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Utilizing New Technology In The Management Of Ocular Disease

Michael Cymbor, OD

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WELCOME!

Host: Dr. Jennifer Stewart

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Thank you to Visionix for exhibiting at this event.

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- For each hour of CE units, attendees ***must be online for a minimum of 50 minutes***
- For a COPE certificate, please fill out the survey link in the chat. Also, the survey link will appear when the webinar ends.
- CE certificates will be delivered by email and sent to ARBO with OE tracker numbers
- We will also display a QR code at the end of the event if you have the OE tracker app on your phone.
- ***CE certificates will be emailed within 4 weeks***
- Ask questions using the zoom on-screen floating panel

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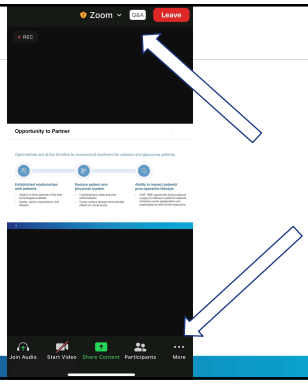

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All financial relationships have been mitigated.

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Speaker Bio –

Dr. Cymbor joined Nittany Eye Associates in 1997. He received his optometric doctorate from the Pennsylvania College of Optometry. He completed a residency in hospital-based optometry with an emphasis in ocular disease at the Wilkes-Barre VA Medical Center.

Dr. Cymbor was named Pennsylvania's "Young Optometrist of the year" in 2000. He was awarded the "Young Optometrist of the Year" by the American Optometric Association in 2001. He was also named as one of the top 175 optometrists in the nation by Newsweek.

He is a Primary Care Optometry News top 250 optometrist. He was a co-winner of the Best of State College in 2021, and named "Best Optometrist of State College" in 2022.

He is a principal investigator in numerous research studies in contact lenses, glaucoma and dry eye. He is published in Optometry and Vision Science, Review of Optometry, Optometry, Primary Care Optometry News, Advanced Ocular Care, Optometric Management, Review of Optometric Business, New OD, and Optometry Times. He was a guest on the "Ask the Eye Doctor" State College radio show.

He is a fellow of the American Academy of Optometry. He is a member of the Optometric Glaucoma Society, the National Optometric Society, the American Optometric Association, the Pennsylvania Optometric Association, and Mid-Counties Optometric Society.

Dr. Cymbor is an adjunct clinical professor at the Pennsylvania College of Optometry (PCO). He is also the co-founder of both the Glaucoma Institute of State College and the Dry Eye Institute of State College. He's also been the Opening Eyes clinic director of the Pennsylvania Special Olympics Summer State Games for over twenty years.

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Financial Disclosures

I am a speaker/KOL for the following:

- Visionix (Optovue)
- Quidel
- New World Medical
- LKC Technologies
- Allergan
- Tarsus
- Sight Sciences
- Thea Pharmaceuticals

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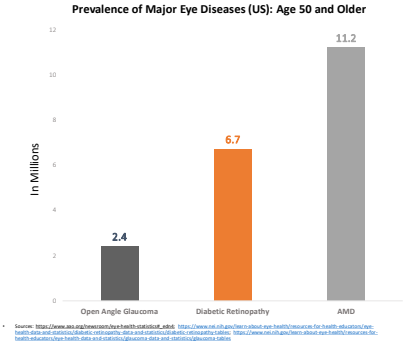
Cause of Legal Blindness in the US



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NIH News Release

Visual impairment, blindness cases in U.S. expected to double by 2050

NIH-funded studies tease out trends by race, ethnicity and sex.

With the youngest of the baby boomers hitting 65 by 2029, the number of people with visual impairment or blindness in the United States is expected to double to more than 8 million by 2050, according to projections based on the most recent census data and from studies funded by the National Eye Institute, part of the National Institutes of Health. Another 16.4 million Americans are expected to have difficulty seeing due to correctable refractive errors such as myopia (nearsightedness) or hyperopia (farsightedness) that can be fixed with glasses, contacts or surgery.

The researchers were led by Rohit Varma, M.D., director of the University of

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Increased Demand for Medical Eye Care

- 20 million more routine and medical eye exams will be required in 2025 than were needed in 2015, and this number will continue to increase every year for the foreseeable future
- The number of FTE optometrists will increase by 13% between 2015 and 2025
- The number of FTE ophthalmologists will increase by 2.1% between 2015 and 2025

"The future of Optometry in America", Richard Edlow, OD. Modern Optometry March 2019

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Imbalance of supply/demand

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Our patient trying to get an appointment

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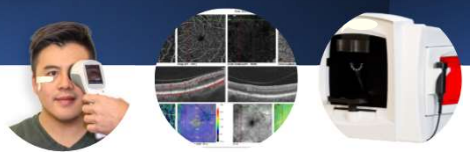
Three Technologies



ERG OCT-A Dark Adaptation

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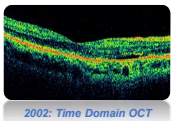
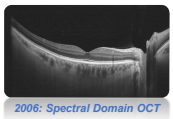
OCT Angiography: *The Next Chapter in Posterior Imaging*

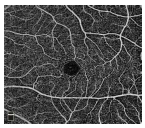
- ❖Time Domain
- ❖Spectral Domain
- ❖OCT Angiography (OCTA)…THE NEXT CHAPTER!!



