

GLAUCOMA - YESTERDAY,
TODAY AND TOMORROW

LEO SEMES, OD
PROFESSOR EMERITUS, UAB

MATTHEW BRINK, MD

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Disclosures - Leo Semes, OD, FAAO, FACMO

Consultant - Apellis
 Speaker Bureau - EyePromise, OptoMed
 Scientific Advisory Board - EyePromise, Apellis, OptoMed
 Stock options - Eye Promise (< 0.01% ownership)
All relevant financial relationships have been mitigated

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Disclosures, Matthew Brink, MD

Dr. Brink serves as a consultant for the following companies:

- Sight Sciences
- Glaukos
- Allergan
- Alcon
- B&L
- New World Medical
- DOMPE

All relevant financial relationships have been mitigated

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COURSE OBJECTIVES

- The attendee will be challenged with cases without clear-cut diagnoses
- The attendee will be presented with alternative diagnoses to optic nerve head disorders
- The attendee will gain a perspective on the use of complementary testing in glaucoma diagnoses
- The attendee will be presented with a template for optic disc and RNFL evaluation using clinical observations
- The attendee will appreciate that few cases are straightforward
- The attendee will be offered discussion and input on the conflict that occurs among clinical findings

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CONTEMPORARY GLAUCOMA DEFINITION

POAG is a progressive, chronic optic neuropathy in adults in which intraocular pressure (IOP) and other currently unknown factors contribute to damage and in which there is a characteristic acquired atrophy of the optic nerve and loss of retinal ganglion cells and their axons. This condition is associated with an anterior chamber angle that is open by gonioscopic appearance.

ala AAO PPP

5

CONTEMPORARY GLAUCOMA DEFINITION...

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ala AAO PPP

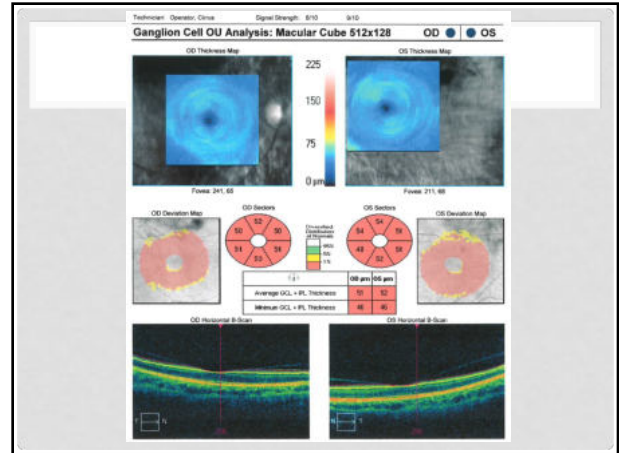
“Can glaucomatous optic neuropathy be induced by a primary non-IOP-related insult . . . alone??” -Claude Burgoyne

6

A CASE ILLUSTRATING POTENTIAL CONTAMINATION OF GCC RESULTS

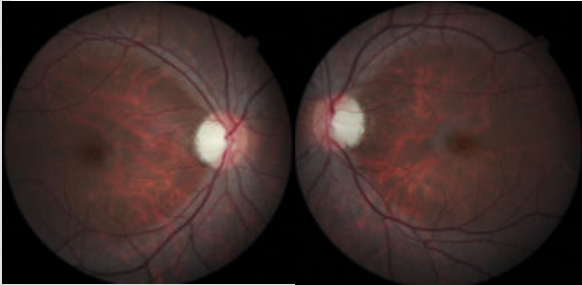
- 40s AA Male
- Longstanding diagnosis of MS with systemic treatment
- BSCVA 20/40, 20/40
- Normal IOP and anterior segment

7



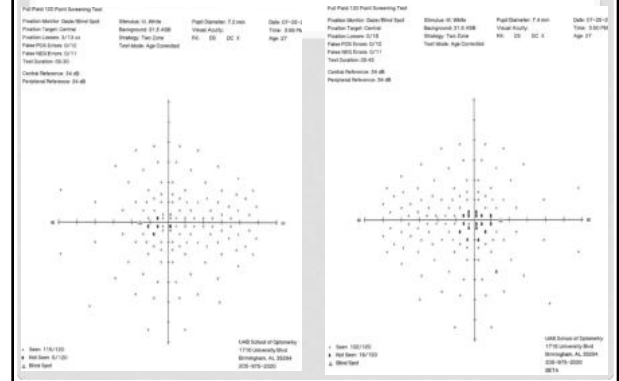
8

FUNDUS



9

SUPRATHRESHOLD VF



10



- Comments
- Questions

12

FLD? GLAUCOMA? ???

- A 24 year-old was referred to the Ocular Disease Service at UAB Eye Care for a glaucoma evaluation.
- Spectacle lens correction for myopic refractive error, personal ophthalmic history is otherwise negative.
- Maternal grandfather with glaucoma (unconfirmed).
- He has never smoked and drinks alcohol socially.
- He takes no Rx medications

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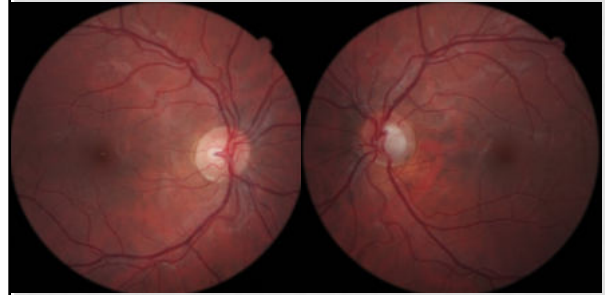
FLD? GLAUCOMA? ???

- Visual acuity is correctable to 20/20 in each eye.
- Pupils are round and equally reactive without RAPD.
- Goldmann applanation tonometry: 16 mm Hg in each eye at 9:55 AM.
- Pachymetry: 619 and 622 um OD, OS, respectively.
- The anterior segments were unremarkable in each eye.

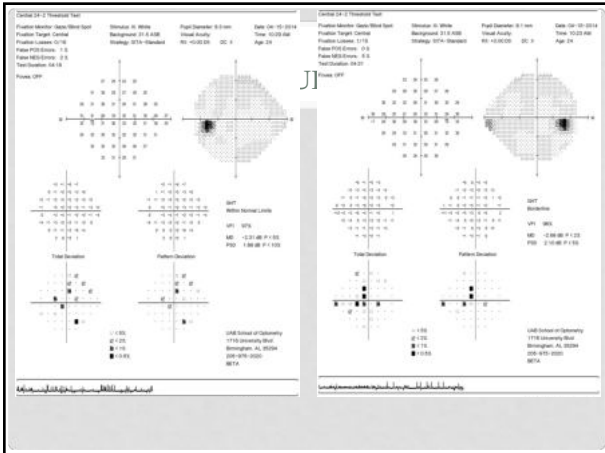
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FIGURE 1

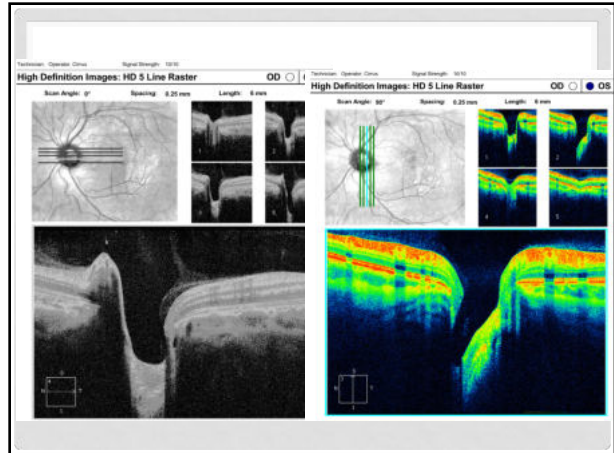
(FROM OPTOMETRY TIMES, RETINA DEPARTMENT)



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16



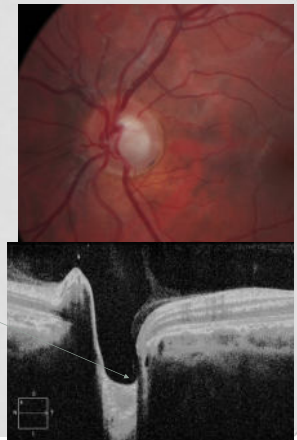
17

WHAT'S YOUR DIAGNOSIS?

