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A Paradigm Shift in Glaucoma:
SLT, MIGS, and Drug Delivery

Ohio Ophthalmological Society Annual Meeting
Saturday, February 28th, 2026

Stephan G. Dixon, MD
MidWest Eye Center - Cincinnati, OH

Adjunct Clinical Associate Professor, Clinical Coordinator of Ophthalmology Elective - Ohio University Heritage College of Osteopathic Medicine
Volunteer Assistant Professor - University of Cincinnati Department of Ophthalmology
Clinical Director of Ophthalmology ICE (Intensive Clinical Experience) Rotation - University of Cincinnati Department of Ophthalmology
Board Member - Ohio Ophthalmological Society

Financial Disclosures

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Speaker/Paid Consultant:

- Abbvie - Xen Gel Stent and Durysta Speaker
- Alcon - Hydrus and DSLT Speaker
- Glaukos - iStent and iDose TR Speaker
- New World Medical - Via360 Preceptorship
- Sight Sciences - Omni Speaker

Learning Objectives

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- Summarize the evidence supporting SLT and MIGS
- Summarize the variety of management options for glaucoma
- Integrate into your practice an updated treatment algorithm for glaucoma

Learning Objectives

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Shift

Open Angle Glaucoma

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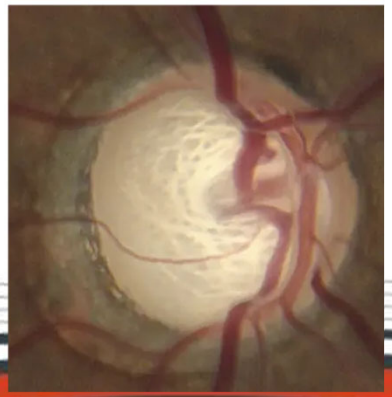
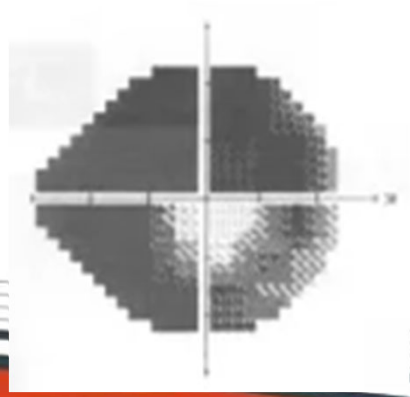
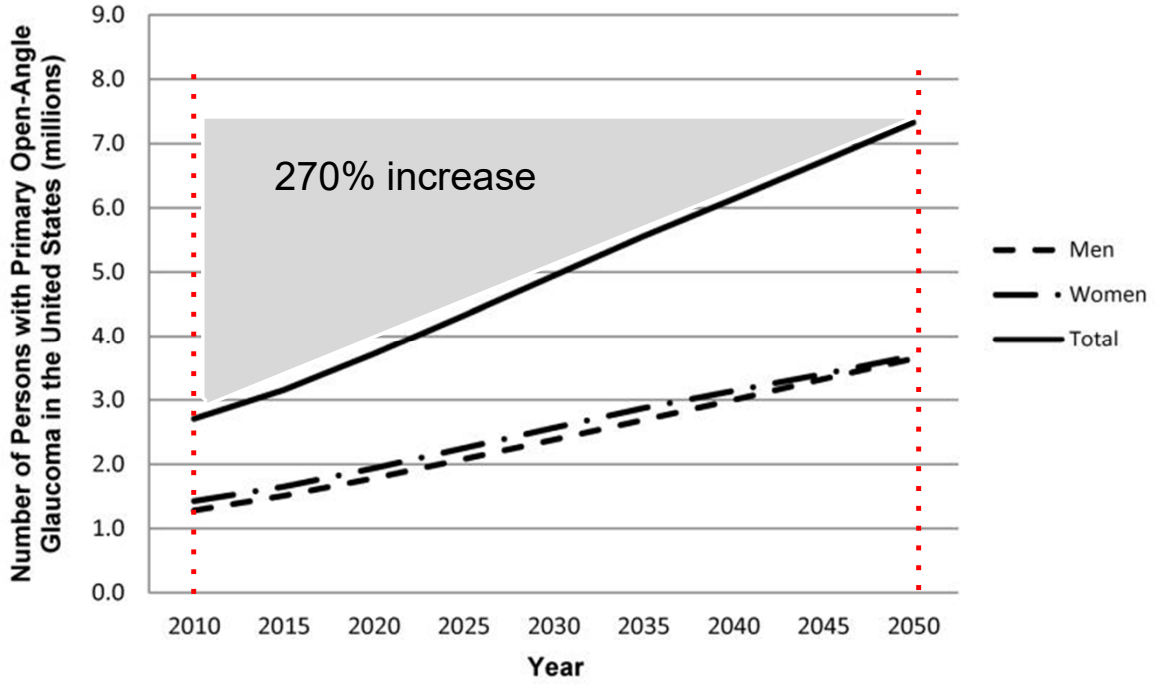
- **<u>Most common cause</u>** of preventable, irreversible blindness
- Prevalence in the U.S. population over 40 is **1.86%**
- People in their 70s have a **3-8x higher** prevalence of POAG





Open Angle Glaucoma



In 2010,

2.7 million

individuals had POAG.

In 2050, an estimated

7.32 million

individuals are projected to have POAG

Source: https://www.nei.nih.gov/learn-about-eye-health/resources-for-health-educators/eye-health-data-and-statistics/glaucoma-data-and-statistics

Source: https://www.brightfocus.org/sources-glaucoma-facts-figures

Compliance

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- **Medication adherence** is crucial for slowing progression
- **Less than 25% of patients** use eye drops continuously for 12 months
- **90% of glaucoma patients** do not continuously refill drops within 12 months
- Barriers include cost, forgetfulness, instillation difficulties, lack of disease recognition, apathy, side effects, etc.

Compliance

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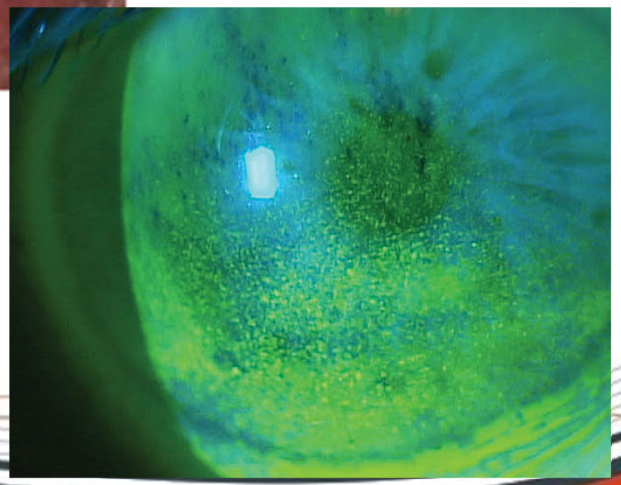

Compliance

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Tear Film

- Disrupts lipid layer
- Reduces mucin production
- Unstable tear film

Trabecular Meshwork

- Trabecular apoptosis
- Oxidative stress
- Long-term degeneration → outflow resistance

Conjunctiva

- Decrease in goblet cell density
  - Inflammatory cell infiltration
  - Scarring of the ocular surface making future treatments difficult

Cornea

- Inhibit cell proliferation and growth
- Disruption of epithelial barrier function
- Neurotoxicity

Source: https://www.medscape.com/viewarticle/723420_5

Management Options

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- SLT
- Drug Delivery
- MIGS (minimally invasive glaucoma surgery)
- Filtering Surgery
- Cyclodestructive Laser

SLT as 1st Line

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- How did we get here?
- 1990 - The Glaucoma Laser Trial (GLT)
- 2012 - SLT-MED Trial
- **2023 - LiGHT Trial**

The Glaucoma Laser Trial (GLT)

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- 1990
- **ALT** vs. topical meds (timolol)
- Drops added if necessary
- **No major differences**

The Glaucoma Laser Trial (GLT)

Abstract: The Glaucoma Laser Trial, a multicenter, randomized clinical trial involving 271 patients, was designed to assess the efficacy and safety of argon laser trabeculoplasty (ALT) as an alternative to treatment with topical medication for controlling intraocular pressure (IOP) in patients with newly diagnosed, previously untreated primary open-angle glaucoma (POAG). Each patient had one eye randomly assigned to ALT (the laser first [LF] eye) and the other eye assigned to timolol maleate 0.5% (the medication first [MF] eye). Medication was initiated or changed for either eye according to the same stepped regimen if the IOP was not controlled. Throughout the 2-year follow-up, LF eyes had lower mean IOPs than MF eyes (1–2 mmHg), and fewer LF eyes than MF eyes required simultaneous prescription of two or more medications to control IOP ($P < 0.001$). After 2 years of follow-up, 44% of LF eyes were controlled by ALT, 70% were controlled by ALT or ALT and timolol, and 89% were controlled within the stepped medication regimen. After 2 years, 30% of MF eyes remained controlled by timolol, and 66% were controlled within the stepped regimen. There were no major differences between the two treatment approaches with respect to changes in visual acuity or visual field over the 2 years of follow-up.
Ophthalmology 1990; 97:1403–1413

The SLT-MED trial

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- 2012
- **SLT** vs. topical meds (PGA)
- **IOP reduction similar**

Selective Laser Trabeculoplasty Versus Medical Therapy as Initial Treatment of Glaucoma
A Prospective, Randomized Trial

Katz, L. Jay MD*; Steinmann, William C. MD†; Kabir, Azad MD‡; Molineaux, Jeanne COA*; Wizov, Sheryl S. COA*; Marcellino, George PhD§

The LiGHT trial

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Laser in Glaucoma and Ocular Hypertension (LiGHT) Trial

Six-Year Results of Primary Selective Laser Trabeculoplasty versus Eye Drops for the Treatment of Glaucoma and Ocular Hypertension

- 2023
- Longer term data
- **SLT > initial drops**
- Reduced need for incisional glaucoma surgery and cataract surgery

SLT as 1st Line

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The paradigm is evolving towards laser as a **first-line treatment**[3-5]

AMERICAN ACADEMY OF OPHTHALMOLOGY®

Recognizes SLT as an effective primary intervention for OAG[3]

European Glaucoma Society
Innovation, Education, Communication, Implementation

Recommends that SLT should be considered as an initial treatment option for mild or moderate OAG and OHT patients[4]

