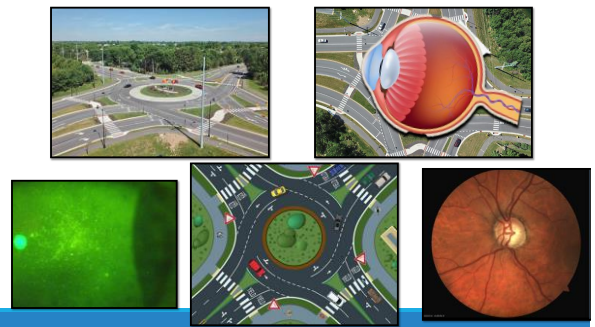


Glaucoma and Dry Eyes *"Frenemies" for Life*

OPTOMETRIC MANAGEMENT SYMPOSIUM 2022
 CENTER FOR SIGHT & DRY EYE INSTITUTE
 AUSTIN LIFFERTH OD, FAO
 DIPLOMATE, GLAUCOMA AAO
 NOVEMBER 4, 2022



Prevalence and Association

80 million people worldwide will have glaucoma this year.¹

Prevalence of DED in studies up to 75% in certain populations.²

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

Nearly 60% of patients on topical glaucoma therapy have DED.³



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, Velez-Rothberg S, Munn WM, Saeed JJ. Ocular Surface Disease and Glaucoma Medications: A Clinical Approach. *Eye & Contact Lens*. 2019; 45: 11-18.

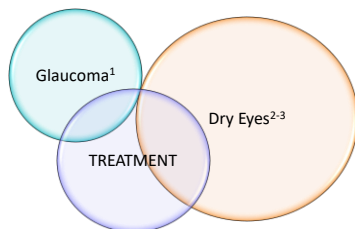
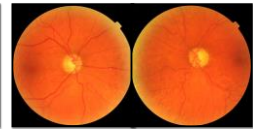
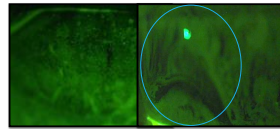
Prevalence and Association

DRY EYES

>30 Million in US

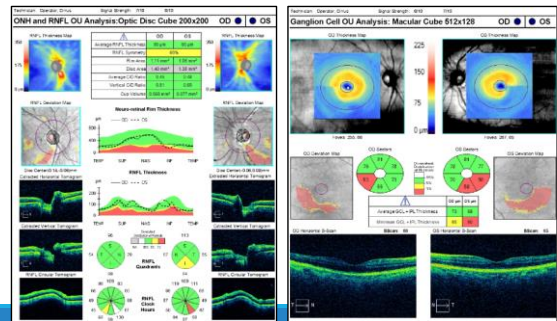
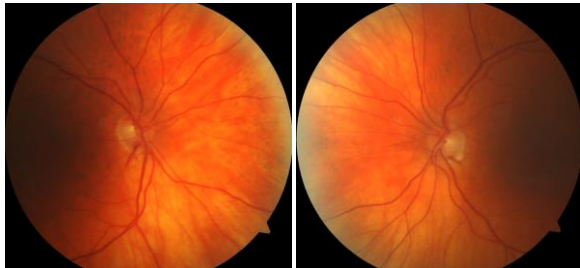
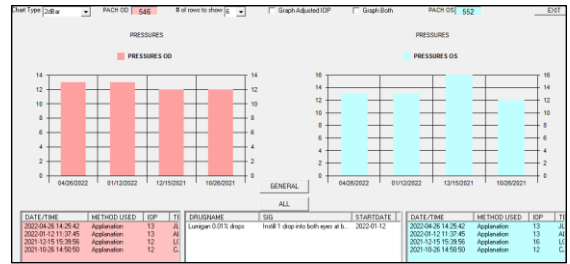
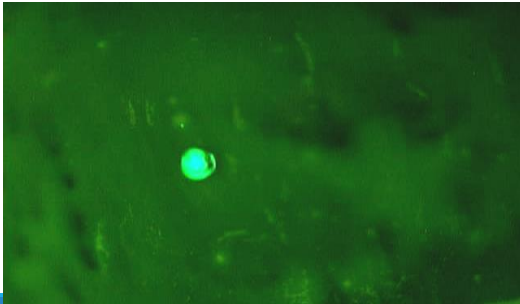
GLAUCOMA

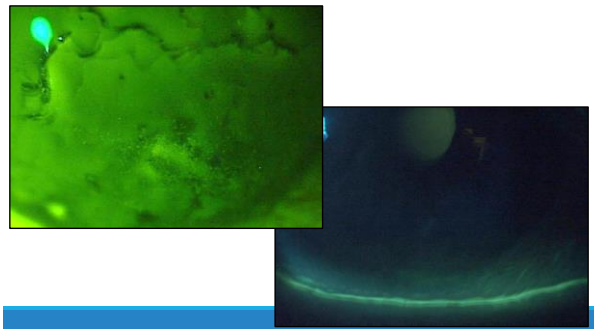
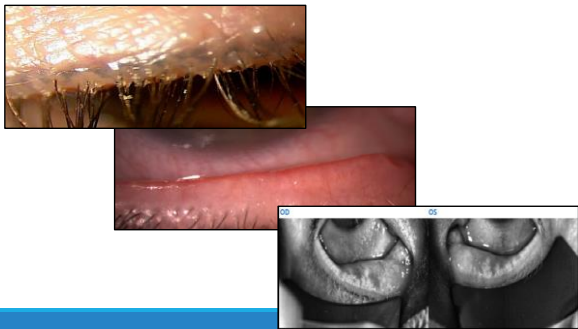
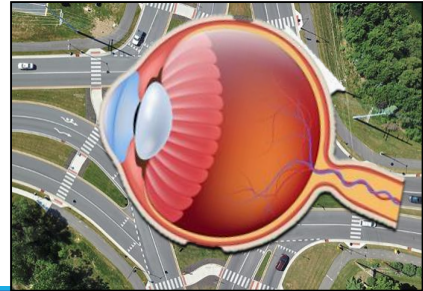
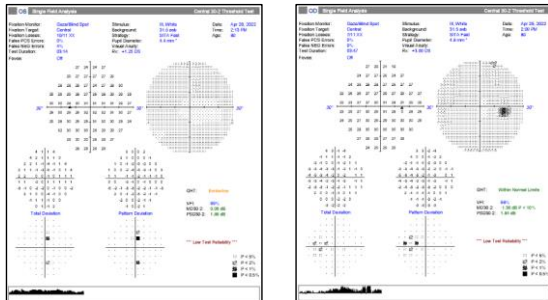
>3 Million in US

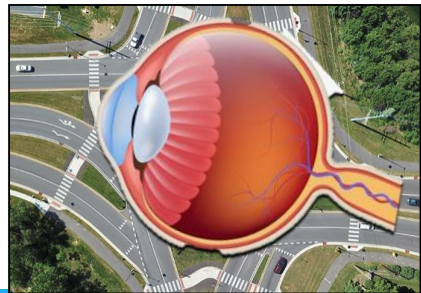
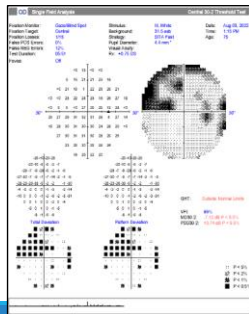
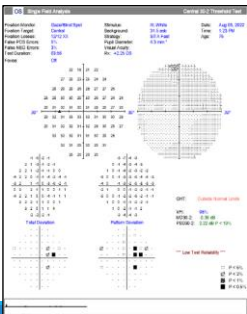
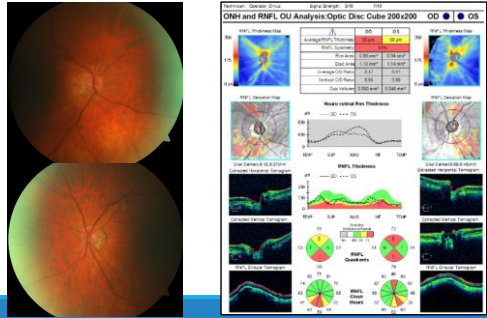
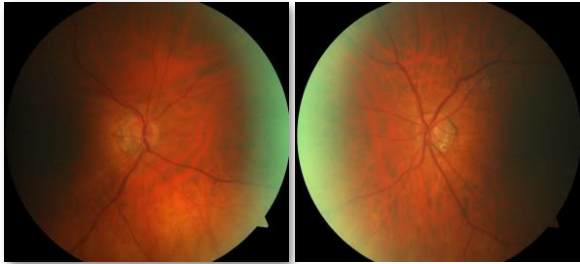


1. Quigley HA, Brannan AT. The number of people with glaucoma worldwide in 2010 and 2020. *Br J Ophthalmol*. 2006;90(3):262-267.
2. The epidemiology of dry eye disease: report of the Epidemiology Subcommittee of the International Dry Eye Workshop (2007). *Ocul Surf*. 2007; 5(2):93-107.
3. Gayton JL.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



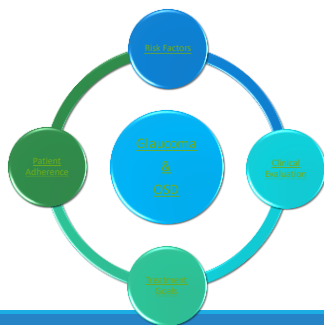
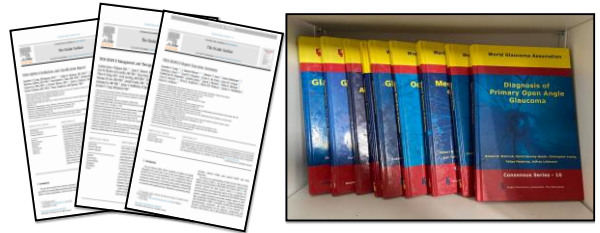






Glaucoma and Dry Eyes “Frenemies for Life”

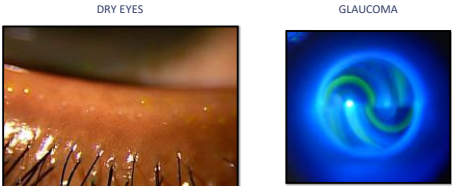
1. To increase awareness of both chronic, progressive, and unyielding conditions.
2. To increase awareness of the strong association between both chronic, progressive, and unyielding conditions.
 - They love to be together.
 - Inseparable and inevitable
3. To increase understanding of the similarities 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, and unyielding conditions when together.
 - They are worse when together.
 - It does not happen overnight.



