
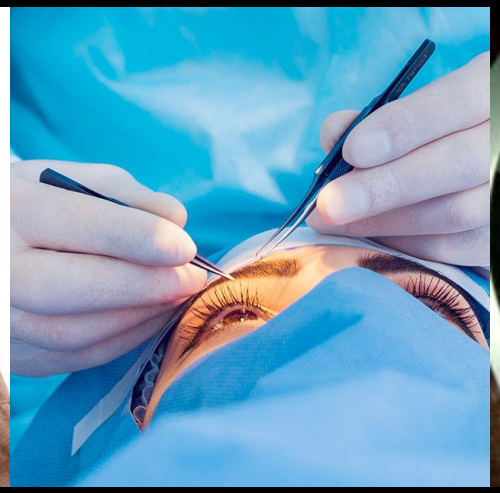

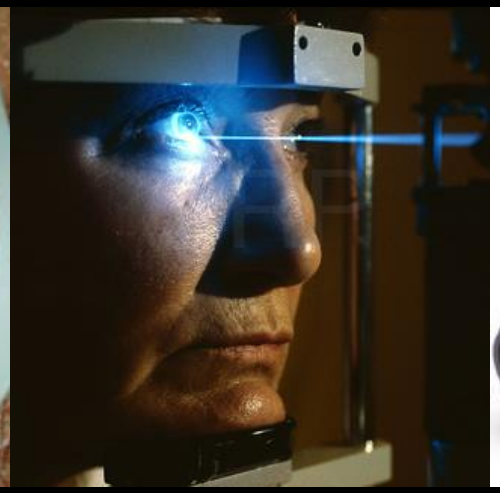
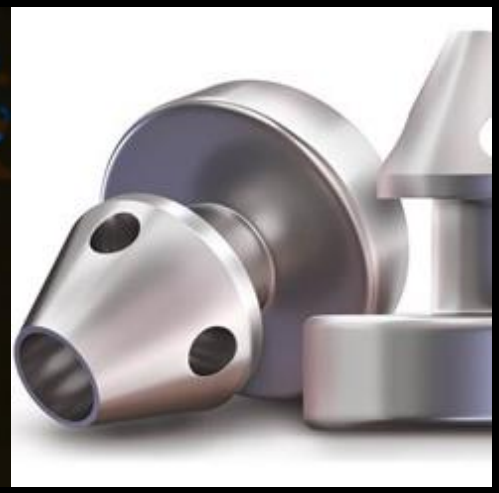

Introduction to Interventional Glaucoma

Richard Trevino, OD, FAAO
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Interventional Glaucoma

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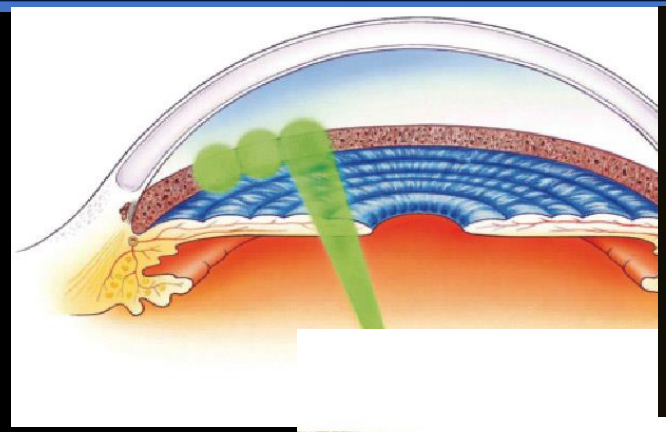
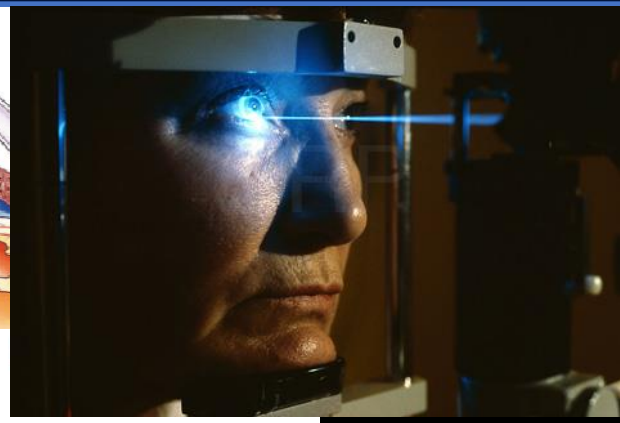
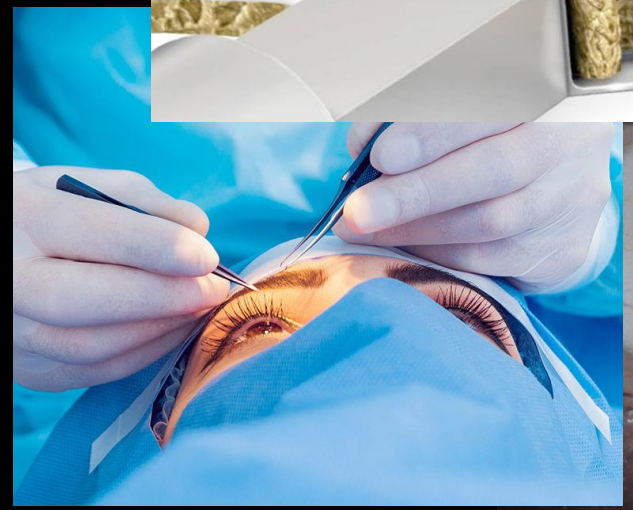
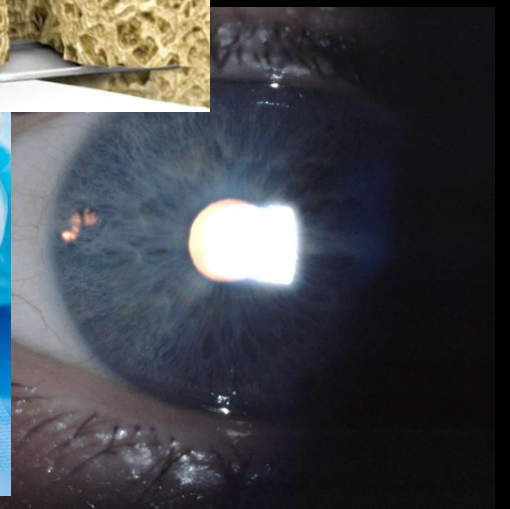
Disclosures
- None









Interventional Glaucoma

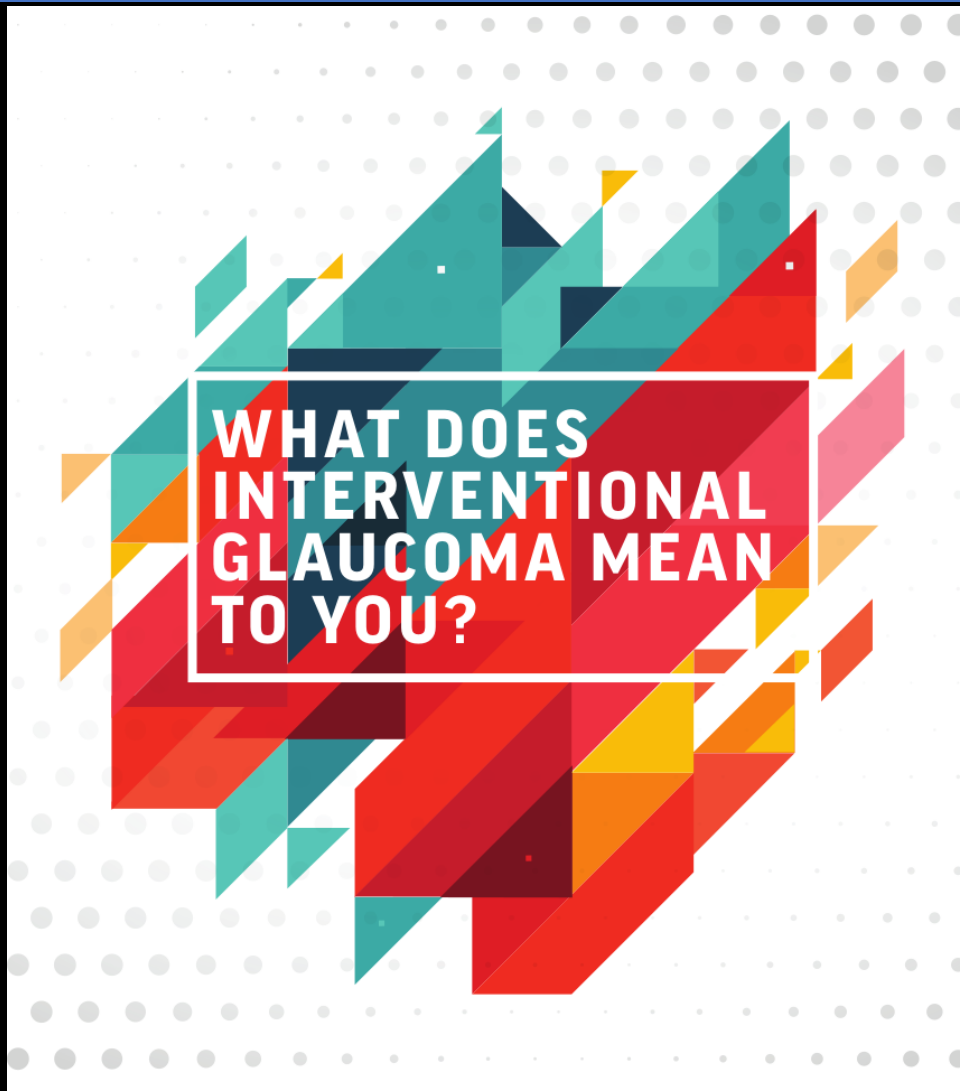
What is Interventional Glaucoma?

- No single definition

"Interventional Glaucoma is procedural glaucoma, or an innocuous way of saying surgery."