NICE National Institute for Health and Care Excellence

Recommends 360° SLT as first-line treatment for people with newly diagnosed OHT or newly diagnosed COAG[5]

Key societies recognize SLT as an initial treatment for OHT and OAG patients[3-5]

The LiGHT study confirmed the **efficacy** of SLT as a **primary procedure** for the treatment of OAG or OHT[12]

Direct SLT

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Direct SLT

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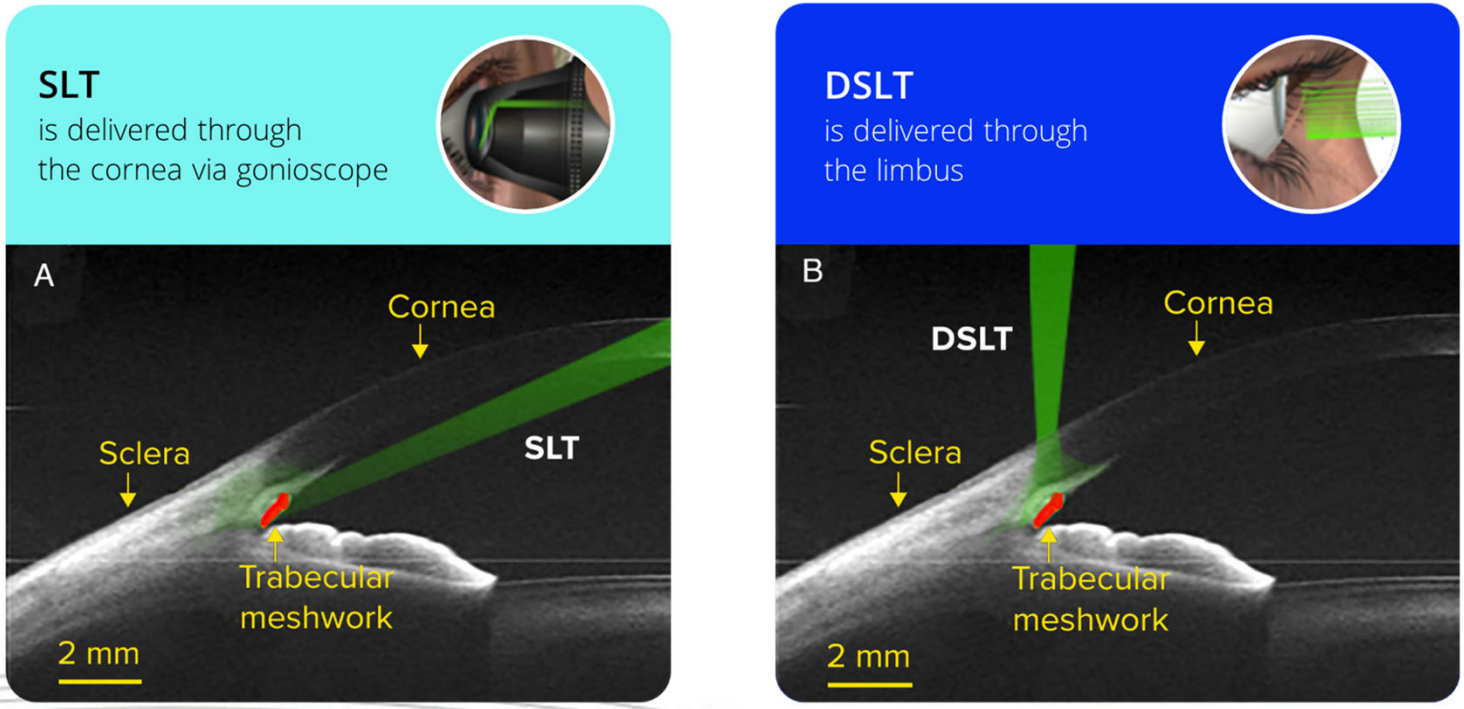

Source: Goldenfeld M, Belkin M, Dobkin-Bekman M, et al. Automated direct selective laser trabeculoplasty: First prospective clinical trial. *Transl Vis Sci Technol*. 2021;10(3):5.

Laser energy transmission explained

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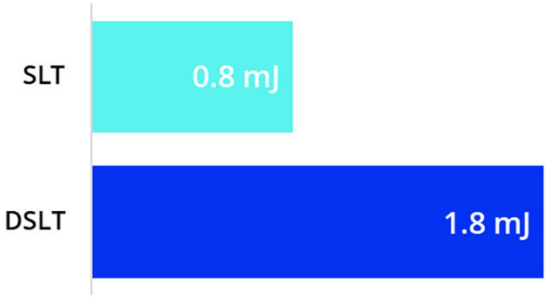
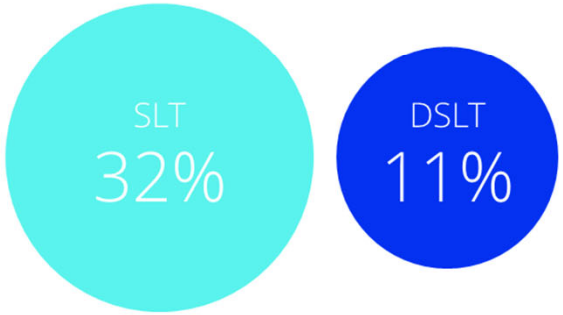
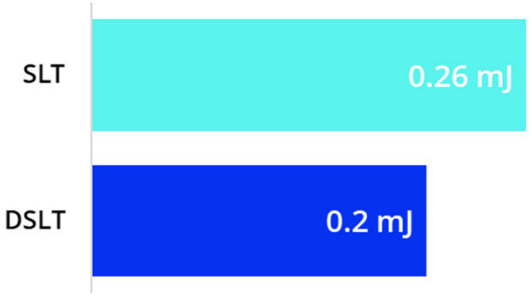
Device output energy range (mJ): SLT 0.3–2.6 DSLT 1.1–1.9



Typical output energy per pulse



Energy transferred



Energy transferred per pulse

Spots addressed per treatment

Calculation

Total energy delivered to TM
= device output energy per pulse × number of spots addressed × total energy transferred to TM

Energy per treatment*

*Based on the results of the GLAUnous trial the average est. total energy delivered was 21.7 mJ for DSLT group and 28.5 mJ for SLT group

TM=trabecular meshwork.

Source: Sacks ZS, Dobkin-Bekman M, Geffen N, Goldenfeld M, Belkin M. Non-contact direct selective laser trabeculoplasty: light propagation analysis. *Biomed Opt Express*. 2020;11(6):2889–2904.

Randomized Noninferiority Trial of Direct Selective Laser Trabeculoplasty in Open-Angle Glaucoma and Ocular Hypertension

Gazzard, GusTraverso, Carlo Enrico et al.

Ophthalmology, Volume 132, Issue 10, 1091 - 1104

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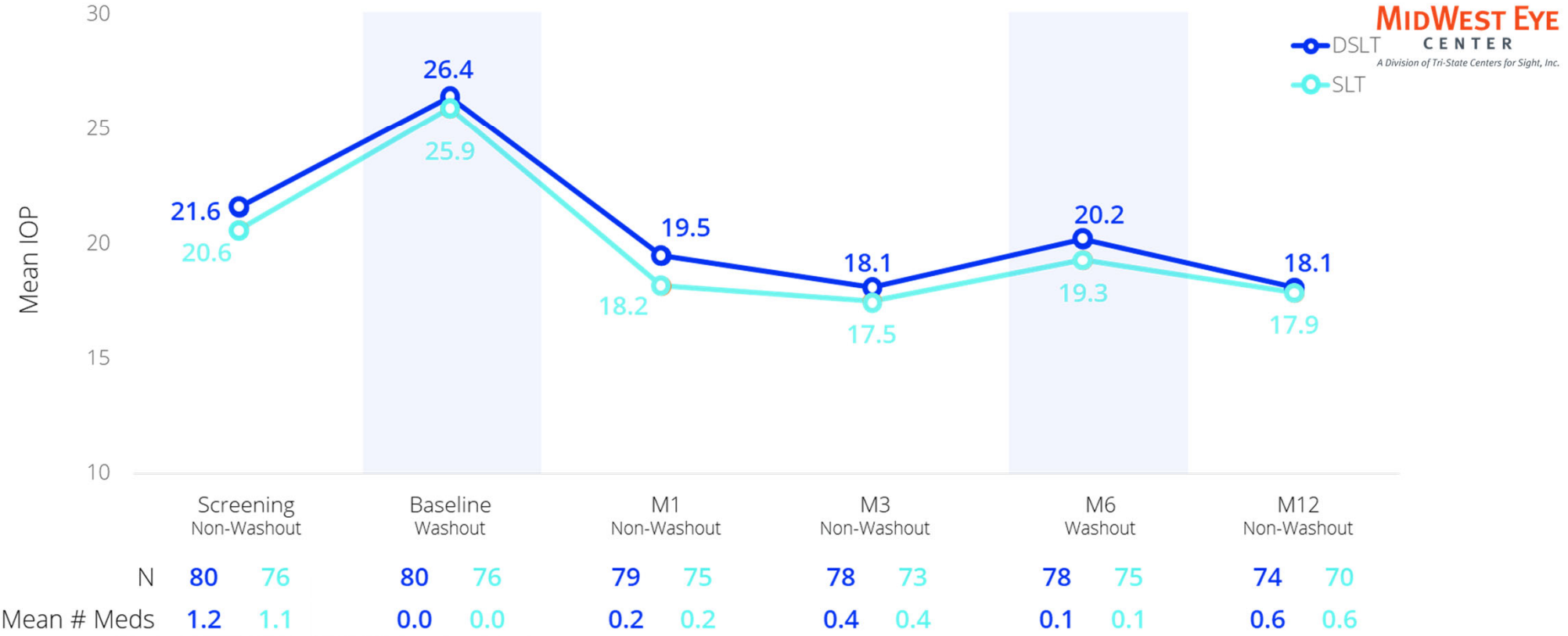

N	80	76	80	76	79	75	78	73	78	75	74	70
Mean # Meds	1.2	1.1	0.0	0.0	0.2	0.2	0.4	0.4	0.1	0.1	0.6	0.6

Drug Delivery

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- Durysta (Bimatoprost)
- iDose TR (Travaprost)
- Spyglass (IOL with Drug Pads)

