My Greatest Spikes: Challenging Glaucoma Cases

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Disclosures

- The content of this presentation was prepared independently by Michael Cooper, OD without input from members of the ophthalmic community.
- Dr. Cooper is affiliated with Allergan, Alcon Surgical, Glaukos, BioTissue, Shire, JJVC, Bausch + Lomb/Valeant, Mentholatum, and TearLab as a consultant/speaker.
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The Cases

All real patients that we all see everyday…

No tricks, but plenty of pearls to share!

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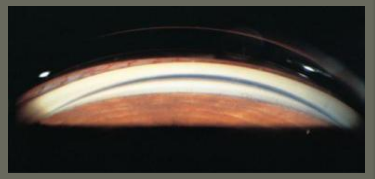
Who is a Glaucoma Suspect?

- Elevated or Asymmetric IOP/ OHTN
- Suspicious disc appearance
- Thin rim tissue
- Disc asymmetry
- Suspicious RNFL
- Disc hemorrhage
- Suspicious visual field loss



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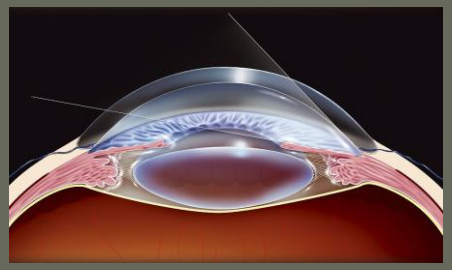
Other Risk Factors

- Family Hx
- Trauma
- Age
- Race
- Phakic Hyperopia



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Steph Curry or Michael Jordan…

Glaucoma in reality is not that well understood!

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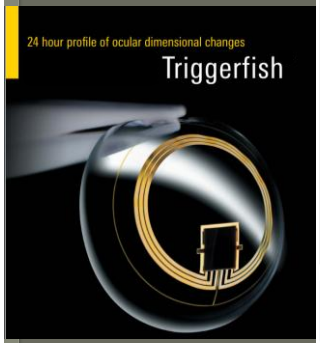

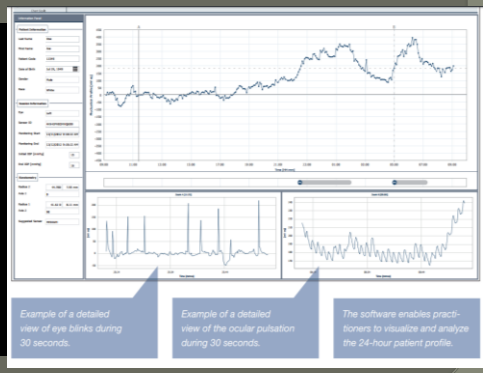

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How Many Lives are Impacted?

- By 2020, over 3 million

NORMAL VISION

WITHGLAUCOMA

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GLAUCOMA

What is it?

A disease of progressive optic neuropathy with loss of retinal neurons and their axons (nerve fiber layer) resulting in blindness if left untreated.

GLAUCOMA

"Glaucoma describes a group of diseases that kill retinal ganglion cells."

"High IOP is the strongest known risk factor for glaucoma but it is neither necessary nor sufficient to induce the neuropathy."

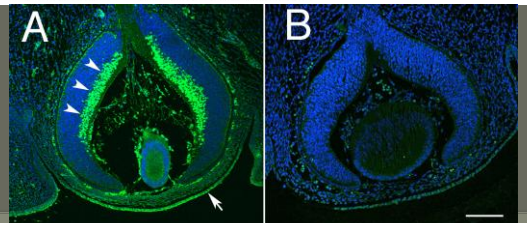
Libby, RT, et al: Annu Rev Genomics Hum Genet 6: 15, 2005

Hot Off the Press– Corneal Thickness Still Matters!

Genomic locus modulating corneal thickness in the mouse identifies *POU6F2* as a potential risk of developing glaucoma

Rebecca King, Felix L. Struebing, Ying Li, Jiaxing Wang, Allison Ashley Koch, Jessica N. Cooke Bailey, Puya Gharahkhani, International Glaucoma Genetics Consortium, NEIGHBORHOOD Consortium, Stuart MacGregor, R. Rand Allingham, Michael A. Hauser, Janey L. Wiggs, Eldon E. Geisert

Published: January 25, 2018 • https://doi.org/10.1371/journal.pgen.1007145



Add POU6F2 to the growing list of genes:
MYOC, *OPTN*, *TBK1*, *CDKN2BAS*

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Table 1. Major Glaucoma Clinical Studies and Select Results

STUDY	SIGNIFICANT RESULTS
Ocular Hypertensive Treatment Study[1]	• Quantification of risk of conversion from ocular hypertension to glaucoma over a five-year period. • Importance of central corneal thickness, IOP and vertical cup-to-disc ratio in assessing risk of conversion from ocular hypertension to POAG.
Early Manifest Glaucoma Trial[2]	• Lowering IOP reduces risk of glaucoma progression. • Visual field more sensitive than evaluation of disc changes in identifying progression.
Advanced Glaucoma Intervention Study[3]	• A treated IOP of less than 18mm Hg, at all visits, significantly reduces the statistical risk of progression.
Diurnal Fluctuations in IOP[4]	• Large diurnal fluctuations in IOP are an independent risk factor in POAG.
Collaborative Normal Tension Glaucoma Study[5]	• Initial IOP must be lowered significantly (30%) to reduce risk of progression in normal tension glaucoma.
Los Angeles Latino Eye Study[6]	• Large vertical cup-to-disc ratio greater than 0.6 is strongly associated with risk of POAG in this ethnic group.

1. Kass M, Heuer D, Higginbotham E, et al. The ocular hypertensive treatment study: a randomized trial determines that topical ocular hypotensive medication delays or prevents the onset of primary open angle glaucoma. Arch. Ophthalmol. 2002 Jun;120 (6):701-13.
2. Heijl A, Leske C, Bengtsson B, et al. Reduction of intraocular pressure and glaucoma progression. Arch Ophthalmol. 2002;120(10):1268-79.
3. VanVeldhuisen PC, Ederer F, Gaasterland DE, et al. The advanced glaucoma intervention study (AGIS): The relationship between control of intraocular pressure and visual field deterioration. Am J Ophthalmol. 2000 Oct;130(4):429-40.
4. Asrani S, Zeimer R, Wilensky J, et al. Large diurnal fluctuations in intraocular pressure are an independent risk factor in patients with glaucoma. J. Glaucoma. 2000 April;9(2):134-42.
5. Anderson DR. Collaborative normal tension glaucoma study. Curr Opin Ophthalmol. 2003, April;14(2):86-90.
6. Kim E, Varma R. Glaucoma in Latinos/Hispanics. Curr Opin Ophthalmol. 2010 Mar;21(2):100-5.

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Case #1

- 21 year old Caucasian male presents for a "routine eye exam"
- IOP: OD= 21, OS=37
- Tech pulls me into the room to figure out what is going on…
- VAcc: OD= 20/20, OS=20/25
- Pupils/EOM/CVF= Normal

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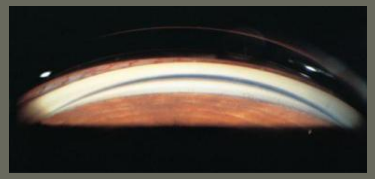
Case #1

- What do you ask next?
- What do you perform next prior to dilation?



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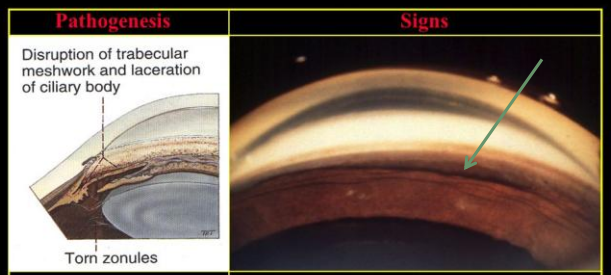
Post-traumatic angle recession glaucoma



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Findings and Tx

- C/D= .35/.35 OD; .45/.45 OS (no violation of ISNT)
- Nerve appeared "thick" and OCT/VF WNL OU
- Gonioscopy revealed 4+ 360, but chocolate appearance at base of angle

- Start Lumigan 0.01% qhs OU
- Saw 2-3 wk later for IOP check: 19 OD, 21 OS

- 3 years later… IOP started to creep up back into high 20's. Started Alphagan P bid OU.
- Saw 2-3 wk later, IOP was 16 OD, 19 OS
- Made aware of surgical intervention likely in future (ie. SLT vs ALT, MIGS + Meds)