– Steven R. Sarkisian
Oklahoma Eye Surgeons

Source: Glaucoma Today. Jan-Feb 2020



Interventional Glaucoma

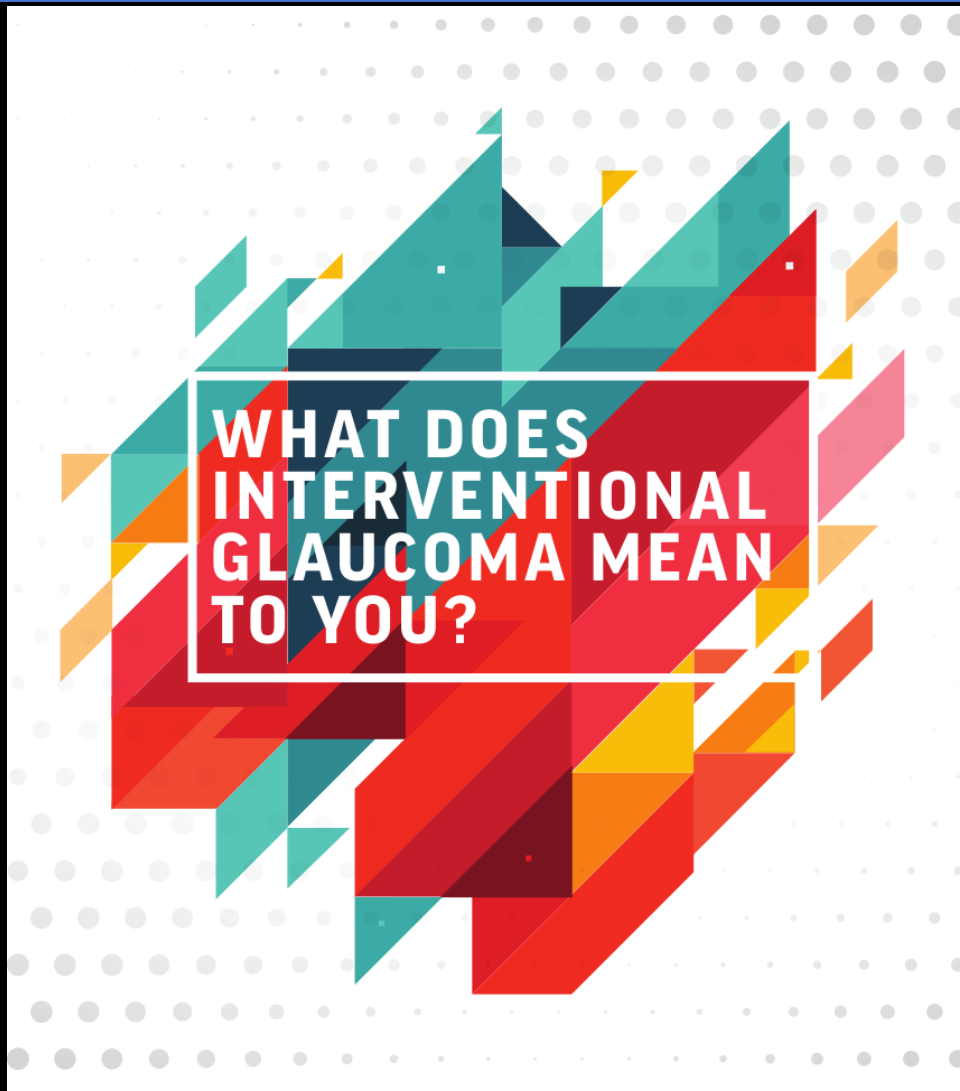
What is Interventional Glaucoma?

- No single definition

"The appropriate use of any and all medical, laser, or surgical therapies required to slow or halt the progression of glaucoma"

– Leonard K. Seibold
University of Colorado

Source: Glaucoma Today. Jan-Feb 2020



Interventional Glaucoma

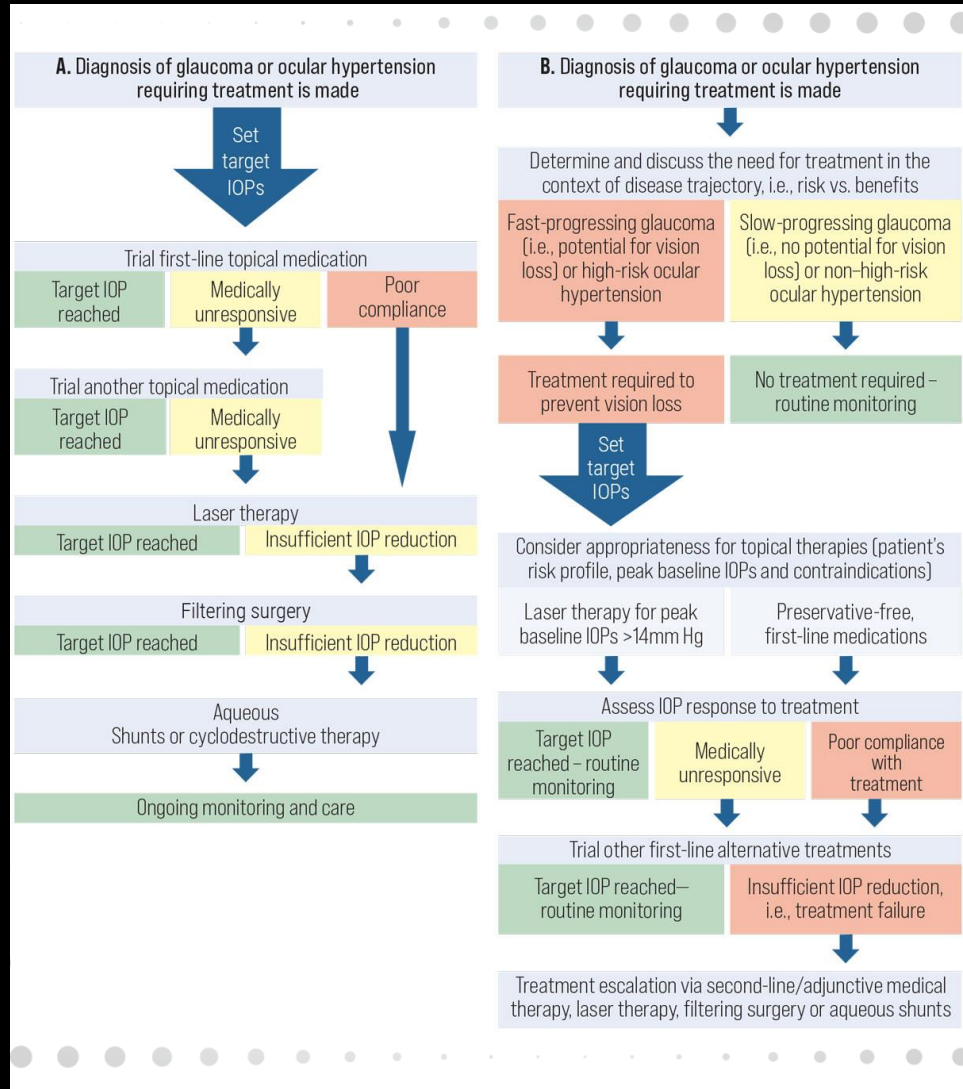
What is Interventional Glaucoma?

- No single definition

"A mindset that encourages the physician to break free from the constraints of programmed, stepwise treatment and instead consider the patient, his or her disease, and his or her preferences."

– Ian Conner
University of Pittsburgh

Source: Glaucoma Today. Jan-Feb 2020

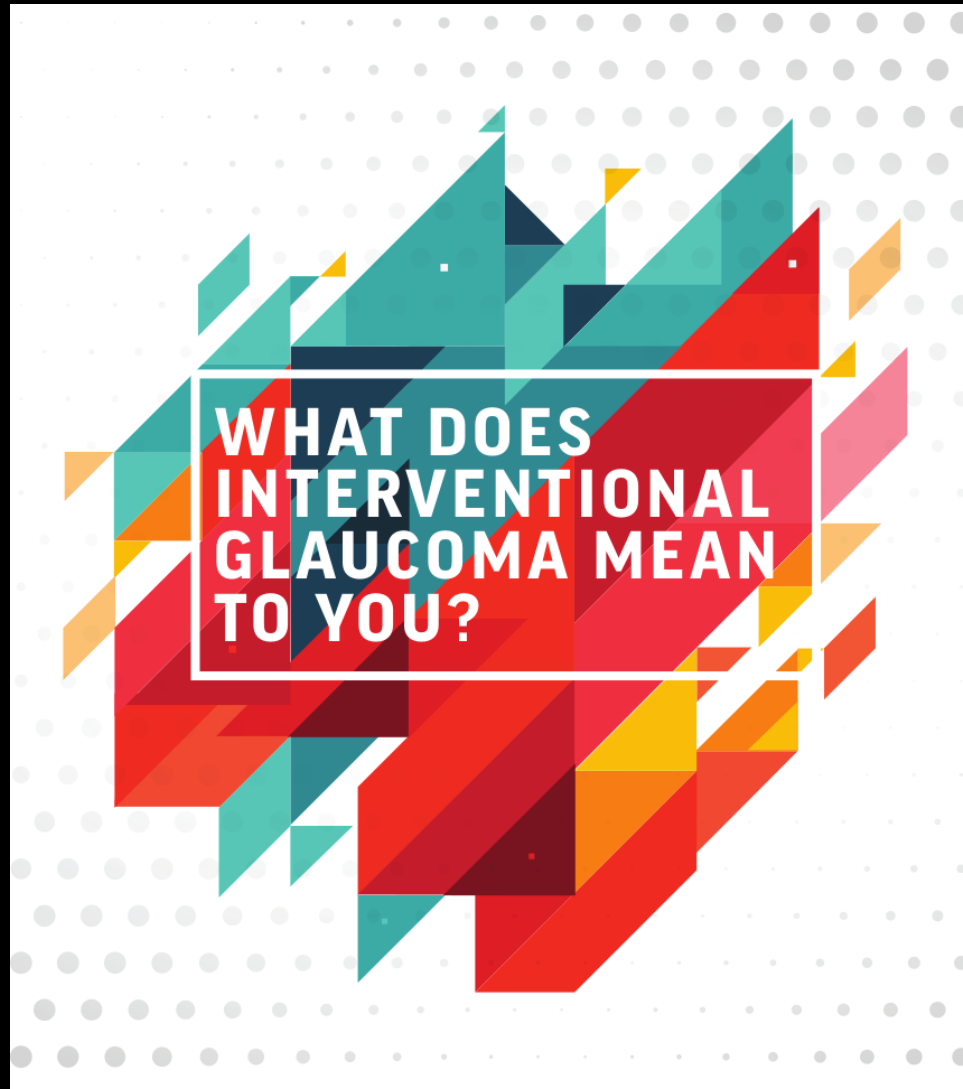


Interventional Glaucoma

What is Interventional Glaucoma?