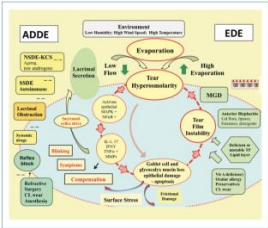
Risk Factors

MODIFIABLE AND NONMODIFIABLE

#1 Modifiable Risk Factor

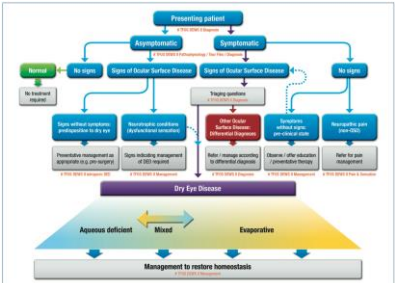


"The _____ cycle"

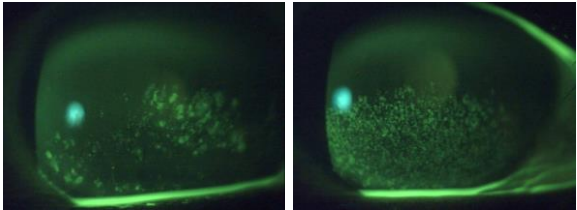


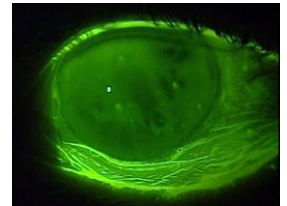
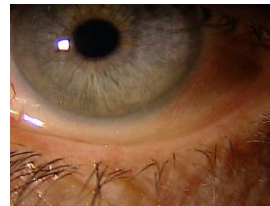
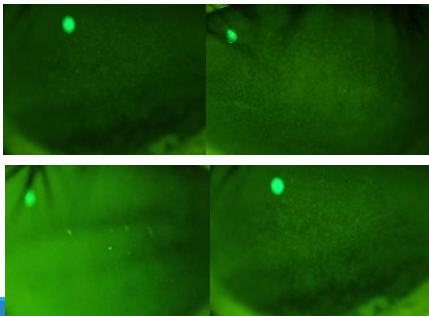
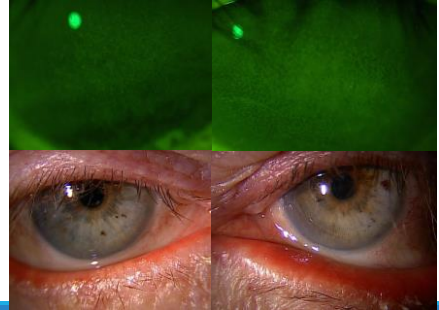
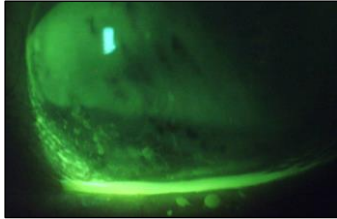
"Since tear osmolality is a function of tear evaporation in either ADDE or EDE, tear hyperosmolarity arises due to evaporation from the ocular surface and, in that sense, all forms of DED are evaporative. In other words, EDE is more accurately considered a hyper-evaporative state."

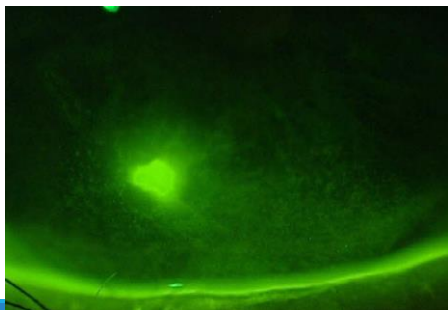
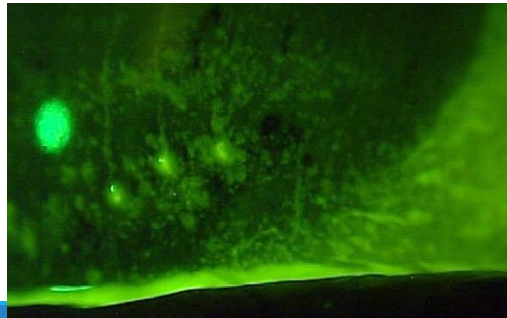
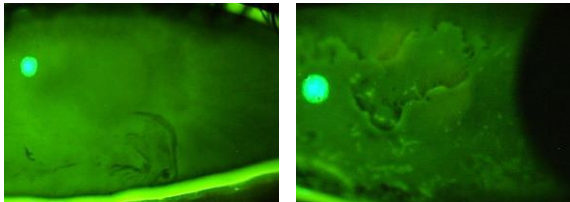
Craig JP, Nelson JD, Azar DT, Balmaine C, Bron AJ, Chauhan VA, de Paiva CS, Gomes JAP, Hammett KM, Jones L, Michalski JJ, Nichols JJ, Nichols KG, Sappington PL, Sullivan DA, Wolffsohn JS, Sullivan DA. TFOS DEWS II Report Executive Summary. Invest Ophthalmol Vis Sci. 2017;58(10):3200-3232.

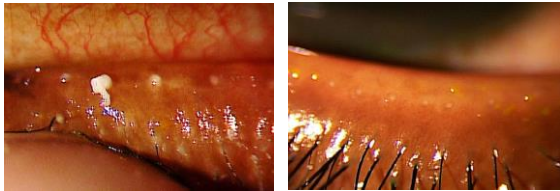


Craig JP, Nelson JD, Azar DT, Balmaine C, Bron AJ, Chauhan VA, de Paiva CS, Gomes JAP, Hammett KM, Jones L, Michalski JJ, Nichols JJ, Nichols KG, Sappington PL, Sullivan DA, Wolffsohn JS, Sullivan DA. TFOS DEWS II Report Executive Summary. Invest Ophthalmol Vis Sci. 2017;58(10):3200-3232.









Intraocular Pressure

IOP is the greatest modifiable risk factor in the development and progression of glaucoma^{1,2}.

Each mmHg of matters^{3,4}.

- Corneal biomechanical properties (central corneal thickness, corneal hysteresis) and applanation technique (decentration, thick/thin tear film, etc.) affect IOP measurement accuracy^{5,6}.

Thinner central corneal thickness and lower corneal hysteresis is associated with the development and progression of glaucoma⁷.

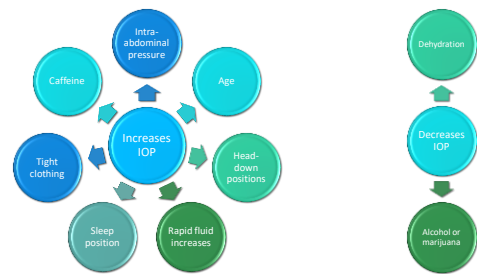
Advanced glaucoma at time of diagnosis is associated with poorer prognosis and greater risk of progression^{8,9}.

Poor adherence to prescribed topical medications is associated with visual field progression¹⁰.

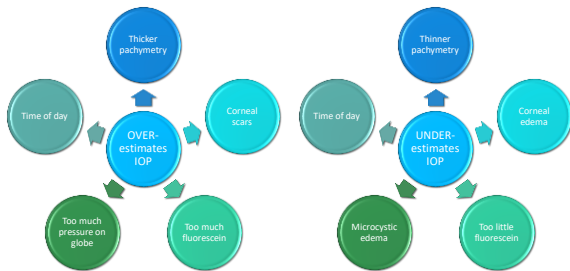
- Kane MA, Haer DK, Hylton-Duncan JJ, et al. The Ocular Hypertension Treatment Study: a randomized trial determines that topical ocular hypotensive medication delays or prevents the onset of primary open-angle glaucoma. *Arch Ophthalmol*. 2002;120(6):701-710.
- Hall A, Linder MC, Rungtavan R, et al. Reduction of intraocular pressure and glaucoma progression results from the Early Manifest Glaucoma Trial. *Arch Ophthalmol*. 2002;120(10):1208-1219.
- Mansueti MC, Gilgrip DW, Nield LM, Lachar PB, Yama R, CIGTS Study Group. Intraocular pressure control and long-term visual field loss in the Collaborative Initial Glaucoma Treatment Study. *Ophthalmology*. 2011;118(5):768-773.
- Mansueti MC, Gilgrip DW, Nield LM, Lachar PB, Yama R, CIGTS Study Group. Intraocular pressure control and long-term visual field loss in the Collaborative Initial Glaucoma Treatment Study. *Ophthalmology*. 2011;118(5):768-773.
- Stromer A, Tschich J, Katz J, et al. Relationship between intraocular pressure and primary open-angle glaucoma among white and black Americans. The Baltimore Eye Survey. *Arch Ophthalmol*. 1994;112(10):1581-1588.
- Stromer A, Tschich J, Katz J, et al. Relationship between intraocular pressure and primary open-angle glaucoma among white and black Americans. The Baltimore Eye Survey. *Arch Ophthalmol*. 1994;112(10):1581-1588.
- Stromer A, Tschich J, Katz J, et al. Relationship between intraocular pressure and primary open-angle glaucoma among white and black Americans. The Baltimore Eye Survey. *Arch Ophthalmol*. 1994;112(10):1581-1588.
- Stromer A, Tschich J, Katz J, et al. Relationship between intraocular pressure and primary open-angle glaucoma among white and black Americans. The Baltimore Eye Survey. *Arch Ophthalmol*. 1994;112(10):1581-1588.
- Stromer A, Tschich J, Katz J, et al. Relationship between intraocular pressure and primary open-angle glaucoma among white and black Americans. The Baltimore Eye Survey. *Arch Ophthalmol*. 1994;112(10):1581-1588.
- Stromer A, Tschich J, Katz J, et al. Relationship between intraocular pressure and primary open-angle glaucoma among white and black Americans. The Baltimore Eye Survey. *Arch Ophthalmol*. 1994;112(10):1581-1588.