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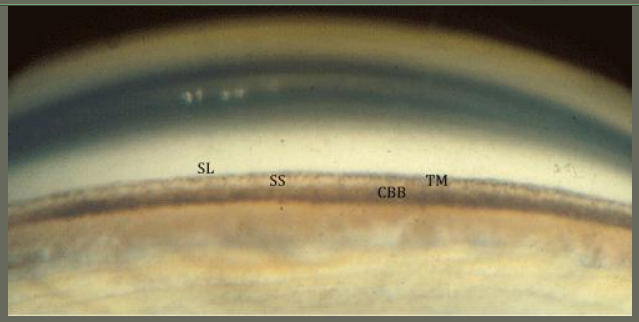
The Power of Gonioscopy



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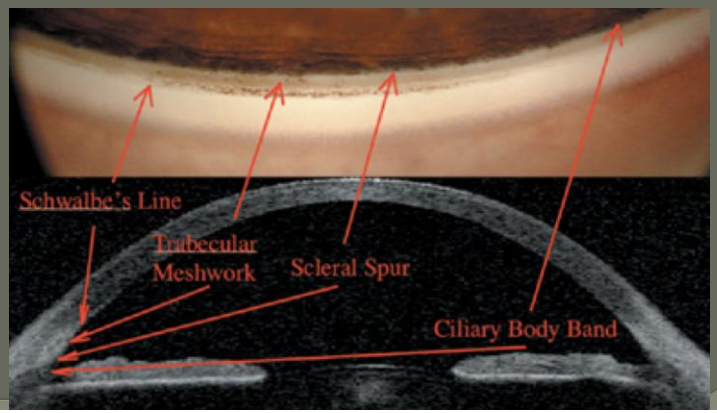

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AAO Glaucoma Severity Staging Descriptions

- Mild Stage: optic nerve changes consistent with glaucoma but NO visual field abnormalities on any visual field test OR abnormalities present only on short-wavelength automated perimetry or frequency doubling perimetry.
- Moderate Stage: optic nerve changes consistent with glaucoma AND glaucomatous visual field abnormalities in one hemifield and not within 5 degrees of fixation.
- Severe Stage: optic nerve changes consistent with glaucoma AND glaucomatous visual field abnormalities in both hemifields and/or loss within 5 degrees of fixation in at least one hemifield.

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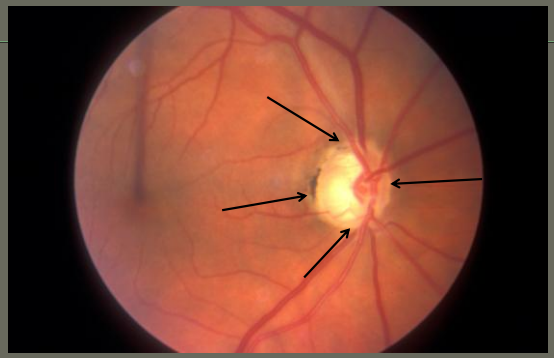

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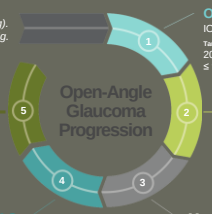
Current OAG Treatment Algorithm

IOP is measured in millimeters of mercury (mm Hg).
Normal IOP in healthy eyes ranges from 10-21 mm Hg.



Ocular Hypertension
IOP of 21-30 mm Hg
Target IOP: 20% ↓ from baseline; ≤ 18 mm Hg
Treatment: 0-1 med

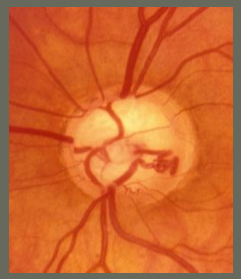
Mild OAG
IOP of 25-30 mm Hg with minor optic nerve damage and visual field loss
Target IOP: 25% ↓ from baseline; ≤ 18 mm Hg
Treatment: ~ 1 med, laser, MIGS

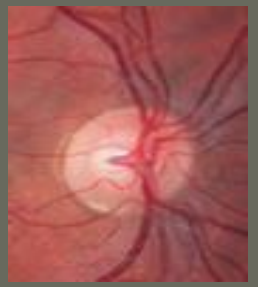
Moderate OAG
IOP of > 30 mm Hg with moderate optic nerve damage and visual field loss
Target IOP: 30% ↓ from baseline; ≤ 15 mm Hg
Treatment: ~ 2 meds, laser, MIGS

Advanced OAG
Uncontrolled IOP with significant optic nerve damage and visual field loss
Target IOP: 35% ↓ from baseline; < 15 mm Hg
Treatment: ~ 3 meds, filtering surgery, tube shunt

Refractory OAG
Uncontrolled IOP with severe optic nerve damage and visual field loss
Target IOP: 35% ↓ from baseline; < 15 mm Hg (ideally ~ 12 mm Hg)
Treatment: 3+ meds, filtering surgery, tube shunt

A Closer Look





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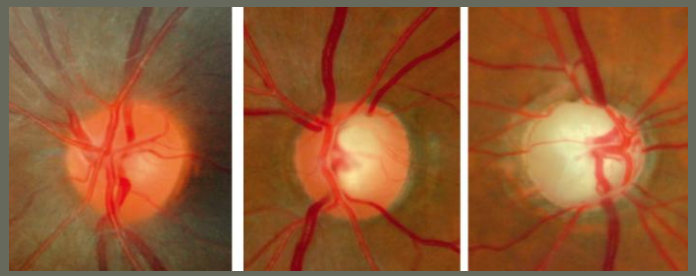
Ticking Time Bombs



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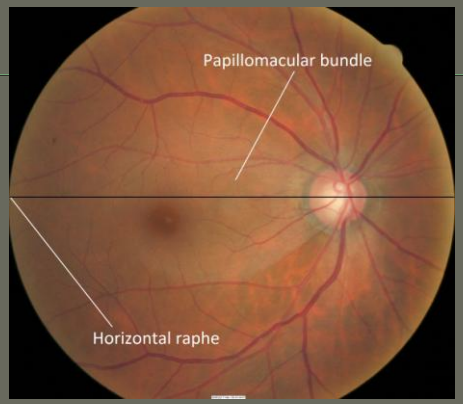
Papillomacular bundle



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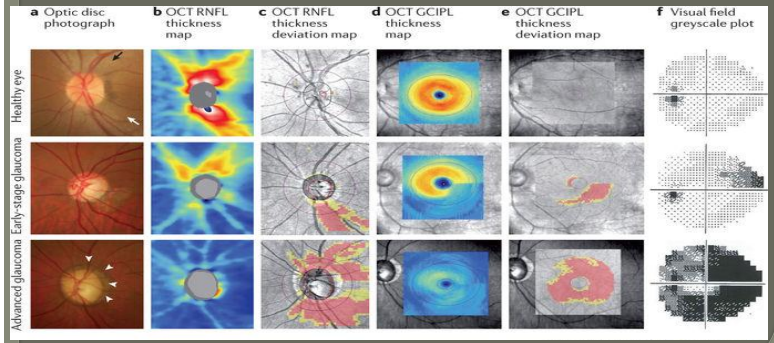
Mirror, Mirror



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What is IOP?

- IOP is typically considered to be the pressure inside the eye.
- Applanation tonometry applies a force outside the eye that equals the force inside the eye (across the cornea) according to the Imbert-Fick principle.

This is a misnomer-- We need to rethink the formula!

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- "This measurement (IOP) is unrelated to the absolute pressure in the eye, because absolute pressure varies significantly with the barometric pressure that is experienced simultaneously by all tissues of the body".
- Maybe a better term is "Transcorneal Pressure Difference".

