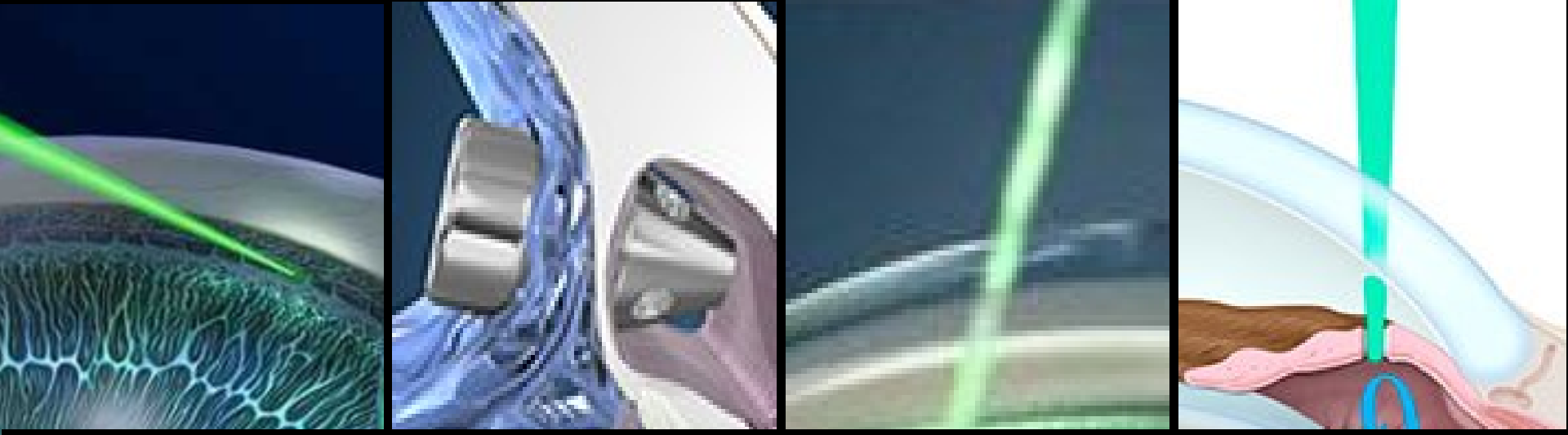

Rapid Fire
Surgical Management of Glaucoma

Richard Trevino, OD, FAAO
Indiana University School of Optometry

Online notes:
richardtrevino.net

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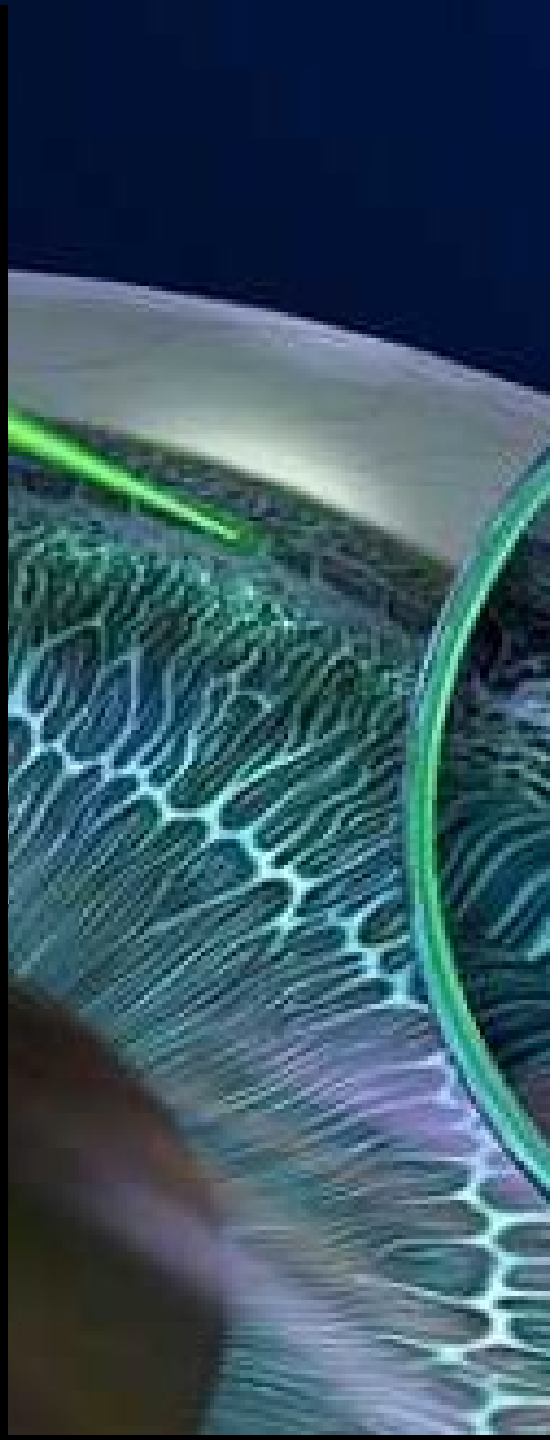
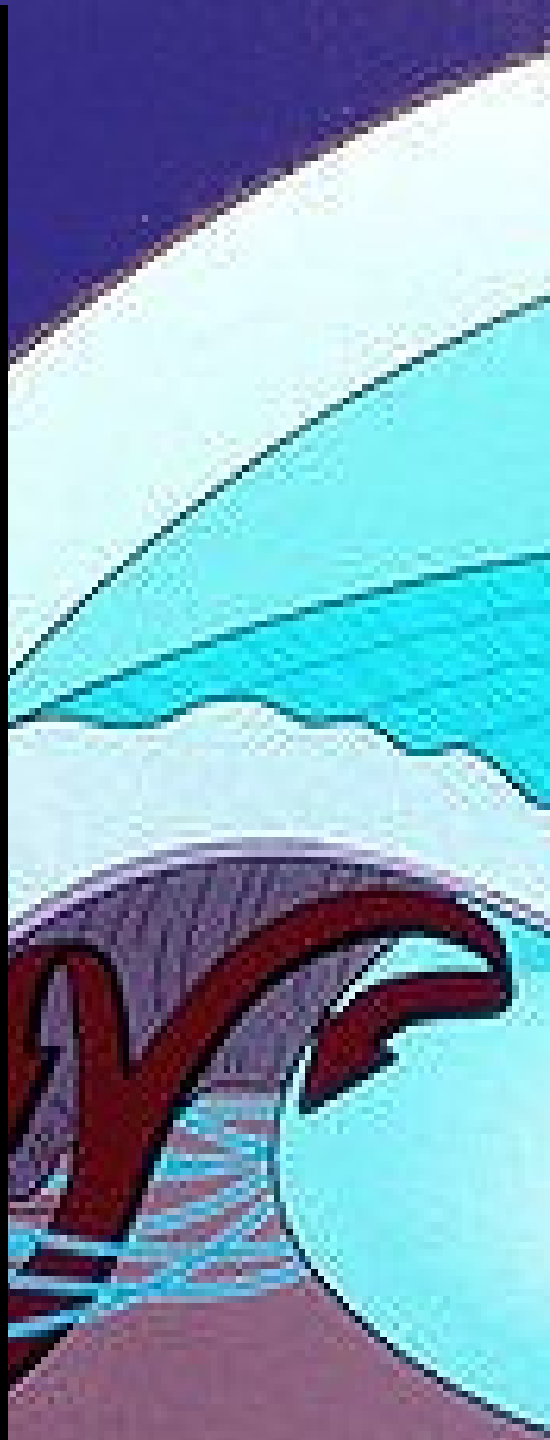
Disclosures:
None



Want more info?

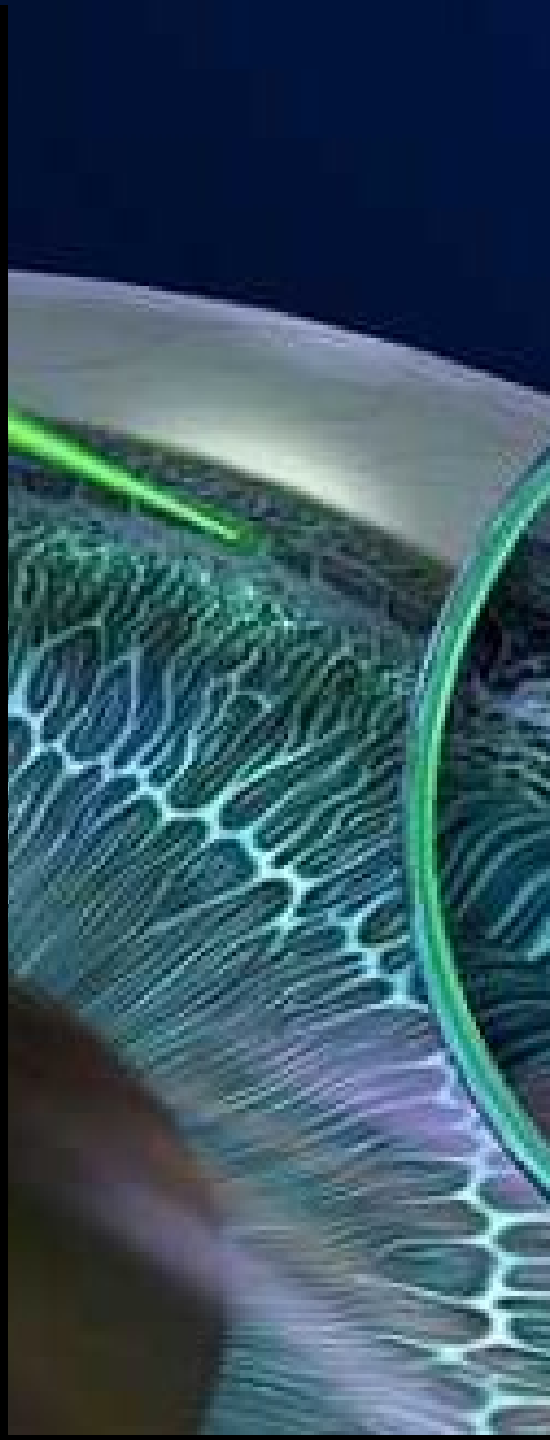
Iowaglaucoma.org

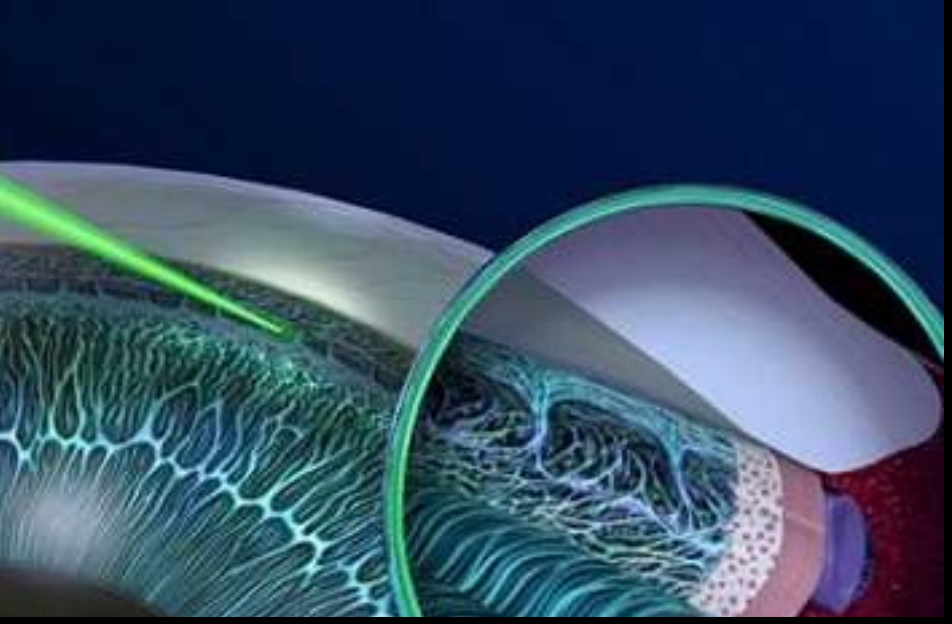


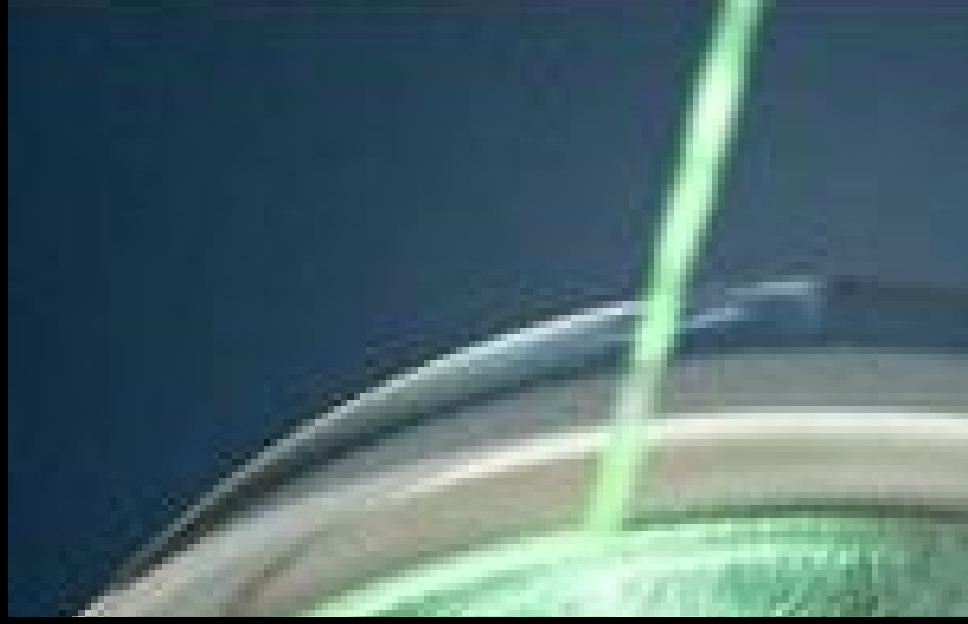
Selective Laser Trabeculoplasty (SLT)

Microinvasive Glaucoma Surgery (MIGS)

Peripheral Laser Iridotomy (LPI)





