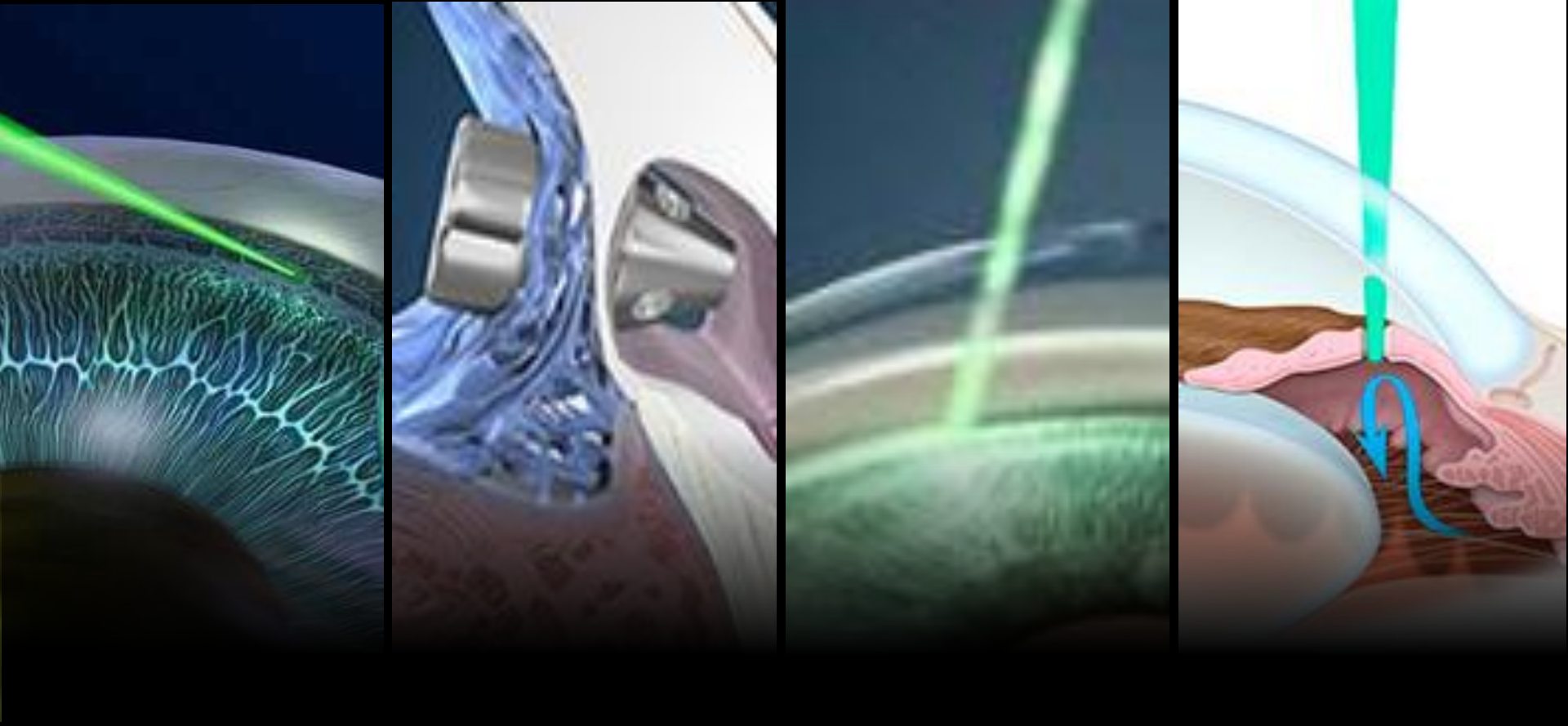

Rapid Fire
Surgical Management of Glaucoma

Richard Trevino, OD, FAAO
Indiana University School of Optometry

Online notes:
richardtrevino.net

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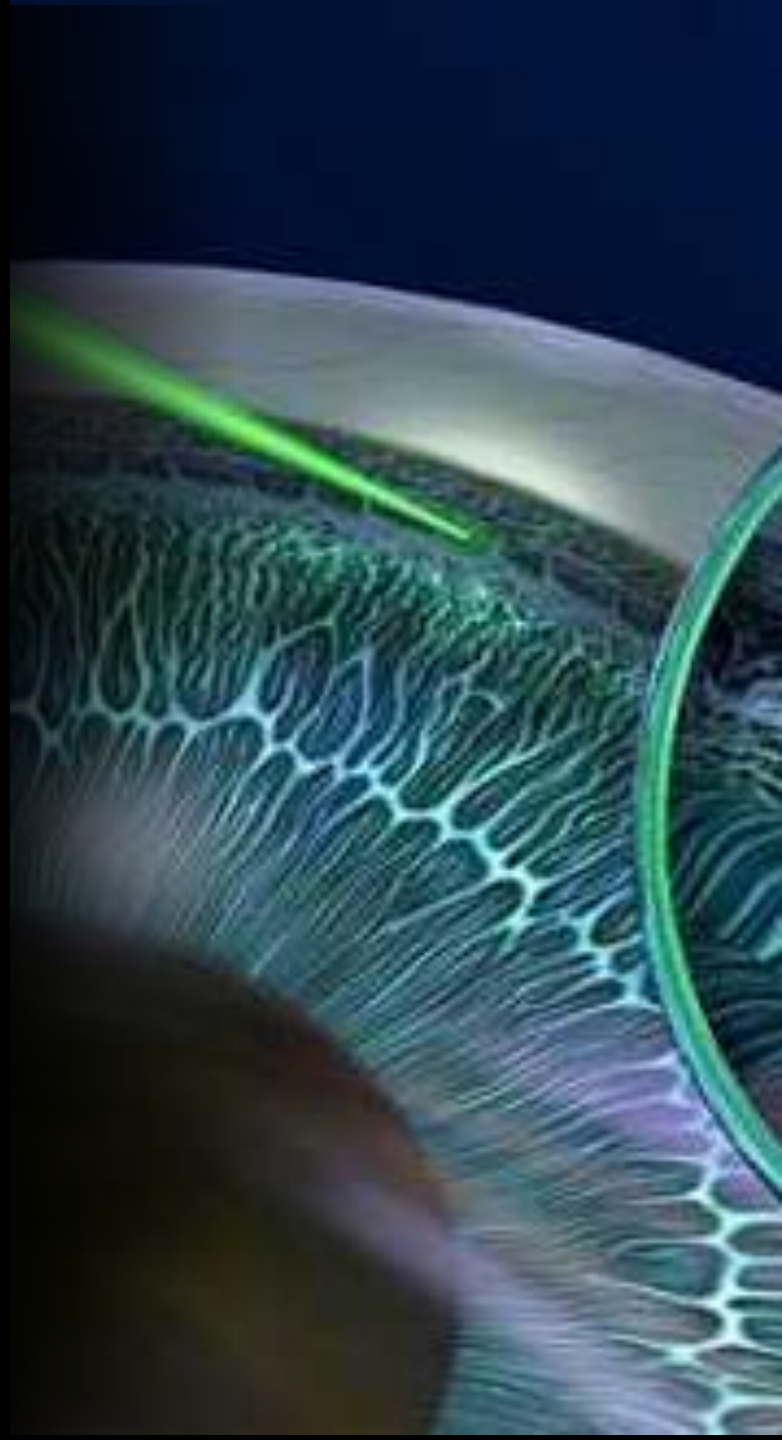
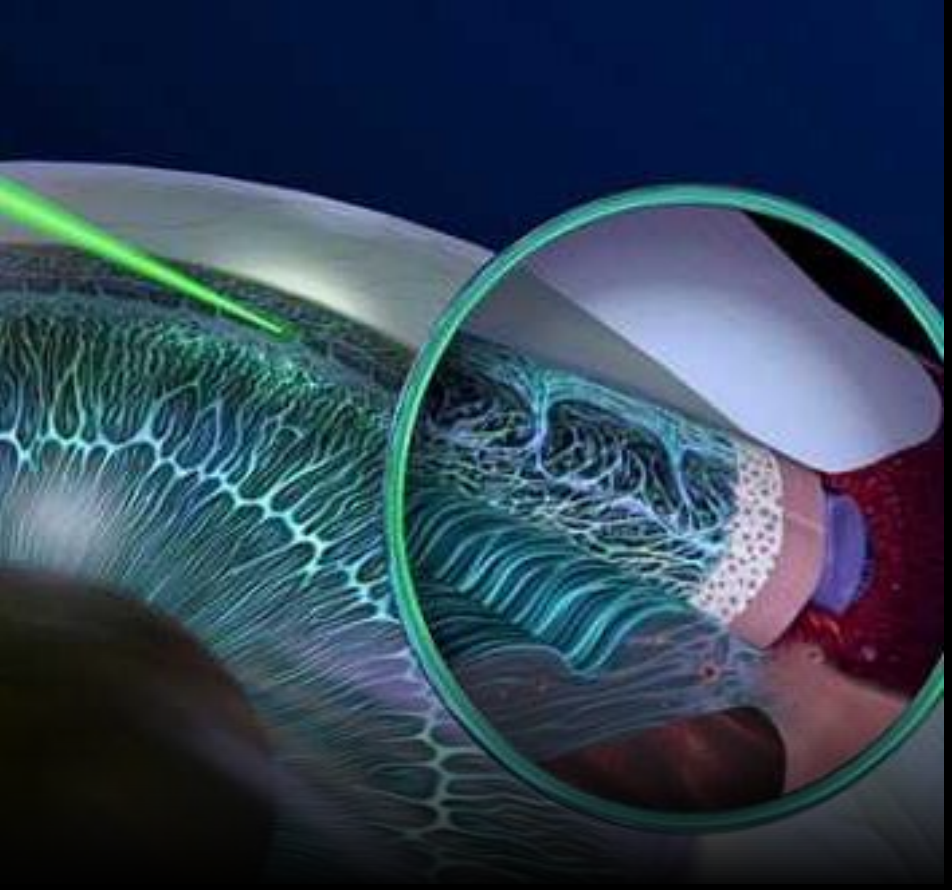
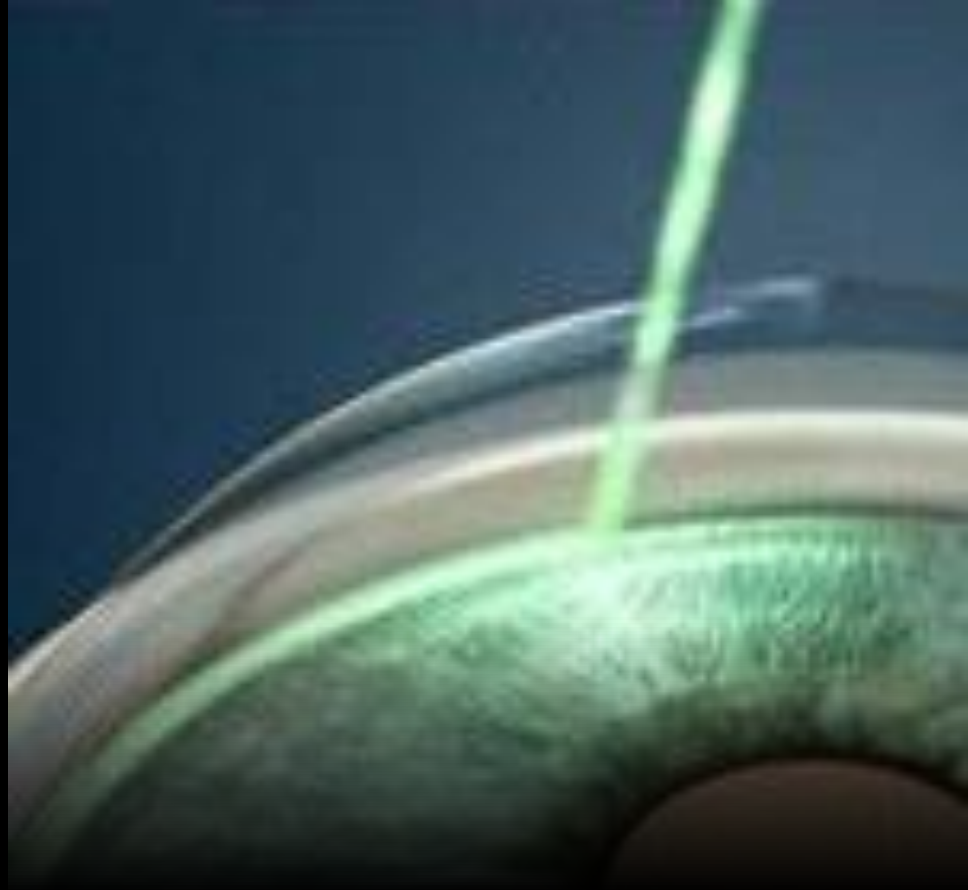
Disclosures:
None



Want more info?