Berdahl J, Glaucoma Today, Oct 2009

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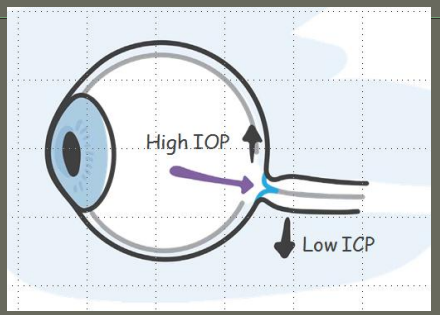

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Translaminar Pressure Difference

- IOP may be important as a surrogate for the pressure difference across the optic nerve head (IOP - ICP)

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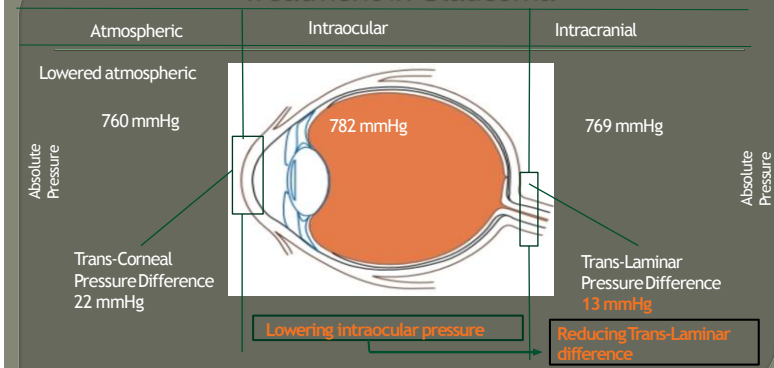
Treatment in Glaucoma



The Relationships

- Normal: Balance between IOP and ICP
- Glaucoma: IOP (TCD) that is higher than the ICP
- Swollen Nerve: ICP that is higher than the IOP ie Pseudotumor cerebri, Optic Neuritis, or ocular hypotony (note the swollen CSF space)

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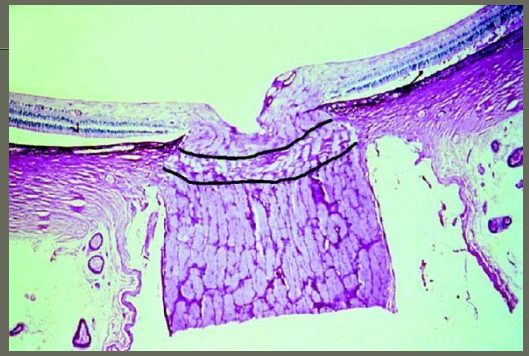

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Corneal Hysteresis (CH)

- An inherent biomechanical property of the cornea which measures the cornea's ability to dampen a force when applied
- Might be a better determinant of how pressure fluctuations impact the tension across the lamina cribosa

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Corneal Hysteresis and Glaucoma

- Glaucoma subjects have lower corneal hysteresis than normal
- CH has been identified as risk factor in progression analysis
- Normal CH=10.5 or higher
- Low CH can lead to potential glaucomatous damage

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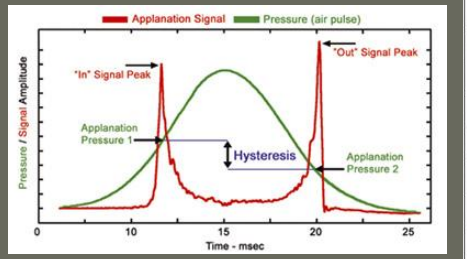
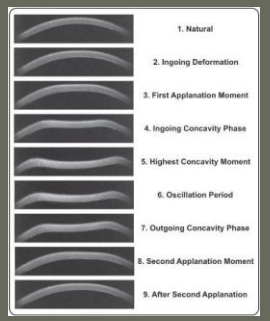
ORA Plots





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My Experience with ORA G3

- When initiating Glaucoma treatment, I have found CH to consistently rise thereafter
- Prior to the device, I had patients who I thought were "well controlled", only to find the CH was lower than expected.

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Target Pressure

- Based on clinical determination of risk when taking all information into account:
  - IOP
  - OCT
  - VF
  - Gonioscopy
  - ONH Photos
  - ORA
  - ERG
  - TCD

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Managing Glaucoma Patients

- Monitor IOP reduction: 1-2 week, 1 month
- Check IOP every 3-4 months
- Repeat VF every 6-12 months
- Disc photos every 1-2 years
- Gonioscopy every year
- Optic nerve analysis every 6-12 months
- Document everything

http://www.aoa.org/optometrists/tools-and-resources/clinical-care-publications/clinical-practice-guidelines

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Pitfalls: Red vs. Green Disease

- Be careful what you wish for with testing (over testing)
- Red= when a normal patient's measurements fall outside normal limits (i.e. too much red on the printout)
- Green= when a patient with true disease has measurements fall within the normative data base (i.e. everything is green)

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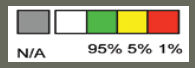
OCT Normative Data: Glaucoma

- Average RNFL Thickness
- RNFL Symmetry
- Rim Area
- Disc Area
- Average C/D Ratio
- Vertical C/D Ratio
- Cup Volume

	OD	OS
Average RNFL Thickness	100 µm	101 µm
RNFL Symmetry	90%	
Rim Area	1.60 mm²	1.72 mm²
Disc Area	3.18 mm²	3.45 mm²
Average C/D Ratio	0.69	0.70
Vertical C/D Ratio	0.66	0.69
Cup Volume	0.567 mm³	0.711 mm³

- Distribution of Normals:
  - Color coded indication of normative data comparison for RNFL and ONH.
- The thickest 5% fall in the white area.
- 90% of measurements fall in the green area.
- The thinnest 5% fall in the yellow area or below.
- The thinnest 1% of fall in the red area.
- *Measurements in red are considered outside normal limits.*
- ONH values will be shown in gray when the disc area does not match with normative data.



Ganglion Cell Analysis

The analysis contains:

- Data for both eyes (OU)
- Thickness Map –
  - shows thickness measurements of the GCL + IPL in the 6mm by 6mm cube and contains an elliptical annulus centered about the fovea.
- Deviation Maps –
  - shows a comparison of GCL + IPL
  - thickness to normative data.
- Thickness table –
  - shows average and minimum thickness within the elliptical annulus.

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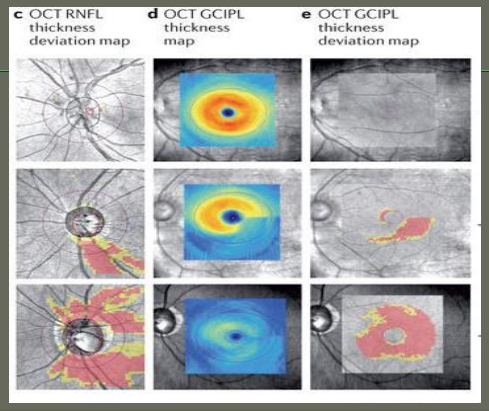

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Ganglion Cell Take Aways

- Is a "complement" to traditional RNFL scans
- Has a large number of false positives.
- Should NOT be used as the sole basis of a diagnosis for glaucoma.

VF Basics for Analysis

- Don't get bogged down with every detail
- Start at the top:
  - Test Parameters- I prefer SITA Standard (Swedish Interactive Threshold Algorithm)
  - Reliability Indices-
    - High Fixation Losses= inaccurate test
    - High False Positive= trigger happy
    - High False Negative= poor attention span, can't see light

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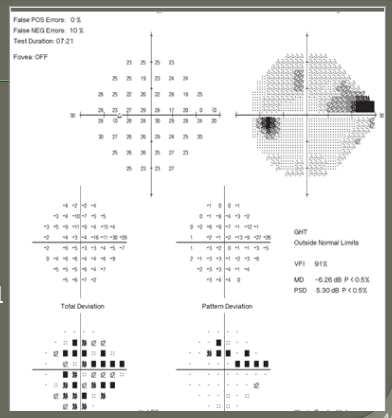
- The Middle
  - Don't be fooled by just looking at Gray Scale
  - Total to Pattern Deviation- Sifting for Gold



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The Final Stops

- Mean Deviation (MD)= Norm is 0 to -2 db
  - Avg Difference from Norm for Hill of Vision (height)
  - Tracks localized visual field loss and progression in later stages
- Pattern Standard Deviation
  - Standard Dev from Tested Spots from Norm giving shape of Hill
  - Tracks localized focal visual field defects and progression in earlier stages

GHT
Outside Normal Limits

VFI 91%

MD -6.26 dB P < 0.5%
PSD 5.30 dB P < 0.5%

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More VF Details

- Glaucoma hemifield test (GHT)= Compares points in the upper hemifield to corresponding points on the lower hemifield with the assumption that sensitivity should be similar in both fields.
- Visual field index (VFI)= Global index gives you percentage of useful vision remaining
  - Central parts of the visual field are weighted more
  - Trend based analysis: Age + "velocity" of progression

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Case #2

- 74 year old French Canadian male presents as referral from one of our local OD colleagues due to elevated IOP (36 mmHg)
  - What's the work up?
  - What options are available
  - How do you follow?
    - Letters
    - Patient choice for flow of care
- Our colleague gave the patient a sample of Simbrinza with a dosage of tid OU

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Findings and Tx

- VAsc: 20/30 OD; 20/25 OS
- Goldmann IOP was 13 OD and 12 OS
- CH was 10.2 OD and 10.1 OS
- C/D measurement was .65/.7 OD; .7/.75 OS
- OCT RNFL thickness: 82 OD; 81 OS
- OCT to Ganglion Deviation Map: Subtle correlation and inf defects present OU
- VF showed nasal step OD>OS, sup arcuate OS
- Gonioscopy: 4+ 360, flat iris approach, no PAS

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Progression?