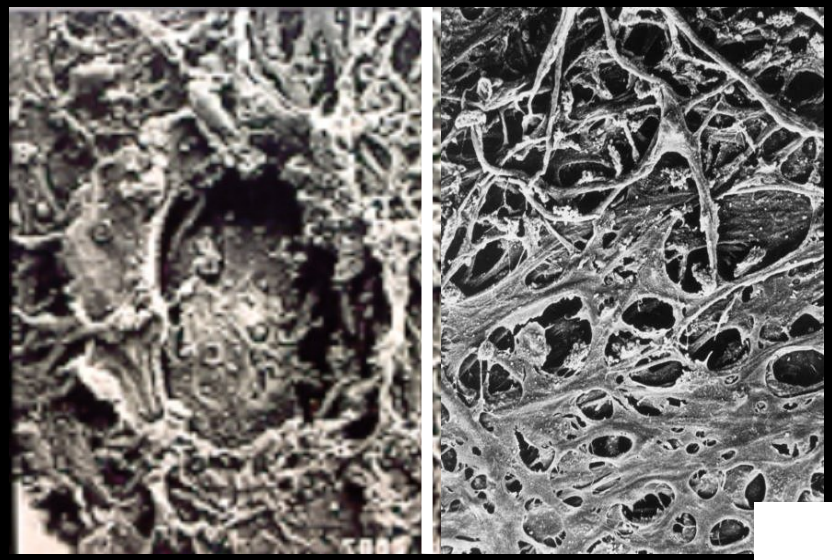


SELECTIVE LASER TRABECULOPLASTY

LASER TRABECULOPLASTY: PAST & PRESENT

Effect of ALT on the TM

Effect of SLT on the TM



PMID 11297496

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

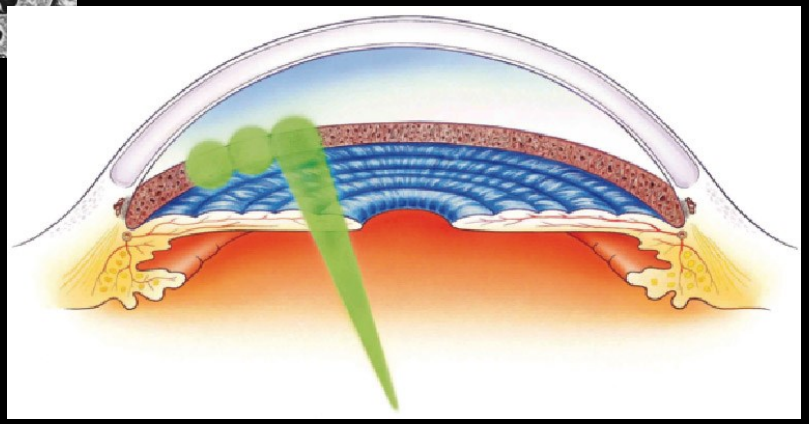
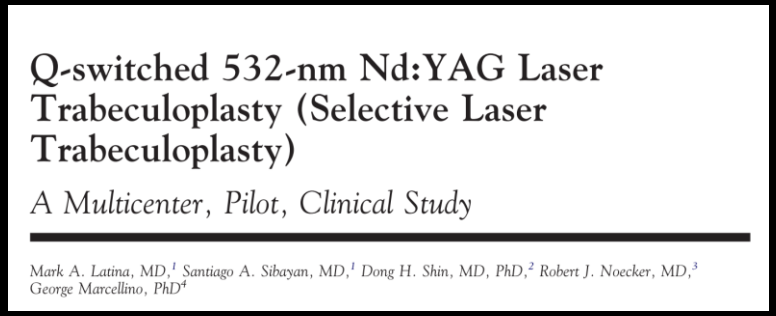


Image courtesy of Ellex Inc

SELECTIVE LASER TRABECULOPLASTY

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



Q-switched 532-nm Nd:YAG Laser Trabeculoplasty (Selective Laser Trabeculoplasty)

A Multicenter, Pilot, Clinical Study

Mark A. Latina, MD,[1] Santiago A. Sibayan, MD,[1] Dong H. Shin, MD, PhD,[2] Robert J. Noecker, MD,[3] George Marcellino, PhD[4]

Langfristige Nachbeobachtung der selektiven Laser-trabekuloplastik bei primärem Offenwinkelglaukom

Long-Term Follow-Up of Selective Laser Trabeculoplasty in Primary Open-Angle Glaucoma

Autoren T. Gračner, M. Falež, B. Gračner, D. Pahor

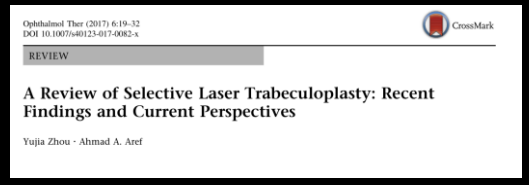
Institut Lehrkrankenhaus Maribor, Augenabteilung, Maribor (Vorstand: Doz. Dr. Dr. med. Dušica Pahor)

Eye (2018), 1–15

Selective laser trabeculoplasty: past, present, and future

A Garg and G Gazzard

REVIEW



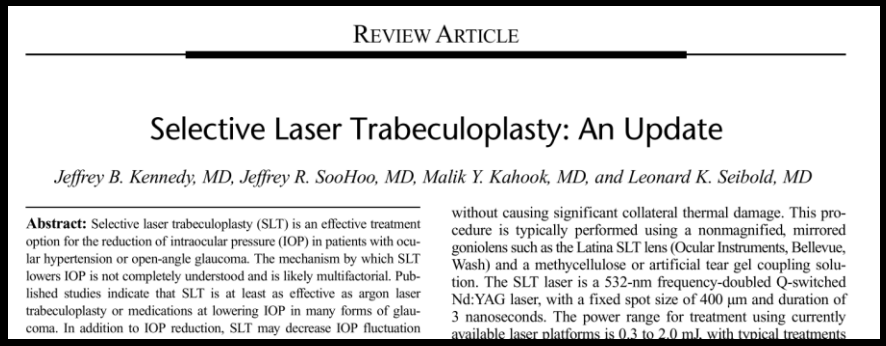
Ophthalmol Ther (2017) 6:19–32

DOI 10.1007/s40123-017-0082-x

REVIEW

A Review of Selective Laser Trabeculoplasty: Recent Findings and Current Perspectives

Yujia Zhou · Ahmad A. Aref



REVIEW ARTICLE

Selective Laser Trabeculoplasty: An Update

Jeffrey B. Kennedy, MD, Jeffrey R. SooHoo, MD, Malik Y. Kahook, MD, and Leonard K. Seibold, MD

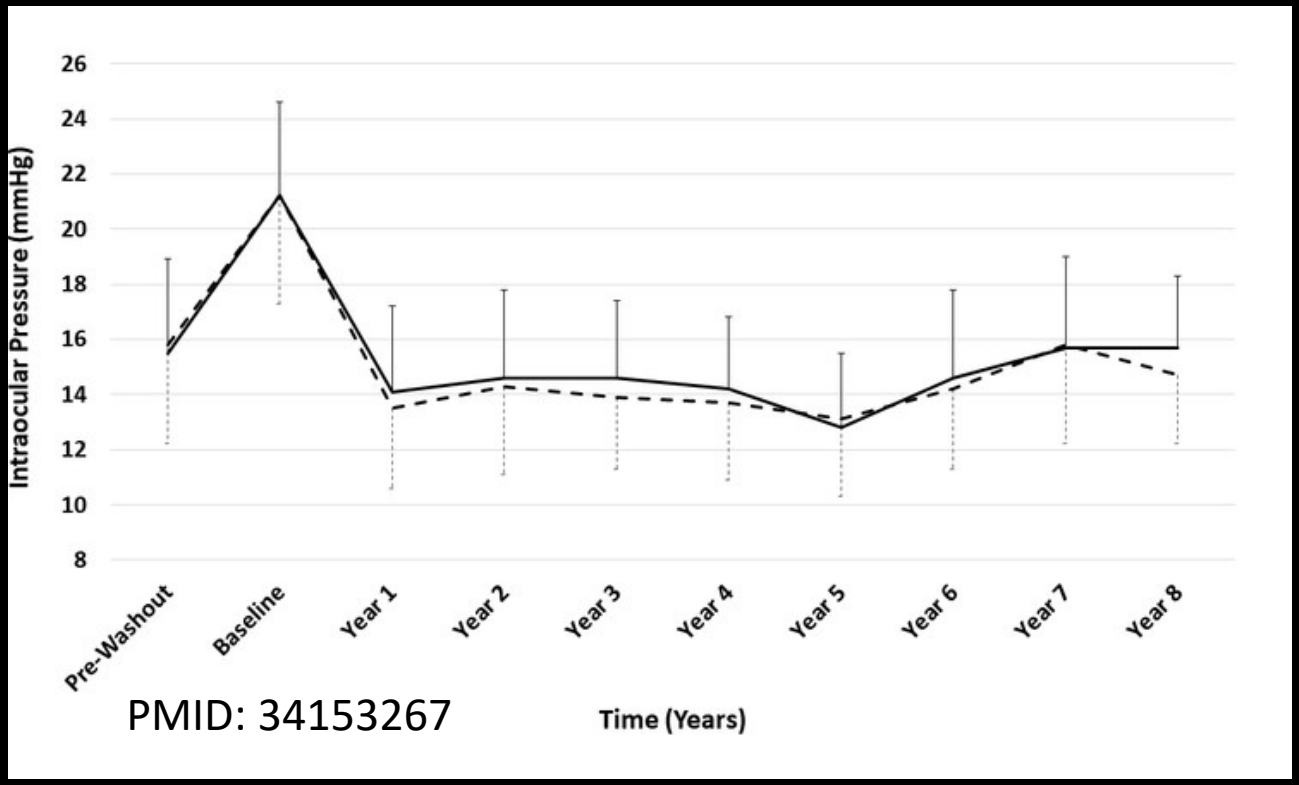
Abstract: Selective laser trabeculoplasty (SLT) is an effective treatment option for the reduction of intraocular pressure (IOP) in patients with ocular hypertension or open-angle glaucoma. The mechanism by which SLT lowers IOP is not completely understood and is likely multifactorial. Published studies indicate that SLT is at least as effective as argon laser trabeculoplasty or medications at lowering IOP in many forms of glaucoma. In addition to IOP reduction, SLT may decrease IOP fluctuation without causing significant collateral thermal damage. This procedure is typically performed using a nonmagnified, mirrored goniolens such as the Latina SLT lens (Ocular Instruments, Bellevue, Wash) and a methycellulose or artificial tear gel coupling solution. The SLT laser is a 532-nm frequency-doubled Q-switched Nd:YAG laser, with a fixed spot size of 400 μm and duration of 3 nanoseconds. The power range for treatment using currently available laser platforms is 0.3 to 2.0 mJ, with typical treatments

SELECTIVE LASER TRABECULOPLASTY

Change in IOP following SLT

SLT produces a rapid and sustained lowering of IOP

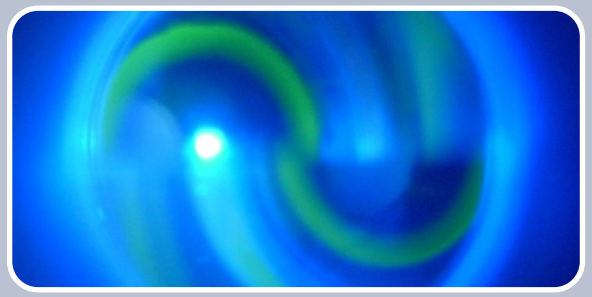
Median medication-free survival time for initial SLT was 85.4 months (7yrs) in both eyes

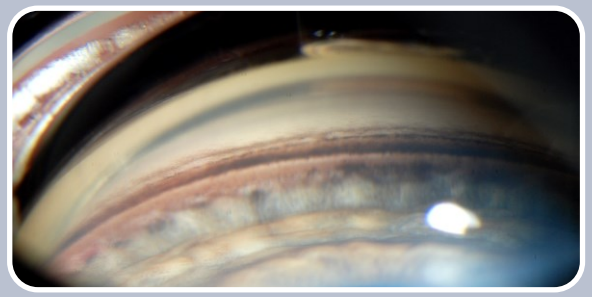


PMID: 34153267

SELECTIVE LASER TRABECULOPLASTY

Predictors of SLT Success
(≥20% ↓IOP)





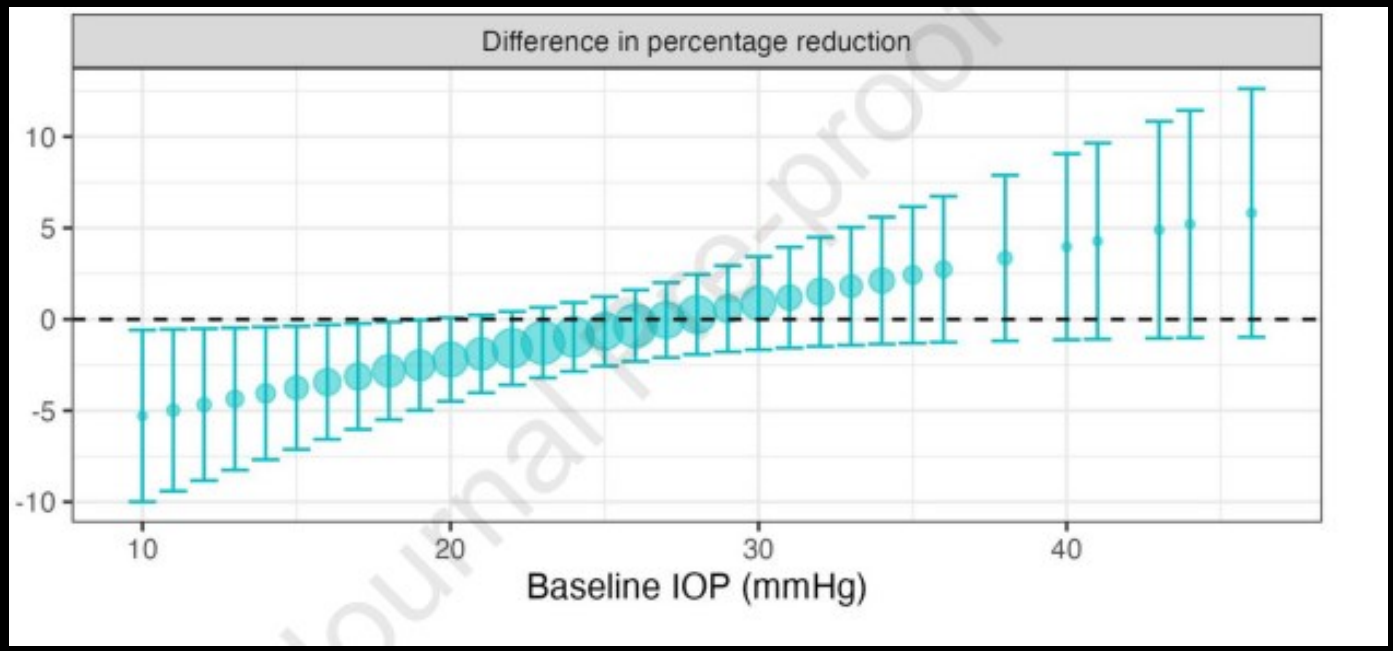
Greater IOP

Angle Pigment

Source: PMID 32672601, 31028768, 31444008

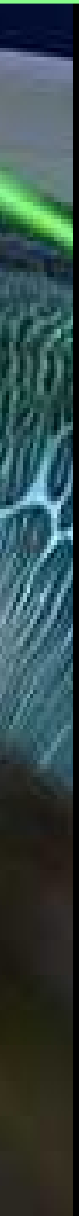
SELECTIVE LASER TRABECULOPLASTY

Lower Baseline IOP Decreases SLT Effectiveness



PMID 38964719

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

Ophthalmol Ther (2023) 12:2823–2839
https://doi.org/10.1007/s40123-023-00831-9

Check for updates

COMMENTARY

Challenging the "Topical Medications-First" Approach to Glaucoma: A Treatment Paradigm in Evolution

Nathan M. Radcliffe · Manjool Shah · Thomas W. Samuelson

Topical medications traditionally have been first-line in the glaucoma treatment paradigm. However, their usage is limited by a host of widespread and impactful downsides, including nonadherence, side effects, inconsistent circadian IOP control, complex dosing regimens, difficulty with self-administration, costs, and decreased quality of life.

