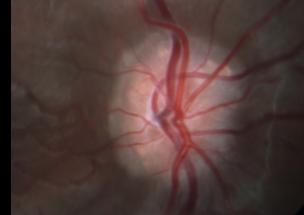
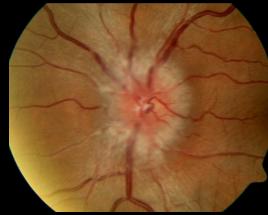


OCT in Neuro-ophthalmic Disorders: Papilledema, Pseudopapilledema, MS & Other Neurodegenerative Diseases



Leonard V. Messner, OD, FAAO

Professor of Optometry

Vice President for Strategy & Institutional

Advancement

Illinois College of Optometry



1

Disclosure Statement:

- King-Devick Technologies (scientific advisory board)
- Heidelberg Engineering (professional advisory board)
- Horizon Therapeutics (professional advisory board)

2

Key Points

- OCT analysis of papilledema vs. pseudopapilledema
- OCT analysis of chiasmal & retrochiasmal lesions
- OCT in neurodegenerative disease
 - Multiple sclerosis
 - Parkinson's disease
 - Alzheimer's disease
 - TBI

3

Definition of Papilledema

- Swelling and elevation of the optic nerves due to elevated intracranial pressure (ICP)

4

Definition of Pseudopapilledema

- An anomalous elevation of one or both optic nerve without optic disc swelling and typically with a small or absent optic cup (may or may not be associated with optic disc drusen)

5

Stages of Papilledema (Frisén Grading Scale)

6

Grade I

- C-shaped halo of optic disc edema with sparing of the temporal papillomacular bundle fibers



7

Grade II

- Circumferential halo of optic disc edema



8

Grade III

- All of Grade II findings + obscuration of major vessels as they leave the disc



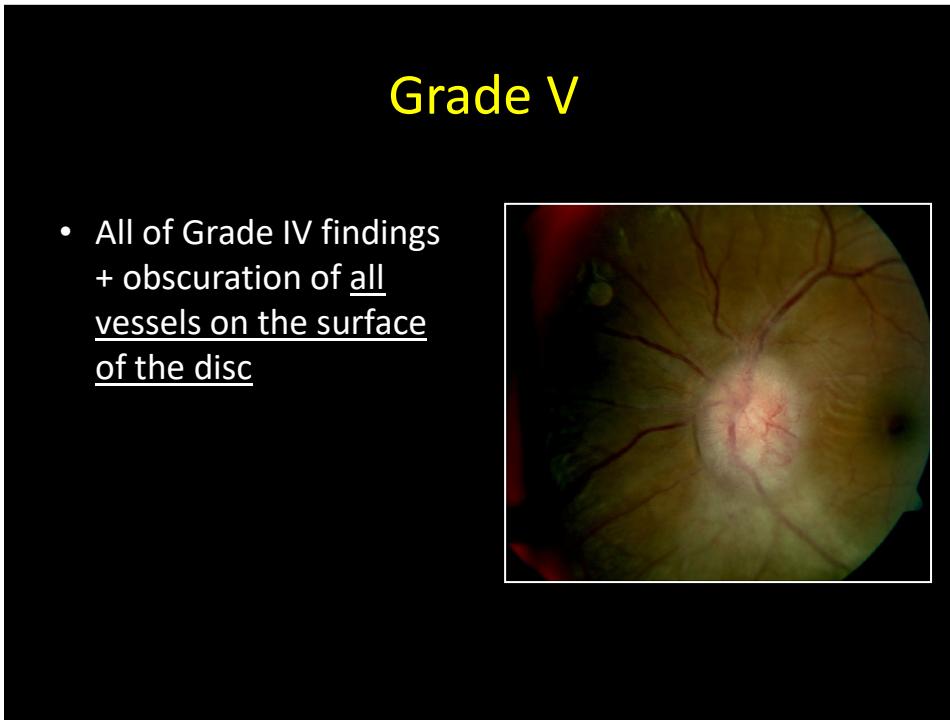
9

Grade IV

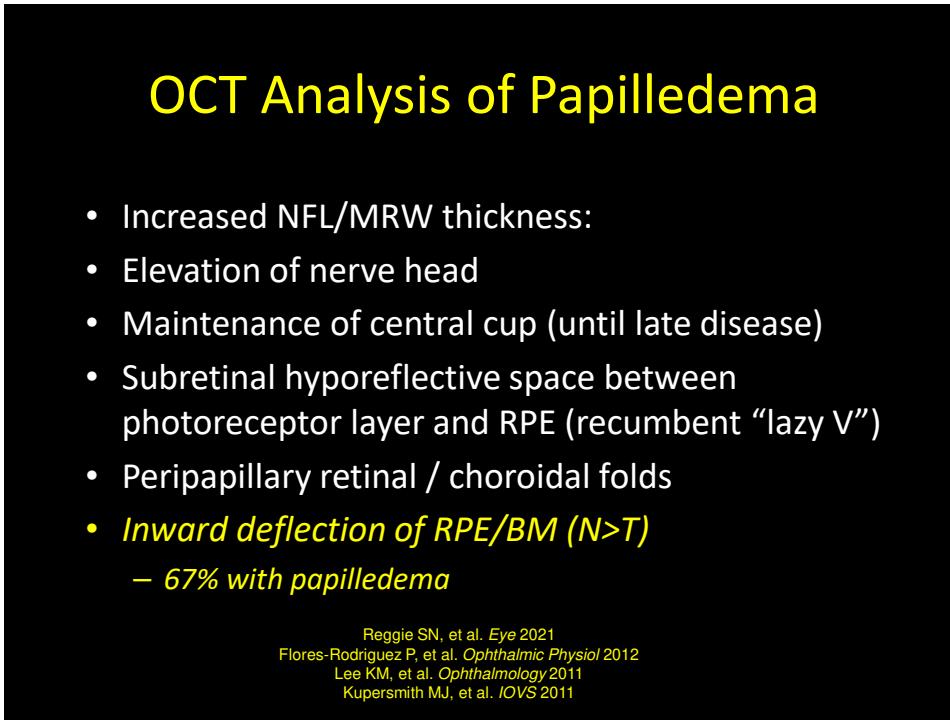
- All of Grade III findings + obscuration of major vessels on the surface of the disc



10

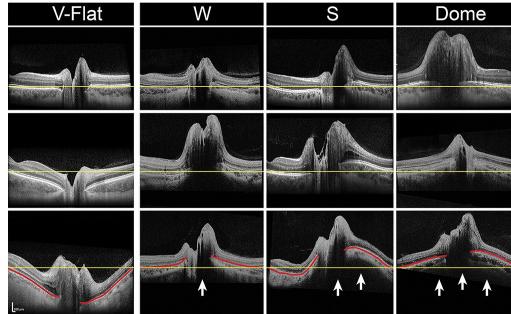


11



12

Patterns of Bruchs Membrane Line (BML) Deflection



Peripapillary shape patterns on transverse axial OCT (10°, 5° vertically scaled, left side of each image temporal to the disc). Shapes are defined by the conglomeration of Bruch's membrane line (BML) illustrated in bottom row with a red line relative to horizontal yellow line that connects the peripheral ends of BML. The most frequent pattern (V-Flat column) is a common that falls between an F (flat) shape and V-shape that lies in or entirely below the horizontal reference line. There are 3, common overlapping, shape patterns associated with anterior deflection or displacement (columns WSDome). The W-shape consists of symmetrical anterior deflection (toward the vitreous) of the inner margins of the BML. The S-shape is anteriorly displaced toward the vitreous nasal above the reference line, and posteriorly displaced temporally, below the horizontal reference line that tilts Bruch's membrane opening. The D or dome shape is a broad-based symmetrical, anterior displacement of the peripapillary BML above the horizontal reference line. The white arrows depict the forces acting on the optic nerve head that presumably give rise to these shape patterns. OCT, optical coherence tomography.

Sibony P, et al. J Neuro-Ophthalmol 2021

13

32 y/o AA Woman

- C/o progressive headaches am > pm
- BMI: 41
- BVA:
 - 20/20 OD
 - 20/20 OS

14



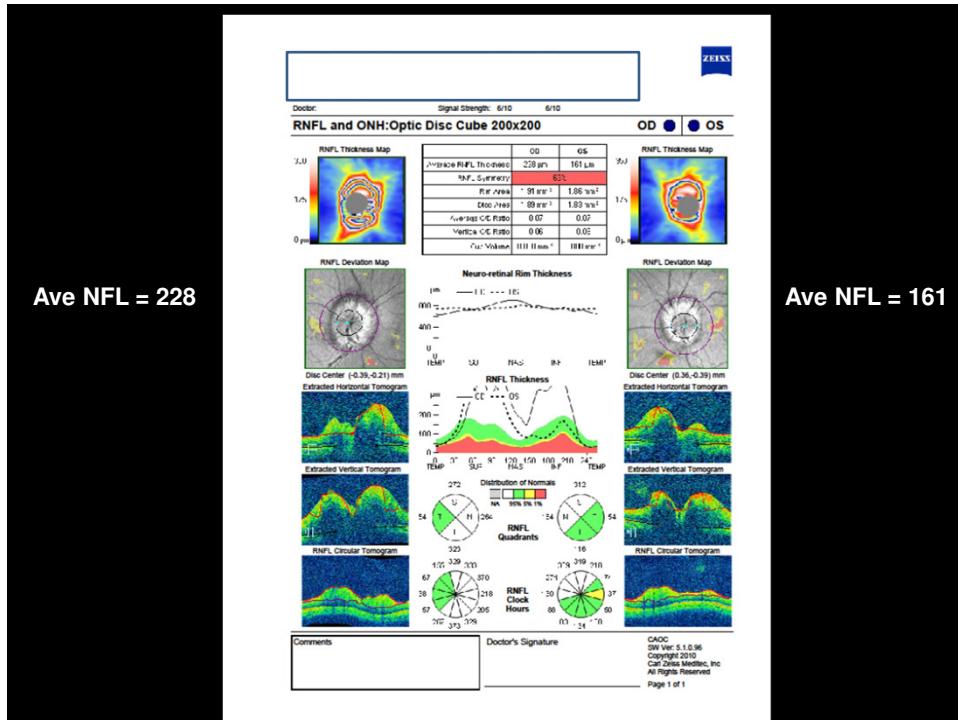
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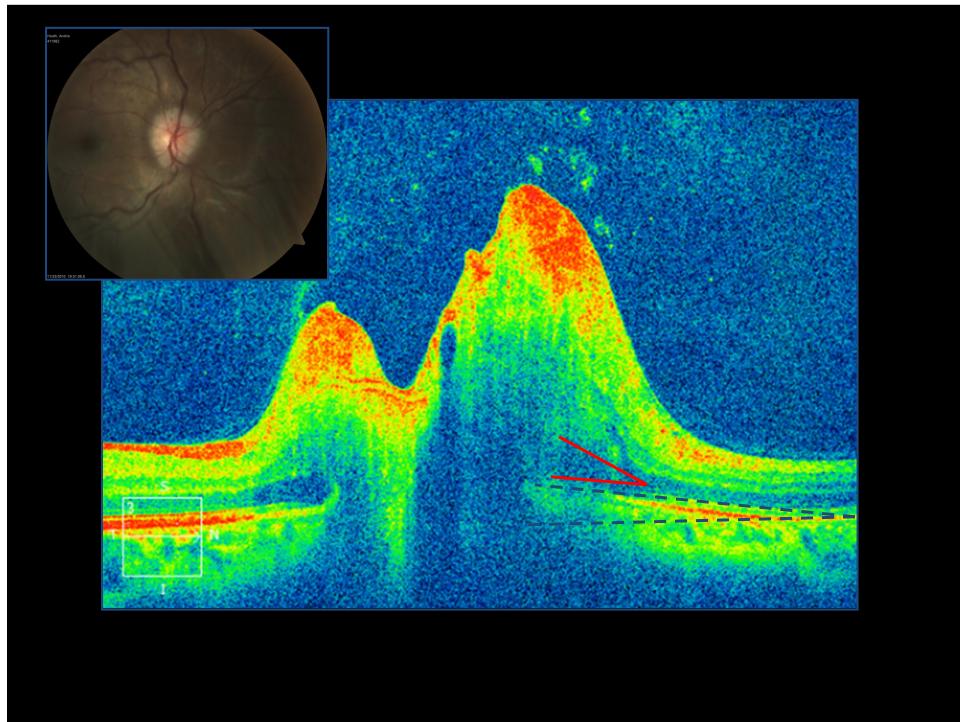
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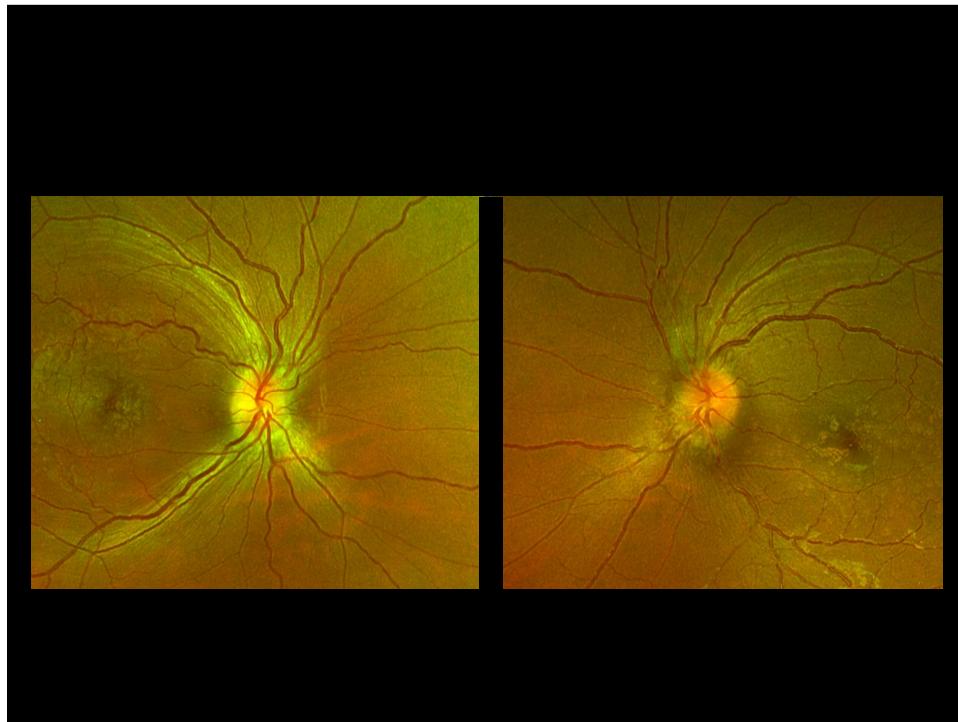


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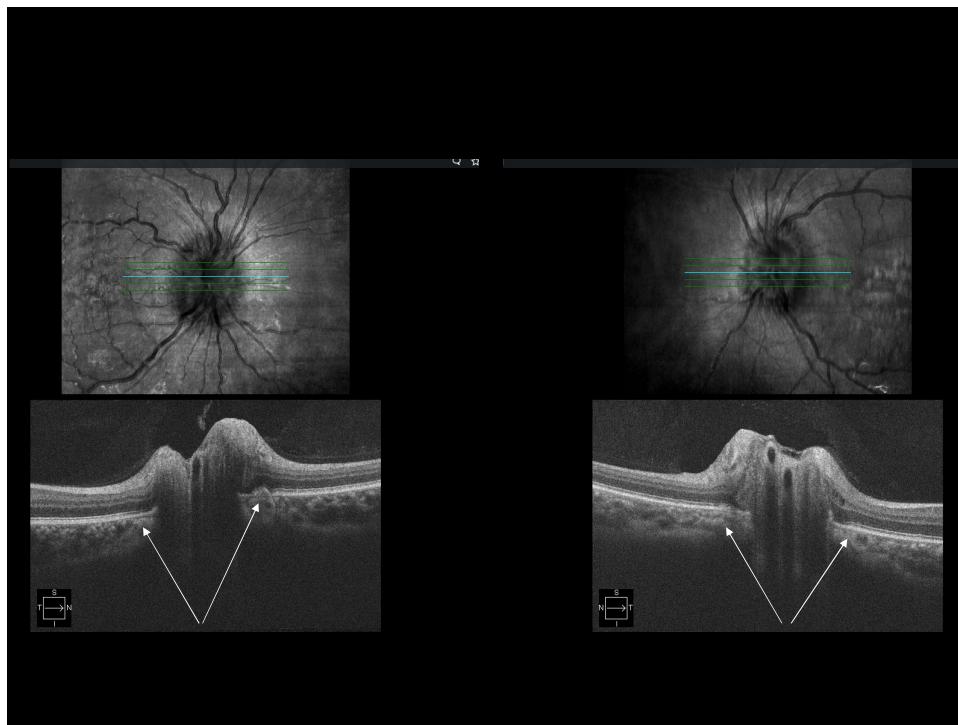
29 y/o AA Woman

- C/o progressive headaches
- + SPT
- BMI: 36
- BVA:
 - 20/20 OD
 - 20/20 OS

20



21

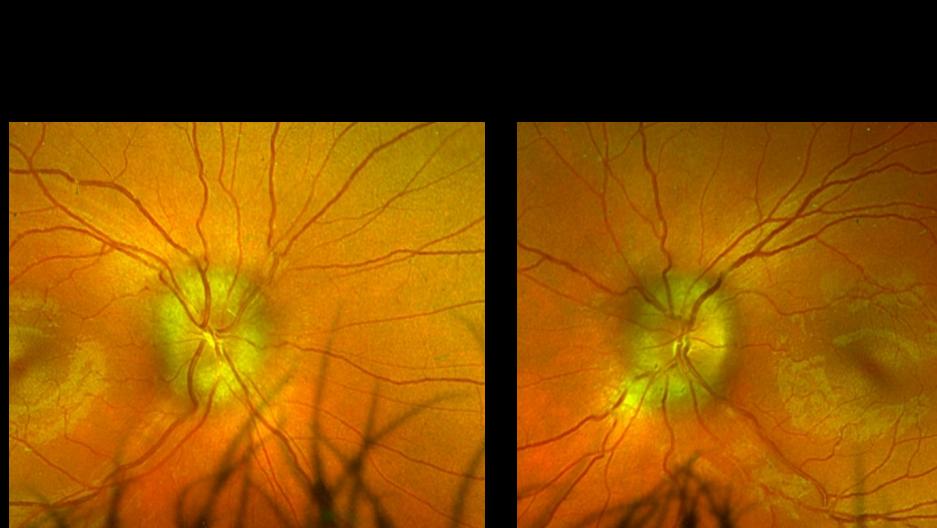


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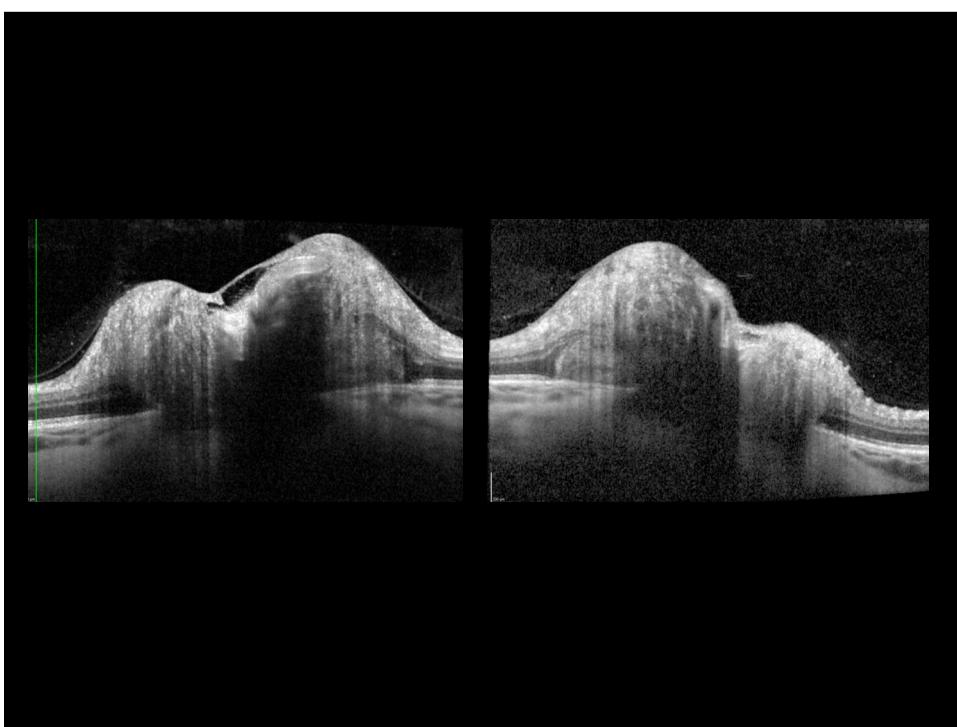
28 y/o AA Woman