- Nope
- Been watching for the past 4 years without any changes to measurements or medication protocol
- He's somewhat of an exception…

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Therapeutic Medication Choices

- Prostaglandins
- Prostaglandin Analogues
- Alpha Agonists
- Beta Blockers
- CAI
  - Topical
  - Oral
- Combination Agents

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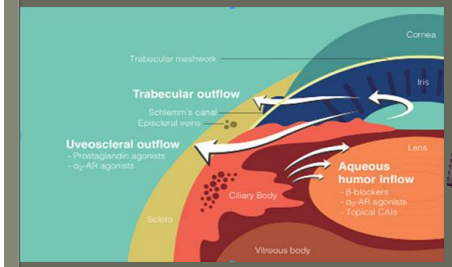
In and Out



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DRUGS THAT DECREASE AQUEOUS PRODUCTION

Beta-Blockers [levobunolol, timolol, carteolol, betaxolol]

- Mechanism: Act on ciliary body to ↓ production of aqueous humor
- Administration: Topical drops to avoid systemic effects
- Side Effects: Cardiovascular (bradycardia, asystole, syncope), bronchoconstriction (avoid with β1-selective betaxolol), depression, increased keratopathy, decreased aqueous tear production, sleep disorder, decreased libido

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Alphas and Betas

- Remember that there are four main types of adrenergic receptors:
  - alpha-1 (arterioles, pupil dilator, and Muller's muscle)
  - alpha-2 (ciliary epithelium)
  - beta-1 (myocardium)
  - beta-2 (bronchi and ciliary epithelium)

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- *Timolol (Timoptic®, Timoptic® in Ocudose, Timoptic-XE®, Betimol®, Istalol®):* Timolol is a noncardioselective beta-blocker.
  - Timolol (0.5% and 0.25%)is usually dosed BID as it has been shown that the IOP-lowering effect lasts for at least 12 hours once instilled.
  - Timolol also works well as a once-daily therapy, and the IOP reduction ranges from about 17-28% with a single drop.

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DRUGS THAT DECREASE AQUEOUS PRODUCTION

Alpha-2 Adrenergic Agonists [apraclonidine, brimonidine]

- Mechanism: ↓ production of aqueous humor and enhancing aqueous outflow through the uveoscleral route
- Administration: Topical drops
- Side Effects: Lethargy, fatigue, dry mouth [apraclonidine is a derivative of clonidine (antihypertensive) which cannot cross BBB to cause systemic hypotension], contraindicated with MAOI, hyperemia, **conjunctival vessel blanching**

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Bausch + Lomb Receives FDA Approval of LUMIFY™ - The Only Over-The-Counter Eye Drop With Low-Dose Brimonidine For The Treatment Of Eye Redness

NEWS PROVIDED BY
Valeant Pharmaceuticals International, Inc. →, Bausch + Lomb →
Dec 22, 2017, 15:02 ET

SHARE THIS ARTICLE

Clinical Studies Showed 95% Symptom Improvement At One Minute, And Reduced Redness For Up To Eight Hours

LAVAL, Quebec, Dec. 22, 2017 /PRNewswire/ -- Bausch + Lomb, a leading global eye health company and wholly owned subsidiary of Valeant Pharmaceuticals International, Inc. (NYSE: VRX and TSX: VRX) ("Valeant"), today announced that the U.S. Food and Drug Administration (FDA) has approved LUMIFY™ (brimonidine tartrate ophthalmic solution 0.025%) as the first and only over-the-counter (OTC) eye drop developed with low-dose brimonidine tartrate for the treatment of ocular redness. Brimonidine, which was first approved by the FDA in 1996 for intraocular pressure (IOP) reduction in glaucoma patients, is available at higher doses in prescription eye care products.

Commercially available now

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- *Alphagan® (Brimonidine):* Is a potent and highly selective alpha-2 adrenoreceptor agonist (about 30x more selective than apraclonidine).
  - There is also evidence that shows that Alphagan® may provide neuroprotective properties that could potentially spare retinal ganglion cells and the optic nerve from further degeneration (this is controversial).
  - Dosing is TID, but when used in combination, community start of care would be BID

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DRUGS THAT DECREASE AQUEOUS PRODUCTION

Carbonic Anhydrase Inhibitors [acetazolamide, dorzolamide]

- Mechanism: Blocks CAII enzyme production of bicarbonate ions (transported to posterior chamber, carrying osmotic water flow), thus ↓ production of aqueous humor
- Administration: Oral, topical
- Side Effects: malaise, kidney stones, possible (rare) aplastic anemia, be wary of Sulfa allergy cross-reactivity, superficial keratopathy, 25% had bitter taste (dysgeusia)

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- *Trusopt® (dorzolamide):* Trusopt® is typically used TID as monotherapy, or BID as an adjunctive treatment.
  - It's IOP-lowering effect has been shown to be similar to betaxolol but inferior to timolol (average decrease in IOP is approximately 23-24%, with peak effect occurring 2 hours after administration).
  - Trusopt® should be used with caution in patients exhibiting corneal endothelial dysfunction, as some studies have shown that it may cause further decompensation.
- *Azopt® (brinzolamide):* The IOP-lowering effect of Azopt® has been proven to be equivalent whether dosed at BID or TID. Its hypotensive effect is similar to that of Trusopt®

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DRUGS THAT INCREASE AQUEOUS OUTFLOW

Prostaglandins [latanoprost]

- Mechanism: May ↑ uveoscleral outflow by relaxing ciliary body muscle
- Administration: Topical drops
- Side Effects: Iris color change, Orbital fat loss, Pro-inflammatory, Hyperpigmentation of periorbital skin tissue, conjunctival hyperemia, hypertrichosis, rare increase risk of HSV/skin rash/URI

- Xalatan® (latanoprost) and Travatan® (travoprost) both increase aqueous humor outflow exclusively through the uveoscleral route
- Lumigan® (bimatoprost) promotes outflow of aqueous through both the uveoscleral and trabecular meshwork routes

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DRUGS THAT INCREASE AQUEOUS OUTFLOW

Parasympathomimetics [pilocarpine, carbachol, echothiophate]

- Mechanism: ↑ contractile force of ciliary body muscle, ↑ outflow via TM
- Administration: Topical drops or gel, (slow-release plastic insert)
- Side Effects: Headache, induced myopia. Few systemic SE for direct-acting agonists vs. AchE inhibitors (diarrhea, cramps, prolonged paralysis in setting of succinylcholine), ?VMT or RD, pupillary block, accommodative spasm

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Combination Drugs

- *Cosopt®:* Timolol and dorzolamide (beta-blocker and carbonic anhydrase inhibitor).
  - Dosing is typically BID
- *Combigan®:* Timolol and brimonidine (beta-blocker and alpha-2 agonist).
  - Dosing is usually BID
- *Simbrinza®:* Combination of brinzolamide and brimonidine (carbonic anhydrase inhibitor and alpha-2 agonist).
  - Dosing is usually TID.
  - Simbrinza® does not contain a beta-blocker (useful in patients in which beta-blockers are contraindicated).

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Vyzulta (Latanoprostene Bunod)

- Dual mechanism of action
  1. Similar to prostaglandins, which is increasing the uveoscleral outflow pathways
  2. The effect of nitric oxide.
     - In addition to relaxing tissue within the trabecular meshwork, the nitric oxide mechanism has an effect on Schlemm's canal that enables it to regulate the volume within the canal.
     - By increasing nitric oxide, it has an effect that can increase how much aqueous humor goes out of the outflow channels.