Iowaglaucoma.org



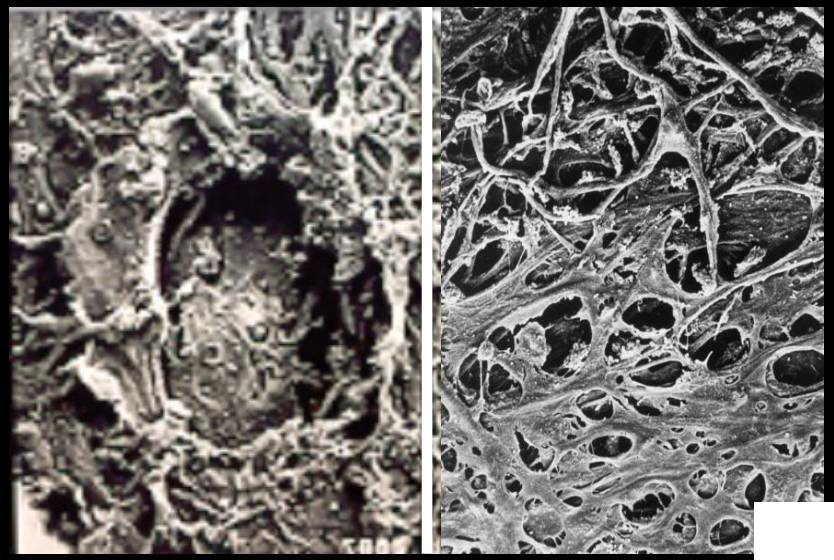


SELECTIVE LASER TRABECULOPLASTY

LASER TRABECULOPLASTY: PAST & PRESENT

Effect of ALT on the TM

Effect of SLT on the TM



Source: PMID 11297496

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

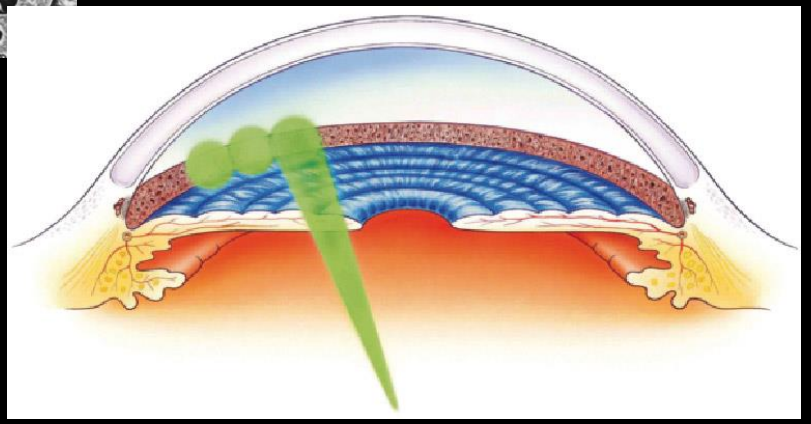


Image courtesy of Ellex Inc

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
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www.nature.com/eye

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

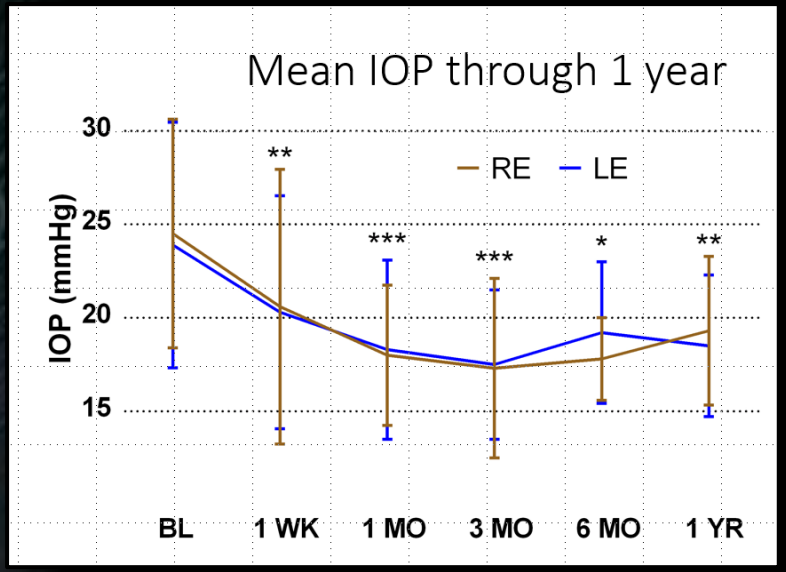
Jeffrey B. Kennedy, MD, Jeffrey R. SooHoo, MD, Malik Y. Kahook, MD, and Leonard K. Seibold, MD

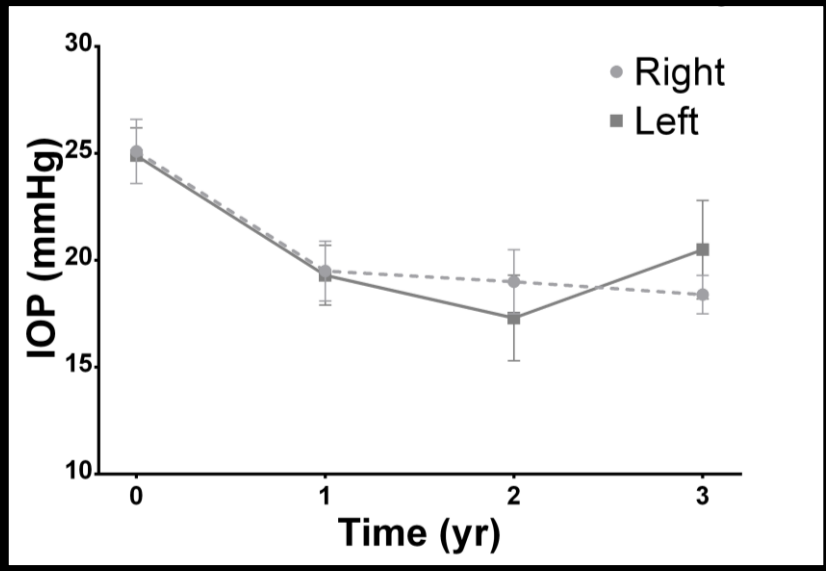
Abstract: Selective laser trabeculoplasty (SLT) is an effective treatment option for the reduction of intraocular pressure (IOP) in patients with ocular hypertension or open-angle glaucoma. The mechanism by which SLT lowers IOP is not completely understood and is likely multifactorial. Published studies 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 that lasts 2-3 years

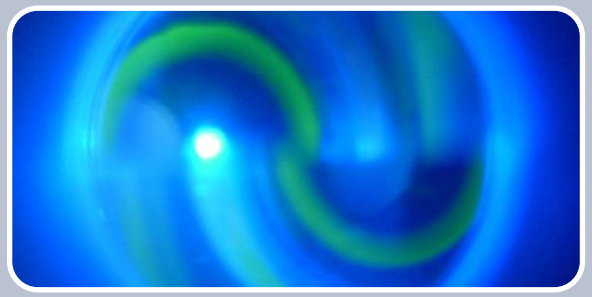


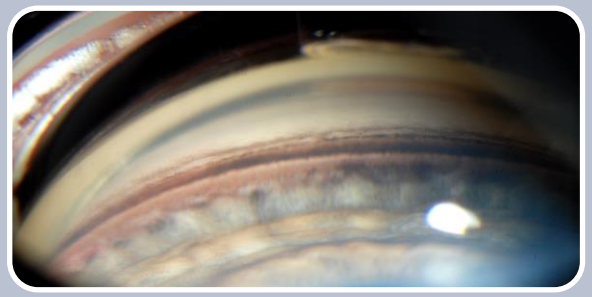


SLT experience at the Rosenberg School of Optometry, unpublished data

SELECTIVE LASER TRABECULOPLASTY

Predictors of SLT Success
(≥20% ↓IOP)



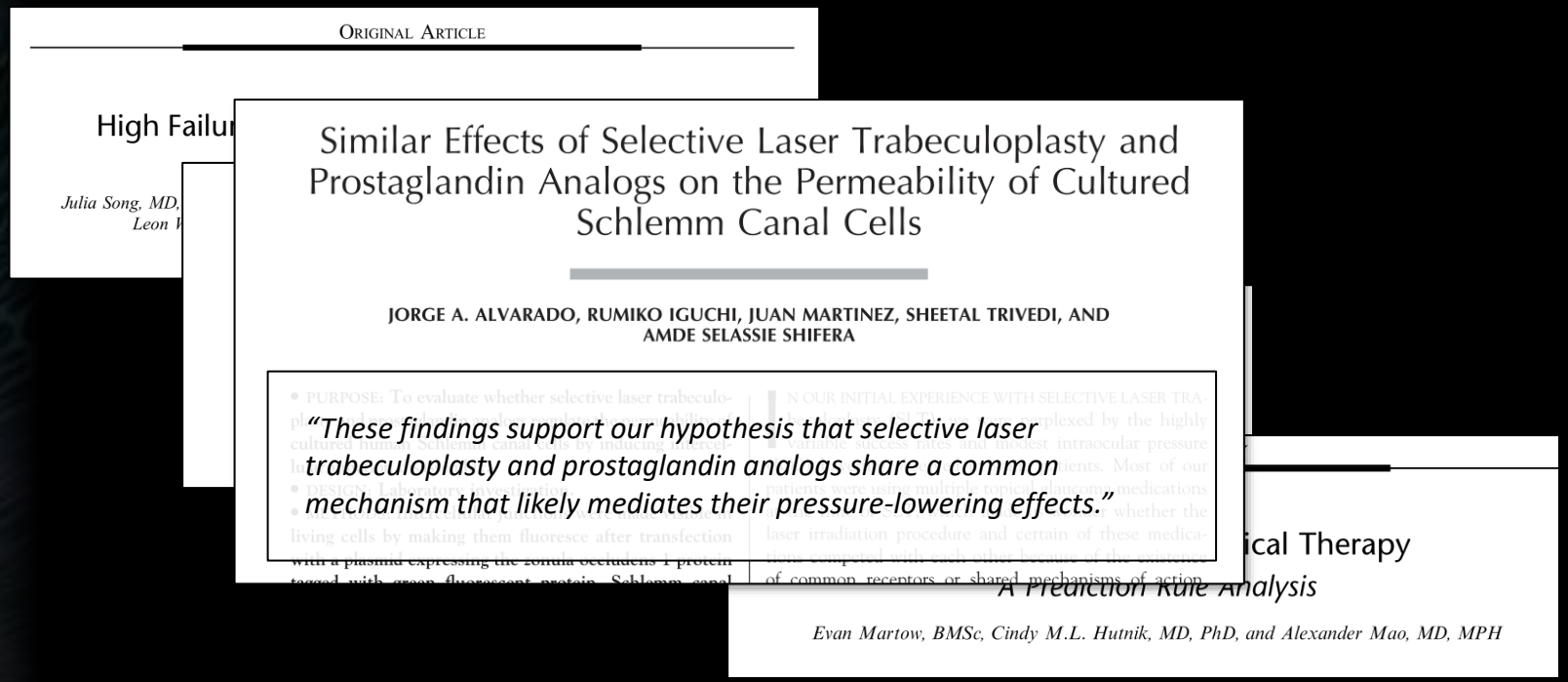


- Greater IOP
- Angle Pigment

Source: PMID 32672601, 31028768, 31444008

SELECTIVE LASER TRABECULOPLASTY

Does Prior Medical Treatment Decrease SLT Effectiveness?



Source: PMID 20570234

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

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

ORIGINAL STUDY

Transscleral Selective Laser Trabeculo
Without a Gonioscopy Lens

Noa Geffen, MD,†‡ Shay Ofir, MD,*† Avner Belkin, MD*
Fani Segev, MD,† Yaniv Barkana, MD,†§ Audrey Kaplan Mess*
Ehud I. Assia, MD,†‡ and Michael Belkin, MD†‖*

Major review

Micropulse laser for the treatment of glaucoma: A literature review

Check for updates

Andre Ma, BA(Cantab)[a,], Stephanie W.Y. Yu, MSc[a,*], Jasper K.W. Wong, MBChB, MSc, MRCSEd, FCOphthHK, FHKAM (Ophthalmology)[b,c,*]*

[a] Li Ka Shing Faculty of Me
[b] Department of Ophthalmo
Kong SAR
[c] Lo Fong Siu Po Eye Centre,

1822

Micropulse diode laser trabeculoplasty- subthreshold is the new threshold

S. Ameen

Western Eye Hospital, Ophthalmology- Glaucoma, London, United

cropulse laser trabeculoplasty: subthreshold is the new
the past, laser treatment was only considered as a
on in the glaucoma- the very mild & end stage. This is
lief that the outcome is unpredictable and short lived.
e towards less invasive interventions, the options of the

Research Article | Vol. 11, No. 6 / 1 June 2020 / *Biomedical Optics Express* 2889

Biomedical Optics EXPRESS

Non-contact direct selective laser trabeculoplasty: light propagation analysis

ZACHARY S. SACKS,[1,*] MASHA DOBKIN-BEKMAN,
MORDECHAI GOLDENFELD,[4] AND MICHAEL BELKI

[1] *BELKIN Laser, Ltd., 13 Gan Raveh, POB 13254, Yavne 8122214, Israel*
[2] *Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv 6997801, Israel*

