New Horizons in Glaucoma Devices

Steven Vold MD
Vold Vision
February 4, 2017

VOLD VISION
YOUR SIGHT IS OUR VISION

Financial Disclosures

Company	Nature of Affiliation
• Vold Vision, P.L.L.C • BK Ventures Group	• Founder and Chief Executive Office • Principal and Director
• Aeon, Allergan, Arie Pharmaceuticals, Calhoun Vision, SOLX, Ocular Therapeutix, Forsight Labs, InnFocus, AqueSys, Ivantis, Glaukos, Alcon, Allergan, Transcend Medical, Bausch & Lomb	• Grants/Research Support

Financial Disclosures

Company	Nature of Affiliation
• Iridex, Carl Zeiss Meditec, Glaukos, Alcon, Lumenis, Transcend Medical, Volk Optical, Wavetec Vision	• Consultant
• Alphaeon, TrueVision Systems, Ocunetics	• Stock/Shareholder
• Neomedix, Allergan	• Speakers' Bureau

Case 1. Clinical History

72 y.o. man presents for regular yearly examination complaining of ocular redness, ocular FB sensation and difficulty reading fine print

Past Ocular History: POAG OU

Past Medical History: Coronary artery disease

Family History: Multiple family members with POAG

Medications: Timolol 0.5% OU QAM; Latanoprost OU QHS

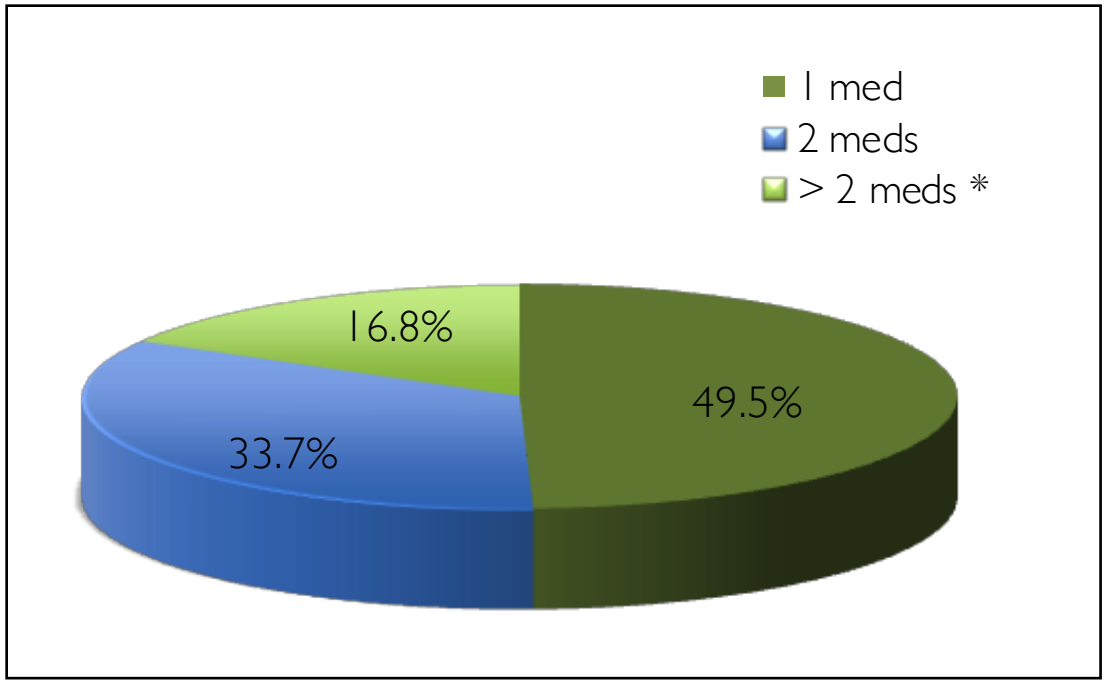
Clinical Examination

Best-corrected Visual Acuity: 20/30 OU, but does glare to 20/50 OU
Manifest Refraction: -1.50 sphere OU
Visual fields: Early arcuate defects OU
Corneal Pachymetry: 540 um OD; 546 um OS
Goldmann Tonometry: 23 mm Hg OU
OHS: 0.7 OU with disc heme inferiorly

How do you recommend that we manage this patient?

1) Alter glaucoma medication regimen
2) Laser trabeculoplasty
3) Filtration surgery alone
4) Combined cataract and filtration surgery
5) Combined cataract and iStent surgery

Current Standard Treatments and Limitations



51% of glaucoma patients are on 2 or more medications.

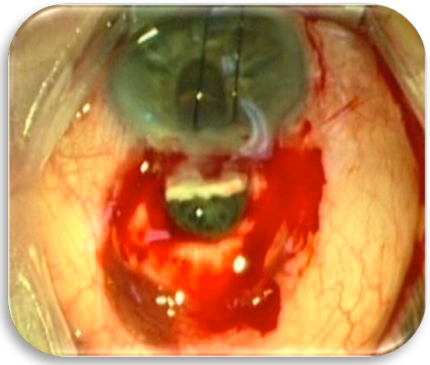
Addition of 3rd and 4th med, no benefit.

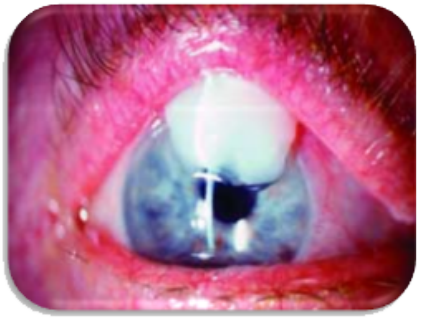
*

Neelakantan MD, A, J Glaucoma 2004 Apr;13(2):130-6, "Is addition of a Third or Fourth antiglaucoma medication effective?"
Okeke, Constance, et al, "Adherence with Topical Glaucoma Medication Monitored Electronically", Ophthalmology, Volume 116, Number 2, Feb 2009

Current Standard Treatments and Limitations

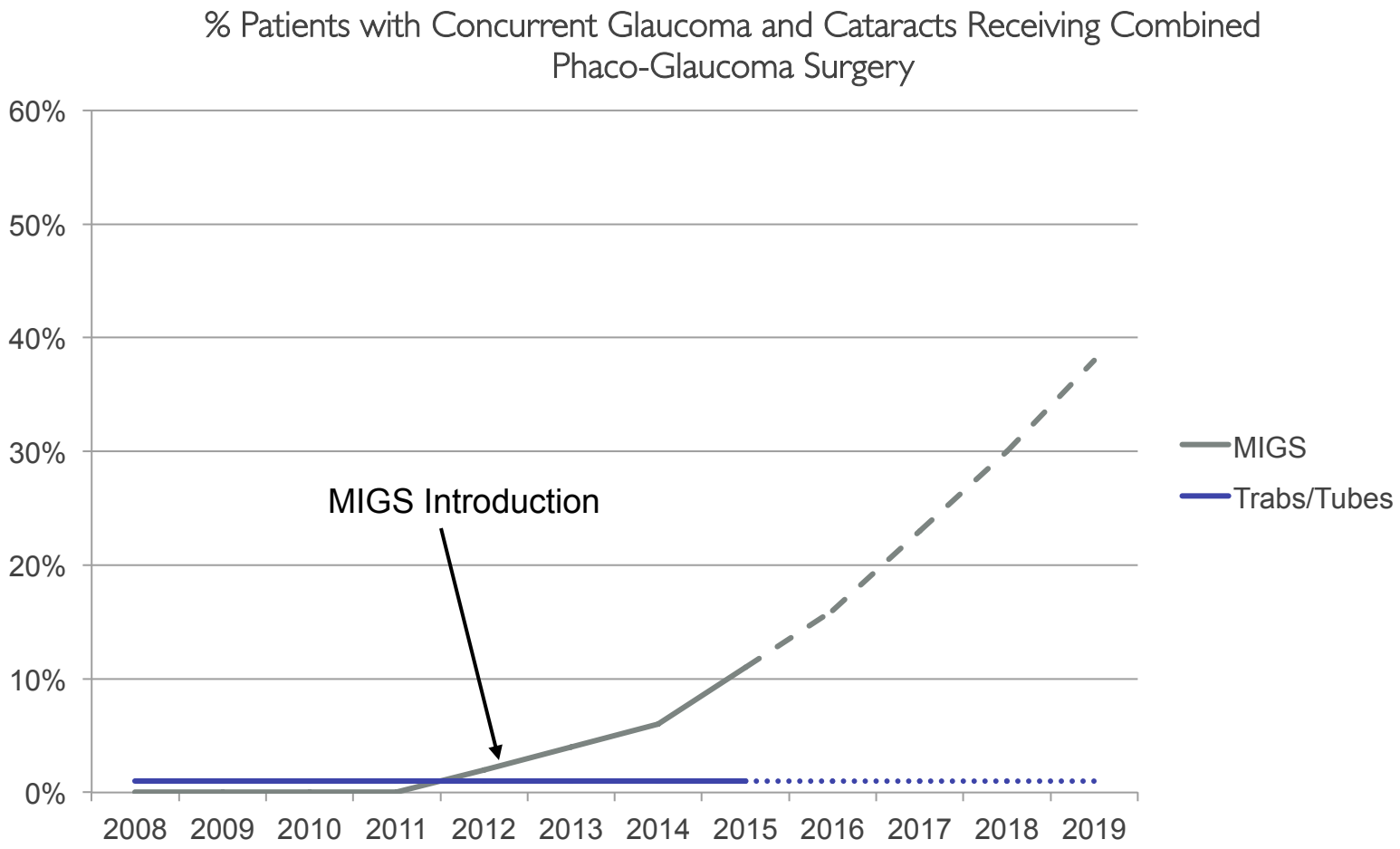
	Trab	External Shunts
Complications: Intra Op	10%	7%
Post Op (1 Yr):	57%	34%
Choroidal Effusion	19%	16%
Choroidal Hemorrhage	3%	2%
Shallow / Flat AC	10%	11%
Hyphema	8%	2%
Endophthalmitis	3%	1%
Vision Loss (≥2 lines)	28%	17%