It's about having *options!*

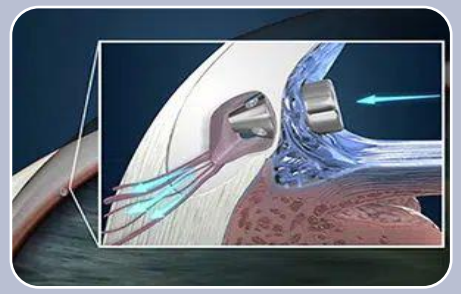
Source: Glaucoma Today. Jan-Feb 2020



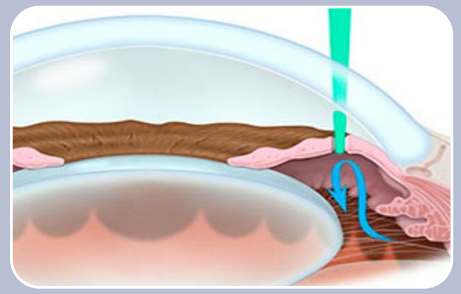
Interventional Glaucoma

Patients have a choice in how best to manage their glaucoma

Drops
vs
SLT



ECCE
vs
MIGS



ECCE
vs
LPI

Selective Laser Trabeculoplasty

SLT involves the application of a low energy, Q-switched, frequency-doubled Nd:YAG laser (532nm) to the TM

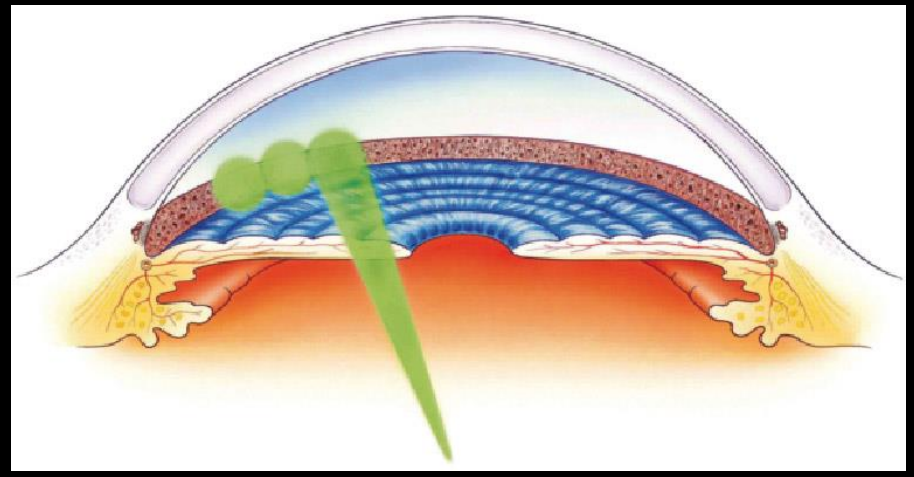
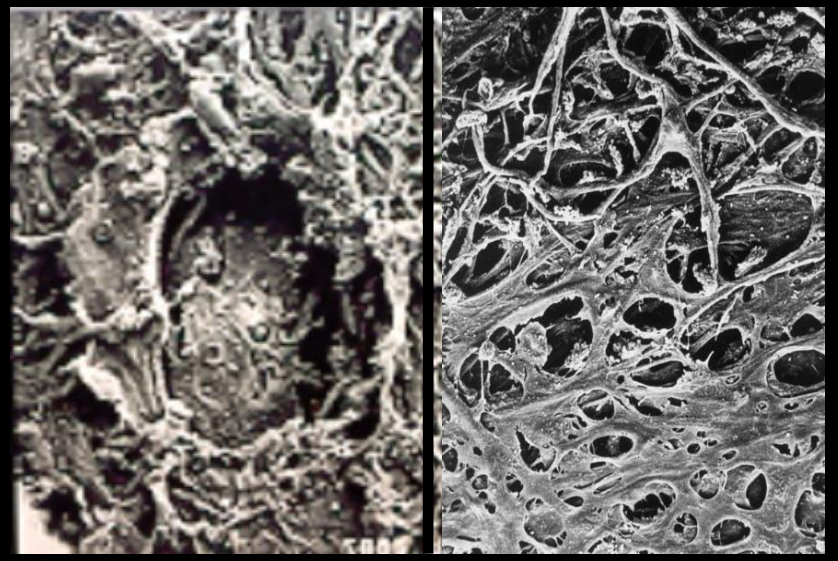


Image courtesy of Ellex Inc

Effect of ALT on the TM

Effect of SLT on the TM

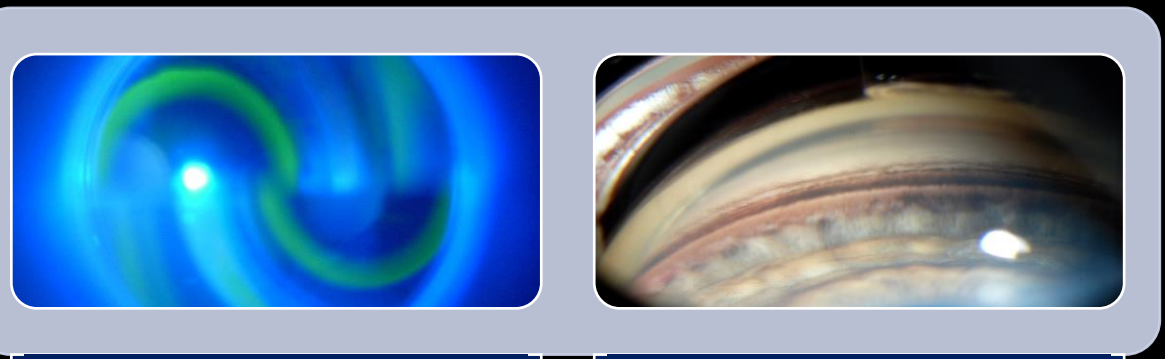


Source: PMID 11297496

Selective Laser Trabeculoplasty

SLT lowers IOP by ≥20% in 60%-95% of eyes at 1yr

Predictors of SLT Success (≥20% ↓IOP)

