



Clinical Pearls in the Management of Diabetic Retinopathy

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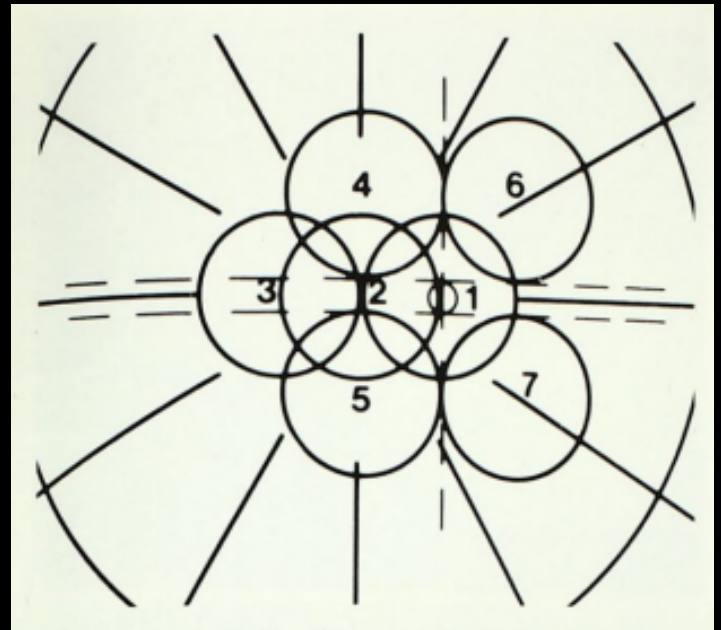
I have no financial disclosures

Objectives

- To review the **standard classification** of diabetic retinopathy
- To advance **clinical examination skills** in the evaluation of patients with diabetic retinopathy
- To improve evaluation of **diagnostic testing** in patients with diabetic retinopathy

ETDRS

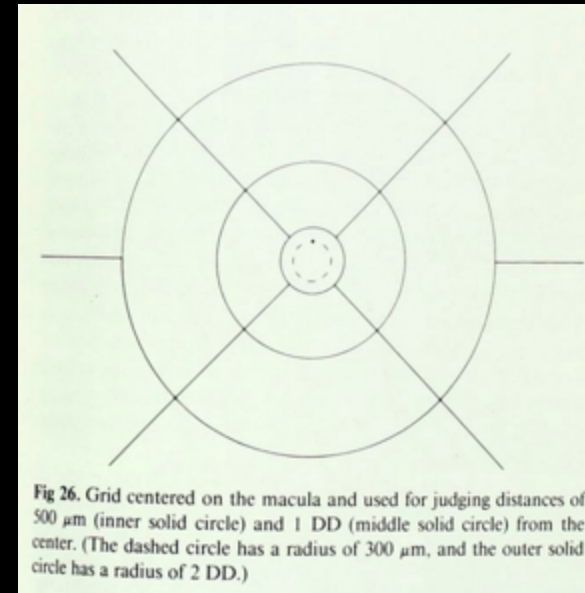
- 7 field stereoscopic photographs
- Classified retinopathy into 13 levels ranging from 10 (no retinopathy) to 85 (severe VH and TRD involving macula)



Early Treatment Diabetic Retinopathy Study Research Group. Grading Diabetic Retinopathy from Stereoscopic Color Fundus Photographs-An Extension of the Modified Airle House Classification. ETDRS Report Number 10. *Ophthalmology*. 1991; 98; 786-806.

ETDRS

- Definition of CSME
 - **Thickening** of the retina at or within 500 μ m of the center of the macula
 - Hard exudate at or within 500 μ m of the center of the macula associated with **thickening** of adjacent retina
 - A zone of retinal **thickening** 1 disc area or larger, within 1 disc diameter of the center of the macula



ETDRS

- 4-2-1 Rule for Severe NPDR
 - 4 quadrants with significant intraretinal hemorrhages
 - 2 quadrants with venous beading
 - 1 quadrant with IRMA



International Classification of Diabetic Retinopathy

Table 1: International Classification of Diabetic Retinopathy and Diabetic Macular Edema

Diabetic Retinopathy	Findings Observable on Dilated Ophthalmoscopy
No apparent DR	No abnormalities
Mild nonproliferative DR	Microaneurysms only
Moderate nonproliferative DR	Microaneurysms and other signs (e.g., dot and blot hemorrhages, hard exudates, cotton wool spots), but less than severe nonproliferative DR
Severe nonproliferative DR	Moderate nonproliferative DR with any of the following: <ul style="list-style-type: none">• Intraretinal hemorrhages (≥ 20 in each quadrant);• Definite venous beading (in 2 quadrants);• Intraretinal microvascular abnormalities (in 1 quadrant);• and no signs of proliferative retinopathy
Proliferative DR	Severe nonproliferative DR and 1 or more of the following: <ul style="list-style-type: none">• Neovascularization• Vitreous/preretinal hemorrhage

C. Wilkinson et al. Proposed International Clinical Diabetic Retinopathy and Diabetic Macular Edema Disease Severity Scales. *Ophthalmology*. 2003;110:1677-1682

ETDRS

- Completed 1989

Table 2a. Re-examination and Referral Recommendations Based on International Classification of Diabetic Retinopathy* and Diabetic Macular Edema for High Resource Settings.

Diabetic Retinopathy (DR)		
Classification	Re-examination Or next screening schedule	Referral to Ophthalmologist
No apparent DR, mild nonproliferative DR and no DME	Re-examination in 1-2 year	Referral not required
Mild nonproliferative DR	6-12 months	Referral not required
Moderate nonproliferative DR	3-6 months	Referral required
Severe nonproliferative DR	< 3-months	Referral required
PDR	< 1 month	Referral required
Diabetic Macular Edema (DME)		
Classification	Re-examination Or next screening schedule	Referral to Ophthalmologist
Noncentral-involved DME	3 months	Referral required
Central-involved DME	1 month	Referral required

* In cases where diabetes is controlled.

<http://www.icoph.org/downloads/ICOGuidelinesforDiabeticEyeCare.pdf>

Which eye is Severe?



A



B

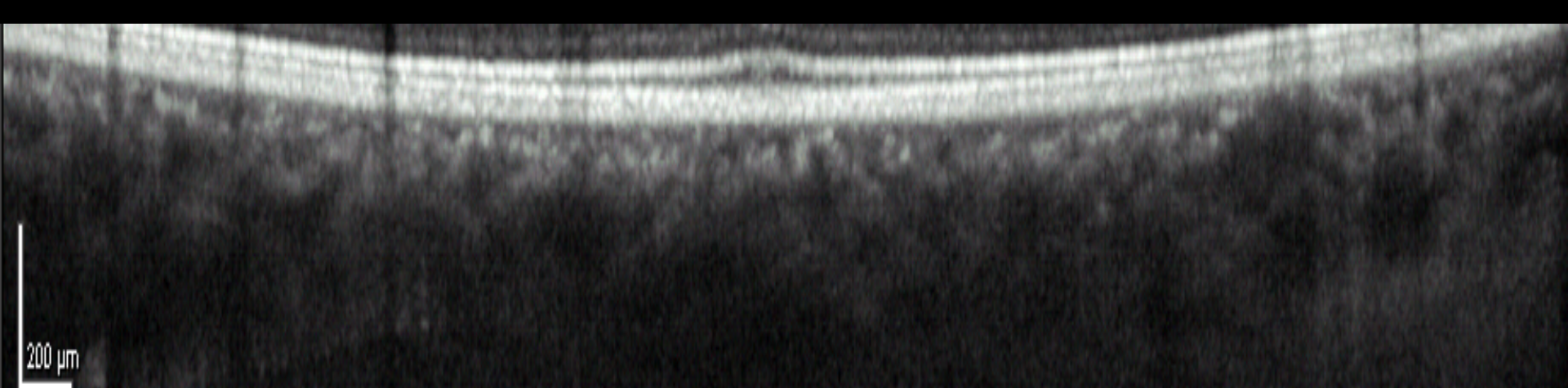
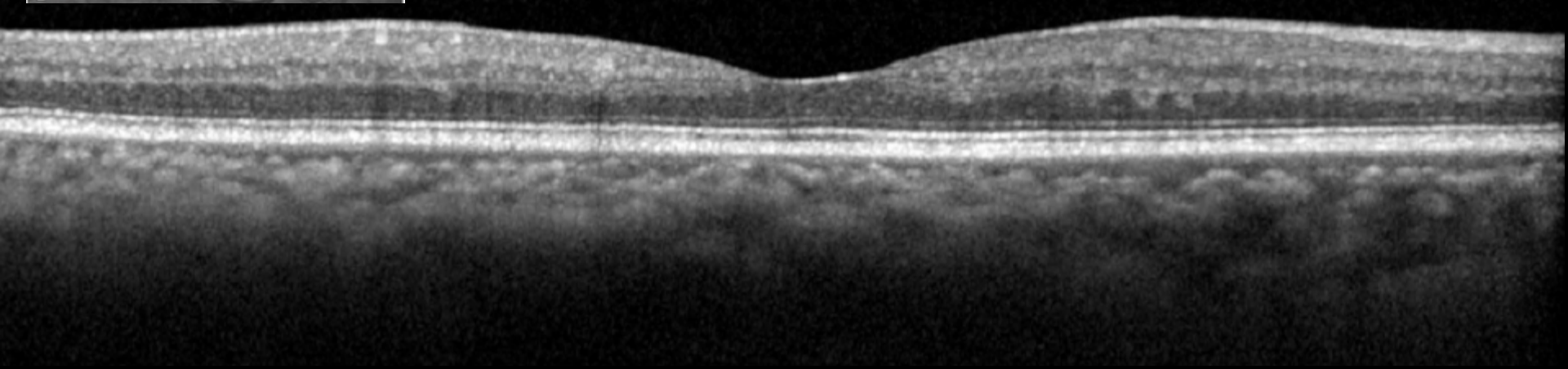
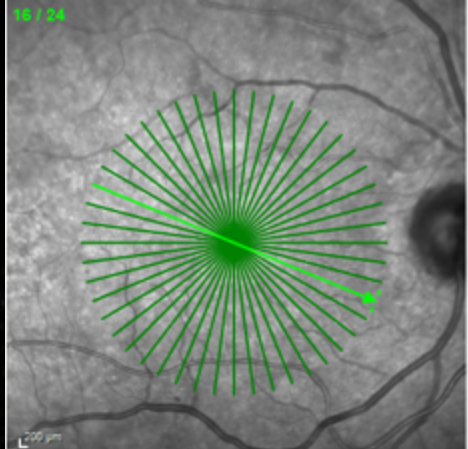
Case 1

Case 1

- 59 year old AAM
 - Type 2 DM x 5 years
 - Initial BS at time of Dx was 600
 - Last A1c 7.2%
 - HTN
 - (+) smoker
- CC: Annual eye exam. Dx with mild NPDR x 1 year
- BCVA: 20/20 OD, 20/20 OS







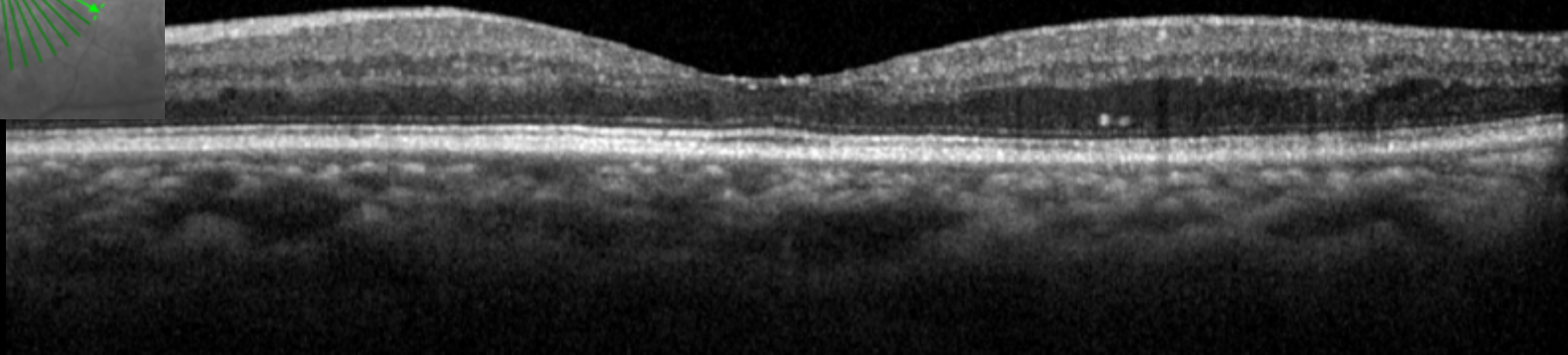
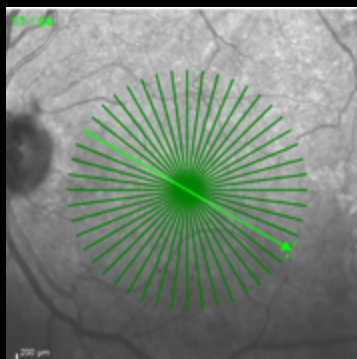
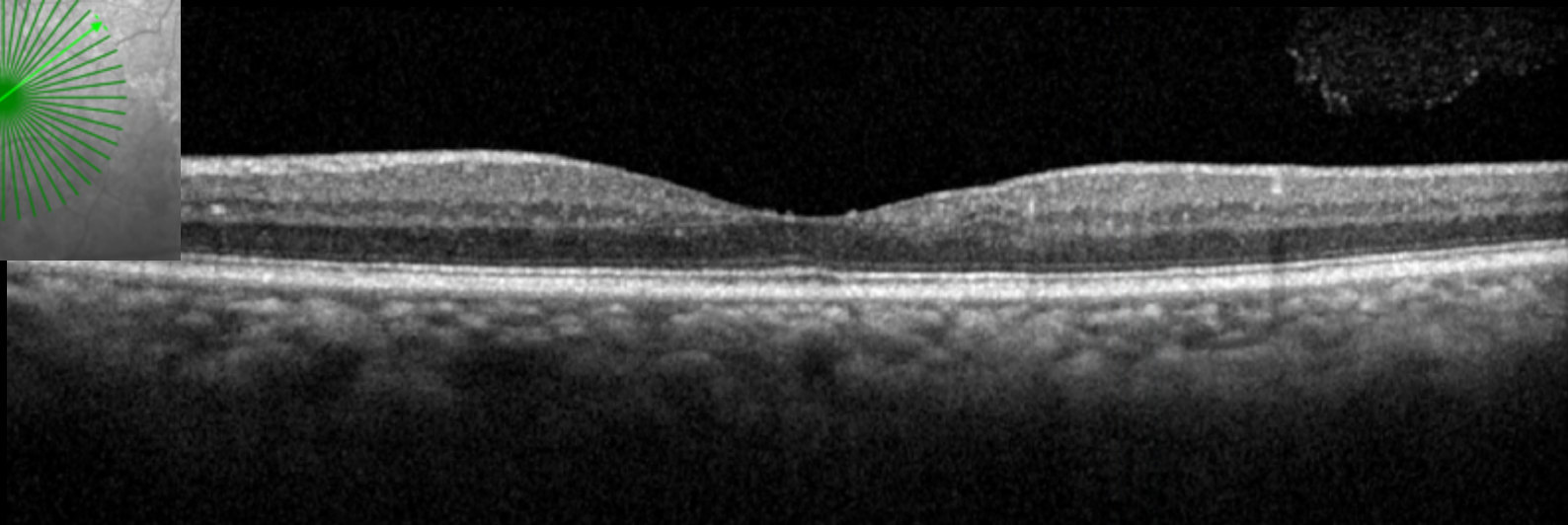
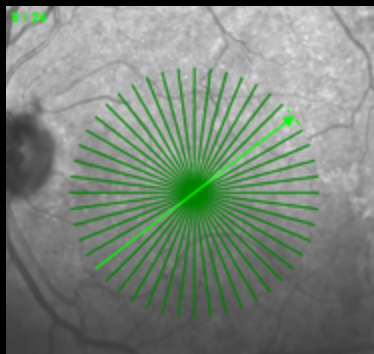
Diabetic Macular Edema	Findings Observable on Dilated Ophthalmoscopy [#]
No DME	No retinal thickening or hard exudates in the macula
Noncentral-involved DME	Retinal thickening in the macula that does not involve the central subfield zone that is 1mm in diameter
Central-involved DME	Retinal thickening in the macula that does involve the central subfield zone that is 1mm in diameter

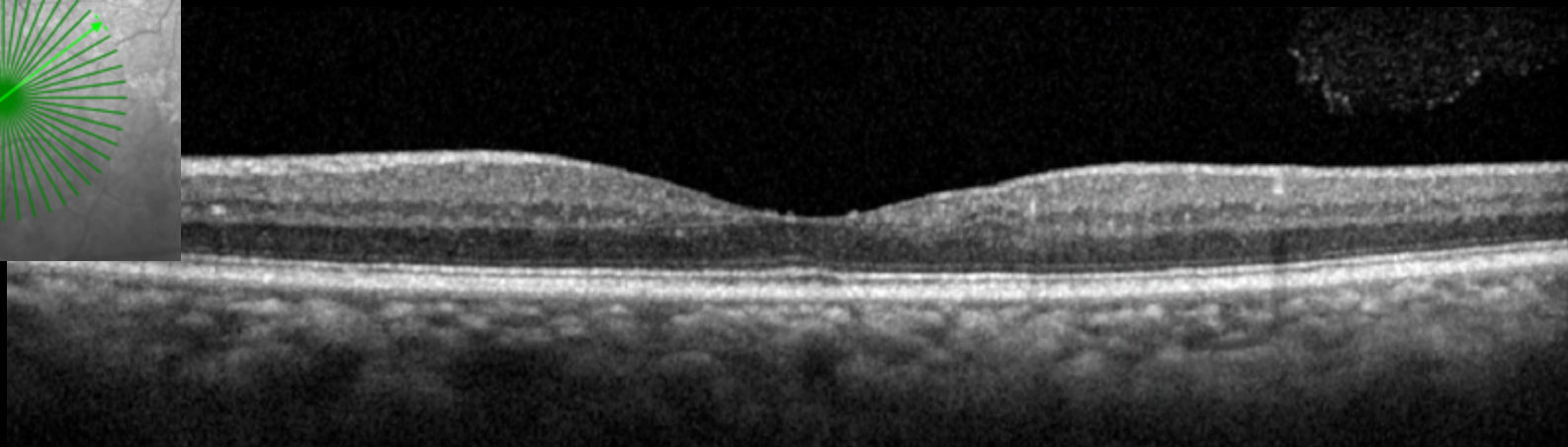
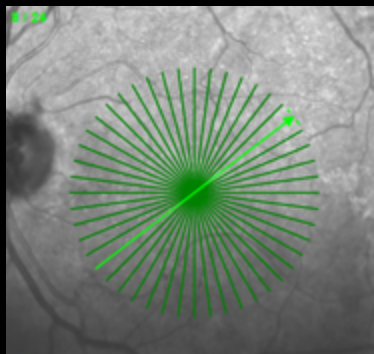
[#] Hard exudates are a sign of current or previous macular edema. DME is defined as retinal thickening, and this requires a three-dimensional assessment that is best performed by a dilated examination using slit-lamp biomicroscopy and/or stereo fundus photography.

3.2.3 Ancillary Tests (High Resource Settings)

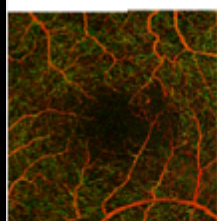
- OCT is the most sensitive method to identify DME. OCT can provide quantitative assessment of DME to determine the severity of DME. Retinal map scan is useful in locating the area with retinal thickening; single scan is useful in detailing the types of DME as diffuse, cystic changes, sub-retinal fluid/detachment, and vitreoretinal traction.
- Fundus photography is a useful way of recording the disease activity. It is useful in determining detailed severity of the disease.
- Fluorescein angiography is not required to diagnose DR, proliferative DR or DME, all of which are diagnosed by means of fundus examination.
- Fluorescein angiography can be used as a guide to evaluate retinal non-perfusion area, presence of retinal neovascularization, and microaneurysms or macular capillary non-perfusion in DME.

<http://www.icoph.org/downloads/ICOGuidelinesforDiabeticEyeCare.pdf>

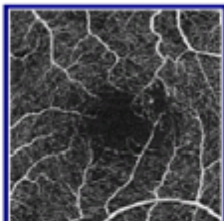




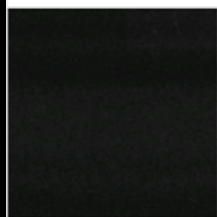
Angiography Analysis : Angiography 3x3 mm



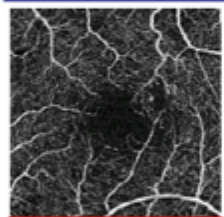
Retina Depth Encoded



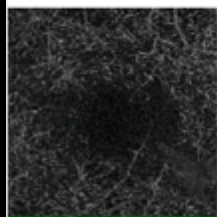
Retina



VRI



Superficial

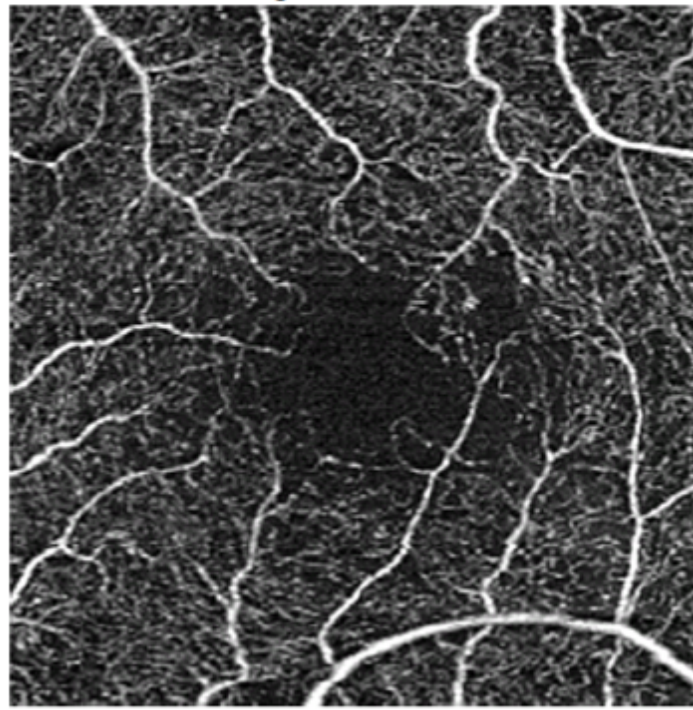


Deep



Avascular

AngioPlex - Retina



Assessment and plan

- Moderate NPDR OU
 - OD without macular edema, OS with macular edema
 - Monitor in 3 months with repeat OCT
 - Educate patient regarding importance of blood sugar control and compliance with follow up care.

Clinical Pearl



OCT is useful in detection of macular edema as well as ischemic atrophy

Sim DA, Keane PA, Fung S, et al. Quantitative Analysis of Diabetic Macular Ischemia Using Optical Coherence Tomography. *Investig Ophthalmology Vis Sci*. 2014;55(1):417.

HoByeon S et al. Foveal Ganglion Cell Layer Damage in Ischemic Diabetic Maculopathy: Correlation of Optical Coherence Tomographic and Anatomic Changes. *Ophthalmology*. 2009; 116(10):1949-59.