- Congenital/developmental optic pit.
Distinguish from APON
Javitt JC, Spaeth GL, Katz LJ, Ponzyses E, Addiego R. Acquired pits of the optic nerve. Increased prevalence in patients with low-tension glaucoma. Ophthalmology. 1990 Aug;97(8):1038-43; discussion 1043-4.
- Careful stereoscopic observation may lead to the diagnosis but additional testing, such as the OCT images are helpful.
- Stereoscopically, the pit is evident.

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- What would not be clear at clinical examination is the extent of any communication between the pit and the sub-sensory retina space.
- The potential conduit can be seen in the cross-sectional images from the OCT.
- (Optic-pit maculopathy)



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OPTIC PIT

- Questions
- Comments



"There's always one annoying piece left over."

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62 WM

- Complained of vision loss superiorly in the left eye.
- VA 20/20 OD, OS; (L)RAPD 2+; IOP 11,9 mmHg.
- Seen by primary-care OD – Dx = NTG, initiated on latanoprost qhs.

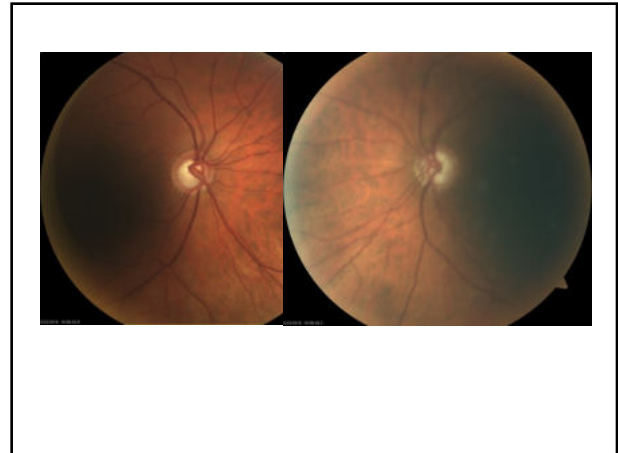
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62 WM

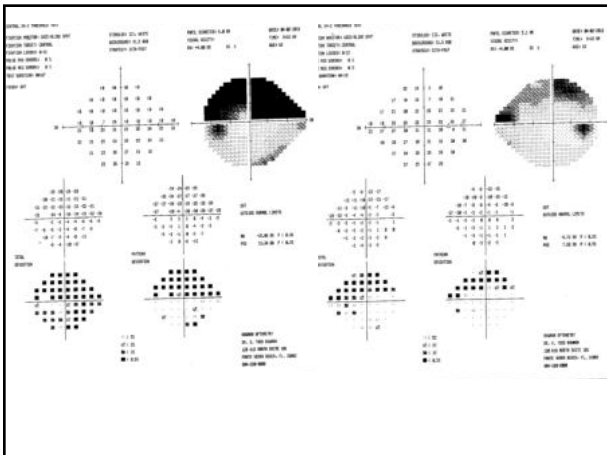
- Complained of vision loss superiorly in the left eye VA 20/20 OD, OS; (L)RAPD 2+; IOP 11,9 mmHg.
- Seen by primary-care OD – Dx = NTG, initiated on latanoprost qhs.

- Sent for consultation/SLT due to significant VF depressions.

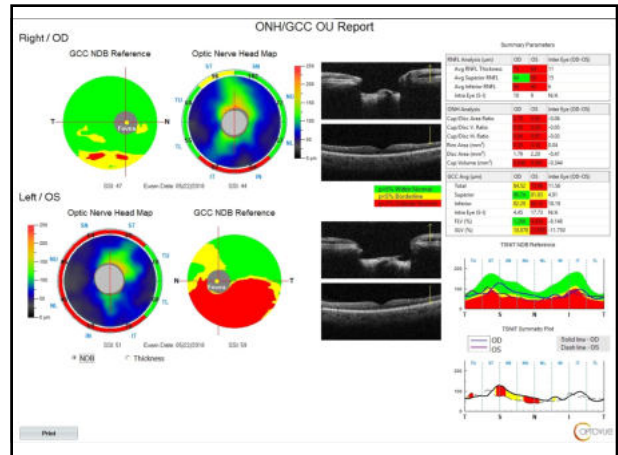
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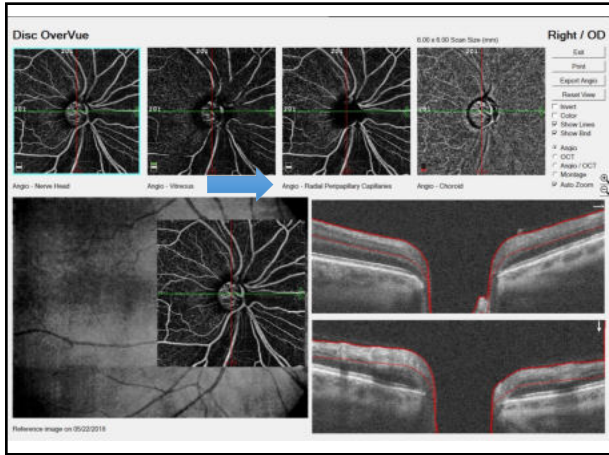
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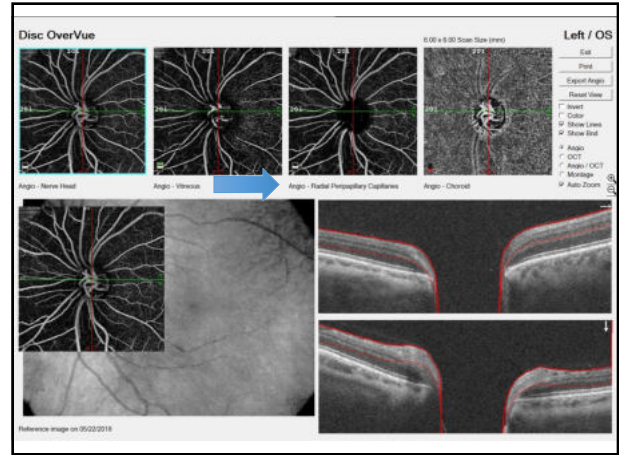
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Additional information

- Patient reveals in social conversation the he suffers from Reynauds syndrome

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Additional information

- Patient reveals in social conversation the he suffers from Reynauds syndrome
- Patient further reveals in casual conversation that he takes a prescription medication for ED, and that it makes his vision blurry!

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SCIENCE ADVANCES | RESEARCH ARTICLE

BIOCHEMISTRY

Cryo-EM structure of phosphodiesterase 6 reveals insights into the allosteric regulation of type I phosphodiesterases

Sahil Gulati^{1,2,3}, Krzysztof Palczewski^{1,2,3*}, Andreas Engel⁴, Henning Stahlberg^{5,6}, Lubomir Kovacic⁴

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Cyclic nucleotide phosphodiesterases (PDEs) work in conjunction with adenylate/guanylate cyclases to regulate the key second messengers of G protein-coupled receptor signaling. Previous attempts to determine the full-length structure of PDE family members at high resolution have been hindered by structural flexibility, especially in their linker regions and N- and C-terminal ends. Therefore, most structure-activity relationship studies have so far focused on truncated and conserved catalytic domains rather than the regulatory domains that allosterically govern the activity of most PDEs. Here, we used single-particle cryo-electron microscopy to determine the structure of the full-length PDE6α2γ2 complex. The final density map resolved at 3.8 Å reveals several previously unseen structural features, including a coiled N-terminal domain and the interface of PDEβγ subunits with the PDE6α2 heterodimer. Comparison of the PDE6α2γ2 complex with the closed state of PDE2α shows light on the conformational changes associated with the allosteric activation of type I PDEs.

Gulati et al., Sci. Adv. 2019; 5: eaav4322. 27 February 2019

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SCIENCE ADVANCES | RESEARCH ARTICLE

BIOCHEMISTRY

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the PDE family (4, 5) and other related enzymes (6). In particular, inhibitors of PDE5, including sildenafil and vardenafil, are widely used for the treatment of erectile dysfunction and pulmonary hypertension (7). However, PDE5 inhibitors have been associated with several ocular side effects, including blurred vision, changes in color vision, transient alterations in the electroretinogram, conjunctival hyperemia, ocular pain, photophobia, and, in extreme cases, damage to the optic nerve (8). These secondary effects are mediated

Gulati et al., Sci. Adv. 2019; 5: eaav4322. 27 February 2019

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But not all data support the risk for AION

- Analysis included reports from MEDLINE, EMBASE, Toxline and VigiBase for NAION and PDE-5 inhibitors
 - Four observational studies, [3 had good methodological protocols]
 - 50 case reports, 12 of which did not have risk factors for NAION, but regular administration was observed in 24/50 (48%) & 39 (78%) were treated for ED
- 608 spontaneous reports

Conclusion: According to the available evidence, the treatment with phosphodiesterase - 5 inhibitors was not found to be associated with NAION.

