Optometric Education Consultants

Glaucoma Update 2023

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Mackinac Island Northern Escape
Optometric Education Consultants

Friday, August 18, 2023

Disclosures- Greg Caldwell, OD, FAAO

All relevant relationships have been mitigated

- The content of this activity was prepared independently by me - Dr. Caldwell
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  - Disclosure: Receive speaker honorariums
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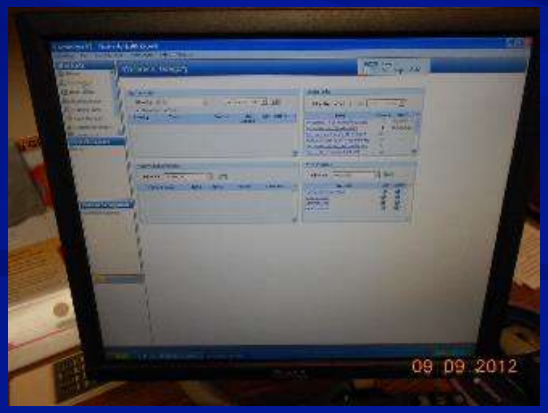
Financial Obligations

My Practice

I am a clinician first then a scientist

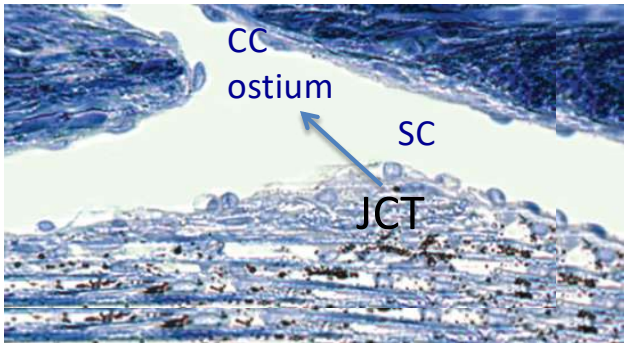
- Some are scientists first then clinician
- I need to simplify for patient and patient care.
- Science is great, but not good if there isn't a clinical application.
- Some lectures are science based without clinical application.
- My lecture will be a hybrid. Showing clinical applications of the science



It is wonderful to have someone who's juggling so many aspects of optometry [scientific, clinical experience, teacher & lecturer]. It is refreshing and very informative. -Sarah

Inflow versus Outflow

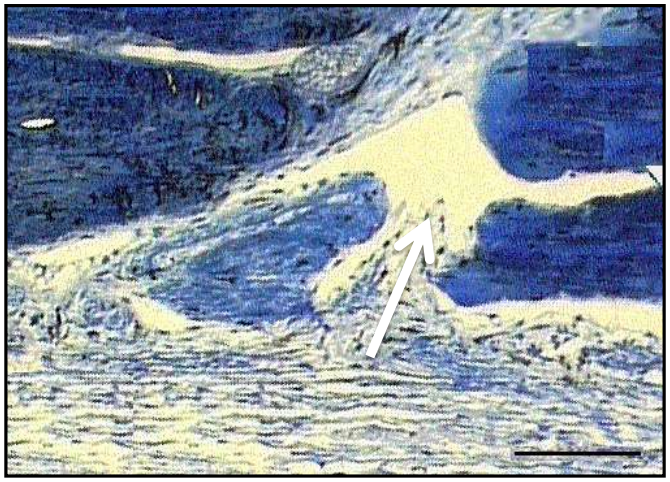
What is glaucoma?



PROGRESSIVE ELEVATIONS OF IOP CREATE PROGRESSIVELY GREATER HERNIATIONS OF THE JCT AND THE INNER WALL OF SCHLEMM'S CANAL INTO THE COLLECTOR CHANNELS LUMENS

7 mmHg

JCT



Partial

Complete

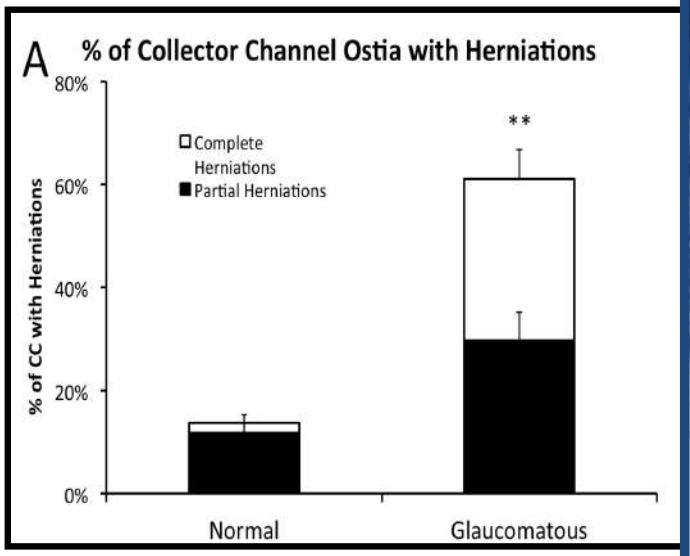
30 mmHg

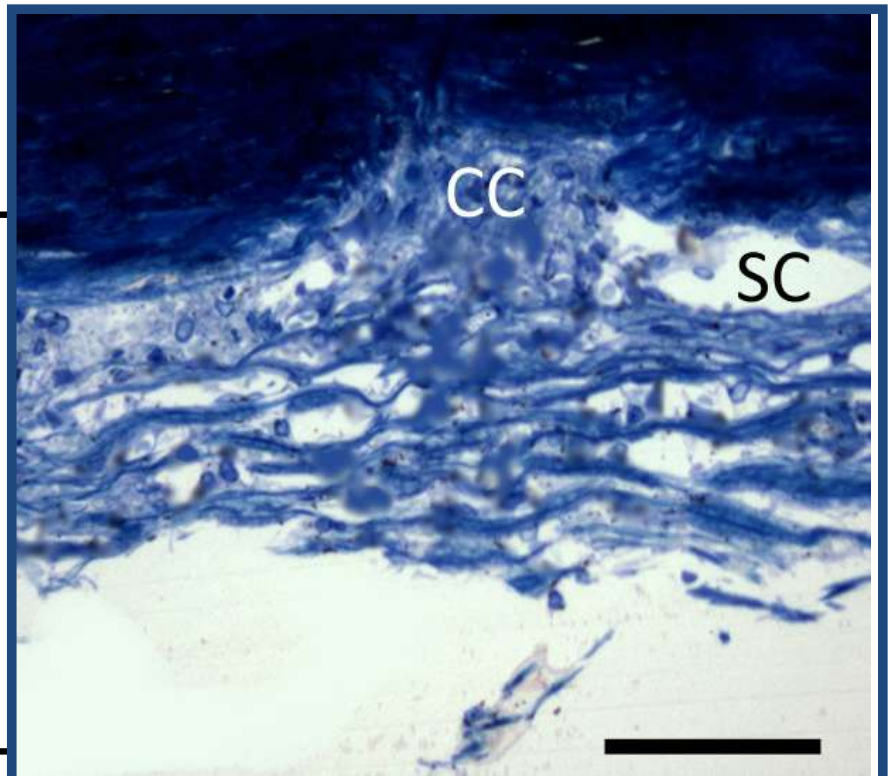
The pressure-induced herniations observed at 30 mmHg were either partially or completely reversible after the IOP was decreased to 7 mmHg in enucleated bovine eyes. So, in normal eyes, these herniations slide in and out with regular rise and fall of IOP.

Human eyes with POAG even at 0mmHg, exhibit herniations and many more than in age-matched normal eyes

A: Significantly more herniations of the TM into CC ostia were found in POAG eyes (33 of 54), than in normal eyes (7 of 51) (61% vs. 14%, $p<0.0001$). In normal eyes, herniations that were present were predominantly partial (86%) rather than complete (14%). In POAG eyes, over half of the larger total number of herniations were complete (52%).

Battista SA, Lu Z, Hofmann S, **Freddo TF**, Overby DR, Gong H**:** Acute IOP elevation reduces the available area for aqueous humor outflow and induces meshwork herniations into collector channels of bovine eyes. Invest. Ophthalmol. Vis. Sci., 49:5346-52, 2008.



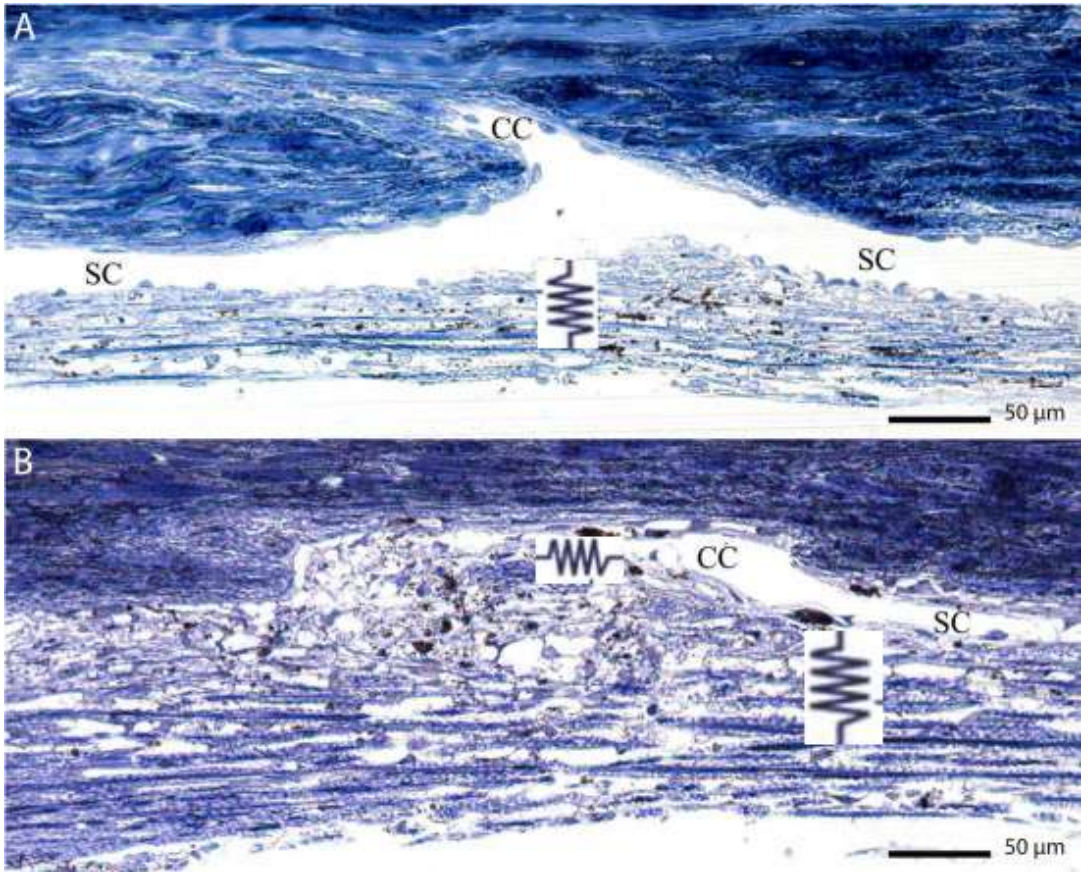


PRINCIPAL NEW FINDING

The presence of herniations, at O mm Hg, suggests they were permanent *in-vivo* obstructions in the ostia of CC, whether partial or complete. These are the only exits from Schlemm's canal. If enough of these 30 channels are fully or even partially blocked, IOP MUST go up.

This study is the first to document the existence of permanent herniations into CC ostia in POAG.

Since resistances in series are additive, it could be that these previously unreported permanent herniations, which obstruct CC ostia, represent an additional source of resistance, distal to the trabecular meshwork, in POAG.

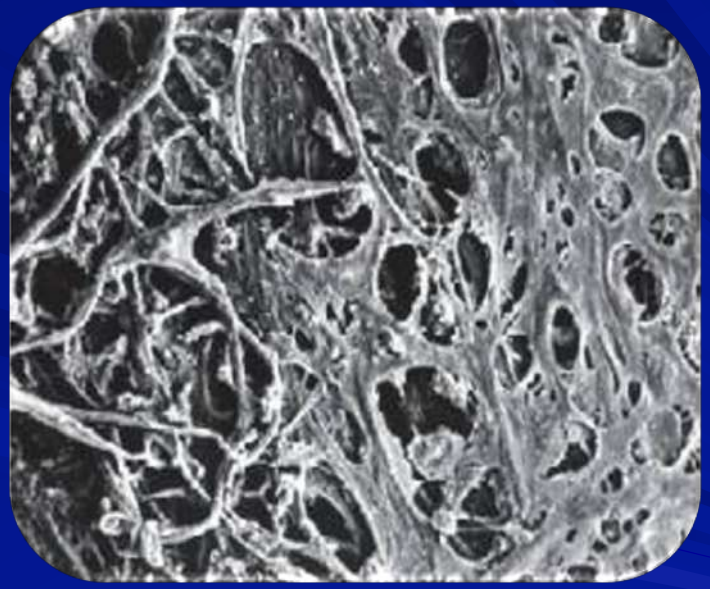


Disease at the TM is responsible for elevated IOP in glaucoma[1,2]

Healthy TM
Normal IOP

Cellular Damage
(eg, Oxidative Stress)

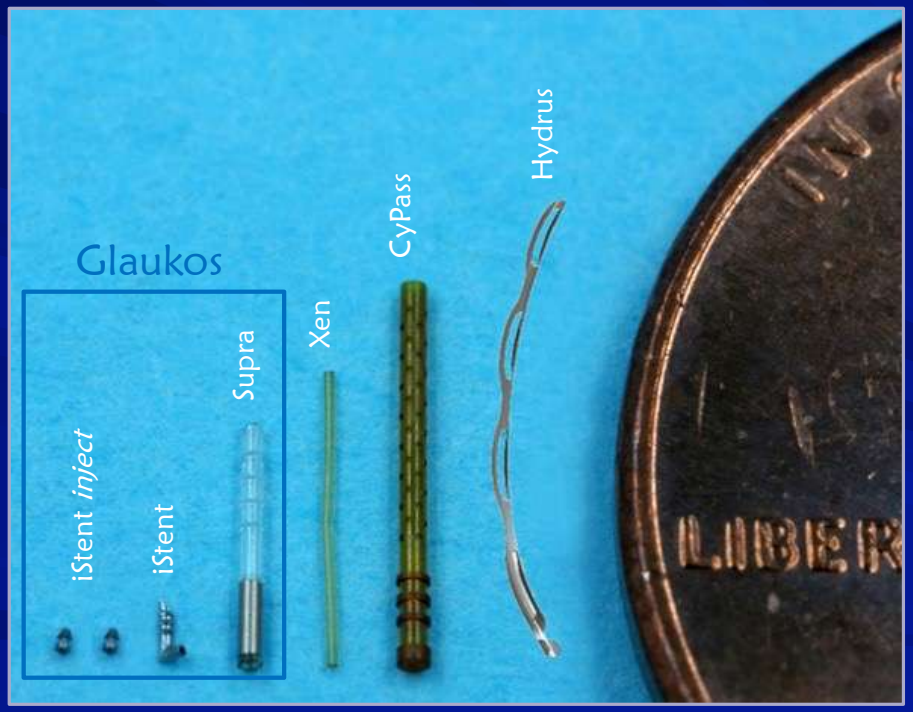
POAG TM Stiffness
Elevated IOP



Scanning electron microscopy (2000x) was used to examine human TM under physiological conditions and in patients with POAG.[2]
POAG, primary open-angle glaucoma; TM, trabecular meshwork.

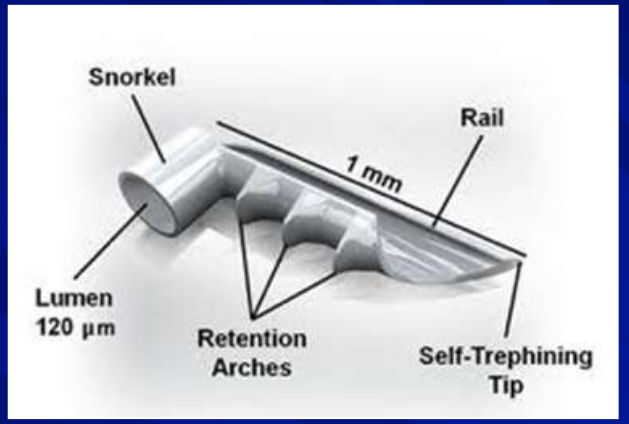
1. He et al. *Invest Ophthalmol Vis Sci*. 2008;49:1447.
2. Saccà et al. *J Cell Physiol.* 2015;230:510.

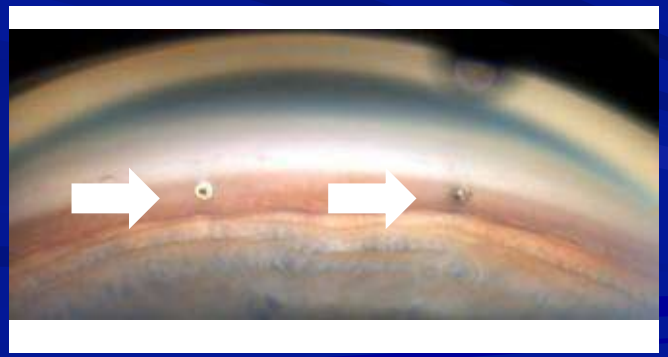
MIGS Technologies



iStent (Glaukos Corp.)

- iStent: Trabecular Micro-Bypass Stent
  - FDA Approved June 2012
  - Not Ex-PRESS shunt
- Mild to Moderate glaucoma in patients who need cataract surgery
- No Bleb is formed
  - Few complications
- Relatively Easy to perform
- Only 1 is approved
  - Often need 2 or more

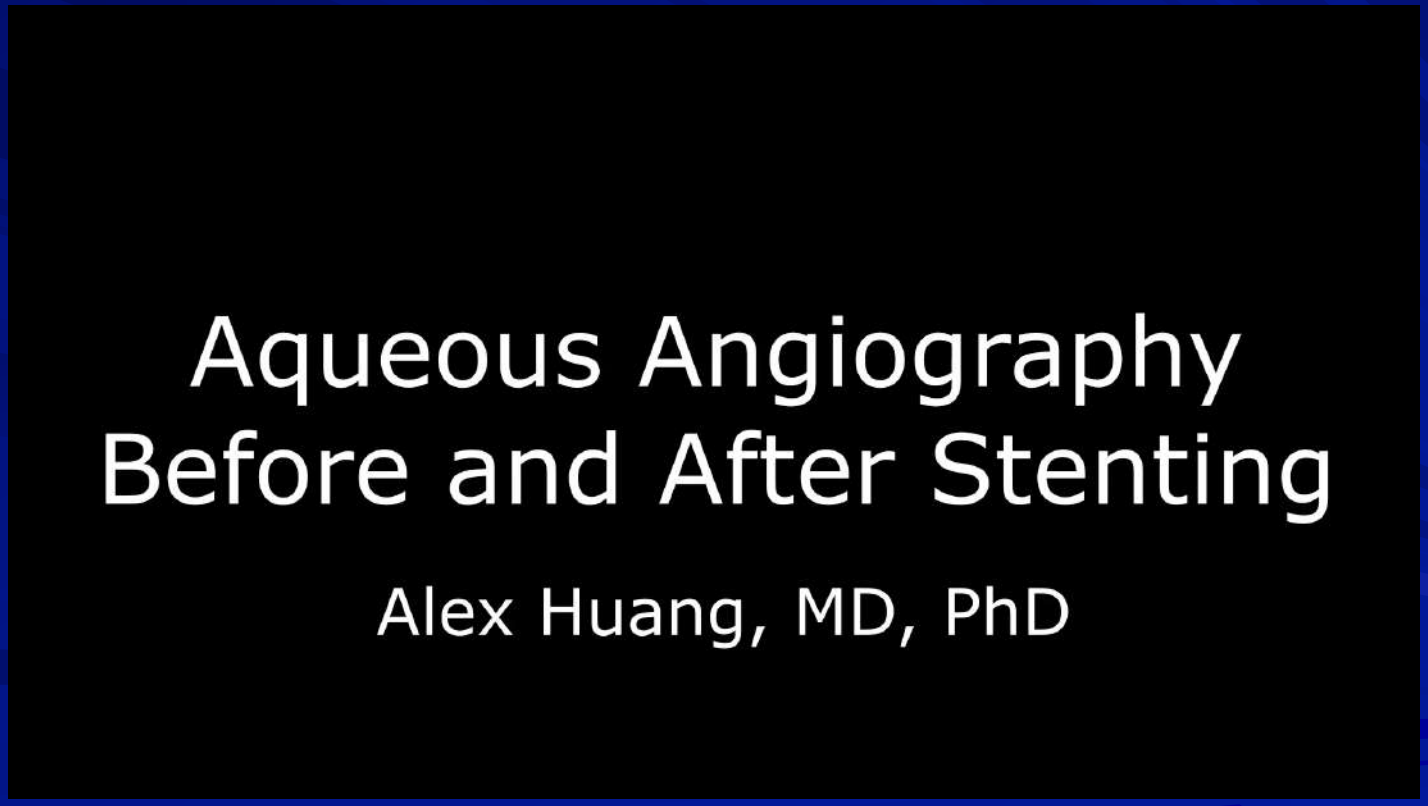




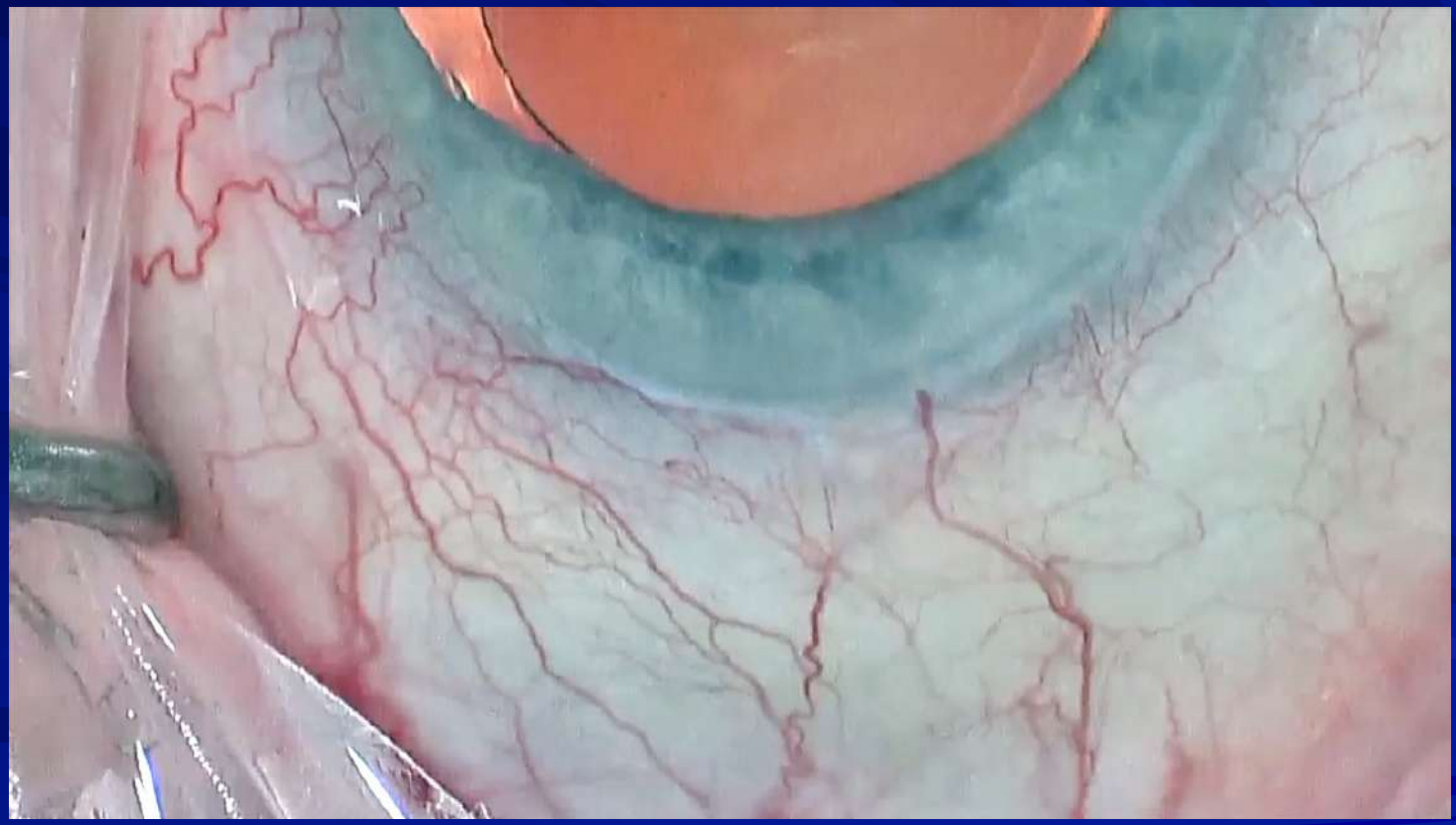
The iStent *inject* Trabecular Micro-bypass

- For patients with cataracts and glaucoma, iStent *inject* is:
- FDA approved therapy for the treatment of elevated IOP in adult patients with mild-to-moderate primary open-angle glaucoma in conjunction with cataract surgery
- The first available *ab interno*, micro-bypass system designed to restore natural physiological outflow **through two openings** through the trabecular meshwork

The goal is to increase outflow
Glaukos iStent Inject

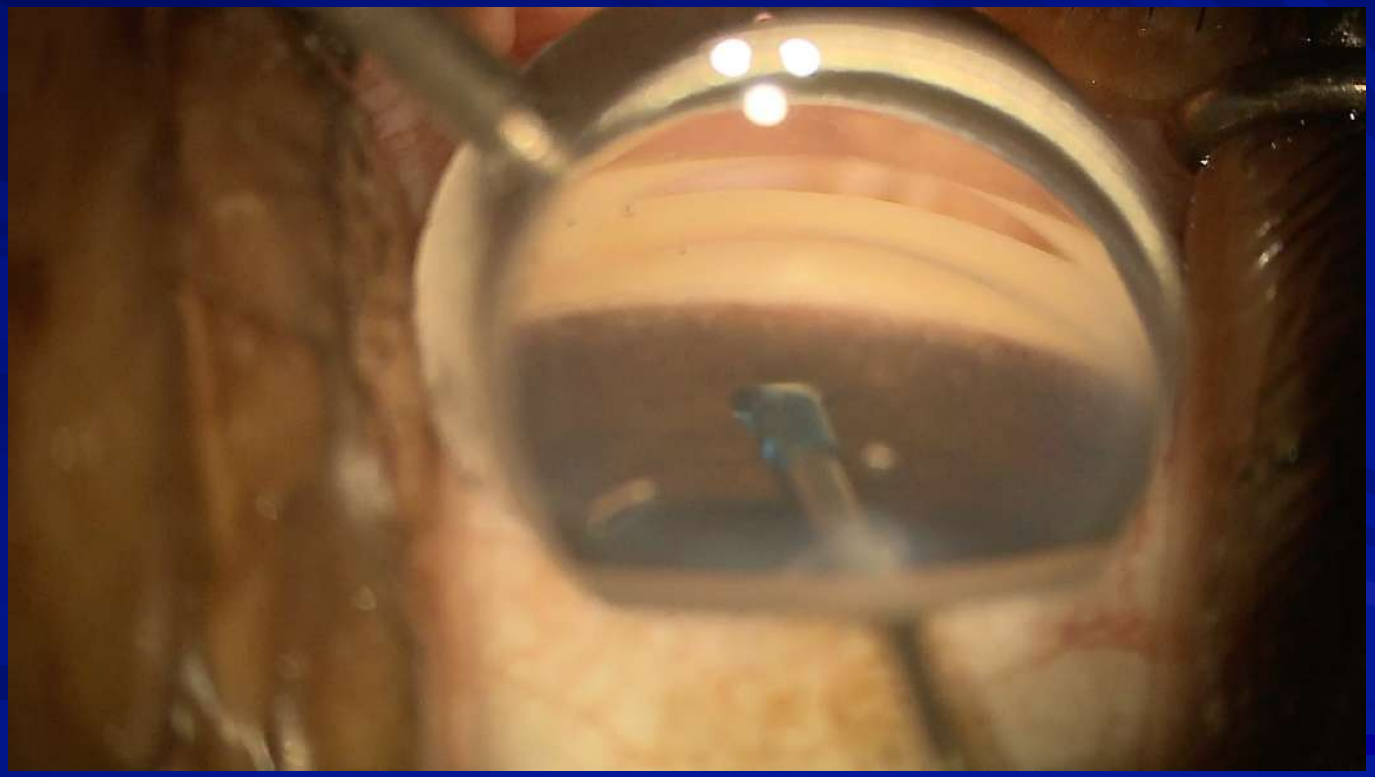


Blanching Confirms Reliable Access to Multiple Collector Channels – Hydrus Microstent

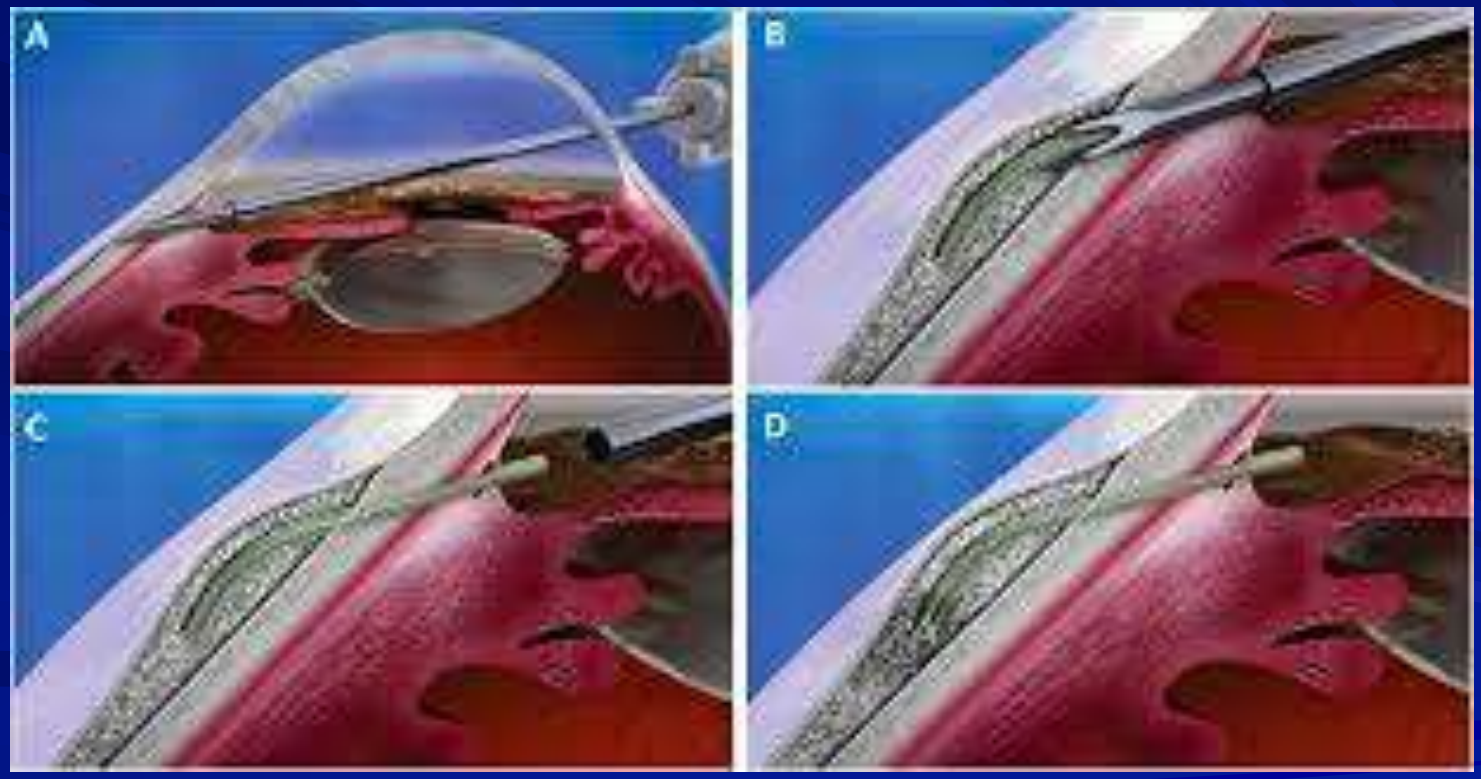


Kahook Dual Blade – KDB/KDB Glide

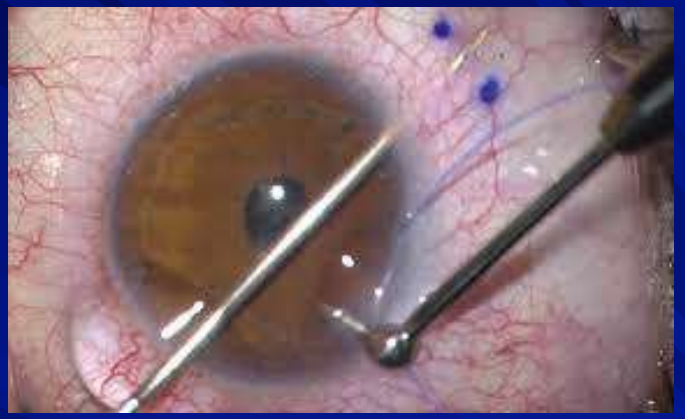
Canaloplasty –Transluminal Dilation



XEN® GEL STENT



XEN® GEL STENT



Endoscopic Cyclophotocoagulation (ECP)

- Ciliary body processes are visualized with an endoscope and are photocoagulated with a laser
- Result is decreased aqueous production and lower IOP

Video of ECP

55-Year-Old Men

500 microns CCT and 21 mm Hg with Goldmann

What is the true IOP?