Durysta (Bimatoprost)

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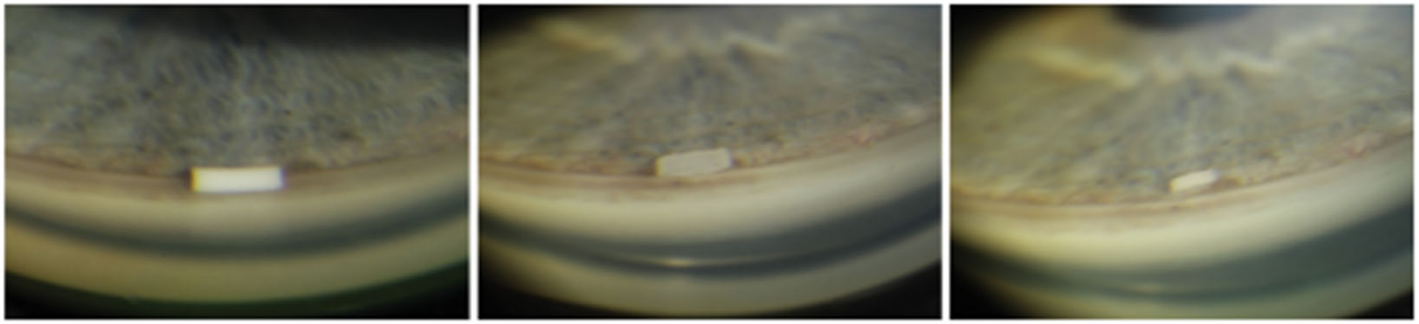
- Intracameral implant of bimatoprost
- Slit lamp administration
- FDA approved for one time use only (for now)

2 weeks **9 months** **12 months**



iDose TR (Travoprost)

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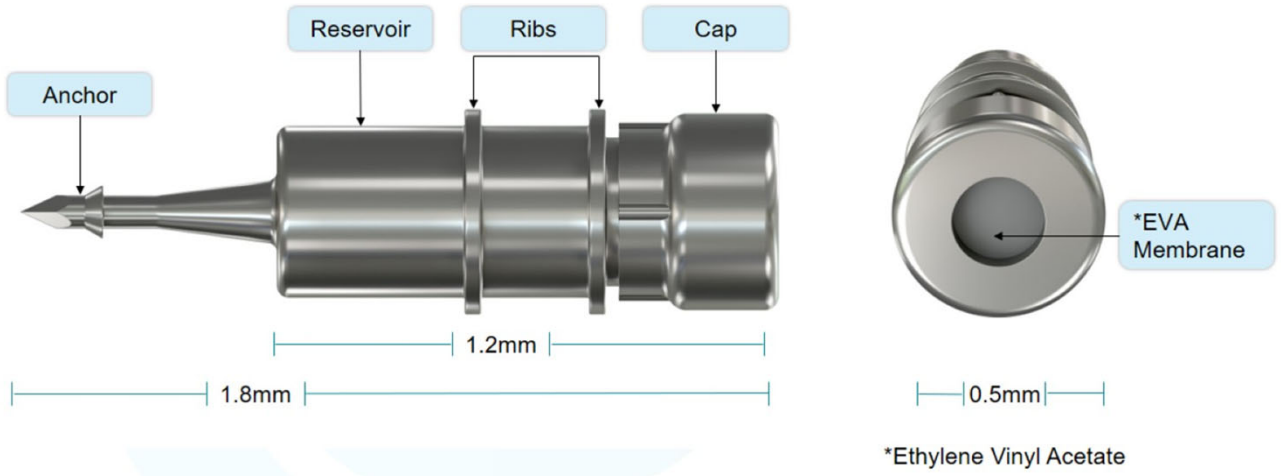

*Ethylene Vinyl Acetate

Titanium – Biocompatible – Sterile – MRI Conditional

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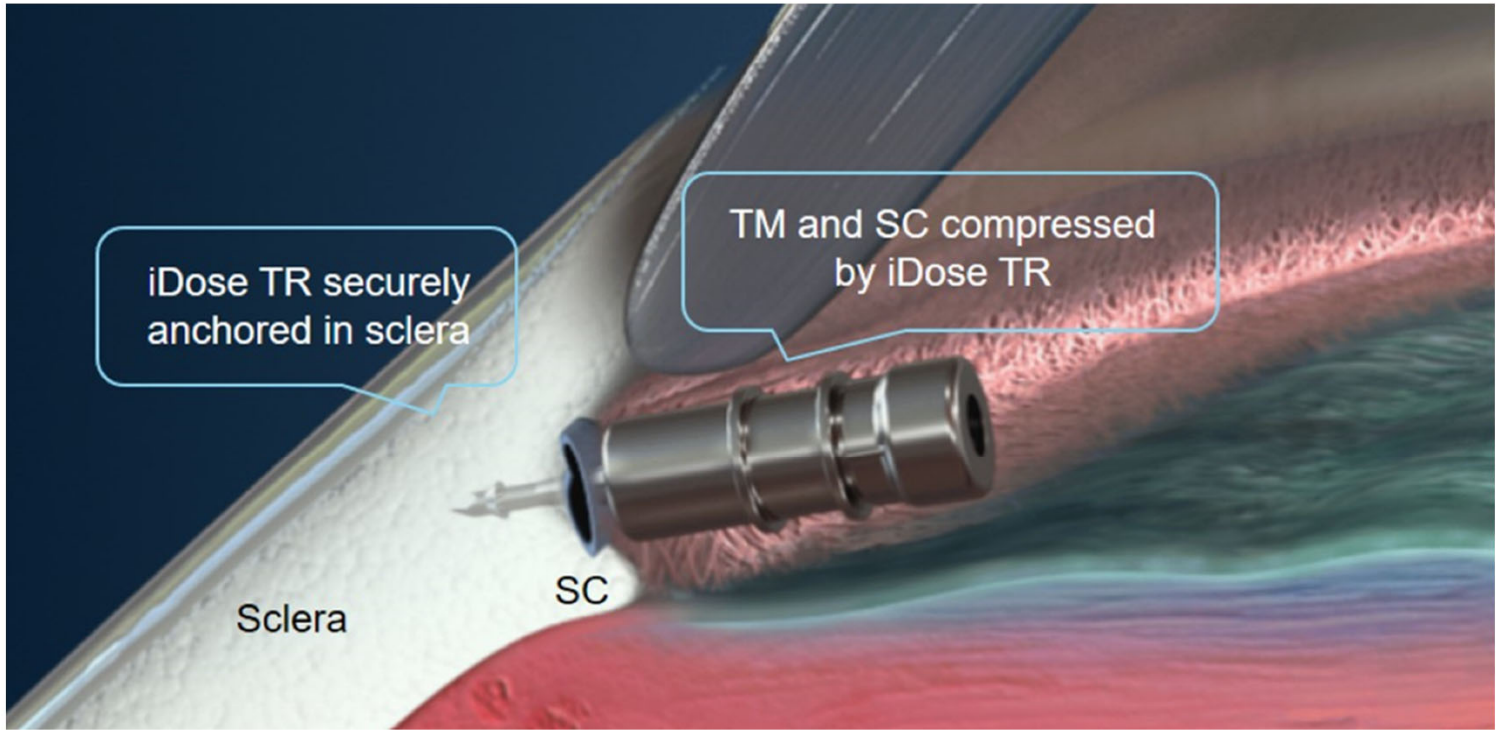

iDose TR (Travoprost)

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- **Update:** As of January 2026, iDose TR has been approved for repeat administration

Spyglass

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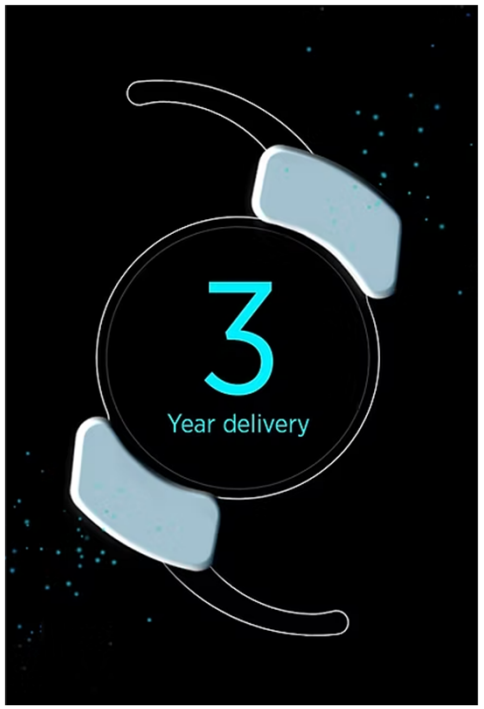
- Not yet approved by FDA
- 3 year delivery of bimatoprost
- **We are enrolling patients currently**



MIGS

Minimally Invasive Glaucoma Surgery

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- iStent
- Hydrus
- Goniotomy (Kahook, Sion)
- Viscodilation (Omni, VIA360, iTrack)

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iStent

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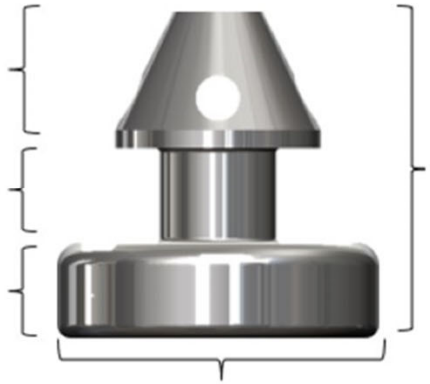
WIDE FLANGE STENT DESIGN