- C/o chronic daily headaches
- + synchronous pulsatile tinnitus
- BMI: 39
- BVA:
 - 20/20 OD
 - 20/20 OS

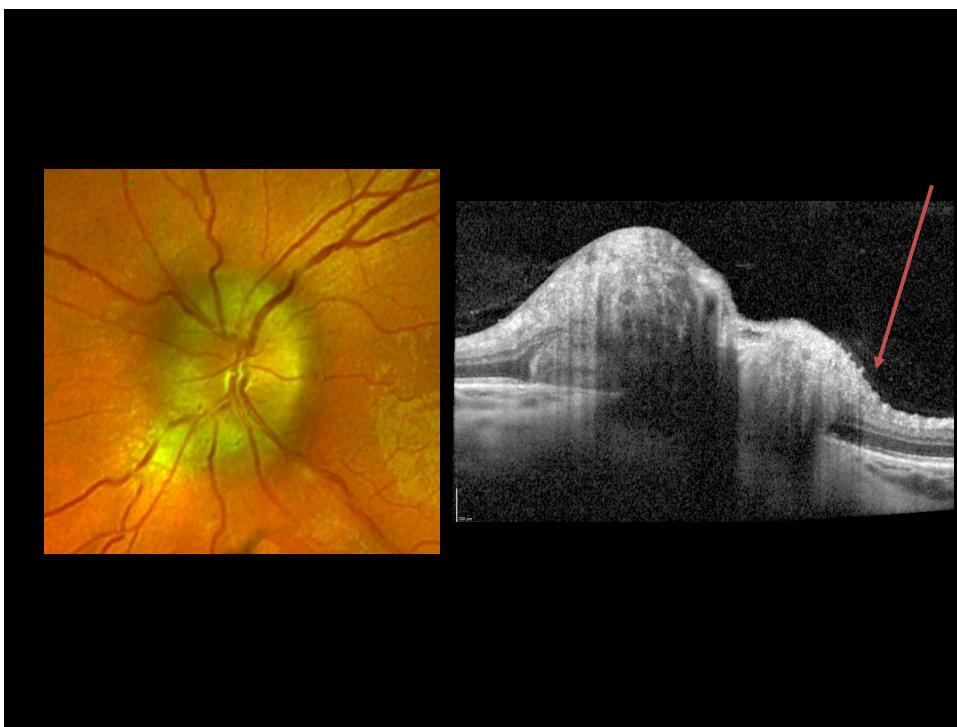
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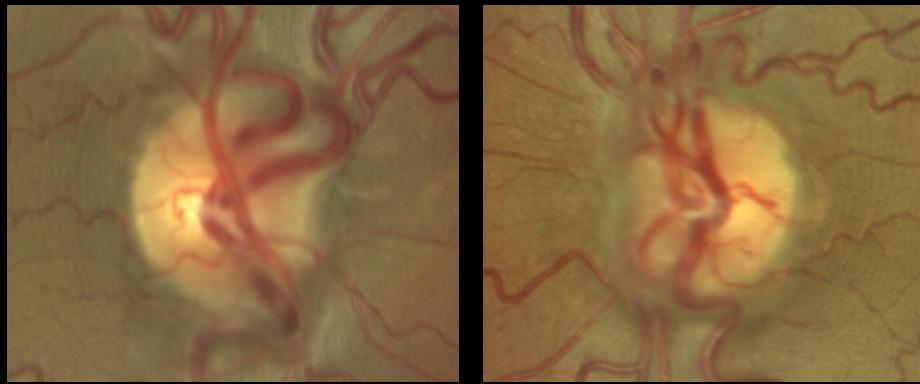


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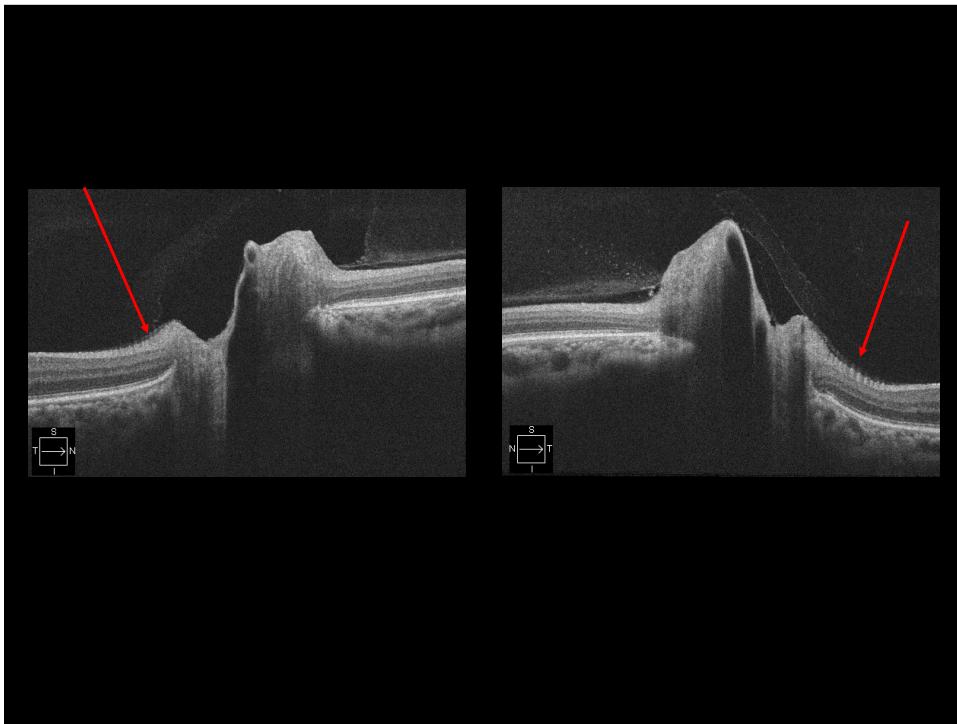
41 y/o AA Woman

- C/o chronic daily headaches
- + SPT
- BMI: 46
- BVA:
 - 20/20 OD
 - 20/20 OS

27



28

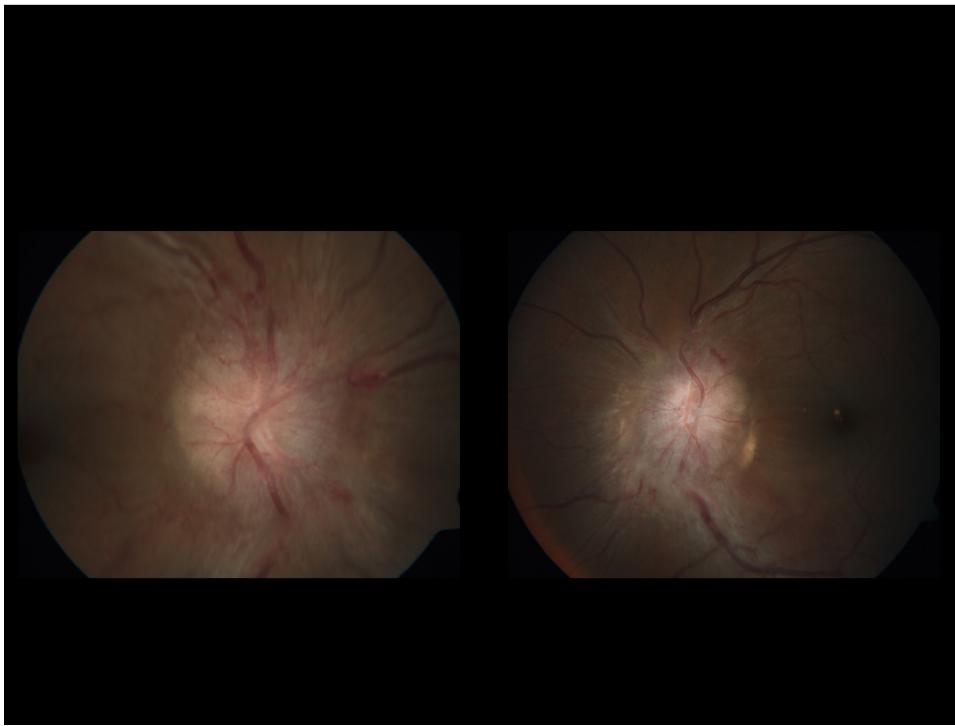


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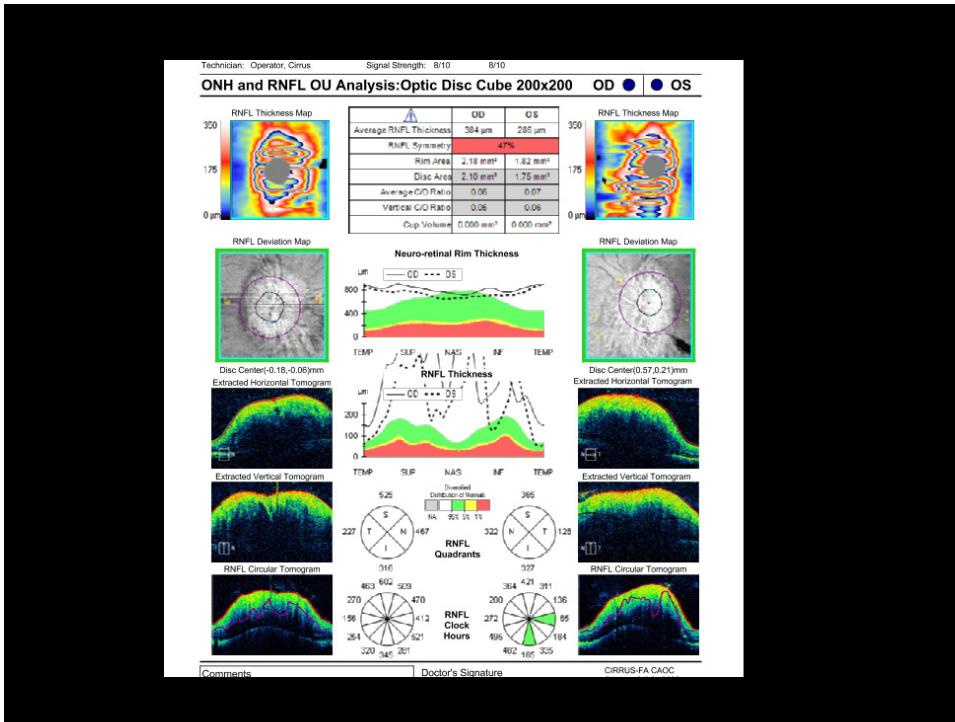
40 y/o AA Woman

- C/o chronic daily HAs
- + SPT
- BMI = 44
- BVA:
 - 20/40 OD
 - 20/40 OS

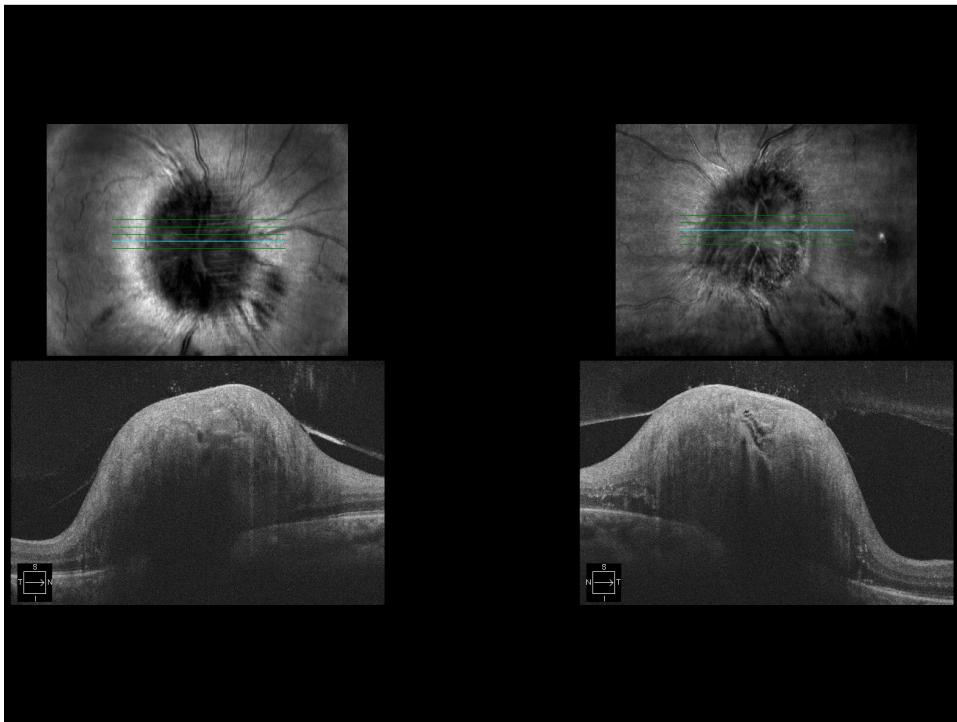
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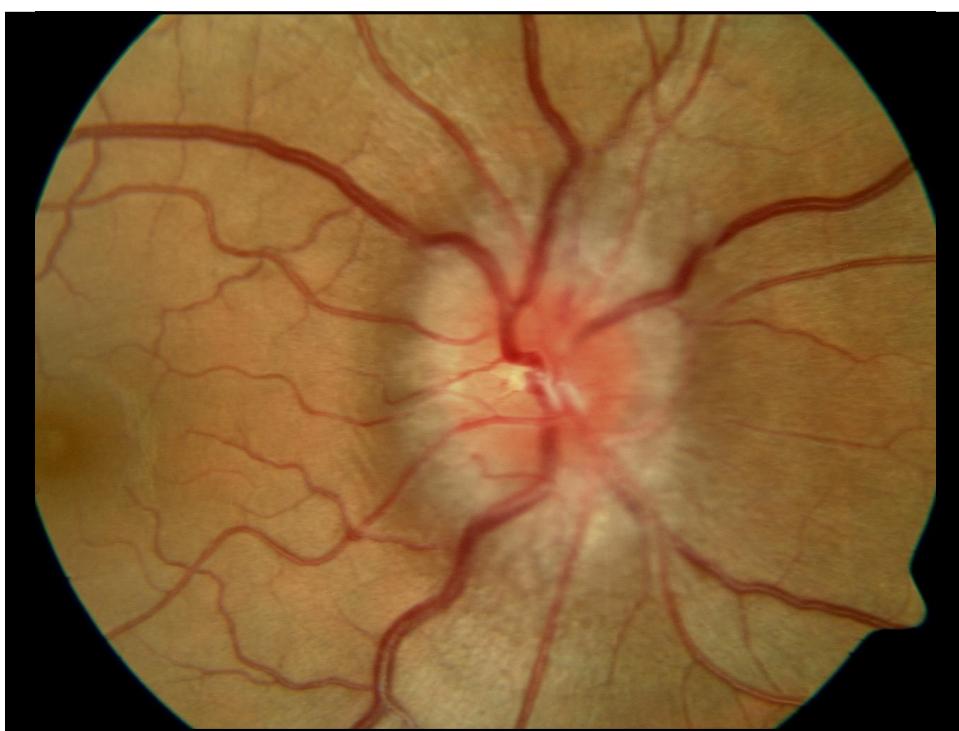


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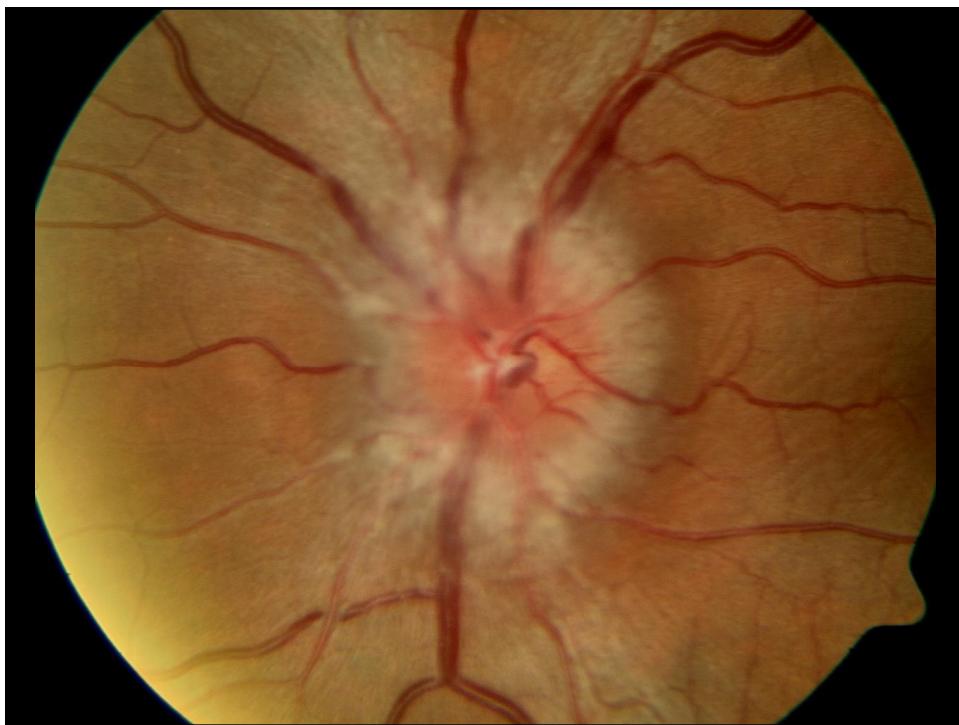
32 y/o Hispanic Woman

- c/o progressive, debilitating headaches x 2 mos.
- Normal neurologic exam
- BVA:
 - 20/20 OD
 - 20/20 OS
- BMI: 38