- Kane MA, Haer DK, Hylton-Duncan JJ, et al. The Ocular Hypertension Treatment Study: a randomized trial determines that topical ocular hypotensive medication delays or prevents the onset of primary open-angle glaucoma. *Arch Ophthalmol*. 2002;120(6):701-710.
- Hall A, Linder MC, Rungtavan R, et al. Reduction of intraocular pressure and glaucoma progression results from the Early Manifest Glaucoma Trial. *Arch Ophthalmol*. 2002;120(10):1208-1219.
- Mansueti MC, Gilgrip DW, Nield LM, Lachar PB, Yama R, CIGTS Study Group. Intraocular pressure control and long-term visual field loss in the Collaborative Initial Glaucoma Treatment Study. *Ophthalmology*. 2011;118(5):768-773.
- Mansueti MC, Gilgrip DW, Nield LM, Lachar PB, Yama R, CIGTS Study Group. Intraocular pressure control and long-term visual field loss in the Collaborative Initial Glaucoma Treatment Study. *Ophthalmology*. 2011;118(5):768-773.
- Stromer A, Tschich J, Katz J, et al. Relationship between intraocular pressure and primary open-angle glaucoma among white and black Americans. The Baltimore Eye Survey. *Arch Ophthalmol*. 1994;112(10):1581-1588.
- Stromer A, Tschich J, Katz J, et al. Relationship between intraocular pressure and primary open-angle glaucoma among white and black Americans. The Baltimore Eye Survey. *Arch Ophthalmol*. 1994;112(10):1581-1588.
- Stromer A, Tschich J, Katz J, et al. Relationship between intraocular pressure and primary open-angle glaucoma among white and black Americans. The Baltimore Eye Survey. *Arch Ophthalmol*. 1994;112(10):1581-1588.
- Stromer A, Tschich J, Katz J, et al. Relationship between intraocular pressure and primary open-angle glaucoma among white and black Americans. The Baltimore Eye Survey. *Arch Ophthalmol*. 1994;112(10):1581-1588.
- Stromer A, Tschich J, Katz J, et al. Relationship between intraocular pressure and primary open-angle glaucoma among white and black Americans. The Baltimore Eye Survey. *Arch Ophthalmol*. 1994;112(10):1581-1588.
- Stromer A, Tschich J, Katz J, et al. Relationship between intraocular pressure and primary open-angle glaucoma among white and black Americans. The Baltimore Eye Survey. *Arch Ophthalmol*. 1994;112(10):1581-1588.



Weinreb R.N., Brandt J.D., Garway-Heath D., et al. World Glaucoma Association Consensus Series 4 – Intraocular Pressure. Kugler Publications, The Hague, The Netherlands. 2007



Weinreb R.N., Brandt J.D., Garway-Heath D., et al. World Glaucoma Association Consensus Series 4 – Intraocular Pressure. Kugler Publications, The Hague, The Netherlands. 2007

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.”¹

“Kill the magic number”²

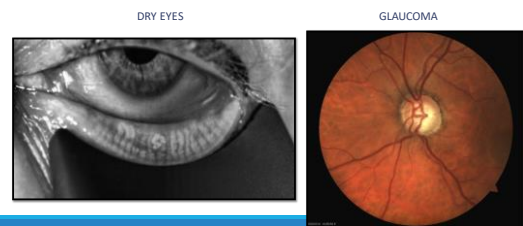
- IOP is not glaucoma.
- How would you monitor for glaucoma if we did not measure IOP?

1. Zeki MP, Khawaja AB, Brumby NC, Ng A, Lohani R, Haddad L, Patel C, Khoo PC, Foulds W. Risk factors for progression in diagnosed primary open-angle glaucoma: the EPIC Norfolk Eye Study Br J Ophthalmol. 2021 Jun 25;105(6):640-647. doi: 10.1093/bjio/abaa200. Epub 2020 Jun 25. 2. Quigley HA. 21st century glaucoma care. Eye (Lond). 2018 Feb;32(2):254-260.

Clinical Evaluation

PREFERENTIAL STRUCTURAL LOSS AND RED FLAGS

Preferential Loss

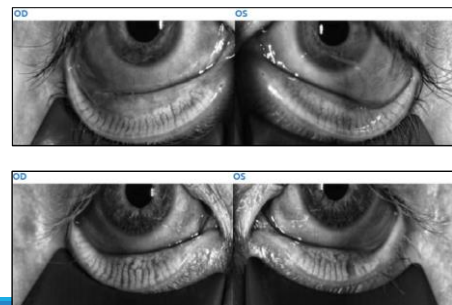
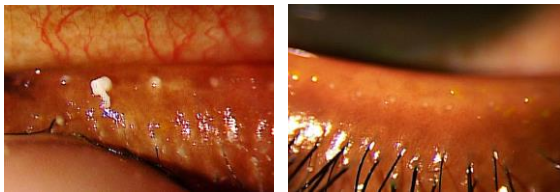


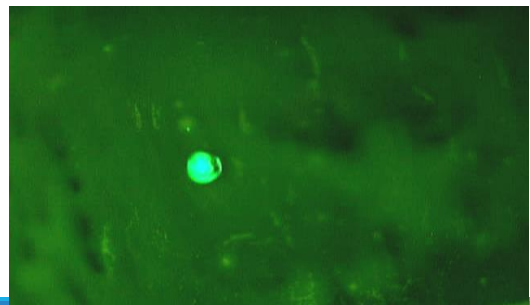
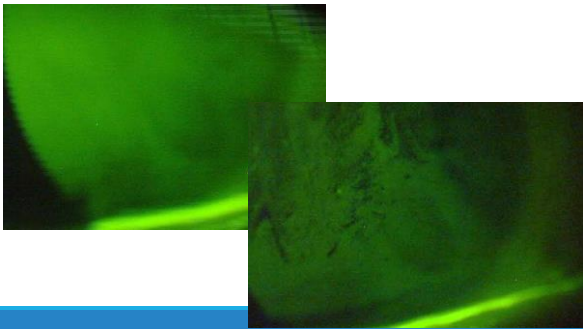
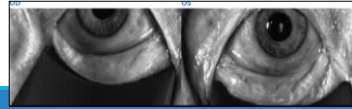
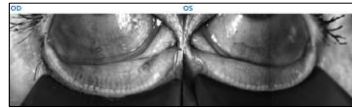
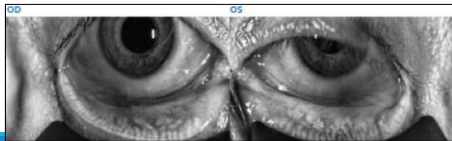
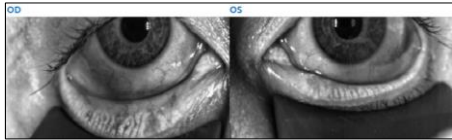
QUESTIONS TO CONSIDER...

- 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





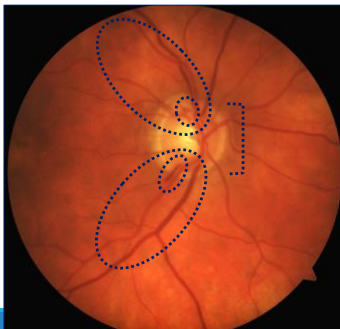
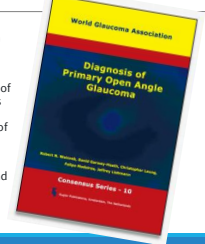


Preferential Loss

"Clinical diagnosis of glaucoma is predicated on the detection of a thinned retinal nerve fiber layer (RNFL) and narrowed neuroretinal rim.

These features often are accompanied by deformation of the optic nerve head (ONH) (cupping). These features often appear first in the supero- or inferotemporal quadrants. Although these features are characteristic of POAG, it is important to exclude non-glaucomatous optic neuropathies.

Detecting progressive glaucomatous RNFL thinning and neuroretinal rim narrowing are the best currently available gold standards for glaucoma diagnosis."



Red Flags

DRY EYES

GLAUCOMA



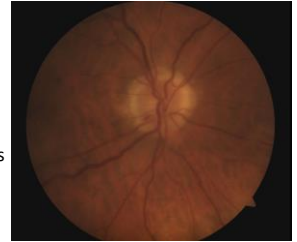
"...its presence should be an unfavorable prognostic event."¹



Shenoy S, Fierman M, Kaur S, Kaur M. The importance of disc hemorrhage in the prognosis of chronic open angle glaucoma. Archives (J OpticNeurology) 2019; 4: 1945
January 2019; 4(1): 194-198

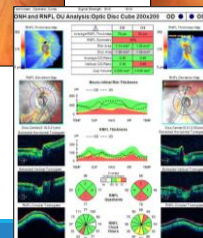
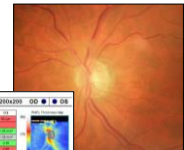
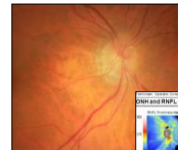
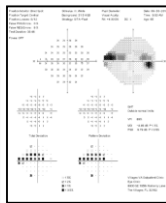
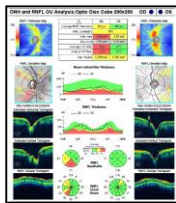
Increased risk of disc hemorrhages was comparable to...