PMID 37855977

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

SELECTIVE LASER TRABECULOPLASTY

SELECTIVE LASER TRABECULOPLASTY

BELKIN
VISION

SELECTIVE LASER TRABECULOPLASTY

BELKIN

VISION

Accessible First-Line Glaucoma Care for All

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§‖*

<u>"Clarifying the Optimal Application of SLT Therapy"</u>

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

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

Source: PMID 33428350

SELECTIVE LASER TRABECULOPLASTY

• Clinical Research •

Efficacy of low-energy selective laser trabeculoplasty on the treatment of primary open angle glaucoma

Li Xu[1,2], Ru-Jing Yu[1,2], Xu-Ming Ding[1,2], Mao Li[1,2], Yue Wu[1,2], Li Zhu[1,2], Di Chen[1,2], Cheng Peng[1,2], Chang-Juan Zeng[1,2], Wen-Yi Guo[1,2]

Low-energy SLT is safe and effective for POAG patients during a 2-year follow-up. Younger POAG patients may obtain better results after low-energy SLT treatment.

PMID 31544039

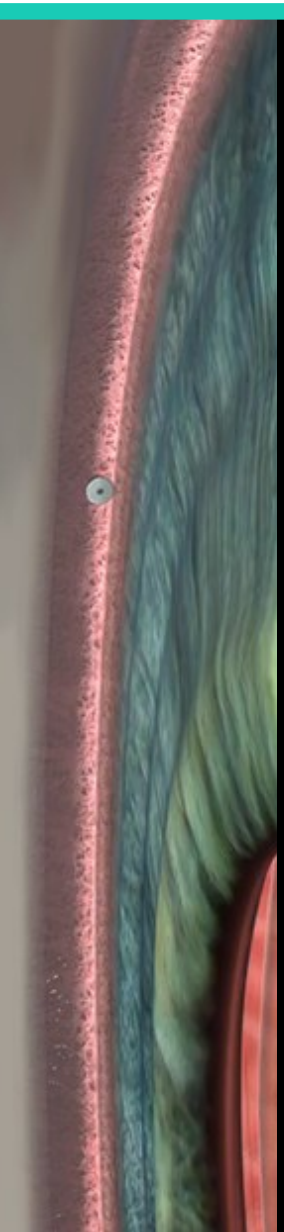
SELECTIVE LASER TRABECULOPLASTY

KEY POINTS

- Consider first-line SLT rather than drops for POAG
- Greater effectiveness with higher baseline IOP and greater TM pigment
- Educate patients that this is not a cure and the effect will wear off eventually

MICROINVASIVE GLAUCOMA SURGERY (MIGS)

MICROINVASIVE GLAUCOMA SURGERY

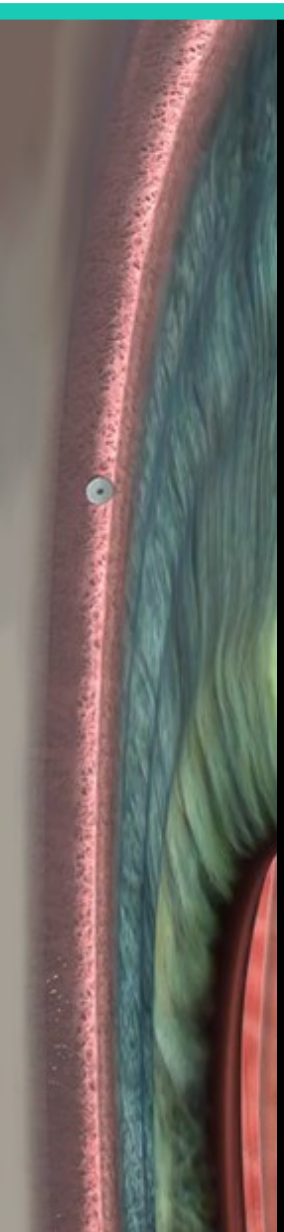


- A group of surgical treatments that utilize an ab-interno approach
- For mild to moderate glaucoma
- Performed with or without cataract surgery
- Often includes the use of an implant

Trade-off between safety and efficacy

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

MICROINVASIVE GLAUCOMA SURGERY



Pros

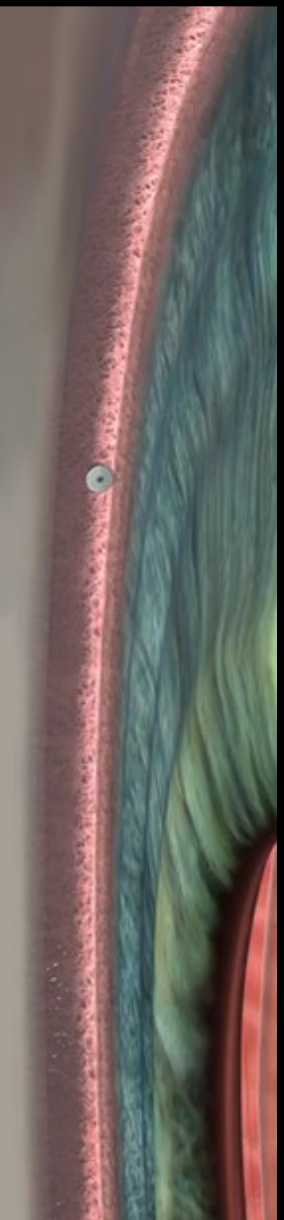
- Minimally traumatic surgery, especially when performed during cataract sx
- Good short-term safety profile
- Reduced medication burden

Cons

- Invasive surgical procedure
- Low-Moderate IOP reduction
- Little long-term experience
- Relative merit of various procedures untested

MICROINVASIVE GLAUCOMA SURGERY

Source:
PMID 32672638



MicroInvasive Glaucoma Surgery

Non-Bleb Forming

Inflow

ECP (endoscopic cyclophotocoagulation) 66711

Outflow

Suprachoroidal
CyPass#
Supra*
MINIject*

TM- Canal

Implants
iStent
Inject,
Hydrus
0191T/
0376T

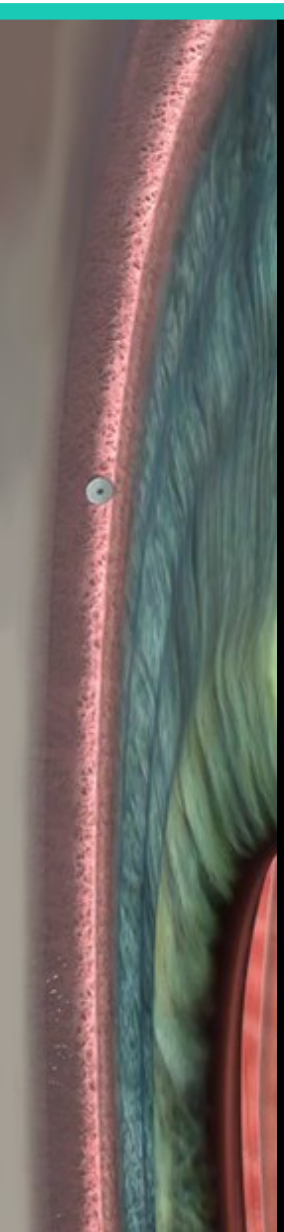
Excise/Cleave
Trabectome,
GATT,
Kahook Dual Blade,
(OMNI)
65820

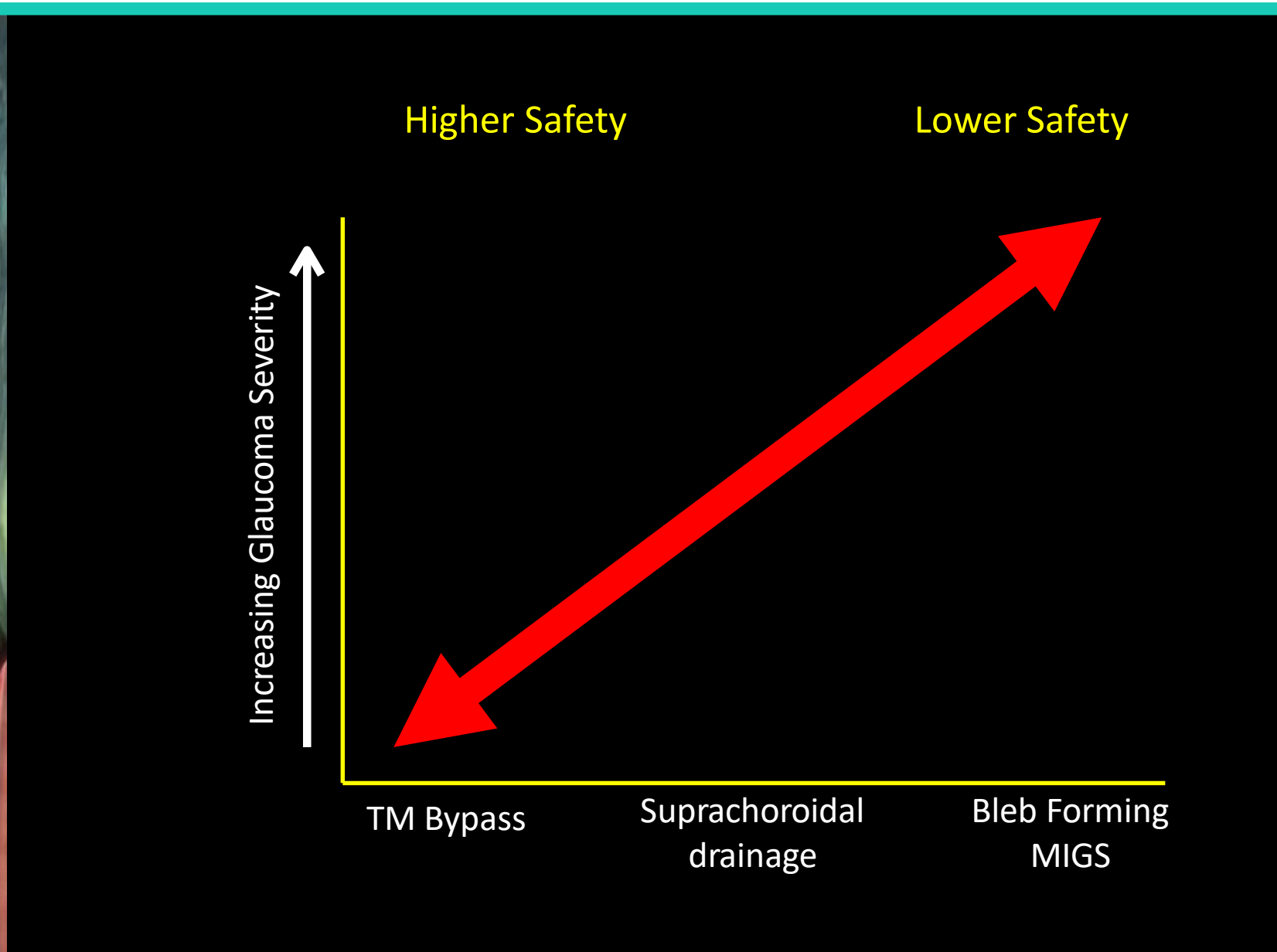
Dilate
ABiC,
OMNI
66174

Bleb Forming

Ab interno implants
XEN
0449T/0450T

MICROINVASIVE GLAUCOMA SURGERY

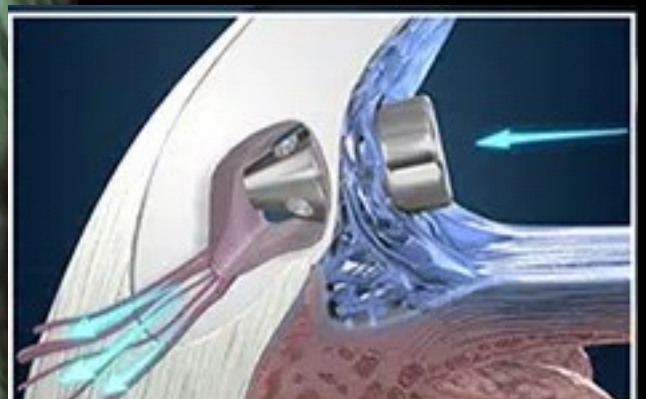




MICROINVASIVE GLAUCOMA SURGERY

iStent

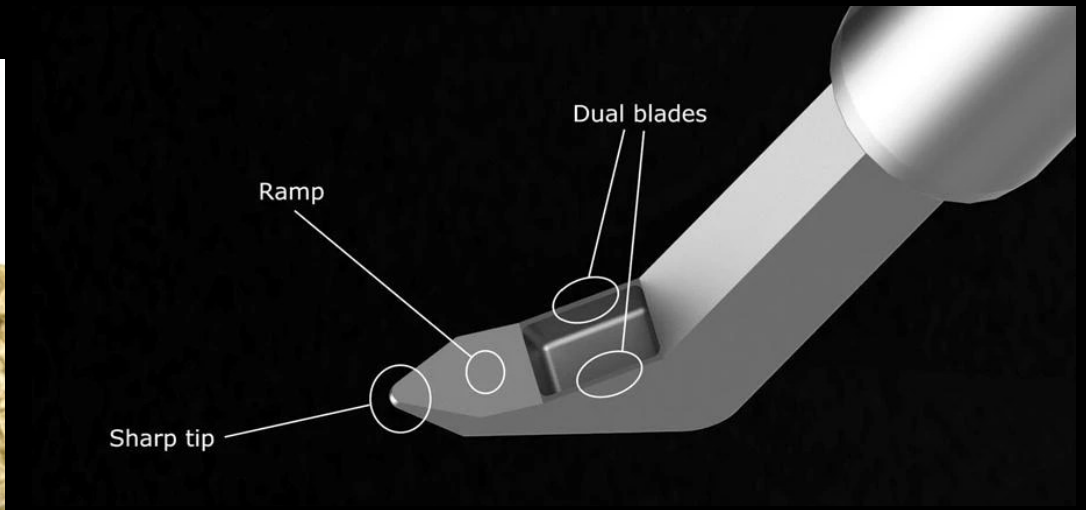
- TM bypass device
- First approved in 2012 to be implanted during cataract surgery
- Second generation (iStent Inject) in 2016
- Preferred placement location unclear
- Optimal number of devices implanted unclear, but many surgeons place 2/eye



