



Pacific University College of Optometry  
 Coeur d'Alene Continuing Education

April 24 & 25, 2015  
 Coeur d'Alene Resort, Idaho  
 COPE EVENT #108901

Date	Speaker	Title	COPE	Certification
Friday, 4/24/2015	Denise Goodwin, OD	Neuroimaging 101 (1 hr) <i>Pages 2-9</i> 1:00pm – 2:00pm	<b>37787</b> <b>NO</b>	1 hour Therapeutic
	Len V. Koh, PhD, OD	AMD Update (1 hr) <i>pages 10-19</i> 2:00 pm – 3:00 pm	<b>44205</b> <b>SD</b>	1 hour Therapeutic
	Lorne Yudcovitch, OD, MS	Shedding Light on Fundus Autofluorescence (1 hr) <i>Pages 20-22</i> 3:00 pm – 4:00 pm	<b>42772</b> <b>PS</b>	1 hour Therapeutic
	Len V. Koh, PhD, OD	Primary Eye Care for Diabetes (1 hr) <i>pages 23-33</i> 4:00 pm – 5:00 pm	<b>44209</b> <b>SD</b>	1 hour Therapeutic
	Lorne Yudcovitch, OD, MS	Ebola and Other Rare Viruses: What Every Optometrist Should Know (1 hr) <i>Pages 34-36</i> 5:00 pm – 6:00 pm	<b>44472</b> <b>SD</b>	1 hour Therapeutic

Therapeutic Hours: PS, PH, AS, SD, PD

TOTAL HOURS ATTENDED: \_\_\_\_\_

Name \_\_\_\_\_ License # \_\_\_\_\_

Mailing Address \_\_\_\_\_

City/ST/ZIP \_\_\_\_\_





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Saturday 4/25/2015	Denise Goodwin, OD	Fundamentals of Gonioscopy (1 hr) <i>Pages 37-45</i> 8:00 am – 9:00 am	<b>44623</b> <b>GL</b>	1 hour Therapeutic
	Len Koh, PhD, OD	Adverse Drug Reactions Pertinent to Eyecare (1 hr) <i>Pages 46-58</i> 9:00 am – 10:00 am	<b>44210</b> <b>PH</b>	1 hour Therapeutic
	Keegan Bench, OD Kolten Kuntz, OD Brandon McFadden, OD	Clinical Cases from Spokane VA Medical Center <i>Pages 59-61</i> 10:00 am – 11:00 am	<b>44660</b> <b>PS</b>	1 hour
	Denise Goodwin, OD	Clinical Applications of Electrophysiology (1 hr) <i>Pages 62-70</i> 11:00 am – 12:00 pm	<b>44624</b> <b>NO</b>	1 hour Therapeutic
	Lorne Yudcovitch, OD, MS	Put a Lid on It: Sutureless Eyelid Procedures (1 hr) <i>Pages 71-74</i> 12:00 pm – 1:00 pm	<b>44473</b> <b>SP</b>	1 hour Therapeutic

Therapeutic Hours: PS, PH, AS, SD, PD

TOTAL HOURS ATTENDED: \_\_\_\_\_

Name \_\_\_\_\_ License # \_\_\_\_\_

Mailing Address \_\_\_\_\_

City/ST/ZIP \_\_\_\_\_



## Coeur D'Alene CE Faculty 2015



Denise Goodwin, OD, FAAO ([goodwin@pacificu.edu](mailto:goodwin@pacificu.edu))

Dr Goodwin is a graduate of Pacific University College of Optometry where she is currently a tenured Professor of Optometry. She is the coordinator of the Neuro-ophthalmic Disease Service and is editor of "Eye on Pacific" a newsletter featuring the College of Optometry referral services and unusual clinical cases. At Pacific University she teaches clinical procedures, ocular disease and ophthalmic imaging. Dr. Goodwin has also maintained a private practice for the past 15 years. Her online course, "Fundamentals of Gonioscopy" is one of the most popular courses on our website.



Len Koh, PhD, OD ([lenskoh@pacificu.edu](mailto:lenskoh@pacificu.edu))

Dr. Koh holds a doctorate in pharmacology and earned his optometry degree from New England College of Optometry. He completed a residency in primary eye care from Salus University Pennsylvania College of Optometry. Dr. Koh holds the rank of Associate Professor of Optometry and serves as the Clinic Director of Pacific EyeClinic Hillsboro. His research interests include Ocular Therapeutics, Biochemical and Molecular Basis of Ocular Disease.



Lorne Yudcovitch, OD, MS ([yudcovil@pacificu.edu](mailto:yudcovil@pacificu.edu))

Dr. Yudcovitch hails from Alberta, Canada, and earned his optometry degree from Pacific University, where he is a full professor and Chief of the Medical Eye/Ocular Disease Service. He is an engaging instructor and has been honored by his students as Didactic Instructor of the Year for three consecutive years. He is also a well-regarded national and international speaker in advanced ocular imaging, diabetes and glaucoma management, and eye disease pharmacological treatment.

### Spokane Veterans Administration Medical Center – OPTOMETRY RESIDENTS

#### Keegan Bench, OD

Dr. Bench earned a Bachelor of Science in Biology from Utah State University, and completed his Doctor of Optometry at Midwestern University Arizona College of Optometry. He is completing his residency in geriatric care and ocular disease.

#### Brandon McFadden, OD

Dr. McFadden earned his undergraduate degree in Exercise Physiology from the University of Utah and his Doctor of Optometry from The Ohio State University College of Optometry. His residency training is in Ocular Disease and Cornea & Contact Lenses.

#### Kolten Kuntz, OD

Originally from Helena, Montana, Dr. Kuntz earned his undergraduate degree from Eastern Washington University and his Doctor of Optometry from Midwestern University Arizona College of Optometry. He is completing his Ocular Disease residency.

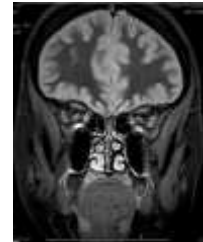
Coeur d'Alene CE Course Administrator; Jeanne Oliver ([jeanne@pacificu.edu](mailto:jeanne@pacificu.edu))

# Neuroimaging 101 for the Optometrist

Denise Goodwin, OD, FAAO  
 Coordinator, Neuro-ophthalmic Disease Clinic  
 Pacific University College of Optometry  
 goodwin@pacificu.edu

## Why?

- ✗ Improve communication
- ✗ Direct studies
- ✗ Understand reports
- ✗ Understand limitations
- ✗ Double check reports



Denise Goodwin, O.D., F.A.A.O.  
 Pacific University College of Optometry  
 Neuro-ophthalmic Disease Service  
 222 SE 8th Ave., Suite 110  
 Hillsboro, OR 97123  
 (503) 532-7500

Patient name: \_\_\_\_\_  
 Patient date of birth: \_\_\_\_\_  
 Patient gender: \_\_\_\_\_  
 Patient phone number: \_\_\_\_\_  
 Patient insurance company: \_\_\_\_\_

Please fax orders to: **503-532-7520**  
 Provider signature: \_\_\_\_\_ Date: **April 9, 2015**  
 Diagnosis, ICD-9 code, or reason for visit: **Visual field defect (362.21)**  
 Clinical information: \_\_\_\_\_

\*\*\*\*\*Please Release CD of Films to Patient\*\*\*\*\*

MRI	CT	MRA
<input type="checkbox"/> Brain	<input type="checkbox"/> Brain	<input type="checkbox"/> Brain
<input type="checkbox"/> Orbits	<input type="checkbox"/> Orbits	<input type="checkbox"/> Neck
<input type="checkbox"/> Fat suppression	<input type="checkbox"/> Chest	<input type="checkbox"/> MRV
<input type="checkbox"/> White matter	<input type="checkbox"/> With contrast	<input type="checkbox"/> Brain
<input type="checkbox"/> Other: _____	<input type="checkbox"/> Bone window	<input type="checkbox"/> CTA
<b>Carotid Ultrasound</b>	<input type="checkbox"/> Other: _____	<input type="checkbox"/> Brain
<input type="checkbox"/> Neck		

If previous films are available, please assess interval change.

## What to Order?

- ✗ MRI
  - Brain
  - Orbits
  - Fat suppression
  - With gadolinium
- ✗ CT
  - Brain → **ABC'S**
    - Acute blood
    - Bone
    - Calcification
    - Sinuses
  - Orbits
  - Chest
  - With contrast

## What to Order?

- ✗ MRI
  - Brain
  - Orbits
  - Fat suppression
  - With gadolinium



### What to Order?

- × MRI
  - Brain **\$1471**
  - Orbits **\$2134**
  - Fat suppression
  - With gadolinium **\$5/mL**
- × CT
  - Brain **\$653**
  - Orbits
  - Chest
  - With contrast

### What to Order?

- × MRI
  - Brain **\$1471**
  - Orbits **\$2134**
  - Fat suppression
  - With gadolinium **\$5/mL**
- × CT
  - Brain **\$653**
  - Orbits
  - Chest
  - With contrast



#### Patient History:

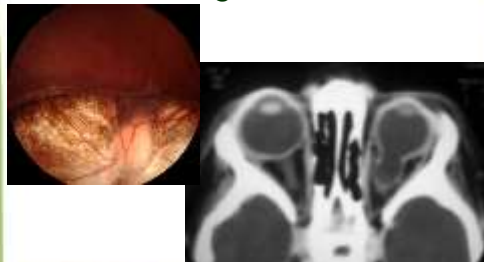
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Cholesterol	<input type="checkbox"/>	<input type="checkbox"/>
Sexual	<input type="checkbox"/>	<input type="checkbox"/>
Recent travel	<input type="checkbox"/>	<input type="checkbox"/>
Allergies	<input type="checkbox"/>	<input type="checkbox"/>
Pregnancy	<input type="checkbox"/>	<input type="checkbox"/>

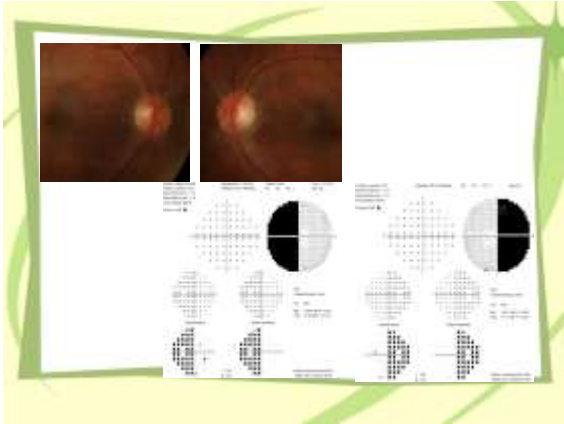
#### Appointment Arranged:

by: \_\_\_\_\_  
 date: \_\_\_\_\_  
 time: \_\_\_\_\_



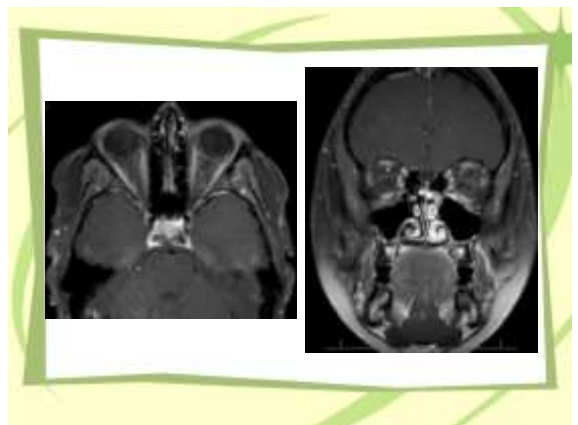
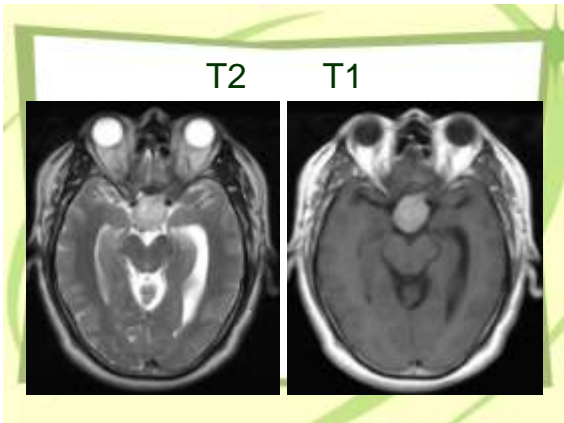
### Diagnosis?





### What to Order?

- × MRI
  - Brain
  - Orbits
  - Fat suppression
  - With gadolinium
- × CT
  - Brain
  - Orbits
  - Chest
  - With contrast





### Diagnosis?

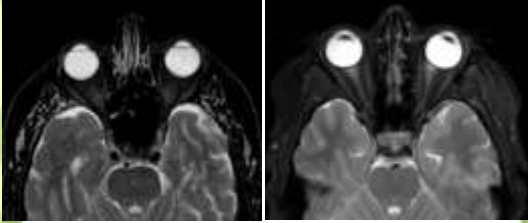
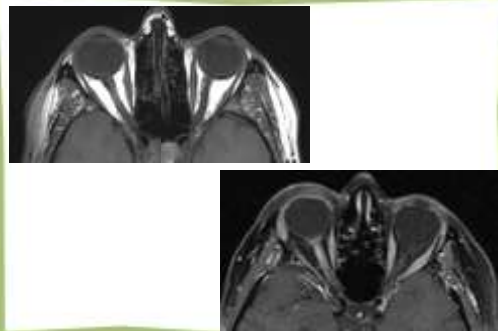
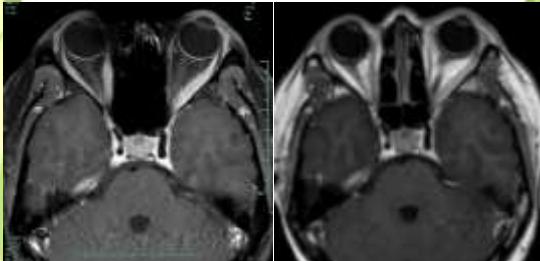
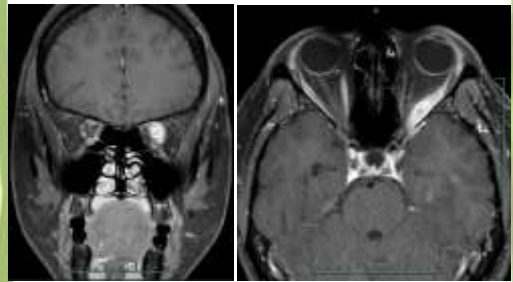
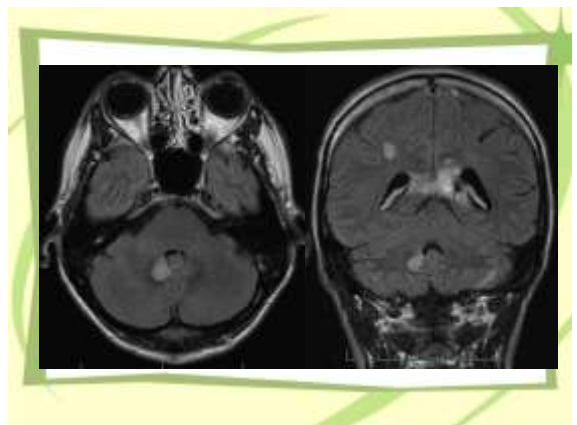
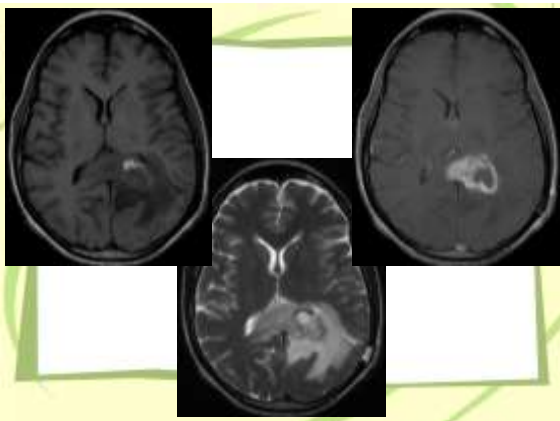
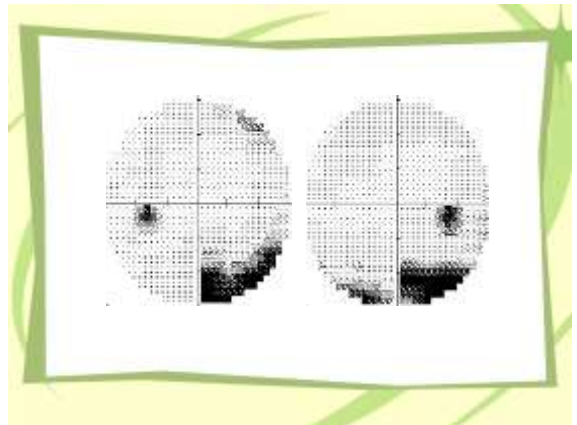
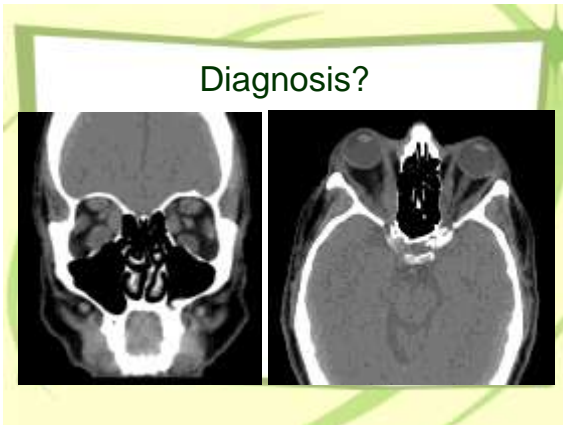
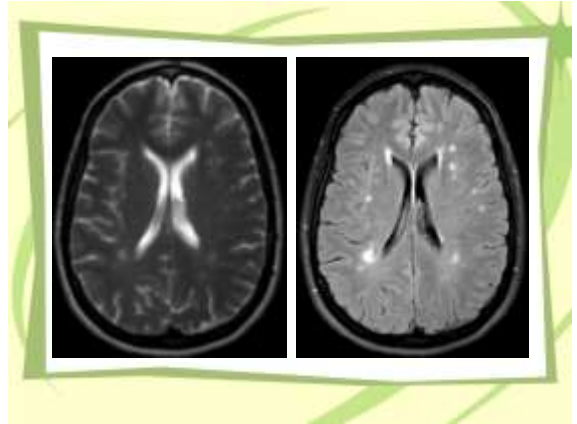
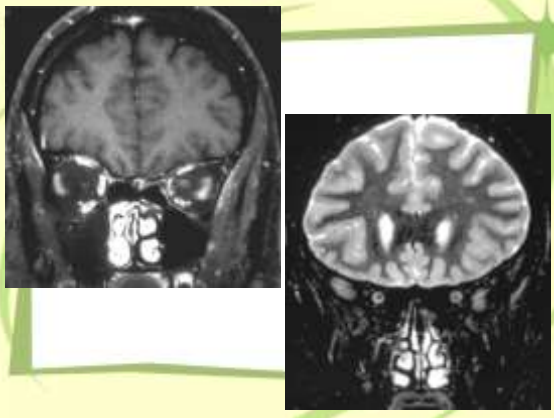


Image by Tracy Doll, OD

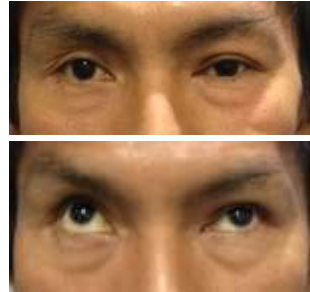
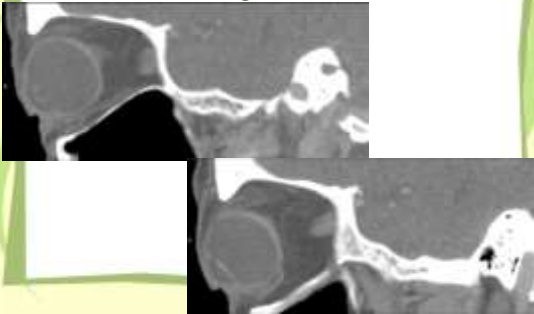
### What to Order?

