

# Glaucoma and Dry Eyes -“Frenemies” for Life-

KENTUCKY OPTOMETRIC ASSOCIATION – FALL CONFERENCE

SATURDAY, SEPTEMBER 14, 2024  
CENTER FOR SIGHT & DRY EYE CLINIC  
AUSTIN LIFFERTH OD, FAAO  
DIPLOMATE (GLAUCOMA) AAO

## Disclosures

Bausch and Lomb Advisory Board

I WISH I APPRECIATED THIS CONNECTION EARLIER IN MY CAREER....

## Glaucoma and Dry Eyes “Frenemies for Life”

1. To increase awareness of both chronic, progressive, active, unstable and *unyielding* conditions.
2. To increase awareness of the strong association between both chronic, progressive, active, unstable, and *unyielding* conditions.
  - They love to be together.
  - Inevitable
  - Inseparable
3. To increase understanding of the similarities of both chronic, progressive, and *unyielding* conditions.
  - They have a lot in common.
4. To increase understanding of the collateral damage between both chronic, progressive, active, unstable and *unyielding* conditions when together.
  - They are worse when together.
  - It does not happen overnight.



## Prevalence and Association

Over 80 million people worldwide have glaucoma.<sup>1</sup>

Prevalence of DED in studies up to 75% in certain populations.<sup>2</sup>

5 million people in U.S. older than age 50 who have dry eyes, 11% have glaucoma.<sup>3</sup>

Nearly 60% of patients on topical glaucoma therapy have DED.<sup>3</sup>

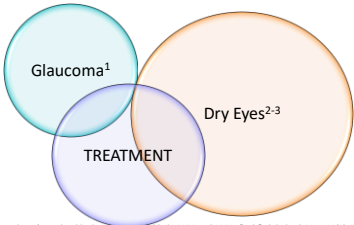
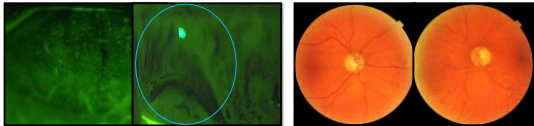


1. Tham YC, Li X, Wong TY, Quigley HA, Aung T, Cheng CY. Global prevalence of glaucoma and projections of glaucoma burden through 2040: a systematic review and meta-analysis. *Ophthalmology*. 2014;121:2081-90.
2. Craig JP, Nelson JD, Azar DT, et al. TFOS DEWS II Report Executive Summary. *The Ocular Surface*. (2017). <http://dx.doi.org/10.1016/j.jtos.2017.08.003>
3. Zhang X, Vadodkar S, Mann RM, Saeed O. Ocular Surface Disease and Glaucoma Medications: A Clinical Approach. *Eye & Contact Lens*. 2019;45: 11-18.

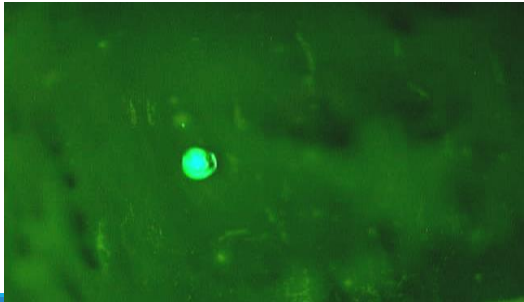
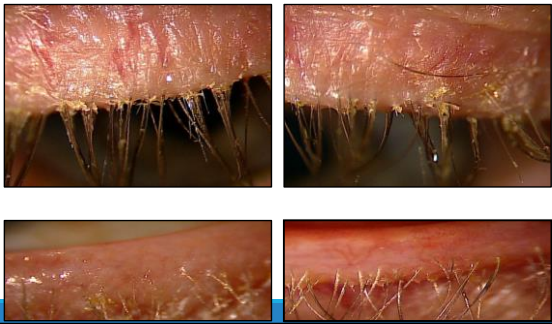
Prevalence and Association

DRY EYES  
>30 Million in US

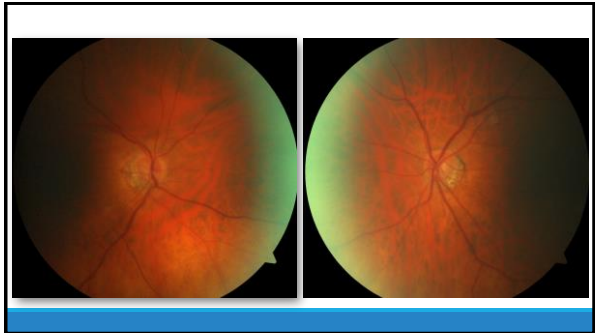
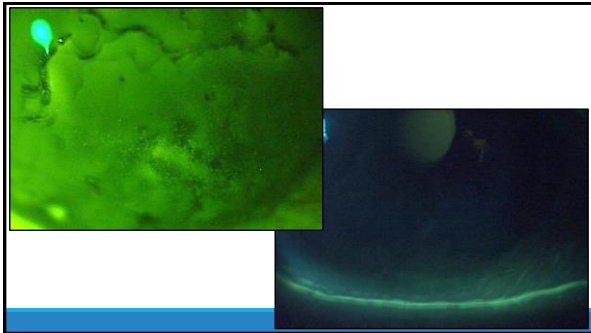
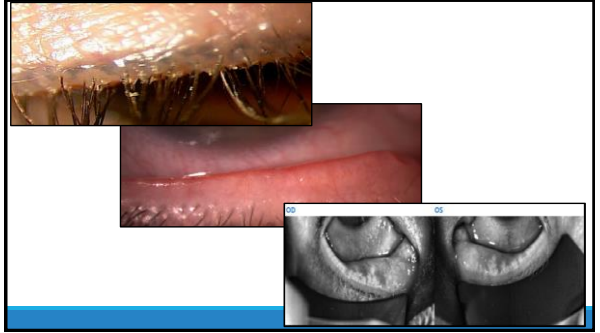
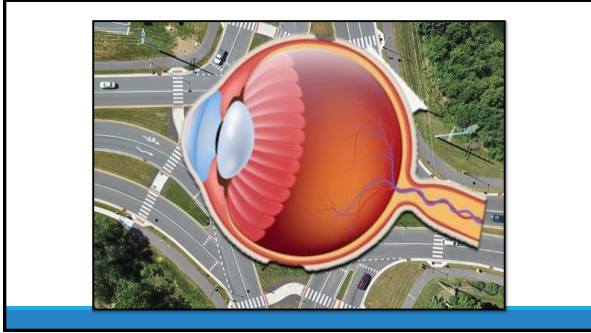
GLAUCOMA  
>3 Million in US

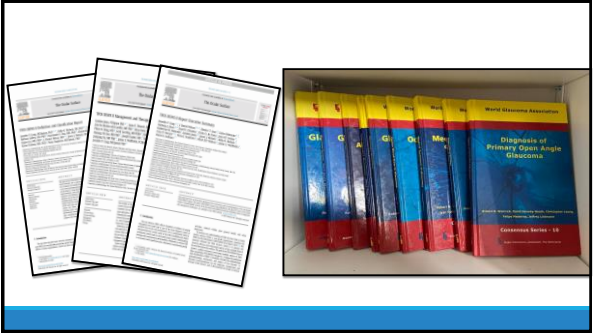
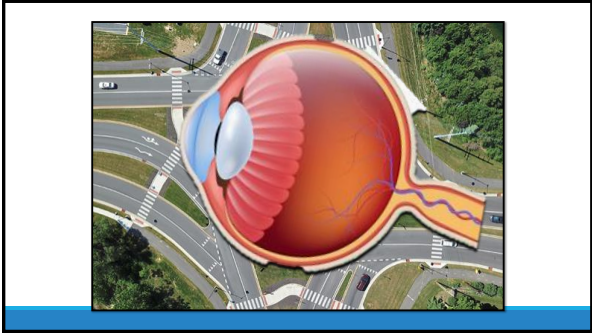
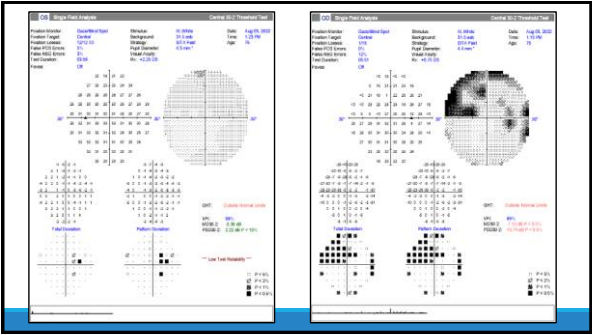
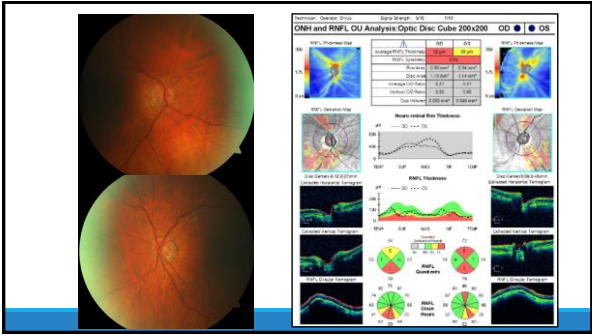


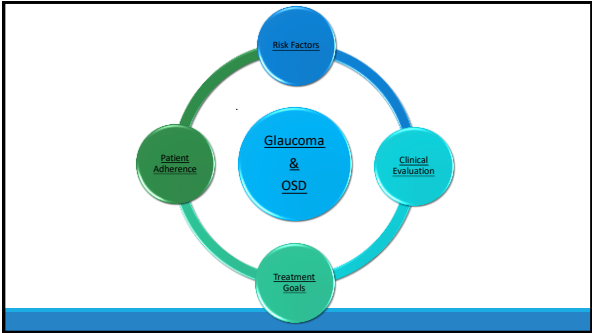
1. Ogilley MA, Broman AT. The number of people with glaucoma worldwide in 2010 and 2020. *Br J Ophthalmol*. 2006;90(3):262-267.
2. The epidemiology of dry eye disease: report of the Epidemiology Subcommittee of the International Dry Eye WorkShop (2007). *Ocul Surf*. 2007;5(2):93-107.
3. Dayton AL. Etiology, prevalence, and treatment of dry eye disease. *Clin Ophthalmol*. 2009;3:405-412.












# Risk Factors

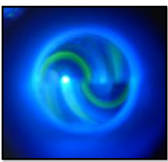
MODIFIABLE AND NONMODIFIABLE

## #1 Modifiable Risk Factor

DRY EYES



GLAUCOMA



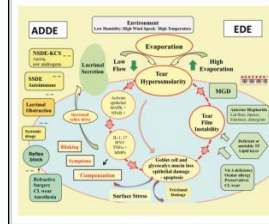
## OSD and G-OSD risk factors –graph 2

NUM 1.M. DE BENTO-LLOPIS L. BODU-OC. VALARANT TS. CORONDO MT. UNDERSTANDING THE QUAL. OUTCOMES TO DRY EYE AND GLAUCOMA AND INTERPRETING PREVIEW. JOUR NAL OPTICOPALMOP (PISA) 2023 OCT-DECEMBER. P. 10-15. NOTE: SEE TABLE 2 FOR A DETAILED SUMMARY OF RISK FACTORS FOR OSD AND G-OSD.

## OSD and G-OSD treatment recommendations –graph 2

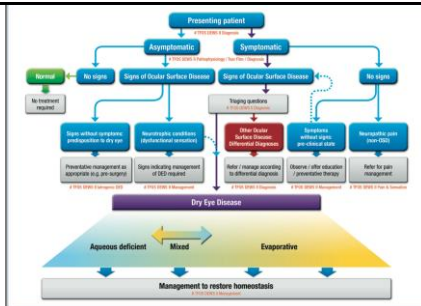
NJUM LM, SCHWEITZER J, GOULD BLACKMORE J  
GLAUCOMA AND DRY EYE DISEASE: OPPORTUNITY TO  
ASSESS AND TREAT. CLIN OPHTHALMOL. 2023 OCT  
17;17:3063-3076.