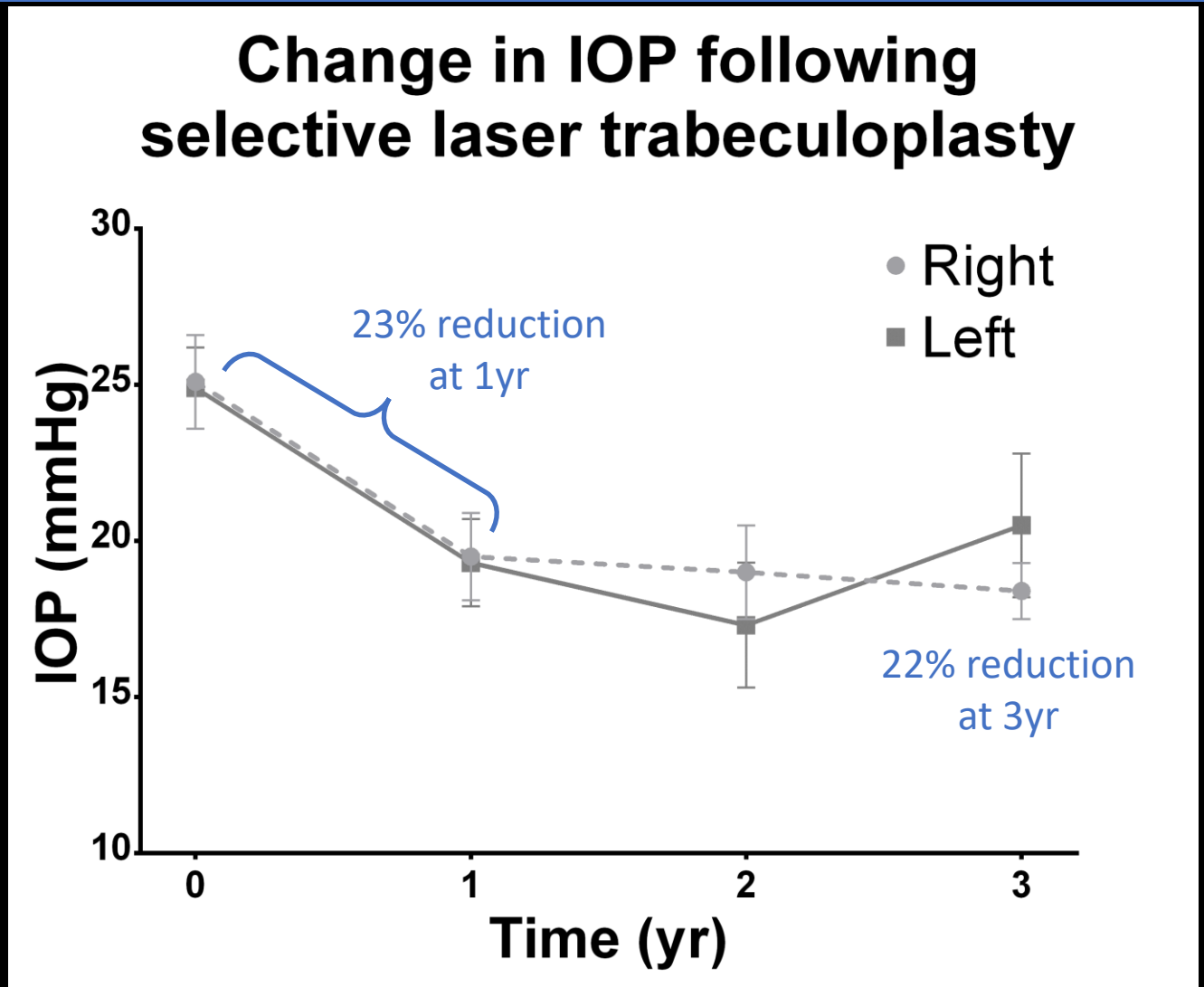


Greater IOP

Angle Pigment

Source: PMID 32672601, 31028768, 31444008

Selective Laser Trabeculoplasty



Experience at RSO

55 eyes of 35 subjects

Washed out prior to SLT

70% of subjects required no additional therapy over 3yrs

Source: ARVO abstract

Selective Laser Trabeculoplasty

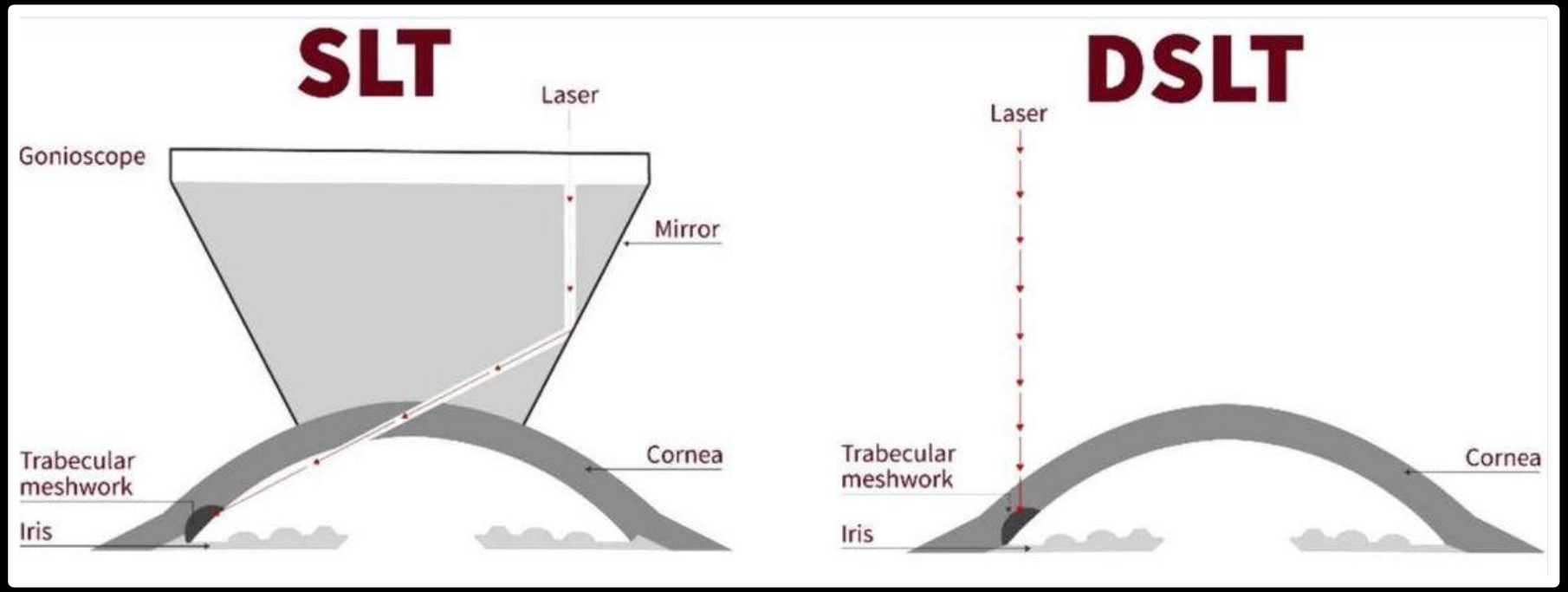
Safety Issues Associated with SLT

- Pain
- Inflammation
- IOP Spike
- Treatment Failure
- Loss to follow-up

Source: PMID 29303146, 32005561

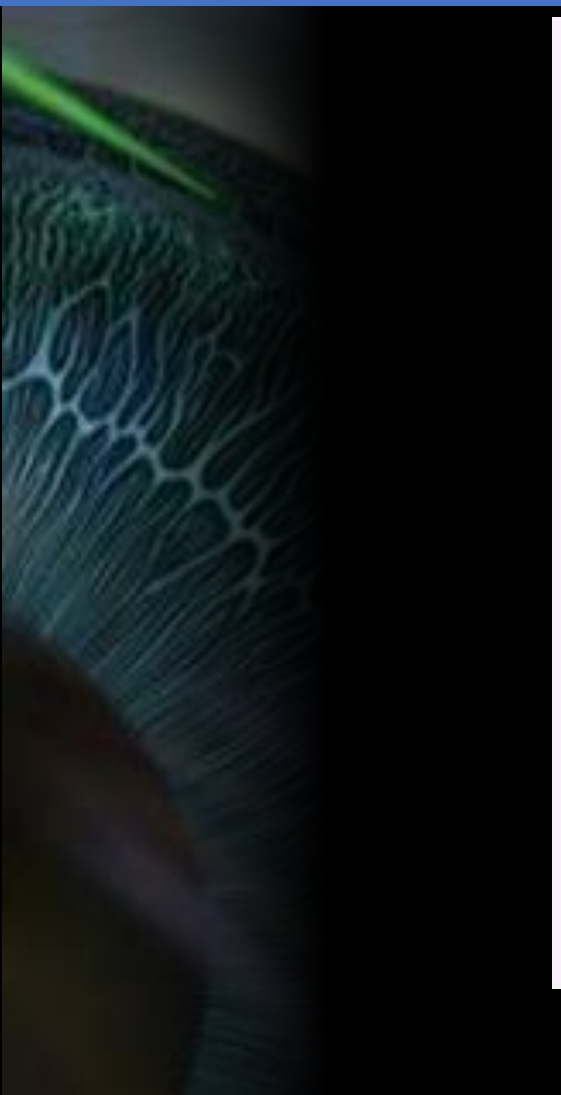
Selective Laser Trabeculoplasty

Direct Selective Laser Trabeculoplasty



Source: PMID 32637231

Selective Laser Trabeculoplasty



Automated Direct Selective Laser Trabeculoplasty

Source: PMID 34003939

Selective Laser Trabeculoplasty

Low-energy Selective Laser Trabeculoplasty Repeated Annually: Rationale for the COAST Trial

Tony Realini, MD, MPH, Gus Gazzard, MD,†‡ Mark Latina, MD,§ and Michael Kass, MD§‖*

"Clarifying the Optimal Application of SLT Therapy"

- 100 spots over 360° delivered at 0.3-0.4mJ per spot
- Procedure is repeated q 12 mos if IOP is controlled

"[Can we] preserve TM cells and maintain TM health rather than await glaucomatous TM reimpairment before rescuing impaired TM cells [with SLT]?"

Source: PMID 33428350

Selective Laser Trabeculoplasty

LiGHT Study – SLT as first-line therapy

	MEDS FIRST	LASER FIRST	
Visits @ Target IOP	91.3%	93.0%	P = 0.04
Progression (all)	36 (5.8%)	23 (3.8%)	P = 0.05
Cataract Extraction	25 (4%)	13 (2.1%)	P = 0.05
Trabeculectomy	11 (1.8%)	0	P = 0.001
Treatment Escalations	348	299	

"Laser-first gave drop-free disease control at stringent target IOPs, lower trabeculectomy rates, less glaucoma progression, and lower cost in ¾ of patients at 3 years"

Source: PMID 30862377

IG: Trabeculoplasty vs Medication

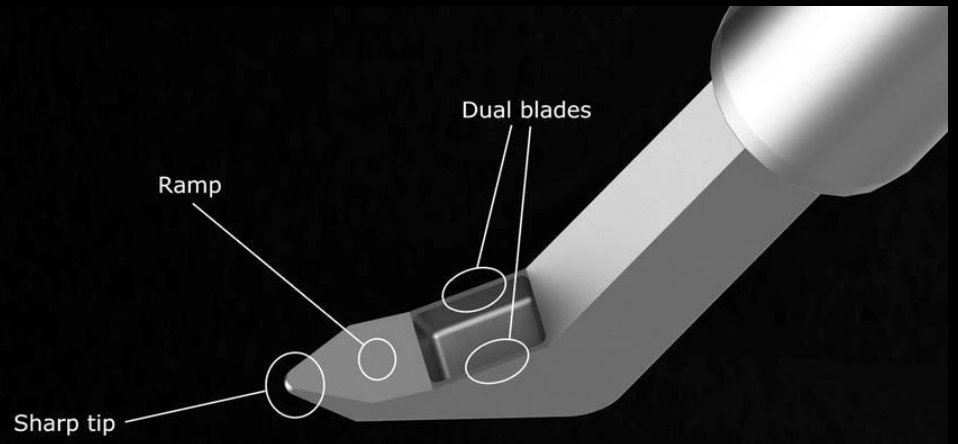
	SLT	MEDS
Effectiveness	Very Good Retreat failures	Very Good Compliance issues
Safety	Excellent Loss to follow-up	Very Good Adverse effects
Cost	Good Medicare: $251	Good Generic PGA: $10-20
QOL	Excellent Drop-free control	Fair Daily instillation

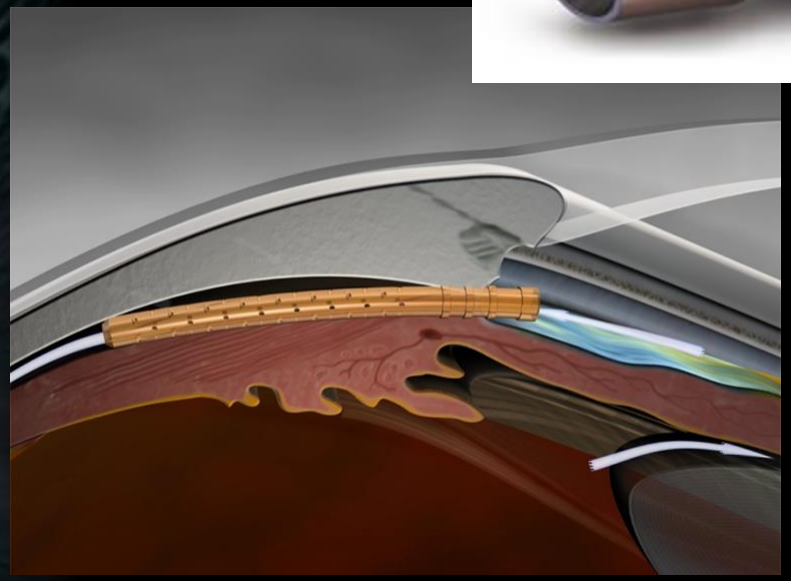
IG: Trabeculoplasty vs Medication

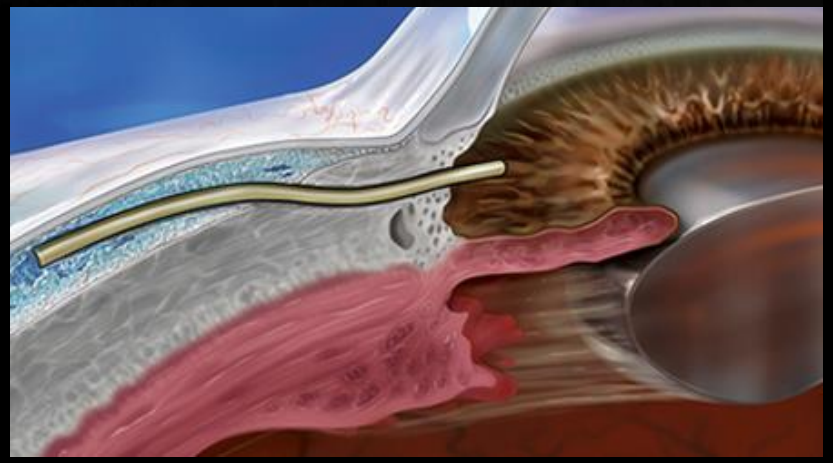
Key Points

- Both treatment options are highly effective and safe
- The potential of achieving drop-free disease control with SLT is a major deciding factor for many patients
- Which option do you recommend to your patients?