- × MRI
  - Brain
  - Orbits
  - Fat suppression
  - With gadolinium
- × CT
  - Brain
  - Orbits
  - Chest
  - With contrast

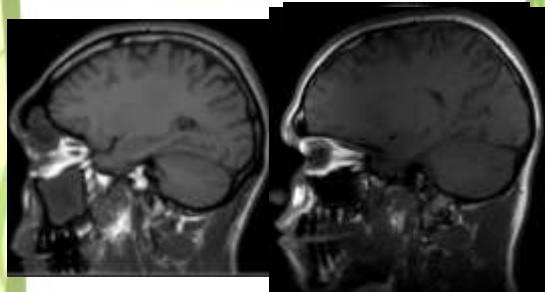




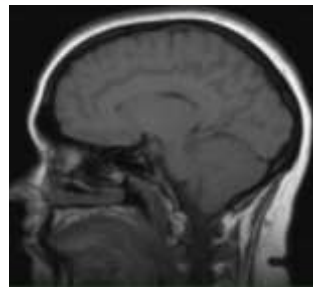
Diagnosis?

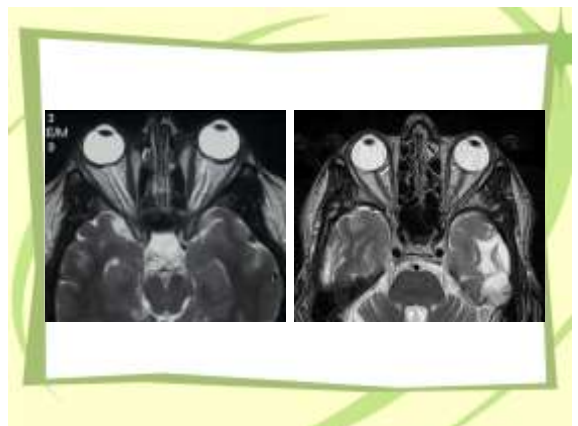
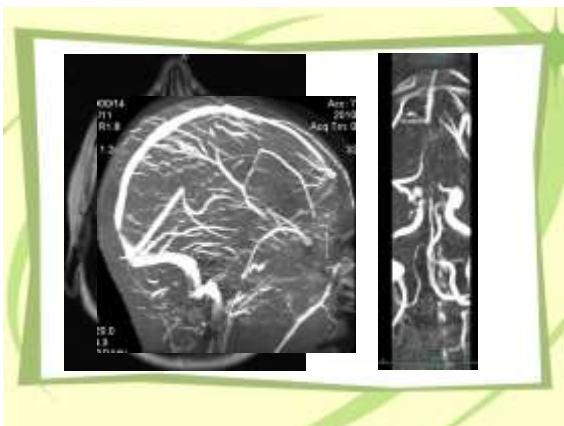
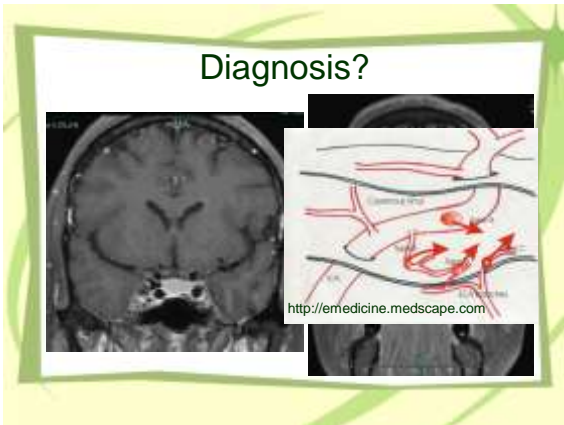
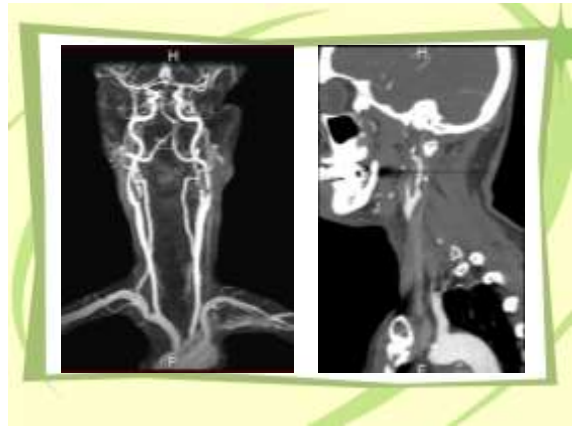
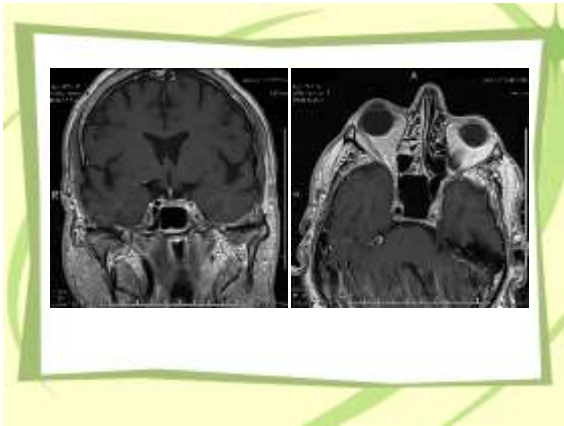


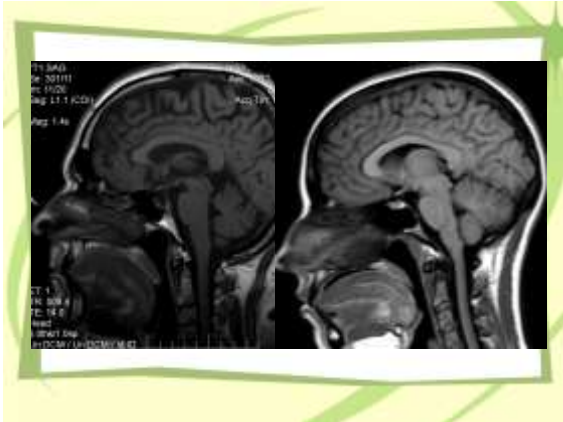
Images by Ami Halvorson, OD



Diagnosis?







## Summary

- × Is neuroimaging necessary?
- × Localize the lesion
- × Provide appropriate clinical information
- × What is the most appropriate sequence?
- × Should contrast should be given?
- × Review you own neuroimaging

## Helpful Resources

- × Neuroimaging in Ophthalmology. Edited by Michael Johnson, Bruno Policani, Andrew Lee, and Wendy Smoker.
- × Imaging of Orbital and Visual Pathway Pathology. Editor WS Muller-Forell
- × MedPix: <http://rad.usuhs.edu/medpix>

# Age-related macular degeneration

Len V Koh

Koh

PUCD

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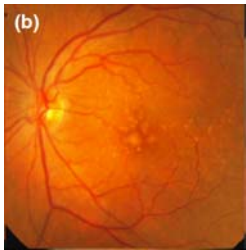
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## Introduction



- Leading cause of irreversible blindness
- More than 8 million Americans

Koh

PUCD

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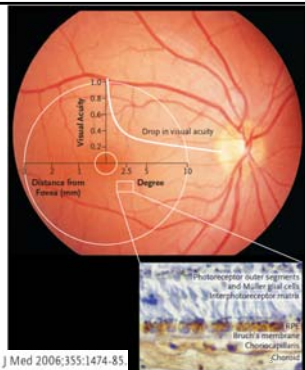
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## Normal Fundus

- Macula, 6 mm
- Fovea, 0.8 mm
- RPE
- Bruch's



N Engl J Med 2006;355:1474-85

Koh

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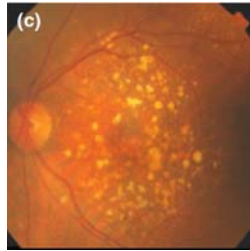
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### Pathophysiology of Age-Related Macular Degeneration



- Drusen
  - small (<63 μm in diameter)
  - medium (63 to 124 μm)
  - large (>124 μm)
- Chronic aberrant inflammation

Koh

PUCD

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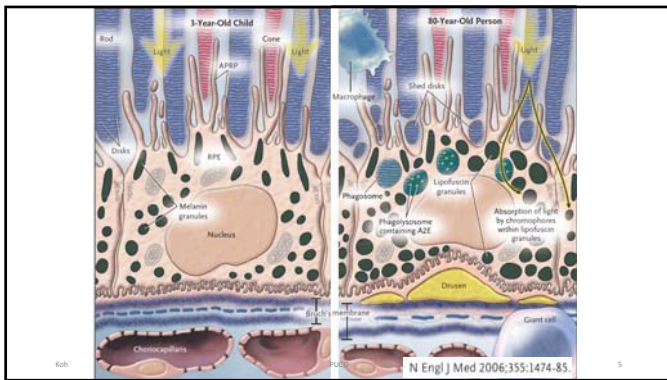
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N Engl J Med 2006;355:1474-85

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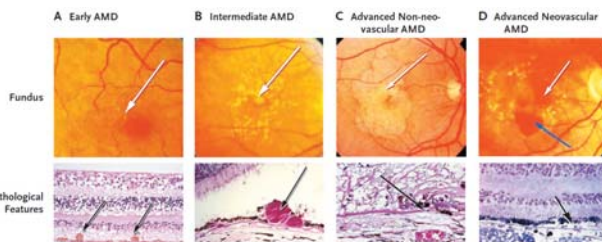
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### Features of AMD



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N Engl J Med 2008;358:2606-17.

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### A Simplified Severity Scale for Age-Related Macular Degeneration

AREDS Report No. 18  
Age-Related Eye Disease Study Research Group\*

- Large druse
  - 125um
  - Width of an average large vein
- Intermediate druse
  - 63um-125um



Koh  
PUCO Arch Ophthalmol. 2005;123:1570-1574

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### 5-year prognosis

**Table 1. Number and Percentage of Patients Developing Advanced AMD in One or Both Eyes at or Before the 5-Year Follow-up Visit for 3211 Patients Free of Advanced AMD in Both Eyes at Baseline**

Drusen Size and No. of Eyes	Pigment Abnormalities					
	None		1 Eye		Both Eyes	
	No. of Events/ No. of Patients at Risk	%	No. of Events/ No. of Patients at Risk	%	No. of Events/ No. of Patients at Risk	%
Small, only one or both eyes (or none)	4/1017	0.4	0/64	0	1/8	12.5
Intermediate, one eye (no large)	2/449	0.5	5/101	5.0	4/31	12.9
Intermediate, both eyes (no large)	4/187	2.1	6/50	12.0	7/35	20.0
Large, one eye	11/283	3.9	17/168	10.1	30/117	25.6
Large, both eyes	27/208	13.0	48/176	27.3	150/317	47.3

Abbreviation: AMD, age-related macular degeneration.  
No. of Risk Factors:  0  1  2  3  4

Koh PUCO 8

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### Progression scoring

**Figure 2.** Risk factor scoring for patient with large drusen and pigment abnormalities in both eyes.

**Figure 6.** Approximate 5-year rates of progression to advanced age-related macular degeneration.

Koh PUCO 9

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### Risk Factors for Advanced Stages of AMD

Strong and consistent association with risk of progression to advanced AMD (OR 1.5 or higher)  
 Age (>60 years or older)  
 Smoking status  
 Previous cataract surgery  
 Positive family history of advanced AMD

Lower strength association with risk of progression to advanced AMD (OR between 1.1 and 1.5)  
 Increased body mass index  
 Hypertensive status  
 Positive history of cardiovascular diseases  
 Increased plasma levels of fibrinogen  
 Diabetic status

No association or not conclusive  
 Gender (female: OR, 1.0–1.06; 95% CI, 0.78–1.44)  
 Positive history of cerebrovascular diseases  
 Serum triglycerides  
 Serum C-reactive protein

Protective factor

RETINA 34:423–441, 2014

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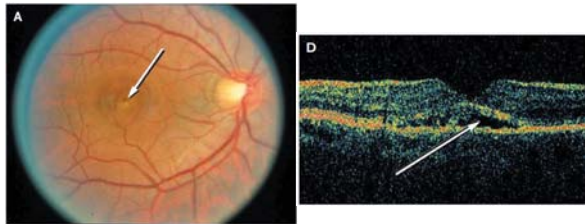
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### Neovascular AMD



Koh PUCO 11

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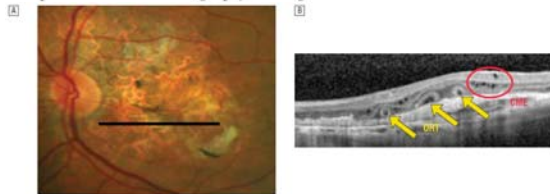
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### Outer Retinal Tubulation

A Novel Optical Coherence Tomography Finding *Arch Ophthalmol.* 2009;127(12):1596-1602



Degenerating photoreceptors may become arranged in a circular or ovoid fashion during a process known as *outer retinal tubulation*.

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**Outer Retinal Tubulation in the Comparison of Age-Related Macular Degeneration Treatments Trials (CATT)**  
*Ophthalmology* 2014;121:2423-2431

• The mean VA of eyes with ORT at week 104 was worse than the mean VA of eyes without ORT.

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**Intravitreal Injection**

Syringe for intravitreal injection (usually 0.05 ml injected)  
 Cotton-tipped applicator with topical anesthetic for displacing the conjunctiva and preventing the eye from moving  
 Eyelid speculum to keep eyelids open

*N Engl J Med* 2008;358:2606-17.

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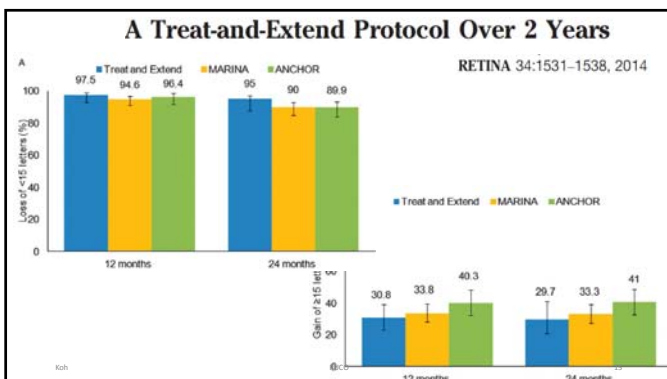
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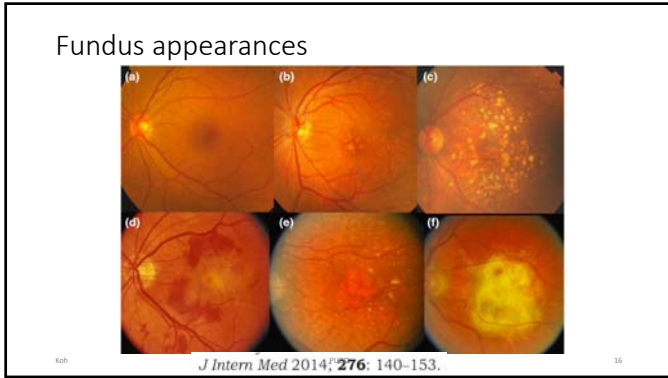
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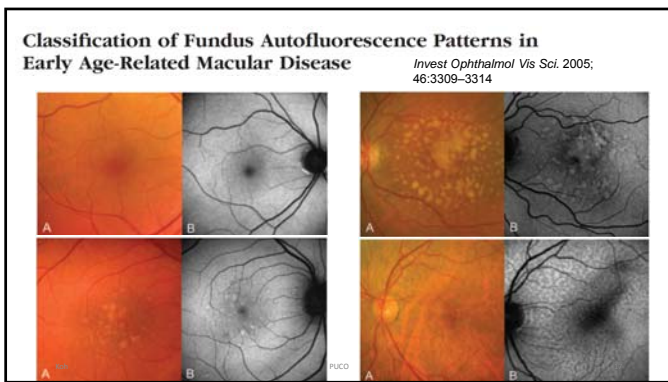
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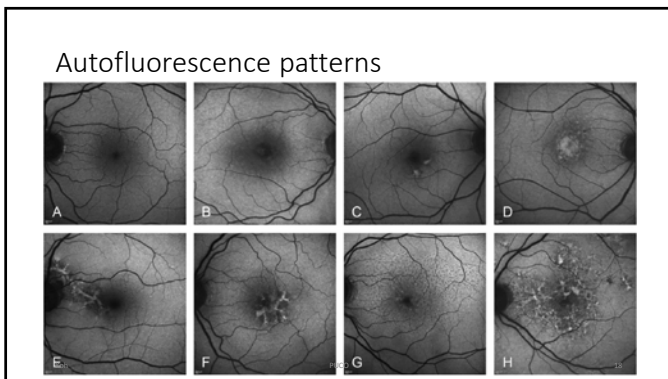
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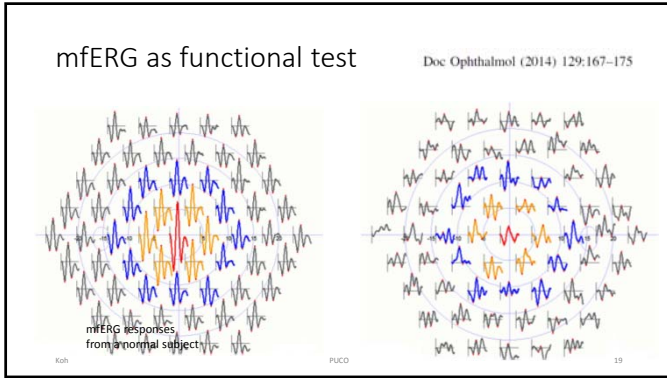
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**Treatment of Dry Age-Related Macular Degeneration** Ophthalmic Res 2014;52:107-115

- **Antioxidants**
  - AREDS
- **Visual Cycle Inhibitors**
  - fenretinide (100 and 300 mg daily, orally)
  - Isotretinoin or 13- *cis* -retinoic acid (Accutane)
- Emixustat
- **Anti-Inflammatory Agent**
  - Eculizumab
  - Sirolimus (rapamycin)
  - Glatiramer acetate (Copaxone)
- **Neuroprotective Therapy**
  - Ciliary neurotrophic factor (CNTF)
- **Stem Cell Therapy**
  - Stem cell-derived RPE and photoreceptors

Koh PUCO 20

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**AMD Categories**

**Table 1** Categorization of age-related macular degeneration (AMD) according to the Age-Related Eye Disease Study (AREDS) guidelines

Brief description	Clinical features	Visual acuity
Category 1 Free of AMD in both eyes	<5 small drusen in one or both eyes	20/32 or better in both eyes
Category 2 Mild to borderline AMD in one or both eyes	Multiple small or intermediate drusen in one or both eyes	20/32 or better in both eyes
Category 3 Absence of advanced AMD in both eyes	Pigment abnormalities in one or both eyes Intermediate or large drusen Geographical atrophy	20/32 or better in better eye
Category 4 Advanced AMD in one eye	Features not involving central macular Advanced AMD or geographical atrophy in worse eye No such features in better eye	20/32 or better in better eye

Key: Small drusen, <63 µm in diameter (disc diameter around 1500 µm); intermediate drusen, 63-124 µm in diameter; large drusen, >125 µm in diameter; pigment abnormalities refer to either hyperpigmentation or depigmentation

Koh PUCO Int Ophthalmol (2011) 31:73-82 <sup>21</sup>

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### AREDS Formulations

*J Intern Med* 2014; **276**: 140-153.

• an approximate cost of \$200 per annum

• Vit C: kidney stones

• Vit #: fatigue, thyroid, stroke

• B-carotene: lung cancer

• Zn: anemia, stomach upset

	Daily dose	RDA (%)
AREDS original formulation		
Vitamin A (beta-carotene)	15 mg	573
Vitamin C (ascorbic acid)	500 mg	753
Vitamin E (dl-alpha tocopheryl acetate)	400 IU	1333
Zinc (zinc oxide)	80 mg	464
Copper (cupric oxide)	2 mg	80
AREDS 2 recommendation		
Lutein	10 mg	NA
Zeaxanthin	2 mg	NA
Vitamin C (ascorbic acid)	500 mg	753
Vitamin E (dl-alpha tocopheryl acetate)	400 IU	1333
Zinc (zinc oxide)	80 mg	464
Copper (cupric oxide)	2 mg	80

RDA, recommended daily allowance.

