ASL Roma A
PRESIDIO TERRITORIALE NUOVO REGINA MARGHERITA
AMBULATORIO PATOLOGIE RETINICHE
Resp. Dott.ssa SUSANNA CATALANO

CENTRO ITALIANO MACULA
Prof Bruno Lumbroso

OCT Angiography: operating principles and clinical cases

Marco Rispoli

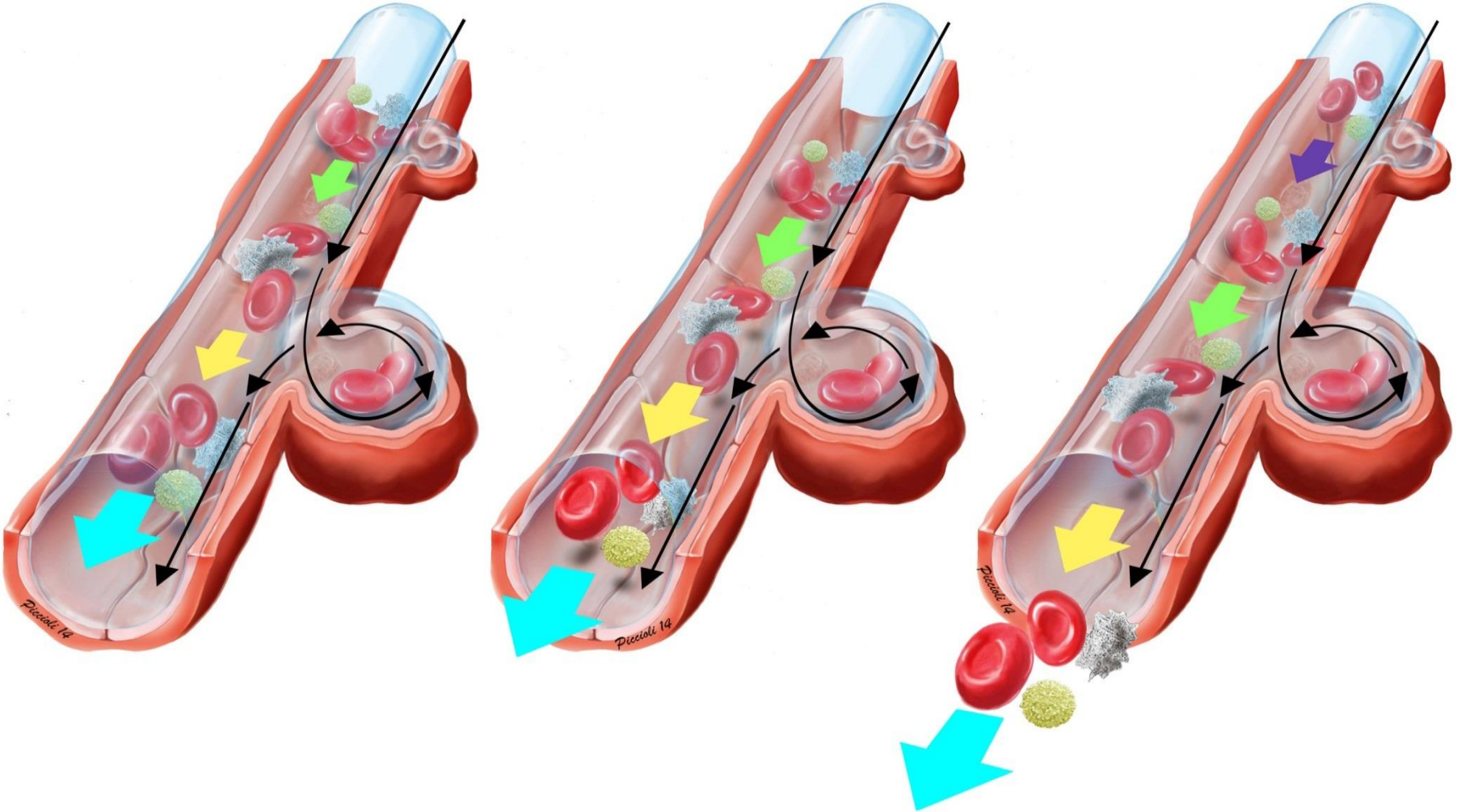
Bruno Lumbroso

introduction

OCT-A is a direct Enface derivation.

It works on SD and SS OCT.

SSADA allows visualization of retinal vessels by their blood flow. Where there is a flow, there will be a grey scale image (flow signal or decorrelation)


Piccioli 14
Piccioli 14
Piccioli 14

warning

We can not absolutely tell about hyper or hypo reflectance in OCT-A. those are words linked to structural OCT. They are absolutely not correlable with flow data, described by other words.

SSADA: aquiring protocol

- Macular cube 304x304 (fast scan, low res)
- horizontal raster scan
- Vertical raster scan
- MCT (motion correction)

- Each scan is divided in several spectrum bands (“split spectrum”)
- The low res allows to enhance contrast between moving and not moving structures. Each spectrum band shows in different way the same variation.
- Combinig the bands balances and optimizes the signal/noise ratio.

Flow signals-quantification

- Vascular signals
- Not vascular signals

- Sensitivity limit (low flows 0.3mm/sec)
- saturation limit (fast flows 4mm/sec)

Take home message

- SSADA generates a “flow projection” of the superficial vascular plexus on the RPE.
- Choroid signal is lowered by the RPE density and fast choroidal flow

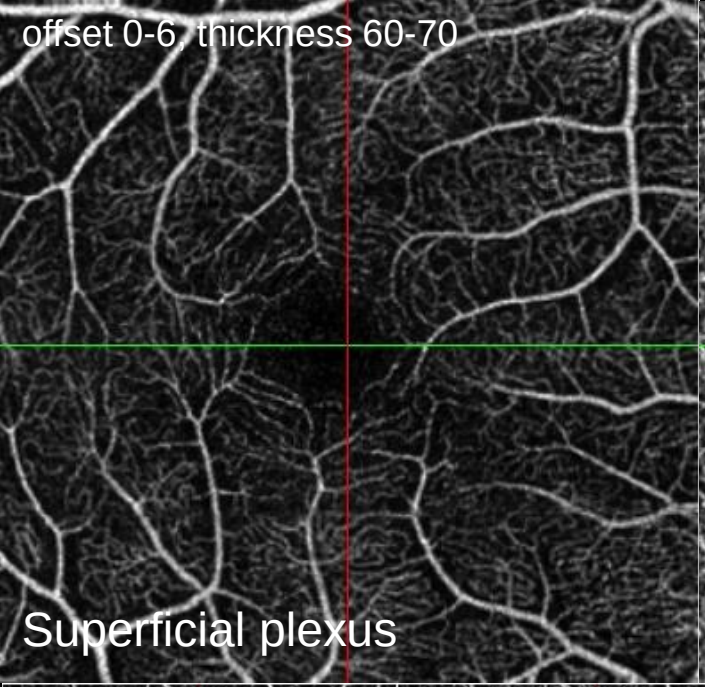
Like the other stratigraphies, OCT-A has to be analyzed layer by layer.

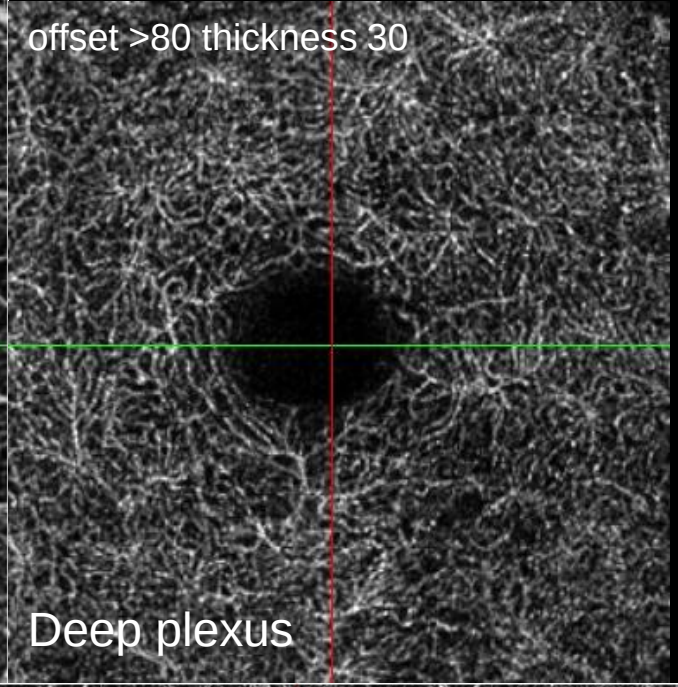
Vascular segmentation differs from structural enface segmentation

Vascular segmentation

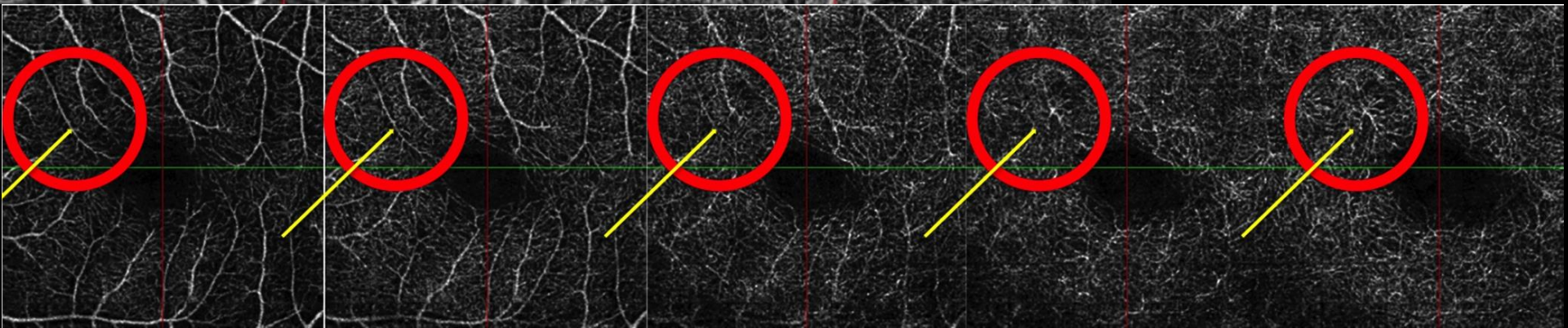
- Superficial vascular plexus (vascular retina)
- Deep vascular plexus (vascular retina)
- Avascular retina (ONL + RPE/Bruch)
- Choroid

After defining segmentation it is necessary to assess depth and thickness of the segmentation. These parameters may change in different pathologies.