Penedones A, Alves C, Batel Marques F. Risk of nonarteritic ischaemic optic neuropathy with phosphodiesterase type 5 inhibitors: a systematic review and meta-analysis. Acta Ophthalmol. 2020 Feb;98(1):22-31. doi: 10.1111/aos.14253. Epub 2019 Sep 27.

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AION ?=? NTG

- Questions
- Comments

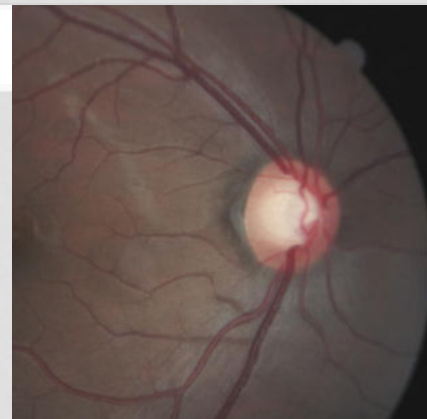


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27 YO ASIAN MALE

- Presents for periodic ophthalmic evaluation
- Unremarkable ocular [ex. myopia] and family history
- Noncontributory medical history
- BSCVA 20/20 (OD, OS)
- Anterior segment – unremarkable (OD, OS)
- IOP 16, 17 mmHg, (OD, OS); (Pachymetry not obtained)

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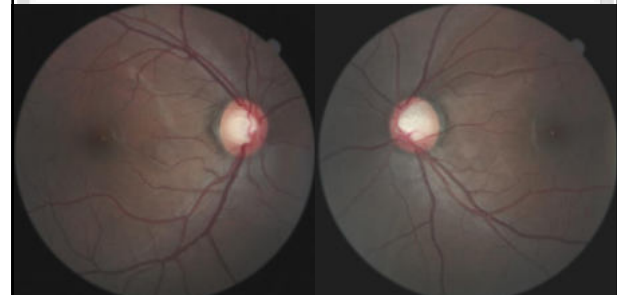
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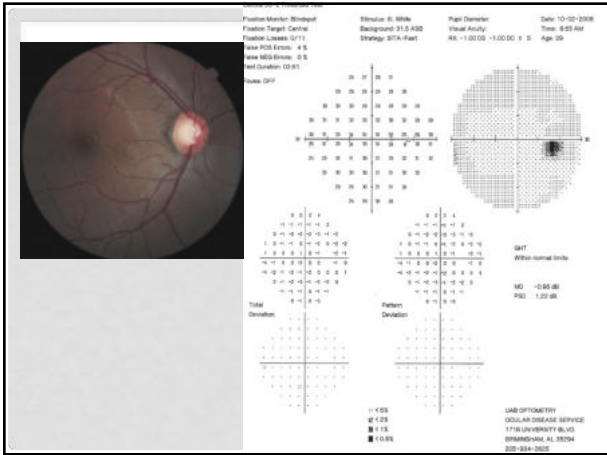
29 A/M 20/20 (-7.50 OD, OS) VS



What do you expect for the VF?

43

43



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CLINICAL GUIDANCE FOR THE PRESENT CASE

Doshi A, Kreidl KO, Lombardi L, Sakamoto DK, Singh K. *Nonprogressive glaucomatous cupping and visual field abnormalities in young Chinese males.* Ophthalmology. 2007 Mar;114(3):472-9. <http://www.ncbi.nlm.nih.gov/pubmed/17123617>

46

PROPOSED MECHANISM TO EXPLAIN CLINICAL FINDINGS

A. Normal

B. Deformed ONH (now obliquely inserted with stable RNFL thickness, ONH appearance and VF).

Doshi A, Kreidl KO, Lombardi L, Sakamoto DK, Singh K. *Nonprogressive glaucomatous cupping and visual field abnormalities in young Chinese males.* Ophthalmology. 2007 Mar;114(3):472-9.

47

Stable over 8 years 42 - 50 AM

Kreidl KO, Lombardi L, Sakamoto DK, Singh K. *Nonprogressive glaucomatous cupping and visual field abnormalities in young Chinese males.* Ophthalmology. 2007 Mar;114(3):472-9.

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FOLLOW-UP DATA AND GUIDANCE (2011)

- Treated and untreated patients suspected of having glaucoma should be followed for several years to determine progression regardless of whether their condition is related to myopia.
- Among young Chinese myopes, the best course may be to initiate treatment "gently" [1 or 2 meds] unless or until there is demonstration of rapid progression.

<http://www.ncbi.nlm.nih.gov/pubmed/21623224>
 Kumar RS, Baskaran M, Singh K, Aung T. Clinical Characterization of Young Chinese Myopes With Optic Nerve and Visual Field Changes Resembling Glaucoma. J Glaucoma. 2011 May 26.

49

FURTHER REPORT

Key conclusions

- Optic disc rotation-VF defect correspondence may be an important prognostic factor for patients with myopic NTG for predicting progression.

(ONH hemorrhage and IOP reduction may contribute as well)

Sung MS, Kang YS, Heo H, Park SW. Optic Disc Rotation as a Clue for Predicting Visual Field Progression in Myopic Normal-Tension Glaucoma. *Ophthalmology*. 2016 May 5. pii: S0161-6420(16)30086-0. doi: 10.1016/j.ophtha.2016.03.040. [Epub ahead of print] <http://www.ncbi.nlm.nih.gov/pubmed/27157844>

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FURTHER REPORT

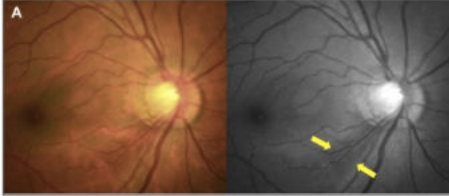
Clinical guidance

- Distinguishing between the direction of ONH rotation and corresponding or non-corresponding VF depressions may allow us to distinguish those myopic patients who are likely to progress.

Sung MS, Kang YS, Heo H, Park SW. Optic Disc Rotation as a Clue for Predicting Visual Field Progression in Myopic Normal-Tension Glaucoma. *Ophthalmology*. 2016 May 5. pii: S0161-6420(16)30086-0. doi: 10.1016/j.ophtha.2016.03.040. [Epub ahead of print] <http://www.ncbi.nlm.nih.gov/pubmed/27157844>

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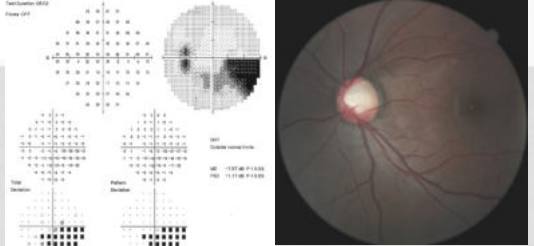
CONNECTING THE DOTS



Inferior optic disc rotation with inferior RNFL defect - and Corresponding VF depressions

www.ncbi.nlm.nih.gov/pubmed/27157844

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Note superior optic disc rotation And ST RNFL defect [Designated as ONH-VF correspondence].

* Cranial imaging was unremarkable for mass.

This configuration places this patient is at risk for progression.

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AFFIRMATION OF OPTIC DISC TILT AND VISUAL FIELD PROGRESSION IN MYOPIC GLAUCOMA

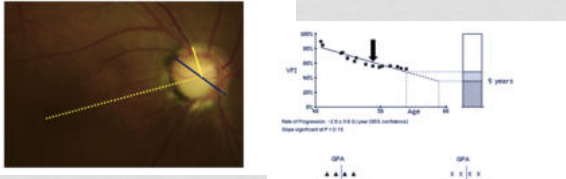
Visual Field Progression Pattern Associated With Optic Disc Tilt Morphology in Myopic Open-Angle Glaucoma

BYUNG CHUL HAN, JUN JUNG LEE, SEUNG HOON KIM, AND CHANGWON KEE

FIGURE 1. Measurement of optic disc tilt and corresponding visual field progression. The optic disc was tilted in the superior direction (blue line) and inferior direction (red line) from the horizontal line. The normal vertical meridian line was defined as the vertical line. The degree of the tilt was measured by the angle of the optic disc tilt. The progression of the visual field was defined as the region of deterioration in the superior and inferior quadrants. When the disc was tilted in the superior direction, the visual field progression was observed in the inferior quadrant. When the disc was tilted in the inferior direction, the visual field progression was observed in the superior quadrant.