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**Table 1.** Level of evidence on the use of supplements in preventing AMD Ophthalmologica 2014;231:185-190

Factor	Strong	Moderate	Weak
Lutein	X		
Zeaxanthin	X		
B-Carotene	X		
Vitamin C	X		
Vitamin E	X		
Zinc	X		
Folic acid		√ 2.5 mg/day supplements*	
Vitamins B <sub>6</sub> /B <sub>12</sub>		√ 50 mg/1 mg/day supplements*	
Ω-3 PUFAs			√ Fish weekly (1 serving) √ Nuts weekly (1-2 servings)
Vitamin D			√ Milk once daily √ Fish once per week

X indicates the presence of evidence against the nutrient, √ B<sub>6</sub>/B<sub>12</sub>, PUFAs and vitamin D mean evidence supporting their use √; 1 serving = 145 g. \* Only in women with previous cardiovascular events or multiple cardiovascular risk factors.

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### Dietary products with AREDS nutrients

Ophthalmologica 2014;231:185-190

Lutein and zeaxanthin	Green leafy vegetables (i.e. spinach and kale)
Ω-3 PUFAs	Eggs, fish (salmon, tuna, herring, mackerel and sardines), nuts, flaxseeds, pumpkin seeds and soybeans
Vitamin C	Fruits (i.e. orange, lemon, mango, papaya, pineapple, strawberries, blueberries, watermelon) Vegetables (i.e. broccoli, cauliflower, peppers, leafy greens, potatoes, tomatoes)
Vitamin E	Wheat germs and sunflower seeds
Vitamin D	Fatty fish, fish oil, milk, eggs and certain mushrooms
Zinc	Meat and vegetables such as nuts, whole grains and legumes

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### Age-related Eye Disease Study 2: perspectives, recommendations, and unanswered questions

Mary E. Aronow and Emily Y. Chew *Curr Opin Ophthalmol* 2014, 25:186-190

**Table 1.** Nutrient formulations included in the primary randomization of the AREDS2

Study formulation	Daily dose
Placebo	—
Lutein/zeaxanthin	10 mg/2 mg
DHA/EPA	350 mg/650 mg
Lutein/Zeaxanthin + DHA/EPA	10 mg/2 mg + 350 mg/650 mg

AREDS2, Age-related Eye Disease Study 2; DHA, docosahexaenoic acid; EPA, eicosapentaenoic acid.

- Although primary analysis of the AREDS2 data did not reveal a clear benefit of daily supplementation with lutein/zeaxanthin and/or omega-3 LCPUFAs (DHA/ EPA) on AMD progression
- secondary exploratory analyses did suggest that lutein/zeaxanthin were helpful in reducing this risk.

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### Ocular Nutritional Supplements

Are Their Ingredients and Manufacturers' Claims Evidence-Based? **ARTICLE IN PRESS**

Jennifer J. Yong, MD, Ingrid U. Scott, MD, MPH, Paul B. Greenberg, MD<sup>1,2</sup>



- The majority of top-selling ocular nutritional supplements did not contain the identical ingredient dosages of the AREDS or AREDS2 formula
- had product description claims that lacked level 1 evidence

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### Candidate genes

**Table 1.** Selected Candidate Genes Most Likely Associated with AMD.<sup>a</sup>

Gene	Putative Mechanism of Normal Gene	Estimated Population Attributable Risk (%)	References
CFH	Complement factor H inhibits activation of alternative complement pathway by binding to heparin and C-reactive protein, thus increasing affinity for complement protein C3b	24-61	Haines et al., <sup>70</sup> Klein et al., <sup>71</sup> Edwards et al., <sup>72</sup> Hageman et al., <sup>73</sup> Despreux et al., <sup>74</sup> Schmidt et al., <sup>75</sup>
CFB and C2	Similar to that of CFH; 1 risk and 2 protective haplotypes	60	Gold et al. <sup>76</sup>
LOC1387715	Unknown	NI	Jakobsson et al., <sup>77</sup> Rivera et al. <sup>78</sup>
APOE	Apolipoprotein E transports lipids and cholesterol in the central nervous system	NI	Klaver et al., <sup>79</sup> Baird et al., <sup>80</sup> Schmidt et al., <sup>81</sup>
ABCA4-ABCE	ATP-binding protein transports vitamin A derivatives	1.3	Alikram et al., <sup>82</sup> Alikram <sup>83</sup>

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N Engl J Med 2006;355:1474-85. 27

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### Direct-to-Consumer Personal Genome Testing for Age-Related Macular Degeneration

Invest Ophthalmol Vis Sci. 2014;55:6167-6174.

Company Name	Website	Costs Per Kit	DNA Source	Easy To Collect?	Additional Notes
23andMe	<a href="https://www.23andme.com">https://www.23andme.com</a>	\$99/€74	Saliva	Difficult in 1 participant	Street address is needed to deliver DTC test
deCODEme* Easy-DNA	<a href="https://www.decodeme.com">https://www.decodeme.com</a> <a href="http://www.easygenetictest.com">http://www.easygenetictest.com</a>	\$1100/€821 \$299/€299	Buccal Blood	Yes Yes	For US residents sample needs to be collected by physician or professional collector
Genetic Testing Laboratories	<a href="http://www.gtdna.com/">http://www.gtdna.com/</a>	\$285/€213	Blood	Yes	Sample needs to be collected by physician or professional collector

\* deCODEme do not offer any new testing possibilities.

- Direct-to-consumer personal genome tests are not suitable for clinical application as yet.

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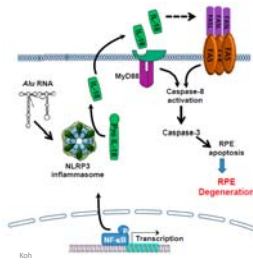
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### DICER1/Alu RNA dysmetabolism induces Caspase-8-mediated cell death in age-related macular degeneration



- RPE death is due to a deficiency in the enzyme DICER1, which leads to accumulation of toxic Alu RNA
- Alu RNA causes RPE death by activating an immune platform called the NLRP3 inflammasome
- Alu RNA induces RPE death by activating the enzyme Caspase-8 downstream of inflammasome activation

16082-16087 | PNAS | November 11, 2014 | vol. 111 | 29

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Ophthalmologica 2014;231:185-190

### Information for patients

Box 1. Information for patients.

- AMD Alliance: <http://www.amdalliance.org/amdalliance/AMDAAlliance/Home>
- Royal National Institute of Blind People: <http://www.rnib.org.uk/eyehealth/eyeconditions/conditionsac/Pages/amd.aspx>
- Macular Society: <http://www.macularsociety.org>
- NHS UK: <http://www.nhs.uk/Conditions/Macular-degeneration/Pages/Introduction.aspx>
- United States Department for Agriculture: <http://www.nel.gov/>

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Shedding Light on Fundus Autofluorescence  
Lorne Yudcovitch, O.D., M.S., F.A.A.O.  
Pacific University College of Optometry  
yudcovil@pacificu.edu

Objectives:

1. Understand the phenomenon and technique of autofluorescence
  2. Familiarize with various retinal conditions that have distinct autofluorescence patterns
1. Autofluorescence
    - a. Cells contain endogenous fluorophores
    - b. Fluoresce when excited by UV/visual radiation
    - c. Different from fluorescent signals obtained using NaFl/ICG dyes
    - d. UV or blue (short) excitation with blue or yellow (longer) emission
  2. Ocular structures that exhibit natural fluorescence
    - a. Lipofuscin pigments in the retina
    - b. Astrocytic hamartomas
    - c. Optic nerve drusen
    - d. Aging crystalline lens
  3. Fundus autofluorescence (FAF) around for decades
    - a. Cameras equipped with excitation and barrier filters for fluorescein angiography
      - i. Results were often inconsistent and unreliable
    - b. Newer filters (i.e. Spaide, others)
      - i. Allows better visualization of FAF
    - c. Confocal imaging (i.e. cSLO)
      - i. Reduces other interference (i.e. crystalline lens)
    - d. Image averaging and widely-distributed light source
      - i. Enhances image
  4. Normal ocular structure FAF appearance
    - a. optic nerve, retinal blood vessels, and the fovea normally appear dark
    - b. background of granular fluorescence from the RPE
  5. Abnormal FAF
    - a. Hyper-autofluorescence
      - i. sign of increased lipofuscin accumulation
      - ii. may indicate degenerative changes or oxidative injury
    - b. Hypo-autofluorescence
      - i. missing or dead RPE cells
  6. Current FAF imaging centers on lipofuscin in retinal pigment epithelium (RPE)
    - a. Accumulates in RPE as by-product of cell metabolism
    - b. Normally increases with age
    - c. May also occur from RPE cell dysfunction
    - d. Dominant fluorophore in lipofuscin: A2-E
      - i. By-product of incomplete degradation of photoreceptor outer segment
      - ii. Toxic - may interfere with normal RPE cell function
    - e. Additional intrinsic fluorophores may occur with disease in various retinal/choroid layers



## 7. Diseases

- a. Age-related macular degeneration
  - i. Geographic atrophy
    - 1. Appears dark in autofluorescent imaging
    - 2. More delineated than traditional retinal photo or FA
    - 3. Increased FAF often present in junctional zone of degeneration
- b. Retinitis pigmentosa
  - i. Hyper AF ring
  - ii. Ring correlates with functional abnormalities
    - 1. Demarcation between normal/abnormal functional retina
- c. Central serous chorioretinopathy
  - i. "Guttering" (fluid tracks)
  - ii. Large, vertically-oriented bands of increased AF
- d. Macular dystrophies
- e. Pseudoxanthoma elasticum
- f. Stargardt disease
- g. Best's disease
- h. Occult choroidal neovascularization
  - i. FAF and FA can look similar
- i. Plaquenil retinotoxicity
  - i. "Bullseye" pattern more evident
- j. Accutane retinotoxicity
- k. MEWDS
- l. Fundus albipunctatis
- m. West Nile Virus retinopathy
- n. Idiopathic juxtafoveal retinal telangiectasia
- o. Optic disc drusen

## 8. FAF limitations

- a. Choroidal nevus – 'masked' with FAF
- b. Choroidal melanoma – 'masked' with FAF
- c. Choroidal hemangioma - Hyper-AF from overlying orange pigment and sub-retinal fluid

## 9. Current retinal cameras with FAF feature

- a. Kowa VX-20
- b. Canon CR-2 PLUS
- c. Carl Zeiss FF450 Plus (with optional filter), Visucam 500, Cirrus photo
- d. Topcon TRC-50DX/EX/IX (with optional filter)
- e. Nidek F-10 scanning laser ophthalmoscope
- f. Ultra Widefield FAF Instruments (Optos 200Tx, Optos Daytona)
- g. OCT with FAF Feature (Heidelberg Spectralis)

## 10. FAF Summary

- a. Fast, non-invasive
- b. Documents RPE and photoreceptor integrity
- c. No other tech can show such RPE detail
- d. Abnormalities with many disorders
- e. Disc drusen also exhibits autofluorescence
- f. Does not normally image sub-RPE tissue
- g. Further use will likely reveal new pathologies

## Selected References

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10. Schmitz-Valckenberg S, Holz F. Fundus Autofluorescence Imaging: Do You Need It and When? *Retinal Physician* 4/1/08. <http://www.retinalphysician.com/articleviewer.aspx?articleid=101628>

## Primary Eye Care for Diabetes

Len V Koh



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## Diabetes Mellitus

- a condition characterized by hyperglycemia resulting from the body's inability to use blood glucose for energy.
- In Type 1 diabetes, the pancreas no longer makes insulin and therefore blood glucose cannot enter the cells to be used for energy.
- In Type 2 diabetes, either the pancreas does not make enough insulin or the body is unable to use insulin correctly.

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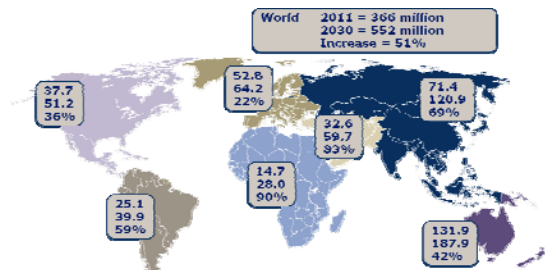
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## The Diabetes Epidemic: Global Projections, 2010–2030



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IDF Diabetes Atlas 5th Ed. 2011

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Prevalence in U.S.

Diagnosed: 18.8 million

Undiagnosed: 7 million

Prediabetes: 79 million

Diabetes Care Volume 37, Supplement 1, January 2014

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Criteria for the diagnosis

A1C  $\geq$  6.5%

FPG  $\geq$  125mg/dL (7mM)

2-h PG  $\geq$  200mg/dL (11.1mM)

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Prediabetes

A1C 5.7-6.4%

FPG 100 – 125 mg/dL

2-h PG 140 - 199mg/dL

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### Frequency of Eye Exam

	First Exam	Subsequent Exam
Early onset (<30 yo)	5 years after Dx	Annually
Later onset (>30 yo)	At the time of Dx	Annually
Pregnancy	Prior to conception	Quarterly

Compliance?

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**Table 4—Criteria for testing for diabetes in asymptomatic adult individuals**

- Testing should be considered in all adults who are overweight (BMI  $\geq 25$  kg/m<sup>2</sup>) and have additional risk factors:
  - physical inactivity
  - first-degree relative with diabetes
  - high-risk race/ethnicity (e.g., African American, Latino, Native American, Asian American, Pacific Islander)
  - women who delivered a baby weighing >9 lb or were diagnosed with GDM
  - hypertension ( $\geq 140/90$  mmHg or on therapy for hypertension)
  - HDL cholesterol level <35 mg/dL (0.90 mmol/L) and/or a triglyceride level >250 mg/dL (2.82 mmol/L)
  - women with polycystic ovarian syndrome
  - A1C  $\geq 5.7\%$ , IGT, or IFG on previous testing
  - other clinical conditions associated with insulin resistance (acanthosis nigricans)
  - history of CVD

BMI Range	Weight Status
BMI less than 18.50	Underweight
BMI 18.50 - 24.99	Healthy weight
BMI 25.00 - 29.99	Overweight
BMI 30	Obese

BMI (kg/m<sup>2</sup>) = WEIGHT (kg) / HEIGHT (m)<sup>2</sup>

- In the absence of the above criteria, testing for diabetes should begin at age 45 years.
- If results are normal, testing should be repeated at least at 3-year intervals, with consideration of more frequent testing depending on initial results (e.g., those with prediabetes should be tested yearly) and risk status.

<sup>10</sup>At-risk BMI may be lower in some ethnic groups.<sup>11,12</sup>

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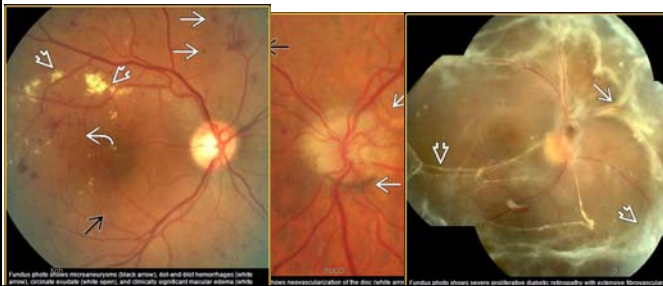
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### Late complication of diabetes




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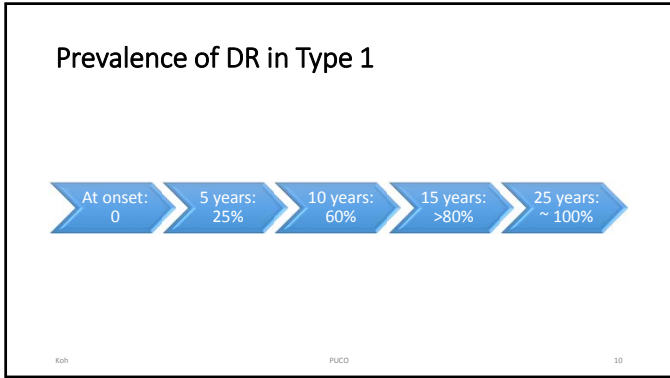
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### 10-year incidence of visual loss

Group	Blindness	Moderate Vision Impairment
Younger onset	1.8%	9.2%
Older onset taking insulin	4.0%	32.8%
Older onset not taking insulin	4.8%	21.4%

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### Risk Factors for DR

Duration      Glycemic control

Type 1 > Type 2      Pregnancy

Hypertension

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### Importance of early Dx & Rx

- Most common cause of vision loss in working-age adults

75K DME  
 65K PDR  
 8K Diabetic Blindness  
 25 X

Zhang X, et al. IAMA. 2010;304(6):649-656

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### Classification

NPDR		PDR	
	Exam Findings		Exam Findings
Mild	Microaneurysms; cotton-wool spots indicate nerve fiber layer infarcts/axoplasmic stasis	Early	Neovascularization that does not meet criteria for high-risk PDR
Moderate	Intermediate between mild & severe	High-risk (1 or more)	<ul style="list-style-type: none"> <li>• Neovascularization of disc (NVD) <math>\geq</math> 1/3 disc area</li> <li>• Any NVD and vitreous/preretinal hemorrhage</li> <li>• Neovascularization elsewhere (NVE) <math>\geq</math> 1/2 disc area and vitreous/preretinal hemorrhage</li> </ul>
Severe (Any)	<ul style="list-style-type: none"> <li>• &gt; 20 intraretinal hemorrhages in all 4 quadrants</li> <li>• 2 quadrants of venous beading</li> <li>• 1 quadrant of intraretinal microvascular abnormality</li> </ul>		

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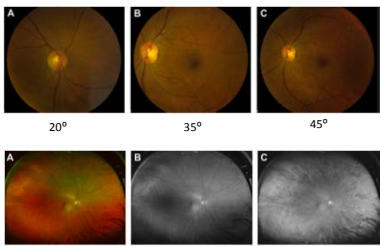
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### Fundus Imaging



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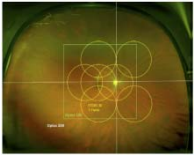
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### Nonmydriatic Ultrawide Field Retinal Imaging Compared With Dilated Standard 7-Field 35-mm Photography and Retinal Specialist Examination for Evaluation of Diabetic Retinopathy

PAOLO S. SILVA, JERRY D. CAVALIERANO, JENNIFER K. SUN, JASON NOBLE, LLOYD M. ARELLO, AND LLOYD PAUL ARELLO



- **PURPOSE:** To compare nonmydriatic stereoscopic Optos ultrawide field images with dilated stereoscopic Early Treatment Diabetic Retinopathy Study 7-standard field 35-mm color 30-degree fundus photographs (ETDRS photographs) and clinical examination for determining diabetic retinopathy (DR) and diabetic macular edema (DME) severity.
- **CONCLUSIONS:** Nonmydriatic ultrawide field images compare favorably with dilated ETDRS photography and dilated fundus examination in determining DR and DME severity; however, they are acquired more rapidly. If confirmed in broader diabetic populations, nonmydriatic ultrawide field imaging may prove to be beneficial as DR evaluation in research and clinical settings. (Am J Ophthalmol 2012;154:649-659. © 2012 by Elsevier Inc. All rights reserved.)

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### ULTRA-WIDE-FIELD ANGIOGRAPHY IMPROVES THE DETECTION AND CLASSIFICATION OF DIABETIC RETINOPATHY

MATTHEW M. WESSEL, MD, GRANT D. AAKER, BA, GEORGE PARLITSIS, MD, MINHEE CHO, MD, DONALD J. D'AMICO, MD, SZILARD KISS, MD



RETINA 32:785-791, 2012

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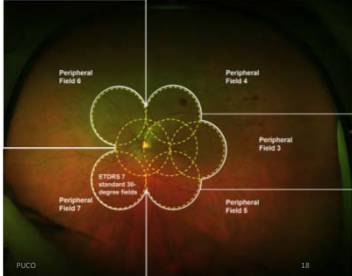
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### Peripheral Lesions Identified by Mydriatic Ultrawide Field Imaging: Distribution and Potential Impact on Diabetic Retinopathy Severity

Optometry 2013; 120:2581-2586

~10% underDx

- **Objective:** To assess diabetic retinopathy (DR) as determined by lesions identified using mydriatic ultrawide field imaging (DISLO200; Optos plc, Scotland, UK) compared with Early Treatment Diabetic Retinopathy Study (ETDRS) 7-standard field film photography
- **Conclusion:** DISLO200 images had substantial agreement with ETDRS film photographs and DFE in determining DR severity. The additional peripheral lesions identified by DISLO200 in this cohort suggested a more severe assessment of DR in 10% of eyes than was suggested by the lesions within the ETDRS fields.