65

Vyzulta (Latanoprostene Bunod)

- 7 to 9 mmHg decrease from baseline Tmax
- Lowers IOP approximately 1.2 mmHg better than Xalatan
- Does still contain hyperemic tendency
- New agent could be particularly appealing for a younger glaucoma patient in whom practitioners would like to keep fluid going through the pathway with the nitric oxide mechanism

(latanoprostene bunod ophthalmic solution), 0.024%

66

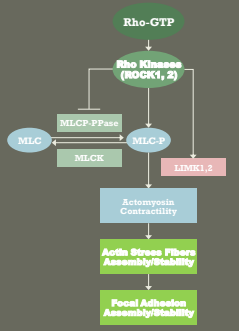
Vyzulta™ (latanoprost bunod)

- In a Phase 2b dose ranging study, LBN demonstrated greater IOP reduction compared with Xalatan (latanoprost ophthalmic solution 0.005%), with the differences reaching more than 1 mm Hg ($p<0.01$) for LBN.
- In addition, 68.7% of subjects treated with LBN ,compared to 47.5% of subjects treated with Xalatan (latanoprost ophthalmic solution 0.005%) achieved a mean diurnal IOP ≤18 mm Hg at the primary efficacy time point ($p<0.05$)
- In two Phase III studies, LBN provided a mean IOP reduction of 7.5-9.1 mm Hg over three months of treatment(statistically superior to timolol between 2 and 12 weeks)
- LBN was safe and well tolerated with no significant adverse events. Rates for hyperemia were comparable to latanoprost

Rho Kinase Inhibition

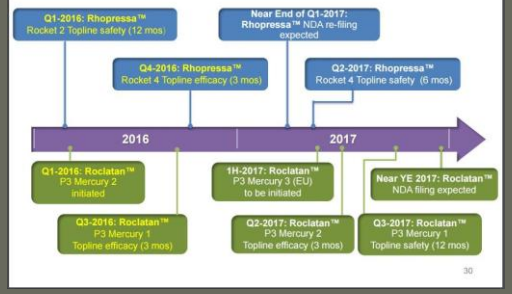
New Development in IOP Reduction

- Rho activation increases contractility of TM cells
  - Induces myosin light chain phosphorylation
  - Results in formation of actin stress fibers and focal adhesions – increased contractility
  - Reduces outflow of aqueous humor
- Rho kinase inhibition relaxes TM cells
  - Reduces actin stress fibers/focal adhesions
  - Increases outflow of aqueous humor
- Rho kinase inhibition may also:
  - Increase ocular blood flow
  - Increase retinal ganglion cell survival



Uehata M, et al. *Nature* 1997;389:990-994
Hirata A, et al. *Graefes Arch Clin Exp Ophthalmol*. 2008;246(1):51-59
Wang SK, Chang RT. *Clin Ophthalmol* 2014;8:883-890

Rhopressa™ and Roclatan™ Key Milestones



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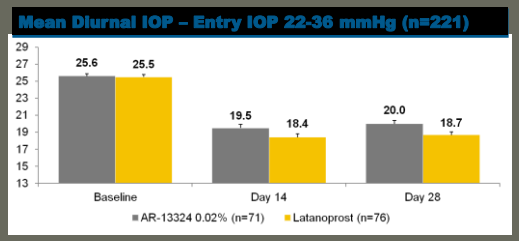
Rhopressa (Netarsudil 0.02% ROCK-NET Inhibitor) Triple-Action

3 Identified IOP-Lowering Mechanisms

- ROCK inhibition relaxes TM[1], increases outflow[1,2]
- NET inhibition reduces fluid production[2]
- ROCK inhibition lowers Episcleral Venous Pressure (EVP)[3]

1. Wang SK, Chang RT. An emerging treatment option for glaucoma: Rho kinase inhibitors. *Clin Ophthal* 2014;8:883-890.
2. Wang RF, Williamson JE, Kopczynski C, Serle JB. Effect of 0.04% AR-13324, a ROCK, and norepinephrine transporter inhibitor, on aqueous humor dynamics in normotensive monkey eyes. *J Glaucoma* 2015. 24(1):51-4.
3. Kiel JW, Kopczynski C. Effect of AR-13324 on episcleral venous pressure (EVP) in Dutch Belted rabbits. *ARVO* 2014. Abstract 2900

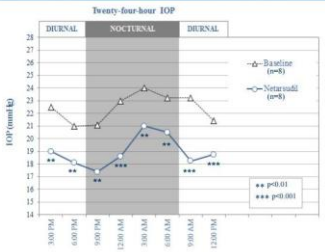
AR-13324 (ROCK-NET Inhibitor): Phase 2b IOP Lowering Results



- Once-daily PM dosing of 0.02% AR-13324 is effective
  - IOP -5.7 and -6.2 mmHg on D28 and D14
- AR-13324 efficacy results within ~1 mmHg of latanoprost
- Favorable tolerability profile with no systemic side effects

Source: Double-masked, Randomized, Dose Response Study of AR-13324 versus Latanoprost in Patients with Elevated Intraocular Pressure. Bacharach et. al. *Ophthalmology*, Volume 122, Issue 2, February 2015, Pages 302–307

Rhopressa™ 24-hour IOP Pilot Study Demonstrates Effective Nocturnal Efficacy



- Netarsudil (active ingredient of Rhopressa™) equally effective during nocturnal and diurnal periods
- Current glaucoma medications either have no efficacy at night (beta blockers, alpha agonists) or reduced efficacy at night (PGAs, CAIs)[1-6]

Data on File: AR-13324-CS204
1. Liu JH, et al. Am J Ophthalmol. 2004; 138:389-395. 2. Gulati V, et al. Arch Ophthalmol. 2012; 130:677-684. 3. Liu JH, et al. Ophthalmology. 2009; 116:449-454. 4. Liu JH, et al. Ophthalmology. 2010; 117:2075-9. 5. Fan S et al. J Glaucoma. 2014; 23:276-81. 6. Liu JH, et al. Am J Ophthalmol. 2016;169:249-257.

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Quadruple-Action PG324 (ROCK-NET Inhibitor/latanoprost)- Rocklatan

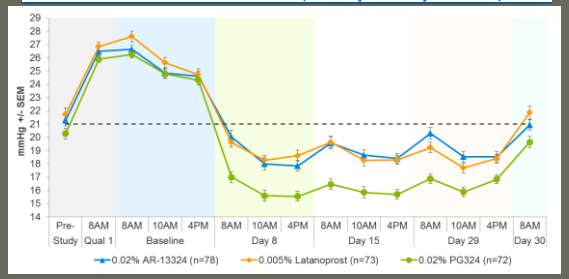
4 Identified IOP-Lowering Mechanisms

- ROCK inhibition relaxes TM[1], increases outflow[1,2]
- NET inhibition reduces fluid production[2]
- ROCK inhibition lowers EVP[3]
- PGA receptor activation increases uveoscleral outflow[4]

1. Wang SK, Chang RT. An emerging treatment option for glaucoma: Rho kinase inhibitors. Clin Ophthal 2014;8:883-890.
2. Wang RF, Williamson JE, Kopczynski C, Serle JB. Effect of 0.04% AR-13324, a ROCK, and norepinephrine transporter inhibitor, on aqueous humor dynamics in normotensive monkey eyes. J Glaucoma 2015; 24(1):51-4.
3. Kiel JW, Kopczynski C. Effect of AR-13324 on episcleral venous pressure (EVP) in Dutch Belted rabbits. ARVO 2014. Abstract 2900
4. Latanoprost prescribing information

PG324 Achieved Statistical Superiority Over Individual Components at All Time Points (p<0.001)

Mean IOP at Each Time Point (Primary Efficacy Measure)



PG324 Phase 2b, Intent to Treat
Source: Bacharach J, Levy B, Ramirez N, Kopczynski CC, Novack GD for the PG324-CS201 Study Group. Evaluation of PG-324, a fixed dose combination of AR-13324 and latanoprost, in patients with elevated intraocular pressure in a double-masked, randomized, controlled study. American Glaucoma Society 2015 (in press).

Rocklatan (NOW Available)

- Rocklatan is a fixed combination agent composed of Rhopressa and latanoprost 0.005%.
- Achieving statistical superiority relative to both latanoprost and Rhopressa, providing additional IOP lowering of 1.9 and 2.6 mm Hg, respectively

Roclatan™ Phase 3 Safety Profile

Adverse Events (≥5.0% in any group)	Roclatan™ n=238	Rhopressa™ n=244	Latanoprost n=236
Eye Disorders			
Conjunctival Hyperemia	126 (52.9%)	99 (40.6%)	33 (14.0%)
Conjunctival Hemorrhage	25 (10.5%)	34 (13.9%)	1 (0.4%)
Eye Pruritus	18 (7.6%)	17 (7.0%)	3 (1.3%)
Lacrimation Increased	14 (5.9%)	15 (6.1%)	1 (0.4%)
Cornea Verticillata	12 (5.0%)	9 (3.7%)	0 (0.0%)
Administration Site Conditions			
Instillation site pain	45 (18.9%)	51 (20.9%)	15 (6.4%)

Patients with known contraindications or hypersensitivity to latanoprost were excluded

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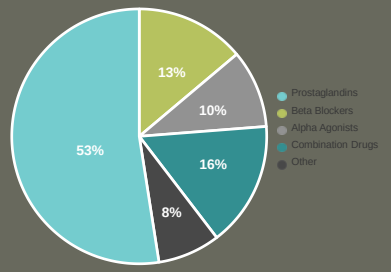
Economic Reality

- 17M Prostaglandin Rx's written annually
- ~70% latanoprost molecule
- Total Glaucoma Market ~$3B
- Prostaglandin Market valued at $1.6B



Market Scope – Glaucoma Medication Prescription Shares in US per IMS Data

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TODAY'S PRACTICE

THE INS AND OUTS OF PRIOR AUTHORIZATIONS

Using these five tips may make navigating the world of prior authorizations less of a headache.

