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Durham
University

New Laser treatments for glaucoma

Pouya Alaghband MD(res), PGCert, FRCOphth

Consultant ophthalmic surgeon

Honorary senior lecturer

Professor in practice

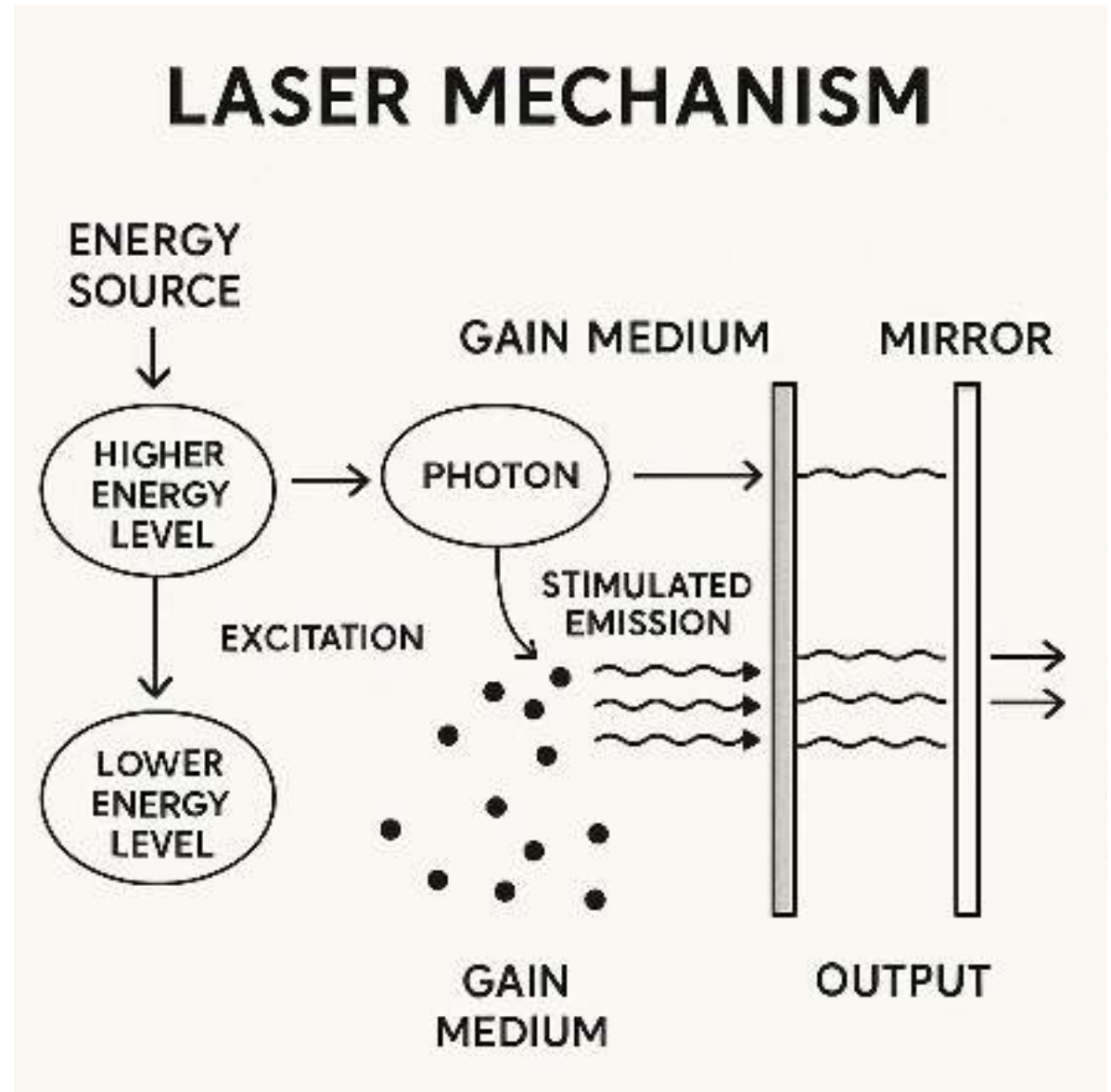
Financial disclosure

- Honoraria from Glaukos, Santen, Thea and iStar medical
- Consultancy fees from Thea, Scope, Abbvie, Alcon, iStar medical, Gore and Santen
- Educational/travel grants from J&J, Thea and Glaukos