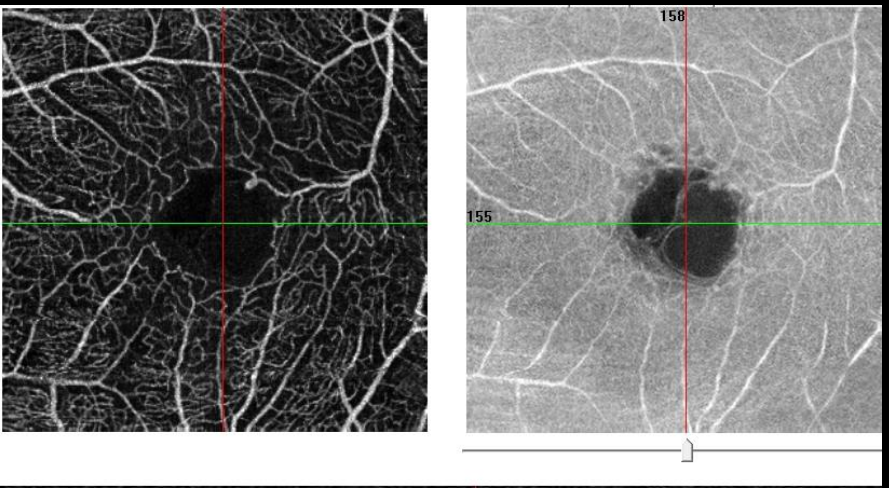


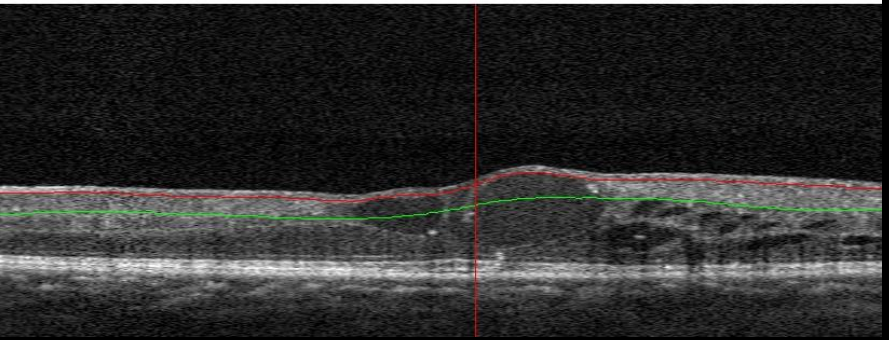


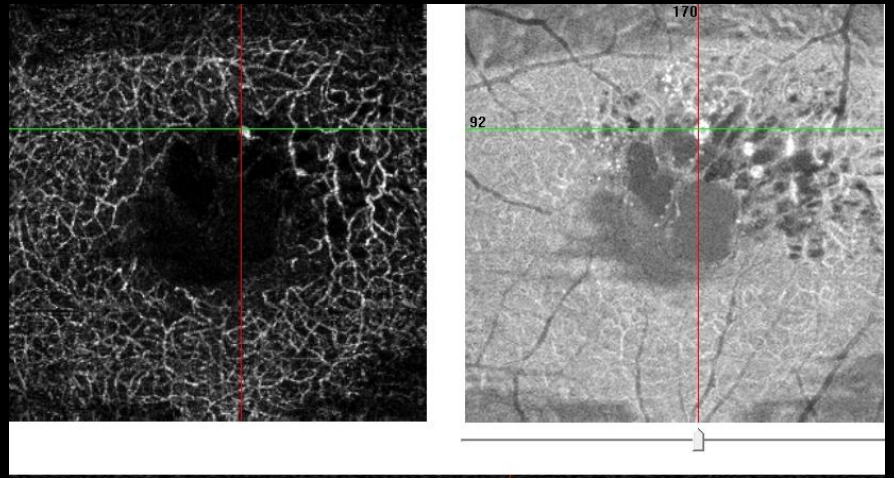
Normal retina and interconnections

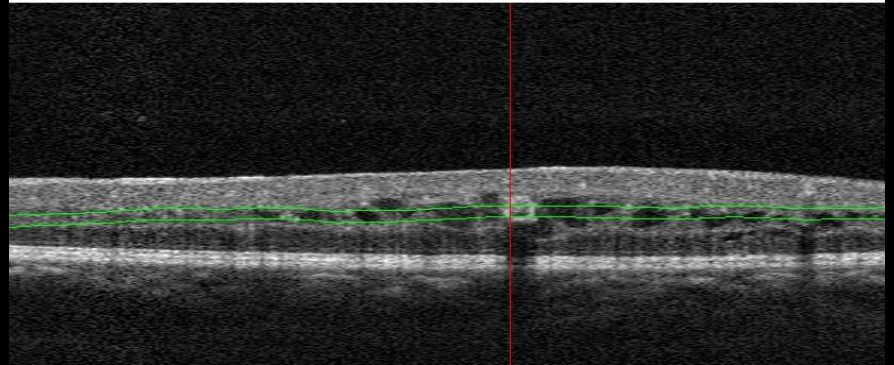


vascular plexa

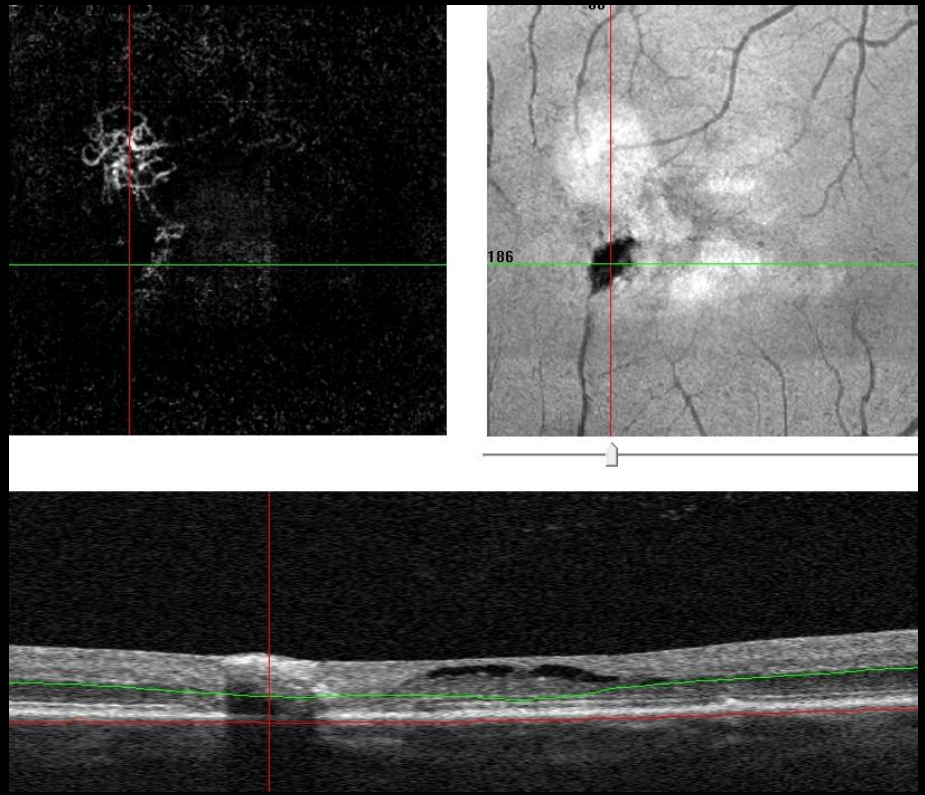


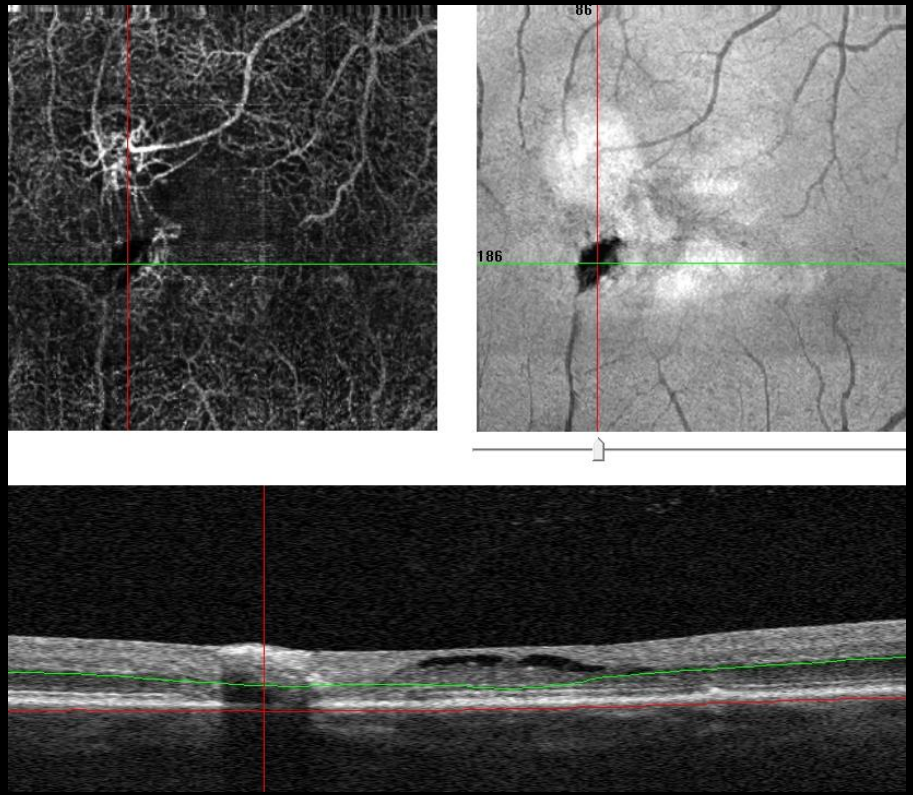




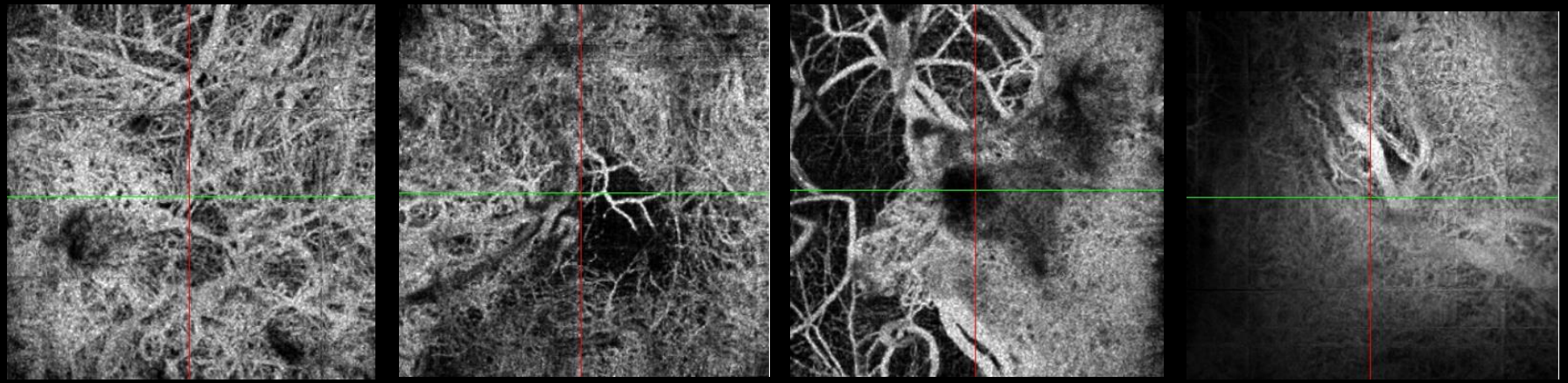


Avascular zone with and without filter

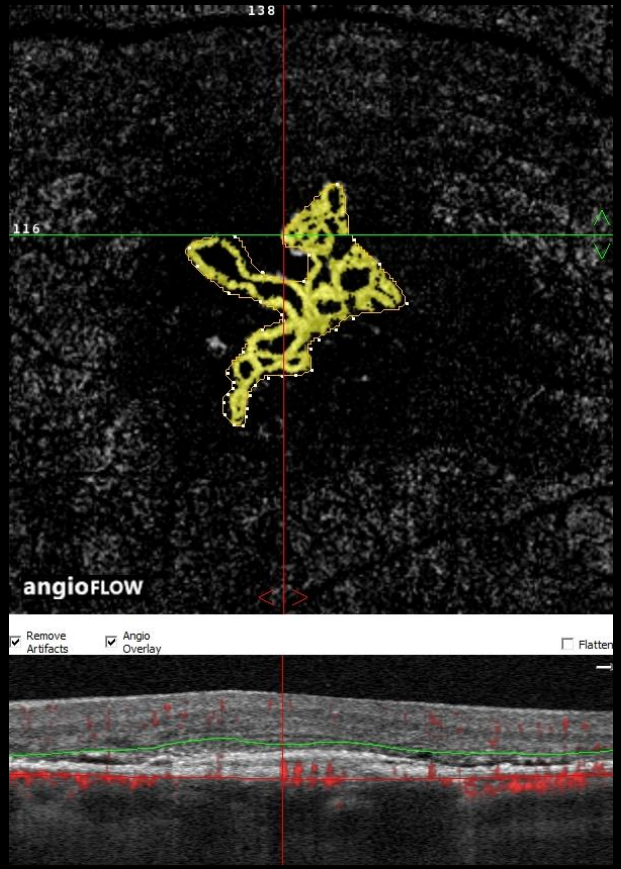


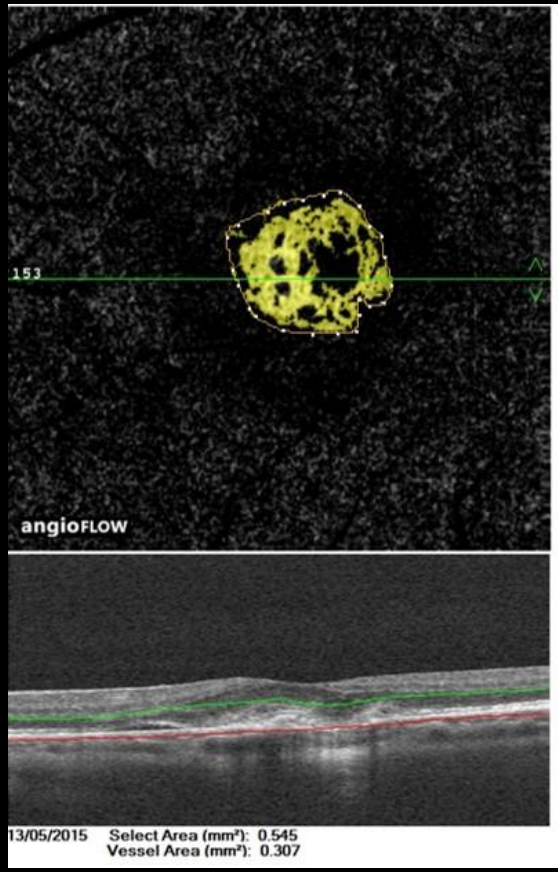


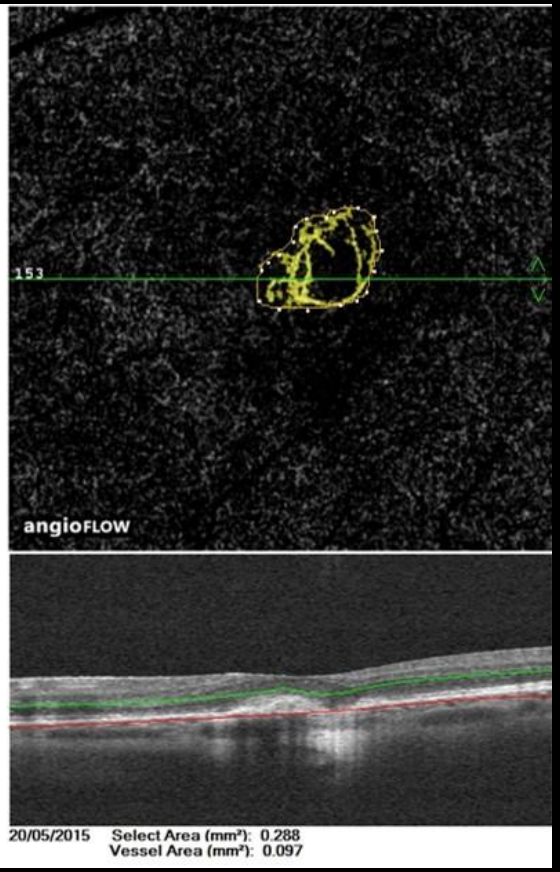
Choroid (myopia)



