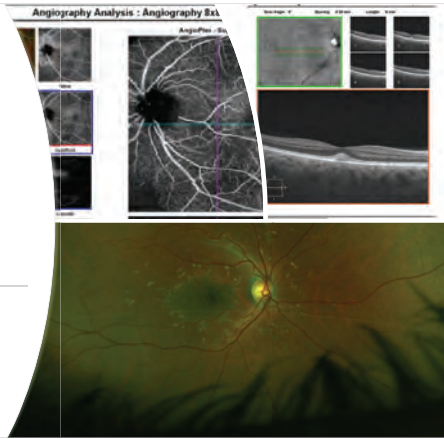


OCT and Retinal Imaging Grand Rounds

Beth A. Steele, OD, FFAO
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Disclosures – Dr. Beth Steele

None

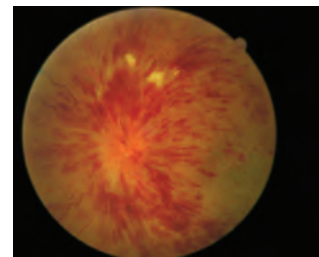
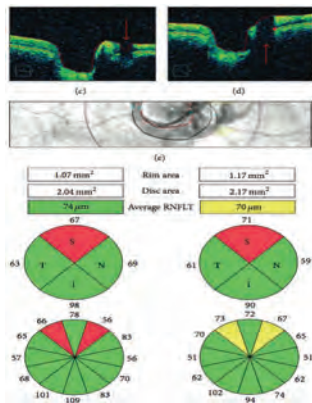
Focusing on Quality 1st...

1. Patient-dependent factors
 - Pupil size, TF, central media opacity
2. Operator-dependent factors
3. Device-dependent factors

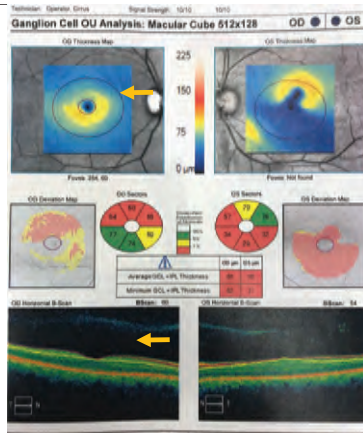
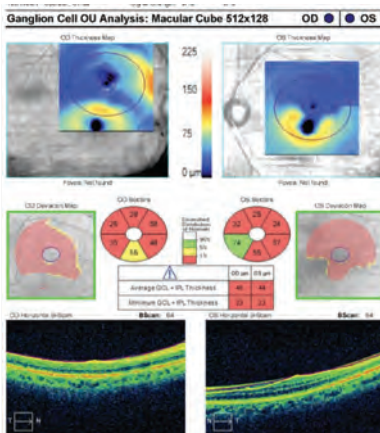
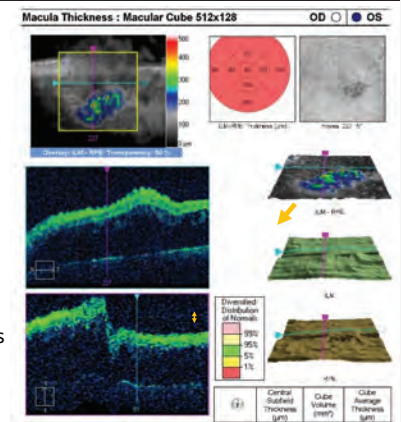
Review Article
 Factors Affecting Cirrus-HD OCT Optic Disc Scan Quality:
 A Review with Case Examples

Joshua S. Buratto, Giovanni Tufano, Keith C. Yellman, Diana Chao, and Christopher Yellman

J Ophth 2013

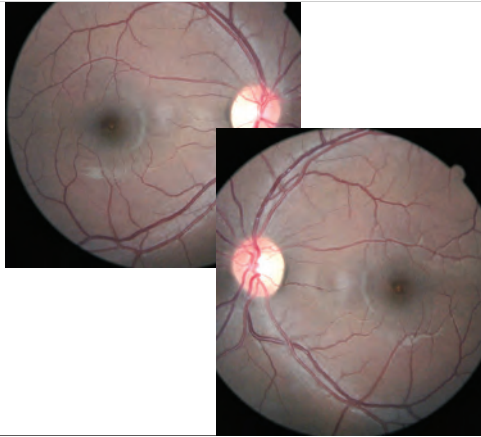


- OCT confused about location of RPE
- Numeric values of macular thickness are erroneously low



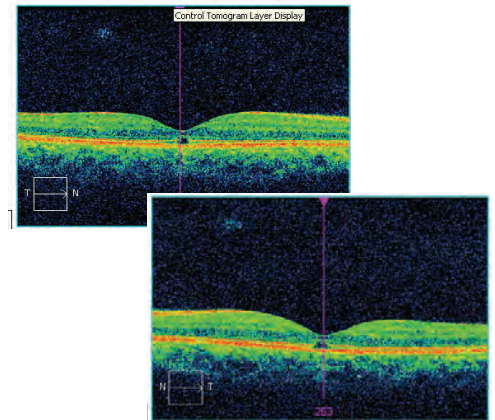
Retinal Grand Rounds

- 34 AA Male
- Smoker
- Schizophrenic
 - Fluphenazine
 - Risperidone
- 20/30 OD, OS, down from 20/20
- Metamorphopsia
- Color vision-normal
- 10-2: clear

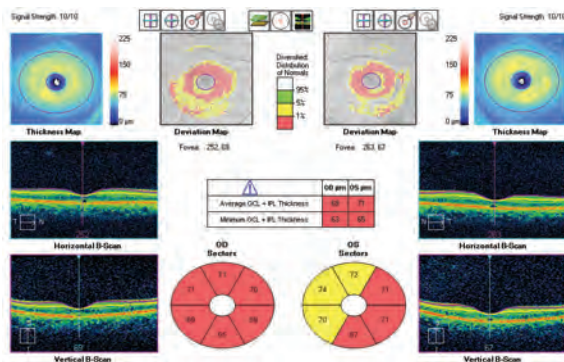


Hmmm...??

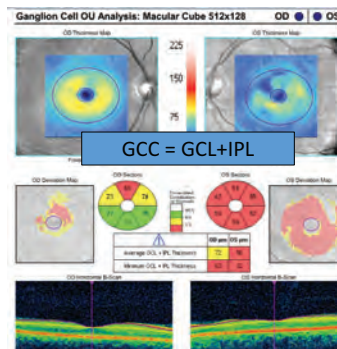
- Macular cyst?
- Vitreomacular traction?
- Inherited disorder?
- Toxicity?
- What else...???



Ganglion Cell Analysis

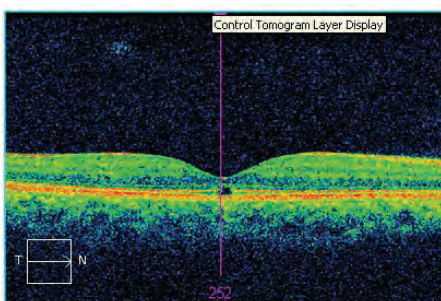


What Else Can Cause Central Inner Retinal Thinning?



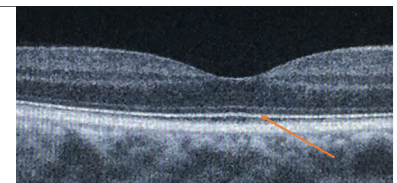
- Glaucoma
- Demyelinating disease
- ONH drusen
- Toxicity
- Retrograde degeneration of GCL from optic tract lesion
- Lebers Hereditary Optic Atrophy
- ION
- Overlying choroidal ischemia

Photoreceptor Integrity Line (PIL) Junction PR I/O segment



Clinical Significance of PIL

- Central blip=elongation on cone outer segment
- Rod monochromat - missing central PIL
- RP - PIL present centrally and then fades away
- Lamen-Moon Bardet-Biedle (LMBB) Syndrome – genetic disease with polydactyly and missing PIL (retinal normal looking), no VEP activity

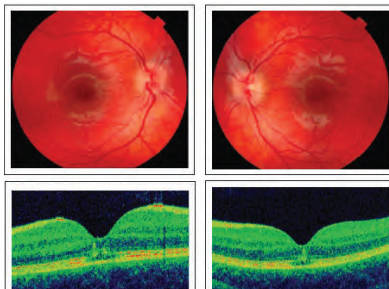


- Toxicities (e.g. Tamoxifen)
- VMT
- Juxtafoveal Macular Telangiectasia
- Welder's retinopathy
- Stargardt's
- Acute Retinal Pigment Epitheliitis
- Or....

Patients admits to “staring at the sun”....

• Solar maculopathy?

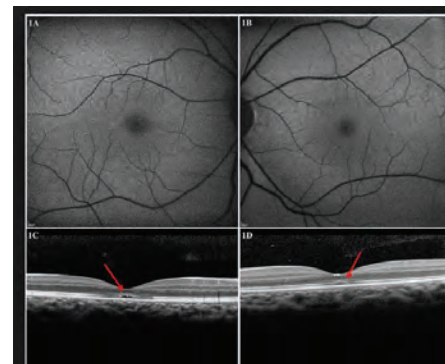
- Damage to outer segment of PR layer, RPE, ↑ choroidal thickness
- Often subtle but permanent vision loss
- OCT findings:
 - Abrupt interruption to OS/IS junction (PIL)
 - Slight separation between RPE and PR



<http://www.retinalphysician.com/issues/2013/october-2013/solar-retinopathy-etiology,-diagnosis,-and-treatment>

Solar Retinopathy - FAF

- Pinpoint hypo at fovea with subtle hyper surrounding it



Chen K, et al. High Definition Spectral Domain Optical Coherence Tomography Findings in Three Patients with Solar Retinopathy and Review of the Literature.

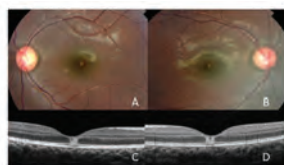


Fig. 1—Case 1: Acute stage. A, B. Color fundus image shows a pale foveal spot. C, D. An optical coherence tomography picture reveals a full-thickness foveal hyperreflectivity. Acute stage of foveal hyperreflectivity (FAF) uninvolved.