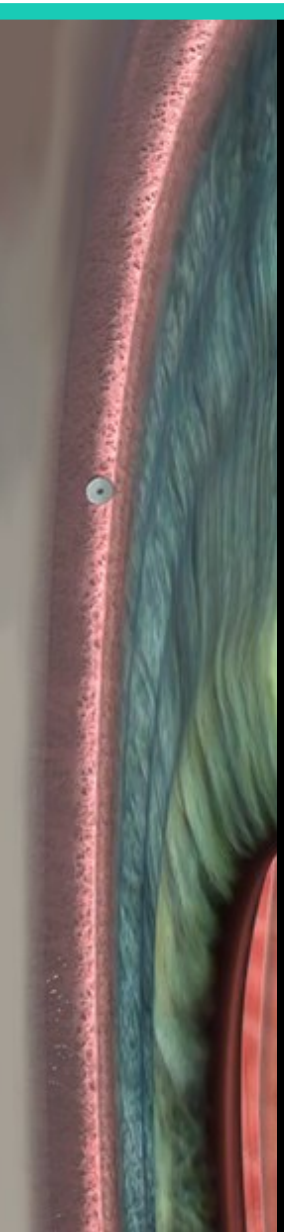
MICROINVASIVE GLAUCOMA SURGERY

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

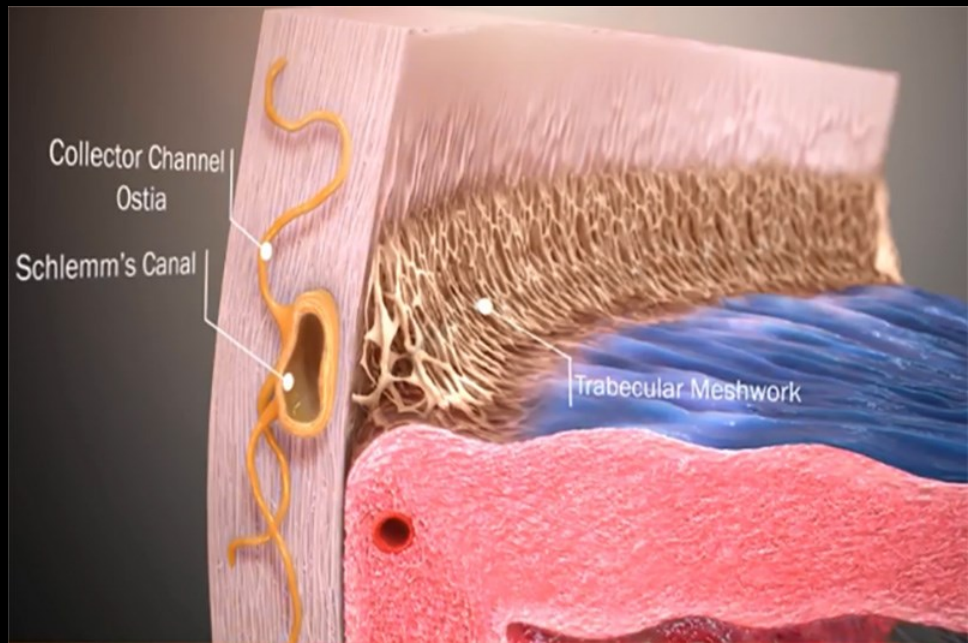


MICROINVASIVE GLAUCOMA SURGERY



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



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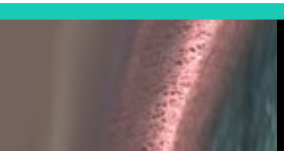
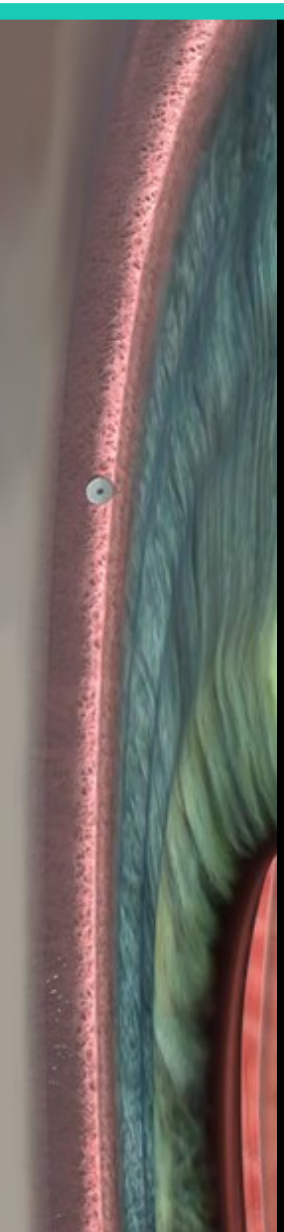
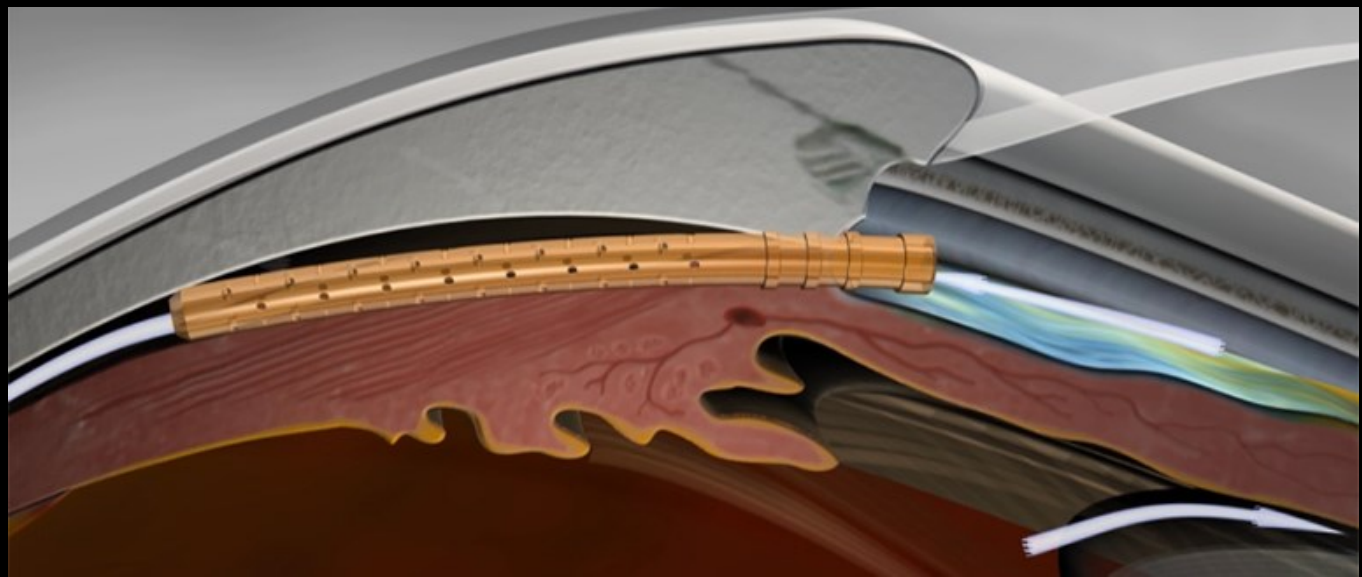