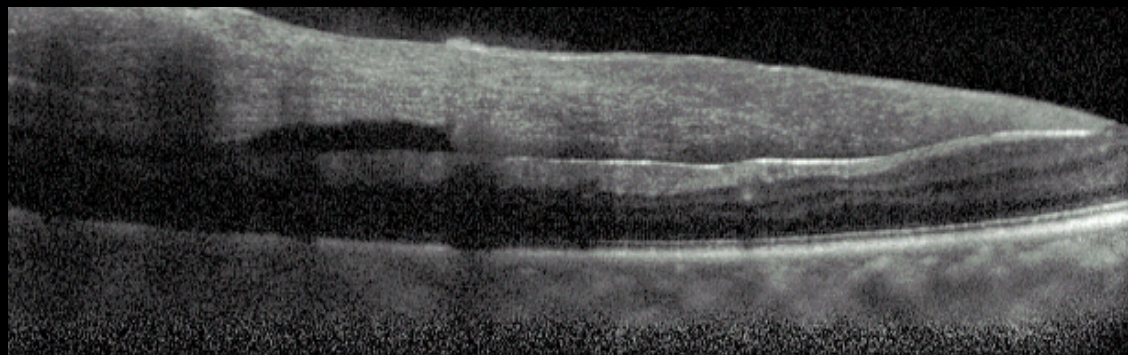
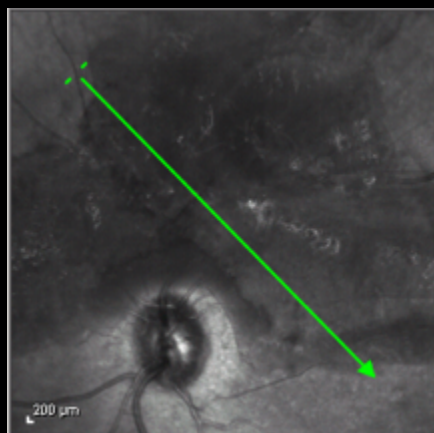
Case 2

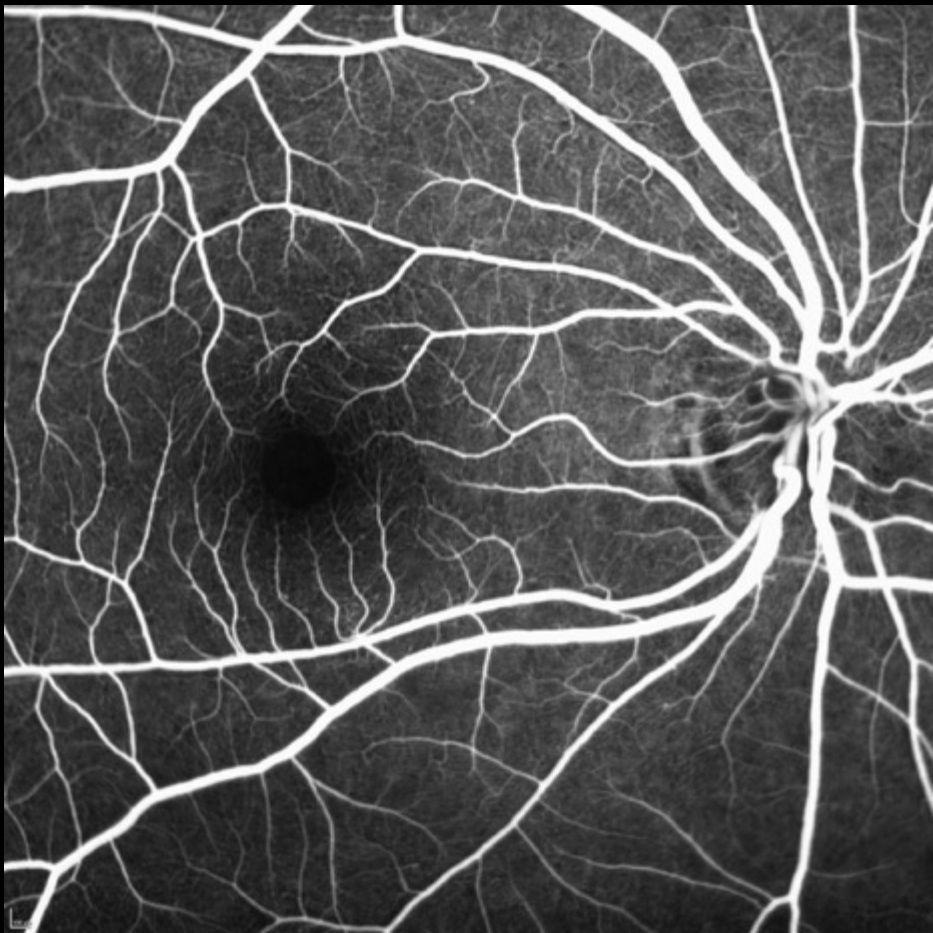
Case 2

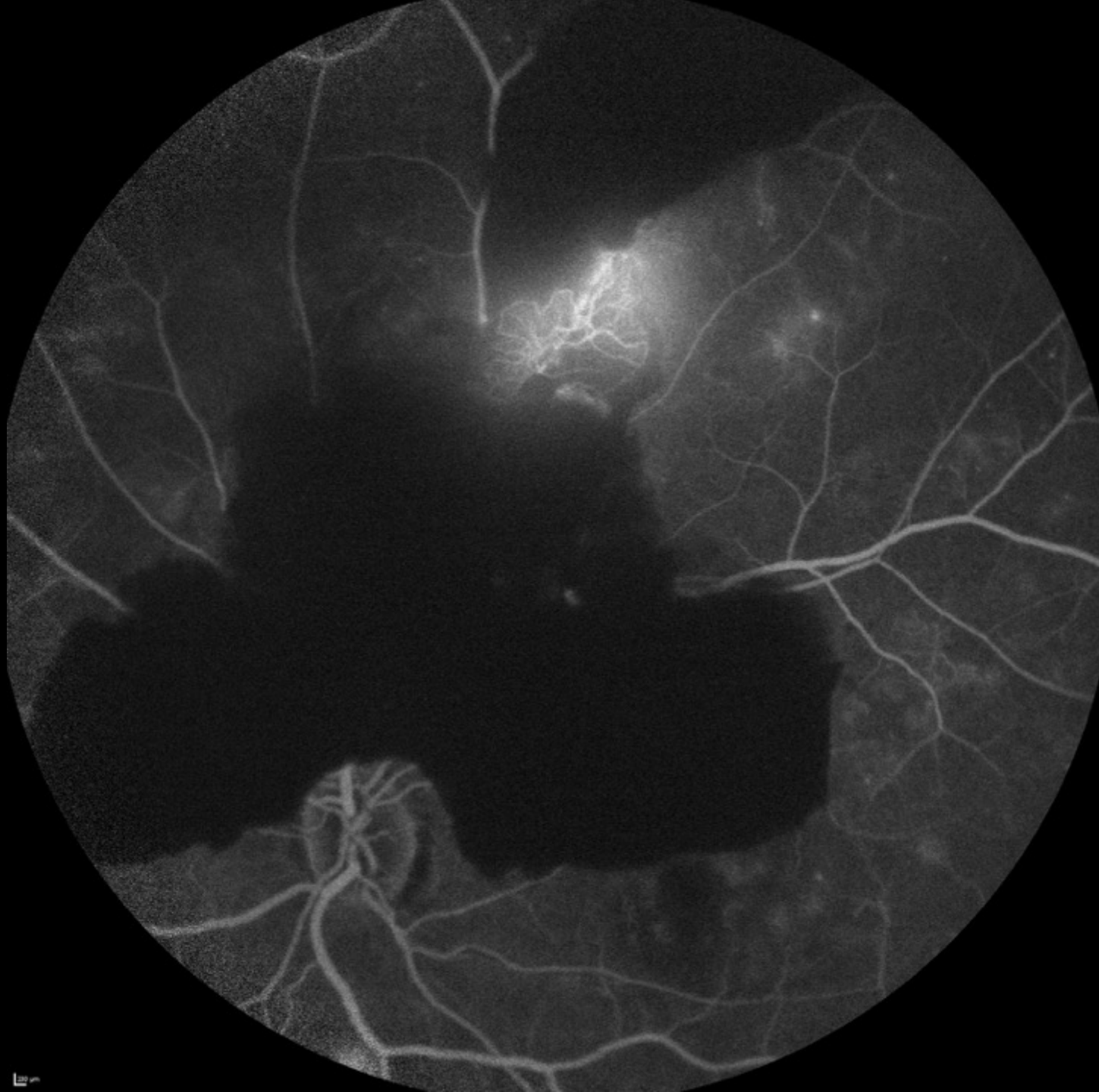
- 51 Year old AAF
 - Type 1 DM dx in childhood; last A1c 6.7
 - HTN, high cholesterol
 - Was seen in outside clinic 6 wks prior with Dx of mild NPDR, told to RTC 1 year.
- CC: Red spot in bottom of vision x 1 day
- BCVA: 20/20 OD, 20/20 OS

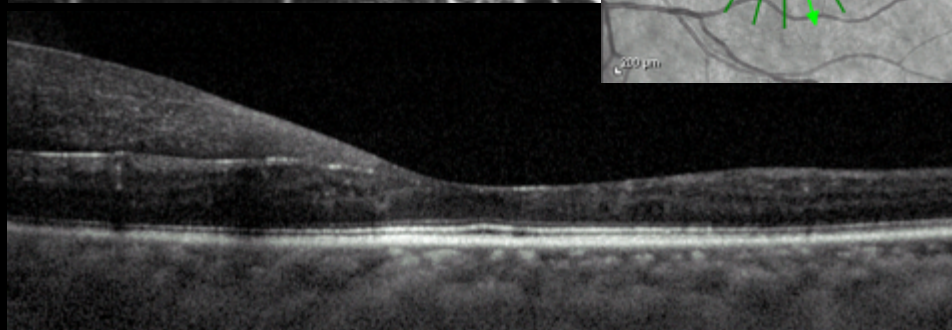
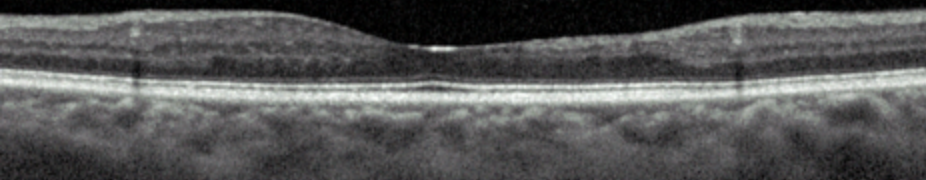
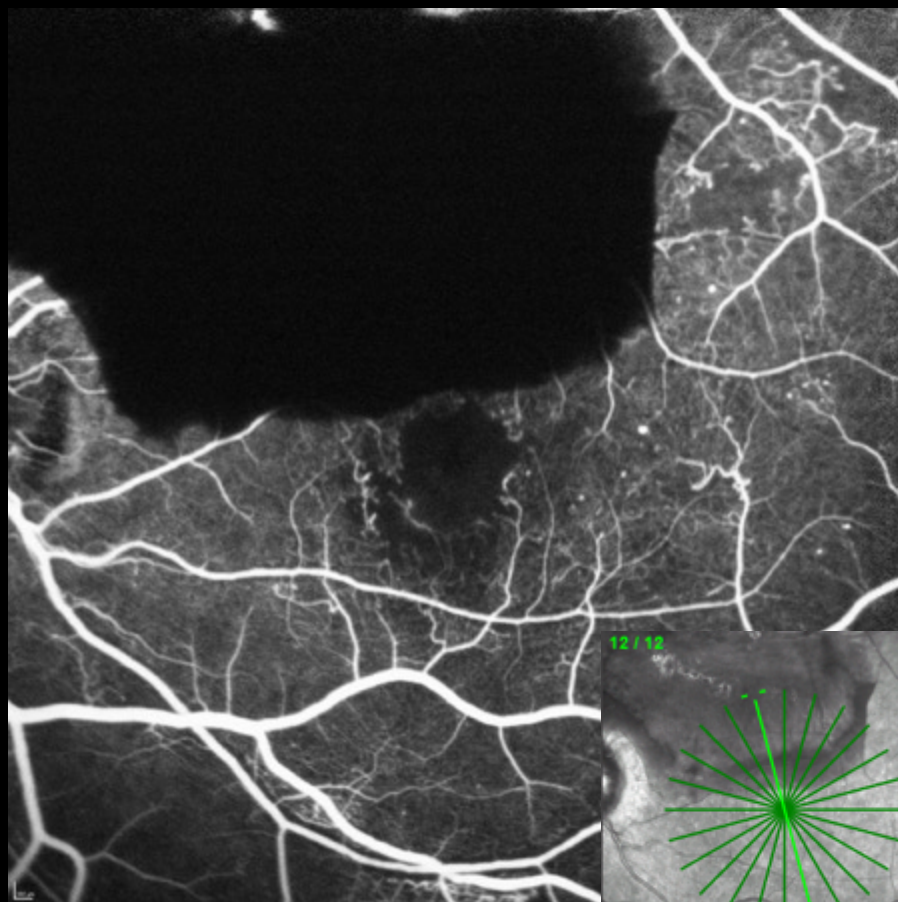
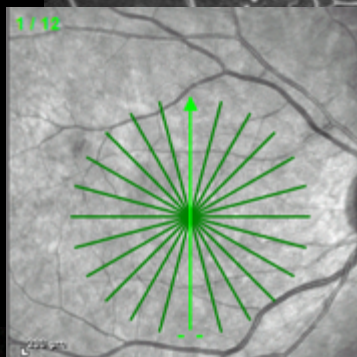
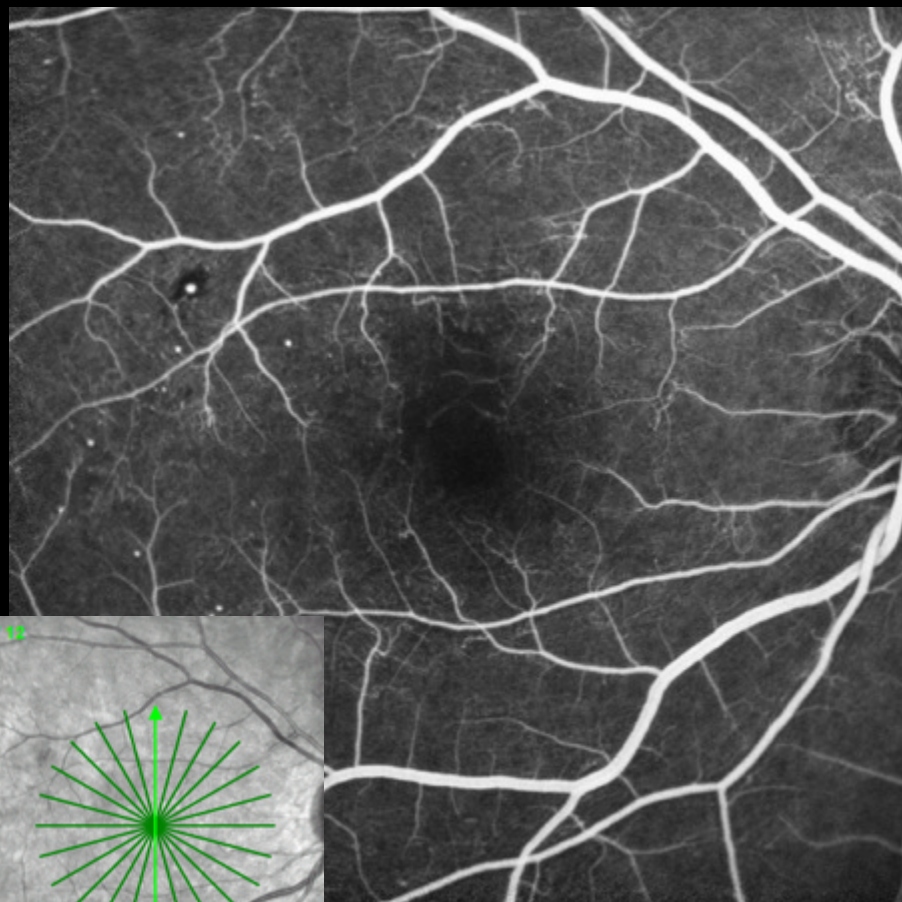


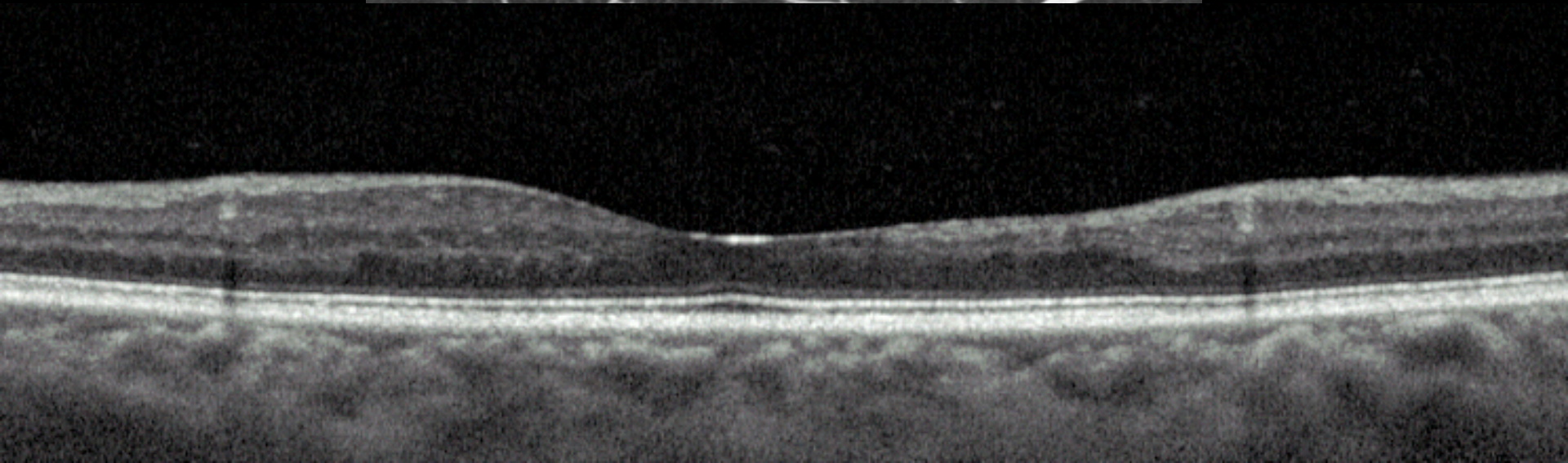
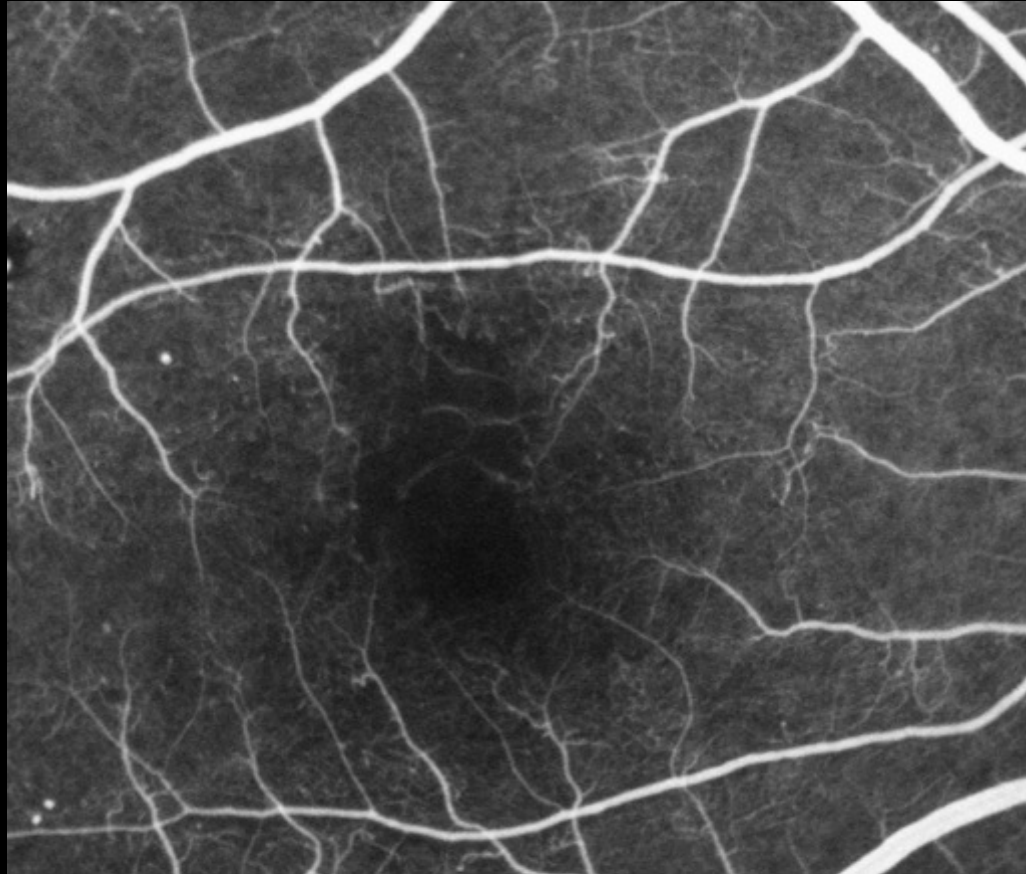
10/20/2016











Assessment and Plan

- Severe NPDR OD without macular edema
 - Monitor
- Proliferative retinopathy OS without macular edema with pre-retinal hemorrhage
 - PPV, endo-PRP, IVA OS
- Educate patient about importance of BS/BP control and compliance with follow up

Clinical Pearls



PRH in diabetic patient likely = PDR



Not all severe/proliferative cases have a striking appearance. Look for **microvascular** changes, not just hemorrhages

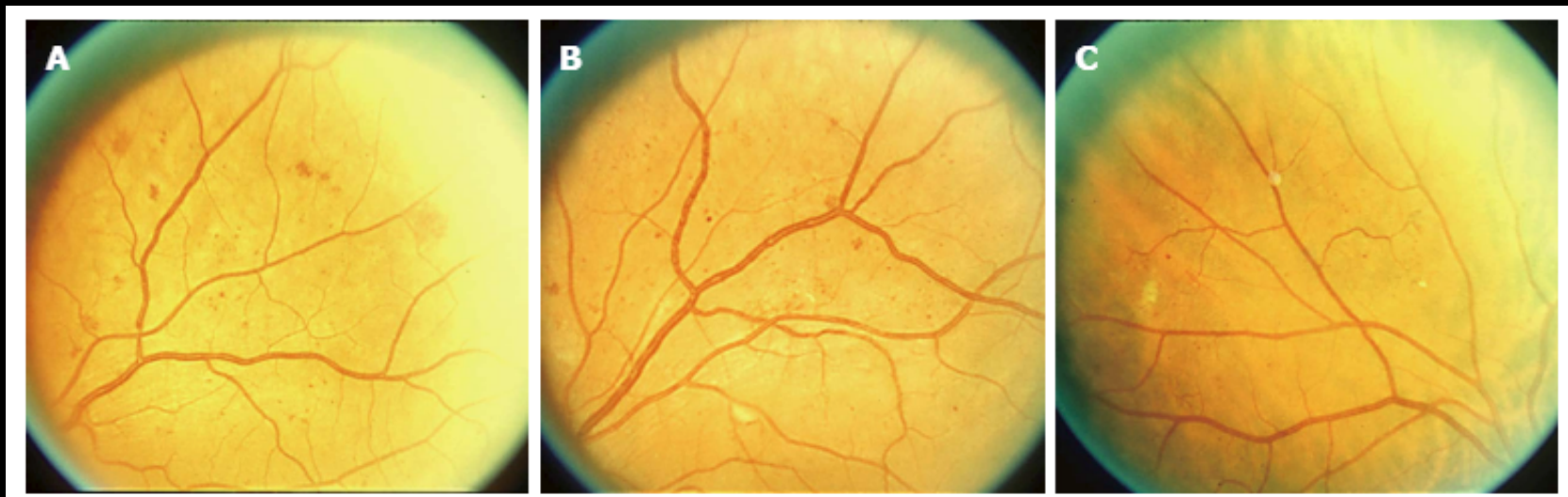
What is IRMA?

- 1968 Airlie Classification of DR
- DRS standard photographs
- ETDRS “tortuous intraretinal vascular segments in fields 4–7, varying in caliber from barely visible to 31 μm ”
- ICO Guidelines:

Intraretinal microvascular anomalies	<p>These are dilated capillary remnants following extensive closure of capillary network between arteriole and venule.</p> <p>Associated features include:</p> <ul style="list-style-type: none">• Venous beading (foci of venous endothelial cell proliferation that have failed to develop into new vessels),• Venous reduplication (rare),• Venous loops (thought to develop due to small vessel occlusion and opening of alternative circulation) and• Retinal pallor and white vessels	They are easiest seen on fluorescein angiography.
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ETDRS

- 4-2-1 Rule for Severe NPDR
 - 4 quadrants with significant intraretinal hemorrhages
 - 2 quadrants with venous beading
 - 1 quadrant with IRMA



HOW MANY **RED DOTS** DO YOU SEE?

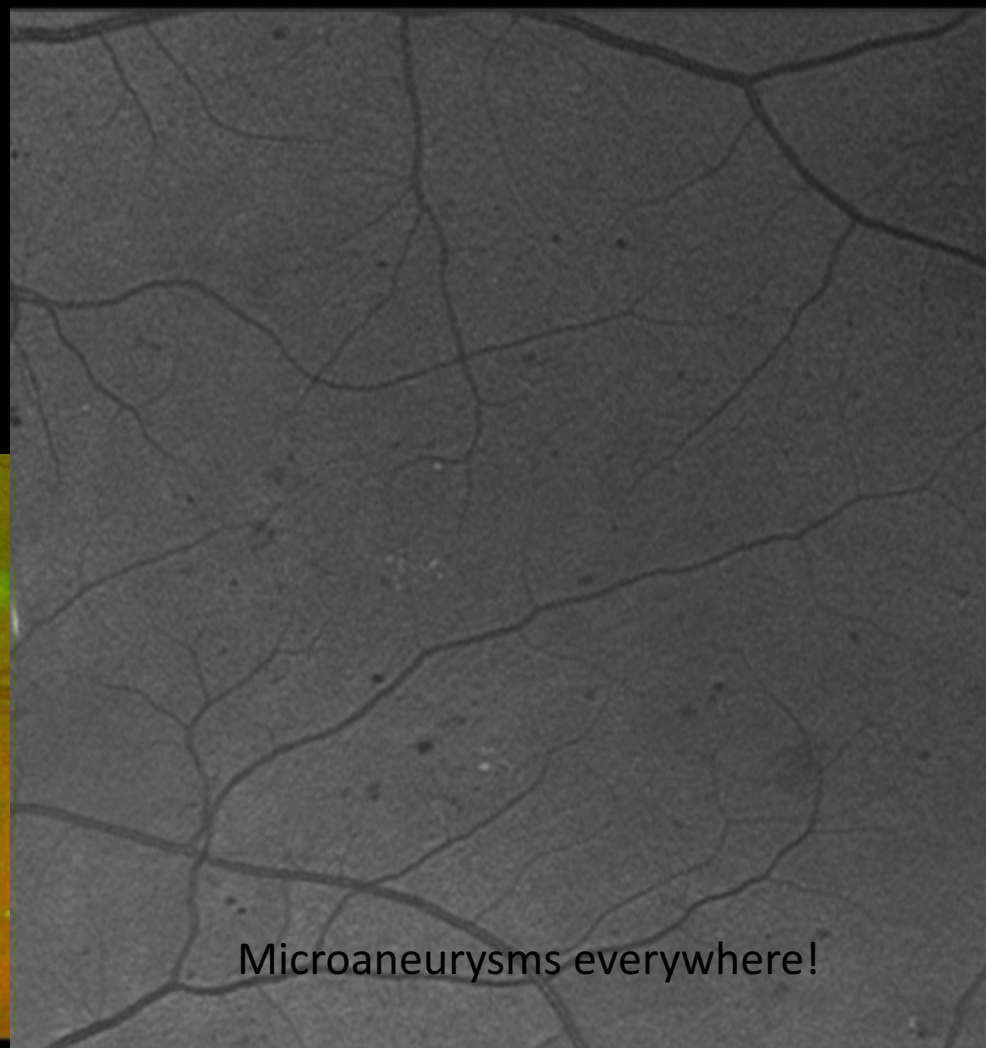


LET'S PLAY!