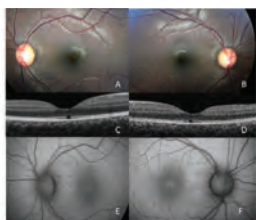


Fig. 2—Case 1: One month after injury (subacute stage). A, B. Color fundus photograph shows a pale foveal spot. C, D. An optical coherence tomography picture reveals a rectangular-shaped micro-hole in the junction between inner and outer segments of photoreceptors. E, F. FAF shows a foveal spot of hyperautofluorescence surrounded by a hyperautofluorescent halo in the center of the greater hyperautofluorescent macular area 1 month after the exposure.



Fig. 3—Case 1: Chronic stage. A, B. A subtle foveal spot appeared in the fundus image. C, D. A rectangular-shaped micro-hole in the junction between inner and outer segments of photoreceptors. E, F. FAF shows a foveal spot of hyperautofluorescence surrounded by a hyperautofluorescent halo in the center of the greater hyperautofluorescent macular area 1 month after the exposure.

Marino-Suarez, Can J Ophthalmol, 2017.

Differentials?

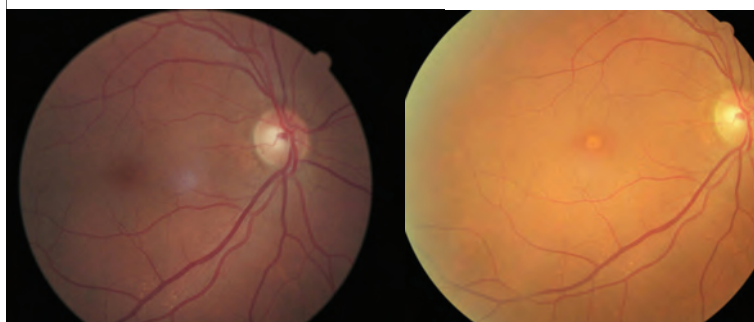
Adult Vitelliform
Pattern Dystrophy
VMT
CSR
PED

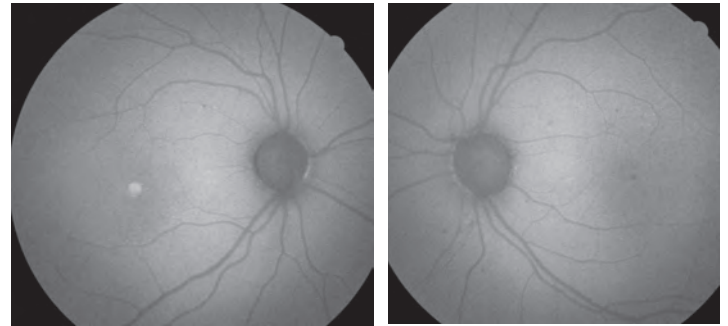
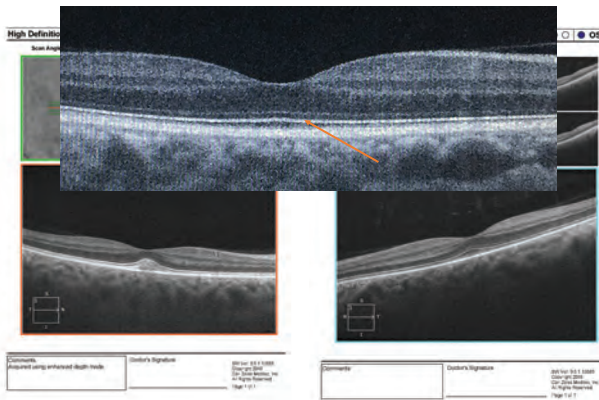
57 year old WM



2 years ago...

Today...

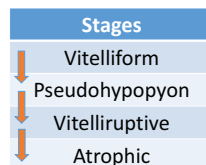
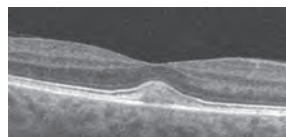




Adult Vitelliform Dystrophy

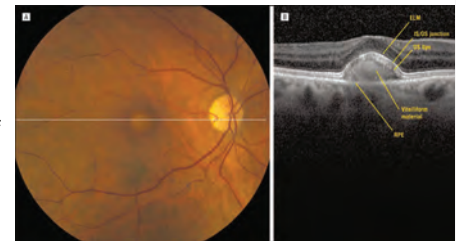
- Typically bilateral pattern dystrophy
 - 1/3-1/2 DD size yellowish elevation
 - Above RPE, below retina
- 4th-6th decade
- Acuity 20/50 or better

- Complications:
 - RPE pigmentation
 - PR disruption
 - CNVM – 11%



Pattern Dystrophy as a Differential for AMD..

- Group 1:** adult-onset foveomacular vitelliform dystrophy.
- Group 2:** butterfly-shaped pigment dystrophy.
- Group 3:** reticular dystrophy of the RPE.
- Group 4:** multifocal pattern dystrophy simulating fundus flavimaculatus.
- Group 5:** fundus pulverulentus.



<https://www.reviewofophthalmology.com/article/pattern-recognition-how-to-identify-and-confirm-multifocal-pattern-dystrophy>

Fundus Autofluorescence – clinical significance

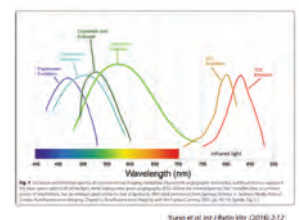
Pros	Cons
Noninvasive, easy Attached to camera (some) Early detection and the potential for predicting progression of many retinal diseases	Expensive addition to retinal camera, and does not allow extra billing Quantification of intensities is subjective Varying reports/data of clinical use

- View of many different retinal disease processes from a *metabolic perspective*
- Outer segment PRs shed → phagocytosis via RPE
→ **Lipofuscin (predominant ocular fluorophore)** is formed as a result

Creates autofluorescence when exposed to wavelengths of light 500-800nm

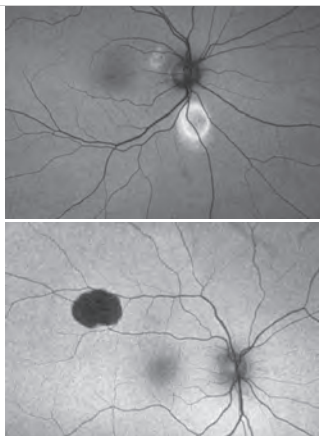
Lipofuscin – hyperfluoresces with 500-800nm

- Byproduct of phagocytosis of PR OS
- Accumulates in the RPE (and eventually in outer retinal layers)
 - naturally with age
 - excess accumulation is a sign of pathology: activity in RPE cell death process
- Lipofuscin exposed to light 500 to 800 nm → lipofuscin molecule excited → spontaneously releases a photon of light with a longer wavelength → visible in photograph

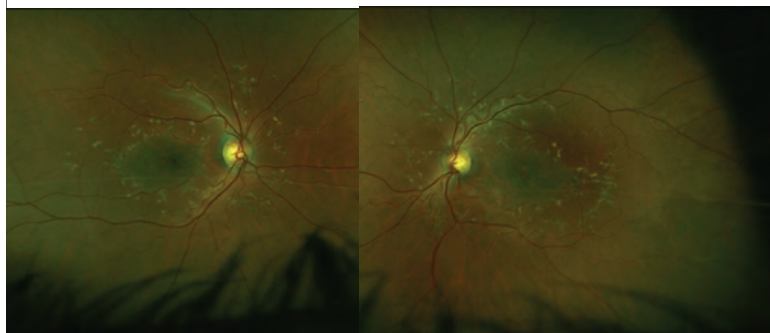


FAF Image Interpretation

- Hyper AF= RPE is metabolically sick
 - LF accumulation
- Hypo AF=
 - RPE is dead or not present (LF gone)
 - Signal blockage
- FAF intensity variables
 - age
 - media opacity
 - pupil size
 - FAF device used

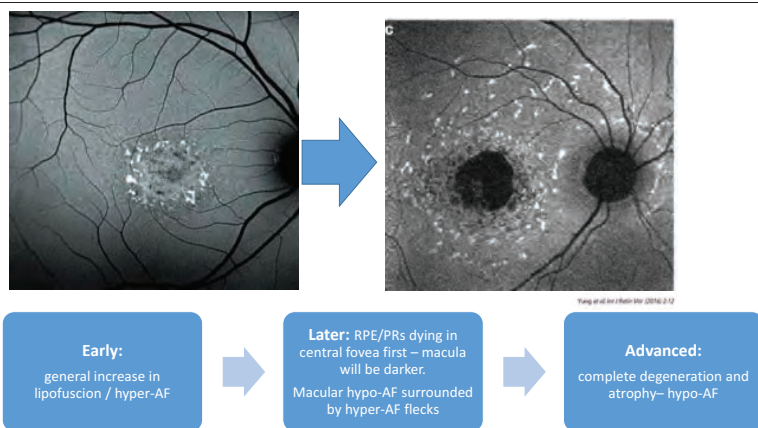
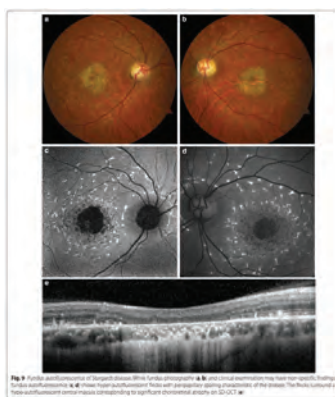