MICROINVASIVE GLAUCOMA SURGERY

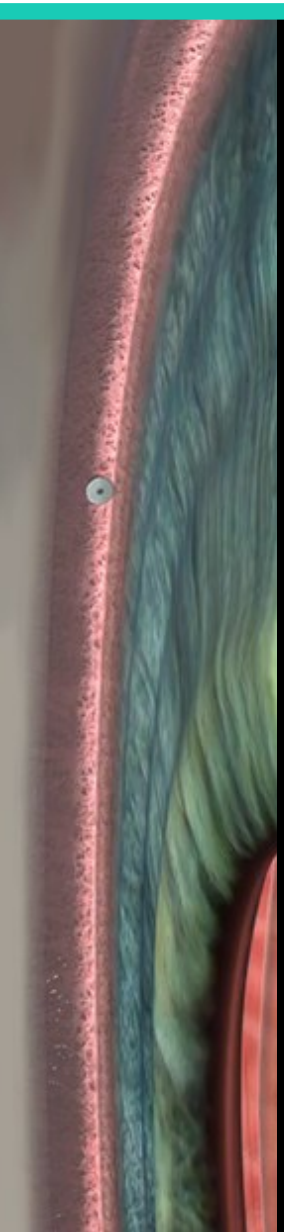


Cypass

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

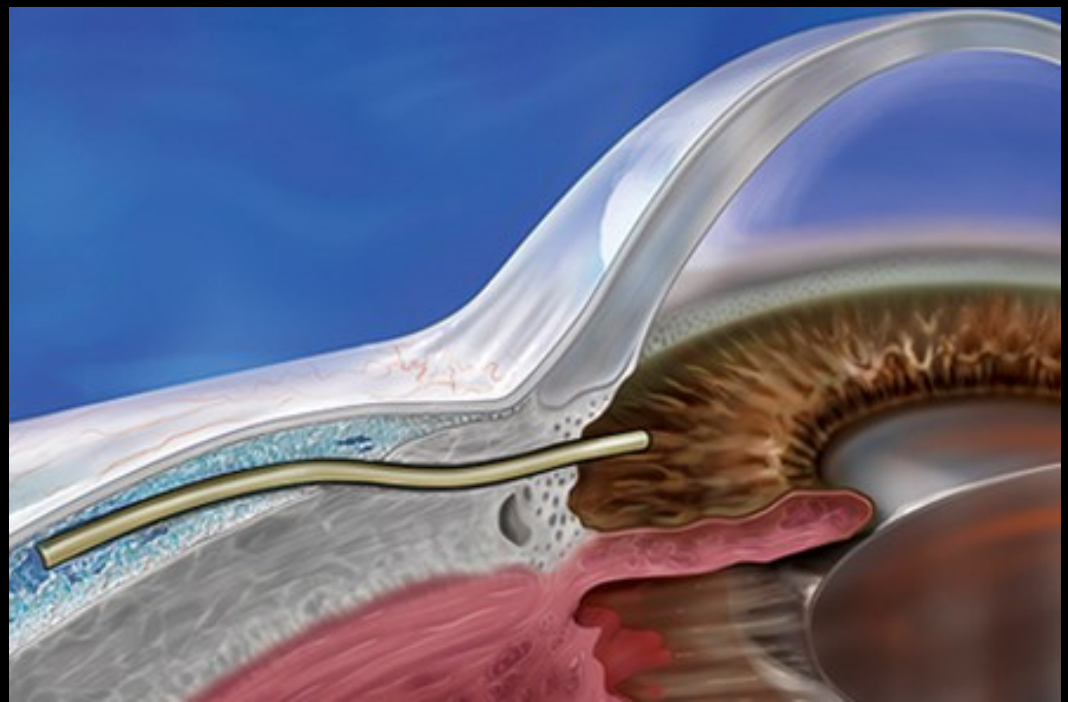


MICROINVASIVE GLAUCOMA SURGERY

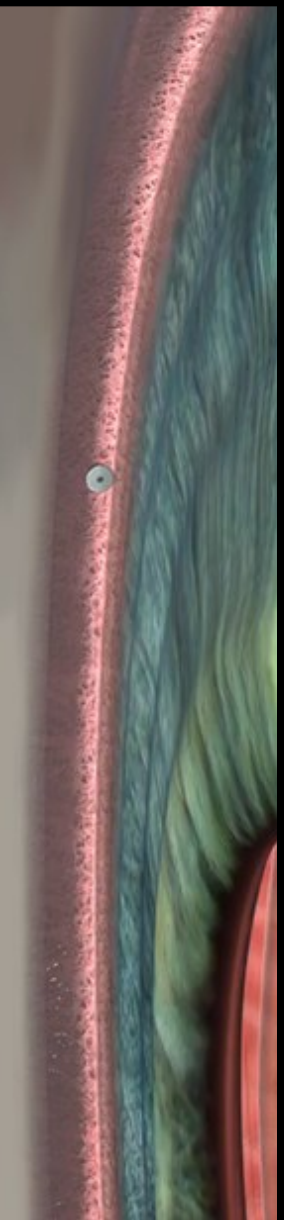


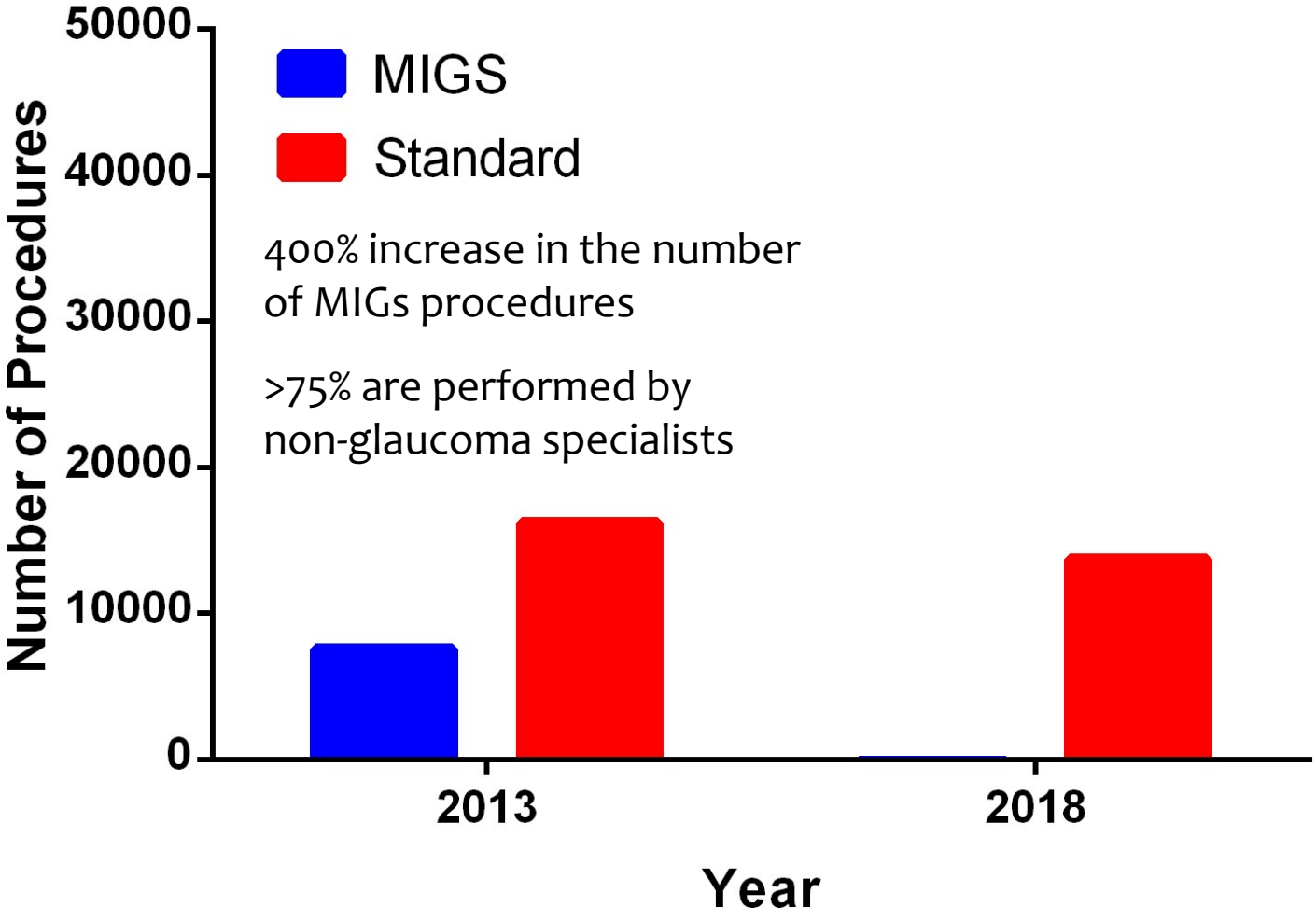
Xen Gel Stent

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



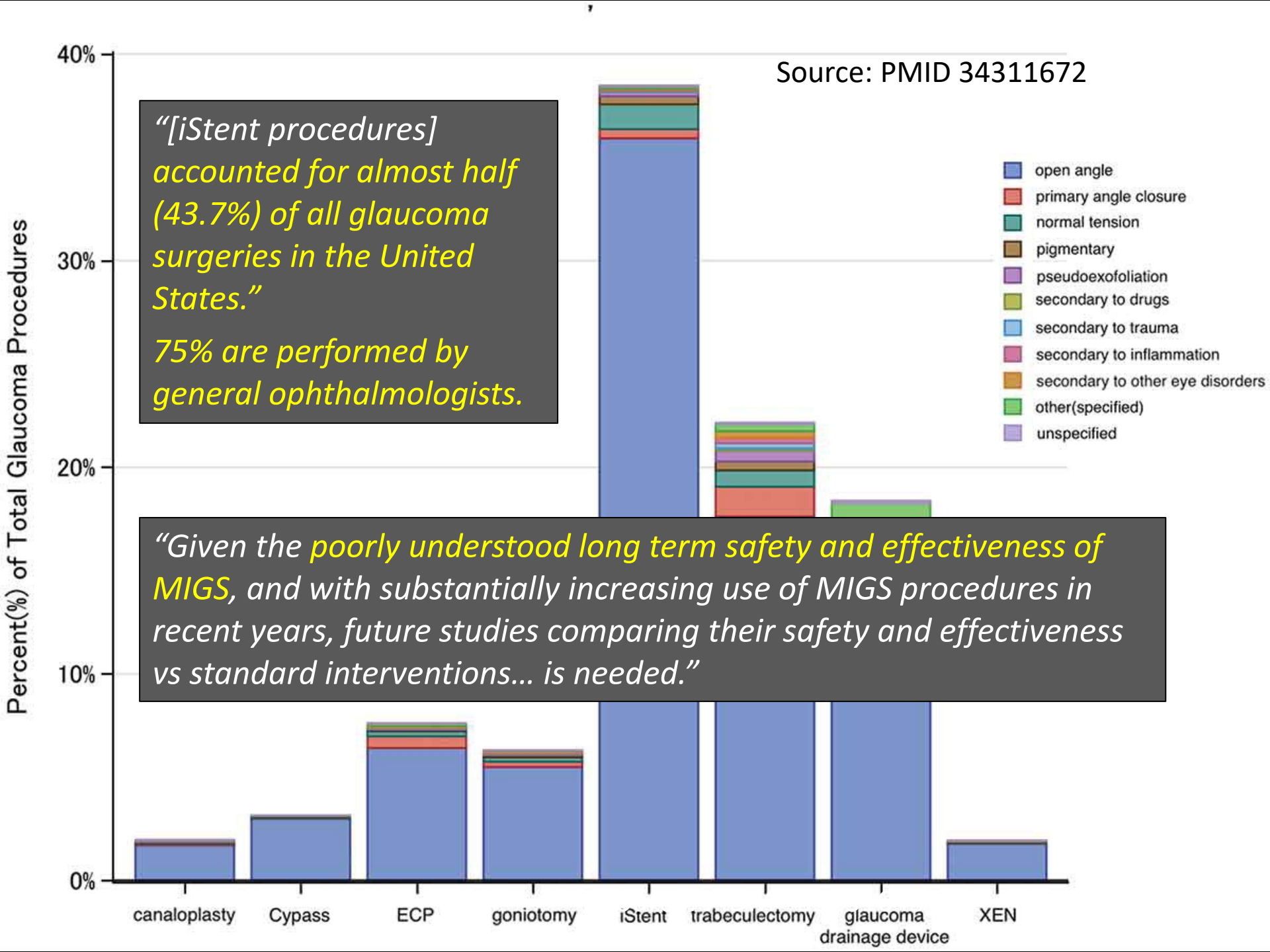
Explosive growth of MIGS procedures performed in USA





Source: PMID 32598949, 33831643

Source: PMID 34311672



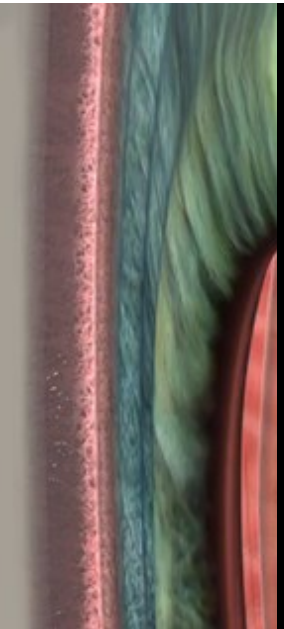
MICROINVASIVE GLAUCOMA SURGERY

REVIEW ARTICLE

OPEN

Minimally Invasive Glaucoma Surgery: Where Is the Evidence?

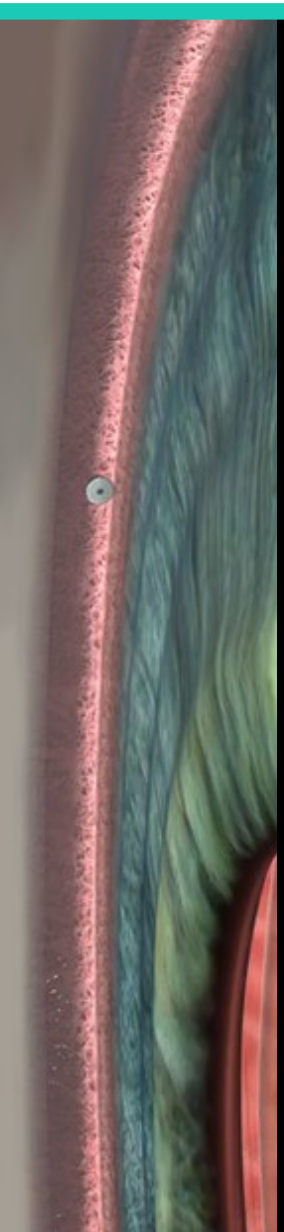
Kevin Gillmann, MBBS, FEBOphth, MArch and Kaweh Mansouri, MD, MPH*†*



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

Source: PMID 32501895

MICROINVASIVE GLAUCOMA SURGERY



Cataract Surgery and IOP in Glaucoma

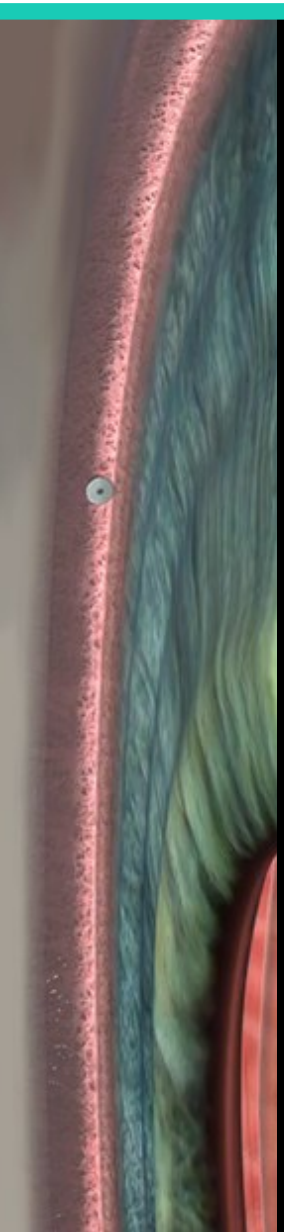
OHTS (2012): Mean decrease in IOP of 17%, with 40% of eyes experiencing at least a 20% decrease.

- 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

Source: PMID 22608478, 25943711

MICROINVASIVE GLAUCOMA SURGERY



Cataract Surgery vs 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

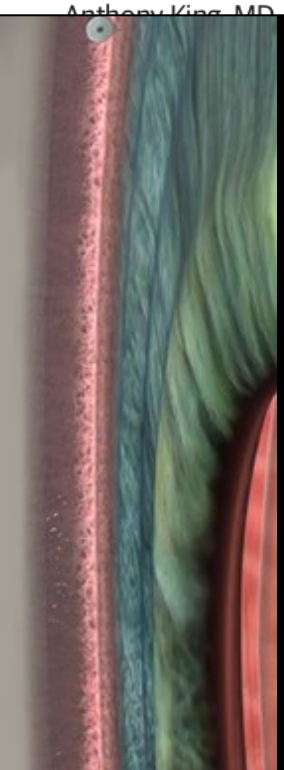
MICROINVASIVE GLAUCOMA SURGERY

JAMA Ophthalmology | Original Investigation

Minimally Invasive Glaucoma Surgical Techniques for Open-Angle Glaucoma

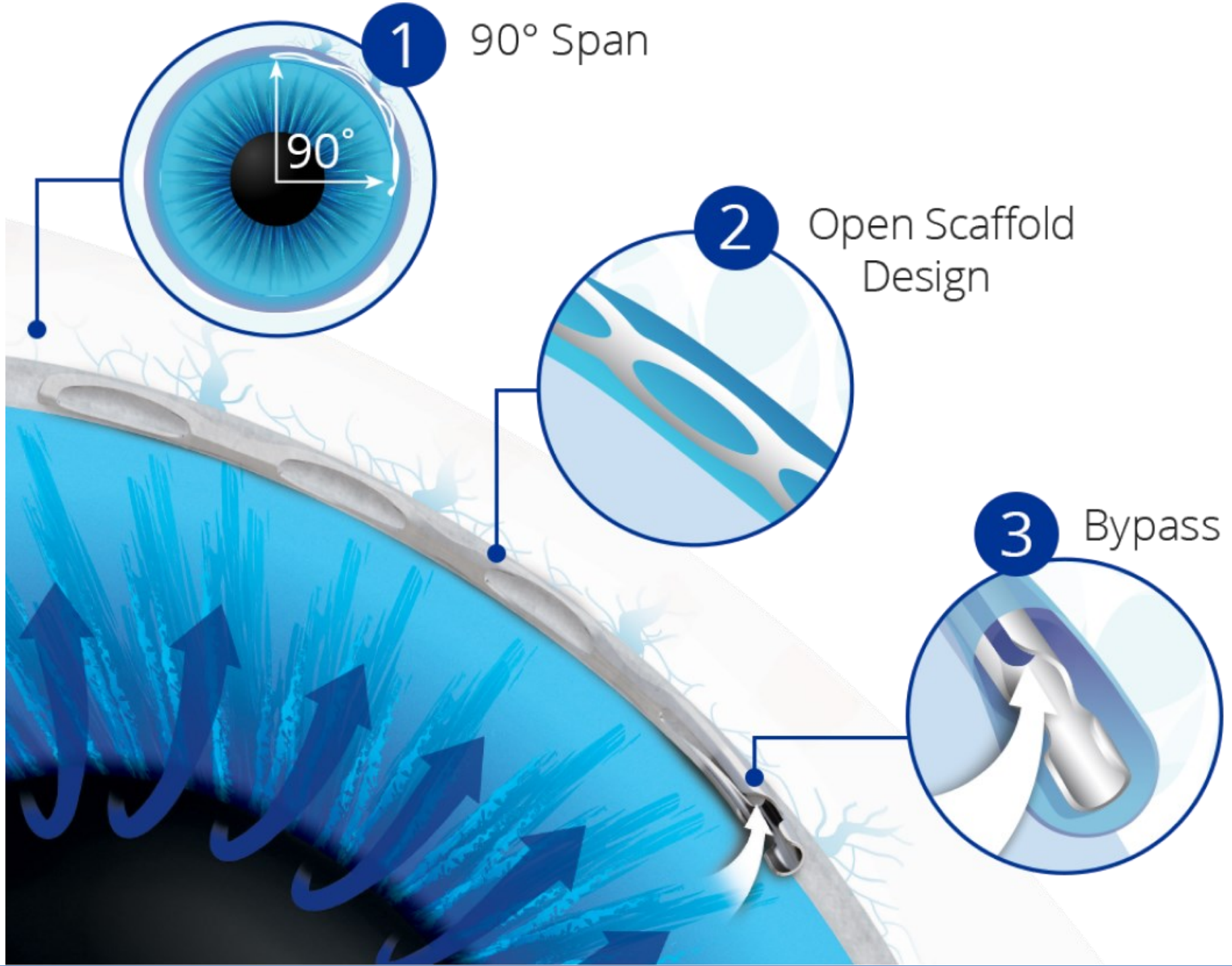
An Overview of Cochrane Systematic Reviews and Network Meta-analysis

Amanda K. Bicket, MD, MSE; Jimmy T. Le, MA, ScD; Augusto Azuara-Blanco, PhD, FRCSEd, FRCOphth; Gus Gazzard, MA, MB BChir, MD, FRCOphth; Richard Wormald, MSc, FRCS, FRCOphth; Catey Bunce, DSc; Kuang Hu, MA, MBBChir, PhD, FRCOphth; Hari Jayaram, MBBS, PhD, FRCSEd;