Microinvasive Glaucoma Surgery







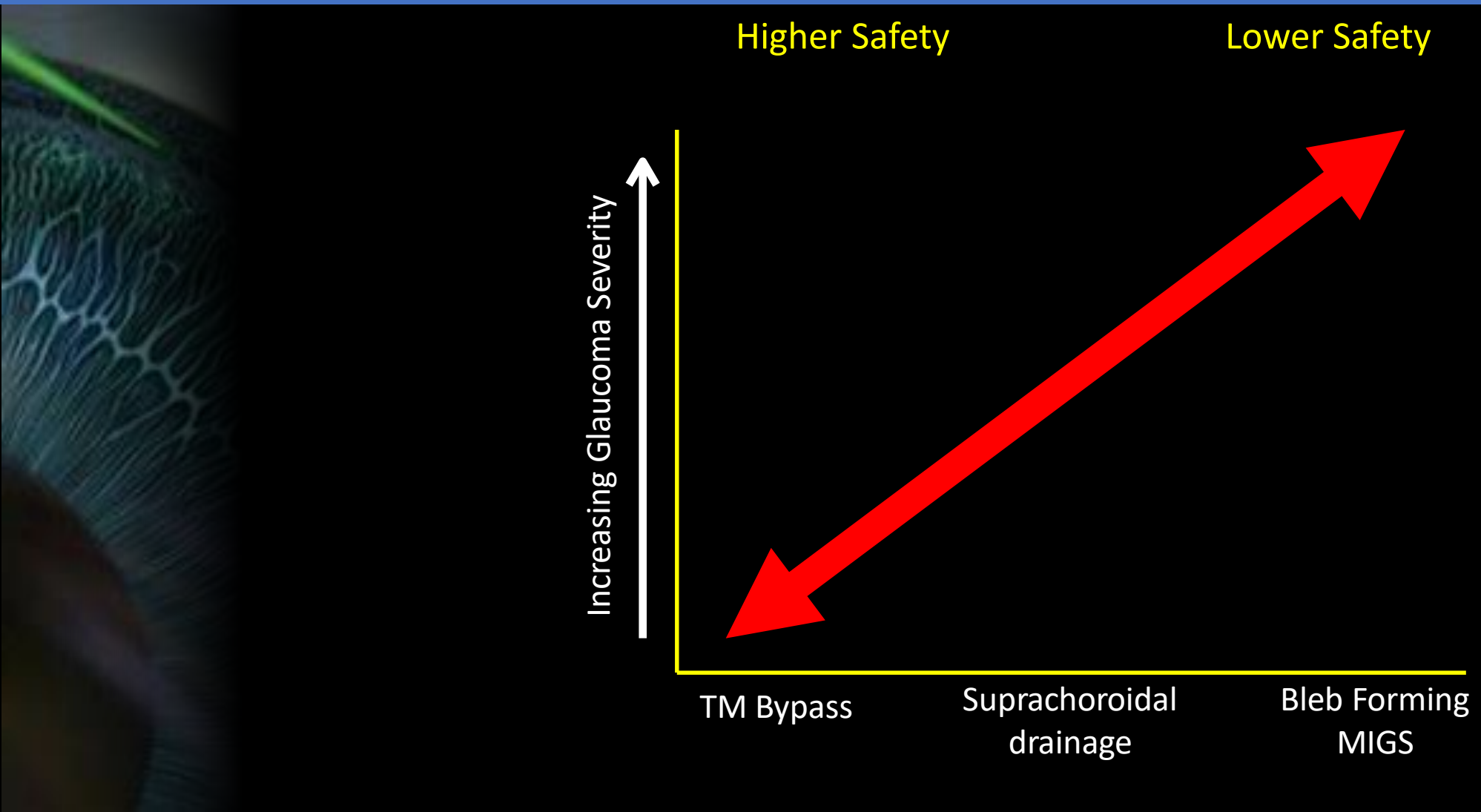
Microinvasive Glaucoma Surgery

- A group of surgical treatments that utilize an ab-interno approach
- For mild to moderate glaucoma
- Performed with or without cataract surgery
- Often includes the use of an implant

Trade-off between safety and efficacy

- MIGS: High safety, low efficacy
- Trabs/Tubes: High efficacy, low safety

Microinvasive Glaucoma Surgery



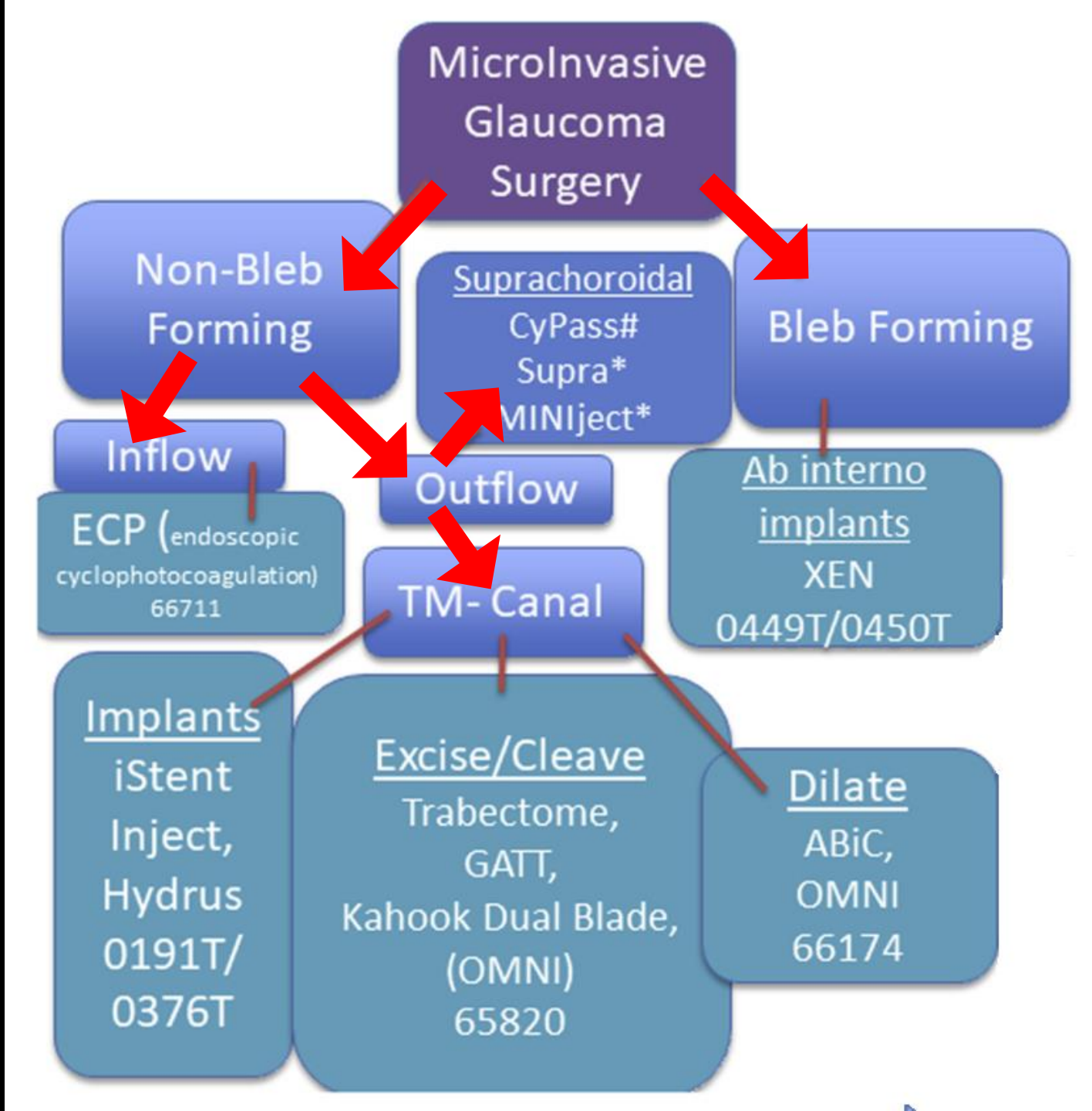
Microinvasive Glaucoma Surgery

Pros

- Minimally traumatic, especially during cataract sx
- Good short-term safety profile
- Reduced medication burden

Cons

- Intraocular surgical procedure
- Little long-term experience
- Relative merit of various procedures untested



Source:
PMID 32672638

Microinvasive Glaucoma Surgery

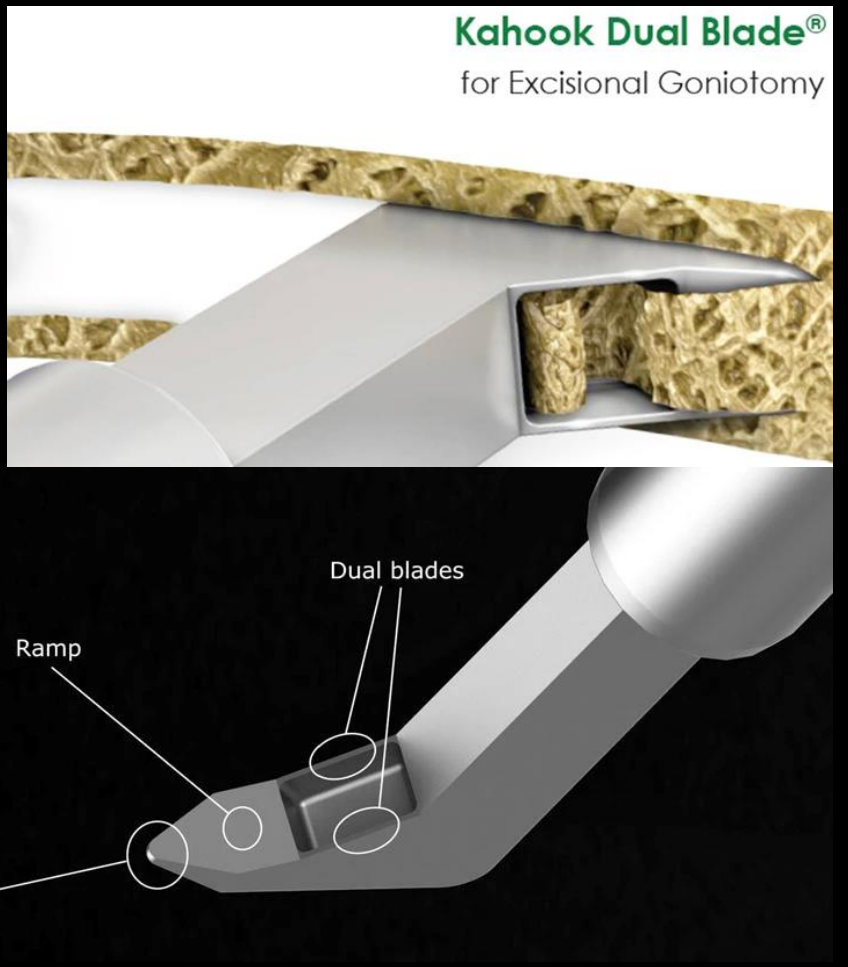
iStent

- TM bypass device
- First approved in 2012
- Second generation (iStent Inject) in 2016
- Preferred placement location unclear
- Optimal number of implants unclear, many surgeons place 2/eye

Microinvasive Glaucoma Surgery

Kahook Dual Blade

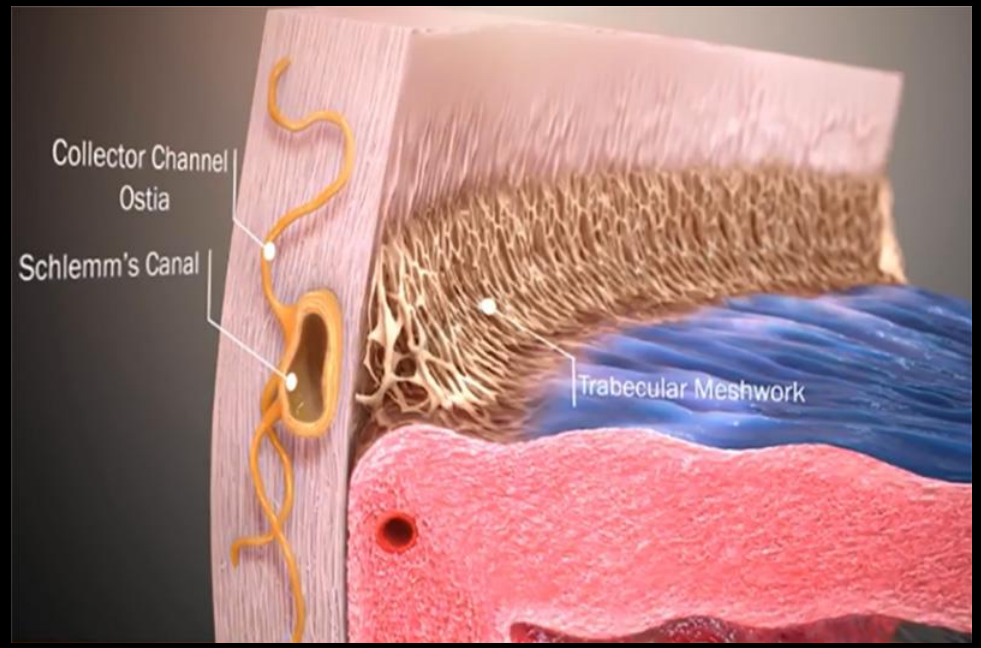
- TM excision procedure
- FDA approved in 2015
- “Unroof” Schlemm’s canal
- More complete removal of TM than other procedures
- Standalone or during cataract surgery



