

# New Clinical Imaging Techniques to Evaluate Solar Retinopathy

UNIVERSITY OF  
**WATERLOO**

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School of Optometry & Vision Science

Solar Eclipse Conference 2018

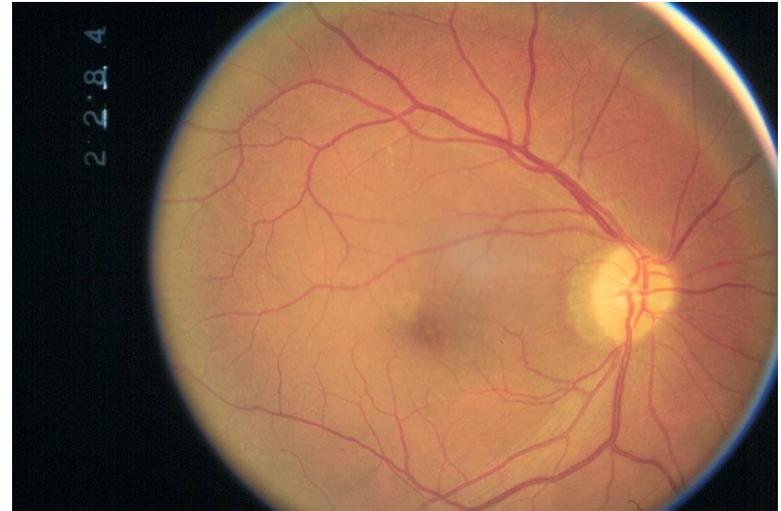
Genk, Belgium

# Clinical Evaluation of Solar Retinopathy

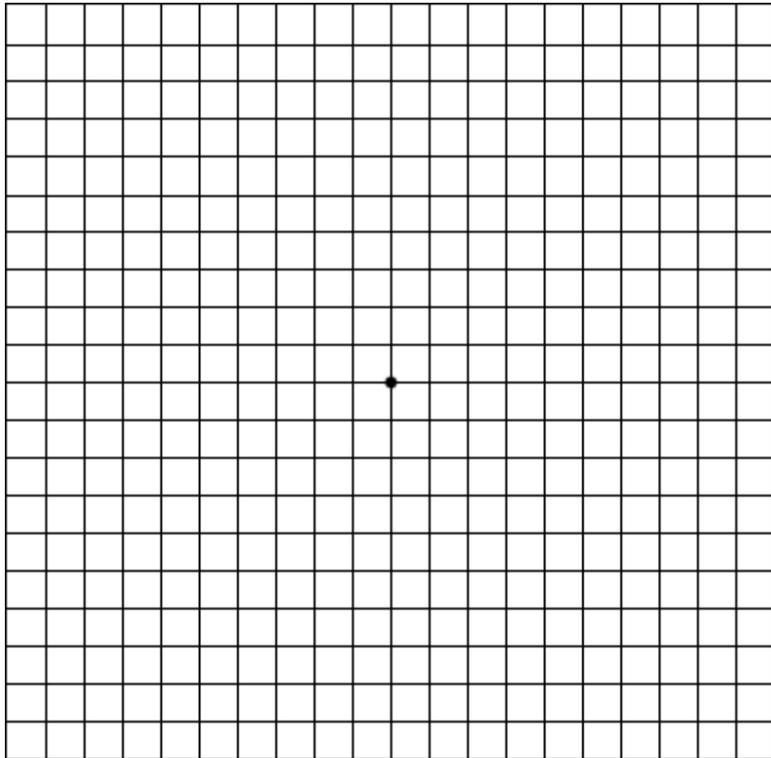
- Case history
  - History of exposure to Sun
  - Mitigating factors
- Visual acuity
- Central visual field assessment
- Retinal assessment and imaging
  - Fundus lens biomicroscopy
  - Retinal imaging