"The \_\_\_\_\_cycle"

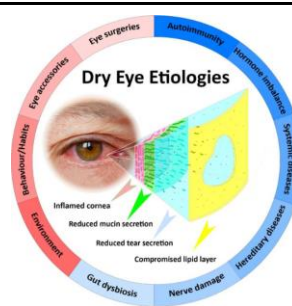


"Since tear osmolality is a function of tear evaporation in either ADDE or EDE, tear hyperosmolarity arises due to evaporation from the ocular surface and, in that sense, all forms of DED are evaporative. In other words, EDE is more accurately considered a hyper-evaporative state."

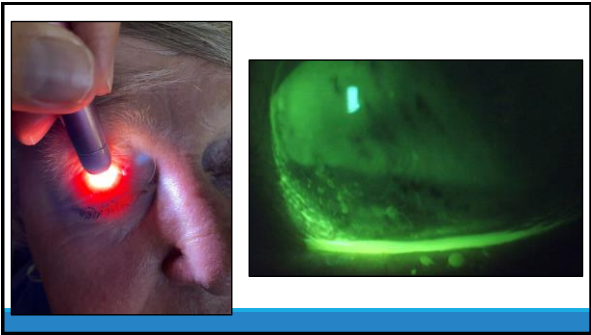
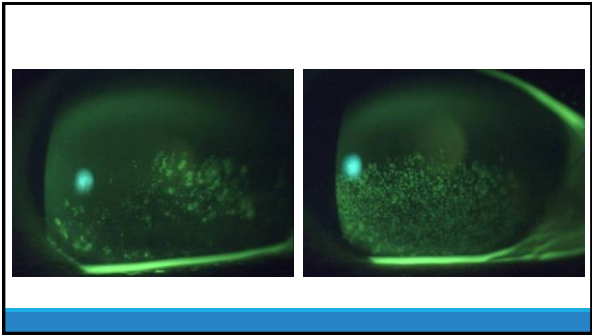
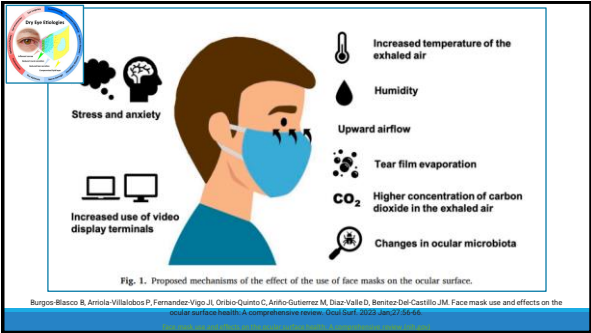
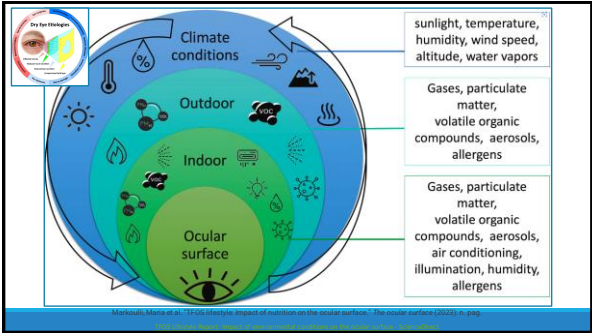
Craig JP, Nelson JD, Azar DT, Balmain C, Bran AJ, Chauhan ST, de Paiva CS, Gomes JAP, Hammit KM, Jones L, Nichols JJ, Nichols KK, Novack GD, Stapleton FJ, Wilson MP, Wolffsohn JS, Sullivan DA. TFOS DEW II Report Executive Summary. *Invest Ophthalmol Vis Sci*. 2017;58(11):3182-3212.



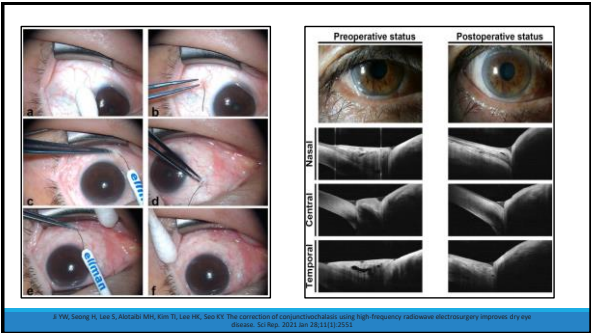
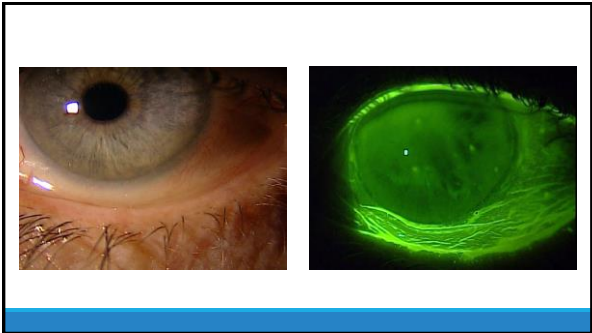
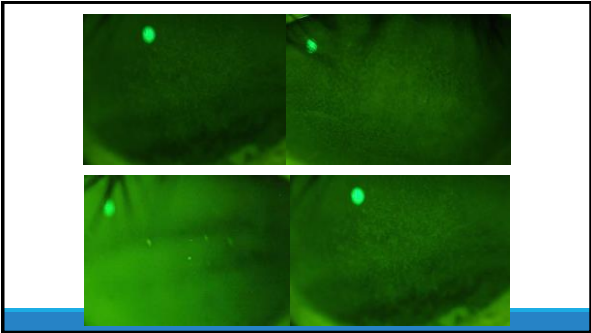
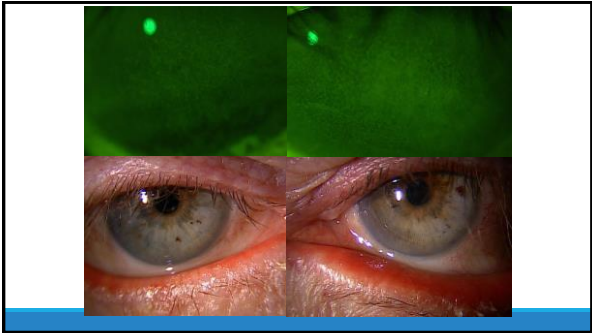
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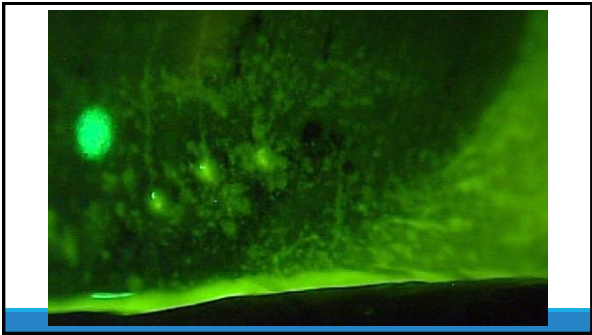
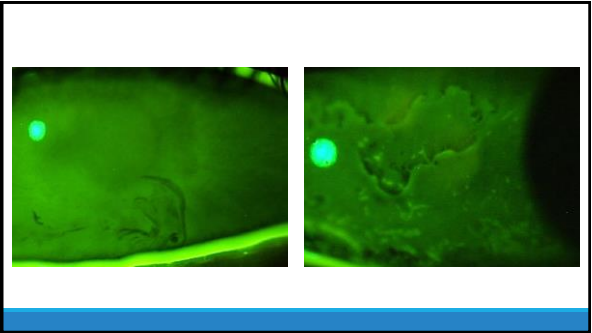
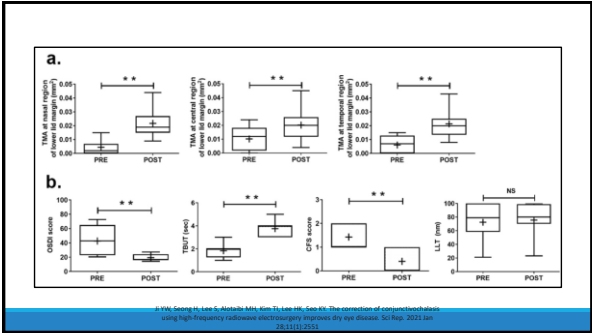


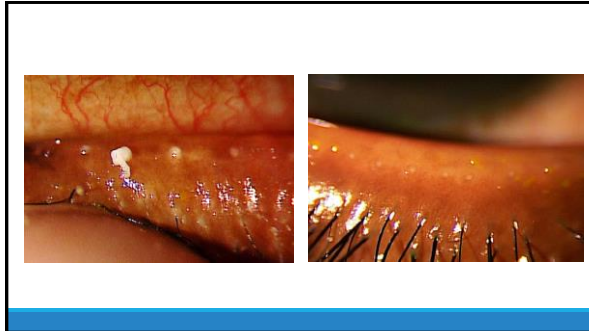
Huang R, Xu G, Fang L, Li J, Chen J, Ding Y. Dry eye syndrome: comprehensive etiologies and recent clinical trials. *Int Ophthalmol*. 2022;42(4):719-733. doi:10.1007/s12033-022-02772-2











*"The management of DED is complicated, due to its multifactorial etiology....This aspect of determining the major causative factors behind the DED is critical to appropriate management."*

1. Craig JJ, Nelson JD, Aziz DT, Belmonte C, Bruni AJ, Chauhan SE, de Paiva CS, Gomes JMS, Hammit KM, Jones L, Nichols JJ, Nichols KK, Nichols KD, Stagonis FJ, Willcox AM, Willcox BG, Sullivan DA. TOSU DRYE: A Report Literature Summary. *Optom*. 2017;98(11):80-91.

## Intraocular Pressure

IOP is the greatest modifiable risk factor in the development and progression of glaucoma<sup>1,2</sup>.

- Each mmHg of matters<sup>3,4</sup>.
- Corneal biomechanical properties (central corneal thickness, corneal hysteresis) and applanation technique (decentration, thick/thin tear film, etc.) affect IOP measurement accuracy<sup>5,6</sup>.

Thinner central corneal thickness and lower corneal hysteresis is associated with the development and progression of glaucoma<sup>7</sup>.

Advanced glaucoma at time of diagnosis is associated with poorer prognosis and greater risk of progression<sup>8,9</sup>.

Poor adherence to prescribed topical medications is associated with visual field progression<sup>10</sup>.

1. Kass MA, Heier DK, Hoggelshoven TJ, et al. The Ocular Hypertension Treatment Study: controlled trial assessing the effect of topical ocular hypotensive medication on the progression of primary open-angle glaucoma. *Arch Ophthalmol*. 2002;120(10):1360-1370.

2. Hoggelshoven TJ, Kass MA, Heier DK, et al. Reduction of intraocular pressure and visual field loss in the Ocular Hypertension Treatment Study. *Arch Ophthalmol*. 2002;120(10):1371-1379.

3. Heier DK, Kass MA, Heier DK, et al. The relationship between central corneal thickness and intraocular pressure in the Ocular Hypertension Treatment Study. *Arch Ophthalmol*. 2002;120(10):1380-1386.

4. The Ocular Hypertension Treatment Study Group. The relationship between central corneal thickness and intraocular pressure in the Ocular Hypertension Treatment Study. *Arch Ophthalmol*. 2002;120(10):1387-1393.

5. Heier DK, Kass MA, Heier DK, et al. The relationship between central corneal thickness and intraocular pressure in the Ocular Hypertension Treatment Study. *Arch Ophthalmol*. 2002;120(10):1394-1400.

6. Heier DK, Kass MA, Heier DK, et al. The relationship between central corneal thickness and intraocular pressure in the Ocular Hypertension Treatment Study. *Arch Ophthalmol*. 2002;120(10):1401-1407.