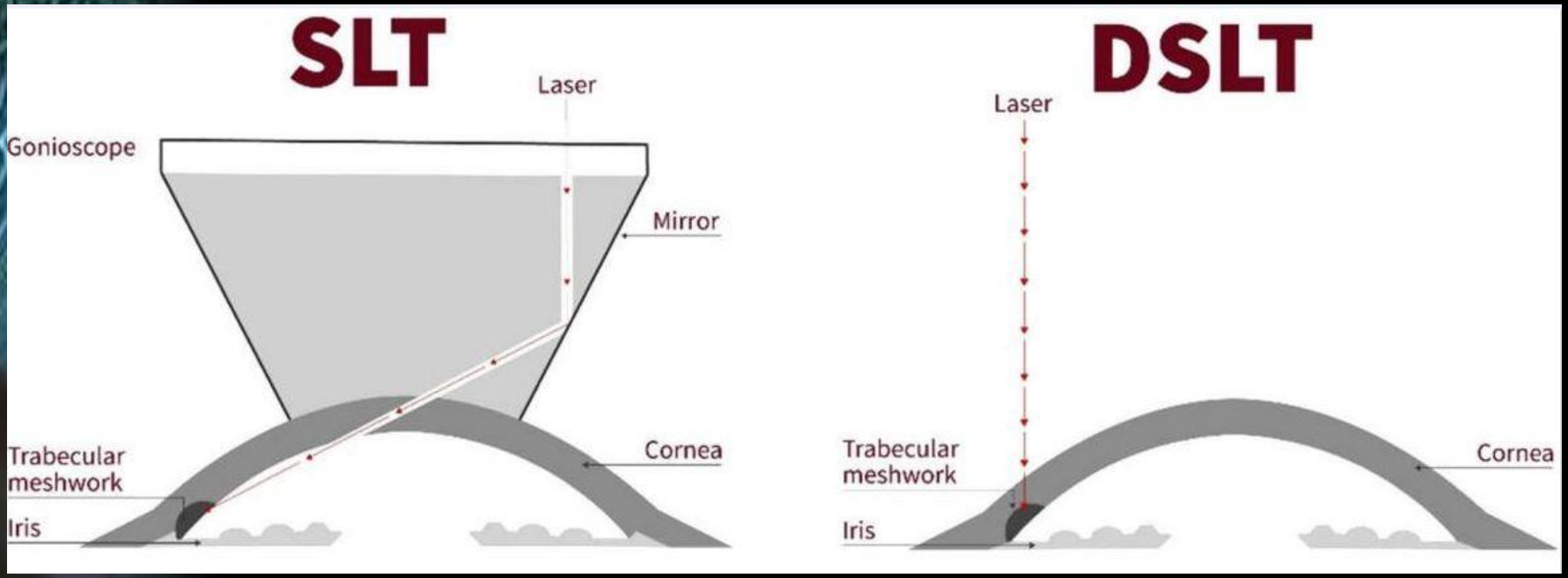
Clinical science

Efficacy and safety of selective laser trabeculoplasty and pattern scanning laser trabeculoplasty: a randomised clinical trial

Mandy Oi Man Wong,[1,2] Isabel SW Lai,[1,2] Poemen Puiman Chan ,[1,2] Noel CY Chan,[1,3] Alison YY Chan,[1,2] Gilda WK Lai,[1] Vivian SM Chiu,[1] Christopher Kai-Shun Leung [1,2]

SELECTIVE LASER TRABECULOPLASTY

“Direct” Selective Laser Trabeculoplasty



Source: PMID 32637231

SELECTIVE LASER TRABECULOPLASTY

Belkin Automated DSLT Device

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§‖*

<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

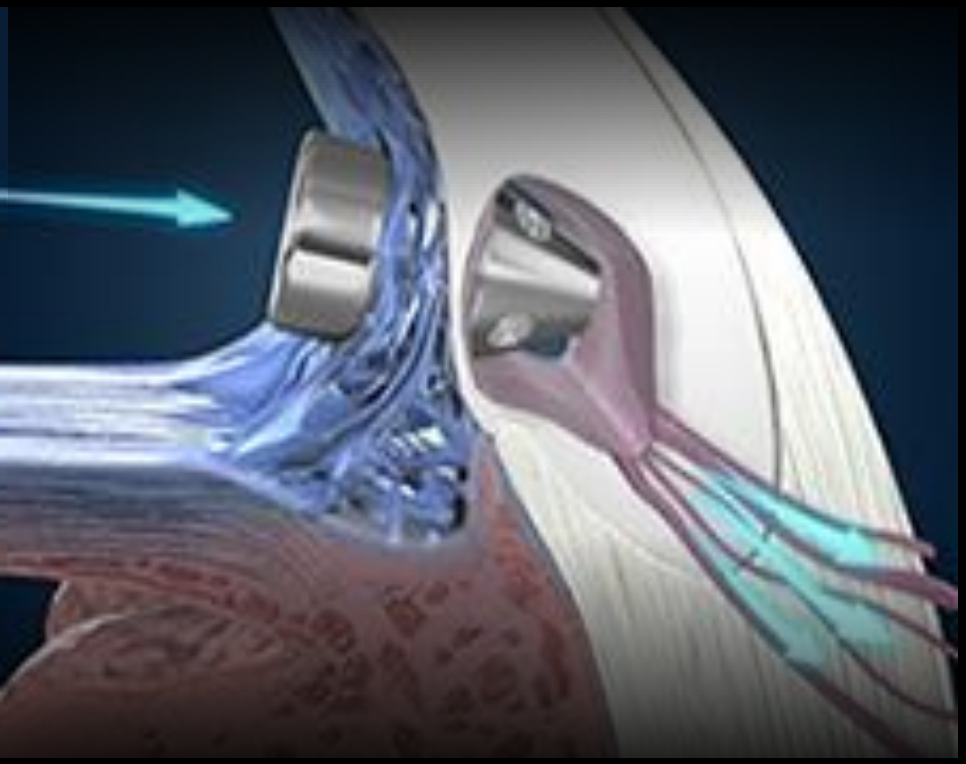
"[Can we] <u>preserve</u> TM cells and <u>maintain</u> TM health rather than await glaucomatous TM reimpairment before <u>rescuing</u> impaired TM cells [with SLT]?"

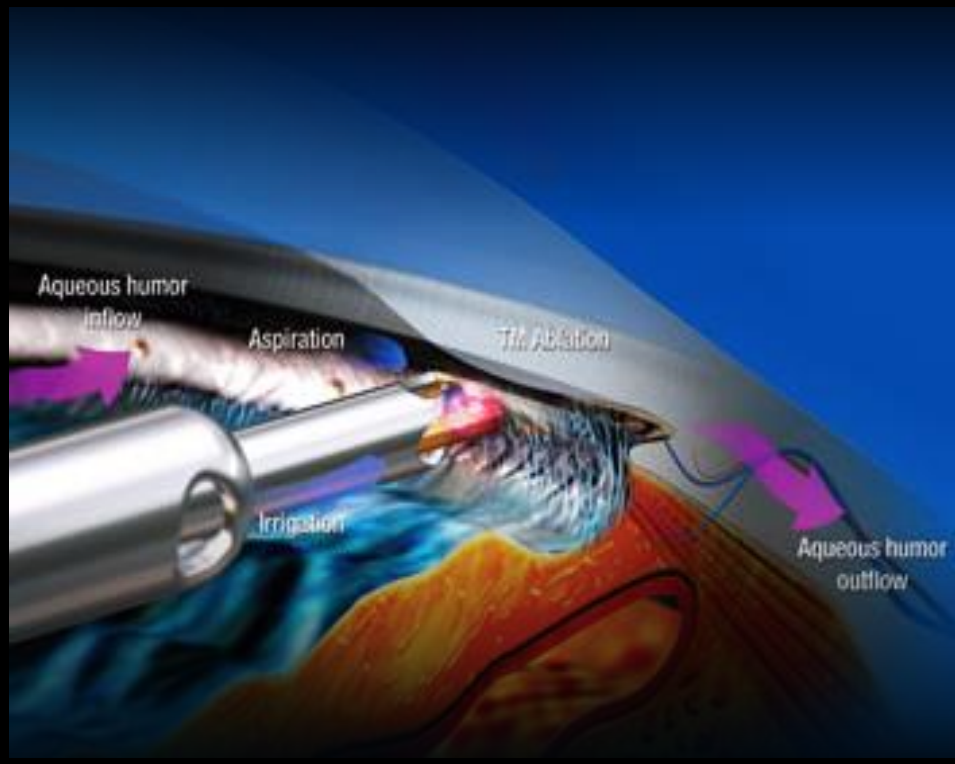
Source: PMID 33428350

SELECTIVE LASER TRABECULOPLASTY

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 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

- Low-Moderate IOP reduction
- Many novel procedures without long-term experience
- Relative merit of various procedures untested

MICROINVASIVE GLAUCOMA SURGERY

MICROINVASIVE GLAUCOMA SURGERY

SURGICAL

- Surgeon skill & experience
- Higher initial cost, but lower long-term
- 24/7 IOP control
- Higher quality of life

MEDICAL

- FDA safety & efficacy standards
- Low initial cost, but higher long-term
- Non-compliance
- Tolerability issues
- Tachyphylaxis

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

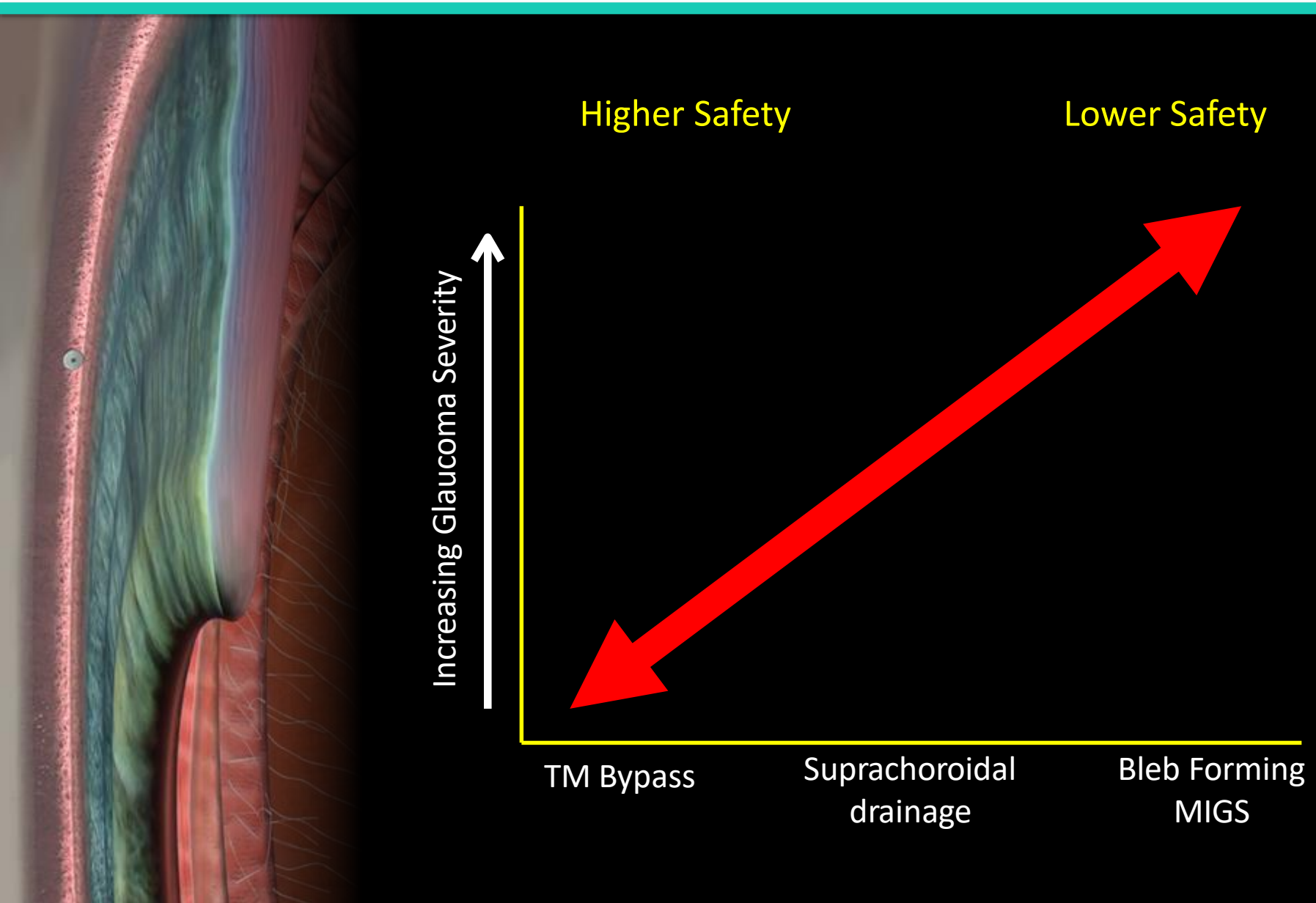
Excise/Cleave
Trabectome,
GATT,
Kahook Dual Blade,
(OMNI)
65820