1. ASO Gedde et al 2007, Vol 143: 9-22 TVT Study

MIGS is transforming the way we treat combined cataract and glaucoma



Market Scope, 2012

The Evolution of Trabecular Bypass Procedures in Adults

Nylon Filament Trabeculotomy.
Comparison with the results of conventional drainage operations in glaucoma simplex

REDMOND SMITH *(London)* 1969

Transactions of the Ophthalmological Society of New Zealand

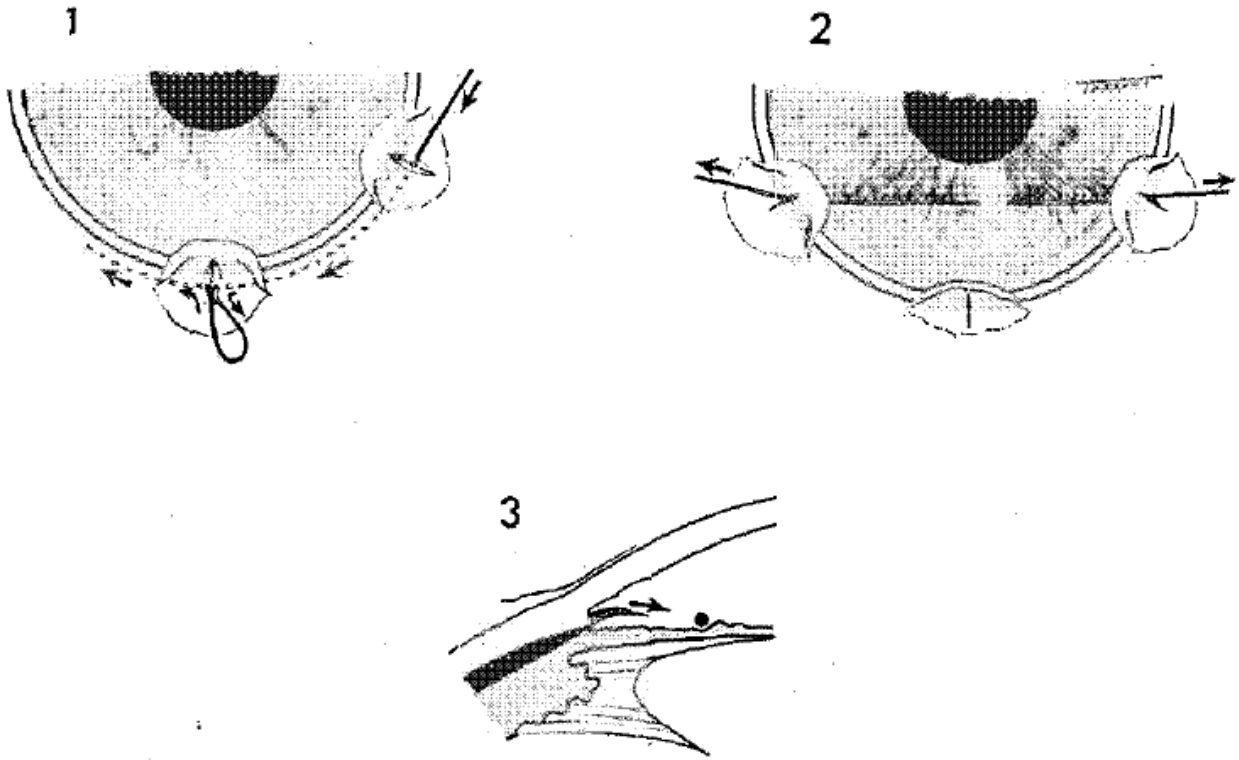


FIG. 1 (a)—Diagram to show the technique of nylon filament trabeculotomy.

Long-term Outcome of Trabeculotomy for the Treatment of Developmental Glaucoma

Arch Ophthalmol. 2004;122:1122-1128 ; *Tomoyuki Muto, MD; Hidenobu Tanihara, MD; Makoto Nagata, MD*

Retrospective review of 149 eyes

Ab externo trabeculotomies

Mean +/- SD follow up time: 9.5 +/- 7.1 years

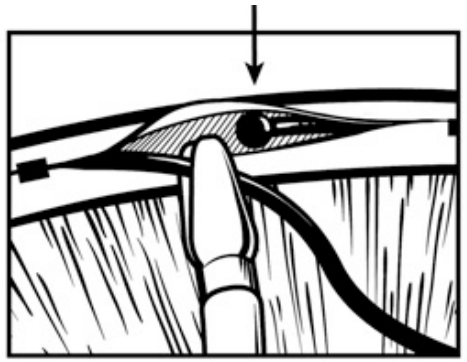
Mean +/- SD IOP at last follow up: 15.6 +/- 5.0

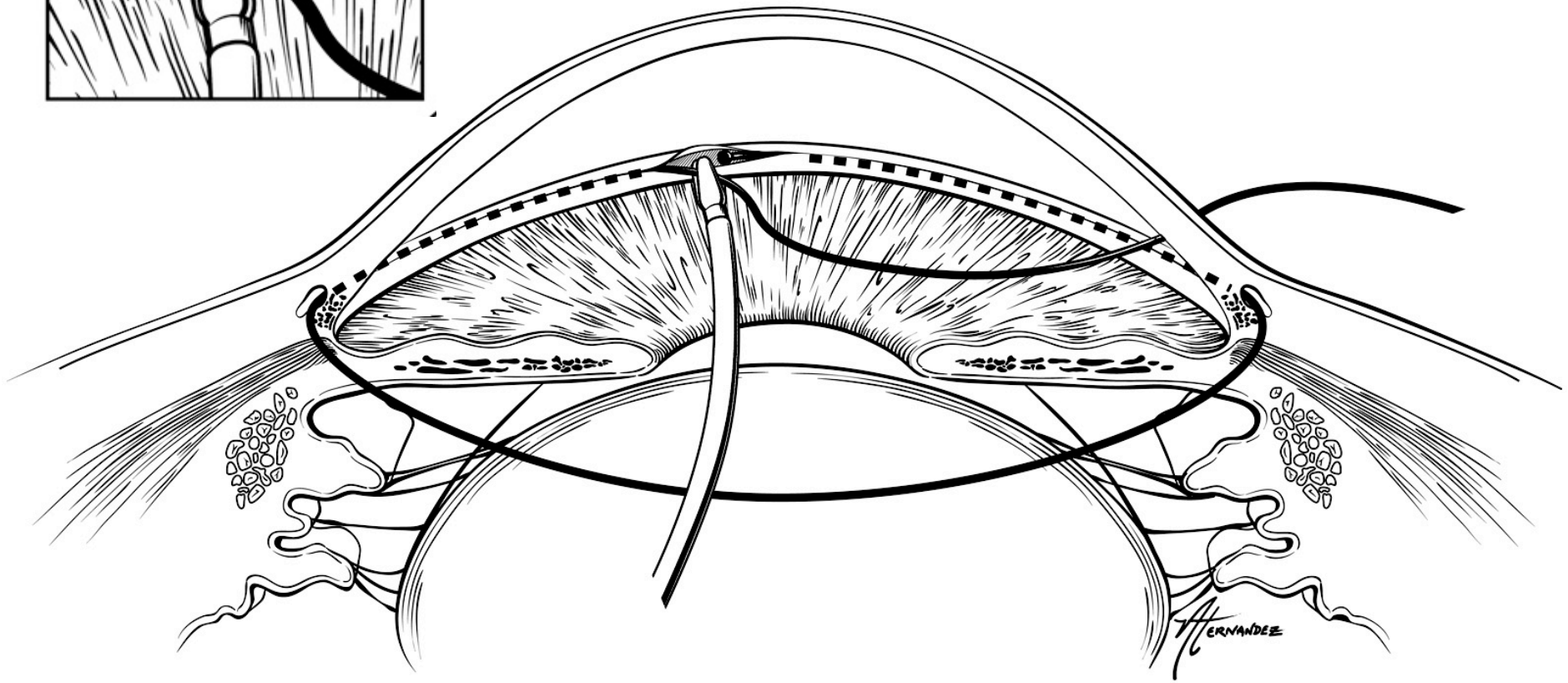
Success rate of nearly 90%

Problems with Trabeculotomy Ab Externo

Length of time (30-60+ minutes)
Numerous Conjunctival and Scleral sutures required
Violate the superior conjunctiva
May preclude or diminish success rates for a subsequent trabeculectomy
Relatively invasive

ABiC (Ab Interno Canaloplasty) vs GATT (Gonioscopy Assisted Transluminal Trabeculotomy)