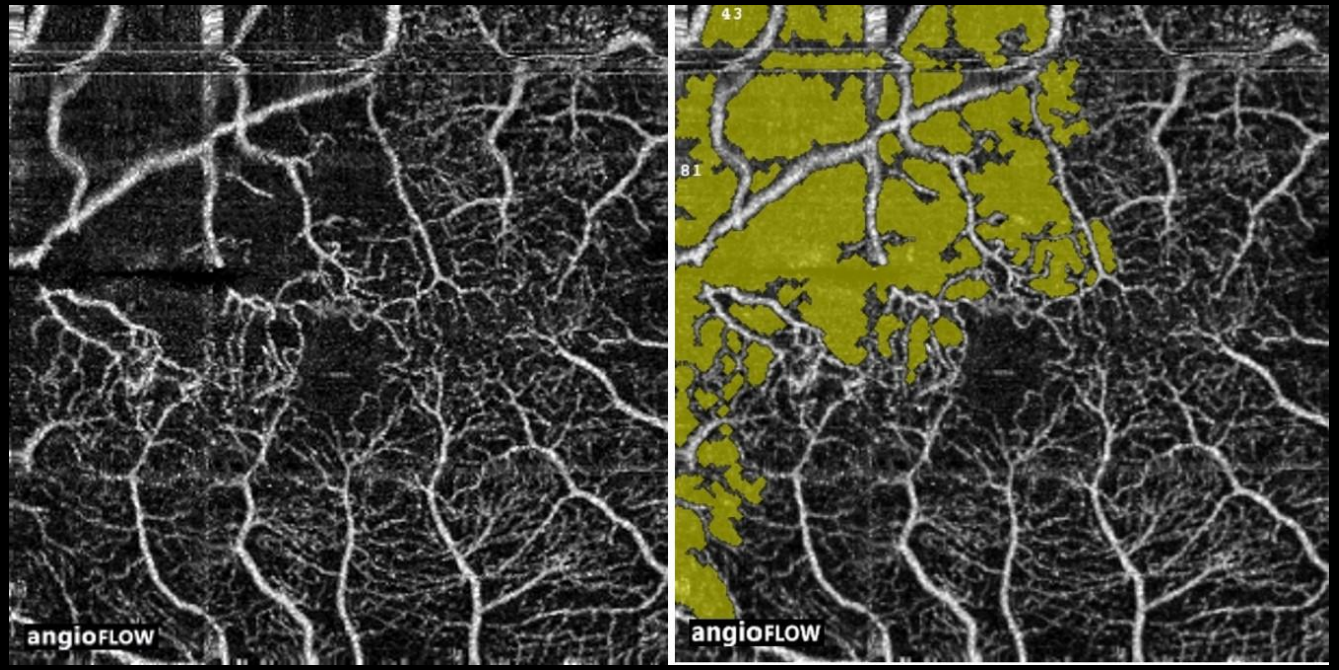
Flow areas


138
116
angioFLOW
Remove Artifacts
Angio Overlay
Flatten

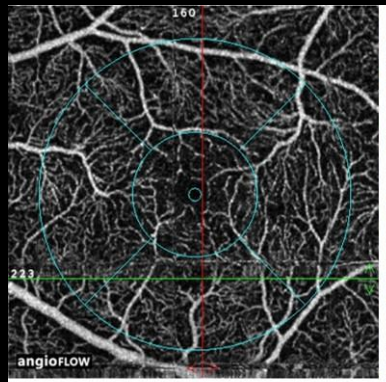

153
angioFLOW
13/05/2015 Select Area (mm²): 0.545
Vessel Area (mm²): 0.307

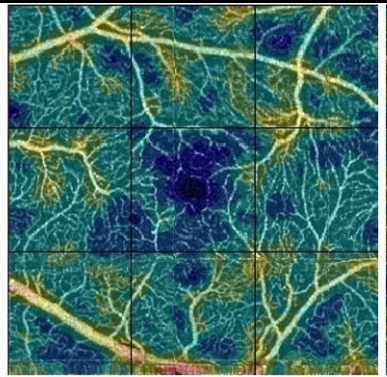

153
angioFLOW
20/05/2015 Select Area (mm²): 0.288
Vessel Area (mm²): 0.097

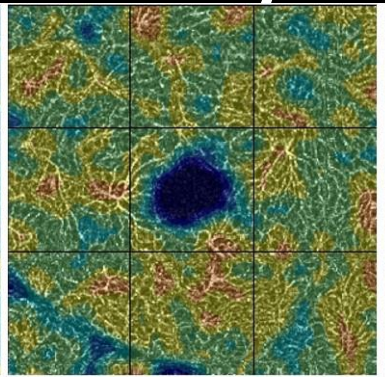
No flow areas

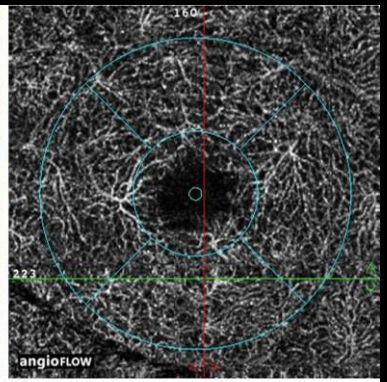


Flow density









OCT Thickness ILM-IPL

Section	Thickness (µm)
ParaFovea	118
- Superior-Hemi	119
- Inferior-Hemi	118

OCT Thickness ILM-RPE & Flow Density

Section	Thickness (µ...	Density (%)
Whole en fa...	N/A	53.17
Fovea	289	33.44
ParaFovea	308	56.90
- Tempo	313	55.48
- Superior	316	55.39
- Nasal	298	55.13
- Inferior	307	61.60

Grid-based Flow Density (%)

52.59	55.56	55.06
56.02	38.08	55.50
50.65	57.76	56.00

OCT Thickness ILM-IPL

Section	Thickness (µm)
ParaFovea	118
- Superior-Hemi	119
- Inferior-Hemi	118

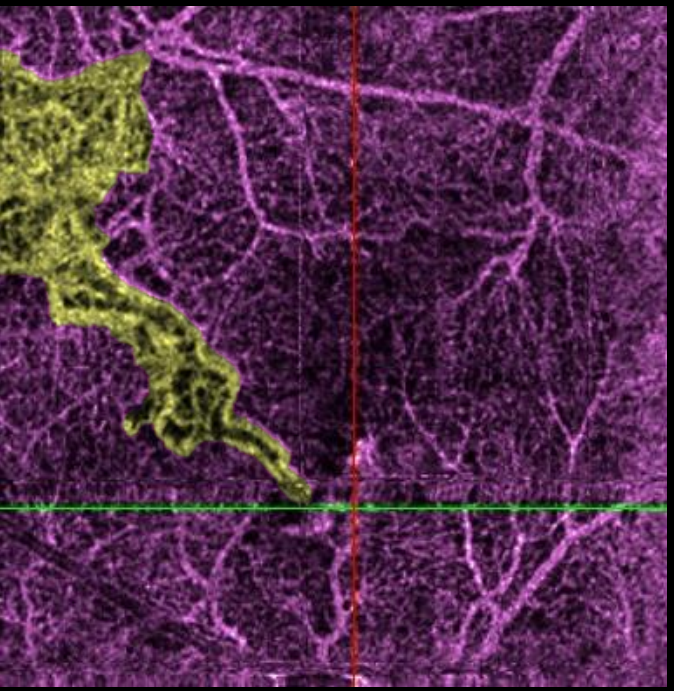
OCT Thickness ILM-RPE & Flow Density

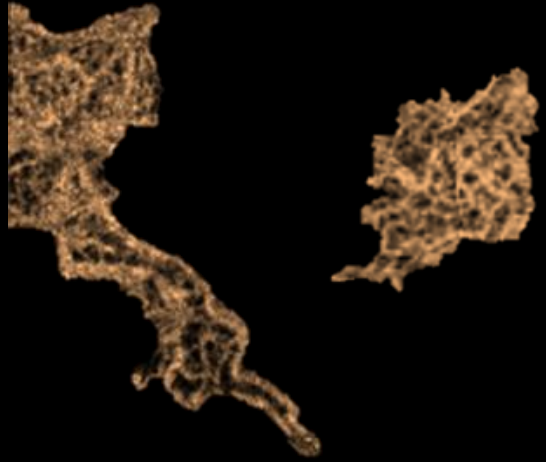
Section	Thickness (µ...	Density (%)
Whole en fa...	N/A	41.40
Fovea	289	27.15
ParaFovea	308	42.25
- Tempo	313	42.46
- Superior	316	43.06
- Nasal	298	41.02
- Inferior	307	42.47

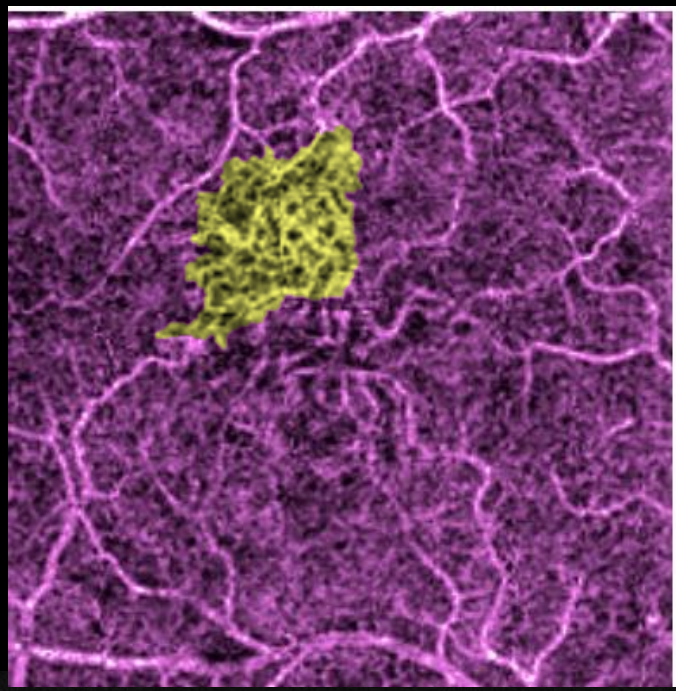
Grid-based Flow Density (%)

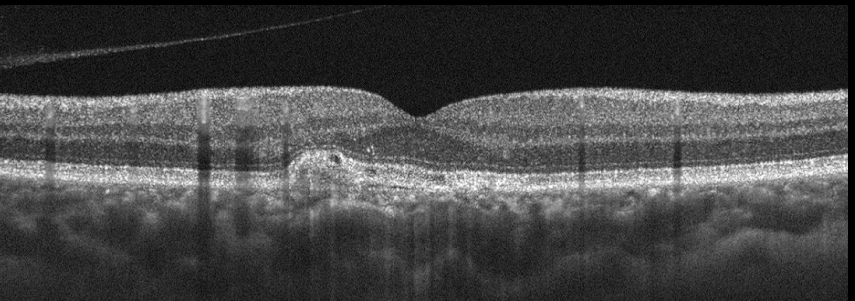
42.62	43.38	41.75
41.90	28.81	38.29
45.02	44.88	45.62