Powered by [playbuzz](#)

How good is your color vision? Were you surprised by the results? We hope you had a lot of fun playing this color test though! If you liked it, **please recommend it to your friends by sharing it now :)**

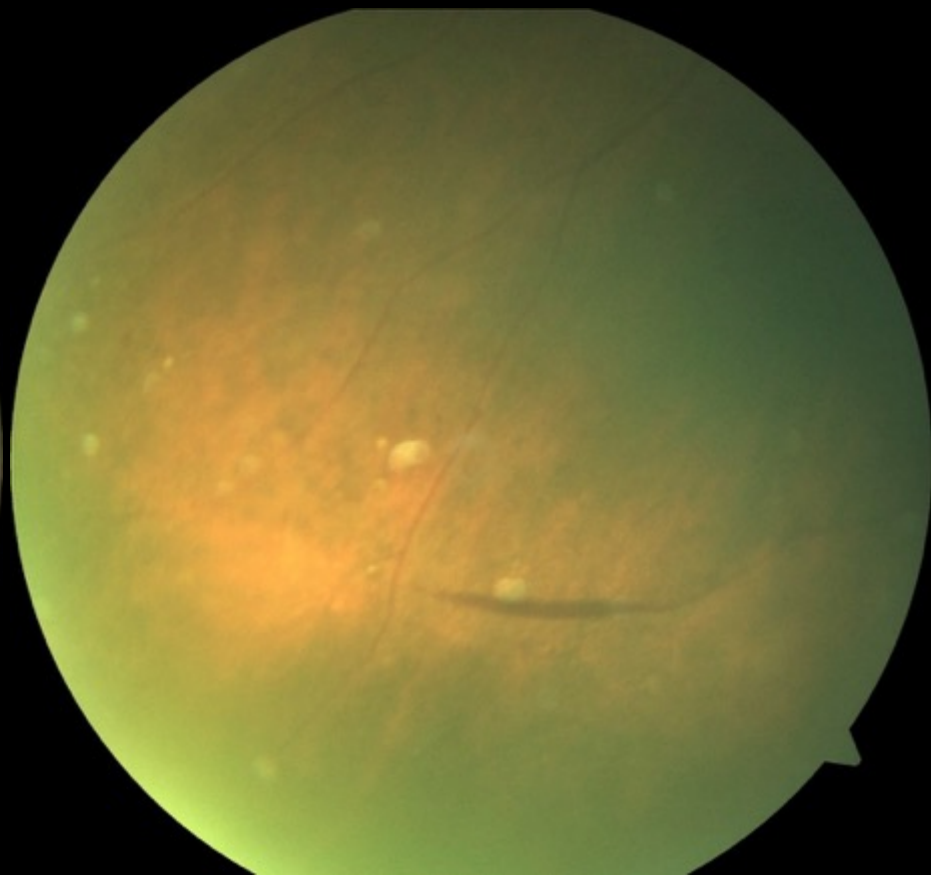




Case 3

Case 3

- 65 YO AAM
 - DM x 15 years; Reports good BS control
 - Does not know last A1c or BS reading
- Monocular patient: OS prosthetic, H/O trauma
- CC: Annual eye exam, no complaints
- BCVA: 20/20 OD



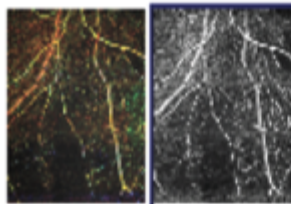
Which eye is Severe?



A



B



Right Eye Fundus

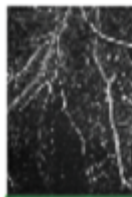
Right Eye



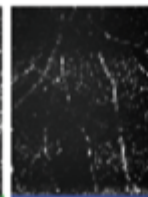
vfl



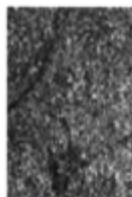
vfl



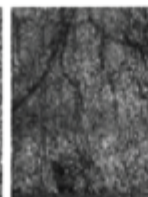
Deep



Retinal



Choriocapillaris

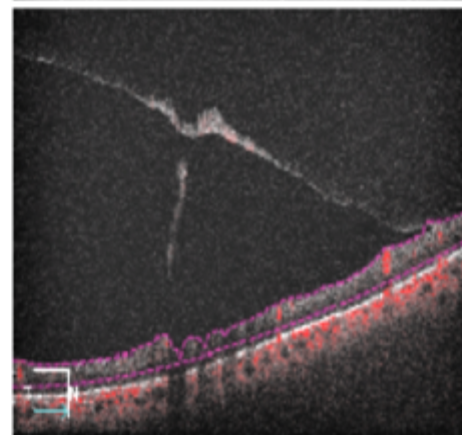
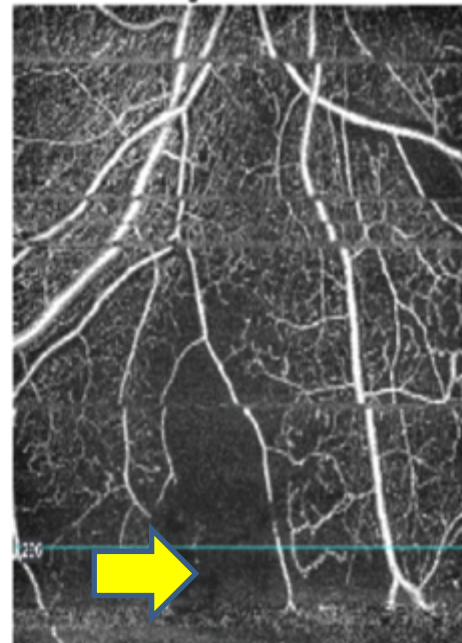


Chorioid



Circle Center (Shift)

AngioPlex - Retina



Slice: 295

Structure - Retina

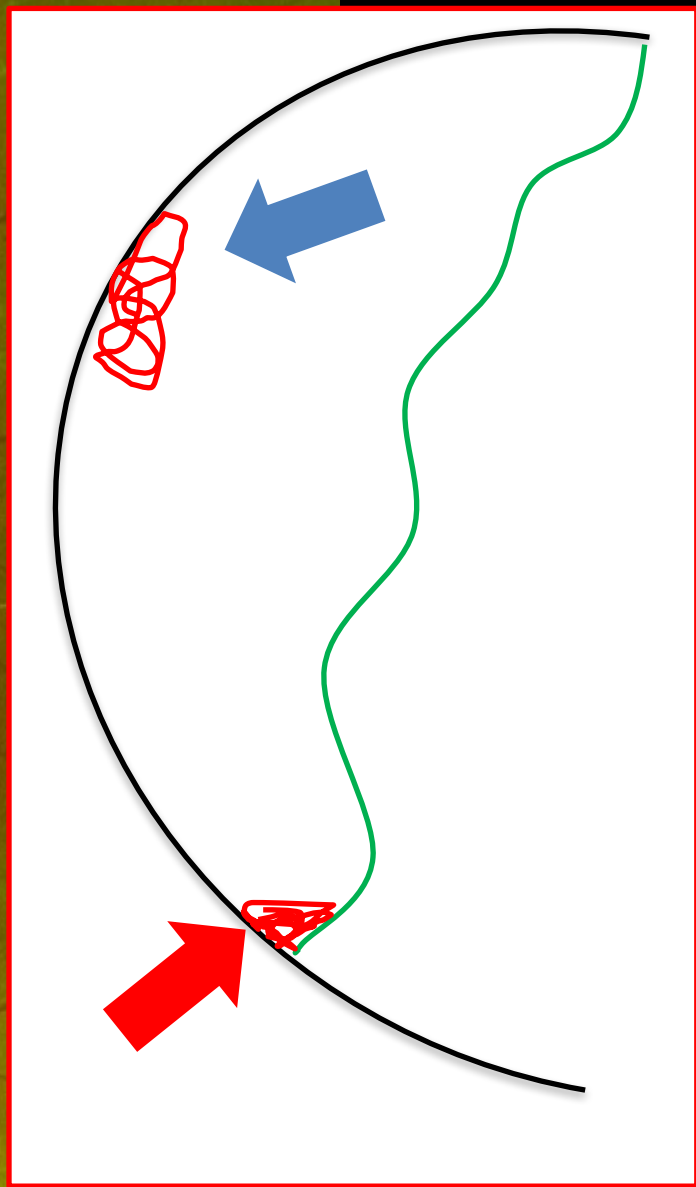
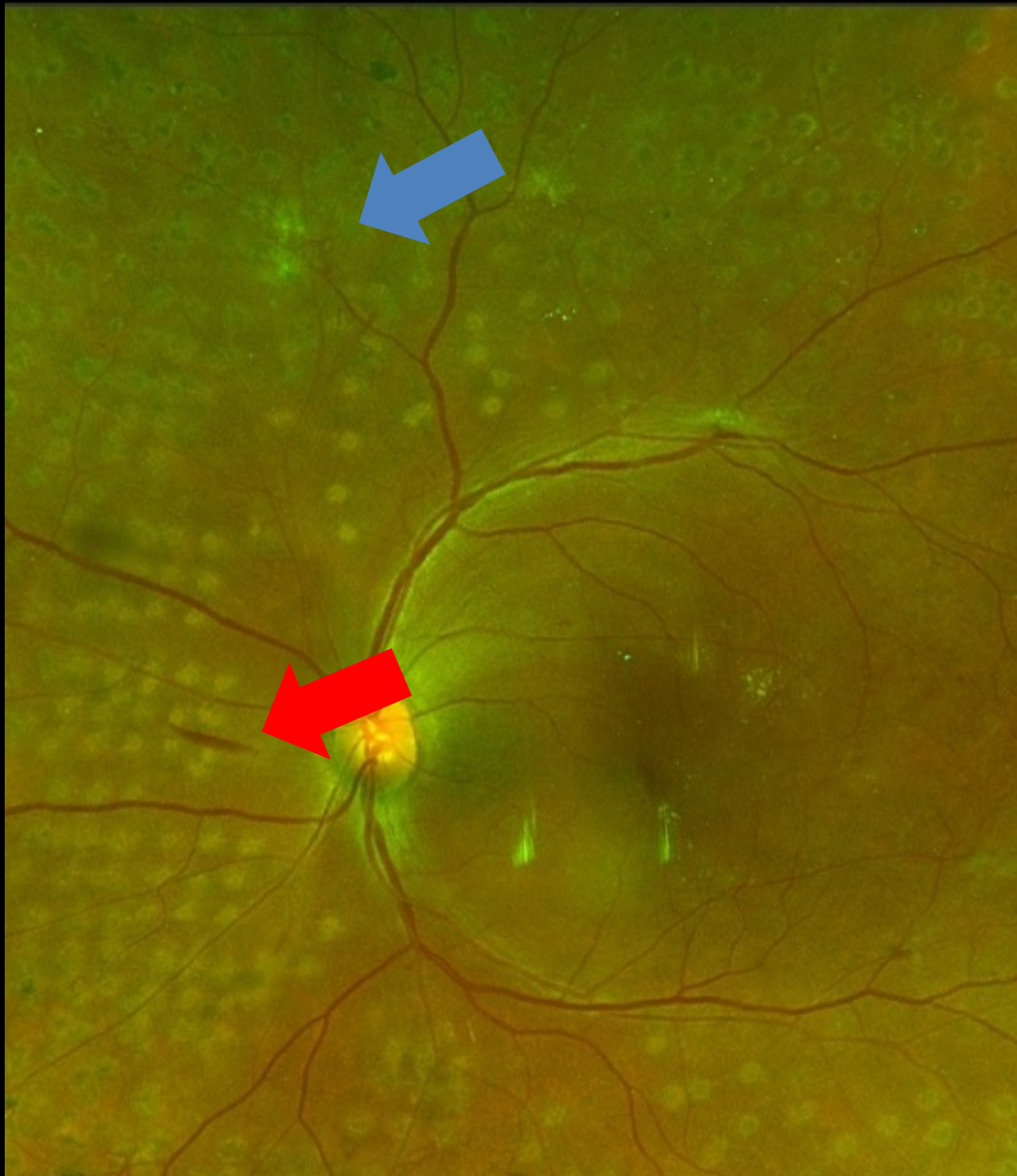


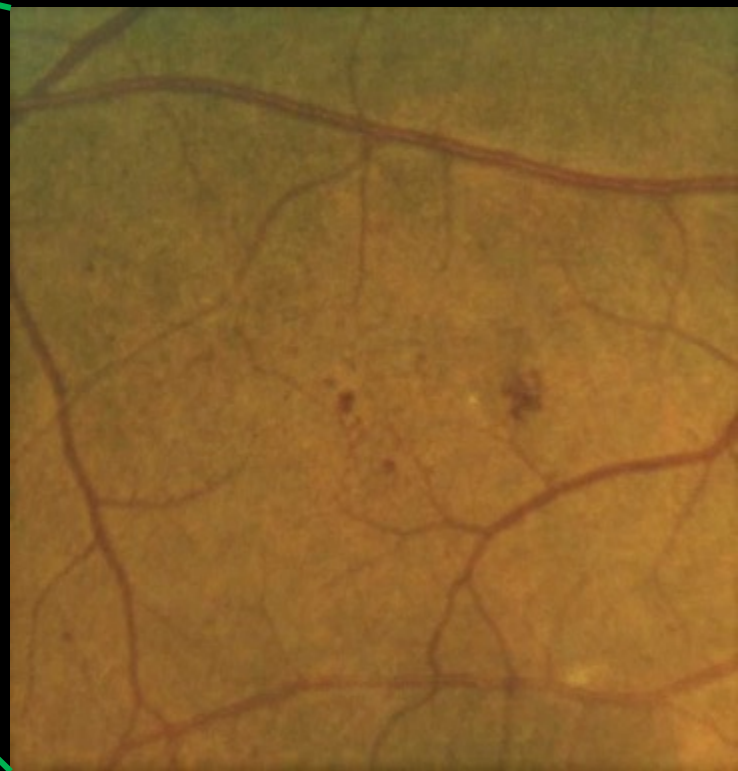
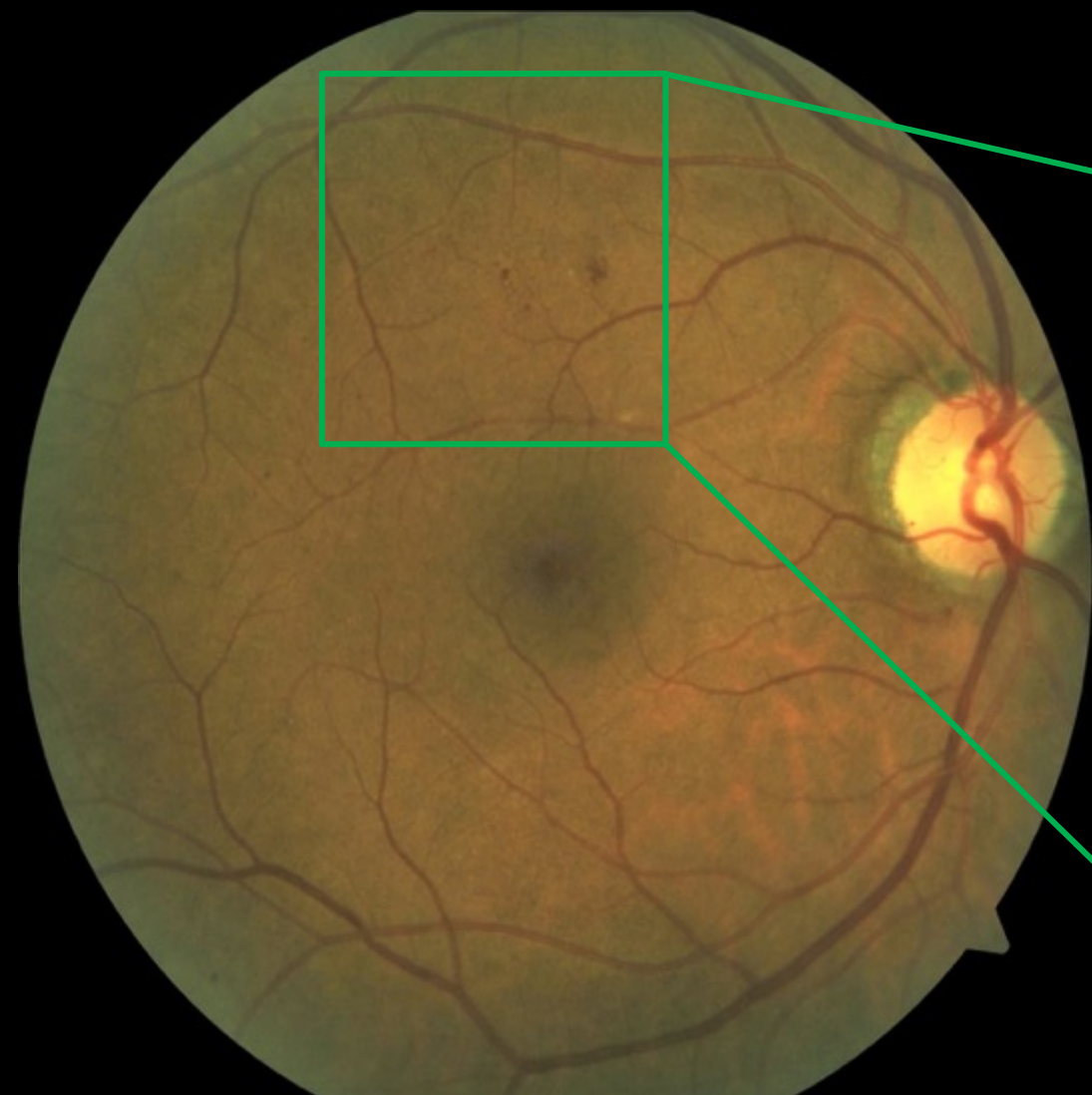
Current View Retina

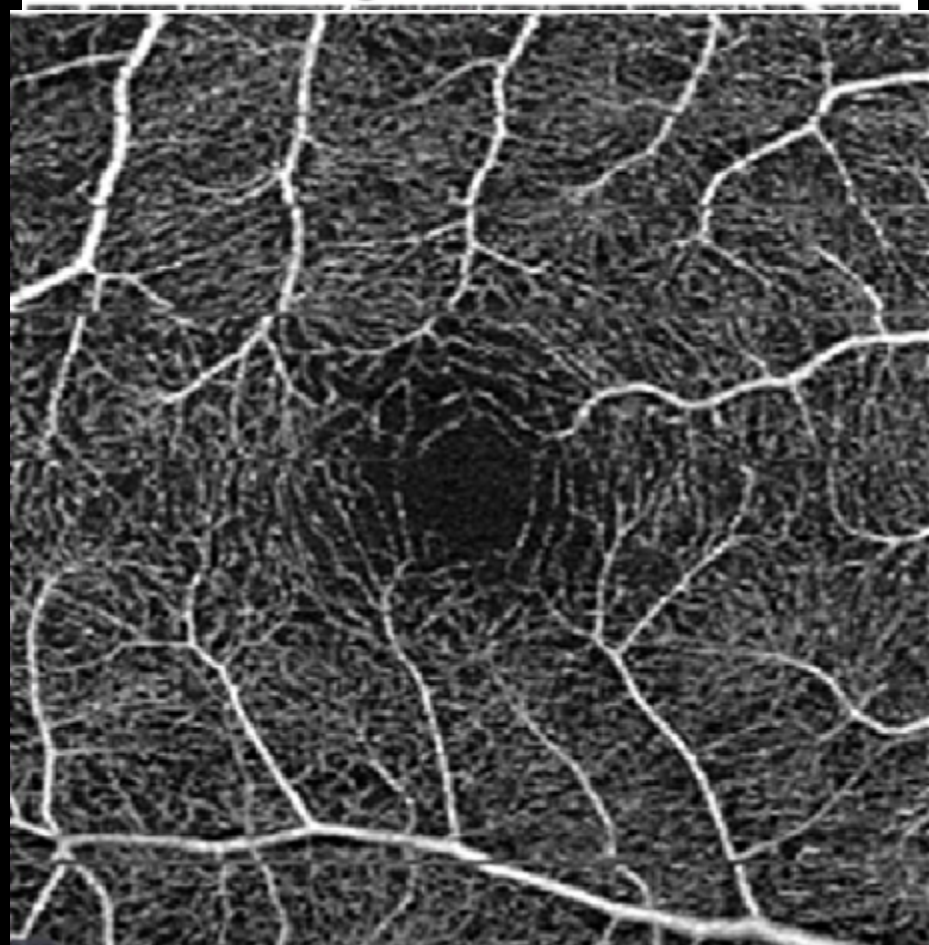
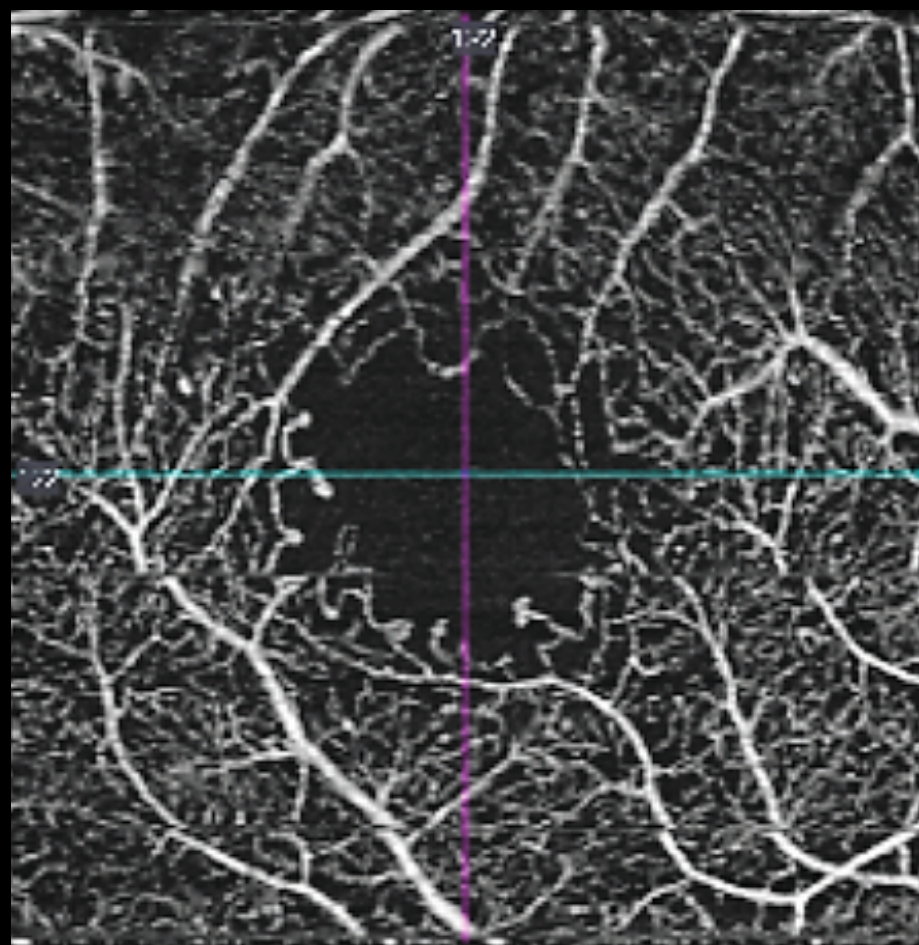
Reference	Offset
Top: ILM	0
Bottom: RPE+Br	70

Comments

Doctor's Signature







Clinical Pearls

- PRH in diabetic patient likely = PDR
- Not all severe/proliferative cases have a striking appearance. Look for microvascular changes, not just hemorrhages
- Neovascularization grows on the retinal surface