2002: Time Domain OCT



2006: Spectral Domain OCT



2014: OCTA

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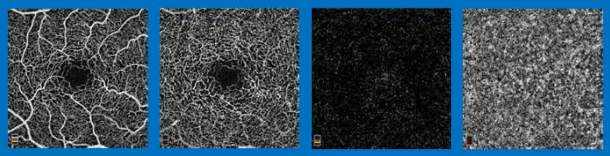
OCT Angiography (OCT-A)



Superficial Capillary Plexus	Deep Capillary Plexus	Outer Retinal Zone	Choriocapillaris
Larger Vessels Smaller FAZ than Deep Plexus	Network of Fine Capillaries Larger FAZ	Avascular	Homogeneous Flow

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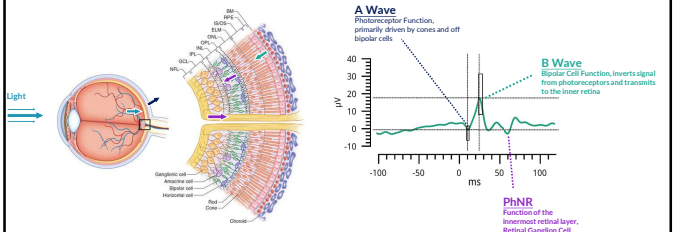
The ERG Waveform



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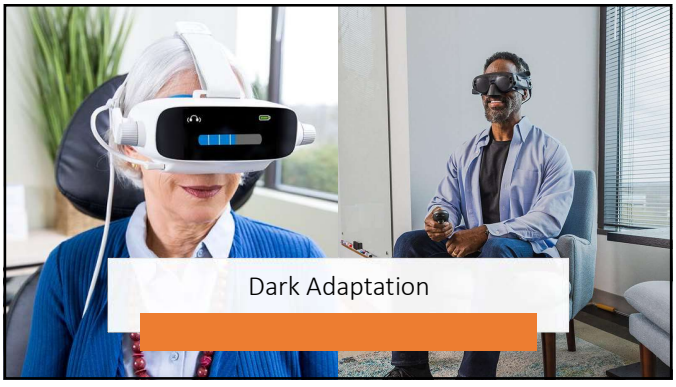

Dark Adaptation

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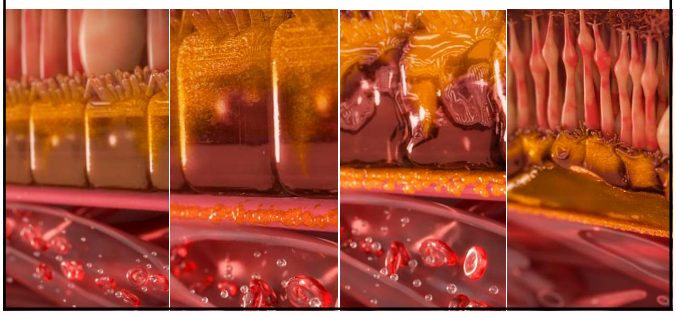
AMD Disease Process



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Three Ocular Disease States

	Glaucoma	Diabetic Retinopathy	AMD
Structure	Photos/OCT	Photos/OCT	Photos/OCT
Function	Visual Fields	?	?
Early Diagnosis	ERG/OCT-A	ERG/OCT-A	Dark Adaptation/OCT-A (wet)

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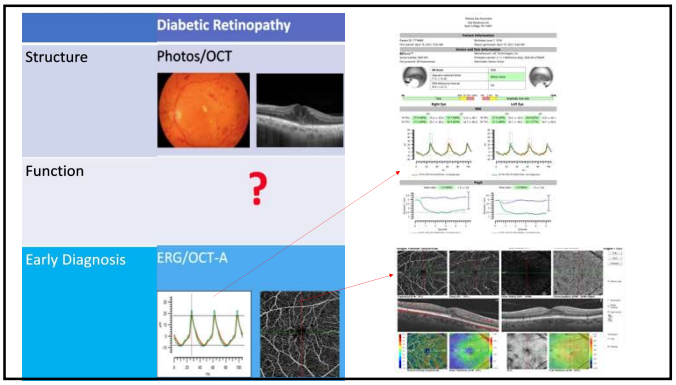

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Let's learn more about OCTA....

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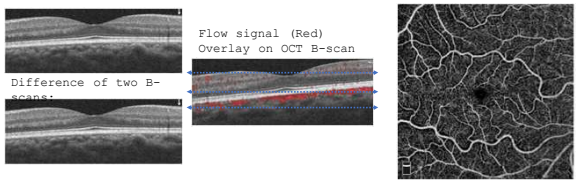
How does OCTA work?

OCTA uses motion contrast to detect flow from OCT data



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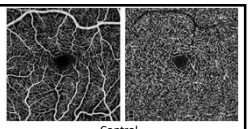
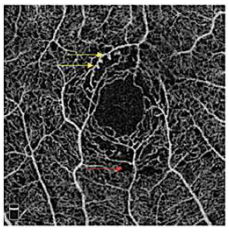
Diabetic Retinopathy



- **Positive Indicators**
  - ❖Retinal capillary non-perfusion seen as blackened area without blood flow outside FAZ
  - ❖Microaneurysms
  - ❖Enlarged FAZ



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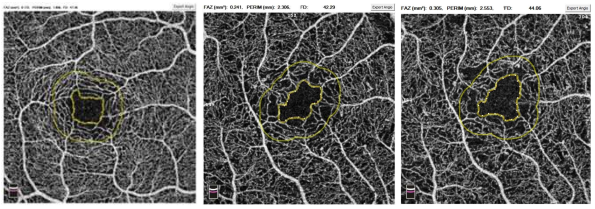
Foveal Avascular Zone in Normal & Diabetic Eyes



Normal Eye | Diabetic Eye | More Advanced Diabetic Eye

Images courtesy of Bernard C. Sirith, OD, Rutgers New Jersey Medical School Department of Ophthalmology and Visual Science

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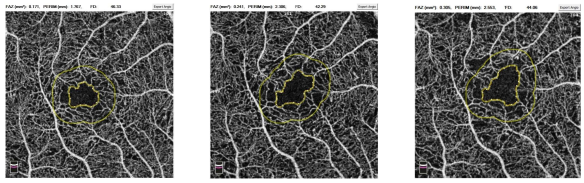
FAZ Change Analysis



2015 | 2016 | 2017

Image courtesy of Bernard C. Sirith, OD, Rutgers New Jersey Medical School Department of Ophthalmology and Visual Science