Microinvasive Glaucoma Surgery

Ab-interno Canaloplasty

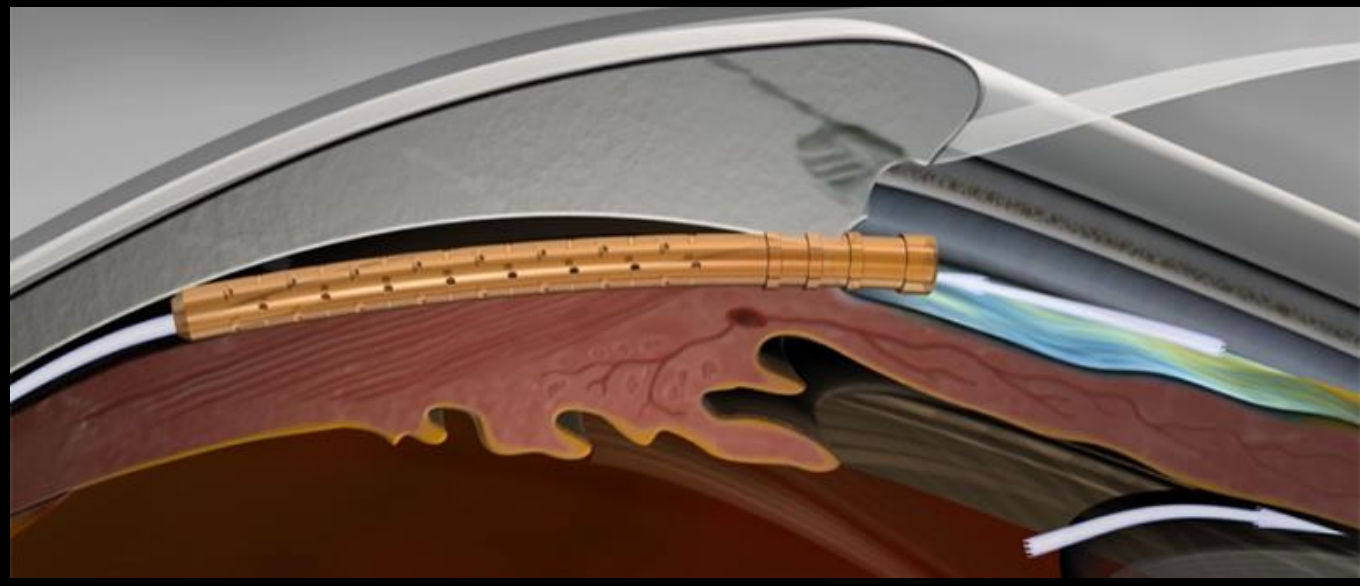
- Schlemm's canal dilation procedure
- FDA approved in 2008 as a stand-alone procedure
- Inject viscoelastic into Schlemm's canal using a catheter



Microinvasive Glaucoma Surgery

Cypass

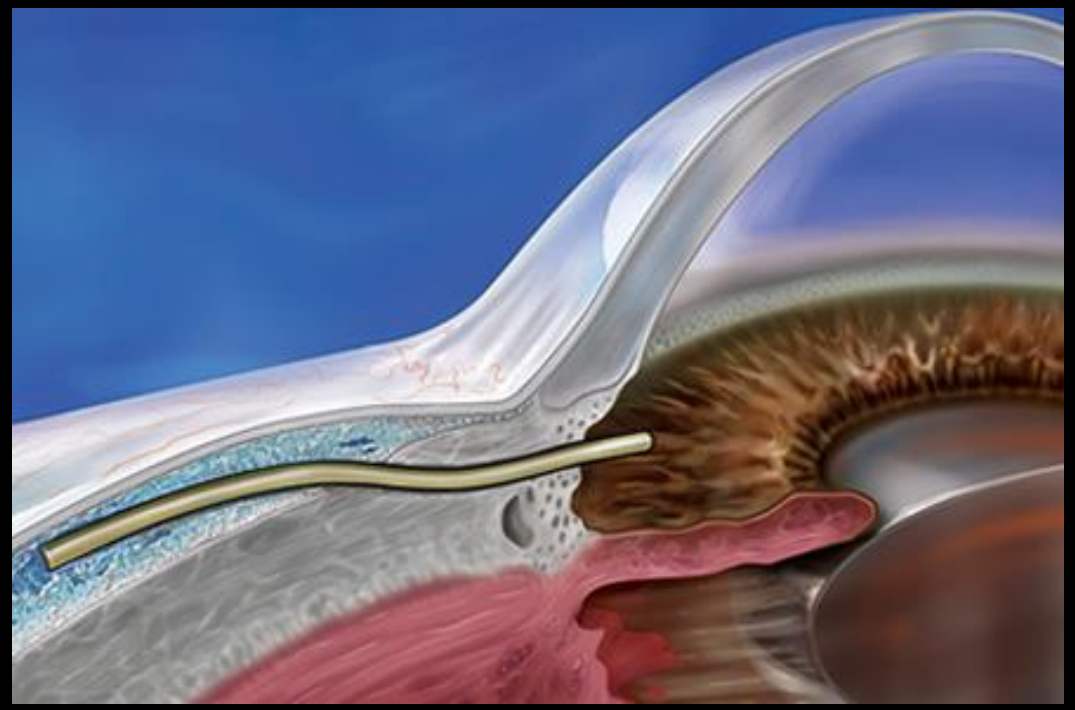
- Suprachoroidal drainage device
- FDA approved in 2016
- Withdrawn from market in 2018 due to high rates of corneal endothelial cell loss



Microinvasive Glaucoma Surgery

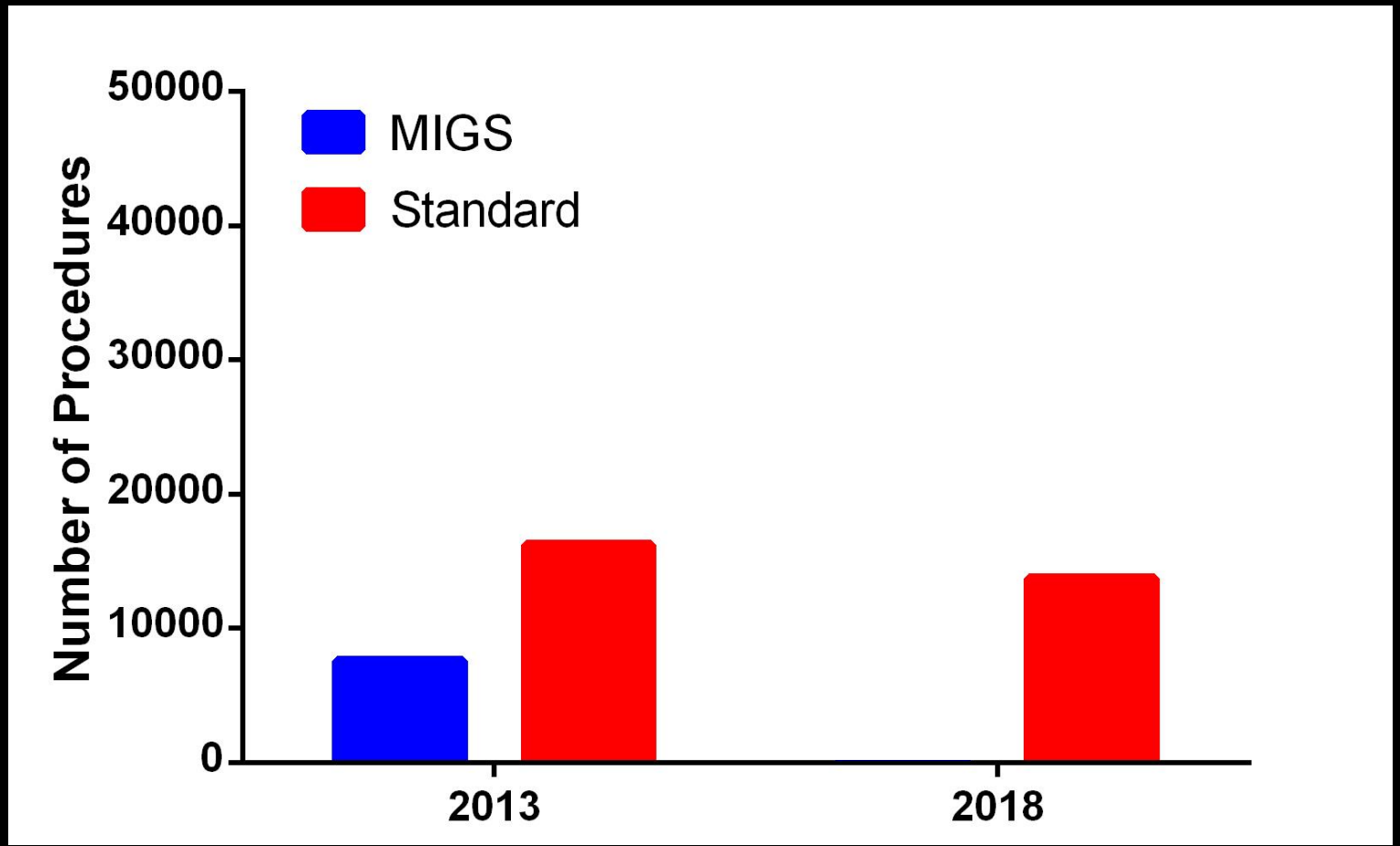
Xen Gel Stent

- Bleb-forming device
- FDA approved in 2016.
- Stent bypasses TM and Schlemm's canal to drain subconjunctivally forming a bleb