Dilate
ABiC,
OMNI
66174

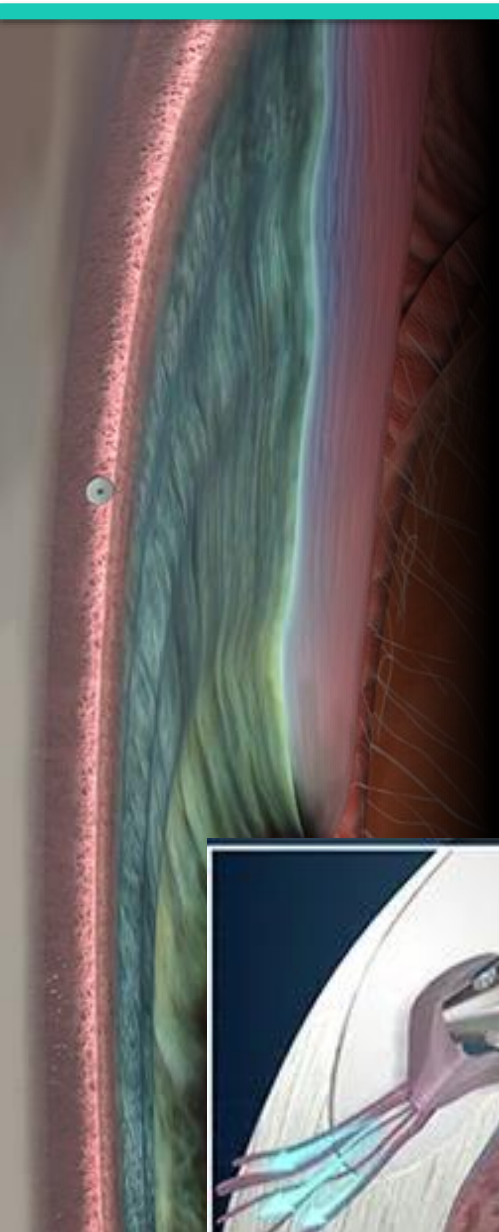
Bleb Forming

Ab interno implants
XEN
0449T/0450T

MICROINVASIVE GLAUCOMA SURGERY

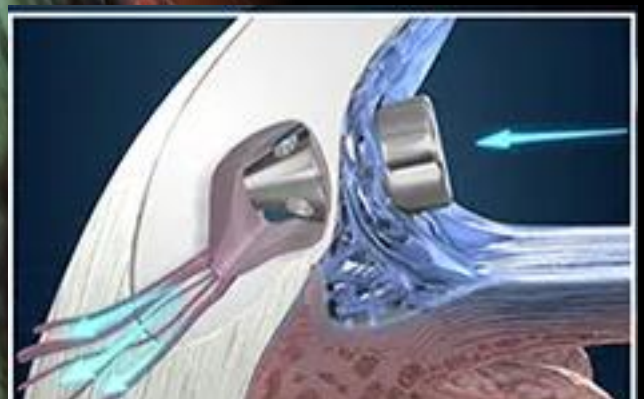


MICROINVASIVE GLAUCOMA SURGERY



iStent

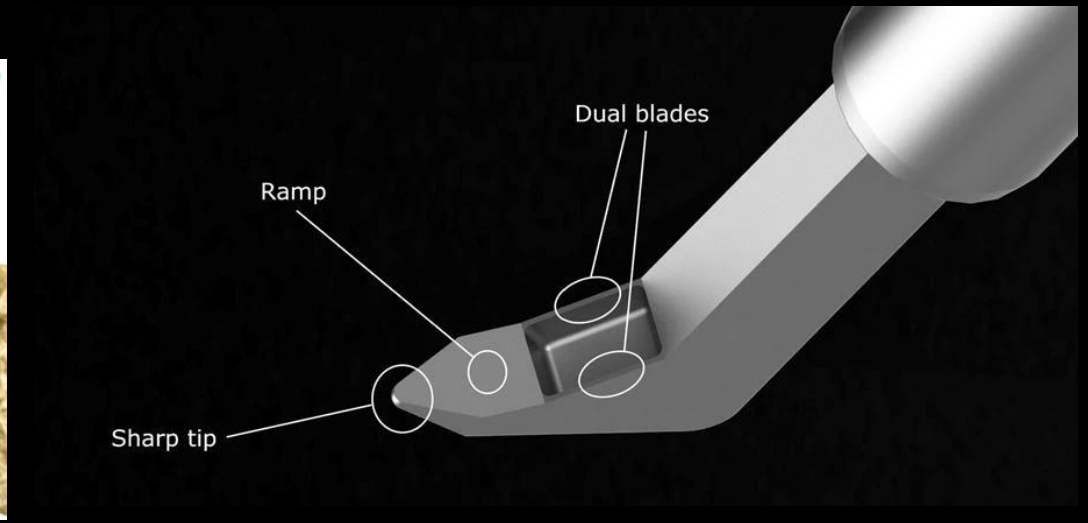
- TM bypass device
- First approved in 2012 to be implanted during cataract surgery
- Second generation (iStent Inject) in 2016
- Preferred placement location unclear
- Optimal number of devices implanted unclear, but many surgeons place 2/eye



MICROINVASIVE GLAUCOMA SURGERY

Kahook Dual Blade

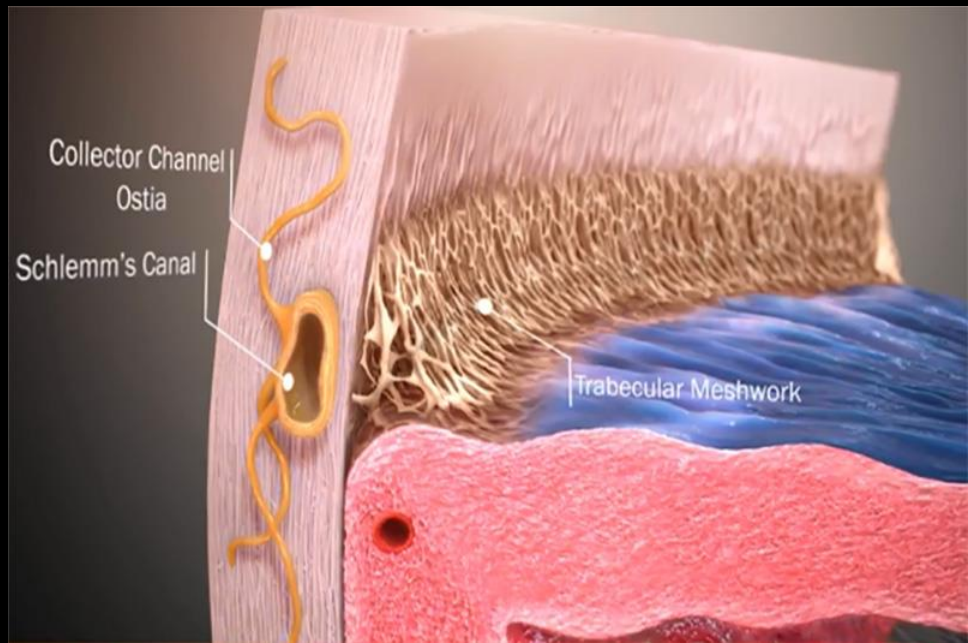
- TM excision procedure
- FDA approved in 2015
- “Unroof” Schlemm’s canal
- More complete removal of TM than other procedures
- Standalone or during cataract surgery



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

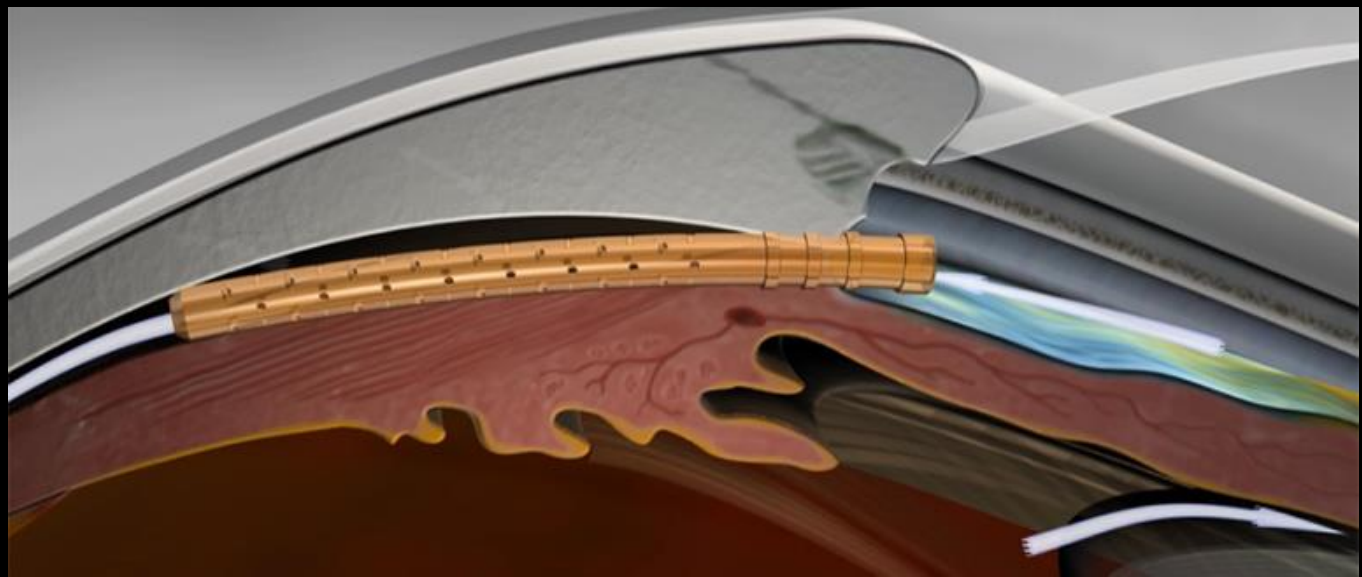


MICROINVASIVE GLAUCOMA SURGERY

MICROINVASIVE GLAUCOMA SURGERY

Cypass

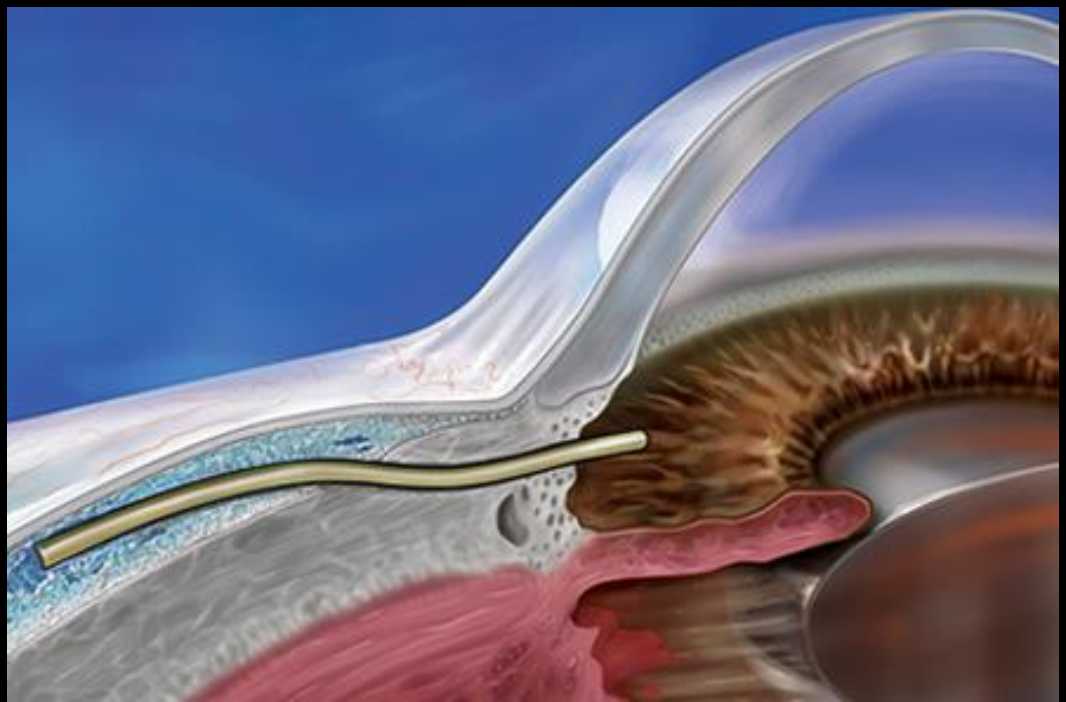
- Suprachoroidal drainage device
- FDA approved in 2016 to be implanted during cataract surgery
- Withdrawn from market in 2018 due to high rates of corneal endothelial cell loss