7. Heier DK, Kass MA, Heier DK, et al. The relationship between central corneal thickness and intraocular pressure in the Ocular Hypertension Treatment Study. *Arch Ophthalmol*. 2002;120(10):1408-1414.

8. Heier DK, Kass MA, Heier DK, et al. The relationship between central corneal thickness and intraocular pressure in the Ocular Hypertension Treatment Study. *Arch Ophthalmol*. 2002;120(10):1415-1421.

9. Heier DK, Kass MA, Heier DK, et al. The relationship between central corneal thickness and intraocular pressure in the Ocular Hypertension Treatment Study. *Arch Ophthalmol*. 2002;120(10):1422-1428.

10. Heier DK, Kass MA, Heier DK, et al. The relationship between central corneal thickness and intraocular pressure in the Ocular Hypertension Treatment Study. *Arch Ophthalmol*. 2002;120(10):1429-1435.

## NON-MODIFIABLE vs. MODIFIABLE

**NON-MODIFIABLE**

- RACE
- CCT
- CORNEAL HYSTERESIS
- AGE

**MODIFIABLE**

- HEALTH LITERACY
- BMI
- DISEASE MITIGATION (HTN, DM, SLEEP APNEA)
- LIFESTYLE
- NUTRITION

IOP<sup>1-7</sup>

1. Kass MA, Heier DK, Hoggelshoven TJ, et al. The Ocular Hypertension Treatment Study: a randomized trial assessing the effect of topical ocular hypotensive medication on the progression of primary open-angle glaucoma. *Arch Ophthalmol*. 2002;120(10):1360-1370.

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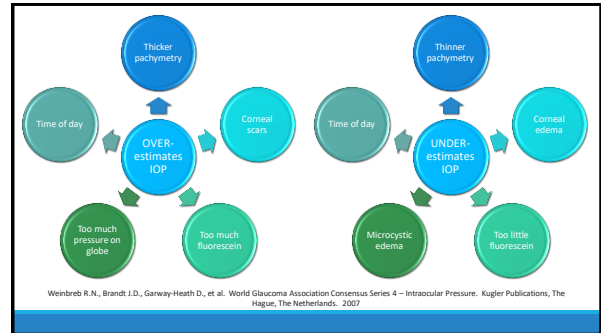
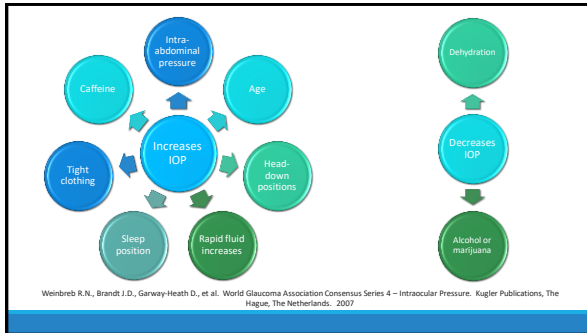
3. Heier DK, Kass MA, Heier DK, et al. The relationship between central corneal thickness and intraocular pressure in the Ocular Hypertension Treatment Study. *Arch Ophthalmol*. 2002;120(10):1380-1386.

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5. Heier DK, Kass MA, Heier DK, et al. The relationship between central corneal thickness and intraocular pressure in the Ocular Hypertension Treatment Study. *Arch Ophthalmol*. 2002;120(10):1394-1400.

6. Heier DK, Kass MA, Heier DK, et al. The relationship between central corneal thickness and intraocular pressure in the Ocular Hypertension Treatment Study. *Arch Ophthalmol*. 2002;120(10):1401-1407.

7. Heier DK, Kass MA, Heier DK, et al. The relationship between central corneal thickness and intraocular pressure in the Ocular Hypertension Treatment Study. *Arch Ophthalmol*. 2002;120(10):1408-1414.



## Over-reliance on IOP levels?



"...the most important healthcare implication from this analysis is to avoid being falsely reassured by a lower level of IOP in glaucoma case finding."<sup>1</sup>

"Kill the magic number"<sup>2</sup>

- IOP is not glaucoma.
- How would you monitor for glaucoma if we did not measure IOP?

1. Chan MY, Krieger M, Broadway DC, Topol L, Lubert R, Popat S, Peto T, Krieger M, Foster R. Risk factors for previously undiagnosed primary open-angle glaucoma: the EPIC Network Eye Study. *Br J Ophthalmol*. 2023 Jun 25:bqad016. doi: 10.1093/bjao/bkac317. Epub 2022 Dec 21. PMID: 36317718.

2. Weinreb R.N. 2022 consensus statement on IOP. *Br J Ophthalmol*. 2022;106(12):1612-1613. doi: 10.1136/bjoph-2022-037118.

## Clinical Evaluation

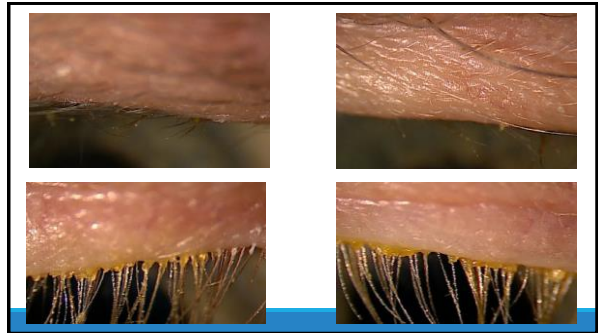
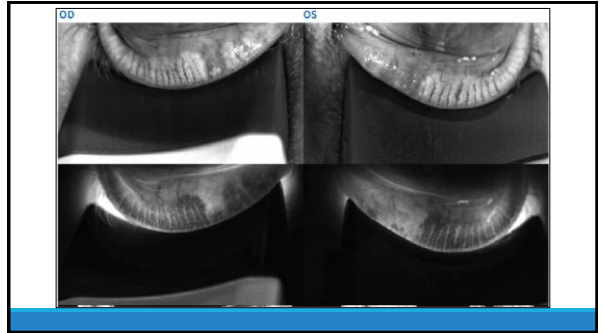
PREFERENTIAL STRUCTURAL LOSS AND RED FLAGS

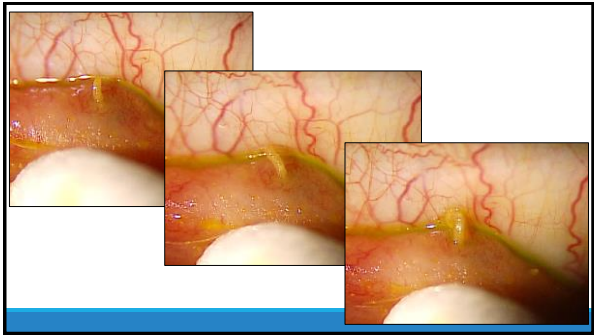
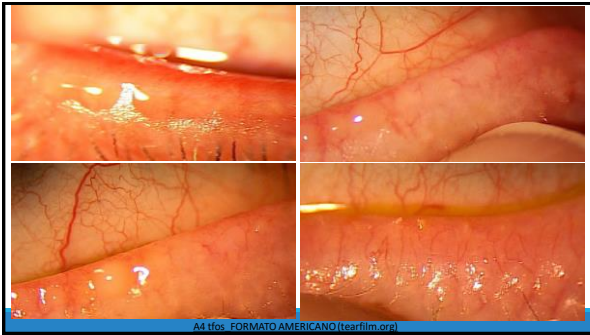
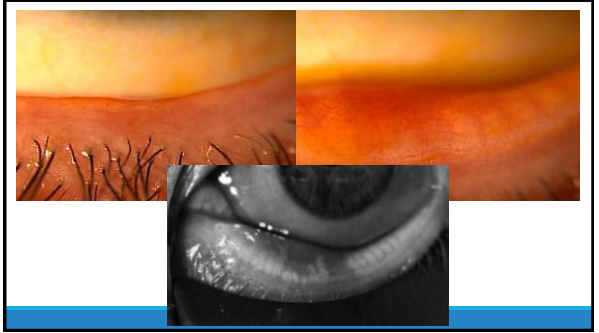
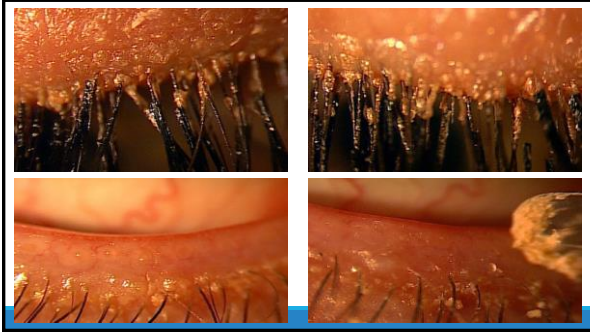
## Preferential Loss

DRY EYES



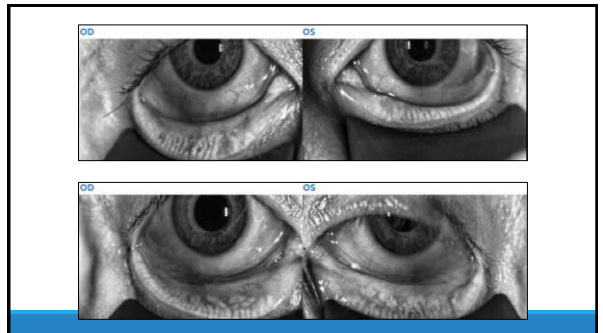
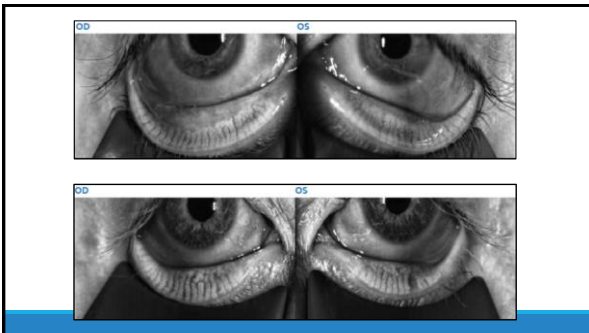
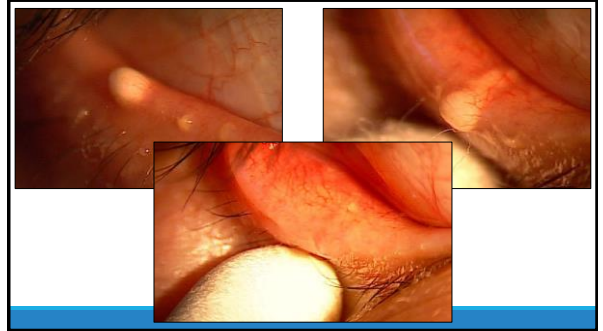
GLAUCOMA