Microinvasive Glaucoma Surgery

Explosive growth of MIGS procedures performed in USA

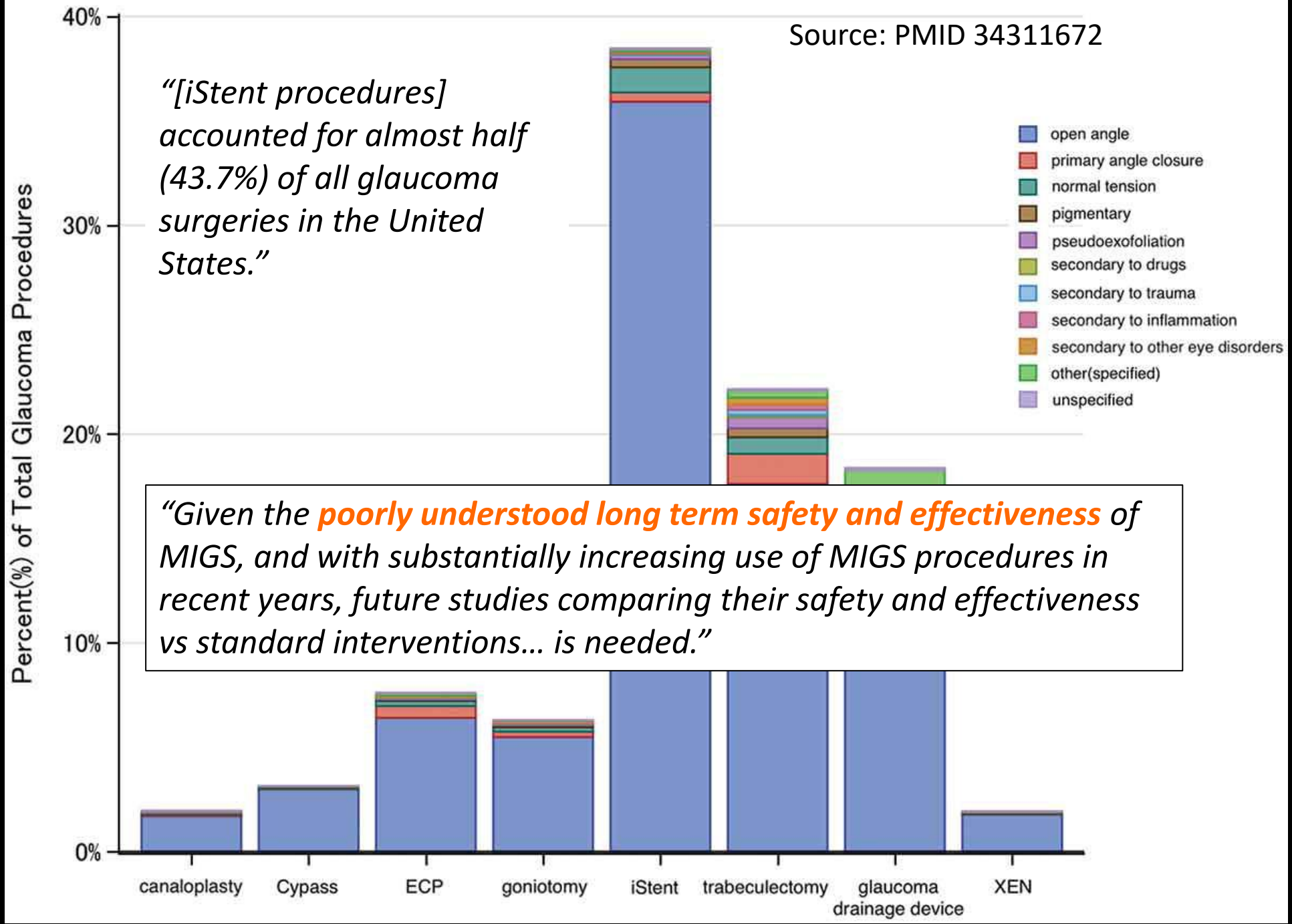


400% increase in the number of MIGs procedures

>75% are performed by non-glaucoma specialists

Source: PMID 34311672

"[iStent procedures] accounted for almost half (43.7%) of all glaucoma surgeries in the United States."



*"Given the **poorly understood long term safety and effectiveness** of MIGS, and with substantially increasing use of MIGS procedures in recent years, future studies comparing their safety and effectiveness vs standard interventions… is needed."*

Microinvasive Glaucoma Surgery

REVIEW ARTICLE

OPEN

Minimally Invasive Glaucoma Surgery: Where Is the Evidence?

Kevin Gillmann, MBBS, FEBOphth, MArch and Kaweh Mansouri, MD, MPH*†*

"Only few studies compare different MIGS techniques and even fewer assess MIGS against criterion standard treatments." (2020)

Source: PMID 32501895

Microinvasive Glaucoma Surgery

Cochrane Library

Cochrane Database of Systematic Reviews

Ab interno trabecular bypass surgery with iStent for open-angle glaucoma (Review)

Le JT, Bicket AK, Wang L, Li T

"There is very low-quality evidence that treatment with iStent may result in higher proportions of participants who are drop-free or achieving better IOP control, in the short, medium, or long-term." (2019)

Source: PMID 30919929

IG: ECCE with/without iStent

Cataract Surgery and IOP in Glaucoma

- OHTS (2012): Mean decrease in IOP of 17%, with 40% of eyes experiencing at least a 20% decrease.
  - Lowest tertile IOP: 11% decrease
  - Highest tertile IOP: 23% decrease
- AAO meta-analysis (2015): Mean 13% reduction at 1 year in patients with medically controlled POAG
- Armstrong meta-analysis (2017): ECCE lowered IOP at 36 months, but the effect waned after 24 months.

Source: PMID 22608478, 25943711, 28333892

IG: ECCE with/without iStent

Samuelson (2019)

- RCT of cataract surgery with/without iStent Inject
- Mild-moderate POAG (n = 505 eyes)
- Unmedicated IOP at 24 months
- ≥20% reduction from baseline:
  - iStent Inject: 76%, Control: 62%
- Mean change from baseline:
  - iStent Inject: 7.0 ±4.0 mmHg, Control: 5.4 ±3.7 mmHg

Source: PMID 30880108

IG: ECCE with/without iStent

- Best (2019)
  - Single-center RCT of cataract surgery with/without iStent Inject
  - Mild-moderate POAG on ≥2 meds (n = 65 eyes)
  - Mean follow-up 14 months
  - Change in medicated post-op IOP
    - iStent Inject: 24%, Control: 10%
  - Change in number of medications at 4 months
    - iStent Inject: 1.3↓, Control: 0.5↓

Source: PMID 30560280

IG: ECCE with/without iStent

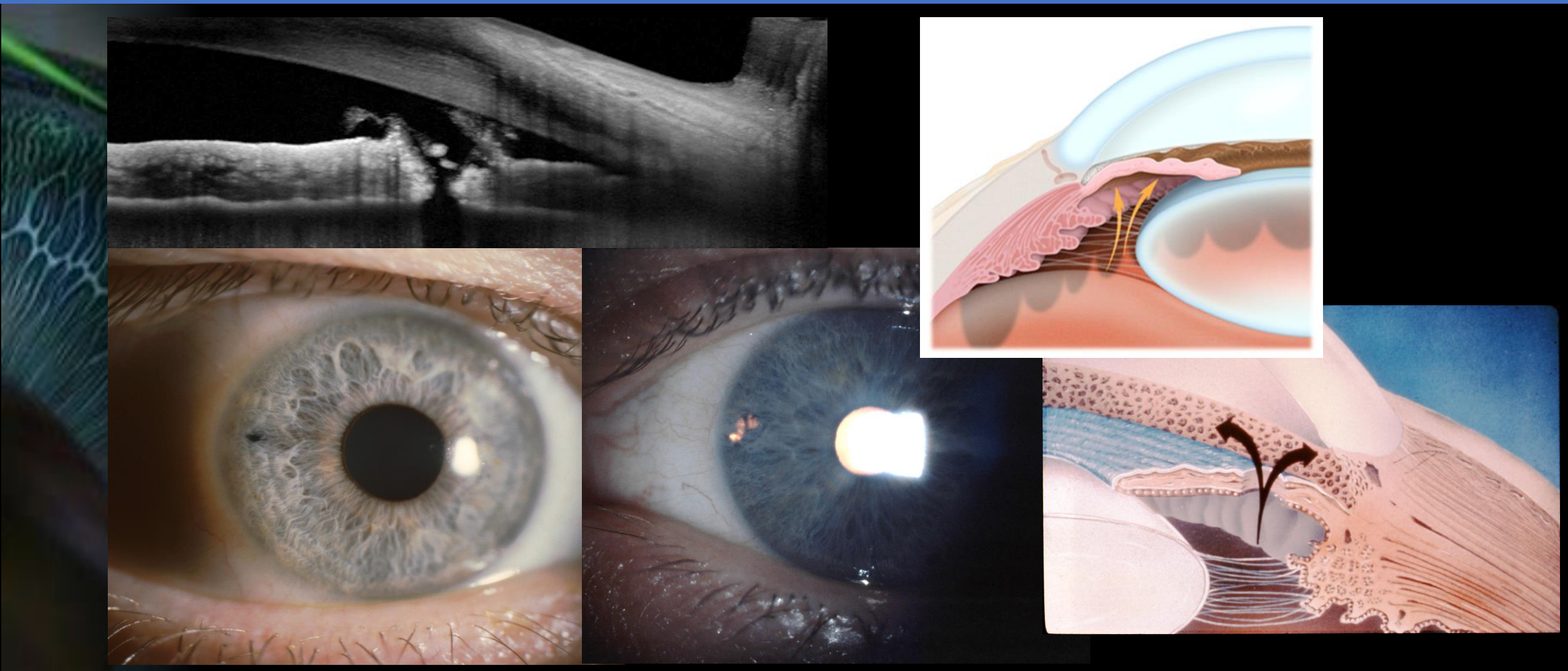
	ECCE + iStent	ECCE
Effectiveness	Good Little high-quality data	Fair 10%-20% ↓IOP
Safety	Excellent Mild and transient	Excellent Low risk of vision loss
Cost	Good Medicare: $683	Good Medicare: $548
QOL	Very Good ↓Medication burden	Very Good ↓Medication burden

IG: ECCE with/without iStent

Key Points

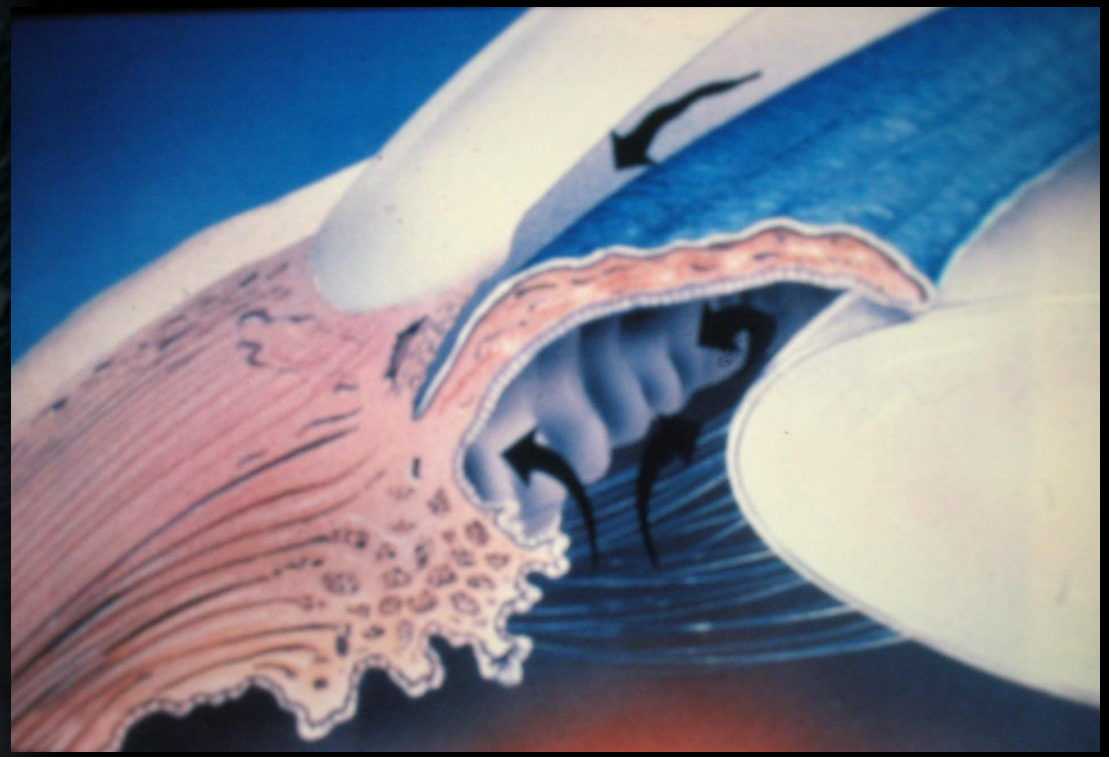
- Little high-quality research to support effectiveness, relative merits, or cost-benefit of MIGS
- iStent associated with low risk but also low benefit
- Which option do you recommend to your patients?