- History of laser (in general, in ophthalmology, in glaucoma)
- Review of evidence for laser
 - ALT (GLT)
 - SLT (LiGHT)
 - DSLT (EAGLE, Belkin or Voyager) (GLAURIUS)
 - MCLASS
 - MP
 - ELIOS (ELT)
 - ECP/LEOS (CONCEPT)
 - FLIGHT
- Conclusion

LASER

(Light Amplification by
Stimulation of Emission of
Radiation)



Features of laser beam

- Coherent (photons are all in the same phase)
 - Monochromatic
 - Uni directional
- 



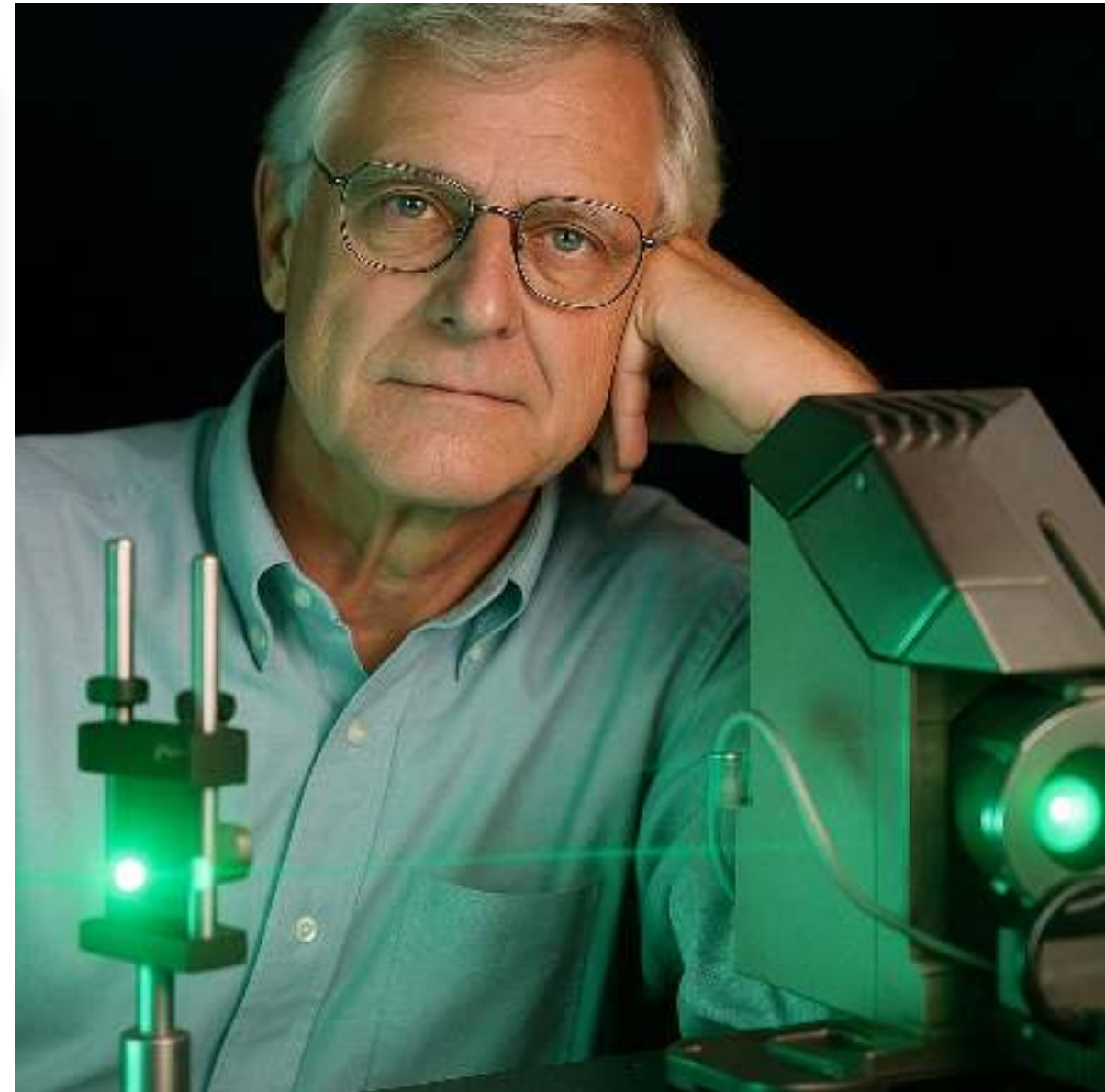
Theodore Maiman

American engineer and
physicist

1927-2007

First applications of LASER

- In 1961, Zaret treated retinal lesions in rabbit utilising Ruby laser
- William Bridges developed Argon laser in 1964
- Argon laser was commercialised by Coherent in 1970