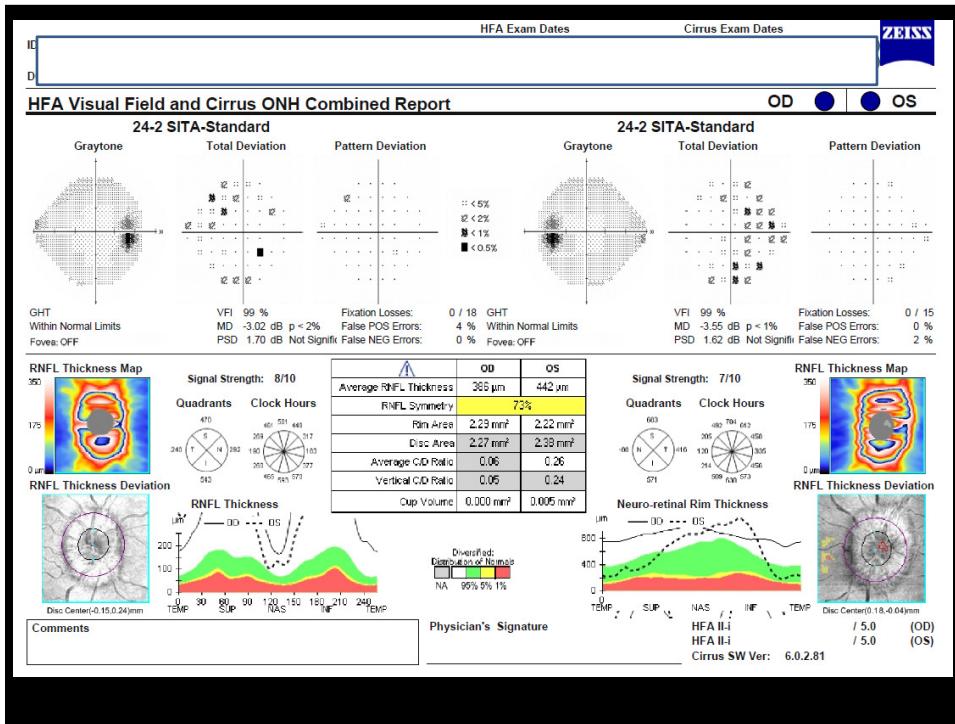
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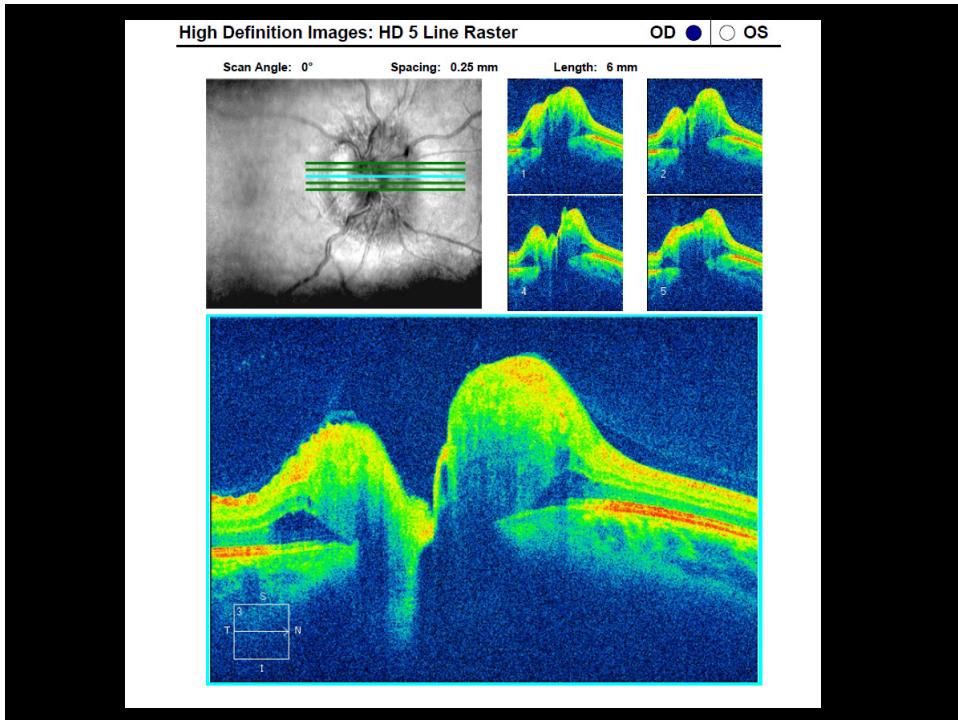
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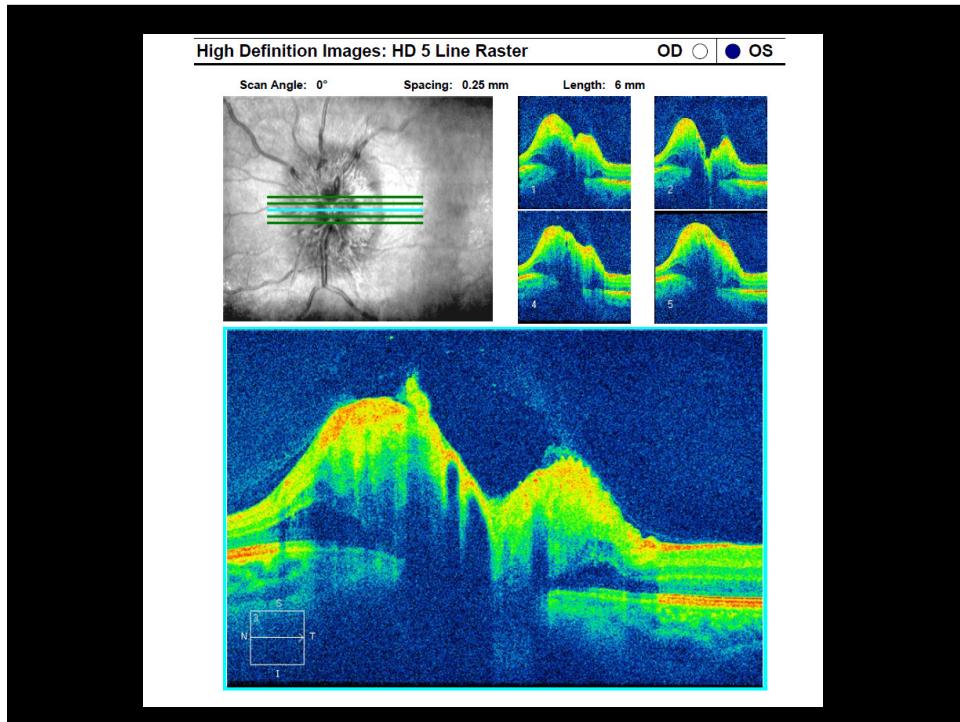
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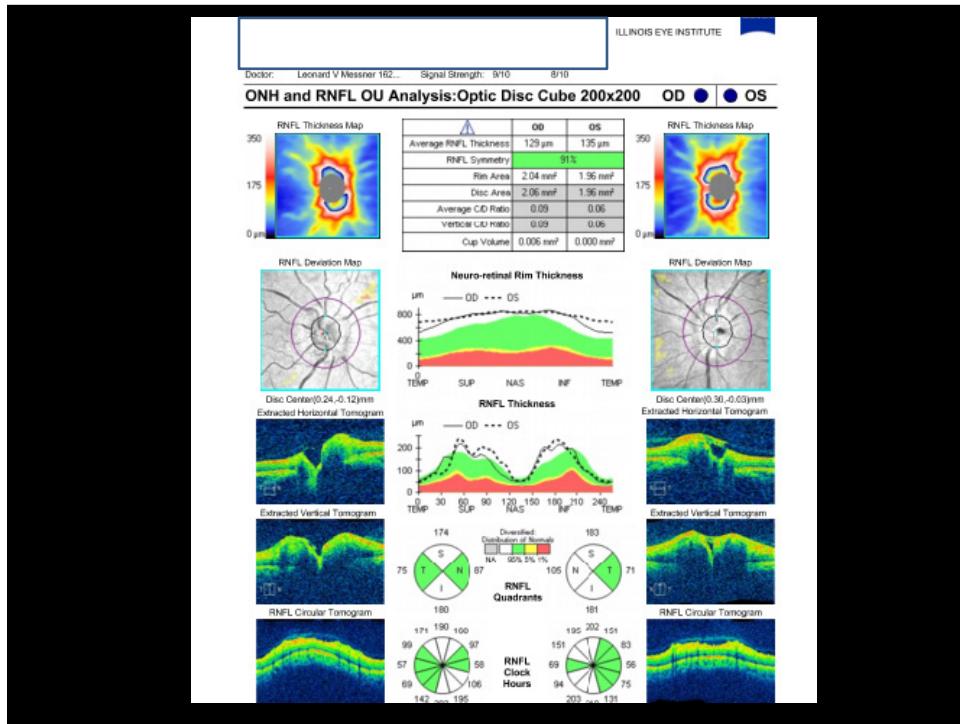


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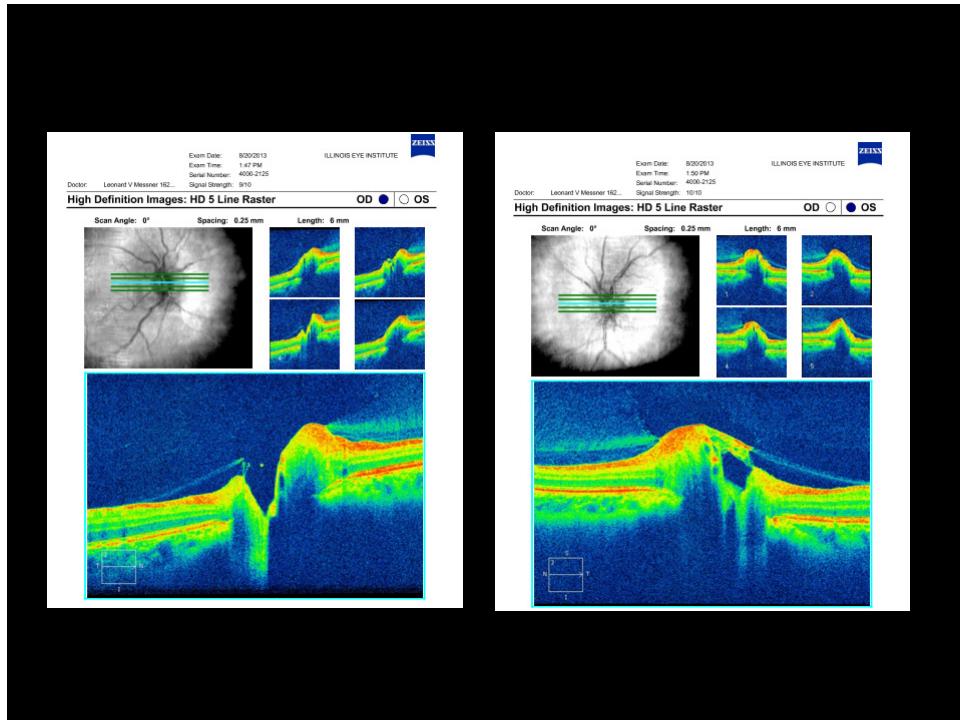
F/U x 6 mos

- Rx acetazolamide (500 mg BID)
- Weight loss (approx. 25 lbs.)
- Improvement in headaches

42



43

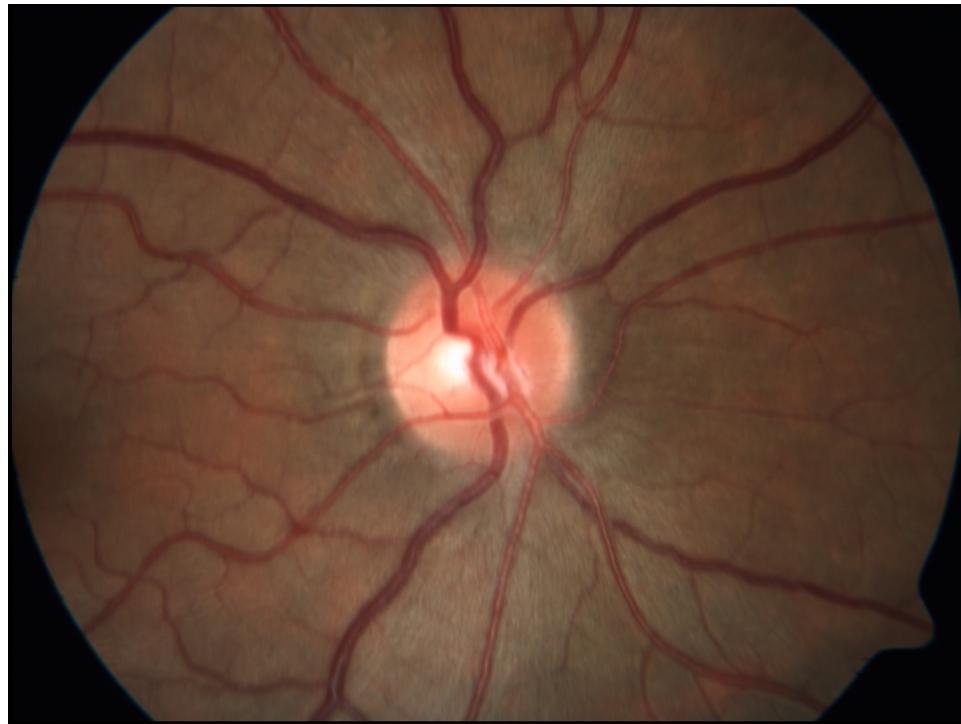


44

F/U x 14 mos

- D/C Diamox x 3 months
- Weight loss (BMI reduction from 38 to 30)
- Headache free

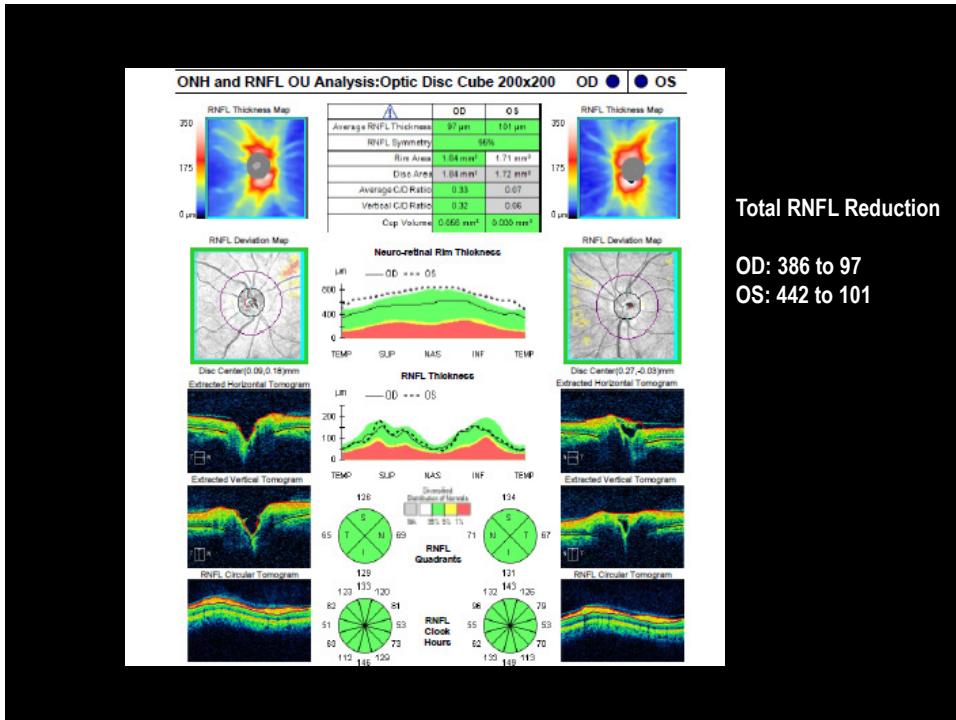
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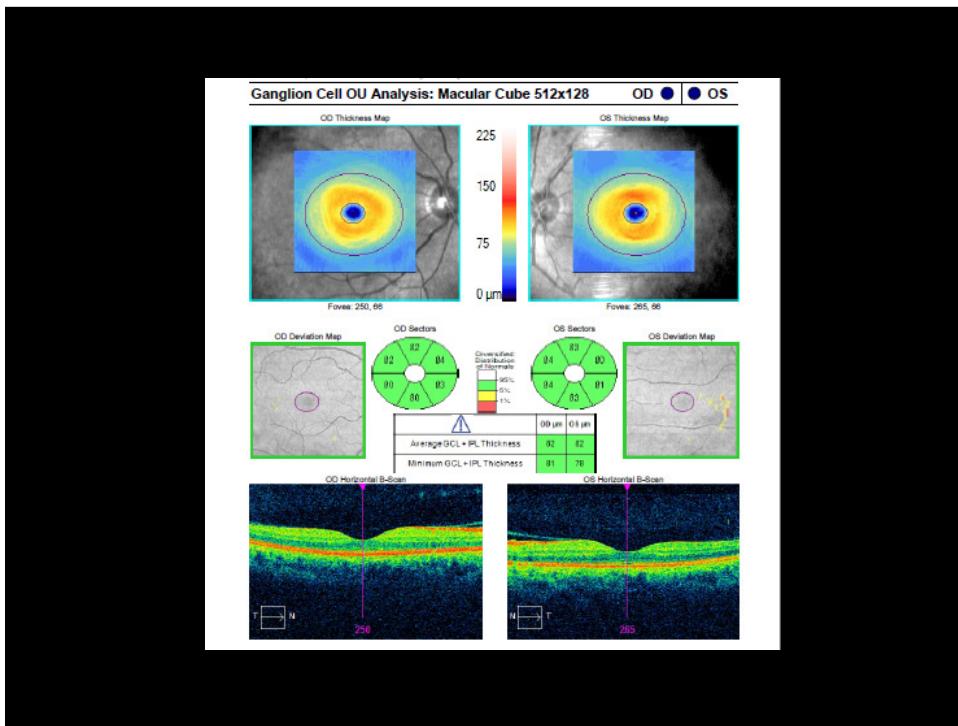
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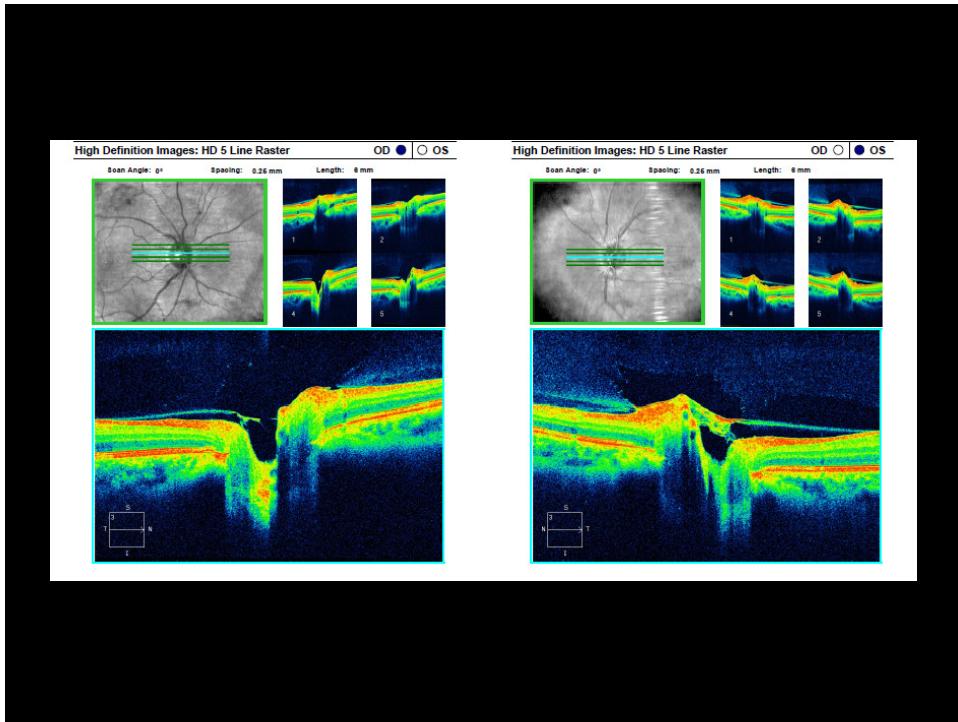
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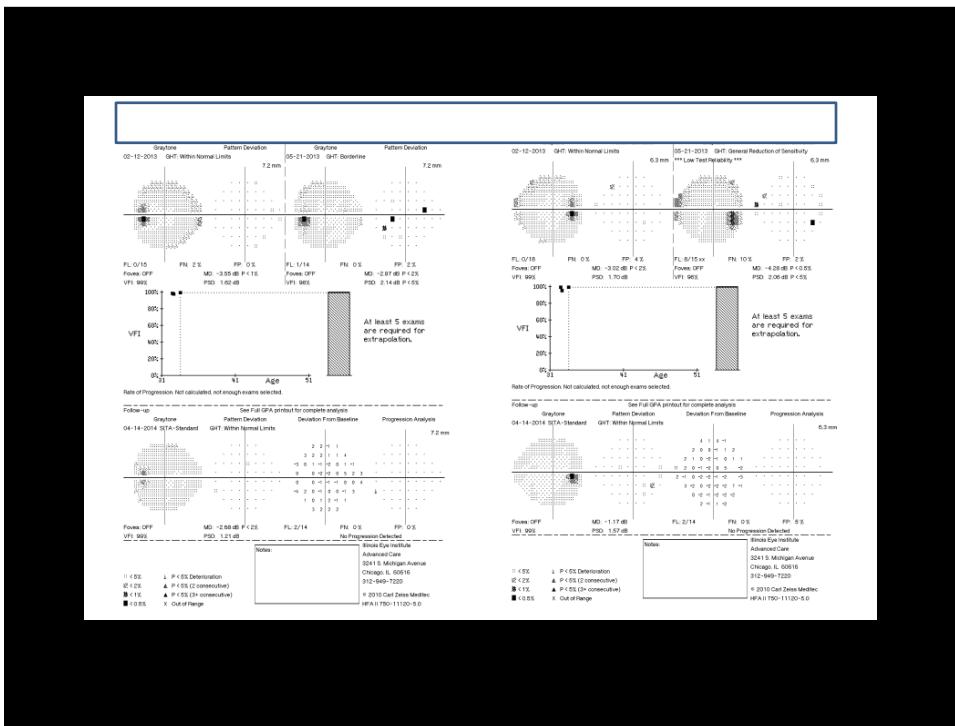
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49



50



51

OCT Analysis of “Pseudoapilledema”

- Increased NFL thickness (+/-)
- Elevation of nerve head
- Lumpy, irregular internal nerve contour (**disc drusen**)
- No “lazy V” hyporeflective pattern
- Absence of central cup
- Neutral / negative RPE/BM deflection

Flores-Rodriguez P, et al. *Ophthalmic Physiol 2012*
 Lee KM, et al. *Ophthalmology 2011*
 Kupersmith MJ, et al. *IOVS 2011*

53

Optic Disc Drusen

- Colloid bodies within substance of optic nerve head (anterior to lamina cribrosa)
- Degeneration of NFL axons (owing to narrow posterior scleral foramen/Bruchs membrane opening)
- Extracellular deposition of axoplasmic material with ultimate calcification
- NFL may be thickened (typically < 7 clock hours) or thinned
- Risk factor for NAION (particularly in younger patients)

Purvin V, et al. *Arch Ophthalmol* 2004
 Johannesen RG, et al. *Am J Ophthalmol* 2022