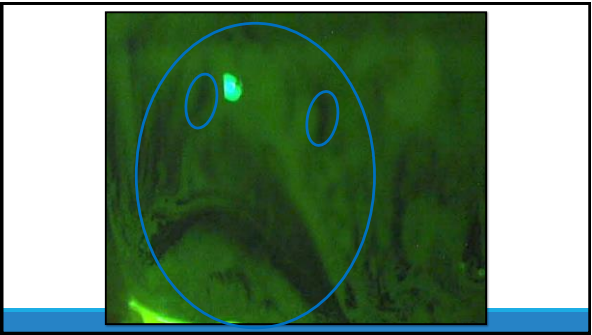
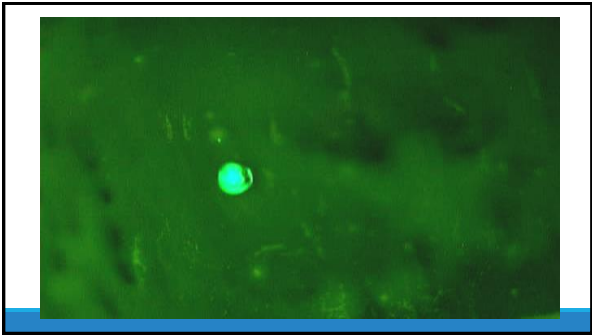
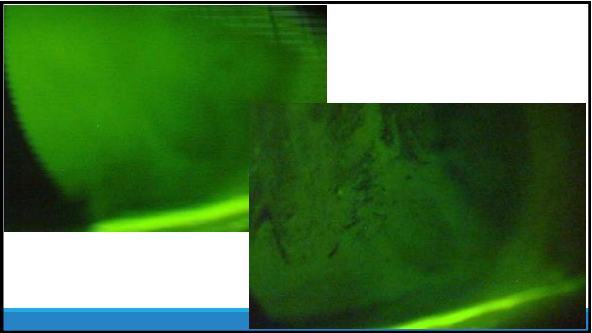
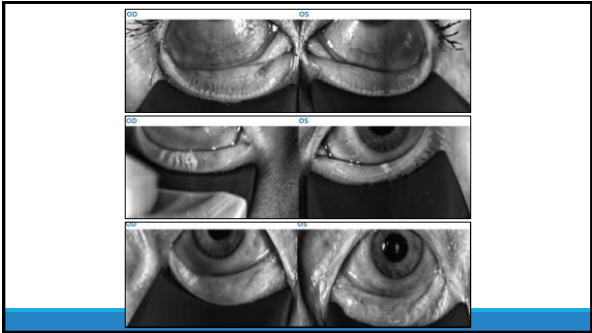




A4 tfo5\_FORMATO AMERICANO (tearfilm.org)











"...its presence  
should be an  
unfavorable  
prognostic  
event."<sup>1</sup>



Shenoi S, Fawcett M, Butler D, Kuttar M. The importance of disc hemorrhage in the prognosis of chronic open-angle glaucoma. Archives of Ophthalmology (Chicago, Ill.). 1993; 111(1):100-106.

Increased risk of disc  
hemorrhages was  
comparable to...

Increasing age by 10.5 years  
Increasing IOP by 11.4 mm Hg  
Decreasing CCT by 23.1 microns  
Worsening PSD by 1.3-dB  
Increasing vertical CDR by 0.1  
unit.



De Angelis G, et al. Rate of visual field progression in eyes with early disc hemorrhages in the ocular hypertension treatment study. Arch Ophthalmol 2012; 130(10):1285-1290.

#### QUESTIONS TO CONSIDER...

- Do you have any family history of glaucoma?
- Have you ever had any eye injury or eye surgery?
- Do your eyes ever feel burning? Tired? Foreign body sensation?
- Does your vision fluctuate after prolonged reading or other tasks?
- Have you ever been diagnosed with dry eyes?
- Do you currently use any artificial tears or prescription dry eye treatment?

#### SIGNS TO LOOK FOR...

- Obstructed meibomian glands
- Telangiectatic lid vessels
- Frothy and/or low tear lake
- Rapid TBUT
- Corneal/conjunctival staining
- Endothelial pigment/keratic precipitates
- Anterior chamber reaction
- Transillumination iris defects
- Posterior synechiae
- Narrow angles
- Elevated/asymmetric IOPs
- Vertical neuroretinal rim thinning
- Disc Hemorrhages



## Treatment Goals

HOME THERAPY VS IN-OFFICE THERAPY  
ADHERENCE – INDEPENDENT OSMOLARITY REDUCTION  
ADHERENCE – INDEPENDENT IOP REDUCTION

## Treatment Goals

### DRY EYES

Improve Quality of Life  
Increase Homeostasis



### GLAUCOMA

Preserve Visual Function  
Decrease IOP



## Treatment Principles

*"The management of DED is complicated, due to its multifactorial etiology...This aspect of determining the major causative factors behind the DED is critical to appropriate management."*

*The ultimate aim of DED management is to restore the homeostasis of the ocular surface and tear film, through breaking the vicious cycle of the disease.*

*"Overall, the treatment of DED remains something of an art, not easily lending itself to a rigid, evidence-based algorithm that accommodates all patients with DED symptoms or signs. All eye care providers who treat patients with DED must exercise their clinical skills to judge the significance of each of the varied pathogenic processes that may manifest similar subjective complaints and similar signs of ocular surface dysfunction."<sup>1</sup>*

*"In general, treatment is indicated for patients with glaucoma or glaucoma suspects who are at risk for developing functional impairment or decrease in vision-related quality of life from the disease."*

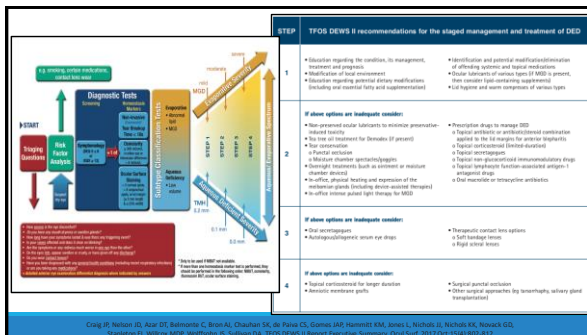
Treatment is generally indicated when the risks of progressive disease outweigh the risks and potential side effects of treatment.

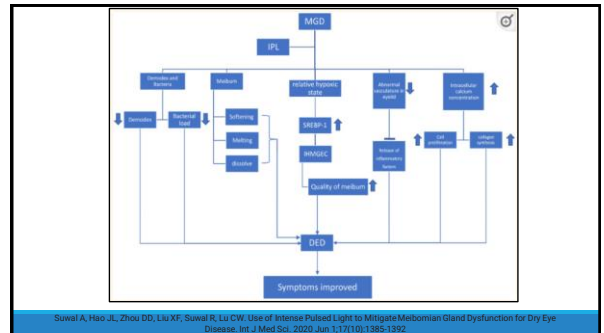
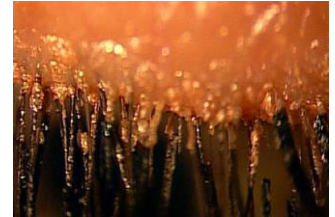
*All treatment decisions should take into account the presence of coexisting ocular conditions [OSD], the patient's life expectancy and general health status, as well as his/her perceptions and expectations about treatment.*

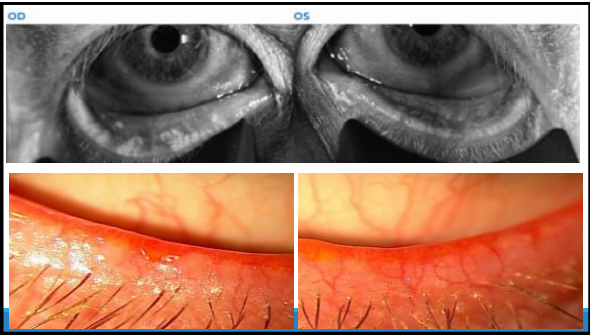
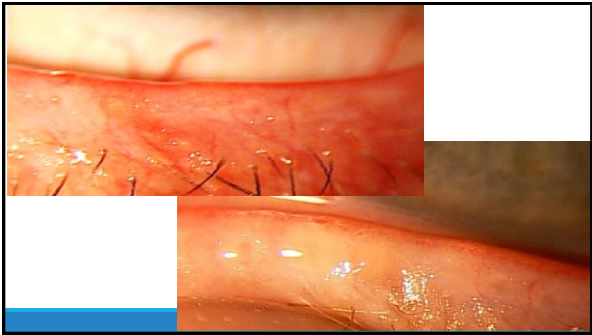
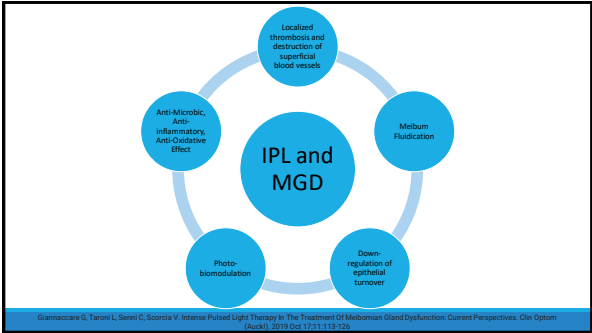
Treatment goals include IOP, visual function and structural (optic disc, RNFL) outcomes and QOL.<sup>2</sup>

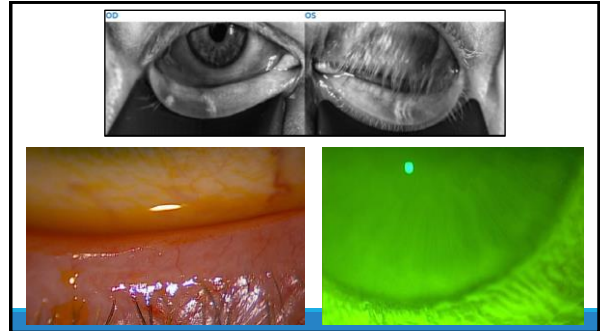
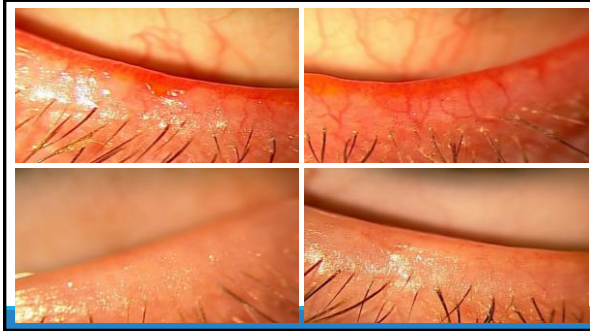
1. Craig JP, Nelson JD, Azar DT, Belmonte C, Bron AJ, Chauhan SK, de Paiva CS, Gomes AP, Hammit KM, Jones L, Nichols JJ, Nichols KK, Novack GD, Stapleton FJ. Medical Ocular Surface Disease. In: TFOS DEWS II Report: Evidence-based Comprehensive Update on Dry Eye Management 2017.

2. Weinreb RN, Ates M, Sacuma S, et al. World Glaucoma Association Consensus Series 7 - Medical Treatment of Glaucoma. Karger Publications, Basel, Switzerland. 2019.