1934-2024

LASER in glaucoma

- GLT (glaucoma laser trial) 1990
- The Glaucoma Laser Trial, a multicenter, randomized clinical trial involving 271 patients, was designed to assess the efficacy and safety of argon laser trabeculoplasty (ALT)

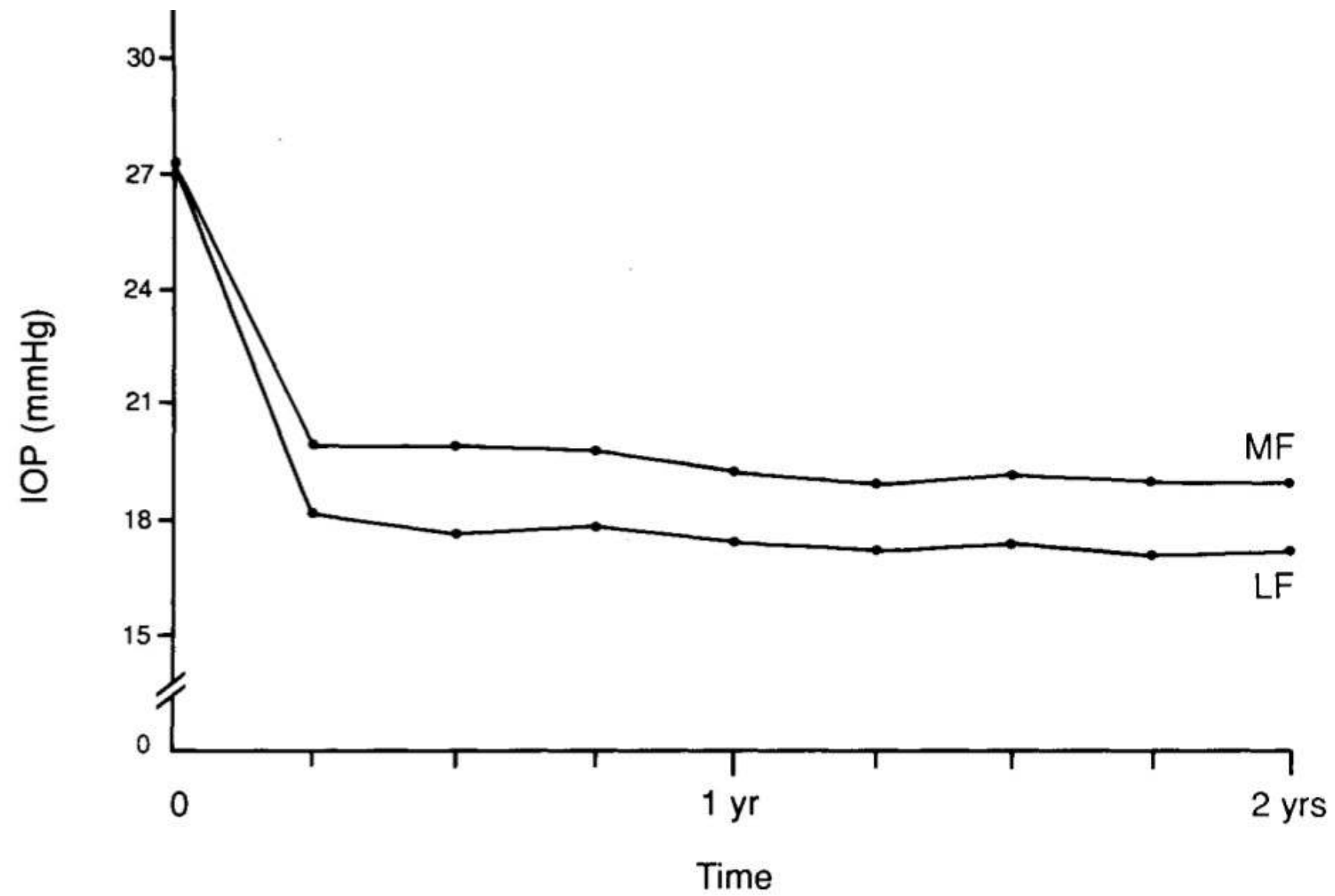


FULL LENGTH ARTICLE · Volume 97, Issue 11, P1403-1413, November 1990 · [Open Access](#)