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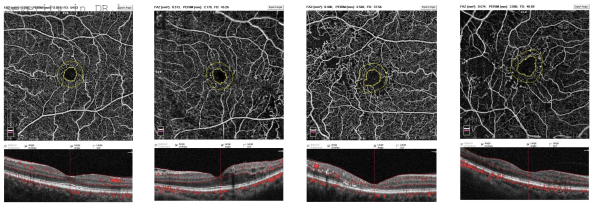
Aid in Disease Severity Assessment with FAZ Measurements

FAZ size and FAZ vessel density are correlated significantly with disease



Mild NPDR | Moderate NPDR | Severe NPDR | PDR

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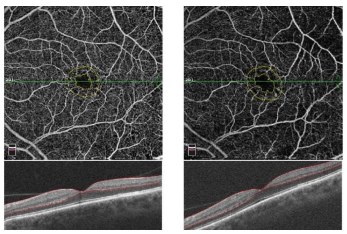
FAZ Enlargement



- OCTA shows progressive increase of FAZ area and reduction of PRVD in both superficial and deep plexus at increasing DR severity
- Mastropasqua R, Toto L, Mastropasqua A, Aloia R, De Nicola C, Mattei PA, Di Marzio G, Di Nicola M, Di Antonio L. Foveal avascular zone area and parafoveal vessel density measurements in different stages of diabetic retinopathy by optical coherence tomography angiography. International journal of ophthalmology. 2017;10(10):1545.

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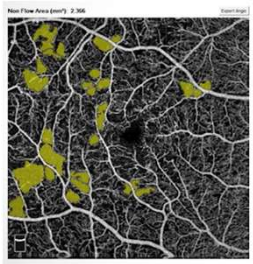
Non-Flow Area



- Based on Superficial Capillary Plexus
- Click on area of interest

Measurement:
- Non-Flow Area: Total area of selected non-flow areas

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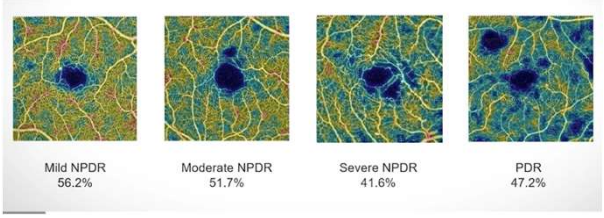
Vessel Density



Mild NPDR 56.2% | Moderate NPDR 51.7% | Severe NPDR 41.6% | PDR 47.2%

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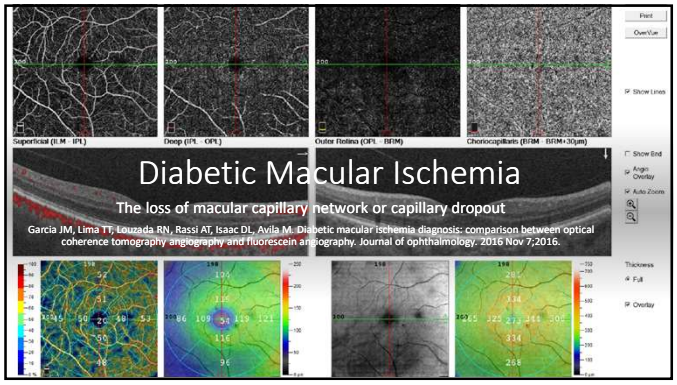

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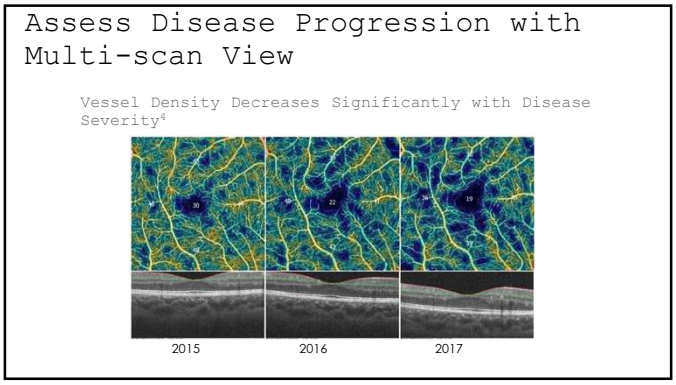

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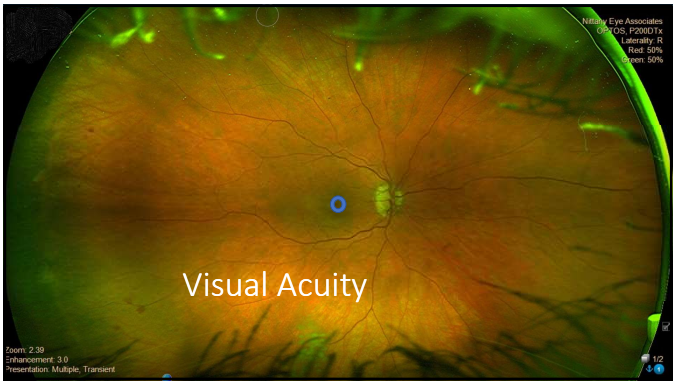

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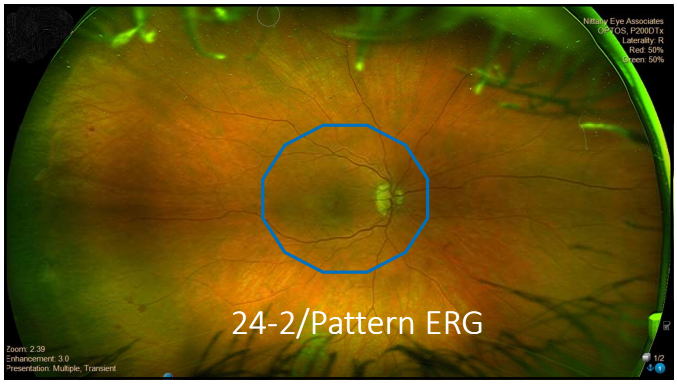