41 AA Male; Never had an eye exam

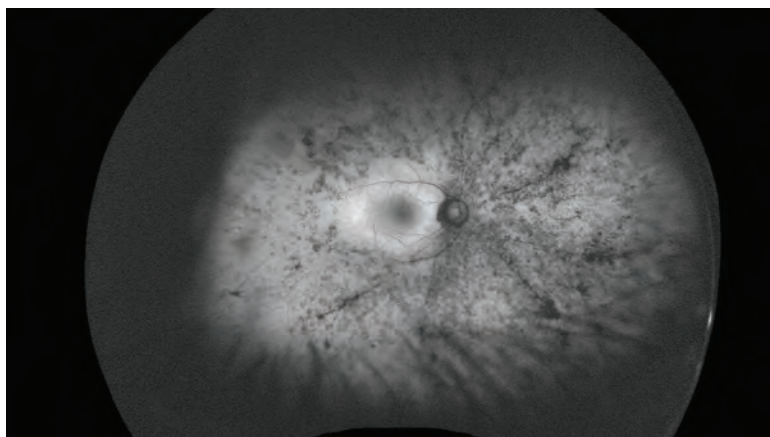
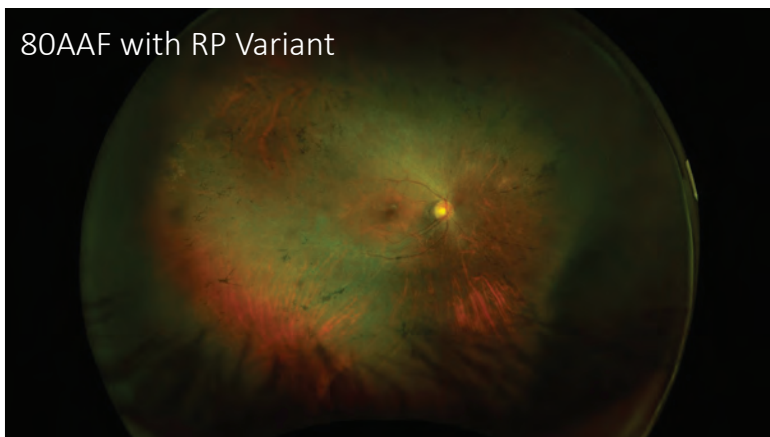


Stargardt Disease

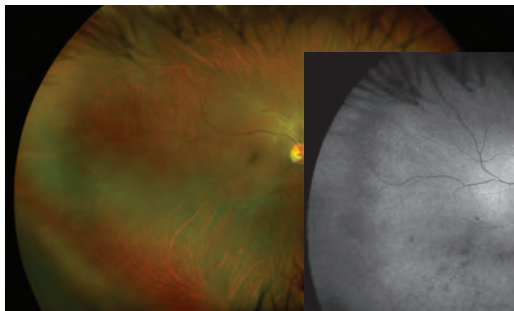
- Defective outer segment degradation, lipofuscin accumulation, and center degeneration of RPE and PRs
- OCT: disruption/loss IS/OS of photoreceptor layer
- FAF: Useful in Dx
 - Early atrophy/flecks not visible otherwise
 - correlates well with vision function



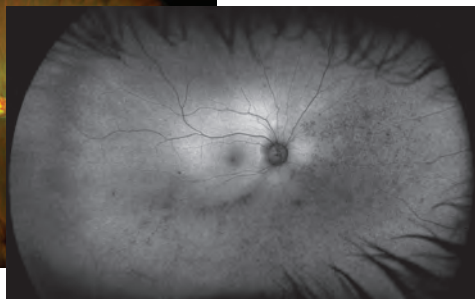
80AAF with RP Variant



What about this one..??



76% more abnormal peripheral findings than standard exam due to use of FAF – Saddy, IOVS, 2012



Images courtesy of Srinivas Saddy, MD via Optos

LUXTERNA™ (voretigene neparvovec-rzyl)

- FDA approved December 2017 for children and adults with mutations of both copies of RPE65 genes
 - Lebers Congenital Amaurosis, RP
- One time gene therapy – inserts a normal copy of the gene into retinal cells
 - Subretinal injection
 - One eye at a time, ≥ 6 days apart
- Improved in visual function based on navigation of an obstacle course at low light levels

Be proactive in...

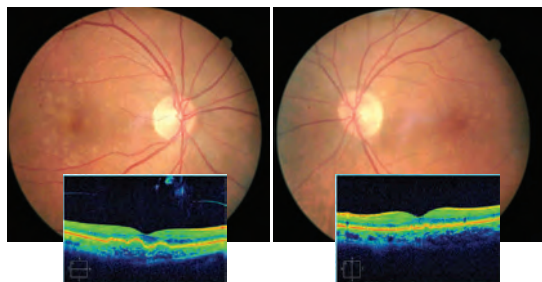
- Genetic testing / counseling
- Low vision referrals
- Defining legal blindness / advocating disability



Dry AMD with drusenoid PED

73 Caucasian female

6-year history of dry AMD OD>OS



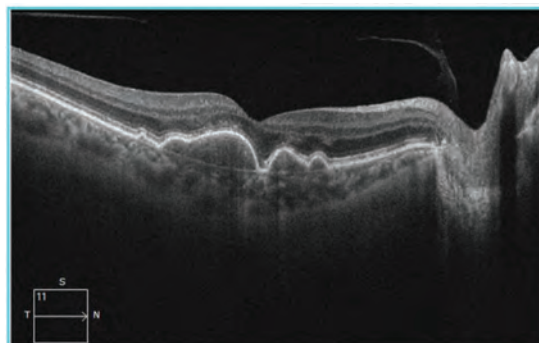
73 Caucasian female

6-year history of dry AMD OD>OS

Diligent compliance with AREDs formula, non-smoker, healthy lifestyle

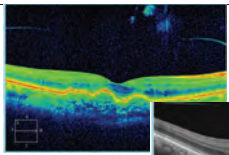
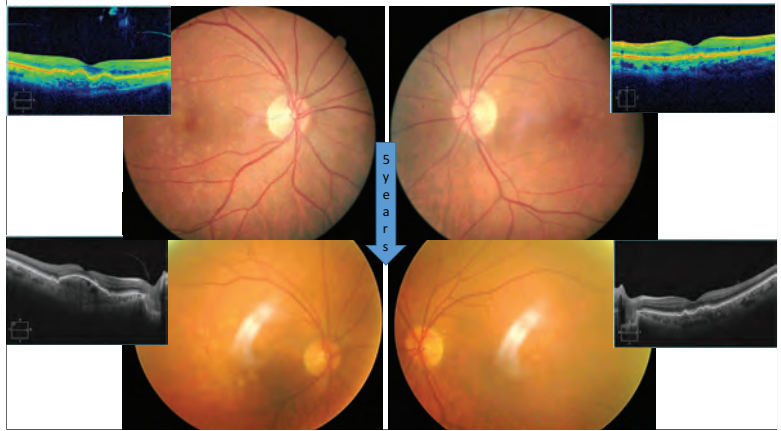
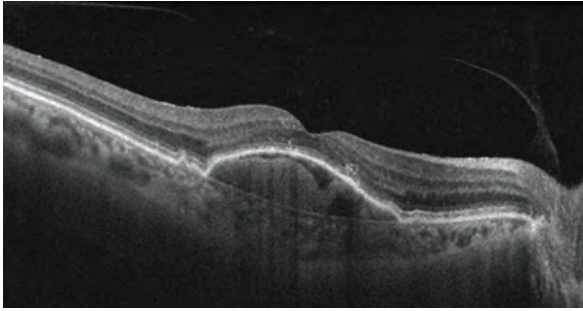
2 years from baseline

- 20/25

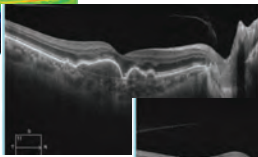


5 years
from
baseline

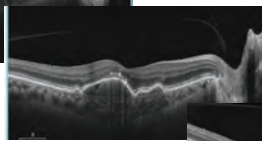
- 20/30



Initial visit
(20/25)

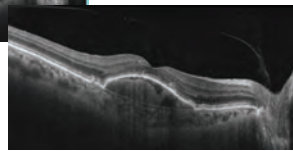


2 years
(20/25)



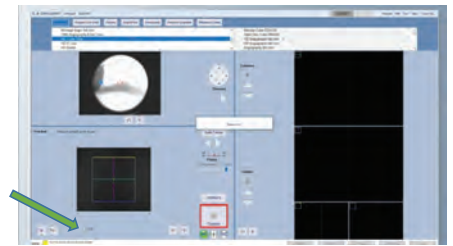
4 years
(20/25-)

5 years
(20/30-)



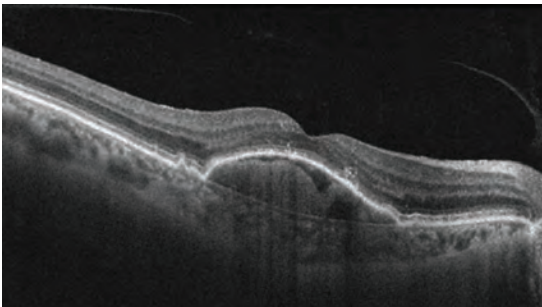
Enhanced Depth Imaging (EDI)

- Deeper scan
- Increase resolution for
outer retina, RPE, choroid



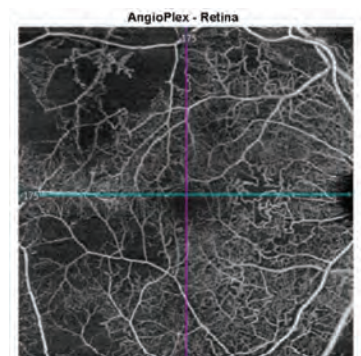
Concerns?