The Glaucoma Laser Trial (GLT)

2. Results of Argon Laser Trabeculoplasty versus Topical Medicines

[The Glaucoma Laser Trial Research Group](#)^{*}



Cons of ALT

Tissue damage (PAS formation)

Limited long-term efficacy

Inability to repeat treatment

IOP spike

Uveitis

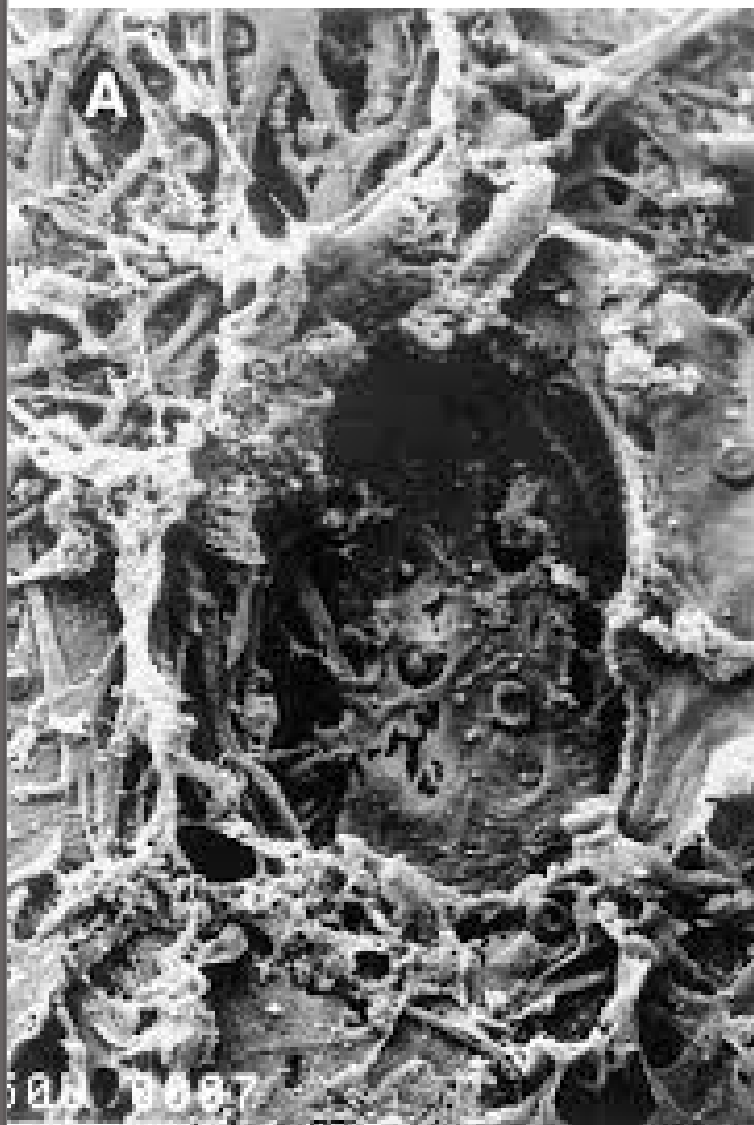
Q-switched 532-nm Nd:YAG laser trabeculoplasty (selective laser trabeculoplasty): A multicenter, pilot, clinical study¹

Presented in part at the American Academy of Ophthalmology annual meeting, San Francisco, California, October 1997.

