



Outline

- Glaucoma
 - Current Stats
- Barriers to Success
 - Adherence
 - Barriers
- Considerations for MIGS
 - Categories
 - Efficacy & Safety
- Recommendations
 - Cost & and QOL



Glaucoma Climate

- 2020: ~75 million people with POAG
- 2040: ~ 111 million people with POAG
- Leading cause of irreversible blindness
- Estimated that 10% of POAG patients are bilaterally blind



Lee RH et al. Translating minimally invasive glaucoma surgery devices. Clin Transl Sci. 2020 Jun;13(1):14-25.
 Agarwal P & Bradshaw SE. Systematic literature review of clinical and economic outcomes of micro-invasive glaucoma surgery in POAG. Ophthalmol Ther. 2018 Jun;7(1):49-73

Primary Open-Angle Glaucoma

- A progressive optic neuropathy
- Characterized by retinal ganglion cell death
- **Annoying** to treat = ADHERENCE
 - Lack of Symptoms
 - Cost
 - Persistence
 - Etc...



Lee RH et al. Translating minimally invasive glaucoma surgery devices. Clin Transl Sci. 2020 Jun;13(1):14-25.

Classic POAG Treatments



Classic POAG Treatments



https://www.gettyimages.com/detail/stock-photo/1202177221/1202177221-1202177221

https://www.amazon.com/Track-Hero-Duty-Carpenter-Blackhawk-Construction-Belt-TL2-2018

Non-Adherence*

- Compliance
 - Refers to whether patients follow their physician's instructions
- Adherence:
 - Implies partnership and patient's role in agreement to the physician's treatments or recommendations



https://www.uspharmacist.com/article/medication-adherence-the-elephant-in-the-room

○ Non-Adherence

• Compliance

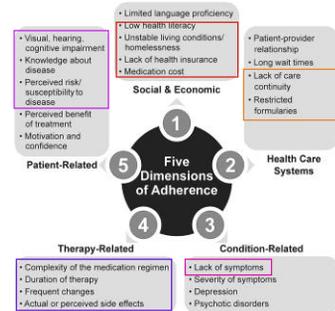


• Adherence:



I'm an important part of this process.

○ Non-adherence



Robin AL & Muir KW. Medication adherence in patients with ocular hypertension or glaucoma. Expert Rev Ophthalmol. (2019);14:4-6, 199-210

○ Non-adherence

- **Social & Economic**
 - 2018 US Census: Average median income/household = \$39,108
 - 2018: 27.8% live in poverty in Memphis, TN
- **Health Care Systems**
- **Condition-Related**
 - Lack of Symptoms
- **Therapy-Related**
 - Drops: complexity, duration, frequency of changes
 - Side-effects
- **Patient-Related**
 - Physical limitations, perceived risk, understanding, motivation

2019 Memphis Poverty Fact Sheet
Robin AL & Muir KW. Medication adherence in patients with ocular hypertension or glaucoma. Expert Rev Ophthalmol. (2019);14:4-6, 199-210

○ Non-adherence: Social & Economic

Table 9 – Memphis' Rank in Poverty Rates

2019 US Census: ~651,000 residents

Memphis		2017		2018		Rank Change
		Poverty Rate	Poverty Rank	Poverty Rate	Poverty Rank	
Among Cities with Populations Greater than 500,000 (36 Cities)	Overall	24.6%	4 th	27.8%	2 nd	-2
	Under 18	39.0%	2 nd	44.9%	2 nd	---
Among Cities with Populations Greater than 200,000 (120 Cities)	Overall	17.1%	6 th	27.8%	5 th	-1
	Under 18	27.1%	6 th	44.9%	4 th	-2

-181,000 residents living in poverty

-23,150 >62YOA living in poverty

2019 Memphis Poverty Fact Sheet
2019 United States Census Quick Facts – Memphis, TN

○ Non-adherence: Social & Economic

- **Cost**
 - Systemic medications or treatments, travel, PTO
- **Medical care costs have inflated 33.52% since 2010¹**
 - 98.89% since 2000
- **Kroger Pharmacy Prices 2021²**
 - Timolol: \$6.65
 - Brimonidine: \$7.80
 - Latanoprost: \$9.78
 - Cosopt: \$13.49
 - Simbrinza: 186.68
 - Combigan: \$200.57
 - Vyzulta: \$218.22 (\$35-45 with valid coupon x 12 mos)³
 - Rhopressa: \$290.97 (\$25-50 discount x 12 mos)⁴
 - Rocklatan: \$303.77 (\$25-50 discount x 12 mos)⁴