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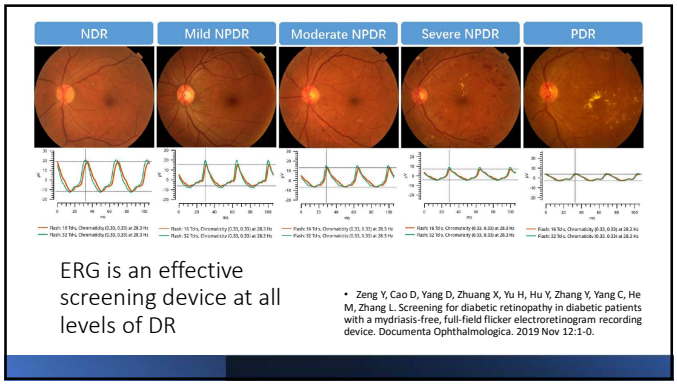

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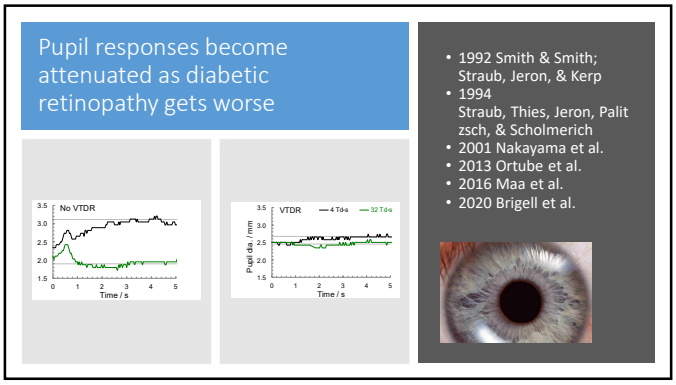

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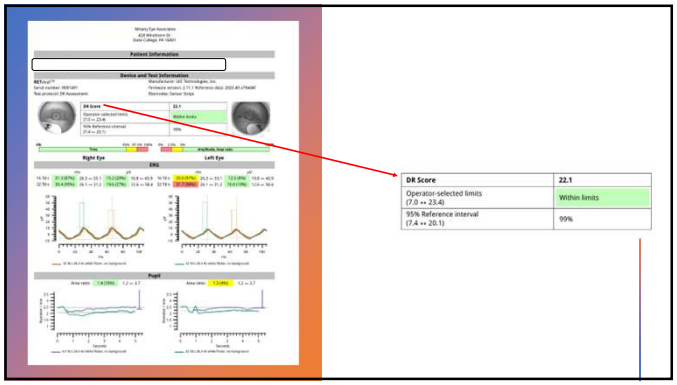

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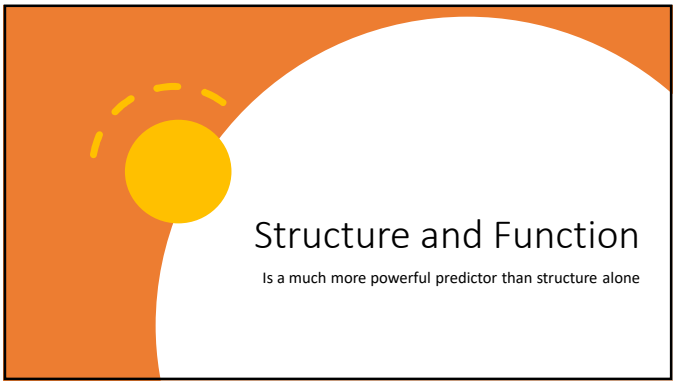

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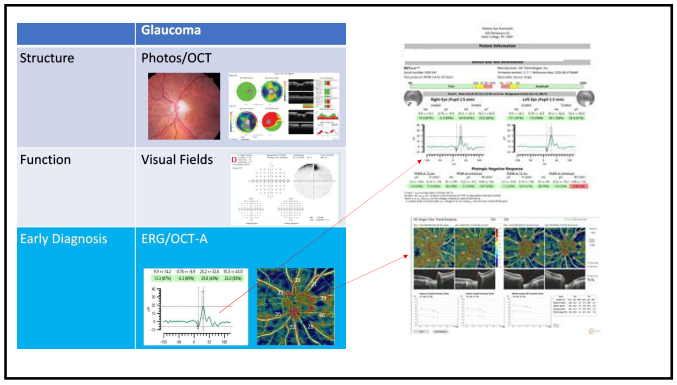

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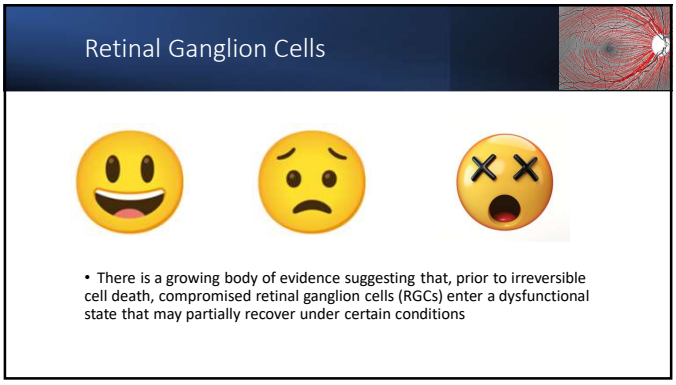

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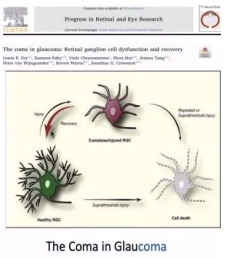
Retinal ganglion cells can recover



The Coma in Glaucoma

Fry LE, Fahy E, Chrysostomou V, Hui F, Tang J, van Wijngaarden P, Petrou S, Crowston JG. The coma in glaucoma: retinal ganglion cell dysfunction and recovery. Progress in retinal and eye research. 2018 Jul 1;65:77-92.