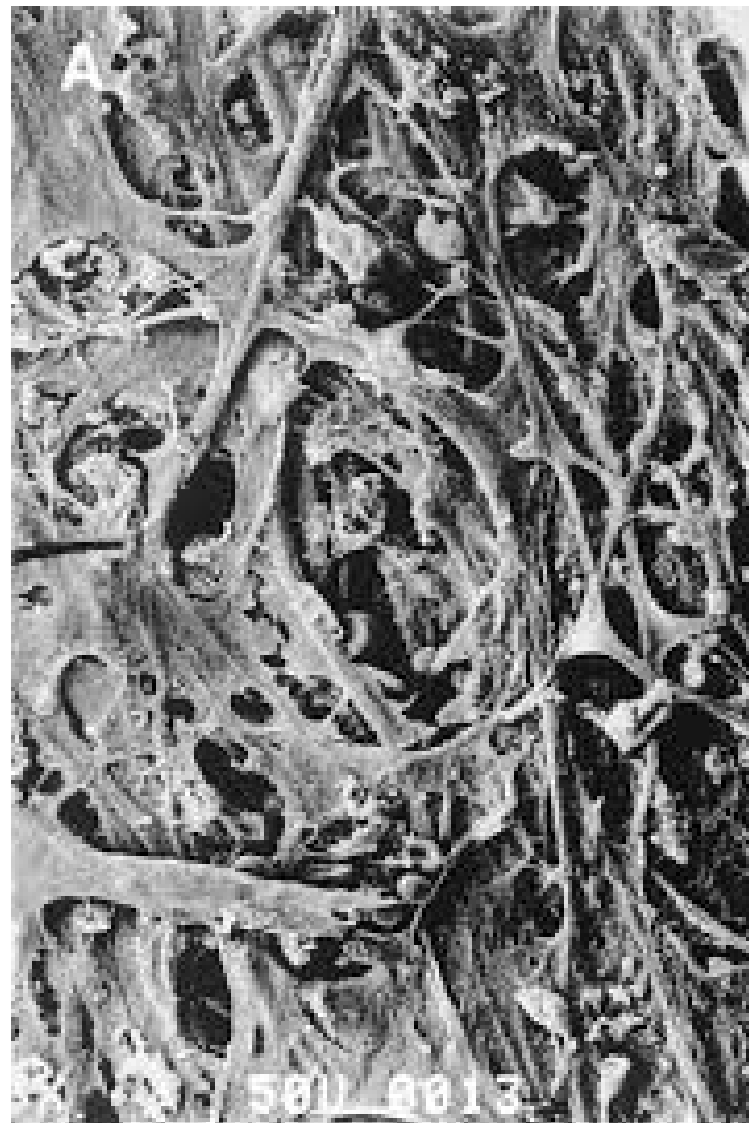
Mark A Latina MD¹ , Santiago A Sibayan MD¹, Dong H Shin MD, PhD², Robert J Noecker MD³,



Feature	Argon Laser Trabeculoplasty (ALT)	Selective Laser Trabeculoplasty (SLT)
Laser Type	Argon laser (blue-green, ~488–514 nm)	Frequency-doubled Nd:YAG (532 nm)
Mechanism	Thermal burns to trabecular meshwork	Targets pigmented cells with minimal heat
Tissue Damage	Moderate; causes scarring	Minimal; no visible tissue damage
Repeatability	Limited; generally, not repeatable	Yes; can be repeated safely
Onset of Action	Days to weeks	Days to weeks
Efficacy (Short-Term)	Moderate IOP reduction	Similar or slightly better than ALT
Efficacy (Long-Term)	Often diminishes over time	More consistent long-term outcomes
Side Effects	Inflammation, pressure spikes	Fewer and milder side effects
Use Today	Rarely used	Commonly used in clinical practice



ALT



SLT

Electron microscopy of TM

THE LANCET

[This journal](#) [Journals](#) [Publish](#) [Clinical](#) [Global health](#) [Multimedia](#) [Events](#) [About](#)



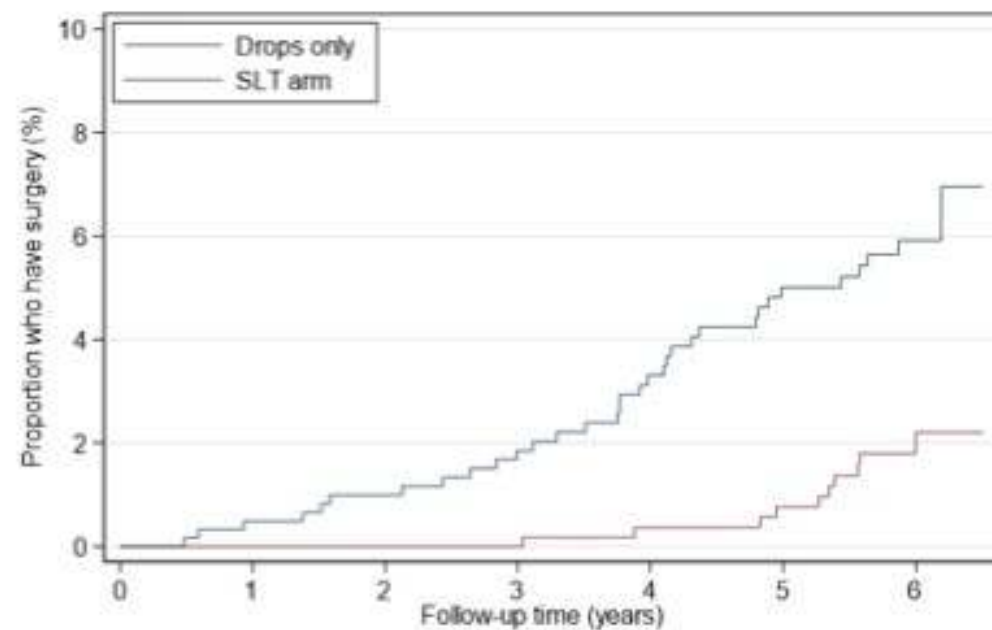
ARTICLES · [Volume 393, Issue 10180](#), P1505-1516, April 13, 2019 · [Open Access](#)