¹https://www.kff.org/medcost/issue-brief/medical-care-price-inflation-2010-to-2020/?utm_source=social&utm_medium=twitter

²https://www.kroger.com

³https://www.kroger.com/medication-price-rebate-coupon

⁴https://www.kroger.com/medication-price-rebate-coupon

○ Non-adherence: Cost

- **Glaucoma costs the U.S. economy \$2.86 billion every year in direct costs and productivity losses (2006).¹**
- **In 2006 average direct cost of glaucoma treatment²**
 - Early-Stage: \$623 per year
 - End-Stage: \$2,511
- **In 2020 average direct cost of glaucoma treatment²**
 - Early-Stage: \$804
 - End-Stage: \$3,243

Zhang P et al. The economic burden of major adult visual disorders in the United States. Arch Ophthalmol. 2006;Dec;124(12):1754-60.
https://www.ncbi.nlm.nih.gov/pubmed/17189123

○ Non-adherence: Condition-Related

- Lack of Symptoms
 - Approx. 50% nonadherent patients report knowledge as a barrier
 - Similar findings on other asymptomatic conditions such as HTN
 - IOP, ONH changes
 - Are these as meaningful to patients as they are to us?
 - Visual Function decreases GRADUALLY
 - Decreased reading speed, spatial awareness, etc.
- Patients do not have clear endpoints that tangibly signal improvement

Robin AL & Mur RW. Medication adherence in patients with ocular hypertension or glaucoma. Expert Rev Ophthalmol. (2019) 14:4-5, 199-210.



○ Non-adherence: Therapy-Related

- Complexity
 - Multiple medications = confusing
 - One med: 81% adherence --> Four meds: 50%
- Duration
 - Apathetic to worsening glaucoma over time
 - Insufficient motivations from fatalistic perceptions
 - "I'm going to go blind anyway"

Robin AL & Mur RW. Medication adherence in patients with ocular hypertension or glaucoma. Expert Rev Ophthalmol. (2019) 14:4-5, 199-210.



○ Non-adherence: Patient-Related

- Physical Limitations
 - Proper instillation technique may reduce nonadherence
 - Newman-Casey: 24% = aim
 - Improved self-confidence and ability after watching instructional video [91]
- Correlation between patients with severe glaucoma and the patients with greatest difficulty with adherence because of difficulty self-administering drops
 - Seeing the drops, other ailments preventing good dexterity

Robin AL & Mur RW. Medication adherence in patients with ocular hypertension or glaucoma. Expert Rev Ophthalmol. (2019) 14:4-5, 199-210.



○ Non-Adherence

- Quality of Life
 - Culmination of all other factors previously discussed
 - Effect on ocular surface
 - Long-term drift of some medications lead to more expensive drops
 - Progression ultimately leads to more invasive surgery
 - Or hesitation for more invasive surgery

Sarkisian SR et al. 360° ab-interno trabeculotomy in refractory primary open-angle glaucoma. Clin Ophthalmol. 2019 Jan 11;13:161-168.
Robin AL & Mur RW. Medication adherence in patients with ocular hypertension or glaucoma. Expert Rev Ophthalmol. (2019) 14:4-5, 199-210.



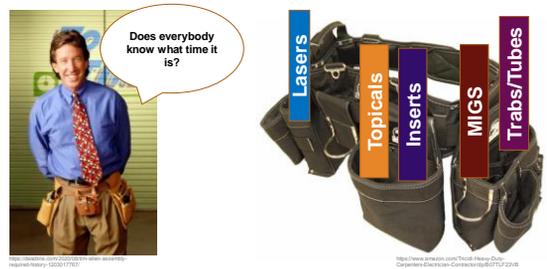
○ Non-Adherence

- Monotherapy: 10% continuously refill their glaucoma medications within 12 months
 - Additional topical therapies further reduce this adherence rate
- Glaucoma Adherence and Persistency Group (GAPS)
 - Nearly 20% of patients do not return visit to their eyecare provider in the 18 months after glaucoma diagnosis
- Non-adherence with glaucoma meds range from 16-30%

Robin AL & Mur RW. Medication adherence in patients with ocular hypertension or glaucoma. Expert Rev Ophthalmol. (2019) 14:4-5, 199-210.
Friedman DS et al. Using pharmacy claims data to study adherence to glaucoma medications. GAPS. Invest Ophthalmol Vis Sci. 2007 Nov;48(11):6562-7.