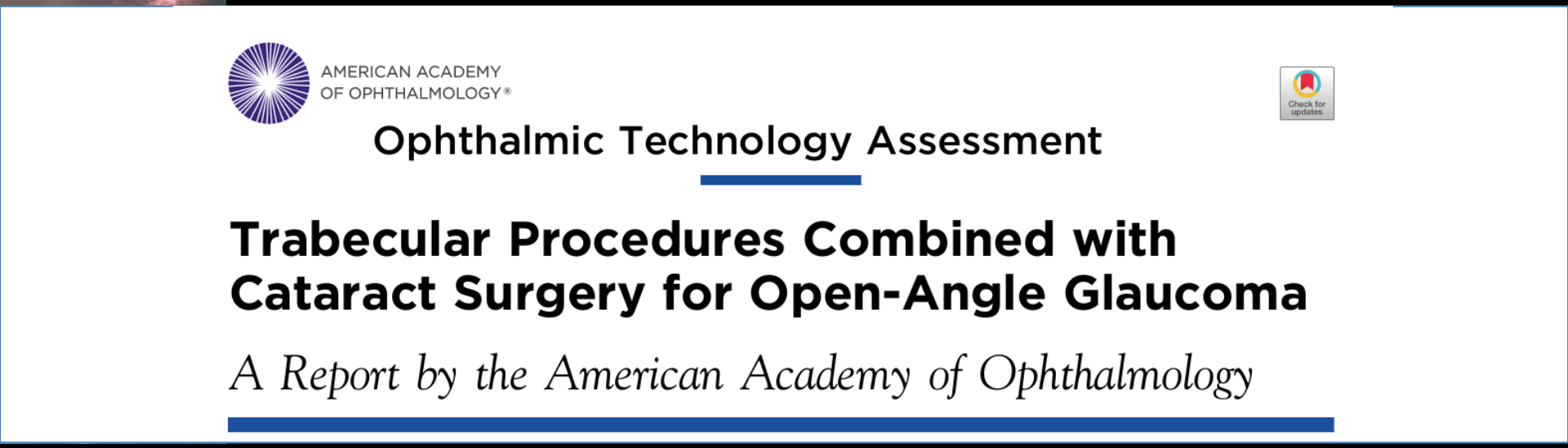


- Addition of either the Hydrus or iStent during cataract surgery increased the likelihood of remaining drop-free at 1 year compared to cataract surgery alone.
- The certainty of the evidence was moderate for the Hydrus and very low for the iStent

Source: PMID 34264292


1
90° Span
90°
2
Open Scaffold Design
3
Bypass

MICROINVASIVE GLAUCOMA SURGERY



Trabecular procedures combined with cataract surgery provide an additional mild (1.6-2.3 mmHg) IOP reduction over cataract surgery alone.

Cataract surgery typically reduces the number of medications by approximately 0.8-1.0 at 2 yrs. Adding a trabecular procedure may reduce the medication burden by an additional 0.4

Source: PMID 38054909

MICROINVASIVE GLAUCOMA SURGERY

EDITORIAL

Analyzing the Shortcomings of Trabecular Micro-bypass Stents for Surgical Management of Glaucoma

Tanuj Dada[1], Nitika Beri[2]

Journal of Current Glaucoma Practice (2024): 10.5005/jp-journals-10078-1439

"Our lives begin to end the day we become silent about things that matter."

—Martin Luther King Jr

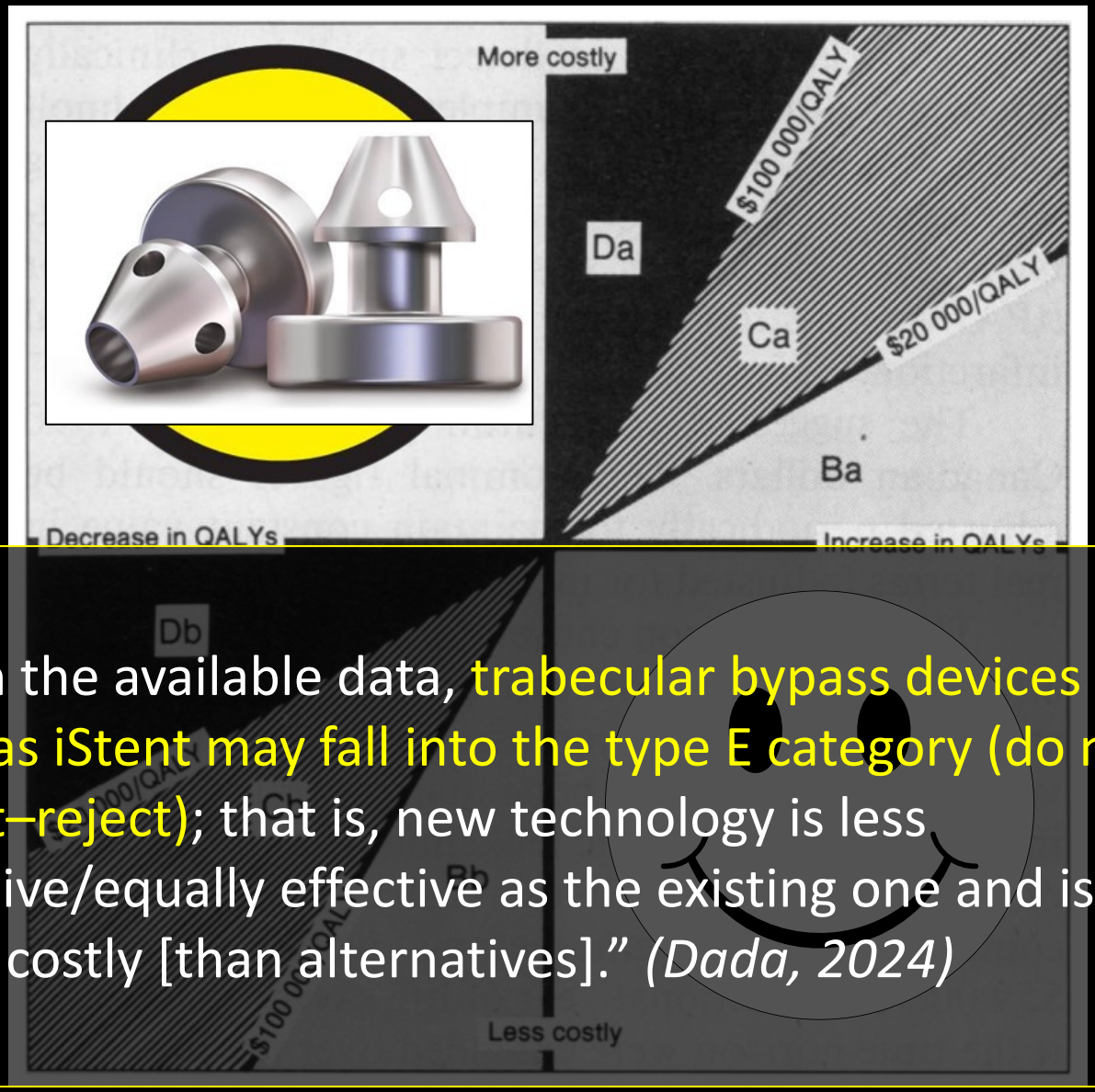
[1,2]Dr Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences, New Delhi, India

Corresponding Author: Tanuj Dada, Dr. Rajendra Prasad Centre for

There is a need to go back to the drawing board to improve the current stent design... Low-cost MIGS innovations, which can be applied on a global scale, need to be popularized and put through rigorous scientific trials…

Source: PMID 38585166

PMID: 1306034



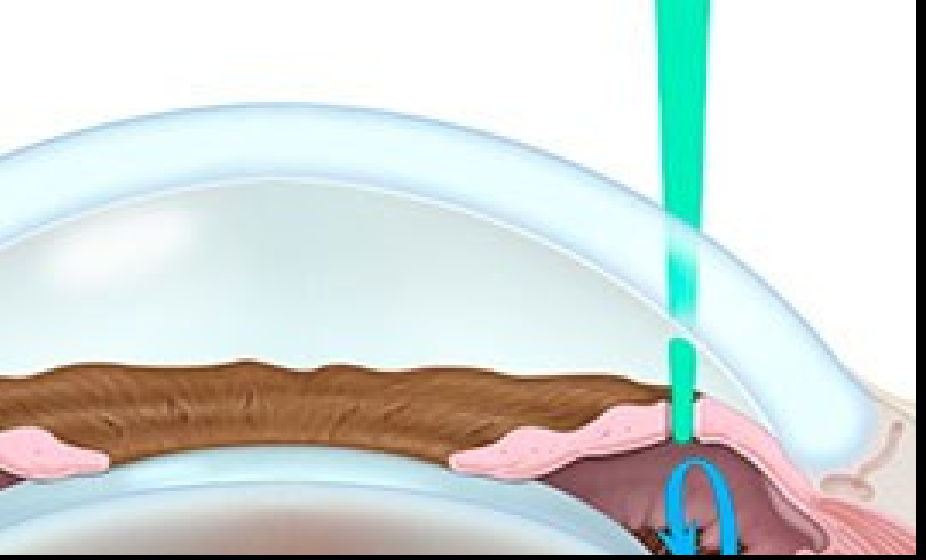
"With the available data, trabecular bypass devices such as iStent may fall into the type E category (do not adopt–reject); that is, new technology is less effective/equally effective as the existing one and is more costly [than alternatives]." *(Dada, 2024)*

QUALITY OF LIFE →

MICROINVASIVE GLAUCOMA SURGERY

KEY POINTS

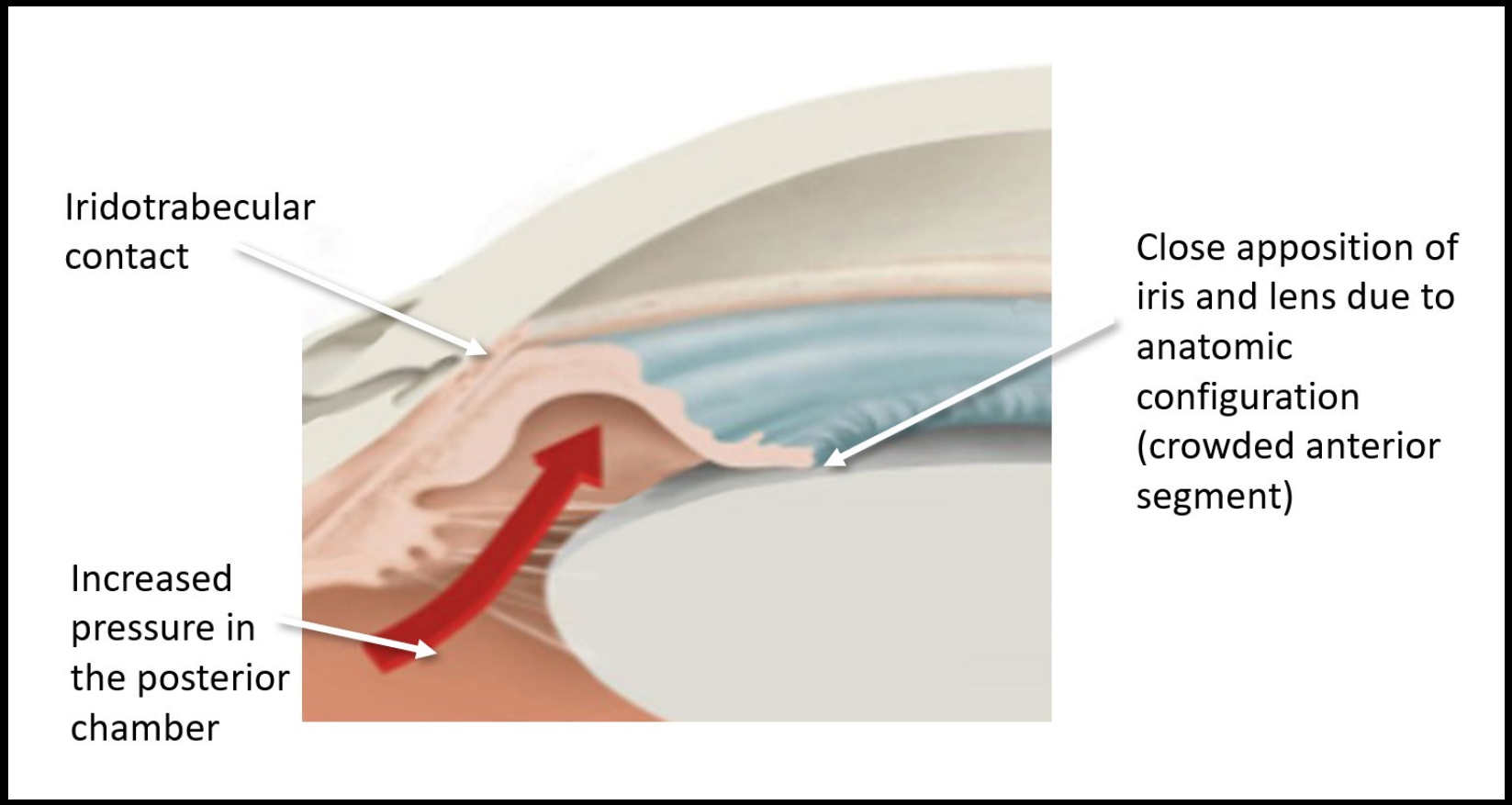
- Many novel procedures without long-term experience
- Little high-quality research to support effectiveness or cost-benefit
- Explosive growth fueled by non-glaucoma specialists