BY MICHAEL S. COOPER, OD

TIP No. 1: EMPOWER STAFF

TIP No. 2: UTILIZE PA SOFTWARE

CoverMyMeds offers several advantages, including the ability to provide the exact forms required by the insurer to get the job completed in a timely fashion. I have heard from many colleagues that they depend on this site, as they have found a heightened success rate as a result of this customization. They provide services to an estimated 700,000 prescribers, and they deal with payers that represent 80% of US prescription volume and 90% of the pharmacy market. In fact, many local pharmacies now send us fax requests with pre-filled demographic data to make submissions even easier for us.

PA submission for PANs Solutions uses a "common" or streamlined form system that captures data for many ophthalmic and nonophthalmic formulations. The process is logical and intuitive, and they provide excellent customer support. Another nice feature is that you can save the demographics for future reference. One distinct difference from CoverMyMeds is the generic form used by PANs for insurance submission. Depending on geographic region, there can be hiccups that delay approval, but I have not encountered this on a consistent basis.

TO THE POINT

Empowering staff, understanding technological changes, and leveraging opportunities presented by industry can ease the burden prior authorizations place on a practice.

"I constantly try to talk to sales representatives about these issues to stay on top of the situation and attempt to avoid being blindsided by changes in coverage gaps, donut holes, and deductibles."

TIP No. 3: MASTER THE ONLINE GAME

TIP No. 4: DON'T FORGET THE CARDS

CONCLUSION

Case #3

51 year old Caucasian female presents as a referral from one of our local OD colleagues for narrow angle evaluation. She reports redness and mild discomfort over brow OU.

- What's the work up?
- What options are available (Meds?, Laser?, Laser + Meds?)
- How do you follow?
  - Letters
  - Patient choice for flow of care

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Findings

- VAcc: 20/40 OD, 20/30 OS
- Pupils WNL, no APD
- IOP: 28 OD, 29 OS

- 2+ conjunctival injection
- No corneal edema

- Gonio: 0-1+ S/T/N OU, 1+ inf OU, no PAS, steep iris approach
- Gonio confirmed by Anterior OCT

- C/D: .6/.75 with thinning inferotemp OD
  .7/.75 with thinning IT and sup

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Images

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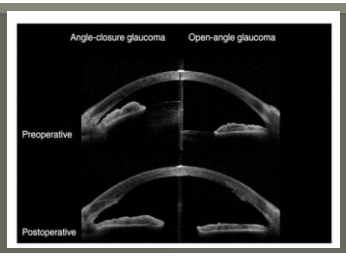

Anterior segment OCT is very useful for patient education. Showing patients examples like the ones above makes the anatomical difference between an open (A) and closed (B) angle immediately apparent.

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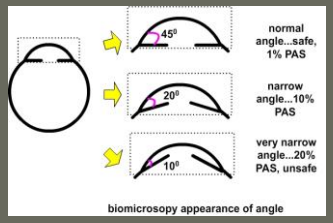
How to Judge the View



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TREATMENT RATIONALE FOR ACUTE CASES:

PULLING THE TRIGGER

LOWER IOP BY:

(1) Decreasing Production of Aqueous Humor

(2) Increasing Outflow of Aqueous Humor

Angle Closure Kit in our Closet:

Apraclonidine + Acetazolamide 500 mg

Suggested Angle Closure Protocol

Stage 1.
Immediate
1. 500 mg acetazolamide slowly via indwelling intravenous cannula (Check sulfonamide allergy) or #2
2. 500 mg acetazolamide (not SR) stat by mouth if not vomiting (maximum effect at 2 h)
3. Carteolol 1% bid if no contraindication (or Timolol)
4. Pred Acetate 1% qid
5. Analgesics and anti-emetics as indicated
6. Patient to lie supine for 1 h

After 1 hour
1. Pilocarpine 4% X 3 drops stat and qid (affected eye only)

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Cont'd

Stage 2
After a further 30 min
1. Recheck intraocular pressure.

If not reduced:
2. 50% glycerol 1 g/kg orally (caution in diabetics) and limit fluid intake for maximum effect (at 30-60 min lasting for 5 h)
3. If vomiting and oral agents useless then 20% mannitol 1-2 g/kg intravenously over 45 min
4. Patient to lie supine for 1 h

Stage 3
After a further 1 hour
1. Recheck intraocular pressure.

If not reduced:
2. 20% mannitol 1-2 g/kg intravenously if not already given
3. Refer to senior colleagues

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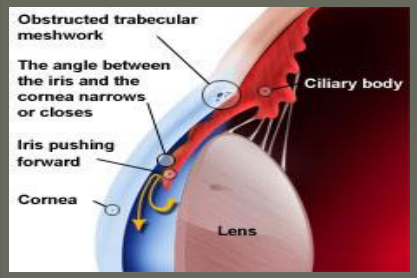
Narrow/Closed Angle Glaucoma



- Apposition of iris and trabecular meshwork
- Parasympatholytics (pupillary dilation) can precipitate attack
- Increase risk with age, increase in volume of lens
- Acute onset, patient complains of nausea, headache (rather than eye ache), malaise, general distress
- Requires immediate treatment

BOTTOM LINE: ↑IOP from ↓Aqueous Flow, 3 Sites

1. Obstructed Trabecular Mesh

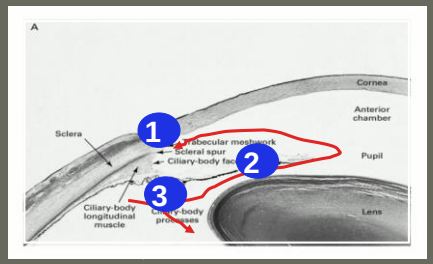
Open Angle: Age-related, genetic

Closed Angle: Anatomic, exacerbated by:

2. Pupillary Block

Dilation of pupil→ iris flattens, ↓ flow via pupil, iris forward ↓iris-cornea angle

3. Swelling of Ciliary Body



Treatment(s) in Case #3

- Started Alphagan P 0.1% (gave sample) with 1st dose in office. Waited 30 minutes and took IOP (22 OU). Waited another 30 minutes, IOP down to 18 OU.
- Patient returned 1 week later (supposed to be 4 days), IOP was 19 OD, 20 OS.
- Referred for Narrow Angle Eval for potential LPI (Laser Peripheral Iridotomy)

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Lasers, MIGS, and Filters Oh My!

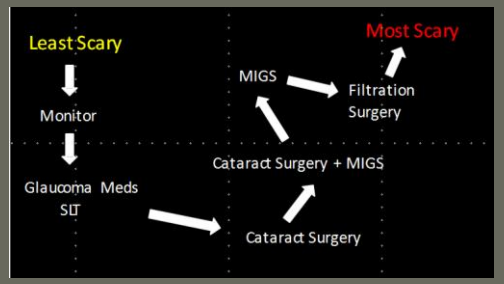

Image courtesy of Justin Schweitzer, OD (Vance Thompson)

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ALT vs SLT

- ALT induces mechanical alterations, due to collateral thermal effects
- SLT induces no apparent tissue alterations, due to the lack of such thermal effects
  - 532 nm frequency doubled, Q-switched, Nd:YAG Laser
  - Laser seems to stimulate the cells in the trabecular meshwork that have not been cleaning out the debris and dividing into new cells.
  - Less coagulative necrosis and stress to the TM

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SLT Efficacy: What I Have Seen

- 360° SLT treatment is equal latanoprost QHS in IOP lowering for up to 2 years post treatment
- 90° or 180° SLT is not as good in lowering IOP as latanoprost QHS

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MIGS Overview

Indications

- Patients with mild-moderate glaucoma
  - Primary open-angle glaucoma, pseudoexfoliation glaucoma, or pigmentary dispersion glaucoma
- Glaucoma is uncontrolled with maximum pharmacologic treatment or there are barriers preventing adequate medication dosing
- Age greater than 18
- Patients with clinically significant cataract, as surgery may be performed simultaneously.