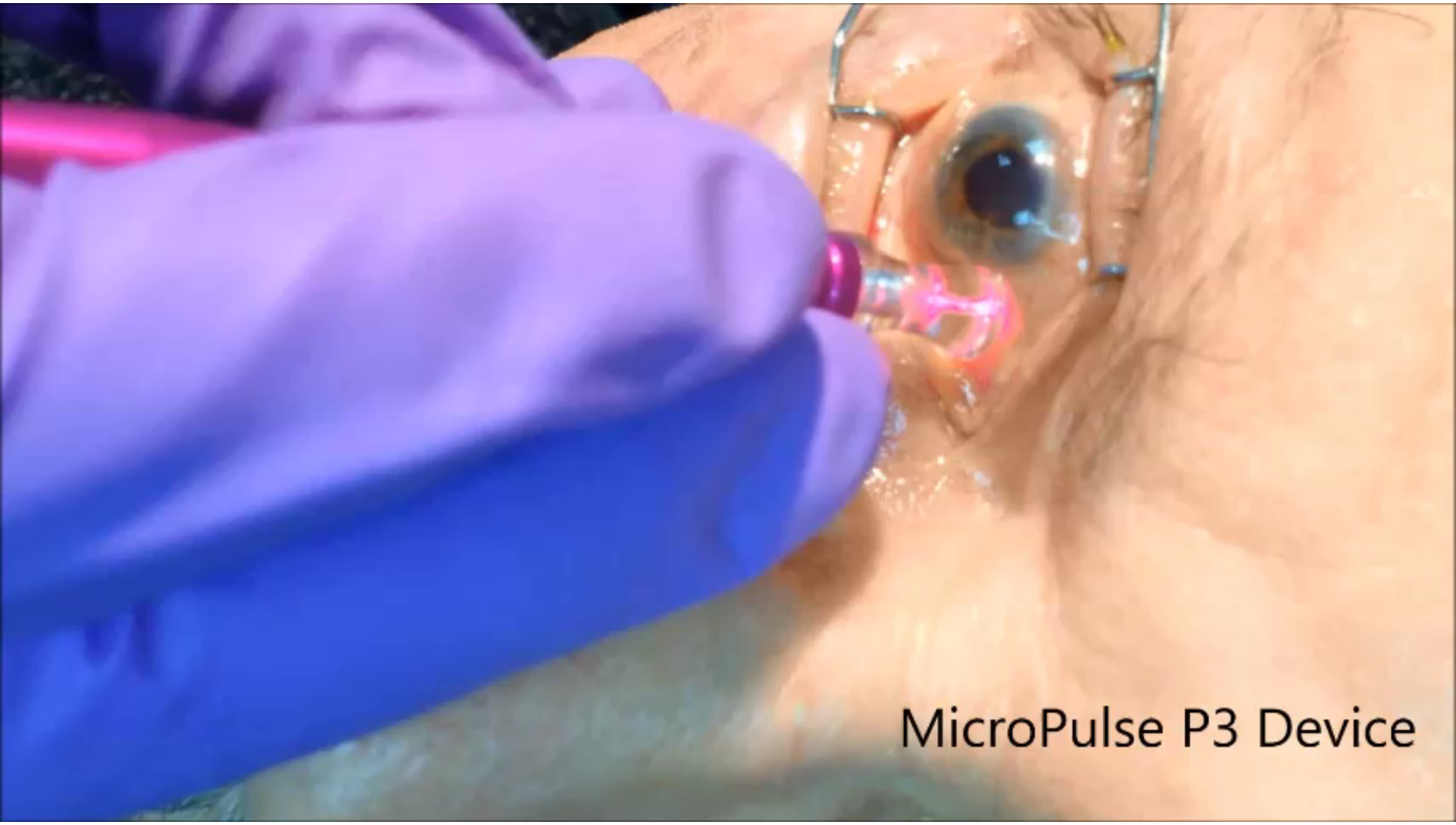

VOLD VISION
PRODUCTIONS

CYCLO G6™

Glaucoma Laser System

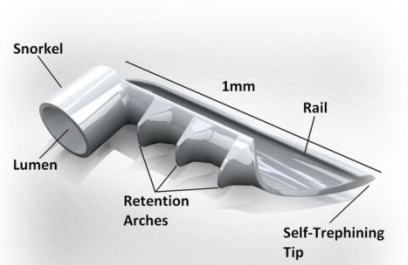
MicroPulse® P3 – Cyclophotocoagulation with MicroPulse Technology

- Excellent Safety Profile
- Efficient & Straightforward for physician and patient
- Can be performed in the Office & OR
- Predictability


MicroPulse P3 Device

Next-Generation Glaucoma Microstents and Implants: Right Around the Corner

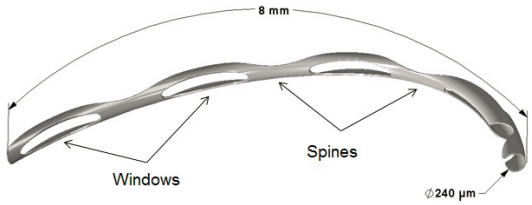
First-Generation Devices Paving the Way



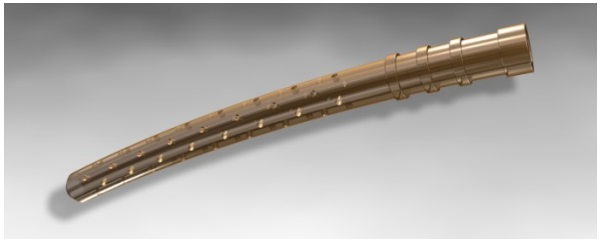
iStent

Ex-PRESS

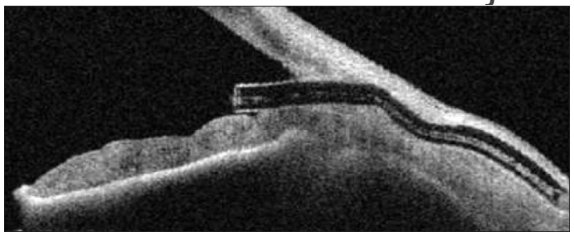
Next-Generation Trabecular Microstents

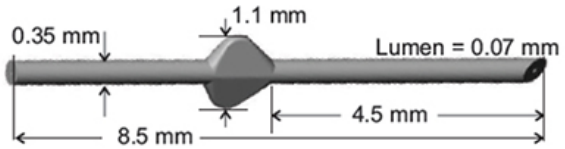


Next-Generation Uveoscleral Microstents



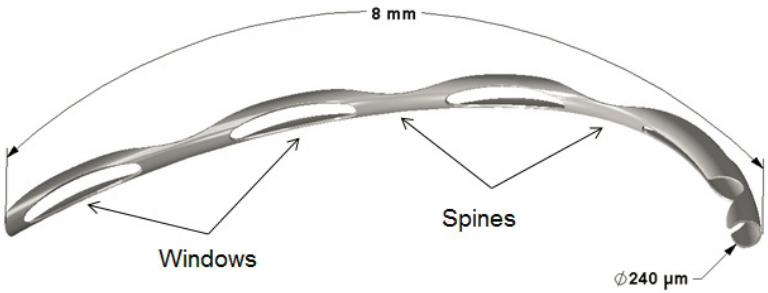
Next-Generation Subconjuntival Implants





Next-Generation Trabecular Microstents

Increasing access to Schlemm's canal to drive more flow



iStent Inject

- CE Mark in 2009
- US IDE trial in progress
- Allow for 2 access points through the trabecular meshwork, expanding potential outflow through Schlemm's canal
- Multiple iStents have been shown to have improved IOP-lowering effect[1]

Hydrus Microstent

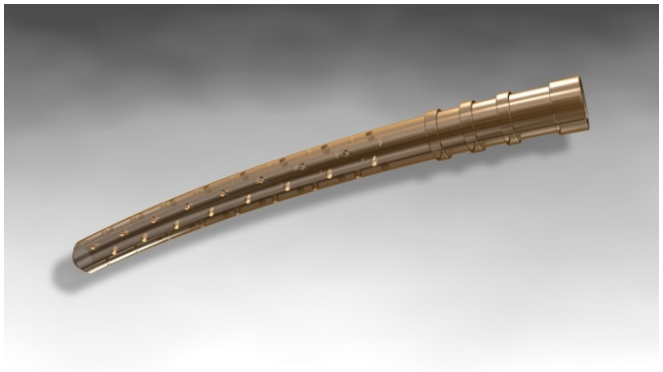
- CE Mark in 2011
- US IDE trial in progress
- Creates entry point through trabecular meshwork and stents open several clock hours to enhance outflow through Schlemm's canal

1. Belovay, JCRS 2012

Hydrus Surgical Video

Next-Generation Uvoescleral Microstents

Unlocking the eye's natural potential through a new mechanism of action



CyPass Micro-Stent

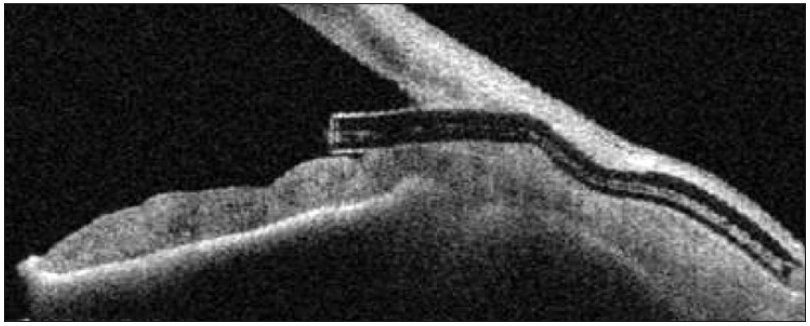
- CE Mark in 2009
- US IDE trial completed
- Leverage uveoscleral outflow, bypassing potentially diseased trabecular outflow pathway
- 6.35 mm length, with lumen of 0.3 mm
- **Currently undergoing FDA review, estimated approval end of 2016**

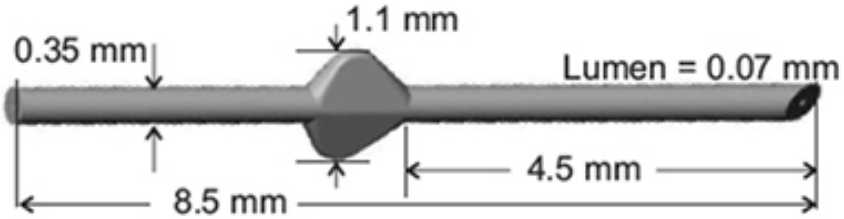
iStent Supra

- CE Mark in 2011
- US IDE trial in progress
- Leverages uveoscleral outflow, bypassing potentially diseased trabecular outflow pathway
- 4mm length, with lumen of 0.16 mm