# Retinal Imaging

- White light image
  - Location, size of lesion

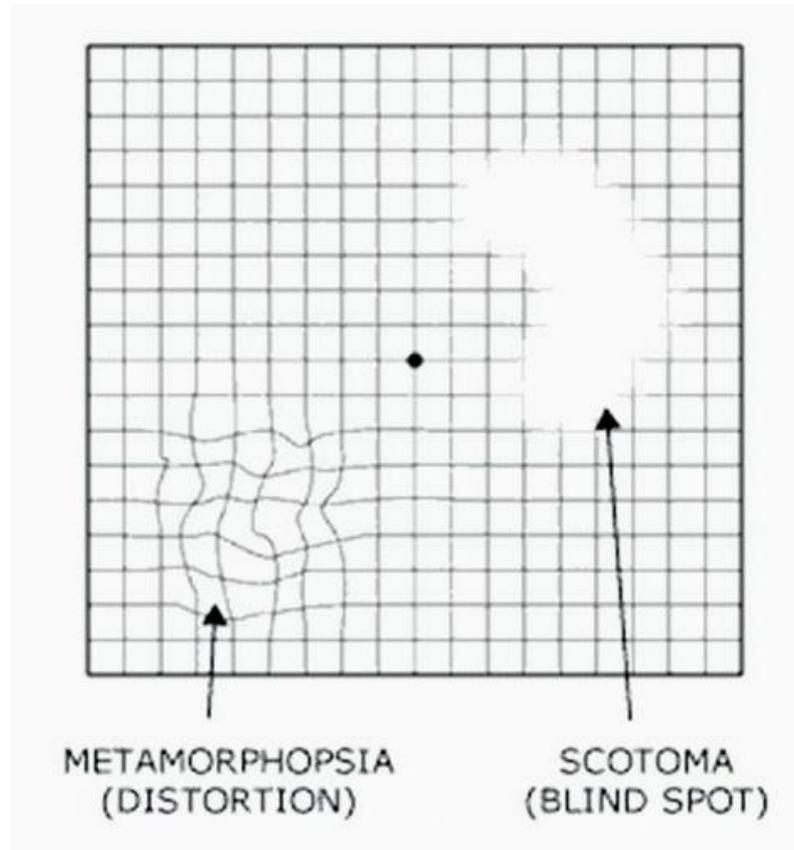


# Visual Field



- Amsler grid
  - Assesses central 10° of visual field
  - Areas of distortion or visual loss can be plotted