54

OCT Characteristics of Optic Disc Drusen

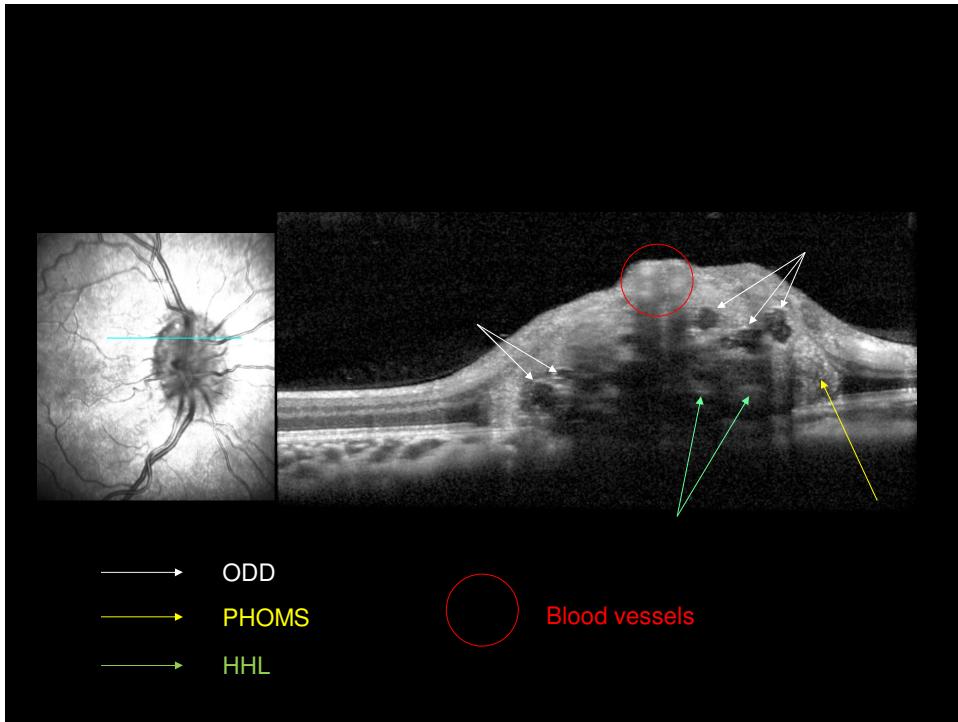
- Always located above the lamina cribrosa
- Always have signal-poor core
- Often seen with hyper-reflective margin (most prominent superiorly)
- Sometimes seen as conglomerates of multiple ODD with internal reflectivity of the signal-poor core
- Hyper-reflective horizontal lines may be precursor to ODD (or artifact-prelaminar location common)
- Peripapillary hyper-reflective ovoid mass-like structures (PHOMS) may represent bulging axons and should not be considered as ODD
 - (evident 360 degrees-corresponding “blurred” disc margins)
 - Associated with CVO, myopic disc tilt, optic neuritis, other optic neuropathies)

Malmqvist L, et al. *J Neuro-ophthalmol* 2018
 Fraser C. NANOS 2021

55



56

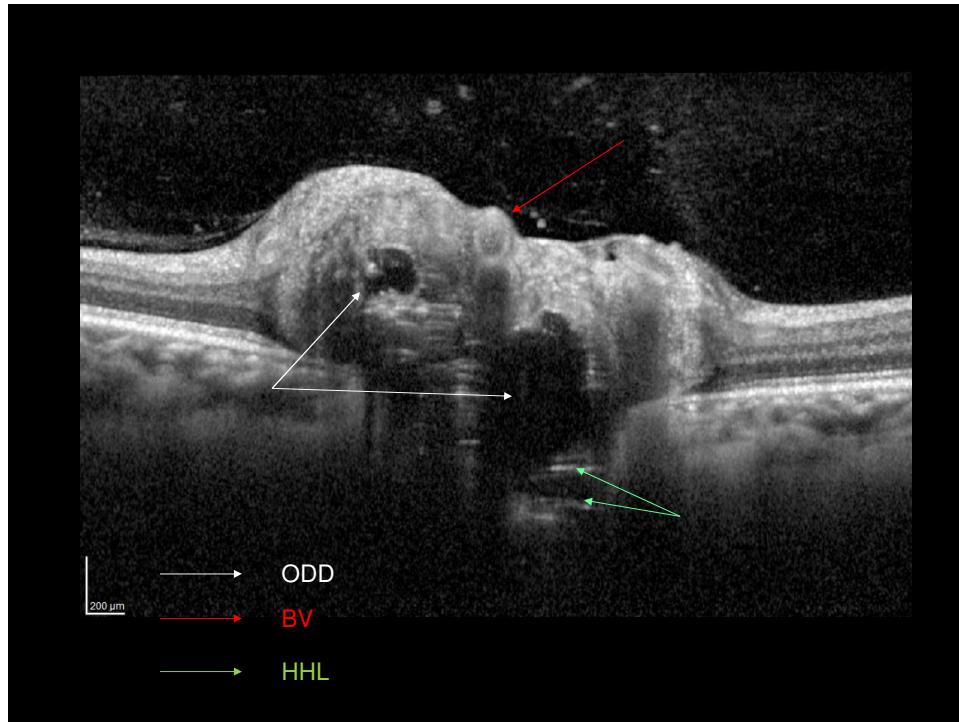


57

33 y/o Hispanic Woman

- Consult for evaluation of ODE OS
- BVA
 - 20/20 OD
 - 20/20 OS
- Normal neurologic exam
- No HAs. synchronous pulsatile tinnitus, diplopia or transient vision loss

58

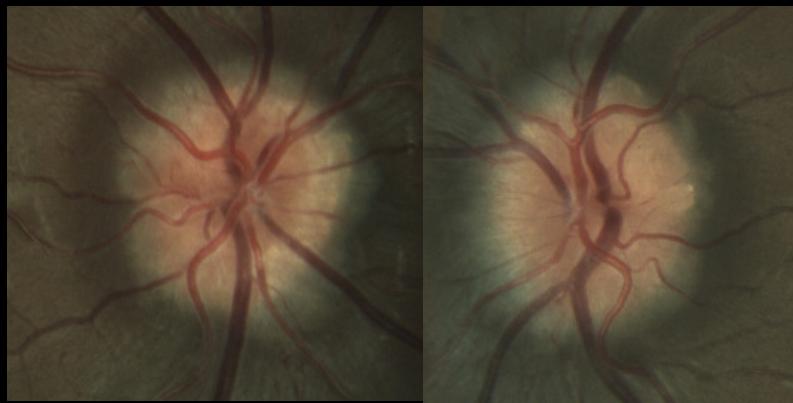


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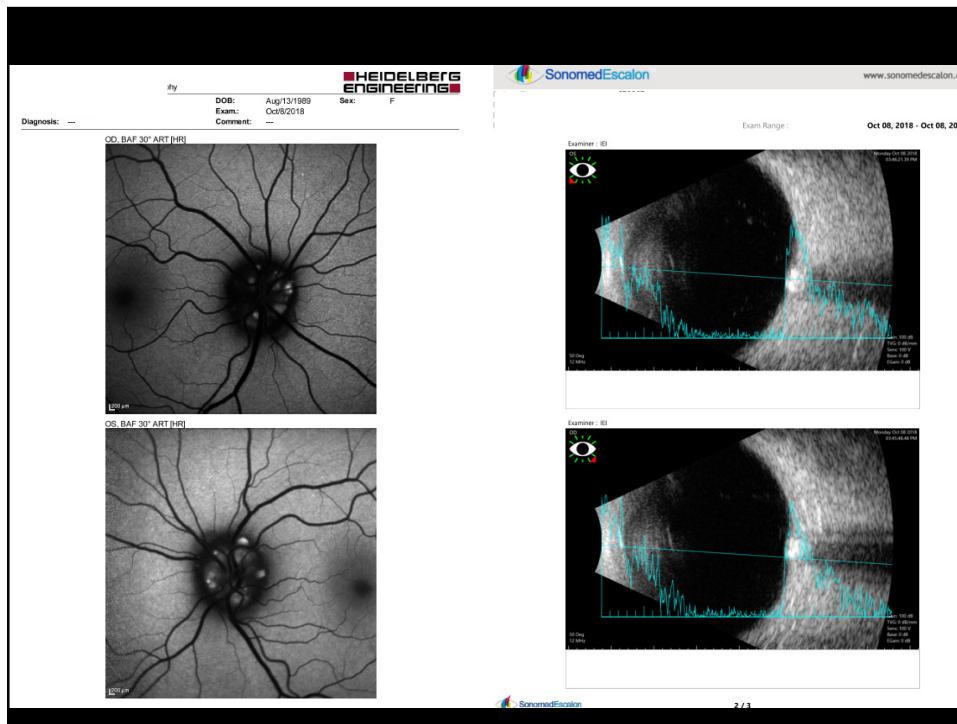
29 y/o AA Woman

- Consult for evaluation of papilledema
- BVA
 - 20/20 OD
 - 20/20 OS
- Normal neurologic exam
- History of migraine headaches
- No synchronous pulsatile tinnitus, diplopia or transient vision loss

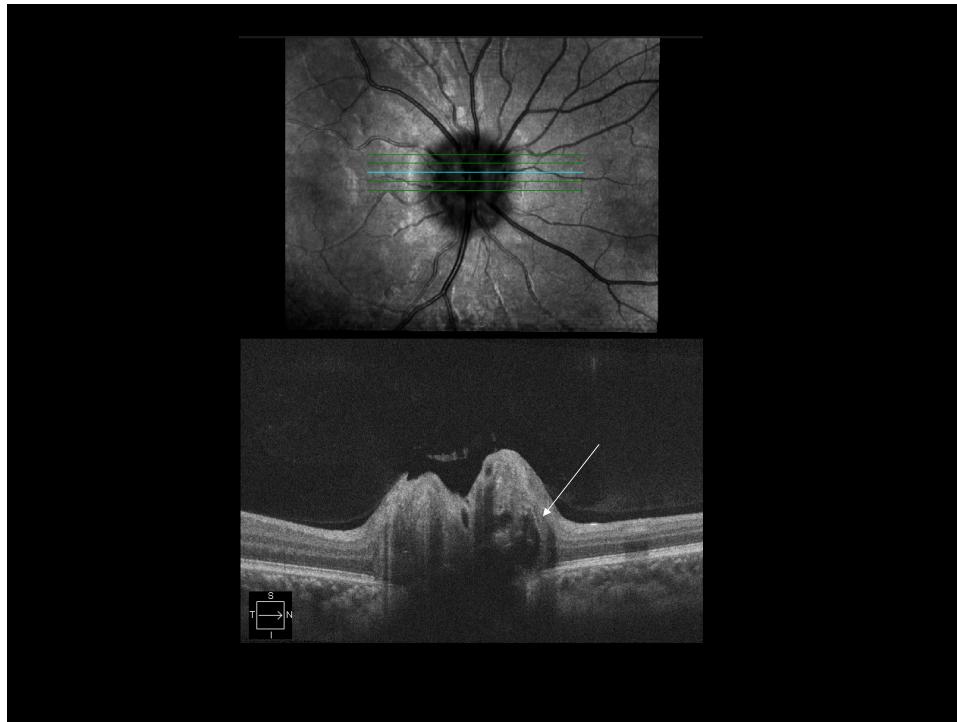
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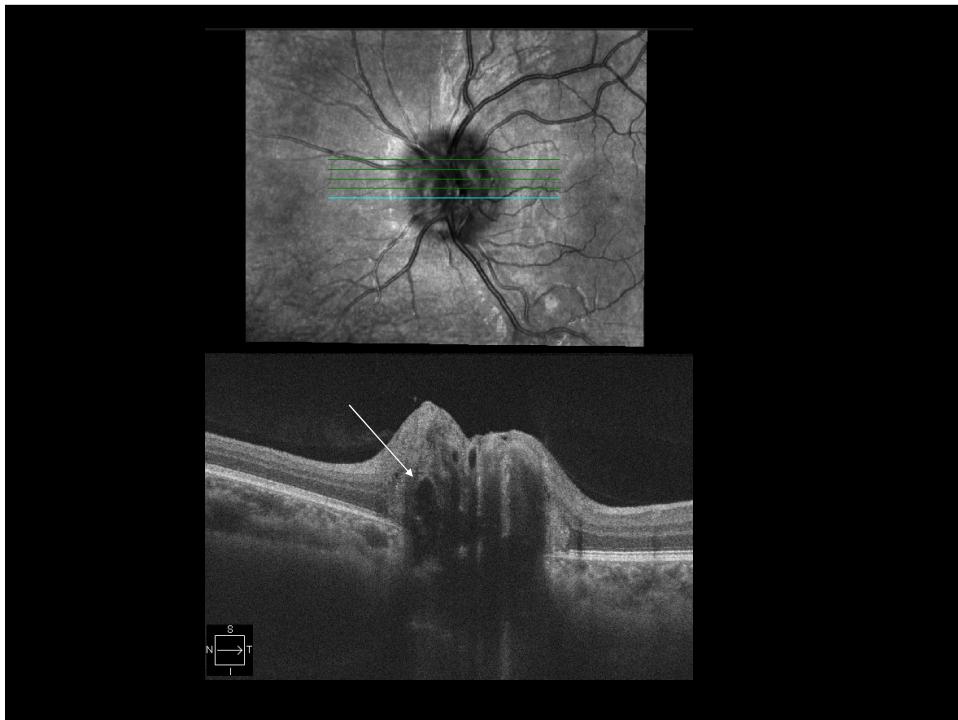
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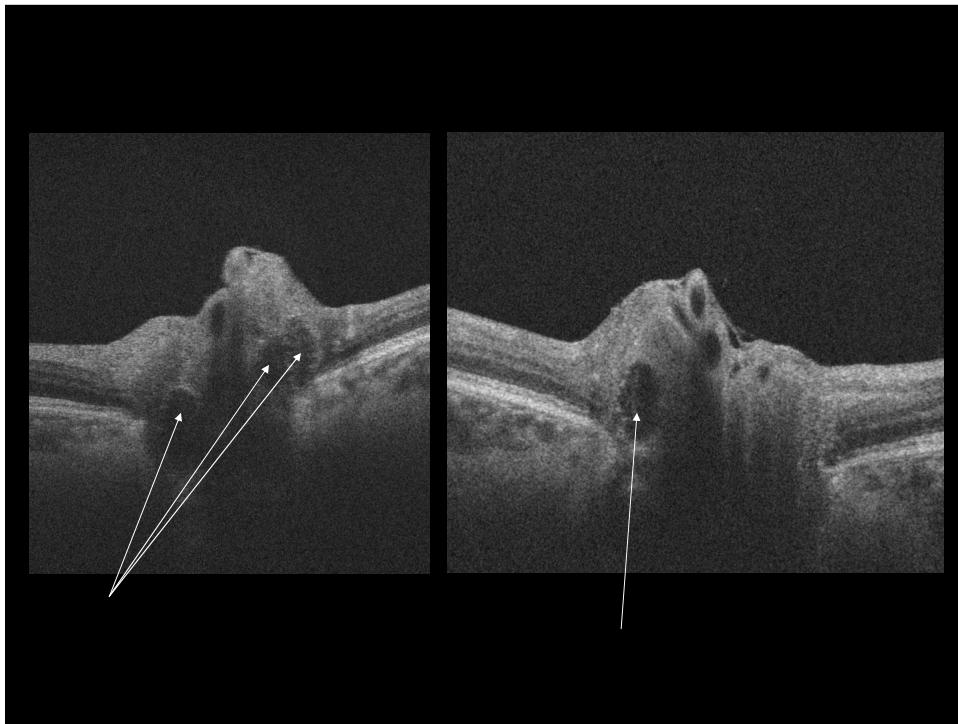


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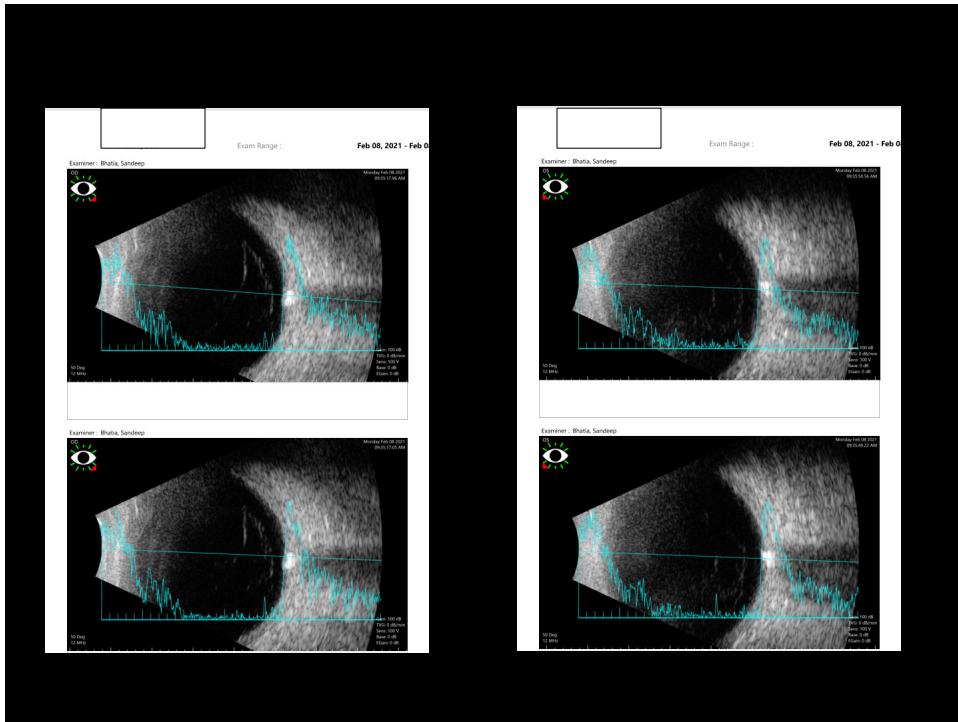
62 y/o AA Woman

- C/o blurry vision OD > OS over past year
- H/o DED (Tx = ATs)
- BVA
 - 20/25 OD
 - 20/25 OS
- No headaches, synchronous pulsatile tinnitus, diplopia or transient vision loss

65



66



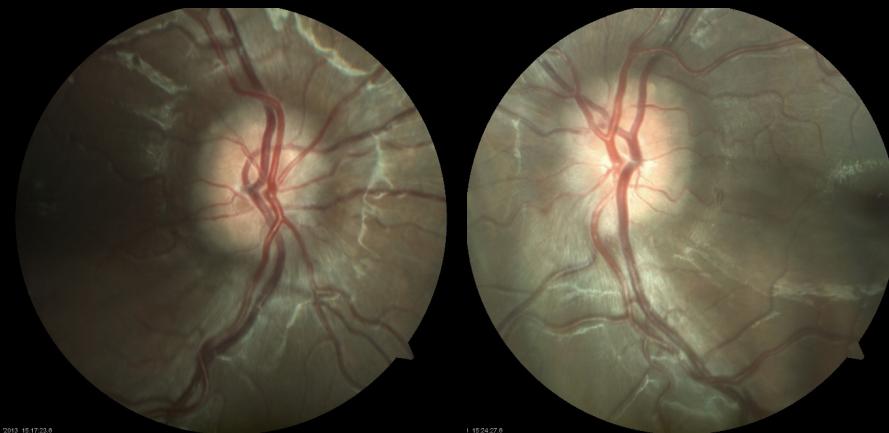
67

7 y/o Hispanic Male

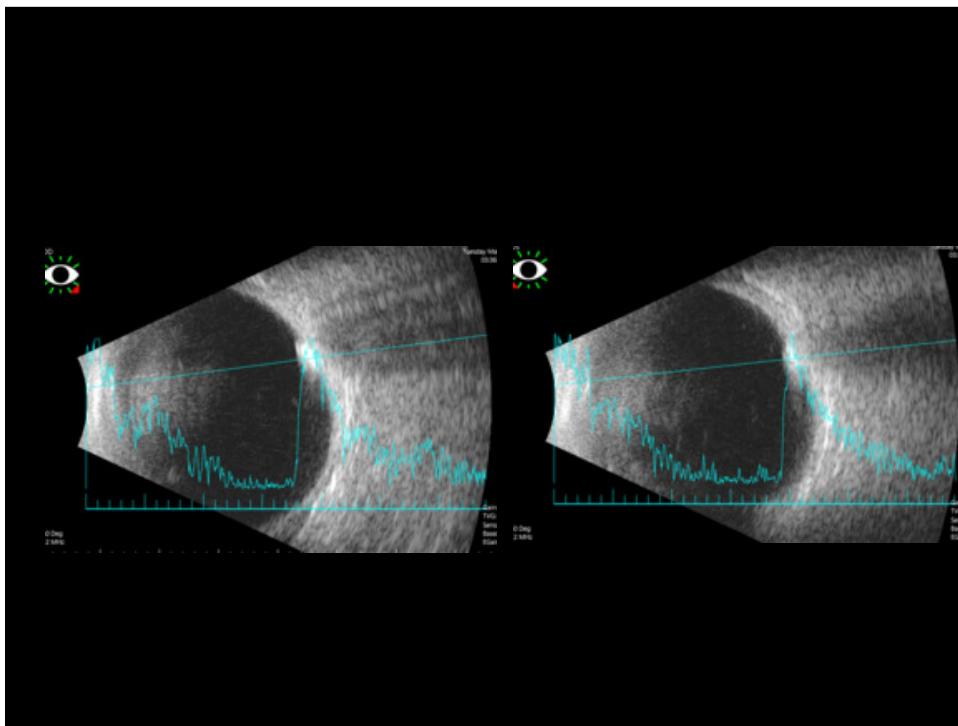
- BVA
 - 20/20 OD
 - 20/20 OS
- Normal neurologic exam
- No headaches, synchronous pulsatile tinnitus, diplopia or transient vision loss