Next-Generation Subconjuntival Implants

Accessing a well-worn path in new ways





XEN Gel Stent

- CE Mark in 2012
- US IDE trial in progress
- Placed ab interno with outflow into subconjunctival space
- Used in conjunction with Mitomycin-C

InnFocus Microshunt

- CE Mark in 2012
- US IDE trial in progress
- Only trial randomized vs trabeculectomy
- Place ab externo into conjunctival pocket
- Used in conjunction with Mitomycin-C

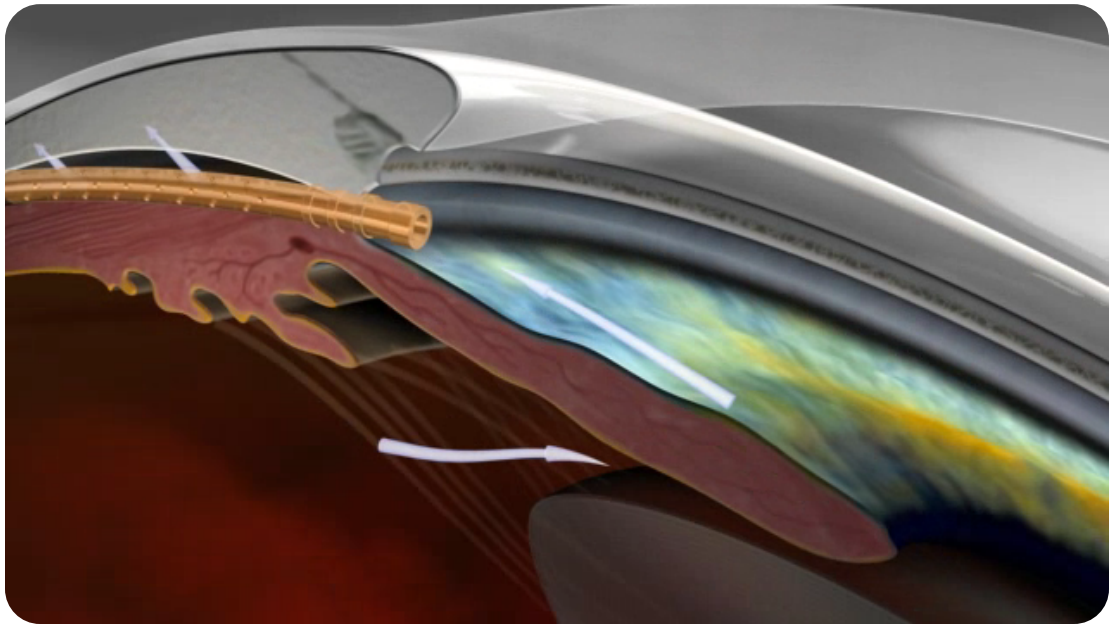
Estimated FDA approval for MIGS implants

MIGS – Ab-interno implants	Estimated FDA approval
Glaukos iStent (PMA)	Q3 – 2012
Transcend Medical CyPass Micro-Stent (PMA)	Q3 – 2016
Glaukos iStent Inject (PMA)	Q1 – 2018
Ivantis Hydrus (PMA)	Q4 – 2018
Glaukos iStent Supra (PMA)	Q1 – 2020

Market Scope 2015
Analyst reports

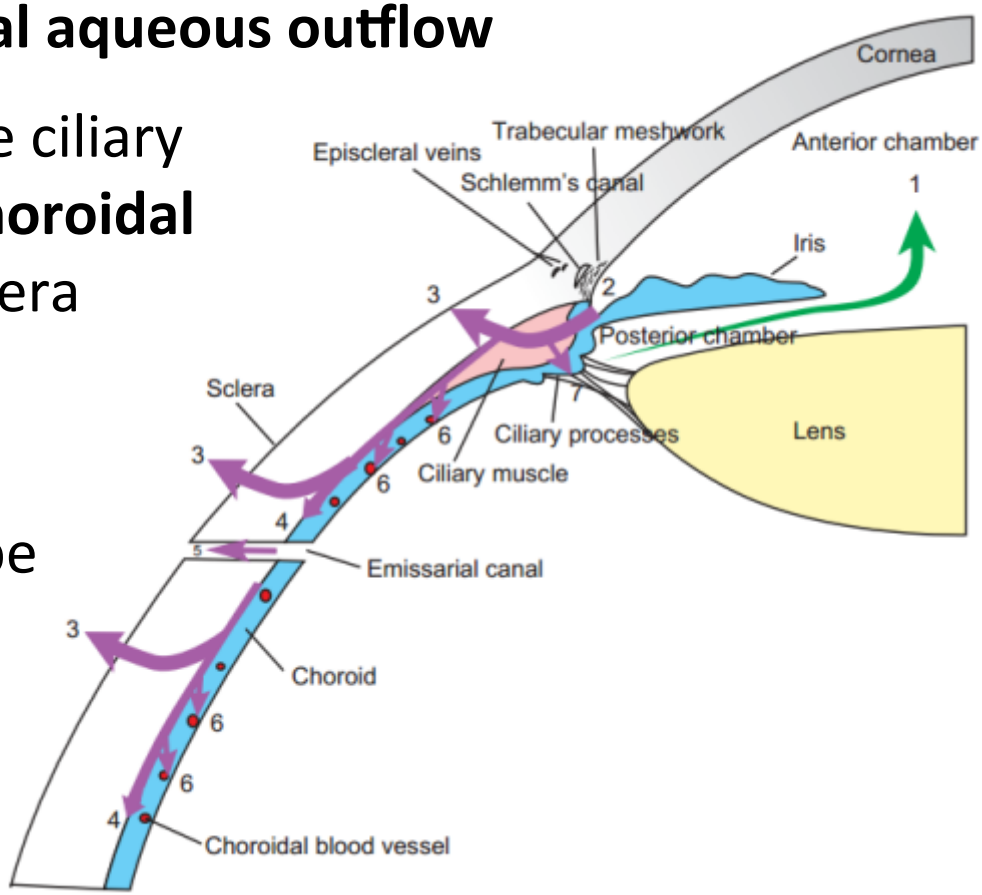
CyPass Micro-Stent

- Recently approved by FDA
- Novel aqueous outflow enhancement: non-trabecular
- Supraciliary vs trabecular stenting
- *Ab interno*, non-perforating, no bleb, no MMC

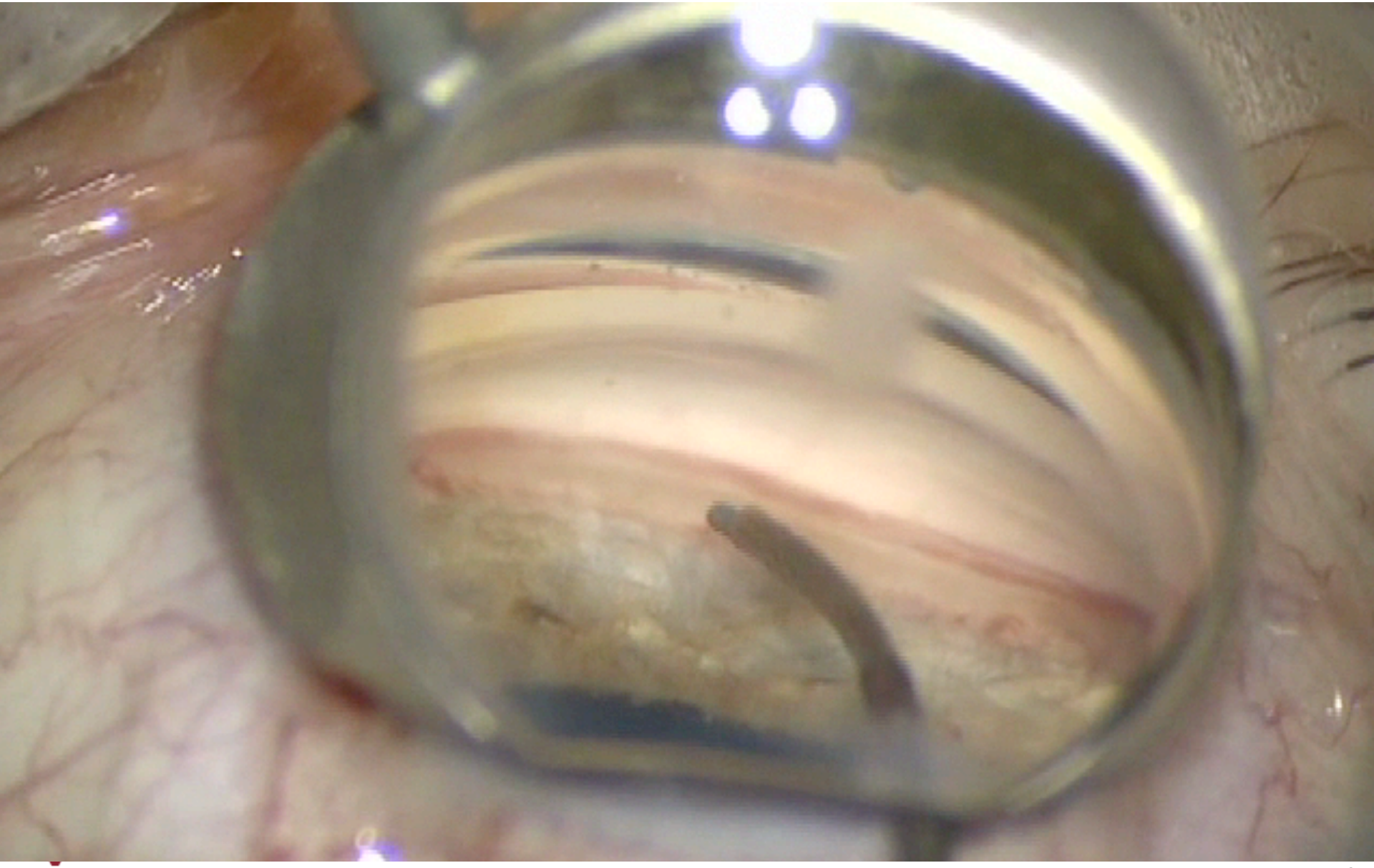


Tapping into the Uveoscleral Outflow Pathway

- Uveoscleral outflow: considered pressure independent and contributes **up to 57% of natural aqueous outflow**
- Aqueous percolates through the ciliary body and **exits into the suprachoroidal space**, primarily through the sclera and choroidal blood vessels
- Bypasses Schlemm's canal and collector channels, which may be **atrophic in glaucoma patients**