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INFERIOR TILT CORRESPONDING WITH SUPERIOR VF DEPRESSIONS



Visual Field Progression Pattern Associated With Optic Disc Tilt Morphology in Myopic Open-Angle Glaucoma

BYUNG CHUL HAN, JUN JUNG LEE, SEUNG HOON KIM, AND CHANGWON KEE

FIGURE 1. Measurement of optic disc tilt and corresponding visual field progression. The optic disc was tilted in the inferior direction (blue line) and superior direction (red line) from the horizontal line. The normal vertical meridian line was defined as the vertical line. The degree of the tilt was measured by the angle of the optic disc tilt. The progression of the visual field was defined as the region of deterioration in the superior and inferior quadrants. When the disc was tilted in the inferior direction, the visual field progression was observed in the superior quadrant. When the disc was tilted in the superior direction, the visual field progression was observed in the inferior quadrant.

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FROM A FORMER STUDENT LAST MONTH

- 59 year old white female.
- H/o high myopia.
- Post-LASIK CCT 482/472.
- Dad and PGF have glaucoma.
- T_{app} at 1:44 pm: 10/11, T_{max} 17/16.

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COLOR FUNDUS PHOTORAPHY

- Discs are large and oval shaped with symmetric, moderate cup depth OU. So generalized rim thinning not really surprising.

58

Noncorresponding VF/Disc rotation = low likelihood of progression

Inferior disc rotation Inferior disc rotation

59

OCT 9/10 signal strength OD/OS.
 Inferior VF defects correspond to OCT thinning but opposite to disc appearance/direction of tilt by observation.

Inferior disc rotation Inferior disc rotation

Noncorresponding VF/Disc rotation = low likelihood of progression

60

WORLDWIDE SUPPORT FOR THE RELATIONSHIP OF MYOPIA & GLAUCOMA

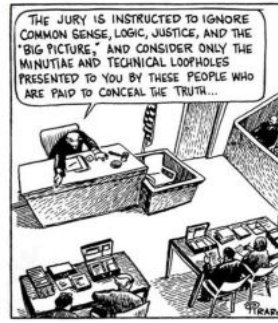
- Grødum K, Hejli A, Bengtsson B. Refractive error and glaucoma. Acta Ophthalmol Scand 2001;79:560-6. [Sweden]
- Mitchell P, Hourihan F, Sandbach J, Wang JJ. The relationship between glaucoma and myopia: the Blue Mountains Eye Study. Ophthalmology 1999;106:2010-5. [Australia]
- Suzuki Y, Iwase A, Araie M, et al. Risk factors for open-angle glaucoma in a Japanese population: the Tajimi Study. Ophthalmology 2006;113:1613-7. [Japan]
- Yoshida M, Okada E, Mizuki N, et al. Age-specific prevalence of open-angle glaucoma and its relationship to refraction among more than 60,000 asymptomatic Japanese subjects. J Clin Epidemiol 2001;54:1151-8. [Japan]

61

WORLDWIDE SUPPORT FOR THE RELATIONSHIP OF MYOPIA & GLAUCOMA

- Mastropasqua L, Lobefalo L, Mancini A, et al. Prevalence of myopia in open angle glaucoma. Eur J Ophthalmol 1992;2: 33-5. [Italy]
- Leske MC, Connell AM, Wu SY, et al. Risk factors for openangle glaucoma. The Barbados Eye Study. Arch Ophthalmol 1995;113:918-24. [Barbados]
- Perera SA, Wong TY, Tay WT, et al. Refractive error, axial dimensions, and primary open-angle glaucoma: the Singapore Malay Eye Study. Arch Ophthalmol 2010;128: 900-5. [Singapore]
- Xu L, Wang Y, Wang S, et al. High myopia and glaucoma susceptibility the Beijing Eye Study. Ophthalmology 2007;114:216-20. [China]
- Jiang X, Varma R, Wu S, et al. Baseline risk factors that predict the development of open-angle glaucoma in a population: the Los Angeles Latino Eye Study. Ophthalmology 2012;119:2245-53. [USA]

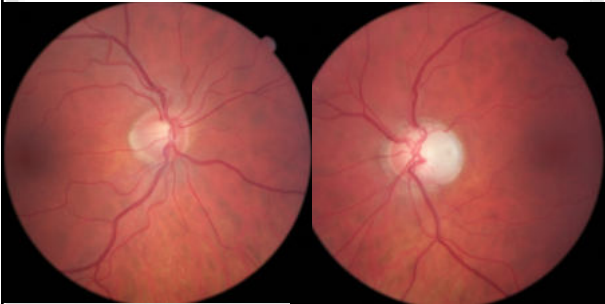
62



- Questions
- Comments

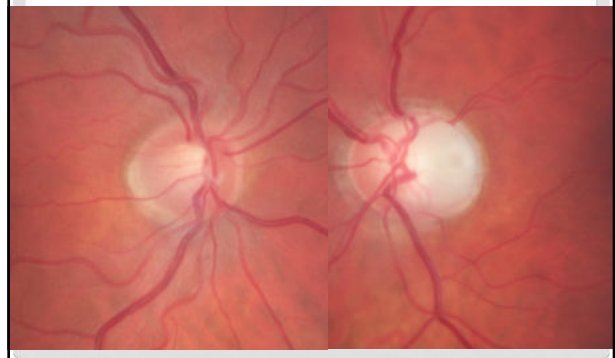
63

57 W/M -5.50 (20/20) -9.50 (5/350)



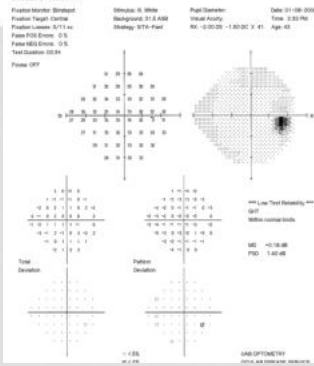
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57 W/M -5.50 (20/20) -9.50 (5/350)



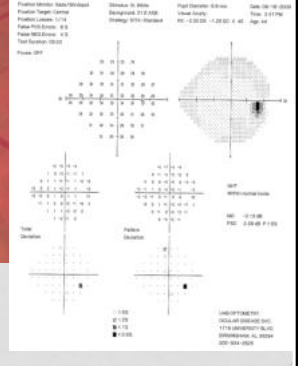
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VF - OD



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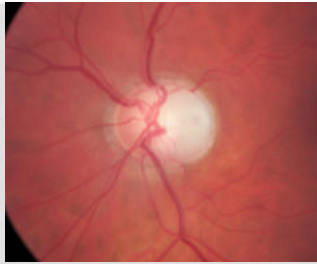
REPEAT



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**FINAL EXAM QUESTION 64
(POSTERIOR SEGMENT OPT-225)**

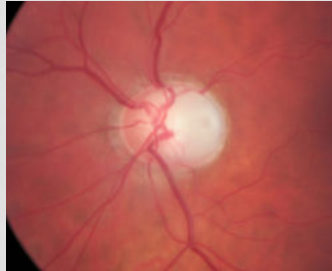
A. Glaucoma
B. Coloboma
C. Staphyloma
D. Melanoma



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**FINAL EXAM QUESTION 31
(GLAUCOMA OPT-314)**

A. Glaucoma
B. Coloboma
C. Staphyloma
D. Melanoma



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Myopia as a Risk Factor for Open-Angle Glaucoma: A Systematic Review and Meta-Analysis

Michael W. Mosen, MS,¹ Margaret M. de Vries, MD,¹ Francisco G. Janoy Montolio, MD,¹ Nanda M. Janowitz, MD, PhD^{2,3}

WHAT IS THE RELATIONSHIP BETWEEN MYOPIA AND GLAUCOMA (2011)

Objective: To determine the association between myopia and open-angle glaucoma.
Design: Systematic review and meta-analysis of observational studies.
Participants: Thirteen studies involving 48 151 individuals.
Methods: Articles published between 1964 and 2010 were identified in PubMed, Embase, and reference lists. Study-specific odds ratios (ORs) were pooled using a random effects model.
Main Outcome Measure: Odds ratios with 95% confidence intervals (CIs) of myopia as a risk factor for open-angle glaucoma.
Results: Data from 11 population-based cross-sectional studies were included in the main analyses. The pooled OR of the association between myopia and glaucoma based on 11 risk estimates was 1.82 (95% CI, 1.54-2.20). On the basis of 7 risk estimates, the pooled ORs of the associations between low myopia (myopia up to -3 D) and glaucoma and between high myopia (>-3 D myopia) and glaucoma were 1.65 (1.26-2.17) and 2.46 (1.58-3.94), respectively. There was considerable heterogeneity among studies that reported an association between any myopia and glaucoma ($I^2=53%$) and low myopia and glaucoma ($I^2=29%$), but not for high myopia and glaucoma ($I^2=0%$). After omitting studies that contributed significantly to the heterogeneity, the pooled ORs were 1.88 (1.60-2.20) for any myopia and glaucoma and 1.77 (1.41-2.23) for low myopia and glaucoma.
Conclusions: Individuals with myopia have an increased risk of developing open-angle glaucoma.

