitoring subretinal neovascularization



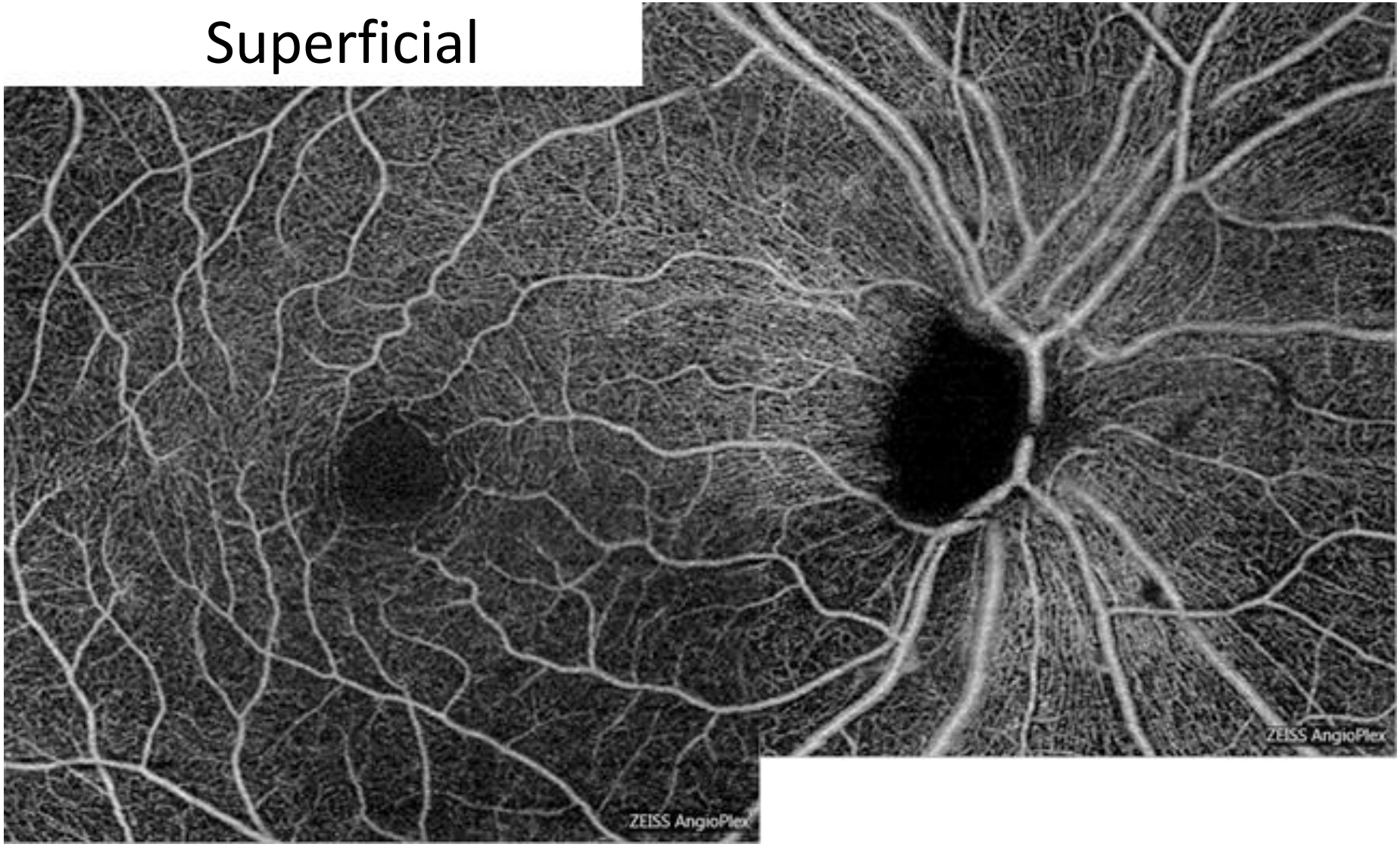
GLAUCOMA

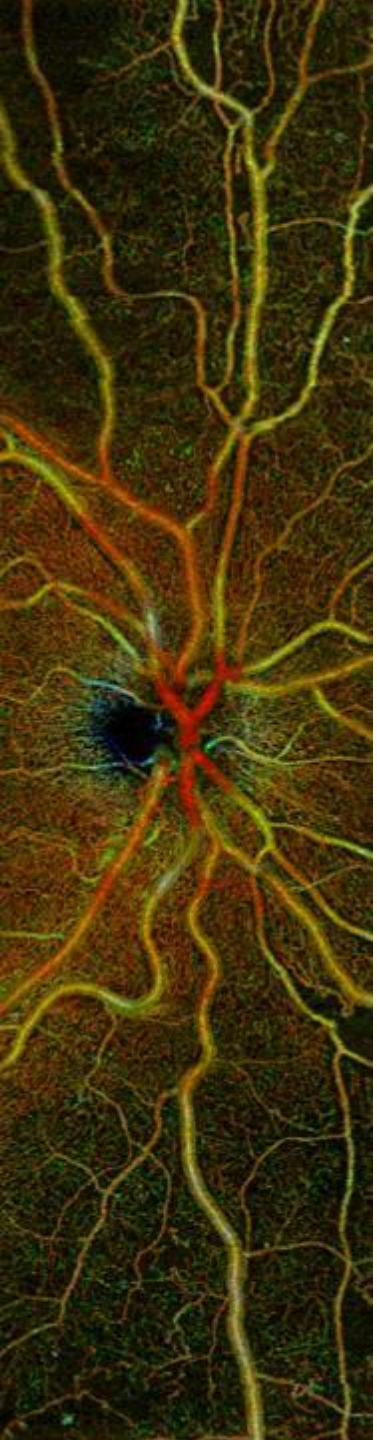
OCTA Clinical Applications

- Screening/diagnosing
- Staging
- Monitoring progression

Glaucoma

Superficial





CONCLUSION

- Many advantages over IVFA
- Better detection of non-perfusion in DR, VO, and AMD
- Detection of subclinical DR
- Earlier detection of pre-retinal and choroidal neovascularization
- Potential for glaucoma and DR staging
- Improved visualization of CNV and precursors