1. 18 mm Hg
2. 21 mm Hg
3. 24 mm Hg
4. Don't Know

600 microns CCT and 21 mm Hg with Goldmann

What is the true IOP?

1. 18 mm Hg
2. 21 mm Hg
3. 24 mm Hg
4. Don't Know

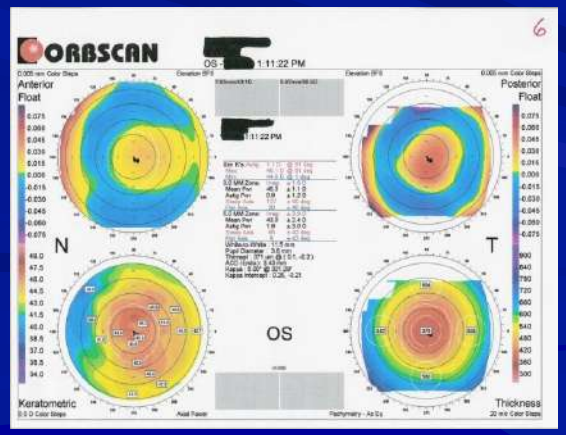
Corneal Curvature

Corneal Thickness

Corneal Rigidity

Pachymetry

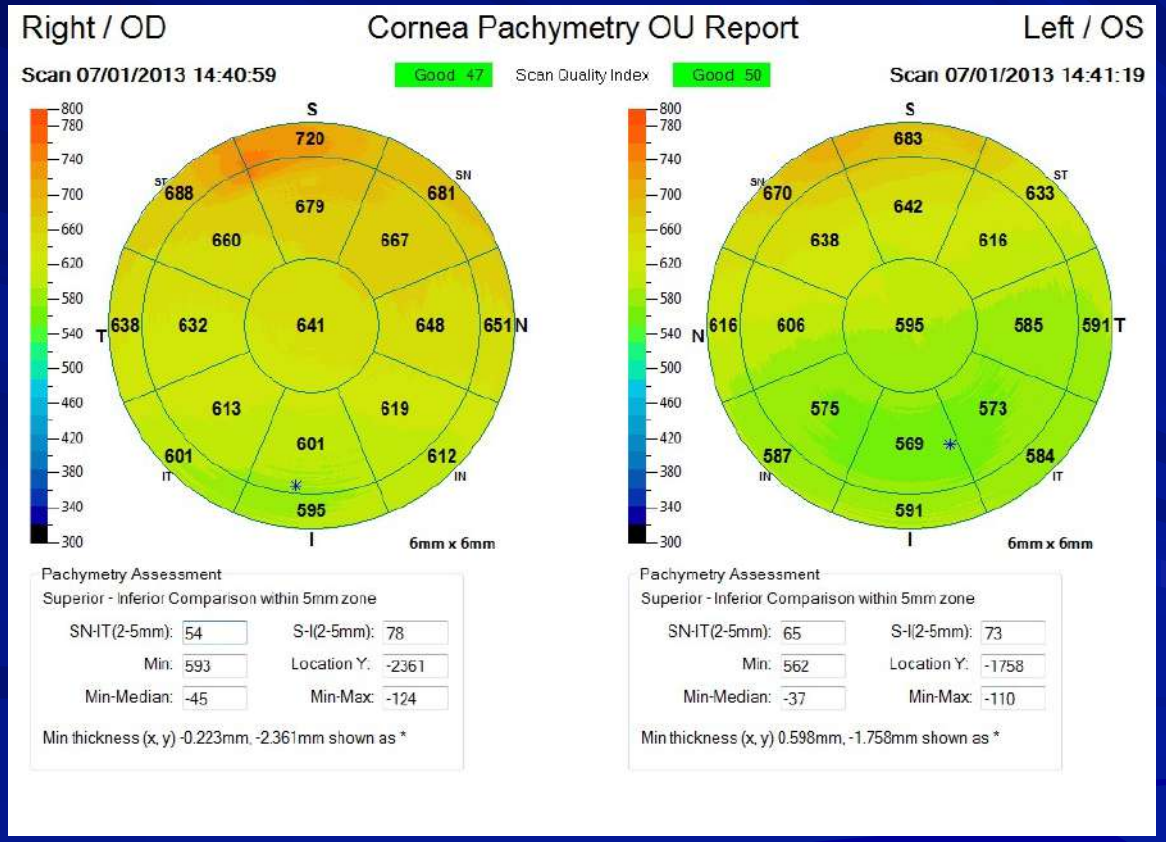
Ultrasonic versus Optical



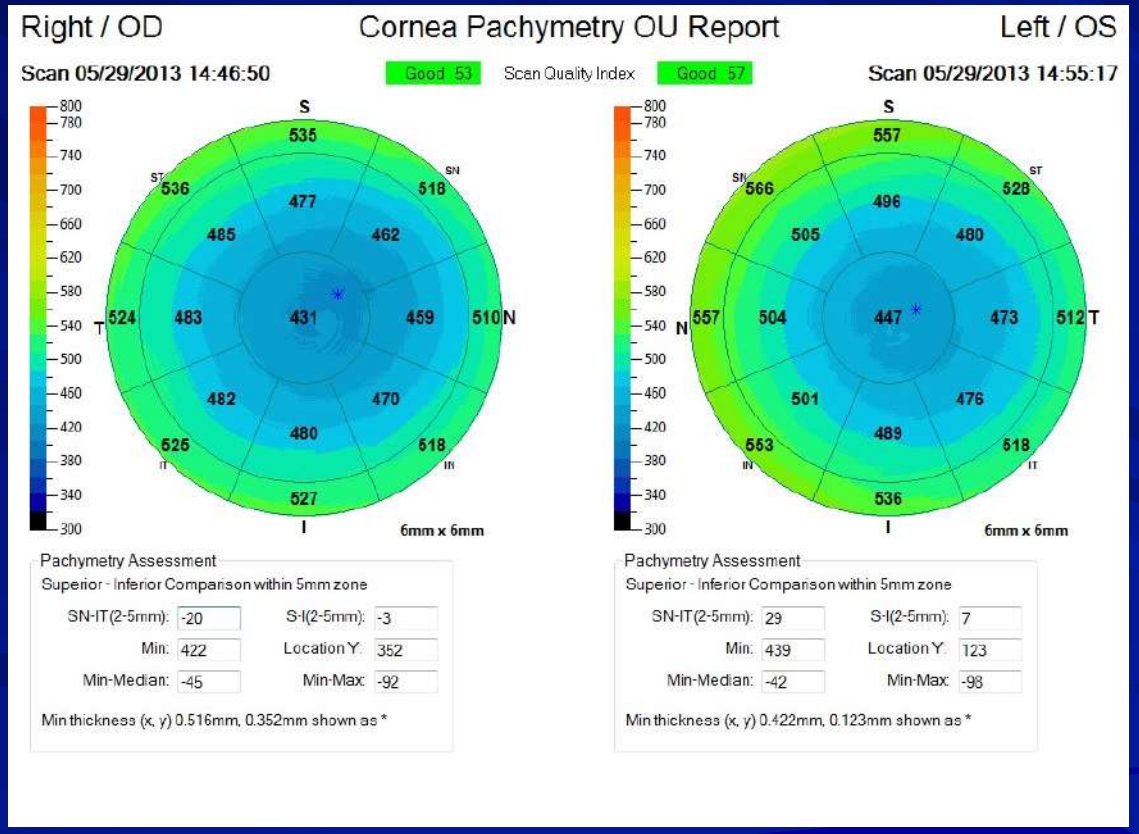
Anterior Segment Imaging
Pachymetry

CCT measurement caliper

Anterior Segment Imaging with OCT Pachymetry



Post-LASIK


Right / OD
Cornea Pachymetry OU Report
Left / OS
Scan 05/29/2013 14:46:50
Good 53
Scan Quality Index
Good 57
Scan 05/29/2013 14:55:17
S
535
SN
518
ST
536
477
485
462
524
483
431
459
510
N
T
482
470
480
525
518
IT
IN
527
I
6mm x 6mm
Pachymetry Assessment
Superior - Inferior Comparison within 5mm zone
SN-IT(2-5mm): -20
S-I(2-5mm): -3
Min: 422
Location Y: 352
Min-Median: -45
Min-Max: -92
Min thickness (x, y) 0.516mm, 0.352mm shown as *
S
557
SN
566
ST
528
496
505
480
557
504
447
473
512
N
T
501
476
489
553
518
IN
IT
536
I
6mm x 6mm
Pachymetry Assessment
Superior - Inferior Comparison within 5mm zone
SN-IT(2-5mm): 29
S-I(2-5mm): 7
Min: 439
Location Y: 123
Min-Median: -42
Min-Max: -98
Min thickness (x, y) 0.422mm, 0.123mm shown as *

Corneal Hysteresis

Ocular Response Analyzer G3

- Evidence - Key findings from over 800 peer-reviewed publications
- Impact of corneal biomechanics on IOP

Key Concepts

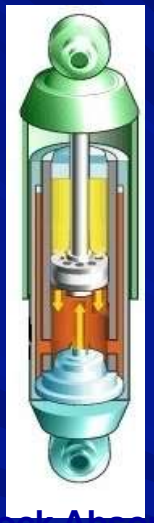
Elasticity, Viscosity, & Damping

Good Shock Absorber

Same (good) Spring Both Sides

Bad Shock Absorber

Spring
(*elastic*)
JOB: Return Energy



Shock Absorber
(aka: Damper)
(*viscous*)
JOB: Dissipate Energy

The Spring is not the problem here. Its the Bad Shock Absorber (*damper*) that cannot dissipate the energy and delivers a harsh ride

Hysteresis

What it is – What it is NOT

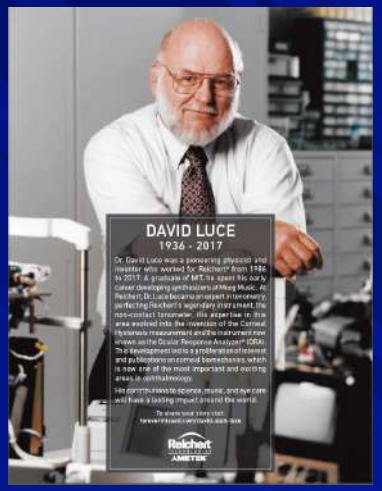
Hysteresis characterizes the response to application and removal of force in materials that ***dissipate a portion of applied energy*** [1]

- *Not a new concept (term defined in 1890)*
- *13,000+ medical publications on hysteresis in a variety of fields* [2]

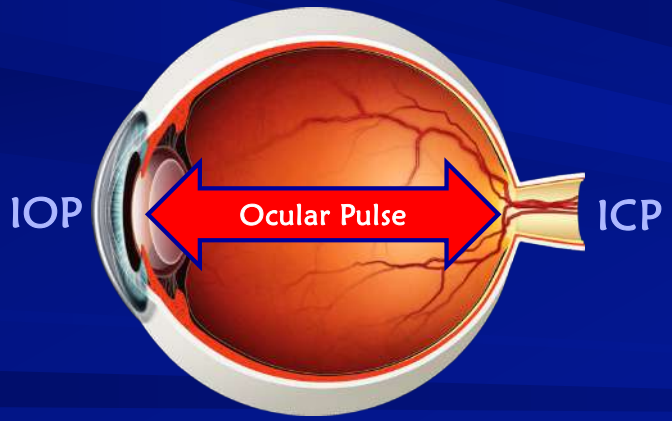
Corneal Hysteresis (CH)

Reflects cornea's ability to ***absorb and dissipate energy*** [3]

- An indication of "damping" capacity of the ocular tissue
  - **NOT an indication of "stiffness" or "rigidity"**



David Luce PhD 1935-2017
Pioneered Corneal Hysteresis



"The eye is under a constant assault"

Hysteresis tells us "How good of a shock absorber" the eye is.

1. Vincent J. Basic elasticity and viscoelasticity. In: Vincent J, ed. *Structural Biomaterials.* 3rd ed. Princeton, NJ: Princeton University Press; 2012:1-28.
2. PubMed Search for "hysteresis" on Mach 11, 2021 returned 13,766 results.
3. Luce DA. *J Cataract Refract Surg.* 2005;31:156-162.

Ocular Response Analyzer G3

Measurement Values, Range, and Interpretation

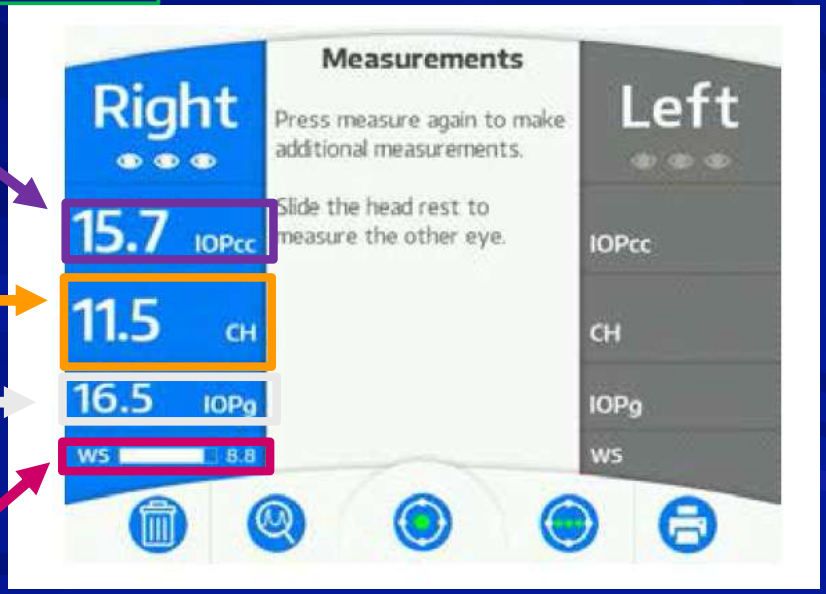
- Average Normal CH is 10.5 mmHg
- Standard dev 1.5 mmHg
- Fairly stable diurnally and with age

Corneal Compensated IOP (IOPcc): Closer to the "true pressure"

Corneal Hysteresis: Normal average 10.5 Typical Range is 8-14 (low = risk)

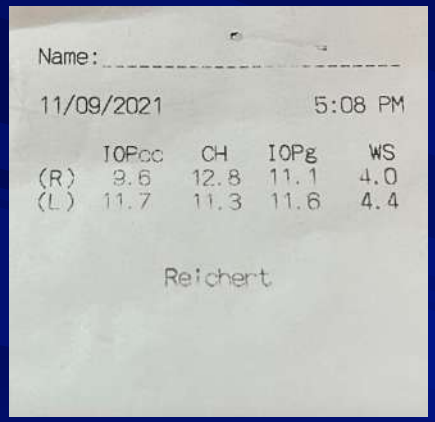
IOPg: "Goldmann equivalent" reference

Waveform Score: signal reliability (0-10)



Ocular Response Analyzer G3

Measurement Values, Range, and Interpretation


Name:

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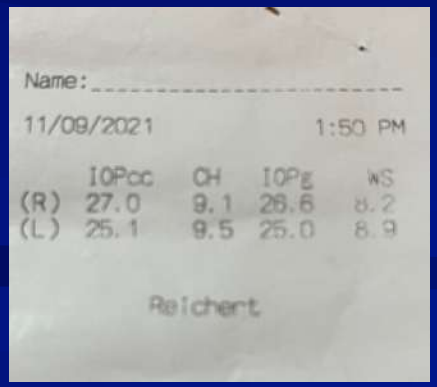
	IOPcc	CH	IOPg	WS
(R)	9.6	12.8	11.1	4.0
(L)	11.7	11.3	11.6	4.4

Reichert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	IOPcc	CH	IOPg	WS
(R)	27.0	9.1	26.6	8.2
(L)	25.1	9.5	25.0	8.9

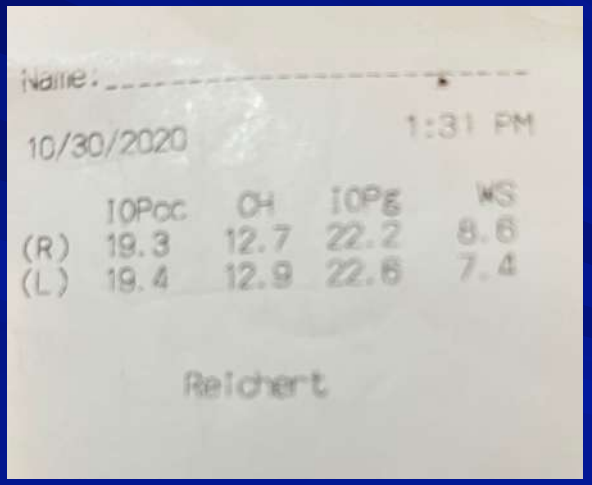
Reichert


Name:

11/09/2021 6:14 PM

	IOPcc	CH	IOPg	WS
(R)	17.3	8.6	14.8	6.3
(L)	15.2	9.6	13.6	7.1

Reichert


Name:

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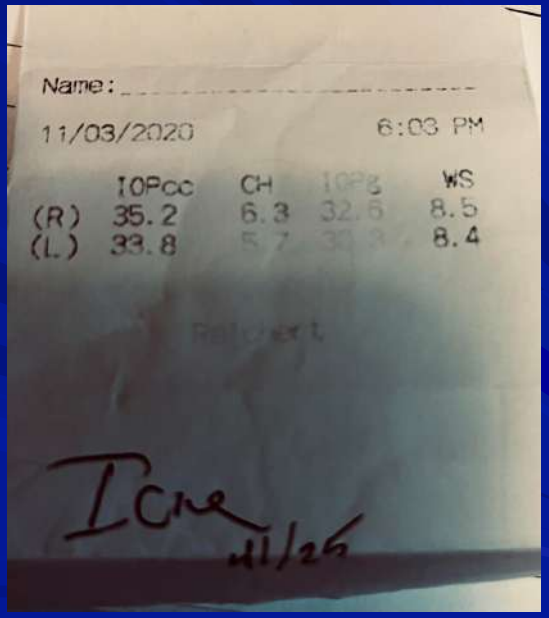
	IOPcc	CH	IOPg	WS
(R)	19.3	12.7	22.2	8.6
(L)	19.4	12.9	22.6	7.4

Reichert


Name:

11/03/2020 6:03 PM

	IOPcc	CH	IOPg	WS
(R)	35.2	6.3	32.6	8.5
(L)	33.8	5.7	30.3	8.4

Reichert

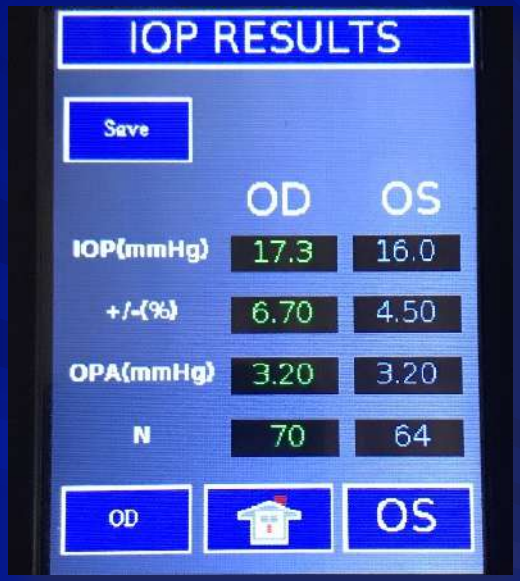
ICM 11/25

Falck Medical Multi-Function Device ™

- The First and Only Device Approved by the FDA for the Measurement of:
  - ★ Aqueous Outflow
  - ★ Ocular Perfusion Pressure
  - ★ IOP Variation

Tonometry

- Optical Applanation IOP Measurement
- Compensates for Corneal Biomechanics
- Serial Systolic and Diastolic IOP
- Ocular Pulse Amplitude
- Disposable Prism Blocks Infection



Ophthalmodynamometry

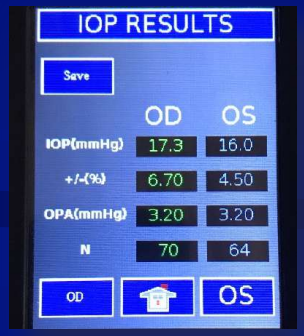
- Central Retinal Artery Pressure
- Intraocular Pressure
- Ocular Perfusion Pressure
- Vascular Disease Risk Assessment
- Screen for Carotid Vascular Disease

Tonography

- Optical Aqueous Outflow Measurement
- Intraocular Pressure
- Verify Outflow Therapy Interventions
- Glaucoma Risk Determination
- Glaucoma Management Tool

Aqueous Humor Outflow, Tonography

- IOP spikes are higher in an eye with impaired aqueous humor outflow
- When aqueous humor production increases
  - ★ The impaired outflow system cannot accommodate the increased aqueous volume
- Impaired aqueous humor outflow is the primary cause of glaucoma
- Eyes with untreated glaucoma have abnormal aqueous humor outflow
- Therapy should be directed at improving the rate of aqueous humor outflow



Question

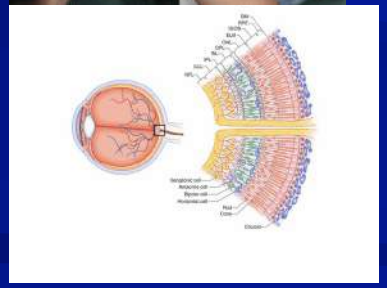
Which method of IOP measure should only be used for glaucoma diagnosis, treatment, and management?

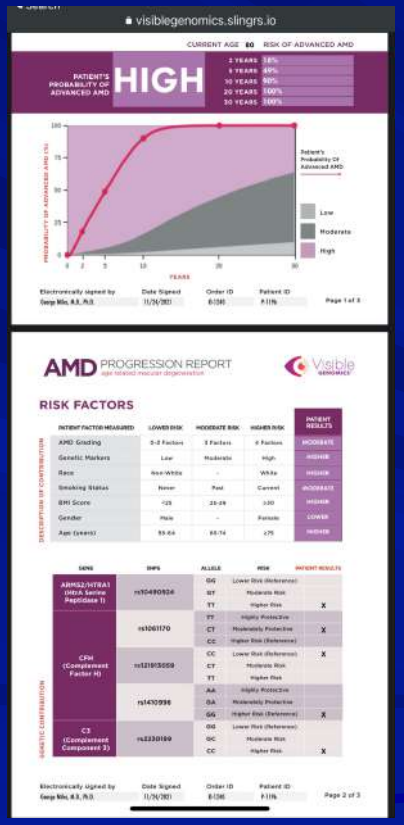
Many methods are acceptable

Early Detection and Allopathic Treatments

Rabin Cone Contrast Test

ERG and VEP





Early Detection

- Patients are expecting it
- Diagnostic equipment keeps evolving

- Rabin Cone Contrast Test
- Genetic Testing
- Dark Adaptation
- Preferential Hyperacuity Perimetry (PHP)
- ERG/VEP testing

Greg's Something to Think About or Advice:

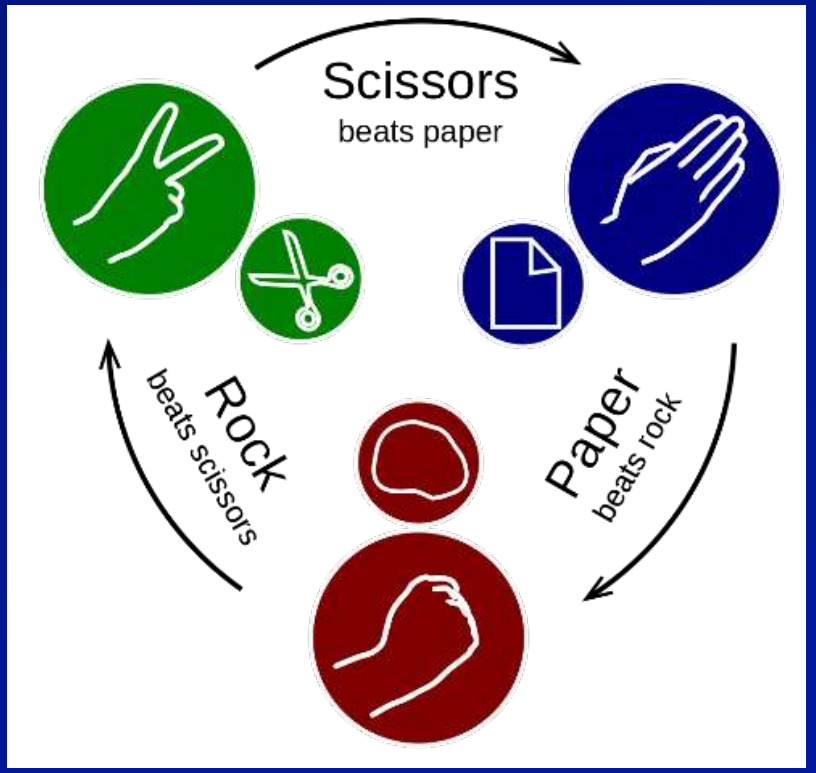
One better understand lifestyle changes, the immune system, and nutrition.

As we are now in areas where "there isn't a pill for that ill"

"Doctors better become more like a nutritionist, or the nutritionist will become more like doctors."