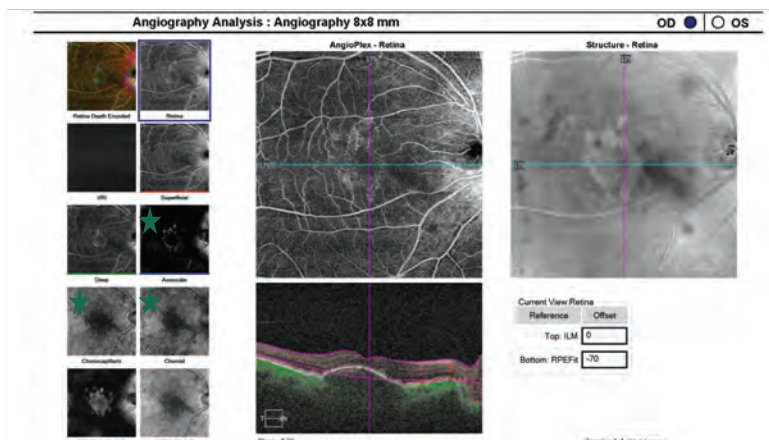
- Enlarged PED
 - drusenoid
 - Vs. serous
 - Vs. hemorrhagic



OCT-A: Overview of Functionality

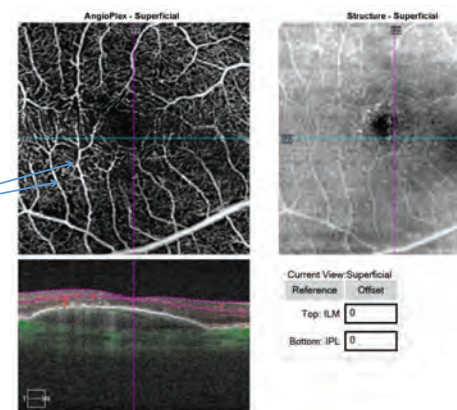
- Isolates microvascular circulation
 - High axial resolution = 5 microns
- Blood flow → bright
- No flow or too slow to detect → dark
- Non-invasive, easily repeatable



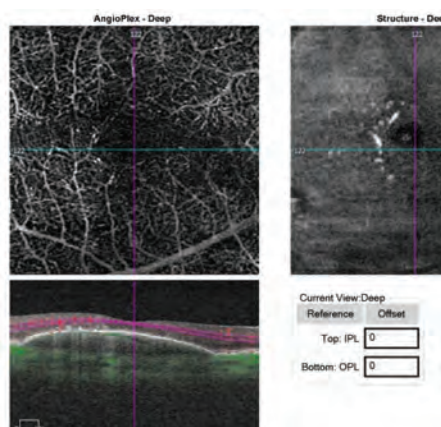


Superficial Capillary Plexus

Some vascular disruption due to underlying PED



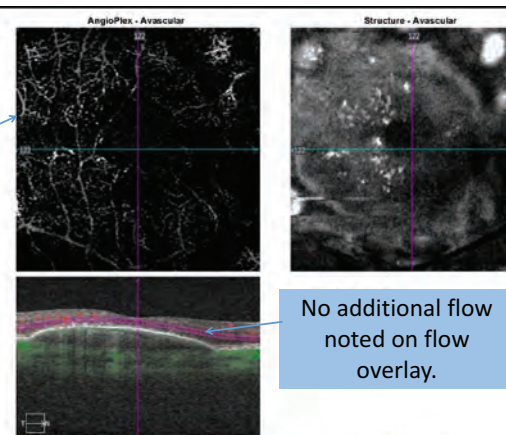
Deep Capillary Plexus



Avascular Zone

Projection artifacts from more superficial layers.

No well-defined additional vasculature.

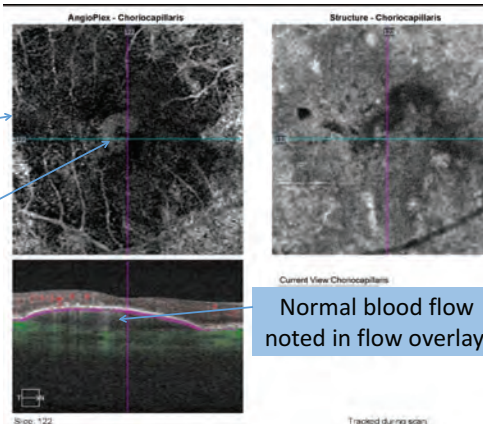


No additional flow noted on flow overlay.

Choriocapillaris

Absence of vascular net.

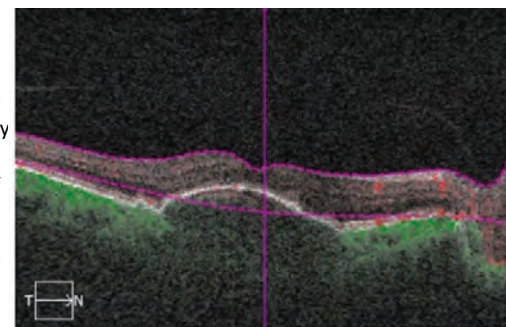
Suspended particles can mimic flow.



Normal blood flow noted in flow overlay.

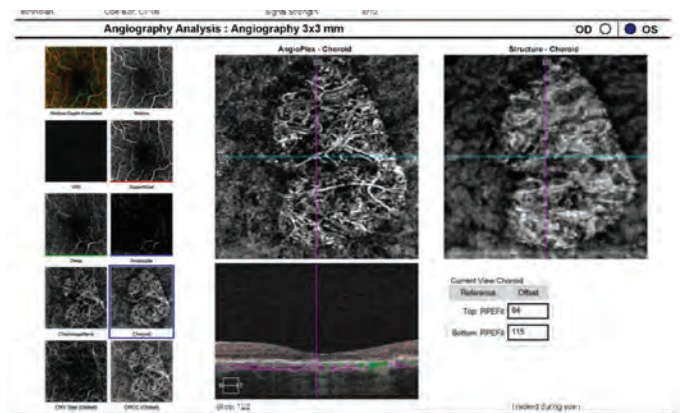
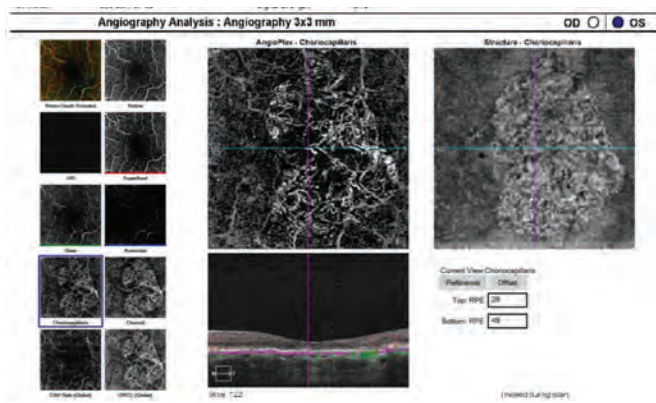
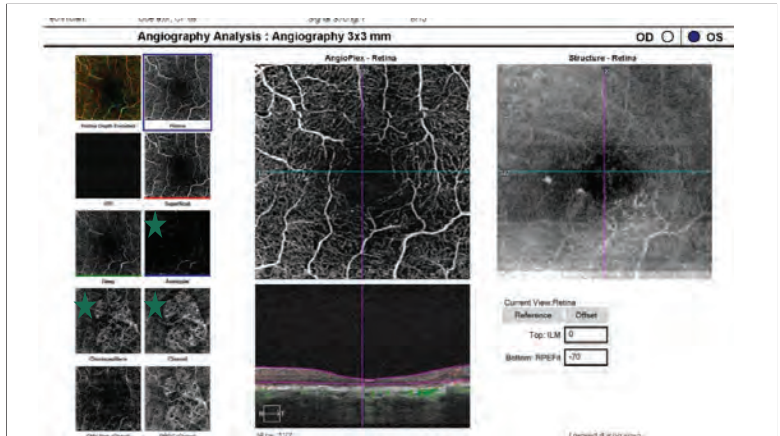
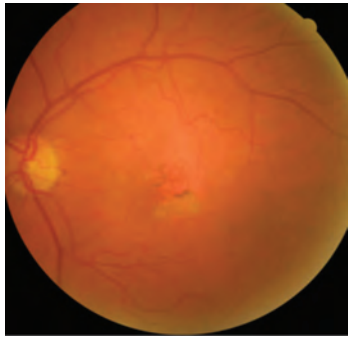
Analysis w/ Flow overlay

- Color coded
 - Red – retinal
 - Green – choroidal
- Increase flow activity under PED if CNVM
- Excellent rule out of CNVM

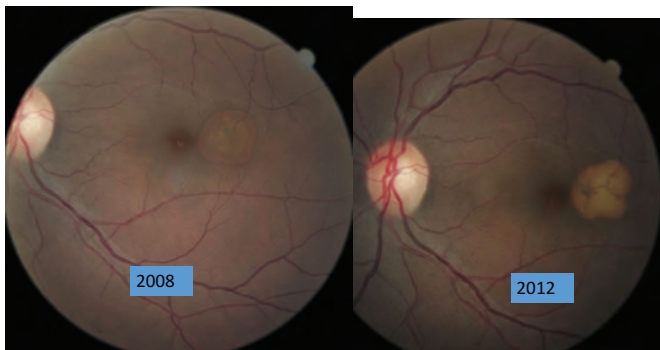


On the other hand...

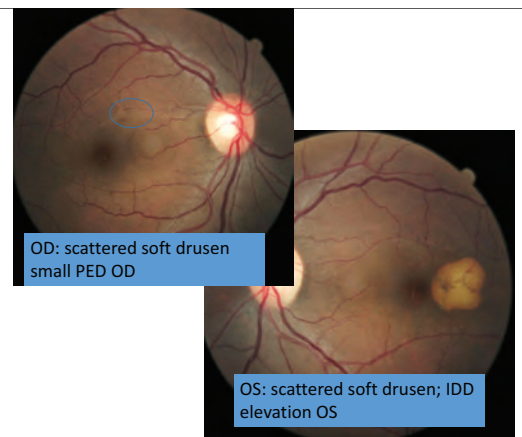
82 WF
History of dry AMD, recent cataract extraction
Pre-operative VA 20/80
1-day post-op
20/80 with significant corneal edema
1-week post-op
20/100, persistent corneal edema
macula flat, -CNVM, OCT raster flat
2-weeks post-op
20/120, corneal edema improved



...VS.