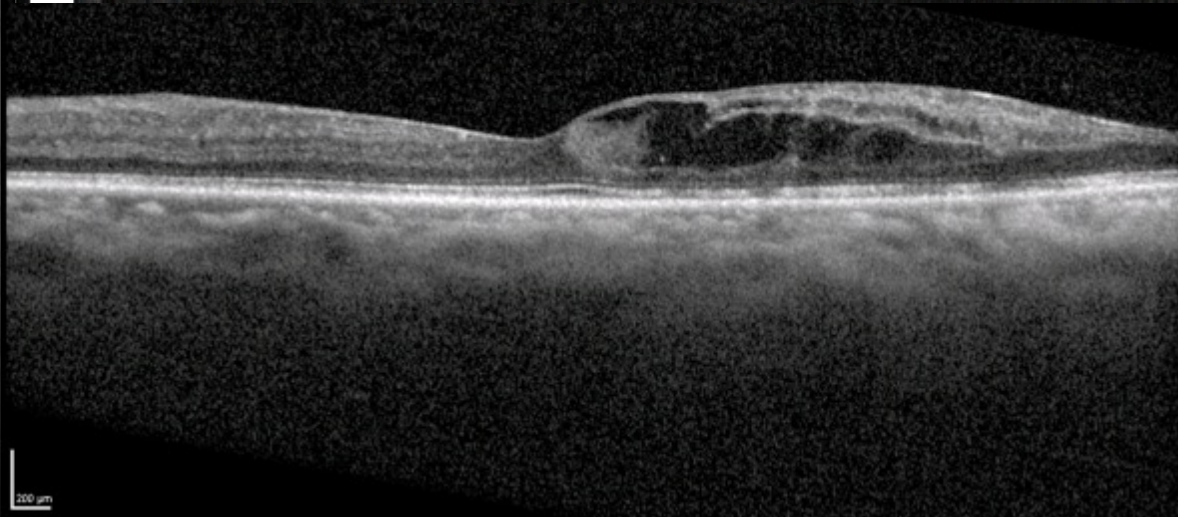
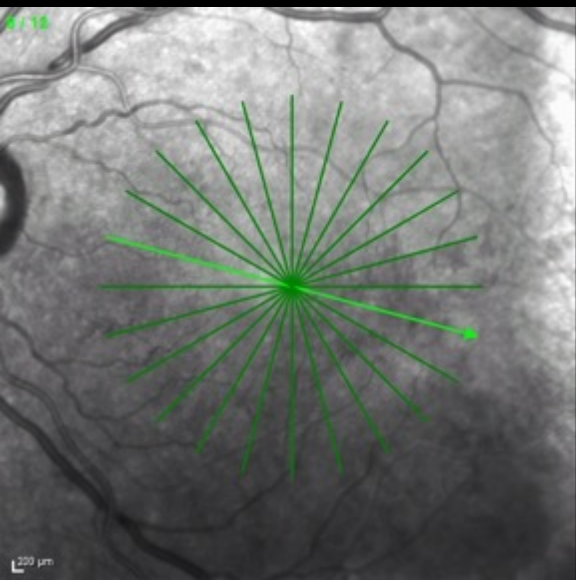
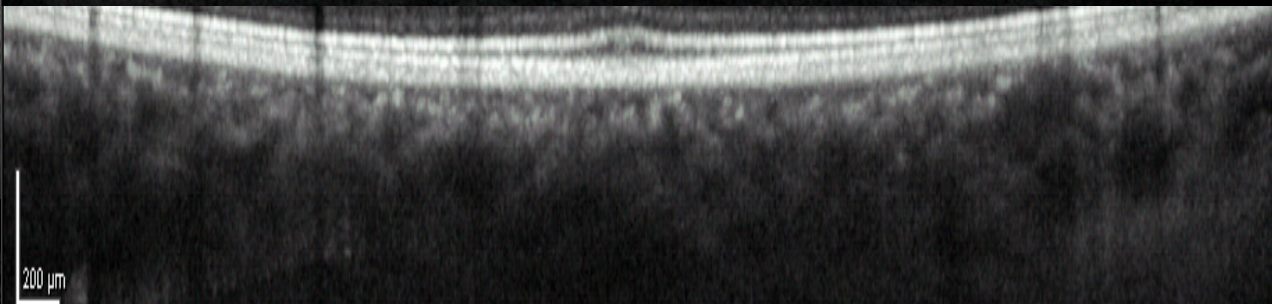
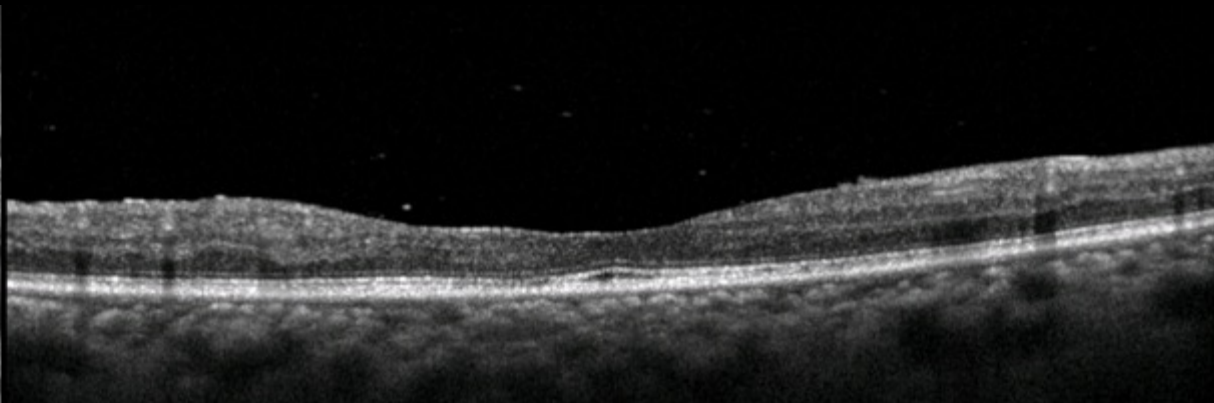
Assessment and Plan

- PDR OD
 - Refer to Retina Specialist for management
 - Educate patient extensively about importance of BS control and compliance with follow up visits

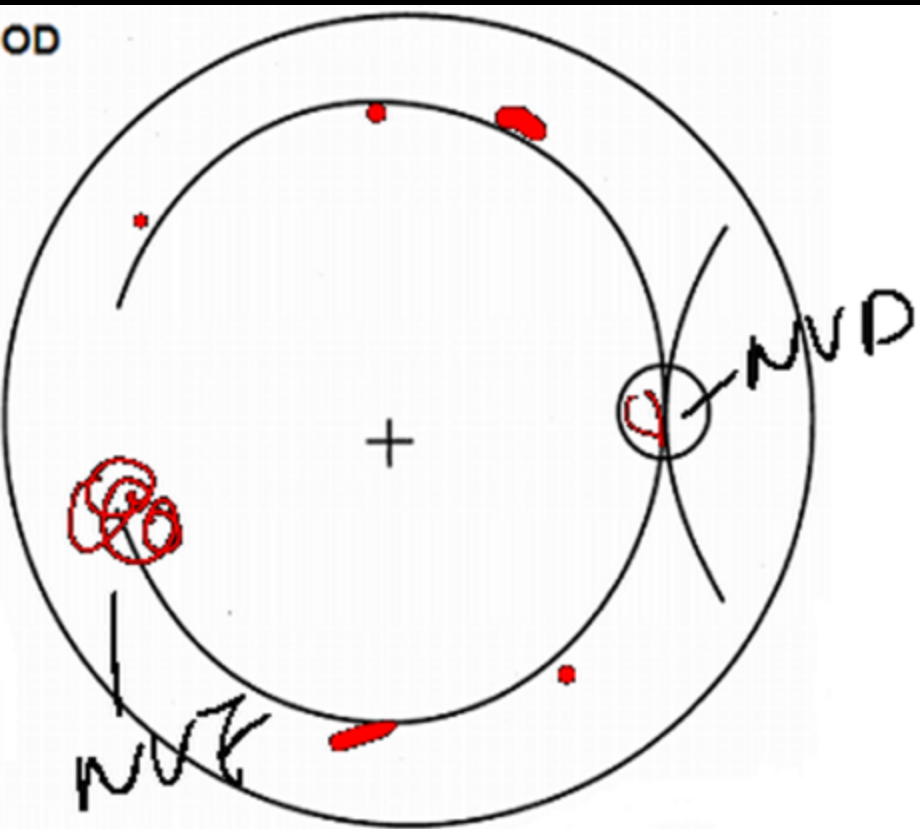
Case 4

Case 4

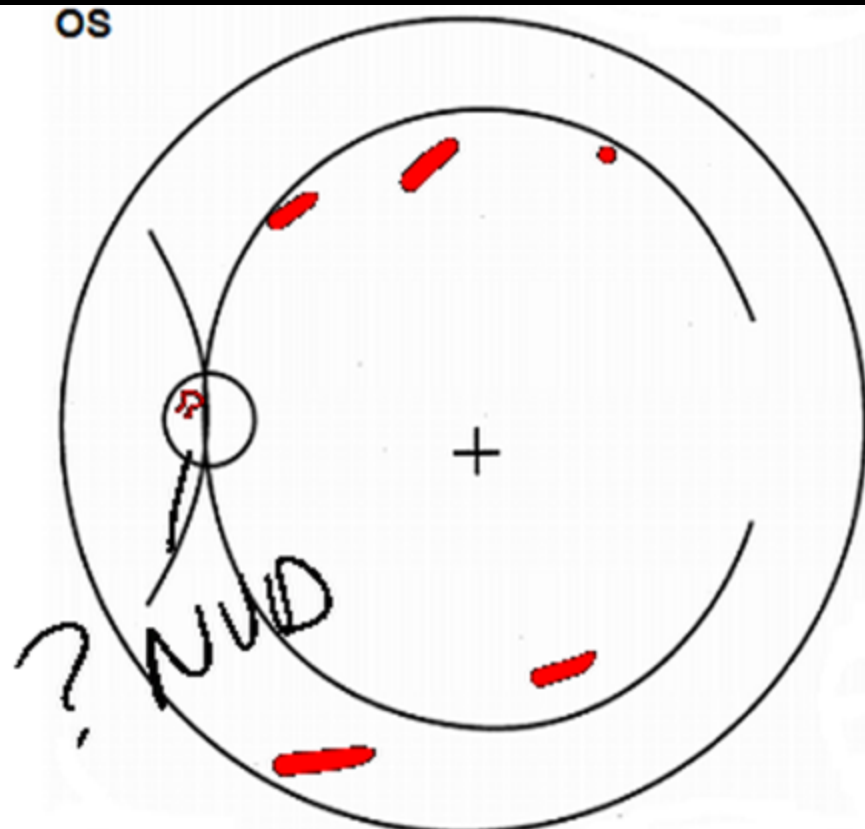
- 53 YO AAF
- DM x 10 years
 - Last H_{a1c} was 11.3
 - “I am working on it”
- BCVA 20/40 OD, 20/25 OS
- Referred for CSME OS

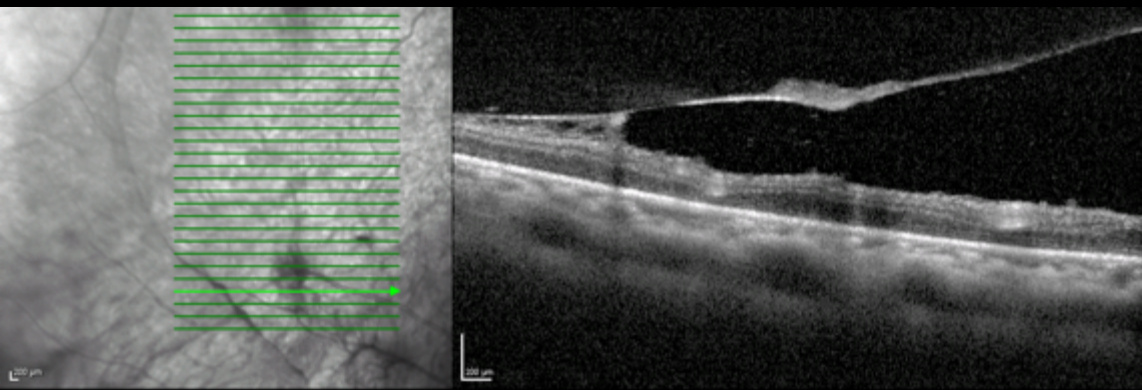


OD

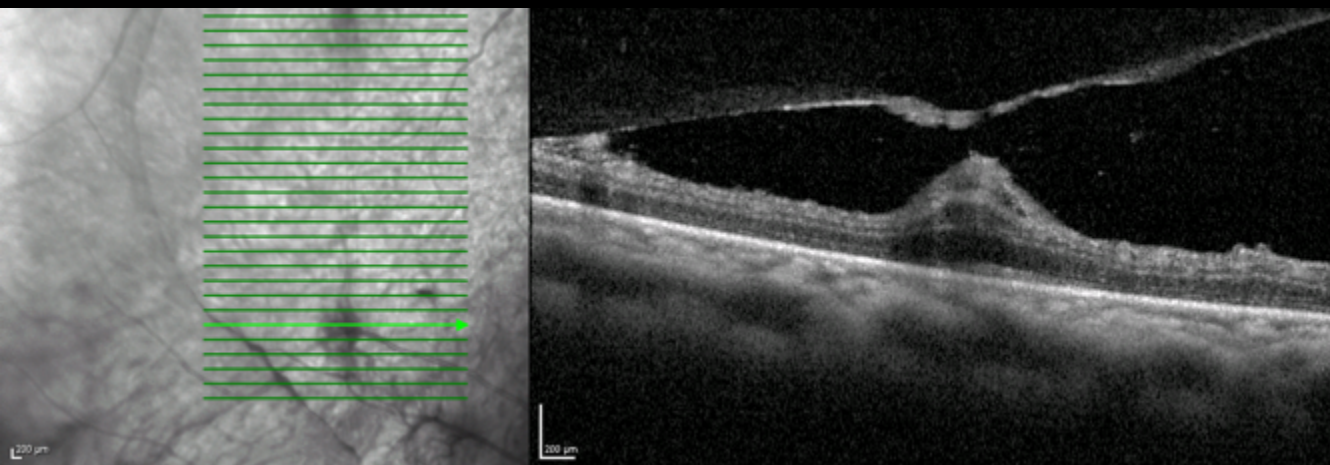
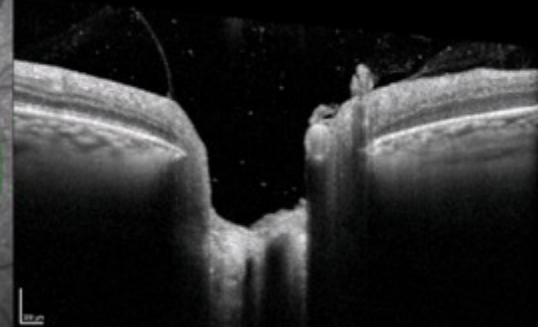
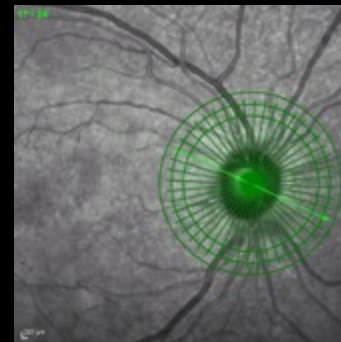
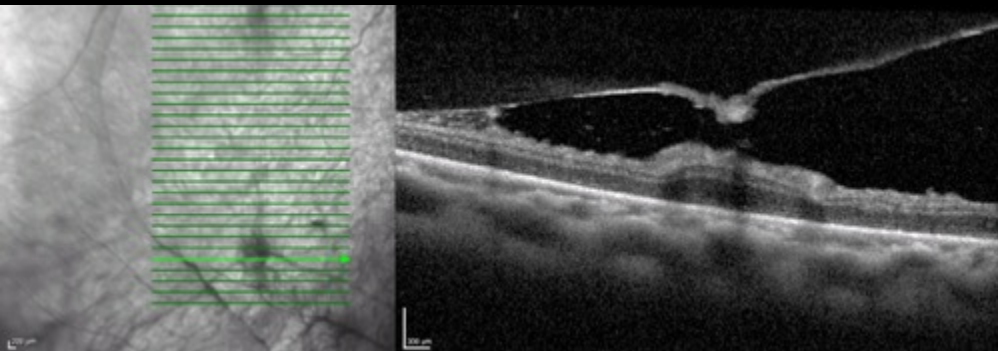


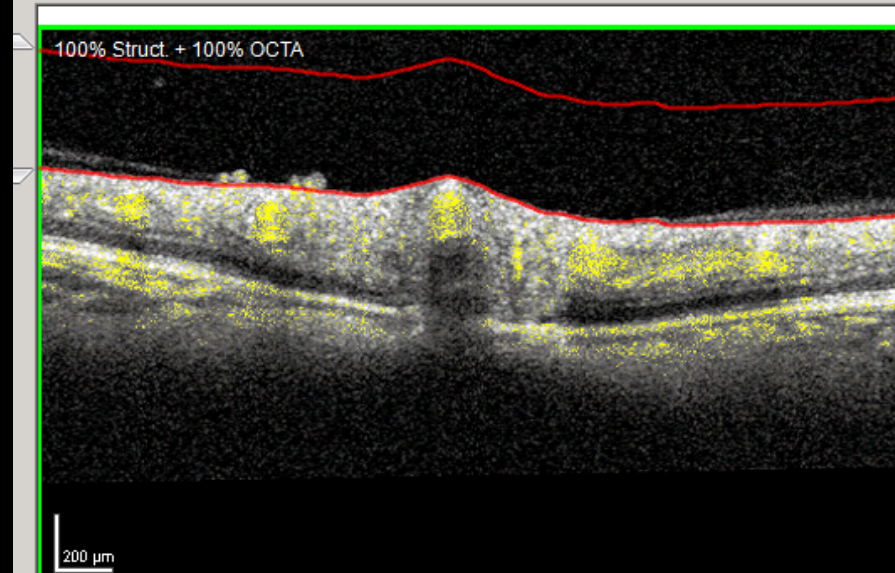
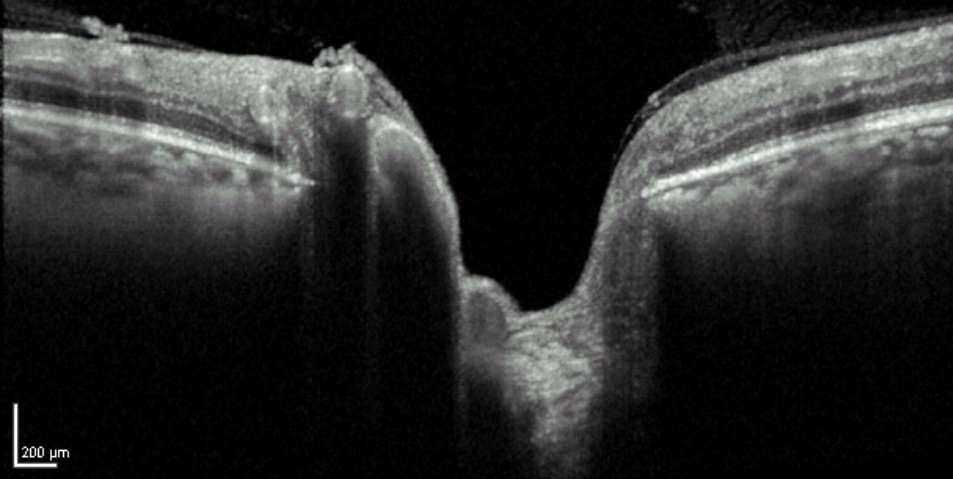
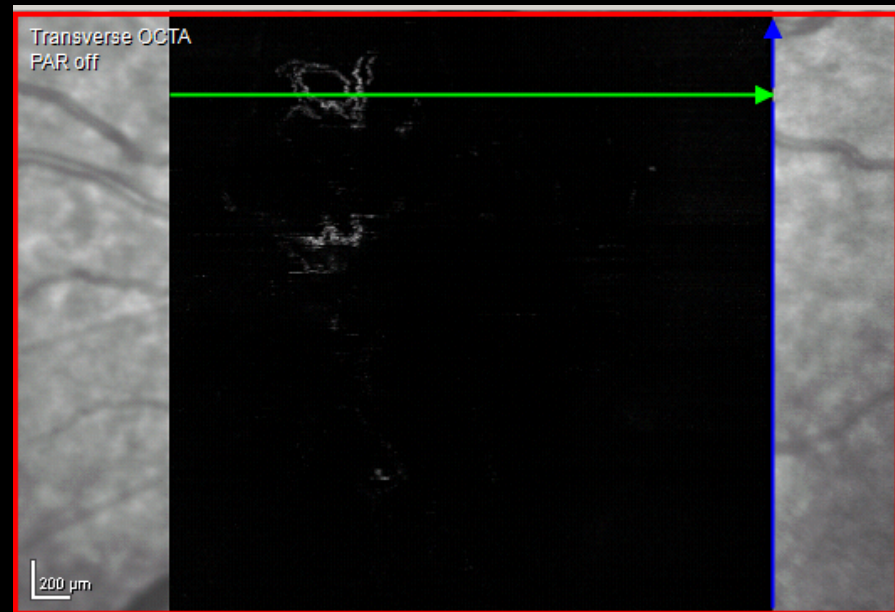
OS

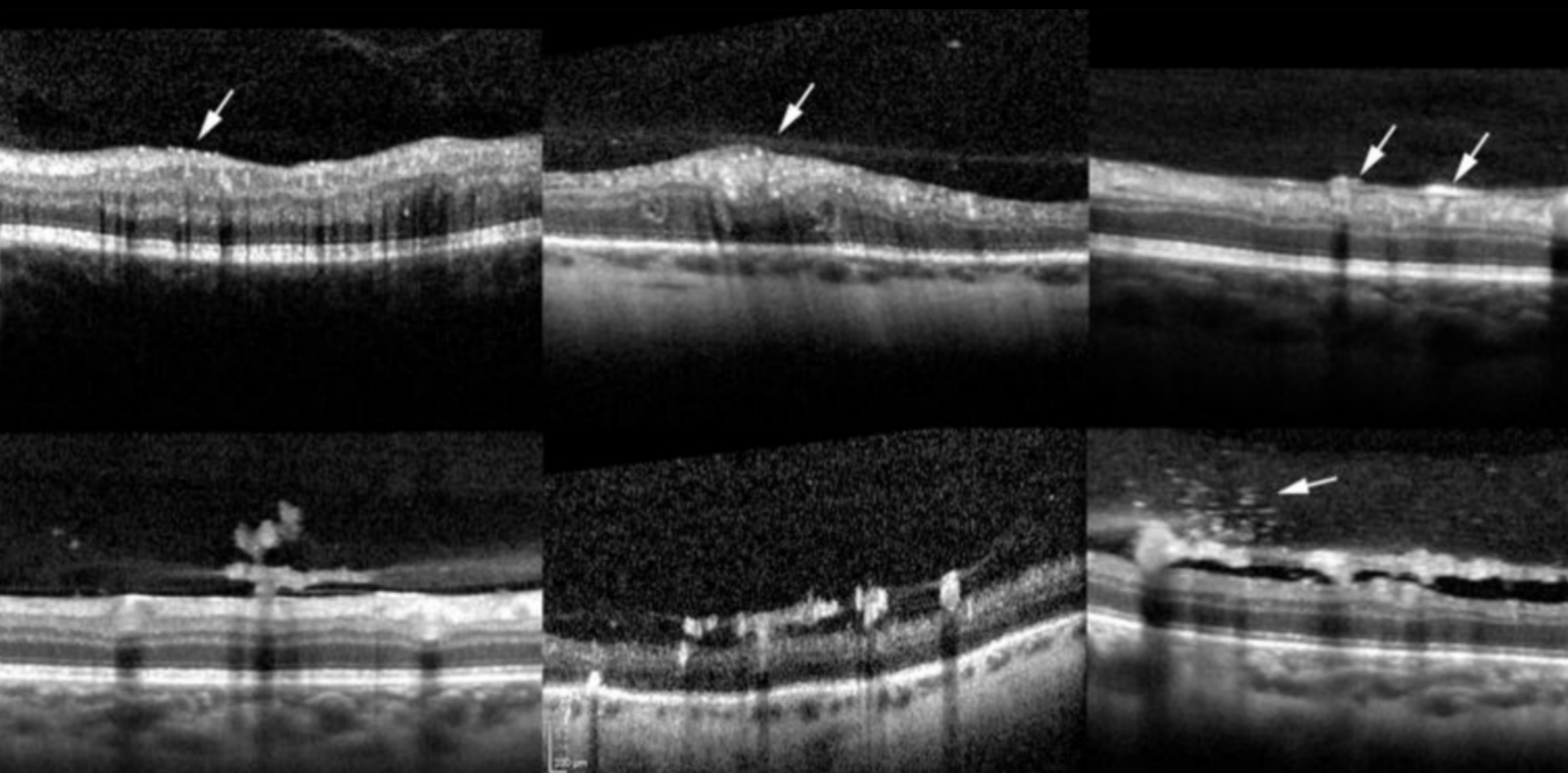




(+)NVE
(+)NVD







Lee C et al. Reevaluating the Definition of Intraretinal Microvascular Abnormalities and Neovascularization Elsewhere in Diabetic Retinopathy using Optical Coherence Tomography and Fluorescein Angiography. Am J Ophthalmol. 2015; 159(1):101-10

Case 4

- Proliferative Retinopathy OD without macular edema
 - PRP OD
- Proliferative Retinopathy OS with macular edema
 - Avastin OS
 - Schedule PRP OS x 1 week

Clinical Pearl



Neovascularization grows on the retinal surface, and might be visualized with OCT imaging

Lee C et al. Reevaluating the Definition of Intraretinal Microvascular Abnormalities and Neovascularization Elsewhere in Diabetic Retinopathy using Optical Coherence Tomography and Fluorescein Angiography. Am J Ophthalmol. 2015; 159(1):101-10