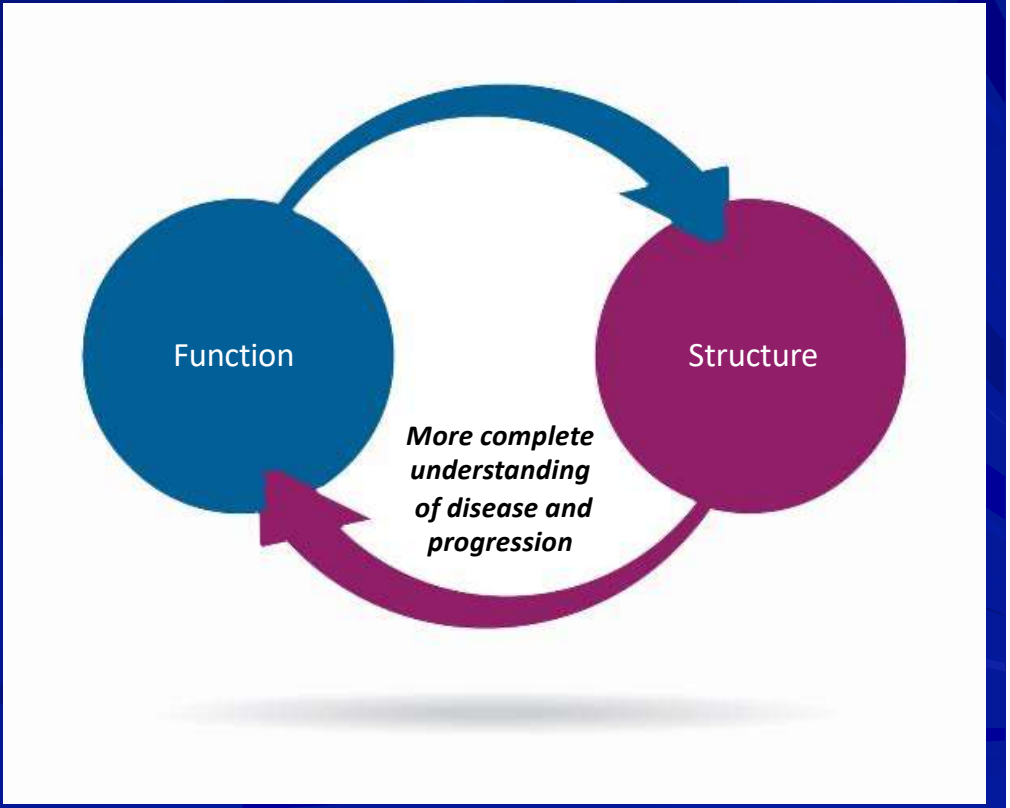
Ocular Structure and Visual Function

- Structure precedes functional damage
- Function precedes structural damage
- Both damage visible simultaneously



Value of Function *plus* Structure

- **Early Detection:** Function precedes structure in many conditions, highlighting problems before structural damage occurs
- **Progression:** Functional tests plays a critical role in detecting sub-clinical progression
- **Improvement:** Structural tests demonstrate stability; only functional tests can demonstrate improvement

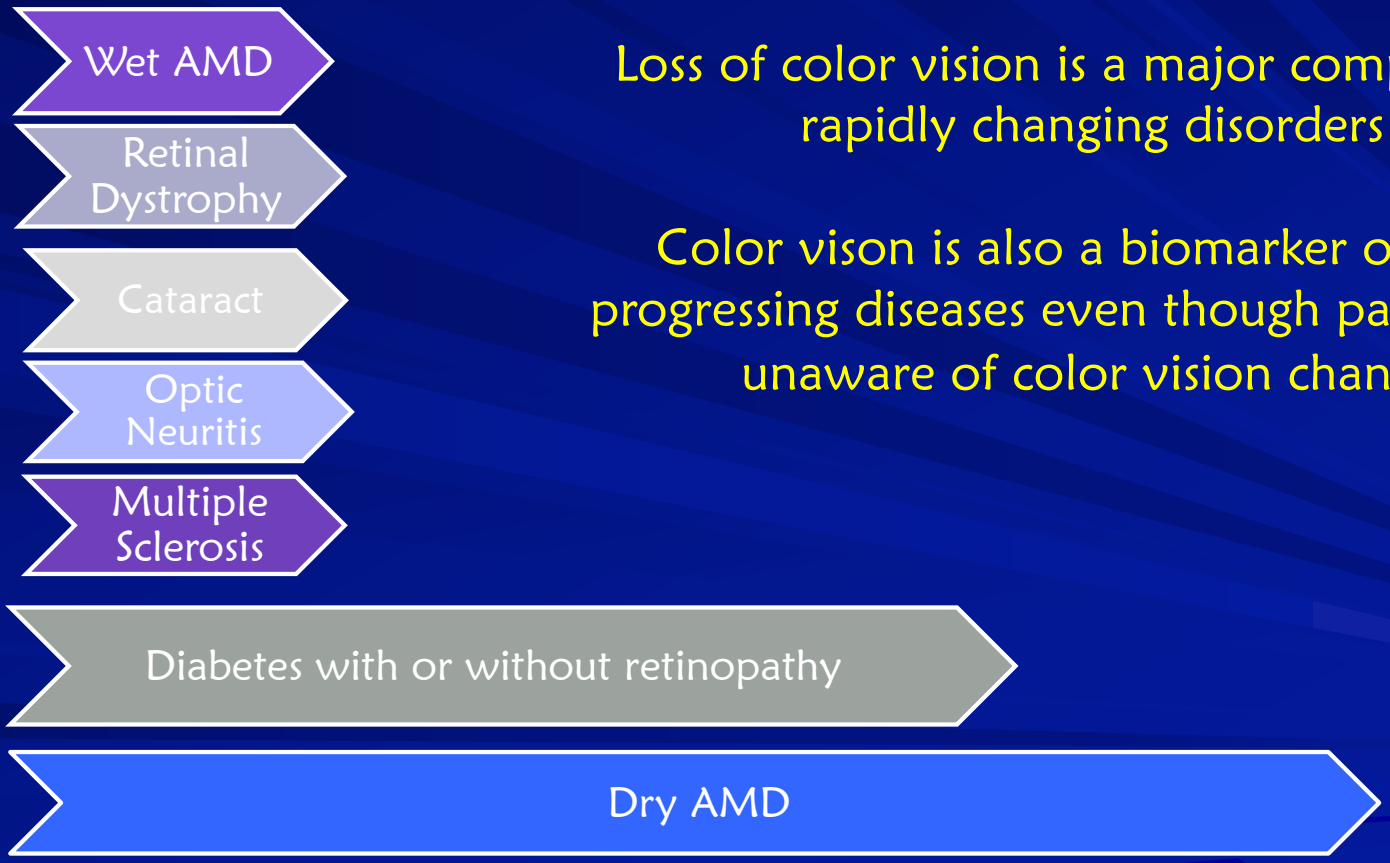


Color vision

Kollners rule:

Congenital is Red Green defects
Acquired is Blue Yellow Defects

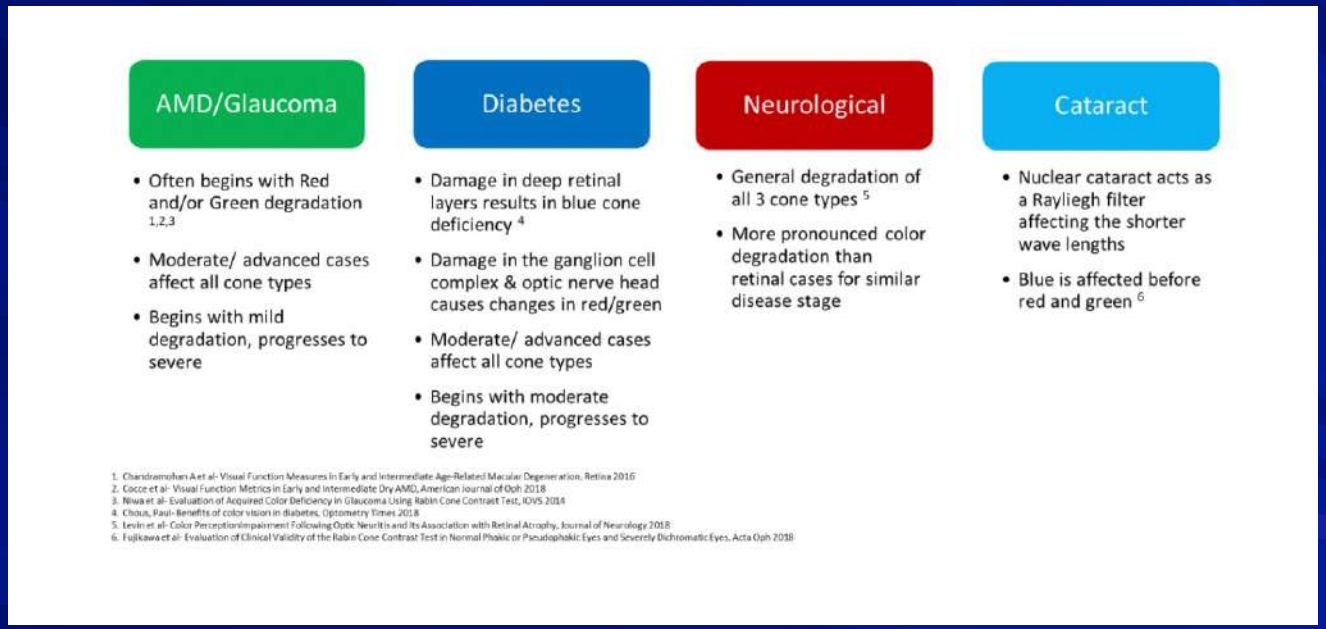
Color Vision as a Biomarker of Disease



Loss of color vision is a major complaint in rapidly changing disorders

Color vison is also a biomarker of slow progressing diseases even though patients are unaware of color vision change

Interpreting Rabin Cone Contrast Test Results Using Color Profiling



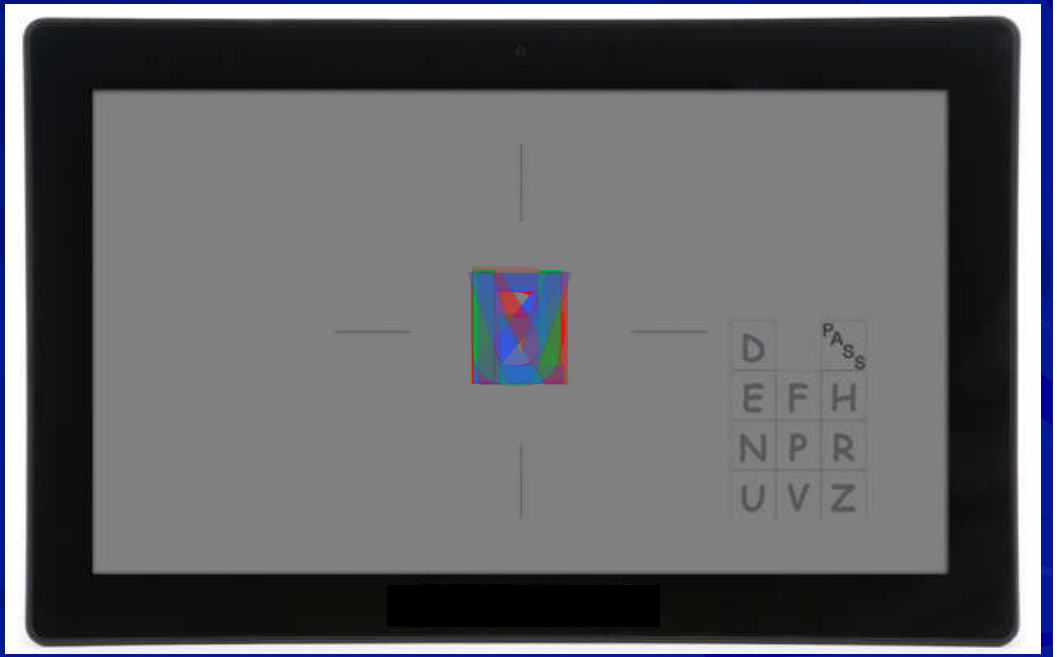
Rabin Cone Contrast Test

- Sensitive color contrasts testing
  - There is difference between traditional color vision tests

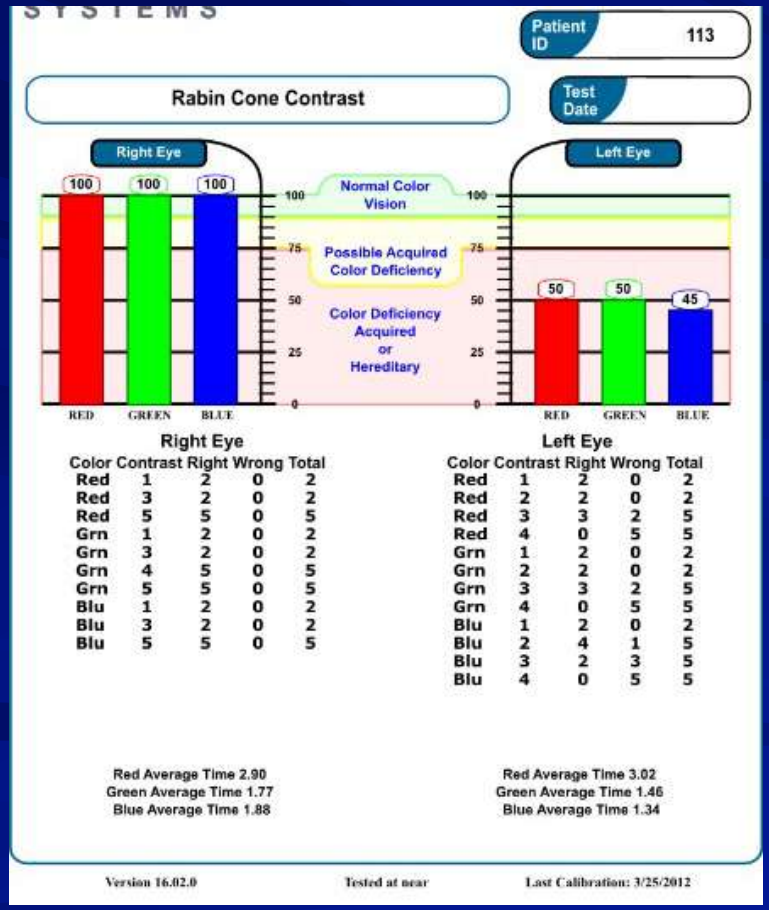
- Rabin Cone Contrast Test can be used for early detection:
  - Age related macular degeneration
  - Diabetic retinopathy
  - Glaucoma
  - Retinal disease

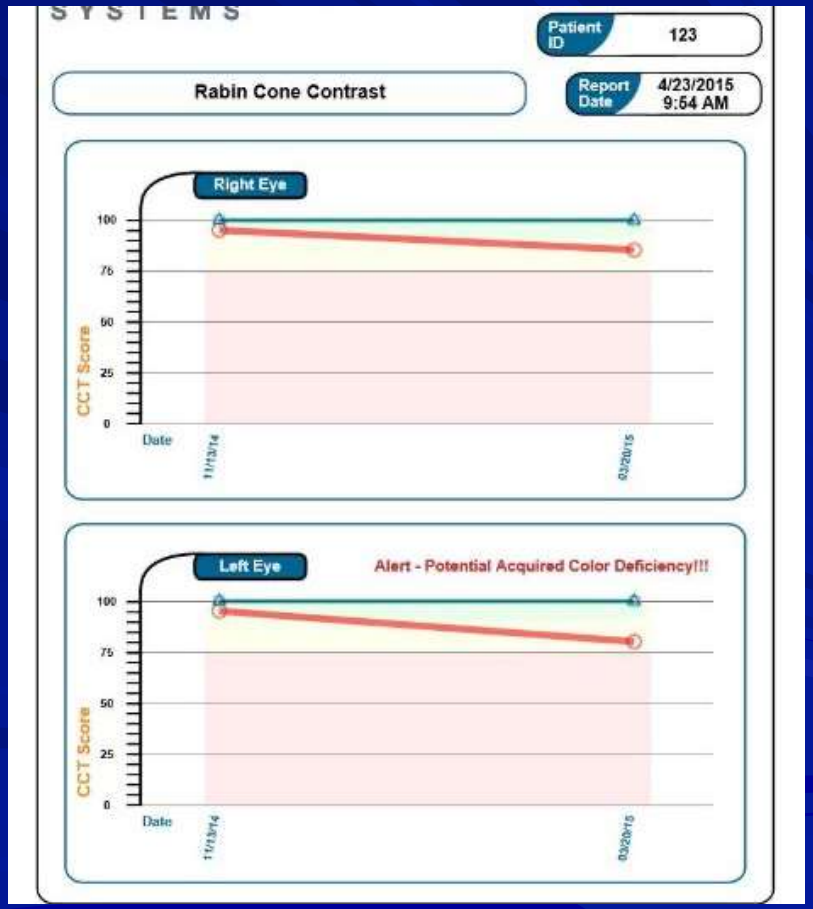
Rabin Cone Contrast Test

- Based in science
  - Co-developed between Innova Systems and US Air Force
- Combines Cone Isolation technology and Contrast Sensitivity
- Color vision technology sensitive enough to detect subtle changes from disease
- Threshold test, similar to visual field
  - But just faster…
  - CPT 92283-$57 national average



Cone Contrast Test Results



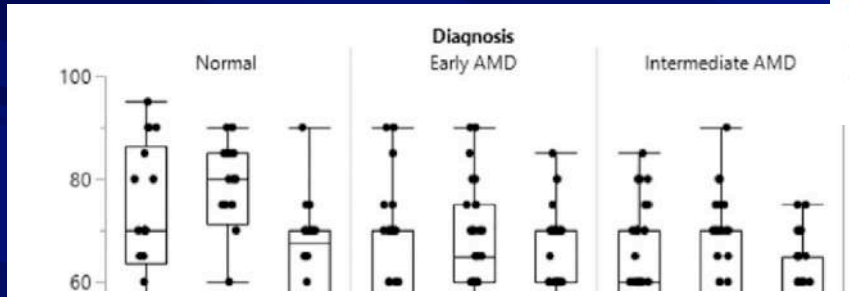


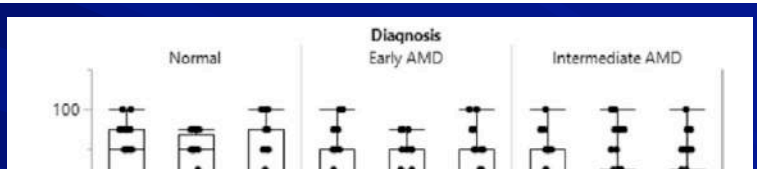
Duke University

AMERICAN ACADEMY OF OPHTHALMOLOGY®

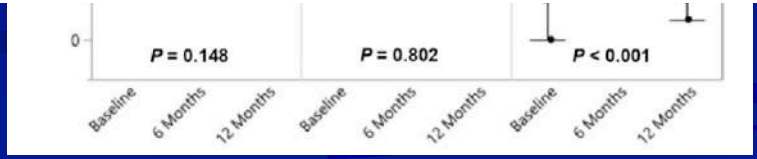
Longitudinal Study of Visual Function in Dry Age-Related Macular Degeneration at 12 Months

S. Tammy Hsu, BA,[1] Atalie C. Thompson, MD, MPH,[1] Sandra S. Stinnett, DrPH,[1] Ulrich F.O. Luhmann, PhD,[2] Lejla Vajzovic, MD,[1] Anupama Horne, MD,[1] Stefanie G. Schuman, MD,[1] Cynthia A. Toth, MD,[1] Scott W. Cousins, MD,[1] Eleonora M. Lad, MD, PhD[1]





- Rabin Cone Contrast Testing can detect progression in dry AMD within a 12 months.
- These functional markers may be useful end points in future clinical trials that assess the effect of potential treatments for AMD.

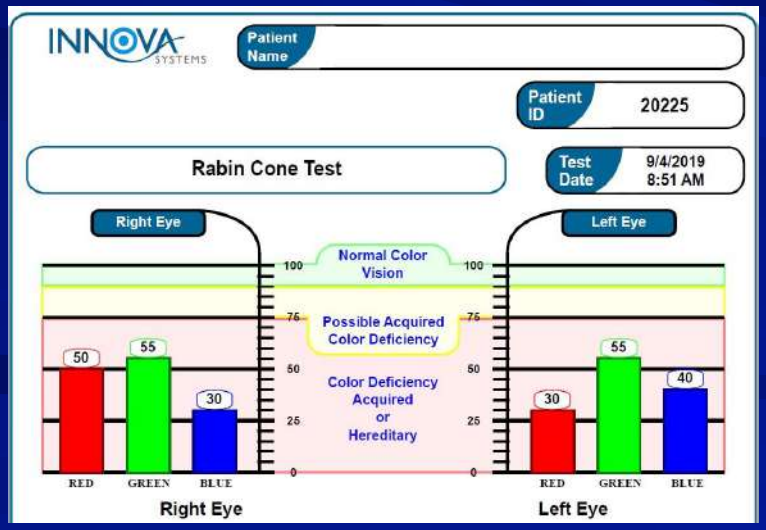


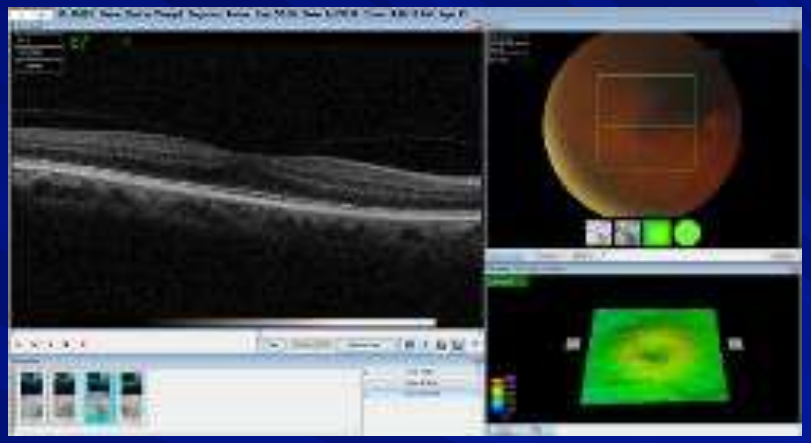
Ophthalmol Retina. 2019 August ; 3(8): 637–648. doi:10.1016/j.oret.2019.03.010

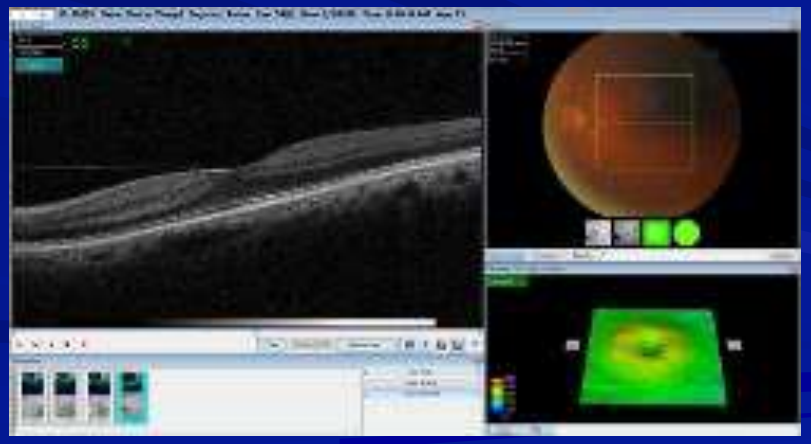
Case: Diabetes Exam- What's Your Diagnosis?

- 72 y/o Indian male
- Type 2 Diabetes
- 20/25 OU
- NS1+ Cataracts OU

What about now?







Case courtesy of Becky Verna, OD

Case: Diabetes Exam- What's Your Diagnosis?

Courtesy of Pinakin Davey OD, PhD

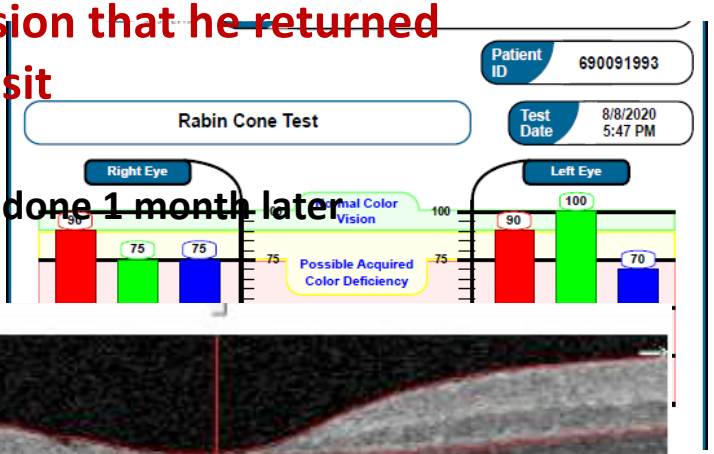
- 49 YO Asian male,
- HO DM type 2, 10 years "recently" not compliant with meds
- HO HTN x10 years
- Restarted metformin recently but has side effect of diarrhea
- Blood pressure today 168/96

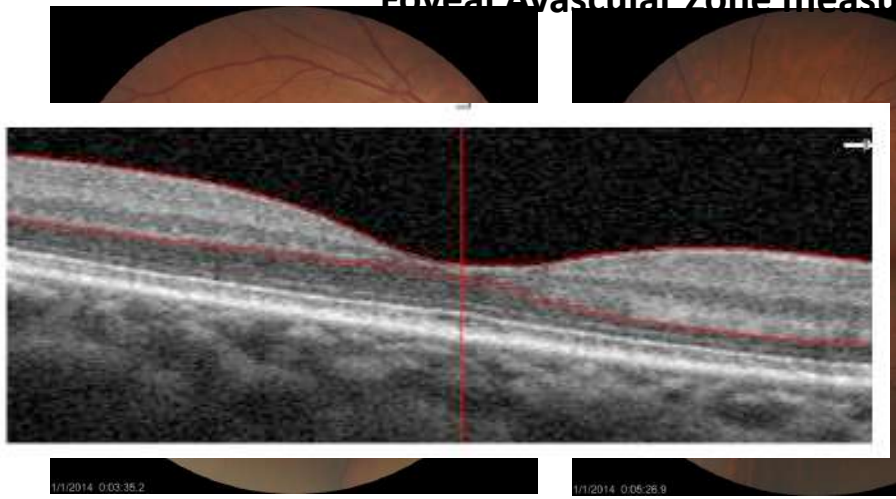
What about now?