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This is where ERG comes in

- The full-field PhNR amplitude provides a potentially reversible measure of inner retinal function that improves after IOP lowering
- Niyadurupola N, Luu CD, Nguyen DQ, Geddes K, Tan GX, Wong CC, Tran T, Coote MA, Crowston JG. Intraocular pressure lowering is associated with an increase in the photopic negative response (PhNR) amplitude in glaucoma and ocular hypertensive eyes. Investigative ophthalmology & visual science. 2013 Mar 1;54(3):1913-9.

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Good Correlation between FF ERG, VF, and OCT

- "RETeval (ERG)...correlated well with VF MD and the established global OCT thickness parameters, both in the total glaucoma severity spectrum and in moderate-to-advanced glaucoma"
- Kita Y, Holló G, Saito T, Momota Y, Kita R, Tsunoda K, Hirakata A. RETeval Portable Electroretinogram Parameters in Different Severity Stages of Glaucoma. Journal of glaucoma. 2020 Jul 8;29(7):572-80.

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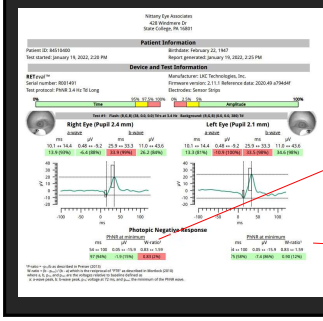
PhNR in Glaucoma



PhNR at minimum		
ms	µV	W-ratio¹
54 ↔ 100	0.05 ↔ -15.9	0.83 ↔ 1.59
97 (94%)	-1.9 (15%)	0.83 (2%)

PhNR at minimum		
ms	µV	W-ratio¹
54 ↔ 100	0.05 ↔ -15.9	0.83 ↔ 1.59
75 (58%)	-7.4 (86%)	0.90 (12%)

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ERG

- Single-centre study included 57 consecutive patients with primary open-angle glaucoma who underwent unilateral glaucoma filtration surgery
- ERG was recorded within 5.1 (2.1 to 8.1) (mean (95% CI)) days after surgery
- PhNR amplitude, PhNR/b-wave amplitude ratio and PhNR implicit time improved significantly after surgery
- Conclusion Even in the early postoperative period within several days, the PhNR amplitude increased with IOP lowering following filtration surgery
- Igawa Y, Shoji T, **Weinreb R**, Miyake Y, Yoshikawa Y, Takano S, Shinoda K. Early changes in photopic negative response in eyes with glaucoma with and without choroidal detachment after filtration surgery. British Journal of Ophthalmology. 2022 Apr 7.

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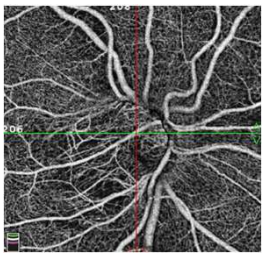
OCT-A



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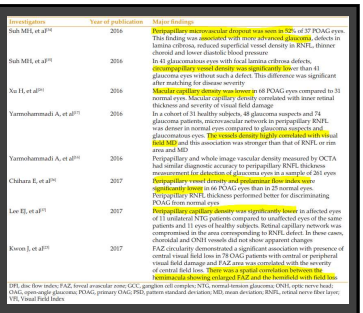
"Almost all published articles demonstrated *a significant reduction of blood flow, capillary diameter and vascular density in glaucomatous eyes*. Interestingly, these differences were detectable even in glaucoma suspects and eyes with preperimetric glaucoma and *increased proportional to the severity of glaucoma damage*."



Investigators	Year of publication	Major findings
Suh MH, et al[34]	2016	Peripapillary microvascular dropout was seen in 92% of 37 POAG eyes. This finding was associated with more advanced glaucoma, defects in lamina cribrosa, reduced superficial vessel density in RNFL, thinner choroid and lower diastolic blood pressure
Suh MH, et al[35]	2016	In 41 glaucomatous eyes with focal lamina cribrosa defects, circumpapillary vessel density was significantly lower than 41 glaucoma eyes without such a defect. This difference was significant after matching for disease severity
Xu H, et al[101]	2016	Macular capillary density was lower in 68 POAG eyes compared to 31 normal eyes. Macular capillary density correlated with inner retinal thickness and severity of visual field damage
Yarmohammadi A, et al[37]	2016	In a cohort of 31 healthy subjects, 48 glaucoma suspects and 74 glaucoma patients, microvascular network in peripapillary RNFL was denser in normal eyes compared to glaucoma suspects and glaucomatous eyes. The vessels density highly correlated with visual field MD and this association was stronger than that of RNFL or rim area and MD
Yarmohammadi A, et al[102]	2016	Peripapillary and whole image vascular density measured by OCTA had similar diagnostic accuracy to peripapillary RNFL thickness measurement for detection of glaucoma eyes in a sample of 261 eyes
Chihara E, et al[36]	2017	Peripapillary vessel density and prelaminar flow index were significantly lower in 66 POAG eyes than in 25 normal eyes. Peripapillary RNFL thickness performed better for discriminating POAG from normal eyes
Lee EJ, et al[33]	2017	Peripapillary capillary density was significantly lower in affected eyes of 11 unilateral NTG patients compared to unaffected eyes of the same patients and 11 eyes of healthy subjects. Retinal capillary network was compromised in the area corresponding to RNFL defect. In these cases, choroidal and ONH vessels did not show apparent changes
Kwon J, et al[103]	2017	FAZ circularity demonstrated a significant association with presence of central visual field loss in 78 OAG patients with central or peripheral visual field damage and FAZ area was correlated with the severity of central field loss. There was a spatial correlation between the hemimacula showing enlarged FAZ and the hemifield with field loss

DFI, disc flow index; FAZ, foveal avascular zone; GCC, ganglion cell complex; NTG, normal-tension glaucoma; ONH, optic nerve head; OAG, open-angle glaucoma; POAG, primary OAG; PSD, pattern standard deviation; MD, mean deviation; RNFL, retinal nerve fiber layer; VFI, Visual Field Index

- Daneshvar R, Nouri-Mahdavi K. Optical Coherence Tomography Angiography: A New Tool in Glaucoma Diagnostics and Research. *J Ophthalmic Vis Res*. 2017;12(3):325-332. doi:10.4103/jovr.jovr_36_17

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OCT-A in Glaucoma

- "OCTA *enhanced both the sensitivity and specificity* for glaucoma diagnosis."
- "OCTA could accurately detect glaucomatous eyes, which may be misdiagnosed by OCT as normal, and OCTA could detect normal eyes, which may be misdiagnosed by OCT as glaucomatous."
- "Therefore, *these two modalities complemented each other* in the diagnosis of glaucoma."