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Surgical Approaches

- Increasing trabecular outflow
  - Neomedix Trabectome (Ab interno)
  - iStent (Ab interno)
  - Hydrus stent (Ab interno)
  - Gonioscopy assisted transluminal trabeculotomy
  - Excimer laser trabeculotomy (Ab interno)
  - Canaloplasty (Ab externo)
  - Kahook Dual Blade (Ab interno)
- Suprachoroidal shunts
  - Cypass micro-stent (Ab interno) ← VOLUNTARILY WITHDRAWN AND NO LONGER AVAILABLE
- Reducing aqueous production
  - Endocyclophotocoagulation
- Subconjunctival filtration
  - XEN Gel Stent (Ab interno)

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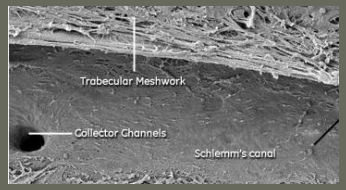
iStent Inject:

- The device is a heparin-coated, non-ferromagnetic titanium stent with a snorkel shape to facilitate implantation.
- Multiple stent placement designed to increase access to more collector channels
- Smallest FDA approved device



Trabectome:

- The system works by removing a strip of trabecular meshwork and the inner wall of Schlemm's canal in order to create a path for the drainage of aqueous humor.
- Ablation of 60°-120° allows for re-establishment of the drainage pathway.
- Maeda et al[8] evaluated the outcome of surgeries using Trabectome in 80 eyes of 69 patients. A mean preoperative IOP of 26.6 ± 8.1 mmHg was found to decrease to a mean postoperative IOP of 17.4 ± 3.4 mmHg within 6 months after the surgery.

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Cypass

*Ab interno

VOLUNTARILY WITHDRAWN

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ONE *CYPASS*® MICRO-STENT IS ALL IT TAKES TO CONNECT TO SAFE, CONSISTENT, LONG-TERM IOP CONTROL

SUPERIOR OUTCOMES ACROSS CLINICAL TRIAL ENDPOINTS

- The two-year COMPASS trial is the largest randomized, controlled MIGS trial completed to date, and included >500 patients with baseline and terminal washout[1]
- Implanted at the time of cataract surgery, the *CyPass*® Micro-Stent was shown to lower IOP for more patients than cataract surgery alone[1]

AT TWO YEARS:

72.5% OF EYES
treated with the *CyPass*® Micro-Stent achieved a ≥20% reduction in IOP vs 58.0% with cataract surgery alone (primary endpoint) (p=0.003)[2]

32% MORE EFFECTIVE
at lowering IOP than cataract surgery alone (-7.0 mmHg vs -5.3 mmHg) (p<0.0001)[2]

61.2% OF EYES
treated with the *CyPass*® Micro-Stent maintained an unmedicated diurnal IOP between 6 mmHg and 18 mmHg vs 43.5% with cataract surgery alone (p=0.0005)[2]

93% OF RESPONDERS*
in the *CyPass*® Micro-Stent group were medication-free[2]

*Those patients who attained an unmedicated mean diurnal IOP reduction of 20% or more as compared with baseline in the absence of IOP-affecting surgery during the study.

Study design: Prospective, randomized, multicenter clinical trial in patients (N=505) with open-angle glaucoma undergoing cataract surgery. Patients were randomized to receive phacoemulsification and *CyPass*® Micro-Stent implantation (n=374) or phacoemulsification alone (n=131), and all patients were followed for two years. The primary outcome measure was the proportion of eyes with unmedicated diurnal IOP reduction ≥20% at two years vs unmedicated baseline IOP. Secondary outcome measures included mean change in 24-month diurnal IOP from baseline and 24-month unmedicated mean IOP (between 6 mmHg and 18 mmHg) vs cataract surgery alone. Medication use at 24 months was also analyzed. The primary and secondary effectiveness analyses were performed using the intent-to-treat (ITT) population.[1]

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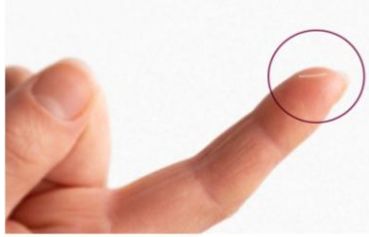
XEN Gel Stent



The XEN® Gel Stent is a surgical implant designed to lower high eye pressure in open-angle glaucoma patients where previous surgical treatment has failed and/or medications alone were insufficient (also known as refractory glaucoma).

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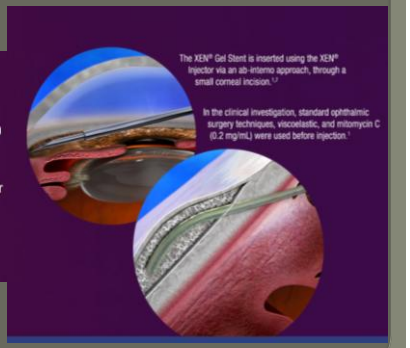
GEL STENT DESIGN

- 6-mm length, 45-micron lumen diameter—about the length of an eyelash[4]
- Gelatin, cross-linked with glutaraldehyde[1]
- Hydrates and minimally swells, softens, and becomes flexible after implantation[1]
- Preloaded, disposable injector[1] with a 27-gauge, double-beveled needle[3,5,6]



99

XEN Efficacy

REDUCED IOP AND MEDICATION USE AT MONTH 12[1]

Mean IOP reduced to
15.9 mm Hg
(N = 52) from 25.1 mm Hg at medicated baseline[1,†]

Mean IOP-lowering medications reduced to
1.7 (N = 52)
from 3.5 at medicated baseline[1,‡]

100

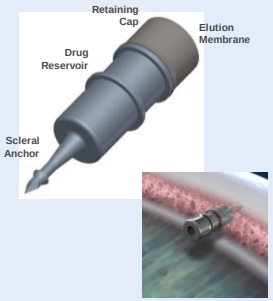
iDose
TRAVOPROST

Titanium implant (1.8 mm x 0.5 mm) designed for continuous drug delivery directly into anterior chamber

Filled with proprietary, novel and uber-potent formulation of travoprost; membrane-controlled Fickian elution; zero-order rates demonstrated *in vitro* and *in vivo*

Elegant and facile injectable procedure; bypassing cornea allows for micro-elution rates to achieve therapeutic index

Anchor keeps device in place and facilitates straightforward exchange upon drug depletion



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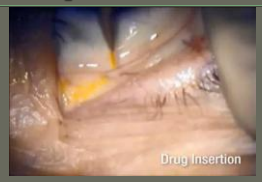
Future Drug Delivery Platforms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Rapid Fire Cases #4

- 42 year old Filipino male presents for acute left eye pain and blurry vision.
  - What's the scenario?
  - Any questions you might want to ask?
  - Exam findings
  - How do you follow?

  - IOP was 12 OD, 54 OS ←Gonio was open 360 OU
  - VA was 20/20 OD, 20/100 OS
  - No cell OD, 1+-2 cell OS, fine white KP
  - Corneal Edema present OS
  - Retina unremarkable

  - Treated with steroids only…

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Glaucomatolytic Crisis
Posner Schlossman Syndrome (PSS)

- Unilateral and Recurrent
- Mild discomfort or blurring of vision
- Increased IOP with open angles
- Mild anterior chamber reaction or fine white keratic precipitates (KP)
- Crises lasting from several hours to weeks
- Normal IOP and no signs of uveitis between attacks
- Normal visual fields and optic discs

Pathophysiology not well understood– potentially autoimmune and/or infectious etiologies.

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Rapid Fire Cases #5

- 45 year old French/Asian female presents with chronic, recurrent bilateral achy eyes and mild blurry vision.
  - IOP was 25 OD, 13 OS ←Gonio was open 360 OU
  - VA was 20/50 OD, 20/40 OS ← High Myope + Cataract
  - 2+-3 cell OD, tr cell OS, 2+ fine white KP OD>OS
  - No Corneal Edema present OU
  - Retina unremarkable

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HLA B-27

- Patient was chronically treated with Pred Acetate for years
- Became a steroid responder, switched to Lotemax when possible and added on Alphagan P 0.1% to her daily regimen
- She refuses to see Rheumatology

I'm hoping Cataract Surgery will reduce burden…

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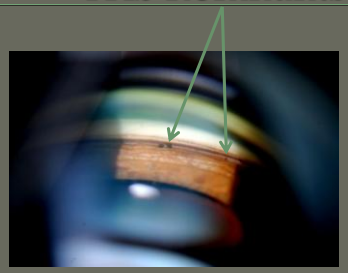
PAS Remnants



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Rapid Fire Cases #6

- 58 year old Caucasian female presents with mild right eye discomfort and blurred vision.
  - IOP was 27 OD, 16 OS ←Gonio was open 360 OU
  - VA was 20/30 OD, 20/20 OS
  - 1+-2 cell OD, no cell OS, 1+-2 fine white KP OD
  - No Corneal Edema present OU
  - Retina unremarkable

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Rheumatoid Arthritis

- Similar issue to Case #5, but this patient went to Rheumatology and was treated with MTX (Methotrexate) for steroid sparing events.
- Systemic treatment of disease state has significantly reduced the need for steroids and has lengthened flare ups from 1-2 months up to 8 months+

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It comes back to the history…

- Inflammatory disease
- Infectious disease
- Managing the aftermath

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Case #7

- 84 year old Caucasian male with Diabetes presents with "blotchy central vision".
  - What's the scenario?
  - Any questions you might want to ask?
  - Exam findings
  - How do you follow?