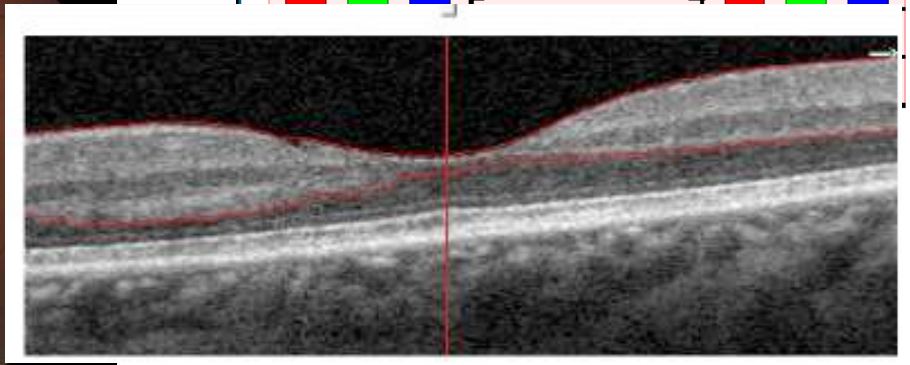
Patient worried enough about change in vision that he returned for 1 Month follow-up visit

Diabetic Eye Exam Standard of Care

Foveal Avascular Zone measurements OCT-A done 1 month later







Based on RCCT, RTC in 1 month for OCT

Rabin Cone Contrast Test

- Completes the comprehensive exam
- Early detection
- Progression
- Can see improvements with your treatments
- Nutritional therapies indeed play a role in management of AMD, diabetes, and glaucoma

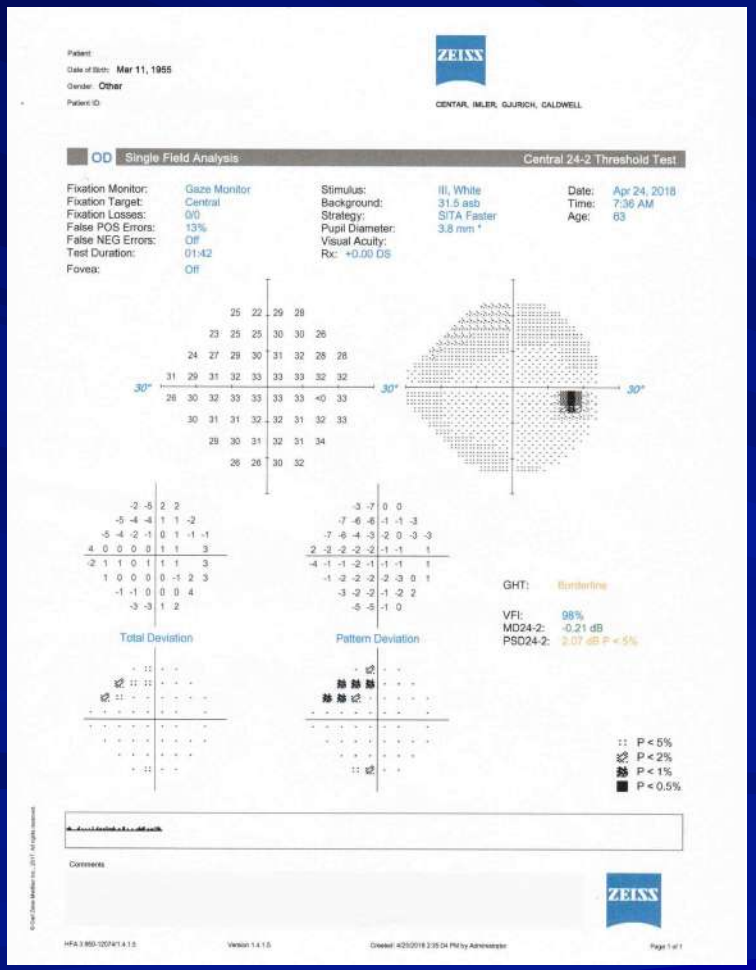
What's New in Visual Fields

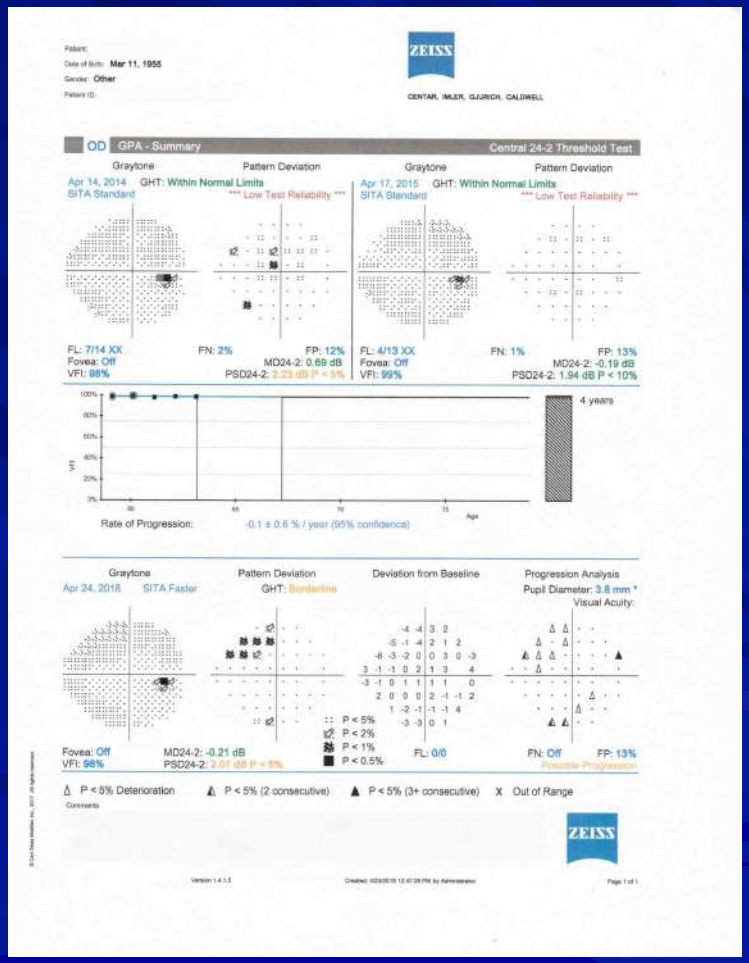
Sita Faster

- Turns off False Negatives
- Turns off Blind Spot monitor
- Leaves on False Positives
- Leaves on Gaze Tracking

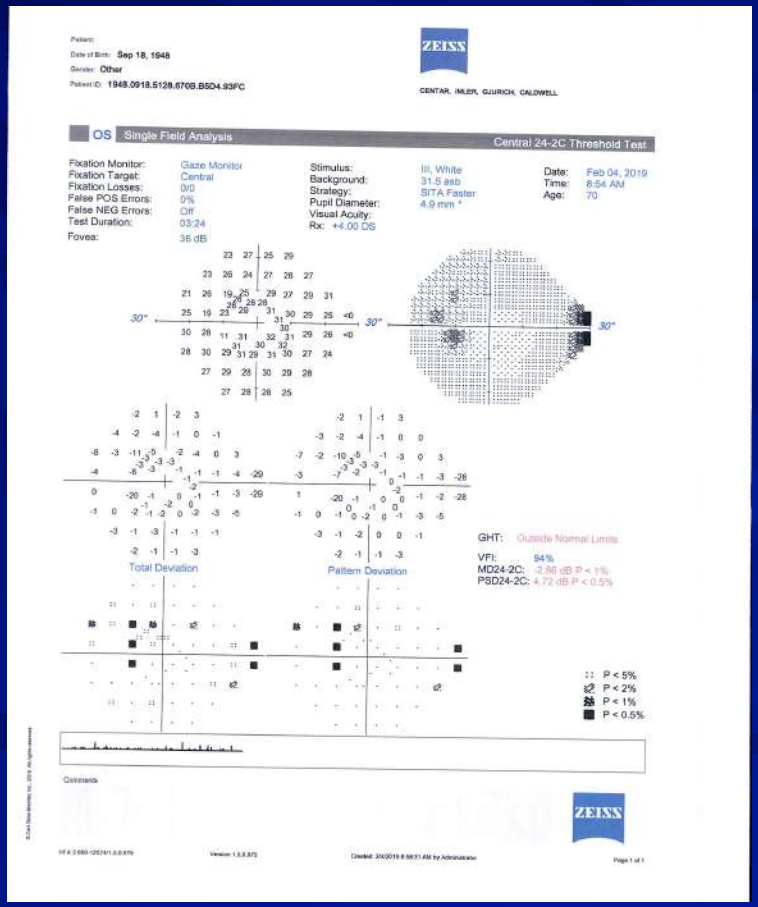
- Faster test with same reliability

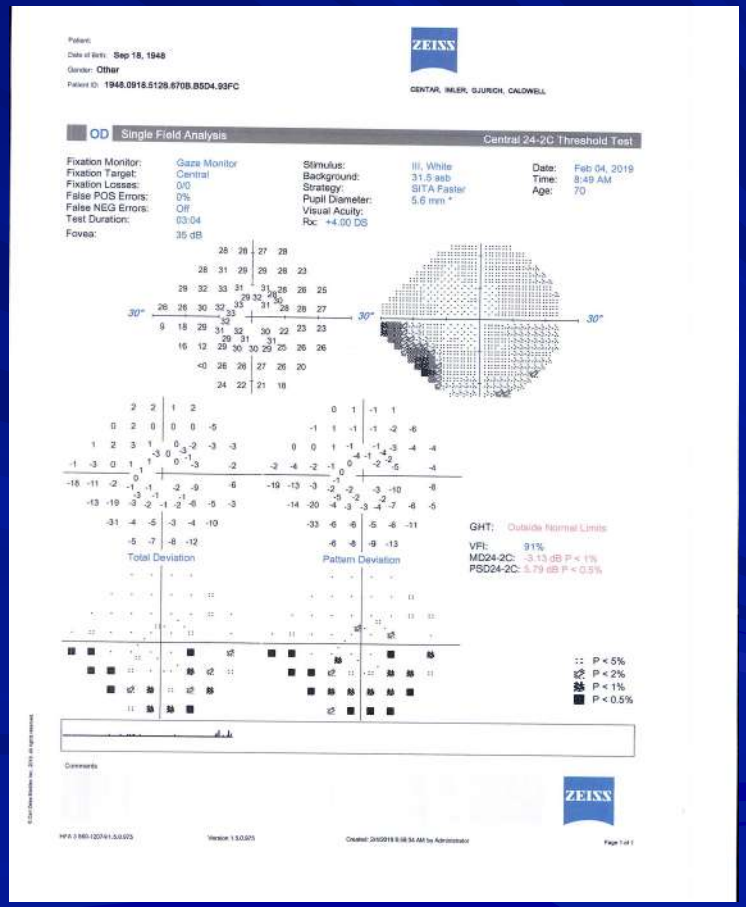
Sita Faster


Patient:
Date of Birth: Mar 11, 1955
Gender: Other
Patient ID:
CENTAR, IMLER, GJURICH, CALDWELL
OD Single Field Analysis
Central 24-2 Threshold Test
Fixation Monitor: Gaze Monitor
Fixation Target: Central
Fixation Losses: 0/0
False POS Errors: 13%
False NEG Errors: Off
Test Duration: 01:42
Fovea: Off
Stimulus: III, White
Background: 31.5 asb
Strategy: SITA Faster
Pupil Diameter: 3.8 mm *
Visual Acuity:
Rx: +0.00 DS
Date: Apr 24, 2018
Time: 7:36 AM
Age: 63
30°
Total Deviation
Pattern Deviation
GHT: Borderline
VFI: 98%
MD24-2: -0.21 dB
PSD24-2: 2.07 dB P < 5%
P < 5%
P < 2%
P < 1%
P < 0.5%
Comments
ZEISS


Patient:
Date of Birth: Mar 11, 1955
Gender: Other
Patient ID:
CENTAR, IMLER, GJURICH, CALDWELL
OD GPA - Summary
Central 24-2 Threshold Test
Graytone
Pattern Deviation
Apr 14, 2014 GHT: Within Normal Limits
SITA Standard
*** Low Test Reliability ***
FL: 7/14 XX
FN: 2%
FP: 12%
Fovea: Off
MD24-2: 0.69 dB
VFI: 88%
PSD24-2: 2.23 dB P < 5%
Apr 17, 2015 GHT: Within Normal Limits
SITA Standard
*** Low Test Reliability ***
FL: 4/13 XX
FN: 1%
FP: 13%
Fovea: Off
MD24-2: -0.19 dB
VFI: 99%
PSD24-2: 1.94 dB P < 10%
4 years
Rate of Progression: -0.1 ± 0.6 % / year (95% confidence)
Graytone
Pattern Deviation
Deviation from Baseline
Progression Analysis
Apr 24, 2018 SITA Faster
GHT: Borderline
Pupil Diameter: 3.8 mm *
Visual Acuity:
Fovea: Off
VFI: 98%
MD24-2: -0.21 dB
PSD24-2: 2.07 dB P < 5%
FL: 0/0
FN: Off
FP: 13%
P < 5%
P < 2%
P < 1%
P < 0.5%
Δ P < 5% Deterioration
Δ P < 5% (2 consecutive)
▲ P < 5% (3+ consecutive)
X Out of Range
Comments
ZEISS

SITA Faster 24-2C





Opportunities for Improvement in Central 10 Degrees

Glaucomatous damage of the macula

Prog Retin Eye Res. 2013 Jan; 32C: 1–21.

Donald C. Hood,[a,b,*,1] Ali S. Raza,[a,c,1] Carlos Gustavo V. de Moraes,[d,e,1] Jeffrey M. Liebmann,[d,e,1] and Robert Ritch[d,f,1]

- Glaucomatous damage of the macula is common and can occur early in the disease
- Can be missed or underestimated or both, with standard 24-2 VF tests that use a 6° grid

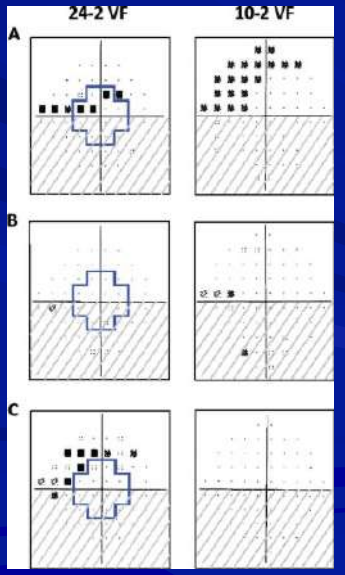
JAMA Ophthalmol. 2014 Mar; 132(3): 291–297.

The Prevalence and Nature of Early Glaucomatous Defects in the Central 10° of the Visual Field

Ilana Traynis, B.S.,[1,2] Carlos G. De Moraes, M.D.,[4,5] Ali S. Raza, B.A.,[1] Jeffrey M. Liebmann, M.D.,[4,5] Robert Ritch, M.D.,[4,6] and Donald C. Hood, Ph.D.[1,3]

24-2 and 10-2 VF Examples

Blue cross region on the 24-2 VF = central 10-2 VF
(A) Both are abnormal.
(B) 24-2 VF normal; 10-2 VF abnormal
(C) 24-2 VF abnormal; 10-2 VF normal



Highest Importance Locations Chosen from 10-2 Pattern

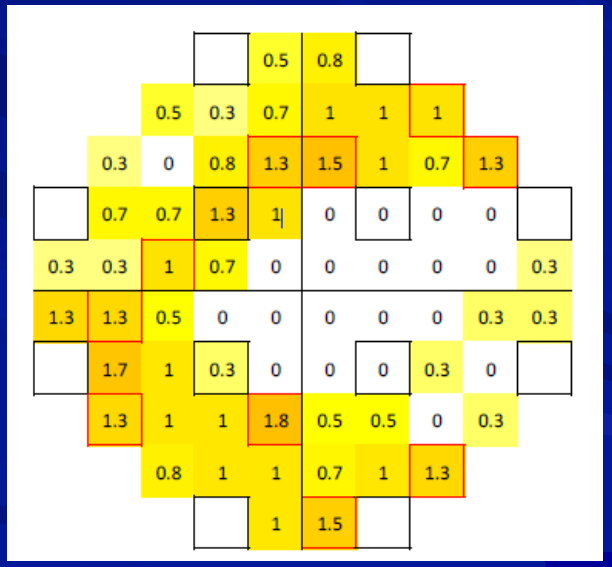
Selecting additional test locations to enhance the 24-2 pattern using a scoring system

Matthias Monhart [1], Gary Lee [2], Aiko Iwase [3], John Flanagan [4]
[1] Carl Zeiss AG, Feldbach, Switzerland, [2] Carl Zeiss Meditec, Dublin CA, United States, [3] Tajimi Iwase Eye Clinic, Tajimi, Japan,
[4] University of California Berkeley, Berkeley, United States

WGCSUB-1642 / P-WT-309

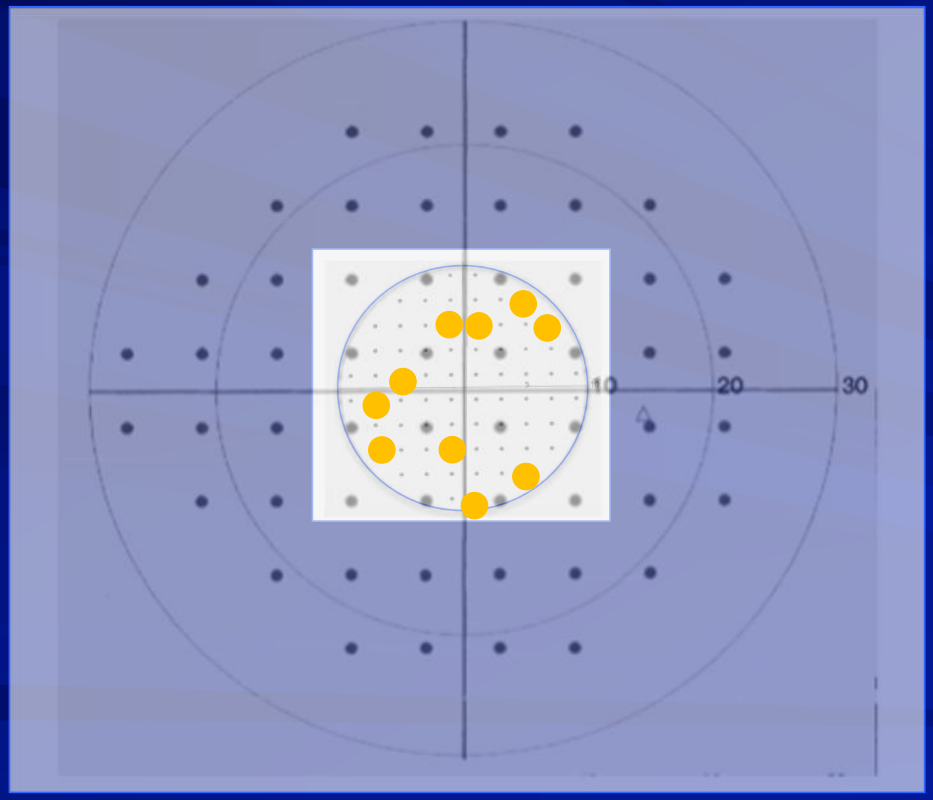
- The expert group selected specific 10-2 test point locations
- Prevalence and depth of glaucomatous macular defects were systematically evaluated to select optimum test points
- Pattern covers areas known to be susceptible to glaucomatous defects both from structural and functional studies

Selected test locations are shown in red boxes



The expert group: Donald C. Hood, Stuart K. Gardiner, Allison M. McKendrick and William H. Swanson.

Resulting SITA Faster 24-2C Pattern on HFA3



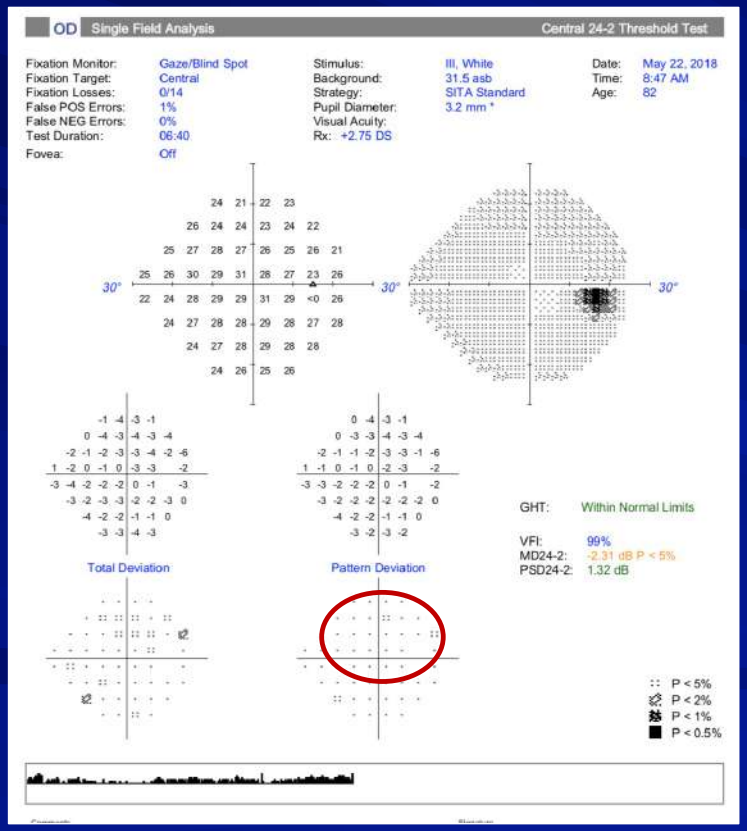
The 24-2C test pattern combines all 24-2 points + ten selected 10-2 points (shown in OD orientation)

Large Gray	24-2 pattern
Large Orange	Ten additional 24-2C points
Small Gray	10-2 pattern

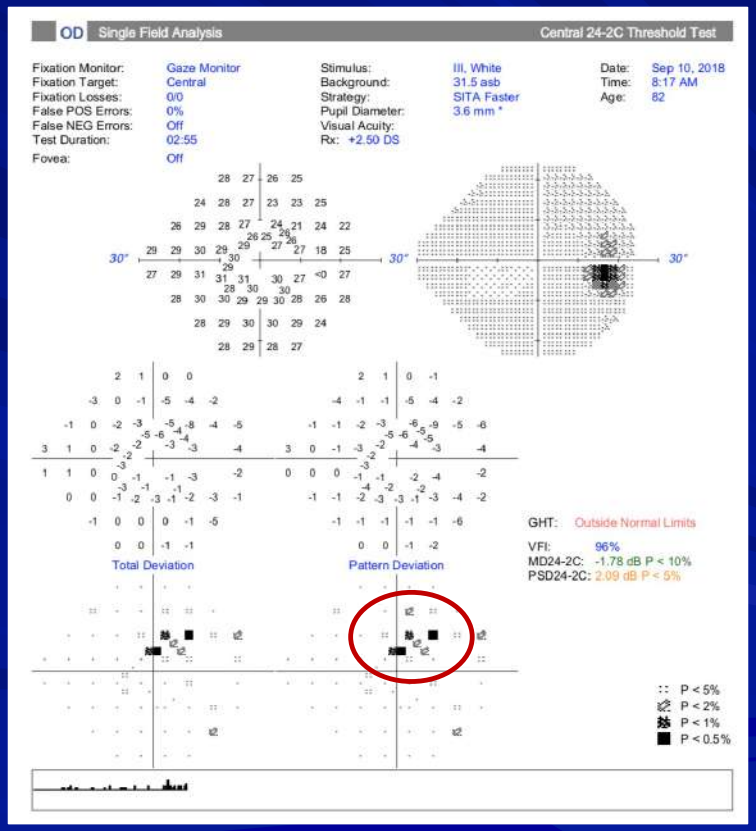
24-2C SITA Faster

Flagged points detected centrally in OD

24-2 SITA Standard



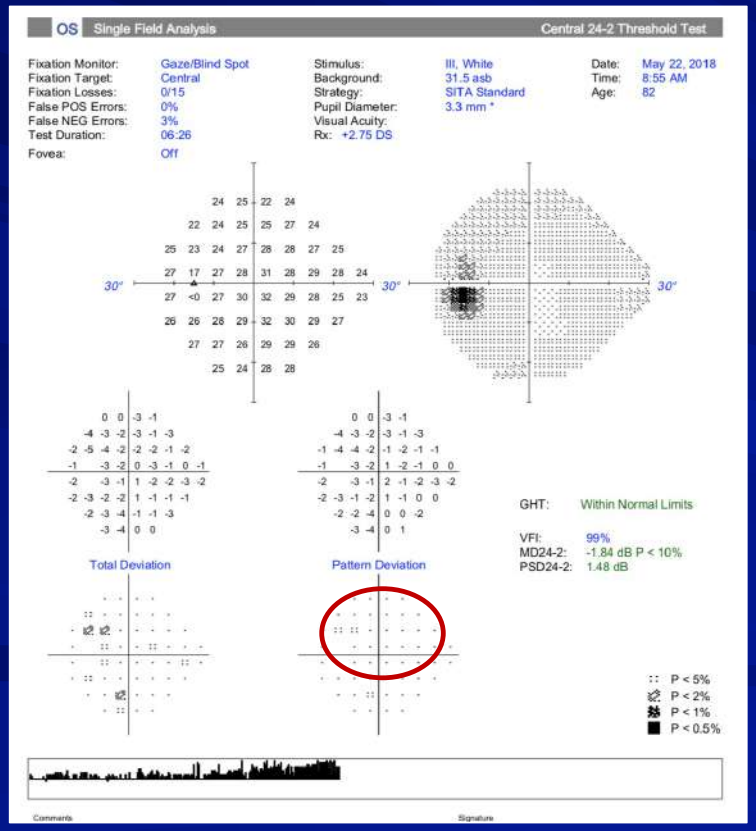
24-2C SITA Faster



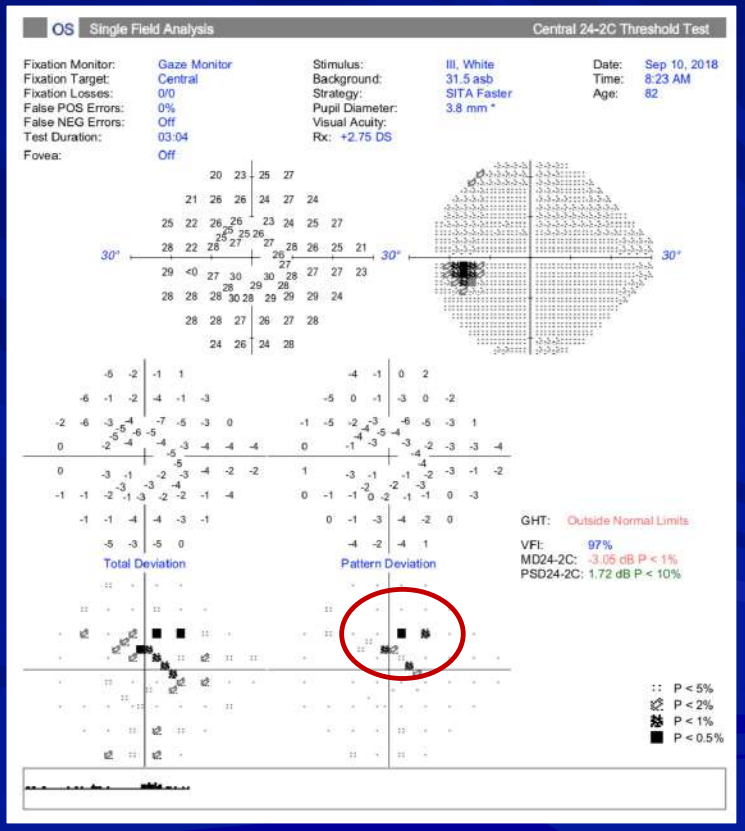
24-2C SITA Faster

Flagged points detected centrally in OS

24-2 SITA Standard

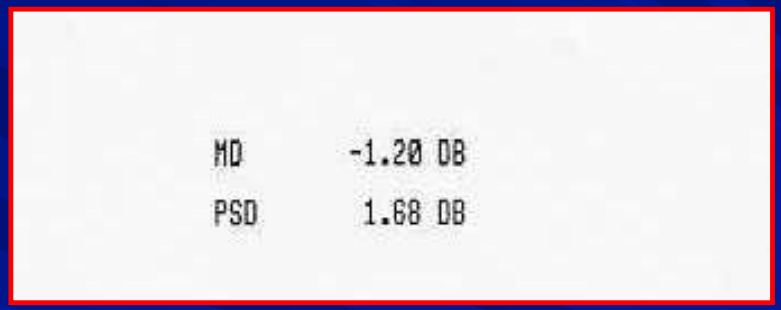


24-2C SITA Faster

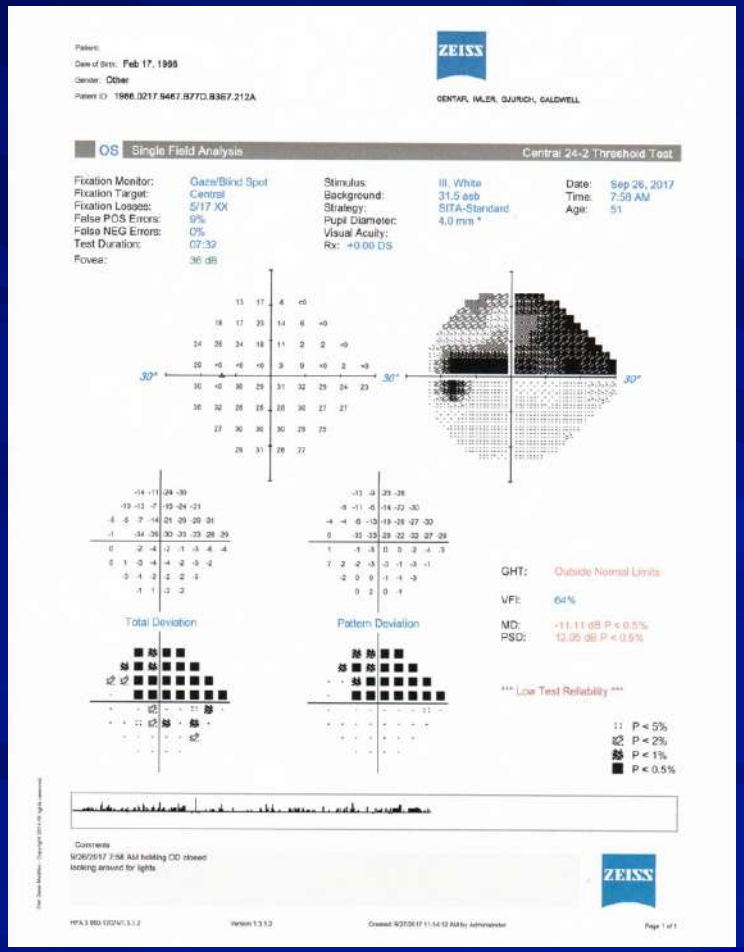


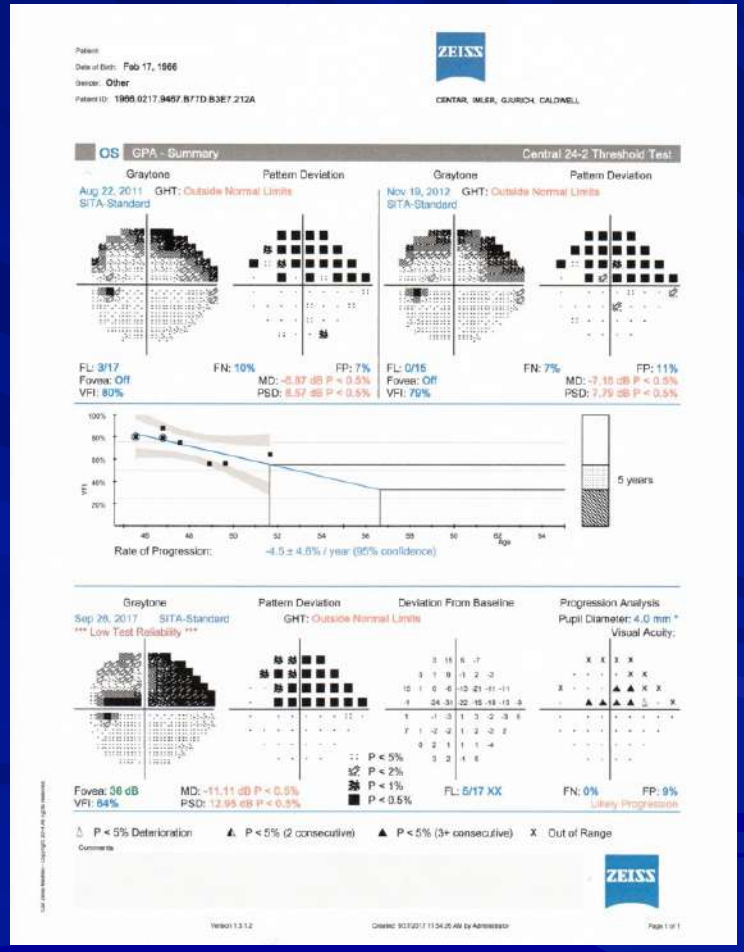
5 Decibel Loss

- Read slower
- Don't leave home as much
- Walk slower
- Increase in car accidents