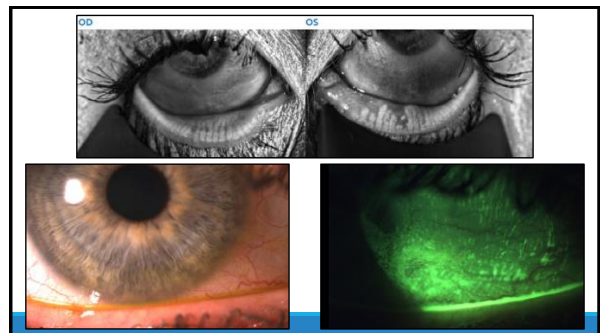




## What's New?

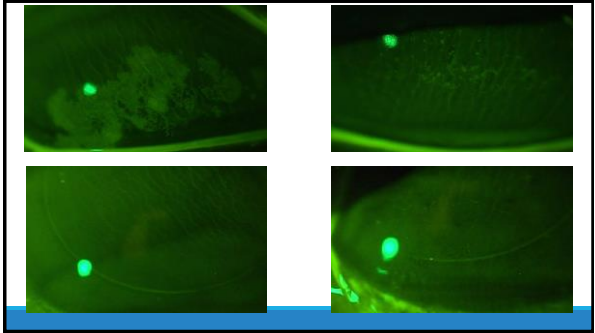
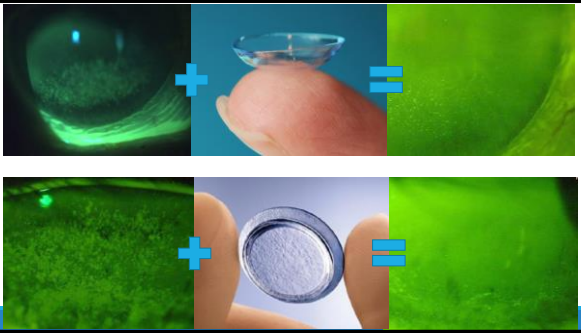
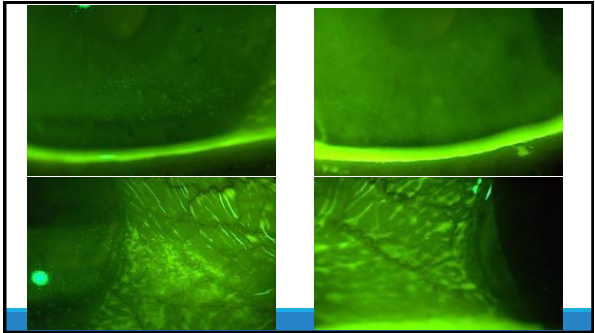
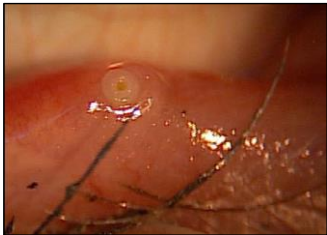
(perfluorohexyloctane  
ophthalmic solution)

**A drop that treats dry eye in a new way**



Causes

- Health conditions
  - Diabetes
  - Auto-immune conditions
    - Arthritis
    - Sjögren's Syndrome
- Medications
  - Allergy, Blood pressure, Depression
- Anti-inflammatory medications
  - Lofeprednol, Flumethalone, etc
  - Nutritional supplements
- Immunomodulator medications
  - Cyclosporine, Lifetgrast, etc
- Additional therapy
  - Autologous serum, PRP
  - Oral secretagogues
  - Neurostimulation





## Topical Therapy

DRY EYES

GLAUCOMA

### 56,000 Ways To Treat Glaucoma

From glaucoma eye medicine. The eye medicine on the eye.



The addition of new glaucoma medications in the past few years, including several with novel drug classes and improved safety profiles, has created a vast array of treatment options for glaucoma patients. The resulting complexity of the choices available to patients and providers has led to a significant increase in the number of ways to treat glaucoma. In fact, there are now over 56,000 ways to treat glaucoma. This number is a result of the combination of different drug classes, dosages, and formulations. The most common drug classes used in glaucoma treatment are beta-blockers, prostaglandin analogs, carbonic dehydratase inhibitors (CAIs), and Rho-kinase inhibitors. Each class has several different drugs, and each drug is available in different dosages and formulations. For example, the beta-blocker class includes drugs like timolol, betaxolol, and carteolol, each available in different dosages and formulations. The prostaglandin analog class includes drugs like latanoprost, bimatoprost, and travoprost, each available in different dosages and formulations. The CAI class includes drugs like dorzolamide and brinzolamide, each available in different dosages and formulations. The Rho-kinase inhibitor class includes the drug netarsudil. The combination of these different drug classes, dosages, and formulations results in a vast number of treatment options for glaucoma patients. This complexity makes it difficult for patients and providers to choose the best treatment option for a given patient. However, it also provides a wide range of options to tailor treatment to the individual needs of each patient. The number of ways to treat glaucoma is a testament to the ongoing research and development in the field of ophthalmology. As new drugs and formulations continue to be developed, the number of ways to treat glaucoma will continue to grow, providing even more options for patients and providers.

67,391 Latanoprostene 1 Rho-Kinase Inhibitor  
Bunod (Netarsudil)

Heidi, Tony/Heidi, Robert D et al. 56,000 ways to treat glaucoma. Ophthalmology, Volume 120, Issue 11, 2013.

## Lower is Better.

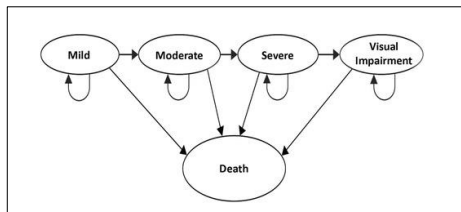
Sufficient IOP reduction

- Residual life expectancy/Age

Sufficient treatment

- Over treatment for older patients?
- Under treatment for younger patients?

## Target IOP Treatment Principles



Boothroyd T. Credit: OP. More frequent, more costly? Health economic modelling aspects of monitoring glaucoma patients in England. BMJ Health Care Res. 2019;10(1):e000100.

## Target IOP Treatment Principles

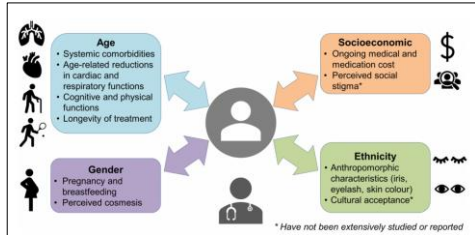
"The decision to initiate glaucoma treatment should be based on the assessment of the risks for development of functional impairment or decrease in vision-related quality of life, taking into account factors such as coexisting ocular conditions, the patient's life expectancy, and general health status, as well as his/her perception and expectations about treatment."

Age  
Stage

Goldmann J, Weinreb R. World Glaucoma & Medical Treatment of Glaucoma: The 17th Glaucoma Report of the World Glaucoma Association. American Society of Ophthalmology. 2013. p 3.

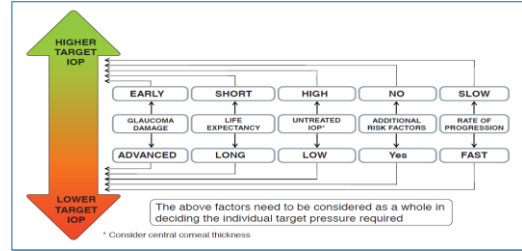


### Target IOP Treatment Principles



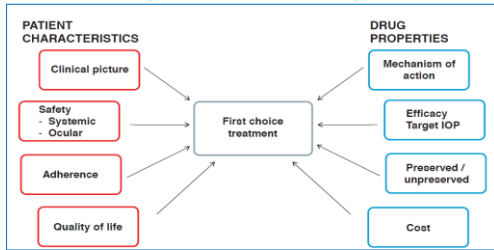
Phu J, Agar A, Wang H, Mawardi K, Kallanits M. Management of open-angle glaucoma by primary eye-care practitioners toward a personalized medicine approach. *Optom*. 2018 Aug; 89(8):44-50.

### Target IOP Treatment Principles



<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC6088854/figure/F1000fig1/>

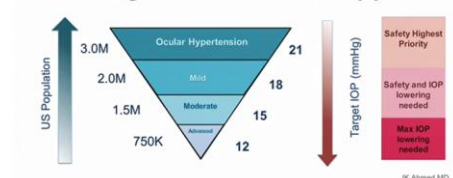
### Target IOP Treatment Principles



<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC6088854/figure/F1000fig1/>

### Target IOP Treatment Principles

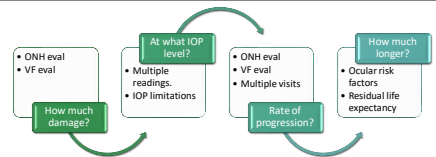
#### The Glaucoma Pyramid: Target IOP Guides Therapy



## Target IOP Treatment Principles

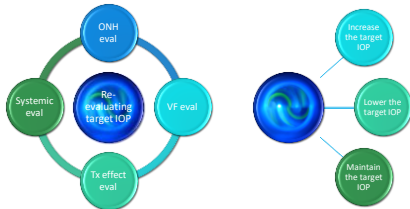


## Evaluating Target IOP



Jampel HJ. Target pressure in glaucoma therapy. J Glaucoma. 1997 Apr;6(2):133-8.  
Woods R, Brandt L, Garway-Heath D, et al. World Glaucoma Association Consensus Series 4 - Intraocular Pressure. Sugar Publications, The Hague, The Netherlands. 2007.  
Raza R, Angmo O, Ramakrishna S, Dada T. Simplifying "target" intraocular pressure for different stages of primary open-angle glaucoma and primary angle-closure glaucoma. Indian J Ophthalmol. 2018 Apr;66(4):505-509.

## Re-evaluating Target IOP



Jampel HJ. Target pressure in glaucoma therapy. J Glaucoma. 1997 Apr;6(2):133-8.  
Woods R, Brandt L, Garway-Heath D, et al. World Glaucoma Association Consensus Series 4 - Intraocular Pressure. Sugar Publications, The Hague, The Netherlands. 2007.  
Raza R, Angmo O, Ramakrishna S, Dada T. Simplifying "target" intraocular pressure for different stages of primary open-angle glaucoma and primary angle-closure glaucoma. Indian J Ophthalmol. 2018 Apr;66(4):505-509.



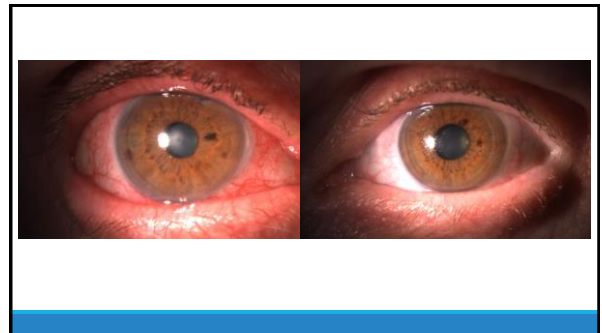
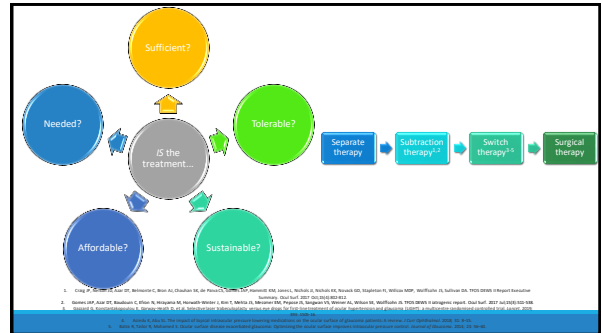
"In treated patients, failing to achieve target IOP was associated with more rapid VF worsening. Eyes with moderate glaucoma experienced the greatest VF worsening from failing to achieve target IOP."

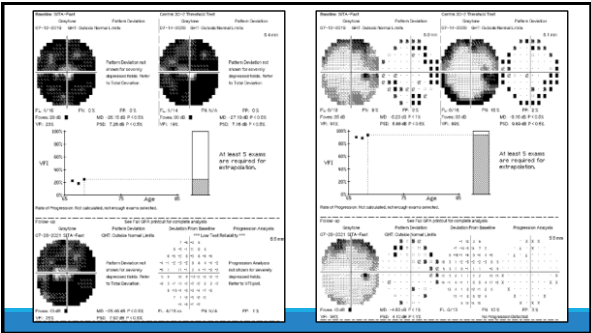
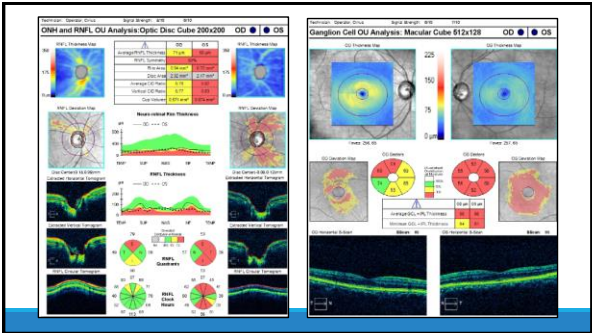
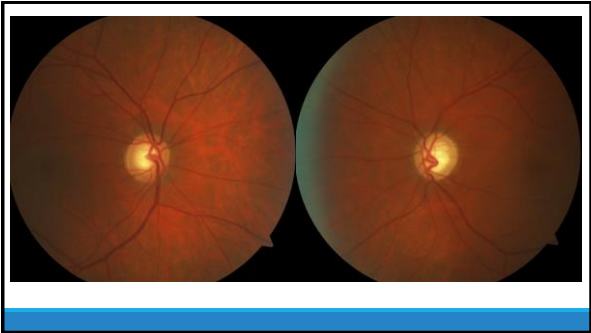
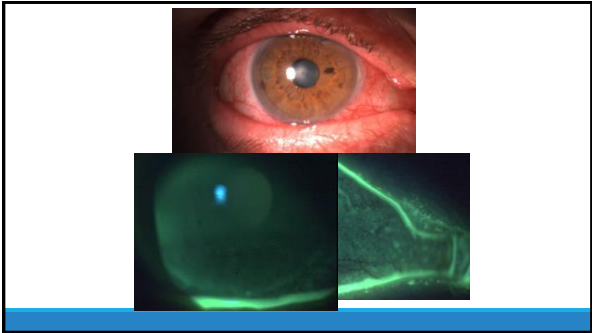
Villasana GA, Bradley C, Ramulu P, Unberath M, Yohannan J. The Effect of Achieving Target Intraocular Pressure on Visual Field Worsening. Ophthalmology. 2022 Jan;129(1):35-44

### Target IOP Treatment Principles

“In the end, it will be impossible to know if we overreacted or did too much, but it will be **QUITE** apparent if we under reacted or did too little.”