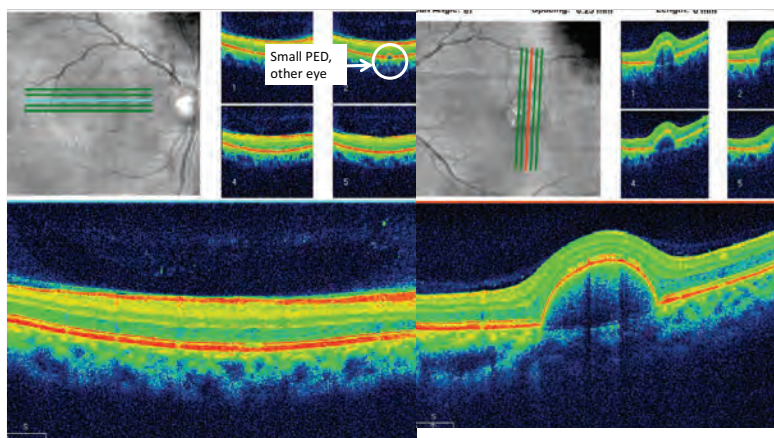


- 55 AA Female
- HTN, anxiety, acid reflux, arthritis
- 140/85mmHg
- 20/20 OD, OS
- (+)metam nasally OS



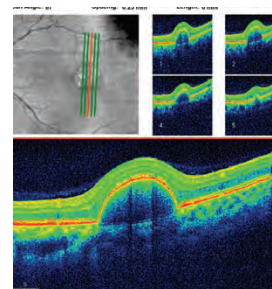
OD: scattered soft drusen
small PED OD

OS: scattered soft drusen; IDD
elevation OS



Pigment Epithelial Detachment

- MC cause is AMD (drusenoid, hemorrhagic)
- Other etiologies/associations:
 - CSR
 - Pattern dystrophies
 - Idiopathic
- 75%--self-limiting
 - Better prognosis if <55
 - Worse if turbid fluid or associated hemorrhage
- Visual loss can occur
 - RPE atrophy
 - Up to 30% lead to CNVM
 - 10% of patients over 55 develop RPE tear
- Overlying serous sensory RD and CSR

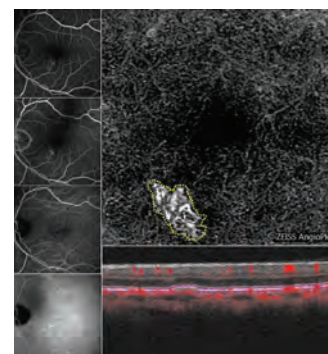


Idiopathic PED: management

- Monitor carefully
 - IVFA
 - SD-OCT
- Avastin?
 - persistent PED
 - PED with CNVM
 - Height of PED predictor for risk of tear after Avastin injection
Chan et al. *Retina*, Feb 2010
 - However....Majority of larger PEDs from CNVM in AMD do not respond to injections
Freeman, et al. *Retina* Oct 2011.
Parodi, et al. *Am J Ophth*, Jan 2013.

Non-exudative Neovascular AMD

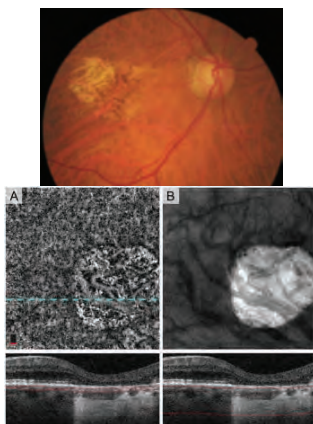
- *Quiescent CNV*
- Not visible on FA – no leakage
- Treat or not to treat ?



Palejwala et al. *Retina* 2015.

Geographic AMD

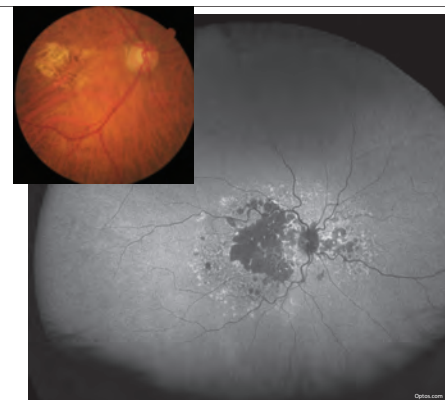
- 11% have quiescent CNV
 - 25% will become exudative
 - Irregular PEDs
 - (-) leak
- Typical anterior displacement of choroidal vessels – don't confuse with CNV
 - Medium sized vessels
 - Visible in CC slab 100% of GA



Capuano V. *Am J Ophth* 2017.
Nesper P. *Retina* 2019.

FAF - Geographic AMD

- More dramatic visualization
- Hypo-AF: no PRs and no lipofuscin in RPE cells
- Hyper-AF at borders - RPE is overworked
 - Important risk factor for progression
 - Indicates an active expansion



New Treatments for Geographic Atrophy (GA) in 2023

- Targets the complement system at different places
- Goal: prevention of progression



Syfovre (pegcetacoplan)

- FDA approval in February 2023
- 15 mg q25 to 60 days
- Targets C3
- OAKS and DERBY trials
 - rate of GA progression reduced by up to 22% with monthly injection
- adverse reactions (>5%)
 - ocular discomfort
 - Wet AMD
 - Floaters
 - conjunctival hemorrhage



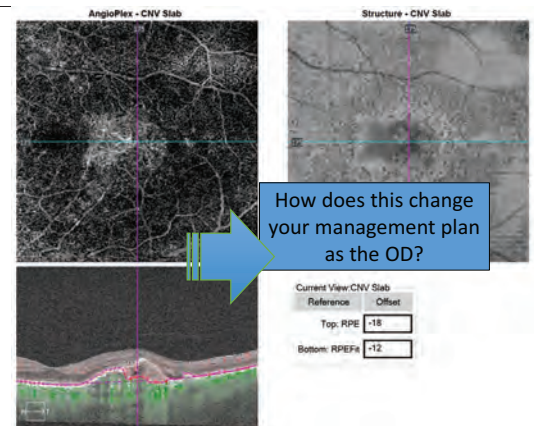
Izervay (avacincaptad pegol)

- FDA approved August 2023
- Intravitreal injection given monthly
- Targets C5
- GATHER1 and GATHER2 trials
 - Up to a 56% reduction in vision loss (15 letters) from baseline
- adverse reactions
 - Wet AMD (7%)
 - Increased IOP (9%)
 - conjunctival hemorrhage (13%)



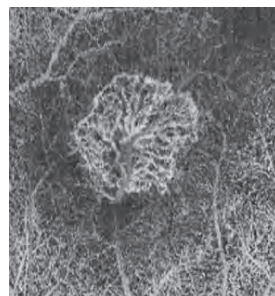
Neovascular AMD

- OCT-A + OCT = 86%
 - Vs. FA or OCT alone = 67%
- Potential quantitative values
 - Blood flow within CNV
 - CNV area
 - Flow index



Change in appearance after treatment

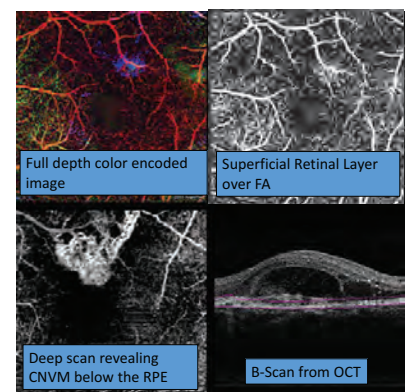
- Type 1
 - Mature, longstanding
 - Resistant to tx
- Type 2
 - Decreased size and VD of CNV after anti-VEGF
 - Trunk/feeder vessels unchanged
 - No reduction in lesion area but reduction in blood flow within CNVM
- Suggestion is to repeat OCT-A x 2 wks to determine need for re-tx



RETINA, THE JOURNAL OF RETINAL AND VITREOUS DISEASES 2017

Neovascular AMD

- Earlier, non-invasive detection
- Can detect actual vasculature, w/o relying on leakage, exudation
- Sub-type, location, size
- Monitor response to Tx/need for re-tx
- Inactive membranes
- Choroidal ischemia

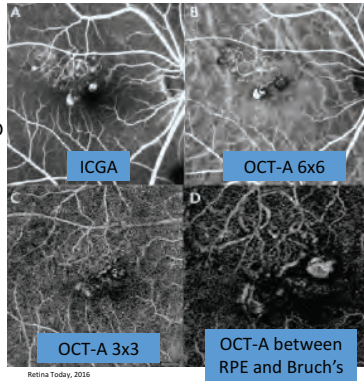


Zelus.com

Vs. Polypoidal choroidal vasculopathy

- Subset of AMD, and/or Pachychoroidal diseases
- Often missed or confused with classic AMD

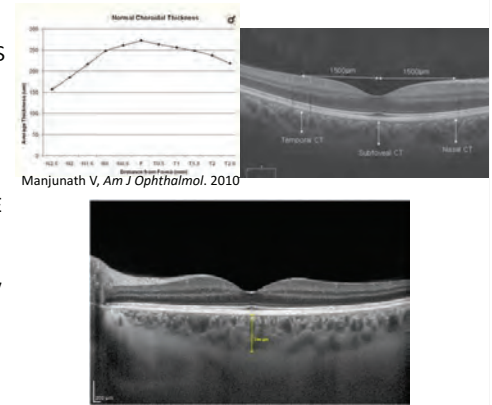
- Mostly pigmented races
- Hemorrhagic PED and serosanguinous maculopathy vs. macular drusen
- ICG gold standard for dx
 - EDI useful : choroidal thickening
 - OCT-A
- PDT often used instead of/along with anti-VEGF



Eleftherios I, et al. Eye, July 2018.