# Amsler grid

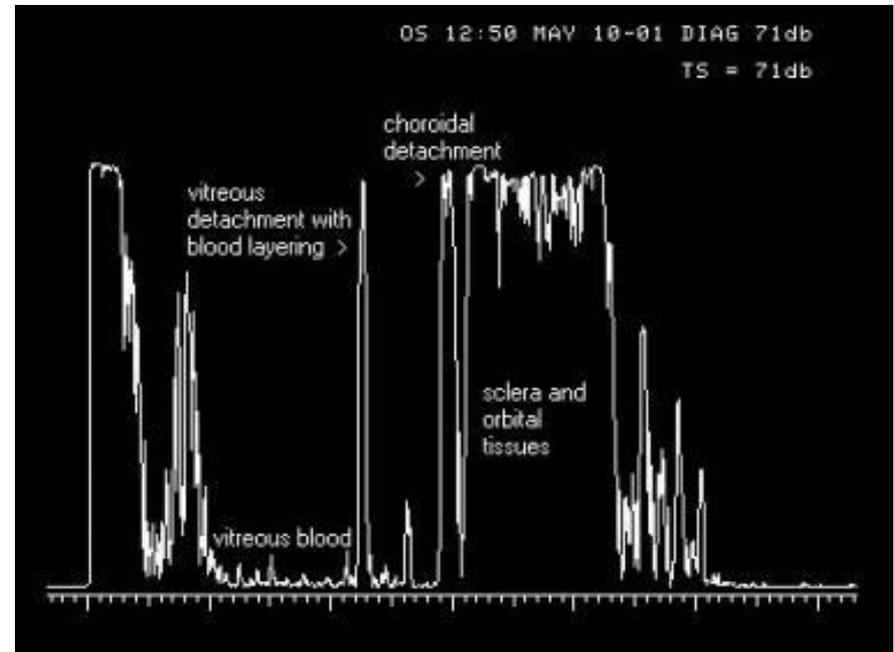


# Limitation

- We know where the damage is
- We don't know the extent of the damage

# Ultrasonic imaging

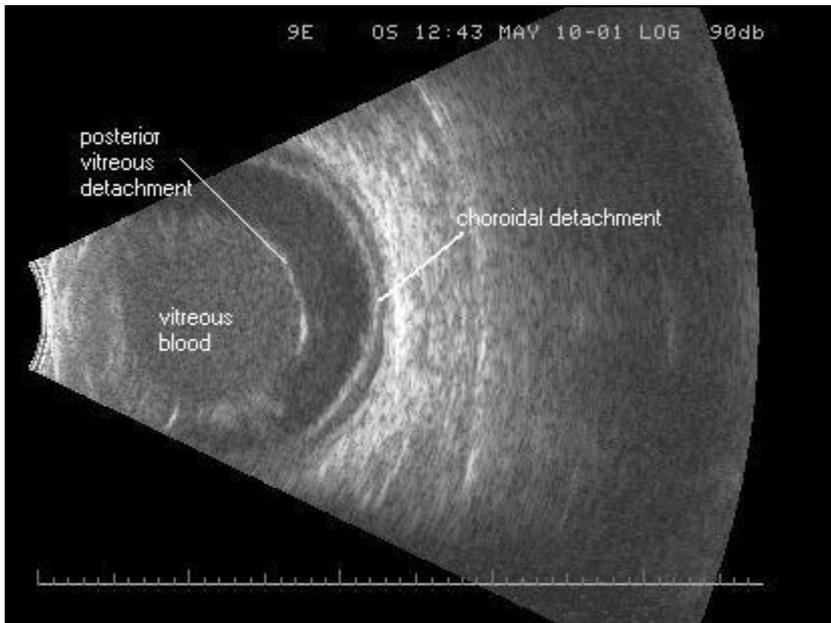
- A-scan
  - Parallel beam of sound
    - Axial scan of eyeball
  - Visualize features that cannot be seen in retinal images
  - Cataract surgery
    - Selection of lens implant power



<https://emedicine.medscape.com>

# Ultrasonic imaging

- B scan
  - Oscillating beam of sound
    - Images a slice of tissue
  - 2-D representation



<https://emedicine.medscape.com>

# Ocular Computed Tomography

- B scan using light
  - Time delay and intensity of reflected light gives A scan data
  - Raster pattern allows views of a slice or a 3-D view of the eye
  - Requires high-speed computer processing of reflection signals