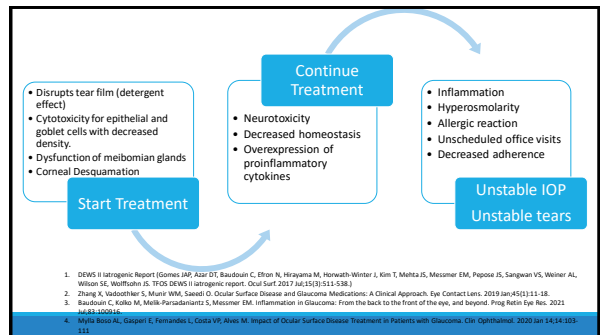
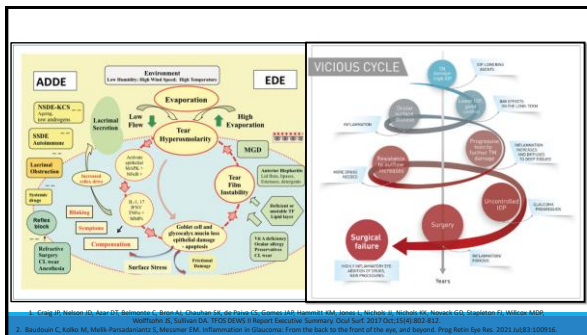
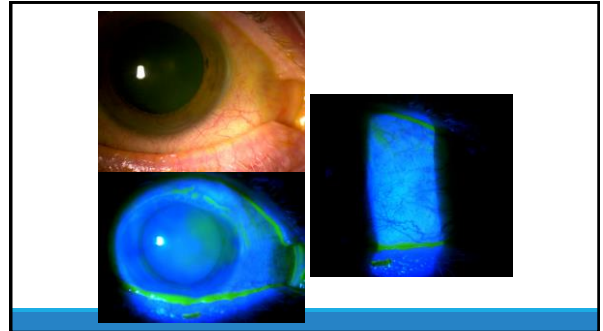
(Dr. Darrin M. Peppard  
March 20, 2020)

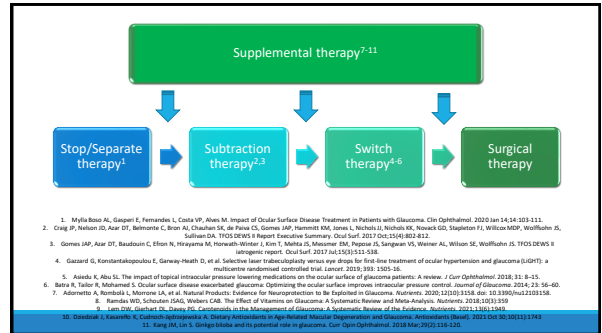
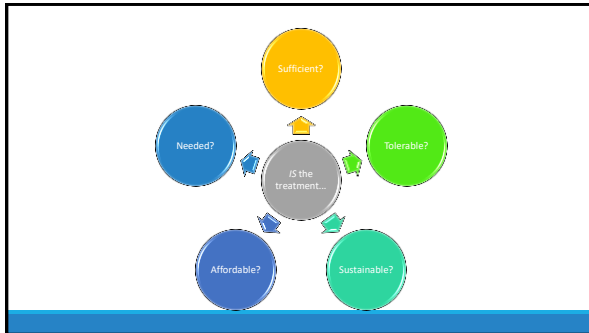




How would you treat the patient if it was...you?

MMT  
MTMT  
MIMT





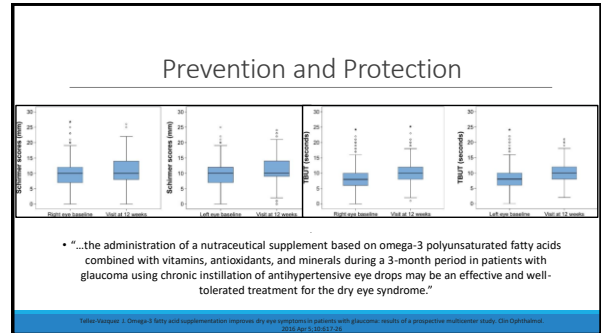
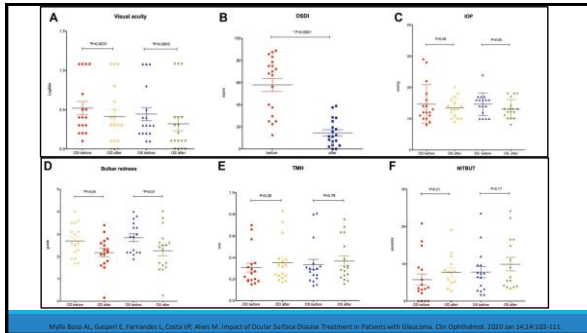
"Patients had a diagnosis of glaucoma for **9.82 ± 7.92 years** and had been on antiglaucoma topical medication since then. The mean number of IOP-lowering drugs used by the patients was **3.05 ± 0.91**, among which **2.58 ± 1.17** were BAK-preserved drops. The mean number of instilled drops was **5.21 ± 1.90** per day."

"All patients underwent a complete OSD treatment, consisting of **eyelid hygiene using a gel twice a day**, **fluorometholone acetate 0.1% one drop at night**, preservative-free lubricant every 2 hrs, oral free-acid supplementation (**omega 3 and flaxseed oil capsule 2g a day**) and oral tetracycline derivate (doxycycline hydrochloride 100 milligram per day, during 30 days). Anti-glaucoma treatment was not modified, and a second appointment was scheduled for the same evaluation 1 to 3 months after treatment."

Mylia Boso AL, Gasperi E, Fernandes L, Costa VP, Alves M. Impact of Ocular Surface Disease Treatment in Patients with Glaucoma. *Clin Ophthalmol*. 2020 Jan 14;14:103-111.

Parameter	Pre-treatment					Post-Treatment						
	Mean	Median	PD	Min	Max	Mean	Median	PD	Min	Max	Mean	P
BCVA OD (LogMAR)	0.52	0.40	0.35	1.08	0.10	0.41	0.30	0.37	1.08	0.00	(-0.13)	<b>0.0031</b>
BCVA OS (LogMAR)	0.44	0.30	0.35	1.08	0.10	0.32	0.15	0.38	1.08	0.00	(-0.12)	<b>0.0003</b>
OSDI	57.86	48.18	25.43	12.50	88.88	14.60	11.36	12.13	0.00	38.90	(-43.3)	<b>&lt;0.0001</b>
TMH OD	0.46	0.25	0.65	0.15	2.90	0.35	0.32	0.20	0.17	0.83	(-0.11)	0.2834
TMH OS	0.49	0.30	0.65	0.14	2.90	0.37	0.30	0.19	0.15	0.75	(-0.12)	0.7851
Schirmer OD	16.76	14.00	11.33	3.00	35.00	19.12	17.00	9.33	6.00	35.00	2.35	0.1228
Schirmer OS	17.82	20.00	10.11	2.00	35.00	17.53	14.00	10.43	4.00	35.00	(-0.29)	0.7505
NITBUT OD	5.74	3.44	4.20	0.00	20.84	7.69	7.75	4.84	0.00	19.12	1.87	0.2117
NITBUT OS	7.76	4.98	5.91	1.72	23.52	9.92	6.31	7.12	3.25	24.00	3.22	0.1742
FBUT OD	4.00	4.00	3.57	0.00	9.00	5.11	5.00	2.37	2.00	9.00	1.29	0.2894
FBUT OS	4.75	4.00	3.28	1.00	10.00	6.75	6.00	3.88	2.00	12.00	2.00	0.0797
Bulbar Redness OD	2.70	2.60	0.73	1.70	4.00	2.26	2.40	0.95	0.24	4.00	(-0.45)	<b>0.0414</b>
Bulbar Redness OS	2.94	2.50	0.70	1.90	4.00	2.10	2.25	0.76	0.15	3.40	(-0.64)	<b>0.0196</b>
Fluorescein OD	6.29	6.00	4.41	1.00	15.00	2.59	1.00	3.57	0.00	15.00	(-3.71)	<b>&lt;0.0001</b>
Fluorescein OS	5.65	5.00	4.09	0.00	14.00	1.88	1.00	2.26	0.00	7.00	(-3.76)	<b>&lt;0.0001</b>
Lissamine OD	1.35	1.00	0.86	0.00	3.00	0.94	1.00	0.65	0.00	2.00	0.13	0.131
Lissamine OS	1.37	1.00	0.95	1.00	3.00	0.88	1.00	0.99	0.00	3.00	0.10	0.101
IOP OD	14.65	12.00	6.23	8.00	29.00	13.44	13.00	3.16	9.00	20.00	(-1.38)	0.9471
IOP OS	14.65	16.00	3.60	10.00	24.00	13.06	13.00	3.07	8.00	18.00	(-1.39)	0.0510

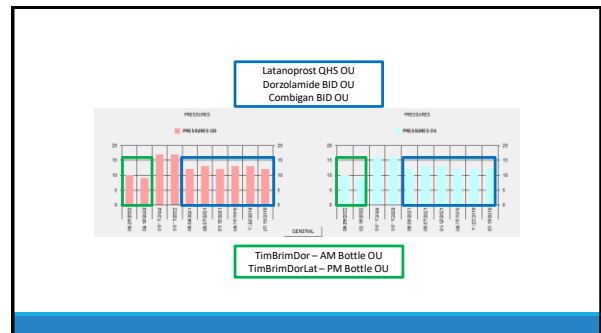
Mylia Boso AL, Gasperi E, Fernandes L, Costa VP, Alves M. Impact of Ocular Surface Disease Treatment in Patients with Glaucoma. *Clin Ophthalmol*. 2020 Jan 14;14:103-111.



## Less IS More

Less is:

- More understanding
  - Less confusion...drop sheets?
- More adherence
- More disease control
- More comfort
  - Decreased side effects
  - Decreased office visits
- More quality of life
- More ocular surface health
  - Decreased ocular surface disease





“The goal of glaucoma treatment is the preservation of vision *and* vision-related quality of life throughout the patient’s lifetime.”

Corbido Consultation in Glaucoma 4th Clinical Questions Data ©, Hsu, Richard A, Lewis, Steve J, Goshin, 2008, SLACK Incorporated, Thorofers, New Jersey, PA.