○ Classic POAG Treatments



○ When to Consider MIGS

- Progression despite adherence (or lack of)
 - Mild – Moderate glaucoma
- Need for cataract surgery
- Patient's systemic health or overall QOL
 - Arthritis, Parkinson's, Stroke, etc.



○ The WHAT

- Minimally/Micro-Invasive
 - Less risk of sight-threatening complications
 - Potentiality for evenly controlled IOP
 - Less aggressive surgical techniques = more surgeons capable
- Multiple locations for treatment
- Mostly non-allergic metals
 - One derived from pig collagen

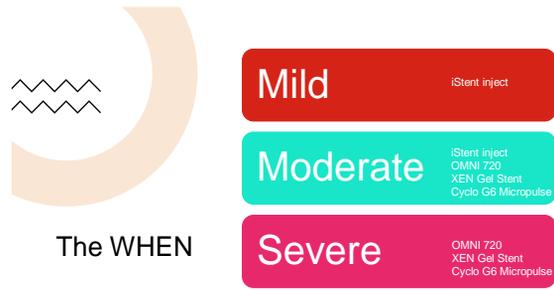
Yin CK et al. Microinvasive glaucoma surgical training in united states ophthalmology residency programs. Clin Ophthalmol. 2020;14:1785-1789.
Yoshi E, Wood JN, Pomeroy JF. Complications of micro-invasive glaucoma surgery. Curr Opin Ophthalmol. 2018;Mar;20(2):147-154.



Gilman K, & Mansour K. Minimally invasive glaucoma surgery: where is the evidence? Asia Pac J Ophthalmol. 2020;9(3):203-21.

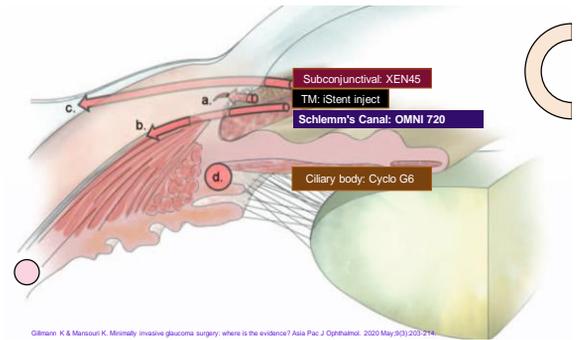


Gilman K, & Mansour K. Minimally invasive glaucoma surgery: where is the evidence? Asia Pac J Ophthalmol. 2020;9(3):203-21.



The WHERE

- iStent inject^(Glaukos): increase trabecular meshwork drainage
- OMNI 720^(Sight Sciences): Schlemm's canal viscodilation + trabeculotomy
- CycloG6^(Intrix): decreasing aqueous production by ciliary body
- XEN 45^(Allergan): alternate flow through subconjunctival space



Mathew DJ et al. Adherence to world glaucoma association guidelines for surgical trials in the era of MIGS. *Ophthalmol Glaucoma*. 2019 Mar;2(2):78-85.

Gillman K & Mansouri K. Minimally invasive glaucoma surgery: where is the evidence? *Asia Pac J Ophthalmol*. 2020 May;9(3):203-214.

Trabecular Meshwork

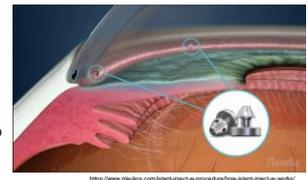
- iStent inject^(Glaukos)
 - Approved in 2018
 - **FDA approved for combo cataract extraction only**
 - Reducing proximal resistance through direct implant into SC
 - Most common AE: hyphema, self-limiting
 - At 1 year: 77% achieved un-medicated IOP ≤ 18 mmHg compared to 24% control



Shah M. Micro-invasive glaucoma surgery - an interventional glaucoma revolution. *Eye Vis (Lond)*. 2019 Sep;29:6-29.
Sahab H, Witneid II. Micro-invasive glaucoma surgery: current perspectives and future directions. *Curr Opin Ophthalmol*. 2012 Mar;23(2):96-104.

Efficacy and Safety

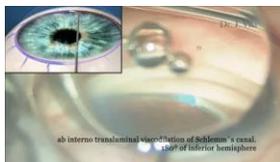
- Gillman et al: 29.1% weighted mean IOP drop after 30-month observation.
- Difficulty comparing this meta-analysis study due to differing study design parameters.



