

Utilizing the latest diagnostic technology in the management of ocular disease

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COPE 72419-PD

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Disclosure

- Key opinion leader and/or speaker for:
 - Visionix (Optovue)
 - Quidel
 - New World Medical
 - LKC Technologies
 - Allergan
 - Tarsus

I do my best to maintain objectivity because my fidelity is to
1) my patients
2) you

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Ways to reach out

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Fred H. Carlin,
O.D. Community
Vision Foundation

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NITTANY EYE ASSOCIATES

Greetings from...

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Cause of Legal Blindness in the US

Prevalence of Major Eye Diseases (US): Age 50 and Older

Eye Disease	Prevalence (In Millions)
Open Angle Glaucoma	2.4
Diabetic Retinopathy	6.7
AMD	11.2

Source: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3444444/>, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3444444/>, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3444444/>, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3444444/>, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3444444/>, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3444444/>, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3444444/>, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3444444/>, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3444444/>, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3444444/>

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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

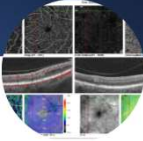


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Three Technologies



ERG



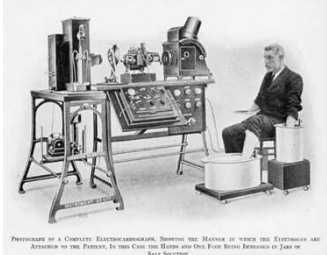
OCT-A



Dark Adaptation

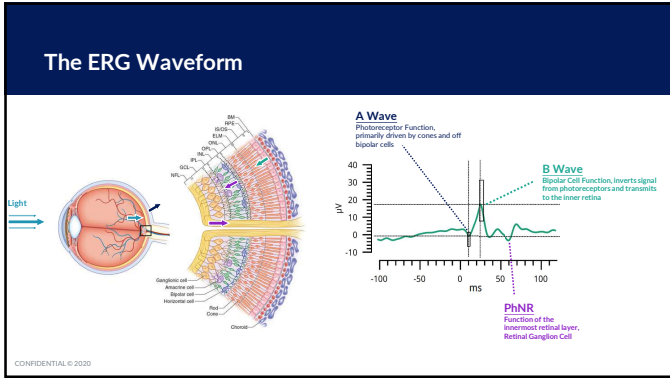
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Not Your Grandparents ERG

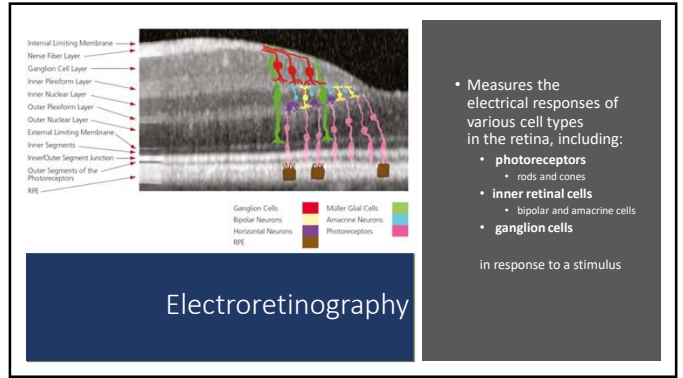


PHOTOGRAPH BY A. COMPTON. ELECTRORETINOGRAPH. SHOWN IS THE MACHINE BY WHICH THE ELECTRODES ARE ATTACHED TO THE PATIENT, IN THIS CASE THE BLIND AND OLD FEAR BOTTLE BEHIND IS JUNE OF 1915.