Deep Visual Field Defect



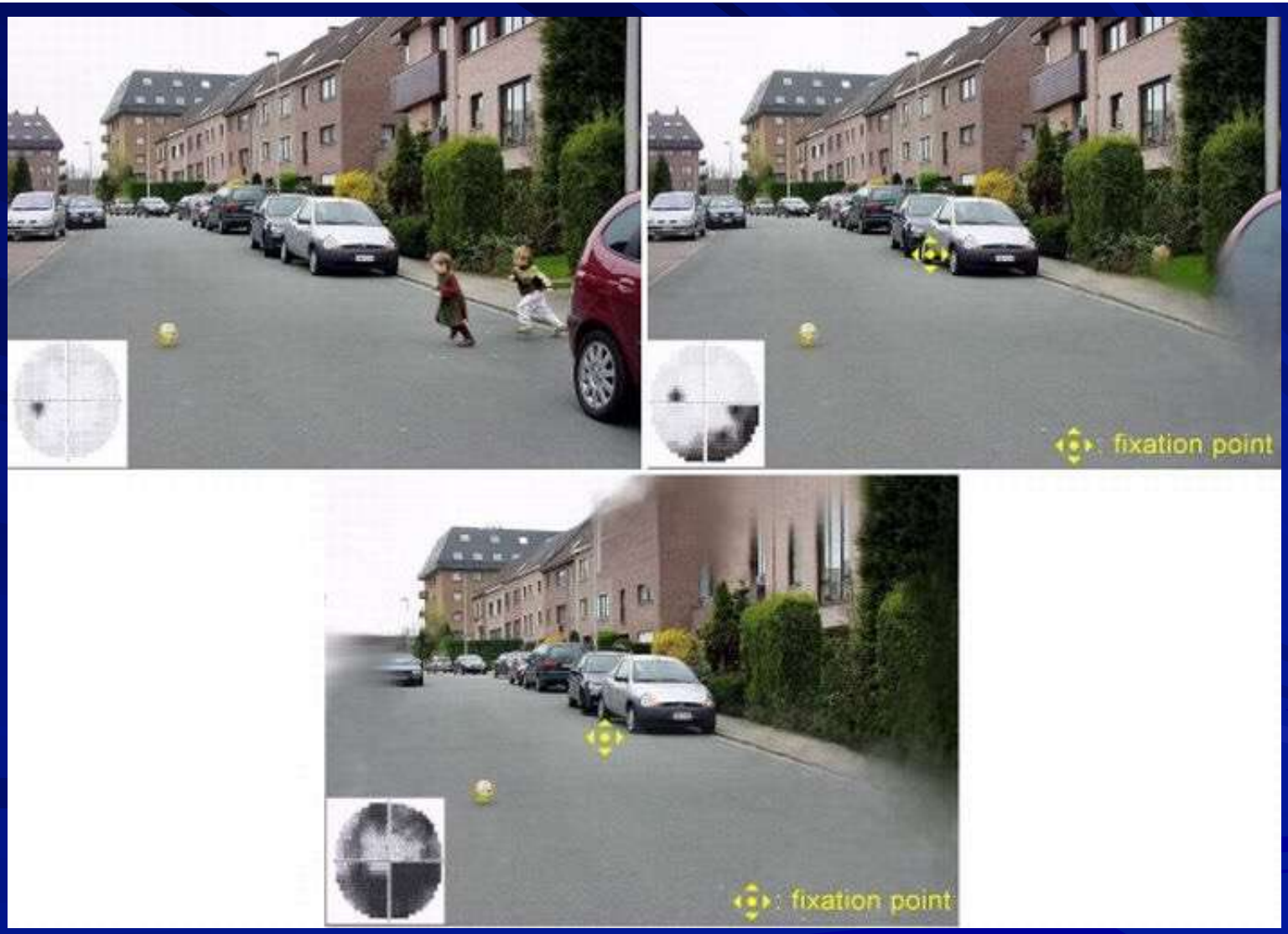


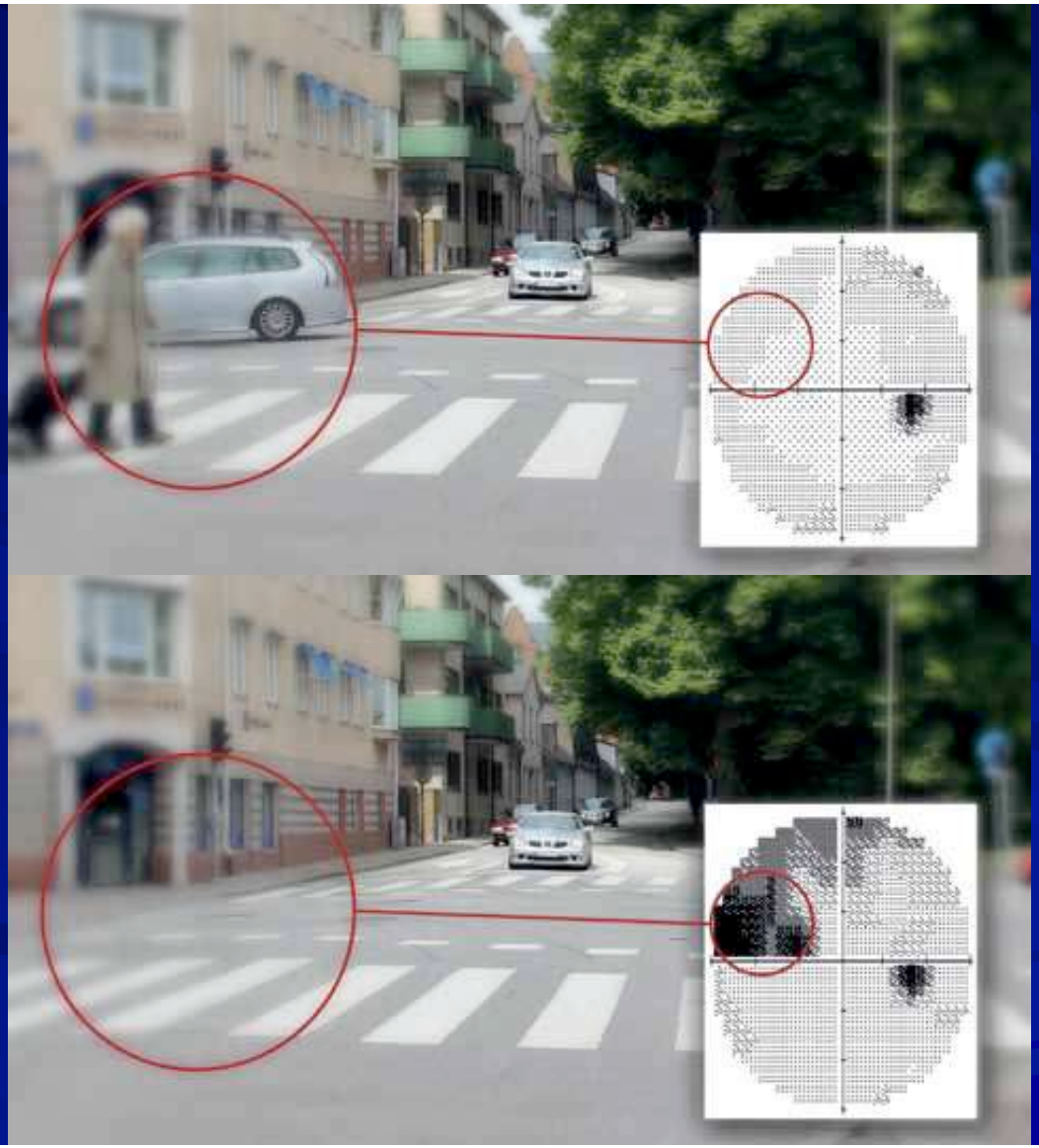
EXTREME GLAUCOMA

ADVANCED GLAUCOMA

EARLY GLAUCOMA

NORMAL VISION

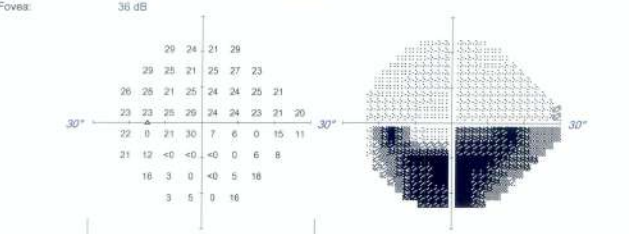

fixation point
fixation point

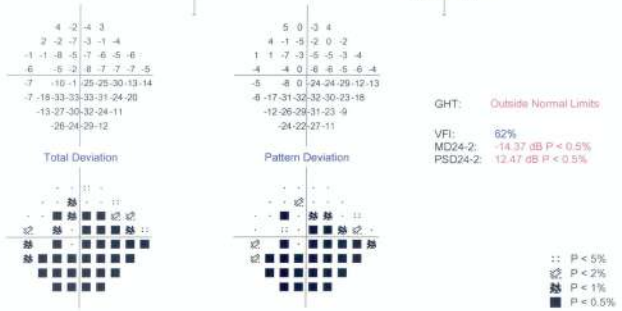


Patient: [redacted]
Date of Birth: Oct 26, 1947
Gender: [redacted]
Patient ID: [redacted]

OS Single Field Analysis — Central 24-2 Threshold Test

Fixation Monitor:	Gaze/Blind Spot	Stimulus:	III, White	Date:	Mar 28, 2022
Fixation Target:	Central	Background:	31.5 asb	Time:	2:02 PM
Fixation Losses:	1/18	Strategy:	SITA Standard	Age:	74
False POS Errors:	5%	Pupil Diameter:			
False NEG Errors:	0%	Visual Acuity:			
Test Duration:	08:14	Rx:	+4.25 DS		
Fovea:	36 dB				





GHT: Outside Normal Limits

VFI: 62%
MD24-2: -14.37 dB P < 0.5%
PSD24-2: 12.47 dB P < 0.5%

:: P < 5%
P < 2%
P < 1%
P < 0.5%

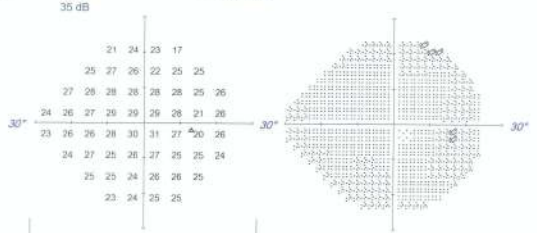
Comments

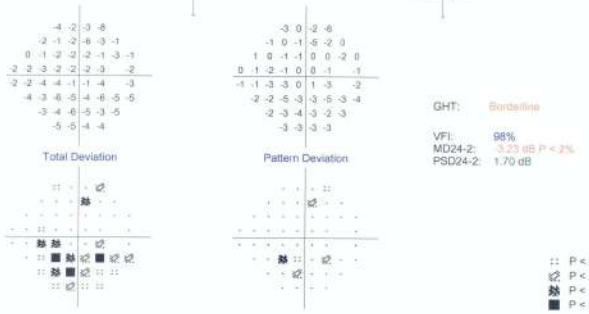
HFA 3-900i-120741-3.2.151 Version 1.0.2.4 Created: 3/28/2022 3:47:21 PM by Administrator Page 1 of 1

Patient: [redacted]
Date of Birth: Oct 26, 1947
Gender: Other
Patient ID: [redacted]

OD Single Field Analysis — Central 24-2 Threshold Test

Fixation Monitor:	Gaze/Blind Spot	Stimulus:	III, White	Date:	Mar 28, 2022
Fixation Target:	Central	Background:	31.5 asb	Time:	1:54 PM
Fixation Losses:	2/15	Strategy:	SITA Standard	Age:	74
False POS Errors:	2%	Pupil Diameter:			
False NEG Errors:	0%	Visual Acuity:			
Test Duration:	05:53	Rx:	+4.75 DS		
Fovea:	35 dB				





GHT: Borderline

VFI: 98%
MD24-2: 3.23 dB P < 2%
PSD24-2: 1.70 dB

:: P < 5%
P < 2%
P < 1%
P < 0.5%

Comments

HFA 3-900i-120741-3.2.151 Version 1.0.2.4 Created: 3/28/2022 3:47:21 PM by Administrator Page 1 of 1

Wearable Technology

Patient:
Date of Birth: Mar 11, 1955
Gender: Other
Patient ID: 1955.0311.933E.7DB8.0703.9556

OD Single Field Analysis — Central 24-2 Threshold Test

Fixation Monitor:	Gaze/Blind Spot	Stimulus:	III, White	Date:	Feb 02, 2022
Fixation Target:	Central	Background:	31.5 asb	Time:	9:59 AM
Fixation Losses:	3/17	Strategy:	SITA Standard	Age:	66
False POS Errors:	2%	Pupil Diameter:			
False NEG Errors:	13%	Visual Acuity:			
Test Duration:	06:32	Rx:	+0.00 DS		
Fovea:	31 dB				

GHT: Outside Normal Limits

VFI: 48%
MD24-2: -12.55 dB P < 0.5%
PSD24-2: 14.30 dB P < 0.5%

:: P < 5%
P < 2%
P < 1%
P < 0.5%

Comments

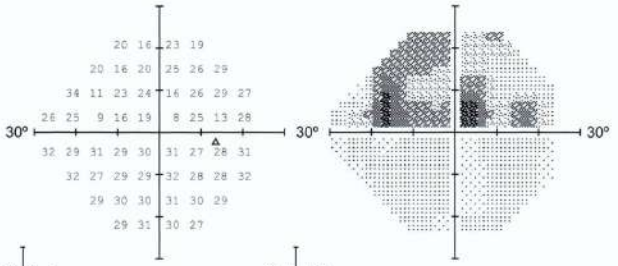
HFA 3 000-I307-H1.3.2.-I31 Version: 1.0.2.-1 Created: 3/2/2022 10:46:22 AM by Administrator Page 1 of 1

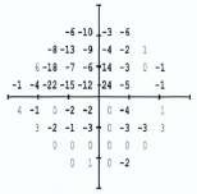
DOB: 1955-03-11
MRN: None

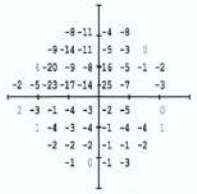
Central 24-2 Threshold Test
Feb 2, 2022 - 10:35 AM

Right Eye

Fixation Monitor	ActiveTrack™	*Strategy*	re:Imagine™	*Age*	66
Stimulus	Dynamic, White	*Input*	Clicker	*VA*	Not Provided
Foveal Threshold	36 dB	*Fixation Losses*	NA	*Rx*	S C
Background	Black	*False POS Errors*	0/6 0%		
Test Duration	3:40	*False NEG Errors*	2/6 33%		







MD -4.24 dB
PSD 6.53 dB

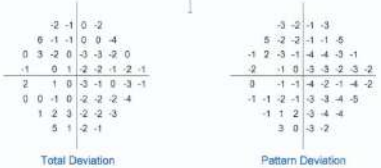
:: P < 5%
P < 2%
P < 1%
P < 0.5%

0.4.6 Clicker

Patient:
Date of Birth: Mar 11, 1955
Gender: Other
Patient ID: 1955.0311.933E.7DB8.0703.9556

OS Single Field Analysis — Central 24-2 Threshold Test

Fixation Monitor:	Gaze/Blind Spot	Stimulus:	III, White	Date:	Feb 02, 2022
Fixation Target:	Central	Background:	31.5 asb	Time:	10:07 AM
Fixation Losses:	4/14 XX	Strategy:	SITA Standard	Age:	66
False POS Errors:	5%	Pupil Diameter:			
False NEG Errors:	2%	Visual Acuity:			
Test Duration:	05:07	Rx:	+1.75 DS		
Fovea:	32 dB				



GHT: Within Normal Limits

VFI: 98%
MD24-2: -0.78 dB
PSD24-2: 2.00 dB P < 5%

*** Low Test Reliability ***

:: P < 5%
P < 2%
P < 1%
P < 0.5%

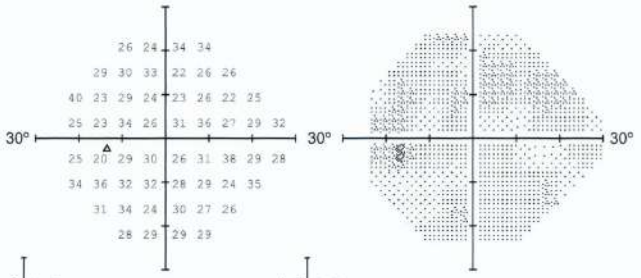
Comments

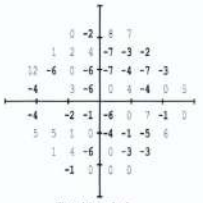
DOB: 1955-03-11
MRN: None

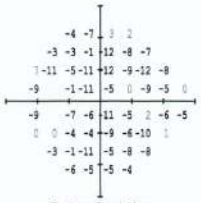
Central 24-2 Threshold Test
Feb 2, 2022 - 10:41 AM

Left Eye

Fixation Monitor	Blind spot	*Strategy*	**re:**Imagine™	*Age*	66
Stimulus	Dynamic, White	*Input*	Clicker	*VA*	Not Provided
Foveal Threshold	27 dB	*Fixation Losses*	NA	*Rx*	S C
Background	Black	*False POS Errors*	2/5 40%		
Test Duration	3:13	*False NEG Errors*	0/5 0%		







MD -0.72 dB
PSD 4.47 dB

:: P < 5%
P < 2%
P < 1%
P < 0.5%

0.4.6 Clicker

Patient:

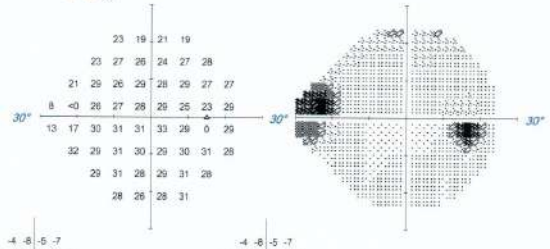
Date of Birth: Jan 12, 1955

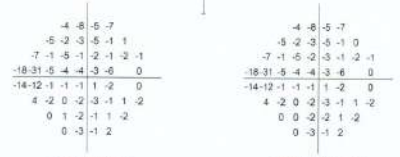
Gender: Other

Patient ID: 1955.0112.B204.E70C.5CF9.B435

OD Single Field Analysis — Central 24-2 Threshold Test

Fixation Monitor:	Gaze/Blind Spot	Stimulus:	III, White	Date:	Jan 11, 2022
Fixation Target:	Central	Background:	31.5 asb	Time:	12:02 PM
Fixation Losses:	0/15	Strategy:	SITA Standard	Age:	66
False POS Errors:	3%	Pupil Diameter:			
False NEG Errors:	0%	Visual Acuity:			
Test Duration:	05:14	Rx:	+2.25 DS		
Fovea:	31 dB				





Total Deviation

Pattern Deviation

GHT: Outside Normal Limits

VFI: 94%
MD24-2: -2.83 dB P < 2%
PSD24-2: 5.23 dB P < 0.5%

:: P < 5%
P < 2%
P < 1%
P < 0.5%

Comments

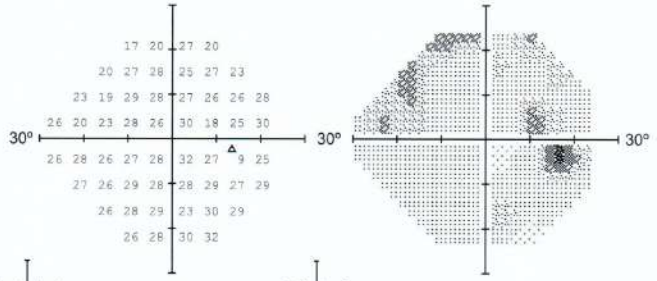
HFA 3 660-1207-11.0.2.431 Version 1.0.2.4 Created: 1/11/2022 2:39:32 PM by Administrator Page 1 of 1

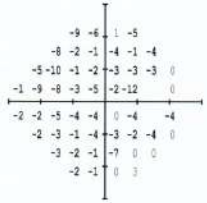
DOB: 1955-01-12
MRN: None

Central 24-2 Threshold Test
Jan 11, 2022 - 12:48 PM

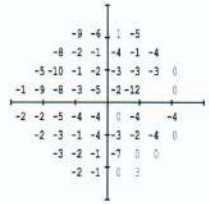
Right Eye

Fixation Monitor	ActiveTrack™	*Strategy*	re:Imagine™	*Age*	66
Stimulus	Dynamic, White	*Input*	Clicker	*VA*	Not Provided
Foveal Threshold	30 dB	*Fixation Losses*	NA	*Rx*	S C
Background	Black	*False POS Errors*	1/6 17%		
Test Duration	3:44	*False NEG Errors*	0/6 0%		





Total Deviation



Pattern Deviation

MD -3.38 dB
PSD 3.06 dB

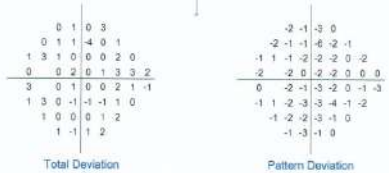
:: P < 5%
P < 2%
P < 1%
P < 0.5%

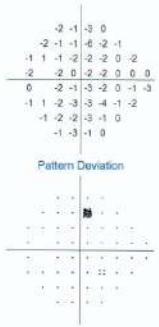
0.4.6 Clicker

Patient:
Date of Birth: Jan 12, 1955
Gender: Other
Patient ID: 1955.0112.B204.E70C.5CF9.B435

OS Single Field Analysis — Central 24-2 Threshold Test

Fixation Monitor:	Gaze/Blind Spot	Stimulus:	III, White	Date:	Jan 11, 2022
Fixation Target:	Central	Background:	31.5 asb	Time:	12:09 PM
Fixation Losses:	0/15	Strategy:	SITA Standard	Age:	66
False POS Errors:	0%	Pupil Diameter:			
False NEG Errors:	0%	Visual Acuity:			
Test Duration:	04:38	Rx:	+2.50 DS		
Fovea:	37 dB				





GHT: Within Normal Limits

VFI: 100%
MD24-2: 0.63 dB
PSD24-2: 1.30 dB

:: P < 5%
P < 2%
P < 1%
P < 0.5%

Comments

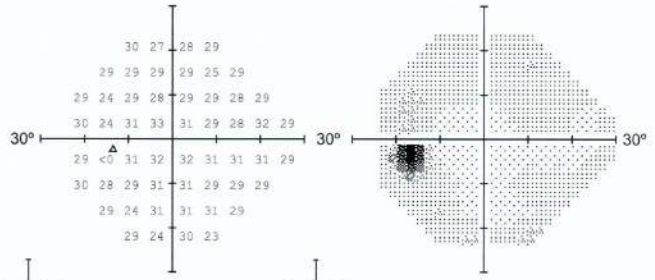
HFA 3 860-12/07a/1.5.2.431 Version 1.0.2.4 Created: 1/11/2022 2:56:46 PM by Administrator Page 1 of 1

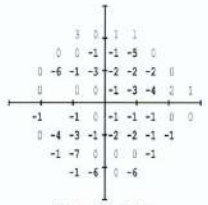
DOB: 1955-01-12
MRN: None

Central 24-2 Threshold Test
Jan 11, 2022 - 12:54 PM

Left Eye

Fixation Monitor	ActiveTrack™	*Strategy*	**re:**Imagine™	*Age*	66
Stimulus	Dynamic, White	*Input*	Clicker	*VA*	Not Provided
Foveal Threshold	33 dB	*Fixation Losses*	NA	*Rx*	S C
Background	Black	*False POS Errors*	0/5 0%		
Test Duration	2:53	*False NEG Errors*	0/6 0%		

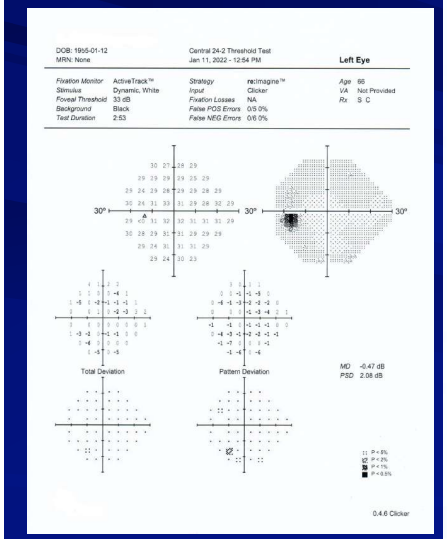




MD -0.47 dB
PSD 2.08 dB

:: P < 5%
P < 2%
P < 1%
P < 0.5%

0.4.6 Clicker



DOB: 1955-01-12
MRN: None

Central 24-2 Threshold Test
Jan 11, 2022 - 12:54 PM

Left Eye

Fixation Monitor	ActiveTrack™	*Strategy*	re:Imagine™	*Age*	66
Stimulus	Dynamic, White	*Input*	Clicker	*VA*	Not Provided
Foveal Threshold	33 dB	*Fixation Losses*	NA	*Rx*	S C
Background	Black	*False POS Errors*	0/5 0%		
Test Duration	2:53	*False NEG Errors*	0/6 0%		

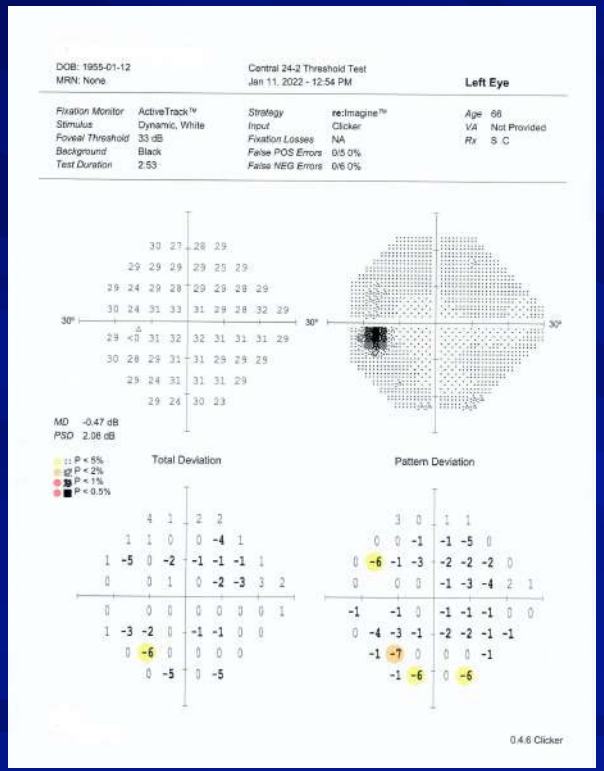
30° 30° 30°

Total Deviation Pattern Deviation

MD -0.47 dB
PSD 2.08 dB

P < 5%
P < 2%
P < 1%
P < 0.5%

0.4.6 Clicker



DOB: 1955-01-12
MRN: None

Central 24-2 Threshold Test
Jan 11, 2022 - 12:54 PM

Left Eye

Fixation Monitor	ActiveTrack™	*Strategy*	re:Imagine™	*Age*	66
Stimulus	Dynamic, White	*Input*	Clicker	*VA*	Not Provided
Foveal Threshold	33 dB	*Fixation Losses*	NA	*Rx*	S C
Background	Black	*False POS Errors*	0/5 0%		
Test Duration	2:53	*False NEG Errors*	0/6 0%		

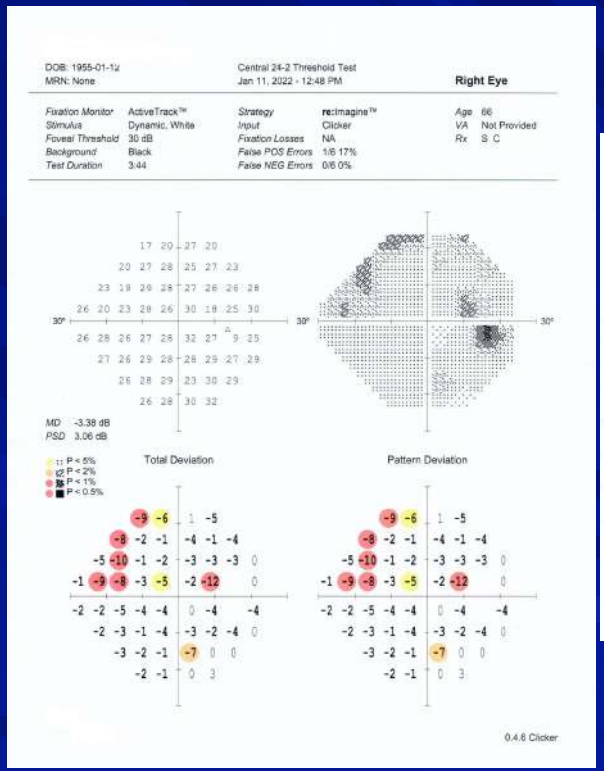
30° 30° 30°

MD -0.47 dB
PSD 2.08 dB

Total Deviation Pattern Deviation

P < 5%
P < 2%
P < 1%
P < 0.5%

0.4.6 Clicker



DOB: 1955-01-12
MRN: None

Central 24-2 Threshold Test
Jan 11, 2022 - 12:48 PM

Right Eye

Fixation Monitor	ActiveTrack™	*Strategy*	re:Imagine™	*Age*	66
Stimulus	Dynamic, White	*Input*	Clicker	*VA*	Not Provided
Foveal Threshold	30 dB	*Fixation Losses*	NA	*Rx*	S C
Background	Black	*False POS Errors*	1/6 17%		
Test Duration	3:44	*False NEG Errors*	0/6 0%		

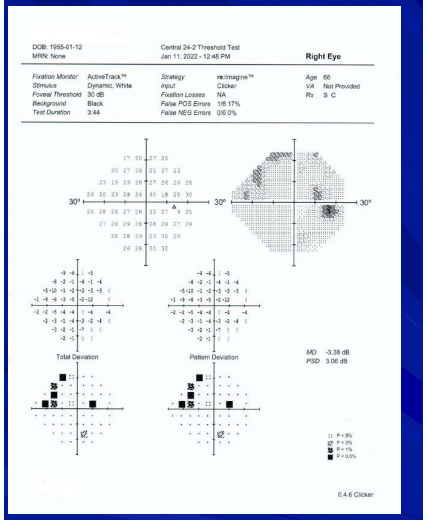
30° 30° 30°

MD -3.38 dB
PSD 3.06 dB

Total Deviation Pattern Deviation

P < 5%
P < 2%
P < 1%
P < 0.5%

0.4.6 Clicker



DOB: 1955-01-12
MRN: None

Central 24-2 Threshold Test
Jan 11, 2022 - 12:48 PM

Right Eye

Fixation Monitor	ActiveTrack™	*Strategy*	re:Imagine™	*Age*	66
Stimulus	Dynamic, White	*Input*	Clicker	*VA*	Not Provided
Foveal Threshold	30 dB	*Fixation Losses*	NA	*Rx*	S C
Background	Black	*False POS Errors*	1/6 17%		
Test Duration	3:44	*False NEG Errors*	0/6 0%		

30° 30° 30°

Total Deviation Pattern Deviation

MD -3.38 dB
PSD 3.06 dB

0.4.6 Clicker

Patients' Thoughts

Medical Management of Glaucoma…

…Has Gotten Boring

Until Recently We Have Some New Pharmaceuticals

Question - Until Rhopressa (netarsudil) what was the last "novel" glaucoma medication?