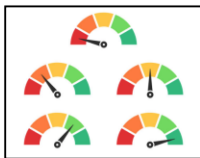
## Patient Adherence

EDUCATION AND ADHERENCE

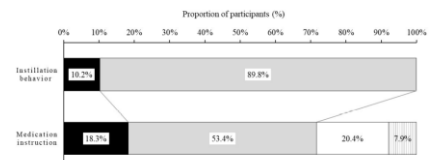
Copyright © 2014 Wolters Kluwer | The Official e-Learning Site

### Treatment Goals – Adherence

DRY EYES



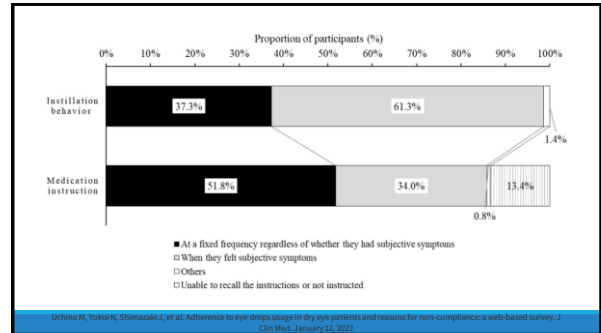
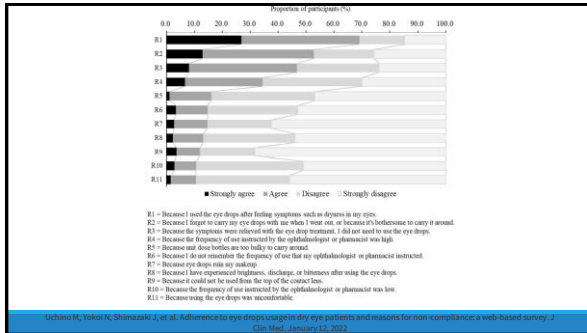
GLAUCOMA



- The frequency specified in the package insert
- The frequency other than specified in the package insert
- The frequency of any eye drop usage varies
- Unable to recall the instructions or not instructed

Uchino M, Yokoi N, Shimazaki J, et al. Adherence to eye drops usage in dry eye patients and reasons for non-compliance: a web-based survey. J Clin Med. January 12, 2022





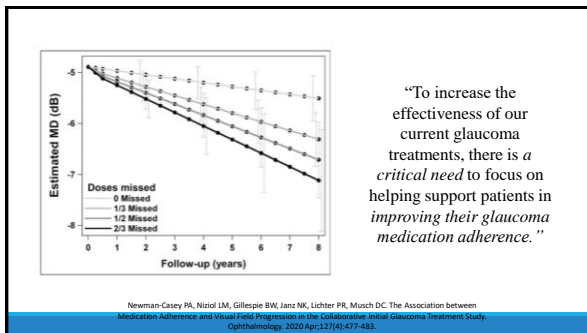
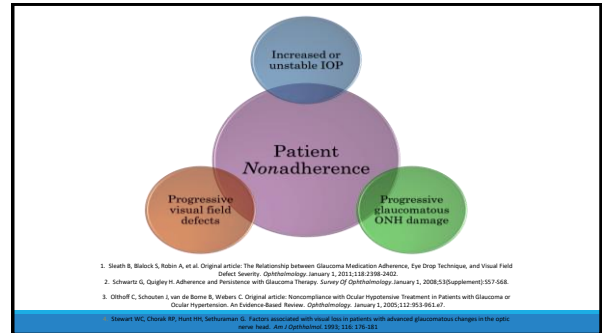
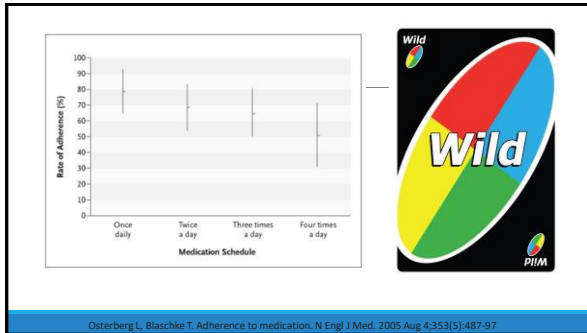
“We showed that most participants with DED did not instill the DED eye drops at the specified frequency...”

Uchino M, Yokoi N, Shimazaki J, et al. Adherence to eye drops usage in dry eye patients and reasons for non-compliance: a web-based survey. *J Clin Med*. January 12, 2022.

“Patient adherence is the wild card in the deck for controlling glaucoma progression.”



Pargaret M, Dickerson J. The Role of Minimally Invasive Glaucoma Surgery Devices in the Management of Glaucoma. *Optometry and Vision Science: Official Publication of The American Academy of Optometry Journal*, online, February 2018;95(2):155-162.



“...increasing the effectiveness of adherence interventions may have a far greater impact on the health of the population than any improvement in specific medical treatments.”

Haynes RB, McDonald H, Garg AX MP. World Health Organization. [http://www.who.int/chp/knowledge/publications/adherence\\_full\\_report.pdf](http://www.who.int/chp/knowledge/publications/adherence_full_report.pdf)

“[Eye care providers]...do a poor job of detecting nonadherence in their patients.”

Budenz D. A Clinician's Guide to the Assessment and Management of Nonadherence in Glaucoma. *Ophthalmology* January 1, 2009;116:543-547.

“Physician *attitude* has been shown to play a large role in patient adherence...”

Budenz D. A Clinician's Guide to the Assessment and Management of Nonadherence in Glaucoma. *Ophthalmology* January 1, 2009;116:543-547.

“...addressing adherence issues involves changing physician behavior, which may result in changes in patient behavior.”

Budenz D. A Clinician's Guide to the Assessment and Management of Nonadherence in Glaucoma. *Ophthalmology* January 1, 2009;116:543-547.

I know it must be difficult to take all your medications regularly. How often do you miss taking them?<sup>23</sup>  
Of the medications prescribed to you, which ones are you taking?  
Of the medications you listed, which ones are you taking?  
Have you had to stop any of your medications for any reason?  
How often do you not take medication X? (address each medication individually)  
When was the last time you took medication X? (address each medication individually)  
Have you noticed any adverse effects from your medications?

Brown MT, Bussell JK. Medication adherence: WHO cares? *Mayo Clin Proc*. 2011;86(4):304-314. doi:10.4065/mcp.2010.0575.

“Managing glaucoma...is influenced by a person’s *perceived susceptibility* to the disease, the *perceived severity* of the disease, the *perceived benefits to treatment* and the *perceived barriers* to the recommended behavior change.”

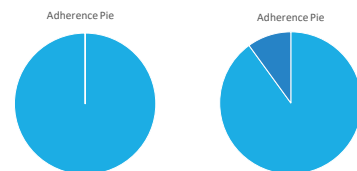
Newman-Cassay PA, Shtein RM, Coleman AL, Herndon L, Lee PP. Why Patients With Glaucoma Lose Vision: The Patient Perspective. / *Glaucoma*. 2015;20(7):4668-4675.

“For a glaucoma patient, this would mean that *the person would only take their medication and return for their follow-up appointments* if they believed that glaucoma would cause undesirable vision loss, the treatments offered by their doctor could mitigate this effect, and the barriers to following their physician’s recommendation were not so difficult to overcome that they outweighed the perceived benefit of treatment.”

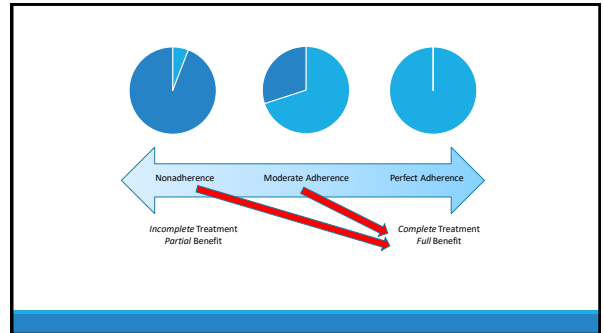
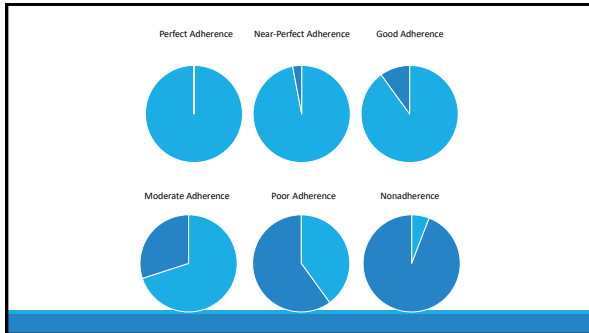
Newman-Cassay PA, Shtein RM, Coleman AL, Herndon L, Lee PP. Why Patients With Glaucoma Lose Vision: The Patient Perspective. / *Glaucoma*. 2015;20(7):4668-4675.

“Ultimately,... nonadherent patients...fail to achieve the intended or full effect of the treatment.”

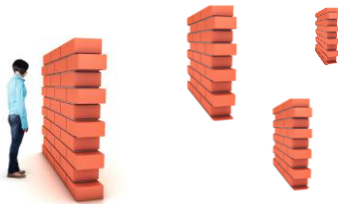
Budenz D. A Clinician's Guide to the Assessment and Management of Nonadherence in Glaucoma. *Ophthalmology* January 1, 2009;116:543-547.



Full Adherence = Complete Treatment = Full Benefit  
Partial Adherence = Incomplete Treatment = Partial Benefit



### What are some barriers to adherence?



### What are some barriers to adherence?

#### Provider Factors

- Dissatisfaction: "I quit taking my drops because I was dissatisfied with my doctor's care."
- Communication: "I stopped taking my drops because I didn't understand initially that I need to take them forever."



Tan K, McClure CA, Ramos SE, Schmitt DG, Pichard JW. Compliance barriers in glaucoma: a systematic classification. J Glaucoma. 2003;12(5):353-356.

## What are some barriers to adherence?

### Situational/environmental Factors

- Major life events: "Two years ago when my wife died I had a hard time taking my drops."
- Travel/away from home: "When I am on vacation it is more difficult to take my drops."
- Competing Activities: "I miss my drops on Sunday mornings when I go to church."



Tsai JC, McClure CA, Ramo SE, Schmitt DS, Pichert JW. Compliance barriers in glaucoma: a systematic classification. *J Glaucoma*. 2008;17(15):193-198.

## What are some barriers to adherence?

"Major reasons cited for non-adherence include:

medication side effects (both local and systemic),  
the inability to notice a visual benefit from the medications (at least short term),  
and difficulty in administering the medication."



Boland MV, Chang DS, Frazier T, et al. Automated telecommunication-based reminders and adherence with once-daily glaucoma medication dosing: the automated dosing reminder study. *JAMA Ophthalmol*. 2014;132:849-855.