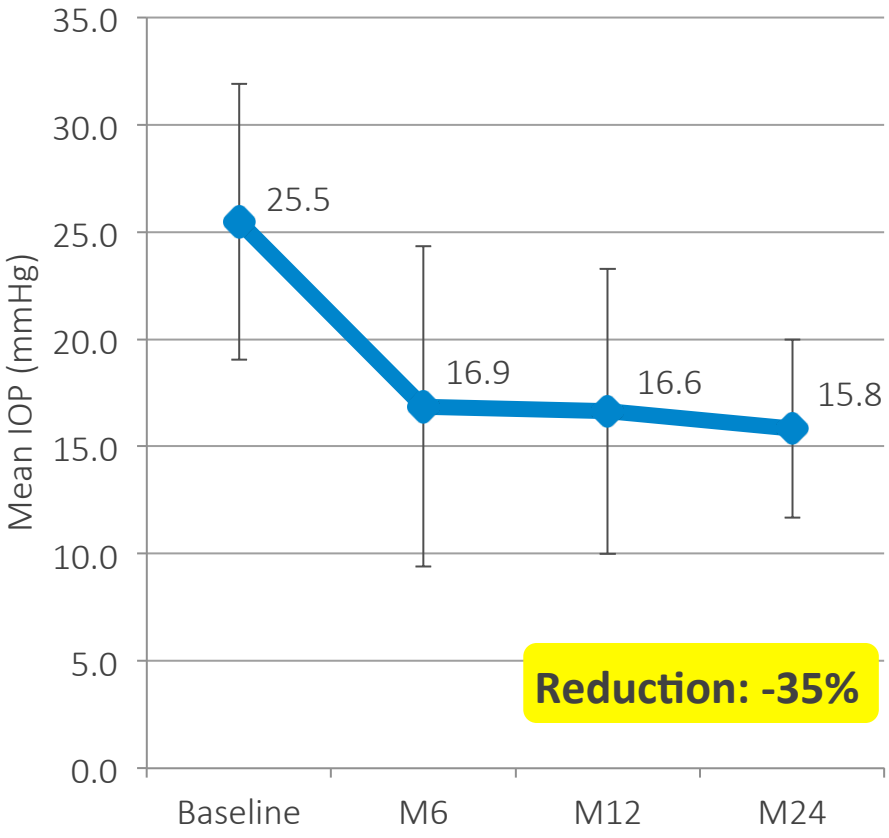


Toris, Camras. Ch 8. Aqueous humor dynamics II. Clinical studies. Curren Topics in Membranes, Vol 62. 2008, Elsevier Inc. 235-7
Fellman. Episcleral venous fluid wave correlates with the type and extent of canal-based surgery. AGS 2014 abstract.

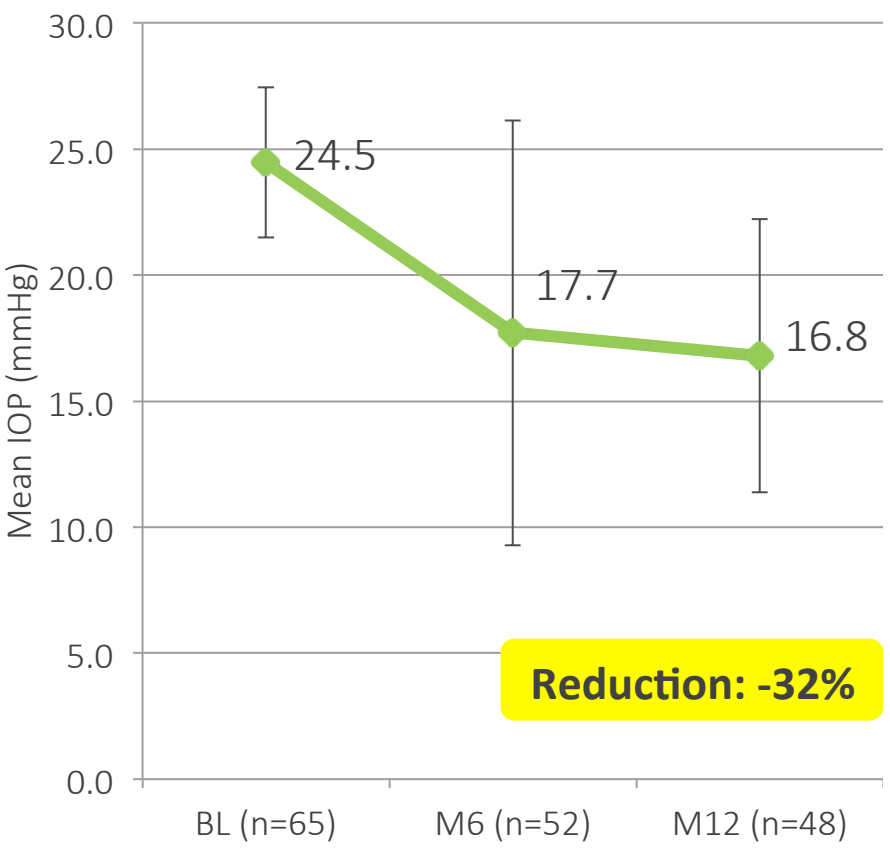


CyPass Clinical Outcomes
Mild –Moderate Glaucoma

Combined with Phaco
CyCle Study



CyPass Implantation Only
DUETTE Study

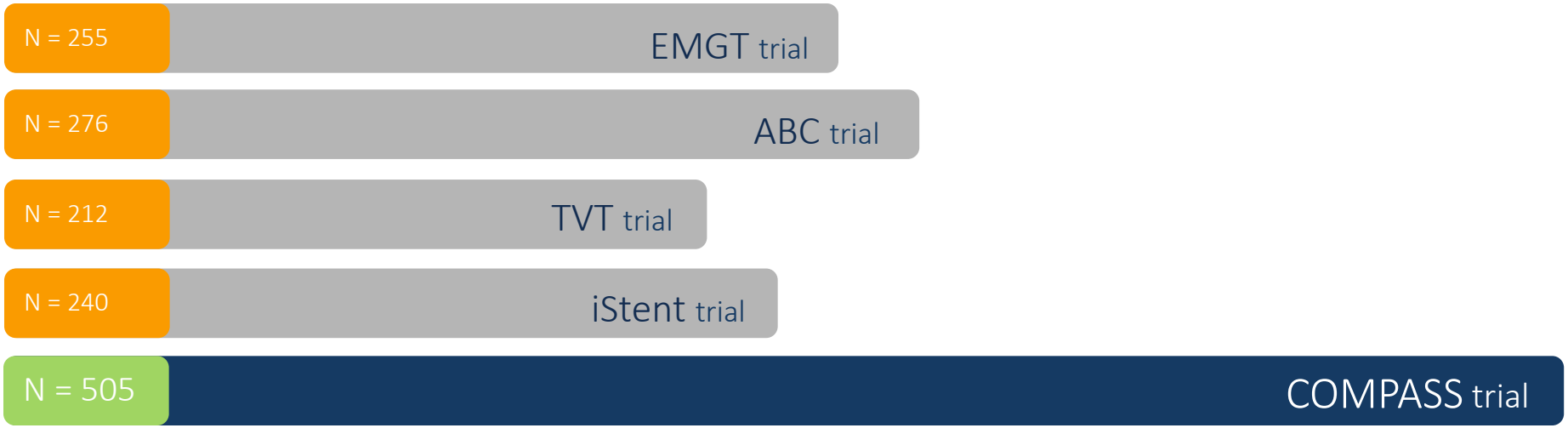


Hoeh, Klin Monbl Augenheil 2014
Garcia-Feijoo, AJO 2015.