Head Resides in Schlemm's Canal

Thorax Resides in the TM

Flange Resides in AC



360 µm

360 µm

- Material: Titanium (medical implant grade)
- Coating: Heparin
- Biocompatible
- Delivered Sterile
- MRI Conditional: Non-ferromagnetic Material

iStent

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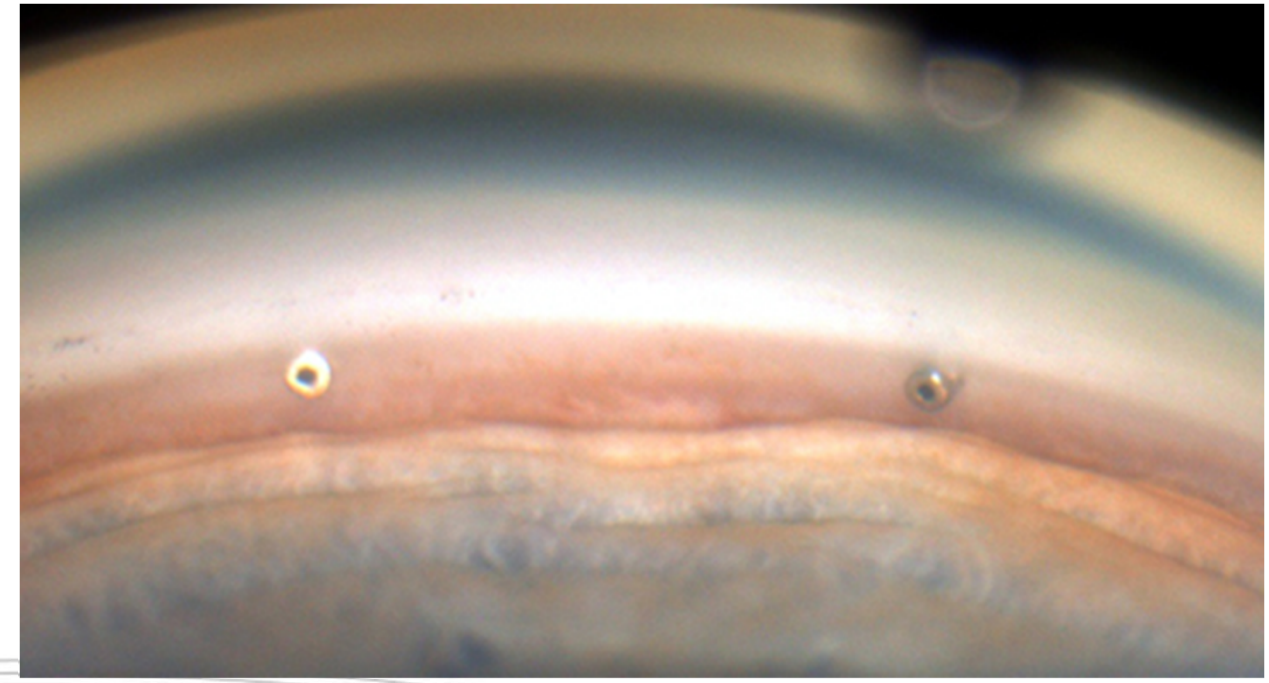

iStent Standalone

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- iStent **Infinite** has a standalone indication
- Indicated for POAG patients in whom previous medical and/or surgical management have failed
    - It is up to us to determine what “failure” means

iStent + iDose TR

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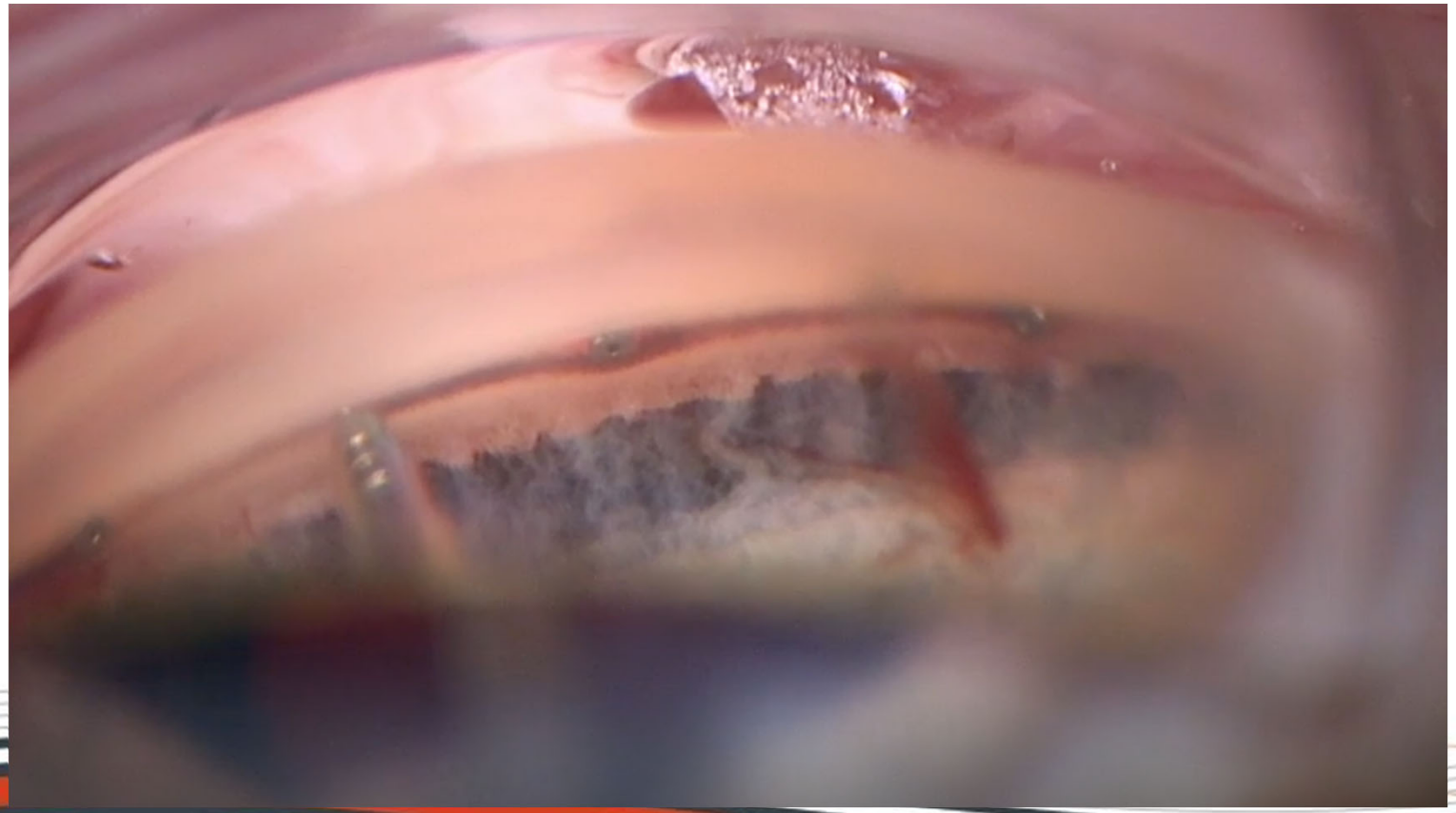

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Hydrus

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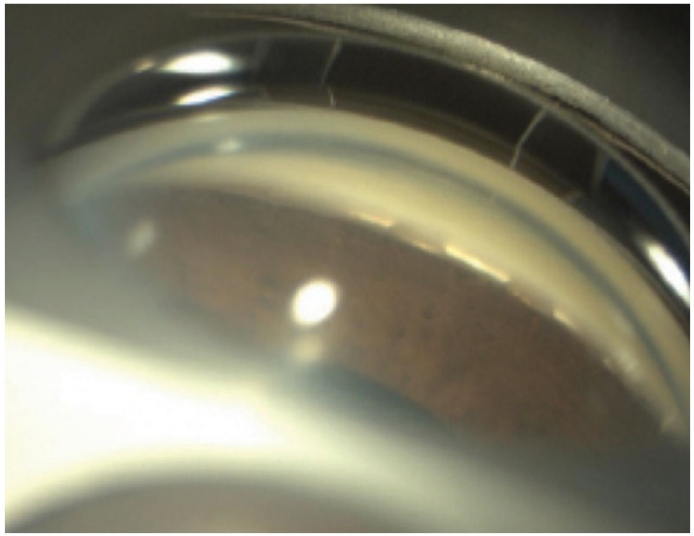

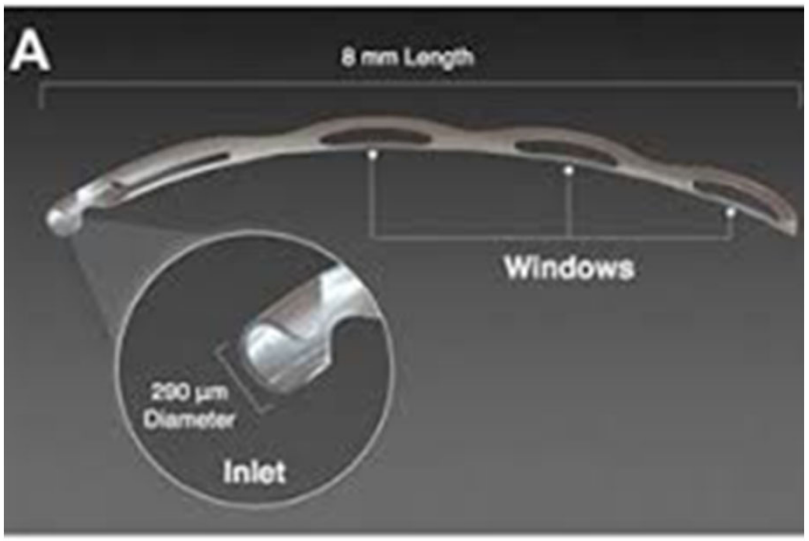

COMPARE

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- Standalone Hydrus resulted in a higher surgical success rate and fewer medications compared with the 2-iStent procedure
- **Hydrus patients had higher rates of reduced meds and being med free at 12 months**