Choroidal Thickness

- SS-OCT or SD-OCT with EDI
- vertical distance from RPE and inner surface of the sclera
- Subfoveally + parafoveally



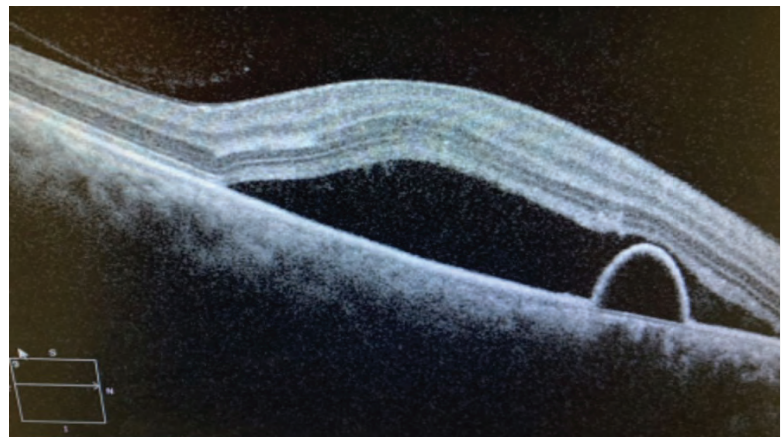
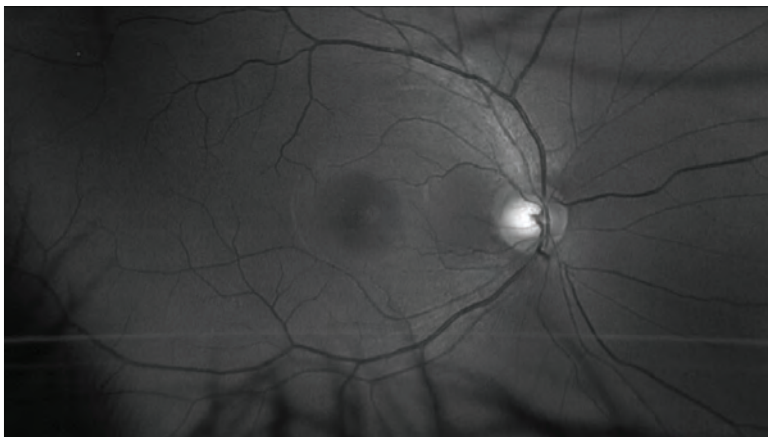
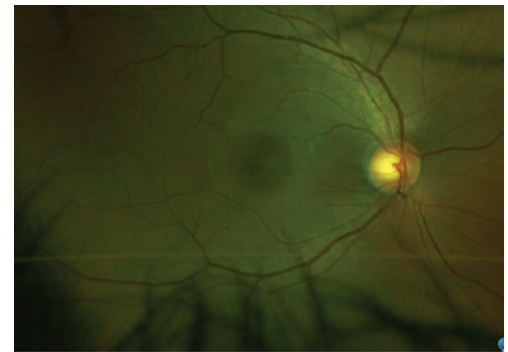
Manjunath V, Am J Ophthalmol. 2010

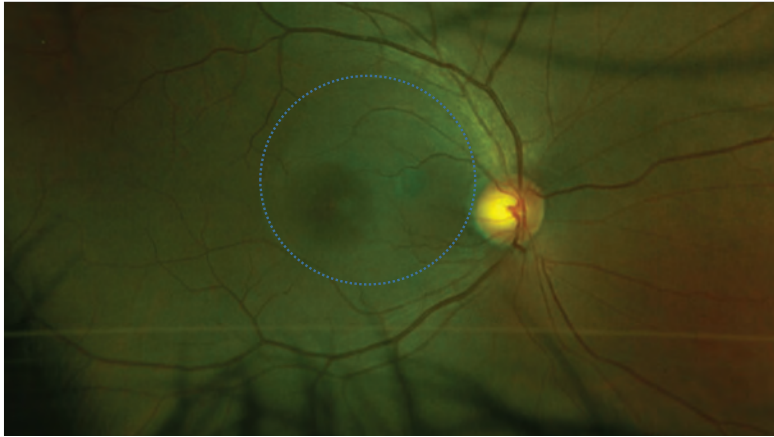
OCT with Enhanced Depth Imaging (EDI)

- Pre-selected setting in the acquisition of OCT
- Higher resolution in deep / outer retinal findings
- Suggested useful for....
 - Choroidal thickness
 - CSR
 - AMD
 - Choroidal nevi/melanoma
 - Optic disc drusen
 - Scleral contour
 - Normal tension glaucoma
 -

44 Hispanic FM

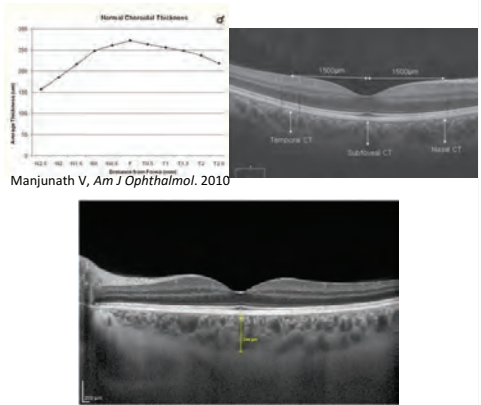
- Blurry vision R eye x 1 month
- 20/200, PHNI
- PMH:
 - HTN
 - GERD
 - Knee pain: Recent history of oral prednisone and fluticasone injection for knee pain



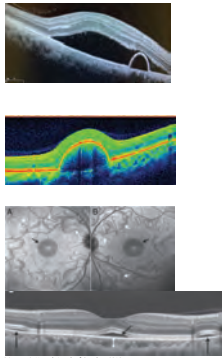


Choroidal Thickness

- SS-OCT or SD-OCT with EDI
- Vertical distance from RPE and inner surface of the sclera
- Subfoveally + parafoveally



Medication	Use/ Therapeutic Effect	Impact to Retina
Steroids (oral, injected, topical creams, nasal sprays)	Inflammation	CSR
Balversa™ (erdafitinib)	Metastatic bladder cancer	CSR PED
MAPK/ERK Kinase (MEK) Inhibitors	Metastatic melanoma	Multiple serous detachments



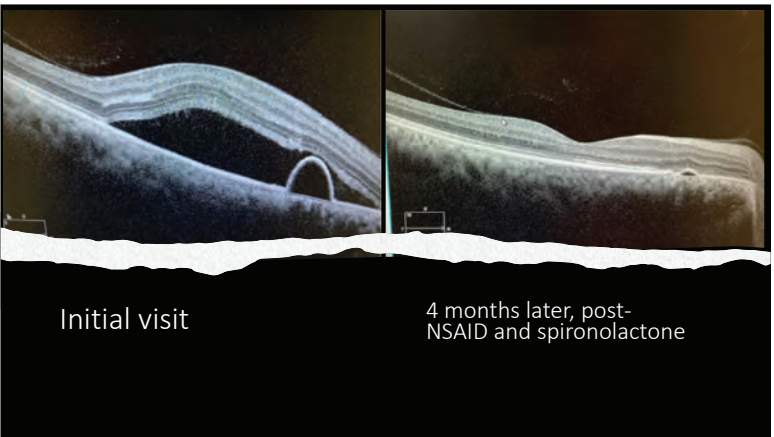
Stephanou N, et al. *Annals of Oncology* 2016.

Plan:

D/C steroids

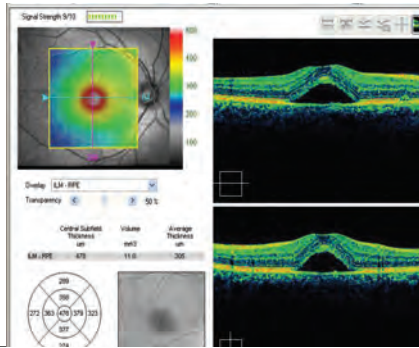
Topical NSAID QID

Oral spironolactone 50mg QD



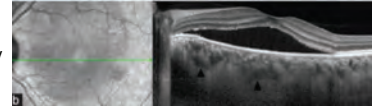
Central Serous Retinopathy – Revisited

- Now considered one of the *pachychoroid* diseases
- Risk Factors, *Liu et al, Retina 2016*
 - Hypertension
 - Helicobacter pylori infection
 - steroid usage
 - sleeping disturbance
 - autoimmune disease
 - psychopharmacologic medications
 - Type A behavior
- Generally a self-limiting disease, however...
 - RPE damage → diffuse retinal pigment epitheliopathy (DRPE)
 - CNVM



CSR (CSC) and Choroidal Thickness

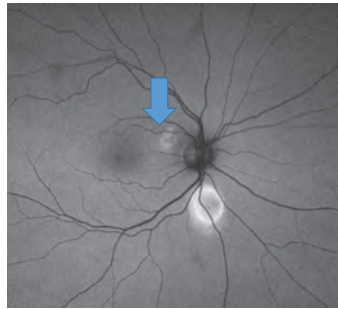
- pachychoroid diseases include
 - CSC
 - pachychoroid pigment epitheliopathy
 - pachychoroid neovascularopathy
 - polypoidal choroidal vasculopathy
- Looking at subfoveal choroidal thickness from EDI
 - increased in CSC eyes *and fellow eyes*
 - eyes with hypermeability also had increased choroidal thickness



Chen G PLoS One. 2017
Zhonghua, 2012

Central Serous Retinopathy

- Initially – hypo FAF due to blockage / absorption by subretinal fluid
- As progresses/current activity:
 - Fluid present affects RPE function
 - Granular hyper FAF
- Longstanding: hypo FAF due to atrophy
 - May identify previous events

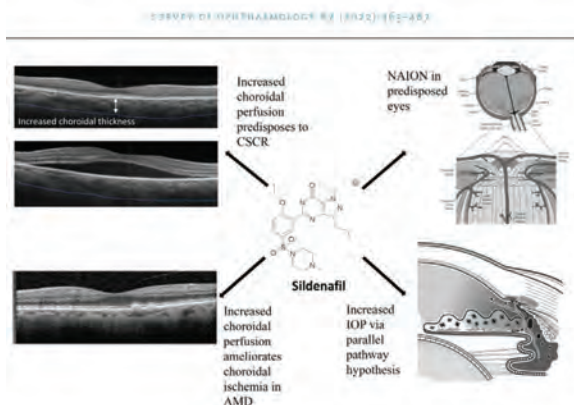


Phosphodiesterase-5 Inhibitors – retinopathy?