Kwon HJ, Kwon J, Sung KR. Additive Role of Optical Coherence Tomography Angiography Vessel Density Measurements in Glaucoma Diagnoses. *Korean J Ophthalmol*. 2019;33(4):315-325

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OCT-A

- Eyes underwent IOP-lowering glaucoma surgery and their fellow (non-surgical) eyes were included.
- OCTA of the macula was performed in both eyes before glaucoma surgery and 3 months postoperatively
- **The FAZ area is decreased with IOP-lowering surgery in patients with POAG, and change in the FAZ area was significantly correlated with both preoperative foveal sensitivity and change in IOP.**
- Shoji T, Kanno J, Weinreb RN, Yoshikawa Y, Mine I, Ishii H, Ibuki H, Shinoda K. OCT angiography measured changes in the foveal avascular zone area after glaucoma surgery. British Journal of Ophthalmology. 2022 Jan 1;106(1):80-6.

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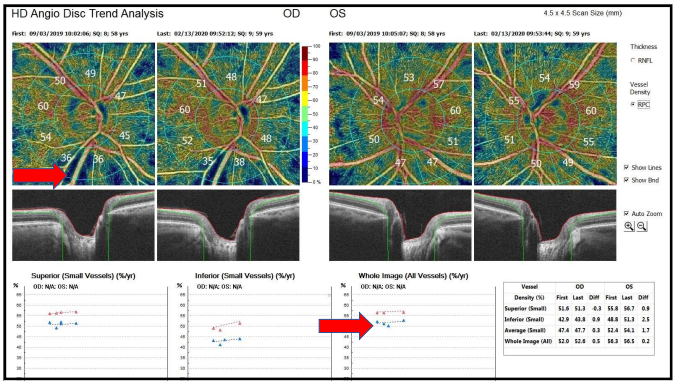

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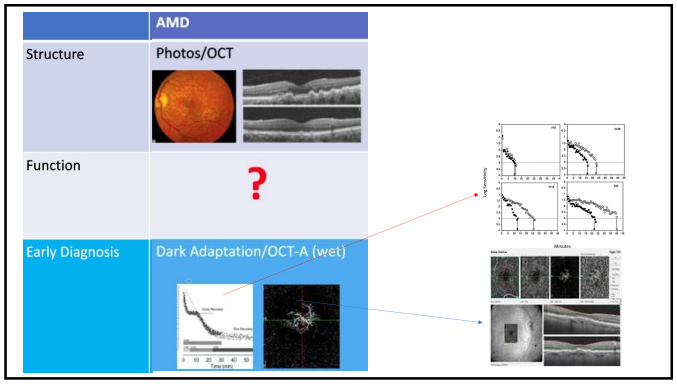

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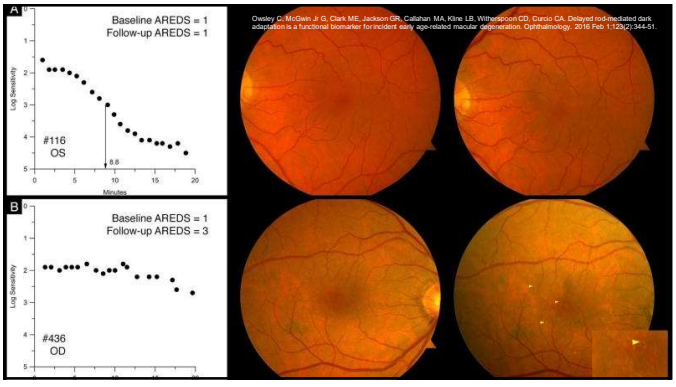

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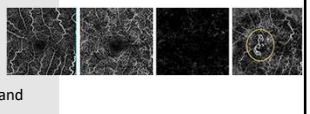
Recent Systematic Literature Review

- This systematic review indicates **overwhelming** evidence of reasonable quality for an association between impaired DA and AMD
- Data on the repeatability and reproducibility of DA measurement are sparse
- Higgins BE, Taylor DJ, Binns AM, Crabb DP. Are current methods of measuring dark adaptation effective in detecting the onset and progression of age-related macular degeneration? A systematic literature review. Ophthalmology and therapy. 2021 Feb 9:1-8.

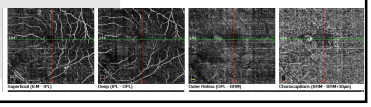
55

OCT-A shows SRNV in AMD

- Can differentiate between SRNV type 1 and 2
  - Type 1
    - New vessels located **BELOW RPE** and ABOVE Bruch's membrane
  - Type 2
    - New vessels located **ABOVE the RPE** and ABOVE Bruch's membrane



Ma J, Desai R, Nesper P, Gill M, Fawzi A, Skondra D. Optical coherence tomographic angiography imaging in age-related macular degeneration. Ophthalmology and eye diseases. 2017 Feb 22;9:1179172116686075.