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### Clinical Significant Macular Edema (CSME)

- Retinal thickening within 500 µm of foveal center
- Hard exudates within 500 µm of foveal center, if associated with adjacent retinal thickening
- Retinal thickening > 1 disc area, part of which is within 1 disc diameter of foveal center



Fundus photo shows microaneurysms (black arrow), dot and blot hemorrhages (red arrow), circinate exudate (white arrow), and clinically significant macular edema (white arrow) (determined by the area of thickening) (Figure 5, Colman, MD)

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### Diabetic Macular Edema Management

- Intravitreal anti-VEGF**
  - First line therapy
  - Most effective
- Intravitreal corticosteroids**
  - Dexamethasone
  - Fluocinolone
- Laser**
  - Juxtafoveal
  - Adjunct
- Vitrectomy**
  - ERM or VMT

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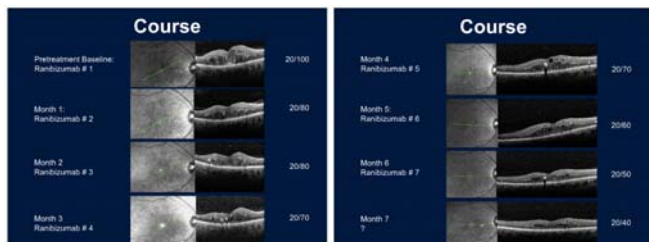
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### Lucentis treatment of DME




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### Follow Up

	Follow Up
Mild NPDR	6-9 months
Moderate to severe NPDR	4-6 months
PDR	2-3 months

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ADA-EASD Position Statement: Management of Hyperglycemia in T2DM

### ANTI-HYPERGLYCEMIC THERAPY

- Glycemic targets
  - HbA1c < 7.0% (mean PG ~150-160 mg/dl [8.3-8.9 mmol/l])
  - Pre-prandial PG <130 mg/dl (7.2 mmol/l)
  - Post-prandial PG <180 mg/dl (10.0 mmol/l)
  - Individualization is key:
    - > Tighter targets (6.0 - 6.5%) - younger, healthier
    - > Looser targets (7.5 - 8.0%+) - older, comorbidities, hypoglycemia prone, etc.
  - Avoidance of hypoglycemia

Koh PG = plasma glucose PUCD Diabetes Care 2012;35:1364-1379 23 Diabetologia 2012;55:1577-1596

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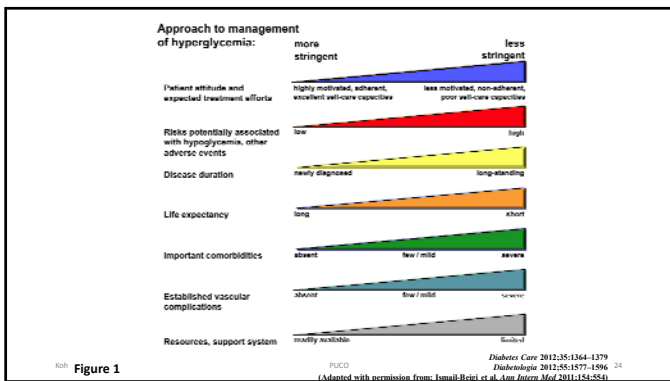
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ADA-EASD Position Statement: Management of Hyperglycemia in T2DM

### ANTI-HYPERGLYCEMIC THERAPY

- Therapeutic options: **Lifestyle**
  - Weight optimization 
  - Healthy diet 
  - Increased activity level 

Koh Diabetes Care 2012;35:1344-1379 25  
Diabetologia 2012;55:1577-1596

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### MEDICAL NUTRITION THERAPY



- Glycemic control more important
- Weight loss (5-10%)
- Regular f/u with registered dietician
- Individualize meal plan
- Moderate carbohydrate intake
- Reduction in saturated fat
- Increased intake of fiber
- Increased physical activity

Koh Diabetes Care 2012;35:1344-1379 26  
Diabetologia 2012;55:1577-1596

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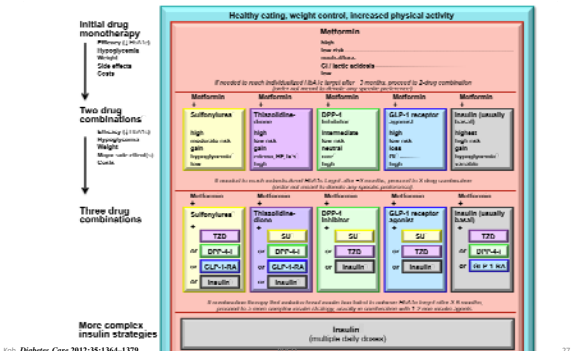
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**Healthy eating, weight control, increased physical activity**

Metformin  
High  
Low risk  
Insulin resistance  
GI tract side effects  
Low

*If needed to reach individualized HbA1c target after 3 months, proceed to 2-drug combination*

<b>Sulfonylureas</b> High Moderate risk gain Hypoglycemia Low	<b>Thiazolidinediones</b> High Low risk gain Weight gain, HF (w/ or w/o)	<b>DPP-4 inhibitors</b> Intermediate Low risk neutral None	<b>GLP-1 receptor agonists</b> High Low risk gain None	<b>Insulin (usually basal)</b> High Low risk gain Hypoglycemia Insulin resistance
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*If needed to reach individualized HbA1c target after 3 months, proceed to 3-drug combination*

<b>Sulfonylureas</b> TZD SU DPP-4i GLP-1 RA or Insulin	<b>Thiazolidinediones</b> SU DPP-4i or GLP-1 RA or Insulin	<b>DPP-4 inhibitors</b> SU TZD or Insulin	<b>GLP-1 receptor agonists</b> TZD or Insulin	<b>Insulin (usually basal)</b> TZD DPP-4i or GLP-1 RA or SU
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*If individualized HbA1c not reached or target exceeds, then both of 2 medicines (Metformin or GLP-1 agonist, if appropriate) proceed to 4-drug strategy (3-drug combination with 1-2 rapid-acting insulin analogs)*

**More complex insulin strategies**

Insulin (multiple daily injections)

Koh Diabetes Care 2012;35:1344-1379 27  
Diabetologia 2012;55:1577-1596

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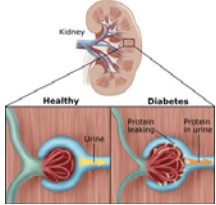
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# NEPHROPATHY

Diabetes Affects the Kidney



- Optimize glucose control to reduce the risk of nephropathy
- Optimize blood pressure control to reduce the risk of nephropathy
- Perform an annual test to quantitate urine albumin excretion

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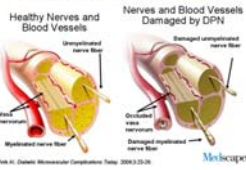
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# NEUROPATHY

Diabetic Peripheral Neuropathy



- All patients should be screened for distal symmetric polyneuropathy (DPN)
- Screening for signs and symptoms of cardiovascular autonomic neuropathy
- Medications for the relief of specific symptoms related to painful DPN and autonomic neuropathy

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# FOOT CARE



- perform an annual comprehensive foot examination to identify risk factors predictive of ulcers and amputations
- Provide general foot self-care education to all patients with diabetes

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### Take away points (TAP)



- Peripheral retina is the early location of pathology
- Follow up mild NPDR more frequently
- Anti-VEGF works well for DME
- Interdisciplinary care is essential

<http://guidelines.diabetes.ca/OrganizingCare/The5Rts/resource>

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Ebola and other Rare Viruses:  
What Every Optometrist Needs to Know  
Lorne Yudcovitch, OD, MS, FAAO  
Pacific University College of Optometry  
yudcovil@pacificu.edu

Course objectives:

1. To become familiar with Ebola virus history, epidemiology, and transmission
  2. To be aware of systemic and ocular findings associated with Ebola virus infection
  3. To learn current in-office protection and triage measures for Ebola and other viruses
- I. Ebola virus
- a. aka Ebola Virus Disease (EVD), Ebola Hemorrhagic Fever (EHF)
  - b. 1976: first identified in Democratic Republic of Congo (formerly Zaire)
  - c. 1976-2013: 24 total outbreaks, 1,716 cases, tropical sub-Saharan Africa
  - d. 2014-Present: largest outbreak; W. Africa (Guinea, Sierra Leone, Liberia)
  - e. Filovirus - Order Mononegavirales (includes measles, mumps, and rabies viruses)
- II. Ebola virus types
- a. All types closely related to marburgviruses (which cause similar symptoms)
  - b. Bundibugyo virus (BDBV)
  - c. Sudan virus (SUDV)
  - d. Tai Forest virus (TAFV)
  - e. Ebola virus (EBOV, formerly Zaire Ebola virus) - Most dangerous; largest outbreaks
  - f. Reston virus (RESTV) - Not thought to cause human disease; other primate disease
- III. Ebola virus disease incubation
- a. Virus exposure → symptoms 2-21 days (5% cases greater than 21 days)
  - b. Influenza-like stage - tired, fever (seen in 95% of infected; usu. > 100.9 °F)
  - c. Weak/extreme asthenia (85-95%)
  - d. Severe headache (50-74%)
  - e. Muscle/joint pain/myalgia (50-79%)
  - f. Decreased appetite/anorexia (45%)
  - g. Sore throat (ALTHOUGH USUALLY NO COUGHING)
  - h. Vomiting, diarrhea, abdominal pain follows
  - i. Shortness of breath, chest pain, swelling, headaches, confusion
- IV. Ebola virus disease progression
- a. Diarrhea (85%)
  - b. Nausea/vomiting (68-73%)
  - c. Abdominal pain (65%)
  - d. Odynophagia or dysphagia (57%)
  - e. Bleeding from mucous membranes (50%)
  - f. Maculopapular skin rash (15-50%)
  - g. Hemorrhagic conjunctivitis (45%)
  - h. Bloody vomit/cough/stool, skin petechiae, purpura, ecchymoses, hematomas
- V. Ebola virus disease outcome
- a. Recovery may begin 7 to 14 days after first symptoms
  - b. Death, if occurs, is 6 to 16 days from first symptoms
    - i. Death often due to low blood pressure from fluid/blood loss
    - ii. Hiccups and tachypnea common (37%) among terminal cases
    - iii. Often in coma near end of life
  - c. Survivors often have ongoing problems
    - i. Muscle/joint pain, liver inflammation, decreased hearing
    - ii. Tired/weak, decreased appetite, difficulty gaining weight back
    - iii. Survivors develop antibodies against Ebola
      1. Last at least 10 years

2. Unclear if immune to repeated infections
3. Survivors can no longer transmit the disease

#### VI. Ebola transmission

- a. Direct contact (broken skin or mucous membranes - eyes, nose, or mouth)
- b. Blood, urine, saliva, sweat, feces, vomit, breast milk, semen, vaginal fluids
- c. Objects (i.e. needles and syringes)
- d. Infected fruit bats, primates, possibly other mammals (i.e. dogs)
- e. Ebola not spread through: air, water, food (unless bush meat), mosquitoes or other insects, animals other than bats, pigs, duiker, primates (so far)

#### VII. Ebola ocular manifestations

- a. ACUTE TO LATE:
  - i. Conjunctival injection (58%) – bilateral
  - ii. Subconjunctival hemorrhages
  - iii. Excessive lacrimation
- b. SUB-ACUTE/CHRONIC:
  - i. Uveitis (15%)
  - ii. May occur in convalescent stage
  - iii. Can be anterior, posterior, or pan-uveitis
  - iv. Topical steroids and cycloplegia effective

#### VIII. Lab tests for Ebola

- a. Should be performed in high-containment labs
- b. Definitive test: virus isolation via tissue culture or reverse-transcription PCR assay
- c. ELISA
- d. IgM-capture or IgG-capture
- e. Immunohistochemical test performed on formalin-fixed postmortem skin
- f. Electron microscopy

#### IX. Ebola treatment

- a. Currently no cure or human vaccine
- b. Recombinant human monoclonal antibody
- c. Discontinue all anticoagulants if taken
- d. Supportive therapy
  - i. attention to intravascular volume, electrolytes, nutrition, and comfort care
  - ii. Intravascular volume repletion highly important
- e. Experimental treatments (mainly animal studies)
  - i. Nucleoside analogue inhibitors
  - ii. Interferon beta treatment
  - iii. Human recombinant interferon alfa-2b with equine immunoglobulin G
  - iv. DNA vaccines expressing Ebola glycoprotein or nucleocapsid protein
  - v. nematode anticoagulant protein
  - vi. small interfering RNAs (siRNAs)
  - vii. phosphorodiamidate morpholino oligomers (PMOs)
- f. Postexposure prophylaxis
  - i. cocktail of 3 different murine monoclonal antibodies (mAbs; ZMab) or 3 chimerized anti-Ebola virus mAbs (MB-003)
- g. Marburg virus antibody - also binds to Ebola virus
- h. ZMapp
  - i. Humanized mAbs produced in genetically modified tobacco plants
  - ii. Handful of people in US with Ebola infection given ZMapp and survived
- i. Vaccine research

#### X. Optometry's role

- a. Further alert and attention to any person who has:
  - i. Elevated body temp or fever, including severe headache, fatigue, muscle pain, vomiting, diarrhea, abdominal pain, or unexplained bleeding; **AND**

- ii. Traveled to W. African country or widespread Ebola virus transmission area or direct contact with symptomatic Ebola patient) within 21 days
- b. <http://www.cdc.gov/vhf/ebola/pdf/ebola-algorithm.pdf>
- c. <http://www.cdc.gov/vhf/ebola/pdf/checklist-patients-evaluated-us-evd.pdf>
- d. APHA's Get Ready campaign Ebola fact sheet
- e. Dedicated medical equipment (preferably disposable, when possible).
- f. Proper cleaning/disposal/sterilization - i.e. needles, syringes, instruments

XI. The 4 "I"s (CDC) – Initiate, Identify, Isolate, Inform

XII. Standard Precautions (formerly called Universal Precautions)

- a. Now includes contact and droplet precautions
- b. Also involves Safe Work Practices
- c. Patient Placement, Transport, and Environmental Measures also involved
- d. Personal Protective Equipment (PPE)
  - i. <http://www.cdc.gov/vhf/ebola/hcp/ppe-training/index.html>
  - ii. No evidence contracted via tears, CLs, or routine patient contact (CDC)
  - iii. Hand wash between patients
  - iv. Gloves if blood risk (not tears)
  - v. Mask if airborne risk (P95)
  - vi. Eye/face shield if splash/spray risk
  - vii. Hazardous waste disposal units
- e. CDC Disinfection Criteria (2008)
  - i. Instrument sterilization
    - 1. Minimum 15 min. @ 121°C
  - ii. Instrument disinfection
    - 1. 10 minute soak in 3% H2O2
    - 2. 15 minute soak in 1:10 bleach dilution
    - 3. 20 minute soak in 2% glutaraldehyde
  - iii. Contact lenses
    - 1. RGPs - H2O2 disinfection
    - 2. Soft CLs - H2O2 disinfection or heat disinfection

XIII. Top 20 other dangerous viruses

1. Marburg virus (50-90% mortality)
2. Ebola virus (90% mortality)
3. Hantavirus (80% mortality)
4. Bird flu (70% mortality)
5. Lassa virus
6. Junin virus
7. Crimeo-Congo fever (30% mortality)
8. Machupo virus
9. Kyasanur Forest virus
10. Dengue fever
11. HIV
12. Rabies
13. Anthrax (50-100% mortality)
14. Yellow fever
15. SARS (15% mortality)
16. Smallpox
17. Influenza
18. Dengue (2.5% mortality)
19. Rotavirus
20. Measles

XIV. Summary



# Fundamentals of Gonioscopy

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Disclosure Statement:  
Nothing to disclose

## Overview

- ✘ Indications
- ✘ Contraindications
- ✘ Anterior chamber angle anatomy
- ✘ Lens types
- ✘ Procedure
- ✘ Common errors
- ✘ Recording and coding
- ✘ Abnormalities

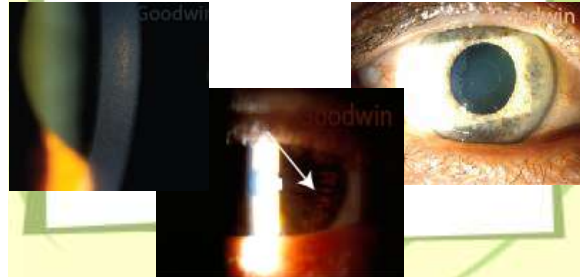
## Indications

- ✘ Determine if patient is at risk for angle closure with dilation



## Indications

- ✘ Glaucoma diagnosis and treatment



## Indications

- ✘ History of trauma



From Clinical Ophthalmology

## Indications

- ✘ Tumor or iris abnormality



## Indications

- ✘ Inflammation



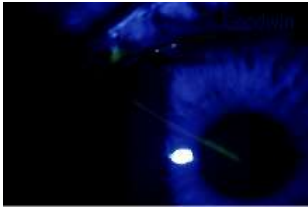
## Indications

- ✘ Compromised vascular system



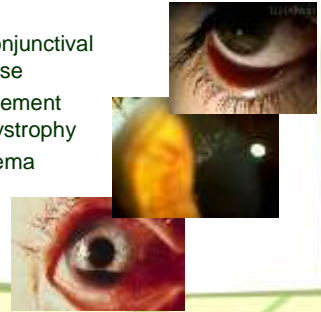
## Contraindications

- ✘ Worry of laceration or globe perforation



## Relative Contraindications

- ✘ Corneal or conjunctival surface disease
- ✘ Epithelial basement membrane dystrophy
- ✘ Recent hyphema



## Anterior Chamber Landmarks



## Anterior Chamber Landmarks



## Anterior Chamber Landmarks



## Anterior Chamber Landmarks



## Indirect Goniolens

- ✘ Suction/fluid lenses
  - Requires solution
  - Better image quality
  - Easier to learn to use
- ✘ Non-suction/Non-fluid lenses
  - Good for rapid evaluation
  - Decreased image quality
  - Harder to manipulate
  - Allows indentation gonioscopy



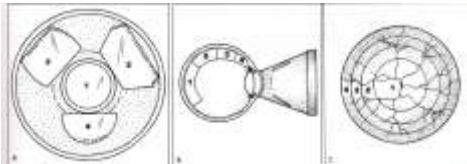
## Indirect Goniolens

- ✘ 4-mirror:
  - Quick
  - No lens rotation
- ✘ 3-mirror
  - Mirrors for retinal exam
  - Lens must be rotated
- ✘ 1 or 2-mirror
  - Good for smaller apertures
  - Lighter
  - More bunched up view.
  - Lens must be rotated



## Indirect Goniolens

- ✘ 3-mirror retinal lenses



From Atlas of Primary Eyecare Procedures

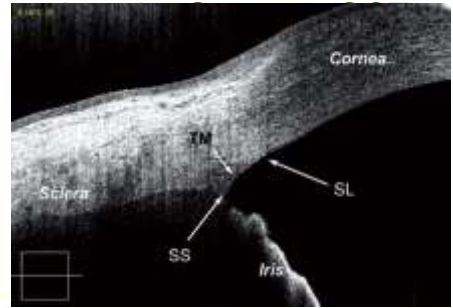
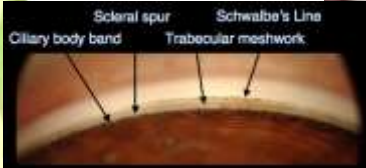
## RetCam

- ✘ Clarity Medical Systems Inc., Pleasanton, CA
- ✘ View the angle directly
- ✘ Dynamic