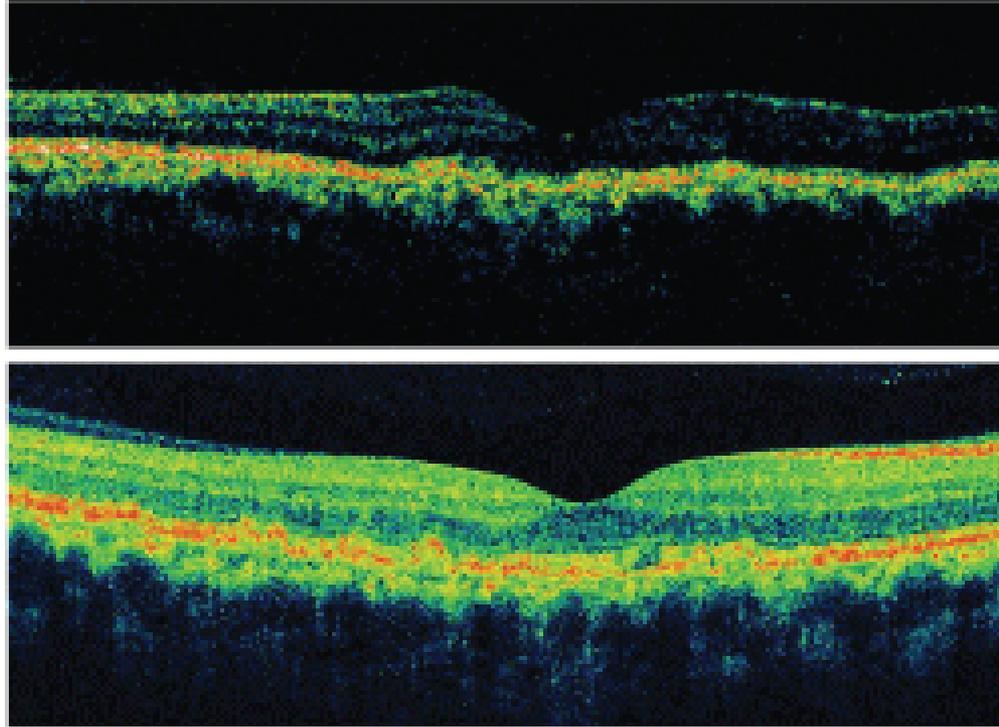
# Time-domain OCT

- Earliest form
- Image stacking of sequential images
  - Similar to stacking of astro-images
- Lower resolution image
- 500 A scans/sec

# Spectral-domain OCT

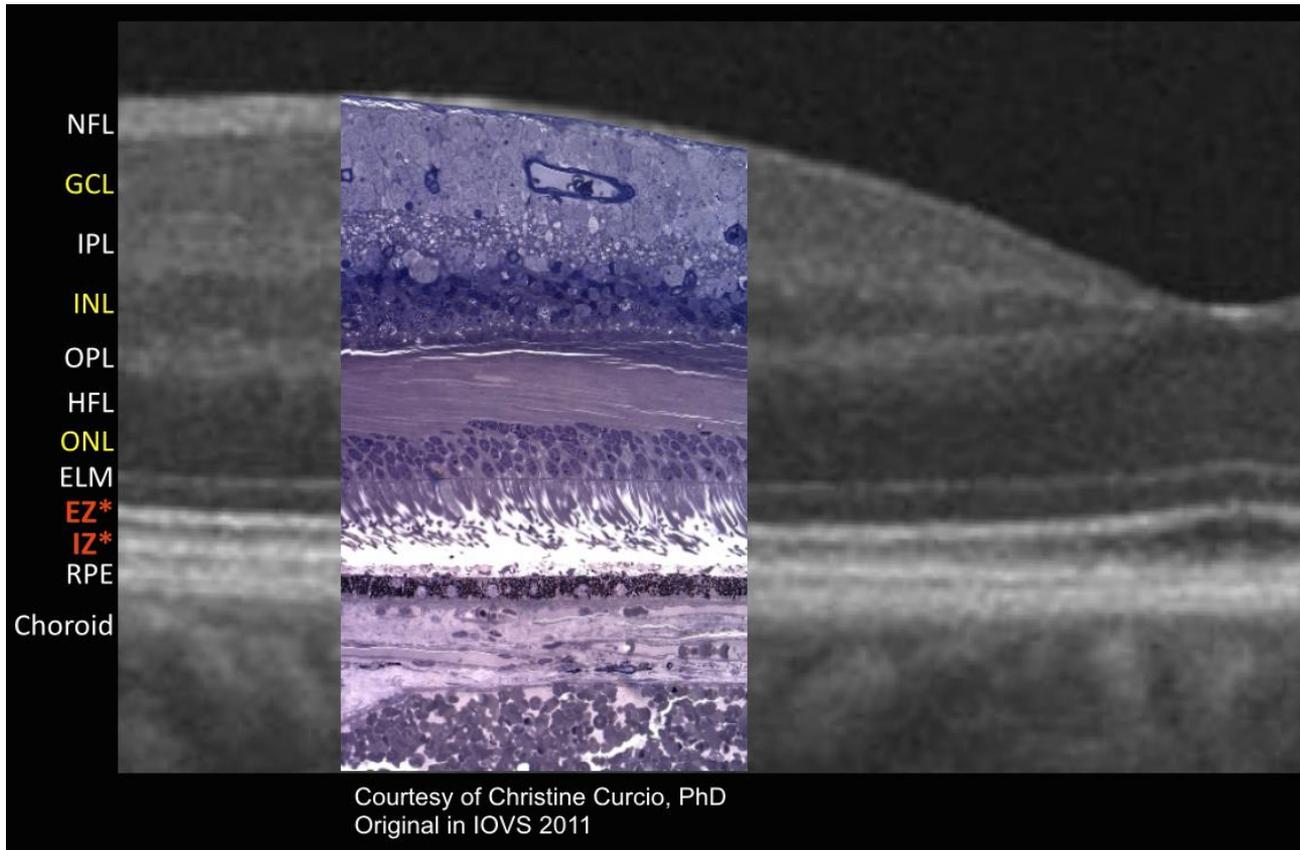
- Simultaneous scan with multiple wavelengths
- Image stacking of simultaneous data
- Higher resolution
- 20k to 40k A scans/sec