Conclusion: Individuals with myopia have an increased risk of developing open-angle glaucoma.

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- Questions
- Comments

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GLAUCOMA SUSPECT
THIS CASE APPEARED IN PCON FEBRUARY 2-14

CBLs

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33 F (NURSE)

- Referred to UAB Eye Care as a glaucoma suspect
- Medical history non-contributory
- Family history positive for "glaucoma"
- Ocular history: refractive correction and mention of amblyopia.
-

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33 F (NURSE)

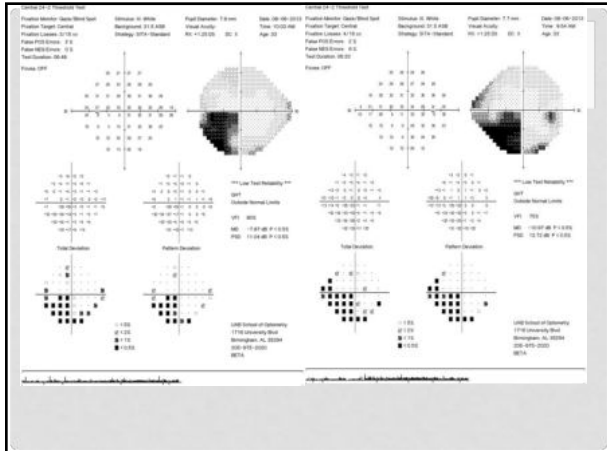
- BSCVA 20/20 OD, OS. Minimal hyperopic refraction
- IOP: 16 mm Hg OD and 18 mm Hg OS
- Pachymetry: 567 microns OD and 562 microns OS
- Angles open with visible CB 360 OS, OS
- Anterior segment unremarkable

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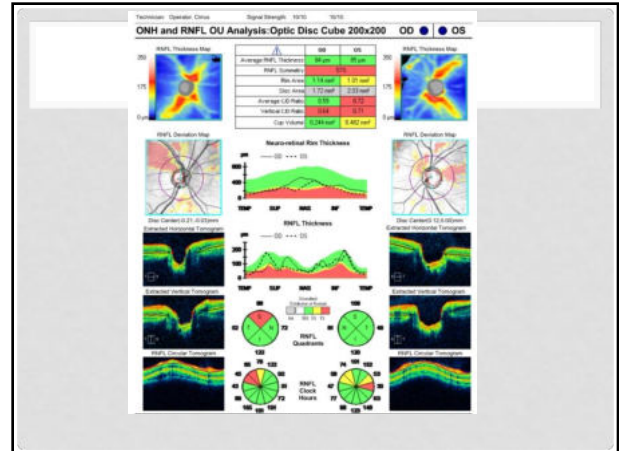


Which ONH looks more suspicious?

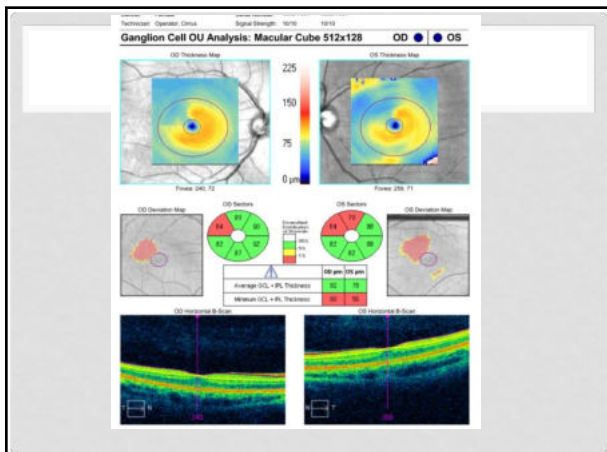
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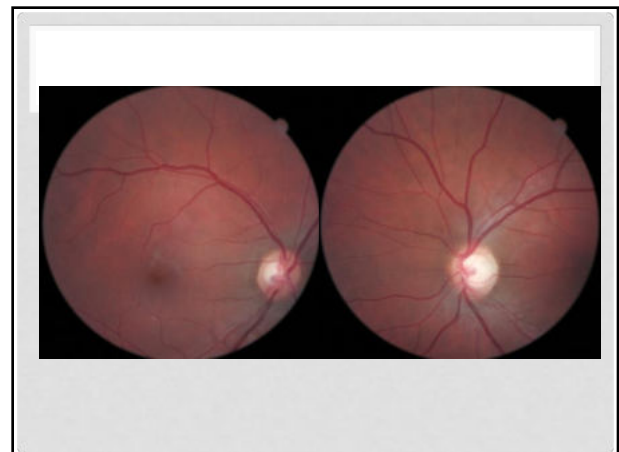
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RADIOLOGY INTERPRETATION

"Right peritrigonal*
leucomalacia which is most likely developmental causing a left homonymous inferior quadrant defect. She is completely stable."
-MSV

*posterior aspect of the lateral ventricles



Liauw L, van der Grand J, Slooff V, et al. Differentiation between peritrigonal terminal zones and hypoxic ischemic white matter injury on MRI. Eur J Radiol. 2008 Mar;65(3):395-401.

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Past / Present Ocular History			Date Diagnosed
Glaucoma	Negative	(mid-50s WM)	
Cataracts	Negative		
Age-Related Macular Degeneration	Negative		
Eye Injury	Negative		
Retinal Disease	Lattice Degeneration OU		
Other Disease	Negative		
Blindness	Negative		
Strabismus	Negative		
Amblyopia	Negative		
Diabetes	Negative		
Dry Eye	Negative		
Refractive	Glasses Full-time		
Other	H/o transient dipl/intermittant dipl, resolved (spectacle adjustment)		

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Social History	
Drugs	None
Alcohol	None
Occupation	Engineer (currently unemployed)
Hobbies	Writer, Musician, Woodworker
Tobacco	Quit smoking 3 yrs ago, uses Nicotine lozenges
Smoking Status	Former smoker

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Family History	
Glaucoma	Negative
Cataracts	Mother, Father
ARMD	Negative
Eye Injury	Negative
Retinal Disease	Negative
Other Disease	Negative
Blindness	Negative
Strabismus	Sister - DV, wears prism in glasses
Amblyopia	Negative
Diabetes	Negative
Cancer	MGM - skin
Heart Disease	Negative
Hypertension	Negative
High Cholesterol	Negative
Kidney Disease	Negative
Stroke	Negative

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OPHTHALMIC FINDINGS

(MID-50S WM)

- BSCVA 20/20 20/20
- -2.25 - 0.50 X 090 -2.50-0.75X 090
- Pupils - normally reactive w/o RAPD
- IOP history (Goldmann)
 - 13/14 (4/24/2014)
 - 16/15 (7/22/2014)
- Pachymetry: 587u, 586u
- Anterior segment - unremarkable
- ACA - open; AC - D&Q

85

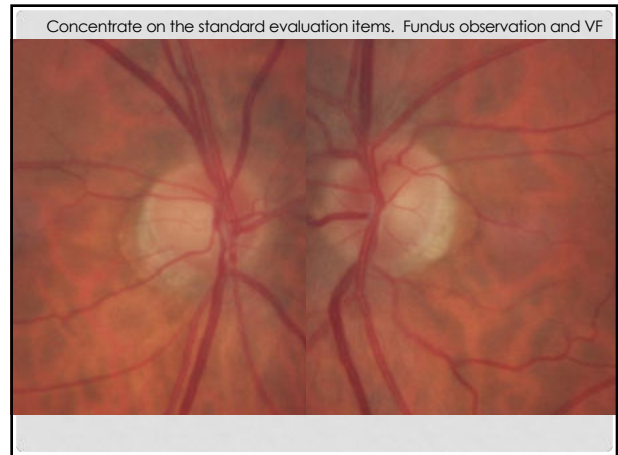
Medications				
Date	Name	Strength	Form	S I C
4/21/2014	Advil			
6/9/2010	Ibuprofen			
4/24/2014	Zyrtec	10 mg	Add'l Sig	

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OPHTHALMIC FINDINGS

- Lens (LOCSIII) : NO 1 / NC2 CS 0 PSC 0 (OD = OS)
- Optic disc
- VF
- OCT
- What do you expect?