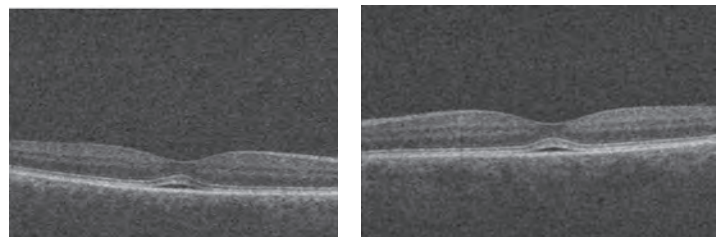
- Indications: Erectile dysfunction, benign prostate hyperplasia, pulmonary hypertension
- Explanation:
 - Choroid is vascularly similar to corpus cavernosum
 - 10% activity against PD6 (retinal phototransduction)
- Suggested Associations:
 - CSR
 - Choroidal thickening

Arora S, Surakiatchanukul T, Arora T, Cagini C, Lupidi M, Chhablani J. Sildenafil in ophthalmology: An update. *Surv Ophthalmol.* 2022 Mar-Apr;67(2):463-487. doi: 10.1016/j.survophthal.2021.06.004. Epub 2021 Jun 25. PMID: 34175342.

Elizalde J, Laiseca A, García de Oteyza G. *Retin Cases Brief Rep.* 2022 Nov 1;16(6):779-782. doi: 10.1097/ICB.0000000000001082. PMID: 33165301

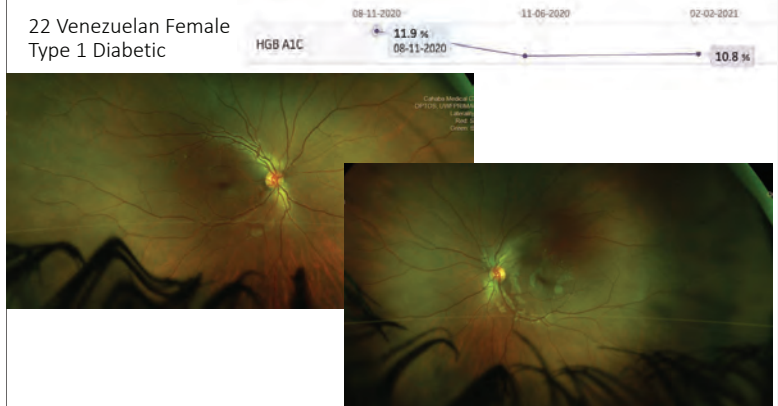


- 63 male, “chief complaint of “losing dimension”
- 20/20-
- Sildenafil Citrate 100MG for erectile dysfunction



Diabetic Retinopathy – Update on Treatment and Protocols

22 Venezuelan Female
Type 1 Diabetic



- BCVA OD 20/25
- PC cataracts OS>OD

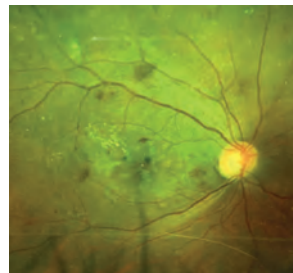
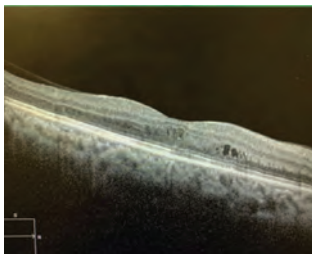
DRCR Net Protocol V: Ok to watch
center involved DME with good VA

Protocol V: Other considerations

- Central thickness 400 : marker for more severe DME
- Applicable to all eyes with CI-DME with good VA?
 - patients had well-controlled diabetes with a mean A1c of 7.6, and
 - enrolled eyes had earlier stages of DR, mild DME

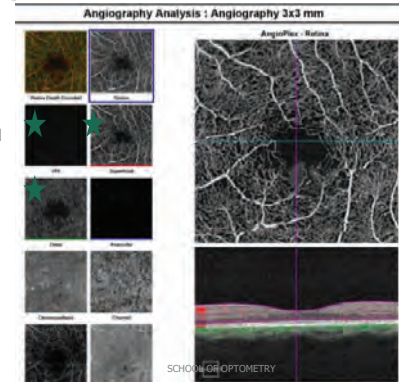
44 year old
Mexican FM

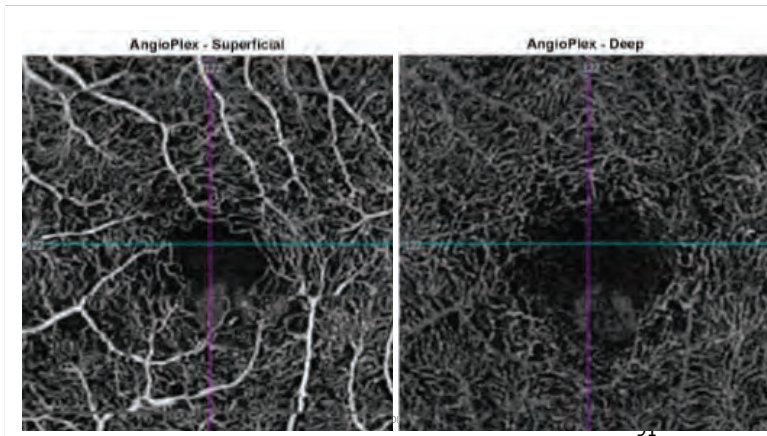
- CIDME, BCVA 20/25+



37 year old, poor BS control, no DR noted clinically

- Layers of interest:
 1. VRI
 2. Superficial
 3. Deep

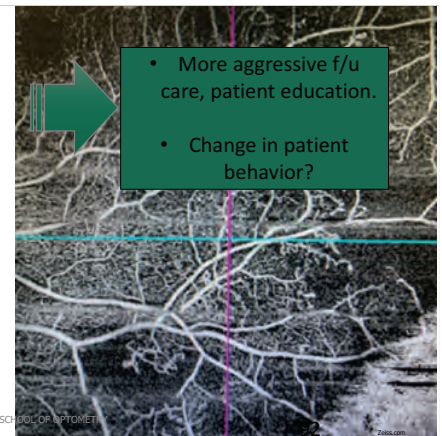




OCT-A for Earlier Detection

• *Earlier, often sub-clinical findings ...*

- Microaneurysms
- Capillary nonperfusion
 - Small pockets of ischemia better visualized than with IVFA
 - Size/integrity of FAZ
 - Reduced vascular density

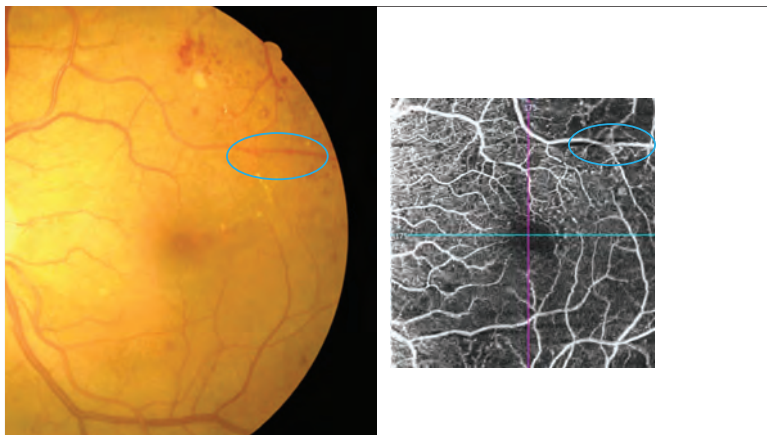
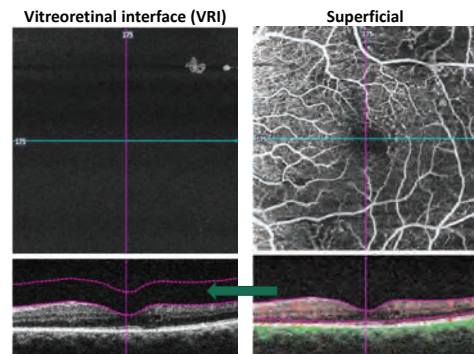


51 AAF with Type 2 DM

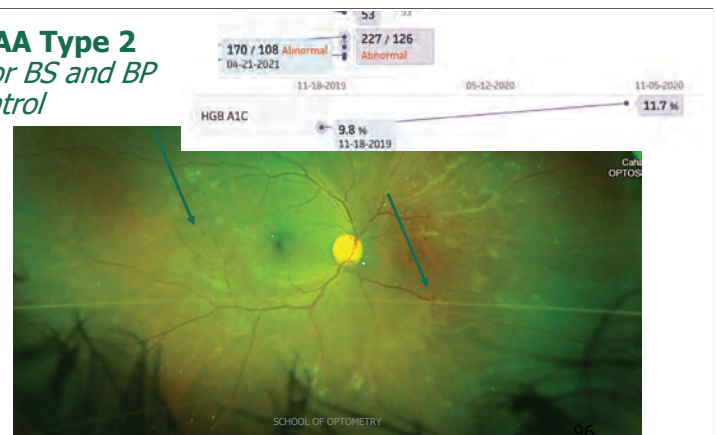
Graded as moderate NPDR



Isolating Blood Flow Data at a Specific Depth

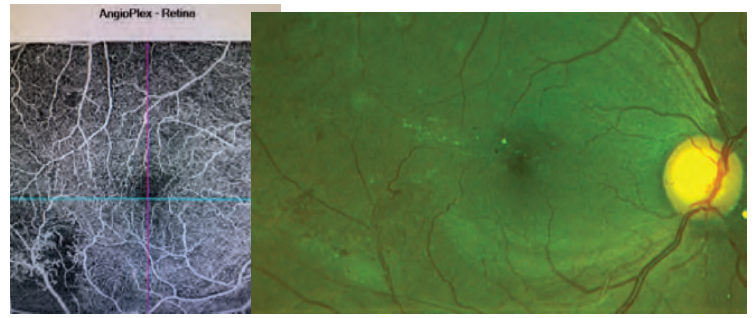


43AA Type 2
poor BS and BP control



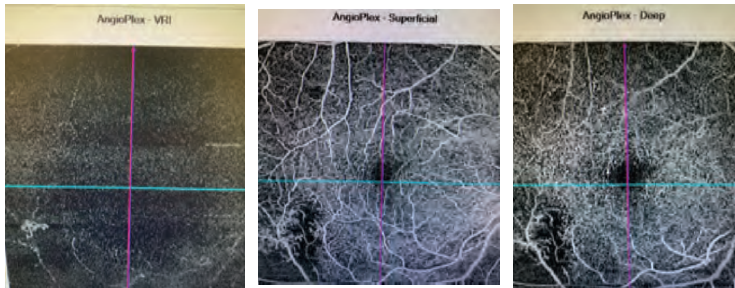


High risk area confirmed and clarified



SCHOOL OF OPTOMETRY

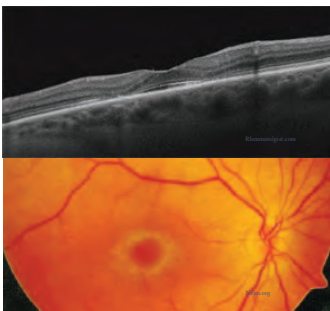
98



On the other hand:

- High risk areas confirmed, -NVE
- Watch carefully for change

Plaquenil Toxicity

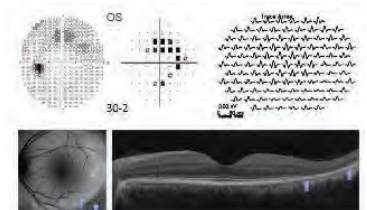


2016 - Revised Recommendations on Screening for Chloroquine and Hydroxychloroquine Retinopathy

Melles RB, Marmor MF. Ophthalmology 2015.