Gillman K, Mansouri K. Minimally Invasive Glaucoma Surgery: Where is the Evidence? *Asia Pac J Ophthalmol (Phila)*. 2020 Jun;9(3):203-214.

Schlemm's Canal

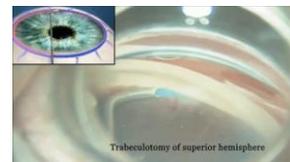
- OMNI 720^(Sight Sciences)
 - Approved in 2018
 - FDA: stand-alone or combo with cataract extraction
 - Combines viscodilation and trabeculotomy, addressing both proximal and distal points of outflow resistance within the trabecular meshwork



Dickerson JE & Brown RH. Circumferential canal surgery: a brief history. *Curr Opin Ophthalmol*. 2020 Mar;31(2):139-146.
Yost SD et al. Canalostomy and trabeculotomy with the OMNI system: The ROMEO Study. *Ophthalmol Glaucoma*. 2020; 2(3):204-7.
Shah M. Micro-invasive glaucoma surgery - an interventional glaucoma revolution. *Eye Vis (Lond)*. 2019 Sep;29:6-29.

Efficacy and Safety

- OMNI 720^(Sight Sciences)
 - Most Common AE: Transient Hyphema
 - IOP reductions 11.1±6mmHg at 12-month p/o
 - Avg 1.1±1.8 fewer meds
 - Consideration: scarring can reduce efficacy
 - Achieved IOP ≤ 18 mmHg in 72% of cases*



Yost SD et al. Canalostomy and trabeculotomy with the OMNI system: The ROMEO Study. *Ophthalmol Glaucoma*. 2020; 2(3):204-7.
Dickerson JE Jr, Brown RH. Circumferential canal surgery: a brief history. *Curr Opin Ophthalmol*. 2020 Mar;31(2):139-146.

○ Subconjunctival

- XEN Gel Stent 45 (Allergan)
 - Approved 2016
 - Ab interno or externo: non-physiologic route of outflow
 - Approx. 75% cases had 20% decrease in IOP from baseline at 12 mos



<https://www.youtube.com/watch?v=VtOC6Bng6>

Armed I et al. XEN gel stent: A comprehensive review on its use as a treatment option for refractory glaucoma. *Clin Ophthalmol.* 2020 Jun 30;14:1805-1832.
Parish Ar et al. Which patients would most likely to benefit: MIGS or MEGS, which one is? *Asia Pac J Ophthalmol.* 2019 Nov-Dec;8(6):436-440.



○ Efficacy and Safety

- Most common AE: **Failure****
 - Noted up to 37-45% of cases need needling or revision
 - Not documented as an AE
- MMC required to reduce immediate scarring
- Successful cases may see IOP reduction from 30-40% from 4-year data



<https://www.youtube.com/watch?v=ST8Wq4h-qU8>

Armed I et al. XEN gel stent: A comprehensive review on its use as a treatment option for refractory glaucoma. *Clin Ophthalmol.* 2020 Jun 30;14:1805-1832.
Parish Ar et al. Which patients would most likely to benefit: MIGS or MEGS, which one is? *Asia Pac J Ophthalmol.* 2019 Nov-Dec;8(6):436-440.



○ Micropulse CycloG6

- Approved 2015
- Micropulse transscleral cyclophotocoagulation
 - Coagulates the pigmented CE
 - Decreases aqueous production
 - Enhance uveoscleral pathway
- Historically used in refractory GLC or poor visual prognosis
 - AAO Guidelines from 2001
 - **Now potentially useful for patient's apprehensive to incisional surgery and/or in earlier GLC stages**



<https://www.youtube.com/watch?v=UvU8Pug08fc&list=PL6p>

Dastgheib A et al. Cyclodestructive procedures in glaucoma: a review of current and emerging options. *Adv Ther.* 2018 Dec;35(12):2103-2127.



○ Micropulse CycloG6

- Most common AE: Pain
- 60-80% achieve ≤ 21 mmHg
- Achieves IOP reduction of ~30%
 - Up to 45% with retreatments (Avg 3.5 treatments)
- Response and efficacy are dose, power, and time dependent
 - Better success in eyes that had already undergone prior traditional GLC surgeries



https://www.youtube.com/watch?v=QEE8Kc_PCo

Dastgheib A et al. Cyclodestructive procedures in glaucoma: a review of current and emerging options. *Adv Ther.* 2018 Dec;35(12):2103-2127.
Chew PT et al. Micropulse transscleral diode laser cyclophotocoagulation in the treatment of refractory glaucoma. *Clin Exp Ophthalmol.* 2010 Apr;38(3):266-72.