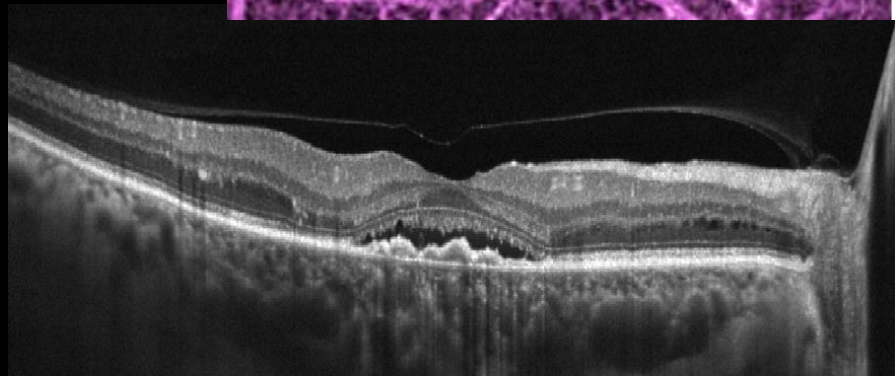
Type 1 CNV



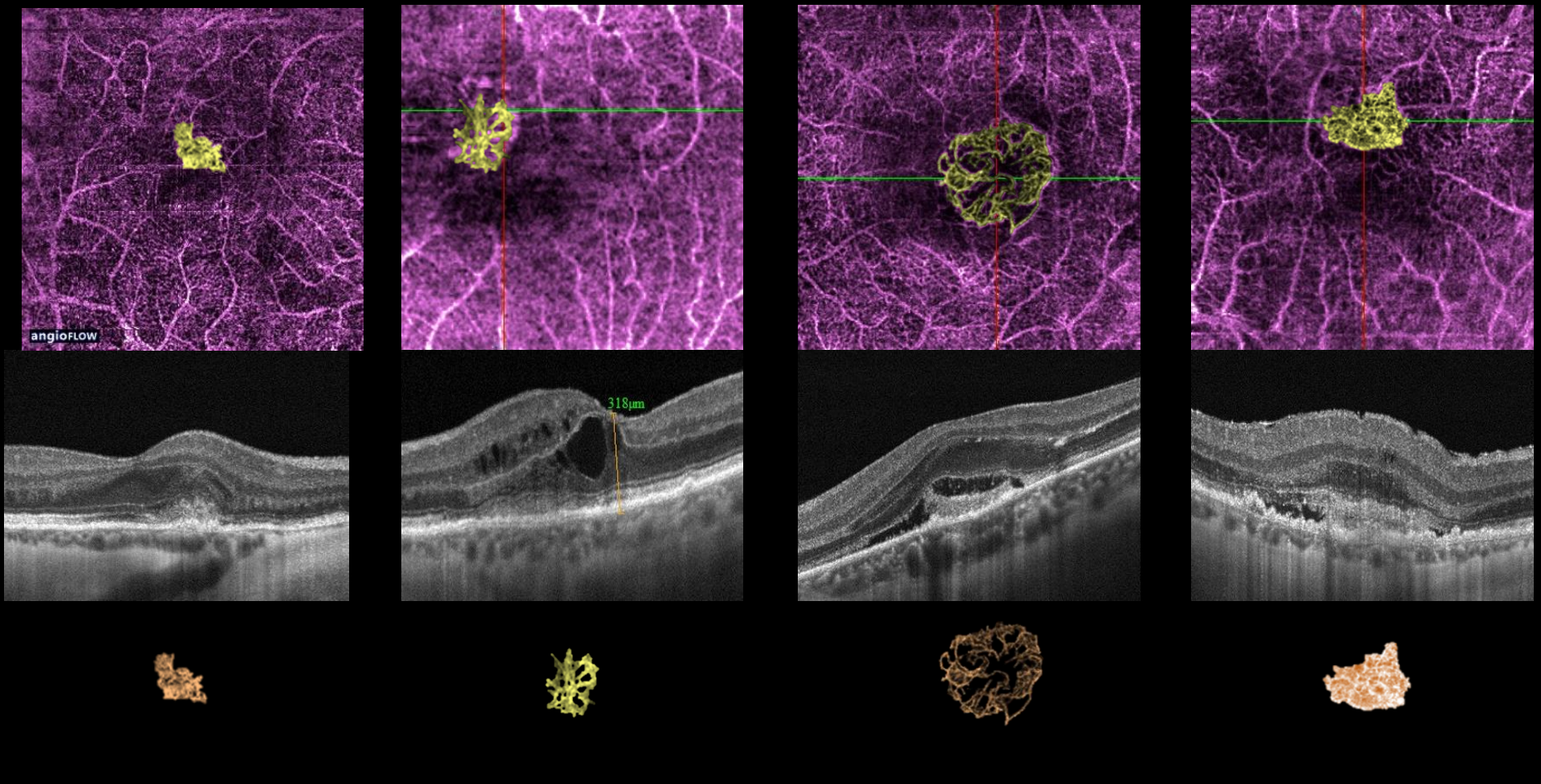




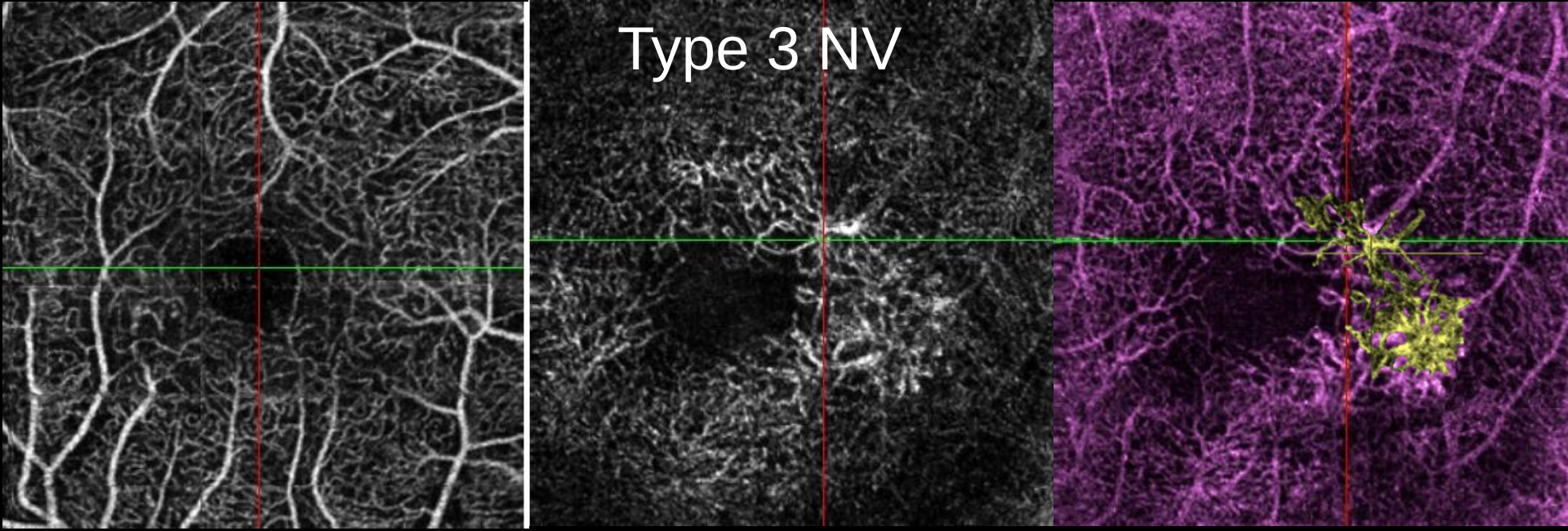


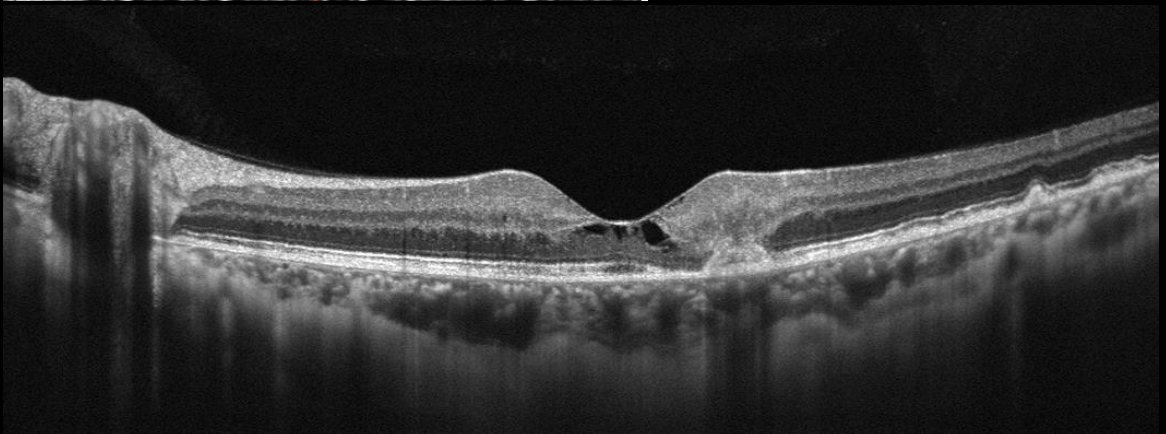


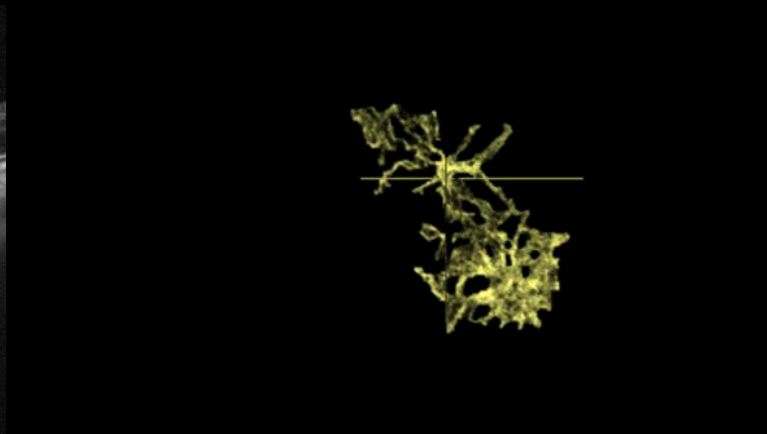
Type 2 CNV



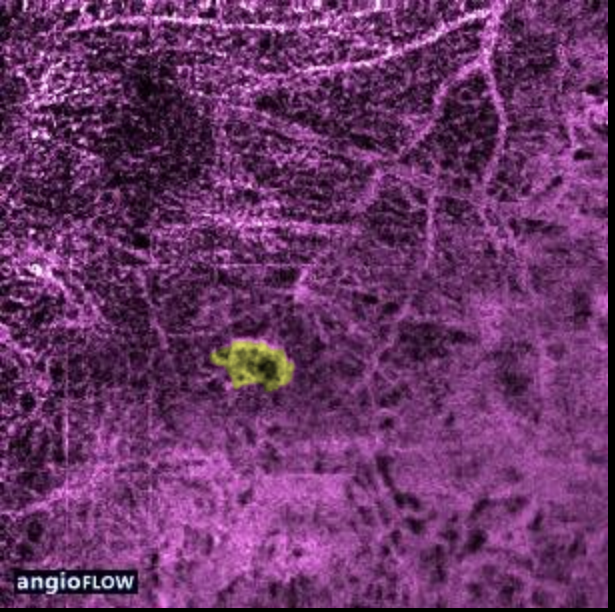
Type 3 NV

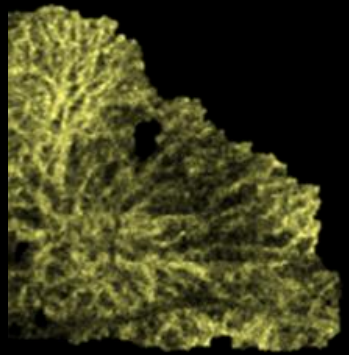


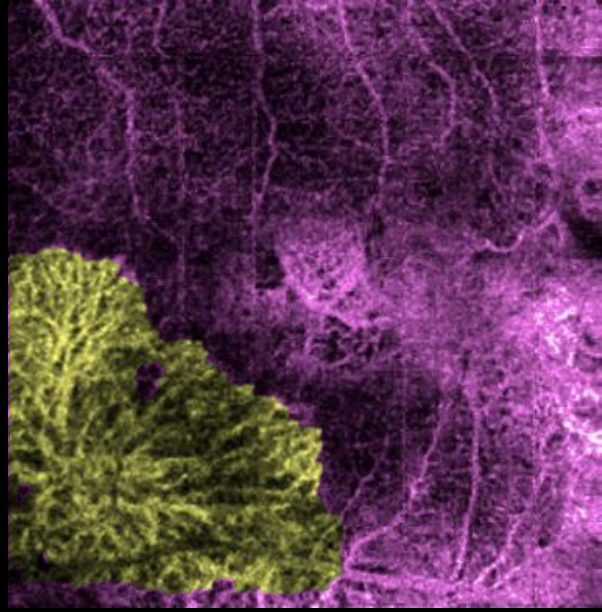


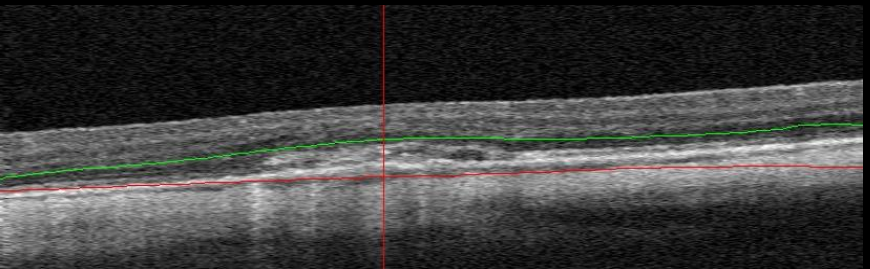


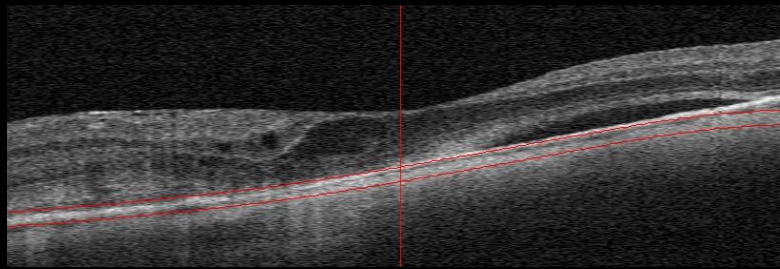
Myopic CNV