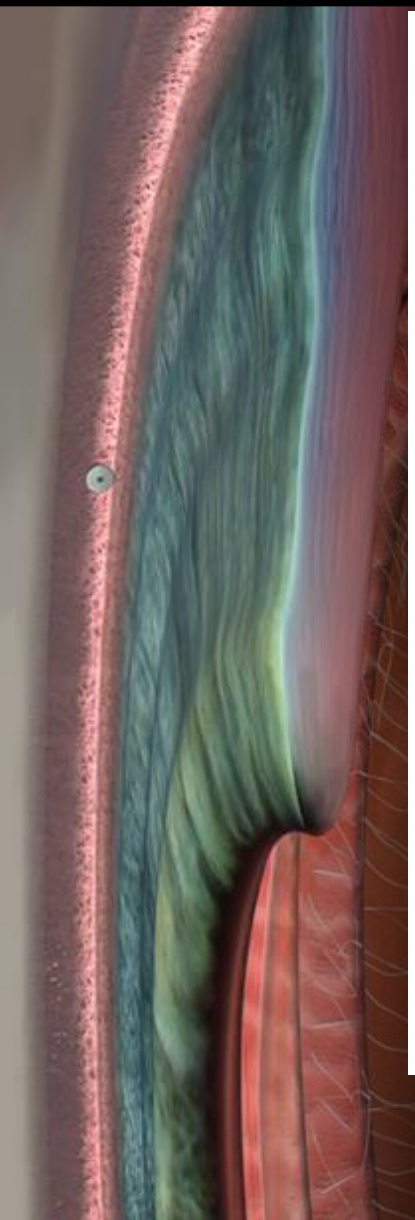
MICROINVASIVE GLAUCOMA SURGERY

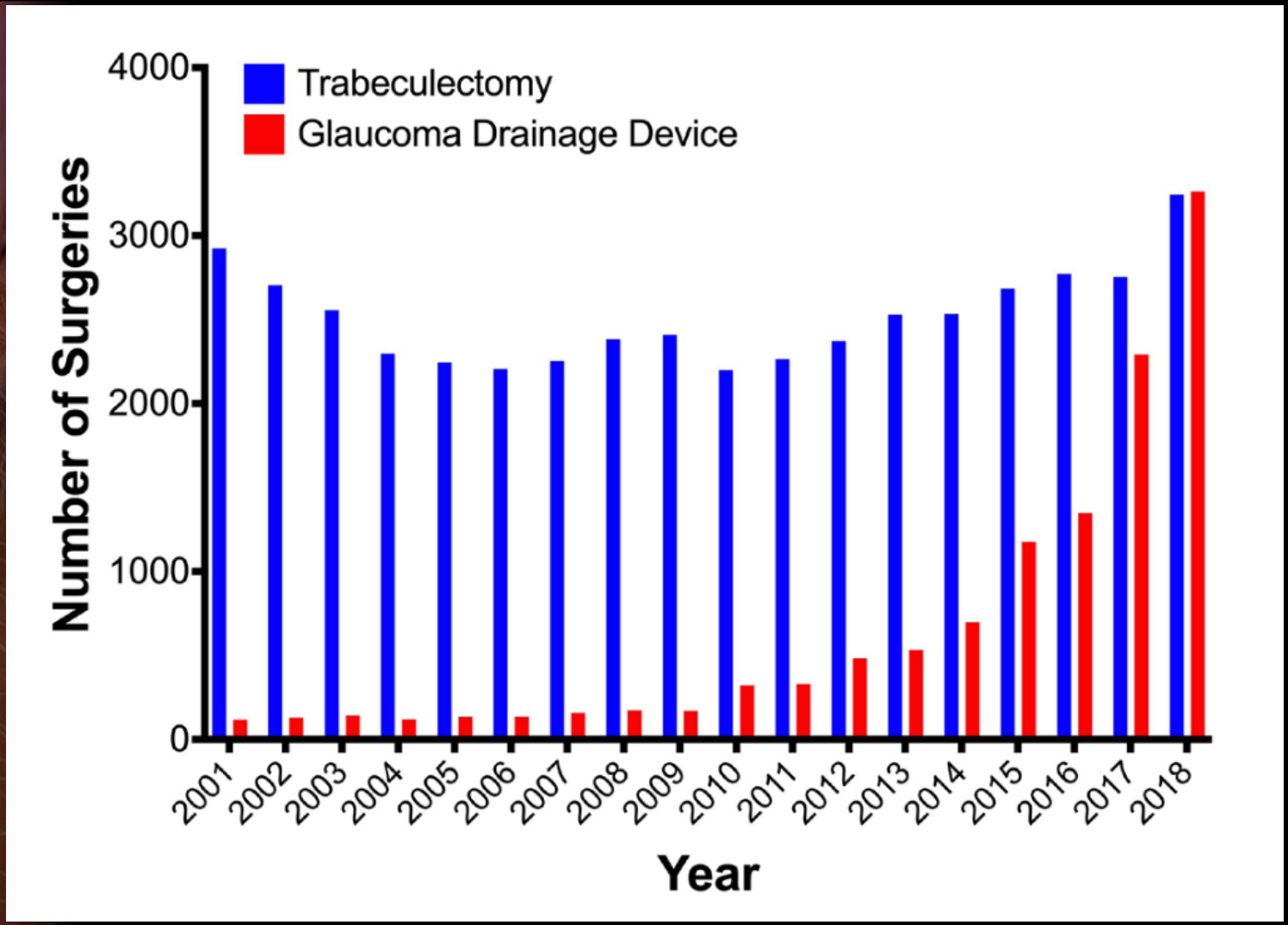
Xen Gel Stent

- Bleb-forming device
- FDA approved in 2016. Recalled in 2019
- Stent bypasses TM and Schlemm's canal to drain subconjunctivally forming a bleb



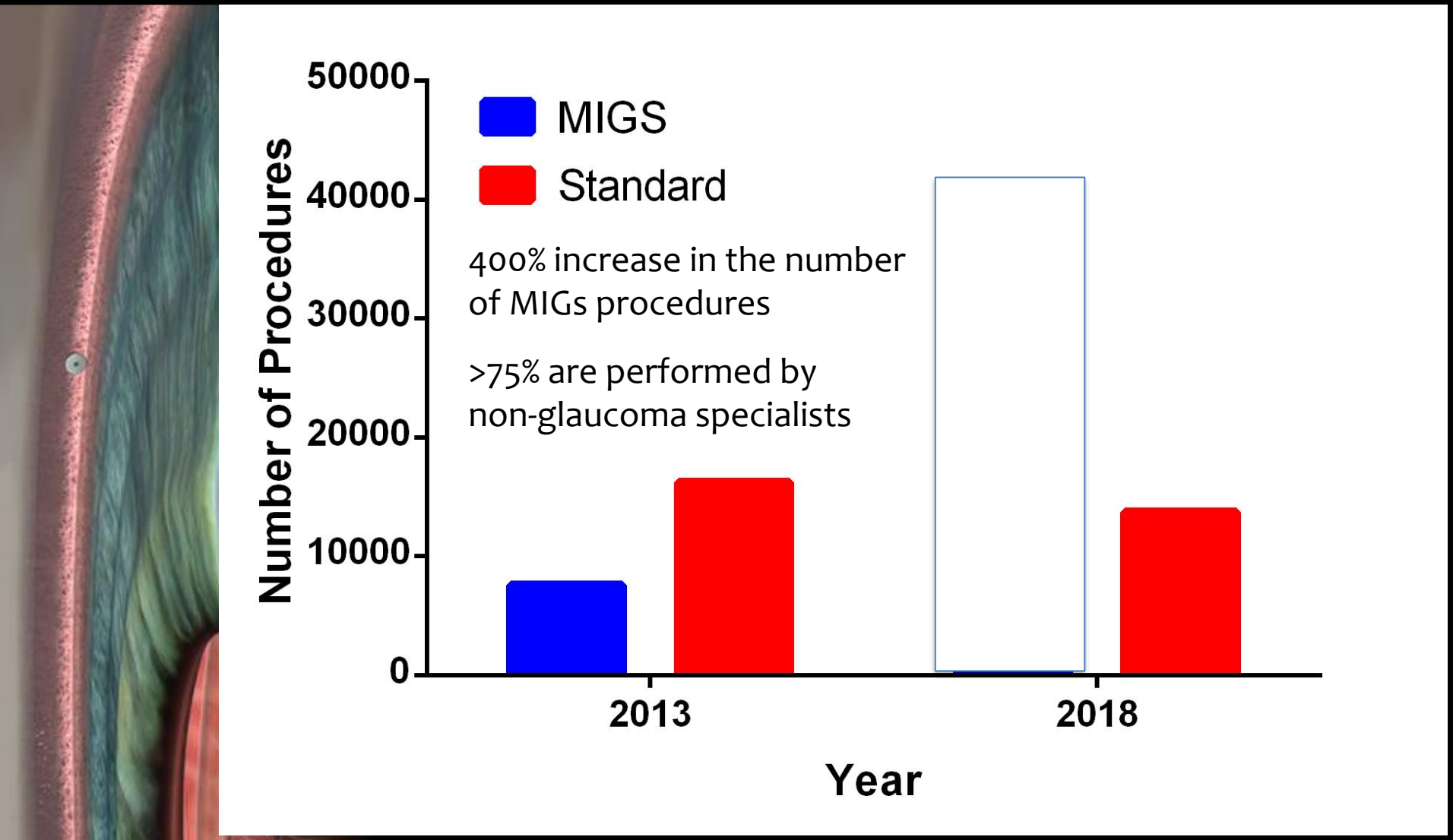
Explosive growth in number of MIGS procedures performed in Australia





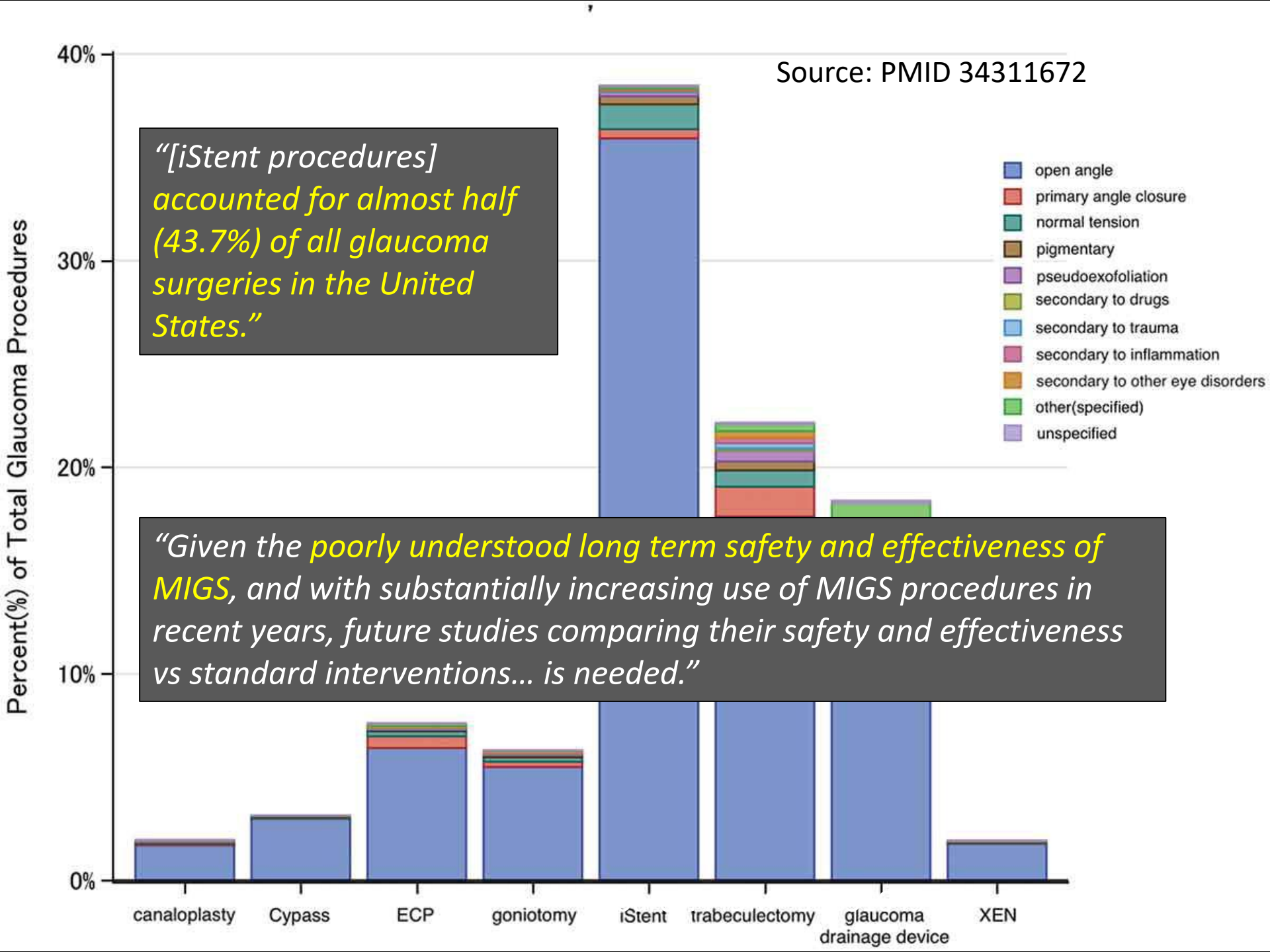
Source: PMID 33597199

Explosive growth of MIGS procedures performed in USA



Source: PMID 32598949, 33831643

Source: PMID 34311672



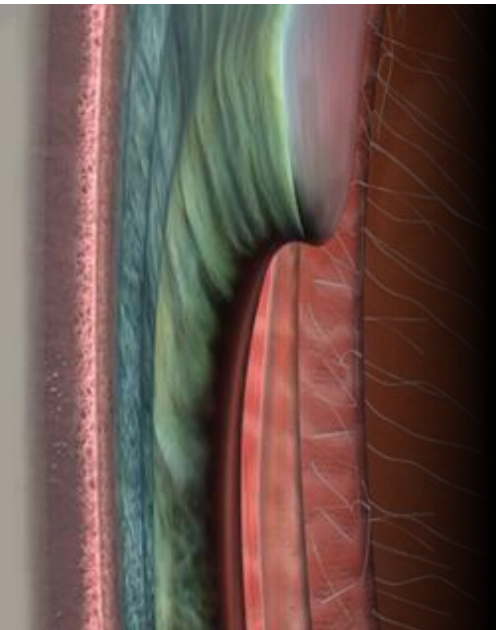
MICROINVASIVE GLAUCOMA SURGERY

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 criterian 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

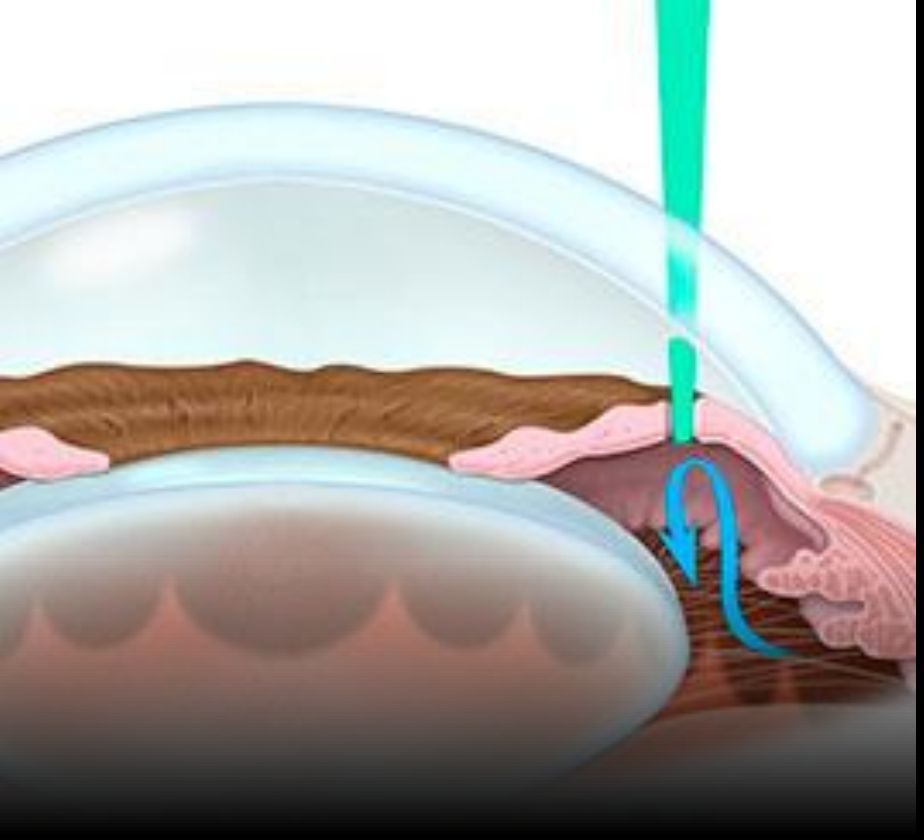
"There is very low-quality evidence that treatment with iStent may result in higher proportions of participants who are drop-free or achieving better IOP control, in the short, medium, or long-term." (2019)