# TD vs SD OCTs



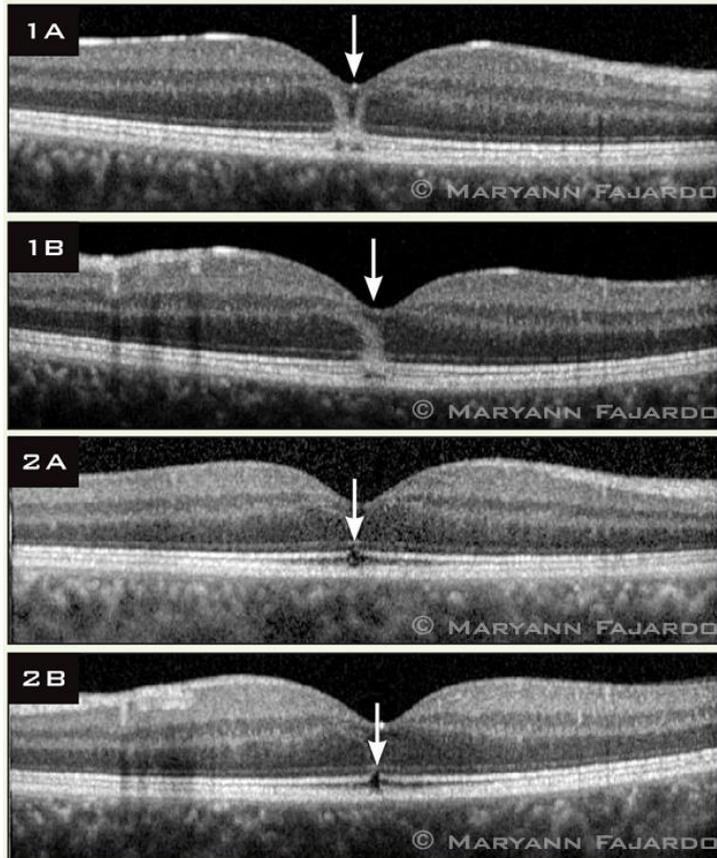
[www.reviewofoptometry.com](http://www.reviewofoptometry.com)

# Retinal landmarks



# Case presentations

# Eclipse maculopathy 1



- 2012 solar eclipse
- Reduced vision 5 days after viewing partial eclipse
  - No eye protection
- 20/30 vision each eye
  - Full thickness hyper reflectivity
- After 3 months 20/25 each eye
  - Discontinuity at ellipsoid zone

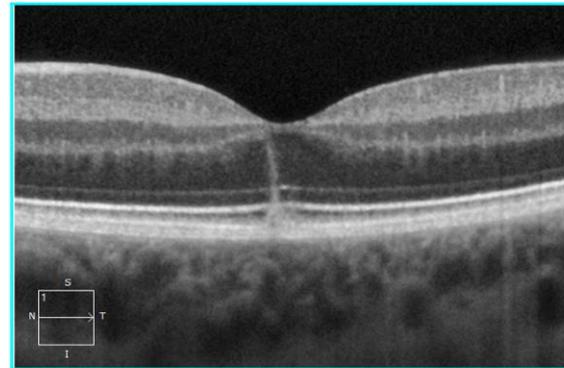
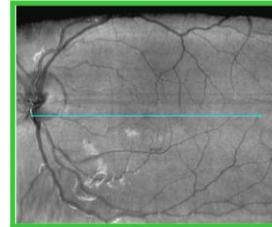
# Eclipse maculopathy 2