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Billing/Coding

Description	CPT Code	Average Medicare Reimbursement
ERG with interpretation and report	92273	$133
Dark adaptation with interpretation and report	92284	$61
OCT with interpretation and report	92134	$41

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Case

- 53 Y/O W/M
- Type 1 Diabetes x 20 years, Hypercholesterolemia x 3 years
- Mild non-proliferative diabetic retinopathy x 5 years
- Last HA1C 6.9
- BCVA 20/20 OD and OS

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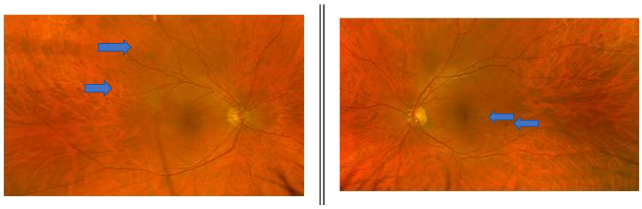
Optomaps



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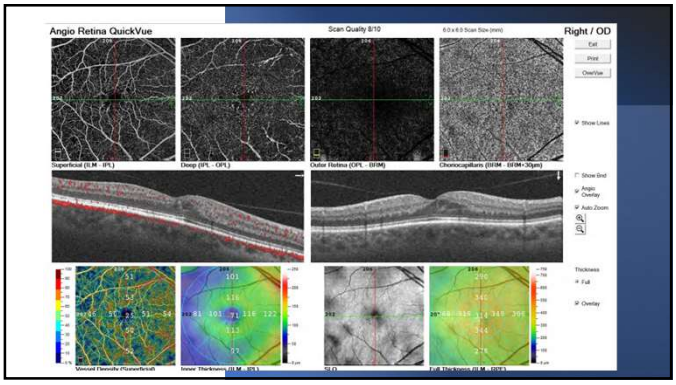

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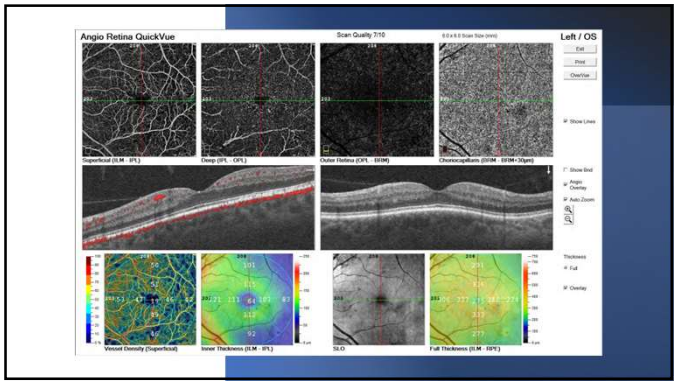

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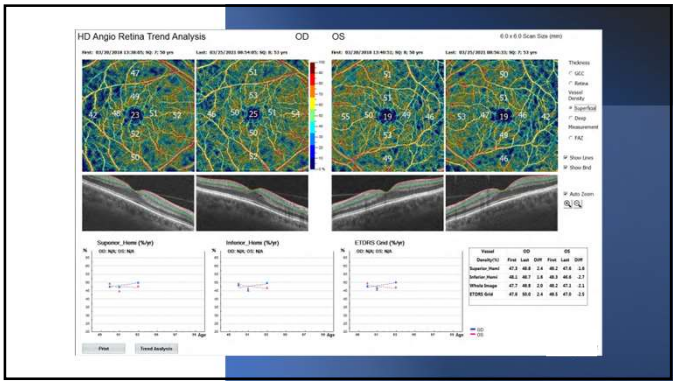

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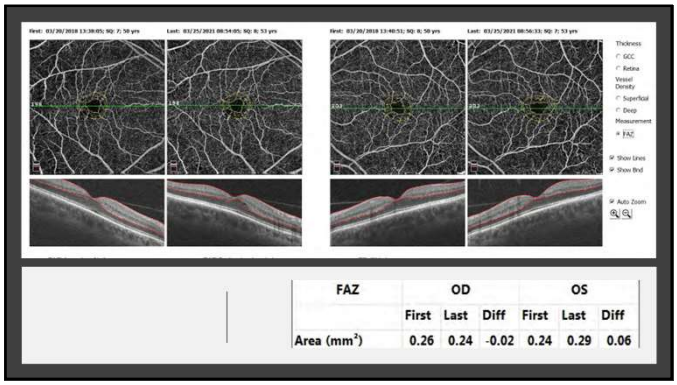

FAZ	OD			OS		
	First	Last	Diff	First	Last	Diff
Area (mm²)	0.26	0.24	-0.02	0.24	0.29	0.06

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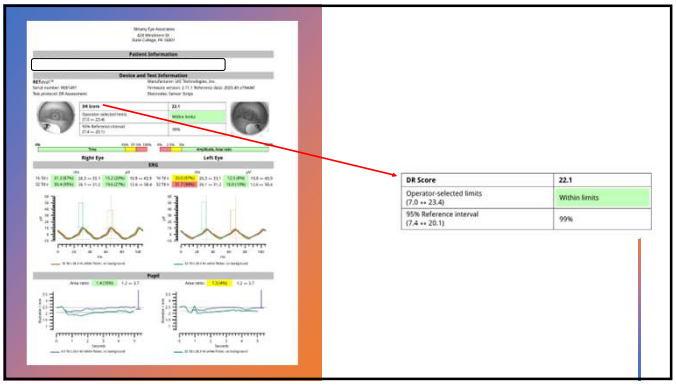

DR Score	22.1
Operator-selected limits (7.0 ↔ 23.4)	Within limits
95% Reference interval (7.4 ↔ 20.1)	99%

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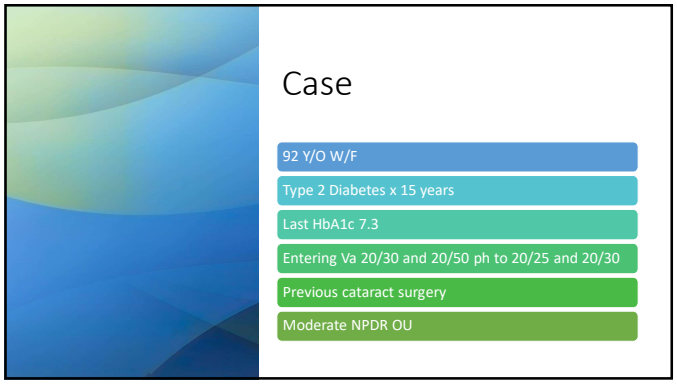