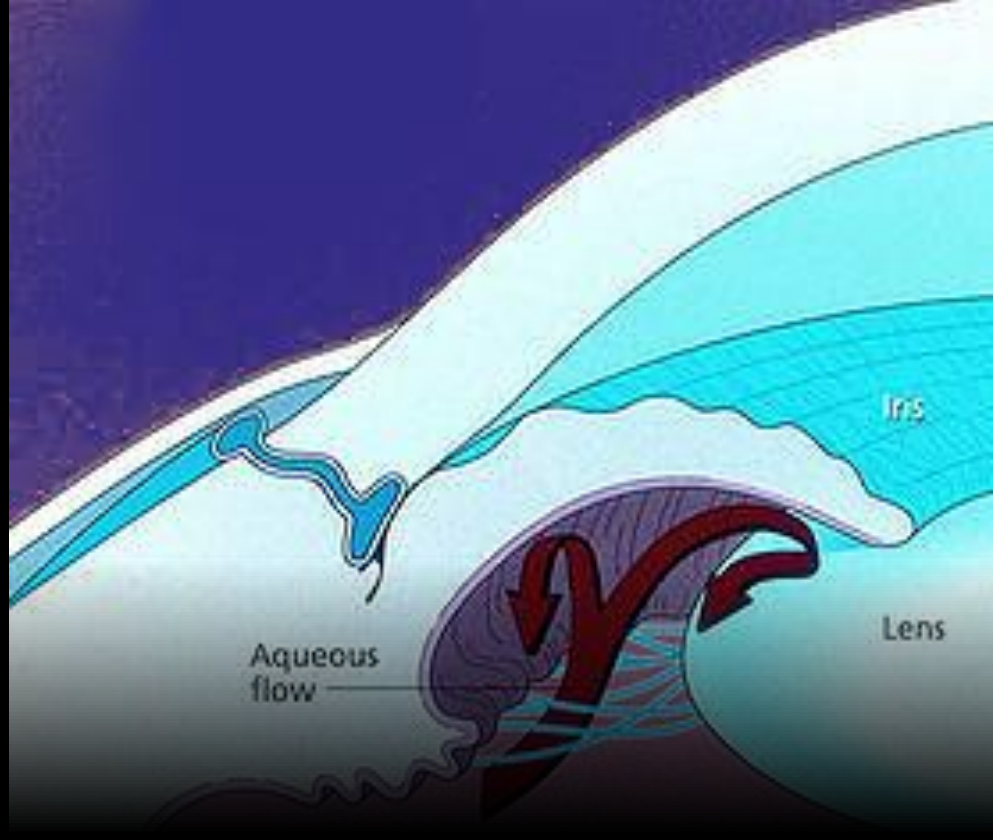
Source: PMID 30919929

MICROINVASIVE GLAUCOMA SURGERY

KEY POINTS

- Many novel procedures without long-term experience
- No high-quality research to support effectiveness or cost-benefit
- Explosive growth fueled by non-glaucoma specialists

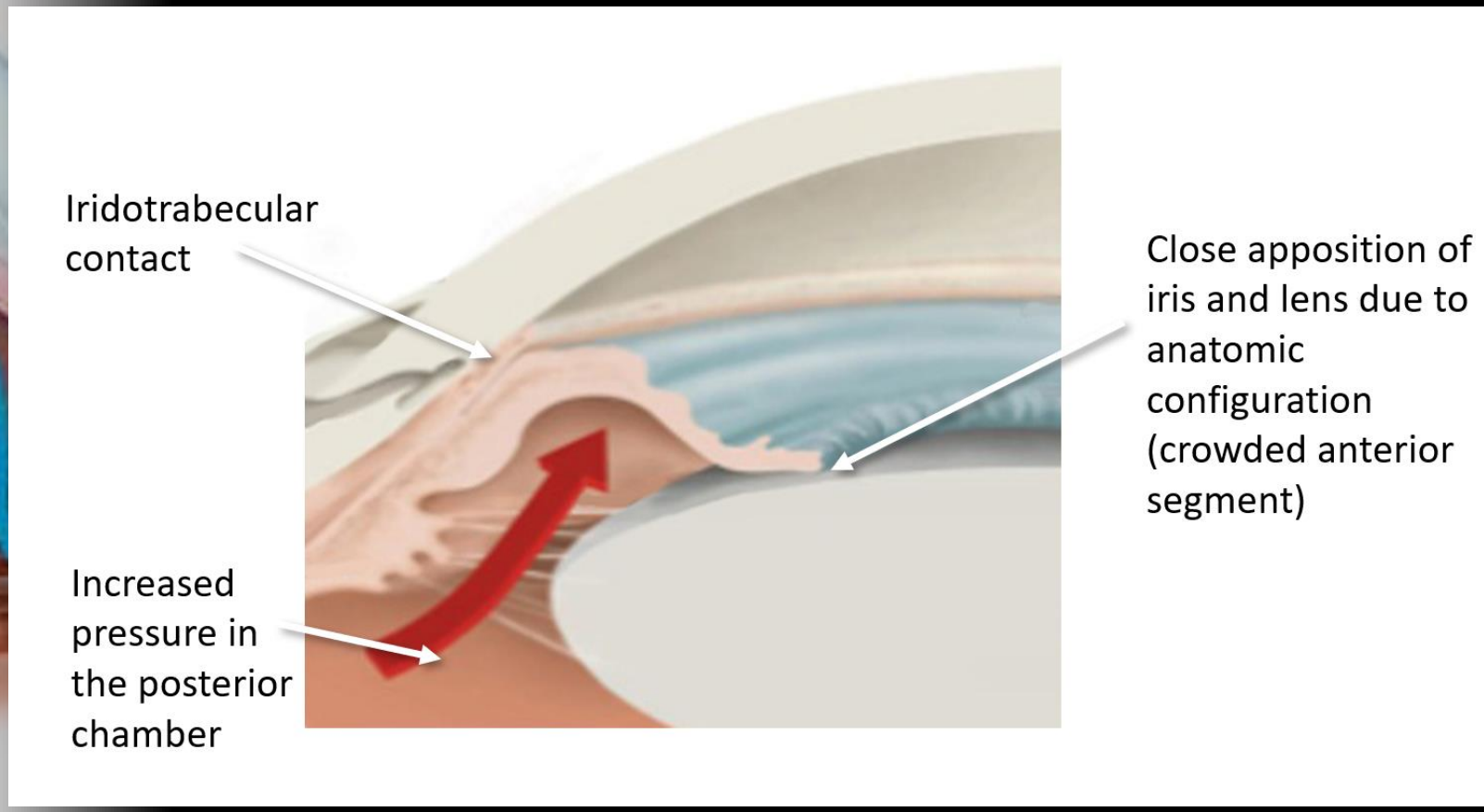




LASER PERIPHERAL IRIDOTOMY

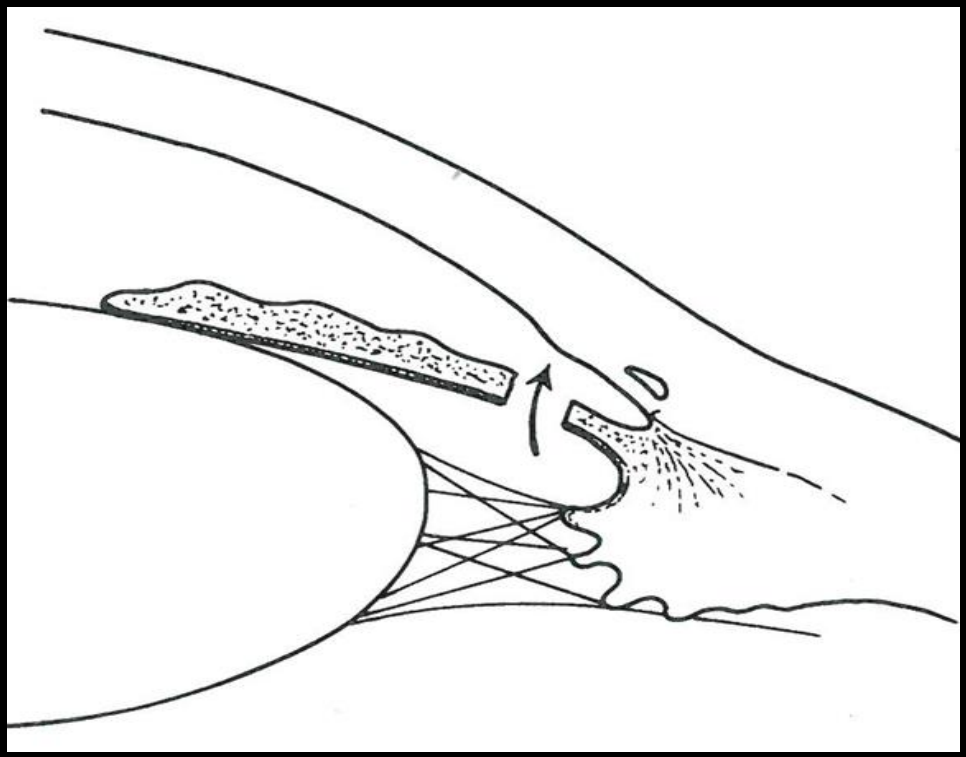
LASER PERIPHERAL IRIDOTOMY

Relative pupillary block traps aqueous in the posterior chamber



LASER PERIPHERAL IRIDOTOMY

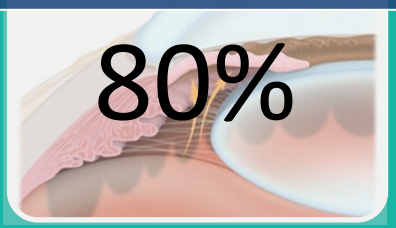
LPI creates a new route for aqueous flow from the post to the anterior chamber, bypassing the pupillary block

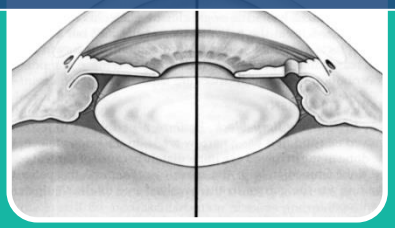


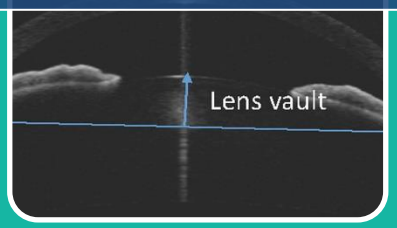
LASER PERIPHERAL IRIDOTOMY

Not all angle closure is due to pupil block

NOT MUTUALLY EXCLUSIVE

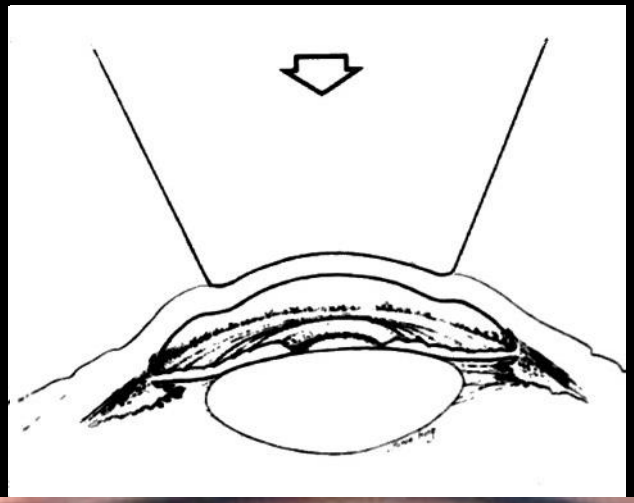






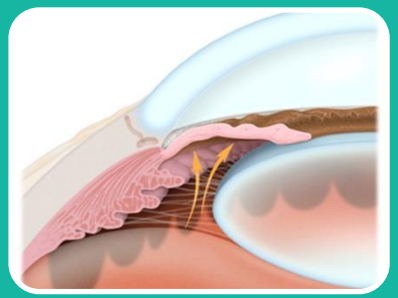
Pupil block	Plateau iris	Lens vault
Iridotomy Lens removal	Iridotomy Iridoplasty	Lens Removal

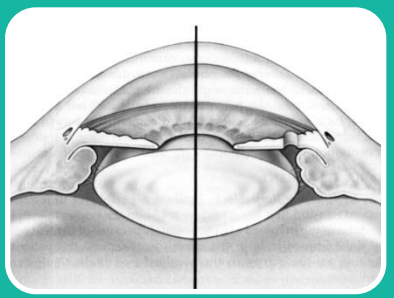
LASER PERIPHERAL IRIDOTOMY

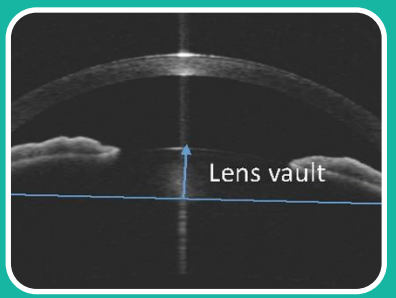


LASER PERIPHERAL IRIDOTOMY

Indentation Gonioscopy Findings







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

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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*

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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.)

