Eclipses, Climate Change, & the Eye

2018 Victoria Conference
Pacific University College of Optometry
James Kundart OD MEd FAAO FCOVD-A

Financial Disclosures: Nothing to Disclose
https://en.wikipedia.org/wiki/Photokeratitis

Learning Objectives
After this course, the practicing optometrist will know how to prevent, differentially diagnose, and treat (when possible):

1. Heat-induced cataract and exfoliation
2. UV-induced pterygium
3. Climatic droplet keratopathy
4. Retinal snow blindness
5. Solar and eclipse retinopathy

Climate Variables That Affect Health Care: UV and Heat!

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5820813/

Ultraviolet Radiation and Climate Change

Table 1: Classification of UV spectrums and absorption by the cornea and aqueous [1, 2]

<table>
<thead>
<tr>
<th>UV band</th>
<th>Wavelength (nm)</th>
<th>Availability</th>
<th>% absorbed by cornea</th>
<th>% absorbed by aqueous</th>
<th>% absorbed by lens</th>
</tr>
</thead>
<tbody>
<tr>
<td>UV-A</td>
<td>315-400</td>
<td>Virtually no UV absorbed by corneal tissue</td>
<td>45 (430 nm)</td>
<td>10 (430 nm)</td>
<td>76 (430 nm)</td>
</tr>
<tr>
<td>UV-B</td>
<td>280-315</td>
<td>Substantial portion absorbed by corneal tissue</td>
<td>27 (430 nm)</td>
<td>14 (430 nm)</td>
<td>56 (430 nm)</td>
</tr>
<tr>
<td>UV-C</td>
<td>100-280</td>
<td>Almost all absorbed by corneal tissue</td>
<td>4 (500 nm)</td>
<td>1 (500 nm)</td>
<td>1 (500 nm)</td>
</tr>
</tbody>
</table>


UV Effects: Basal Cell Carcinoma of the Eyelid: Early or Late Exposure?

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3682081/

Heat-Induced (Glassblower’s) Cataract and Lens Exfoliation Case #1: 83 YOF

https://www.jstage.jst.go.jp/article/jnms/74/1/74_1_55/_pdf;jsessionid=582e84
Heat-Induced (Glassblower’s) Cataract and True Exfoliation Case #1

[https://www.jstage.jst.go.jp/article/jnms/74/1/74_1_88.pdf/-/char/en](https://www.jstage.jst.go.jp/article/jnms/74/1/74_1_88.pdf/-/char/en)

Heat-Induced (Glassblower’s) Cataract and Lens Exfoliation Case #2: 86 YOM

[https://www.jstage.jst.go.jp/article/jnms/74/1/74_1_88.pdf/-/char/en](https://www.jstage.jst.go.jp/article/jnms/74/1/74_1_88.pdf/-/char/en)

UV Effects: Pterygia

The Chesapeake Bay Study (1989) of 838 watermen in Maryland found those with the highest quartile of UV-A and UV-B exposure had a 3x higher odds ratio for pterygia


Treating Pteryigia with Topical Azasite Case #1: 54 YOHM


Treating Pteryigia with Topical Azasite Case #2: 58 YOHF

Treating Pterygia with Topical Azasite
Case #3: 37 YOHM

Treating Pterygia with Azasite:
$185 (US) a bottle, with coupon
https://www.goodrx.com/azasite?drug-name=azasite

Treating Pterygia with Topical Azasite:

Climatic Droplet Keratopathy #1

Climatic Droplet Keratopathy #2
Found in Labrador, Newfoundland

Climatic Droplet Keratopathy #3
How Other Species Prevent Corneal Snow Blindness

- The concentration of vitamin C in the corneal epithelium of reindeer is 2x higher than that found in humans.
- Our corneal vitamin C is the highest in the human body.
- Reindeer live in higher elevations (>100m above sea level), where there is higher UV exposure.


Phototoxicity and the Retina

M A Contín, M M Benedetto, M I Quintana-Quintana, and M E Guido

Light pollution: the possible consequences of excessive illumination on retina


Case #1: 58 YOM with UV Retinopathy (Snow Blindness): 20/20 OD, 20/50 OS

Case #1: 58 YOM with Snow Blindness
Macular OCT 5-Line Raster

Erythropsia in Mountain Climbers

https://julbo-canada.ca/blogs/news/33320880-the-most-common-eye-disorder-found-in-climbers
**Prevention and Treatment of Snow Blindness (and Retinal Hemorrhage!)