COMPASS Study of the CyPass Micro-Stent

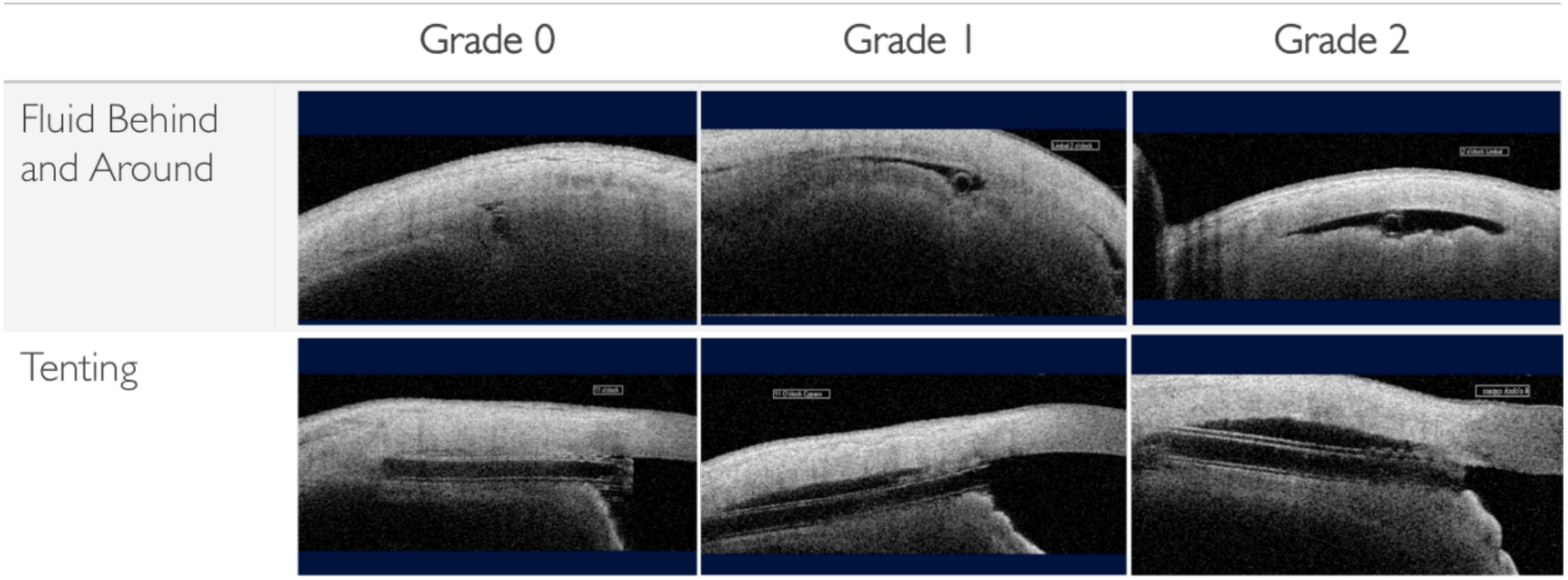
Largest randomized controlled trial of a glaucoma implant to date

- Terminal wash out at 12 and 24 months
- Strict criteria for re-introduction of meds
- Rigorous analysis of endothelial cell density
- Strong primary endpoint outcome: 2-year diurnal un-medicated IOP change



The Future of Uveoscleral Microstents

- Presence of aqueous lake posterior to and around the micro-stent was imaged and identified using OCT and UBM
- Some patients had a greater degree of subscleral aqueous lake
- **This increased lake correlated with improved IOP outcomes**

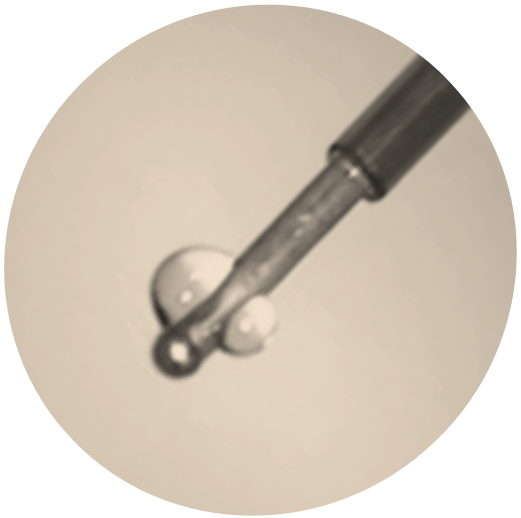


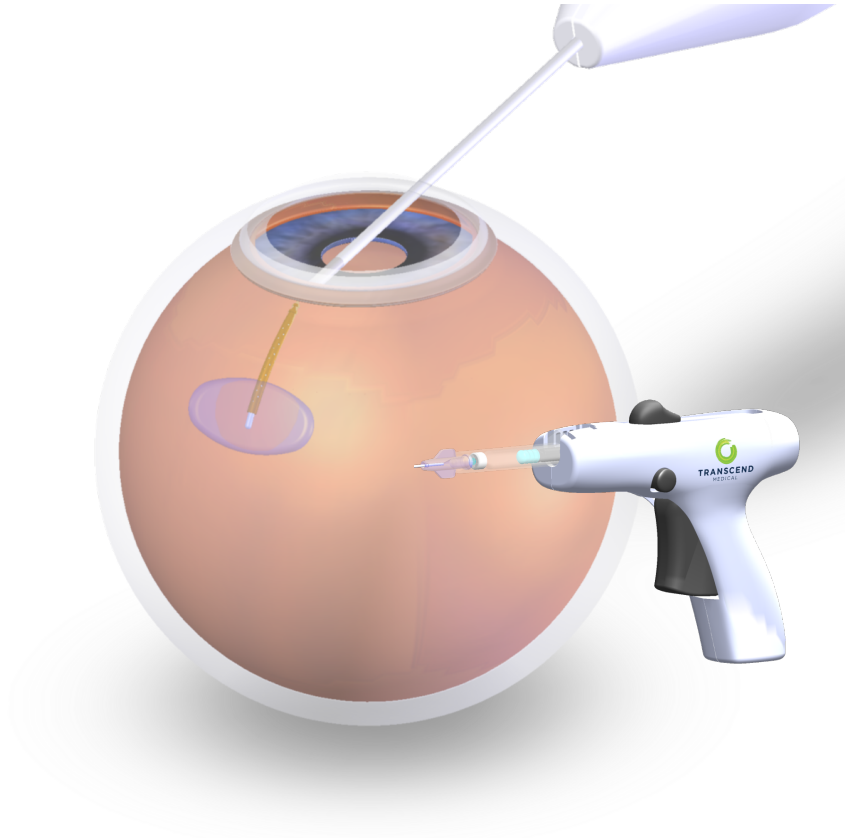
Saheb H. Br J Ophthalmol. 2014 Jan;98(1):19-23

CyPass Vx

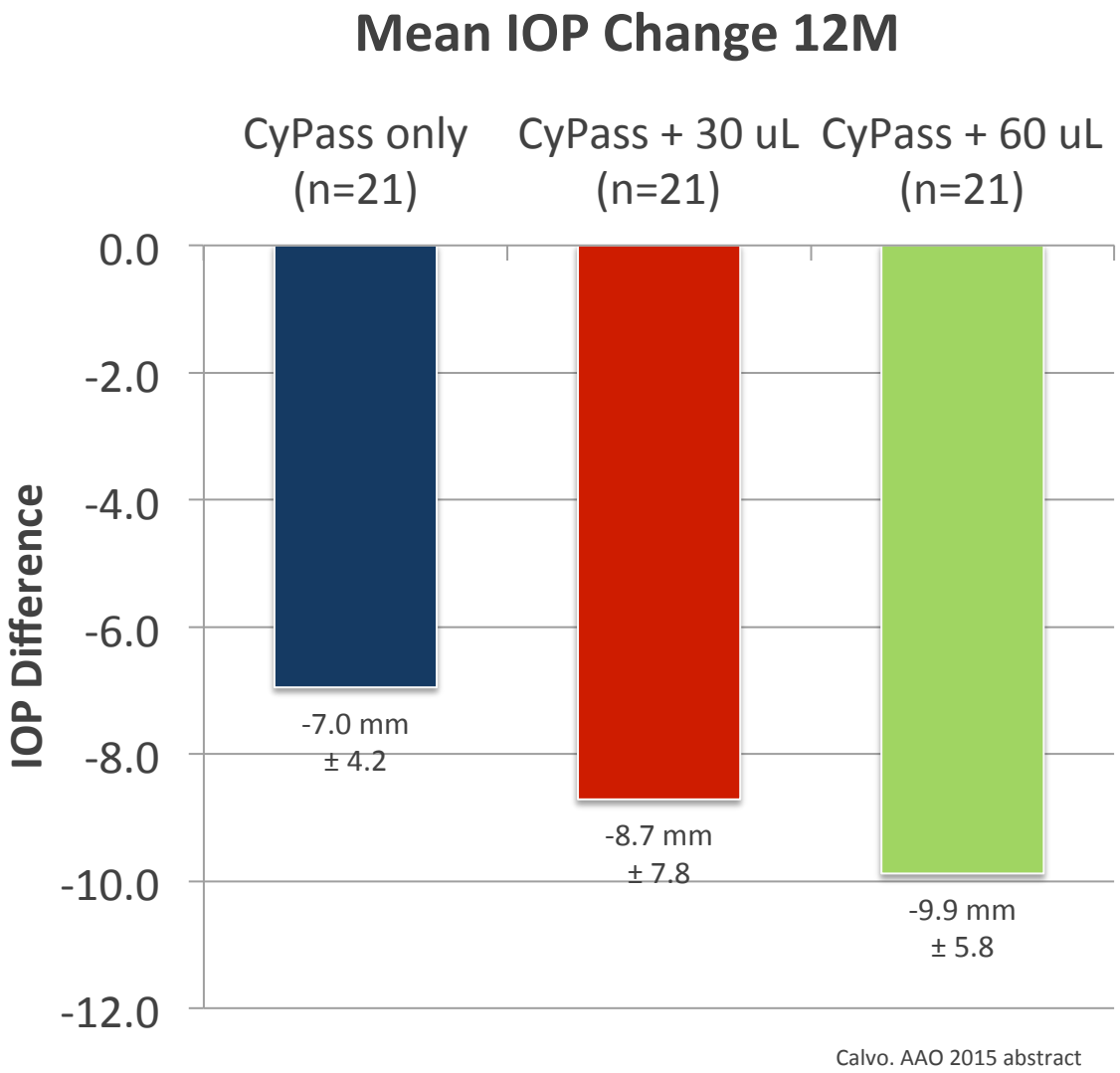
Enabling CyPass Micro-Stent with Visco-Expansion