Case 5

Case 5

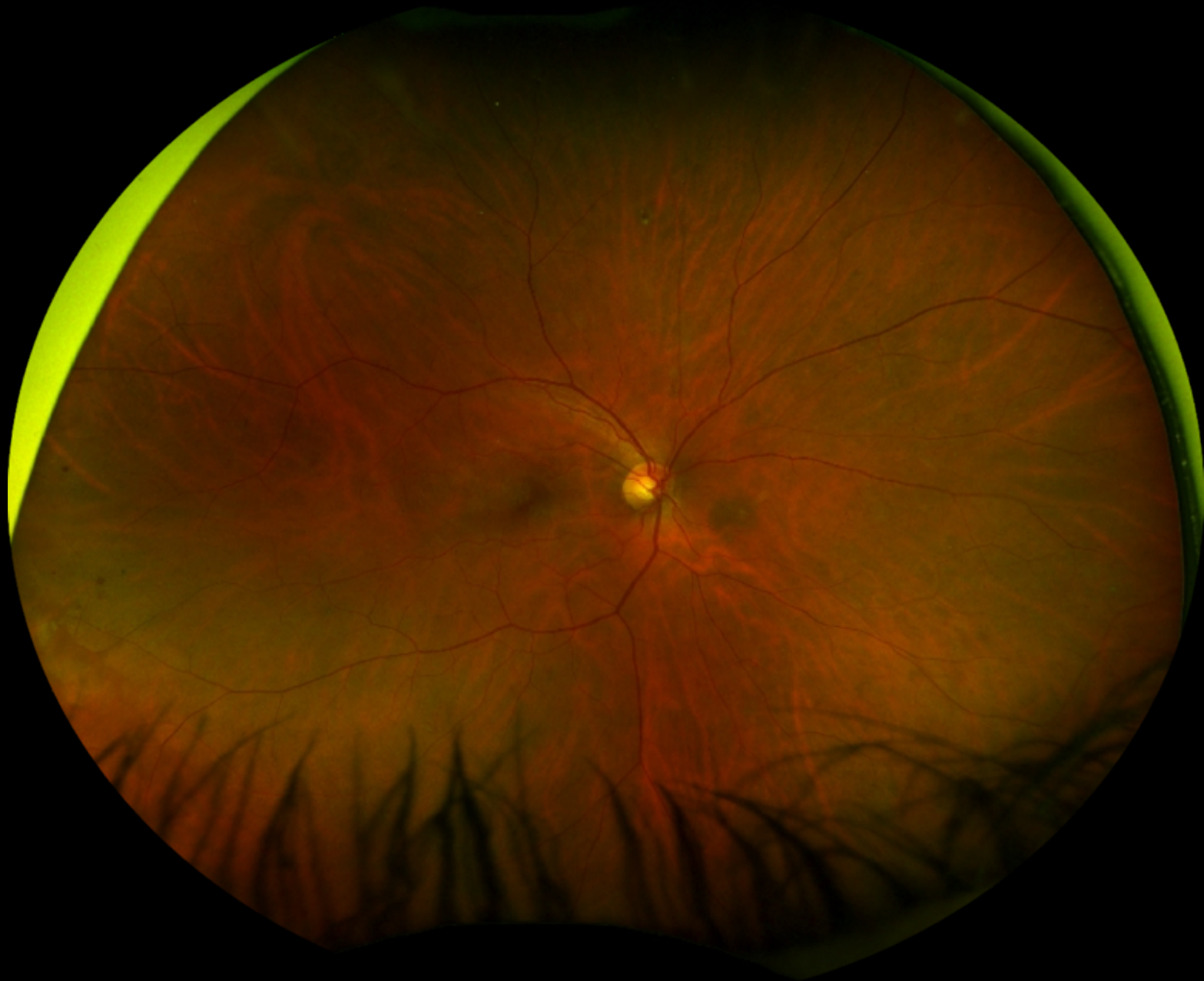
- 46 year old WM
- DM x 20 years; good control with A1c of 6.4
- HTN well controlled
- H/O PRP OS in 2009; was lost to follow up

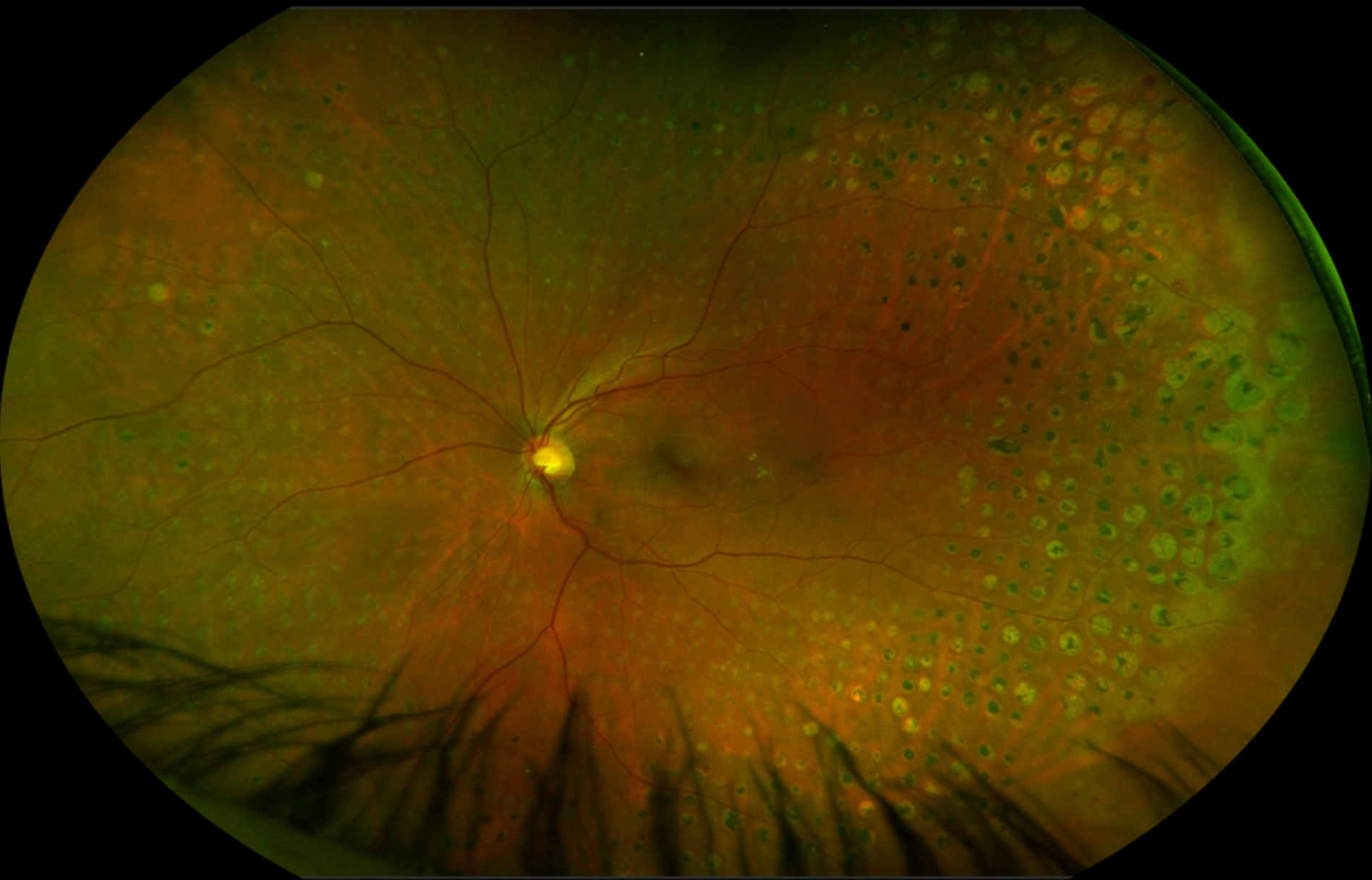


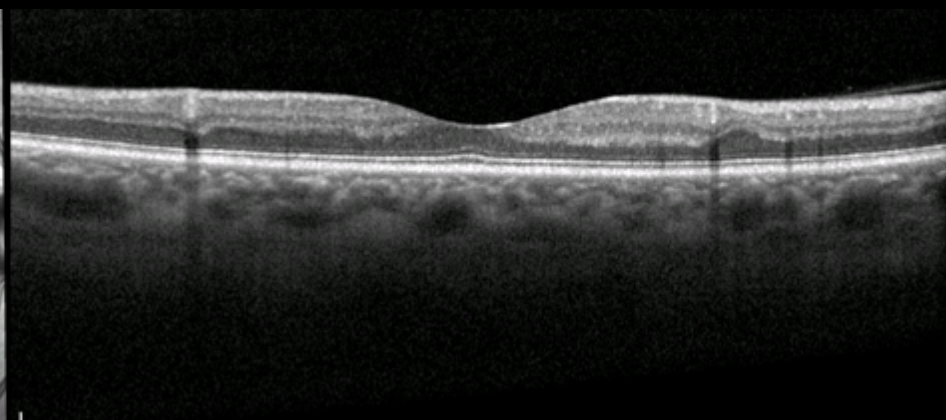
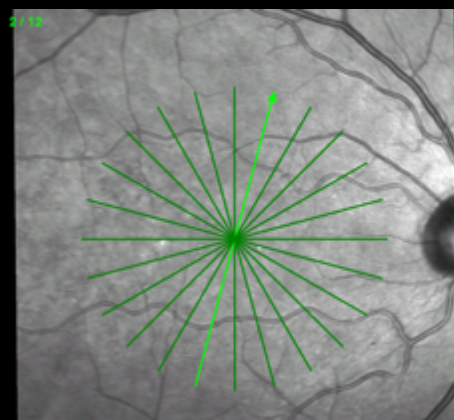
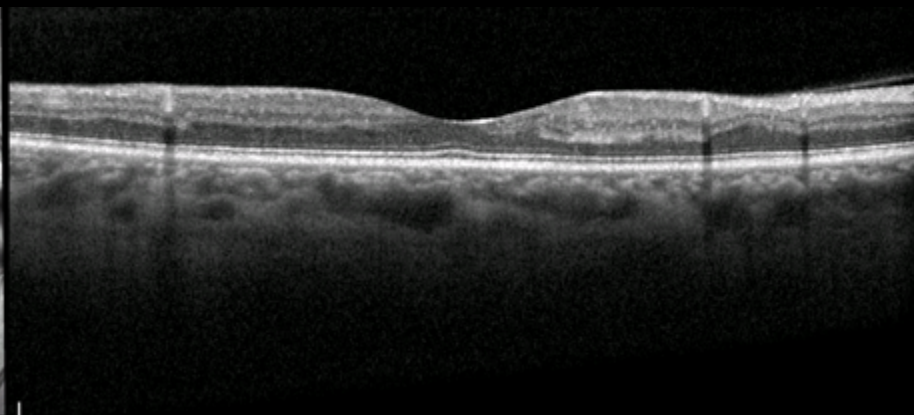
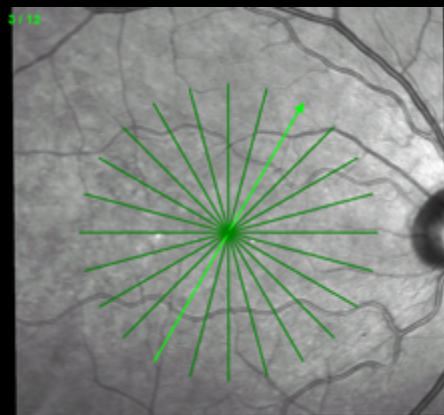
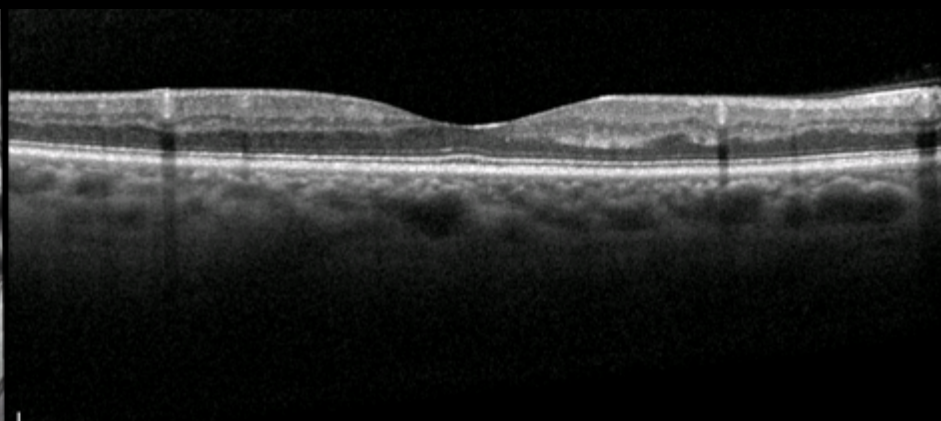
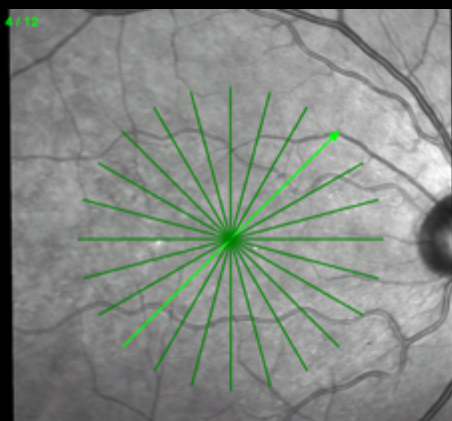
4/23/2009

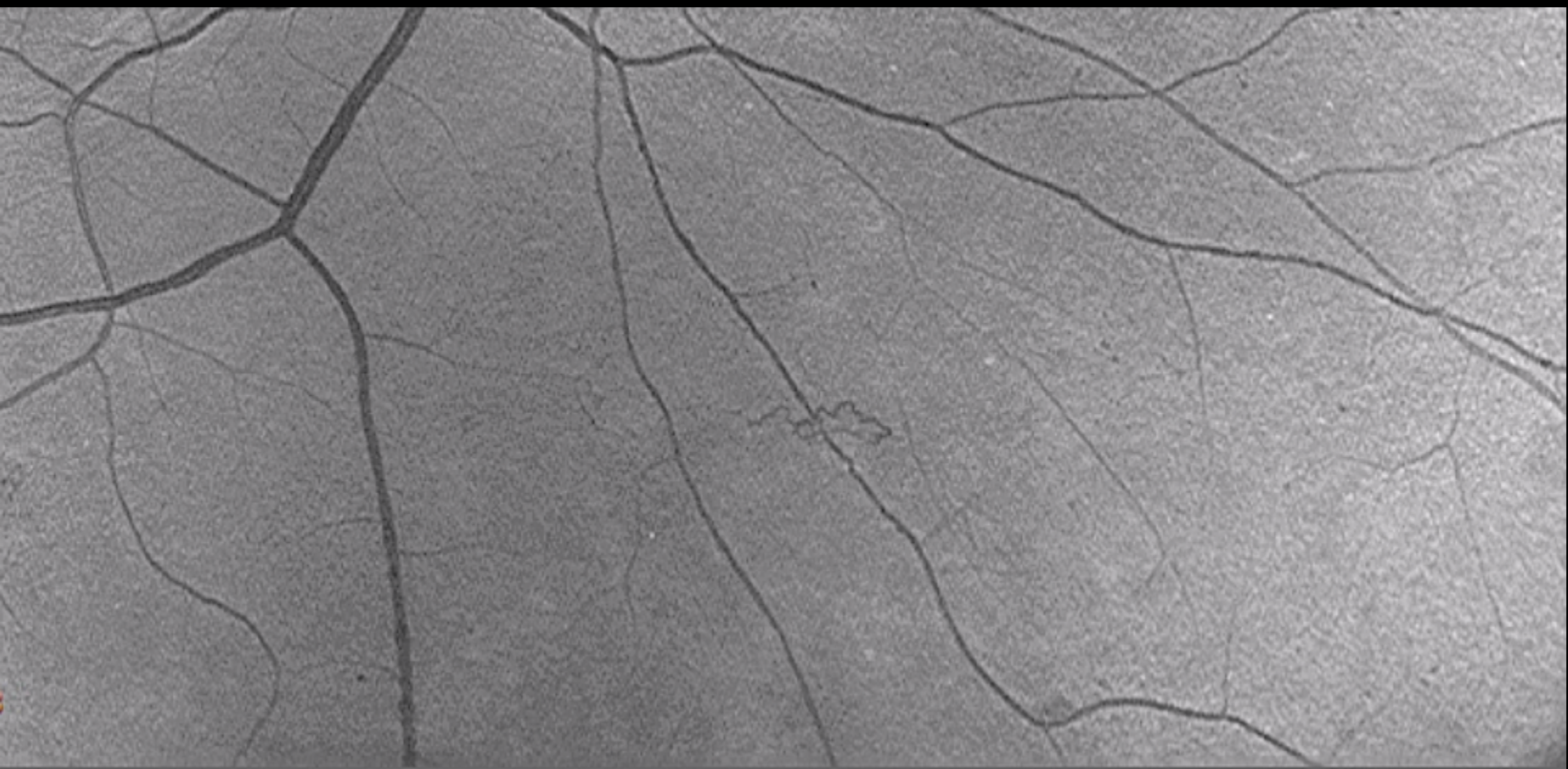


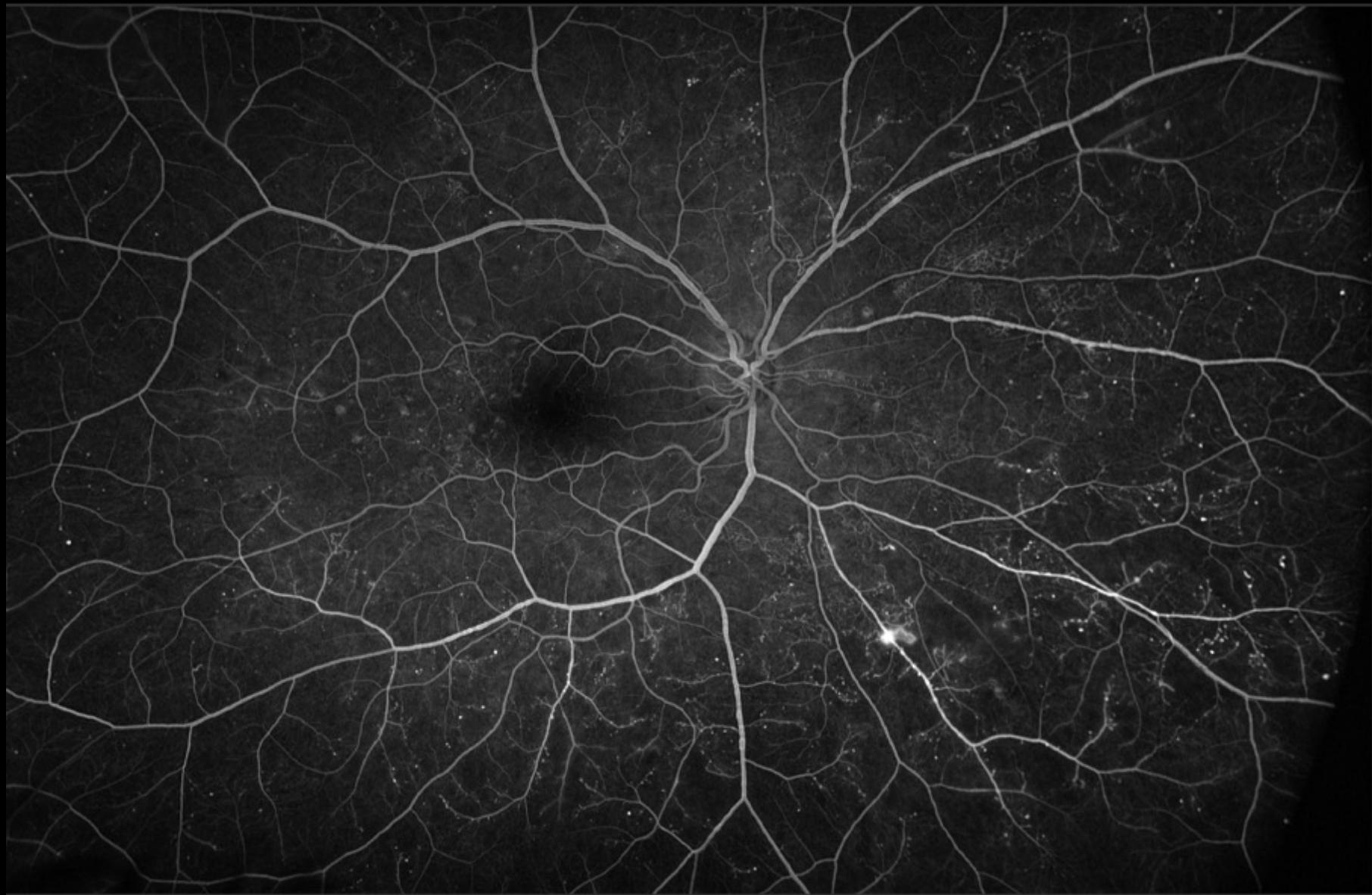
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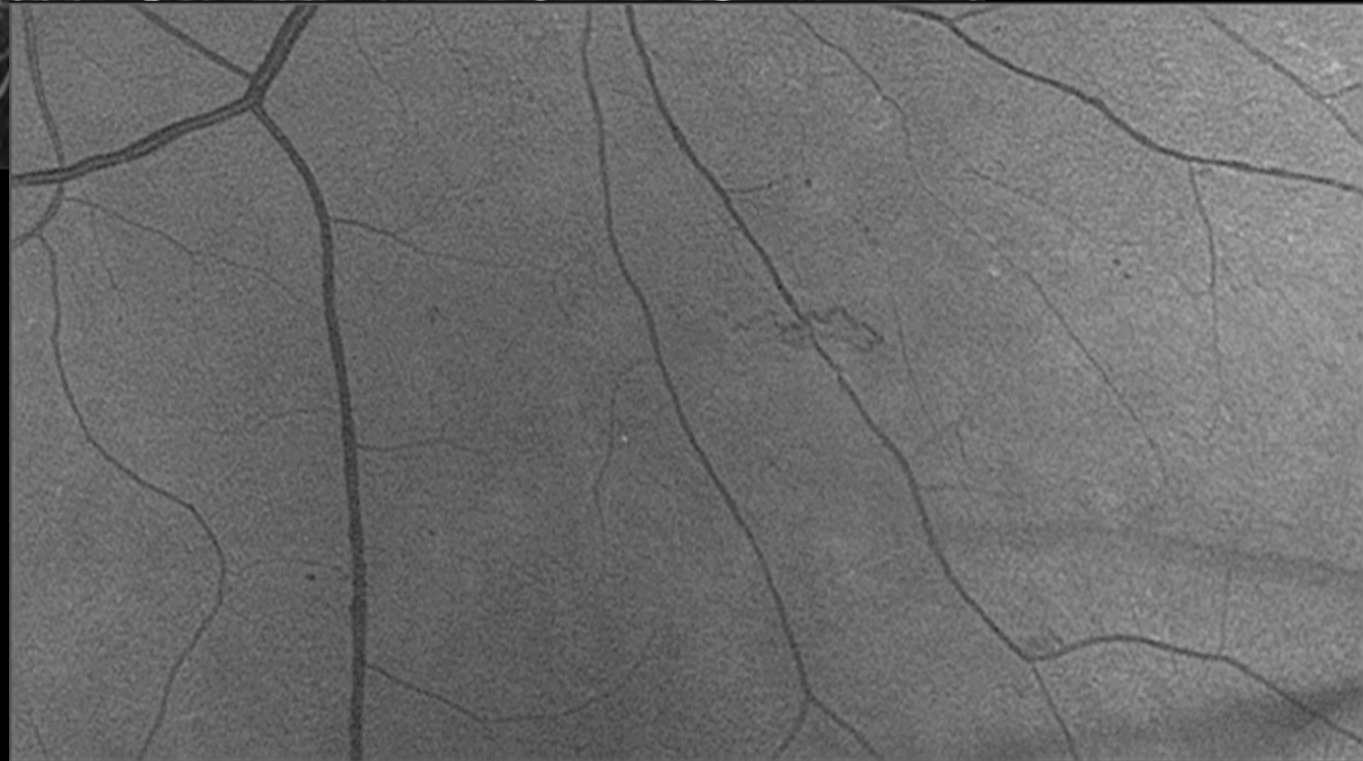
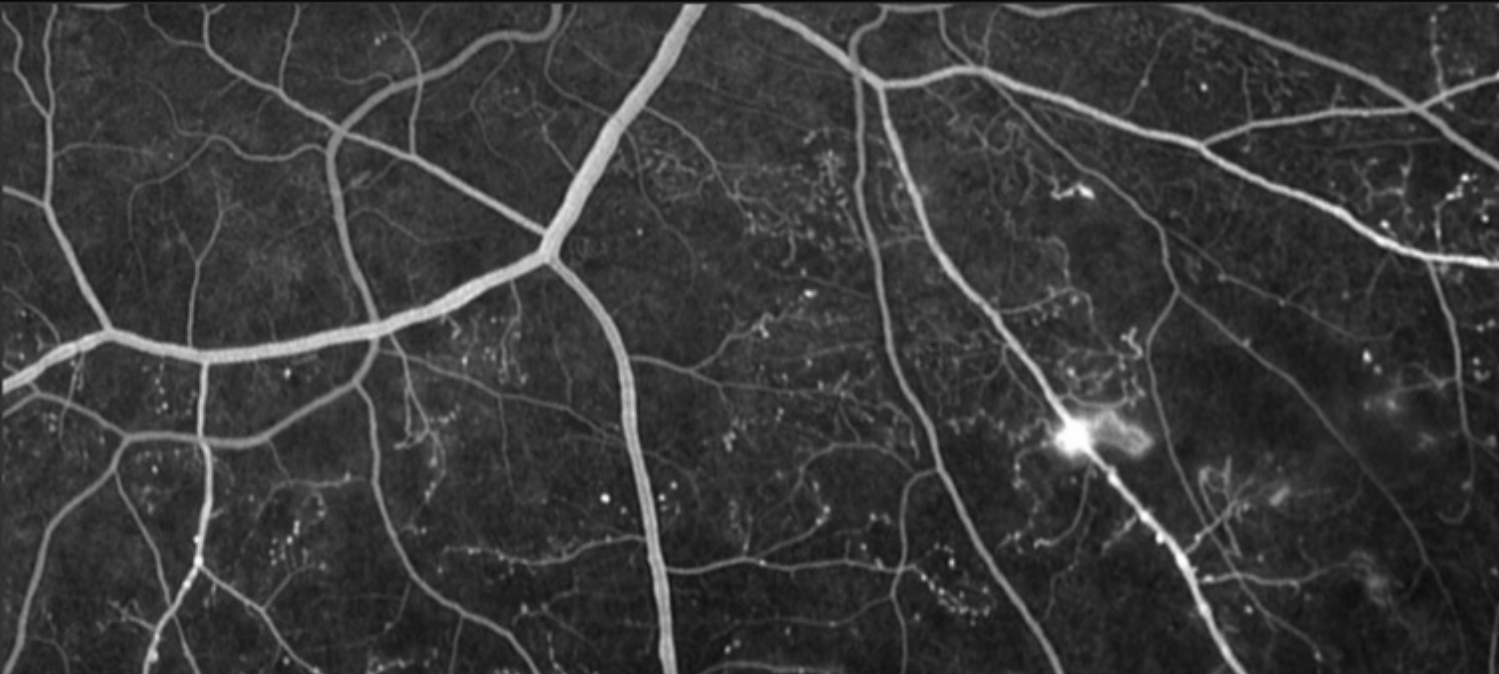