- 19-year-old male
- Aug 2017 eclipse
  - Viewed with left eye for a few minutes without protective filter
- Reduced vision
  - Full thickness hyper-reflective lesion at fovea

Name: [REDACTED]   
ID: 10069346 Exam Date: 8/23/2017 CZMI  
DOB: 11/19/1998 Exam Time: 9:49 AM  
Gender: Male Serial Number: 5000-7023  
Technician: Operator, Cirrus Signal Strength: 10/10

High Definition Images: HD 1 Line 100x  OD  OS

Scan Angle: 0° Spacing: 0 mm Length: 9 mm



Comments

Doctor's Signature

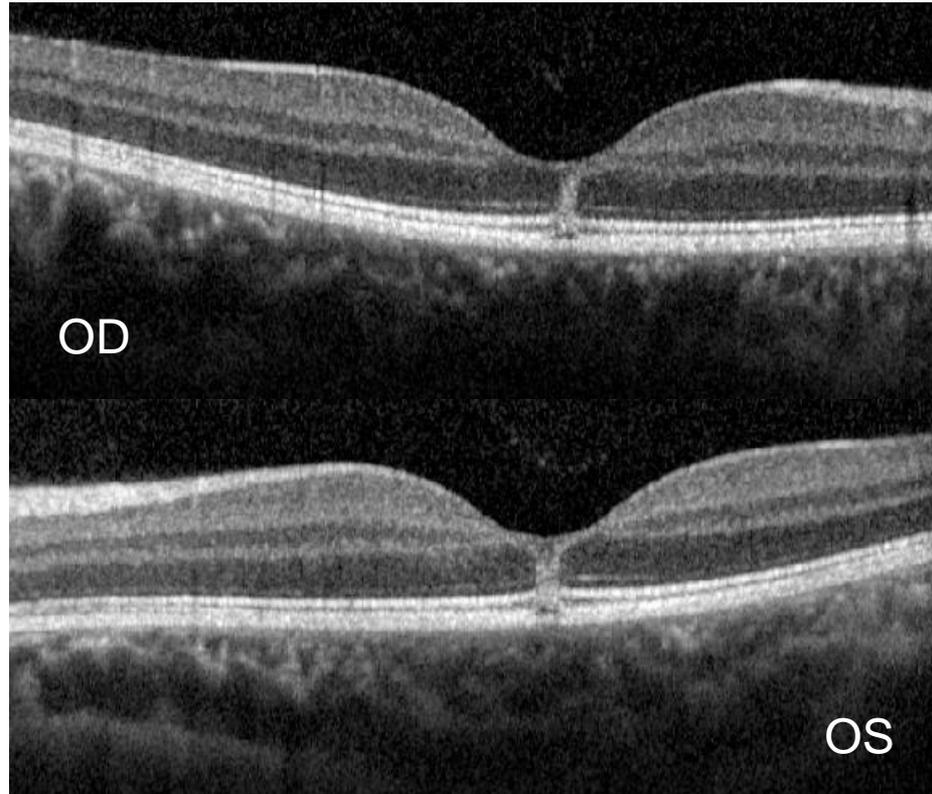
SW Ver: 9.5.0.8712  
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J. Shovlin, OD, FAAO

# Eclipse maculopathy 3

- 24 year-old female
- Viewed Aug 2017 eclipse without protection for 5 m
- Presentation 2 days later
  - R 20/25 L 20/20