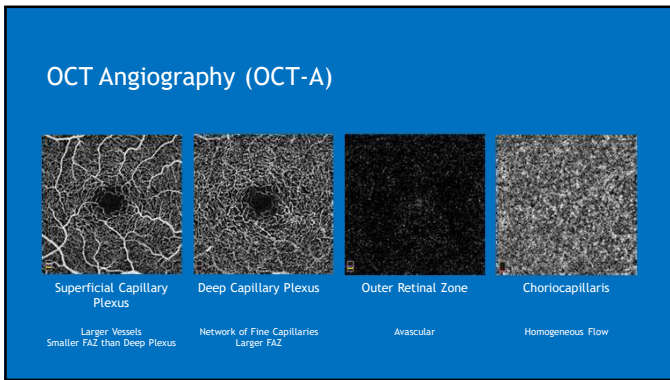
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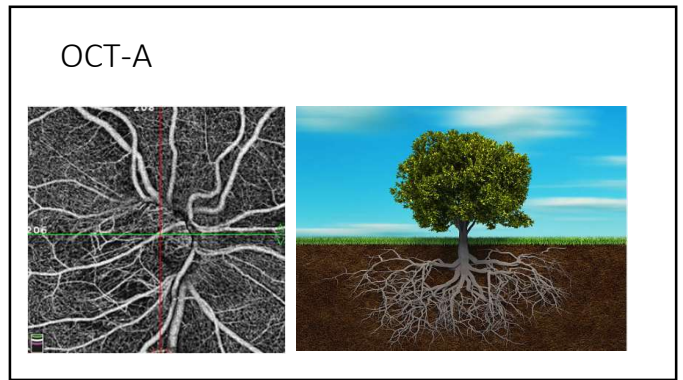
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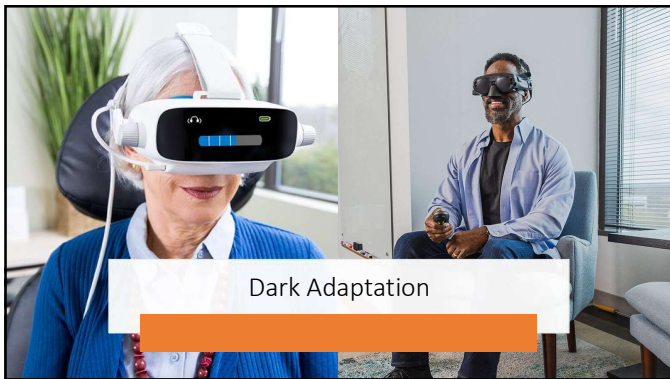
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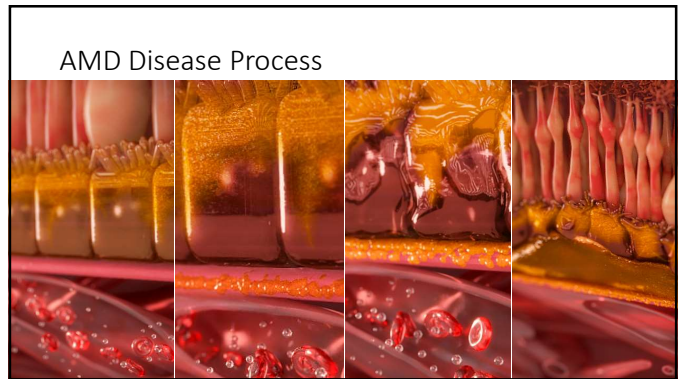
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Three Ocular Disease States

	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)

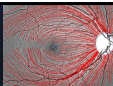
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Glaucoma

Structure	Photos/OCT	
Function	Visual Fields	
Early Diagnosis	ERG/OCT-A	

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Retinal Ganglion Cells

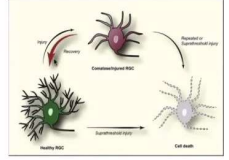


- There is a growing body of evidence suggesting that, prior to irreversible cell death, compromised retinal ganglion cells (RGCs) enter a dysfunctional state that may partially recover under certain conditions

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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

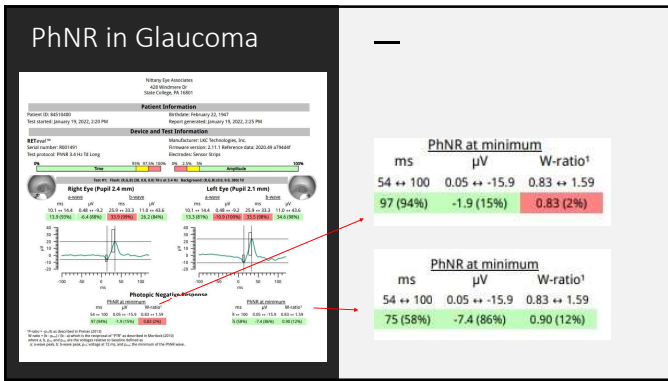
- The full-field PhNR amplitude provides a potentially reversible measure of inner retinal function that improves after IOP lowering
- Niyadurupola N, Luu CD, Nguyen DQ, Geddes K, Tan GX, Wong CC, Tran T, Coote MA, Crowston JG. Intraocular pressure lowering is associated with an increase in the photopic 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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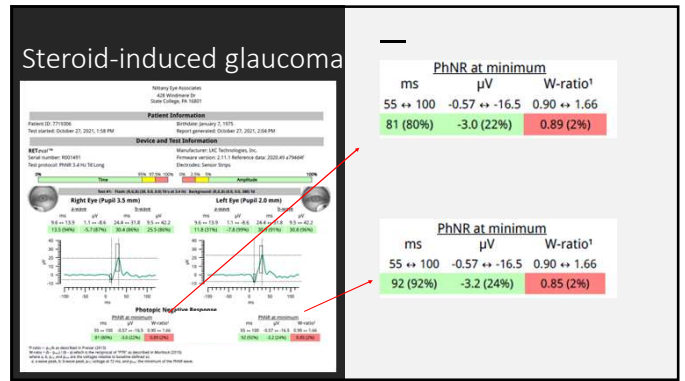
Good Correlation between FF ERG, VF, and OCT

- "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.