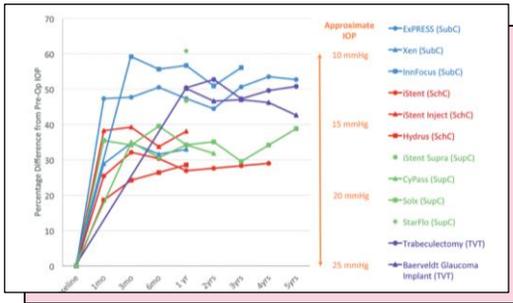
○

○ Long-Term Data

- Continuously Publishing
 - Data ~5 years old = longevity continues to be re-measured
 - Data and studies not consistent across each study
 - Different primary IOP outcomes, few RCT's published at this time
 - Leads to difficulty comparing studies for meta-analysis
- Standardized methodologies needed
 - Long term data should include functional and structural markers of glaucoma progression
- Meeting the 10-10-10- Goal
 - 10-minute surgery, Pressure under 10mmHg, 10-year sustainability

Gilman K, Mansouri K. Minimally Invasive Glaucoma Surgery: Where is the Evidence? *Asia Pac J Ophthalmol (Phila)*. 2020 May-Jun;9(3):203-214.
Lee RMH et al. Translating Minimally Invasive Glaucoma Surgery Devices. *Clin Transl Sci.* 2020 Jun;13(1):14-25.





Lee RMH, Boueiri M, Y. Eames I, Broochi S, Khaw PT. Translating Minimally Invasive Glaucoma Surgery Devices. Clin Transl Sci. 2020;Jan(13):14-25.

Cost-to-Benefits

- Medicare costs**
 - iStent Inject: ~\$500-600/eye
 - OMNI 720: ~\$500-550/eye
 - XEN 45: ~\$650-700/eye
- Data insufficient to determine long-term cost-effectiveness
 - No US-based prospective or non-industry sponsored studies providing cost savings benefits.

Lee RMH et al. Translating Minimally Invasive Glaucoma Surgery Devices. Clin Transl Sci. 2020;Jan(13):14-25. Agnew P, Brackley SE. Systematic literature review of clinical and economic outcomes of MIGS in PCAG. Ophthalmol Ther. 2018;Jun(7):149-73.



Cumulative Cost Per Patient (Canadian Dollar \$, 2014)						
	1 year	2 year	3 year	4 year	5 year	6 year
Trabectome	744.00	744.00	744.00	744.00	744.00	744.00
iStent	1044.00	1044.00	1044.00	1044.00	1044.00	1044.00
Endoscopic Photocoagulation	244.00	244.00	244.00	244.00	244.00	244.00
Medical Therapy						
Mono-drug	170.54	341.08	511.61	682.15	852.69	1023.23
Bi-drug	386.09	772.18	1158.28	1544.37	1930.46	2316.55
Tri-drug	528.12	1056.24	1584.36	2112.48	2640.60	3168.71

Table 3: Cumulative 6-Year Cost Comparison of Trabectome, iStent, and ECP versus Mono-drug, Bi-drug, and Tri-drug Therapy. Adapted from Journal of Glaucoma. 23(2):e112-e118, 2014.[38]

Cost-to-Benefits

- Berdahl et al: 5-year cost savings of \$1,797 via iStents vs. topicals
 - Only comparing one type of MIGS
 - Undisclosed which topicals used, when added or switched
 - Only known US-based analysis at this time, perspective study

Tarveev D, Gibbons FM. Is MIGS more cost-effective than medical treatment? Ocular Surgery News. Glaucoma. 2020;Jan(10). Berdahl JP et al. J Med Econ. 2017;Jul(20):769-766.



Finding the Niche

- MIGS can increase the longevity of a patients functioning vision and improve their overall QOL when they are successful
- Adherence = 100%
- Available to more ophthalmologists = more patients managed
- Potential higher cost-savings when used in mild-moderate glaucoma



○ Finding the Niche

- Help the patients you can
 - Not everyone will be able to afford the up-front costs
 - Long term costs will also affect patients' ability to afford treatment
- Potential to improve QOL, give peace of mind, save vision