## What are some barriers to adherence?

Newman-Casey et al. • Barriers to Glaucoma Medication Adherence  
Table 1. Barriers to Glaucoma Medication Adherence

Barriers to Glaucoma Medication Adherence	Literature Sources
Beliefs about glaucoma, skepticism that glaucoma will cause vision loss	Freidman et al (2009), <sup>12</sup> Lacey et al (2009), <sup>13</sup> Tsai et al (2003), <sup>14</sup> Sheth (2010) <sup>20</sup>
Beliefs about glaucoma medications, skepticism that glaucoma medications will improve vision loss	Freidman et al (2009), <sup>12</sup> Lacey et al (2009), <sup>13</sup> Sheth et al (2010), <sup>21</sup> Sheth et al (2012), <sup>22</sup> Sheth et al (2013) <sup>23</sup>
Poor self-efficacy	Freidman et al (2009), <sup>12</sup> Lacey et al (2009), <sup>13</sup> Sheth et al (2010), <sup>21</sup> Sheth et al (2012), <sup>22</sup> Sheth et al (2013) <sup>23</sup>
Poor knowledge about glaucoma	Freidman et al (2009), <sup>12</sup> Lacey et al (2009), <sup>13</sup> Sheth et al (2010), <sup>21</sup> Sheth et al (2012), <sup>22</sup> Sheth et al (2013) <sup>23</sup>
Manner of physician	Freidman et al (2009), <sup>12</sup> Lacey et al (2009), <sup>13</sup> Sheth et al (2010), <sup>21</sup> Sheth et al (2012), <sup>22</sup> Sheth et al (2013) <sup>23</sup>
Difficulties with eye drop administration	Freidman et al (2009), <sup>12</sup> Lacey et al (2009), <sup>13</sup> Sheth et al (2010), <sup>21</sup> Sheth et al (2012), <sup>22</sup> Sheth et al (2013) <sup>23</sup>
Medication cost	Freidman et al (2009), <sup>12</sup> Lacey et al (2009), <sup>13</sup> Sheth et al (2010), <sup>21</sup> Sheth et al (2012), <sup>22</sup> Sheth et al (2013) <sup>23</sup>
Medication-induced side effects	Freidman et al (2009), <sup>12</sup> Lacey et al (2009), <sup>13</sup> Sheth et al (2010), <sup>21</sup> Sheth et al (2012), <sup>22</sup> Sheth et al (2013) <sup>23</sup>
Forgetfulness	Freidman et al (2009), <sup>12</sup> Lacey et al (2009), <sup>13</sup> Sheth et al (2010), <sup>21</sup> Sheth et al (2012), <sup>22</sup> Sheth et al (2013) <sup>23</sup>
Difficulties with the medication schedule	Freidman et al (2009), <sup>12</sup> Lacey et al (2009), <sup>13</sup> Sheth et al (2010), <sup>21</sup> Sheth et al (2012), <sup>22</sup> Sheth et al (2013) <sup>23</sup>
Life stress	Hall (2014), <sup>24</sup> Kessler (2014), <sup>25</sup> Cohen et al (1991) <sup>26</sup>



Newman-Casey P, Rubin A, Lee P, et al. Original article: The Most Common Barriers to Glaucoma Medication Adherence: A Cross-Sectional Survey. *Ophthalmology*. July 1, 2013;121:1548-1556.

## What are some barriers to adherence?

Newman-Casey et al. • Barriers to Glaucoma Medication Adherence  
Table 3. Barriers to Medication Adherence

Barrier <sup>a</sup>	Univariate Analysis, Odds Ratio (95% Confidence Interval)	P Value	Bivariate Analysis, Odds Ratio (95% Confidence Interval)	P Value
Difficulties with drop administration	2.1 (1.2-4.1)	.004	2.5 (1.4-4.6)	.001
Poor self-efficacy	4.7 (2.1-9.7)	<.0001	4.7 (2.1-9.7)	<.0001
Poor knowledge	1.5 (0.7-2.9)	.03	1.4 (0.7-2.8)	.04
Beliefs about glaucoma <sup>b</sup>	1.0 (0.5-1.9)	.09	1.1 (0.5-2.3)	.09
Beliefs about medication <sup>c</sup>	1.0 (0.5-1.9)	.09	1.0 (0.5-1.9)	.09
Life stress	2.1 (1.0-4.4)	.037	1.9 (0.9-3.9)	.01
Forgetfulness	1.5 (0.8-1.4)	<.0001	1.7 (1.0-2.9)	<.0001
Side effects	2.1 (1.0-4.1)	.004	1.9 (0.9-4.0)	.09
Cost	1.0 (0.5-1.9)	.03	1.0 (0.5-1.9)	.02
Difficulties with the medication schedule	2.1 (1.4-3.2)	.0009	2.0 (1.4-2.7)	<.0001
Manner of physician	1.0 (0.5-1.9)	.09	1.0 (0.5-1.9)	.02
No. of barriers	1.1 (1.0-1.2)	.0007	1.1 (1.0-1.2)	.001

<sup>a</sup>Controlled with subjects who did not report each issue as an important barrier.

<sup>b</sup>Adjusted for self.

<sup>c</sup>Adjusted for self.

<sup>d</sup>Adjusted for self.

<sup>e</sup>Adjusted for self.

<sup>f</sup>Adjusted for self.

<sup>g</sup>Adjusted for self.

<sup>h</sup>Adjusted for self.

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<sup>cp</sup>Adjusted for self.

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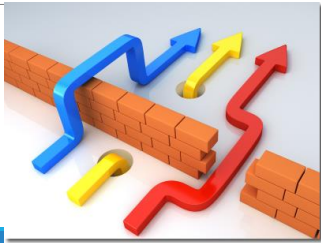
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## What can we do to overcome barriers to adherence?



## What can we do to overcome barriers to adherence?

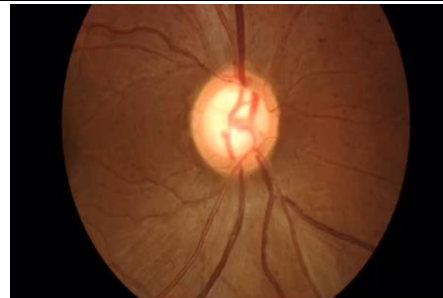
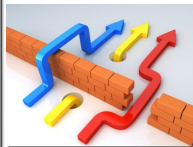
**Table 3. Strategies for Improving Adherence to a Medication Regimen.\***

<p><b>Identify poor adherence</b></p> <ul style="list-style-type: none"> <li>Look for markers of nonadherence: missed appointments, "forgetfulness", lack of response to medication, missed refills.</li> <li>Ask about barriers to adherence without being confrontational.</li> </ul> <p><b>Emphasize the value of the regimen and the effect of adherence</b></p> <ul style="list-style-type: none"> <li>Elicit patient's feelings about his or her ability to follow the regimen, and if necessary, design supports to promote adherence.</li> </ul> <p><b>Provide simple, clear instructions and simplify the regimen as much as possible</b></p> <ul style="list-style-type: none"> <li>Encourage the use of a medication-taking system.</li> <li>Listen to the patient, and customize the regimen in accordance with the patient's wishes.</li> <li>Obtain the help from family members, friends, and community services when needed.</li> <li>Reinforce desirable behavior and results when appropriate.</li> <li>Consider more "forgiving" medications when adherence appears unlikely. <ul style="list-style-type: none"> <li>Medications with long half-lives</li> <li>Orally disintegrating tablets</li> <li>Transdermal medications</li> </ul> </li> </ul>	
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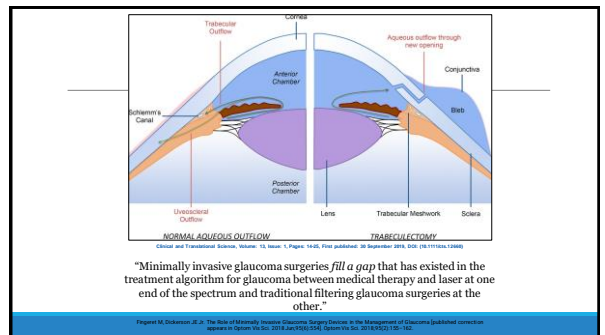
Osterberg L, Blaschke T. Adherence to medication. N Engl J Med. 2005 Aug 4;353(5):487-97.

**Table 1. Summary of Strategies to Address Adherence Issues**

<p><b>General</b></p> <ul style="list-style-type: none"> <li>Be proactive. Assume most patients are nonadherent.</li> <li>Use tailored, patient-centered approaches.</li> <li>Learn which interventions work best in your practice, with your style.</li> <li>Use a combination of methods.</li> </ul> <p><b>Specific</b></p> <ul style="list-style-type: none"> <li>Actively address at-risk patients. <ul style="list-style-type: none"> <li>Simplify and optimize treatment regimens when possible (dosing, frequency, side effects).</li> <li>Reduce drug costs when possible.</li> <li>Understand the patient's health beliefs about glaucoma.</li> </ul> </li> <li>Use patient education. <ul style="list-style-type: none"> <li>Reinforce regularly. <ul style="list-style-type: none"> <li>Use verbal and written delivery.</li> </ul> </li> <li>Adapt information to those with poor vision or low literacy.</li> <li>Make use of other staff.</li> <li>Review drug administration at each visit.</li> <li>Suggest that patients keep a medication diary, which will be part of the patient record.</li> <li>Use telephone or mail reminders when possible.</li> <li>Suggest the patient incorporate drops into daily activities.</li> <li>Involve a helpful caregiver/family member to assist with applying drops or reminding to take drops.</li> </ul> </li> <li>Be supportive. Use open communication. <ul style="list-style-type: none"> <li>Ask-tell-ask dialog.</li> <li>Motivational interviewing.</li> <li>Stages of readiness for change.</li> </ul> </li> <li>Be prepared to act in coach/patienthood.</li> </ul>	
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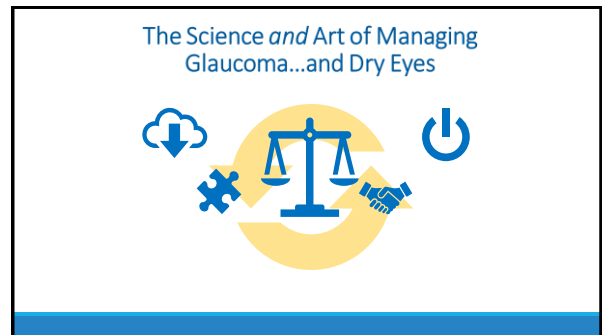
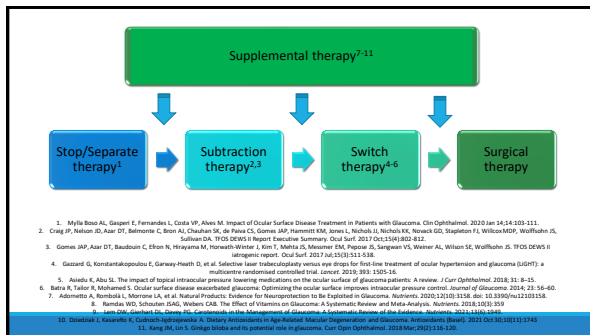
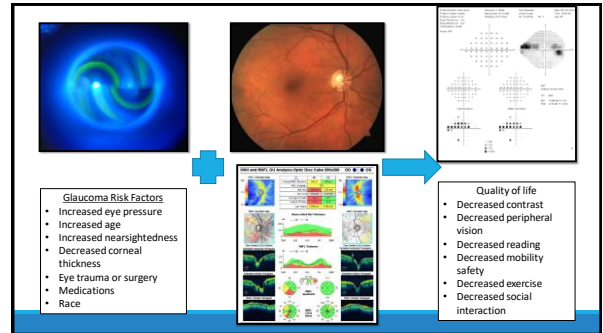
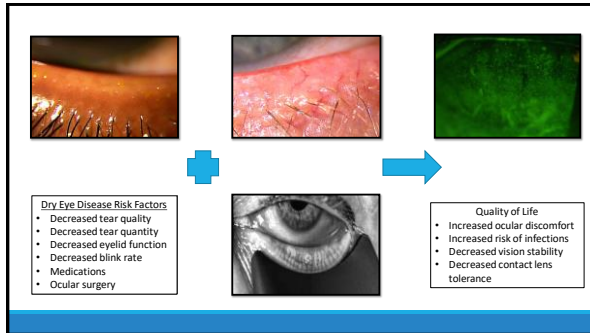


Robert D. Adelman's Guide to the Assessment and Management of Nonadherence in Glaucoma. Ophthalmology, January 5, 2016; 125(1):10-17.



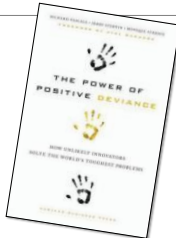






## Better providers...Better care

"Positive Deviance (PD) is based on the observation that in every community there are certain individuals or groups whose uncommon behaviors and strategies enable them to find better solutions to problems than their peers, while having access to the same resources and facing similar or worse challenges."



## Questions??

Email: [austin@carinforeyes.com](mailto:austin@carinforeyes.com)

Instagram: [qlaucomaqd](https://www.instagram.com/qlaucomaqd)

Website: [www.glaucomaqd.org](http://www.glaucomaqd.org)