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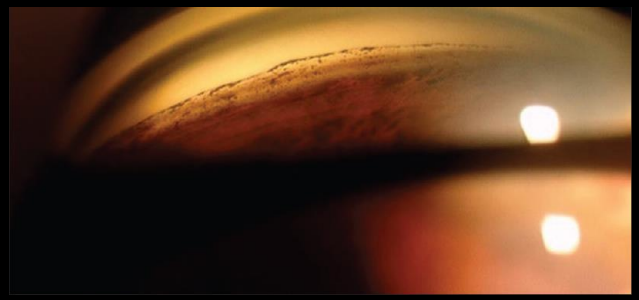
Gonioscopic evidence of prior closure

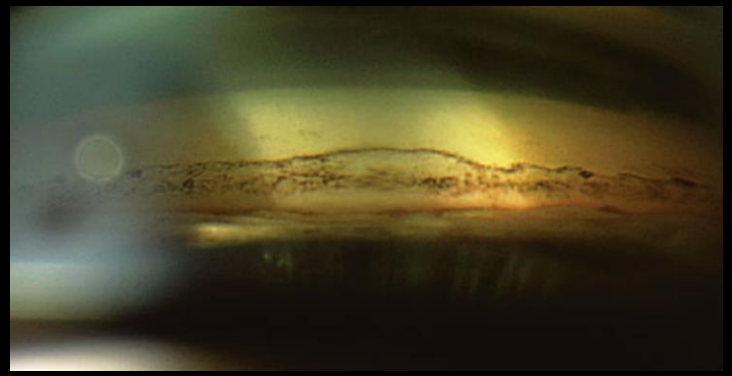
Peripheral anterior synechia → *Primary Angle Closure*

Irregular blotchy angle pigmentation

Pigment on and anterior to Schwalbe's line

Pigment superior angle > inferior angle





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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

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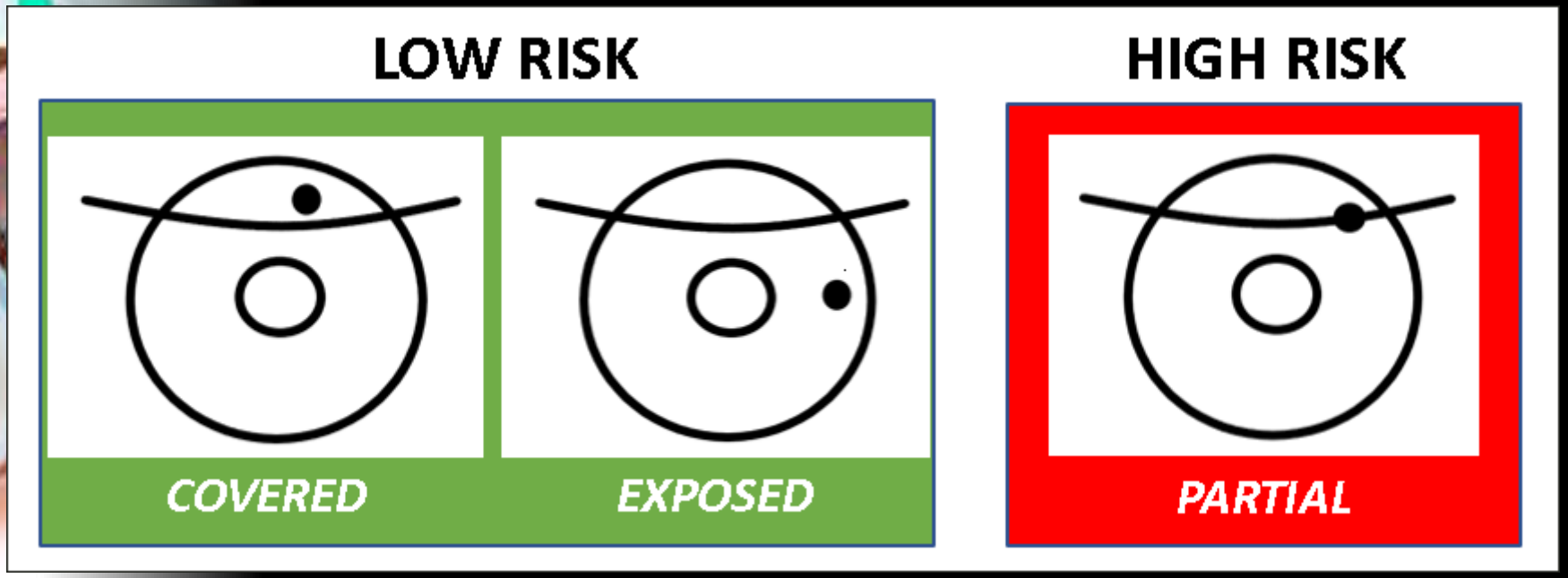
LPI complications: Dysphotopsia

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



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Pigment plume is crucial!!

“Just because you see *black* doesn’t mean you're through, wait for the pigment plume!”

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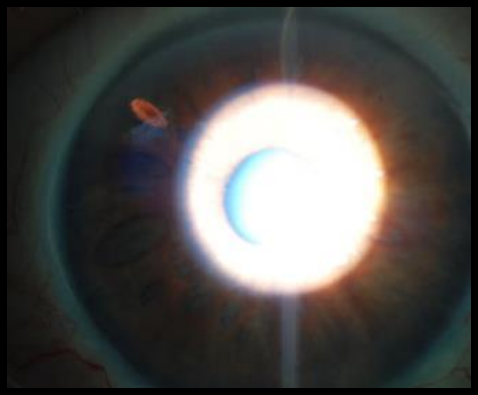
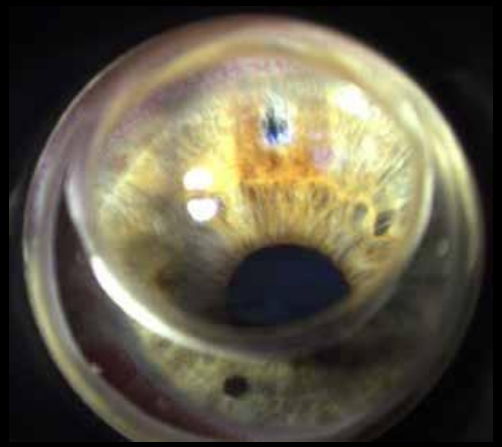
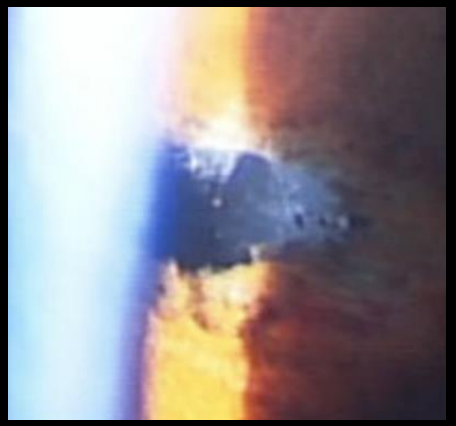
Assessing LPI patency

- Iris transillumination alone does not tell you whether an LPI is patent!
- The best way to assure patency is to directly visualize structures through it (CB, lens zonules)
- May need to use laser lens/OCT to view
- Confirm on each F/U visit







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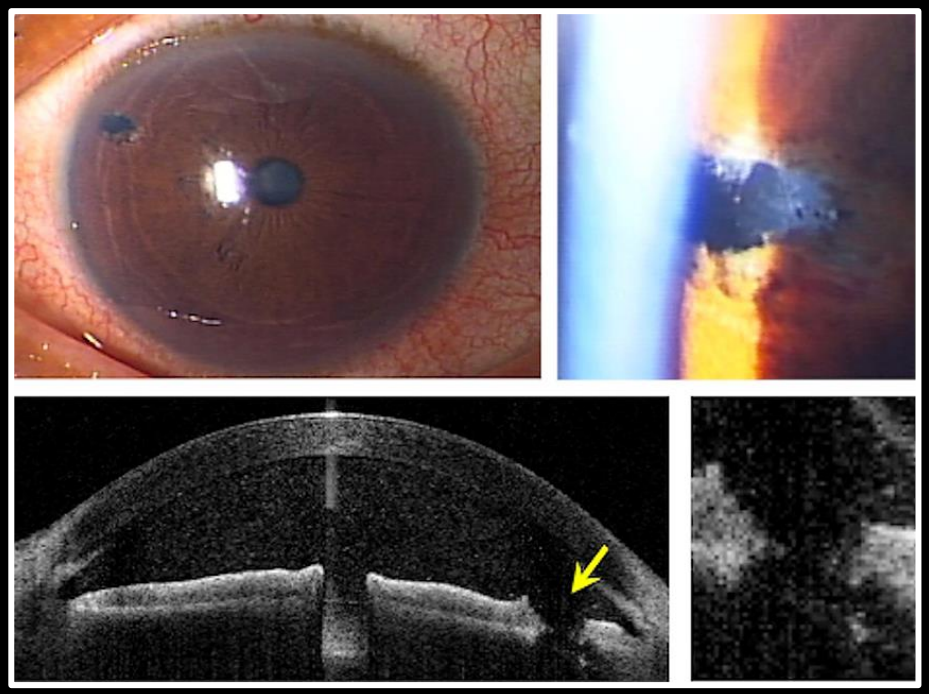
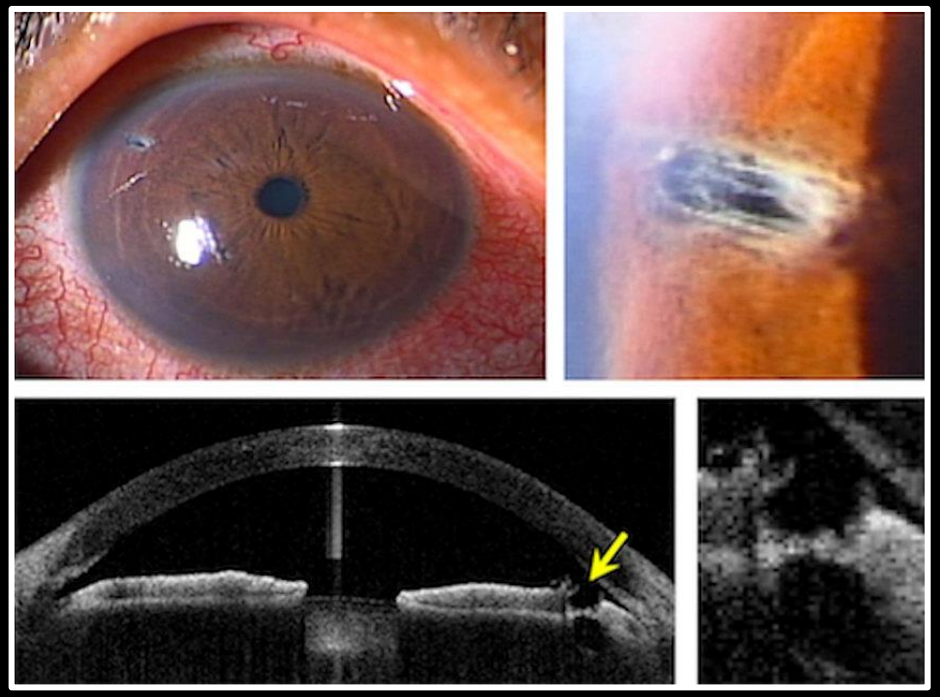
Assessing LPI patency





Source: PMID 24711692

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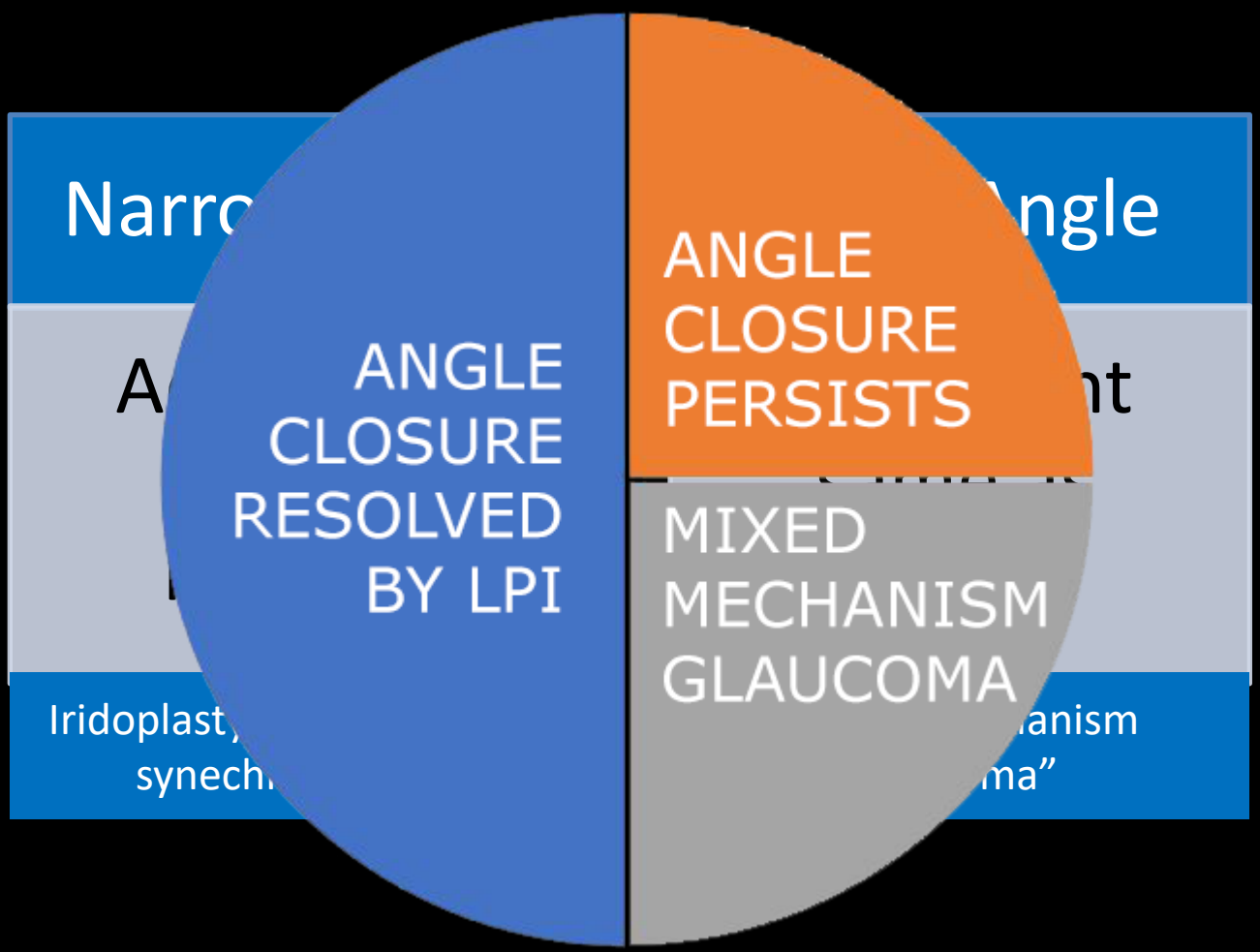
Treatment is often needed after LPI