- Risk of toxicity increases sharply towards 1% after 5-7 yrs of use, or cumulative dose of 1000 g HCQ
- Initial baseline exam, then annual screenings after 5 years
- Screening:
 - Regular exams with DFE
 - 10-2
 - 24-2 or 30-2 for Asian patients
 - SD OCT*, FAF or mfERG

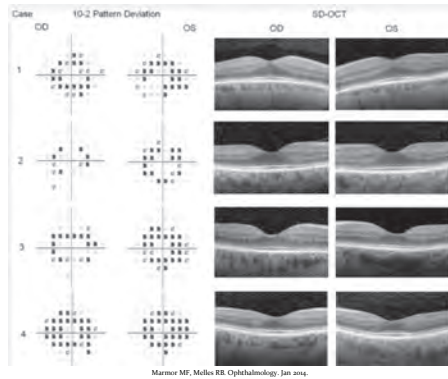
*most objective, lowest variability



Melles RB, Marmor MF. Ophthalmology 2015.



- 10% of patients with a ring scotoma did NOT show damage with SD-OCT!



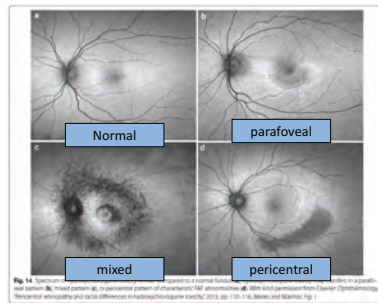
Damage is not always parafoveal!!

Melles, Marmor, Ophthalm Aug 2014

Figure 2. Comparison of hydroxychloroquine retinopathy patterns in 30° (9 mm) spectral-domain optical coherence tomography (SD-OCT) line scans. Images from 4 different patients (top to bottom): normal (A), parafoveal pattern (B), mixed pattern (C), and pericentral pattern (D). Arrows indicate areas of outer retinal loss.

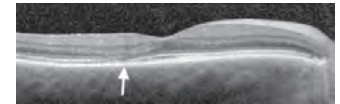
FAF: Plaquenil Toxicity

- May contribute to earlier detection
 - Before RPE degeneration develops
- Early change:
 - hyper AF
 - 2-6 degree ring around fovea
 - Early photoreceptor damage – subtle
- Later change:
 - hypo AF
 - Coalesces into dark absence of FAF – cells are dead



OCT – what to look for early

- Scans
 - High resolution
 - Raster or radial
 - Enhanced depth imaging (EDI)
 - Macular cube – quantifiable
- Outer retinal thinning
- Disruption to PIL



Toxicity is Dose-Dependent

- Proper dose → <1% with toxicity
- 6.5mg/kg based on IDEAL weight
- Typically 200mg BID – ok for normal size patient
 - Not ok if short/small
 - Not ok if obese
 - Not ok if kidney disease
- Mostly clinically significant cases of toxicity are iatrogenic
 - Overdosing (>10%)
 - Lack of screening
 - Inadequate screening/missed findings
 - Damage can progress up to 3 years after discontinuation....

Other Risk Factors

- Kidney disease
 - (consider that it is commonly used in conditions that themselves affect the kidneys such as SLE)
- Existing retinal/macular disease
- Concurrent use of tamoxifen

Melles RB, Marmor MF. JAMA Ophthalmol. 2014 Dec;132(12):1453-60. doi: 10.1001/jamaophthalmol.2014.3459.PMID: 25275721

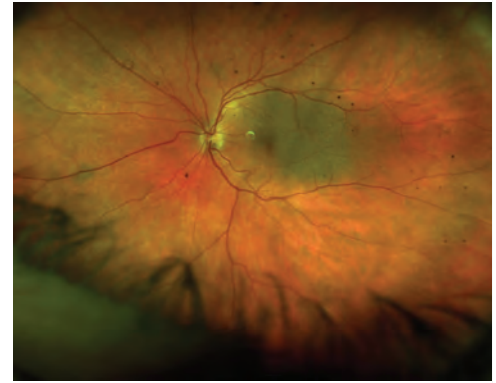
But what if Plaquenil is life-saving?

- A patient with systemic lupus erythematosus on hydroxychloroquine (HCQ) was taken off the drug due to toxic maculopathy. Four years later, HCQ was resumed because of a compelling need to do so to control her disease activity. At seven years since the resumption of HCQ, there has been only mild, slow progression of the retinopathy.

Sunness JS, Sunness RH, Hellmann DB.
Hydroxychloroquine can be resumed with close monitoring after retinopathy has developed, without major visual loss: Case Report. Retin Cases Brief Rep. 2023 Dec 12. doi: 10.1097/CB.0000000000001536. Epub ahead of print. PMID: 38150578.

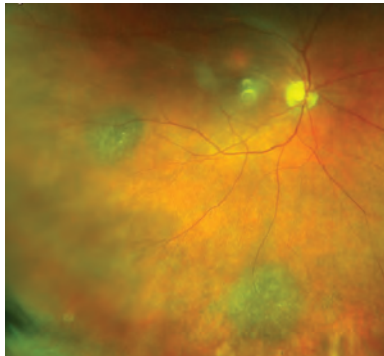
Differentiating Suspicious Choroidal Nevi

52 year old Caucasian male



How Many Choroidal Nevi Did You See This Week?

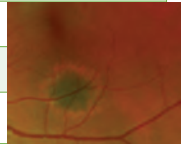
- prevalence in the posterior pole
 - 4.1% in whites
 - 0.7% in blacks
 - 1.2% in Hispanics
 - 0.04% in Chinese
- 3 features changed with age
 1. thickness
 2. multiplicity
 3. drusen
- Annual transformation rate to melanoma: estimated at 1 in 8,845 (0.0113%)



Shields C et al. Retina 2014.

$\geq 3 = 50\%$ chance of transformation in 5 years
*These 3 = 69% risk!

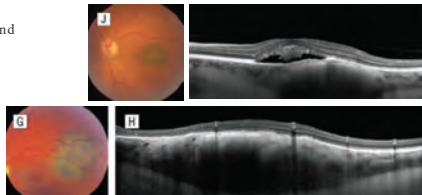
High Risk Features for Small Nevus Conversion to Melanoma		
To*	Thickness	Thickness of $>2\text{mm}$ (as measured by ultrasound) - bad
Find	Fluid	Overlying subretinal fluid - bad
Small*	Symptoms	Symptoms of flashes/floaters/blurry vision – bad
Ocular	Orange pigment	Presence of lipofuscin – bad
Melanomas*	(Disc) Margin	Nevus $\leq 3\text{mm}$ from disc margin - bad
Use	Ultrasound	Hollowness noted on ultrasound - bad
Helpful	Hollowness	
Hints	Halo	Presence of halo - good
Daily	Drusen	Presence of overlying drusen – good



Shields C et al. Retina 2014.
Shields C, et al. JAMA 2012.

‘To Find Small Ocular Melanoma Doing IMaging’ (TFSOM-DIM).

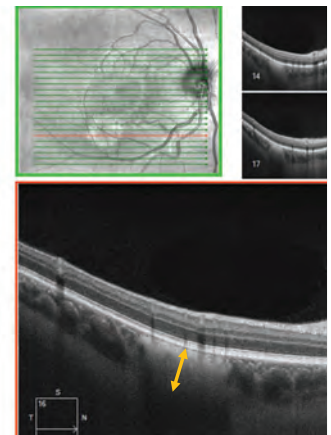
- 3806 choroidal nevi imaged by OCT, B-scan and FAF
- Transformation into melanoma
 - 5.8% at 5 years
 - 13.9% at 10 years
- Predictive factors
 - thickness more than 2 mm (B-scan),
 - fluid subretinal (OCT),
 - symptoms vision loss (VA),
 - orange pigment (FAF),
 - melanoma hollow (B-scan), and
 - Diameter more than 5 mm (photo)
- mean 5-year estimate of nevus growth into melanoma
 - 1.1% for those with 0 risk factor
 - 11% with one factor,
 - 22% with two factors,
 - 34% with three factors,
 - 51% with four factors
 - 55% with five risk factors



Arch Ophthalmol. 2012;130(7):850-856. doi:10.1001/archophthalmol.2012.1135

OCT Tips and Tools

- Use Enhanced Depth Imaging (EDI)
- Measure tumor thickness
 - Largest distance from base of RPE to base of tumor
 - $>2\text{mm}$ or $\uparrow$ in thickness: significant
 - Ultrasound: standard but may overestimate
- Look for subretinal fluid – 92%
- “shaggy” photoreceptors-49%



Shields CL, et al. Retina. 2019
Shields C et al. Retina 2014.
Shields C, et al. JAMA 2012.

Implications of chromosome changes