http://www.mrcophth.com/ophthalmologyonstamps/phototoxicity/e.html

**Case #2: Solar Retinopathy (indirectly) from Bipolar Disorder in 45 YOF

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1860187/

**Case #2: Time-Domain OCT

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1860187/

**Case #3: Baseline Sungazing Retinopathy

(A) Right eye at initial presentation showing a retinal pigment epithelial defect at the fovea. (B) Left eye at initial presentation showing a retinal pigment epithelial defect at the fovea. BCVA 20/30 OD, OS.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3604317/

**Sungazing Retinopathy: One Month Follow-Up

(A) Right eye at 1 month: persistent retinal pigment epithelial (RPE) changes at the fovea

(B) Left eye at 1 month: persistent RPE changes at the fovea

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3604317/

**Sungazing Retinopathy: Six Month Follow-Up

Right eye at 6 months: improvement in foveal changes and

(B) Left eye at 6 months: improvement in foveal changes

Damage is thought to be photochemical, not thermal!

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3604317/
Sungazing Retinopathy: One Year Follow-Up
(A) Right eye at 1 year; almost full resolution of retinal pigment epithelial (RPE) changes
(B) Left eye at 1 year; almost full resolution of RPE changes

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3804317/

Case #4: 38 YOWF Solar Retinopathy Without Abnormal Exposure, Baseline and Six Months Later (20/20)

http://www.scielo.br/pdf/abo/v76n2/12.pdf

Case #4: 38 YOWF, Macular OCT Solar Retinopathy w/o Abnormal Exposure

http://www.scielo.br/pdf/abo/v76n2/12.pdf

Case #5: 21 YOM Solar Retinopathy OD, 20/30 BCVA

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3149141/

Case #5: 21 YOM Solar Retinopathy Fluorescein Angiography

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3149141/

Case #5: 21 YOM Solar Retinopathy Time-Domain OCT OD

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3149141/
Case #5: 21 YOM Solar Retinopathy Spectral-Domain OCT OD, BCVA 20/25

Pediatric Case #6: 10 YOM Solar Retinopathy OS, BCVA 20/25

Case #6: 10 YOM Solar Retinopathy Fluorescein Angiography OS

Case #6: 10 YOM Solar Retinopathy Time-Domain OCT OS, BCVA 20/20

Case #6: 10 YOM Solar Retinopathy Spectral-Domain OCT OS

Eclipse Retinopathy Case #7: 29 YOM, BCVA 20/40 OD

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3149141/

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https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4213866/
Eclipse Retinopathy Case #8: 29 YOF, BCVA 20/40 OD, 20/20 in 1 mo.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4213866/

Pediatric Eclipse Case #9: 13 YOF, BCVA 20/20 OD, OS

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4213866/

Pediatric Eclipse Case #10: 14 YOF, BCVA 20/80 OD x 1 year

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4213866/

Case #11: 63 YOF Eclipse Retinopathy BCVA 20/30 OD

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3545138/

Case #11: Eclipse Retinopathy Auto-fluorescence

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3545138/

Case #11: Eclipse Retinopathy Baseline Macular OCT

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3545138/
Case #11: Epiretinal Membrane 1 Mo. Later BCVA 20/40 OD

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3846138/

Case #11: Membrane Peel and Vitrectomy BCVA 20/20 OD

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3846138/

Case #11: Eclipse Retinopathy 63 YOF Resolution

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3846138/

Pediatric Case #12: Eclipse Retinopathy 10 YOM, 20/40-20/30 OS


Pediatric Case #13: Eclipse Retinopathy in 8 YOF, OD > OS


Pediatric Case #14: Venus Transit Retinopathy in 11 YOF, Metamorphopsia

Preventing Solar and Eclipse Retinopathy

https://eclipse2017.nasa.gov/safety

Looking directly at the sun is unsafe except during the brief total phase of a solar eclipse ("totality"), when the moon entirely blocks the sun’s bright face, which will happen only within the narrow path of totality (https://eclipse2017.nasa.gov/2017eclipse). The only safe way to look directly at the un eclipsed or partially eclipsed sun is through special-purpose solar filters, such as "solar glasses" (examples shown at left) or hand-held solar viewers. Homemade filters or ordinary sunglasses, even very dark ones, are not safe for looking at the sun; they transmit thousands of times too much sunlight.

Treating Solar Retinopathy

- There is no standardized treatment for solar retinopathy, but...
- Antioxidant vitamins and micronutrients similar to AREDS (vitamin A, C, E, lutein, zeaxanthin, and zinc) have shown promise
- Oral prednisolone has been tried, but it is a risk factor for central serous chorioretinopathy

Questions?
Thank You!

James Kundart OD
MEd FAAO FCOVD-A
Professor, Pacific University
College of Optometry
3D Performance Clinic
Kundart@pacificu.edu

THANKS FOR THE MEMORIES, MS. JEANNE OLIVER!