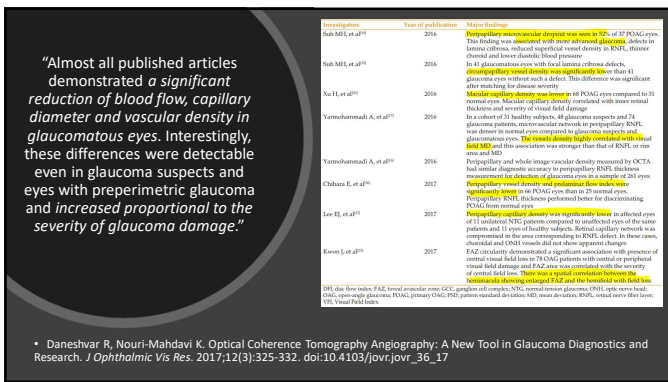
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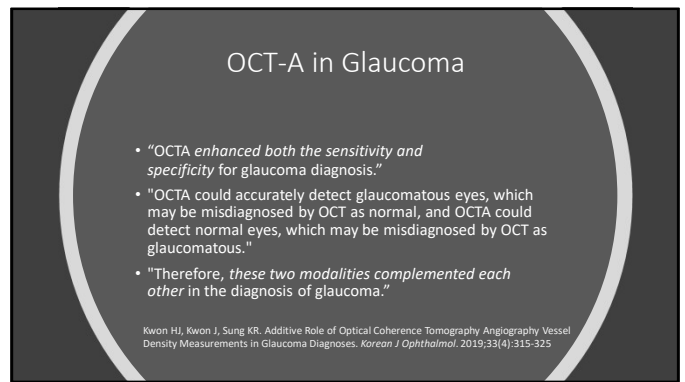
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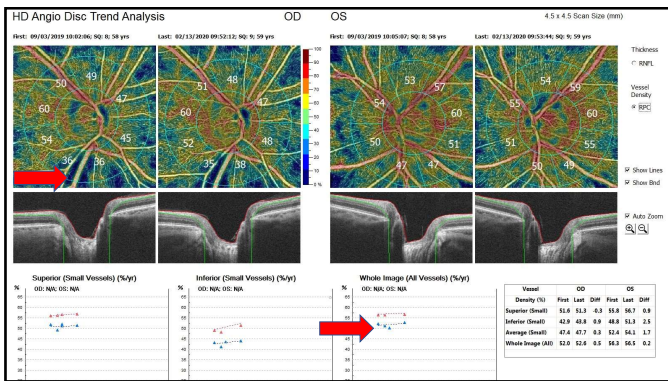
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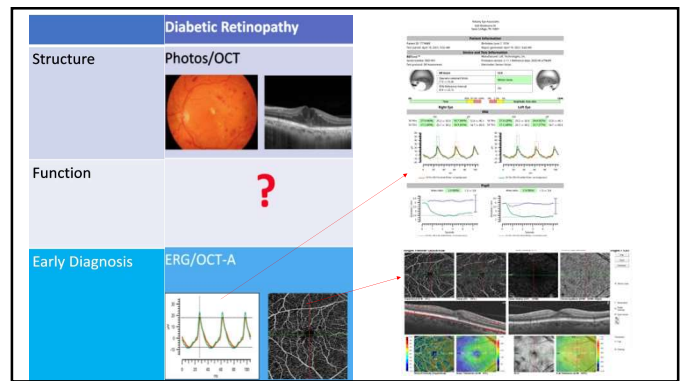
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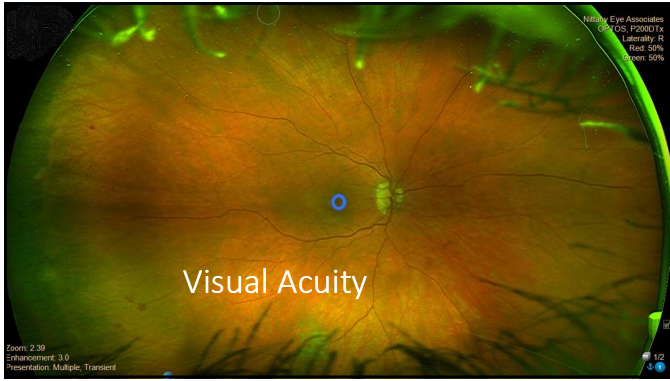
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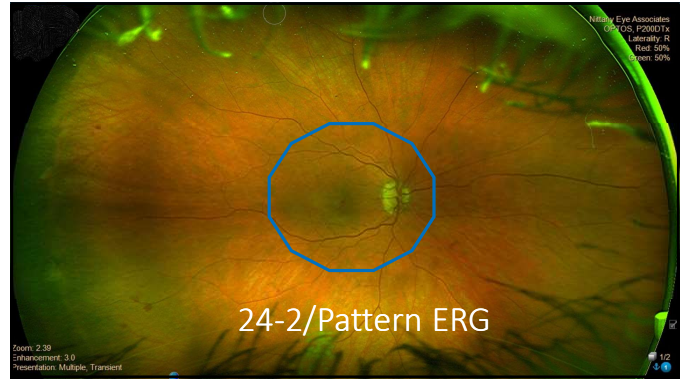
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Does diabetic retinal damage precede diabetic retinopathy?