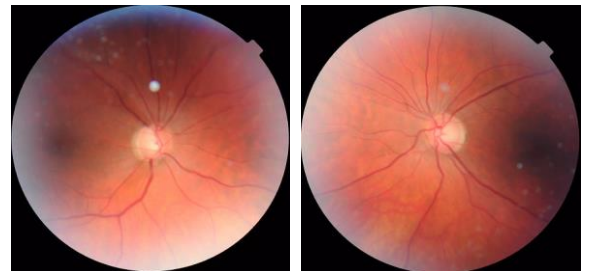
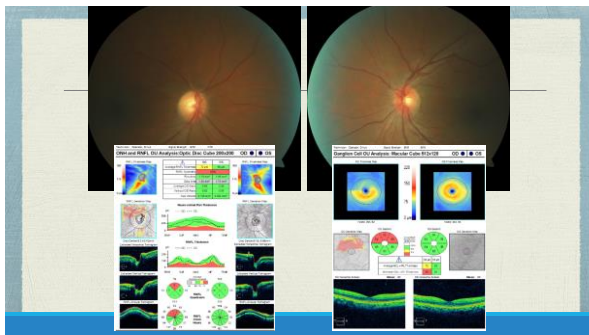
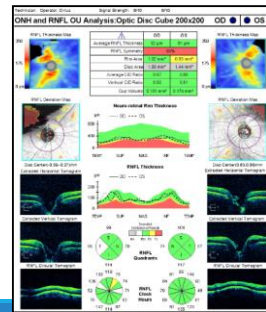
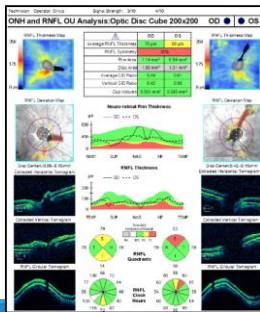
- Increasing age by 10.5 years
- Increasing IOP by 11.4 mm Hg
- Decreasing CCT by 23.1 microns
- Worsening PSD by 1.3-dB
- Increasing vertical CDR by 0.1 unit.

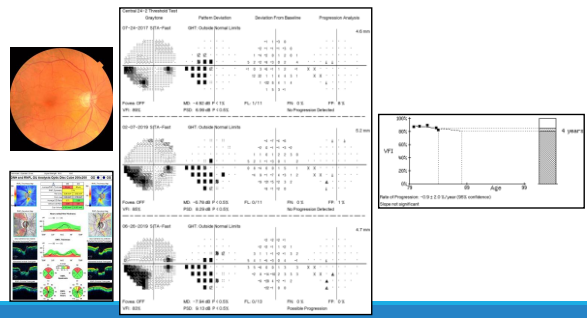
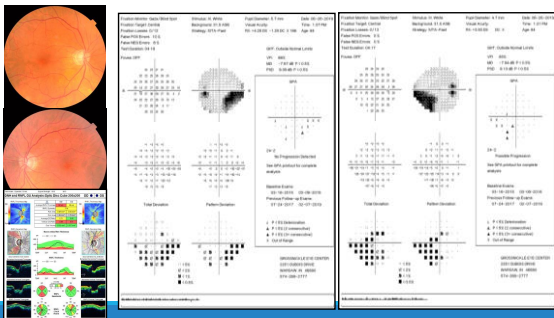
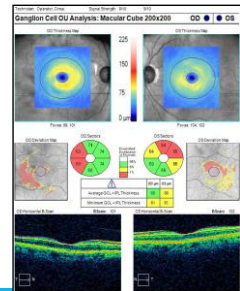
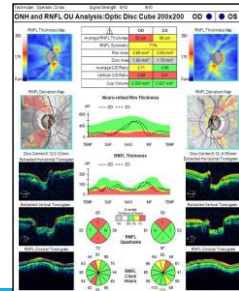
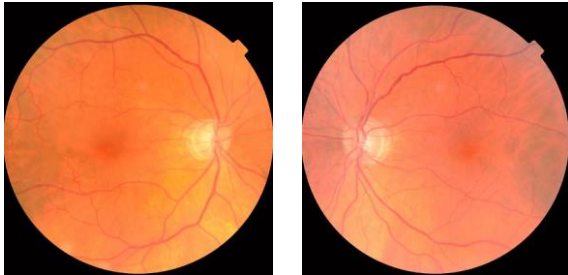


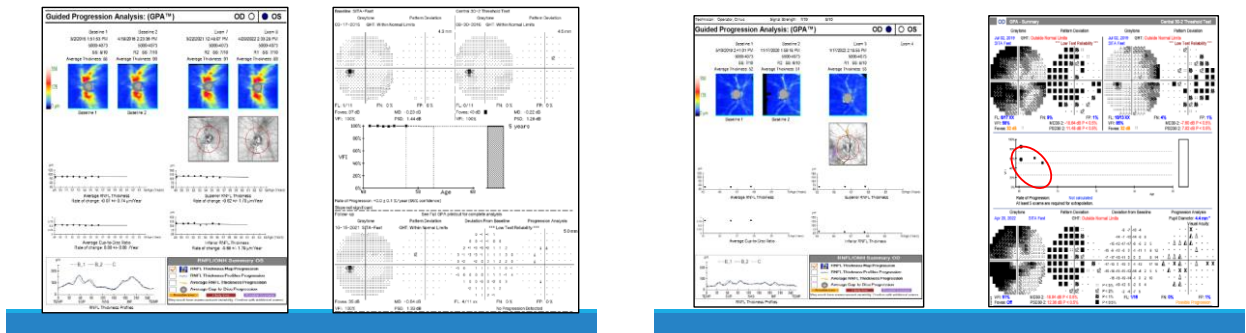
De Araoz C, et al. Rate of visual field progression in eyes with early disc hemorrhages in the ocular hypertension treatment study. Arch Ophthalmol 2012; 130: 150-156

Preferential Loss - Structural and Functional Correlation -



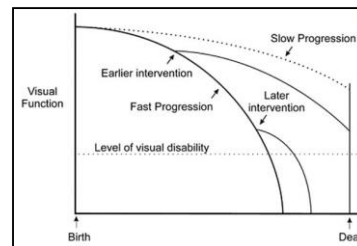
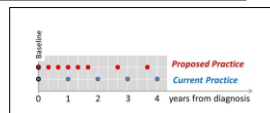






“Perform sufficient examinations to detect change.”

- “A good baseline of reliable VFs is essential to be able to monitor for progression.”
- “Decisions on progression should not be made by comparing only the most recent field with the one before.”
- “Suspected progression should be confirmed by repeating the field.”¹



“Clinicians should aim to measure the rate of VF progression.”

1. R.N. Weinreb, D. G.-H. (2011). *Progression of Glaucoma - World Glaucoma Association 8th Consensus Meeting*. Paris: Karger Publications.
Boudreau T, Crabb DP. More frequent, more costly? Health economic modelling aspects of monitoring glaucoma patients in England. *BMC Health Serv Res*. 2016;16(1):611.
See also: Chatham BC, Gierke-Hughes CP, Clark P, Rosenblatt D, Vignatelli M, Hsu A. Practical recommendations for measuring rates of visual field change in glaucoma. *WJ Optom*. 2008 Apr;2(2):163-73.

R.N. Weinreb, D. G.-H. (2011). *Progression of Glaucoma - World Glaucoma Association 8th Consensus Meeting*. Paris: Karger Publications.
Caplan J. The importance of rates in glaucoma. *Am J Ophthalmol*. Feb 2008;145(2):191-192.

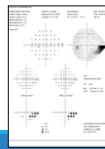
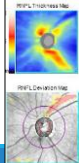
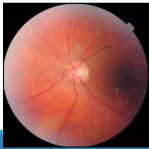
Visual Field Progression - WHERE do we see it? -

Regional preferential rim loss depending on stage of disease:

- Early: Look carefully in I.T. and S.T. disc regions
- Moderate: Temporal horizontal disc region
- Advanced: Inferior nasal, then superior nasal rim loss

The sequence of disc sector rim loss *correlates* with the progression of the VF defects:

- Early VF loss: Nasal upper or lower quadrant
- Moderate VF loss: Connecting arcuate
- Advanced: Island of sensitivity in the inferior-temporal VF



Visual Field Progression - HOW can we detect it? -



LOOK for:

- Deepening of current defects (PSD)
- Enlargement of current defects (MD)
- NEW defects

"Visual field progression may be analyzed by either 'event-' or 'trend'-based methods"

- "In general, event-based methods are used early in the follow-up, when few VFs are available for serial analysis.
- "In general, rate-based analyses are used later in the follow-up, when a greater number of VFs is available over a sufficient period of time to measure the rate of progression."

R.N. Wormald, B.Sc.M. (2011). Progression of Glaucoma – World Glaucoma Association 8th Congress Meeting, Paris: Taylor Publications.

Treatment Goals

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

Treatment Goals

DRY EYES

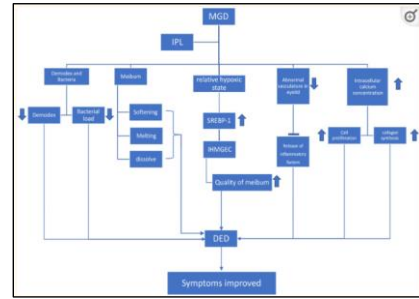
Improve Quality of Life
Increase Homeostasis



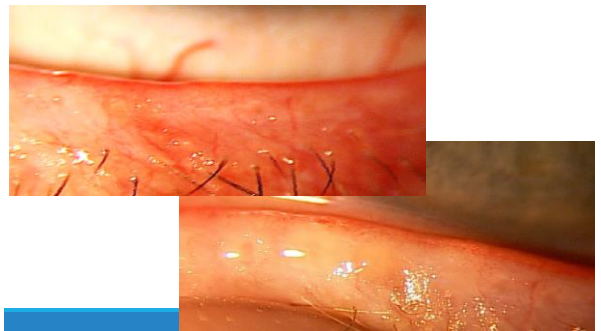
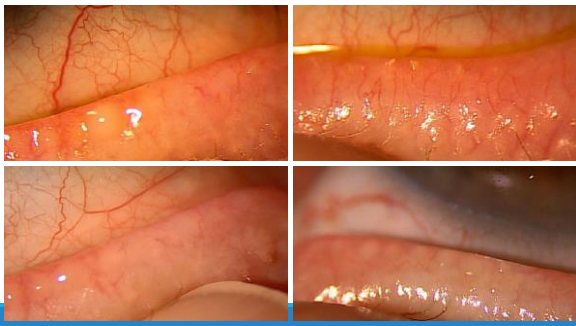
GLAUCOMA

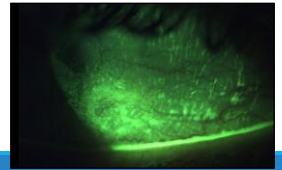
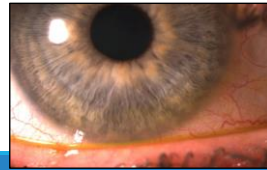
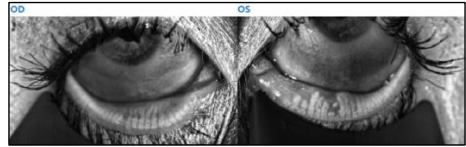
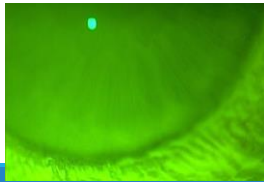
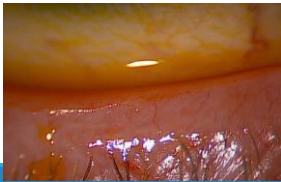
Preserve Visual Function
Decrease IOP





Suwei A, Hao J, Zhou DD, Liu XF, Suwei R, Lu CW. Use of Intense Pulsed Light to Mitigate Meibomian Gland Dysfunction for Dry Eye Disease. Int J Med Sci. 2020 Jun 1;17(10):1385-1392.