LASER PERIPHERAL IRIDOTOMY

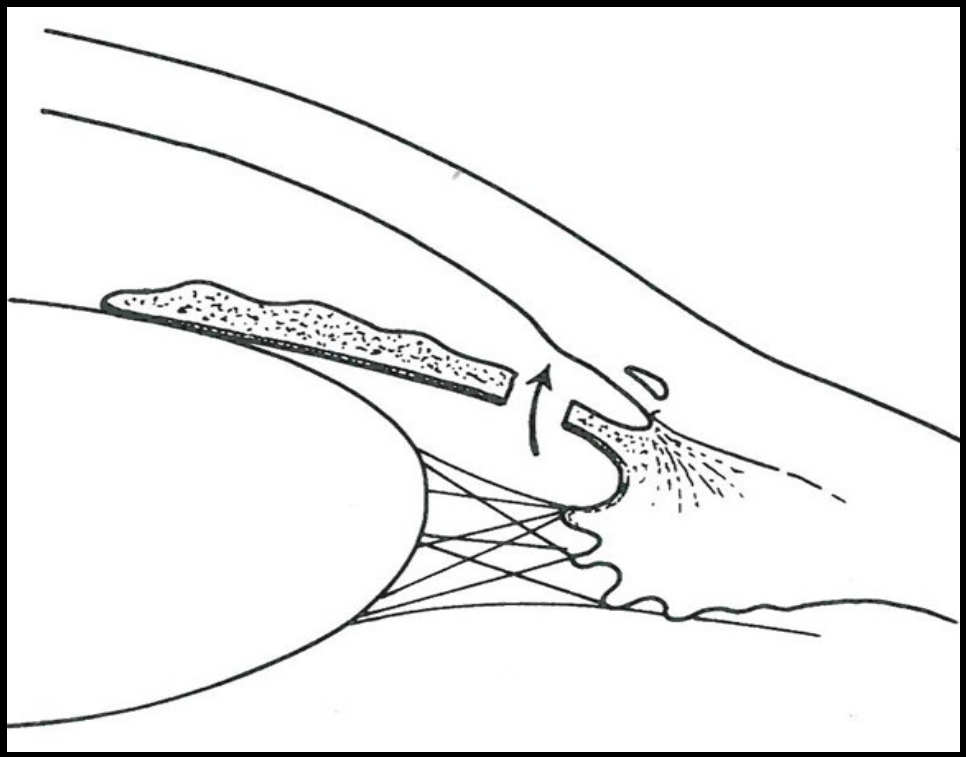
LASER PERIPHERAL IRIDOTOMY

Relative pupillary block traps aqueous in the posterior chamber



LASER PERIPHERAL IRIDOTOMY

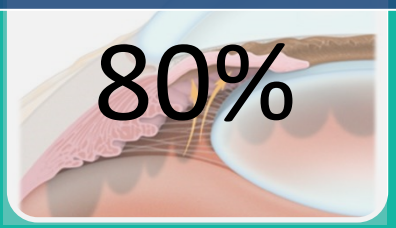
LPI creates a new route for aqueous flow from the post to the anterior chamber, bypassing the pupillary block

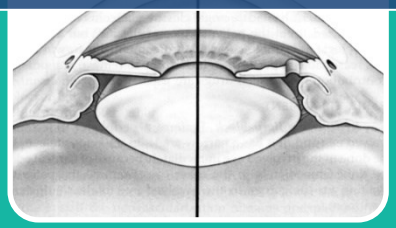


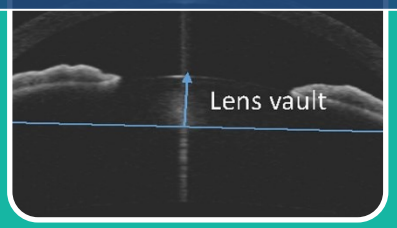
LASER PERIPHERAL IRIDOTOMY

Not all angle closure is due to pupil block

NOT MUTUALLY EXCLUSIVE

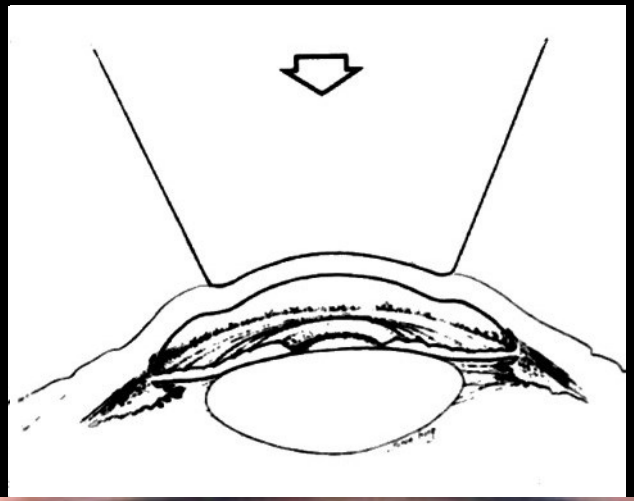


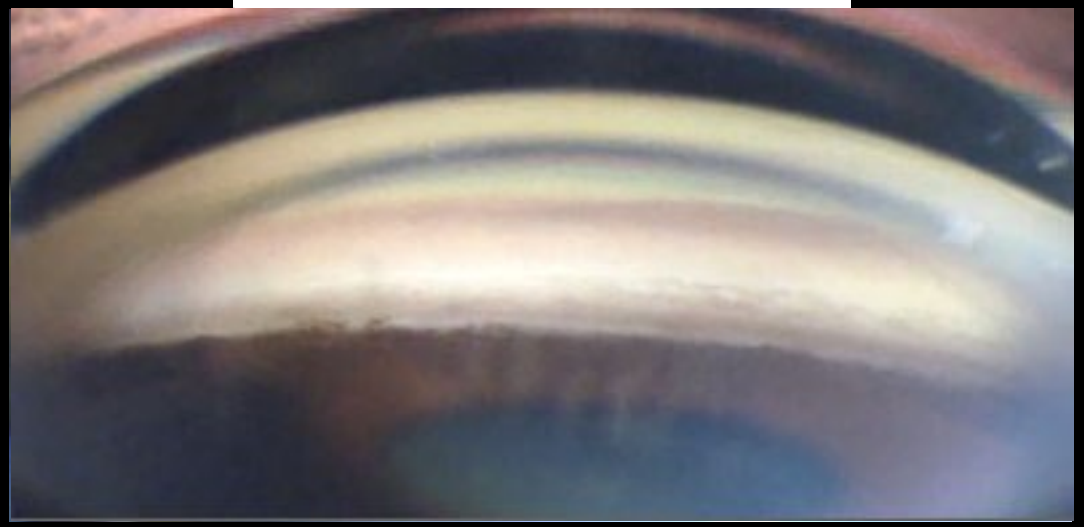




Pupil block	Plateau iris	Lens vault
Iridotomy Lens removal	Iridotomy Iridoplasty	Lens Removal

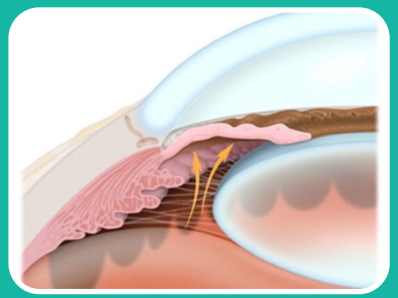
LASER PERIPHERAL IRIDOTOMY





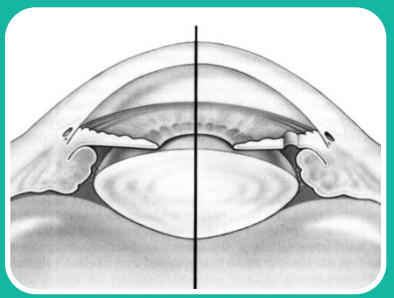
LASER PERIPHERAL IRIDOTOMY

Indentation Gonioscopy Findings



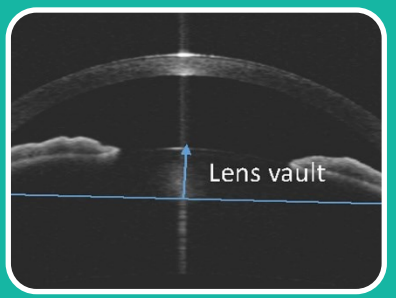
Pupil block

Large posterior displacement



Plateau iris

Double hump



Lens vault

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.)

LASER PERIPHERAL IRIDOTOMY

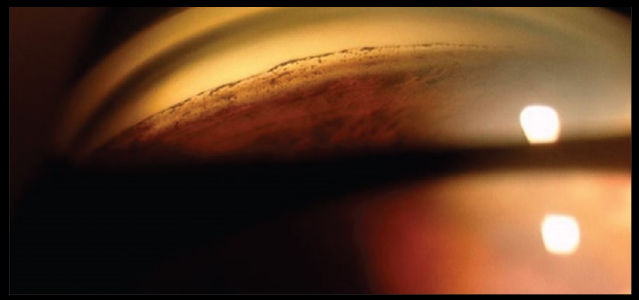
Gonioscopic evidence of prior closure

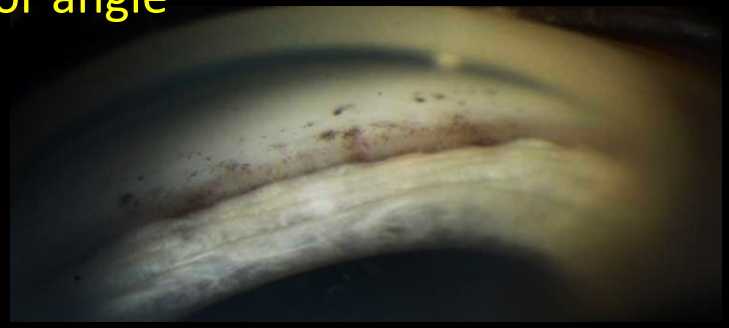
Peripheral anterior synechia → *Primary Angle Closure*

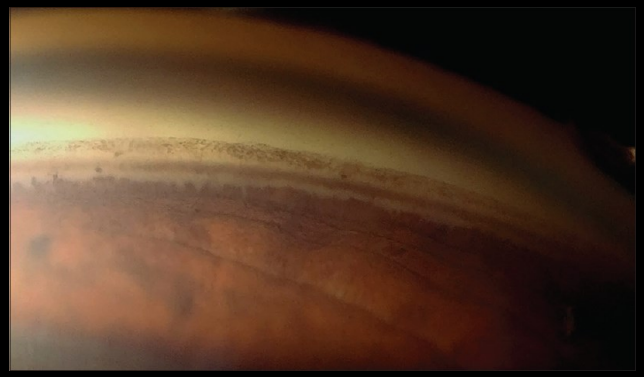
Irregular blotchy angle pigmentation

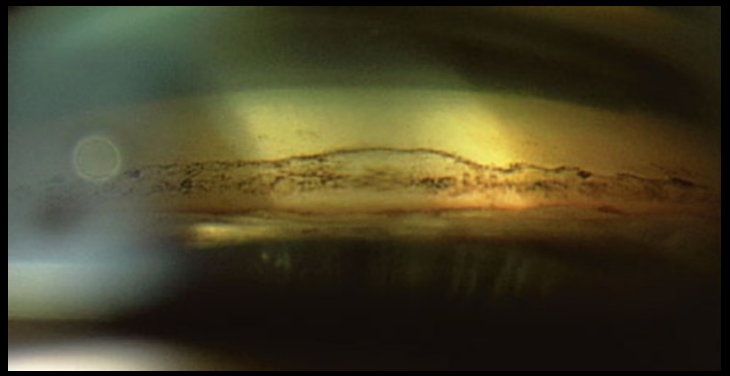
Pigment on and anterior to Schwalbe's line

Pigment superior angle > inferior angle









LASER PERIPHERAL IRIDOTOMY

LPI vs. Lens Extraction

EAGLE (2016): Clear-lens extraction showed greater efficacy and was more cost-effective than LPI, and should be considered as an option for *first-line treatment*

Lens extraction: Phacomorphic component, any lens opacity, older age

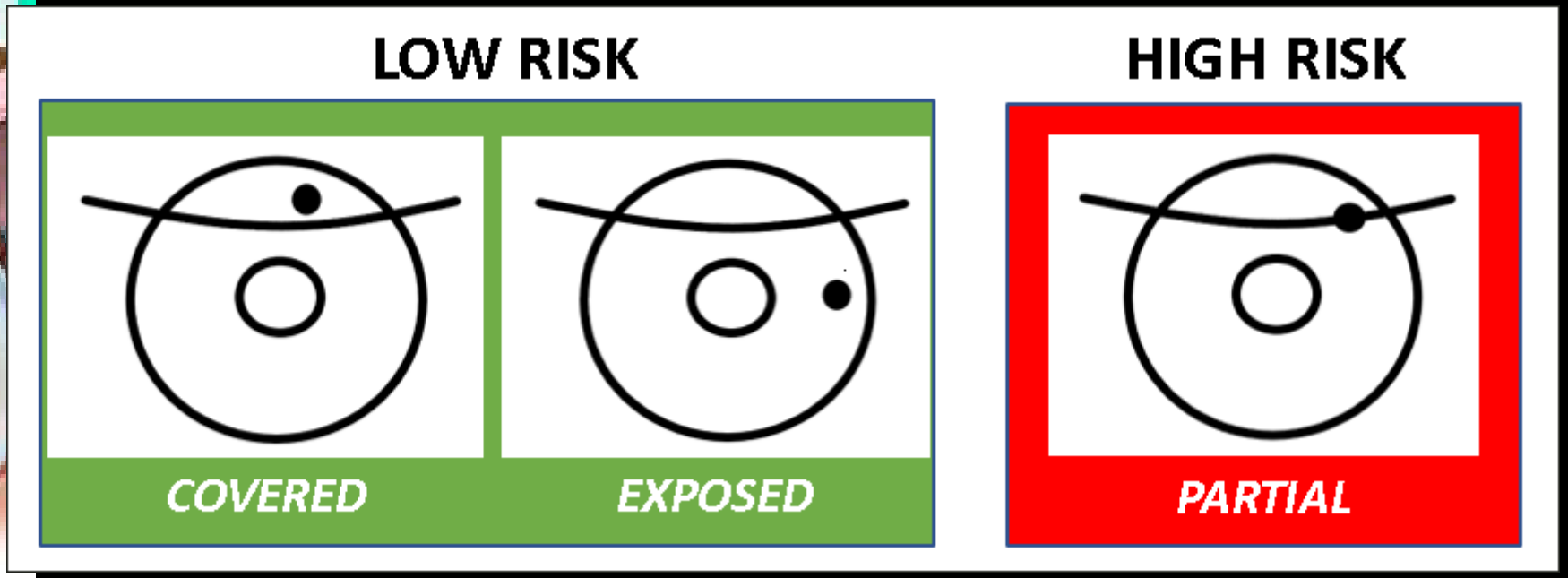
LPI: Pupil block, clear lens, younger age