HORIZON

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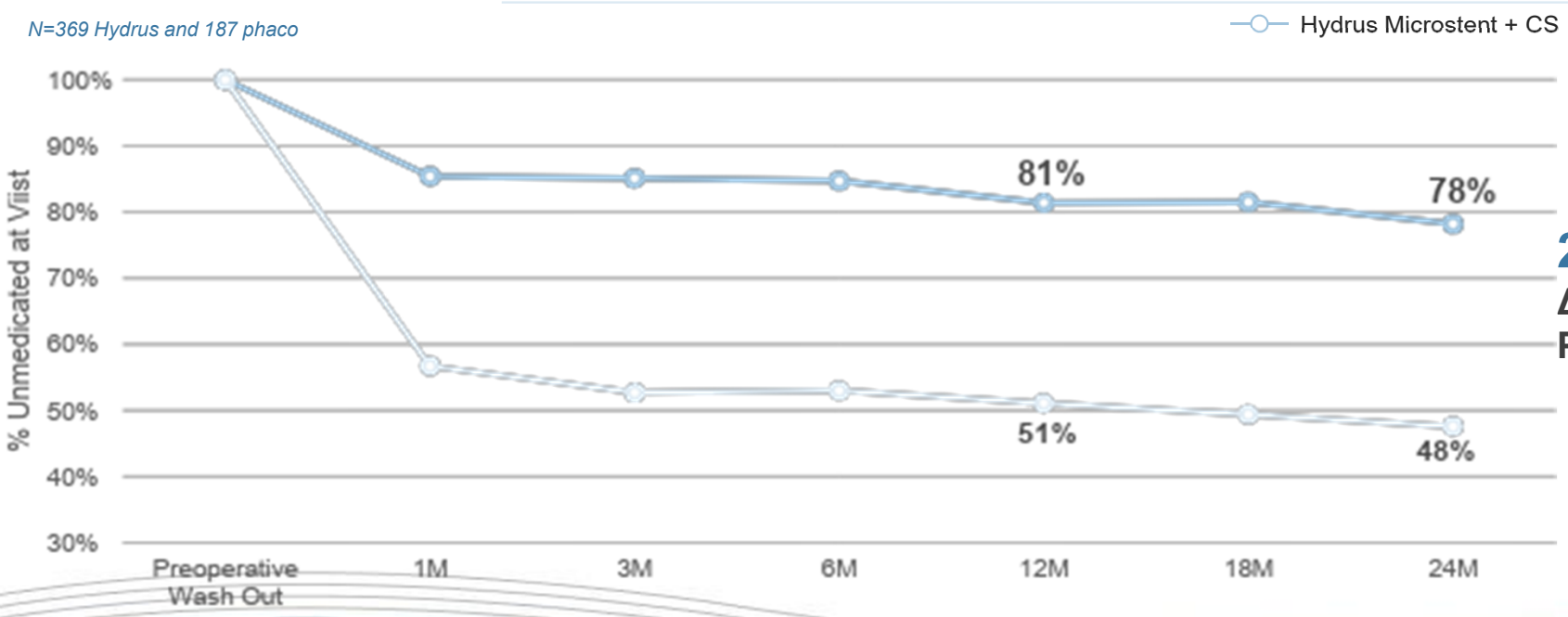
Largest treatment effect of all MIGS pivotal trials to date[1-4]

N=369 Hydrus and 187 phaco



24 Months
Δ = 30%
P<0.001

1. Samuelson TW, Chang DF, Marquis R, et al. A Schlemm canal microstent for intraocular pressure reduction in primary open-angle glaucoma and cataract: The HORIZON Study. Ophthalmology 2019;126:29-37. 2. Vold S, Ahmed II, Craven ER, et al; CyPass Study Group. Two-Year COMPASS Trial Results: Supraciliary Microstenting with Phacoemulsification in Patients with Open-Angle Glaucoma and Cataract. Ophthalmology. 2016;123(10):2103-2112.
3. US Food and Drug Administration. Summary of Safety and Effectiveness Data (SSED): Glaukos iStent® Trabecular Micro-Bypass Stent. US Food and Drug Administration website. https://www.accessdata.fda.gov/cdrh_docs/pdf8/P080030B.pdf. Published June 25, 2012. Accessed
4. Food and Drug Administration. Summary of Safety and Effectiveness Data (SSED): iStent inject® Trabecular Micro-Bypass System. US Food and Drug Administration website. https://www.accessdata.fda.gov/cdrh_docs/pdf17/P170043b.pdf. Published June 21,

HORIZON

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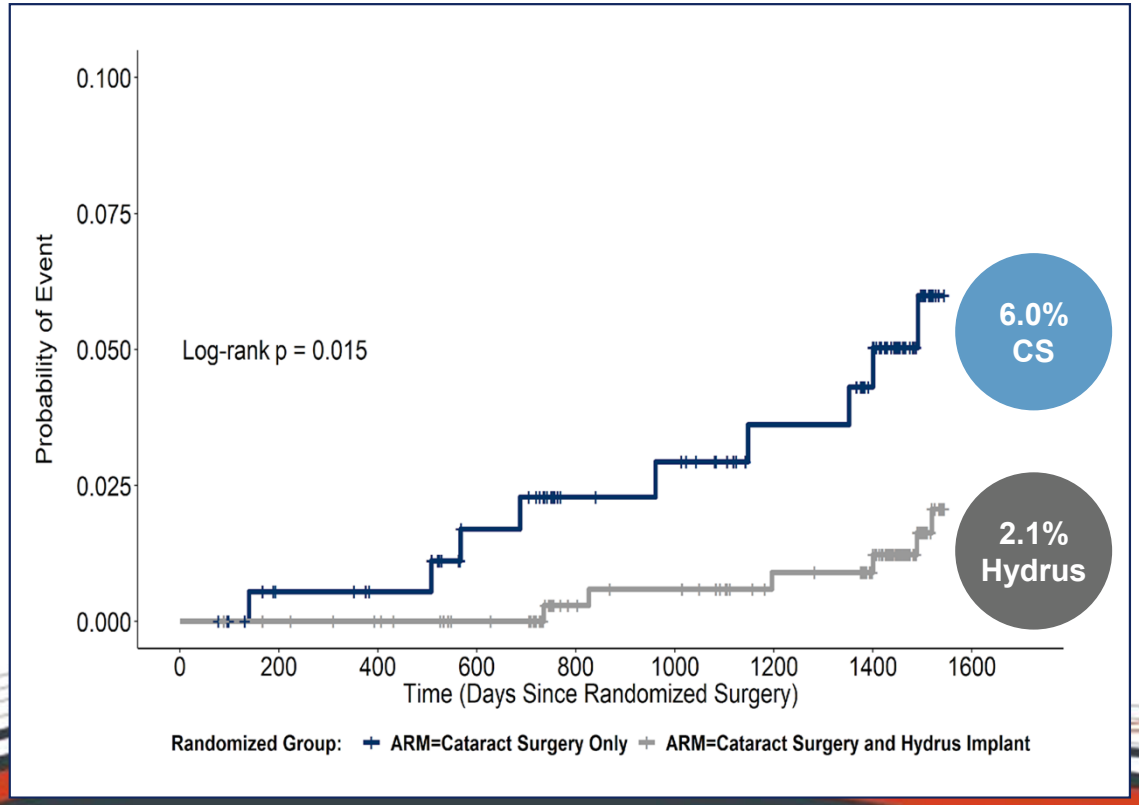
4- Year Kaplan Meier Cumulative Incisional Glaucoma Surgery Probability Plot



- **3X** reduction in risk of SSI
  - trabeculectomy, tube shunt, and/or cilioablative procedures
- One of every 25 patients treated with Hydrus will avoid an SSI versus patients treated with phaco alone
- More than half of these patients were mild at baseline (VF MD -4 DB or better)

65% Reduction in 4-Year Risk of SSI

Rhee DJ. 4 Year Findings from the HORIZON Trial AGS 2020, Washington DC

MIGS

Minimally Invasive Glaucoma Surgery

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Goniotomy

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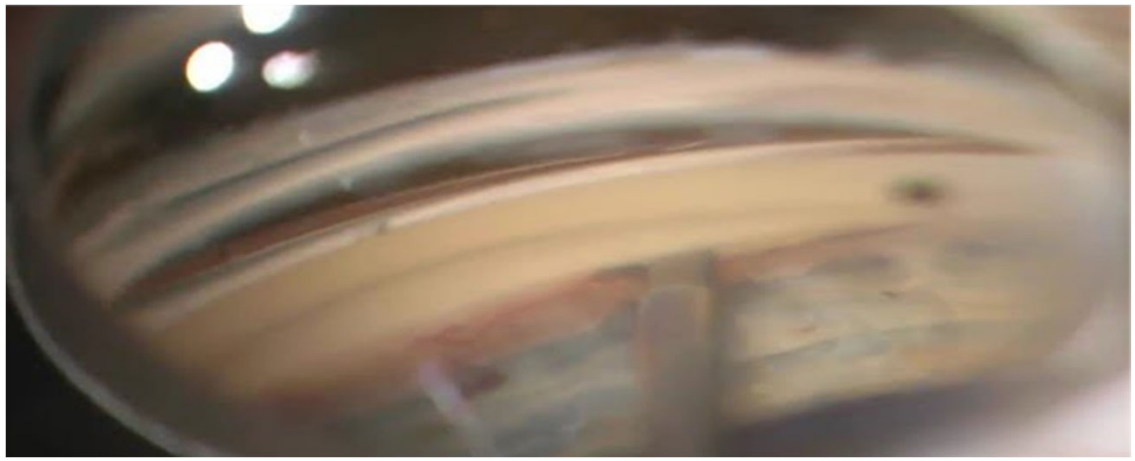

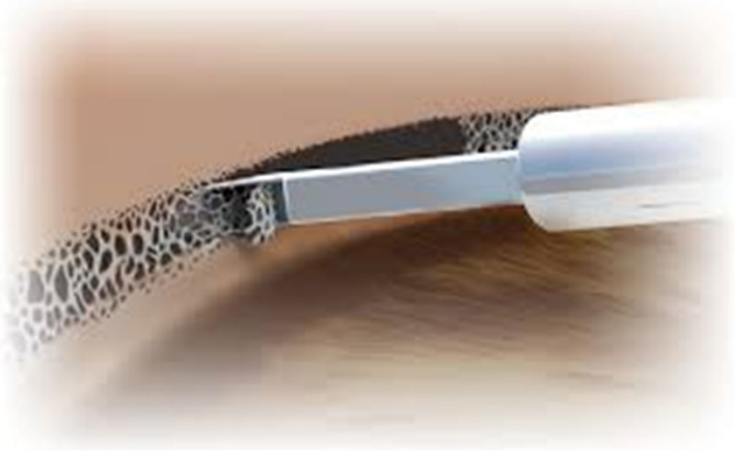

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Viscodilation +/- Goniotomy

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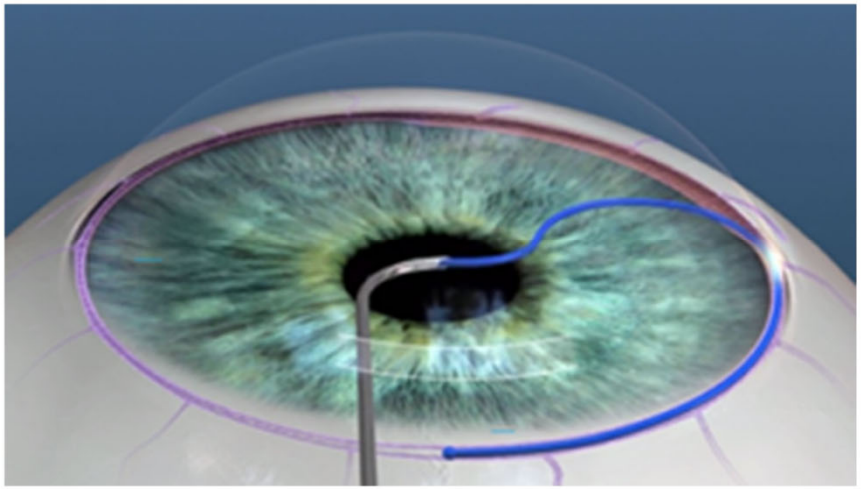