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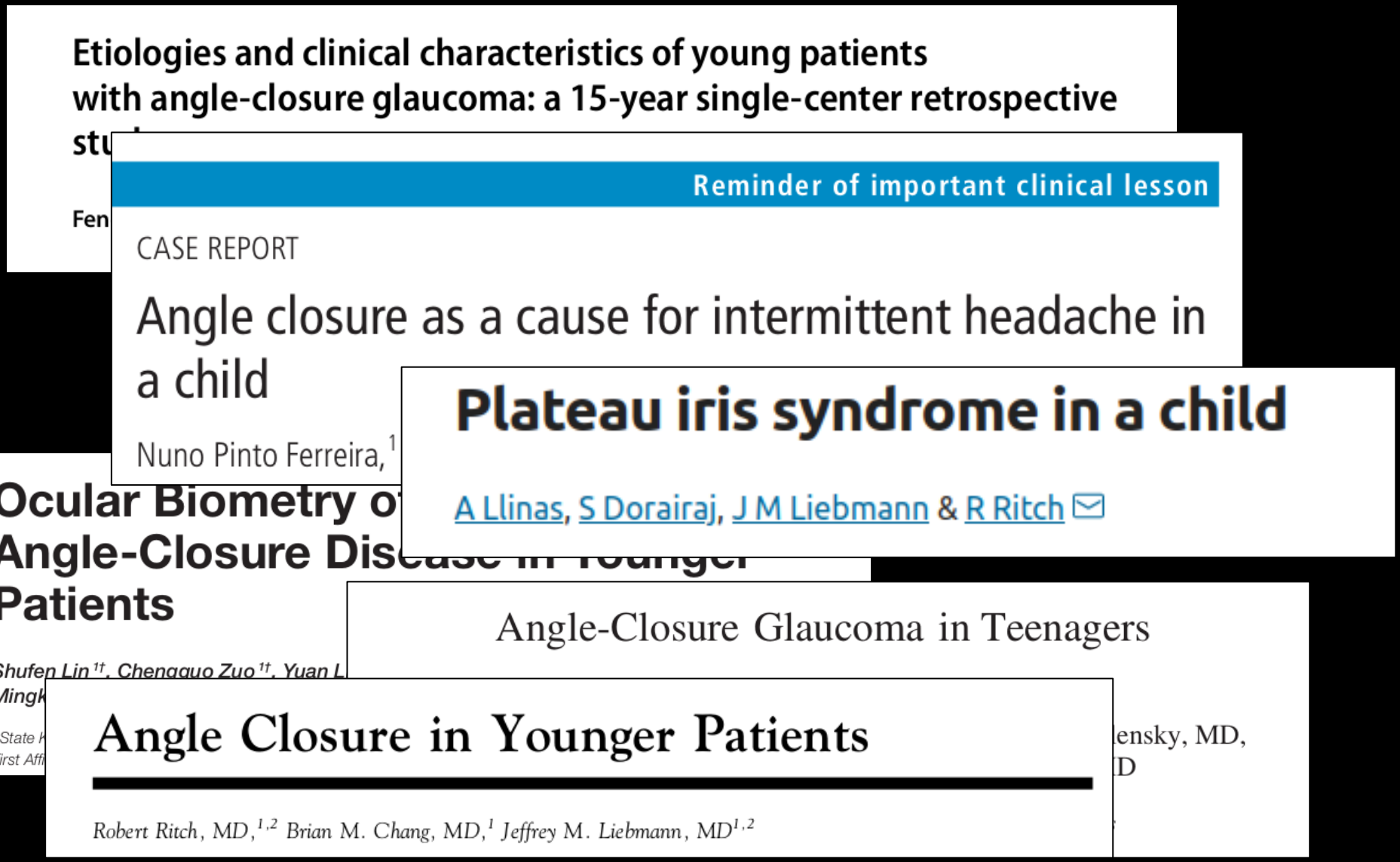

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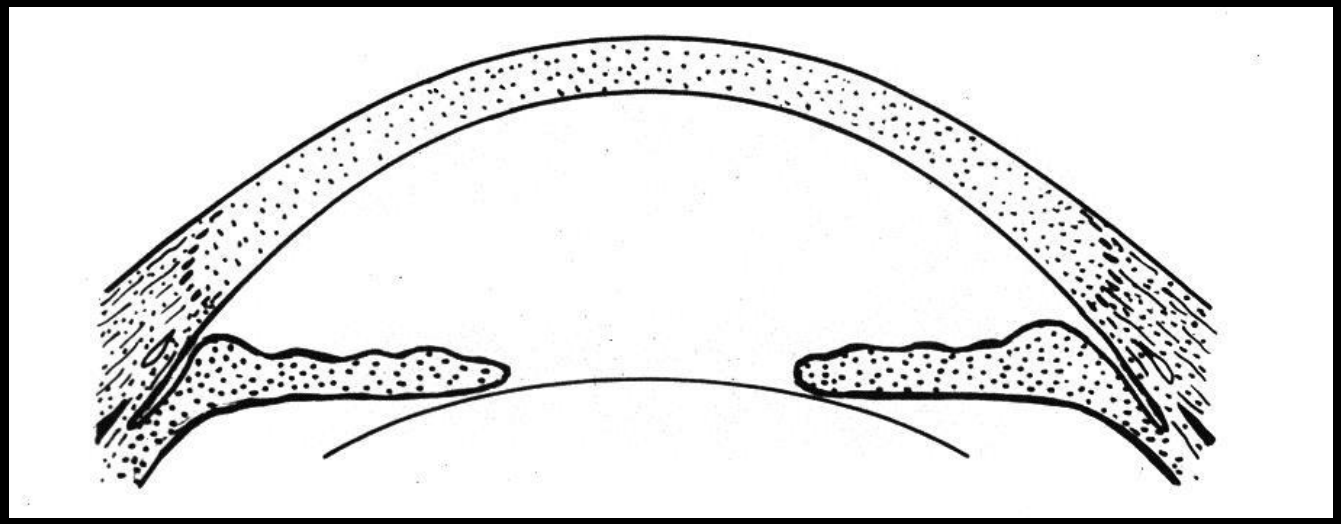
Angle closure in young people

- 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

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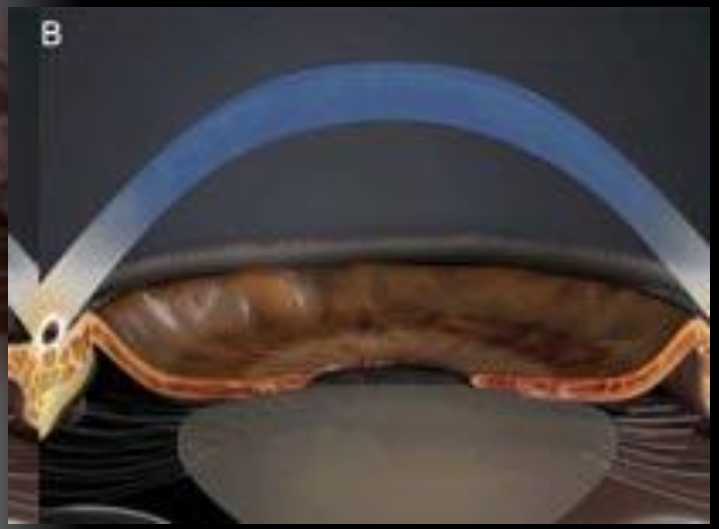
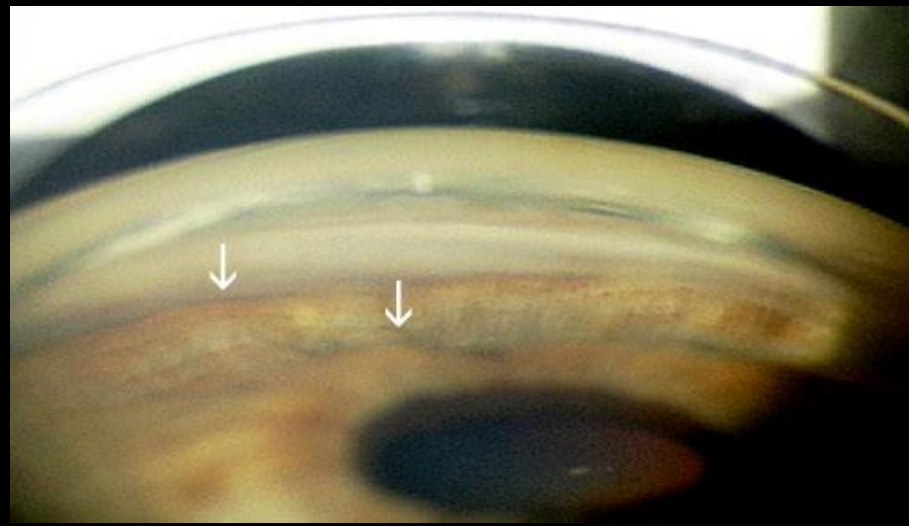
Angle closure in young people

- 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





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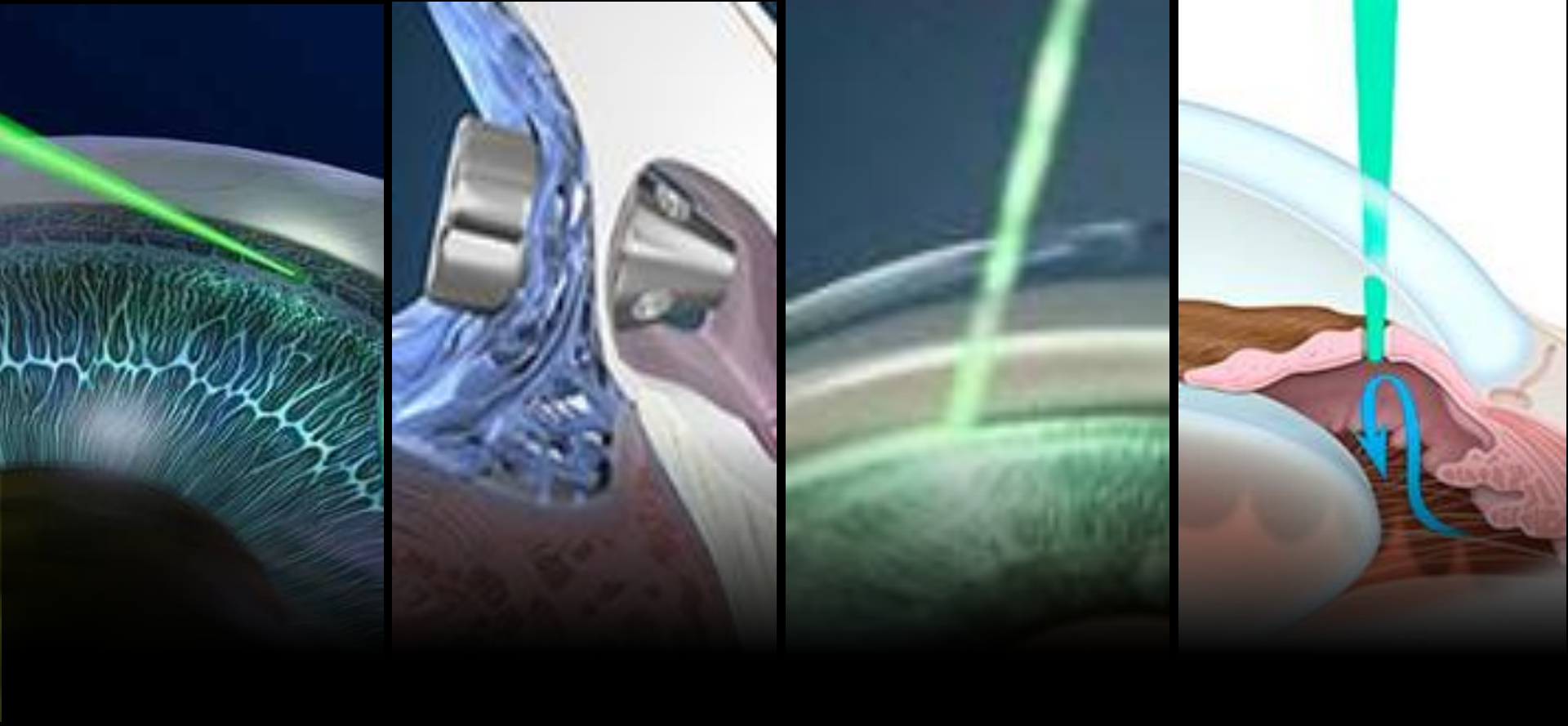
KEY POINTS

- 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!