## RetCam

- ✗ Use with Genteal Gel



## Gonioscopy

Examination of the Anterior Chamber Angle



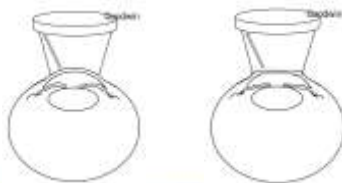
## Common Errors

- ✗ Bubbles
- ✗ Procedural errors
  - Poor lens centration
  - Slit lamp position
  - Obstruction (fingers)



## Angle Grading Considerations

- ✗ Indentation gonioscopy
- ✗ Ambient lighting



## Angle Grading Considerations

- ✗ Gonioscopy position
- ✗ Gonioscopy lens type



## Common Errors

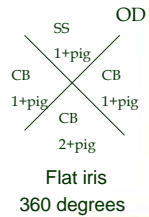


## Common Errors



## Recording

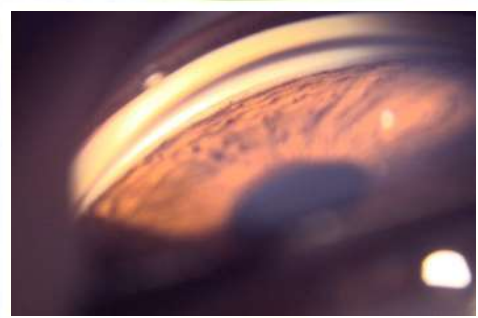
- ✘ Most posterior structure seen in each quadrant
  - CB, SS, TM, SL
- ✘ Iris approach
  - Flat, convex, concave
- ✘ TM Pigment: grade from 0-4

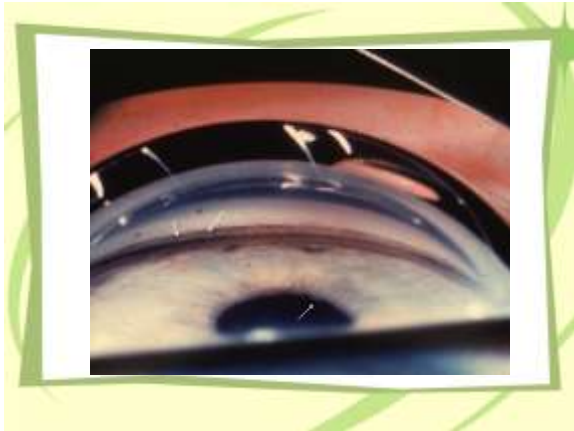


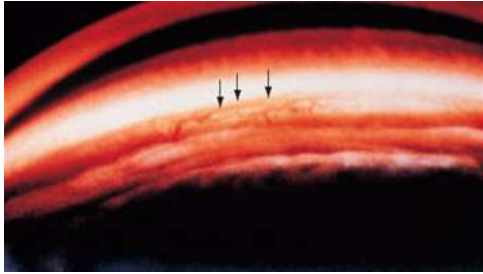
## Billing

- ✘ CPT code: 92020
  - Bilateral procedure
- ✘ Common billable diagnoses
 

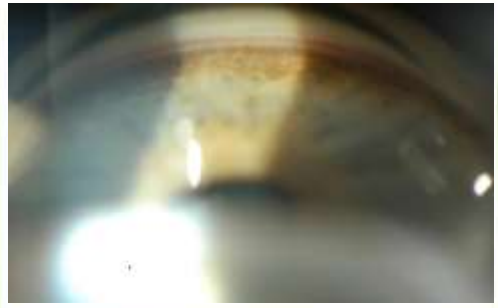
<ul style="list-style-type: none"> <li>– All types of glaucoma except steroid induced</li> <li>– potential angle-closure</li> <li>– pigment dispersion syndrome</li> <li>– CRA and CRV occlusion</li> <li>– uveitis</li> <li>– angle recession</li> </ul>	<ul style="list-style-type: none"> <li>– rubeosis</li> <li>– anterior or posterior synechiae</li> <li>– diabetic retinopathy</li> <li>– neoplasm</li> <li>– retinal vasculitis</li> <li>– retinal detachment</li> <li>– iris lesions</li> </ul>
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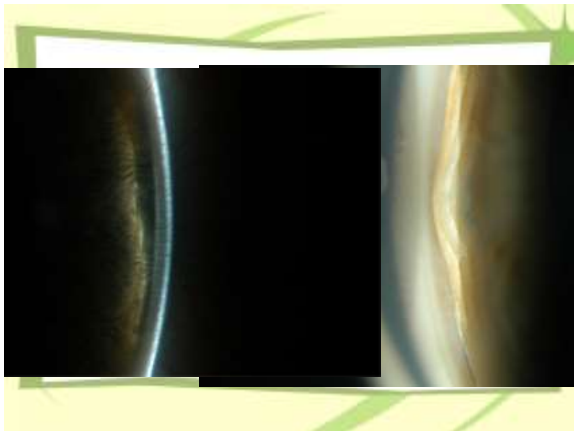




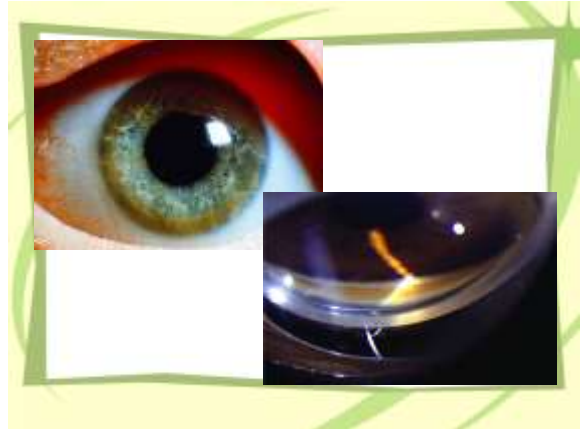


From Gonioscopy in the Management of Glaucoma









Thank You!

<http://www.gonioscopy.org>

<http://www.pacificu.edu/optometry/ce/courses/21171/gonioscopypg5.cfm>

# Adverse Drug Reactions Pertinent to Eyecare

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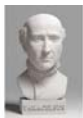
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## Adverse Drug Reactions (ADRs)

- "All substances are poisons: there is none which is not a poison. The right dose differentiates a poison and a remedy." Paracelsus (1493-1541)
- Over 2 million serious ADRs yearly
- 100, 000 Deaths yearly
- 4<sup>th</sup> leading cause of death



Institute of Medicine, National Academy Press, 2000  
 Lazarou J et al. JAMA 1998;279(15):1200-1205  
 Gurwitz JH et al. Am J Med 2000;109(2):87-94

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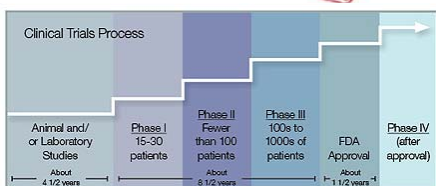
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## Why is the drug not safe?



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JAMA. 1999;281:824-9

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### Alendronate (Fosamax)



Generic Name	Brand Name
alendronate	Fosamax
ibandronate	Boniva
risedronate	Actonel, Atevelia
zoledronic acid	Reclast

- Bisphosphonate derivative
- Osteoporosis, Paget's disease
- Dose:
  - Prophylaxis: 5 mg once daily or 35 mg once weekly
  - Treatment: 10 mg once daily or 70 mg once weekly
- Inhibits bone resorption
- ADRs:
  - >10%: hypocalcemia (18%, mild)
  - <6%: musculoskeletal pain
- <1%: **Episcleritis, scleritis, uveitis**

ARCH OPHTHALMOL/VOL 117, JUNE 1999; p.837  
N Engl J Med. 2003;348:1187-8

#### Signs and Symptoms of Ocular Inflammation Potentially Induced by Alendronate Sodium

	Patient No.		
	1	2	3
Ocular symptoms			
Diplopia	X	X	X
Ocular pain	X	X	X
Eyelid swelling	X	X	
Ocular signs			
Conjunctivitis	X		X
Iritis	X		
Scleritis			
Posterior	X		X
Anterior		X	

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### Amiodarone (Cordarone)



- Antiarrhythmic agent, Class III
  - Recurrent ventricular fibrillation
  - Hemodynamically-unstable ventricular tachycardia
- Dose:
  - 800 to 1600 mg daily in 1 to 2 doses for 1 to 3 weeks, then when adequate arrhythmia control is achieved, decrease to 600 to 800 mg daily in 1 to 2 doses for 1 month;
  - maintenance: 400 mg daily
- ADRs:
  - CNS (3% to 40%): ataxia, dizziness, fatigue, memory impairment, peripheral neuropathy
  - GI: Nausea, vomiting (oral: 10% to 33%), anorexia (≤25%) constipation (≤25%)
  - Tremor (3% to 40%)
  - Hyperthyroidism (3% to 10%), hypothyroidism (1% to 10%),
  - **Corneal deposits (>90%; causes visual disturbance in <10%), photophobia**
  - **May cause optic neuropathy and/or optic neuritis → visual impairment.**

Koh PUCO 5

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Slit-lamp photomicrograph of corneal verticillata in a 55-year-old male who had been taking 200 mg/d of amiodarone for 5 years. *Surv Ophthalmol.* 1998;42:360-366.

Koh PUCO 6

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**Table 1. Systemic medications associated with vortex keratopathy**

Amiodarone
Aminoquinolones (chloroquine, hydroxychloroquine, amodiaquine)
Atovaquone
Clofazimine
Gentamicin (Subconjunctival)
Gold
Ibuprofen
Indomethacin
Mepacrine
Mono benzene (topical skin ointment)
Naproxen
Perhexiline maleate
Phenothiazines
Suramin
Tamoxifen
Tilorone hydrochloride

Koh PUCO *Surv Ophthalmol.* 1998;42:360-366. 7

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### Bimatoprost (Lumigan, Latisse)



- Prostaglandin analogues
  - Elevated intraocular pressure
  - Hypotrichosis of the eyelashes
- Decreases intraocular pressure by increasing the outflow of aqueous humor
- Headache (1% to 5%)
- Conjunctival hyperemia (25% to 45%), eye pruritus (>10%)
- Erythema of eyelid (1% to 10%), skin hyperpigmentation, pigmentation of the periocular skin
- Hirsutism
- Cystoid macular edema



Seminars in Ophthalmology, vol. 17, pp. 181-186, 2002. Koh PUCO 8

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### Prostaglandin-Associated Periorbitopathy (PAP)



A left-sided PAP and hypertrichosis



A severe bilateral orbital fat atrophy

http://webeye.ophth.uiowa.edu/eyeforum/cases/181-prostaglandin-orbitopathy.htm Koh PUCO 9

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### Digoxin (Lanoxin)



- Antiarrhythmic Agent
  - Heart failure
  - Atrial fibrillation
- Inhibition of the sodium/potassium ATPase pump
- Dose:
  - Initial: 0.75 to 1.5 mg
  - Maintenance: Oral: 0.125 to 0.25 mg once daily
- CNS: Dizziness (6%), mental disturbances (5%), headache (4%),
- Ocular: Visual disturbances (blurred or yellow vision)

Koh PUCO 30

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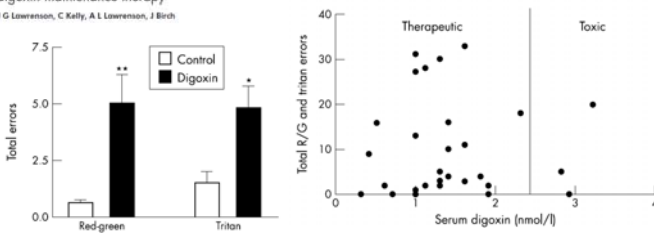
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**SCIENTIFIC CORRESPONDENCE**  
 Acquired colour vision deficiency in patients receiving digoxin maintenance therapy  
 J G Lawrenson, C Kelly, A L Lawrenson, J Birch



Histogram showing the total red-green and total tritan error scores for controls and patients receiving digoxin therapy. The differences are statistically significant \*p<0.05, \*\*p<0.01 (unpaired t test)

Graph comparing serum digoxin levels with combined error scores for red-green (R/G) and tritan tests. The mean serum digoxin level = 1.4 (SD 0.7) nmol/l.

Koh PUCO *Br J Ophthalmol* 2002;86:1259-1261 31

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### Ethambutol (Myambutol)



- Antitubercular Agent
  - Tuberculosis
- Dose:
  - 15 mg/kg once daily (maximum dose: 1.5 g) for 60 days
- ADRs:
  - Myocarditis
  - Dermatitis
  - Gout
  - Hepatitis
- Ocular: Optic neuritis (1-5%); color blindness, or visual defects (usually reversible with discontinuation)

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**Table 1 Clinical characteristics of eight patients with ethambutol-induced optic neuropathy**

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7	Patient 8
Age (years), gender	53, M	63, F	73, F	68, M	75, F	82, F	64, F	58, F
Duration of ethambutol treatment	9 months	5 months	3 months	16 months	6 months	22 months	6 months	4 months
Duration of symptoms before initial presentation	2 weeks	1 month	1.5 months	1 month	1.5 months	3 months	3 months	1 month
Interval between cessation of ethambutol and initial presentation	1 week	2 weeks	1 month	1 month	1.5 months	2 months	3 months	3 months
Interval between initial and follow-up visits	12 months	12 months	10 months	6 months	2 months	2 months	9 months	12 months
Initial examination (OD on top, OS on bottom)								
Visual acuity	CF at 3 feet	20/40	CF at 3 feet	20/200	20/70	20/70	20/60	20/400
	CF at 3 feet	20/80	CF at 4 feet	20/250	20/100	20/80	20/200	CF at 6 ft
Colour vision	NI	NI	Test plate	Test plate	NI	Test plate	Test plate	Test plate
	2/11	NI	Test plate	Test plate	3/11	6/11	Test plate	NI
Mean deviation on HVF	Unable	-5.35	-14.22	-6.70	-10.80	-3.85	-1.19	-11.28
	Unable	-4.95	-18.23	-5.25	-10.42	-3.35	-2.31	-9.12
Optic nerve appearance	Pale	Normal	Normal	Normal	Normal	Normal	Pale	Pale
	Pale	Normal	Normal	Normal	Normal	Normal	Pale	Pale
Follow-up examination								
Visual acuity	CF at 3 feet	20/100	20/400	20/25	20/50	20/50	20/30	20/200
	CF at 3 feet	CF at 2 feet	CF at 5 feet	20/30	20/70	20/40	20/50	20/200
Colour vision	NI	7/9	NI	10/11	NI	6/11	Test plate	Test plate
	NI	Test plate	NI	10/11	Test plate	7/11	Test plate	NI
Mean deviation on HVF	Unable	-11.67	-13.64	-2.77	-6.50	-17.91	-2.25	-4.48
	Unable	-17.04	-14.15	-8.84	-5.42	-18.38	-5.10	-3.26
Optic nerve appearance	Pale	Slightly pale	Pale	Slightly pale	Normal	Normal	Pale	Pale
	Pale	Slightly pale	Pale	Slightly pale	Normal	Normal	Pale	Pale

CF, counting fingers; F, female; HVF, Humphrey visual field; M, male; OD, right eye; OS, left eye.

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**SCIENTIFIC REPORT**

Decreased retinal nerve fibre layer thickness detected by optical coherence tomography in patients with ethambutol-induced optic neuropathy  
*Br J Ophthalmol* 2007;91:895-897.  
 Samantha J Choi, Rod Foroozan

**Table 2** Change in retinal nerve fibre layer thickness in eight patients with ethambutol-induced optic neuropathy

Quadrant	Mean change in RNFLT	p Value
Temporal	-26.5 µm [-22.8%]	0.009
Superior	-18.6 µm [-15.7%]	0.019
Nasal	-15.0 µm [-18.2%]	0.025
Inferior	-14.9 µm [-9.0%]	0.130
Mean (SD)	-18.8 (5.4) µm [-16.4 (5.8)%]	

RNFLT, retinal nerve fibre layer thickness.

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## Hydroxychloroquine (Plaquenil)



- Aminoquinoline (antimalarial)
  - Malaria
  - Rheumatoid arthritis, lupus erythematosus
- Dose:
  - Malaria, chemoprophylaxis: 400 mg weekly on same day each week
  - Malaria, acute attack: 800 mg initially, followed by 400 mg at 6, 24, and 48 hours
  - Rheumatoid arthritis: 400-600 mg/day taken with food or milk.
  - Lupus erythematosus: 400 mg every day or twice daily for several weeks-months
- Ophthalmic effects: loss of visual acuity, macular pigmentary changes, and loss of foveal reflex.
  - Risk factors include daily doses >6.5 mg/kg lean body weight.




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American Academy of Ophthalmology Update

## Revised Recommendations on Screening for Chloroquine and Hydroxychloroquine Retinopathy

*Ophthalmology* 2011;118:415-422

Michael F. Marmor, MD,<sup>1</sup> Ulrich Kellner, MD,<sup>2</sup> Timothy Y. Y. Lee, MD,<sup>3</sup> Anwarul S. Lyons, MD,<sup>4</sup> William F. Meier, MD,<sup>5</sup> for the American Academy of Ophthalmology

**Screening Tests:** Newer objective tests, such as multifocal electroretinogram (mfERG), spectral domain optical coherence tomography (SD-OCT), and fundus autofluorescence (FAF), can be more sensitive than visual fields. It is now recommended that along with 10-2 automated fields, at least one of these procedures be used for routine screening where available. When fields are performed independently, even the most subtle 10-2 field changes should be taken seriously and are an indication for evaluation by objective testing. Because mfERG testing is an objective test that evaluates function, it may be used in place of visual fields. Amsler grid testing is no longer recommended. Fundus examinations are advised for documentation, but visible bull's-eye maculopathy is a late change, and the goal of screening is to recognize toxicity at an earlier stage.

**Counseling:** Patients should be aware of the risk of toxicity and the rationale for screening (to detect early changes and minimize visual loss, not necessarily to prevent it). The drugs should be stopped if possible when toxicity is recognized or strongly suspected, but this is a decision to be made in conjunction with patients and their medical physicians.

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Table 1. Factors Increasing the Risk of Chloroquine and Hydroxychloroquine Retinopathy	
Duration of use	>5 yrs
Cumulative dose	
HCQ	>1000 g (total)
CQ	>460 g (total)
Daily dose	
HCQ	>400 mg/day
CQ	>6.5 mg/kg ideal body weight for short individuals (>250 mg/day)
CQ	>3.0 mg/kg ideal body weight for short individuals (>150 mg/day)
Age	Elderly
Systemic disease	Kidney or liver dysfunction
Ocular disease	Retinal disease or maculopathy
CQ = chloroquine; HCQ = hydroxychloroquine	

Table 2. Chloroquine and Hydroxychloroquine Screening Procedures	
<b>Timeline</b>	Baseline examination within first year of use Annual screening after 5 yrs of use
<b>Recommended Screening Procedures</b>	
Ocular examination	Dilated retinal examinations are important for detection of associated retinal disorders, but should not be relied on for screening (low sensitivity).
Automated visual field	White 10-2 threshold testing. Interpret with a low threshold for abnormality, and retest if abnormalities appear.
In addition, if available, perform one or more of the following objective tests:	
SD-OCT	Rapid test that can be done routinely; can show abnormalities very early, even before field loss.
mfERG	Valuable for evaluation of suspicious or unstable visual field loss; may show damage earlier than visual field testing.
FAF	May validate other measures of toxicity; can show abnormalities earlier than field loss.
<b>Not Recommended for Screening</b>	
Fundus photography	Recommended for documentation, especially at baseline, but not sensitive for screening.
Time-domain OCT	Insufficient resolution for screening.
Fluorescein angiography	Use only if confirmation of retinopathy changes is needed.
Full-field ERG	Important for evaluation of established toxicity, but not for screening.
Amsler grid	Use only as adjunct test.
Color testing	Use only as adjunct test.
ECG	Questionable sensitivity.

ECG = electrocardiogram; FAF = fundus autofluorescence; mfERG = multifocal electroretinogram; SD-OCT = spectral domain optical coherence tomography.

*Ophthalmology* 2011;118:415-422

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## Interferons




INTRON A  
Interferon Alfa-2a (peginterferon)



AVONEX  
(interferon beta-1a)

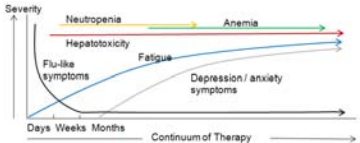


BETASERON  
Interferon Beta-1b (SCL)



ACTIMUNE  
(interferon gamma-1b)

IFN categories	Earlier Designation
Alpha (α)	Leukocyte
Beta (β)	Fibroblast
Gamma (γ)	Immune IFN



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### Interferon Retinopathy



- a baseline fundoscopic examination at initiation
- a follow-up examination at least every 3 months thereafter?