111

Before Me and After With Me

Visit 1:
VA was 20/20 OU,
ONH WNL, C/D .35 OD, .35 OS
IOP was 11 OU
Dx in chart was CRVO
No FA or Bloodwork performed

Visit 2 (2 mo later):
VA was 20/25 OD, 20/300 OS
ONH same size as Visit 1, but ?pallor OS
IOP was 12 OD, 14 OS
Dx states CRVO w/ ?ischemic optic neuropathy

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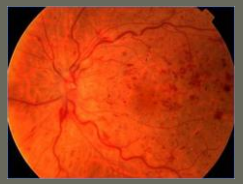
Visit 3 (2 wks later):
- VA was 20/25 OD, 20/800 OS
- C/D .35 OD, .35 OS, ?pallor OS
- IOP was 11 OU
- DME written in chart and Avastin injection administered
- Dx in chart was CRVO w/ ?ischemic optic neuropathy



Visit 4 (2 wks later)
- VA was 20/25 OD, 20/100 OS
- C/D .35 OD, .35 OS, ?pallor OS
- IOP was 10 OD, 13 OS
- DME resolving
- Dx in chart was CRVO w/ ?ischemic optic neuropathy

Visit 5 (1 mo later)
- VA was 20/25 OD, 20/400 OS
- C/D .35 OD, .35 OS, ?pallor OS
- IOP was 11 OD, 12 OS
- DME returns with more elevation, Avastin injection administered again
- Dx in chart was CRVO w/ ?ischemic optic neuropathy
- Sent to Retina for consultation

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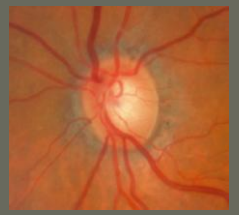
Visit 6 (5 months later, was lost to follow up due to hospitalization):
****When I entered the scene when he came in as an emergency****
- VA was 20/25 OD, CF 1' OS
- C/D .35/.3 OD, .65/.65 OS, +pallor OS and ?shunt vessels
- IOP was 13 OD, 22 OS
- 1+ cell OS, no flare, no KP
- My Dx was CRVO w/ likely ischemic optic neuropathy,
- **Watch carefully for pressure spike**
- Rx given for Pred Acetate 1% qid OS and Combigan tid OS
- I personally called Retina to figure out where they stood



Visit 7 (1 day later):
****Seen back by original physician****
- VA was 20/25 OD, CF 2' OS
- C/D .35 OD, .45 OS,+pallor OS
- IOP was 13 OD, 18 OS
- Foveal elevation and RPE changes noted
- Dx in chart was CRVO w/ ?ischemic optic neuropathy, pt was told to D/C Combigan

Subsequent visits showed pressure after another Avastin injection rose as high as 45. Pt was sent to the glaucoma specialist for further evaluation

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100 Day Glaucoma to Neovascular Glaucoma

- Secondary open-angle or secondary closed-angle mechanism depending on the extent of neovascularization.
- The prognosis of ischemic CRVO is extremely poor due to macular ischaemia.
- Rubeosis irides develops in about 50% of eyes, usually between 2 and 4 months (100-day glaucoma), and there is a high risk of neovascular glaucoma.
- The development of optociliary shunts may protect the eye from anterior segment neovascularization and probably indicates a dramatic reduction in risk.
- Retinal neovascularization occurs in about 5% of eyes

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Watching out for Systemic Pathology Crossover

- Amiodarone
  - More visually significant is amiodarone-induced optic neuropathy. Its presentation has been described as insidious at onset, simultaneous and bilateral with visual field loss, and with visual acuity ranging from 20/20 to 20/200.
  - Alternatively, the presentation may be acute in onset or the localization retrobulbar.
- Cardiovascular disease (Ischemia)
- Sleep Apnea
- Anesthesia


Br J Ophthalmol. 2003 Apr; 87(4): 420–422.

Amiodarone induced optic neuropathy

P K Nagra, R Foroozan, P J Savino, I Castillo, and R C Sergott

Author information ▶ Article notes ▶ Copyright and License information ▶


Oman J Ophthalmol. 2016 Sep-Dec; 9(3): 125–134. PMCID: PMC5084493

doi: 10.4103/0974-620X.192261

Glaucoma and its association with obstructive sleep apnea: A narrative review

Aditya Chaitanya, Vijaya H. Pai,[1] Aswini Kumar Mohapatra,[2] and Ramesh S. Ve

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Case #8

- 46 year old Hispanic male with Chronic POAG, but poor adherence to therapy.
  - How would you communicate the risk of progression?
  - More drops vs. surgical intervention?
  - What's the recall look like?
  - Would you "phone a friend"?

C/D .7/.75 OD, .9/.95 OS
IOP swings between 13 and 30

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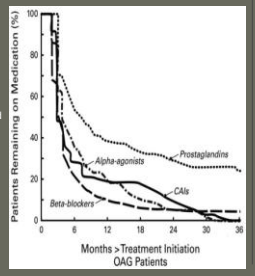
Understanding the Problem

Statistics[1]

10-25% of newly prescribed patients don't refill their 2nd prescription

~40-60% of newly prescribed patients are still taking their meds at end of year 1

70-75% compliance reported for "compliant" patients



Reasons[1]

Complex dosing regimens, especially for patients on multiple topical medications

Cost and forgetfulness

Difficulty properly instilling drops, especially in elderly patient population

Adverse side effects and/or intolerance with topical medications

Inconvenience and/or misunderstanding about the need

Value of Adherence to Therapy[2]

Lowering IOP is the only proven method of treating glaucoma

Multiple studies have shown that low IOP is associated with reduced progression of optic nerve damage and visual field defect

The risk of progression decreases about 10% with each mm Hg of IOP reduction from baseline

Patients with poor glaucoma medication adherence are shown to have worse visual field defect severity

1 Quigley HA Glaucoma. What Every Patient Should Know 2011; Friedman DS et al Invest Ophthalmol Vis Sci. 2007; Glaucoma Research Foundation; Market Scope
2 AGIS Investigators Am J Ophthalmol. 2000; Leske MC et al Arch Ophthalmol. 2003; Blalock S et al Ophthalmology 2011; Olthoff et al Ophthalmology 2005

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OSD and Glaucoma

- Glaucoma medications significantly elevate the risk and progression of MGD[1]
- Preservatives and dry eye[2]

**Glaucoma and MGD: 96% (using Prostaglandins) had obstructive Prostaglandin Therapy vs. 58% of those on non Prostaglandin Therapy.[3]

1.Arita R, Itoh K, Maeda S, et al. Comparison of the long-term effects of various topical antiglaucoma medications on meibomian glands. Cornea. 2012 Nov 31(11): 1229-34.
2.Baudouin, C, Labbe, A, Liang, H, et. Al. Preservatives in eyedrops: The good, the bad and the ugly, Progress in Retinal and Eye Research, Volume 29, Issue 4, July 2010, Pages 312-334
3.Mocan MC, et al. The Association of Chronic Topical Prostaglandin Analog Use With Meibomian Gland Dysfunction. J Glaucoma. 2016 Sep;28(9):770-4.

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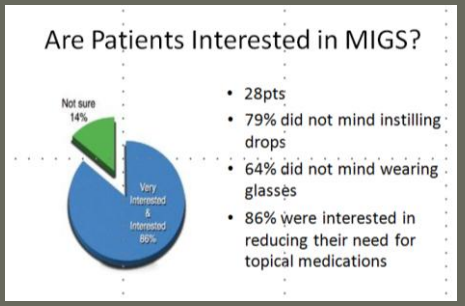
Is it time for MIGS in Case #8?



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Focus on Dry Eye Prevalence

- Cataract Surgery 77%
- •Penetrating Keratoplasty 60%
- •Lasik 27%
- •Glaucoma Surgery 78%
- •Blepharoplasty 26%

Trattler, ASCRS CME Supplement, 2013
Sheppard, WCC, 2015
Azuma, BMC Research Notes, 2014
Leung, Journal of Glaucoma, 2008
Prischmann, JAMA Facial Plastic Surgery, 2013

Slide Courtesy of Walt Whitley

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Conclusions

- Don't forget about Gonioscopy!
- Work the case, don't let the case work you.
- Analyze all the data and gauge options.
- Remember the ocular surface challenges.
- Reach out to your colleagues– collaborate!!

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Thank You!

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