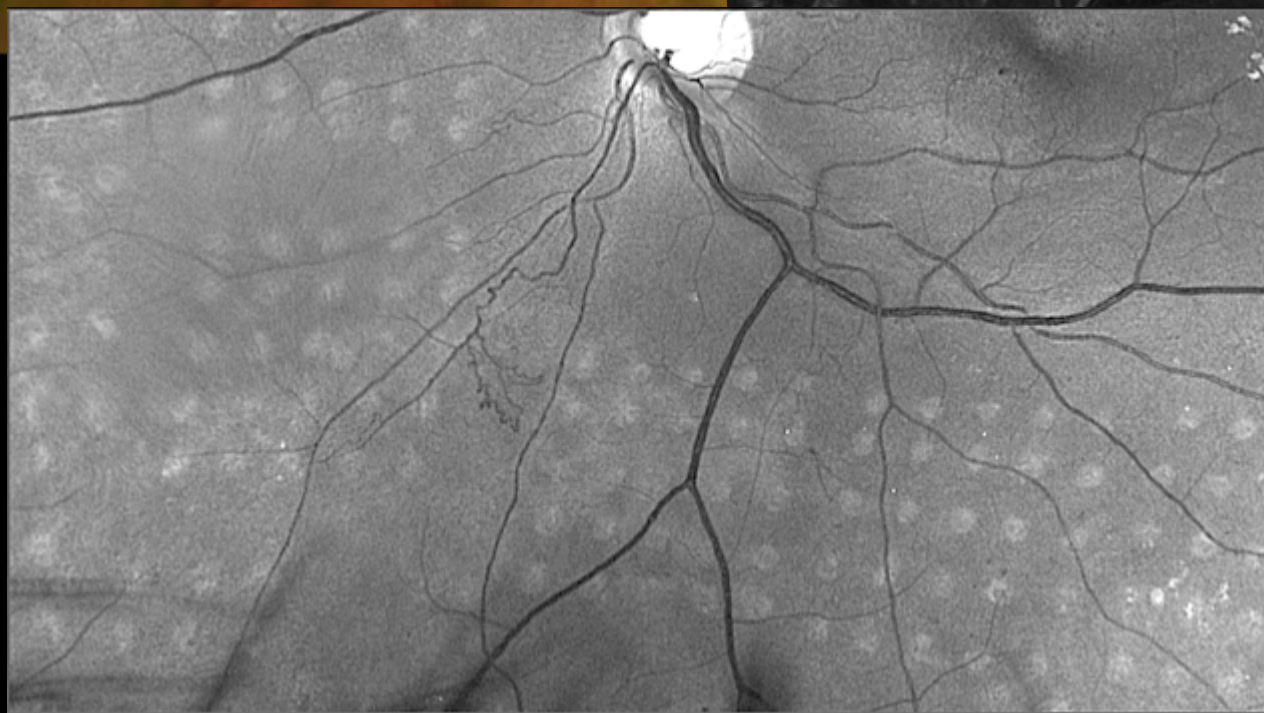
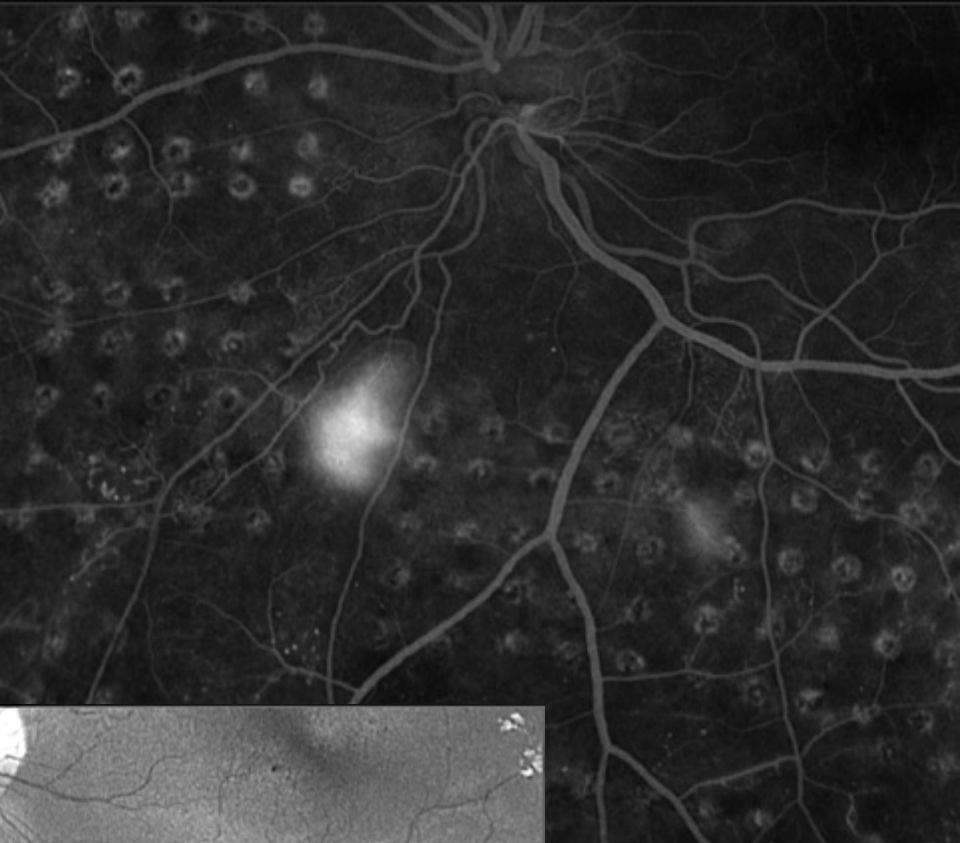
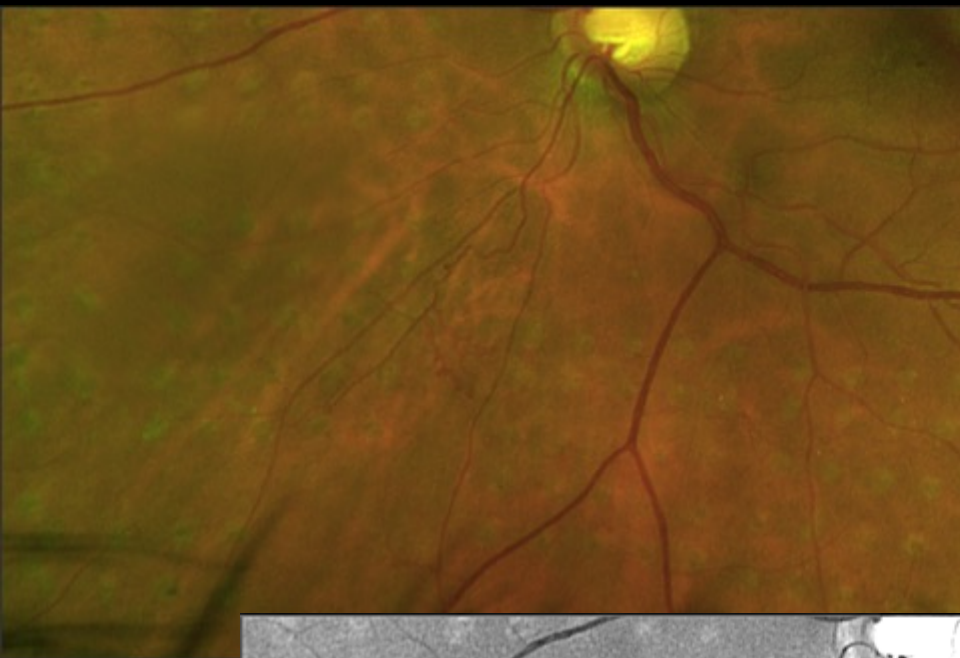


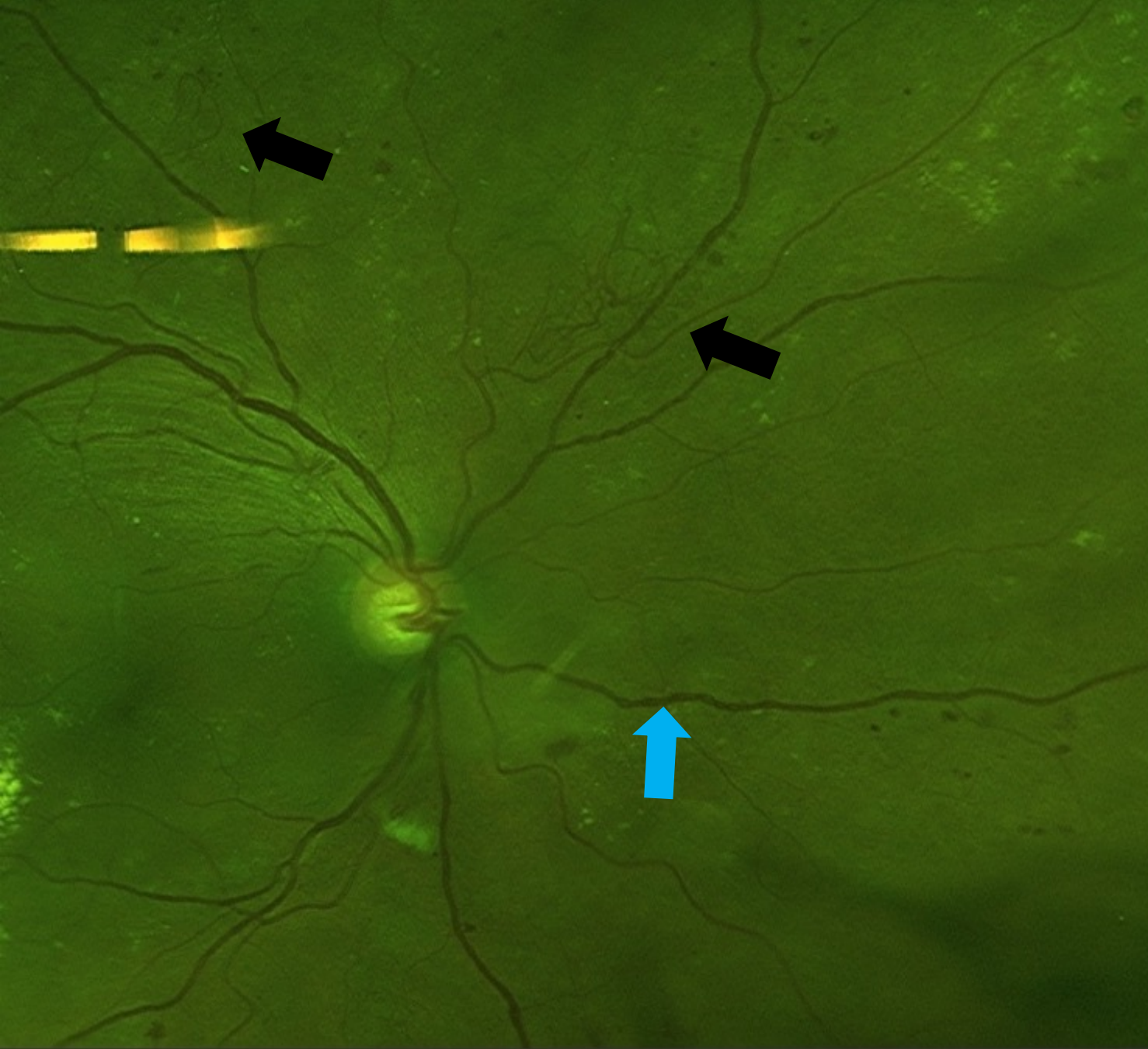








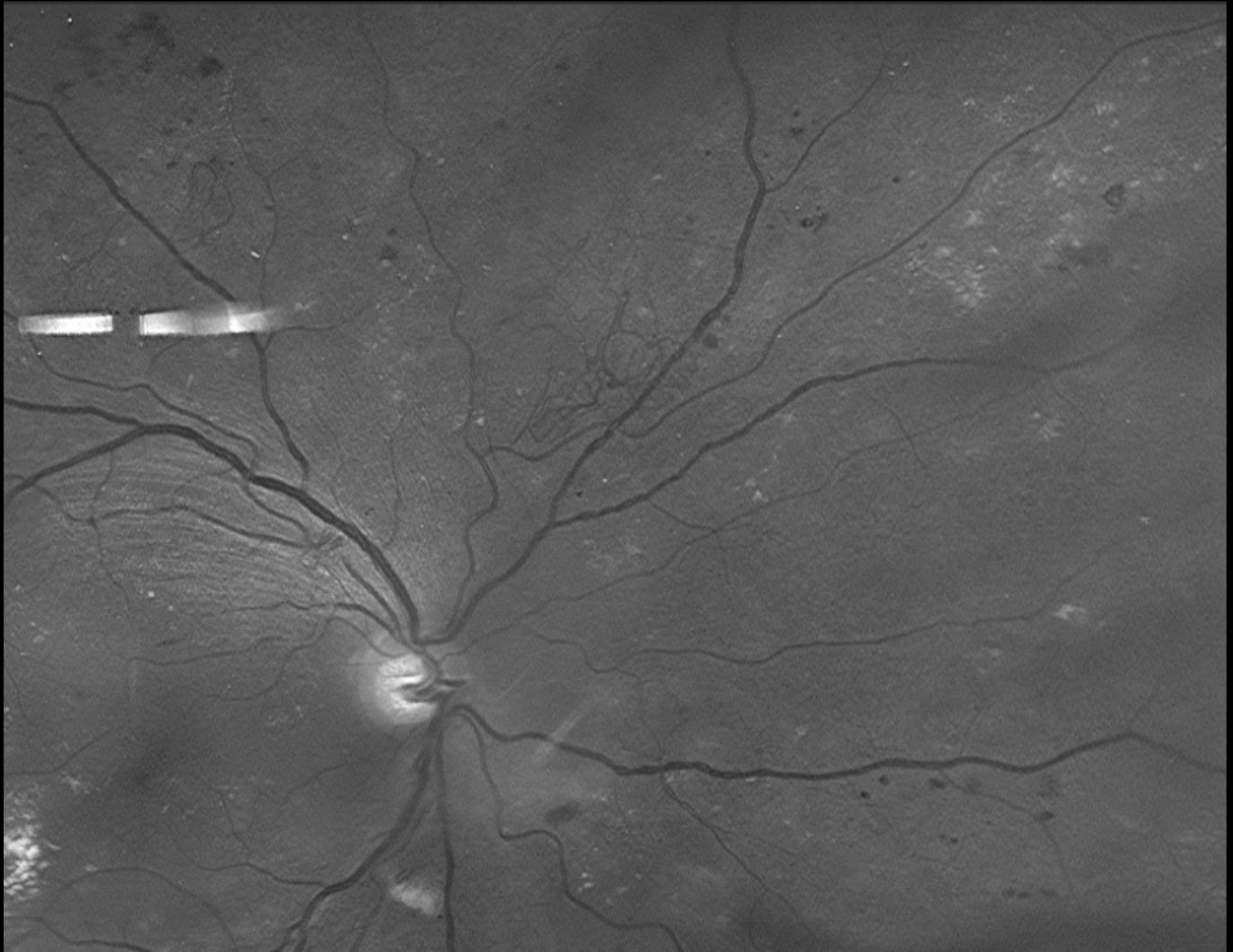




NVE black arrows

Venous Beading
Blue arrow

Red free filter can be helpful to see retinal vasculature



Assessment and Plan

- PDR OU, retinal neovascularization OU
 - PRP OD
 - IVA OS
 - Monitor 1 mos

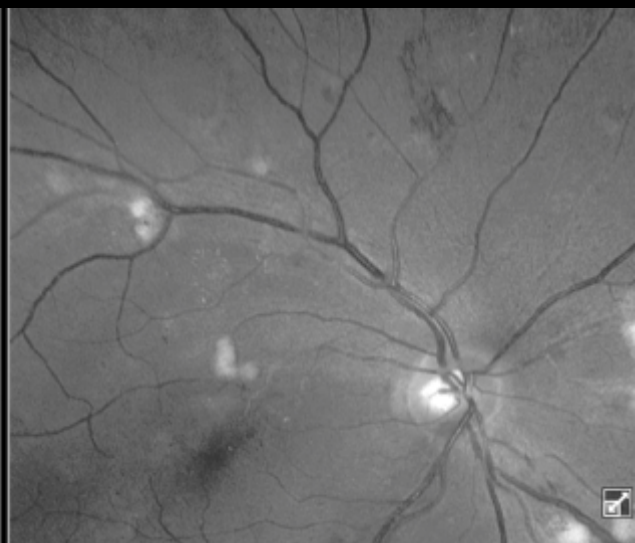
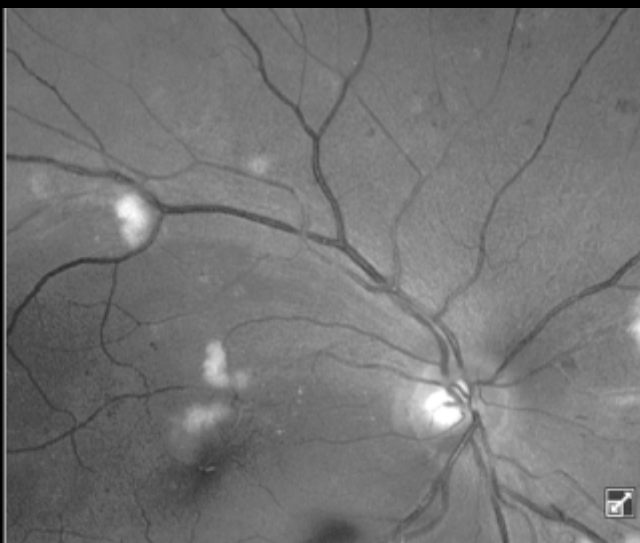
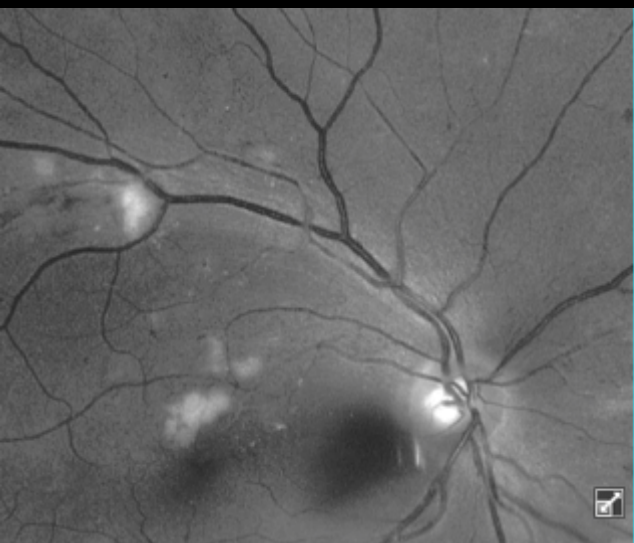
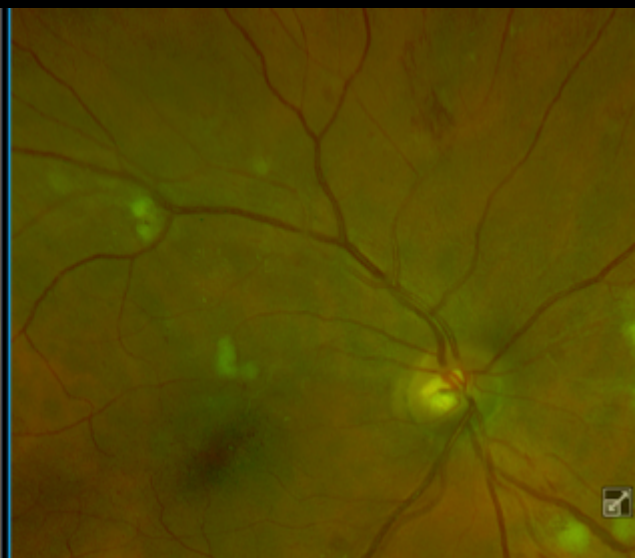
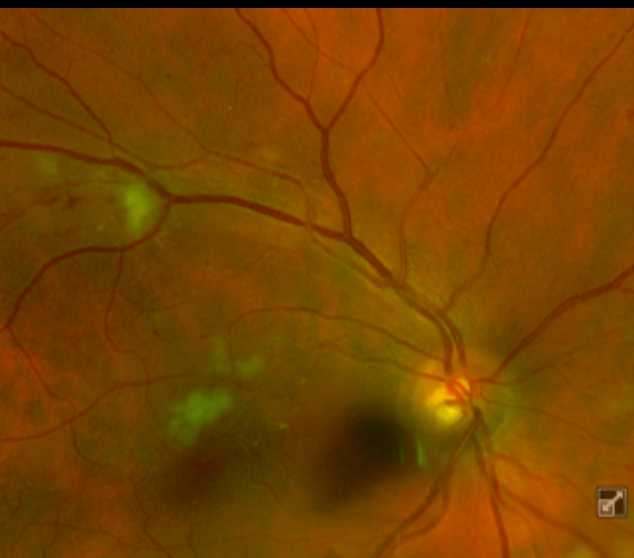
Clinical Pearl



Red free photography or use of red free filter can help to visualize IRMA, NVE, and other vascular changes.

Venkatesh P, Sharma R, Vashist N, Vohra R, Garg S. Detection of retinal lesions in diabetic retinopathy: comparative evaluation of 7-field digital color photography versus red-free photography. *Int Ophthalmol*. 2015;35:635-640. doi:10.1007/s10792-012-9620-7.

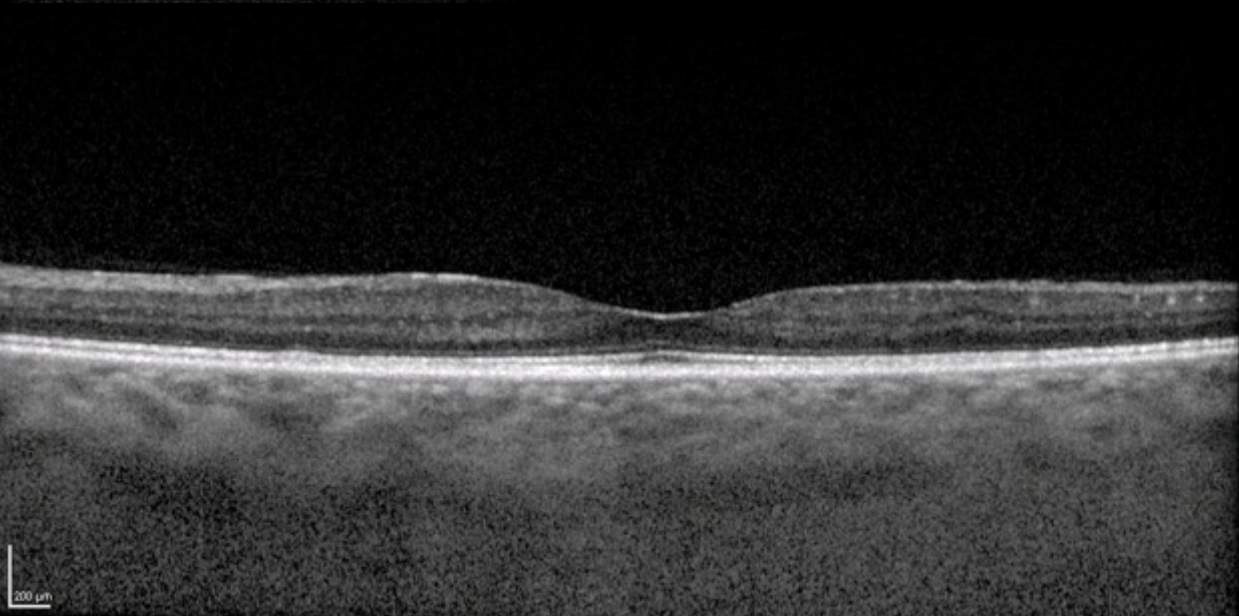
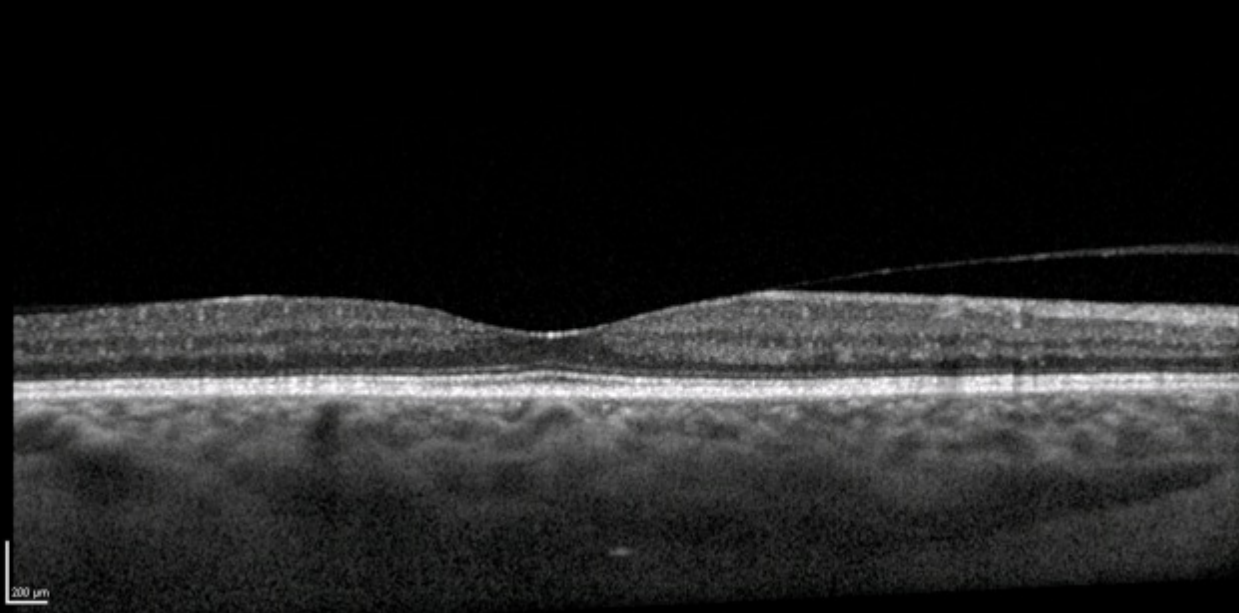
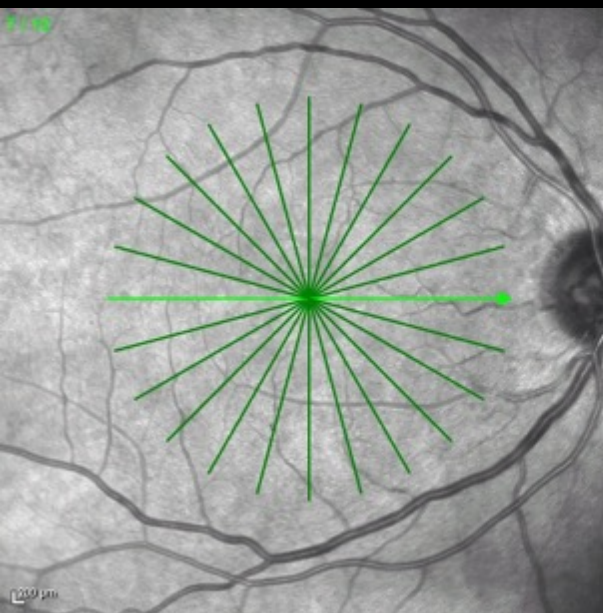
“...detection of most retinopathy lesions in patients with diabetes mellitus is **better** with red-free images than with color images. The red-free images revealed important lesions like **IRMA and NVE** more often than color images.”