Br J Ophthalmol 2004;88:1518-1520

Esmaili B, Keller C, Papadopoulos N, et al. Interferon-induced retinopathy in asymptomatic cancer patients. Ophthalmology 2001;108:859-60.

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### Isotretinoin (Accutane)

- Acne Products, Antineoplastic Agent
  - Acne, severe recalcitrant nodular
  - Neuroblastoma, high-risk
- Reduces sebum production
- Dose:
  - Severe: 0.5-1 mg/kg/day in 2 divided doses for 15-20 weeks
  - Moderate: 20mg/day for 6 months
- Ocular: Conjunctivitis (4%), blepharitis (1%), chalazion (1%), hordeolum (1%), night vision decreased, photophobia.
- Pseudotumor cerebri especially in children

Br J Ophthalmol. 2006;90:957-9

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### Thioridazine (Mellaril)

- First Generation (Typical) Antipsychotic
  - Schizophrenia/psychosis
- blocks postsynaptic mesolimbic dopaminergic receptors
- Dose:
  - Initial: 50-100 mg 3 times/day with gradual increments
  - maximum: 800 mg/day in 2-4 divided doses
- Ocular: Pigmentary retinopathy, blurred vision, cornea and lens changes

ARCH OPHTHALMOL/VOL. 116, JUNE 1998 827

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### Chlorpromazine (Thorazine)

- Antimanic Agent; First Generation (Typical) Antipsychotic
- psychotic disorders
- Ophthalmic: Blurred vision, corneal changes, epithelial keratopathy, retinitis pigmentosa
- Ocular examination (yearly in patients >40 years; every 2 years in younger patients)



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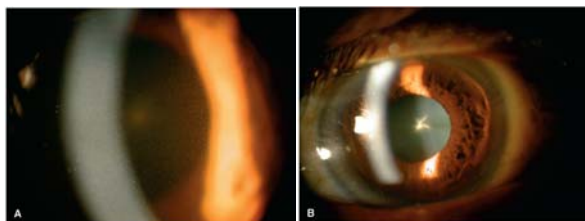
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### Thioridazine & Chlorpromazine



Diffuse corneal pigmentation, predominantly located in the posterior stroma (A), and stellate anterior subcapsular lenticular pigmentation in the sun-exposed interpalpebral zone (B) are present.

Arch Ophthalmol 1960, 64:65-76

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Arch Ophthalmol 1973, 90:251-255.

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### Prednisone



- Corticosteroid, Systemic
- Acute asthma, COPD, gout, antineoplastic, RHA
- Ophthalmic conditions:
  - Allergic conjunctivitis, keratitis, allergic corneal marginal ulcers, herpes zoster ophthalmicus, iritis and iridocyclitis, chorioretinitis, anterior segment inflammation, diffuse posterior uveitis and choroiditis, optic neuritis
  - Giant cell arteritis (off-label use): Oral: Initial: 40 to 60 mg daily; typically requires 1 to 2 years of treatment, but may begin to taper after 2 to 3 months; alternative dosing of 30 to 40 mg daily has demonstrated similar efficacy.
  - Graves ophthalmopathy prophylaxis (off-label use): Oral: 0.4 to 0.5 mg/kg/day, starting 1 to 3 days after radioactive iodine treatment, and continued for 1 month, then gradually taper over 2 months.
  - Herpes zoster (off-label use; Dworkin, 2007): Oral: 60 mg daily for 7 days, followed by 30 mg daily for 7 days, then 15 mg daily for 7 days
  - Bell palsy (off-label use): Oral: 60 mg daily for 5 days, followed by a 5-day taper. Treatment should begin within 72 hours of onset of symptoms.

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**Major side effects associated with glucocorticoid therapy**

<b>Dermatologic and soft tissue</b>	<b>Renal</b>
Skin thinning and purple striae	Hypocalcemia
Cushingoid appearance	Fluid volume shifts
Hemecia	<b>Cardiovascular and reproductive</b>
Ache	Arteriothrombolytic
Hematuria	Endometrial growth retardation
Striae	<b>Bone</b>
Hypertension	Osteoporosis
<b>Eye</b>	Acute angle closure
Proximal interphalangeal contracture	<b>Muscle</b>
Elevated intraocular pressure/glaucoma	Myopathy
Exophthalmos	<b>Neuropsychiatric</b>
<b>Cardiovascular</b>	Diaphoresis
Arteriothrombolytic (arteriothrombolytic and therapy)	Depressive depression
Hypertension	Insomnia/nightmares
Hypertension of various types	Manic-depressive psychosis
Arteriothrombolytic disease	Pseudotumor cerebri
<b>Cardiovascular</b>	<b>Endocrine</b>
Carditis	Endocrine myopathy
Proximal interphalangeal contracture	Myopathy/arthralgia/arthralgia
Pericarditis	<b>Infection disease</b>
Myocarditis	Increased risk of fungal infections
Myocarditis	Capsulitis infections
Myocarditis	Deep vein thrombosis

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### Sildenafil (Revatio, Viagra)

- Phosphodiesterase-5 Enzyme Inhibitor
  - Erectile dysfunction
  - Pulmonary arterial hypertension
- Ophthalmic: Visual disturbance (2% to 11%; including vision color changes, blurred vision, and photophobia; dose related)
- Dose:
  - 5 mg or 20 mg 3 times daily
  - Maximum 100mg once daily
- ADRs:
  - Flushing (10-19%), headache (16-46%), dyspepsia (3-17%)



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### Retinal Effects of 6 Months of Daily Use of Tadalafil or Sildenafil

*Arch Ophthalmol. 2009;127(4):367-373*

**Table 3. Other Visual Testing (Per Protocol Analysis): Changes (Average for Both Eyes) From Baseline to Endpoint in Subjects Who Completed All 6 Months of Daily Study Drug and Who Were Compliant 70% or More of the Study\***

	Placebo (n=49)	Tadalafil, 5 mg (n=57)	Sildenafil, 50 mg (n=49)
<b>Color vision: Farnsworth-Munsell 100 total error score</b>			
Baseline mean <sup>a</sup>	42.54	46.63	46.73
Endpoint mean <sup>b</sup>	39.13	43.90	45.06
P value <sup>c</sup>		.88	.32
<b>Visual acuity score</b>			
Baseline mean <sup>a</sup>	90.40	90.14	91.73
Endpoint mean <sup>b</sup>	91.86	90.94	92.99
P value <sup>c</sup>		.09	.95
<b>Peripheral vision deviations, dB</b>			
Baseline mean <sup>a</sup>	-0.22	-0.08	-0.11
Endpoint mean <sup>b</sup>	-0.10	+0.17	-0.01
P value <sup>c</sup>		.27	.99
<b>Intraocular pressure, mm Hg</b>			
Baseline mean <sup>a</sup>	14.99	15.00	14.84
Endpoint mean <sup>b</sup>	14.56	14.54	14.41
P value <sup>c</sup>		.32	.90

**Conclusions:** No abnormalities in ERG or visual function and no treatment-related findings suggestive of drug toxicity are associated with daily administration of tadalafil or sildenafil for 6 months.

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## Tamsulosin (Flomax)

- Alpha<sub>1A</sub> Blocker
- ADR >10%
  - Headache (19% to 21%),
  - Dizziness (15% to 17%)
  - Ejaculation failure (8% to 18%)
- Intraoperative floppy iris syndrome (<1%)
- Blurred vision (≤2%)



An iris of a tamsulosin patient undergoing cataract surgery exhibiting floppy iris, pupil constriction, and iris prolapse to the wound and stab incisions

Invest Ophthalmol Vis Sci. 2006;47:3766-71

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## Topiramate (Topamax)



- Anticonvulsant
  - Epilepsy
  - Migraine prophylaxis
  - Multiple off-label uses
- Blocks neuronal voltage-dependent sodium channels
- Dose
  - Epilepsy: 200 mg twice daily, slow increase from 25mg
  - Migraine: 100 mg daily given in 2 divided doses
- Acute myopia and secondary angle-closure glaucoma in adults and children, typically within 1 month of initiation
- Discontinue in patients with acute onset of decreased visual acuity and/or ocular pain.

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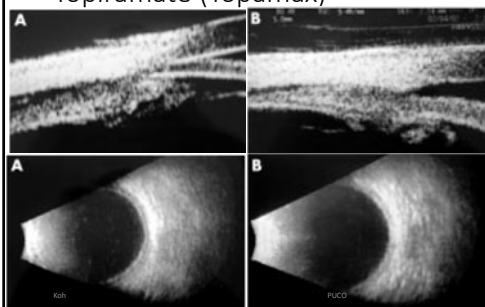
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## Topiramate (Topamax)



(A) Ultrasound biomicroscopy of case 1 (left eye) on the day of initial presentation. Ciliary body swelling and uveal effusions are present. (B) Case 1 (left eye) 3 days later. Uveal effusions are resolving and the angle is more open.

(A) B scan of case 1 (left eye) showing 360° choroidal effusions. (B) Case 1 (left eye) 3 days later. Effusions are almost completely resolved.

Br J Ophthalmol. 2003;87:648-9

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### Tamoxifen (Soltamox)



- Antineoplastic Agent, Estrogen Receptor Antagonist; Selective Estrogen Receptor Modulator (SERM)
- Breast cancer treatment and risk reduction
  - Competitively binds to estrogen receptors on tumors and other tissue targets
- Dose:
  - 20 mg once daily for 5 years
- Cataract (7%)
- (<1%): Decreased visual acuity, retinal vein thrombosis, retinopathy, corneal changes, and color perception changes.

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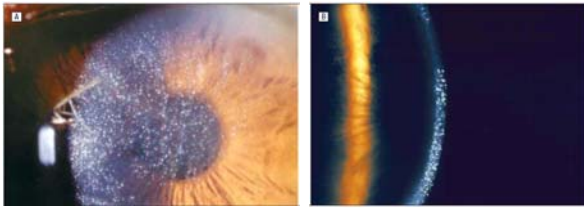
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### Tamoxifen keratopathy



A and B, Slitlamp external photograph of the right eye shows subepithelial crystal-like substance deposition in the cornea.

Koh PUCO ARCH OPHTHALMOL/VOL 124, JULY 2006 32

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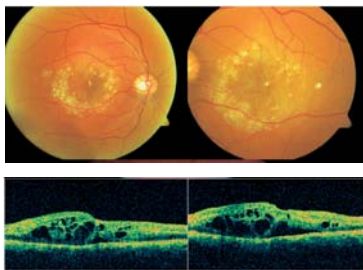
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### Tamoxifen maculopathy



Am J Ophthalmol: 2007;144:126-8

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### Vigabatrin (Sabril)



- Anticonvulsant
  - Refractory complex partial seizures
- Inhibits gamma-aminobutyric acid transaminase (GABA-T)
- Dose: 1.5g twice daily
- Somnolence (adults 22% to 24%; infants 17% to 45%), headache (33%), fever (adults 4% to 5%; infants 19% to 29%)
- Visual field constriction ( $\geq 30\%$ ), nystagmus (13% to 15%), blurred vision (11% to 13%), Diplopia (3% to 7%)
- [www.SABRIL.net](http://www.SABRIL.net) for more info

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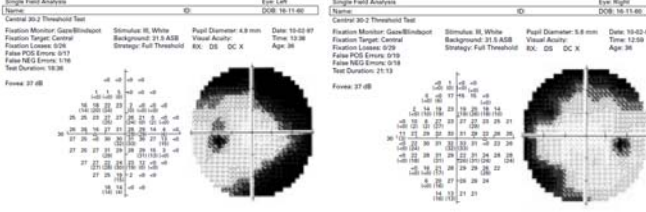
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### Vigabatrin



*J Neurol Neurosurg Psychiatry 1999;67:716-722*

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### Conclusions

- Many drugs have potential ocular adverse drug reactions
- All structure of the eyes can be affected
- Multiple medications can lead to a single clinical manifestation
- A single medication can lead to multiple ocular disorders
- Some of the ophthalmic ADRs are irreversible
- Pharmacovigilant and comanagement are essential

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## References

- Miguel A. et al. Ophthalmic adverse drug reactions to systemic drugs: a systematic review. *pharmacoepidemiology and drug safety* 2014; 23: 221–233
- <http://www.uptodate.com/home>
- <http://www.drugs.com/>

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## **Clinical Cases from Spokane VA Medical Center**

Brandon McFadden, OD

Keegan Bench, OD

Kolton Kuntz, OD

### **Description:**

This course highlights clinical cases and research from optometric residents at the Spokane VA Medical Center. Included are: OCT for peripheral retinal lesions; treatment of patients with Homonymous Hemianopia; and current and upcoming IOL designs, surgical platforms, and procedure techniques for cataract surgery.

- The doctor will be able to better recognize findings in ocular coherence tomography of peripheral retinal lesions
- The attendees will be able to
  - Better utilized existing Ganglion Cell Analysis software
  - Better appreciate the need for exam findings to match their diagnosis
  - Better educate their patients of the nature of their particular vision loss
- Understand new advancements in cataract surgery management.
- Obtain an understanding of today's intra-ocular lens designs, surgical platforms, and intra-operative techniques.
- Become better prepared for to discuss new advances in cataract surgery with the patient population.

### **Part 1: Using Ocular Coherence Tomography for Analysis of Peripheral Retinal Findings (Brandon McFadden, OD)**

1. Introduction to the use of Ocular Coherence Tomography in less common areas of the retina.
  - a. If you can get good view of lesion on 90D behind slit lamp, OCT may be possible
2. Findings discussed for specific lesions
3. OCT of the choroidal nevus
  - a. Identifying risk factors of melanoma:
    - i. To Find Small Ocular Melanoma Using Helpful Hints Daily
      1. Thickness greater than 2mm
      2. Subretinal Fluid
      3. Symptoms
      4. Orange Coloration (lipofuscin)

5. Distance from Optic Nerve Head within 2 DD
  6. Ultrasound Hollowness
  7. Absence of Halo
  8. Absence of Drusen
  9. Size
  10. Borders
- b. OCT of peripheral RPE drop out
  - c. OCT of retinal hole
    - i. look for subretinal fluid
  - d. OCT to help differentiate for retinal detachment
4. Using other technology to determine risk
    - a. B-Scan
    - b. Photos
    - c. OCT

**References:**

1. Shields CL, Shields JA, Kiratli H, De Potter P, Cater JR. Risk factors for growth and metastasis of small choroidal melanocytic lesions. *Ophthalmology*. 1995;102:1351–61.
2. Shields CL, Furuta M, Berman EL, et al. Choroidal Nevus Transformation Into Melanoma: Analysis of 2514 Consecutive Cases. *Arch Ophthalmol*. 2009;127(8):981-987.
3. Shields CL, Kaliki S, Rojanaporn D, Ferenczy SR, Shields JA. Enhanced Depth Imaging Optical Coherence Tomography of Small Choroidal Melanoma: Comparison With Choroidal Nevus. *Arch Ophthalmol*. 2012;130(7):850-856.

**Part 2: Retrograde Degeneration of Retinal Ganglion Cells Detected with Optical Coherence Tomography in Patients with Homonymous Hemianopia (Keegan Bench, OD)**

1. Review of Homonymus Hemianopsia
  - a. Etiology and prognosis
2. Review Ganglion Cell Analysis Software
  - a. Zeiss Cirrus
    - i. GANGLION CELL LAYER + INNER PLEXIFORM LAYER
    - ii. Uses normative data for comparison
    - iii. Does not include NFL
  - b. Optovue RTVue
    - i. GCC = NFL + GCL + IPL
    - ii. Uses normative data
  - c. Heidelberg Spectralis
    - i. GCC = NFL + GCL + IPL
    - ii. Uses normative data



3. GCA and Glaucoma
  - a. Predicting visual fields
4. Patient 1
  - a. 77 yr old White Female
  - b. Presents with blind spot OD beginning 6 months ago
5. Related Literature Review
  - a. Chiasmal and optic tract lesions have been shown to present with RNFL loss.
  - b. Congenital and longstanding occipital lesions can present with Wallerian Pallor and RNFL thinning.
  - c. Cases of GCC loss that correlates to visual field loss due to cerebral infarctions.
6. Patient 2
  - a. 66 yr old Male with hemorrhagic stroke x 1 year
7. Patient 3
  - a. 76 yr old Female with unspecified stroke x 1 month
8. Other post-chiasmal lesions with GCC loss

### **Part 3: A Look into Current Trends and Future Advances in Cataract Surgery. (Kolten Kuntz, OD)**

1. Review brief history of cataract surgery.
2. Discuss pre-operative examination and lens calculation advancements.
3. Discuss intra-ocular lens designs, where we came from to where we are today.
  - a. Multi-focal IOL's
  - b. Toric IOL
  - c. Multifocal-Toric IOL
  - d. Future of the IOL
4. Discuss cataract surgery platforms.
  - a. Standard vs. new advanced instrumentation.
    - i. Discuss the benefits of the femtosecond laser platforms.
      1. Comparative surgical outcomes.
      2. T-cut technique
      3. Reduced risk, less energy, less time intra-ocular
5. Discuss intra-operative techniques with advanced instrumentation.
  1. Discuss benefits of ORA and OCT imaging in real-time during surgery.
  2. Intra-operative aberrometry
6. Discuss intra-operative solutions and advances.
  - a. Benefits of OVD and Provisc viscoelastics
7. Discuss future techniques and advances on the horizon.

# Ocular Electrophysiology in Clinical Practice

Denise Goodwin, OD, FAAO  
Pacific University College of Optometry  
Neuro-ophthalmic Disease Clinic

## That was then...



wikipedia.org

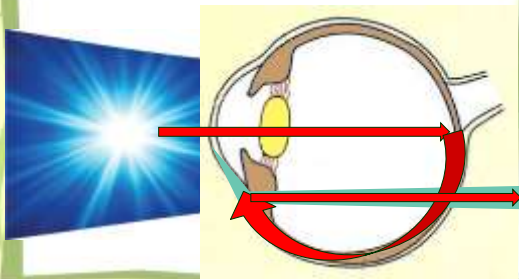
## This is now...