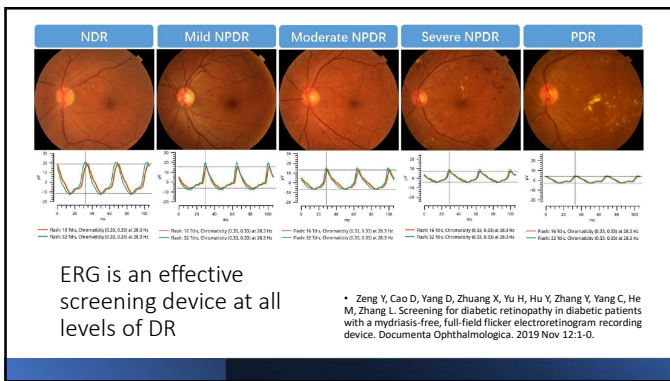
"Our data provide structural and functional evidence to support the hypothesis of neuronal damage in DM, prior to clinically evident vascular changes"

"Our data also confirm that a simple measurement of BCVA might be insufficient to fully characterize the changes in visual function"

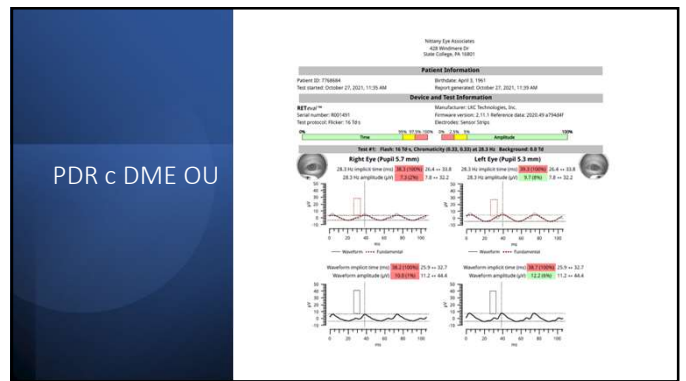
- Raza Shah, MD, retinal specialist
- Retinal damage occurs earlier than we currently realize or seem to admit
- We will need to either change definitions or treatment criteria

Montesano G, Ometto G, Higgins BE, Das R, Graham KW, Chakravarthy U, McGuiness B, Young IS, Kee F, Wright DM, Crabb DP. Evidence for Structural and Functional Damage of the Inner Retina in Diabetes With No Diabetic Retinopathy. *Investigative Ophthalmology & Visual Science*. 2021 Mar 5;62(3):35.

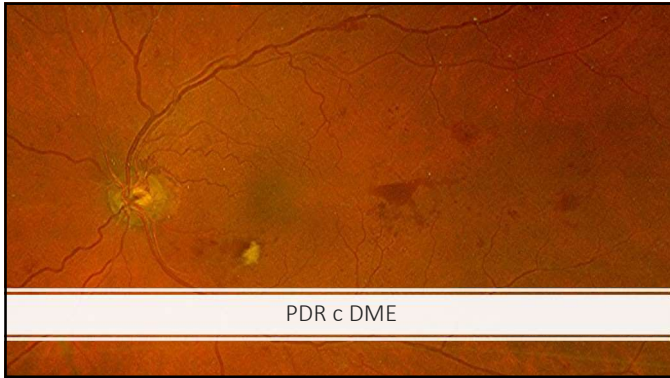
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Pupil responses become attenuated as diabetic retinopathy gets worse

- 1992 Smith & Smith; Straub, Jeron, & Kerp
- 1994 Straub, Thies, Jeron, Palitzsch, & Scholmerich
- 2001 Nakayama et al.
- 2013 Ortube et al.
- 2016 Maa et al.
- 2020 Brigell et al.

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Combining ERG with pupillary analysis may be a powerful predictor of diabetic retinopathy

1. Best eye's ERG implicit time
 - How long it takes the retina to respond
2. Best eye's ERG amplitude
 - How strong the signal is from the retina
3. Worst eye's pupil response
 - Change in pupil area from dim to bright light
4. Age

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ERG DR Score

- William Feuer, MS
 - CIGTS
 - OHTS
 - Tube v Trab
 - Ahmed Baerveldt Comparison Trial
 - Leber's Biostatistics Center

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Combining Diabetic Structure and Function

- VTDR+ = positive vision threatening diabetic retinopathy
- VTDR+
 - Severe NPDR
 - Proliferative DR
 - ME
- If patient had VTDR+, the chance of ocular intervention at 1, 2 and 3 years were **19%, 31%, 43%**
- If VTDR+ patient had ERG DR score greater than 23.5, chance of ocular intervention was **34%, 54%, 74%**
- If VTDR+ patient had ERG score less than 23.5, the chance of ocular intervention was **3%, 4%, 25%**

Brigell MG, Chiang B, Maa AY, Davis CO. Enhancing risk assessment in patients with diabetic retinopathy by combining measures of retinal function and structure. Translational vision science & technology 2020 Aug 3;9(9):40.

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In other words...

- 58 Y/O W/M
- Followed for years with moderate non-proliferative diabetic retinopathy
- Now – severe non-proliferative His chance of needing an ocular intervention within 1 year is **19%**
- Refer him?