Causes

- Health conditions
 - Diabetes
- Auto-immune conditions
 - Arthritis
 - Sjögren's Syndrome
- Medications
 - Allergy, Blood pressure, Depression

Anti-inflammatory medications

- Eysuvis, Flarex, Lotemax etc
- Nutritional supplements

Immunomodulator medications

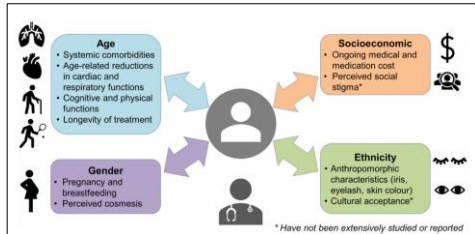
- Cequa, Restasis, Xiidra, etc

Additional therapy

- Autologous serum (Ex: Vital tears)
- Oral secretagogues (Ex: pilocarpine and cevimeline)
- Neurostimulation (Ex: Tyrvaya, iTear 100)

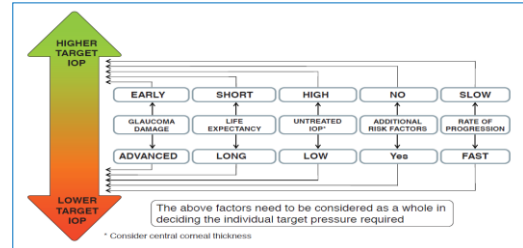


Target IOP Treatment Principles



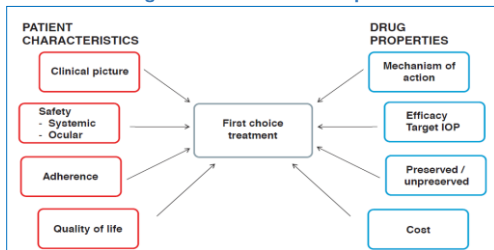
Phu J, Agar A, Wang H, Mawardi K, Kallanidis M. Management of open-angle glaucoma by primary eye-care practitioners: toward a personalized approach. *Optom*. 2019;90(10):20-30. doi:10.1016/j.opt.2019.08.001

Target IOP Treatment Principles



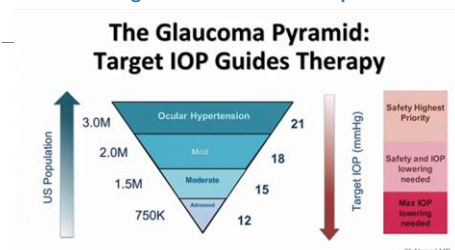
Phu J, Agar A, Wang H, Mawardi K, Kallanidis M. Management of open-angle glaucoma by primary eye-care practitioners: toward a personalized approach. *Optom*. 2019;90(10):20-30. doi:10.1016/j.opt.2019.08.001

Target IOP Treatment Principles



Phu J, Agar A, Wang H, Mawardi K, Kallanidis M. Management of open-angle glaucoma by primary eye-care practitioners: toward a personalized approach. *Optom*. 2019;90(10):20-30. doi:10.1016/j.opt.2019.08.001

Target IOP Treatment Principles

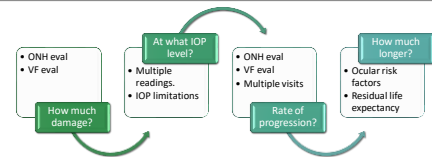


IK Ahmed MD

Target IOP Treatment Principles

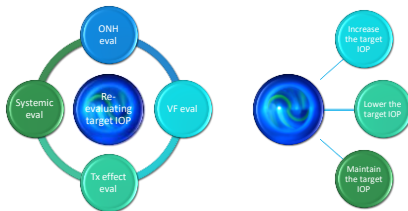


Evaluating Target IOP



Jampel HD. Target pressure in glaucoma therapy. J Glaucoma. 1997 Apr;6(2):133-8.
Woods R, Brandt J, Garway-Heath D, et al. World Glaucoma Association Consensus Series 4 - Intraocular Pressure. Sugar Publications, The Hague, The Netherlands. 2007.
Batra R, Agrawal S, 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

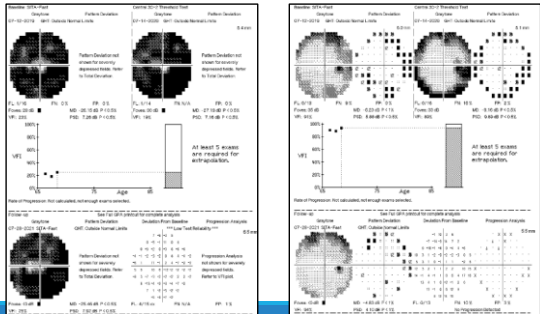
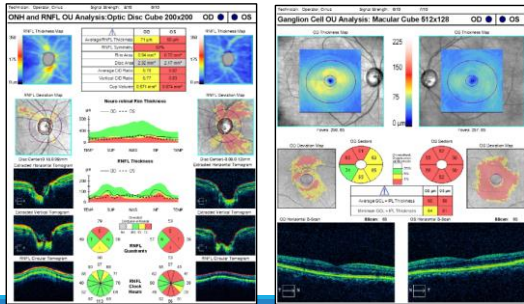
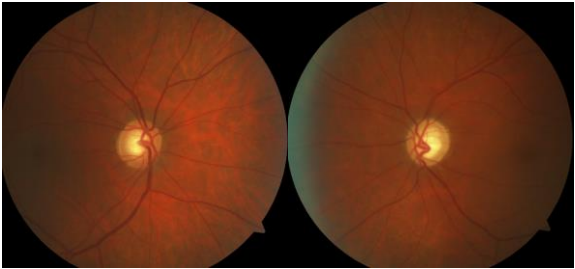
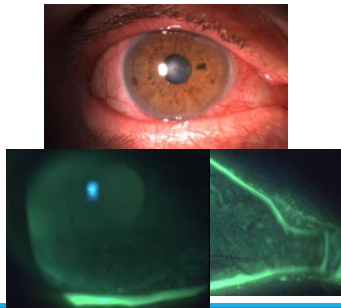


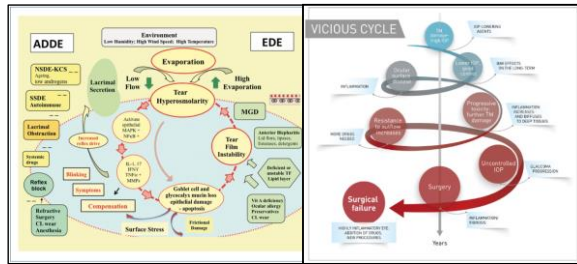
Jampel HD. Target pressure in glaucoma therapy. J Glaucoma. 1997 Apr;6(2):133-8.
Woods R, Brandt J, Garway-Heath D, et al. World Glaucoma Association Consensus Series 4 - Intraocular Pressure. Sugar Publications, The Hague, The Netherlands. 2007.
Batra R, Agrawal S, Ramakrishna S, Dada T. Simplifying "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."

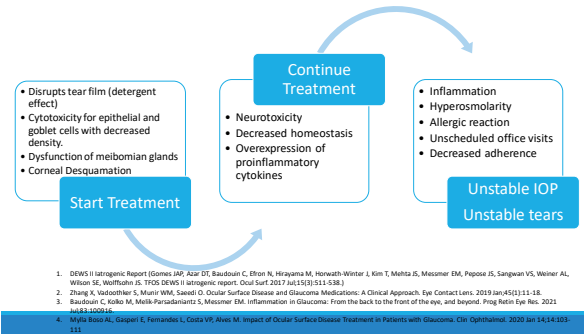
Villasana GA, Bradley C, Ramulu P, Unberath M, Yohannan J. The Effect of Achieving Target Intraocular Pressure on Visual Field Worsening. Ophthalmology. 2022 Jan;129(1):35-44.



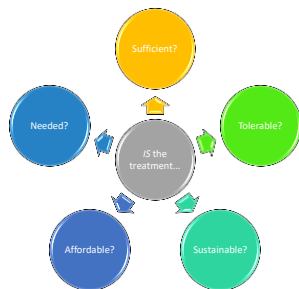


1. Craig JP, Nelson JD, Azar DT, Belmonte C, Bron AJ, Chauhan SK, de Paiva CG, Gomes JAP, Hammit KM, Jones L, Nichols JJ, Nichols KK, Rowan GD, Stapleton FJ, Wilson MD, Wolffsohn JS, Sullivan DA. TFOS DEWS II Report Executive Summary. *Ocul Surf* 2017;15(1):148-802-812.

2. Baudouin C, Kohli M, Mehta P, Parthasarathy S, Messmer EM. Inflammation in Glaucoma: From the back to the front of the eye, and beyond. *Prog Retin Eye Res* 2021;103:100916.