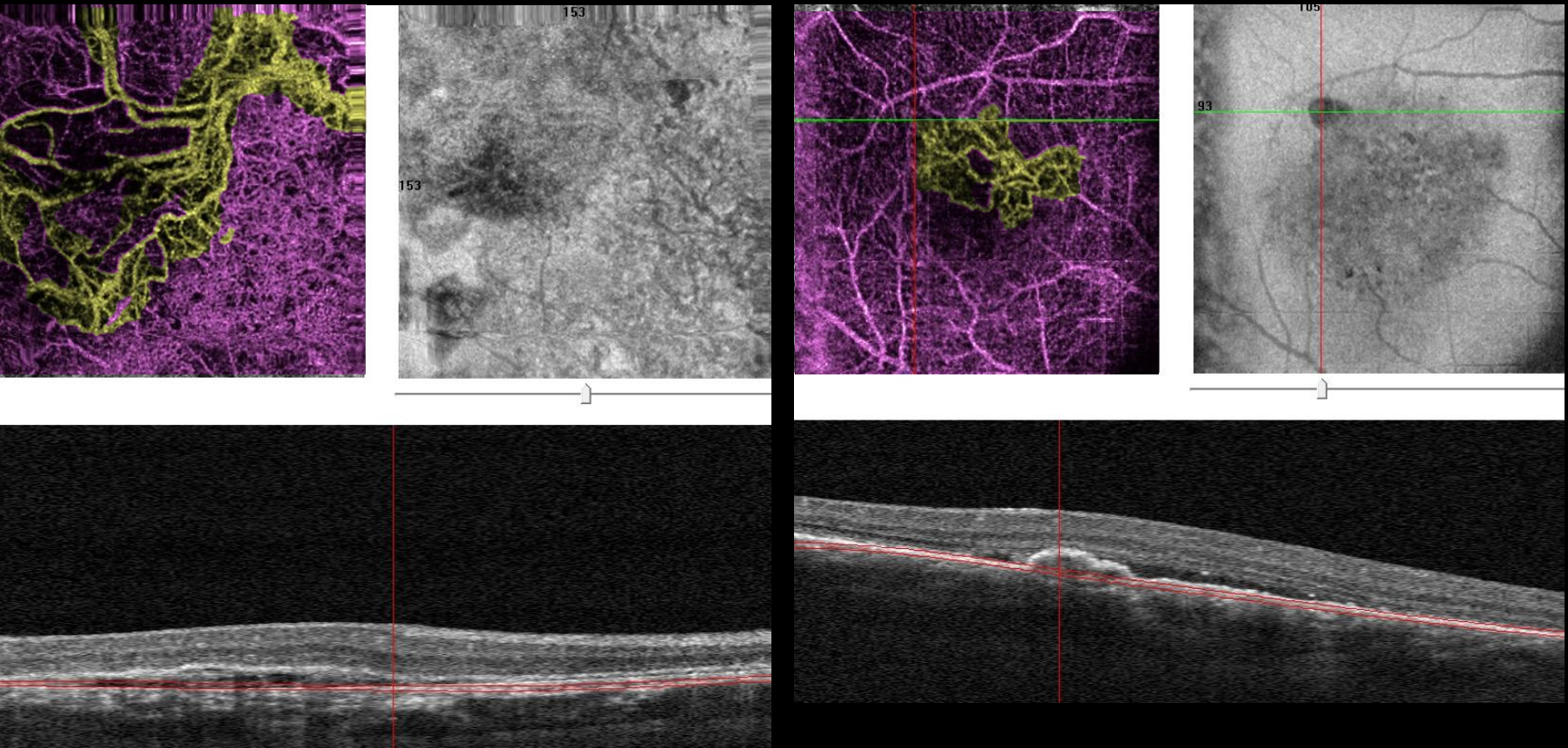
Filamentous CNVs

AMERICAN ACADEMY OF OPHTHALMOLOGY
The Eye M.D. Association

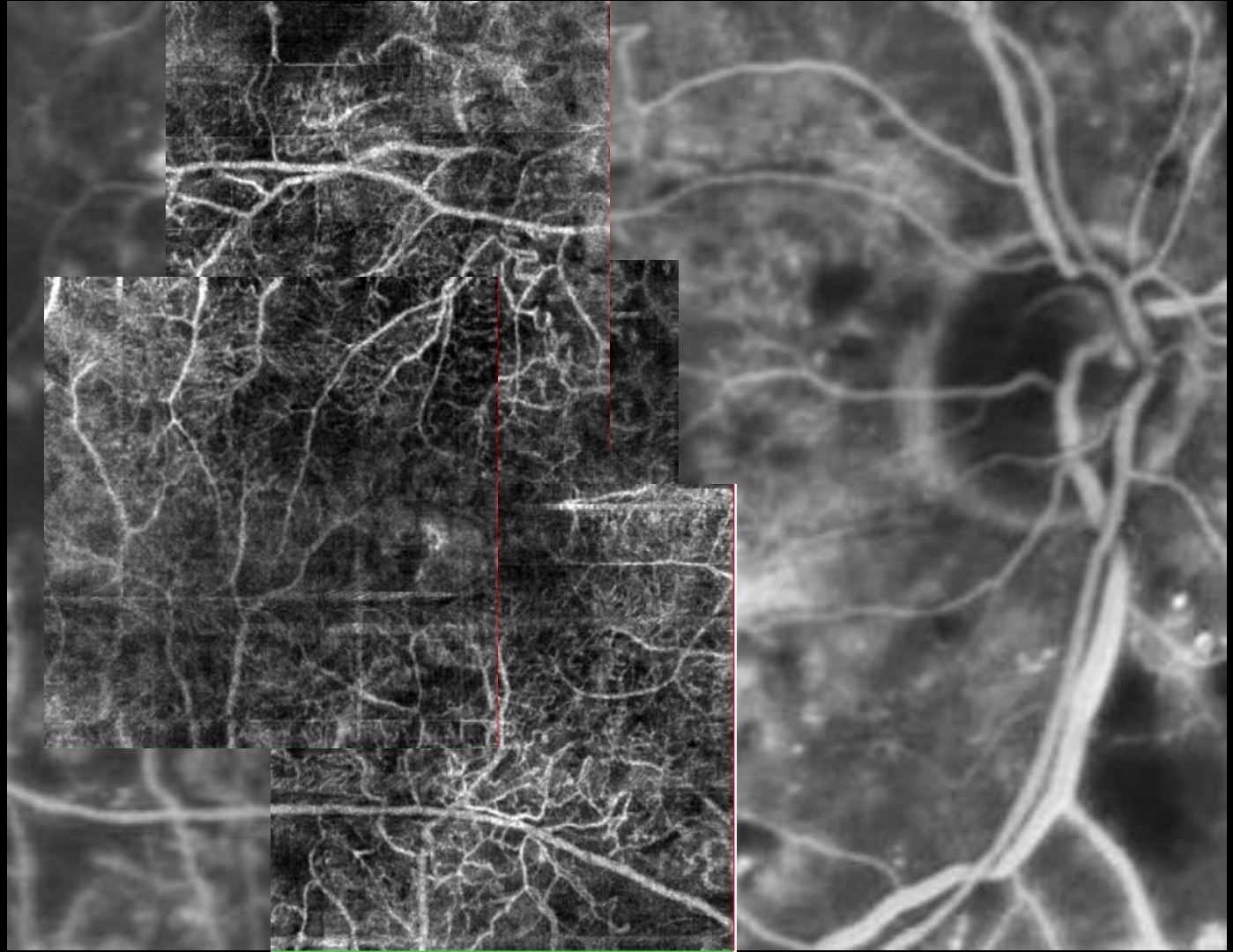
Spectral-Domain Optical Coherence Tomography Angiography of Choroidal Neovascularization

Talisa E. de Carlo, BA,[1,2] Marco A. Bonini Filho, MD, PhD,[1,3] Adam T. Chin, BA,[1] Mehreen Adhi, MD,[1,2] Daniela Ferrara, MD, PhD,[1] Caroline R. Baumal, MD,[1] Andre J. Witkin, MD,[1] Elias Reichel, MD,[1] Jay S. Duker, MD,[1] Nadia K. Waheed, MD, MPH[1]