- If ERG DR score is greater than 23.5 then **34%** chance of needing ocular intervention
- If less than 23.5 then **3%** chance of needing ocular intervention

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Structure and Function
Is a much more powerful predictor than structure alone

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If I had an instrument that...
Increased Vegas odds like that, I could retire tomorrow

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Diabetic Macular Ischemia
The loss of macular capillary network or capillary dropout
Garcia JM, Lima TT, Louzada RN, Rassi AT, Isaac DL, Avila M. Diabetic macular ischemia diagnosis: comparison between optical coherence tomography angiography and fluorescein angiography. Journal of ophthalmology. 2016 Nov 7;2016.

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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
Mastropopoulou R, Tzito L, Mastropopoulou A, Aloia R, De Nicola C, Mattei PA, Di Marzio G, Di Nicola M, Di Antonio L. Foveal avascular zone area and perifoveal 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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	AMD
Structure	Photos/OCT
Function	?
Early Diagnosis	Dark Adaptation/OCT-A (wet)

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A Baseline AREDS = 1
Follow-up AREDS = 1
#116 OS

B Baseline AREDS = 1
Follow-up AREDS = 3
#436 OD

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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.

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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, Neuper P, Gill M, Fawzi A, Skarinda D. Optical coherence tomographic angiography imaging in age-related macular degeneration. *Ophthalmology and eye diseases*. 2017 Feb 22;9:1179-1213.6666075.

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Billing/Coding

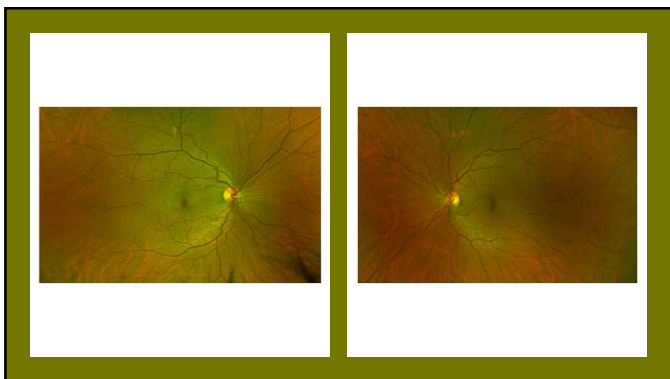
Description	CPT Code	Average Medicare Reimbursement
ERG with interpretation and report	92273	\$133
Dark adaptation with interpretation and report	92284	\$61
OCT with interpretation and report	92134	\$41

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Case

- 46 Y/O W/F
- Type 2 Diabetes x 5 years, HTN x 5 years
 - Metformin
 - Last A1C 6.8

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ERG

ERG Score: 12.5

Operator-selected limits (7.0 to 23.4): **Within limits**

95% Reference interval (9.4 to 22.1): 2%

DR Score

Operator-selected limits (7.0 to 23.4)	12.5
95% Reference interval (9.4 to 22.1)	2%

ERG Score: 12.5 (23.0%) 1.3 to 3.0

Pupil: Area ratio: 2.0 (20%) 1.3 to 3.0

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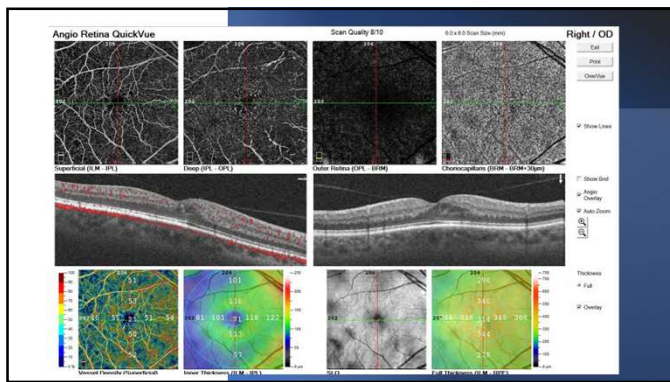
Case

- 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

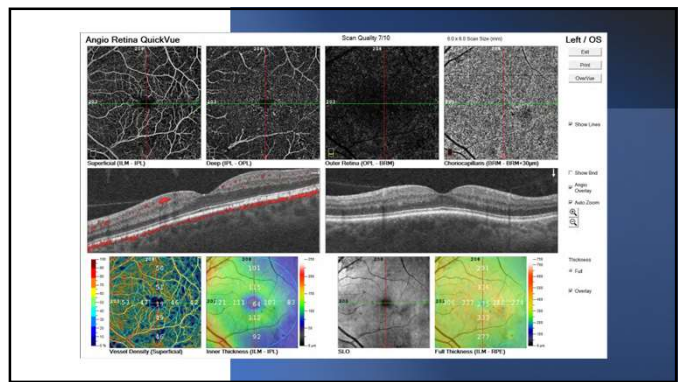
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Optomaps