## Overview

- × mfERG and VEP procedure
- × Test selection
- × Clinical uses
- × Evaluation of the results

## Electroretinogram (ERG)

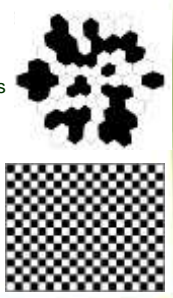
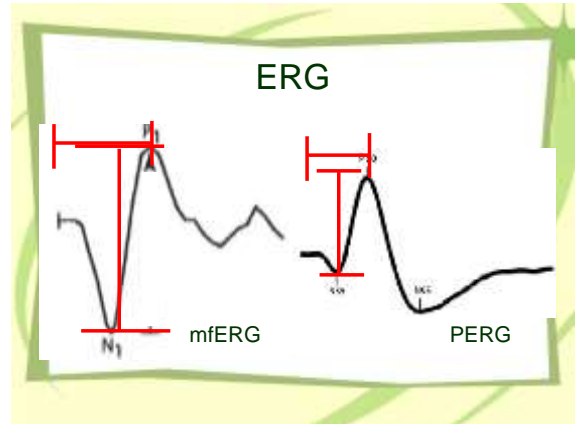


## ERG



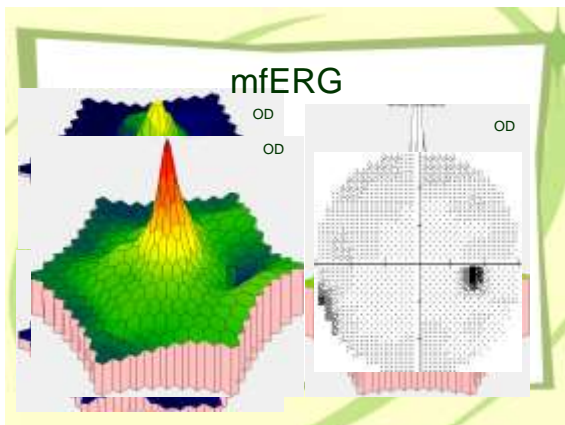
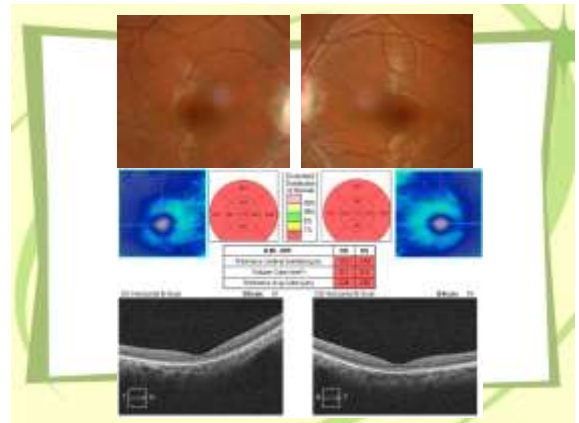
### ERG

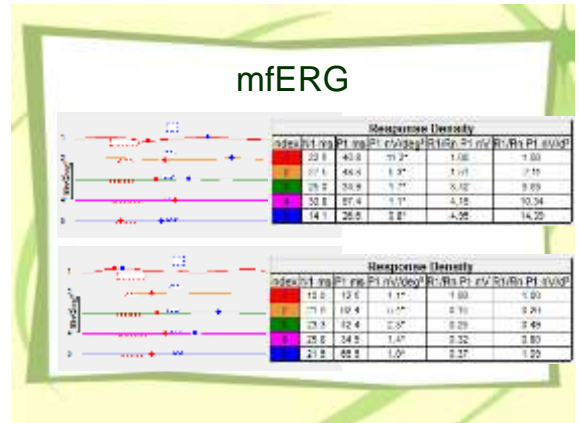
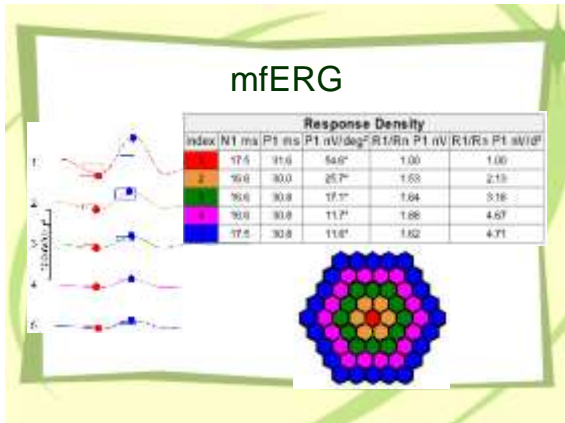
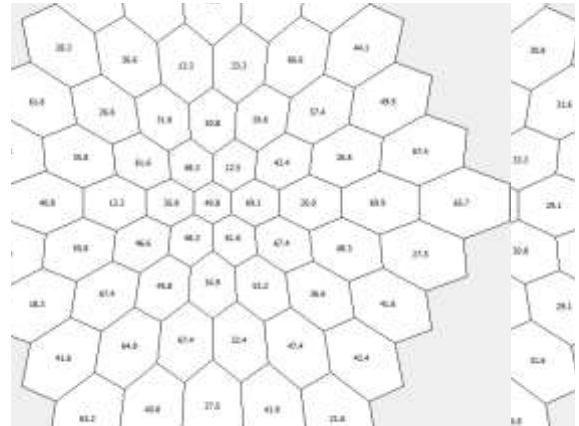
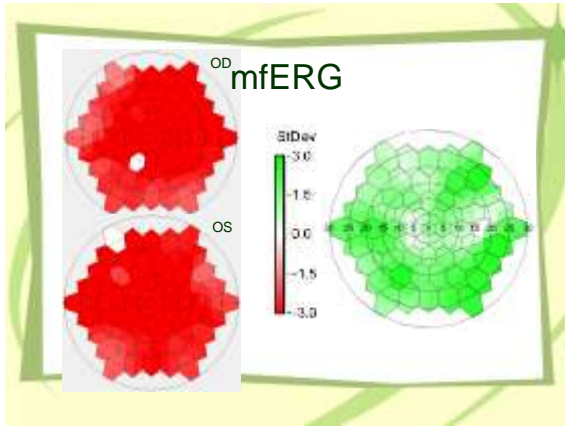
- ✦ Flash ERG
  - Photoreceptors and bipolar cells
- ✦ Multifocal ERG (mfERG)
  - Cones and bipolar cells
- ✦ Pattern ERG (PERG)
  - Ganglion cell layer

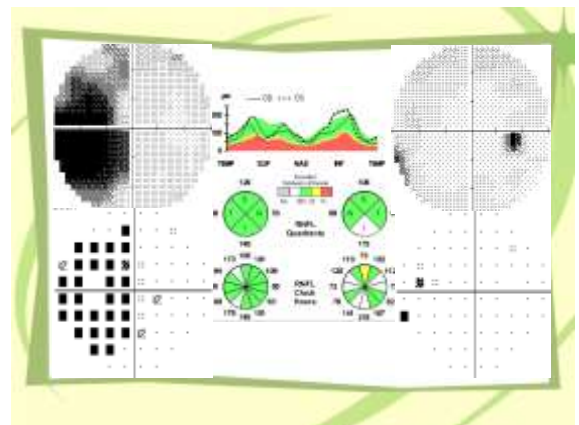
### ERG Uses

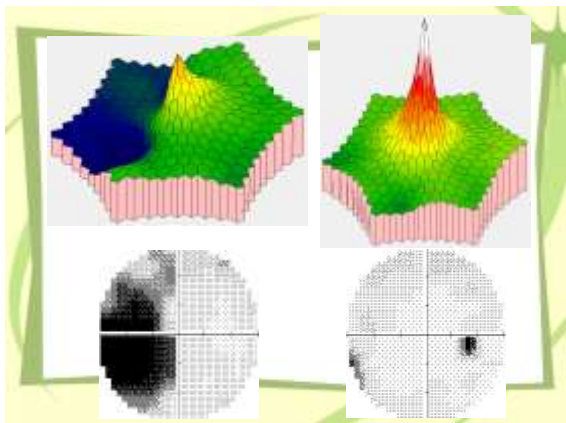
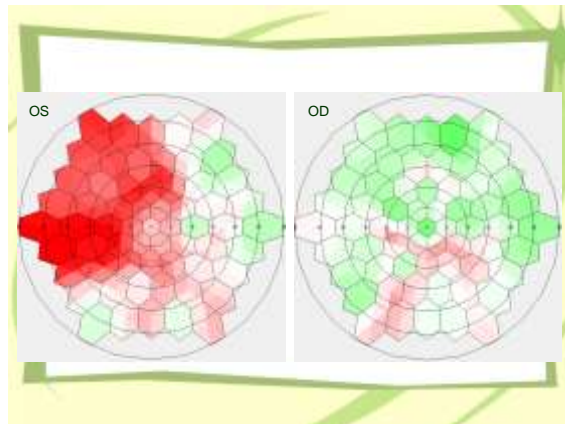
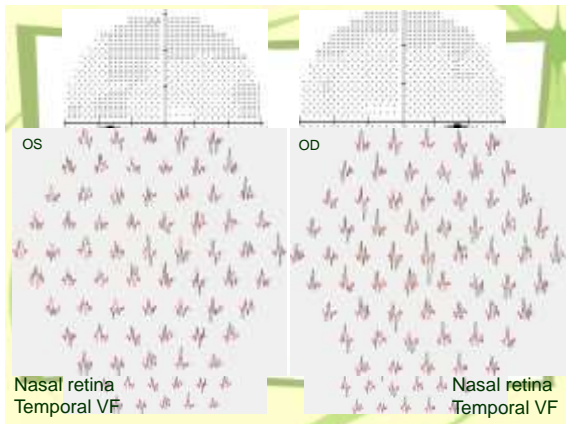
<ul style="list-style-type: none"> <li>✦ mfERG (outer retina)                             <ul style="list-style-type: none"> <li>- Macular degeneration</li> <li>- Diabetic retinopathy</li> <li>- Hydroxychloroquine toxicity</li> <li>- Central serous retinopathy</li> <li>- Occult macular/cone dystrophy</li> <li>- Cancer associated retinopathy</li> <li>- Acute zonal occult outer retinopathy</li> <li>- Other hereditary retinal disease</li> <li>- Branch retinal artery occlusion</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>✦ PERG (ganglion cells)                             <ul style="list-style-type: none"> <li>- Glaucoma</li> <li>- Optic nerve dysfunction</li> <li>- Multiple sclerosis</li> </ul> </li> </ul>
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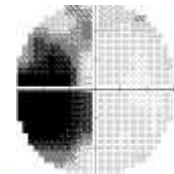
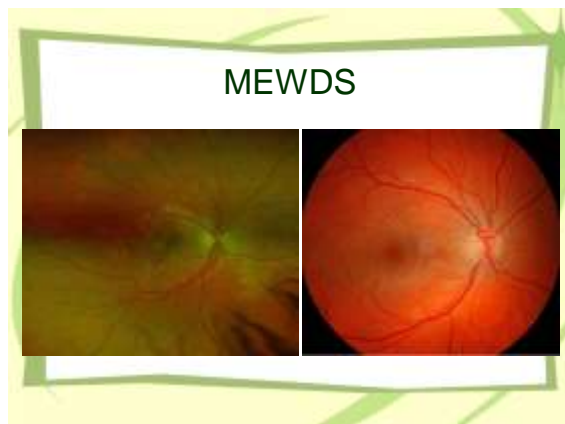
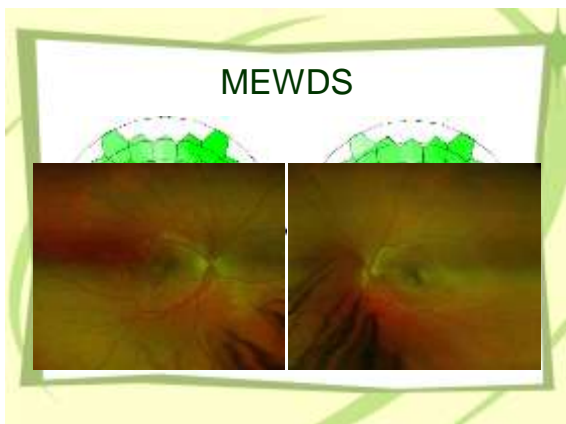
- 29 yo white female
- BCVA: 20/20 OD, 20/30 OS
- PIP: 10/10 OD, 6/10 with 80% red desaturation

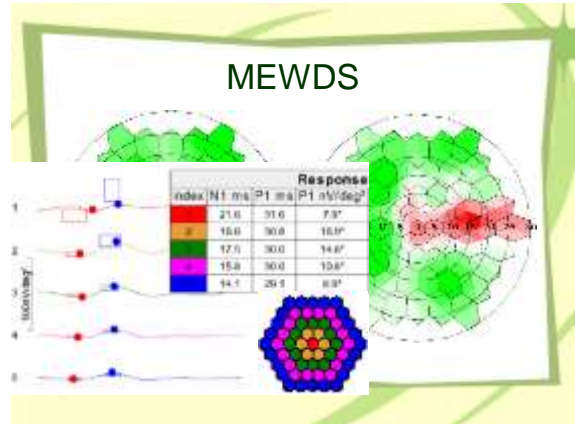
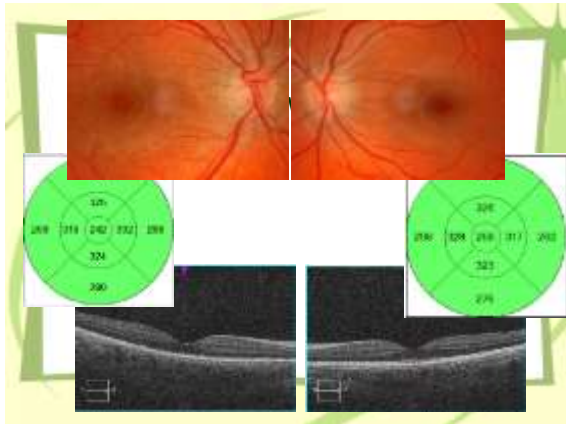




### AIBSE

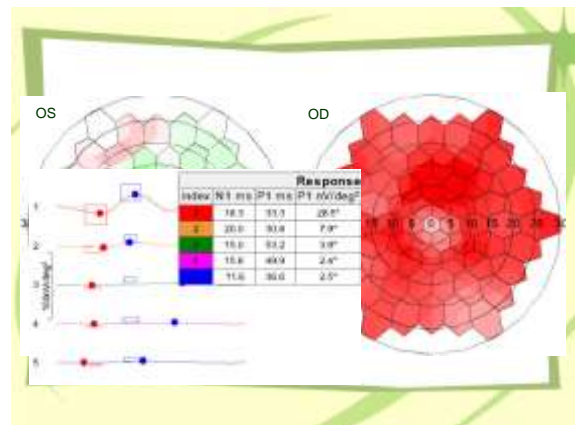
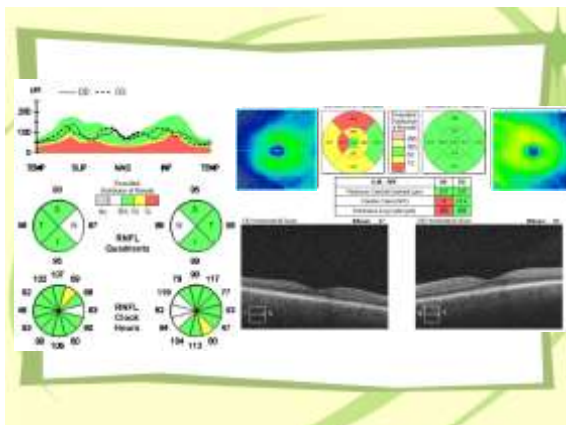
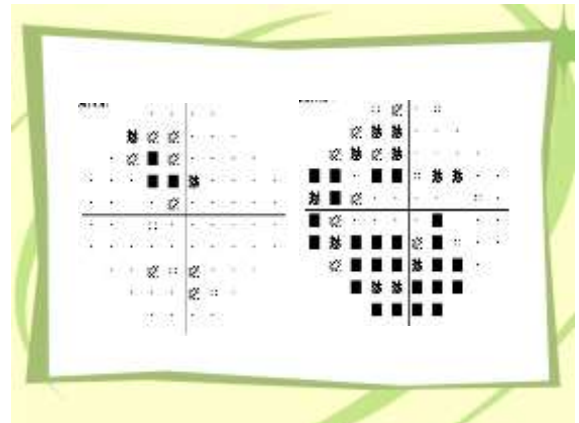
- ✗ Acute idiopathic blind spot enlargement
- ✗ Acute zonal occult outer retinopathy (AZOOR)
- ✗ Women, 16-50 years
- ✗ Photopsias followed by vision loss
- ✗ Absolute scotoma with steep borders



- × 64 yo diabetic white male
- × Meds: metformin, Lipitor, and lisinopril
- × BP: 139/90
- × BCVA: 20/25-1 OD, 20/20 OS
- × PIP: 9/17 OD, 16/17 OS
- × Pupils: equal, reactive, no RAPD

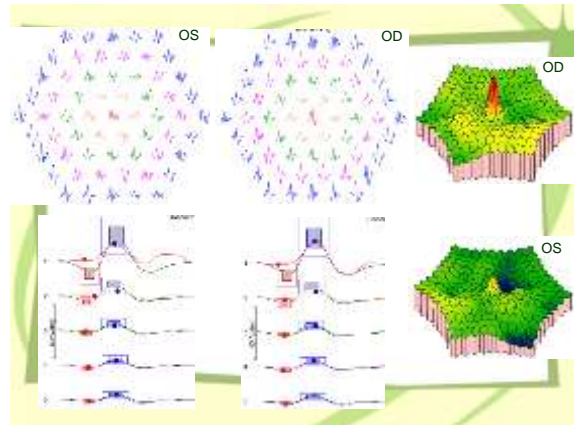
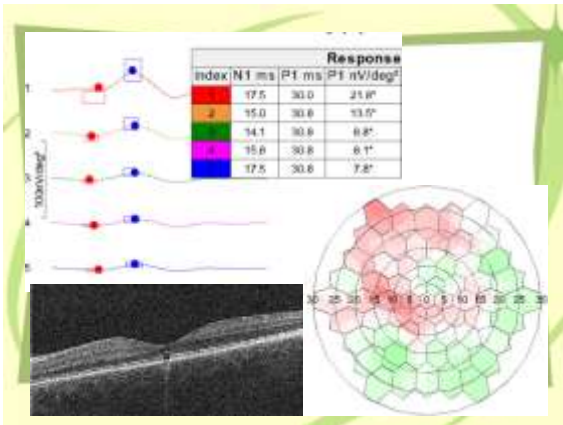
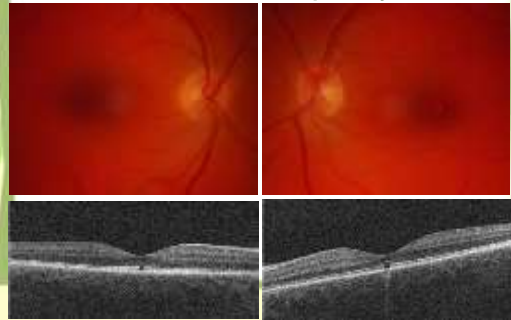
Two fundus photographs showing the retina of the right eye (OD) and left eye (OS). The images show a normal-appearing macula and optic discs.