- DEWS II Intraocular Report [Gomes JAP, Azar DT, Baudouin C, Efron N, Hirayama M, Horwath-Winter J, Kim T, Mehta JS, Messmer EM, Papase JS, Sangwan VS, Weiner AL, Wilson SE, Wolffsohn JS]. TFOS DEWS II Intraocular Report. *Ocul Surf* 2017;15(1):511-538.
- Zhang X, Vaidyanathan S, Munir WM, Saeed O. Ocular Surface Disease and Glaucoma Medications: A Clinical Approach. *Eye Contact Lens* 2019;45(1):11-18.
- Baudouin C, Kohli M, Mehta P, Parthasarathy S, Messmer EM. Inflammation in Glaucoma: From the back to the front of the eye, and beyond. *Prog Retin Eye Res* 2021;103:100916.
- Mylla Bosa 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.



- Mylla Bosa 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.
- Craig JP, Nelson JD, Azar DT, Belmonte C, Bron AJ, Chauhan SK, de Paiva CG, Gomes JAP, Hammit KM, Jones L, Nichols JJ, Nichols KK, Rowan GD, Stapleton FJ, Wilson MD, Wolffsohn JS, Sullivan DA. TFOS DEWS II Report Executive Summary. *Ocul Surf* 2017;15(1):148-802-812.
- Gomes JAP, Azar DT, Baudouin C, Efron N, Hirayama M, Horwath-Winter J, Kim T, Mehta JS, Messmer EM, Papase JS, Sangwan VS, Weiner AL, Wilson SE, Wolffsohn JS. TFOS DEWS II Intraocular Report. *Ocul Surf* 2017;15(1):511-538.
- Gazzard G, Konstantakopoulou I, Garway-Heath D, et al. Selective laser trabeculoplasty versus eye drops for first-line treatment of ocular hypertension and glaucoma (SIGUT): a multicentre randomised controlled trial. *Lancet* 2015;385:1505-16.
- Aslido K, Abu SI. The impact of topical intracranial pressure lowering medications on the ocular surface of glaucoma patients: A review. *J Curr Ophthalmol* 2018;31:81-84.
- Batra R, Teller K, Mohamed S. Ocular surface disease exacerbated glaucoma: Optimizing the ocular surface improves intraocular pressure control. *Journal of Glaucoma* 2014;23:36-40.

"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 derivative (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."

Mylla 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.

Table 1 OSD Classification According to Each Parameter Studied

	0	1	2	3
	None	Mild	Moderate	Severe
OSDI Score	<13	13-22	23-30	>30
FBUT (seconds)	8-15	7-5	4-1	breakdown
Fluorescein staining	0-1	2-4	5-9	10-15
Lissamine green staining	0-1	2-3	4-5	6-9
Schirmer test (mm)	>10	10-5	5-1	0
Pelliculosa	0	1	2	3
Tear meniscus height (mm)	<0.3	0.3-0.2	0.2-0.1	0.1-0

Note: Grading used for dry eye disease severity classification.
Abbreviations: OSD, Ocular Surface Disease Index; FBUT, Fluorescein Breakdown Time; mm, millimeters.

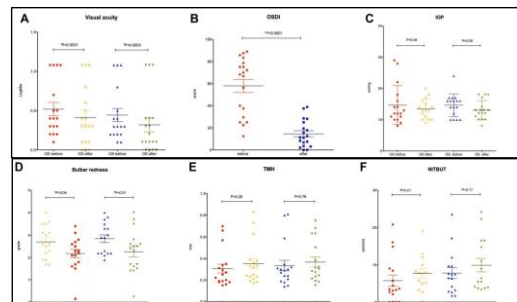
Table 3 Comparison Between the Evaluated Parameters in the Study Group Before Ocular Surface Treatment and Healthy Subjects (Control Group)

Parameter	Pre-treatment	OSDI CI	Median	Control	OSDI CI	Median	P value
BCVA OD (LogMAR)	0.526535	0.34-0.69	0.46	0.836534	0.71-0.95	1	0.05
BCVA OS (LogMAR)	0.466535	0.26-0.62	0.36	0.856533	0.79-0.92	0.9	0.00018
OSDI	17.862243	4.51-76.23	48.18	11.641249	5.11-18.16	10.41	<0.0001
TMH OD	6.466535	0.12-0.79	0.25	0.946533	0.12-0.26	0.24	0.82
TMH OS	6.466535	0.15-0.82	0.35	0.266538	0.12-0.30	0.28	0.49
Schirmer OD	16.762133	10.94-22.59	14.00	14.721537	9.96-19.48	11.00	0.65
Schirmer OS	17.821631	12.63-23.03	20.00	14.386839	11.85-20.70	14.00	0.18
NTBUT OD	5.794630	2.84-8.92	3.49	14.421535	11.98-16.85	12.48	0.0002
NTBUT OS	7.716536	4.60-10.90	6.98	15.765371	10.34-15.32	13.52	0.0004
FBUT OD	4.066537	1.25-6.74	4.00	9.186437	6.85-11.02	7.50	0.006
FBUT OS	1.771330	0.85-3.70	4.00	9.874361	7.33-11.49	9.00	0.0001
Bulbar Redness OS	2.759572	2.31-3.88	2.60	1.558535	1.38-1.72	1.50	<0.0001
Bulbar Redness OS	2.866539	1.47-3.31	2.40	1.571548	1.378-1.769	1.50	<0.0001
Fluorescein OD	6.276441	4.02-8.36	6.00	0.316574	0.036-0.637	0.0	<0.0001
Fluorescein OS	5.664439	3.54-7.75	5.00	0.526577	0.15-0.89	0.0	<0.0001
Lissamine OD	1.358586	0.9099-1.796	1.00	0.786131	0.15-1.42	0.0	0.03
Lissamine OS	1.275670	0.86-1.88	1.00	0.632131	0.14-1.11	0.0	0.009
Pelliculosa	1.765539	1.3-1.22	1.00	1.054	0.67-1.32	1.00	0.01
Age	66.762579	62.03-71.46	70.00	62.343437	59.92-64.72	62.00	0.05

Mylla 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					P
	Mean	Median	PD	Min	Max	Mean	Median	PD	Min	Max	
BCVA OD (LogMAR)	0.52	0.40	0.35	1.08	0.10	0.41	0.30	0.37	1.08	0.00	0.0031
BCVA OS (LogMAR)	0.44	0.30	0.35	1.08	0.10	0.32	0.15	0.38	1.08	0.00	0.0003
OSDI	57.86	48.18	25.63	12.50	88.88	14.60	11.36	12.13	0.00	38.90	<0.0001
TMH OD	0.46	0.25	0.65	0.15	2.90	0.35	0.32	0.20	0.17	0.83	0.2834
TMH OS	0.49	0.30	0.65	0.14	2.90	0.37	0.30	0.19	0.15	0.75	0.7851
Schirmer OD	16.76	14.00	11.33	3.00	35.00	19.12	17.00	9.33	6.00	35.00	0.1228
Schirmer OS	17.82	20.00	10.11	2.00	35.00	17.53	14.00	10.63	4.00	35.00	0.7505
NTBUT OD	5.74	3.44	6.20	0.00	20.84	7.69	7.75	4.84	0.00	19.12	0.2117
NTBUT OS	7.76	6.98	5.91	1.72	23.52	9.92	6.31	7.12	3.25	24.00	0.1742
FBUT OD	4.00	4.00	3.57	0.00	9.00	5.11	3.00	2.37	2.00	9.00	0.2894
FBUT OS	4.75	4.00	3.28	1.00	10.00	6.75	6.00	3.88	2.00	12.00	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	0.0414
Bulbar Redness OS	2.84	2.90	0.70	1.90	4.00	2.18	2.25	0.76	0.15	3.40	0.0464
Fluorescein OD	6.29	6.00	4.41	1.00	15.00	2.59	1.00	3.57	0.00	15.00	<0.0001
Fluorescein OS	5.65	5.00	4.09	0.00	14.00	1.88	1.00	2.26	0.00	7.00	<0.0001
Lissamine OD	1.35	1.00	0.86	0.00	3.00	0.94	1.00	0.65	0.00	2.00	0.131
Lissamine OS	1.37	1.00	0.95	1.00	3.00	0.88	1.00	0.99	0.00	3.00	0.101
IOP OD	14.65	12.00	6.23	8.00	29.00	13.44	13.00	3.16	9.00	20.00	0.9471
IOP OS	14.65	14.00	3.60	10.00	24.00	13.06	13.00	3.07	8.00	18.00	0.0510

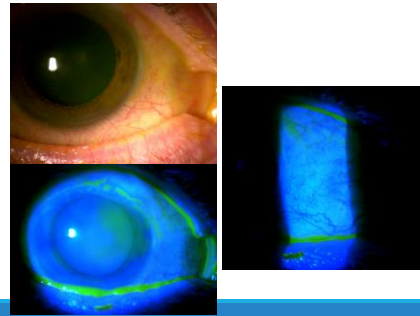
Mylla Boso AL, Gasperi E, Fernandes L, Costa VP, Alves M. Impact of Ocular Surface Disease Treatment in Patients with Glaucoma. Clin Ophthalmol. 2020 Jan 14;14:103-111.



Mylla 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.

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

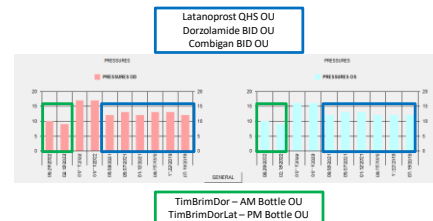
MMT
MTMT
MRMT



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





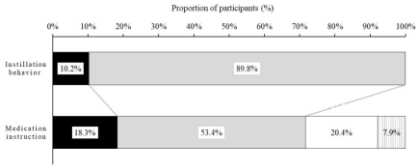
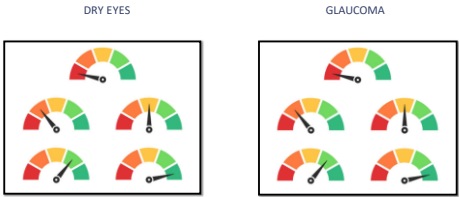
“The goal of glaucoma treatment is the preservation of vision *and* vision-related quality of life throughout the patient’s lifetime.”

Curbside Consultation in Glaucoma: 40 Clinical Questions Dale K. Hauer, Richard A. Lewis, Steve J. Gedde, 2008, SLACK Incorporated, Thorofore, New Jersey, NJ.