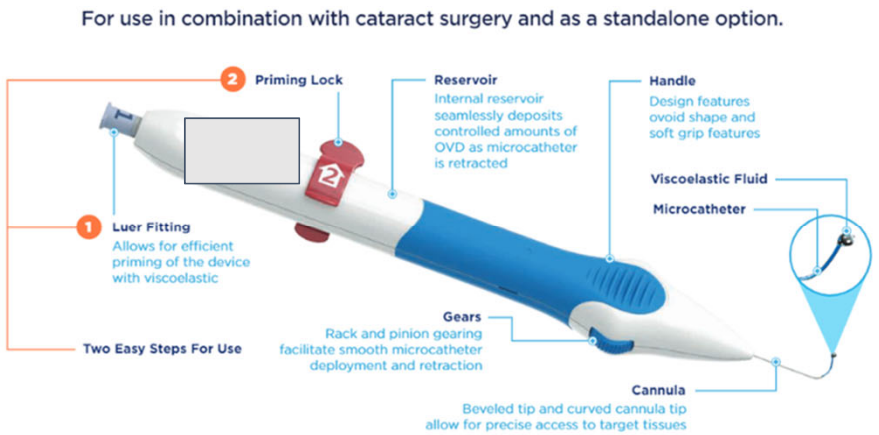

Viscodilation +/- Goniotomy

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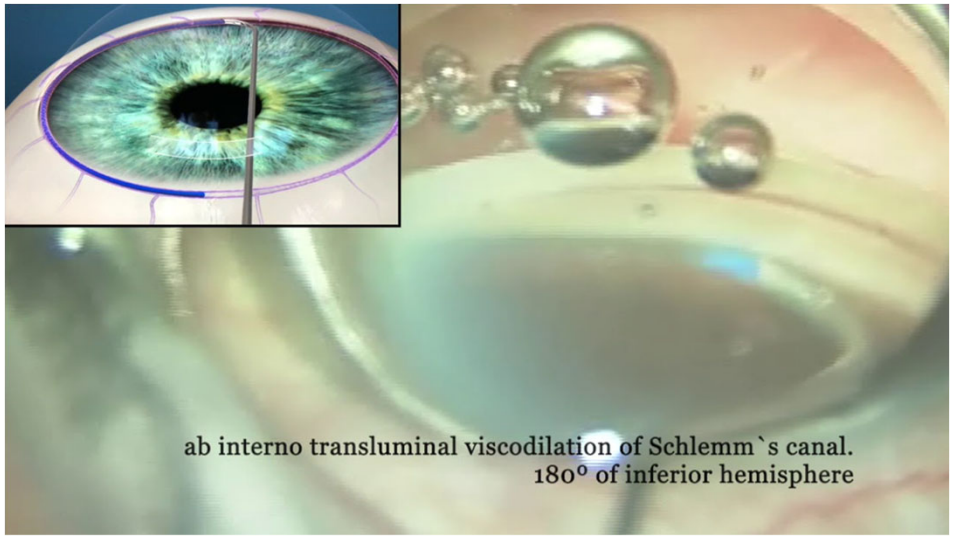

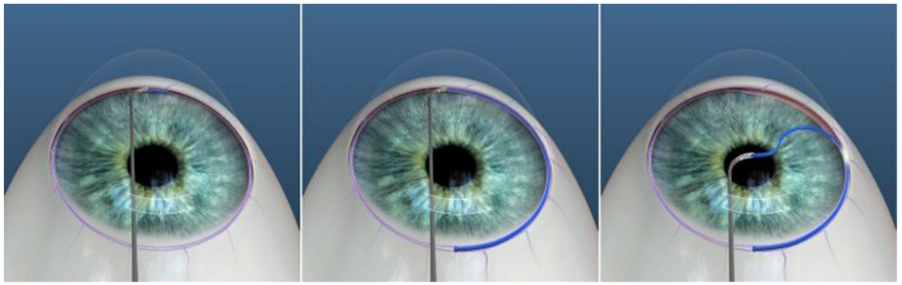

Filtering Surgery

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XEN

Tube Shunt
(Valved and Non-Valved)

Trabeculectomy

Filtering Surgery

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XEN Gel Stent

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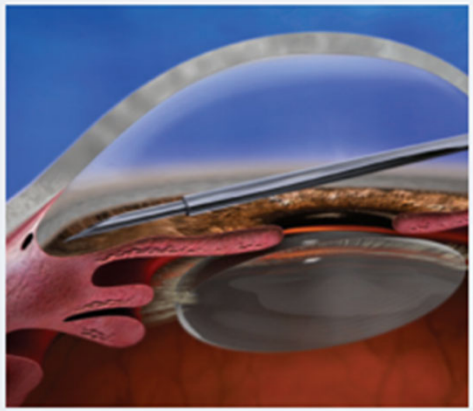
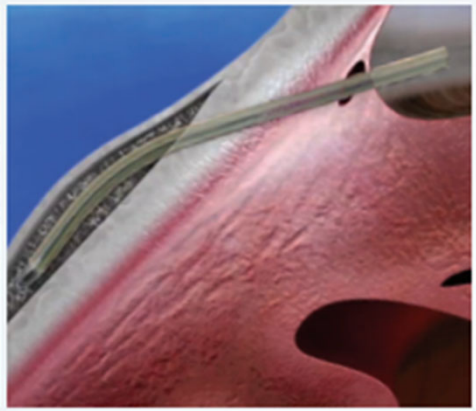
- Multiple methods of performing this surgery
- Ab-interno vs ab-externo; open vs closed conjunctiva; different concentrations of MMC, etc.





XEN Gel Stent

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- Typical bleb is low and posterior
- Xen should be free and mobile

- Recent advances in the technique have allowed for outstanding results

Pivotal Study

Results With XEN® Gel Stent: Reduced IOP at Month 12

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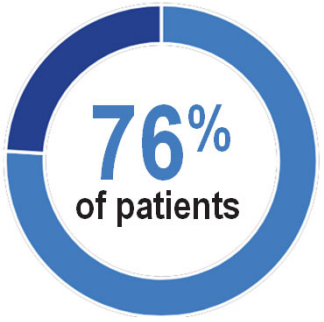
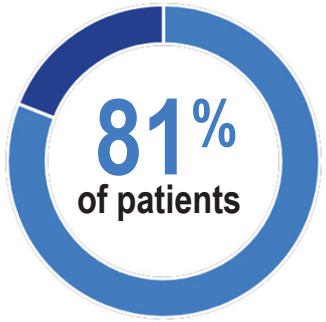


ACHIEVED ≥ 20% REDUCTION
in mean diurnal IOP on the same or fewer medications[1,*]

All Enrolled Patients, ITT (N = 65)



ACHIEVED ≥ 25% REDUCTION
in mean diurnal IOP on the same or fewer medications[2]

Patients Who Completed the 12-Month Visit (n = 52)

Mean Reduction in IOP[1]

25.1 (± 3.7) mm Hg — Baseline mean medicated IOP

15.9 (± 5.2) mm Hg — Month-12 mean IOP (n = 52)

ITT = intent to treat.

Results of a prospective, multicenter, single-arm, open-label, US clinical trial to evaluate the safety and effectiveness of XEN® Gel Stent in refractory glaucoma subjects (N = 65) where previous filtering or cilioablative procedures failed, or IOP was unresponsive to maximum tolerated medication. Medication washout was not performed; all IOP-lowering medications were discontinued on the day of surgery. Study eyes undergoing glaucoma-related secondary surgical intervention (SSI) and/or removal of XEN® Gel Stent prior to the 12-month evaluation were considered to be nonresponders. Seven subjects in the study underwent needling procedures with mitomycin C; 4 of these subjects were considered responders.[1]

*76.3% (95% CI = 65.8%, 86.8%); using observed data and failures for subjects with glaucoma-related SSI and multiple imputations for missing data (N = 65).