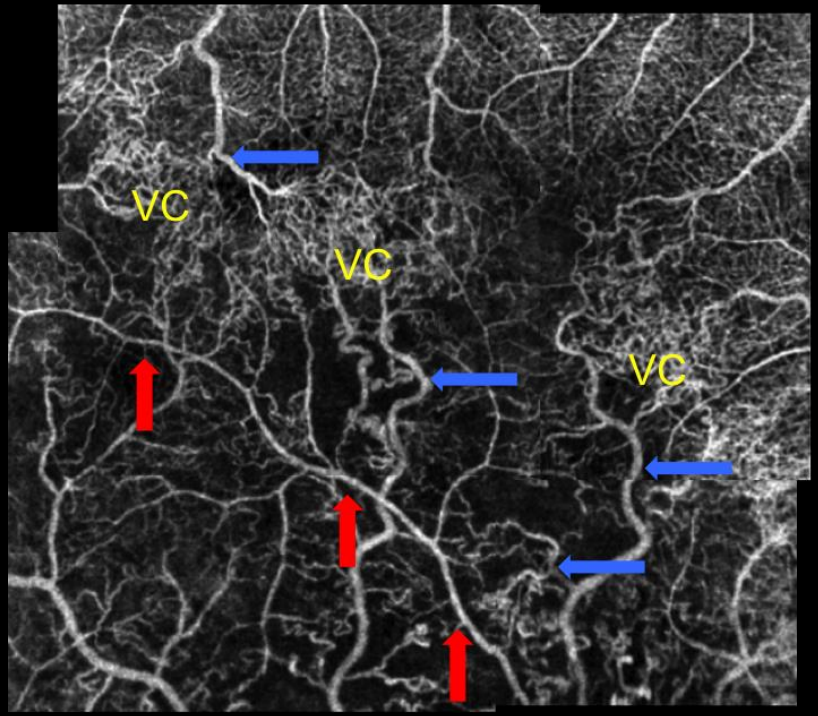
Filamentous CNV

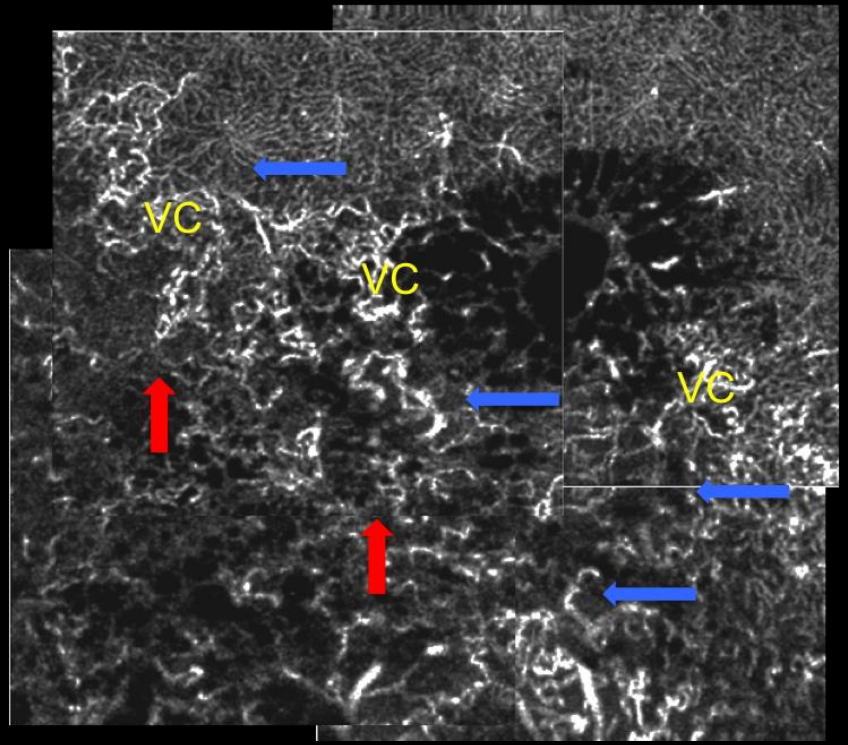


Diabetic edema

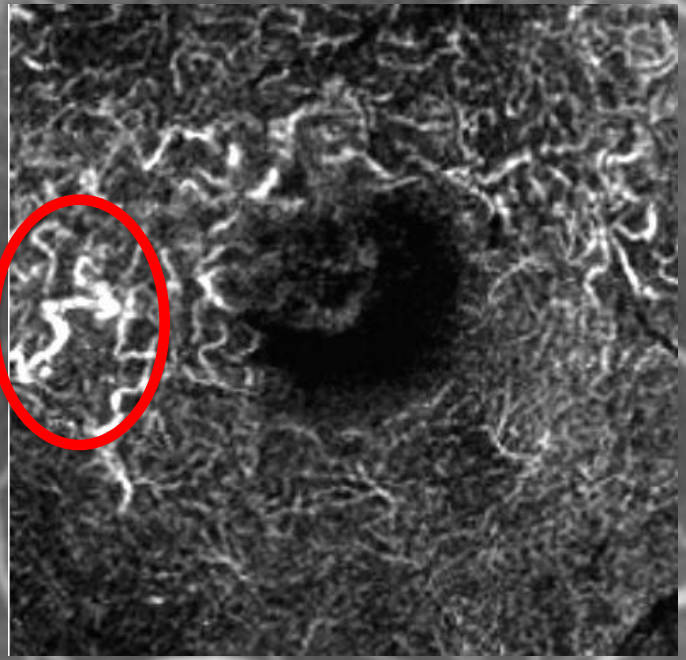


Brvo: vascular congestion

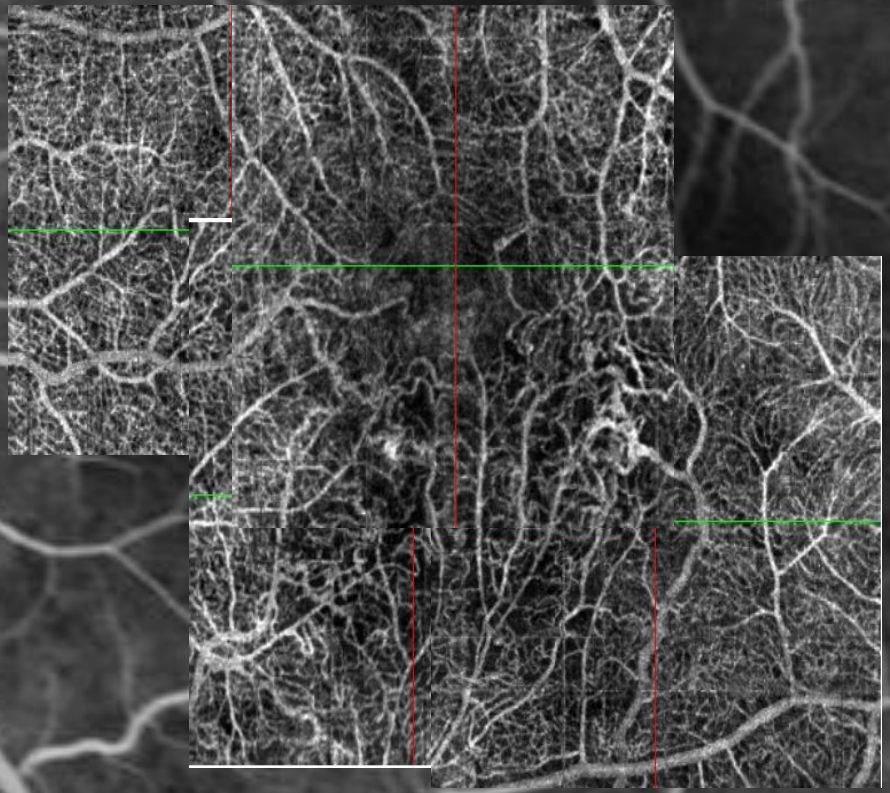


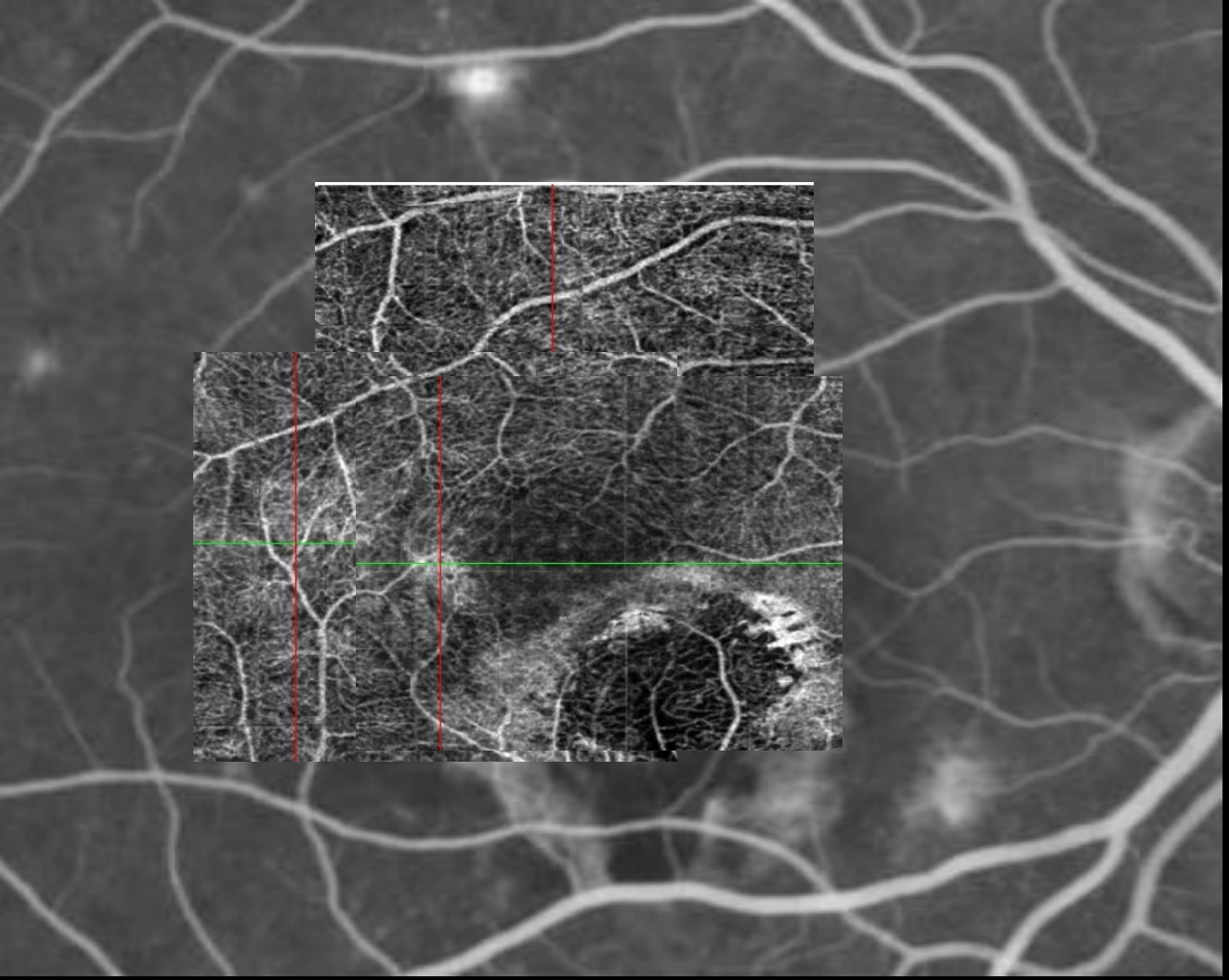


RVO



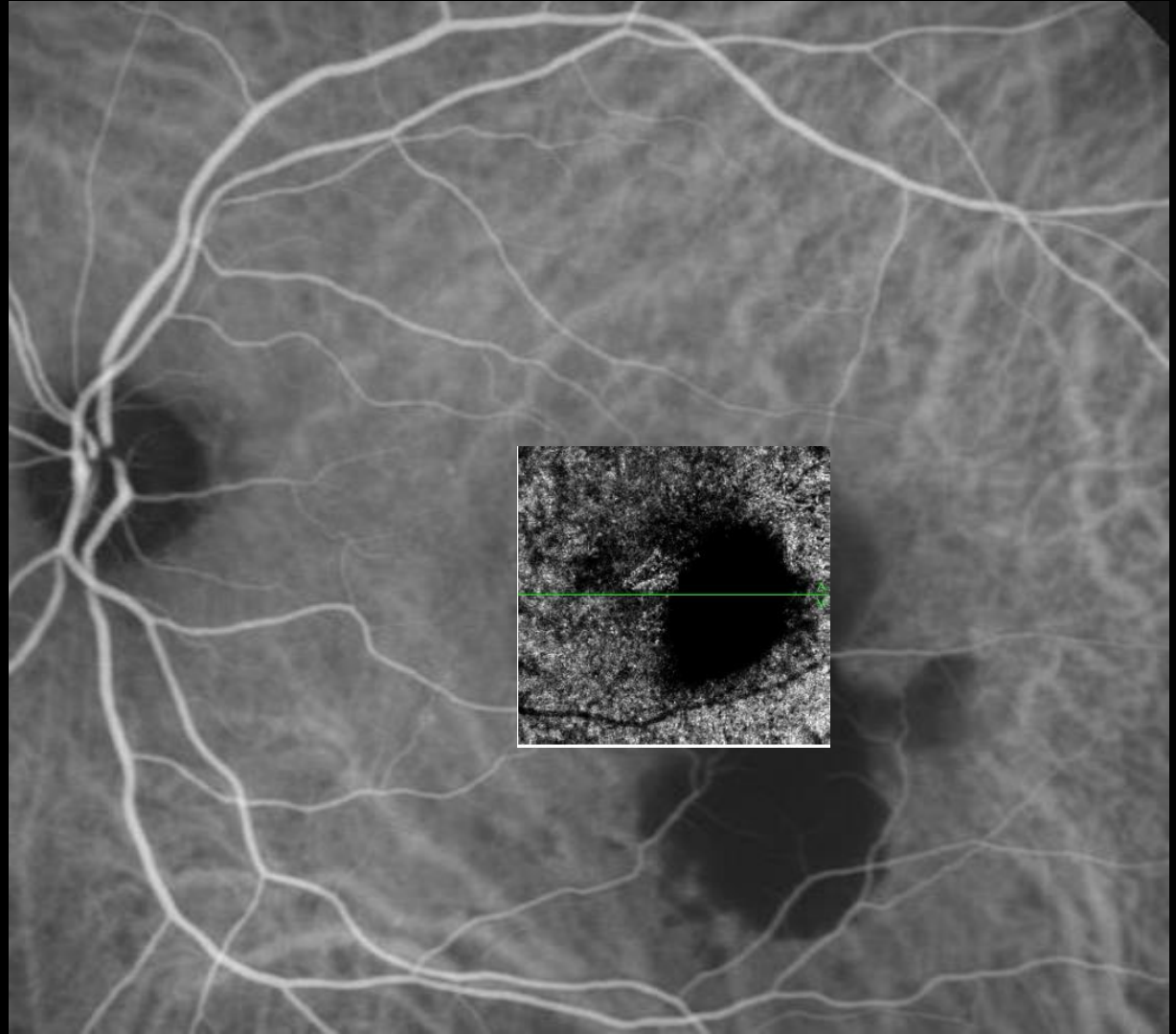
LEBER COATS





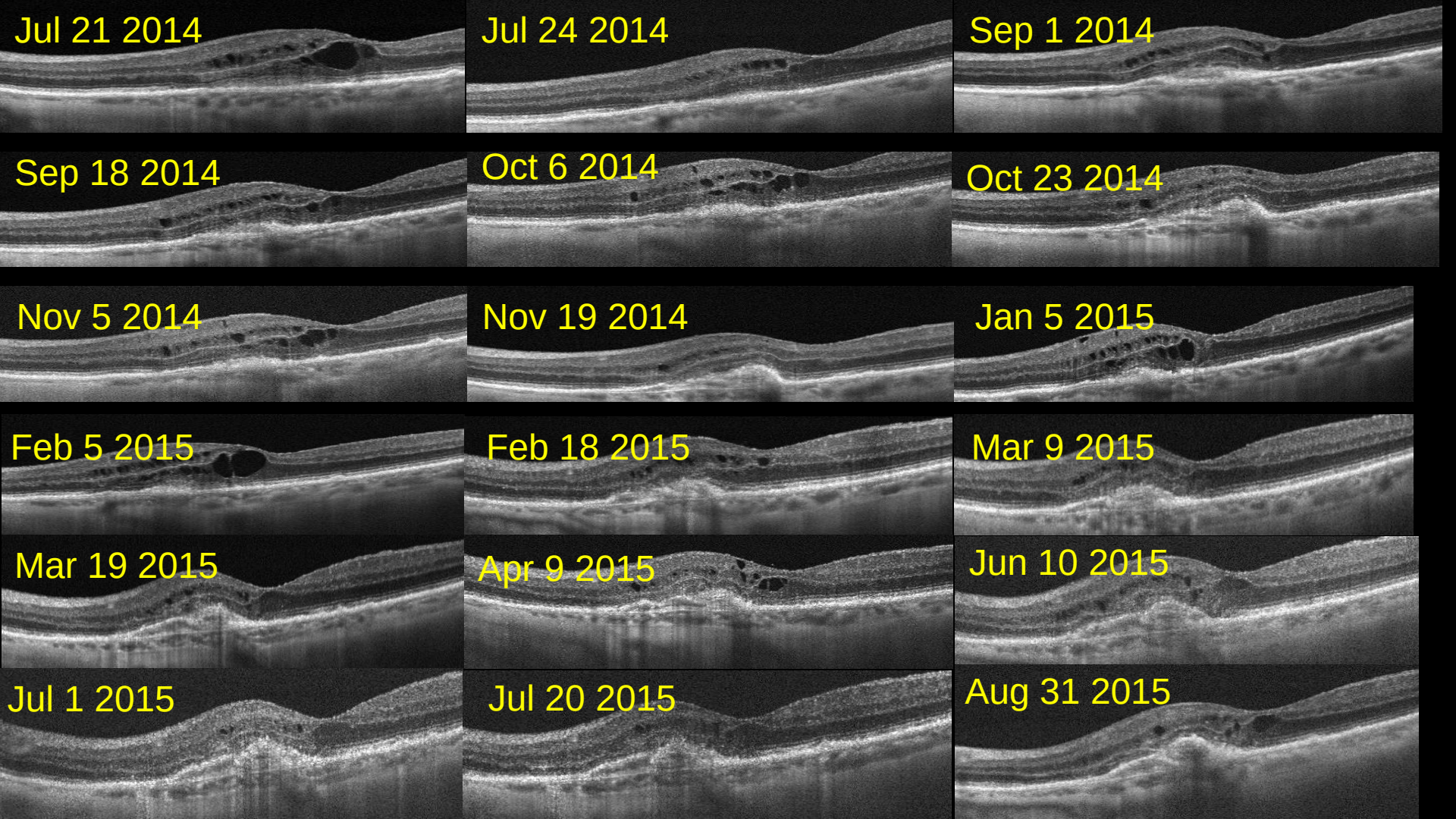
MULTIFOCAL CHOROIDITIS

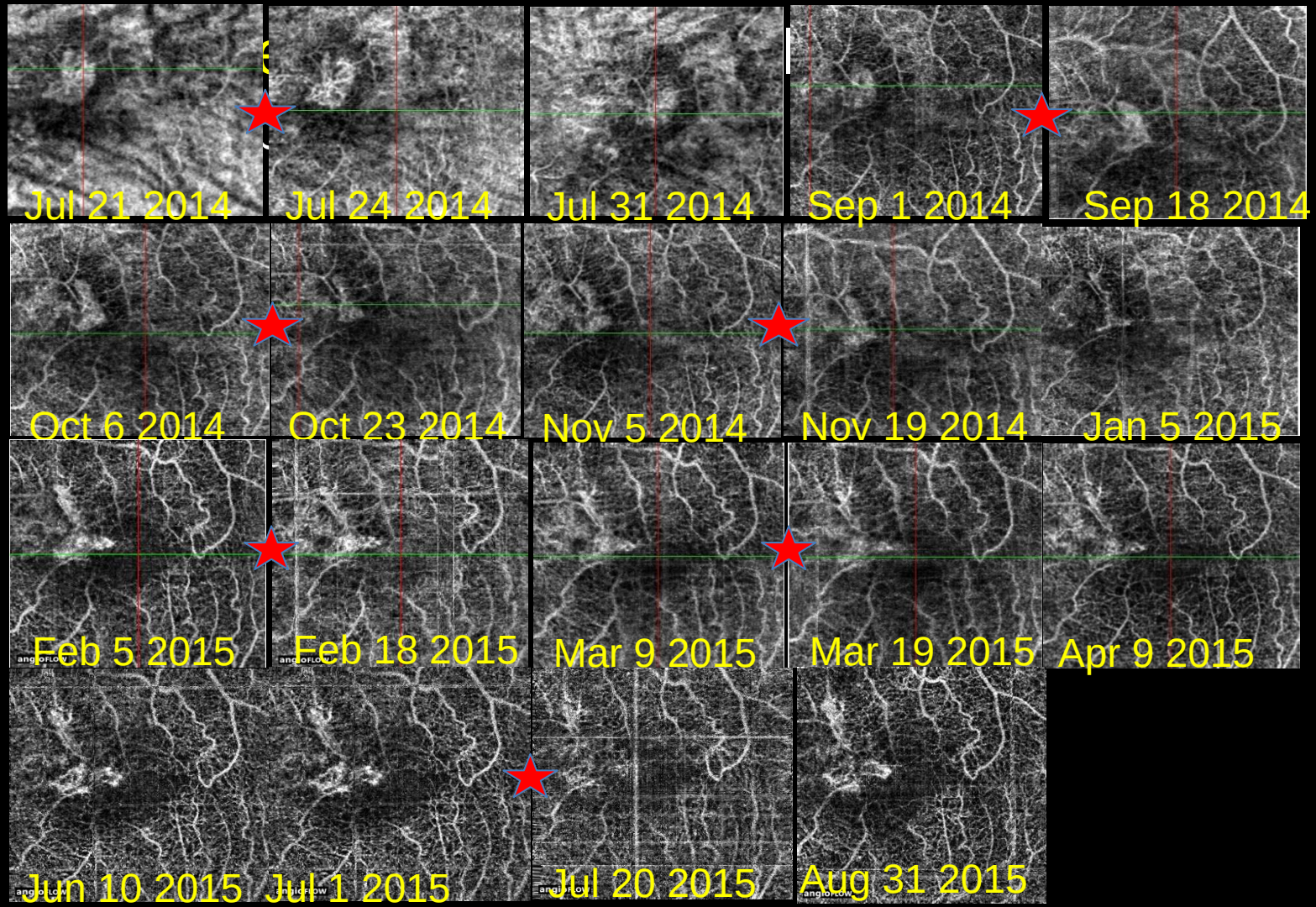
Full thickness analysis



OCT Angiography clinical case: AMD CNV monitoring after treatment

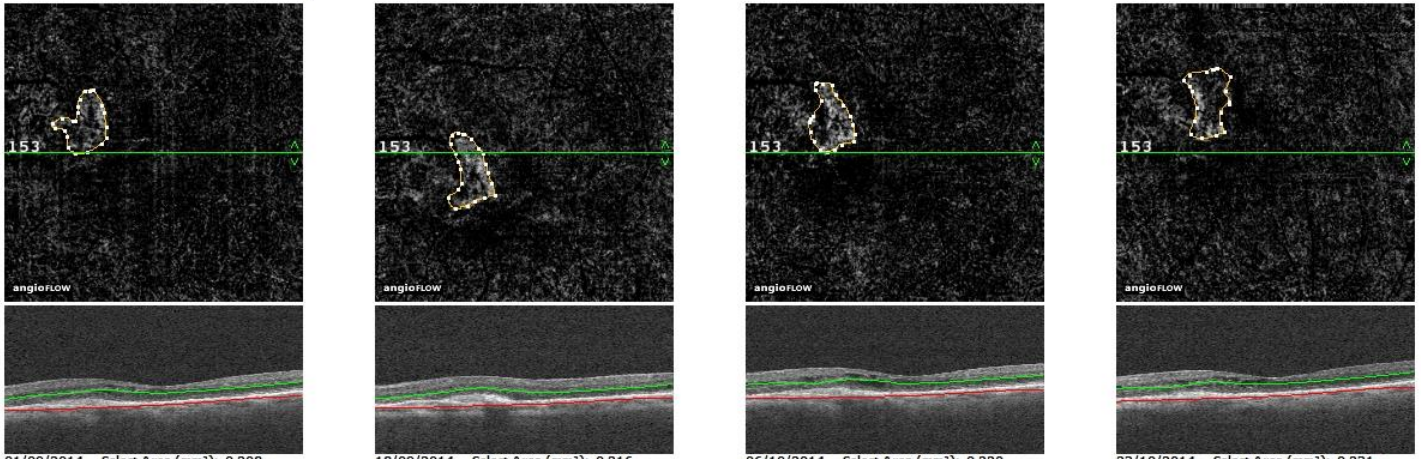
- Female, 83 yo, Emmetropic,
- Va 20/50, AMD, CNV type 2
- 13 months follow up
- OCT Angiography may give quantitative data in the CNV follow-up, that are not available with fluorescein angiography or ICG
- CNV area, VA, Retina Thickness at CNV level, Macular volume


Jul 21 2014
Jul 24 2014
Sep 1 2014
Sep 18 2014
Oct 6 2014
Oct 23 2014
Nov 5 2014
Nov 19 2014
Jan 5 2015
Feb 5 2015
Feb 18 2015
Mar 9 2015
Mar 19 2015
Apr 9 2015
Jun 10 2015
Jul 1 2015
Jul 20 2015
Aug 31 2015


Jul 21 2014
Jul 24 2014
Jul 31 2014
Sep 1 2014
Sep 18 2014
Oct 6 2014
Oct 23 2014
Nov 5 2014
Nov 19 2014
Jan 5 2015
Feb 5 2015
Feb 18 2015
Mar 9 2015
Mar 19 2015
Apr 9 2015
Jun 10 2015
Jul 1 2015
Jul 20 2015
Aug 31 2015