Patient Adherence

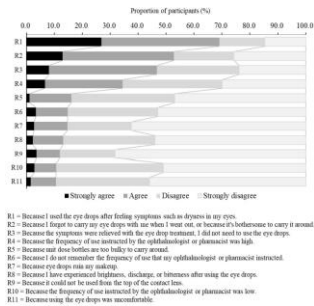
EDUCATION AND ADHERENCE

Treatment Goals – Adherence

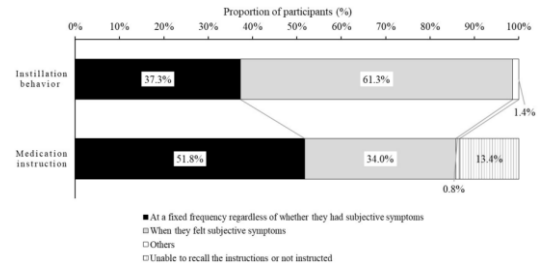


- The frequency specified in the package insert
- ▨ The frequency other than specified in the package insert
- The frequency of any eye drop usage varies
- ░ Unable to recall the instructions or not instructed

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



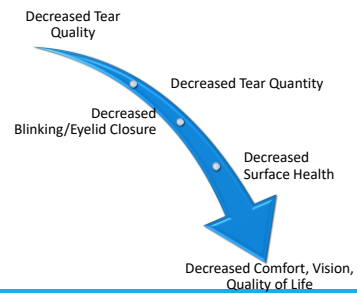
Uchino M, Yokoi N, Shimazaki J, et al. Adherence to eye drops usage in dry eye patients and reasons for non-compliance: a web-based survey. *J Clin Med.* January 12, 2022.

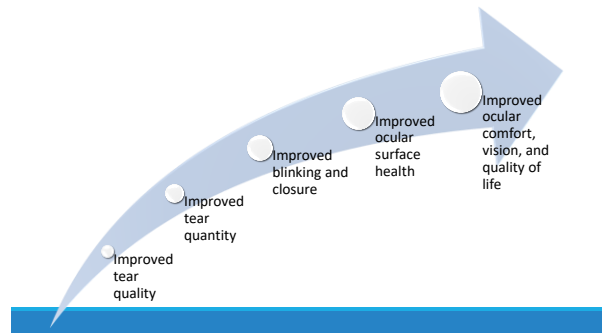
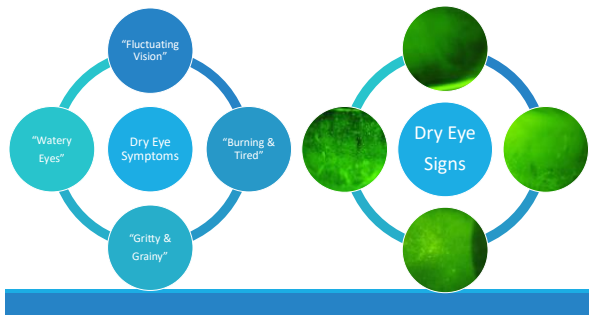


Uchino M, Yokoi N, Shimazaki J, et al. Adherence to eye drops usage in dry eye patients and reasons for non-compliance: a web-based survey. *J Clin Med.* January 12, 2022.

“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.

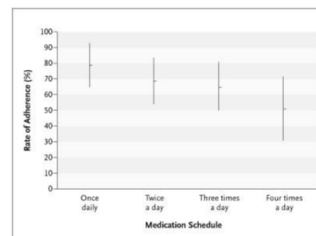




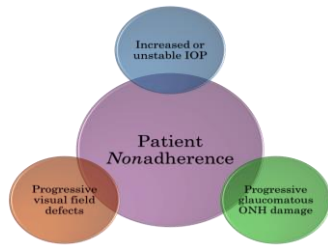
"Patient adherence is the wild card in the deck for controlling glaucoma progression."



Figure 1. The Role of Minimally Invasive Glaucoma Surgery Devices in the Management of Glaucoma. *Ophthalmology*. 2018;125(11):155-162.

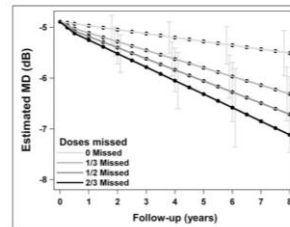


Osterberg L, Blaschke T. Adherence to medication. *N Engl J Med*. 2005 Aug 4;353(5):487-97.



1. Sieth B, Blalock S, Rubin A, et al. Original article: The Relationship between Glaucoma Medication Adherence, Eye Drop Technique, and Visual Field Defect Severity. *Ophthalmology*. January 1, 2011;118:2398-2402.
2. Schwartz G, Quigley H. Adherence and Persistence with Glaucoma Therapy. *Survey of Ophthalmology*. January 1, 2008;53(Supplement):557-568.
3. Olshuff C, Schooten J, van de Borne B, Webers C. Original article: Noncompliance with Ocular Hypertensive Treatment in Patients with Glaucoma or Ocular Hypertension. An Evidence-Based Review. *Ophthalmology*. January 1, 2005;112:953-963.e7.

Stewart WC, Charak RP, Hunt RH, Seltman G. Factors associated with visual loss in patients with advanced glaucomatous changes in the optic nerve head. *Am J Ophthalmol*. 1989;108:176-185.



“To increase the effectiveness of our current glaucoma treatments, there is a critical need to focus on helping support patients in improving their glaucoma medication adherence.”

Newman-Casey PA, Niziol LM, Gillespie BW, Janz NK, Lichter PR, Musch DC. The Association between Medication Adherence and Visual Field Progression in the Collaborative Initial Glaucoma Treatment Study. *Ophthalmology*. 2020 Apr;127(4):477-483.

“...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/chi/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?²
 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.”

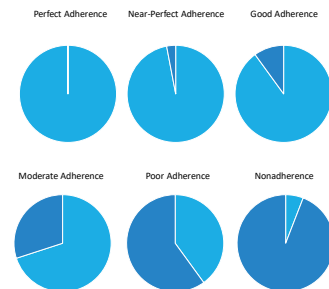
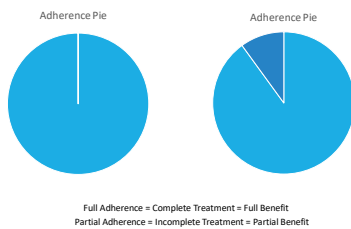
Newman-Cassy PA, Shtein RM, Coleman AL, Herndon L, Lee PP. Why Patients With Glaucoma Lose Vision: The Patient Perspective. *J Glaucoma.* 2016;33(7):e668-e675.

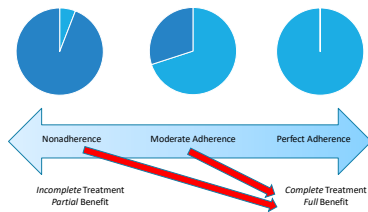
“For a glaucoma patient, this would mean that the person would only take their medication and return for their follow-up appointments *if* they believed that glaucoma would cause undesirable vision loss, the treatments offered by their doctor could mitigate this effect, and the barriers to following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

Newman-Casey PK, Sittain RM, Coleman AL, Herndon L, Lee PP. Why Patients With Glaucoma Lose Vision: The Patient Perspective. *J Glaucoma*. 2015;25(7):e668-e675.

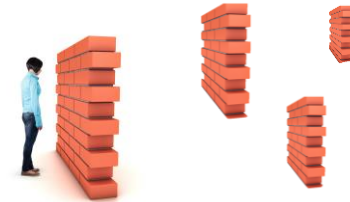
“Ultimately,... nonadherent patients...fail to achieve the intended or full effect of the treatment.”

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





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."



Tsai JC, McCune CA, Ramos SE, Schunert DG, Pichler IM. Compliance barriers in glaucoma: a systematic classification. / Glaucoma. 2003;1:375-393-398.

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, McCune CA, Ramos SE, Schunert DG, Pichler IM. Compliance barriers in glaucoma: a systematic classification. / Glaucoma. 2003;1:375-393-398.

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.”



Boylan MG, Chang DS, Frazer T, et al. Automated telecommunication-based reminders and adherence with once daily glaucoma medication dosing: the automated dosing reminder study. *AMIA Conference* 2014:132-45-46.

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, depression that glaucoma will cause vision loss	Prodromou et al (2009), ¹¹ Lacey et al (2009), ¹² Tsai et al (2003), ¹³ Sheth (2010) ¹⁴
Beliefs about glaucoma medications, depression that glaucoma medications will damage vision loss	Prodromou et al (2009), ¹¹ Lacey et al (2009), ¹² Stricker et al (2010), ¹⁵ Tsai et al (2003), ¹³ Sheth et al (2010) ¹⁴
Poor self-efficacy	Prodromou et al (2009), ¹¹ Lacey et al (2009), ¹² Stricker et al (2010), ¹⁵ Tsai et al (2003), ¹³ Sheth et al (2010) ¹⁴
Poor knowledge about glaucoma	Prodromou et al (2009), ¹¹ Lacey et al (2009), ¹² Stricker et al (2010), ¹⁵ Tsai et al (2003), ¹³ Sheth et al (2010) ¹⁴
Minors of physician	Stricker et al (2010), ¹⁵ Lacey et al (2009), ¹² Tsai et al (2003), ¹³ Sheth et al (2010) ¹⁴
Difficulties with eye drop administration	Lacey et al (2009), ¹² Tsai et al (2003), ¹³ Sheth et al (2010) ¹⁴
Medication cost	Prodromou et al (2009), ¹¹ Tsai et al (2003), ¹³ Sheth et al (2010) ¹⁴
Medication-induced side effects	Prodromou et al (2009), ¹¹ Tsai et al (2003), ¹³ Sheth et al (2010) ¹⁴
Forgetfulness	Lacey et al (2009), ¹² Stricker et al (2010), ¹⁵ Tsai et al (2003), ¹³ Sheth et al (2010) ¹⁴
Difficulties with the medication schedule	Lacey et al (2009), ¹² Tsai et al (2003), ¹³ Sheth et al (2010) ¹⁴
Likeness	Hall (2014), ¹⁶ Kennedy (2016), ¹⁷ Cohen et al (1983) ¹⁸



Newman-Casey F, Rubin A, Lee P, et al. Original article: The Most Common Barriers to Glaucoma Medication Adherence: A Cross-Sectional Survey. *Ophthalmology*. July 1, 2015;122:100-106.