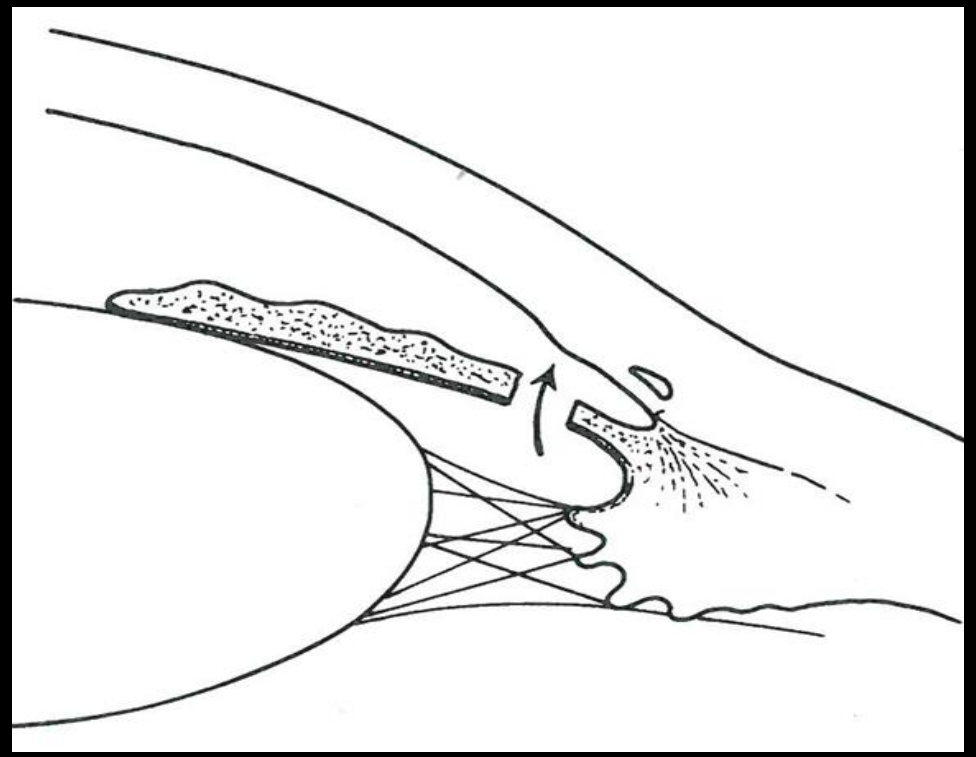
Laser Peripheral Iridotomy



Laser Peripheral Iridotomy

Relative pupil block is relieved by an iridotomy

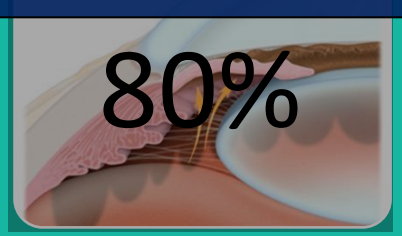


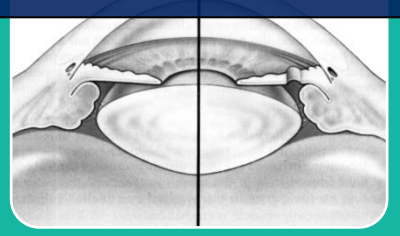


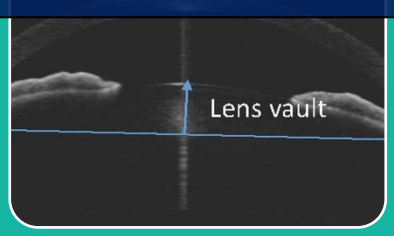
Laser Peripheral Iridotomy

Not all angle closure is due to pupil block

NOT MUTUALLY EXCLUSIVE

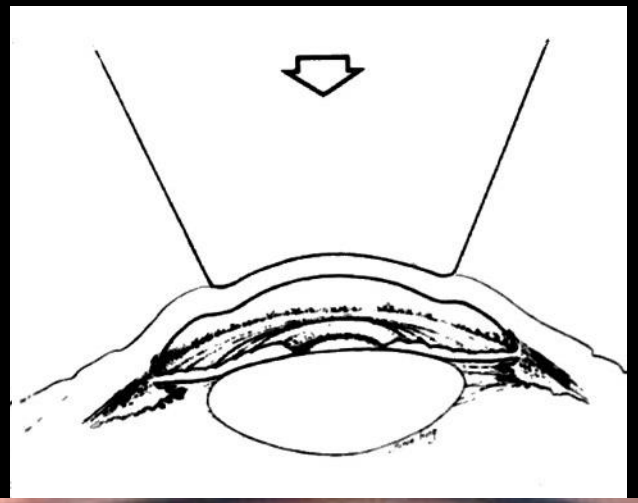






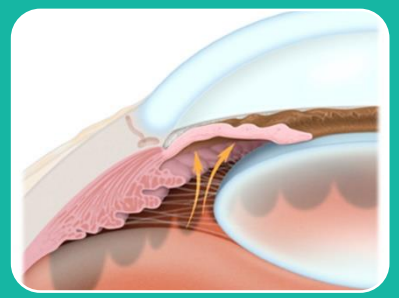
Pupil block	Plateau iris	Lens vault
Iridotomy Lens removal	Iridotomy Iridoplasty	Lens Removal

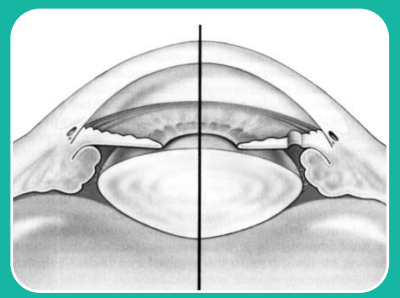
Laser Peripheral Iridotomy

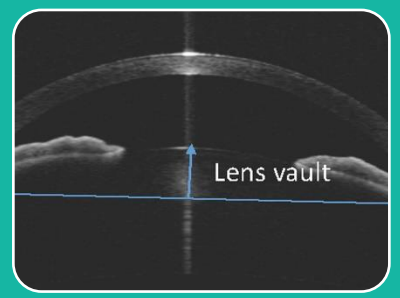


Laser Peripheral Iridotomy

Indentation Gonioscopy Findings







Pupil block	Plateau iris	Lens vault
Large posterior displacement	Double hump	Minimal posterior displacement

Laser Peripheral Iridotomy

Who Needs Treatment?

Angle Closure Stages

Angle closure suspect — *Closure is possible*

- Occludable angles
- +/- symptoms, no PAS, normal IOP

Primary angle closure — *Closure has occurred*

- Peripheral anterior synechia
- Elevation of IOP

Angle closure glaucoma — *Vision loss has occurred*

Laser Peripheral Iridotomy

Angle Closure Suspects

To treat or not to treat, that is the question!!

- **Symptomatic**
- **Evidence of prior closure**
- ACD < 2.0mm
- Strong family history
- Predisposing systemic meds
- Poor F/U compliance
- Difficulty in accessing immediate care (nursing home, etc.)

Treatment is often needed after LPI

Narrow Angle	Open Angle
Additional surgery needed	Treatment same as OAG
Iridoplasty, lens extraction, synechialysis, etc.	“Mixed mechanism glaucoma”

Laser Peripheral Iridotomy

Safety Issues Associated with LPI

- Hyphema
- Dysphotopsia
- IOP Spike
- Treatment Failure
- Cataract Progression

Source: PMID 30143096

IG: Cataract Surgery vs LPI

- Numerous studies document increased angle depth, decreased PAS, and lower IOP following lens extraction in eyes with PAC and PACG
- Angle depth increase and IOP reduction are greater following lens extraction than LPI
- Eyes with uncontrolled PACG and a patent LPI experience significant IOP reduction following lens extraction

Source: PMID 32339525

IG: Cataract Surgery vs LPI

EAGLE (2016)

- RCT of clear lens extraction vs LPI in PAC and PACG
- All subjects were >50yo without cataract (n = 419)
- PAC subjects must have IOP >30 mmHg
- Mean change from baseline at 36 months:
  - Phaco: 12.9 mmHg, LPI: 12.4 mmHg
- Medication-free at 36 months:
  - Phaco: 61%, LPI: 21%

IG: Cataract Surgery vs LPI

	Phaco	LPI
Effectiveness	Excellent AC depth & IOP	Good 50% success
Safety	Excellent Low risk of vision loss	Excellent Mild and transient
Cost	Fair Cost-savings in 10yrs	Excellent Medicare: $315
QOL	Excellent Vision improvement	Fair ↓Medication burden

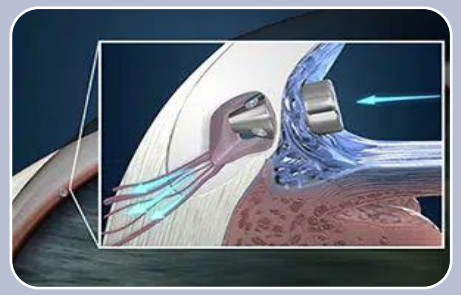
IG: Cataract Surgery vs LPI

Key Points

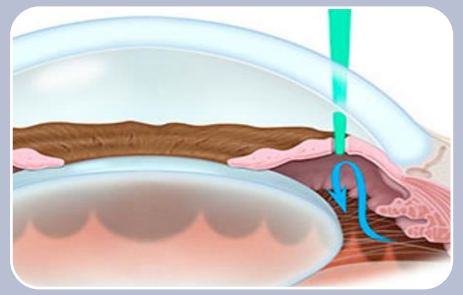
- Both treatment options are safe and effective, but expect a greater treatment effect with lens extraction
- The visual gains following lens extraction are a major advantage of this option
- Which option do you recommend to your patients?

Interventional Glaucoma

Drops
vs
SLT



ECCE
vs
MIGS



ECCE
vs
LPI


Thank You!