# Eclipse maculopathy 3



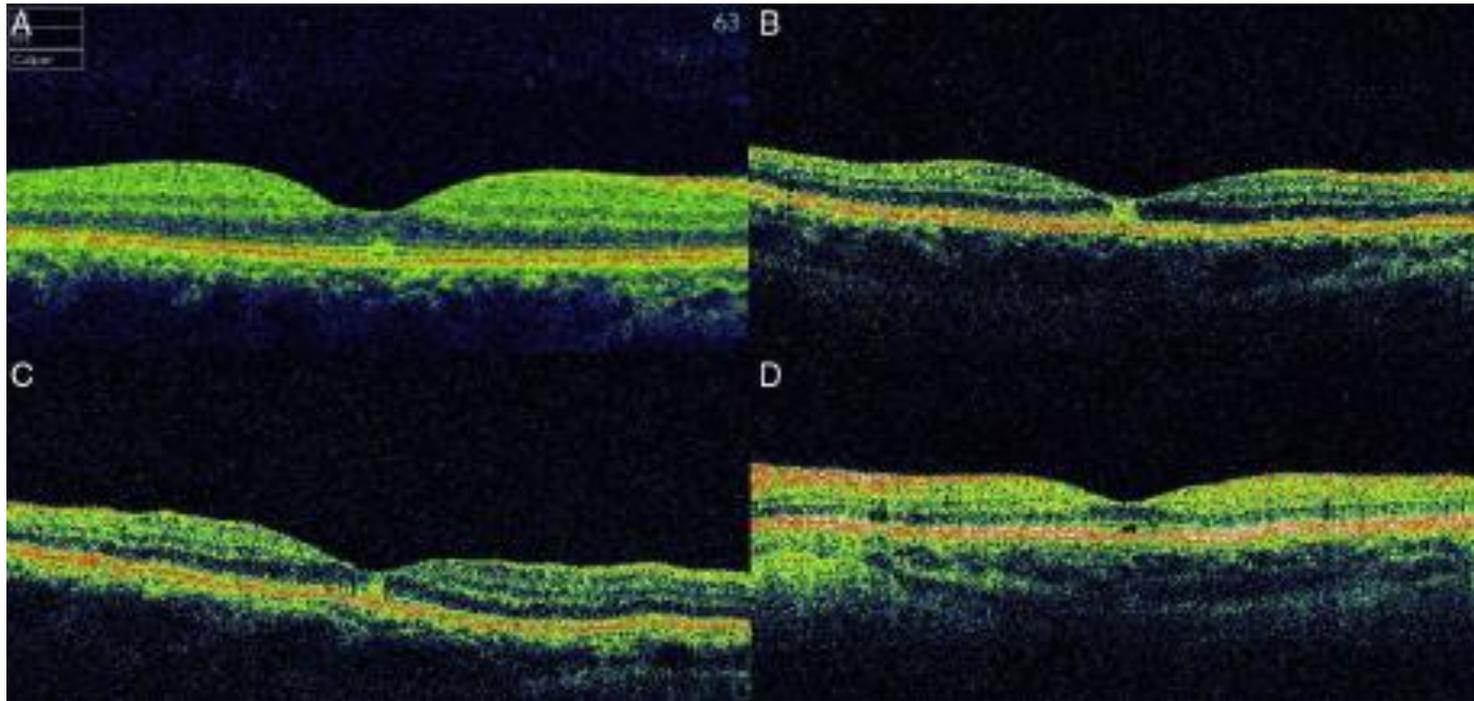
[www.octmd.org/solar-eclipse-retinopathy/](http://www.octmd.org/solar-eclipse-retinopathy/)

# Eclipse maculopathy 4

- Khatib et al.
  - 4 patients ages 14 to 29 years
  - Viewed solar eclipse of 2011-01-04 without protective filters
  - All demonstrated foveal damage in affected eye with reduced acuity
  - Follow-up 3 weeks to 6 months after initial presentation

<http://dx.doi.org/10.1016/j.optom.2013.12.006>

# Eclipse maculopathy 4



Visual acuity on follow-up: A, B, C 20/20 D 20/80

# Eclipse maculopathy 5

- 20s woman viewed Aug 2017 partial eclipse several times, about 6 s each, without protection, then about 20 s with eclipse glasses
- Noted metamorphopsia, blur, colour distortion 4 hours later, left worse
- Saw central black spot in left eye