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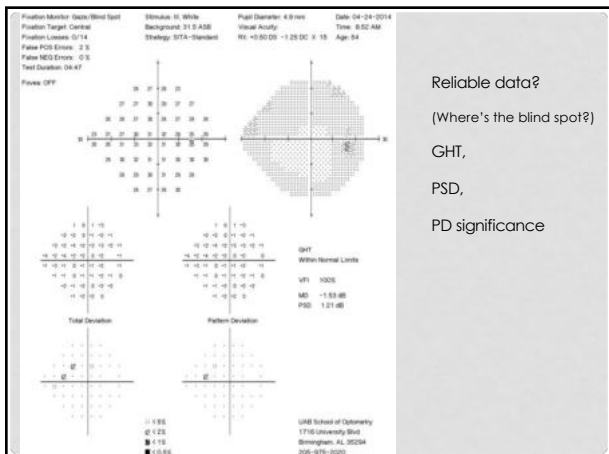
WHAT ARE YOUR OBSERVATIONS OF THE ONHS

89

WHAT ARE YOUR OBSERVATIONS OF THE ONHS

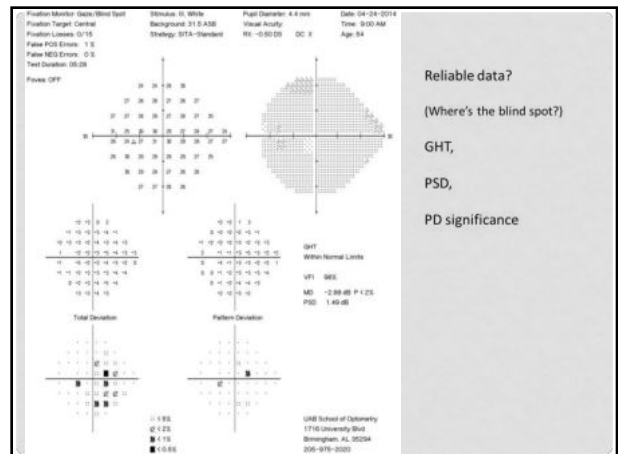
- Small
- Temporal crescent consistent with RE
- OBL insertion OS > OD
- Inferior notch OD > OS
- β -zone PPA (OD where rim tissue is thinnest; OS greater temporally than inferiorly)

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Reliable data?
 (Where's the blind spot?)
 GHT,
 PSD,
 PD significance

91



Reliable data?
 (Where's the blind spot?)
 GHT,
 PSD,
 PD significance

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WHAT IS YOUR INTERPRETATION OF THE VF

<ul style="list-style-type: none"> • Right <ul style="list-style-type: none"> • Correct test • Correct eye • Appropriate correction • Reliable data • GHT – WNL • PSD – not flagged • PD significance – no clusters in areas suspicious for glaucoma 	<ul style="list-style-type: none"> • Left <ul style="list-style-type: none"> • Correct test • Correct eye • Appropriate correction • Reliable data • GHT – WNL • PSD – not flagged • PD significance – ? clusters in areas suspicious for glaucoma
---	---

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ONH and RNFL OU Analysis-Optic Disc Cube 200x200

	OD	OS
Average RNFL Thickness	112 µm	111 µm
Min RNFL Thickness	52 µm	52 µm
Average Neuro-retinal Rim Thickness	0.87 mm	0.87 mm
Min Neuro-retinal Rim Thickness	0.43 mm	0.43 mm
Cap Volume	0.995 ml	0.942 ml

Good scan quality
 Note segmentation markers
 ← Symmetry
 ← Ave RNFL thickness
 ← ONH size C/D!
 ← Disc margin
 Note RNFL "defects."
 RNFL profile
 Clock-hour portrayal may be deceiving!

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Ganglion Cell OU Analysis: Macular Cube 512x128

	OD	OS
Average GCL + RNFL Thickness	108 µm	108 µm
Minimum GCL + RNFL Thickness	75 µm	75 µm

Excellent scan quality
 Note the island of GCC thinning IT OD that corresponds to RNFL defect.
 And, RNFL average sectors are within reference range.

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OCT AND GLAUCOMA

- Utility
 - Confirming or ruling out the diagnosis of glaucoma
 - Monitoring progression
- Capabilities
 - RNFL thickness*
 - ONH profile
 - ONH "topography"
 - Macular RNFL**

96

96

EMERGING TRENDS IN GCC FOR GLAUCOMA

Sakamoto A, et al. 3-D Imaging of the Macular RNFL in Glaucoma with SD OCT. (Invest Ophthalmol Vis Sci. 2010;51:5062–5070.

97

EMERGING TRENDS IN GCC FOR GLAUCOMA

Sakamoto A, et al. 3-D Imaging of the Macular RNFL in Glaucoma with SD OCT. (Invest Ophthalmol Vis Sci. 2010;51:5062–5070.

98

Support of horizontal raphe sign for progression

- Bak E, et al. Preperimetric Open Angle Glaucoma with Young Age of Onset: Natural Clinical Course and Risk Factors for Progression. *Am J Ophthalmol.* **2020 Mar** 25;S0002-9394(20)30126-4.
- Shin JW, et al. Ganglion Cell-Inner Plexiform Layer Change Detected by Optical Coherence Tomography Indicates Progression in Advanced Glaucoma. *Ophthalmology.* 2017. Oct;124(10):1466-1474.
- Kim KE, et al. Long-term follow-up in preperimetric open-angle glaucoma: progression rates and associated factors. *Am J Ophthalmol.* 2015 Jan;159(1):160-8.e1-2.
- Yu M, et al. Risk of Visual Field Progression in Glaucoma Patients with Progressive Retinal Nerve Fiber Layer Thinning: A 5-Year Prospective Study. *Ophthalmology.* 2016. Jun;123(6):1201-10.

99

WHAT ARE OUR NEXT STEPS?

100

WHAT ARE OUR NEXT STEPS?

- Reviewing the data
 - Good VA
 - (-) family history of glaucoma
 - ? SAS / (+) heart murmur // no beta-blocker meds.
 - Normal IOP
- Apparently clean VF
- Evidence of ONH / RNFL damage

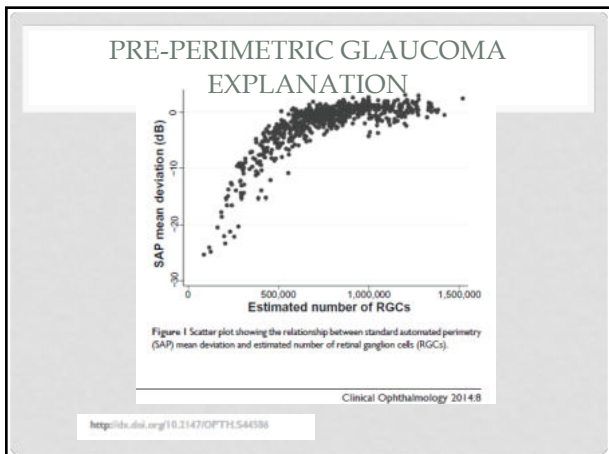
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DIAGNOSTIC LABELING