- Delivers viscoelastic to the supraciliary and suprachoroidal spaces
- Creates and maintains space for enhanced aqueous outflow
- Can achieve volumetric expansion 50X current CyPass Micro-Stent





IOP Reduction 12M vs Baseline

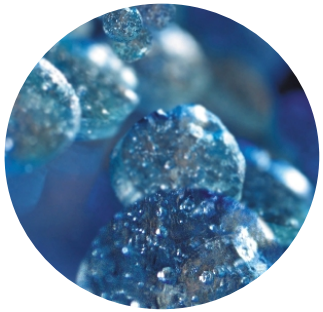


Calvo. AAO 2015 abstract

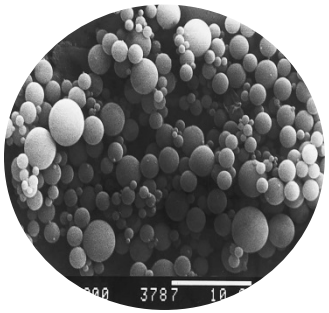
IOP reduction

Dose response trend identified with increasing volume of viscoinjection

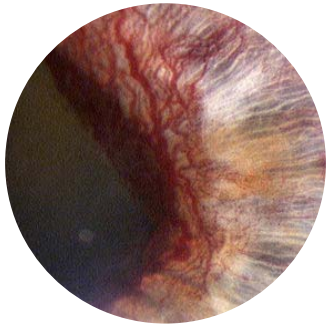
Future Therapeutic Platform Technology in the Suprachoroidal Space



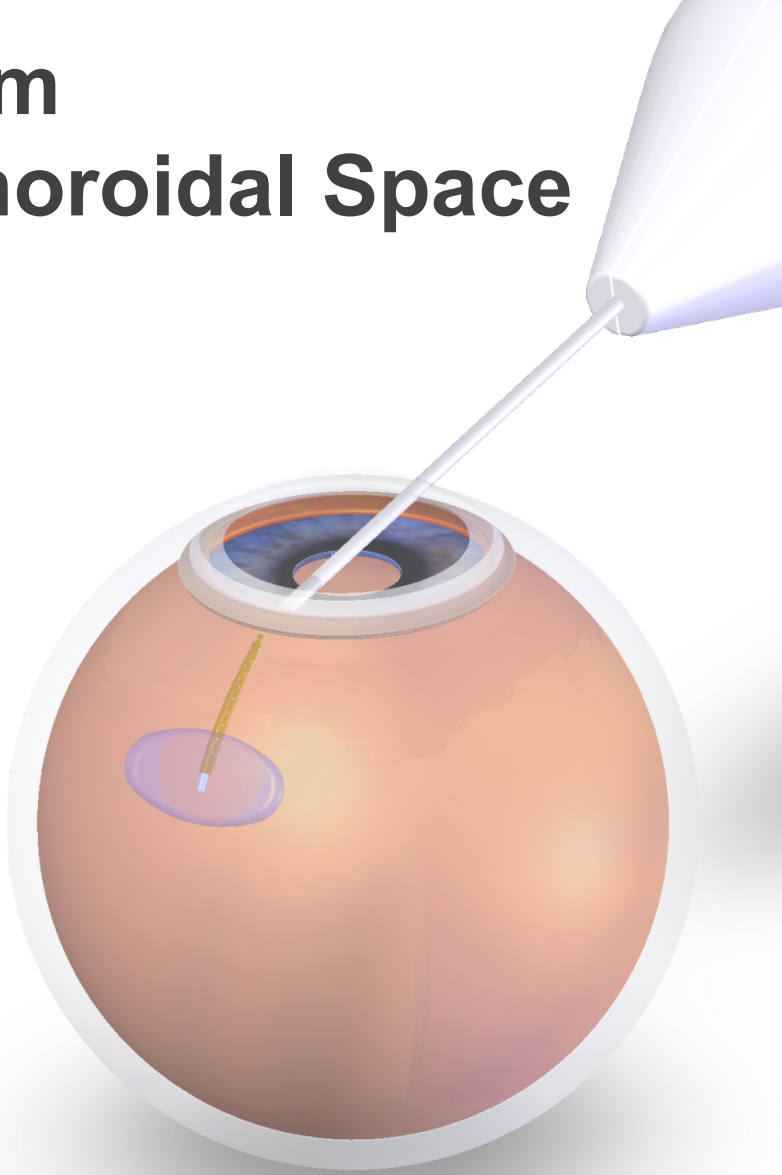
Drug-infused visco



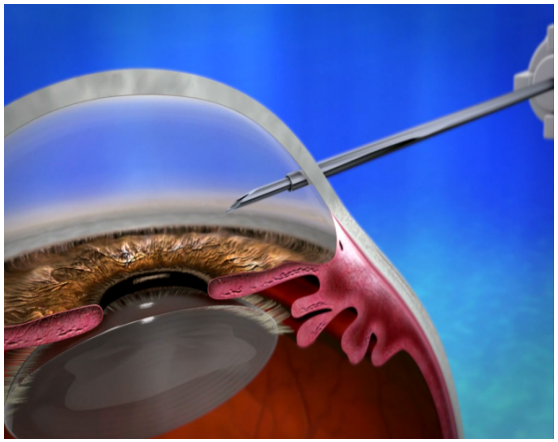
Sustained release



Retinal disease /
Neovascular glaucoma



XEN GEL STENT

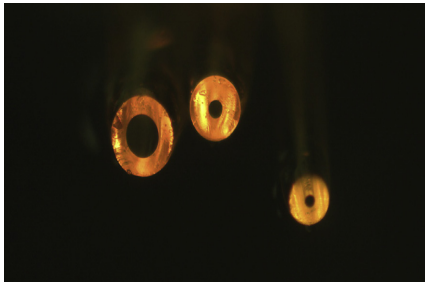


Effective Subconjunctival Drainage Made Simple

- Delivers significant and sustained reduction of IOP through the sub-conjunctival outflow pathway
- Bypasses all potential aqueous outflow obstruction through an ab interno approach
- Spares ocular tissue, leaving all other treatment options available
- Minimizes implant related complications because of its soft, gelatin material (non-inflammatory, non-migrating)

Preloaded Injector Provides Convenience

- Pre-loaded, disposable, “IOL-like” injector comes loaded with the XEN Gel Stent.
- Can be done as a primary procedure or in combination with cataract surgery



Portfolio Progression for Hypotony Control

XEN 140 GEL STENT

N=100

6mm/140 micron inner lumen
Minimal hypotony protection

3 year IOP= 13.6 mmHg
-38% IOP & -79% Meds

XEN 63 GEL STENT

N=150

6mm/ 63 micron inner lumen
Medium hypotony protection

3 Year IOP= 12.4mmHg
-44% IOP & -76% Meds

XEN 45 GEL STENT

N=~700

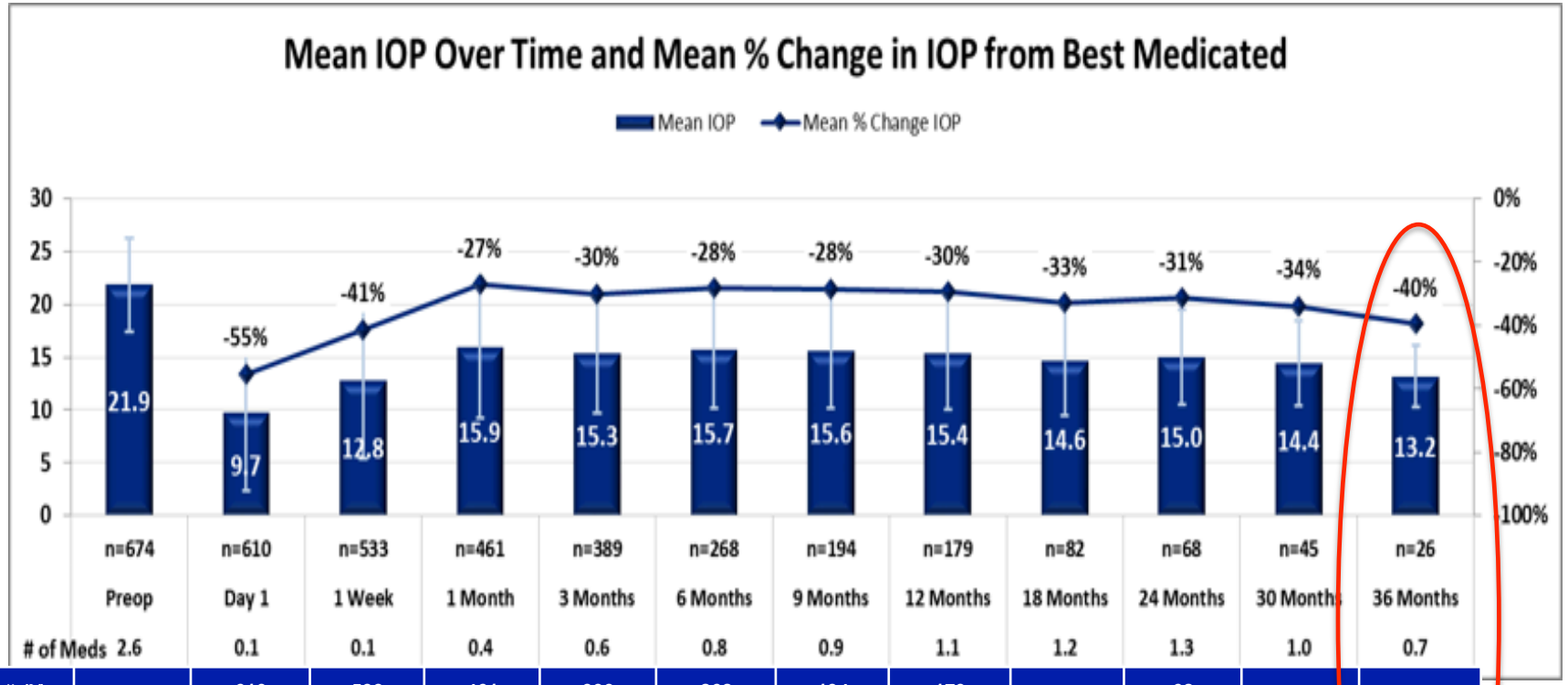
6mm/45 micron inner lumen
Strong hypotony protection