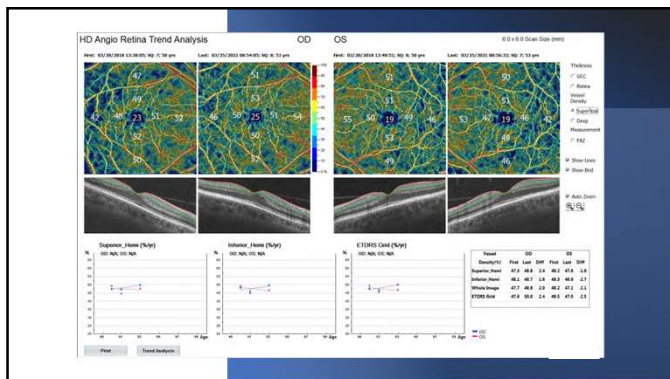
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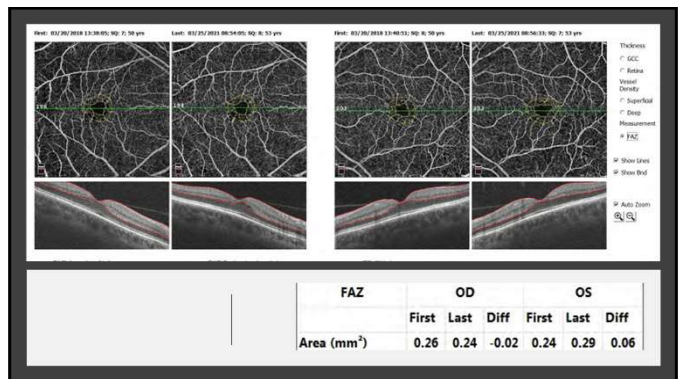
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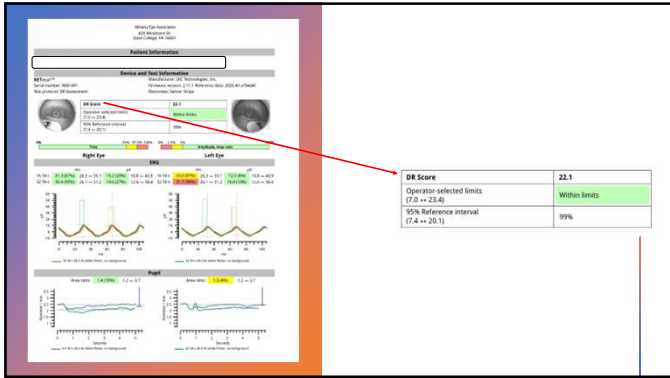
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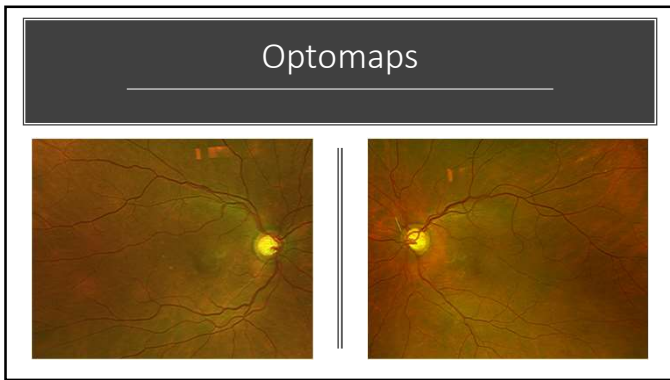


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Case

- 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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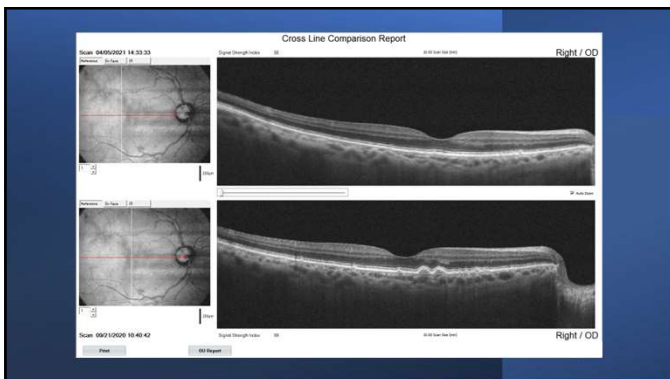


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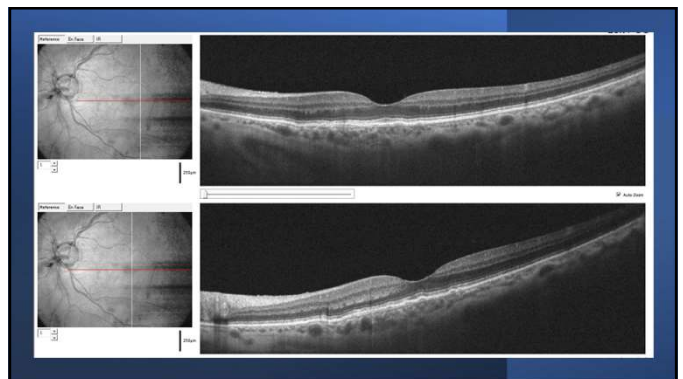
And now...