Case

- 92 Y/O W/F
- Type 2 Diabetes x 15 years
- Last HbA1c 7.3
- Entering Va 20/30 and 20/50 ph to 20/25 and 20/30
- Previous cataract surgery
- Moderate NPDR OU

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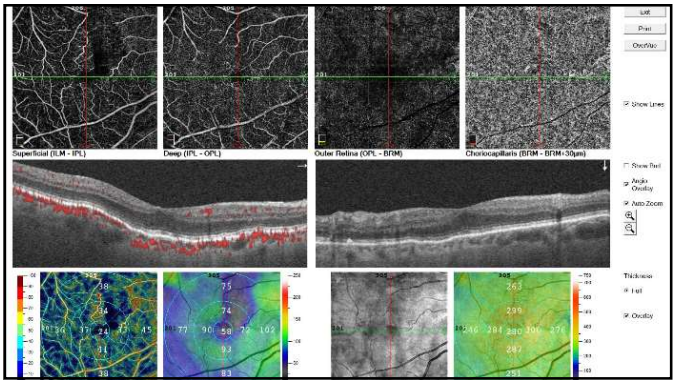

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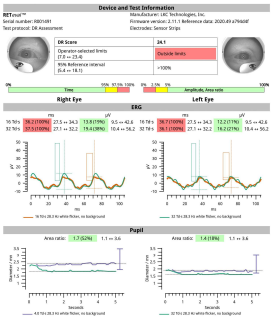
6 months ago



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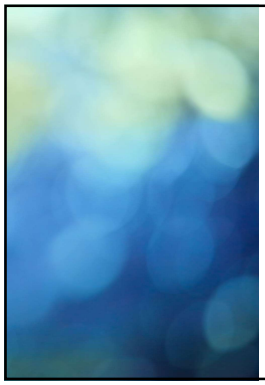

Treatment

Began fish oil supplement

Increased exercise

Increased Metformin

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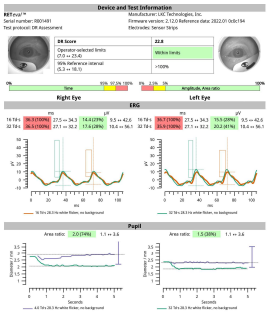
Now



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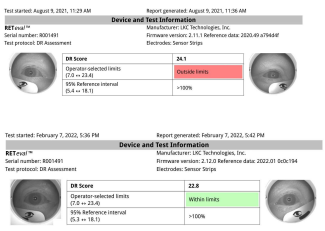
Dr Score

- Improved from 24.1 to 22.8



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Case

- 80 Y/O W/F
- Dx with AMD 2013
- Used AREDS/AREDS2 "off and on"
- 6 months ago Adapt Dx Rod Intercept 13.2

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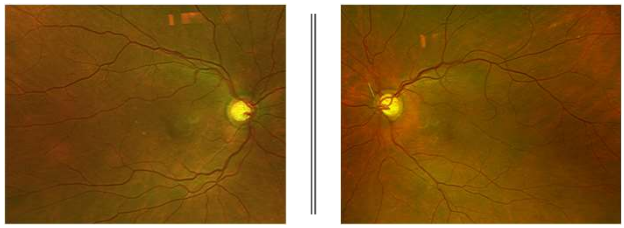
Optomaps



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And now...

- 6 months ago, began new supplement, reports excellent compliance
- Adapt Dx 12.1 (Baseline 13.2)

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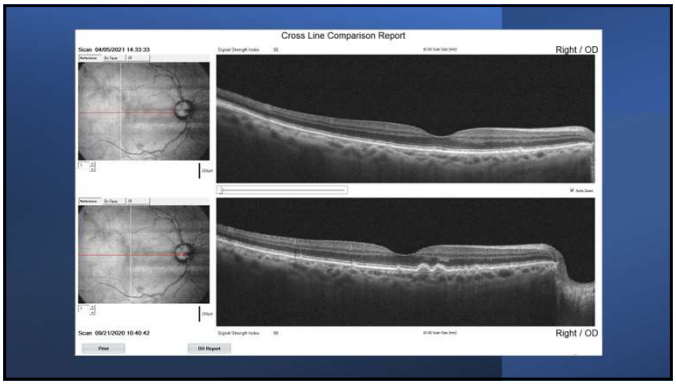

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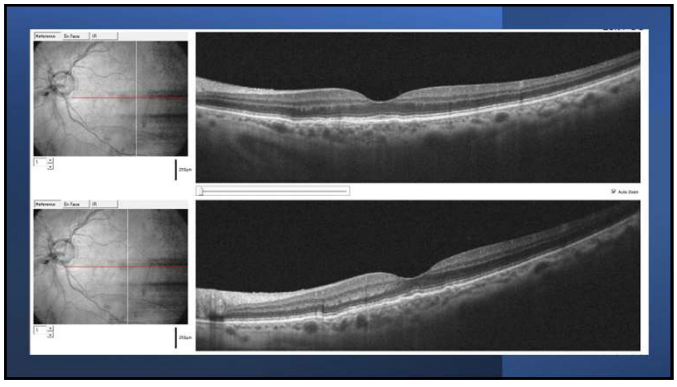

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Three Ocular Disease States

	Glaucoma	Diabetic Retinopathy	AMD
Structure	Photos/OCT	Photos/OCT	Photos/OCT
Function	Visual Fields	?	?
Early Diagnosis	ERG/OCT-A	ERG/OCT-A	Dark Adaptation/OCT-A (wet)

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