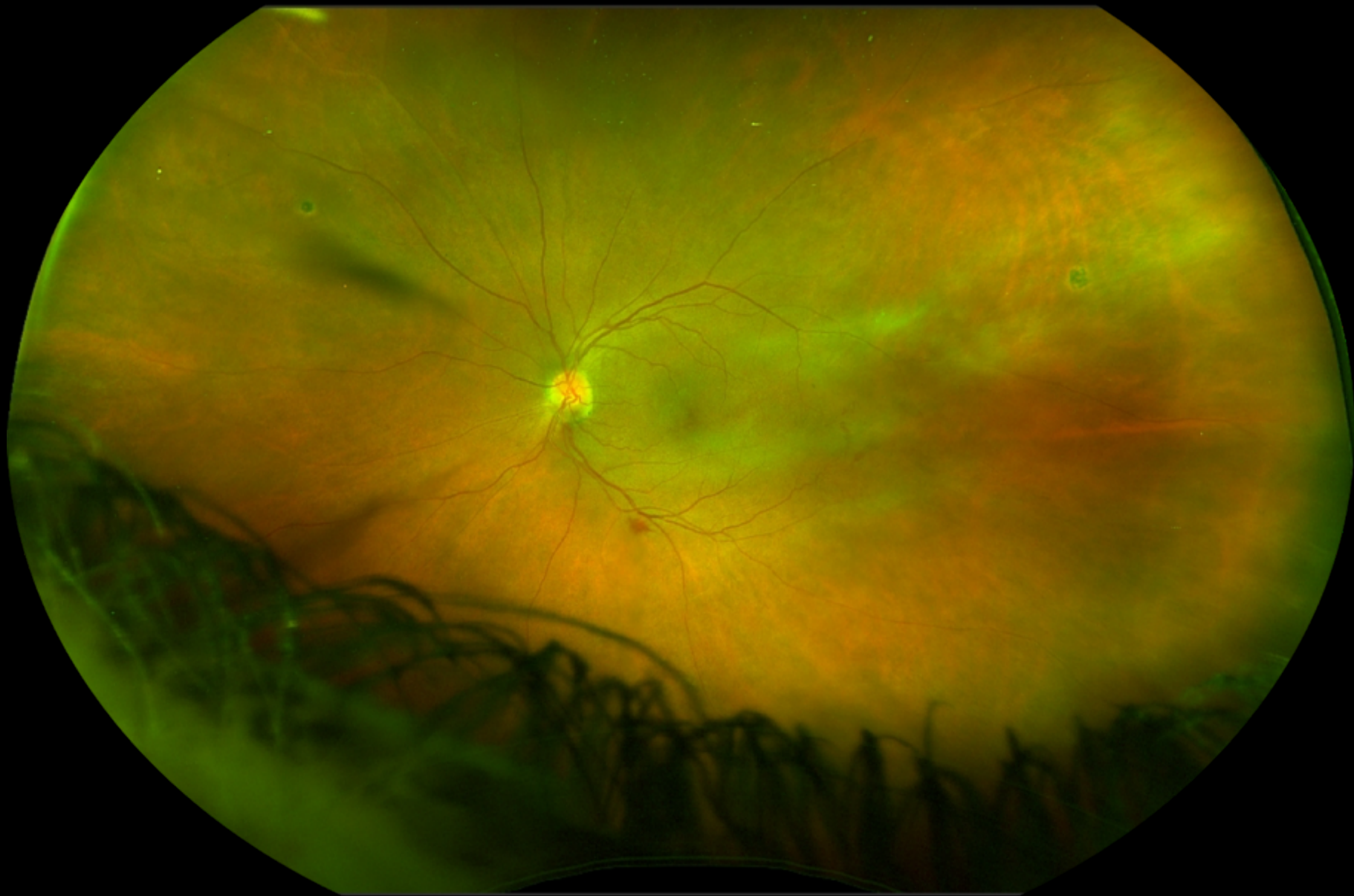


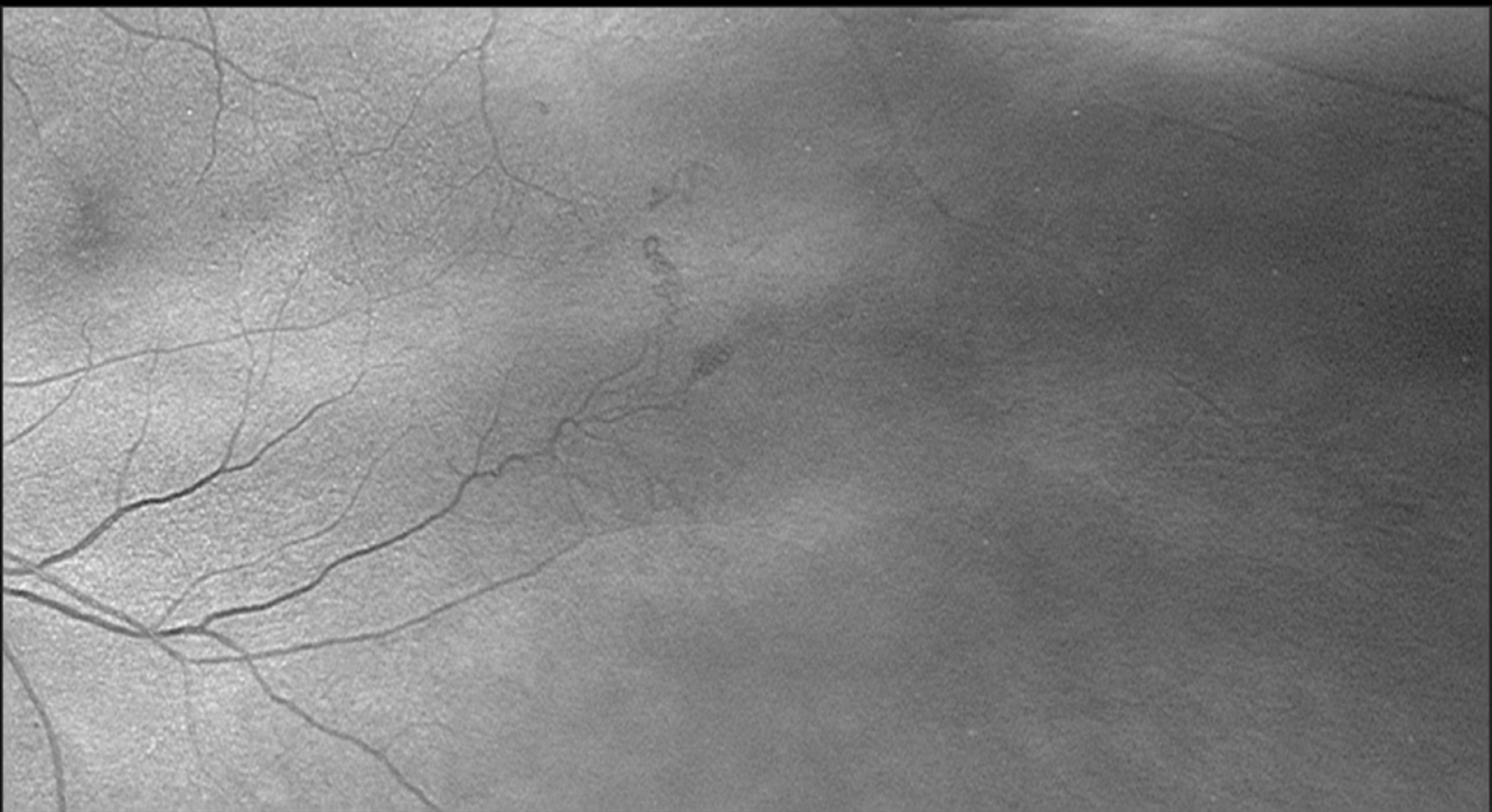
Case 6

Case 6

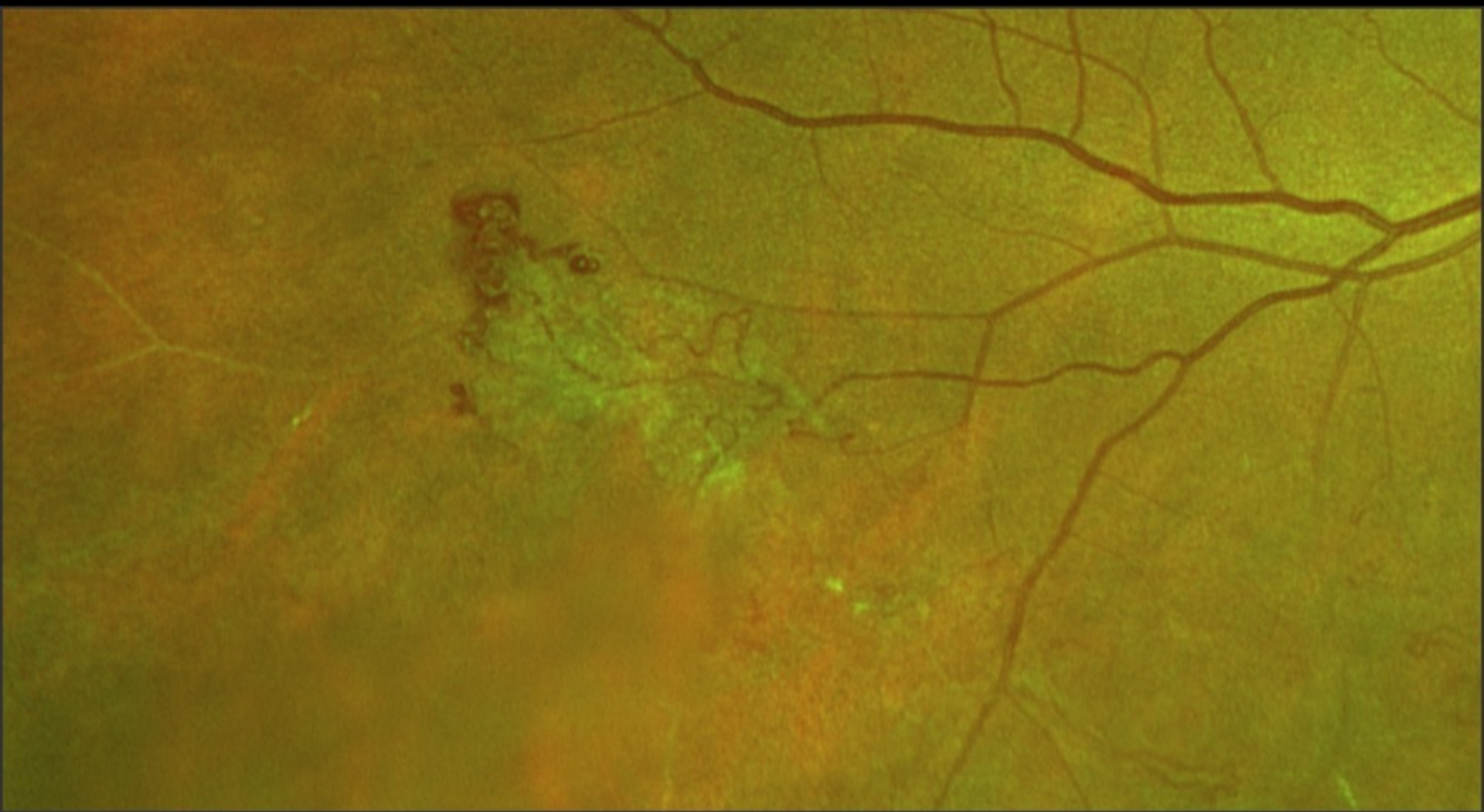
- 52 YO WF
- DM type 2 x 25 years
 - Reports good BS control, last H_{a1c} 6.9
 - HTN x 20 years
- No visual complaints, referred by primary optometrist
- BCVA: 20/25 OD, 20/30 OS
- 2+ NS, 2+ cortical OU



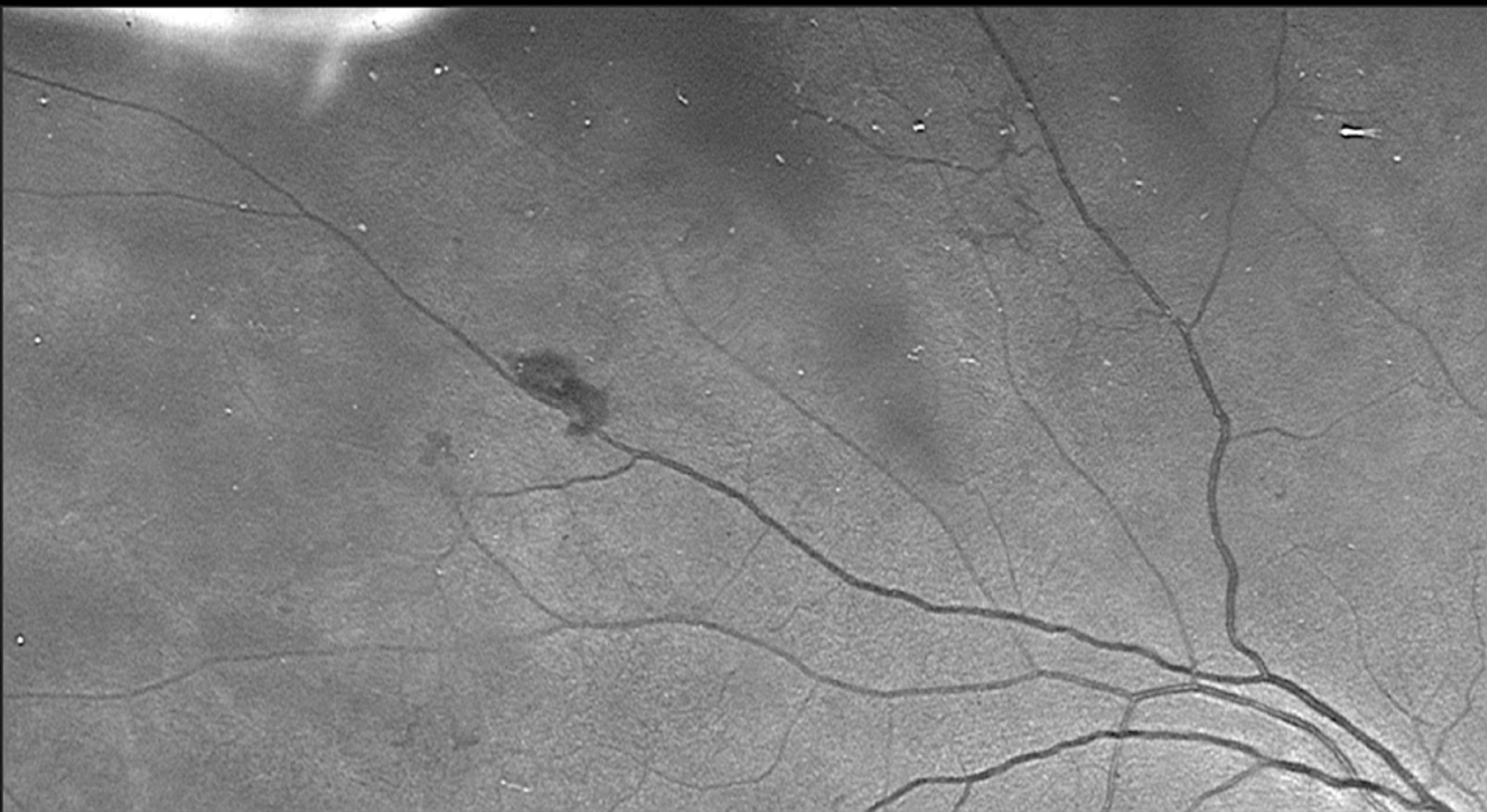


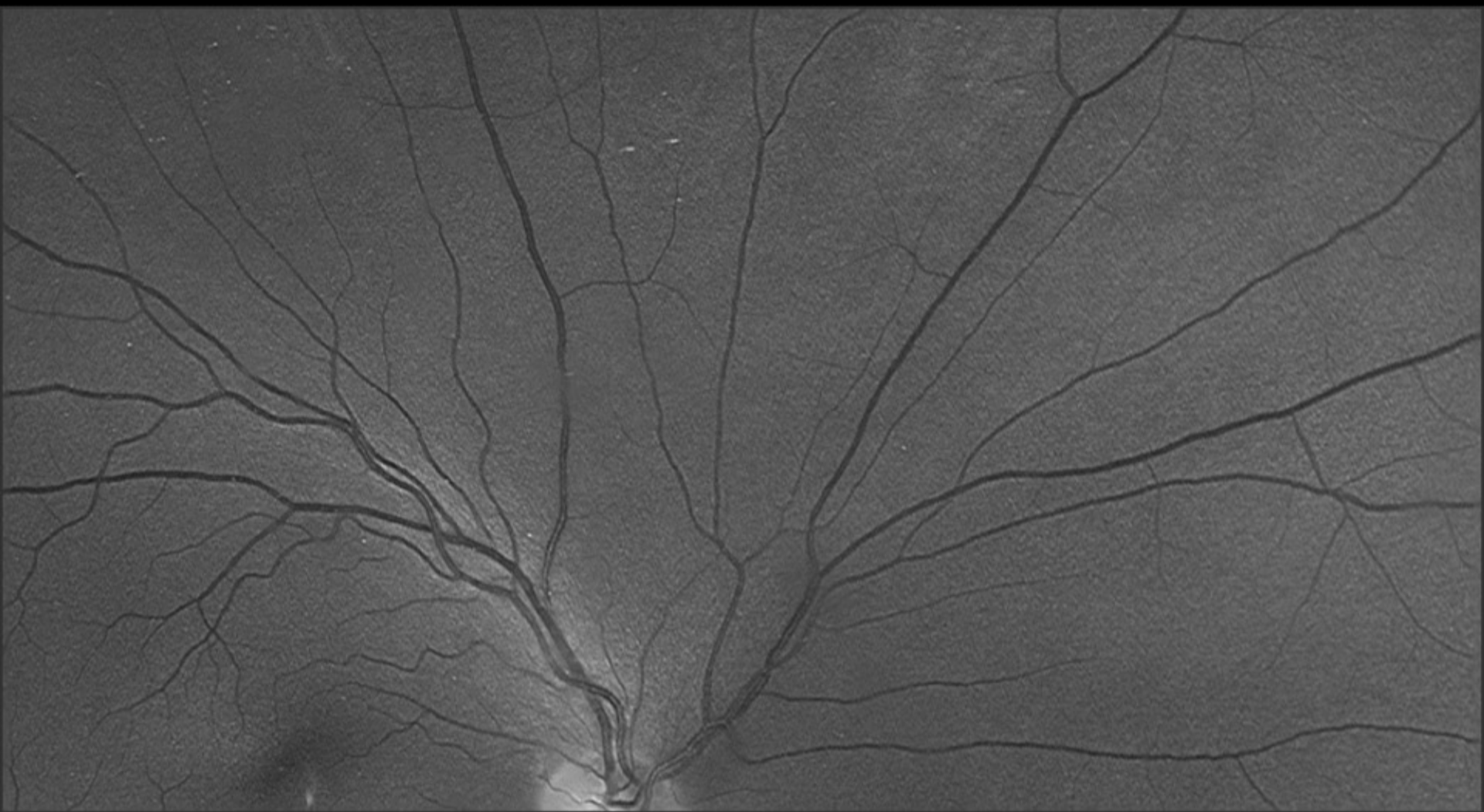


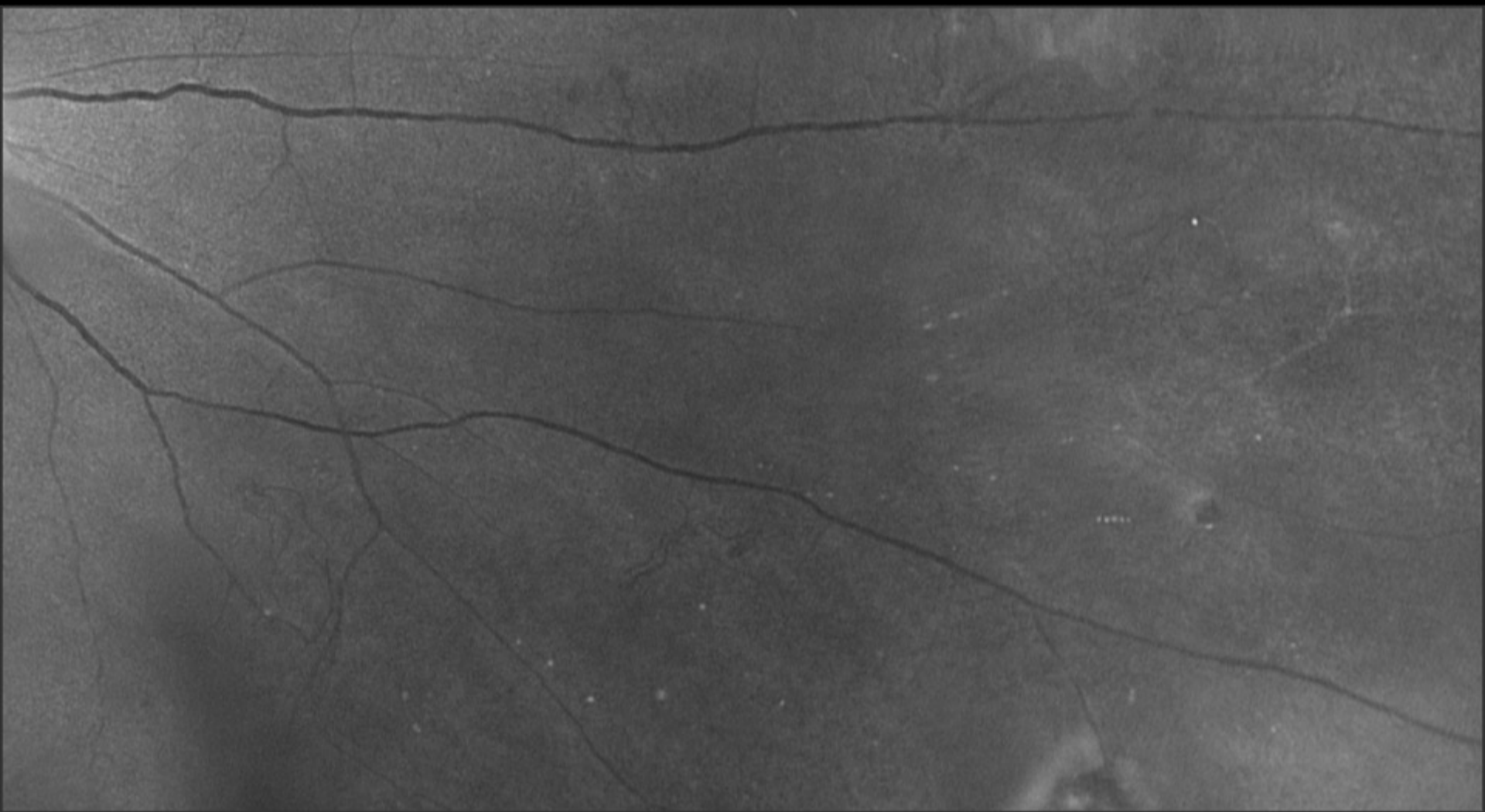












Clinical Pearl



Red free photography or use of red free filter can help to visualize IRMA, NVE, and other vascular changes.