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

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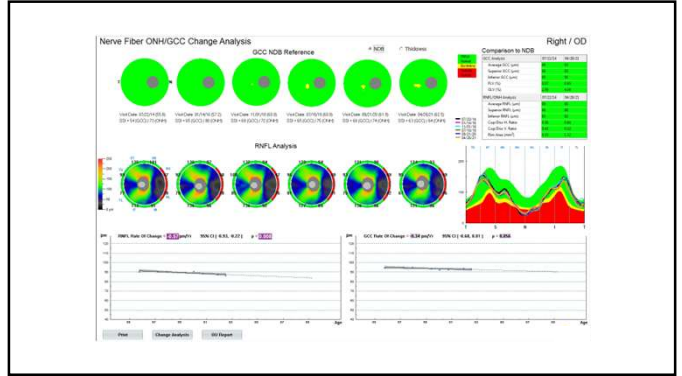


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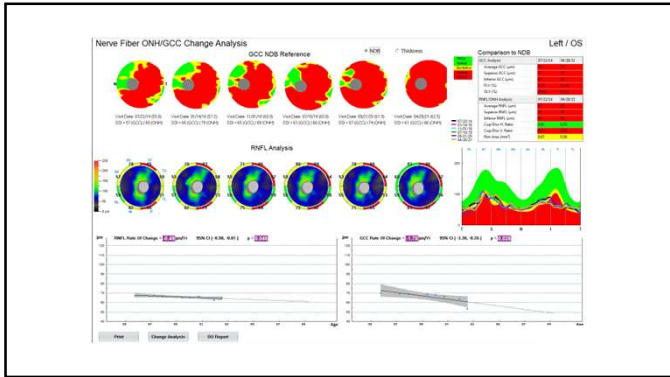
Case

- 62 Y/O W/M
- POAG OU, Mild OD and Moderate OS
- On Vyzulta and Rhopressa, both qhs OU
- Reports good compliance
- CcIOP 12.3 OD and 16.7 OS
- CH 10.8 and 9.9, Pachs 521 and 520

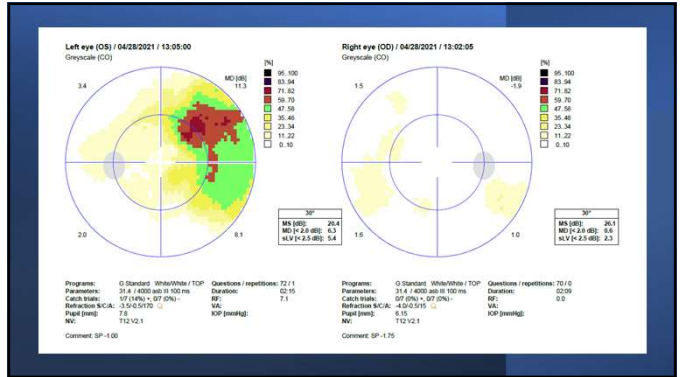
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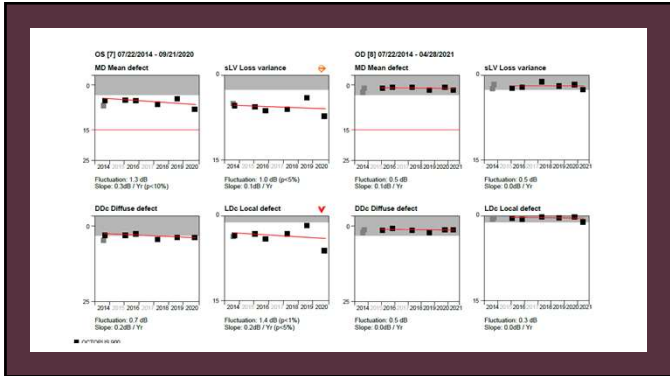
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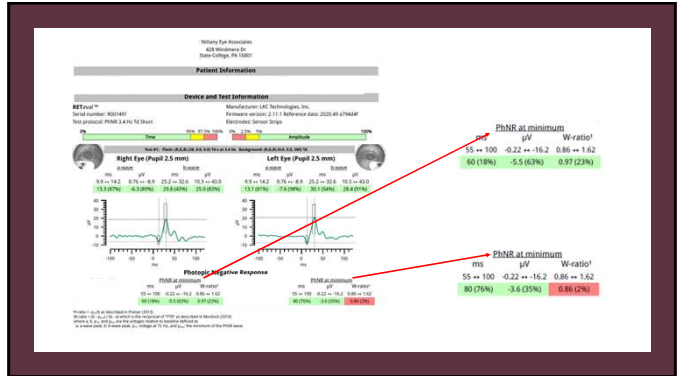
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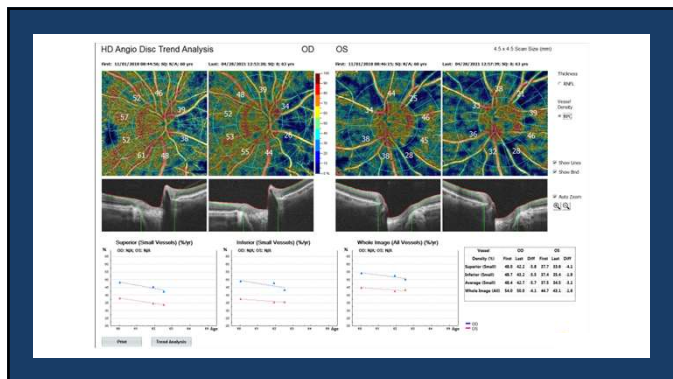
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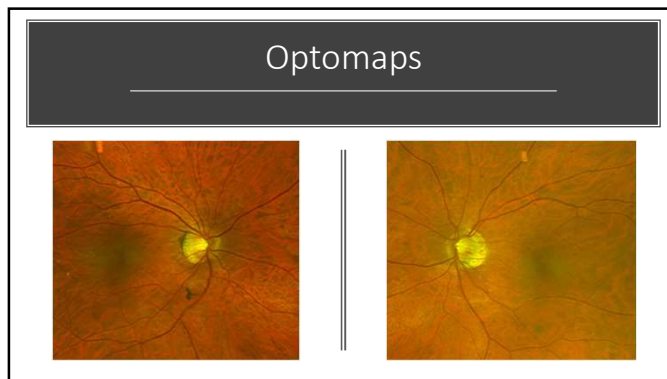
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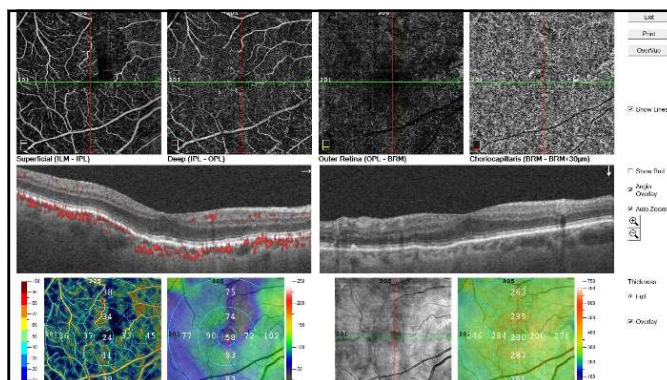