Source: PMID 27707497

LASER PERIPHERAL IRIDOTOMY

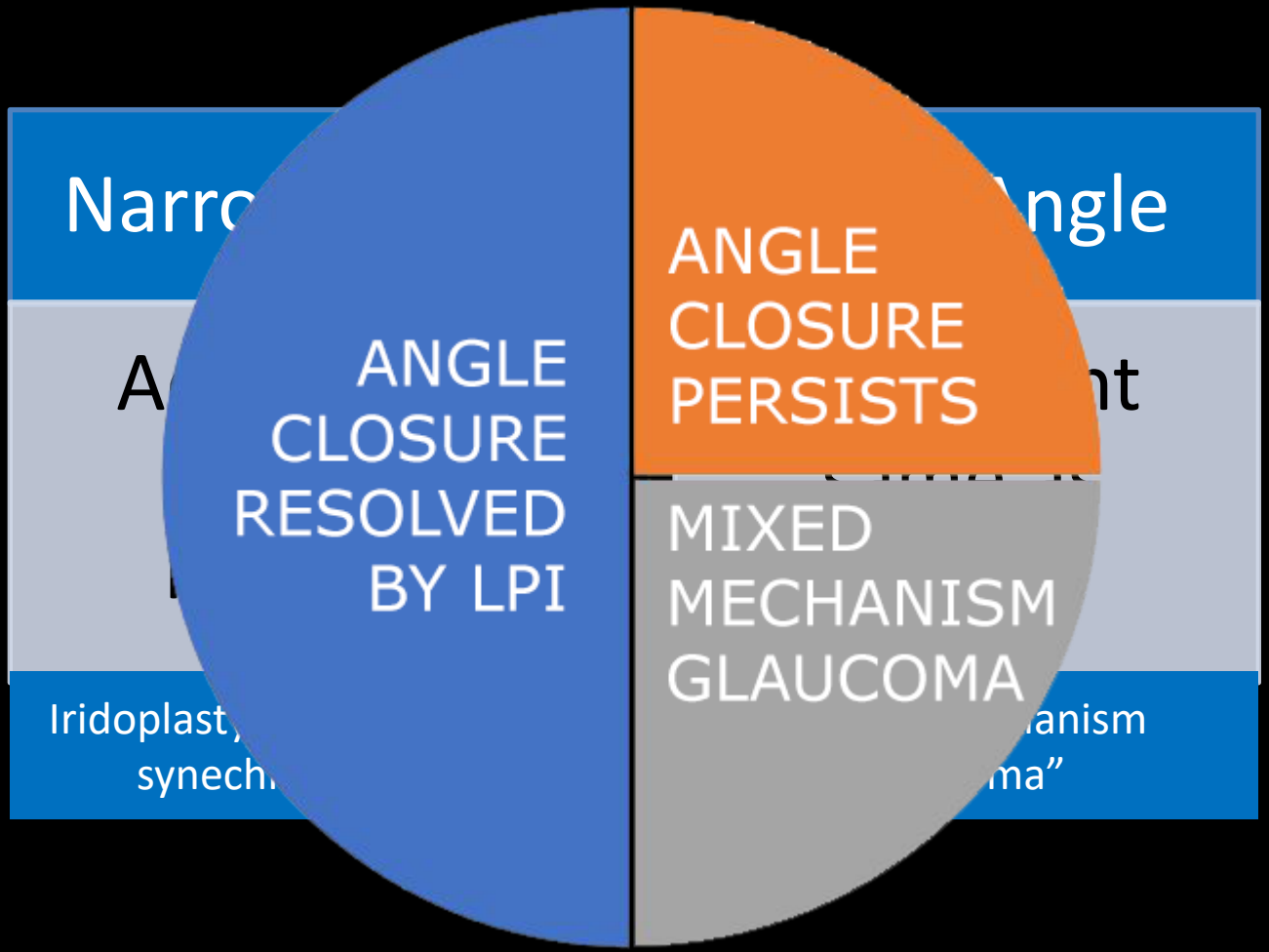
LPI complications: Dysphotopsia

- 7%-10% of patients experience transient dysphotopsia (glare, streaks, blur, etc)
- Risk is related to lid position

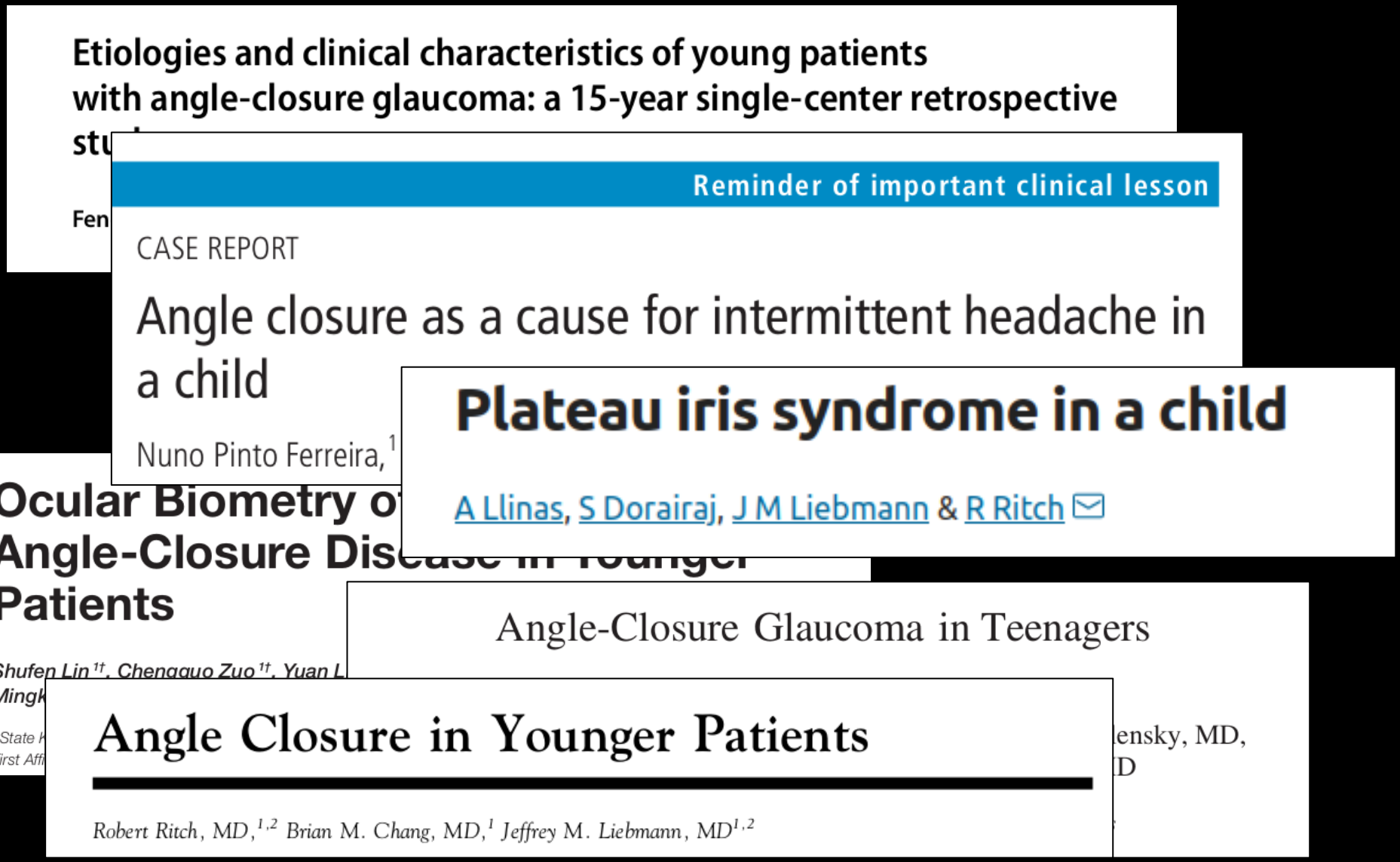


LASER PERIPHERAL IRIDOTOMY

Treatment is often needed after LPI



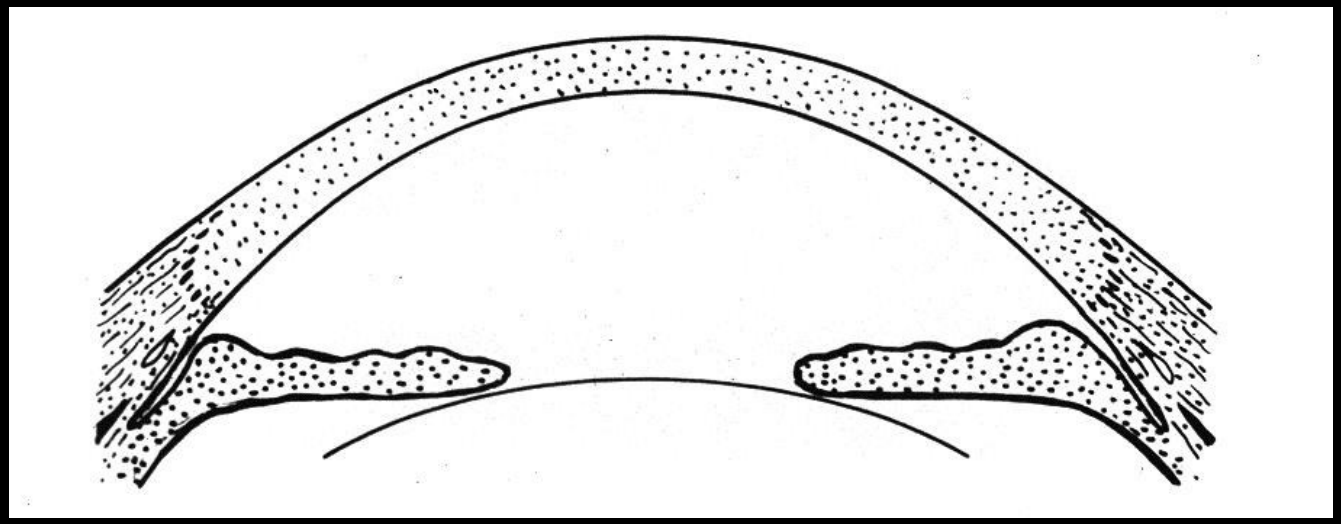
LASER PERIPHERAL IRIDOTOMY



LASER PERIPHERAL IRIDOTOMY

Angle closure in young people

- Not typically caused by pupillary block
- Plateau iris most common cause in one large study
- Intermittent, recurrent, unilateral HA is a key finding
- HA may be misinterpreted as migraine

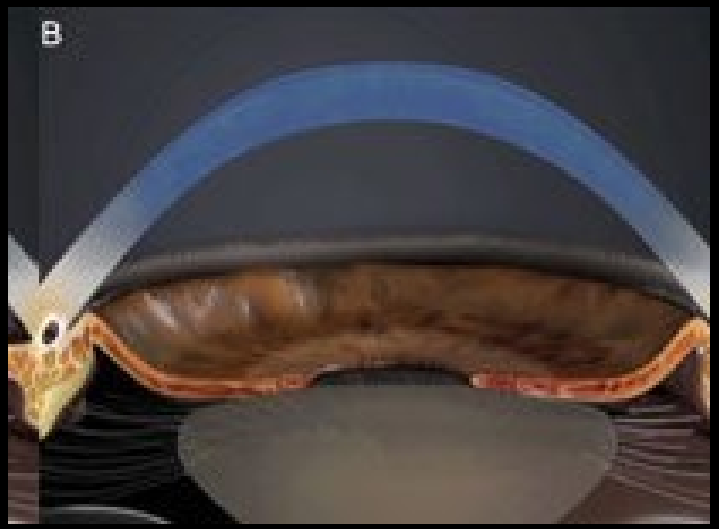


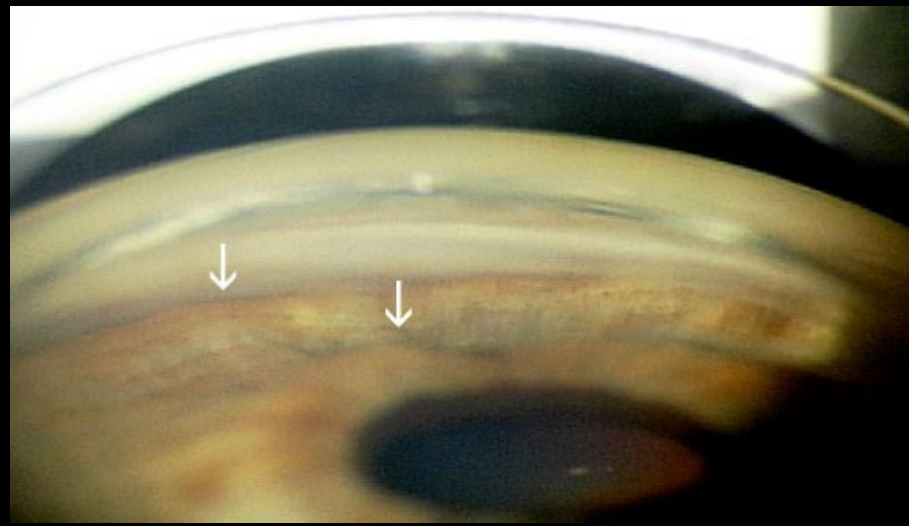
Source: PMID 14522758

LASER PERIPHERAL IRIDOTOMY

Angle closure in young people

- R/O other causes of HA (hyperopia, BV issues, migraine, intracranial disease)
- Check angles with gonioscopy
- Look for signs of plateau iris (“double hump”)
- In adults, 65% of plateau iris cases resolve with LPI

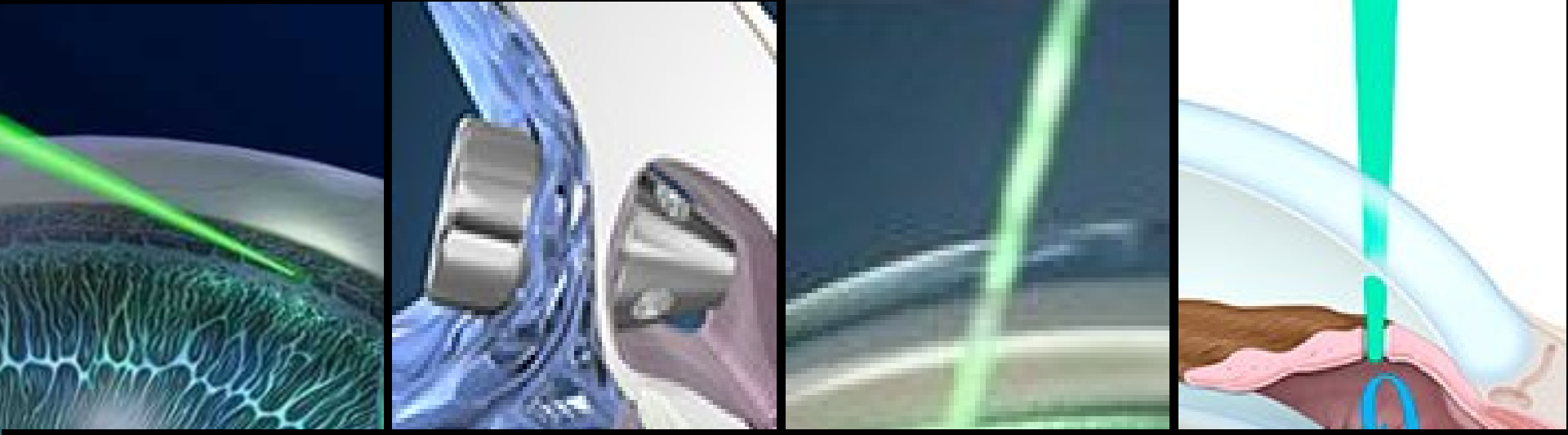




LASER PERIPHERAL IRIDOTOMY

KEY POINTS

- 50% of patients will require additional medical or surgical therapy
- Always consider lens extraction as an alternative treatment
- Include angle closure in differential diagnosis of HA for all patients, *including kids*



THANK YOU!