68

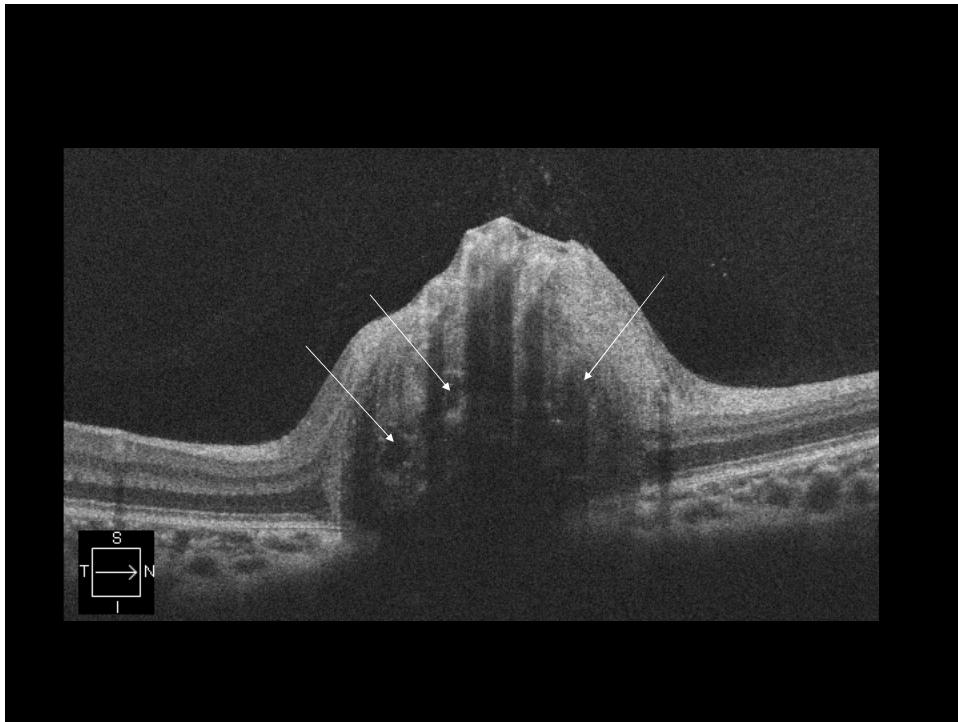
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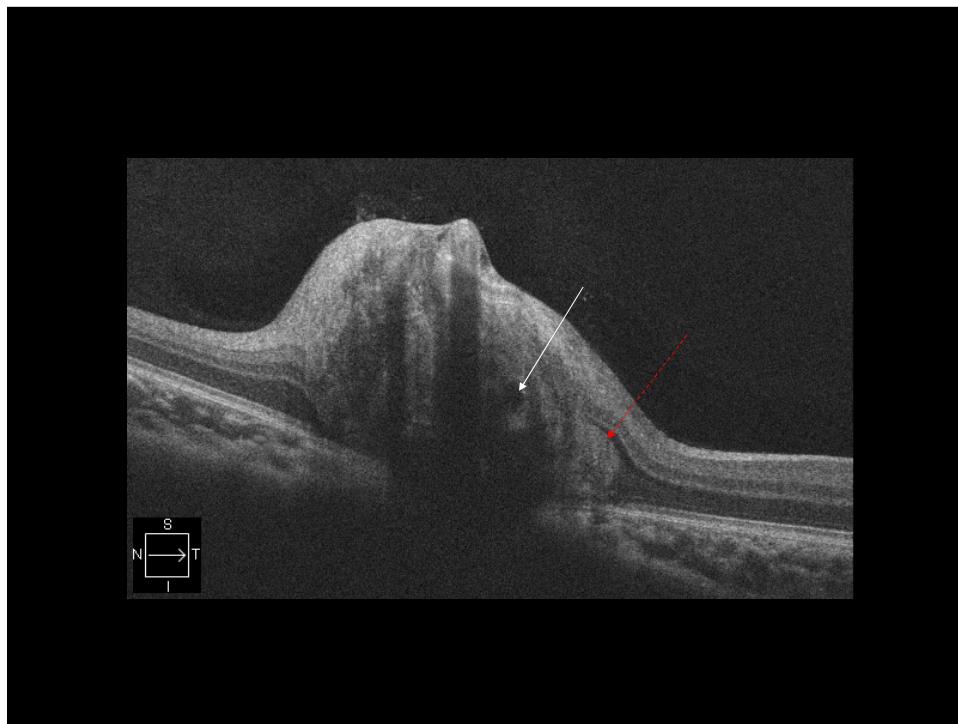
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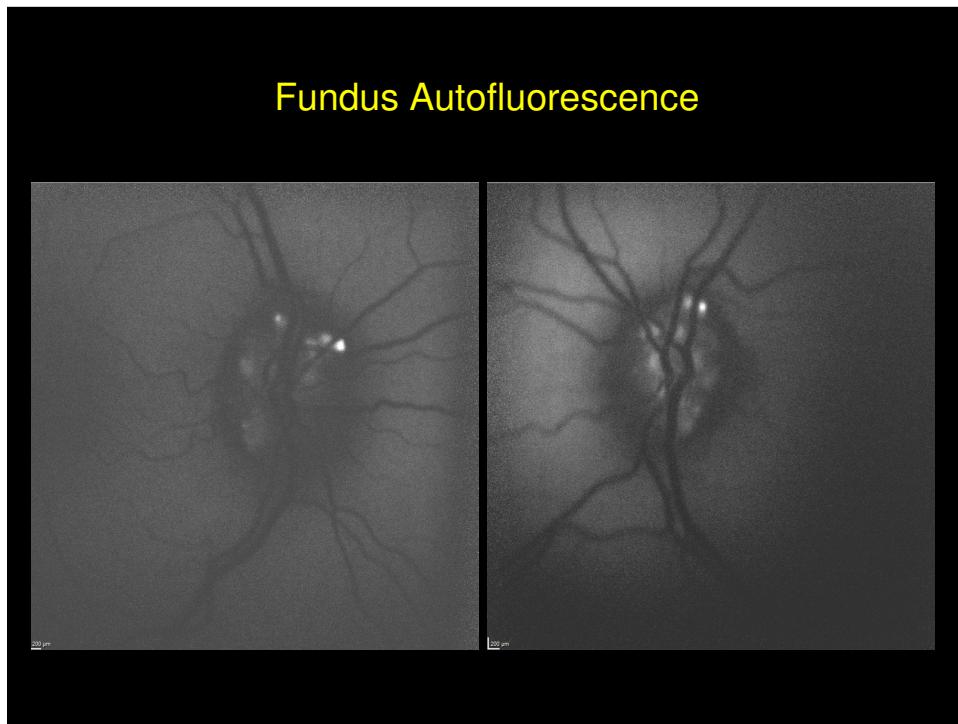
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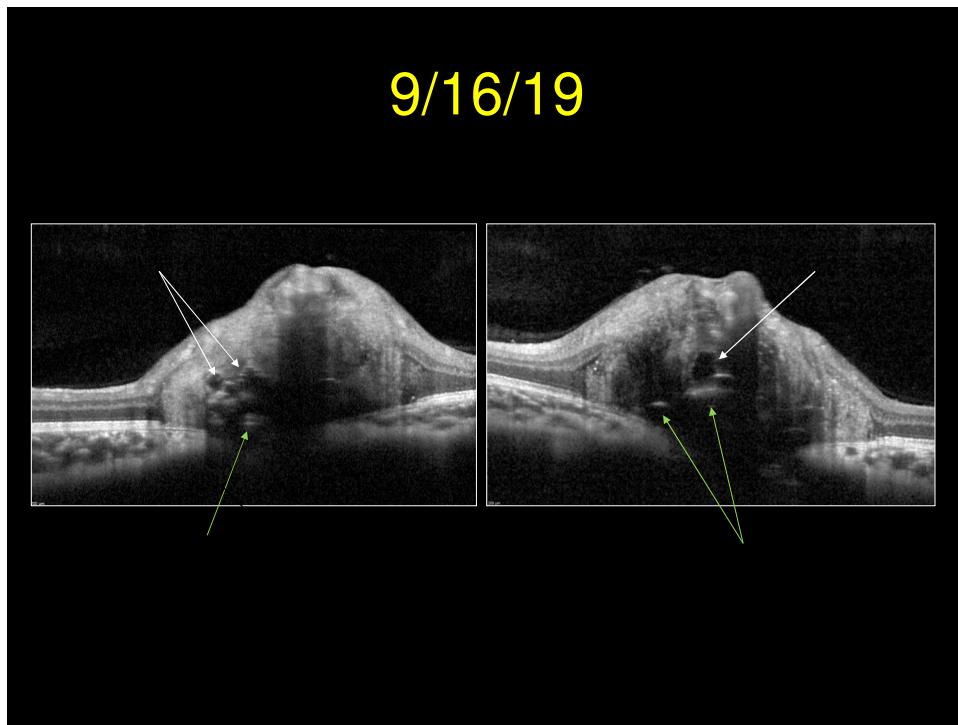
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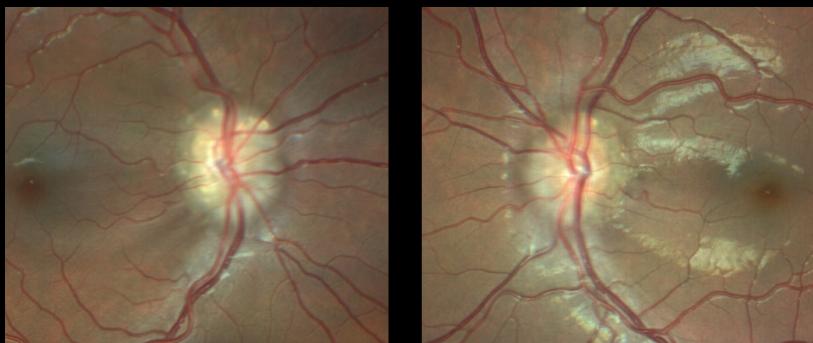


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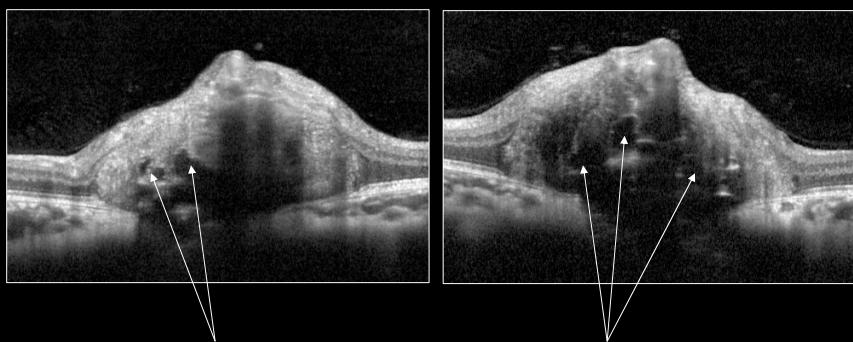
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8/09/21



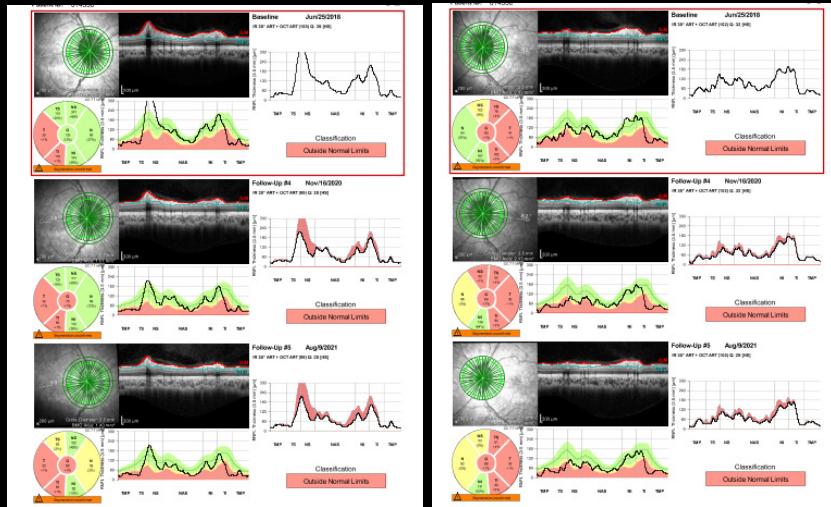
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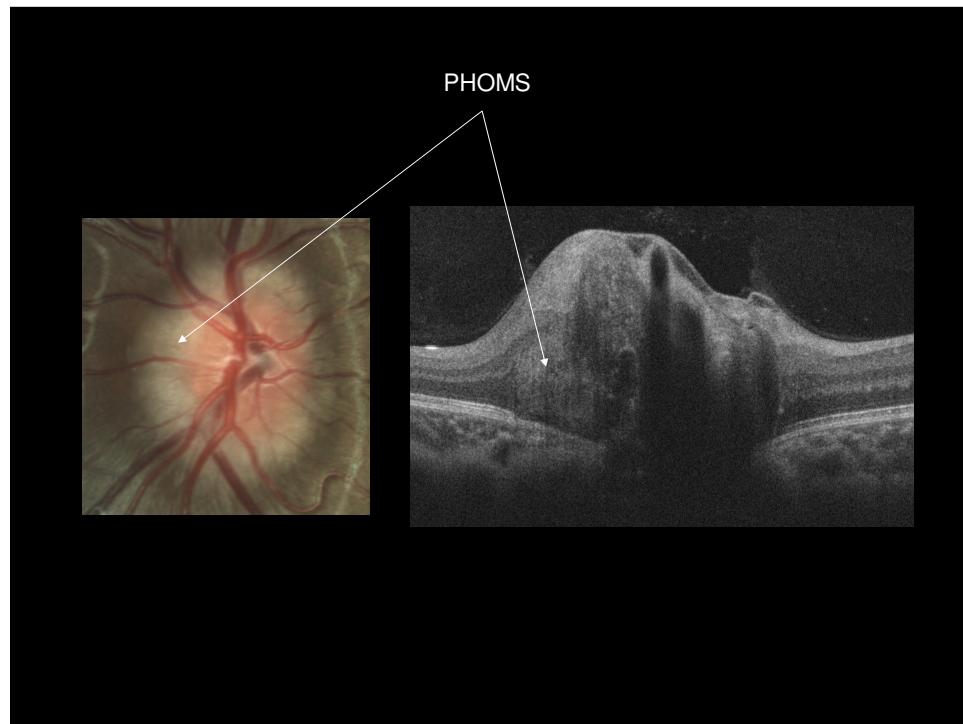


78

What is that white ring around
the disc?



79



80

OCT Analysis of Chiasmal & Retrochiasmal Lesions



82

OCT Analysis of Chiasmal Lesions

- Nasal optic nerve fibers decussate in the paracentral region of the chiasm
- Crossed fibers most vulnerable to compressive damage
- These fibers sub-serve the nasal aspect of the optic nerve & ganglion cell complex

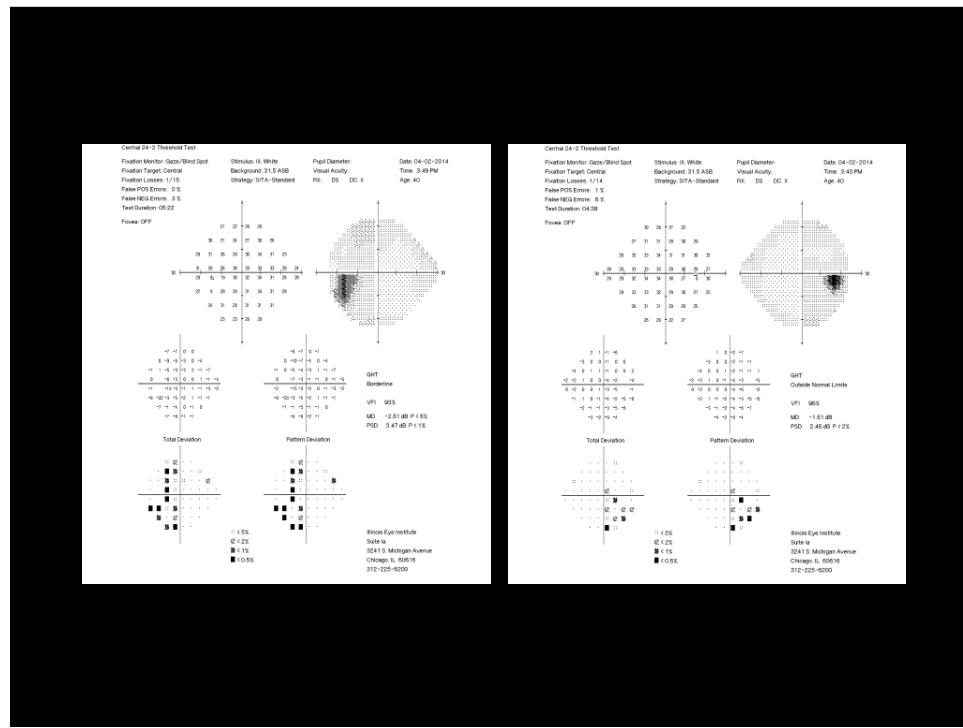
Neeranjali S, et al. IOVS 2015

83

40 Y/O Caucasian Man

- C/o progressive side-vision loss, both eyes
- Several months duration
- BVA:
 - 20/20 OD
 - 20/20 -2 OS

84

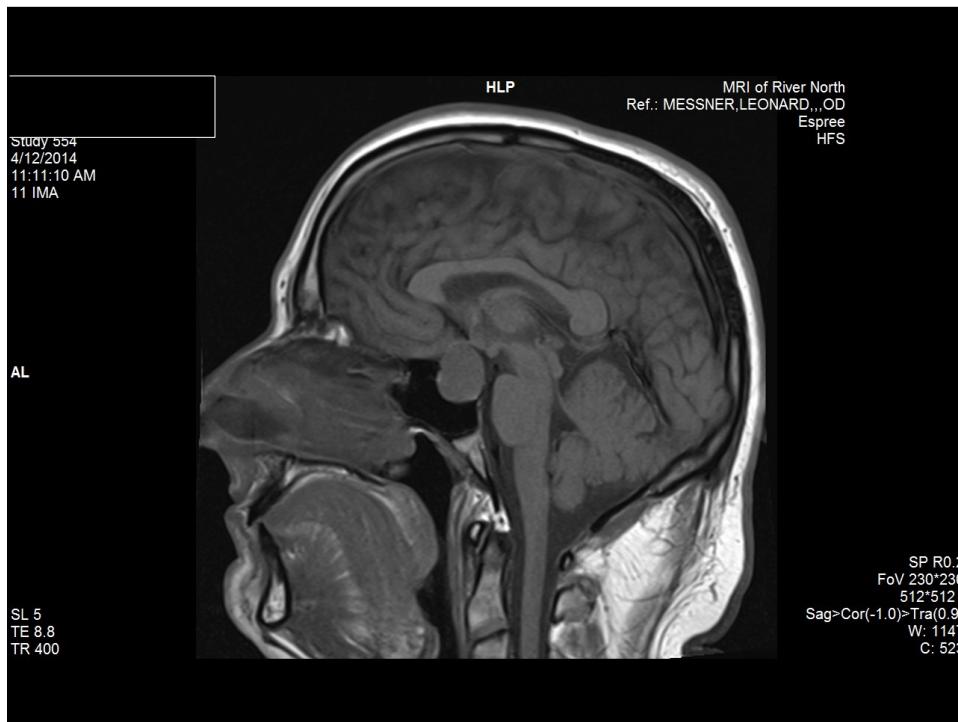


85

GCC analysis: Bi-nasal GCC thinning



86



87



88

Optical coherence tomography retinal ganglion cell complex analysis for the detection of early chiasmal compression

Richard J. Blanch^{1,2,3} · Jonathan A. Micieli¹ · Nelson M. Oyesiku⁴ · Nancy J. Newman^{1,4,5} · Valérie Bioussé^{1,5}

Published online: 10 August 2018
© Springer Science+Business Media, LLC, part of Springer Nature 2018

Abstract
Purpose To report patients with sellar tumors and chiasmal compression with normal visual fields, who demonstrate damage to the retinal nerve fiber layer (RNFL) and ganglion cell complex (GCC) on optical coherence tomography (OCT).
Methods Seven patients with sellar tumors causing mass effect on the optic chiasm without definite visual field defect, but abnormal GCC are described. GCC/RNFL analyses using Cirrus-OCT were classified into centiles based on the manufacturer's reference range.
Results In seven patients with radiologic compression of the chiasm by a sellar tumor, OCT-GCC thickness detected compressive chiasmal compression before visual defects became apparent on standard automated visual field testing. Without OCT, our patients would have been labelled as having normal visual function and no evidence of compressive chiasmal compression. With only OCT-RNFL analysis, 3/7 patients would still have been labelled as having no compression of the anterior visual pathways.
Conclusions These patients show that OCT-GCC analysis is more sensitive than visual field testing with standard automated perimetry in the detection of compressive chiasmal compression or optic neuropathy. These cases and previous studies suggest that OCT-GCC analysis may be used in addition to visual field testing to evaluate patients with lesions compressing the chiasm.