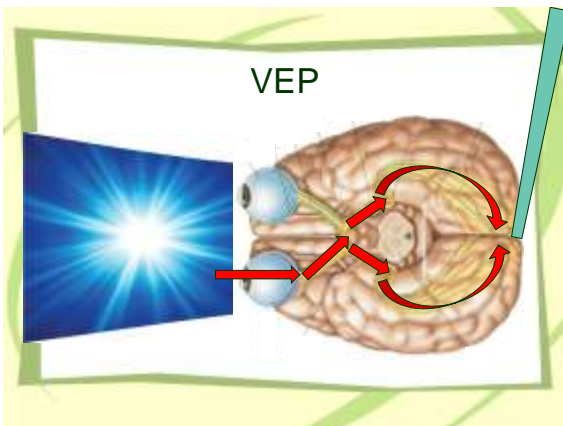
### CAR

- ✗ Cancer associated retinopathy
- ✗ Autoimmune retinopathy
- ✗ Look for underlying malignancy
- ✗ Painless vision loss, photopsias, photosensitivity
- ✗ Normal retina with markedly abnormal ERG
- ✗ Laboratory tests for circulating retinal antibodies

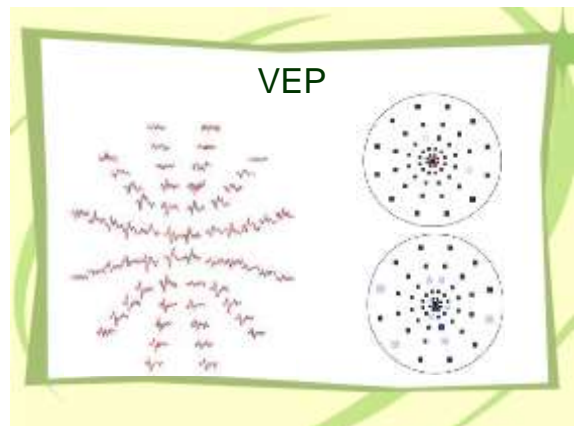
### Solar Retinopathy

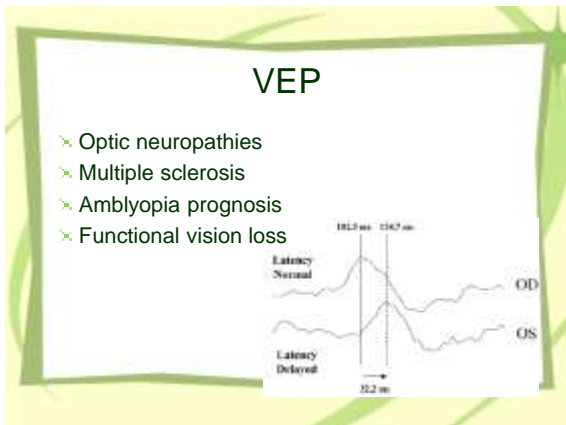
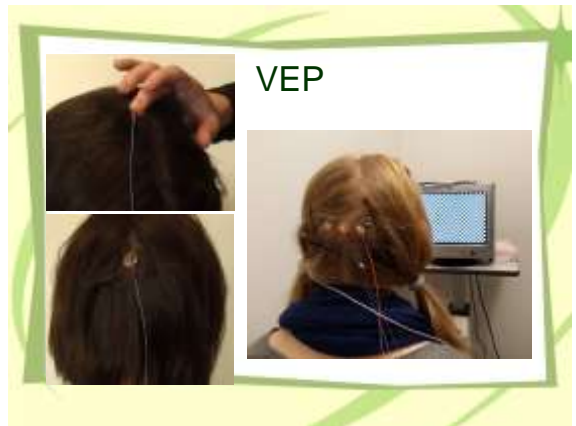
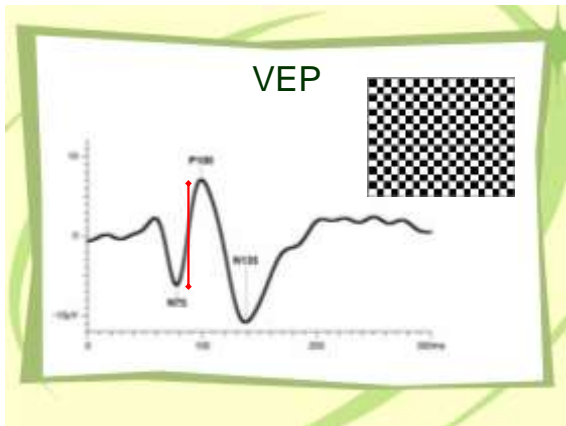


### VEP



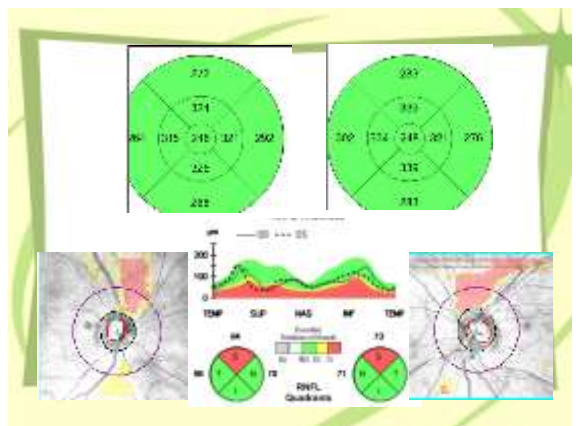
### VEP



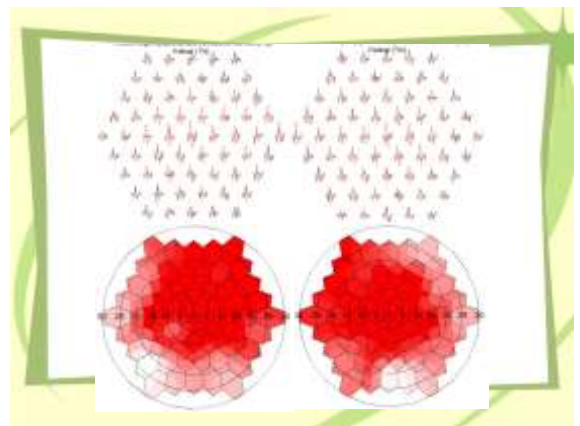
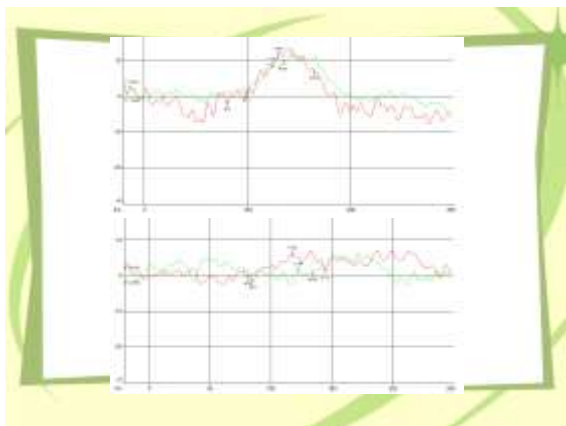
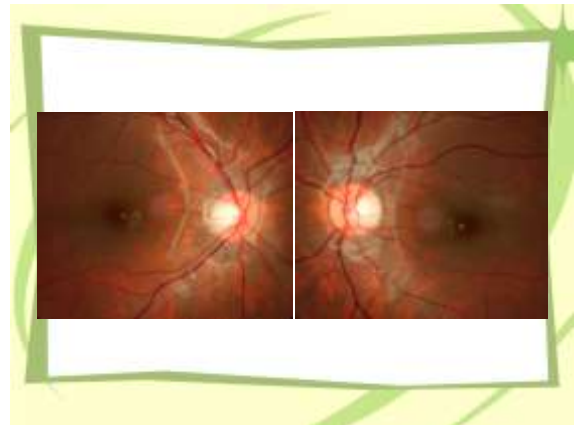
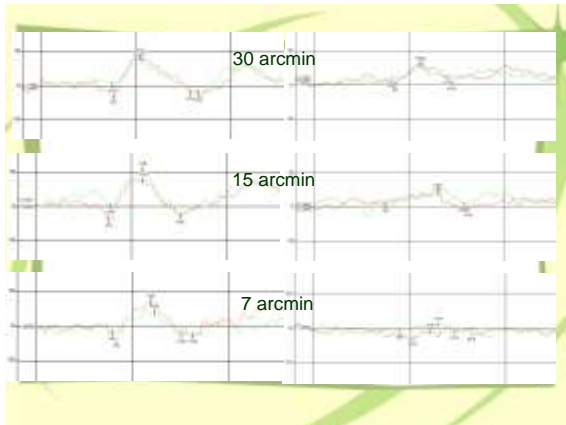
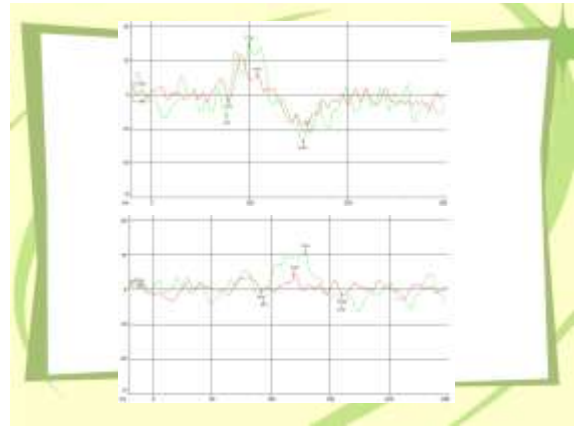
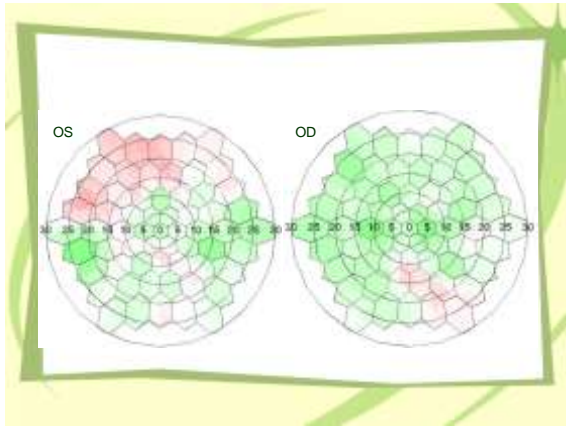


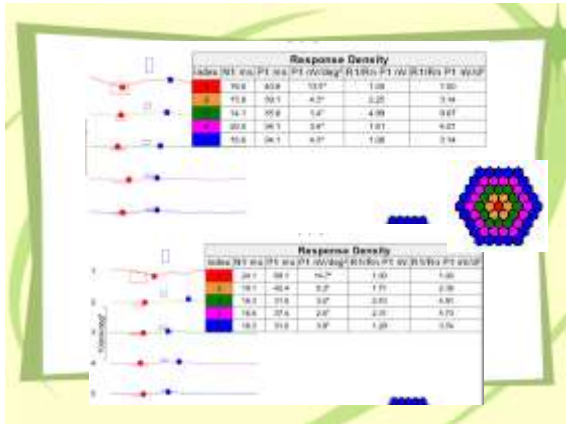
- ✗ 46 yo white female
- ✗ BCVA: HM OD, HM OS
- ✗ Pupils: physiologic anisocoria, briskly reactive to light, no RAPD

The image contains two fundus photographs showing the optic discs and retinal vessels. The left photograph shows a normal-appearing optic disc, while the right photograph shows a slightly smaller optic disc, consistent with the clinical findings of physiologic anisocoria.









# Thank You

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Put a Lid On It:  
 Sutureless Eyelid Procedures  
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 yudcovil@pacificu.edu

Course objectives:

1. To learn specific sutureless eyelid procedures for various eyelid pathologies
2. To become familiar with instruments and techniques required for sutureless eyelid procedures
3. To understand practice aspects related to sutureless eyelid procedures

- I. Sutureless Eyelid Procedures
  - a. Cyst drainage/expression
  - b. Lesion cautery (chemical, cryo, electrical, thermal)
  - c. Punctal cautery
  - d. Lesion snip excision
  - e. Chalazion steroid injection
  - f. Chalazion excision & curettage
  
- II. Indicated Diagnoses with ICD-9 Code
 

a. Achrochordon (skin tag)	757.39
b. Benign neoplasm (papilloma, nevus)	216.1
c. Chalazion	373.2
d. Commedome	374.84
e. Concretions (conjunctiva)	373.54
f. Concretions (eyelid)	374.56
g. Conjunctival cyst	372.75
h. Eccrine sweat gland cyst (hydrocystoma)	705.89
i. Epiphora	375.20
j. Epidermal inclusion cyst	706.2
k. Eye cyst (retention)	379.8
l. Hordeolum internum (stye)	373.12
m. Meibomian retention cyst	373.2
n. Meibomianitis	373.12
o. Milia	374.84
p. Keratoacanthoma	238.2
q. Spastic entropion	374.03
r. Senile ectropion	374.11
s. Sudiferous cyst (of Moll)	374.84
t. Subcutaneous sebaceous cyst (eyelid)	374.84
u. Trichiasis	374.05
v. Verruca (viral wart)	078.1
w. Xanthelasma	272.2
  
- III. Procedures with CPT Code
  - a. 11900 Intralesional injection
  - b. 17000 Destruction of benign lesion (first lesion)
  - c. 17003 Destruction, second through fourteen lesions
  - d. 17004 Destruction, fifteen lesions and above
  - e. 17250 Chemical cautery
  - f. 17380 Electrolysis for trichiasis
  - g. 65210 Concretion removal
  - h. 65900 Excision of eye lesion
  - i. 67700 Incision and drainage, eyelid abscess
  - j. 67800 Chalazion excision with anesthesia, single
  - k. 67801 Chalazion excision, multiple, same lid
  - l. 67805 Chalazion excision, multiple, different lids
  - m. 67810 Biopsy of eyelid
  - n. 67820 Correction of trichiasis; epilation, by forceps only

- o. 67825 Epilation by other than forceps (e.g., electrosurgery, cryotherapy, laser)
- p. 67830 Incision of lid margin
- q. 67840 Eyelid lesion excision (except chalazion) without closure or simple direct closure
- r. 67850 Destruction of lesion (< 1cm)
- s. 67922 Thermocautery of punctum, eyelid
- t. 67938 Removal of embedded foreign body, eyelid
- u. 68020 Incision of conjunctiva, cyst drainage
- v. 68110 Excision of lesion, conjunctiva, up to 1 cm
- w. 68115 Excision of lesion, conjunctiva, over 1 cm
- x. 68135 Destruction of lesion, conjunctiva
- y. 68200 Subconjunctival injection (anesthetic, steroid)
- z. 68420 Incision and drainage of lacrimal sac
- aa. 68440 Snip incision of lacrimal punctum
- bb. 68705 Correction of everted punctum, cautery
- cc. 68760 Closure of lacrimal punctum, thermocautery

#### IV. Recommended Equipment

- a. Needles and Syringes
- b. Westcott Scissors
- c. Tissue Forceps
- d. Chalazion Clamp
- e. Curette
- f. Anterior Chamber Irrigation Cannula With Bulb
- g. Precision Jewelers Forceps
- h. Golf Club Spud
- i. Cilia Forceps
- j. 4 x 4 Gauze
- k. Jaeger Plate
- l. Electrocautery/Thermal Cautery Unit
- m. Lidocaine - 4% topical, 1% or 2% injection, 1:100,000 epinephrine with injection
- n. Triamcinolone suspension - 10mg/mL (Kenalog-10) or 40mg/mL (Kenalog-40)
- o. Saline
- p. Cotton-Tipped Applicators
- q. Loupe
- r. Instrument Sterilizer/Autoclave
  - i. CDC criteria: 15 psi @ 121°C (250°F) for 30 minutes
  - ii. [http://www.cdc.gov/hicpac/pdf/guidelines/Disinfection\\_Nov\\_2008.pdf](http://www.cdc.gov/hicpac/pdf/guidelines/Disinfection_Nov_2008.pdf)
- s. Dichloroacetic Acid (DCA)
- t. Disposable Stainless Steel Scalpels
- u. In-office Pharmaceuticals/ER kit
  - i. Proparacaine drop
  - ii. Antibiotic drop (i.e. fluoroquinolone, Polytrim)
  - iii. Steroid/antibiotic drop (i.e. Tobradex)
  - iv. Antibiotic ointment (i.e. Bacitracin)
  - v. Artificial tears
  - vi. Diphenhydramine (Benadryl) or cetirizine (Zyrtec)
  - vii. Epi-pen
  - viii. Fox shield or clear plastic eye shield
  - ix. Skin tape (3M)
- b. Protection/Hygiene/Disposal Supplies
  - i. Alcohol swabs
  - ii. Iodine swabs
  - iii. Disinfecting wipes (i.e. Sani)
  - iv. Hand sanitizer (i.e. Purell)
  - v. Gloves
  - vi. Eye shield/Face shield
  - vii. Surgical mask
  - viii. Sharps container
  - ix. Hazardous waste bags

- V. Eyelid Anatomy
  - a. Eyelid neuroanatomy
  - b. Eyelid cross section
  - c. Rhytids of Eyelid and Face
  
- VI. Procedural Techniques
  - a. Cautery – Chemical, Heat, Electro (Fulguration)
  - b. Incision – Stab, Lineate (Cruciate)
  - c. Excision – Snip, Shave
  - d. Exteriorization
  - e. Marsupialization
  
- VII. Questions To Ask Patient
  - a. Allergies to meds/anesthetics
  - b. Taking blood thinners/bleed easily
  - c. Procedural informed consent/doctor-patient communication
  
- VIII. SUTURELESS PROCEDURES
  - a. Cyst Drainage/Expression
    - i. 27-30 gauge needle
    - ii. Proparacaine only for conjunctival cysts
    - iii. Lidocaine injection for skin cysts
    - iv. Multiple stab incisions indicated if clustered
    - v. Cilia or flat-tipped forceps to express if needed
    - vi. Inform patient: bleeding may result (sub-conj heme), cyst may re-fill
    - vii. Antibiotic drop or ointment TID x 3 days
  
  - b. Chemical Cautery
    - i. Proparacaine drop
    - ii. Jaeger plate if lesion close to eyelid margin
    - iii. Alcohol wipe lesion and surrounding skin
    - iv. Apply very small amounts of acid with wood utensil
    - v. Inform patient of 'stinging' sensation that subsides
    - vi. Lesion turns white → black (eschar) → falls off ~10d
    - vii. Can repeat after 2 weeks if not completely resolved
    - viii. Care with dark-pigmented skin; keloid risk
  
  - c. Thermal Cautery
    - i. Uses: punctal occlusion, eyelid apposition, skin tag removal, hemostasis
    - ii. Lidocaine 1 to 2% with 1:100,000 epi, 1 to 2cc injection
    - iii. Assure anesthesia with syringe needle tip testing
    - iv. Put lid on temporal stretch for punctal cautery
    - v. Turn on unit for 1 second to sanitize then cool
    - vi. Insert tip cold, punctum blanches, remove tip hot
    - vii. Antibiotic ointment TID x 3 days
  
  - d. Snip Excision
    - i. Clean area with alcohol or iodine
    - ii. Very small tags may be removed with topical anesthesia (i.e. topical lidocaine)
    - iii. Lidocaine with 1:100,000 epi injection 1cc if big skin tag
    - iv. Snip forceps pulls lesion taught
    - v. Westcott scissors cuts thinnest section
    - vi. Apply pressure afterward with 4 x 4 if bleeding
    - vii. Thermal cautery option – built-in hemostasis
    - viii. Antibiotic ointment TID x 3 days

- e. Steroid Injection
  - i. 0.1-0.2cc Kenalog-40
  - ii. 27G needle; can use chalazion clamp if desired
  - iii. 3 injection types: intralesional, paralesional, translesional
  - iv. "Rule of 6" (David K. Talley, O.D.)
    - 1. If chalazion < 6 mm,
    - 2. and/or < 6 mo duration,
    - 3. 60% chance will respond to intralesional steroid injection
  - v. RTC 2 weeks; if persists, can re-inject once more
  - vi. White skin color from sub-Q steroid bolus
  - vii. Antibiotic ointment TID x 3 days
- f. Excision and Curretage
  - i. Two lidocaine applications required:
    - 1. Ring block between chalazion and nerve source
    - 2. Deep peribulbar injection *or* 4% lidocaine-soaked conj application
  - ii. Test with needle tip to ensure anesthesia
  - iii. Proparacaine instillation before clamp applied
  - iv. 3-4mm lineate incision parallel with lid margin
  - v. Cotton applicator pressure, curette, and irrigate contents
  - vi. Antibiotic ointment TID x 3 days

#### IX. Alternatives to Suturing

- a. Steristrip (3M)
  - i. Thin adhesive strips
  - ii. Threads within the strips
  - iii. Can close small wounds
  - iv. Generically known as butterfly stitches
  - v. Used instead of sutures in some cases due to less scars and easier to care for
- b. Dermabond (Ethicon)
  - i. Cyanoacrylate adhesive
  - ii. Some antimicrobial properties
  - iii. Suture replacement for 5-0 or smaller sutures
  - iv. Should not be used on: Animal bites, contaminated wounds, ulcers, puncture wounds, mucous membranes/mucocutaneous junctions, high moisture areas
  - v. Do not apply topical antibiotics/water – breaks down adhesive
  - vi. Adhesive will spontaneously peel off in 5-10 days

#### X. Summary





More information for these conferences can be found at: [www.pacificu.edu](http://www.pacificu.edu) (search for Optometry Continuing Education)

**Residents Conference**, up to 10 hours of education presented by the 2014/15 residents

**June 12 & 13, 2015**

Pacific University, Jefferson Hall

Registration: \$100

**2015 Victoria Conference**, featuring: Curtis Baxstrom, Tad Buckingham, Terry Burris and Danica Marrelli

20 hours of optometric continuing education, 4 hours of Paraoptometric education

**July 16 – 19, 2015**

Inn at Laurel Point

Victoria, British Columbia

Registration: \$450

**GWCO “CE on the BUS”** – a game show format to test your management of various clinical cases.

This event includes a tour of the College of Optometry. 2 hours of continuing education is offered.

**Saturday, September 4, 2015**

Registration: COMPLIMENTARY with your GWCO registration.

**Tulalip CE** – Enjoy a weekend getaway and explore the outdoor activities, cultural events and premium shopping.

6 hours of continuing education

**Sunday, September 20, 2015**

Tulalip Resort Casino, Washington

Registration: \$250

**Glaucoma Symposium** – Howard Barnebey and Murray Fingeret

**Saturday, January 9, 2016**

Willows Lodge, Woodinville, Washington

Information: Marti Fredericks [frederim@pacificu.edu](mailto:frederim@pacificu.edu)

**2016 Island Eyes Conference**

Up to 29 hours of optometric continuing education and 9 hours of Paraoptometric education

**January 17 – 24, 2016**

Sheraton Maui Resort

Registration: \$700

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