- Glaucoma suspect
- Glaucoma
- Pre-perimetric glaucoma
- OHT

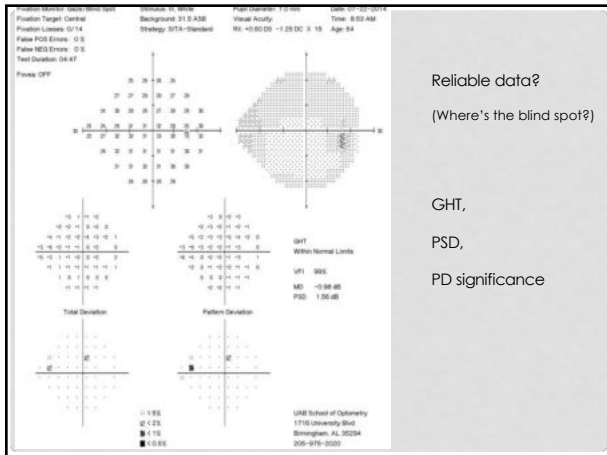
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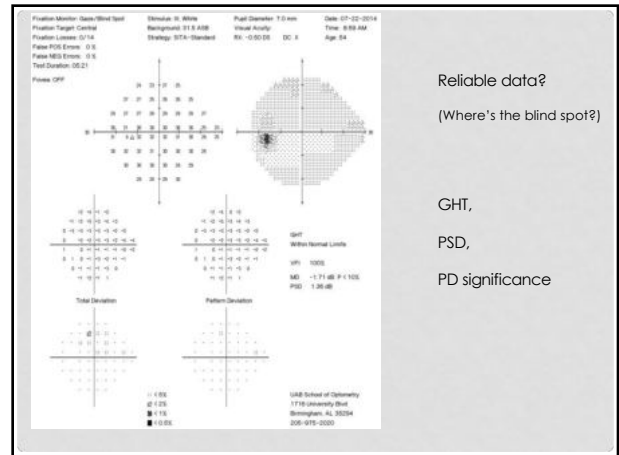
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REPEAT THE VISUAL FIELD !!!

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WHAT IS YOUR INTERPRETATION OF THE VF

- Right
 - Correct test
 - Correct eye
 - Appropriate correction
- Left
 - Correct test
 - Correct eye
 - Appropriate correction
- Reliable data
- GHT – WNL
- PSD – not flagged
- PD significance – ? cluster in nasal step region

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RECONCILING THE DATA-OD

Recall the RNFL profile

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CORRELATING THE DATA-OS

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MANAGEMENT

- Critical questions
 - Degree of damage
 - Burden of treatment
 - Life span

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MANAGEMENT

- Critical questions
 - Degree of damage
 - Burden of treatment
 - Life span
- No treatment at this time
- Follow, repeating all tests X 6 mo
- ? Alternatives?

111

MOST RECENT VISIT

- IOP = 19/20
- Updated disrupted sleep status – diagnosed with SAS and using CPAP device. Reportedly, “...feeling much better.”
- Does this change our thinking?

112

- Questions
- Comments

Got up at 5am, 8km run completed, came back prepared a vegetable smoothie for breakfast.... Don't remember the rest of the dream....

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RS 70S W F

FOLLOWED AS GLAUCOMA SUSPECT X 7 YEARS

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RS - FOLLOWED X 7 YRS

- Non-contributory medical and family histories
- IOP averages 23 (narrow range: 2-3 mm fluctuation)
- DDX?
 - Glaucoma suspect
 - Ocular hypertensive

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BASELINE PHOTOS



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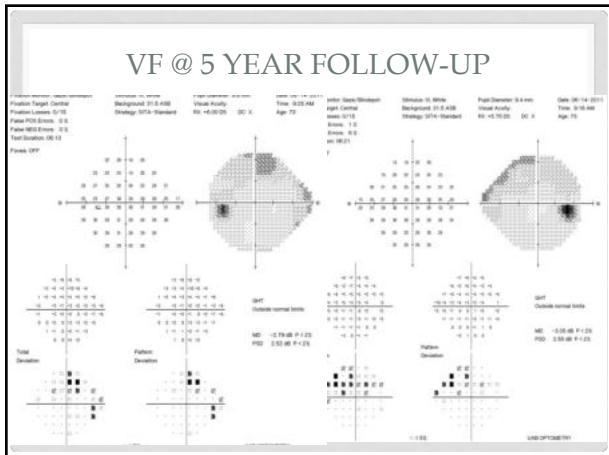
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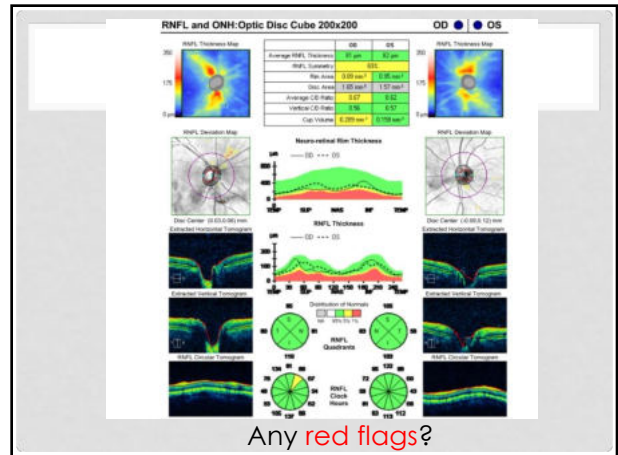
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And this just in . . .

Journal Pre-proof
 The Weiss ring, a major confounding factor for measurements of peripapillary retinal nerve fiber layer thickness
 PII: S0002-9394(22)00003-4
 DOI: <https://doi.org/10.1016/j.ajo.2022.01.001>

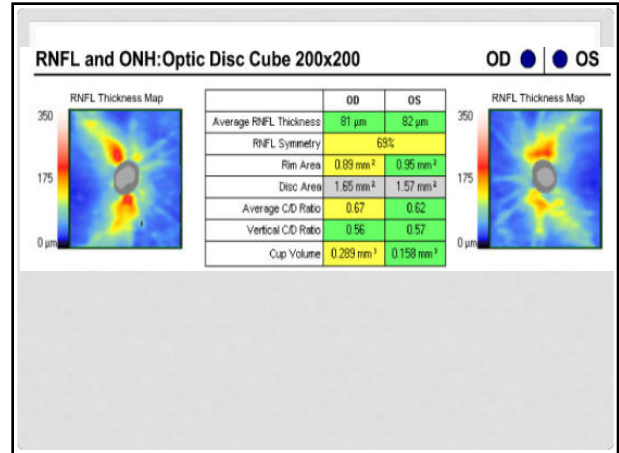
To appear in: *American Journal of Ophthalmology*

Accepted date: January 1, 2022

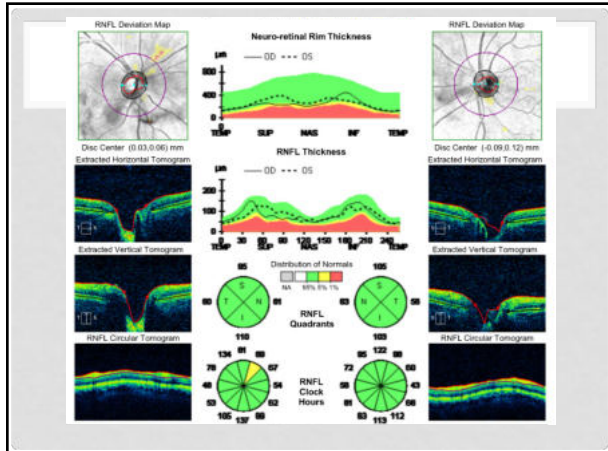
Highlights

Eyes with a Weiss ring showed thinner mean and inferior pRNFL thicknesses than normal controls, which could be a major confounding factor for analyses of pRNFL changes, especially in glaucoma patients.