Keywords Pituitary adenoma · Sellar mass · Chiasmal compression · Optic neuropathy · Visual field test · Optical coherence tomography · Ganglion cell complex analysis

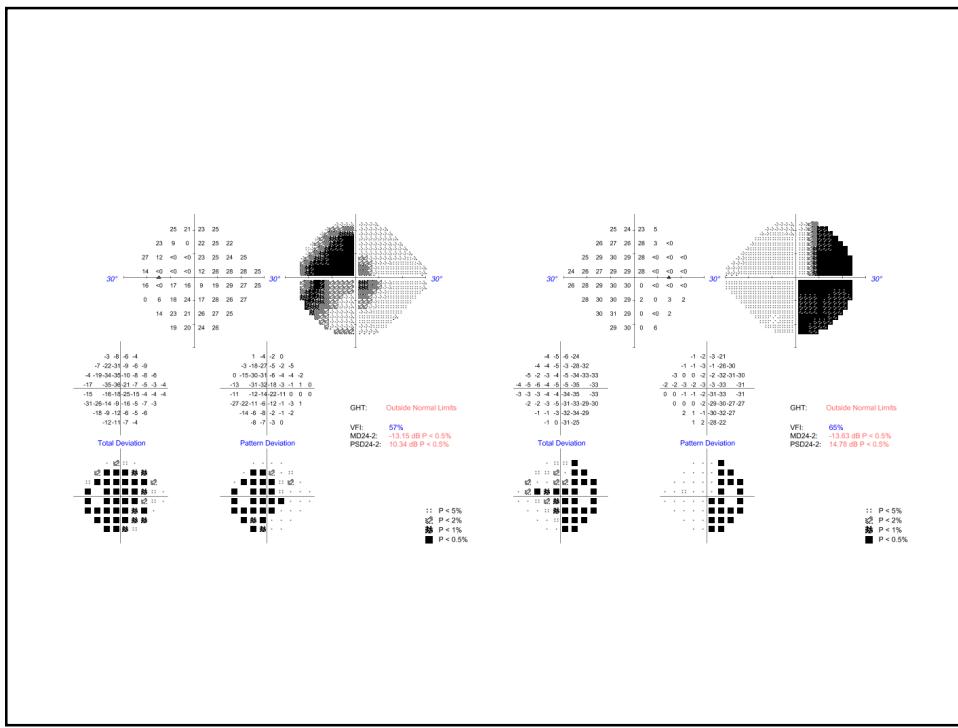
Blanch RJ, et al. *Pituitary* 2018

89

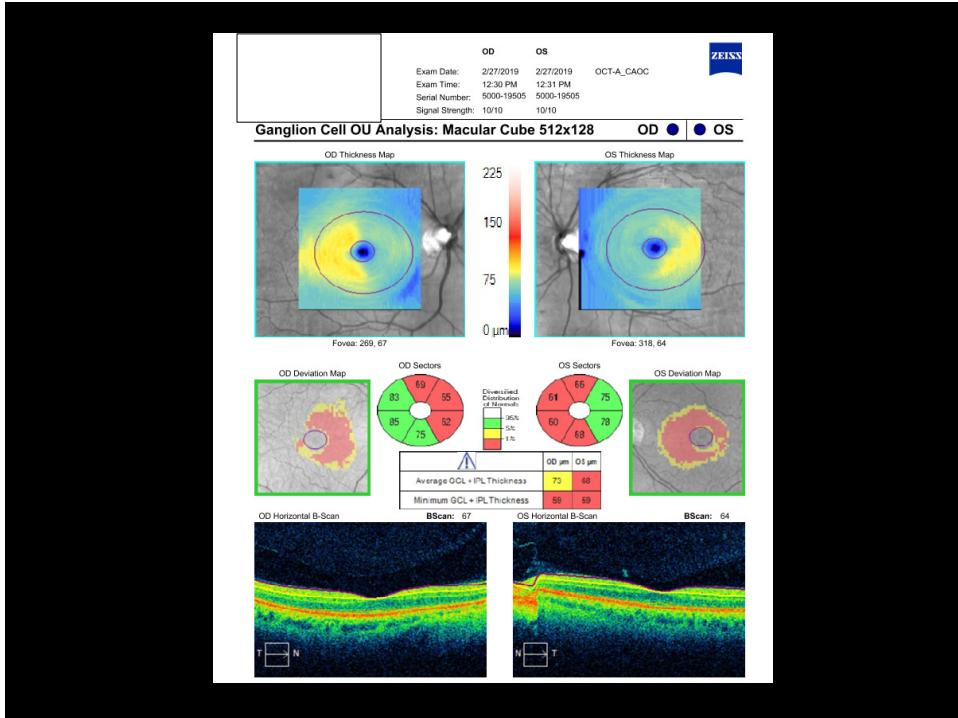
31 y/o Caucasian Man

- History of motor vehicle accident with subsequent bitemporal hemianopia
- BVA:
 - 20/40 OD
 - 20/80 OS

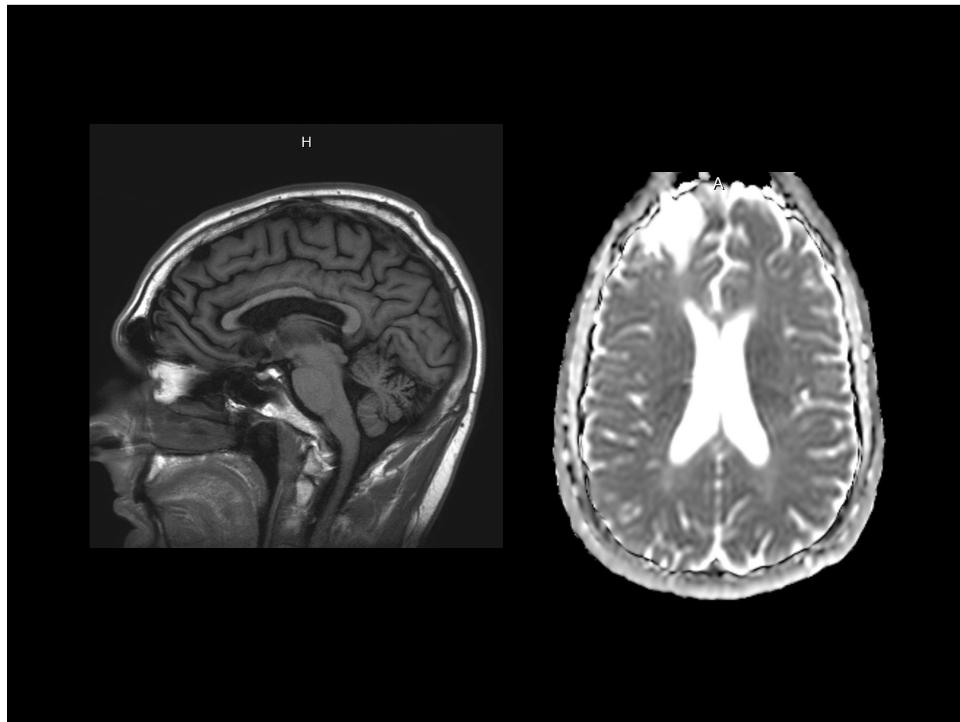
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OCT Analysis of Retrochiasmal Lesions

- Insult of ipsilateral temporal axons and contralateral nasal axons → ipsilateral temporal GCIPPL thinning and contralateral nasal GCIPPL thinning
- Correlation with other clinical findings:
 - Contralateral homonymous hemianopia
 - Contralateral “bow tie” optic atrophy and RAPD (optic tract lesions)

Micieli JA, et al. *Ophthalmology* 2018
Muhlemann F, et al. *Neurology* 2020

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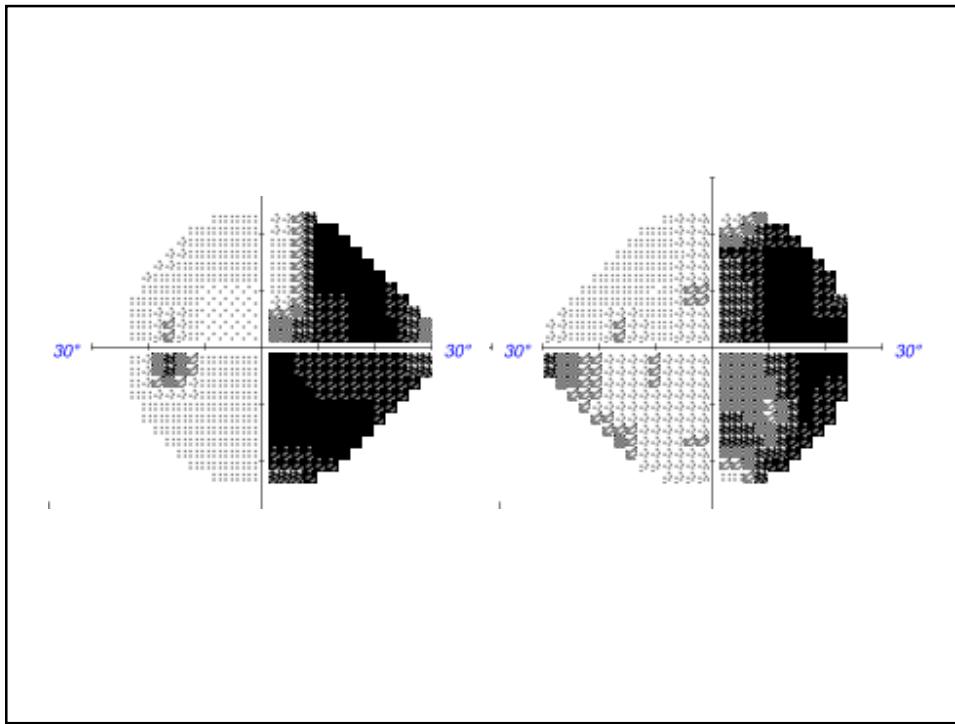
21 y/o Female

- History of left hemispherectomy at age 12 for intractable epilepsy
- Right-sided hemiparesis
- Aphasia
- BVA:
 - 20/25 OD
 - 20/20 OS
- 1+ RAPD OD
- Myelinated NFL OS (incidental finding)

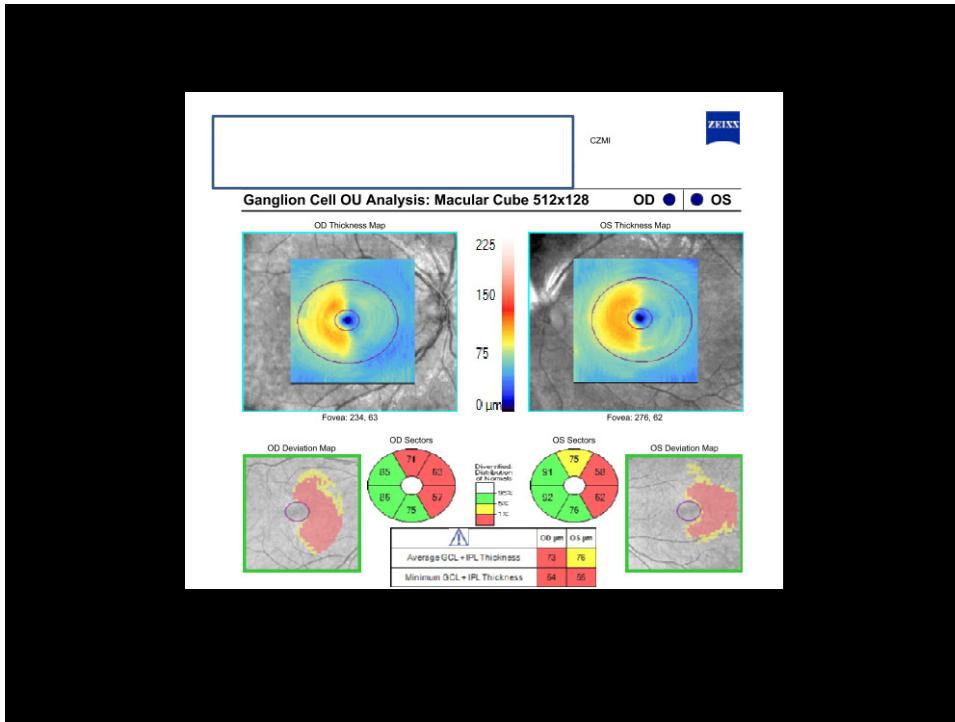
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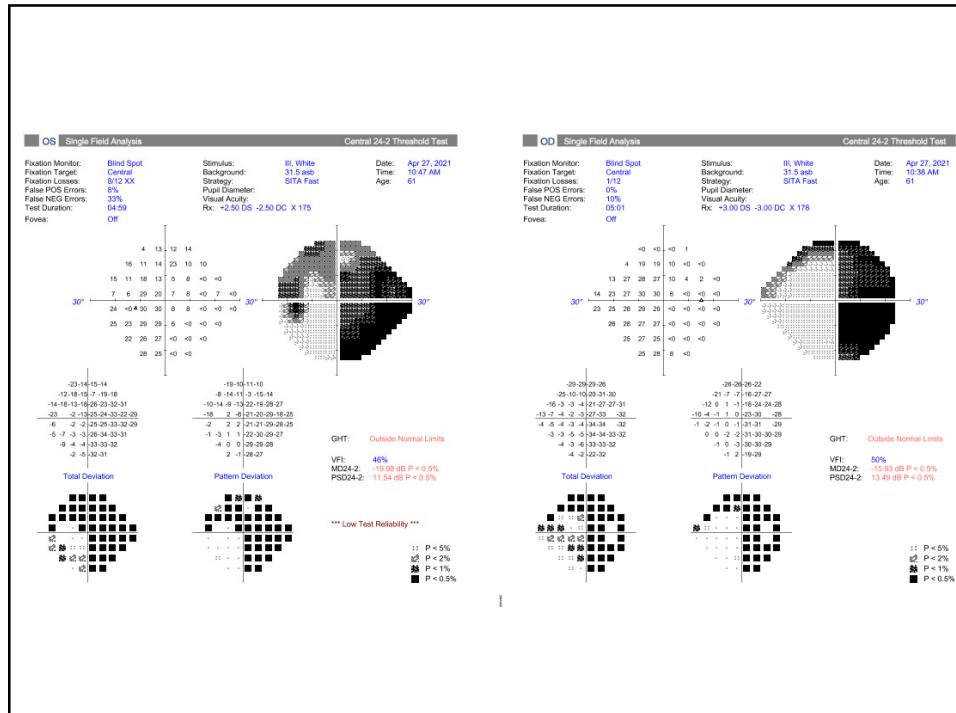


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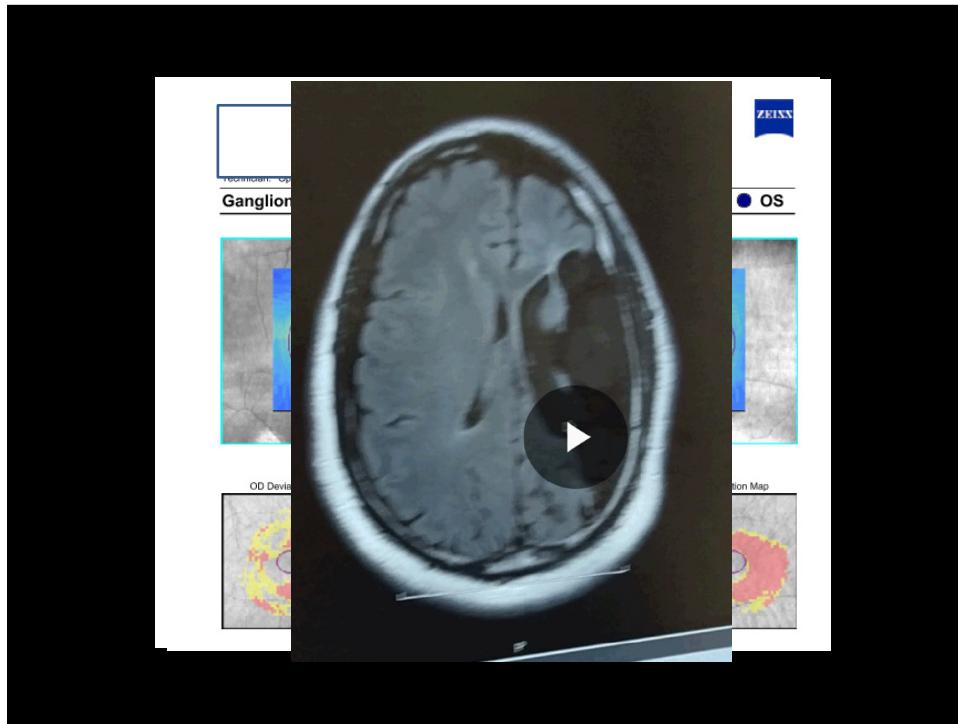
61 y/o Male

- History of cerebral palsy with right-sided hemiparesis
- Concomitant OAG (latanoprost qhs)
- BVA:
 - 20/25 OD
 - 20/25 OS

99



100



101

Rapid homonymous hemi-macular atrophy of the optical coherence tomography ganglion cell complex after stroke

Arshia Eshtiaghi,¹ Jonathan A Micieli

DESCRIPTION
A 44-year-old man developed sudden-onset right-sided weakness, aphasia and blurred vision after a cardiac valvuloplasty. Initial CT and CT angiography of the head showed early ischaemic changes involving the left medial temporal lobe, occipital lobe and thalamus with a left P2 occlusion. He was not a candidate for hyperacute therapy given his recent surgery and was already on dual anti-platelet therapy. He had improvement in his weakness and aphasia and was seen in ophthalmology consultation 1 month after the onset of stroke. He was found to have a visual acuity of 20/20 in both eyes, a complete right homonymous hemianopia and optical coherence tomography (OCT) of the macular ganglion cell-inner plexiform layer (GCIPIL) showed left homonymous hemi-macular atrophy. OCT of the retinal nerve fibre layer (RNFL) showed early inferonasal thinning, but the overall thickness was within the normal range (**figure 1**).
The cell bodies of the retinal ganglion cells are located in the ganglion cell layer of the retina. Their axons first travel in the RNFL, then in the optic nerve, optic chiasm and optic tract before they synapse in the lateral geniculate nucleus, after which information is conveyed to the visual cortex.¹ Disruption of the post-geniculate visual pathway will manifest as hemi-macular atrophy of the OCT GCIPIL, but this takes at least several months.

- Pre-geniculate lesions = rapid GCIPIL thinning (1 month)
- Post-geniculate lesions = delayed GCIPIL thinning (5-6 months)

Eshtiaghi A, et al. *BMJ* 2021

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OCT in Neurodegenerative Disease

- Multiple sclerosis
- Parkinson's disease
- Alzheimer's disease
- TBI

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OCT in Neurodegenerative Disease

- Multiple sclerosis
- Parkinson's disease
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Why use OCT in the evaluation of MS patients?