1. XEN® Directions for Use; 2. Grover et al. *Am J Ophthalmol.* 2017.

GPS Study

Primary Endpoint Results[1]

Established noninferiority of XEN® Gel Stent to trabeculectomy

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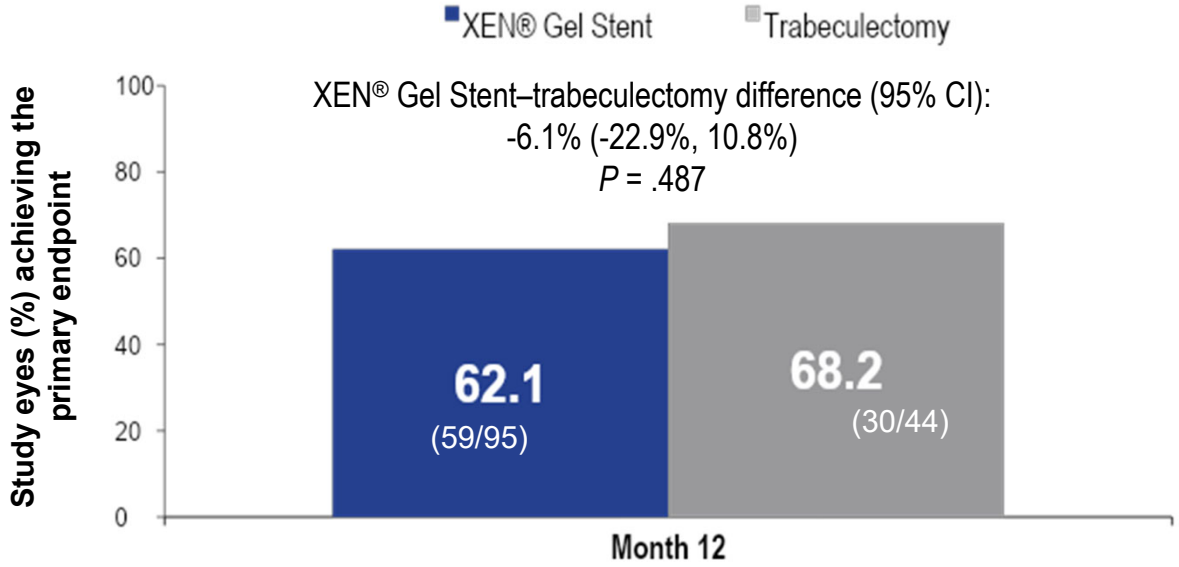
Primary effectiveness endpoint

A composite endpoint of patients (%) achieving ≥ 20% IOP reduction from baseline at the 12-month visit without any of the following:

- Increase in topical IOP-lowering medication
- Clinical hypotony (IOP ≤ 6 mm Hg with vision reduction [≥ 2 lines] related to macular changes [macular folds], optic disc edema, and/or serous choroidal detachments)
- Vision loss to counting fingers
- SSI

Study Eyes (%) Achieving the Composite Primary Endpoint at Month 12[a]



- **Noninferiority of the XEN® Gel Stent to trabeculectomy was claimed if the lower limit of the 95% CI was greater than -24%**
- **At month 12, XEN® Gel Stent was statistically noninferior to trabeculectomy**
- **There was no statistically significant difference between the proportion of patients achieving the primary endpoint in both arms**

[a]Patients with missing data were considered failures in this analysis.[2]

1. Sheybani et al. *Am J Ophthalmol*. 2023; 2. Sheybani et al. AGS. 2022.

US-XEN-240061

GPS Study

Secondary Endpoints: Mean IOP and IOP-Lowering Medication Count[1]

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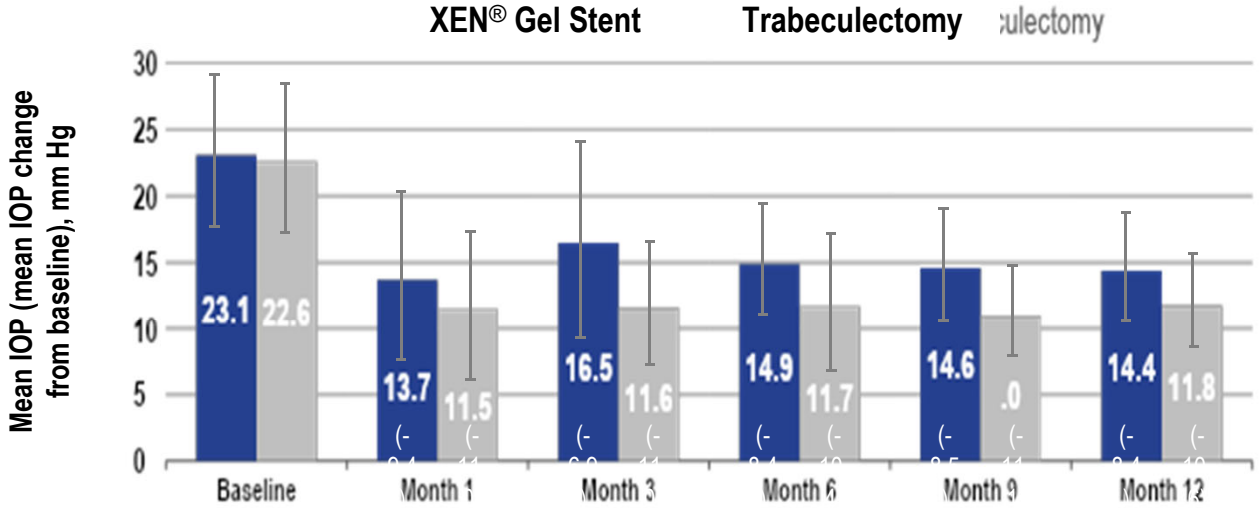
Limitations: All secondary endpoints were prespecified, nonranked endpoints and were not controlled for multiplicity. Therefore, these secondary endpoints cannot be regarded as statistically significant.



Eyes, n	95	44	94	43	89[a]	41[b]	81	41	81	41	78	38
Mean meds	2.8	2.5	0.4	0.2	0.6	0.1	0.7	0.3	0.7	0.3	0.6	0.3
SD	1.2	1.3	1.0	0.6	1.1	0.4	1.2	0.8	1.3	0.6	1.1	0.6

XEN® Gel Stent Mean Medications at Month 12	
0.6	(± 1.1) mean medications from a baseline of 2.8 (± 1.2) mean medications
62.1%	(59/95) of eyes medication free

Trabeculectomy Mean Medications at Month 12	
0.3	(± 0.6) mean medications from a baseline of 2.5 (± 1.3) mean medications
70.5%	(31/44) of eyes medication free

meds = medications.
[a]n = 91 (month 3), 82 (month 6), and 87 (month 12). [b]n = 42 (month 3) and 41 (month 12). Both footnotes refer to the medication count analysis.

1. Sheybani et al. *Am J Ophthalmol.* 2023.

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Postoperative Interventions[1]

Postoperative Interventions in Office

Eyes with postoperative procedures	XEN® Gel Stent (n = 95)	Trabeculectomy (n = 44)
Office-based, % (n)	34.7% (33)	63.6% (28)
Needling, % (n) Mean (SD) procedures per eye	23.2% (22) 1.7 (1.0)	18.2% (8) 1.4 (0.7)
Laser suture lysis (LSL), % (n)	NA	31.8% (14)
5-fluorouracil injection, % (n)	15.8% (15)	18.2% (8)
Bandage contact lens, % (n)	2.1% (2)[a]	18.2% (8)[a]
Other,[b] % (n)	10.5% (10)	11.4% (5)
Office-based excluding LSL, % (n)	34.7% (33)	40.9% (18)

Needling Procedures and Related Variables

	XEN® Gel Stent (n = 95)	Trabeculectomy (n = 44)
Total patients needled, % (n) With antifibrotics/antimetabolites	23.2% (22) 16.8% (16)[c]	18.2% (8) 15.9% (7)
Mean time to needling, days (SD) Min, max	78.8 (72.5) 8, 274	53.3 (51.7) 8, 169
Needled eyes achieving > 20% IOP reduction from baseline at month 12 without increase in medication count, % (n/N)	87.5% (14/16)	85.7% (6/7)

- **34.7% of XEN® Gel Stent patients and 63.6% of trabeculectomy patients required an office-based postoperative intervention. After excluding laser suture lysis from the analysis, 40.9% of patients in the trabeculectomy arm required an office-based postoperative intervention**[1]
  - The needling rate was 23.2% with XEN® Gel Stent and 18.2% with trabeculectomy

NA = not applicable.
[a]See notes. [b]Included air injection in the anterior chamber (n = 2), XEN® Gel Stent removal (n = 2), laser iridotomy (n = 2), digital ocular compression (n = 1), goniosynechialysis (n = 1), laser iridoplasty (n = 1), and paracentesis (n = 1) in the XEN® Gel Stent arm, and digital ocular compression (n = 2) and suture removal (n = 3) in the trabeculectomy arm. [c]Two patients received both MMC and 5-fluorouracil during needling.

1. Sheybani et al. *Am J Ophthalmol*. 2023.

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Postoperative Ocular AEs[1]

Postoperative ocular AEs, % (n)	XEN® Gel Stent (n = 95)	Trabeculectomy (n = 44)
Bleb fibrosis	4.2% (4)	0
Bleb leak	0	15.9% (7)
Cataract progression[a]	3.2% (3)	2.3% (1)
Choroidal effusion	2.1% (2)	9.1% (4)
Device extrusion	3.2% (3)	NA
Glaucoma progression[b]	0	6.8% (3)
Hyphema	6.3% (6)	6.8% (3)
Hypotony (IOP < 6 mm Hg at any time)	23.2% (22)	50.0% (22)
Clinical hypotony	1.1% (1)	22.7% (10)
IOP increased ≥ 10 mm Hg from baseline at any time	21.1% (20)	11.4% (5)
Iris adhesions	3.2% (3)	4.5% (2)
Visual acuity reduced (≥ 2 lines at any time)	38.9% (37)	54.5% (24)

[a]Per the investigator's slit-lamp assessment and the following categories: lens clear, lens opacity present–not significant, and lens opacity present–visually significant.
[b]Based on visual field changes.

1. Sheybani et al. *Am J Ophthalmol*. 2023.

Summary of Xen Data

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- At 12 months, Xen **non-inferior** to trab for >= 20% IOP reduction
- Xen resulted in fewer postoperative interventions, better visual recovery, and fewer adverse events

Cyclophotocoagulation (CPC)

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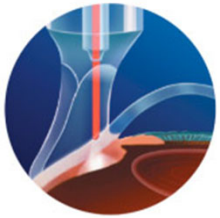
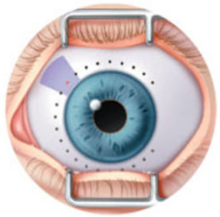
- Continuous-Wave CPC (G-probe) and Micropulse