- Combigan
- Azopt
- Alphagan
- Vyzulta
- Xalatan

Caldwell, G.A., *Photodynamic Therapy (PDT).* Optometric Seminar, 1 hour Continuing Education Approval. 2000 Pennsylvania Optometric Association, Southwest Optometric Society SWOS). Lecture Presentation, 2000, September 24, University of Pittsburgh at Johnstown, Johnstown, PA 15904.

Blaustein, B., Cakanac, C., Caldwell, G.A. and Talbot-Bailey, J., *Clinical Challenges in Ocular Disease.* Course PC 104 TPA, 3 hours Continuing Education Approval. 2000 Pennsylvania Optometric Association Annual General Congress. Westin William Penn, Pittsburgh, PA. June 3, 2000.

Caldwell, G.A. and Nichamin, L.D., *Complications of Refractive Surgery*. Optometric Seminar, Lecture Presentation, Continuing Education Approval, 1999, June 14, Altoona, PA; 1999, June 16, Knox, PA and 1999, June 19, Brookville, PA.

Caldwell, G.A. and Nunneley, J., *Key Points of Success in Refractive Surgery*. Optometric Seminar, Lecture Presentation, 1999, April 5, Altoona, PA; 1999, April 6, Knox, PA and 1999, March 6, Brookville, PA.

Caldwell, G.A. and Nichamin, L.D., *Refractive Surgery for the New Millennium*. Optometric Seminar, Lecture Presentation, Continuing Education Approval, 1999, March 1, Altoona, PA; 1999, March 3, Knox, PA and 1999, March 6, Brookville, PA.

Caldwell, G.A., *Refractive Seminar*. Patient Seminar, Lecture Presentation, Monthly Presentations, August 1996 to December 2001 at Various Laurel Eye Clinic Offices.

Caldwell, G.A., *Aging Eye Seminar*. Patient Seminar, Lecture Presentation, Quarterly Presentation, December 1996 to December 2002 at Various Laurel Eye Clinic Offices.

Caldwell, G.A., *New Developments in the Topical Treatment of Glaucoma.* Grand Rounds Lecture Presentation, 1996, April, Pennsylvania College of Optometry, Philadelphia, PA 19141, B.Blaustein, Coordinator.

Caldwell, G.A., *New Caps, New Colors, New Bottles*. Grand Rounds Lecture Presentation, 1996, March, Pennsylvania College of Optometry, Philadelphia, PA 19141, B.Blaustein, Coordinator.

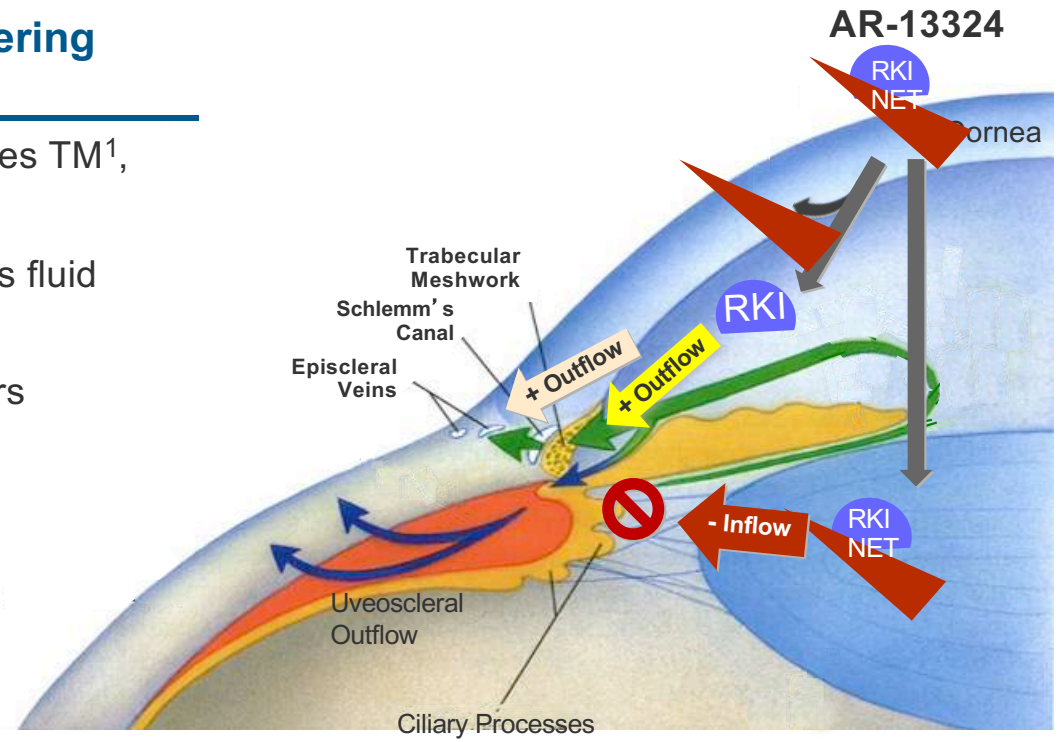
Rhopressa™ 0.02% (netarsudil ophthalmic solution)

- Aerie Pharmaceuticals – Asset acquired by Alcon
  - Approved December 2017
  - Treatment of glaucoma or ocular hypertension
  - Rho kinase inhibitor
    - ROCK-NET Inhibitor
  - Once daily in the evening
    - Twice a day dosing is not well tolerated and is not recommended
  - Side Effects
    - Conjunctival hyperemia
    - Corneal verticillata
    - Conjunctival hemorrhage

Rhopressa (ROCK-NET Inhibitor) Triple-Action

3 Identified IOP-Lowering Mechanisms

- ROCK inhibition relaxes TM[1], increases outflow[1,2]
- NET inhibition reduces fluid production[2]
- ROCK inhibition lowers Episcleral Venous Pressure (EVP)[3]



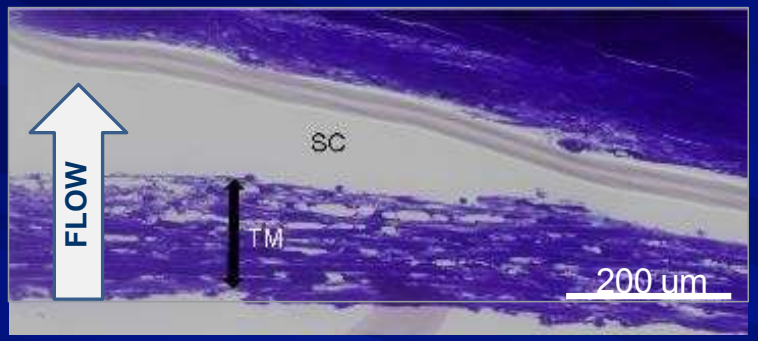
1. Wang SK, Chang RT. An emerging treatment option for glaucoma: Rho kinase inhibitors. *Clin Ophthal* 2014;8:883-890.
2. Wang RF, Williamson JE, Kopczynski C, Serle JB. Effect of 0.04% AR-13324, a ROCK, and norepinephrine transporter inhibitor, on aqueous humor dynamics in normotensive monkey eyes. *J Glaucoma* 2015. 24(1):51-4.
3. Kiel JW, Kopczynski C. Effect of AR-13324 on episcleral venous pressure (EVP) in Dutch Belted rabbits. *ARVO* 2014. Abstract 2900

Rhopressa™ 0.02% (netarsudil)

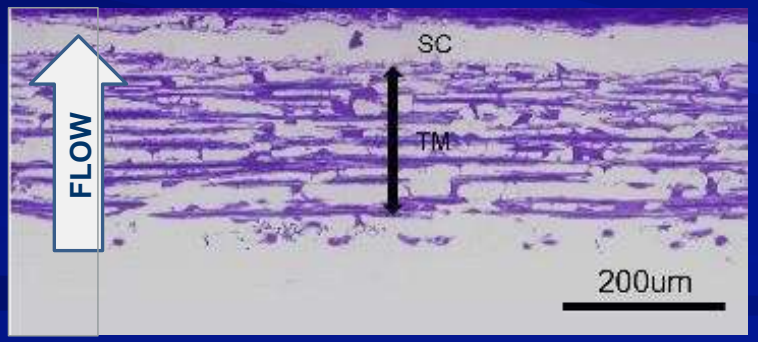
Causes Expansion of TM in Donor Eyes

Increases TM Outflow Facility in Clinic

Trabecular Meshwork (Donor Eyes)[1]

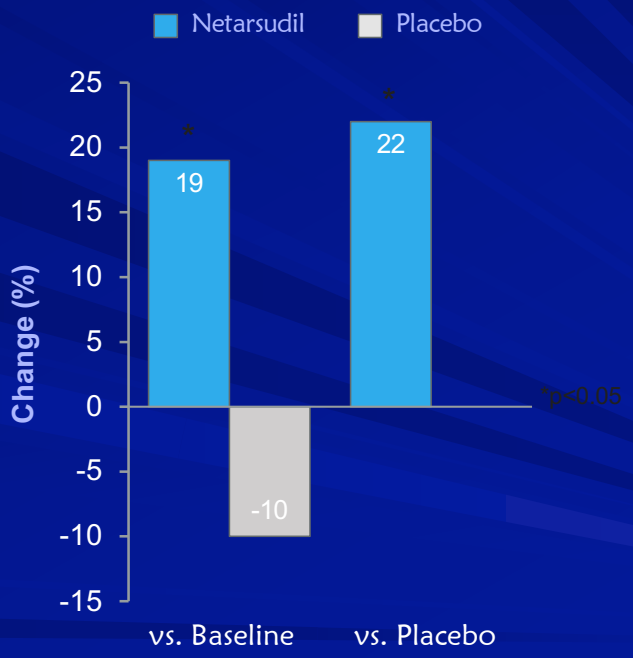


Control



+ Netarsudil

TM Outflow Facility
(Healthy Volunteers)[2]



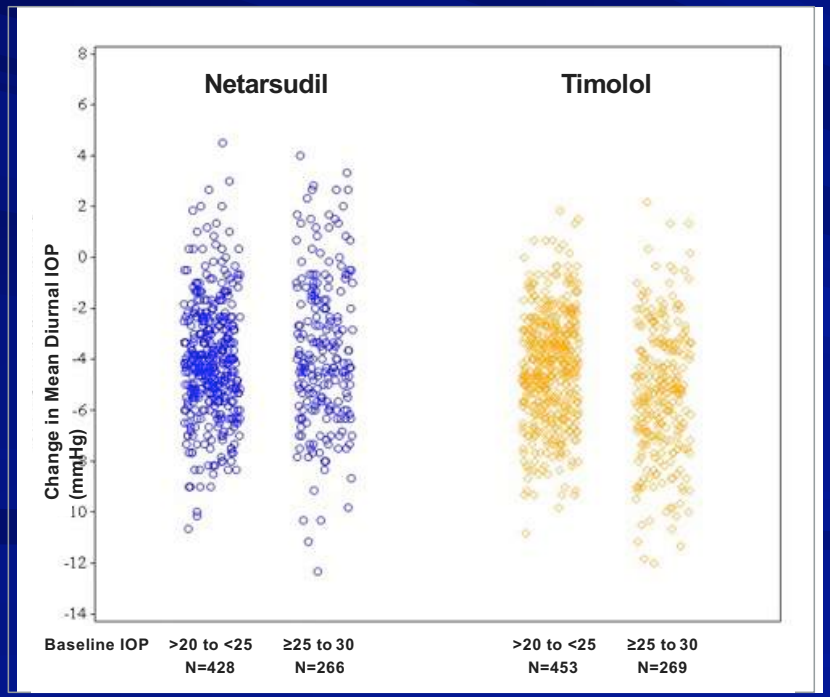
TM: Trabecular Meshwork; SC: Schlemm's Canal; Control: buffered saline solution; ESV: Episcleral Vein

1. Ren R et al. Invest Ophthalmol Vis Sci. 2016;57(14):6197-6209. 2. Sit AJ et al. Presented at AGS 2017.

Netarsudil is Similarly Effective at Baseline IOPs <25 mmHg and ≥25 mmHg

Pooled Analysis Rocket 1, Rocket 2, Rocket 4

Day 90: Change from Baseline IOP by Baseline Subgroup (Pooled)



Baseline IOP >20 to <25 mmHg

	Netarsudil QD	Timolol BID
Median	-4.2	-4.3
Mean	-4.1	-4.3
Max	-10.7	-10.8

Baseline IOP ≥25 to <30 mmHg

	Netarsudil QD	Timolol BID
Median	-4.0	-5.3
Mean	-3.7	-5.3
Max	-12.3	-12.0

Rhopressa™ 0.02%

- No labeled contraindications for Rhopressa™
- No clinically relevant effects on vital signs
  - Blood Pressure
    - Changes were generally small and not clinically relevant in both groups
  - Heart Rate
    - Timolol caused statistically significant reduction in the phase 3 studies by an average of 2-3 beats per month

1. RHOPRESSA® (netarsudil ophthalmic solution) 0.02% Prescribing Information. 2. Khouri et al. Association for Research in Vision and Ophthalmology oral presentation 2017 [E-abstract 2461].

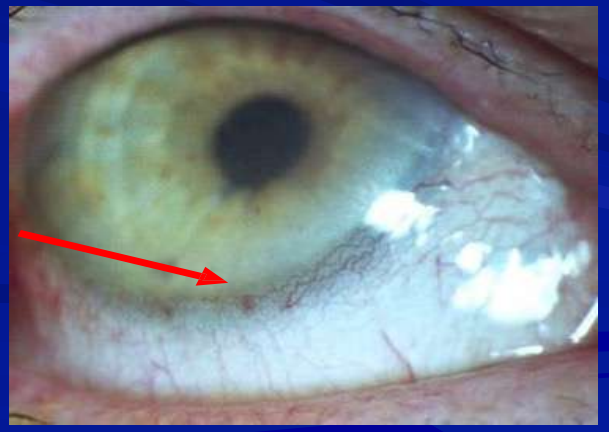
Conjunctival Hemorrhage was Sporadic and Severity did not Increase with Continued Dosing

Adverse Events	Netarsudil 0.02% QD (N=839) n (%)	Timolol 0.5% BID (N=839) n (%)
TEAE Conjunctival Hemorrhage	144 (17.2)	15 (1.8)
AE Resulting in Discontinuation	8 (1.0)	0

Majority 92.4% (133/144) of the conjunctival hemorrhage in netarsudil QD group was mild, 6.3% (9/144) was moderate and 1.4% (2/144) was severe

Self-resolving with continued dosing

Conjunctival hemorrhage

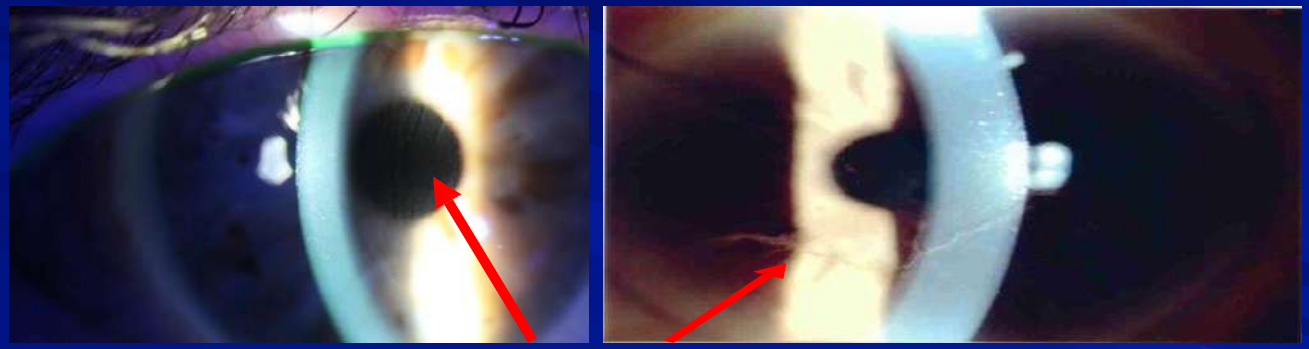


Images were taken from netarsudil subjects

Source: Courtesy of study investigators AR-13324-CS301, -CS302

Cornea Verticillata Observed in Phase 3 Studies

- Cornea verticillata refers to a whorl-like pattern of deposits typically localized to the basal corneal epithelium
- Subjects are asymptomatic
- The onset was ~6 to 13 weeks (netarsudil QD)



Cornea verticillata

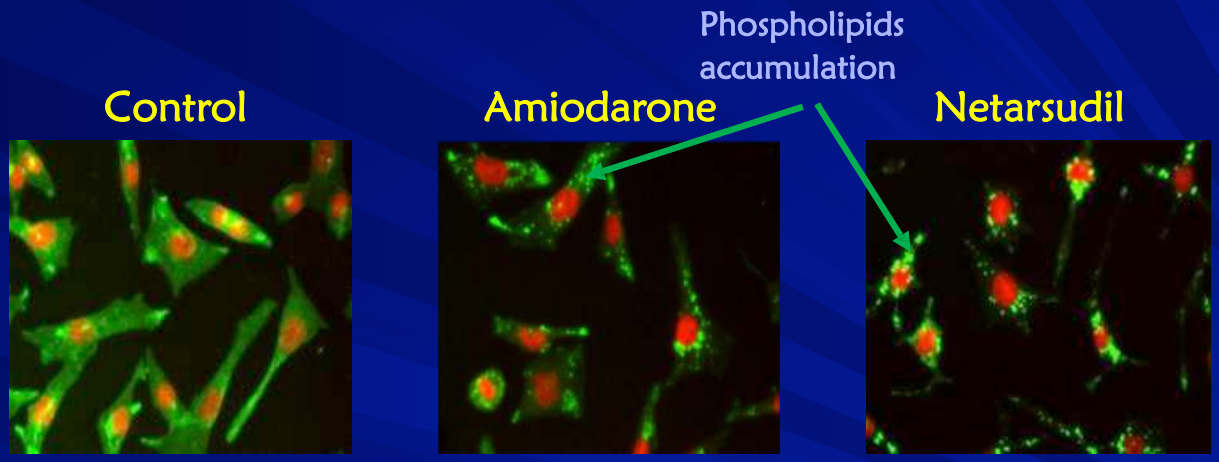
AR-13324-CS302
netarsudil QD subject

AR-13324-CS302
netarsudil BID subject

Images were taken from netarsudil subjects
Source: Courtesy of study investigators AR-13324-CS302

Cornea Verticillata Due to Phospholipidosis

Medications known to cause verticillata: amiodarone, chloroquine, naproxen, phenothiazine, ocular gentamicin and tobramycin*

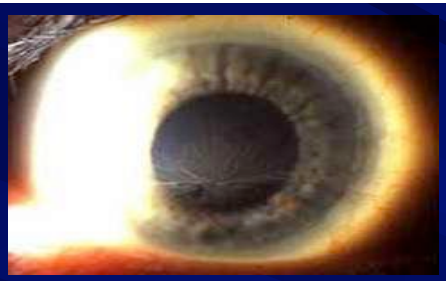


Due to phospholipidosis where the parent drug is complexed with phospholipids in the lysosomes

Literature review suggested it is an adaptive response by the body rather than an adverse pathology*

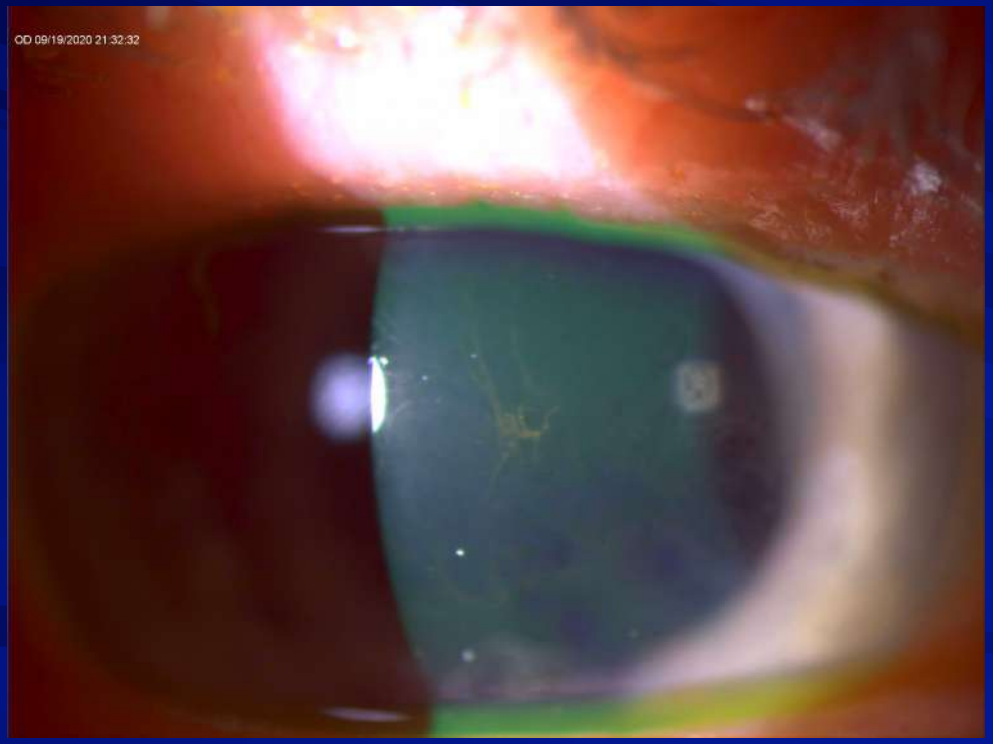
Data on File Based on AR-13324-IPH07

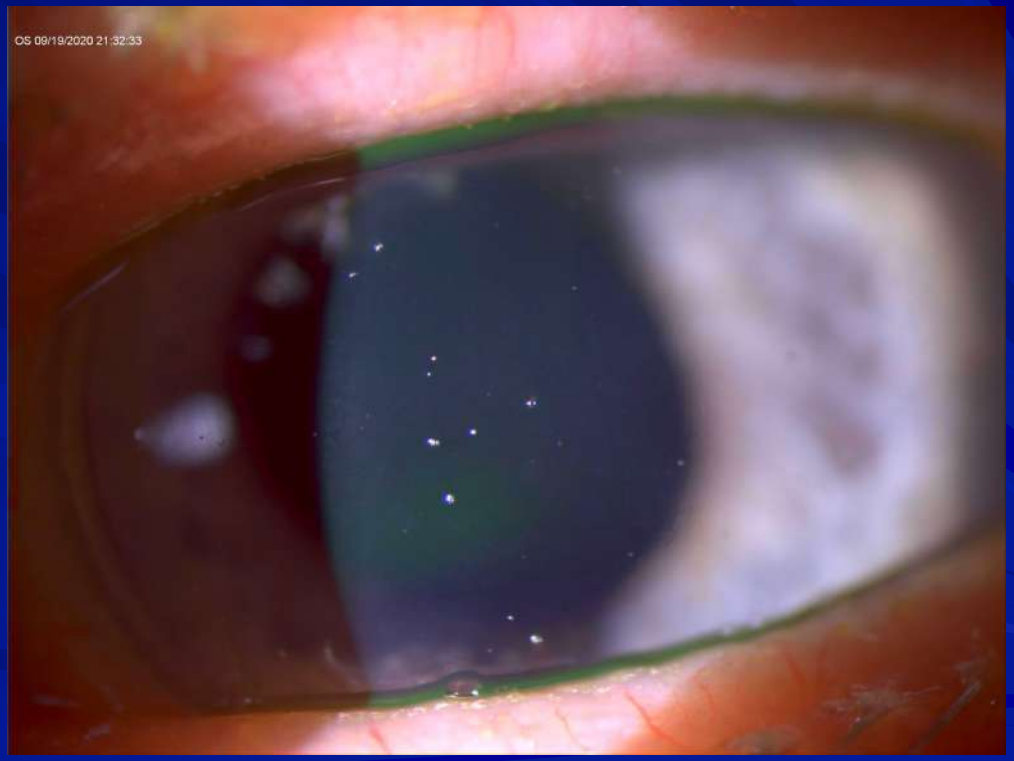
* Raizman MB et al. Surv. Ophthalmol. 2017;62:286-301



My Experience

OD treated OS gtts





Summary of the Most Common Netarsudil Ocular TEAEs

Conjunctival Hyperemia

- 54.4% TEAE
- Severity did not increased with continued dosing
- Sporadic

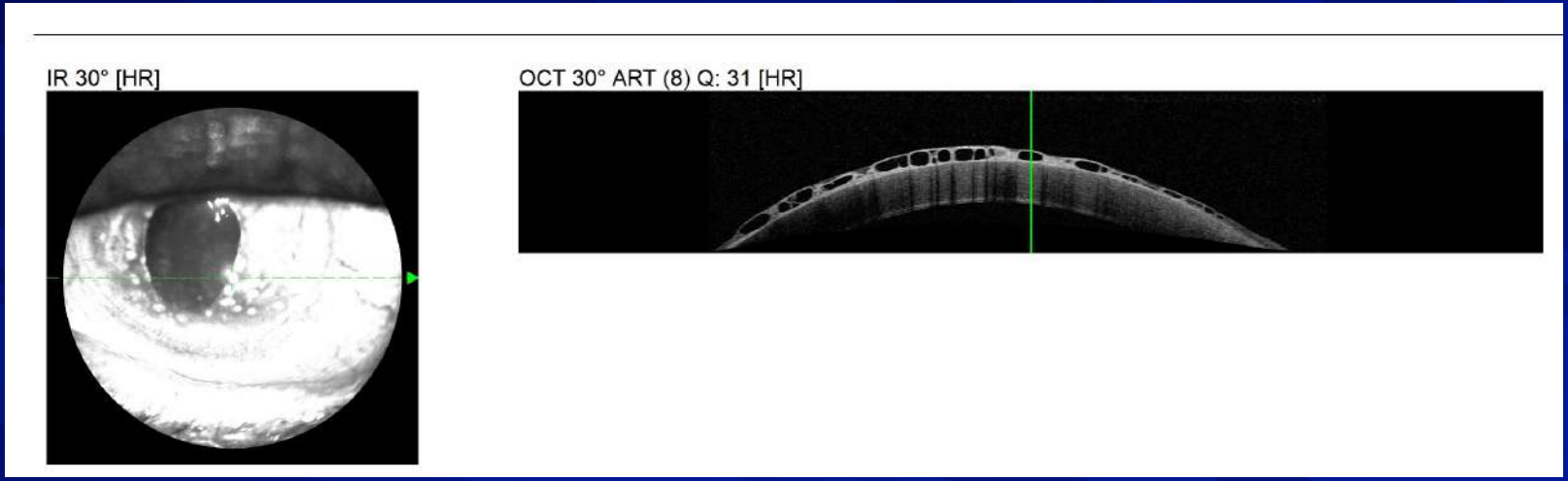
Cornea Verticillata

- 20.9% TEAE
- Asymptomatic
- 7.4% experienced reduced visual acuity
- Not clear to a directly associated
- All resolved after 13 weeks of D/C

Conjunctival Hemorrhage

- 17.2% TEAE
- Mild in severity and transient
- Self-resolving with continued dosing

Honeycomb Epithelial Edema Associated With Rho Kinase Inhibition



- Thank you, Charles McBride, O.D., Beaverton, OR (12-23-2020 OGS – Google Groups)
- Sample of Rocklatan yesterday to lower his IOP of 46mmHg
- IOP today was 34
- Didn't measure corneal thickness
- The eye is blind and pretty sure it is neovascular glaucoma
- He's not been seen in three years and recently relocated from Missouri

Honeycomb Epithelial Edema Associated With Rho Kinase Inhibition Graft Patient

Thank you! Joe Shovlin, OD, FAAO

Glaucoma Drop FDA Approval

- Inferiority
- Superiority

Rocklatan™

(netarsudil/latanoprost ophthalmic solution)
0.02%/0.005%

- Approved March 14, 2019
- Aerie pharmaceuticals - Asset acquired by Alcon
- Once-daily eye drop
- One approved PGA combination in USA
  - ★ Inferiority (Timolol) versus Superiority
- Treatment of ocular hypertension and primary open angle glaucoma
  - ★ Board indication

Durysta™ (Bimatoprost Implant)

- Allergan
  - Approved May 23, 2020
- Indication: Intracameral administration for the reduction of intraocular pressure in patients with Open Angle Glaucoma or Ocular Hypertension
- Sustained-Release, biodegradable intracameral Implant
- Intracameral implant containing 10 mcg in the drug delivery system
- Contraindications:
  - Active or suspected ocular or periocular infections
  - Corneal endothelial cell dystrophy (e.g. Fuch's Dystrophy)
  - Prior corneal transplantation or endothelial cell transplants (e.g., Descemet's Stripping Automated Endothelial Keratoplasy [DSAEK])
  - Absent or ruptured posterior lens capsule, due to the risk of implant migration into the posterior segment
  - Hypersensitivity to bimatoprost or any other components of the product

Durysta™ (Bimatoprost Implant)

- Warnings and Precautions
  - Corneal adverse reactions
    - Bimatoprost implants has been associated with corneal adverse reactions and increased risk of corneal endothelial cell loss
  - Iridocorneal angle:
    - Bimatoprost implant should be used with caution in patients with narrow iridocorneal angles (Shaffer grade < 3)
    - Anatomical obstruction (e.g. scarring) that may prohibit settling in the inferior angle
  - Macular edema
    - Bimatoprost implant should be used with caution in aphakic patients, in pseudophakic patients with a torn posterior lens capsule, or in patients with known risk factors for macular edema
  - Intraocular inflammation
  - Pigmentation
  - Endophthalmitis

Durysta™ (Bimatoprost Implant)

- Dosage and Administration
  - Bimatoprost implant is an ophthalmic drug delivery system for a single intracameral administration of a biodegradable implant
  - Should not be readministered to an eye that received a prior bimatoprost implant
    - On label
- Efficacy
  - Demonstrated in two Phase 3 studies
  - IOP reduction of approximately 5 - 8 mmHg
  - In patients with a mean baseline IOP of 24.5 mmHg

Did Combigan Go Generic?