- OCT allows for detailed evaluation of CNS non-myelinated axons
- OCT provides reliable and reproducible measures of “neuroaxonal structure” within the CNS that correlates with other measures of disease severity & progression (standardized disease progression algorithms)
- Incorporation of OCT, low-contrast acuity measurement & vision-specific QOL measures incorporated into MS clinical trials

Kappos L, et al. *Lancet* 1999
 Kanda T, et al. *Radiology* 2015
 Balcer LJ. *J Neuroophthalmol* 2014
 Costello F, et al. *Eye and Brain* 2018

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OCT Findings in Optic Neuritis

- Acute optic neuritis associated with RNFL & GCL-IPL thinning of 20% - 40% X 3 months

Petzold A, et al. *Lancet Neurol* 2017
 Balcer LJ. *Neuroophthalmol* 2014
 Sakai RE et al. *J Neuroophthalmol* 2011
 Fisher JB, et al. *Ophthalmology* 2006

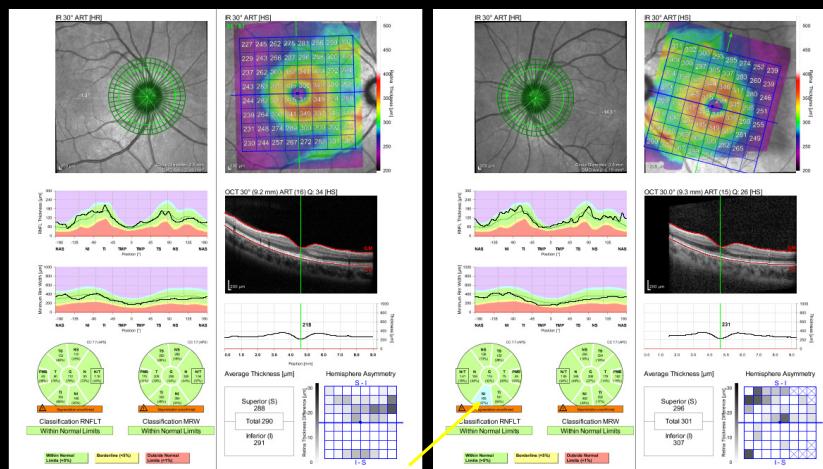
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45 y/o Woman

- Recent-onset monosymptomatic optic neuritis OS
- BVA:
 - 20/20 OD
 - 20/500 OS

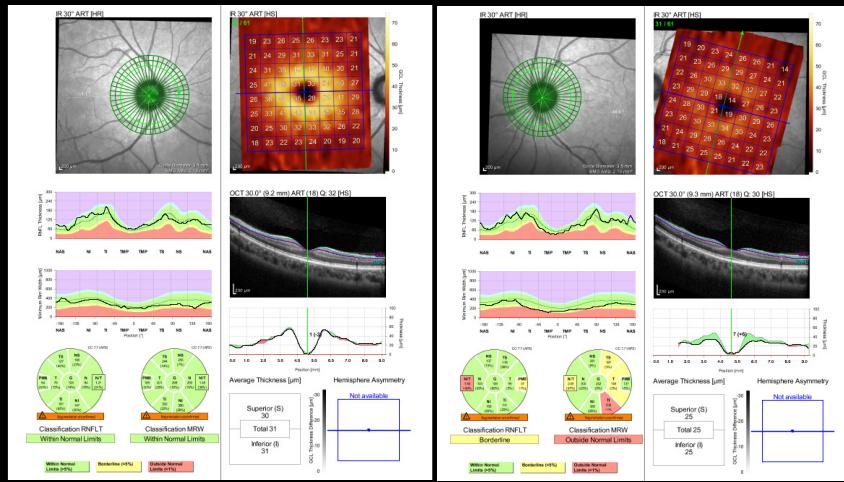
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July 29, 2019 (BVA: 20/500 OS)



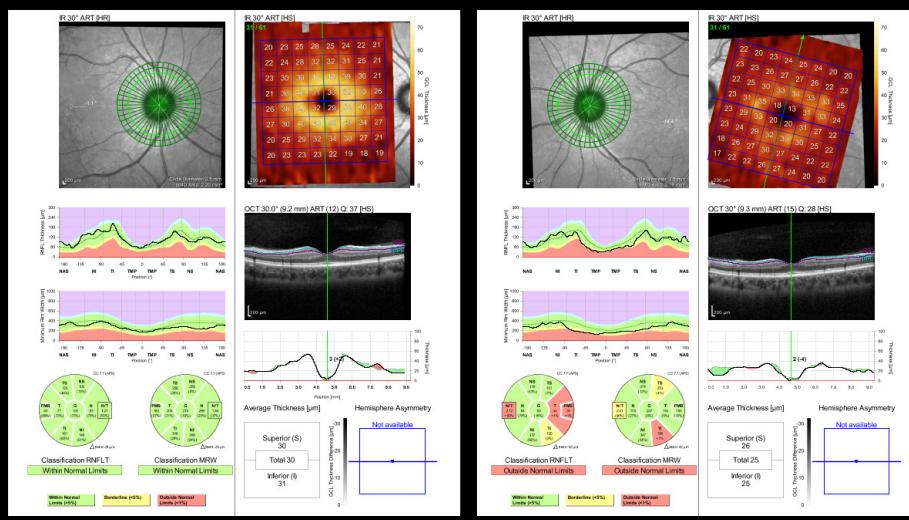
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September 29, 2019 (BVA: 20/20 OS)

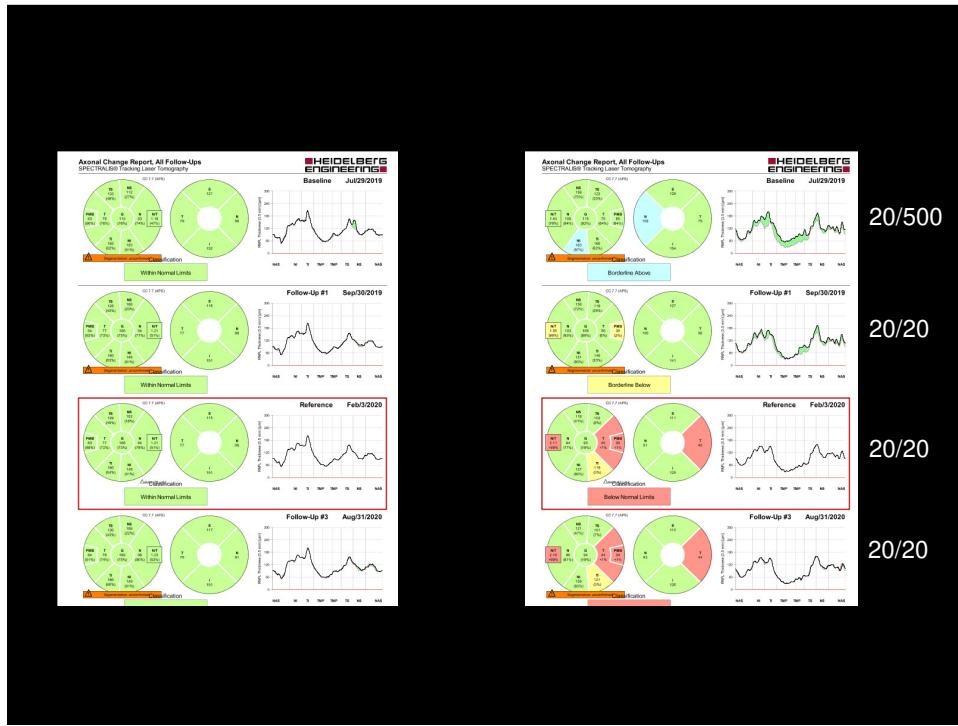


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February 3, 2020 (BVA: 20/20 OS)



111

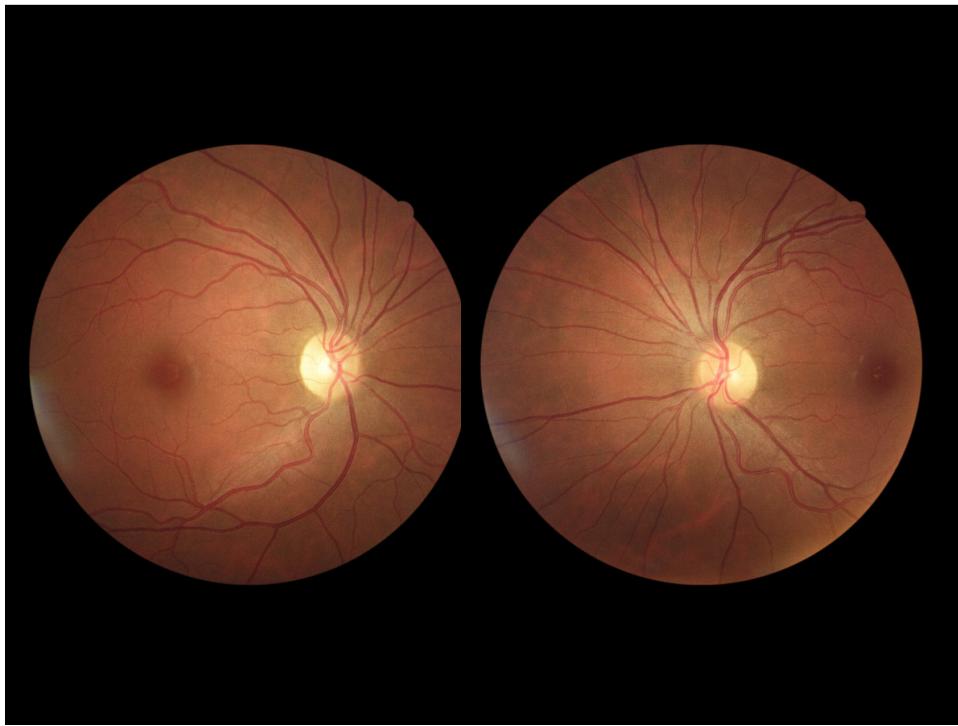


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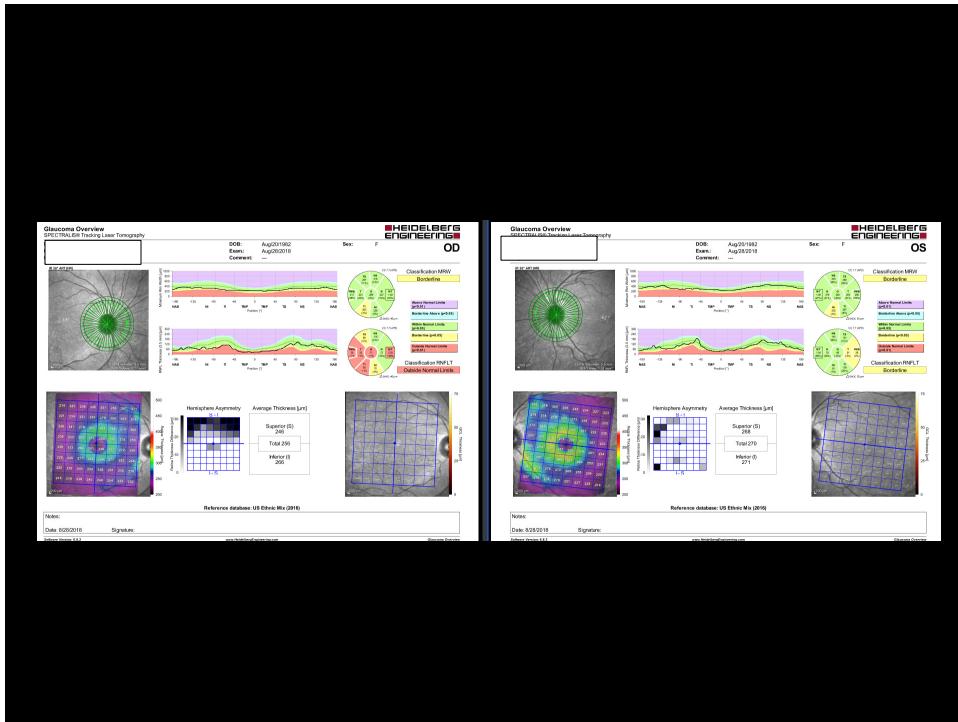
31 y/o Woman

- 10-year Hx of RRMS
- Meds:
 - Ocrevus (ocrelizumab)
- Prior optic neuritis OD
- BVA:
 - 20/20 -1 OD
 - 20/20 OS

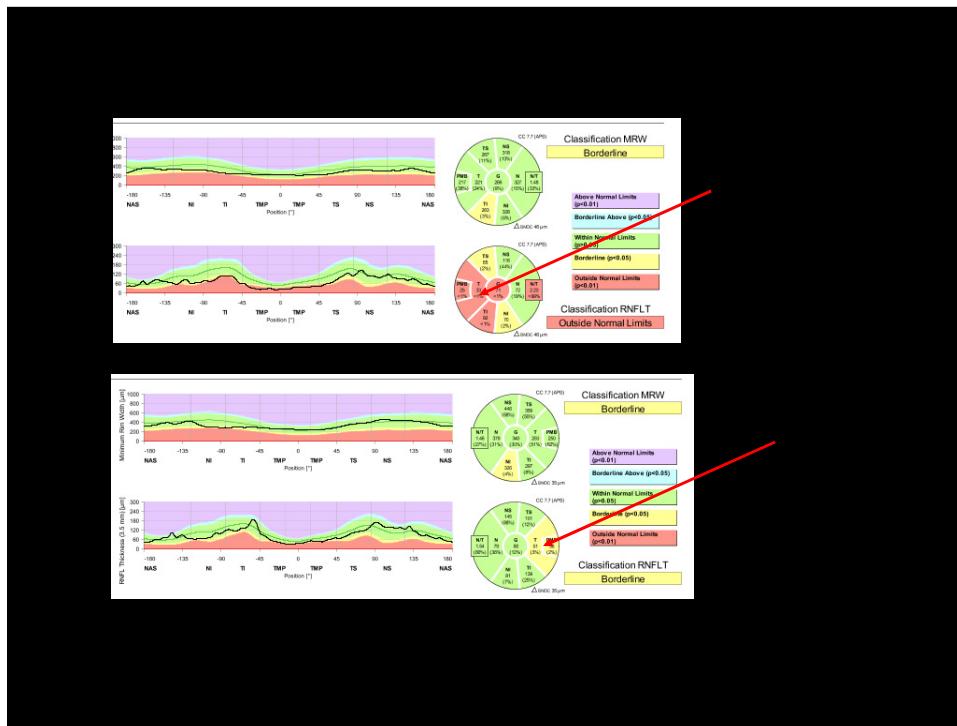
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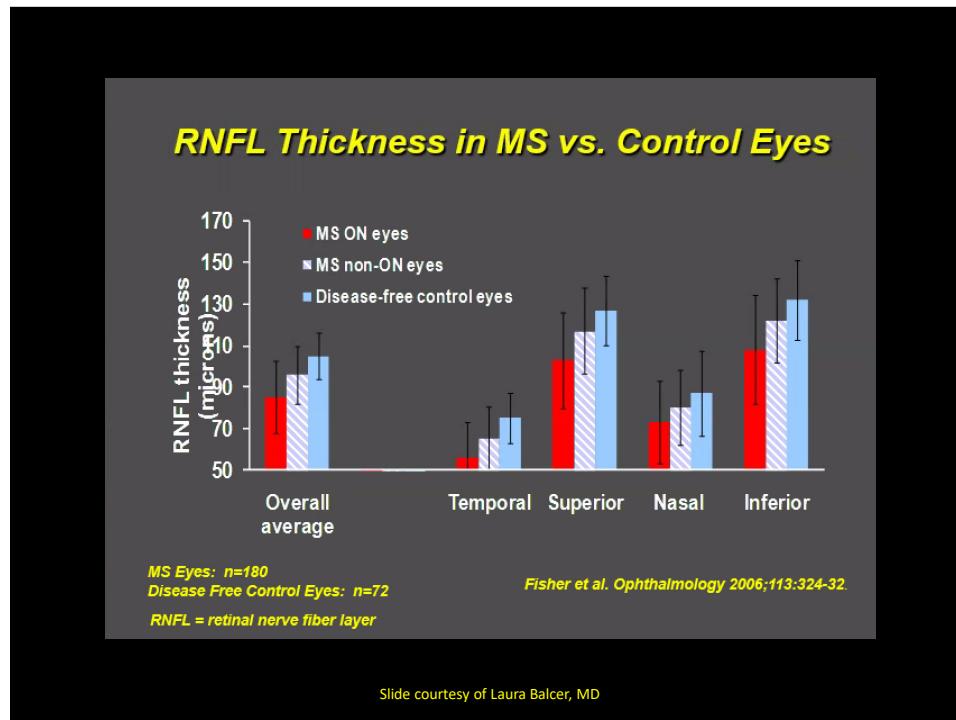
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OCT Findings in MS

- Thinning of RNFL & GCIPL occurs over time with MS in the absence of optic neuritis (thinning of 12%)

Balcer LJ. *Neuroophthalmol* 2014
 Sakai RE et al. *J Neuroophthalmol* 2011
 Fisher JB, et al. *Ophthalmology* 2008

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Retinal and Optic Nerve Degeneration in Patients with Multiple Sclerosis Followed up for 5 Years

Elena Garcia-Martin, PhD,^{1,2} Jose R. Ara, PhD,^{2,3} Jesus Martin, PhD,^{2,3} Carmen Almarcegui, PhD,^{2,4} Isabel Dolz, PhD,^{2,4} Elisa Vilades, MD,^{1,2} Laura Gil-Arribas, PhD,^{1,2} Francisco J. Fernandez, PhD,^{1,2} Vicente Polo, PhD,^{1,2} Jose M. Larrosa, PhD,^{1,2} Luis E. Pablo, PhD,^{1,2} Maria Satue, PhD^{1,2}

Garcia-Martin E, et al. *Ophthalmology* 2017

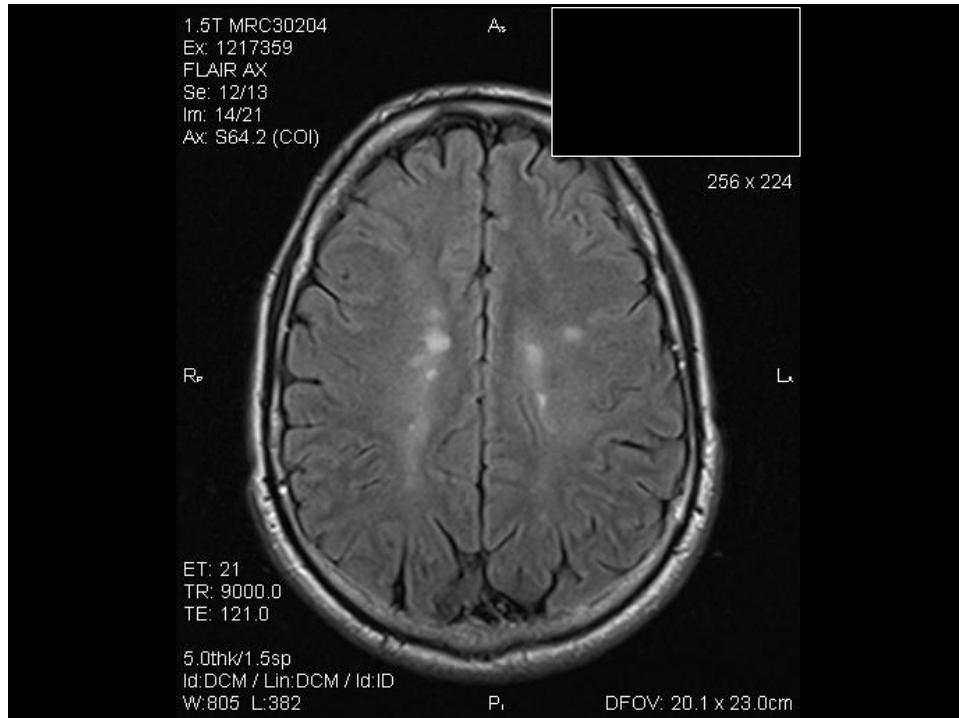
- Thinning of RNFL & increased VEP latencies with MS
- Normal standard assessments of vision (VA, color vision & visual fields)
- RNFL thinning greatest temporal and inferior temp
- Thinning correlation with decreased QOL

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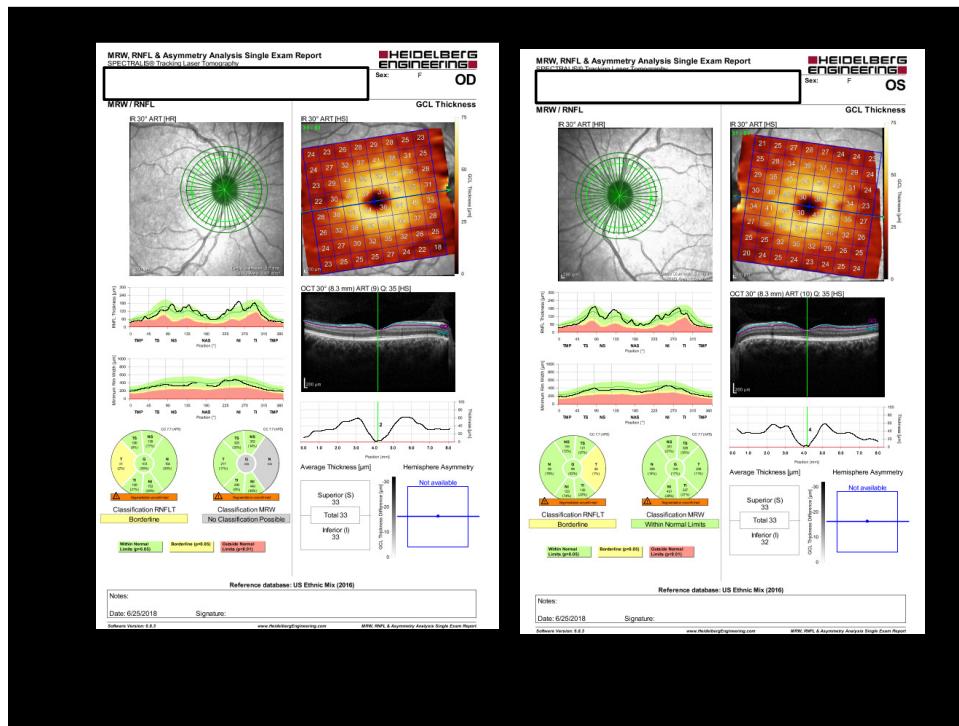
30 y/o AA Woman