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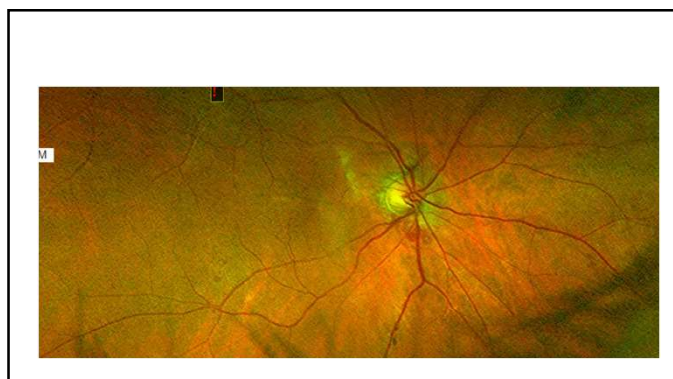
Case

- 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

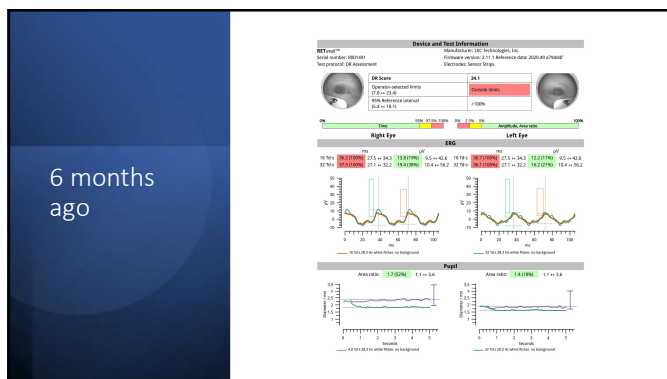
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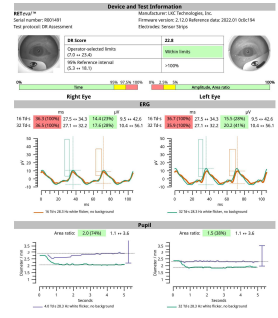
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Treatment

-  Began fish oil supplement
-  Increased exercise
-  Increased Metformin

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Now



Device and Test Information

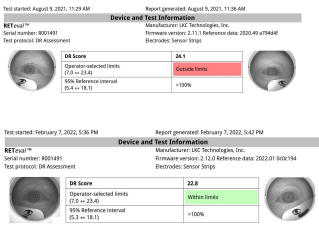
DR Score: 22.8

ERG: Right Eye, Left Eye

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Dr Score

- Improved from 24.1 to 22.8



Test started August 9, 2021, 11:29 AM

DR Score: 24.1

Test started February 7, 2022, 5:36 PM

DR Score: 22.8

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	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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Summary

- Early diagnosis leads to early treatment
- Early treatment leads to better patient outcomes
- Better patient outcomes increase patient satisfaction
- Increased patient satisfaction leads to increased doctor appreciation
- Increased doctor appreciation reduces burnout

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Thank You

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