1 Year IOP= 13.2mmHg
-40% IOP & -85% Meds

Progression: Same Strong Efficacy + Strong Safety/Minimal Post-Op "Fire and Forget"

Feasibility Data:
Shows Long Term Efficacy

N=674 All 3 Models

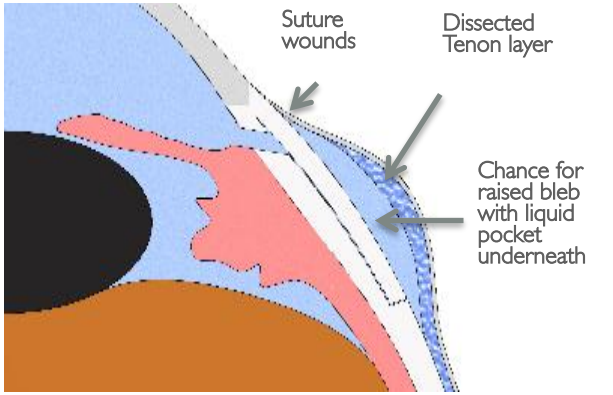


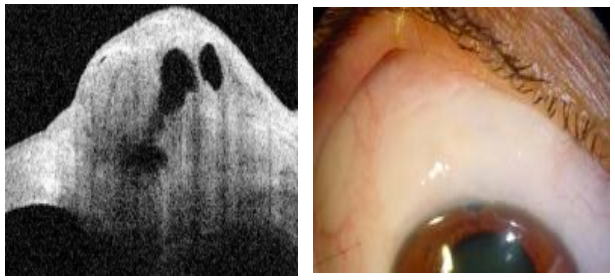
Complete # (%)	674	610 (90.5%)	533 (79%)	461 (74%)	399 (63%)	268 (42%)	194 (29%)	179 (26.5%)	82 (12%)	68 (10.5%)	45 (7%)	26 (4%)
Additional Surgery (Cumulative)	-	0/ 674 (0%)	0/ 674 (0%)	2/ 674 (0.5%)	8/ 674 (1%)	14/ 674 (2%)	23/ 674 (3%)	26/ 674 (4%)	27/ 674 (4%)	30/ 674 (4%)	30/ 674 (4%)	32/ 674 (5%)
Missed Visit	-	14 (2%)	18 (2.5%)	30 (5%)	16 (3%)	11 (2%)	9 (1%)	0 (0%)	9 (1%)	2 (0.5%)	3 (0.5%)	0 (0%)
Study Closed/ LTFU	-	2 (0.5%)	2 (0.5%)	4 (0.5%)	9 (1%)	13 (2%)	16 (3%)	17 (2.5%)	19 (3%)	21 (3%)	23 (3.5%)	24 (4%)
Pre-Window	-	48 (7%)	121 (18%)	128 (20%)	206 (32%)	333 (52%)	432 (64%)	452 (67%)	537 (80%)	553 (82%)	573 (85%)	592 (87%)

XEN Bleb

Ab Externo Bleb vs. XEN Ab Interno Bleb

After Trabeculectomy/Express





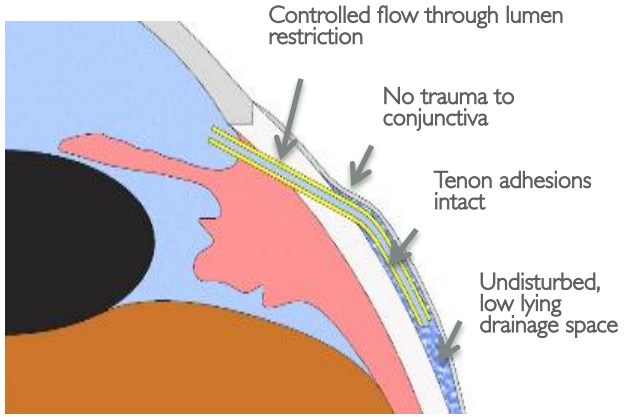
Effective IOP lowering

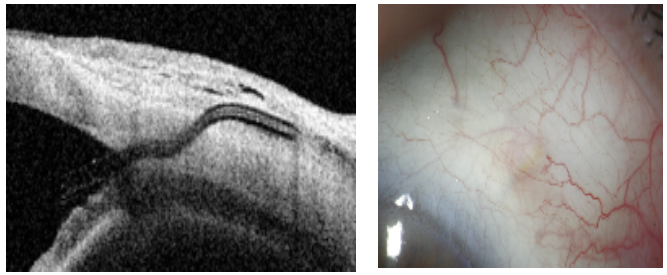
Elevated and focal due to dissection

Thin Walled

Higher risk of infection

After XEN





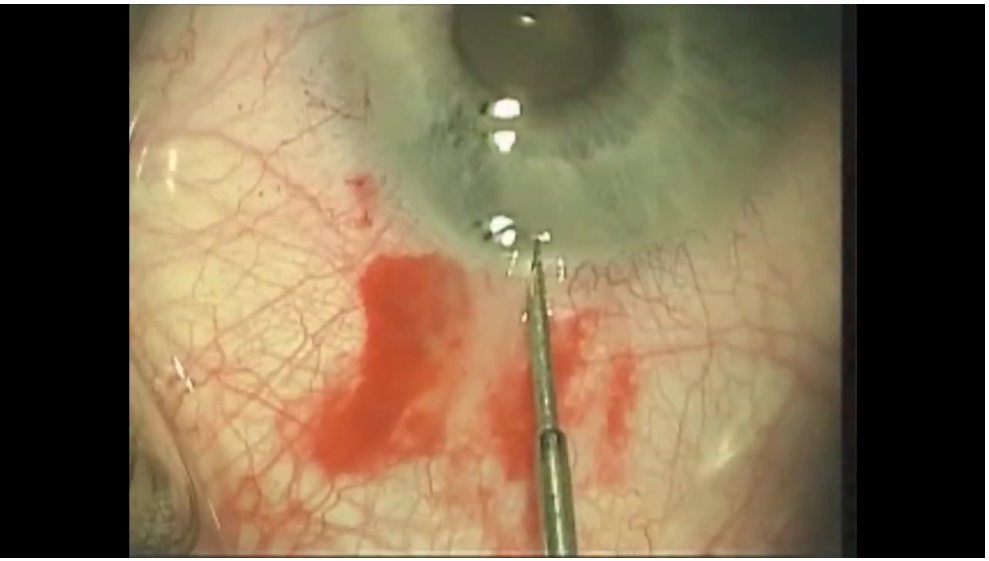
Effective IOP lowering

Low lying and diffuse

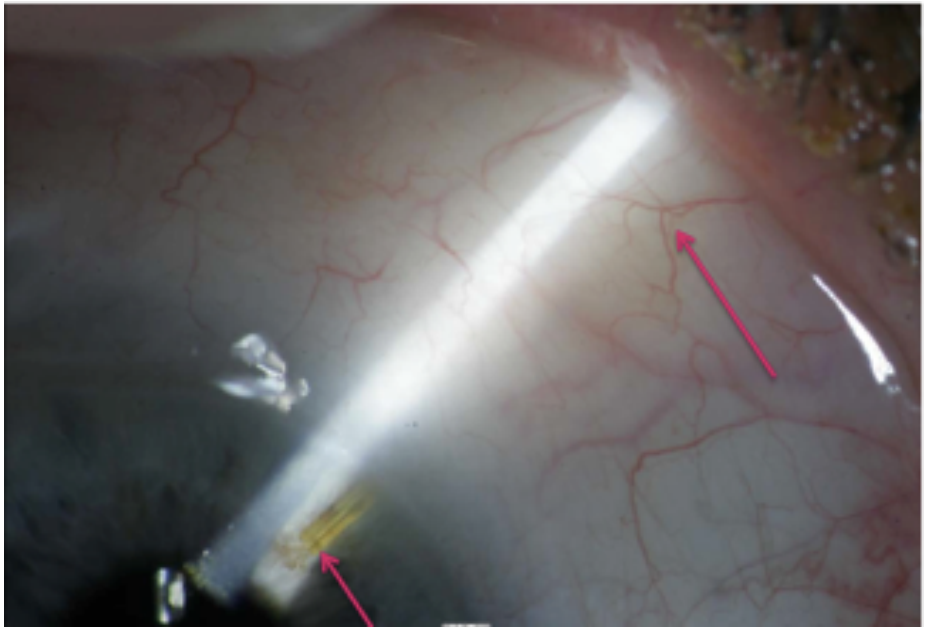
Deep in the intra tenon's tissue

Low risk of infection

XEN: The Procedure



AqueSys @24M: Low, diffuse, posterior drainage



Glaucoma Devices: The Shape of Things to Come

- The development of patient-specific imaging and diagnostics for optimal therapy selection
- Consider trabecular bypass procedures early on
- Suprachoroidal microstents offer excellent MIGS alternative in mild-moderate open-angle glaucoma patients
- Subconjunctival microshunts appear to be promising option in the treatment of moderate to more advanced glaucomas
- The combination of aqueous outflow implants with drug delivery to achieve ideal long-term results

Thank You