Angio Retina Change Analysis

Left / OS

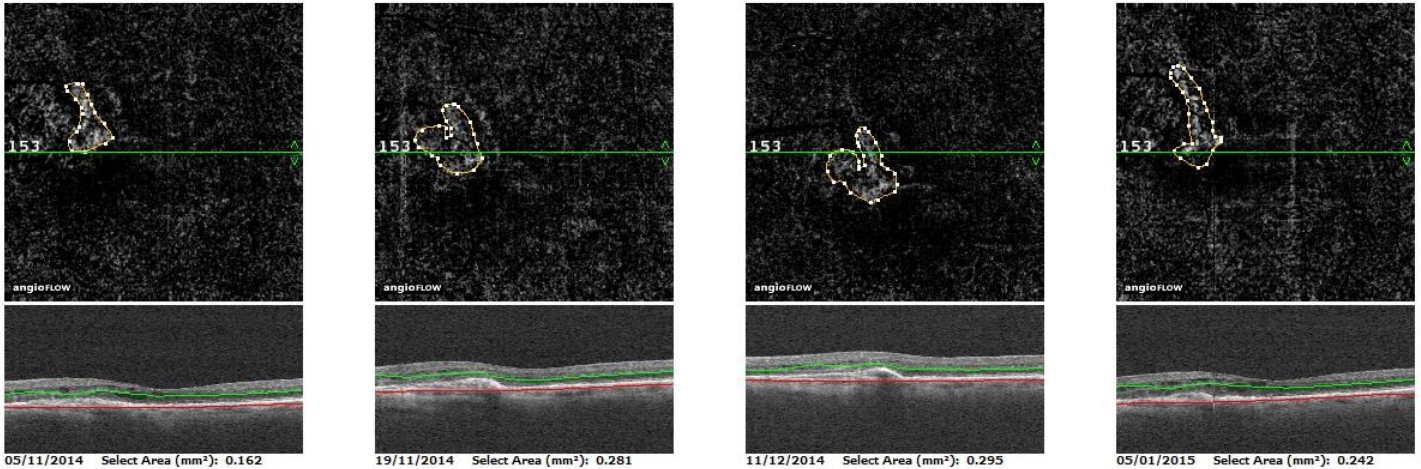


01/09/2014 Select Area (mm²): 0.208
Vessel Area (mm²): 0.120

18/09/2014 Select Area (mm²): 0.216
Vessel Area (mm²): 0.133

06/10/2014 Select Area (mm²): 0.220
Vessel Area (mm²): 0.138

23/10/2014 Select Area (mm²): 0.231
Vessel Area (mm²): 0.126



05/11/2014 Select Area (mm²): 0.162
Vessel Area (mm²): 0.106

19/11/2014 Select Area (mm²): 0.281
Vessel Area (mm²): 0.151

11/12/2014 Select Area (mm²): 0.295
Vessel Area (mm²): 0.169

05/01/2015 Select Area (mm²): 0.242
Vessel Area (mm²): 0.122

Reference
- ○ Superficial
- ○ Deep
- ◉ Outer Retina
- ○ Choroid Cap

Measurement
- ○ None
- ◉ Flow Area
- ○ Non Flow Area

- ☐ Invert
- ☐ Color
- ☑ Show Bnd

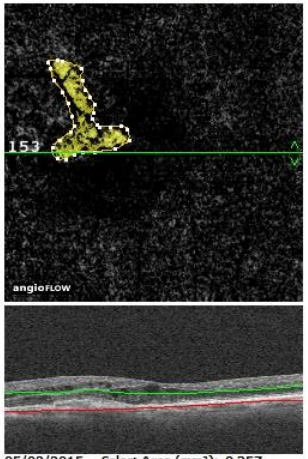
- ◉ Angio
- ○ OCT

Print | Change Analysis

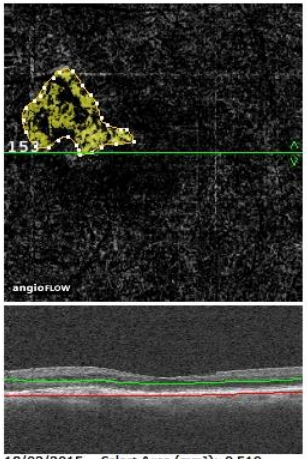
optovue

Angio Retina Change Analysis

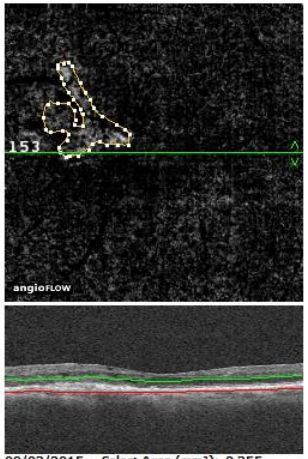
Left / OS



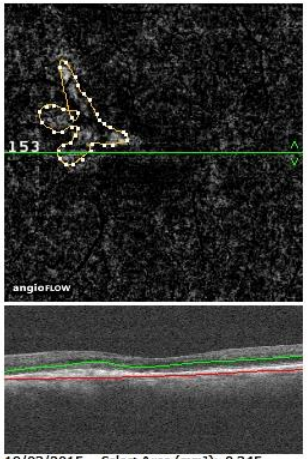
05/02/2015 Select Area (mm²): 0.357
Vessel Area (mm²): 0.200



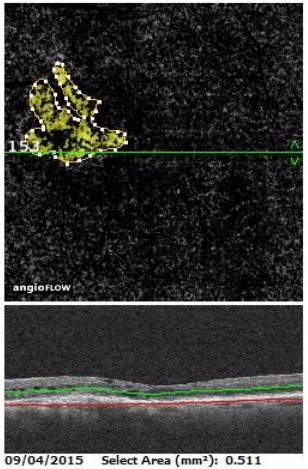
18/02/2015 Select Area (mm²): 0.519
Vessel Area (mm²): 0.279



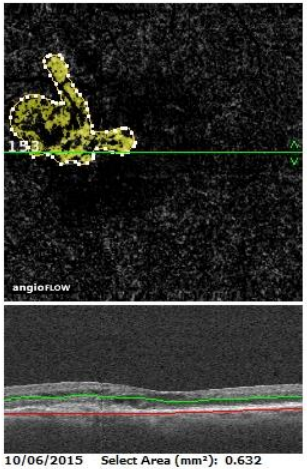
09/03/2015 Select Area (mm²): 0.355
Vessel Area (mm²): 0.220



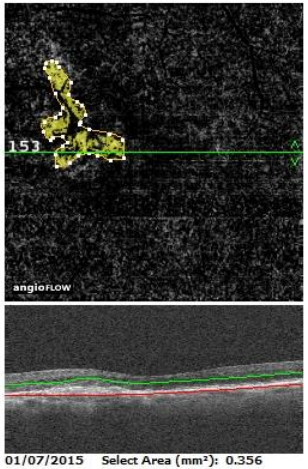
19/03/2015 Select Area (mm²): 0.345
Vessel Area (mm²): 0.185



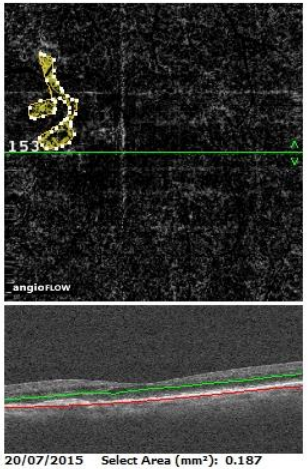
09/04/2015 Select Area (mm²): 0.511
Vessel Area (mm²): 0.255



10/06/2015 Select Area (mm²): 0.632
Vessel Area (mm²): 0.337



01/07/2015 Select Area (mm²): 0.356
Vessel Area (mm²): 0.198



20/07/2015 Select Area (mm²): 0.187
Vessel Area (mm²): 0.107

Reference

- ○ Superficial
- ○ Deep
- ◉ Outer Retina
- ○ Choroid Cap

Measurement

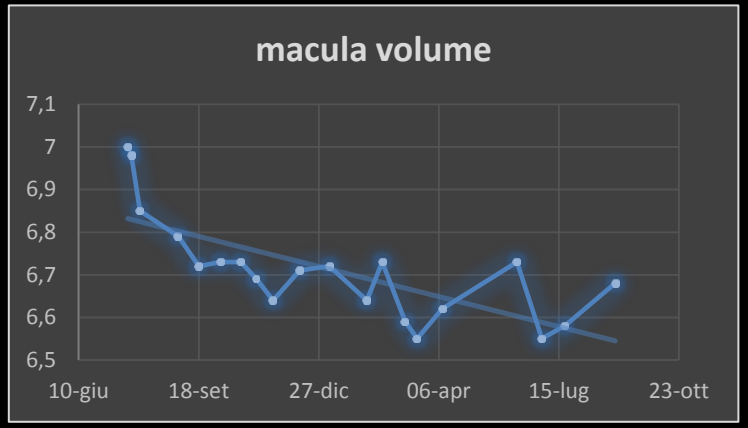
- ○ None
- ◉ Flow Area
- ○ Non Flow Area

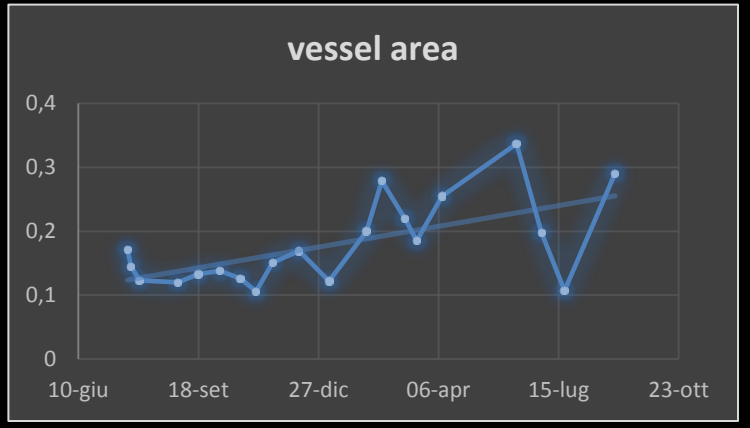
- ☐ Invert
- ☐ Color
- ☑ Show Bnd

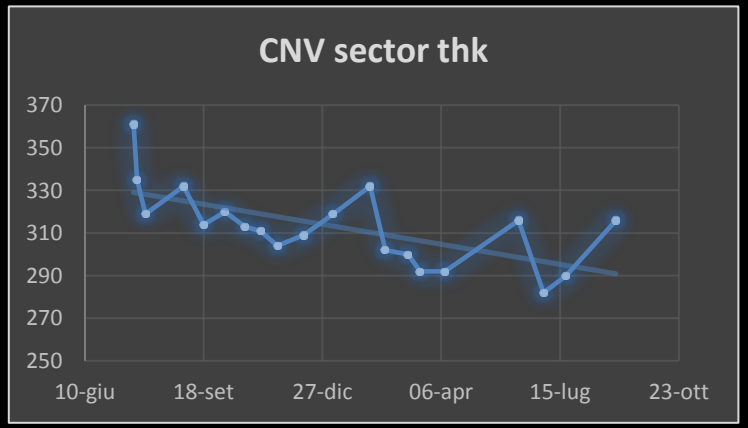
- ◉ Angio
- ○ OCT

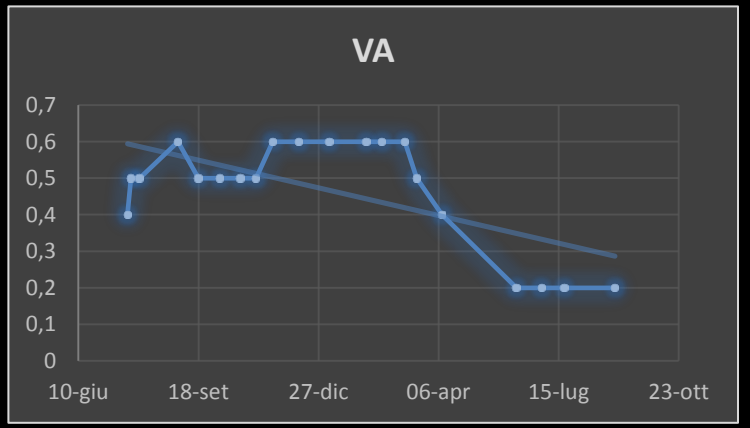
Print | Change Analysis

optovue

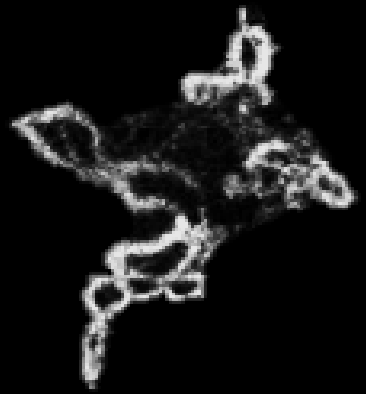

macula volume
7,1
7
6,9
6,8
6,7
6,6
6,5
10-giu
18-set
27-dic
06-apr
15-lug
23-ott


vessel area
0,4
0,3
0,2
0,1
0
10-giu
18-set
27-dic
06-apr
15-lug
23-ott


CNV sector thk
370
350
330
310
290
270
250
10-giu
18-set
27-dic
06-apr
15-lug
23-ott


VA
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
10-giu
18-set
27-dic
06-apr
15-lug
23-ott

Time progress



Preliminary impressions

- **CNV flow decreases 24 hours after injection and reopens after 4 weeks**
- **CNV area decreases sharply after the first injection,and decreased even more after the other injections**
- **CNV flow and area do not relate**
- **Vision increase in this case is related to decrease CNV activity**
- **Same main vessels reappear after 4 weeks**

conclusions

OCT angiography is a modern imaging technique adding functional data and quantification on the classic structural OCT examination.

Rome, December 11-12, 2015

Hotel NH Vittorio Veneto – Corso d'Italia, 1

Third International "En Face" OCT and OCT Angiography Congress

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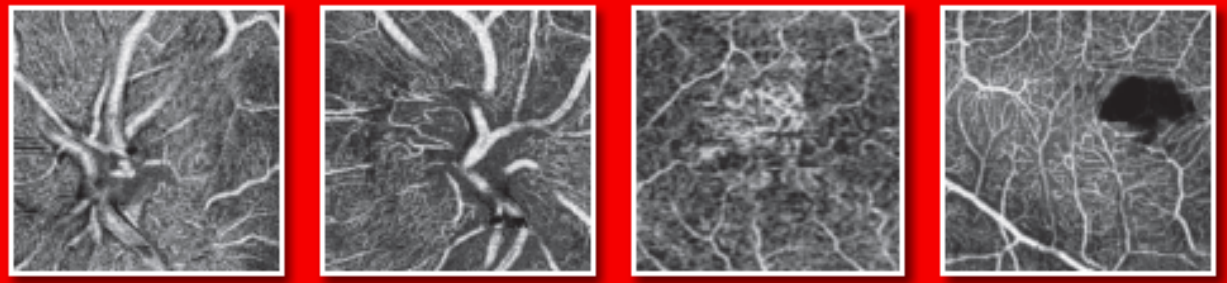
Martine Mauget Faysse (Lyon), Andre Romano (São Paulo), Marco Rispoli (Rome), Nadia Waheed (Boston), Yali Jia (Portland)



Thank you