April 19, 2022

Screenshot from Pharmacompass

Pictures Taken February 21, 2022

2-2-2022

Screenshot from Carlisle Medical

Generic Release Of Combigan Is Now Available

Released: 02/02/2022

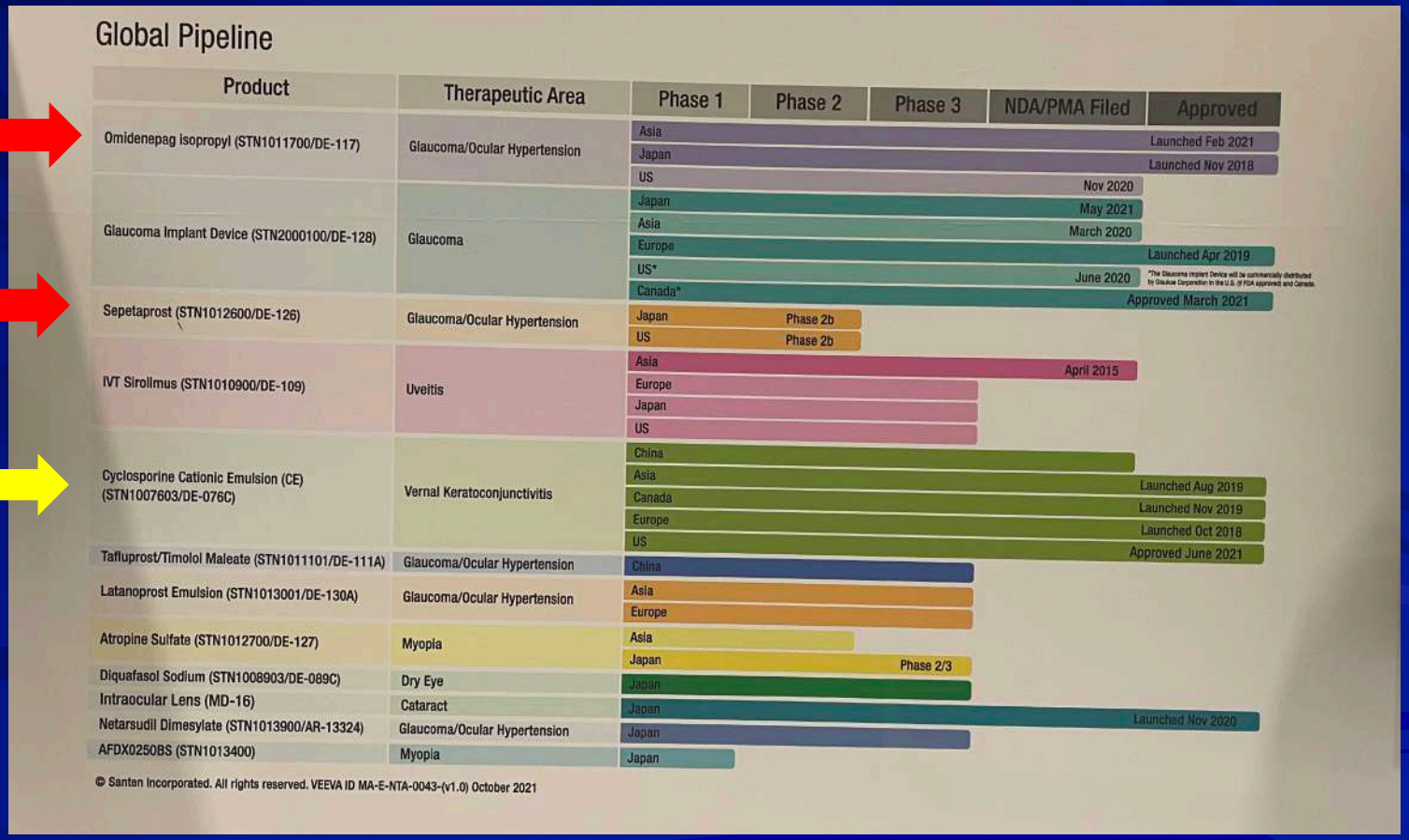
Apotex Corporation has launched the authorized generic version of Combigan® (Brimonidine Timolol OPSO 0.2%/0.5%) in the United States.

Brimonidine Timolol is indicated for the reduction of elevated intraocular pressure (IOP) in patients with glaucoma or ocular hypertension. Brimonidine Timolol is now available in 5ML, 10ML and 15ML bottles.

Generic prescription drugs approved by the FDA have the same high quality and strength as brand name drugs. Generic prescription drug manufacturing and packaging sites must pass the same quality standards as those of brand name drugs.

If you have any questions or if we may assist you with your pharmacy needs, please contact us at 800-553-1783 or at pharmacy@carlislemedical.com.

What is Coming?



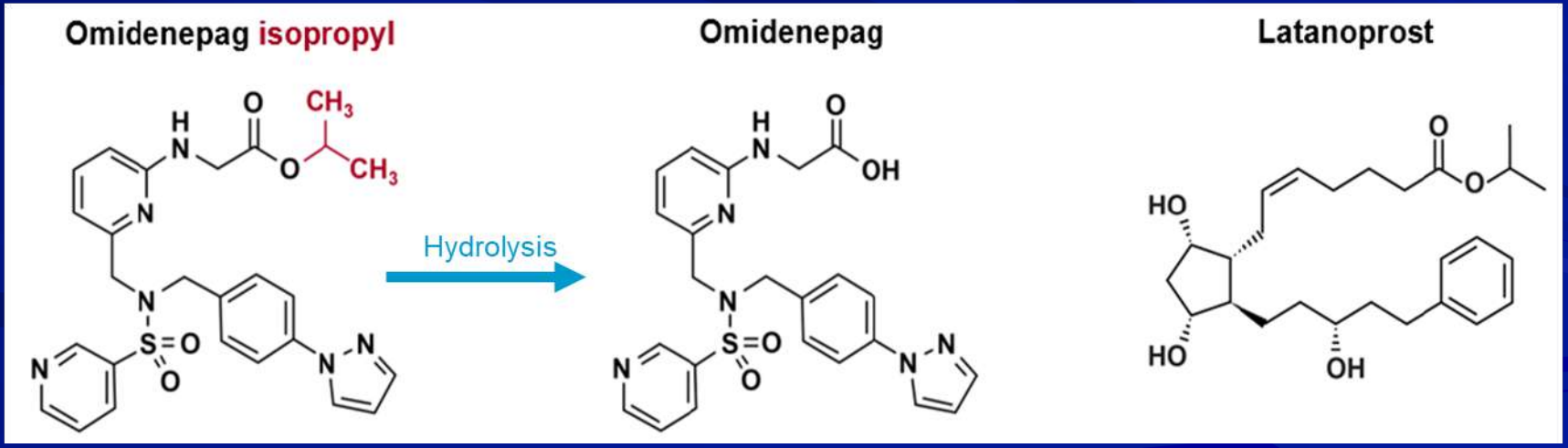
Global Pipeline

Product	Therapeutic Area	Phase 1	Phase 2	Phase 3	NDA/PMA Filed	Approved
Omidenepag isopropyl (STN1011700/DE-117)	Glaucoma/Ocular Hypertension	Asia				Launched Feb 2021
		Japan				Launched Nov 2018
		US			Nov 2020	
Glaucoma Implant Device (STN2000100/DE-128)	Glaucoma	Japan			May 2021	
		Asia			March 2020	
		Europe				Launched Apr 2019
		US*			June 2020	
		Canada*				Approved March 2021
Sepetaprost (STN1012600/DE-126)	Glaucoma/Ocular Hypertension	Japan	Phase 2b			
		US	Phase 2b			
IVT Sirolimus (STN1010900/DE-109)	Uveitis	Asia			April 2015	
		Europe				
		Japan				
		US				
Cyclosporine Cationic Emulsion (CE) (STN1007603/DE-076C)	Vernal Keratoconjunctivitis	China				
		Asia				Launched Aug 2019
		Canada				Launched Nov 2019
		Europe				Launched Oct 2018
		US				Approved June 2021
Tafluprost/Timolol Maleate (STN1011101/DE-111A)	Glaucoma/Ocular Hypertension	China				
Latanoprost Emulsion (STN1013001/DE-130A)	Glaucoma/Ocular Hypertension	Asia				
		Europe				
Atropine Sulfate (STN1012700/DE-127)	Myopia	Asia				
		Japan		Phase 2/3		
Diquafasol Sodium (STN1008903/DE-089C)	Dry Eye	Japan				
Intraocular Lens (MD-16)	Cataract	Japan				Launched Nov 2020
Netarsudil Dimesylate (STN1013900/AR-13324)	Glaucoma/Ocular Hypertension	Japan				
AFDX0250BS (STN1013400)	Myopia	Japan				

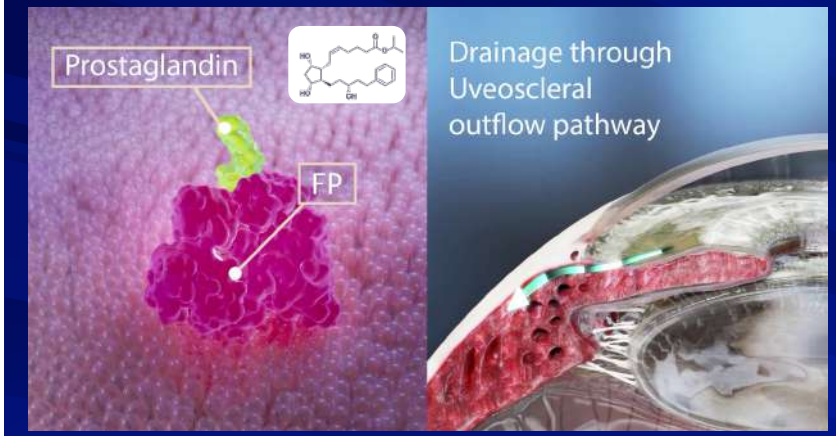
*The Glaucoma Implant Device will be commercially distributed by Glaukos Corporation in the U.S. (if FDA approved) and Canada.

Omidenepag Isopropyl Non-Prostaglandin Structure

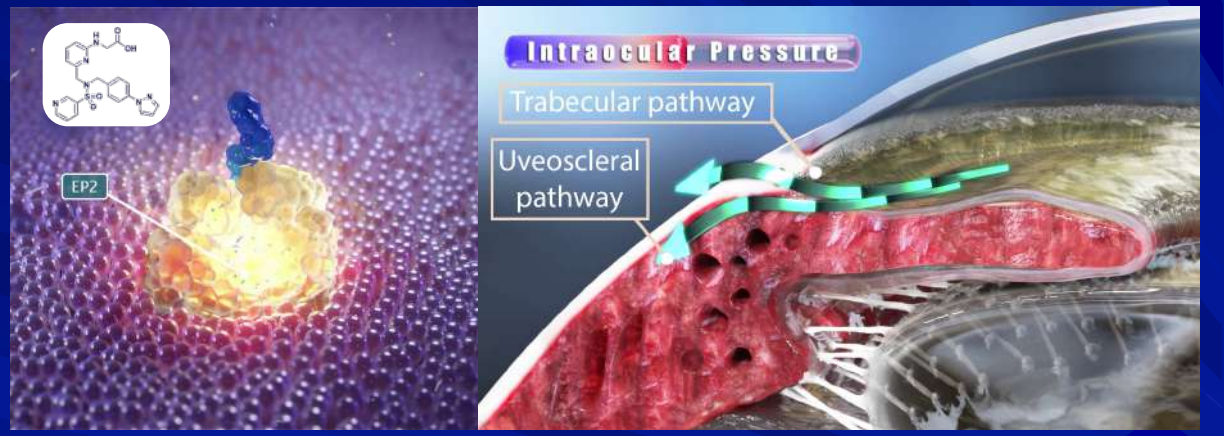
OMDI is a topical prodrug that is hydrolyzed in the eye during corneal penetration to omidenepag, a selective, non-prostaglandin, prostanoid EP2 receptor agonist



OMDI IOP-lowering Effect Using a Unique Dual MoA



↑ AH outflow primarily through **uveoscleral pathway**[1–3]



↑ AH outflow through **conventional pathway** and **uveoscleral pathway**[4]

↓IOP

Omidenepag Isopropyl

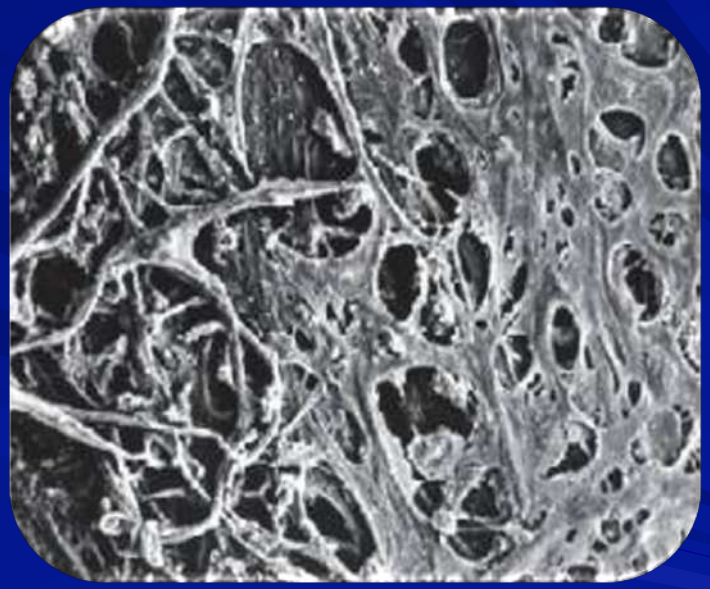
- MOA versus MOD
- Selective, non-prostaglandin, prostanoid EP2 receptor agonist
- QD dosing
- ↑ AH outflow through **conventional pathway** and **uveoscleral pathway**
- **OMDI is Non-Inferior to Timolol**
- **OMDI Non-Inferior to Latanoprost**
- **OMDI Resulted in Significant IOP Reduction in Patients with POAG or OHT Who Were Non/Low Responders to Latanoprost**
- **Safety outcomes**
  - No serious ocular adverse events (AEs) reported in either group
  - The most frequently reported AE in patients treated with OMDI was mild conjunctival hyperemia
  - No cosmetic AEs were reported in the OMDI group

Disease at the TM is responsible for elevated IOP in glaucoma[1,2]

Healthy TM
Normal IOP

Cellular Damage
(eg, Oxidative Stress)

POAG TM Stiffness
Elevated IOP

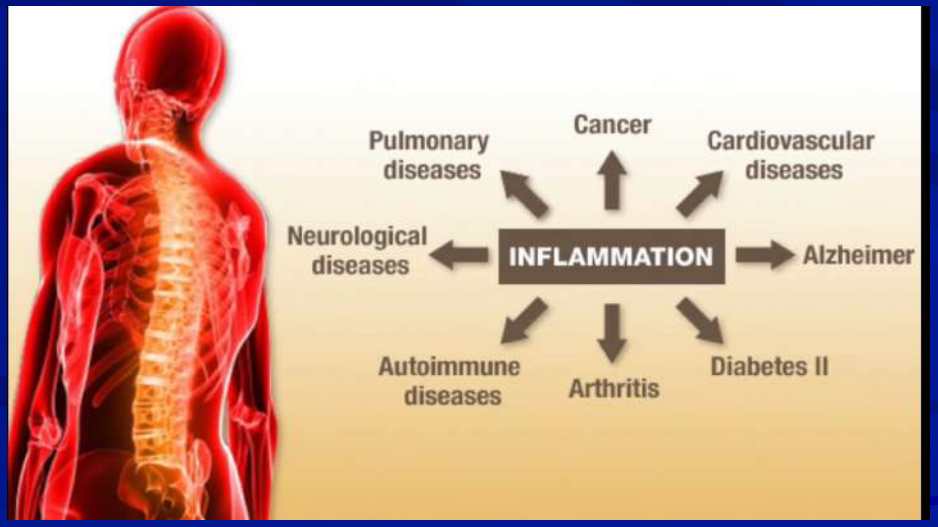


Scanning electron microscopy (2000x) was used to examine human TM under physiological conditions and in patients with POAG.[2]
POAG, primary open-angle glaucoma; TM, trabecular meshwork.

1. He et al. *Invest Ophthalmol Vis Sci*. 2008;49:1447.
2. Saccà et al. *J Cell Physiol.* 2015;230:510.

Chronic and Low-Grade Inflammation

Like cancers and other slow-burn diseases, identifying these conditions early can make the difference between full recovery or a dramatically reduced quality of life or even death (vision loss or blindness)



Credit to: James LaValle, RPh, CCN

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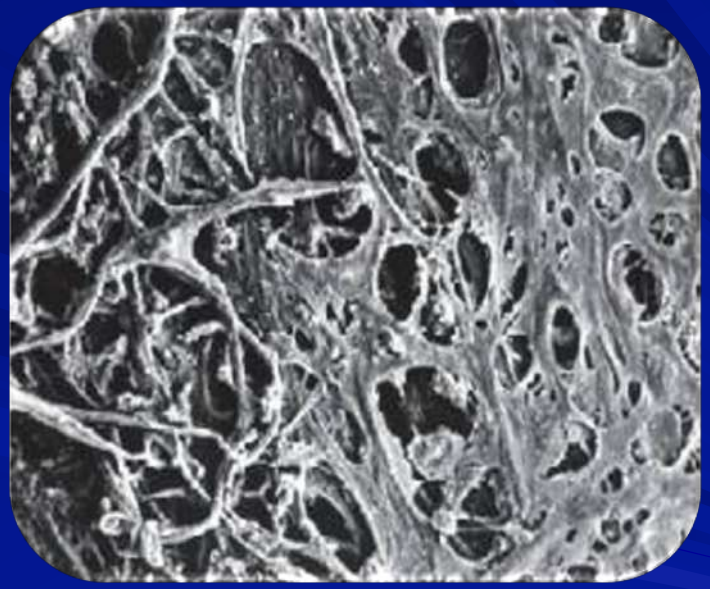
Healthy TM
Normal IOP

Cellular Damage
(eg, Oxidative Stress)

POAG TM Stiffness
Elevated IOP



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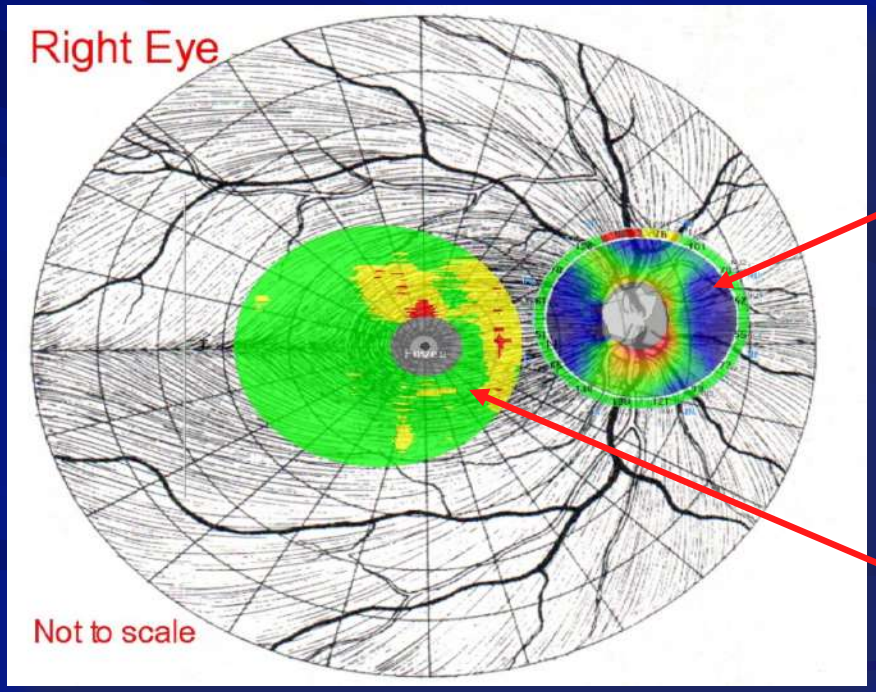
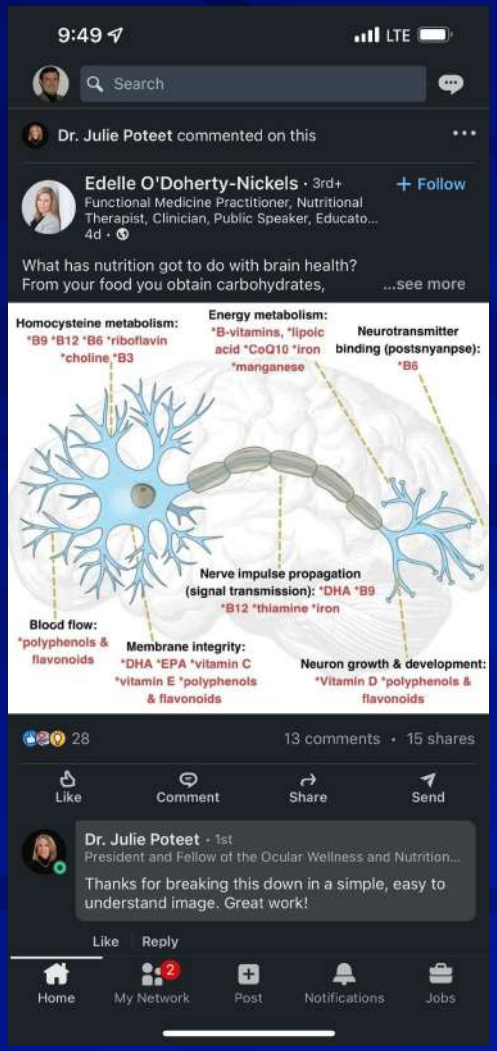
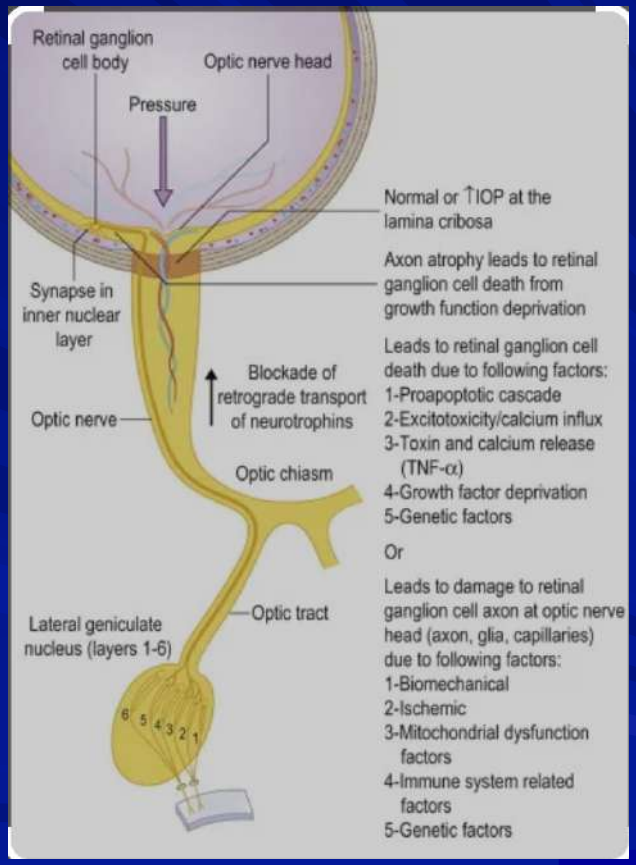
Overlay of the RNFL and GCC




9:49
LTE
Search
Dr. Julie Poteet commented on this
Edelle O'Doherty-Nickels · 3rd+
Functional Medicine Practitioner, Nutritional Therapist, Clinician, Public Speaker, Educato...
4d ·
+ Follow
What has nutrition got to do with brain health?
From your food you obtain carbohydrates,
...see more
Homocysteine metabolism: *B9 *B12 *B6 *riboflavin *choline *B3
Energy metabolism: *B-vitamins, *lipoic acid *CoQ10 *iron *manganese
Neurotransmitter binding (postsnyanpse): *B6
Nerve impulse propagation (signal transmission): *DHA *B9 *B12 *thiamine *iron
Blood flow: *polyphenols & flavonoids
Membrane integrity: *DHA *EPA *vitamin C *vitamin E *polyphenols & flavonoids
Neuron growth & development: *Vitamin D *polyphenols & flavonoids
28
13 comments · 15 shares
Like
Comment
Share
Send
Dr. Julie Poteet · 1st
President and Fellow of the Ocular Wellness and Nutrition...
Thanks for breaking this down in a simple, easy to understand image. Great work!
Like
Reply
Home
My Network
Post
Notifications
Jobs


Retinal ganglion cell body
Optic nerve head
Pressure
Normal or ↑IOP at the lamina cribosa
Axon atrophy leads to retinal ganglion cell death from growth function deprivation
Synapse in inner nuclear layer
Leads to retinal ganglion cell death due to following factors:
1-Proapoptotic cascade
2-Excitotoxicity/calcium influx
3-Toxin and calcium release (TNF-α)
4-Growth factor deprivation
5-Genetic factors
Blockade of retrograde transport of neurotrophins
Optic nerve
Optic chiasm
Or
Leads to damage to retinal ganglion cell axon at optic nerve head (axon, glia, capillaries) due to following factors:
1-Biomechanical
2-Ischemic
3-Mitochondrial dysfunction factors
4-Immune system related factors
5-Genetic factors
Optic tract
Lateral geniculate nucleus (layers 1-6)
6 5 4 3 2 1

Acta Ophthalmologica

Acta Ophthalmologica 2018

The effects of antioxidants on ocular blood flow in patients with glaucoma

Alon Harris, Josh Gross, Nicholas Moore, Thai Do, Amelia Huang, Willy Gama and Brent Siesky

Glaucoma Research and Diagnostic Center, Eugene and Marilyn Glick Eye Institute, Indiana University School of Medicine, Indianapolis, IN, USA

- No on-label approved treatment medically increase blood flow
- Intraocular pressure lowering is a proven alterable risk factor in glaucoma
- Despite IOP lowering individuals progress and not all ocular hypertensive develop glaucoma
- Vascular mechanisms is an established risk factor in glaucoma

Placebo controlled double blind, crossover design- Optic Nerve Formula

Ingredient	Daily Dose
Vitamin C (ascorbic acid)	250 mg
Vitamin E (d-alpha tocopherol, mixed tocopherols)	30 IU
Vitamin B6 (pyridoxine hydrochloride)	10 mg
Folate (50% folic acid, 50% calcium folinate)	400 mcg
Vitamin B12 (methylcobalamin)	300 mcg
Magnesium (magnesium oxide, aspartate)	120 mg
Taurine	250 mg
N-Acetylcysteine (NAC)	300 mg
Alpha Lipoic Acid	200 mg
Gingko biloba Extract (leaf)(24% ginkgo flavone glycosides)	120 mg
Omega-3 Fatty Acid (Docosahexaenoic acid 100 mg, Eicosapentaenoic acid 20 mg)	120 mg
Bilberry fruit extract (25% anthocyanidins)	115 mg
Coenzyme Q10 (CoQ10)	50 mg
Grape seed extract (95% proanthcyanidins)	50 mg
Quercetin	50 mg
Flax seed oil (460 mg omega-3), gelatine, glycerine, water, beeswax, lecithin (from soya beans), lemon oil flavouring, caramel colour, and titanium dioxide	

Measurements performed

- Intraocular pressure
- Ocular perfusion pressure
- Retrobulbar blood flow
- Retinal capillary blood flow
- Heidelberg Retinal Flowmeter

nutrients

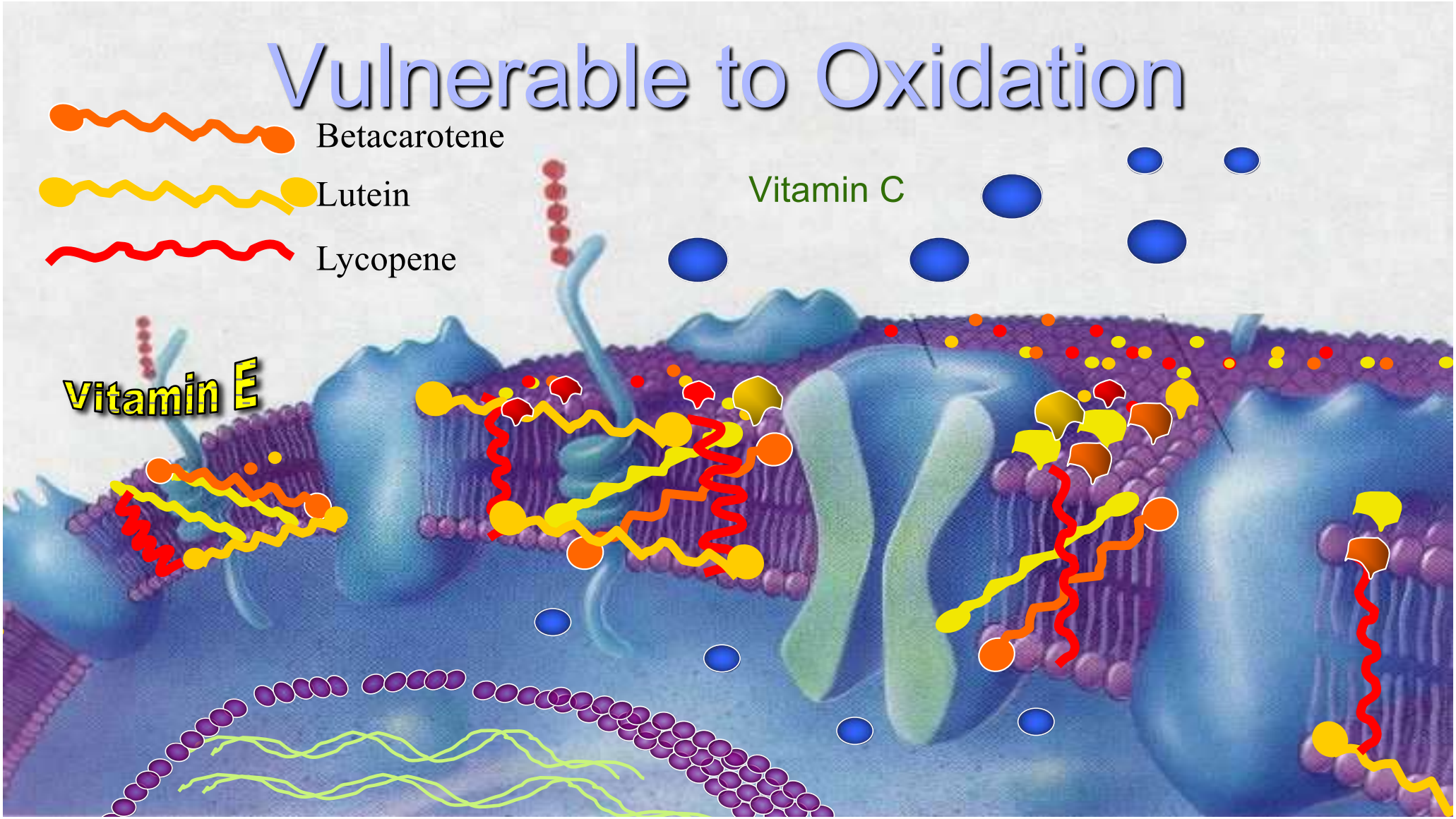
MDPI

Review

Carotenoids in the Management of Glaucoma: A Systematic Review of the Evidence

Drake W. Lem [1], Dennis L. Gierhart [2] and Pinakin Gunvant Davey [1,*]

- We know the advantages of multivitamins and AMD
  1) Prevents oxidative damage, 2) Quenches any free radical 3) Prevents photoreceptor death 4) Absorbs stray light
- Oxidative damage can also occur in glaucoma
  - Both Anterior and posterior segment
  - Animal studies and few human trials suggest carotenoids vitamin therapy exerts synergistic neuroprotective benefits.