Placement



Application

Treatment

My Old Treatment Algorithm

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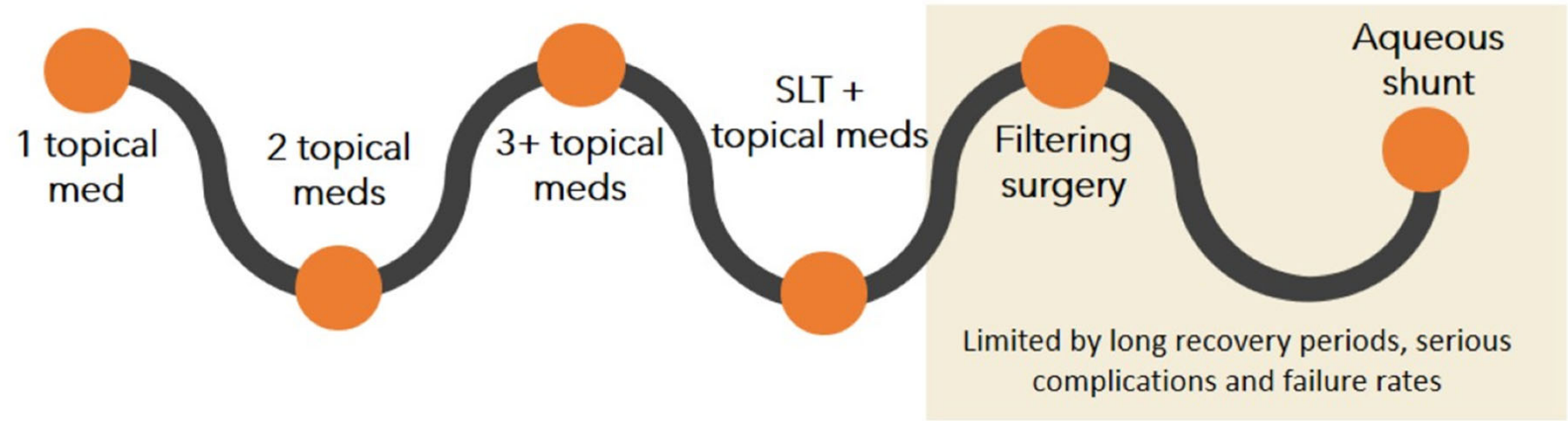

Landmark glaucoma studies show that

- ✓ **Even patients diagnosed and treated with topical medication regimens can suffer significant disease progression[1]**
- ✓ **Early surgical intervention can slow disease progression more effectively than medical therapy[2]**

The current "meds-first and always" mindset is being challenged

1. Malihi M, *et al. Ophthalmology.* 2014;121(1):134-41; 2. Lichter PR, *et al. Ophthalmology.* 2001;108(11):1943-1953

My New Treatment Algorithm

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Interventional glaucoma consensus treatment protocol

Christine M. Funke[a], Deborah Ristvedt[b], Arkadiy Yadgarov[c] and J. Morgan Micheletti[d]

[a]Barnet Dulaney Perkins Eye Center, Tempe, AZ, USA; [b]Vance Thompson Vision, Alexandria, MN, USA; [c]Omni Eye Services, Atlanta, Georgia, United States GA, USA; [d]Berkeley Eye Center, Sugar Land, TX, USA

ABSTRACT

Introduction: Topical medications are a common treatment for glaucoma, but a number of caveats limit their long-term utility and sustainability. In recent years, as a wider variety of treatment options has become more widespread for glaucoma – such as laser trabeculoplasty, minimally invasive glaucoma surgery (MIGS), and sustained-release procedural pharmaceuticals – it has become increasingly possible to manage the disease procedurally and at earlier stages. This evolution in care has been termed 'interventional glaucoma' (IG).

Areas covered: The present paper reviews the evidence behind the IG revolution, then turns to a central question: determining the optimal treatment algorithm at each patient stage within the IG paradigm, from ocular hypertension to severe glaucoma. The paper summarizes the consensus opinion of 10 glaucoma experts committed to IG principles and advancing patient care.

Expert opinion: Within this consensus protocol, each glaucoma stage has its own stepwise, logical procession of treatment(s), with rationale behind each step. The resulting framework is intended to be a practical guide or starting point for providers seeking to incorporate IG principles into their practices.

ARTICLE HISTORY
Received 12 December 2024
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KEYWORDS
Consensus; glaucoma; interventional; SLT; MIGS; procedure; protocol; treatment

Proactive Interventional Management

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- Enables more continuous 24-hour IOP control
- Improves compliance
- Delayed visual field progression
- Revitalizes the natural outflow pathway
- Reduces need for more invasive procedures
- **Earlier offering of SLT, MIGS, and/or sustained-release**

Preferred Treatment Protocol

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- Primary goal is to deliver care that maximizes safety and quality of life without compromising efficacy
- The protocol takes into account lens status, disease state, number of drops, prior treatment, angle anatomy, ocular surface disease, among other factors

Preferred Treatment Protocol

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- Treatment is not “one size fits all”
- A glaucoma patient’s treatment journey is lifelong

Preferred Treatment Protocol

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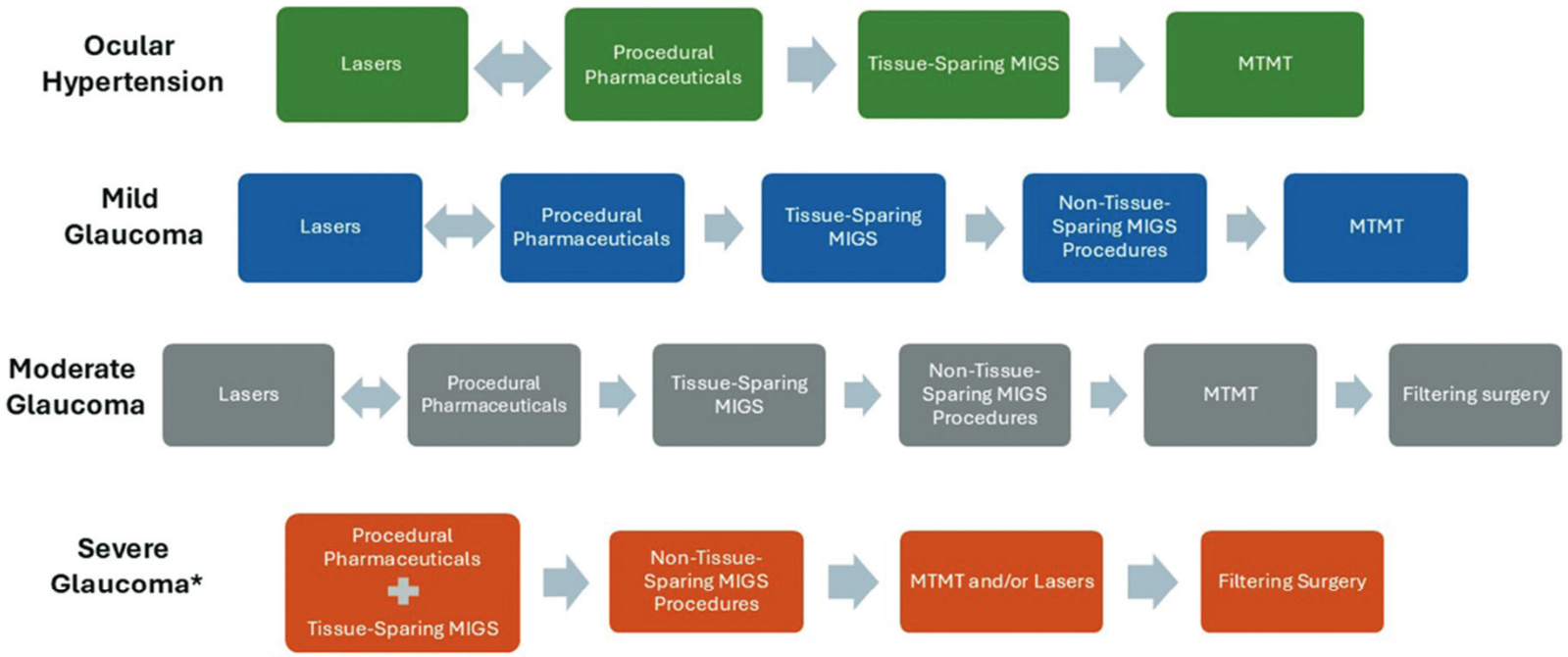
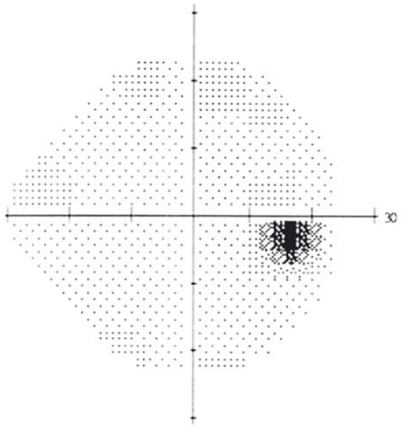


Ocular Hypertension



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Procedural pharmaceuticals = Durysta, iDoseTR
Tissue sparing MIGS = iStent, Viscodilation (Omni, VIA360)
MTMT = maximum tolerated medical therapy

Mild Glaucoma

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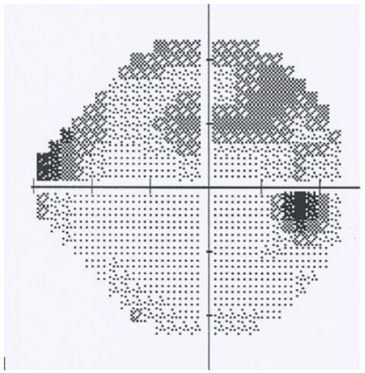
Non-tissue sparing MIGS = goniotomy

Moderate Glaucoma



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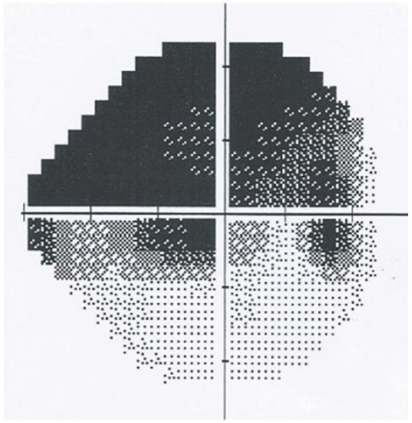
Filtering surgery = Xen, trabeculectomy, tube shunt

Severe Glaucoma



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Procedural Pharmaceuticals + Tissue-Sparing MIGS → Non-Tissue-Sparing MIGS Procedures → MTMT and/or Lasers → Filtering Surgery

Scope of Practice and SLT

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- Even something as “simple” as SLT is not benign
- Refrain from using the terms *easy, simple, etc.*
- My multi-specialty practice in Cincinnati and Northern Kentucky employs ODs, but they do not perform lasers or cutting procedures

Take Home Points

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- Evidence supports a shift towards earlier intervention directed towards laser and drug delivery
- Drops have a role, but likely more as a bridge to other interventions
- **Every severe glaucoma patient was once a mild glaucoma patient**
- No intervention is perfect, and glaucoma patients should expect multiple treatments over their lifespan

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Questions?

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