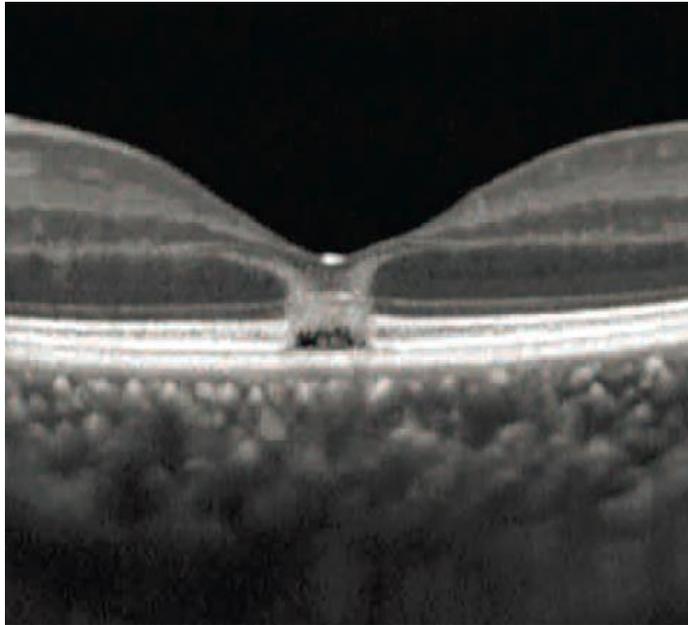
# Eclipse maculopathy 5

- On presentation next day
  - Right 20/20 Left 20/25
  - Left central field defect (Amsler)

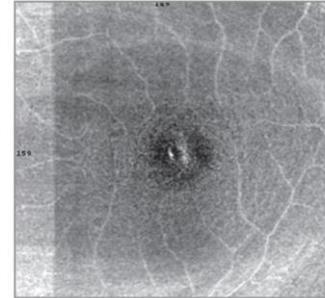


- Left eye dominant; no significant history
- SD-OCT slices and *en face* images taken

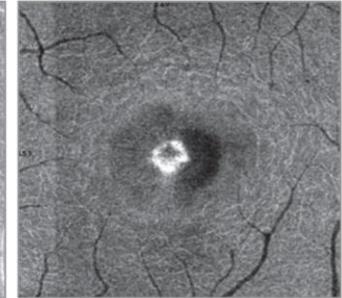
# Eclipse maculopathy 5



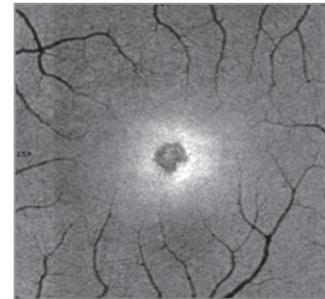
A Inner retina



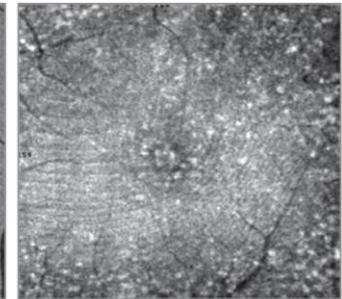
B Middle retina



C Outer retina



D Choriocapillaris



# Eclipse maculopathy 5

- 6 weeks after injury, central scotoma still present in left eye
  - Permanent visual loss
- Best documented case of eclipse retinopathy in peer-reviewed literature
- Wu et al. *JAMA Ophthalmol.* 2018;136(1):82-85.  
doi:10.1001/jamaophthalmol.2017.5517

# Summary

- SD-OCT provides high resolution views of retinal lesions
  - Comparable to light microscopy views but in living eyes
- Hyper-reflective features in eclipse maculopathy indicate tissue damage
- Voids in retinal interdigitation zone predictive of permanent reduced vision