Case 7

- 55 YO WF
- DM x 3 years
 - Reports BS is controlled now, but historically was not
- Monitored for mild NPDR, noticed change in VA OS
- BCVA 20/20 OD, 20/50 OS

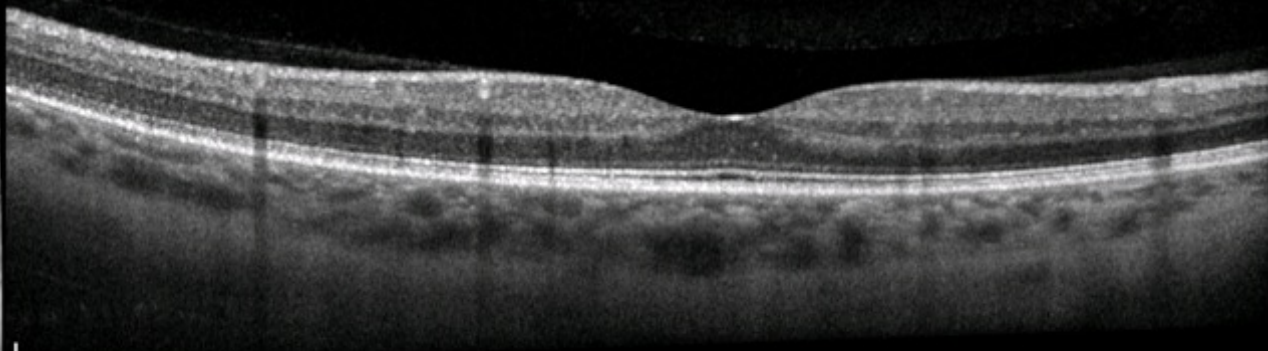
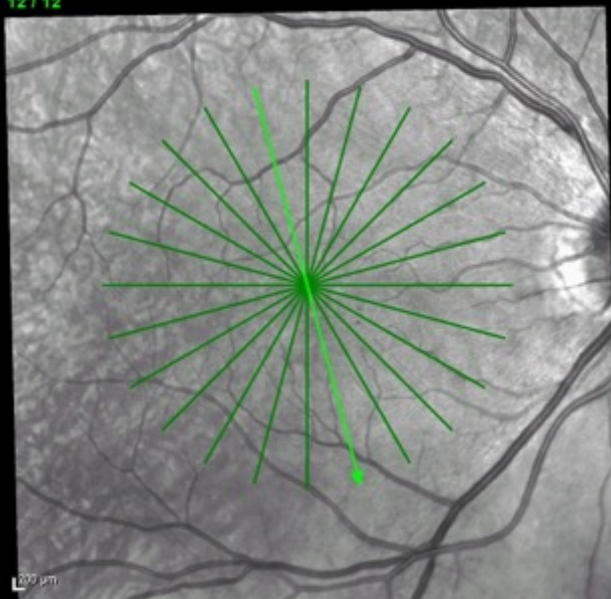


13/2018

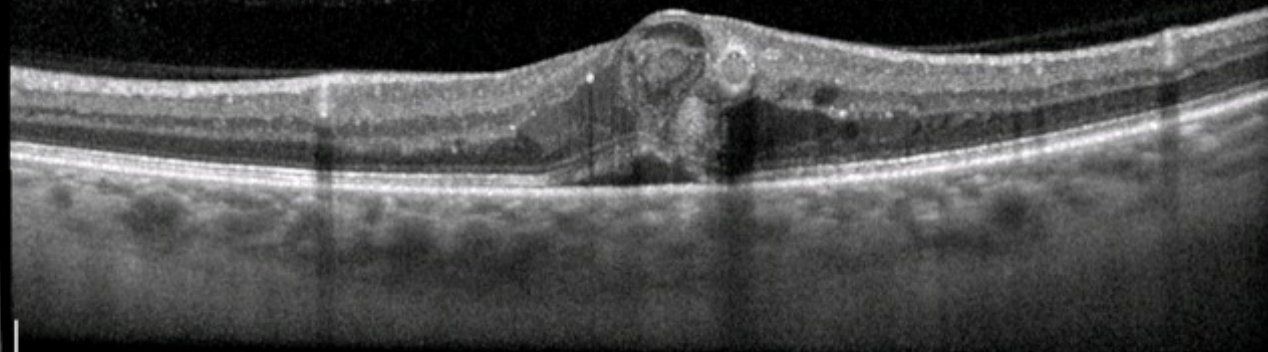


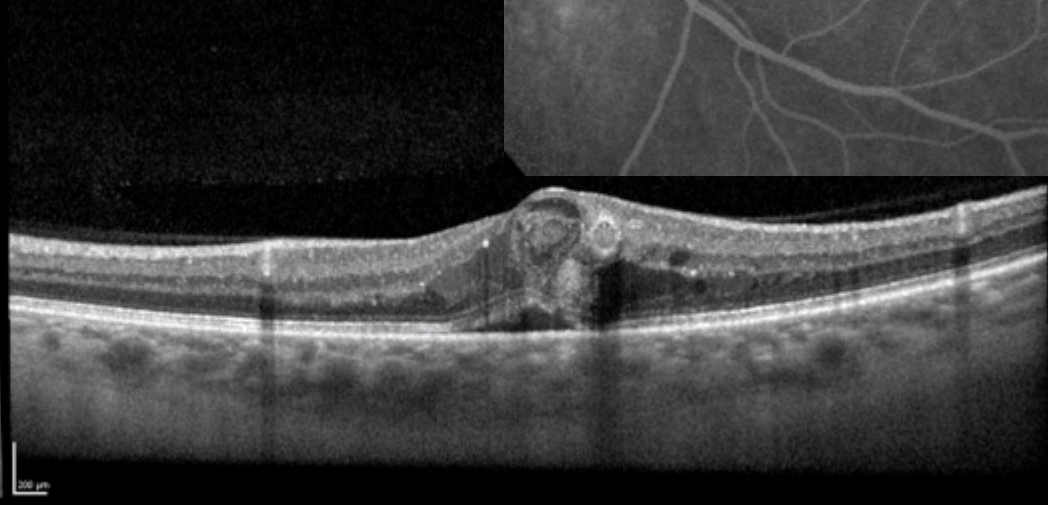
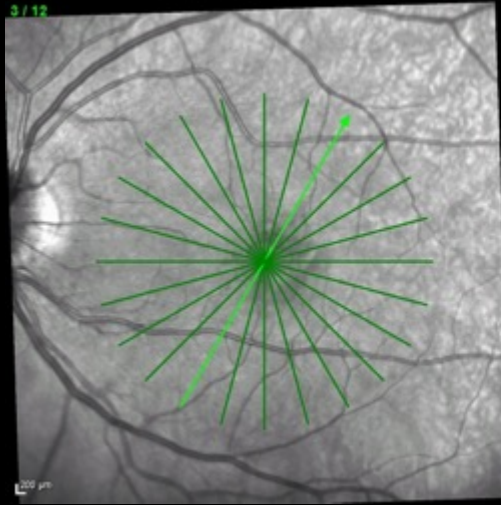
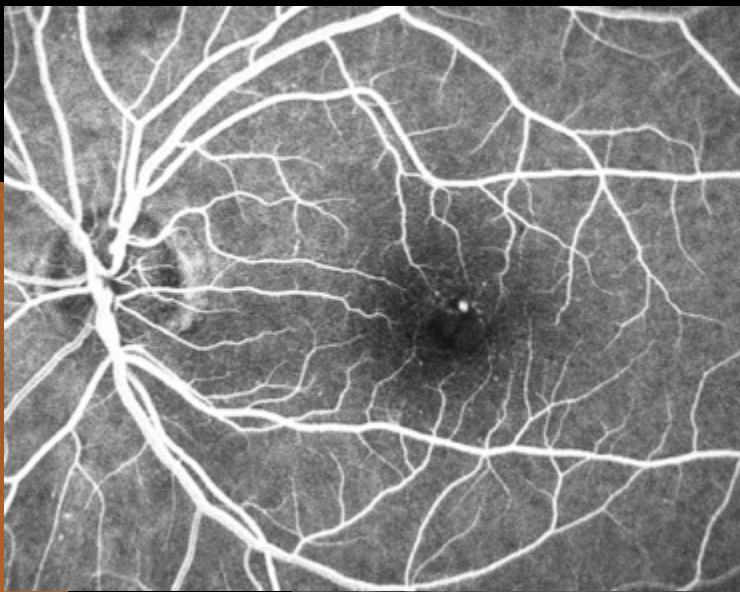
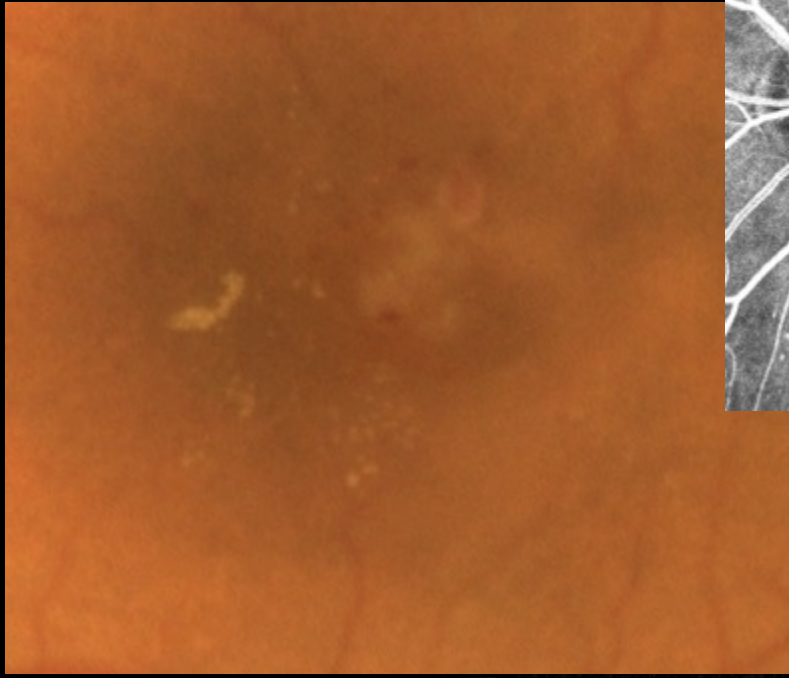
3/2018

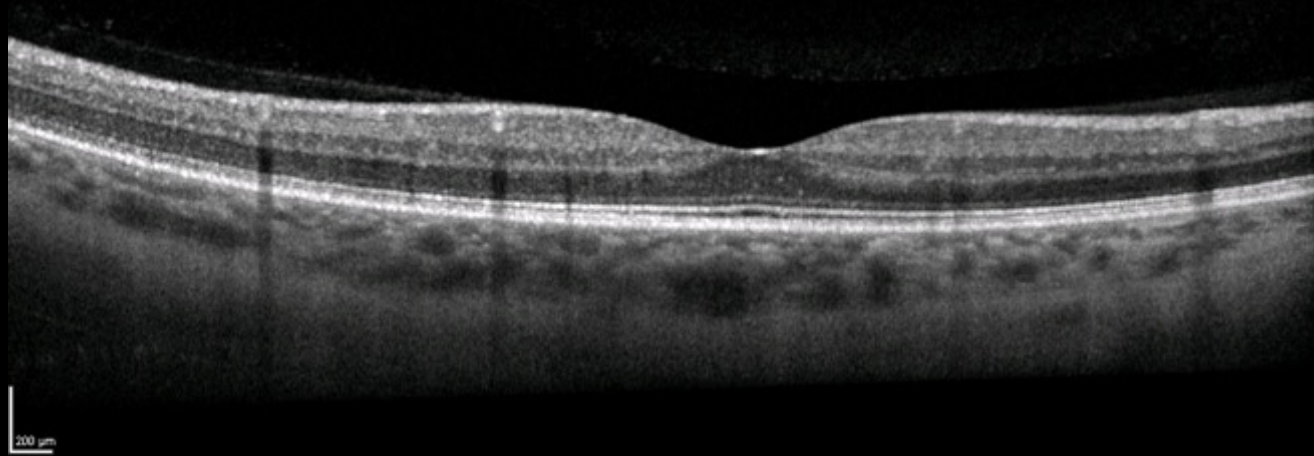
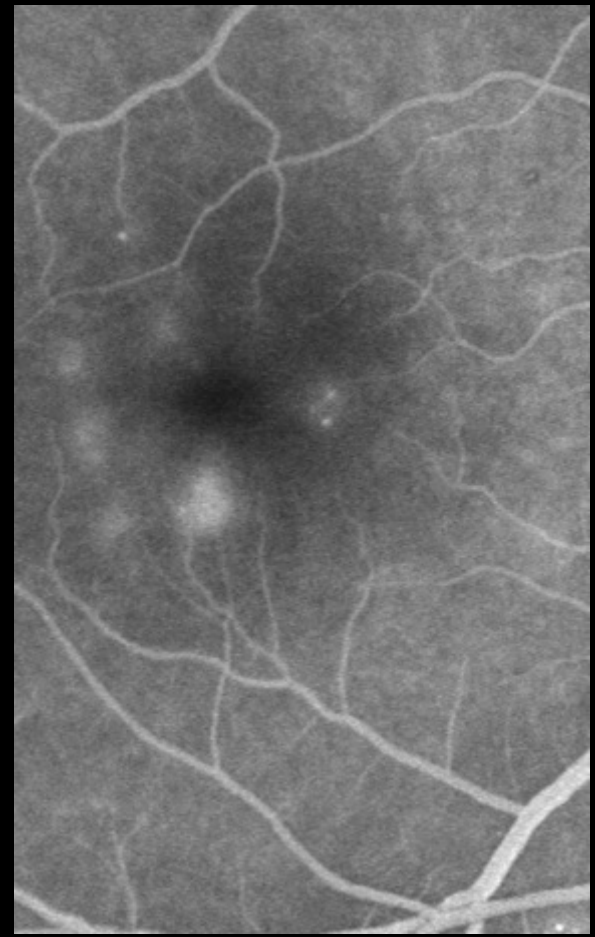
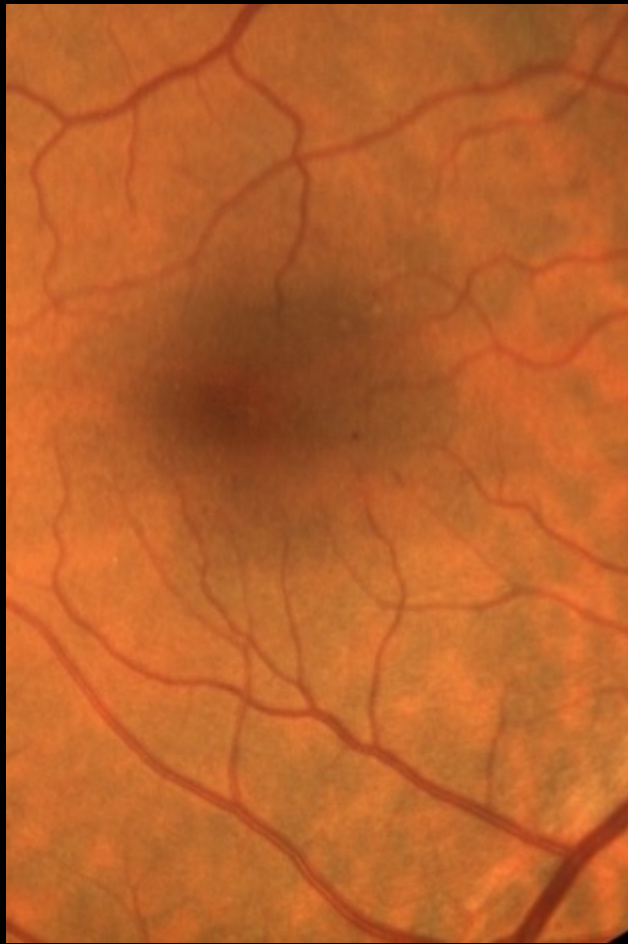
12 / 12



3 / 12



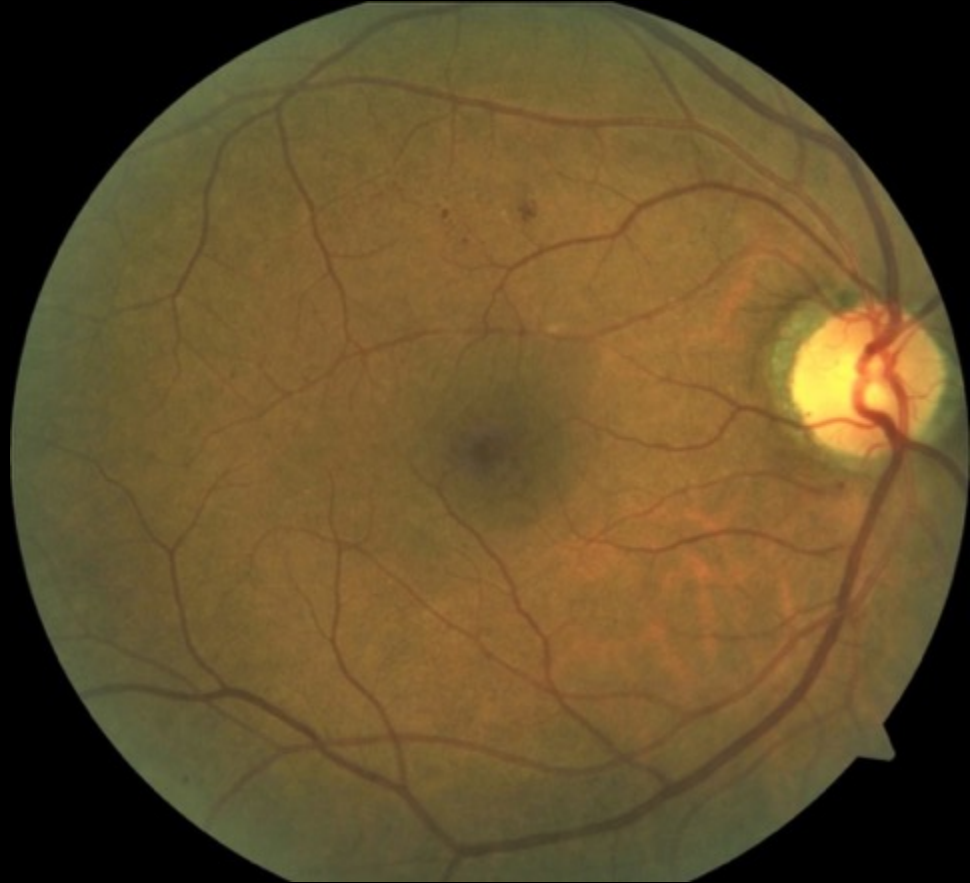




Clinical Pearls

- Macular edema can occur at any stage of retinopathy
- Consider possibility of macular edema when there is exudate present
- DME? Fundoscopy, IVFA, OCT?

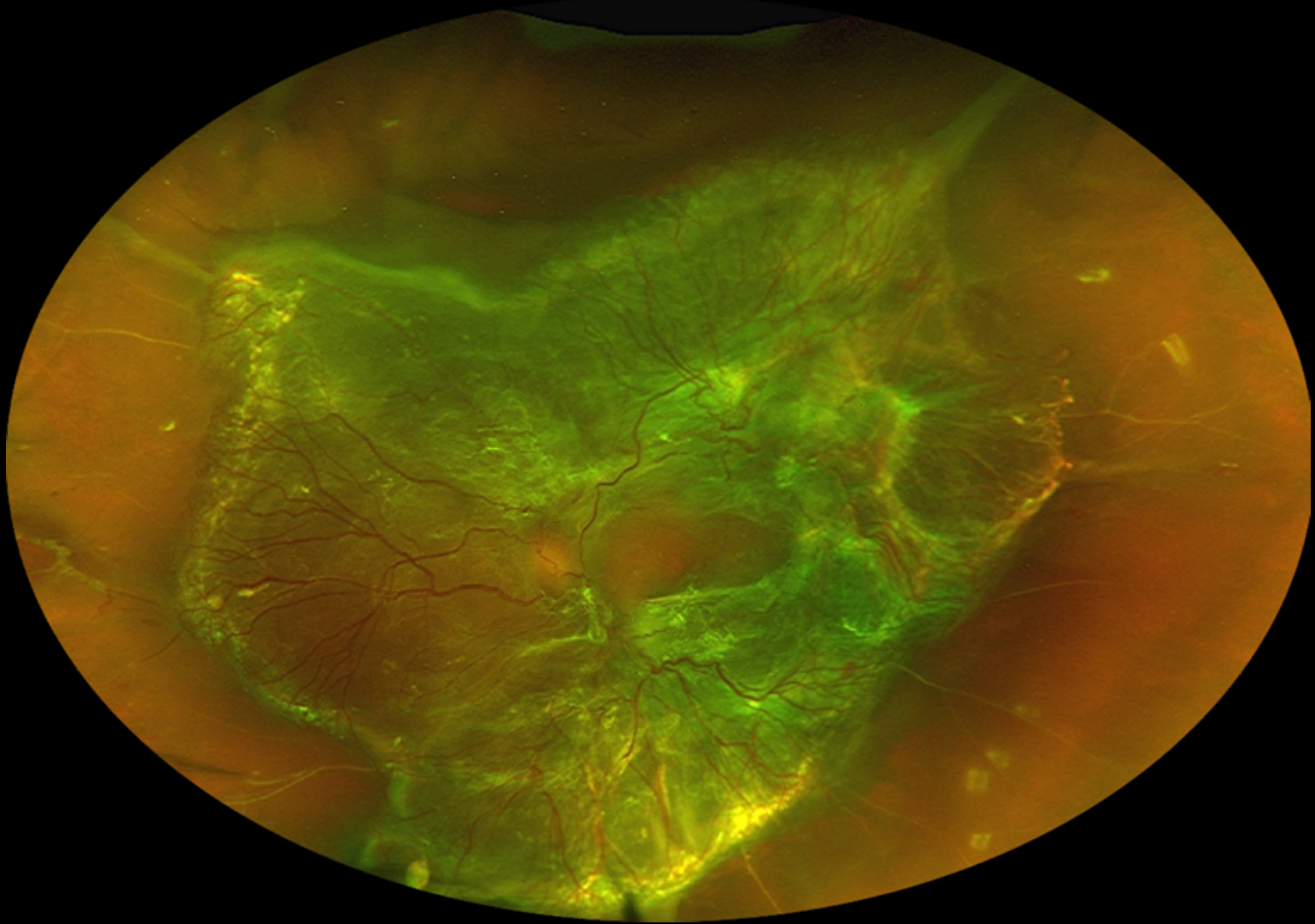
Which eye is Severe?



Summary of Pearls

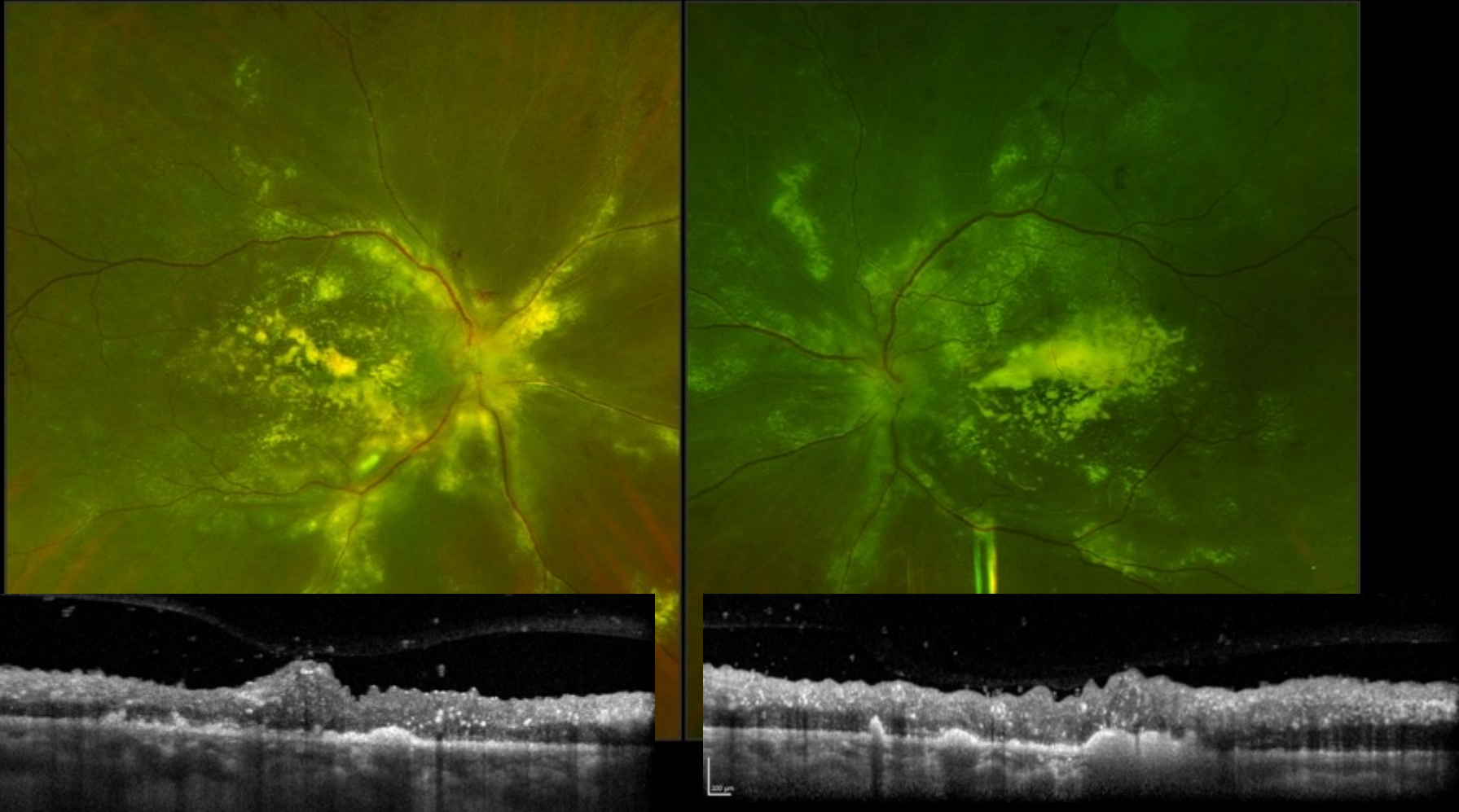
- OCT is helpful in detecting macular edema and macular ischemia.
- PRH in diabetic patient likely = PDR.
- Not all severe/proliferative cases have a striking appearance. Look for microvascular changes, not just hemorrhages.
- Red free photography can help to visualize microvasculature changes.
- Neovascularization grows on the surface of the retina. Don't necessarily need OCT-A to see it...
- Macular edema can occur at any stage of DR.
- Presence of exudates has high correlation with macular edema.

What's The Point?



“I saw my optometrist 5 years ago, they said I **just** had a little bleeding from diabetes”

What's the point



“I saw fine until a few months ago”

What's the point?



"I don't know why I am here. I don't have any problems"

What's the point?

- Up to **98%** of blindness from DM could be prevented by timely treatment with anti-VEGF, laser, and surgery.