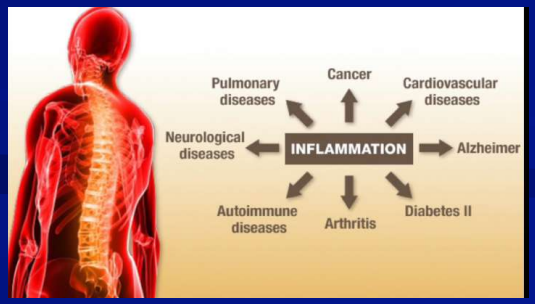

Vulnerable to Oxidation
Betacarotene
Lutein
Lycopene
Vitamin C
Vitamin E

Carotenoid (Molecular) Levels

NIH National Institutes of Health
Turning Discovery Into Health

- Quick Test (approx. 30 sec)
- Portable
- Cost Effective
- Remeasure in 60 days
- Reassurance to you and patient

Chronic and Low-Grade Inflammation



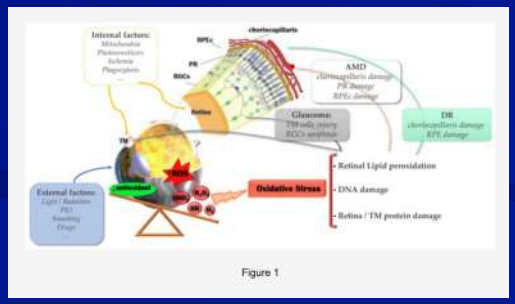
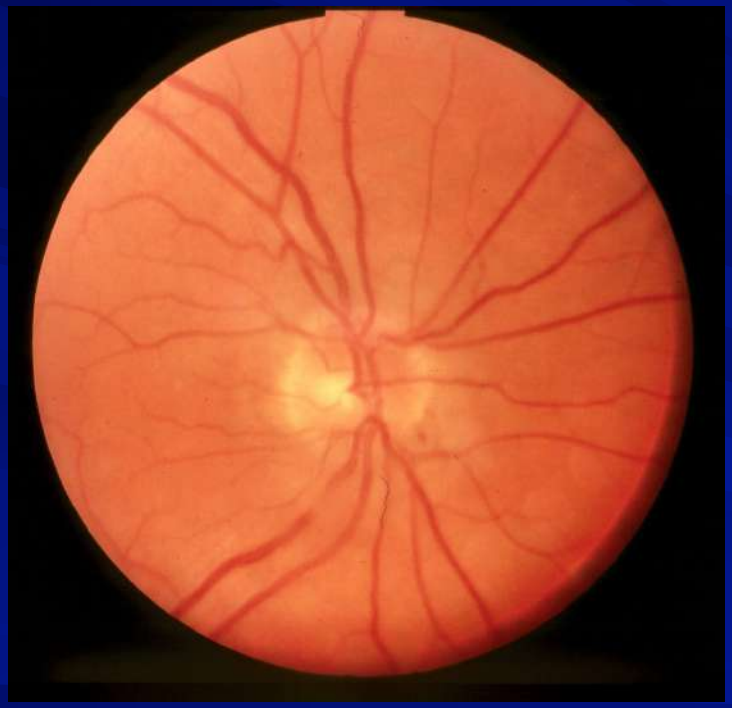


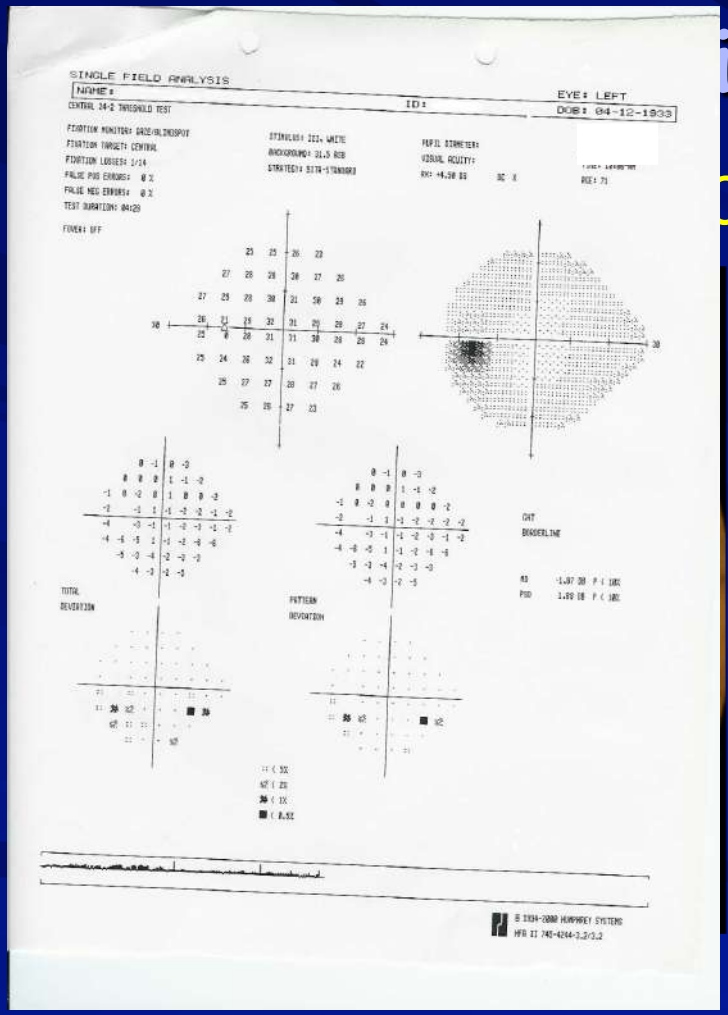
Figure 1

Disk Hemorrhages

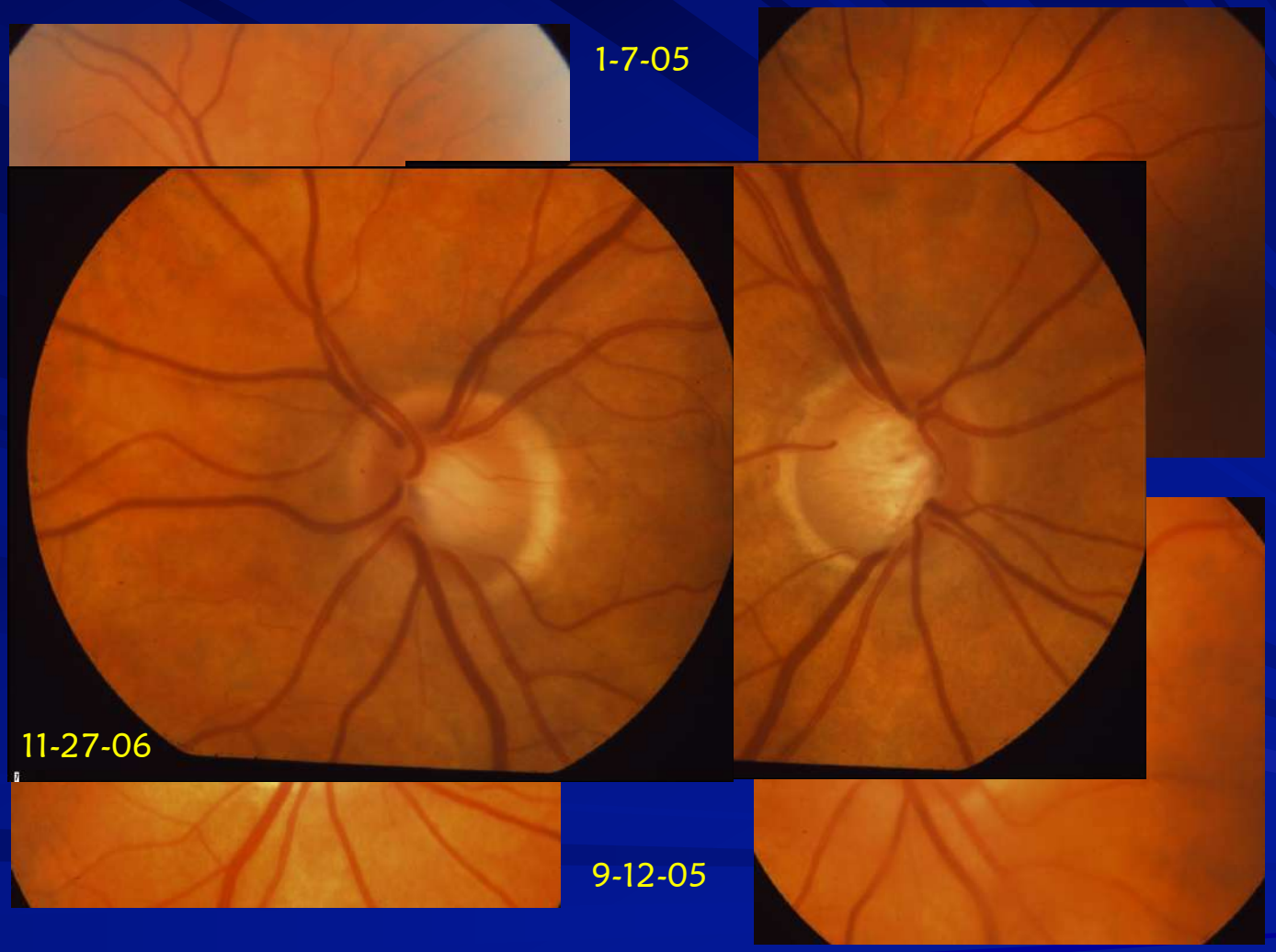
- Non-specific finding
- However, when associated with glaucoma it typically indicates you should:
  - Initiate a more careful monitoring
  - Re-evaluate the therapy you are doing
  - Treat the patient if not being treated

Non-Specific Finding



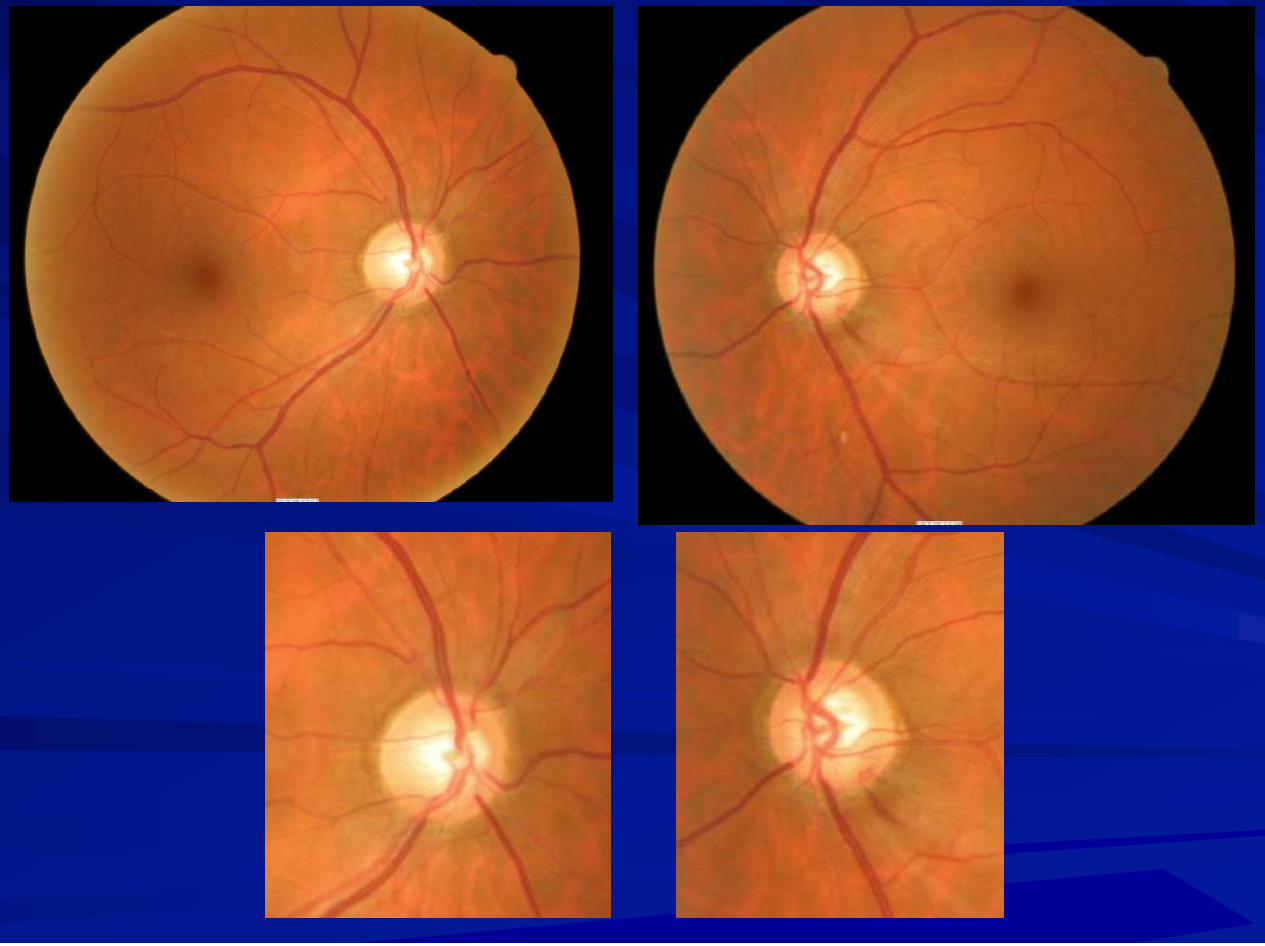

SINGLE FIELD ANALYSIS
EYE: LEFT
DOB: 04-12-1933


SINGLE FIELD ANALYSIS
EYE: RIGHT
DOB: 04-12-1933
4-23-06

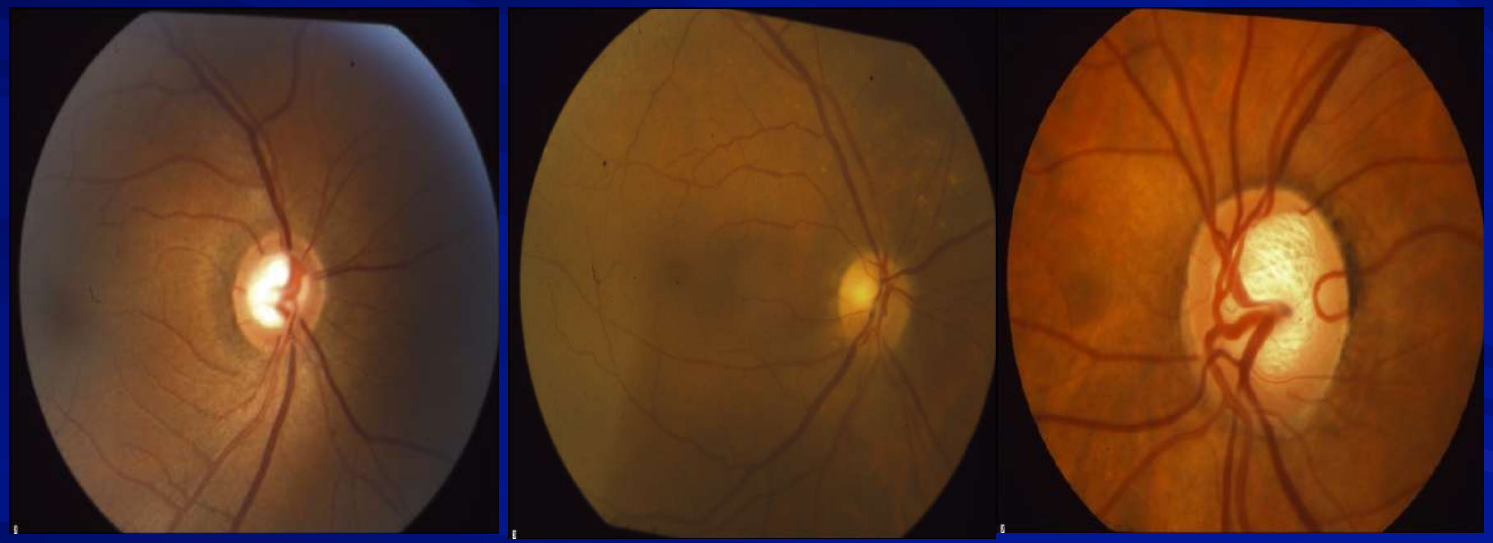

1-7-05
11-27-06
9-12-05

Disc Hemorrhage

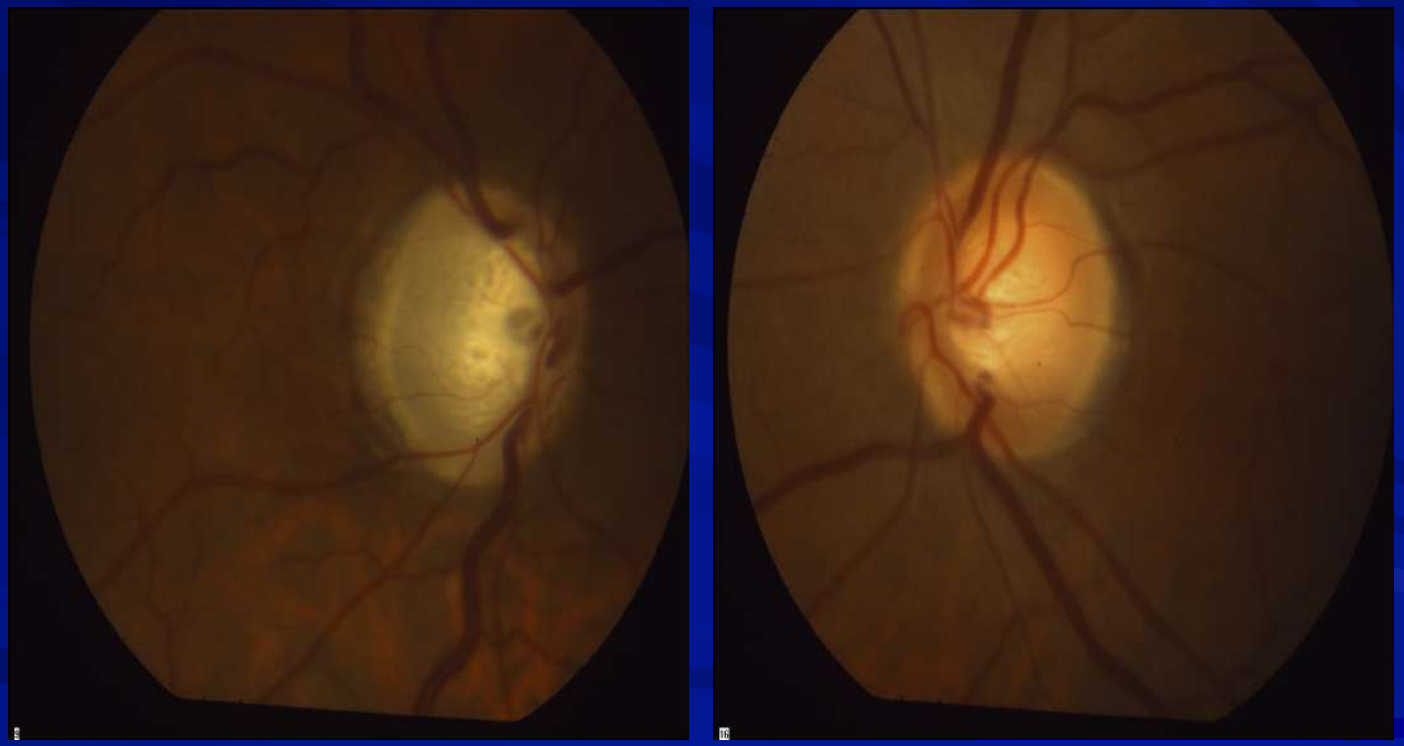
Adjacent to Existing Loss



Pallor



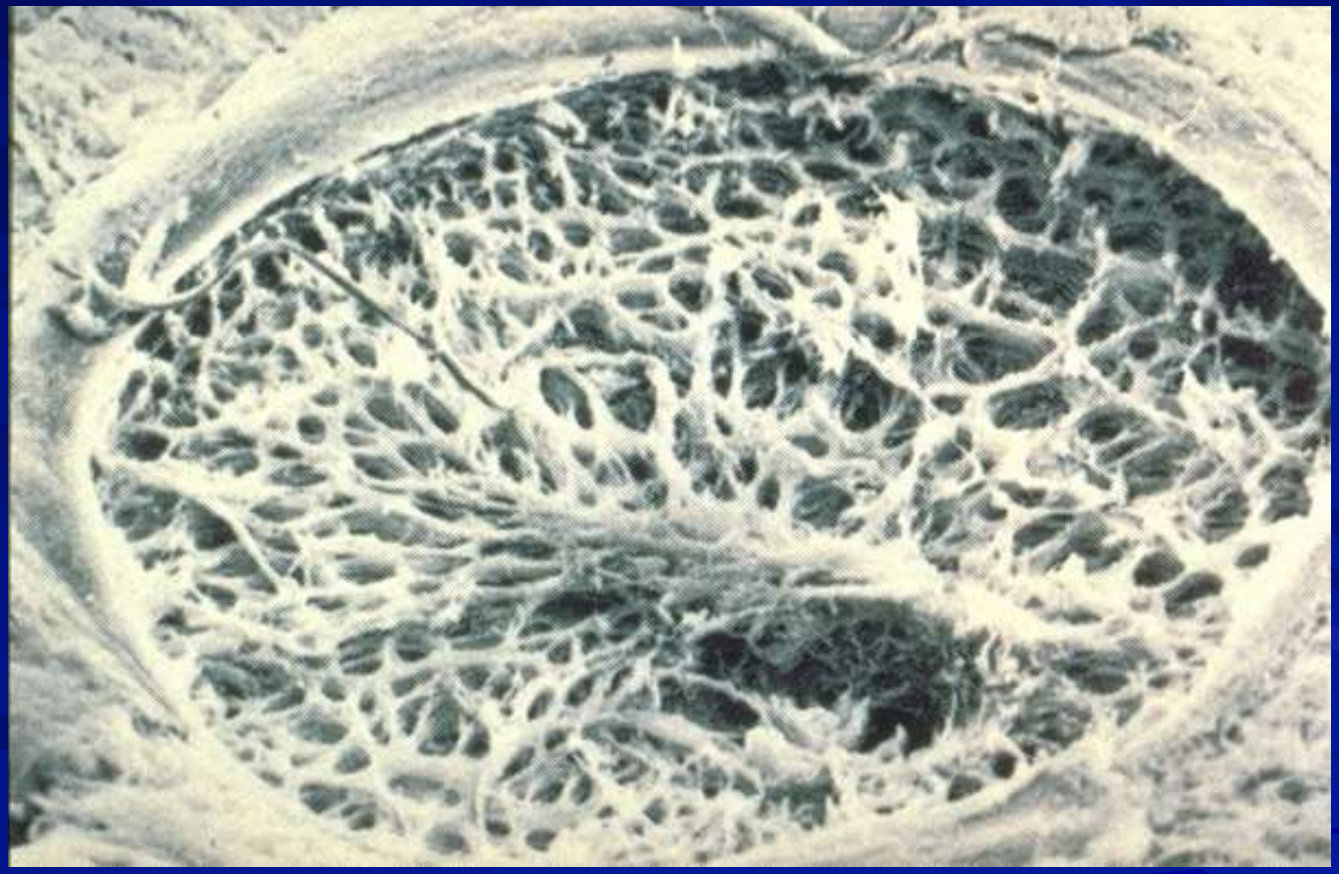
Patient declined treatment for 10 years
Pallor



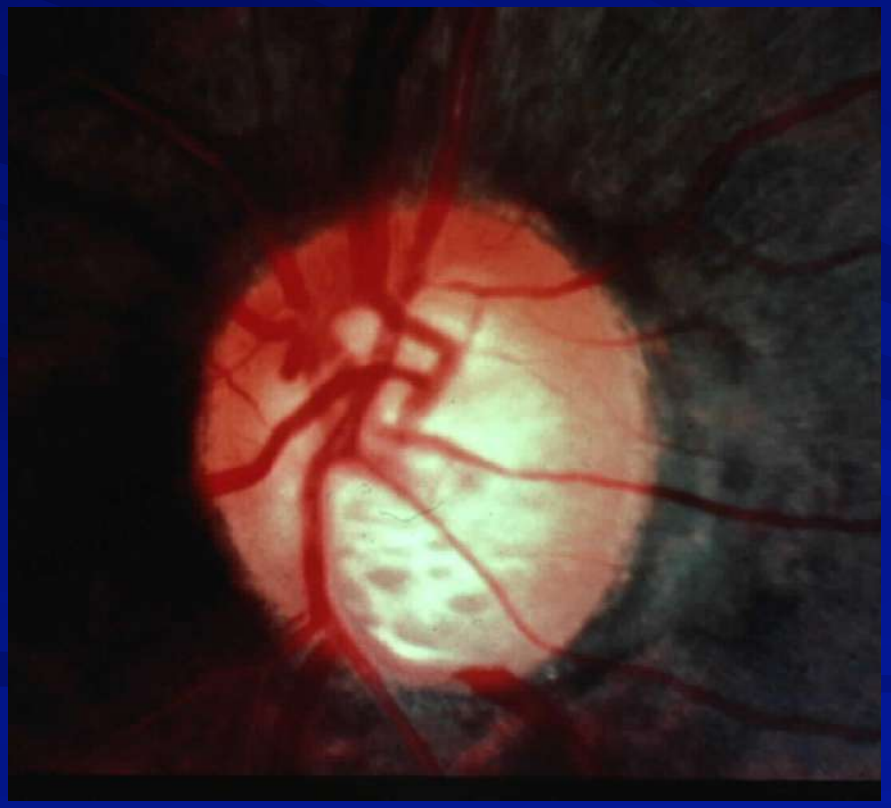
Laminar Dots

- Found in many normal eyes
- 34% of myopic eyes have laminar dots
- Shape of dots may be clinically helpful in determining glaucoma damage to optic nerve head
  - Round holes become more horizontal slits in glaucoma

Lamina Cribrosa



Laminar Dots



Optometric Education Consultants

Glaucoma Update 2023

Greg Caldwell, OD, FAAO

Mackinac Island Northern Escape
Optometric Education Consultants

Friday, August 18, 2023