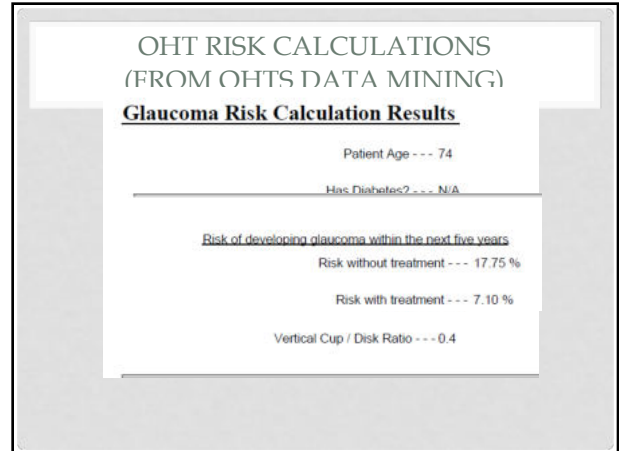
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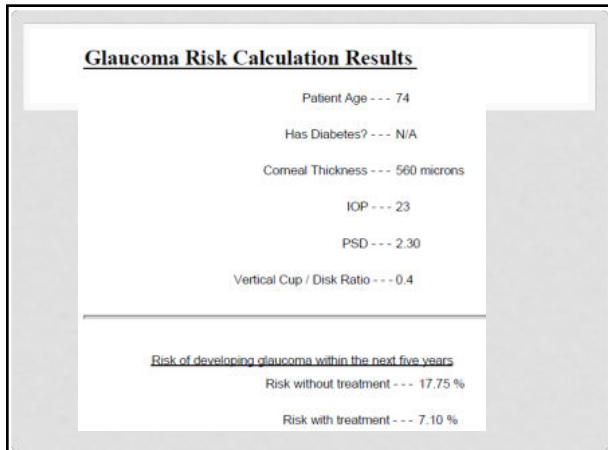
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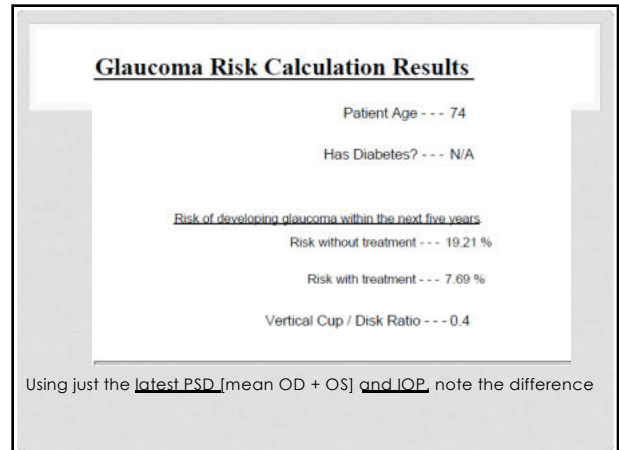
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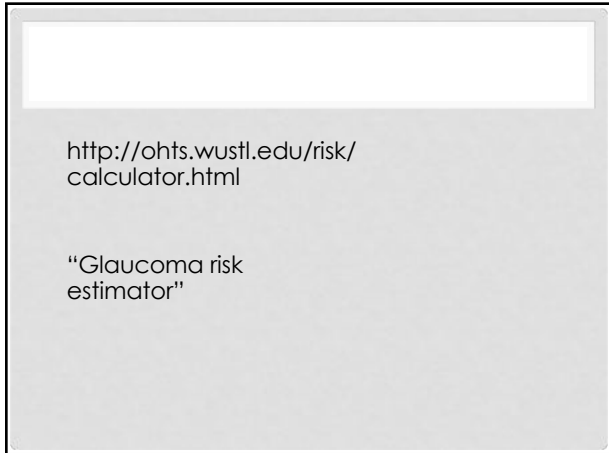
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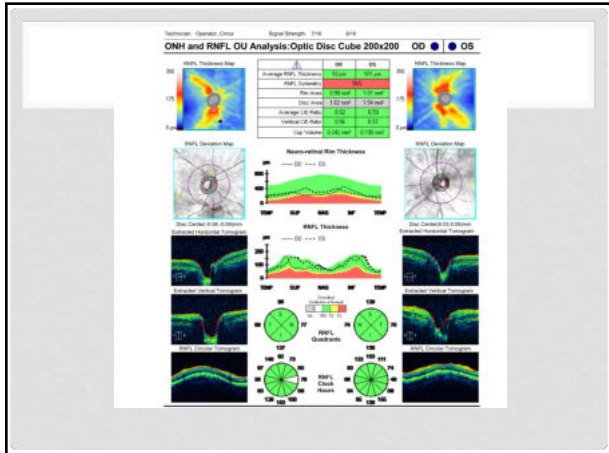
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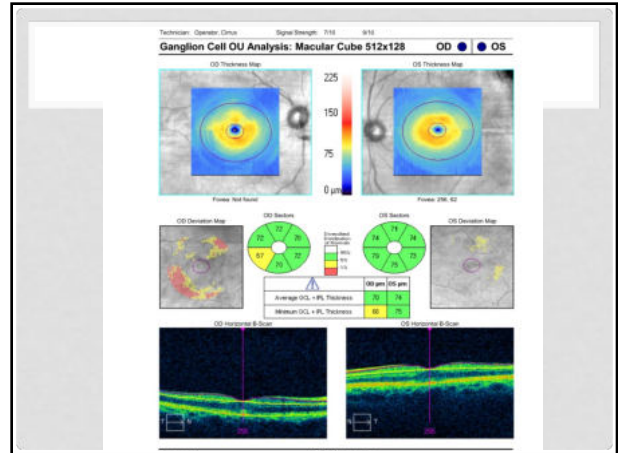
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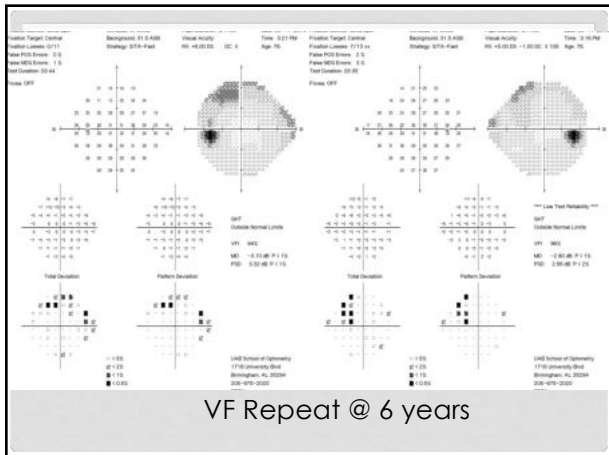
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OHT FOLLOW-UP - MOST RECENT

- Treatment option offered and pt started on PGA ghs
- F/U @ 2 weeks IOP = 16mm Hg in each eye.
- Continued on treatment with low teens IOP

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OHT 20-YEAR FOLLOW

Assessment of Cumulative Incidence and Severity of Primary Open-Angle Glaucoma Among Participants in the Ocular Hypertension Treatment Study After 20 Years of Follow-up The Ocular Hypertension Study Group

JAMA Ophthalmol. 2021;139(5):558-566. doi:10.1001/jamaophthalmol.2021.0341
Published online April 15, 2021. Corrected on July 22, 2021.

Twenty-year cumulative incidence and severity of POAG in 1 or both eyes after adjustment for exposure time.

CONCLUSIONS AND RELEVANCE In this study, only one-fourth of participants in the OHTS developed visual field loss in either eye over long-term follow-up. This information, together with a prediction model, may help clinicians and patients make informed personalized decisions about the management of ocular hypertension.

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2-minute drill

- While elevated IOP is the #1 risk for glaucoma, reduced ONH perfusion, SAS and RE> -6.00 all may contribute.
- Stereoscopic ONH evaluation/documentation and VF testing is Standard, electrodiagnostic testing is not.
- There is a spectrum of considerations when offering a treatment recommendation.
- OHT is defined as normal discs and fields.
- Ganglion-cell counts (thickness) are emerging as the earliest sign of glaucoma (structural).
- The three parameters from VF testing to support/refute a DX of glaucoma are PSD, GHT, PD significance.
- Corneal hysteresis is an amplification of CCT.
- AION and glaucoma may be related structurally but not temporally.
- CCT, IOP, family history are all significant as risks for glaucoma.
- Thinner CCT has been established as a risk for glaucoma as well as conversion from OHT to glaucoma.

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2-minute drill

- Asians are the most likely group to have suspicious but stable ONH appearance.
- Repeating the VF remains important to establish a DX of glaucoma.
- The "glaucoma risk calculator" uses PSD from VF, not MD.
- The "glaucoma risk calculator" is for estimating the risk of converting from OHT to OAG.
- Congenital white-matter lesions can produce VF defects that may mimic glaucoma.
- OCT is adjunctive to disc and VF evaluation.
- Having good data for the VF is essential to interpretation.
- Ganglion-cell patterns of raphe respect is an important early sign of glaucoma damage.
- Retinal detachment repair is not a risk for glaucoma.
- Stable ganglion-cell measurements are an important indicator of stability among OAG and GS

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THANK YOU

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