- 1-year Hx of RRMS
- Meds:
 - Ocrevus (ocrelizumab)
 - baclofen
- No prior history of optic neuritis
- BVA:
 - 20/20 OD
 - 20/20 OS

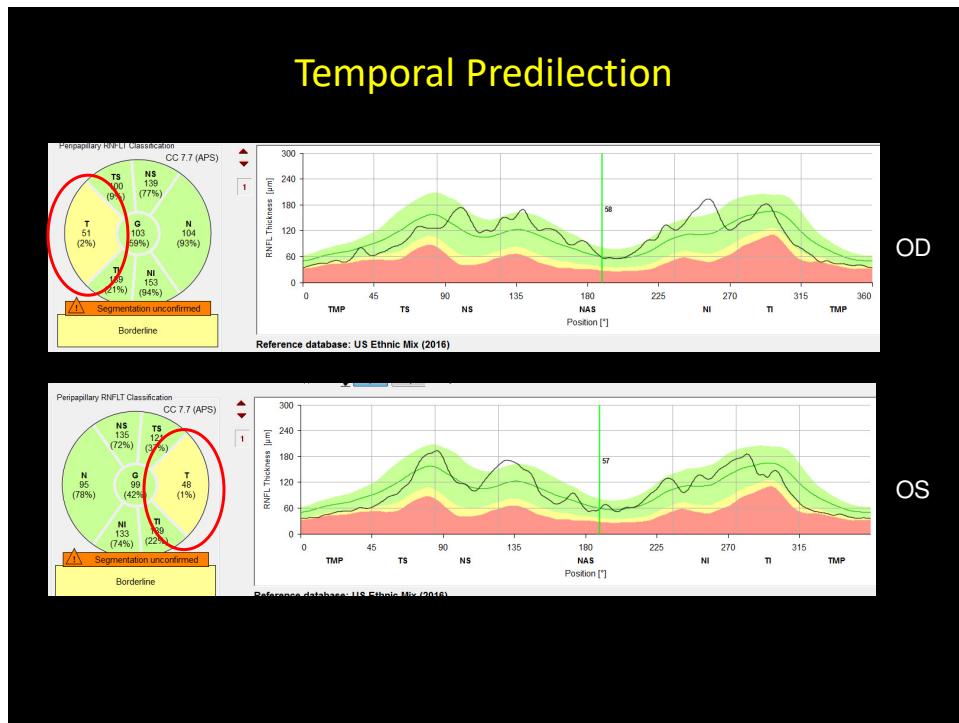
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Active MS is associated with accelerated retinal ganglion cell/inner plexiform layer thinning

Ratchford, John N. MD; Saidha, Shiv MRCPI; Solirchos, Elias S. MD; Oh, Jiwon A. MD, FRCPC; Seigo, Michaela A. ScB; Eckstein, Christopher MD; Durbin, Mary K. PhD; Oakley, Jonathan D. PhD; Meyer, Scott A. PhD; Conger, Amy COA; Frohman, Teresa C. BS; Newsome, Scott D. DO; Balcer, Laura J. MD, MSCE; Frohman, Elliot M. MD, PhD; Calabresi, Peter A. MD

- Longitudinal study of ganglion cell/inner plexiform (GCIP) layer q 6 months in 164 MS patients (59 health controls)
- Exclusion if development of optic neuritis
- Faster rates of GCIP thinning if:
 - Relapses (42% faster, $p = 0.007$)
 - New gad-enhancing lesions (54% faster, $p < 0.001$)
 - New T2 lesions (36% faster, $p = 0.002$)
- Highest annual rates of GCIP thinning if combination of new gad-enhancing lesions, new T2 lesions & disease duration < 5 yrs. (70% faster in patients with all three characteristics vs. without, $p < 0.001$)

Ratchford JN, et al. *Neurology* 2013

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OCT in Neurodegenerative Disease

- Multiple sclerosis
- Parkinson's disease
- Alzheimer's disease
- TBI

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Dopamine and Retinal Function

- Dopamine is released by retinal amacrine cells and binds to D1 and D2 receptors
- Responsible for light adaptation, circadian rhythm, cell survival and eye growth
- Reduction in retinal dopamine levels → retinal and NFL thinning

Witkovsky P. *Documenta Ophthalmologica* 2004
 Sengupta P, et al. *Ann Indian Acad Neurol* 2018

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- RNFL thinning in PD associated with **visual hallucinations & with PD duration and severity**
- Potential for OCT as a surrogate biomarker of disease activity/progression

Lee JY, et al. *J Parkinson's Disease* 2014

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OCT Findings in Parkinson's Disease

- Global reduction in RNFL thickness, ganglion cell complex thickness and macular volume
 - RNFL thinning Temporal > nasal
 - Thinning of OCT parameters correlate with severity and duration of PD

Sengupta P, et al. *Ann Indian Acad Neurol* 2018
Aydin TS, et al. *Kaohsiung J Med Sci* 2018
Yidiz D, et al. *Ann Indian Acad Neurol* 2019

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OCT in Neurodegenerative Disease

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- TBI

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Alois Alzheimer, MD (1906)



- South-West German Psychiatrists' Meeting presentation on pre and post-mortem findings of Auguste Deter - "*On a Peculiar Disease of the Cerebral Cortex*"

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Alzheimer's Disease

- Progressive dementia with loss of neurons and the presence of two main microscopic neuropathological hallmarks: **extracellular amyloid plaques and intracellular neurofibrillary tangles**

Gheorghita M, et al. Rom J Psychopharmacol 2010

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The NEW ENGLAND JOURNAL of MEDICINE

Vol. 315 No. 8 OPTIC NEUROPATHY IN ALZHEIMER'S DISEASE — HINTON ET AL. 485

OPTIC-NERVE DEGENERATION IN ALZHEIMER'S DISEASE

DAVID R. HINTON, M.D., ALFREDO A. SADUN, M.D., PH.D., JANET C. BLANKS, PH.D., AND CAROL A. MILLER, M.D.

Abstract Alzheimer's disease is a dementing disorder of unknown cause in which there is degeneration of neuronal subpopulations in the central nervous system. In postmortem studies, we found widespread axonal degeneration in the optic nerves of 8 of 10 patients with Alzheimer's disease. The retinas of four of the patients were also examined histologically, and three had a reduction in the number of ganglion cells and in the thickness of the nerve-fiber layer. There was no retinal neurofibrillary degeneration or amyloid angiopathy, which are typically seen in the brains of patients with Alzheimer's disease. The changes we observed in the patients with Alzheimer's disease were clearly distinguishable from the findings in 10 age-matched controls and represent a sensory-system degeneration that occurs in Alzheimer's disease. Study of the retina in patients with this disease may be helpful diagnostically, and isolation of the affected ganglion cells may facilitate molecular analysis of the disorder. (N Engl J Med 1986; 315:485-7.)

- 1986 study post mortem study of optic nerves in patients with AD
- Wide-spread axonal degeneration in 8/10 optic nerves
- Specificity for larger M-cell degeneration

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OCT Findings in AD

- RNFL & paramacular thinning in AD vs. controls (Polo V, et al. *Eye* 2014)
- RNFL thinning (superior quadrant selectivity with mild cognitive impairment/early AD) parallels dementia progression in AD (Liu D, et al. *BMC Neurol* 2015)
- RNFL and superior retinal thickness/GCPL thinning (Cunha JP, et al. *Graefe's Arch Clin Exp Ophthalmol* 2017)

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The image shows the cover of a scientific journal. At the top left is the Elsevier logo, which includes a tree and the word "ELSEVIER". Next to it is the CrossMark logo. To the right is the journal title "Alzheimer's & Dementia" with a decorative flourish. Below the title is the subtitle "Retinal Imaging". Underneath that is the article title "Retinal thickness in Alzheimer's disease: A systematic review and meta-analysis". The authors listed are Jurrie den Haan, Frank D. Verbraak, Pieter Jelle Visser, and Femke H. Bouwman. Below the authors are four small lines of text indicating their affiliations: "Neurology, VU University Medical Center Alzheimer Centre, Amsterdam, The Netherlands", "Academic Medical Center, University of Amsterdam, Amsterdam, The Netherlands", "Ophthalmology Department, VU University Medical Center, Amsterdam, The Netherlands", and "Alzheimer Centre, School for Mental Health and Neuroscience (MHeNS), University Medical Centre, Maastricht, The Netherlands". At the bottom of the cover is a small black bar with the text "den Haan J, et al. Alzheimer's & Dementia 2017".

- Meta-analysis of 25 studies involving 887 AD patients, 216 MCI patients and 864 health controls
- AD & MCI patients had thinner RNFL ($p < 0.0001$) & macular thickness ($p = 0.0001$) as compared to healthy controls

ML1

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Slide 137

ML1 Messner, Leonard, 8/8/2021

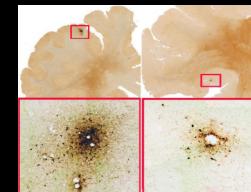
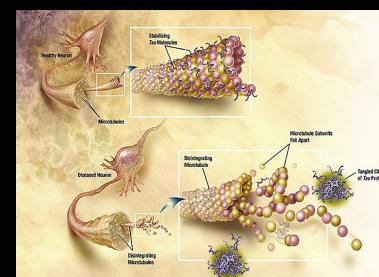
OCT in Neurodegenerative Disease

- Multiple sclerosis
- Parkinson's disease
- Alzheimer's disease
- TBI

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Diffuse Axonal Injury (DAI)

- Rapid axonal stretching
- Axoplasmic stasis with focal axonal swelling ("axonal varicosities" / "axonal bulbs")
- Ionic imbalance (Ca^{++} and K^{+})
- Accumulation of candidate proteins – amyloid precursor protein (APP)
- Microtubular disarrangement
- Dispersal and accumulation of preivasicular neurofibrillary tau tangles

Johnson VE, et al. *Exp Neurol*/2012

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Evidence for OCT as a Potential Surrogate Biomarker of Chronic Traumatic Encephalopathy

- Approx. 50% of brain devoted to vision and visual motor function
- Opportunity for retrograde axonal degeneration into the optic nerve
- Identification of TDP-43 retinal deposition in autopsied eyes from CTE subjects

Goodwill V, et al. *Invest Ophthalmol Vis Sci* 2020
Ann McKee, MD: personal communication

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Original Contribution

Visual Structure and Function in Collision Sport Athletes

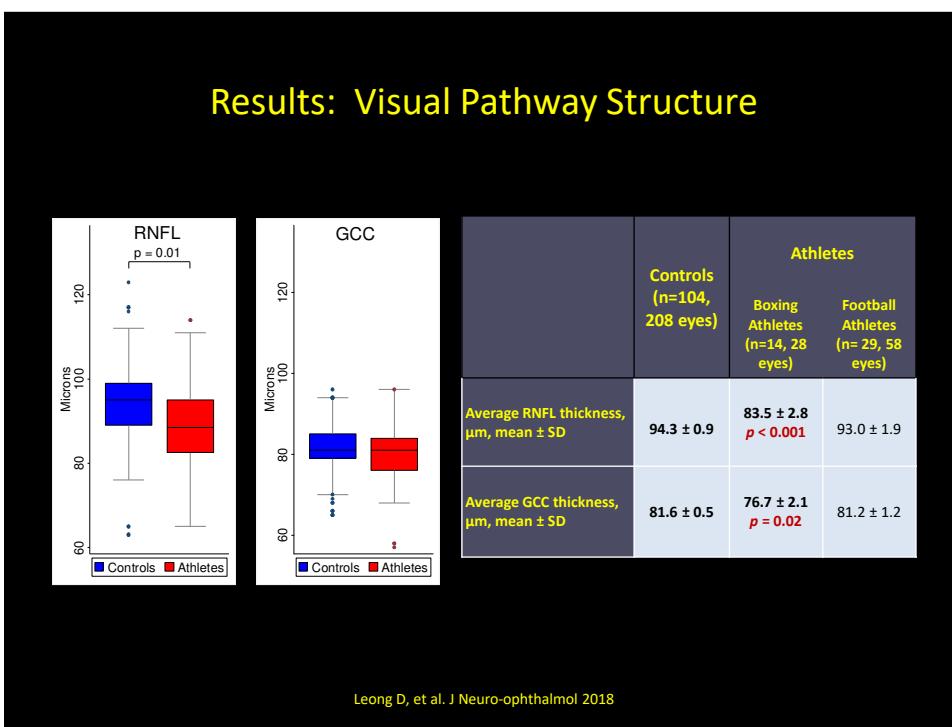
Danielle Leong, OD, PhD, Christina Morettin, OD, Leonard V. Messner, OD, Robert J. Steinmetz, OD, Yi Pang, MD, OD, PhD, Steven L. Galetta, MD, Laura J. Balcer, MD, MSCE

- Multi-center study of 46 collision sport athletes as compared to age-matched healthy controls
 - Illinois Eye Institute/Illinois College of Optometry
 - NYU Langone Medical Center/Department of Neurology
- Comparison of OCT, low contrast acuity, rapid number naming & quality of life among boxers/retired NFL players vs. age-matched controls

Leong D, et al. *J Neuro-ophthalmol* 2018

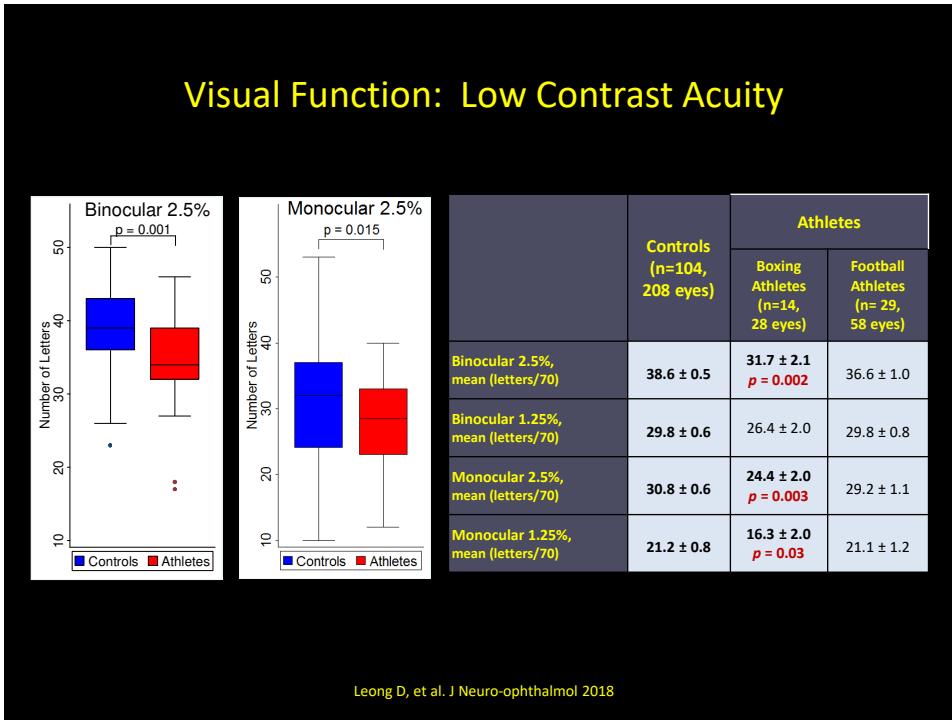
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Results: Visual Pathway Structure

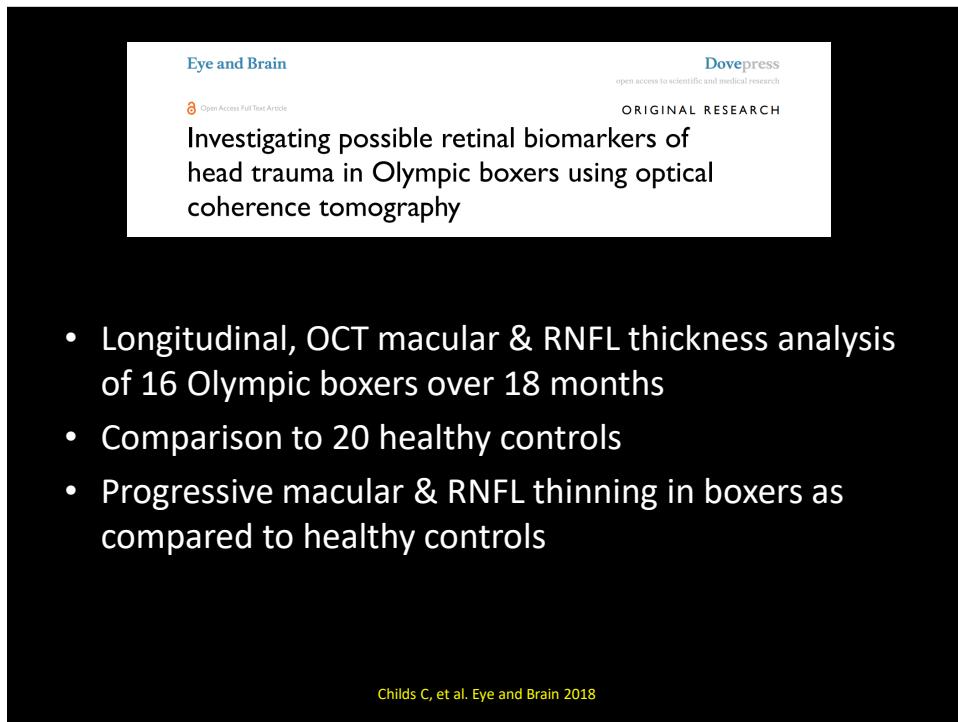


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Visual Function: Low Contrast Acuity

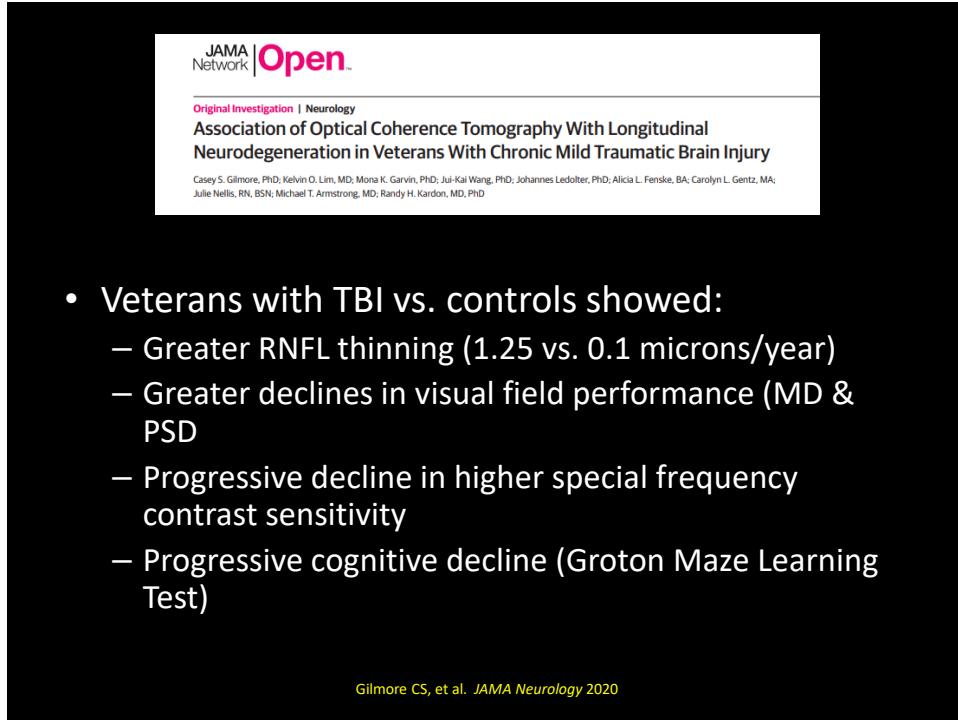


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- Longitudinal, OCT macular & RNFL thickness analysis of 16 Olympic boxers over 18 months
- Comparison to 20 healthy controls
- Progressive macular & RNFL thinning in boxers as compared to healthy controls

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- Veterans with TBI vs. controls showed:
 - Greater RNFL thinning (1.25 vs. 0.1 microns/year)
 - Greater declines in visual field performance (MD & PSD)
 - Progressive decline in higher special frequency contrast sensitivity
 - Progressive cognitive decline (Groton Maze Learning Test)

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Key Points

- OCT analysis of papilledema vs. pseudopapilledema
- OCT analysis of chiasmal & retrochiasmal lesions
- OCT in neurodegenerative disease
 - Multiple sclerosis
 - Parkinson's disease
 - Alzheimer's disease
 - TBI

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**OCT, it's not just for glaucoma
and retinal disease anymore!**



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Thank you!



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