What are some barriers to adherence?

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

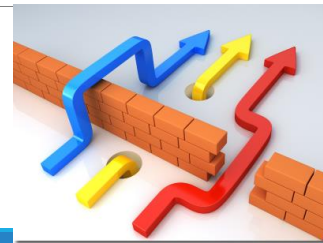
Table 1. Barriers to Medication Adherence

Barriers*	Univariate Analysis, OR Ratio (95% Confidence Interval)	P Value	Bivariate Analysis, OR Ratio (95% Confidence Interval)	P Value
Difficulties with drop administration	2.1 (1.0-4.3)	0.04	2.1 (1.1-4.0)	0.02
Poor self-efficacy	4.1 (2.1-7.7)	<0.001	4.1 (2.1-7.7)	<0.001
Poor knowledge	1.5 (0.7-2.9)	0.3	1.4 (0.7-2.5)	0.4
Beliefs about glaucoma†	1.0 (0.7-1.5)	0.9	1.0 (0.7-1.2)	0.9
Beliefs about medications†	0.9 (0.7-1.4)	0.9	0.9 (0.7-1.4)	0.9
Likeness	2.2 (1.1-4.4)	0.02	1.9 (0.9-3.9)	0.1
Forgetfulness	1.5 (0.9-2.4)	<0.001	1.7 (1.2-2.4)	<0.001
Side effects	2.1 (1.0-4.3)	0.04	1.9 (0.9-4.0)	0.08
Cost	1.8 (0.9-3.4)	0.1	1.6 (0.9-3.0)	0.1
Difficulties with the medication schedule	2.6 (1.4-5.1)	0.006	2.9 (1.4-6.0)	0.003
Minor of physician	1.0 (0.7-1.2)	0.9	0.9 (0.6-1.9)	0.7
No. of barriers	1.1 (0.7-1.2)	0.007	1.1 (0.7-1.2)	0.01

* Compared with subjects who did not report each issue as an important barrier.
† Adjusted for age.
‡ Significant for glaucoma with vision loss.
§ Significant for glaucoma medications will damage vision loss.

Newman-Casey F, Rubin A, Lee P, et al. Original article: The Most Common Barriers to Glaucoma Medication Adherence: A Cross-Sectional Survey. *Ophthalmology*. July 1, 2015;122:100-106.

What can we do to overcome barriers to adherence?



What can we do to overcome barriers to adherence?

Table 1. Strategies for Improving Adherence to a Medication Regimen.¹²

Identify poor adherence.
 Look for markers of nonadherence: missed appointments ("no shows"), lack of response to medication, missed refills.
 Ask about barriers to adherence without being confrontational.

Emphasize the value of the regimen and the effect of adherence.
 Elicit patient's feelings about his or her ability to follow the regimen, and if necessary, design supports to promote adherence.

Provide simple, clear instructions and simplify the regimen as much as possible.
 Encourage the use of a medication-taking system.
 Listen to the patient, and customize the regimen in accordance with the patient's wishes.
 Obtain the help from family members, friends, and community services when needed.
 Reinforce desirable behavior and results when appropriate.

Consider more "forgiving" medications when adherence appears unlikely.
 Medications with long half-lives.
 Depot (extended-release) medications.
 Transdermal medications.

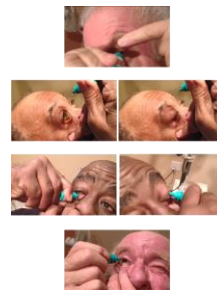
Osterberg L, Blaschke T. Adherence to medication. *N Engl J Med*. 2005 Aug 4;353(5):487-97.

Table 1. Summary of Strategies to Address Adherence Issues

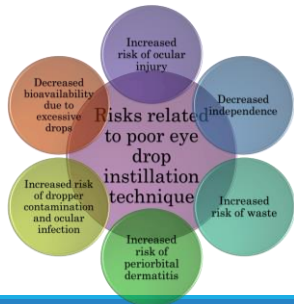
- General**
- Be proactive. Assume most patients are nonadherent.
 - Use tailored, patient-centered approaches.
 - Learn which interventions work best in your practice, with your style.
 - Use a combination of methods.
- Specific**
- Actively address at-risk patients.
 - Simplify and optimize treatment regimens when possible (dosing, polypharmacy, side effects).
 - Reduce drug costs when possible.
 - Understand the patient's health beliefs about glaucoma.
 - Use patient education.
 - Reinforce regularly.
 - Use verbal and written delivery.
 - Adapt information to those with poor vision or low literacy.
 - Make use of office staff.
 - Review drug administration at each visit.
 - Suggest that patients keep a medication diary, which will be part of the patient record.
 - Use telephone or mail reminders when possible.
 - Suggest the patient incorporate drops into daily activities.
 - Involve a helpful caregiver/family member to assist with applying drops or reminding to take drops.
 - Be supportive. Use open communication.
 - Ask tell-stick dialog.
 - Motivational interviewing.
 - Stages of readiness for change.
 - Be prepared to act as coach/quarterback.



Bauman D. A Clinician's Guide to the Assessment and Management of Nonadherence in Glaucoma. *Ophthalmology*. January 1, 2008;115(1):suppl:141-147.

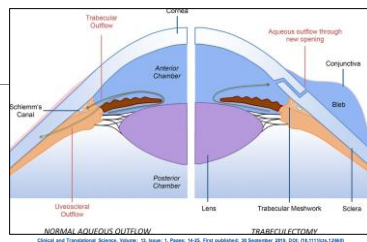


Quinn R, Grant R, Mural G. Review on the Building Self-motivation Techniques and Factors Affecting These Techniques in Glaucoma Patients. *Journal of* 10/1/2014.



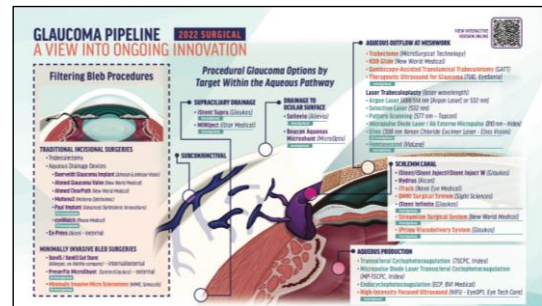
"Ineffective self-installation of eye drops was associated with an increased risk of glaucoma progression or treatment advancement to incisional surgery."

Rajanala AP, Prager AJ, Park MS, Tanna AP. Association of the Effectiveness of Eye Drop Self-installation and Glaucoma Progression. J Glaucoma. 2022 Mar 1;31(3):156-159

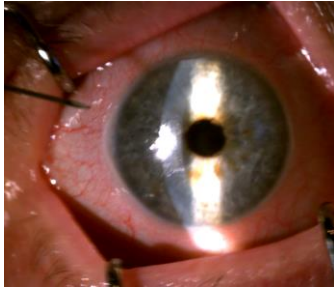


"Minimally invasive glaucoma surgeries fill a gap that has existed in the treatment algorithm for glaucoma between medical therapy and laser at one end of the spectrum and traditional filtering glaucoma surgeries at the other."

Regeert M, Dickerson J, Jr. The Role of Minimally Invasive Glaucoma Surgery Devices in the Management of Glaucoma [published correction appears in Nature Reviews 2018; 18(4):502-508. Suggested doi: 10.1038/s41585-018-0021-2]

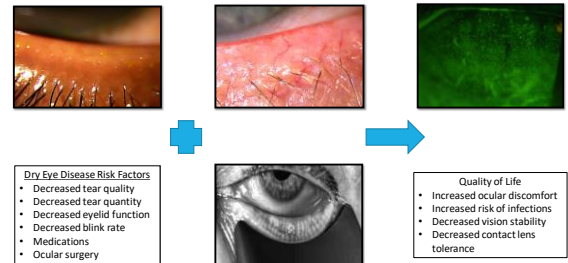
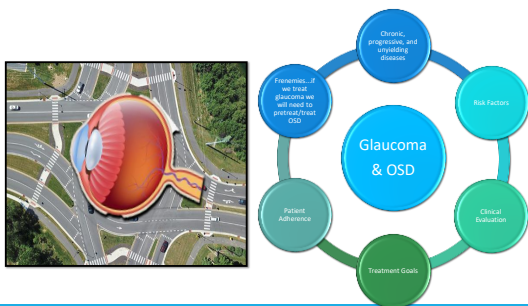


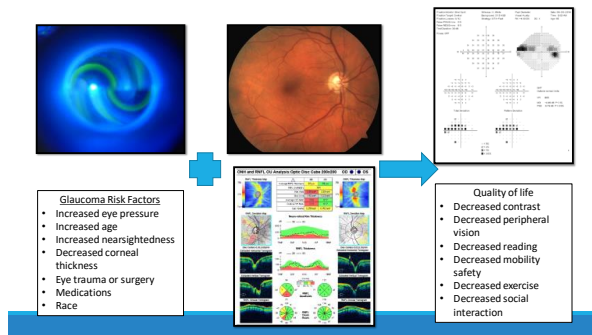
Almoud I, Samuels I, Mahan M. Glaucoma Pipeline. Glaucoma Today. March, 2022



Glaucoma and Dry Eyes “Frenemies for Life”

1. To increase awareness of both chronic, progressive, and unyielding conditions.
2. To increase awareness of the strong association between both chronic, progressive, and unyielding conditions.
 - They love to be together.
 - Inseparable and Inevitable
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, and unyielding conditions when together.
 - They are worse when together.
 - It does not happen overnight.



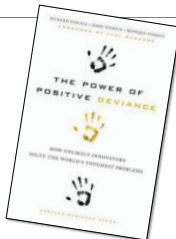


The Science *and* Art of Managing Glaucoma...and Dry Eyes



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@carineforeyes.com

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

Website: www.glaucomaqd.org