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Selective laser trabeculoplasty versus eye drops for first-line treatment of ocular hypertension and glaucoma (LiGHT): a multicentre randomised controlled trial

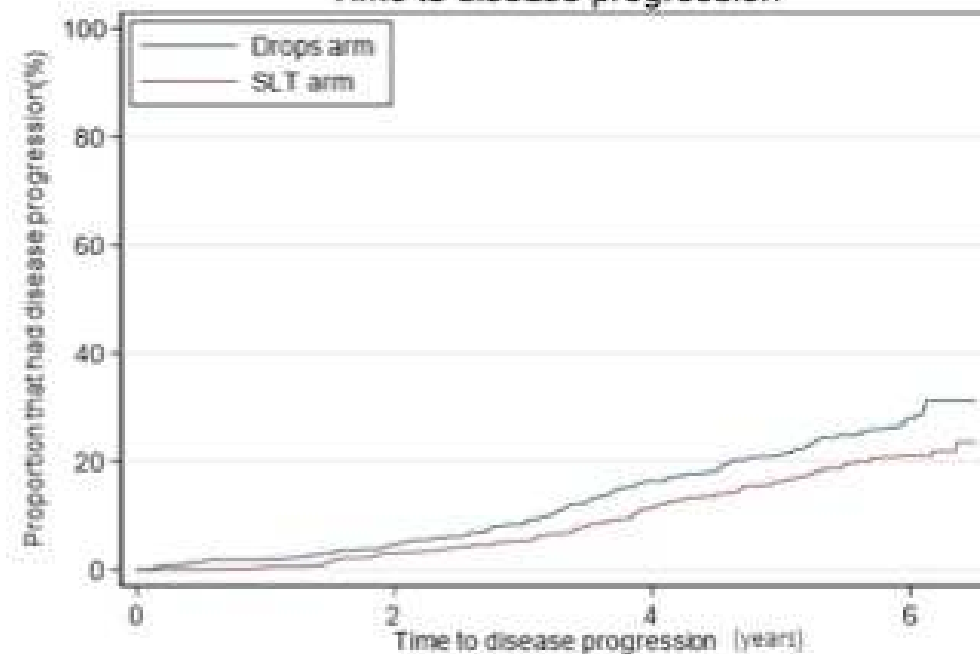
[Gus Gazzard, FRCOphth](#) ^{a,b}  · [Evgenia Konstantakopoulou, PhD](#)^{a,b} · [Prof David Garway-Heath, MD](#)^{a,b} · [Anurag Garg, FRCOphth](#)^{a,b} · [Victoria Vickerstaff, MSc](#)^{c,d} · [Rachael Hunter, MSc](#)^d · et al. [Show more](#)

Time to glaucoma surgery



Number of patients at risk / years	0	1	2	3	4	5	6*
Drops arm	361	352	342	334	307	291	266
SLT arm	355	351	345	328	304	287	270

Time to disease progression



Number of patients at risk / years	0	2	4	6*
Drops arm	361	335	282	235
SLT arm	355	339	287	243

SLT is recommended as a first line treatment for OHT and OAG

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DSL



Direct selective laser trabeculoplasty in open angle glaucoma study design: a multicentre, randomised, controlled, investigator-masked trial (GLAUrious)

Nathan Congdon ^{1,2} Augusto Azuara-Blanco ¹ Yoram Solberg,³
Carlo E Traverso,⁴ Michele Iester ⁴ Carlo Alberto Cutolo ⁴ Alessandro Bagnis,⁴
Tin Aung,⁵ Scott J Fudenberg,⁶ Richard Lindstrom,^{7,8} Thomas Samuelson,⁷
Kuldev Singh,⁹ Eytan Z Blumenthal,^{10,11} Gus Gazzard,^{12,13} On behalf of GLAUrious
study group

Ophthalmology, Epub May 2025

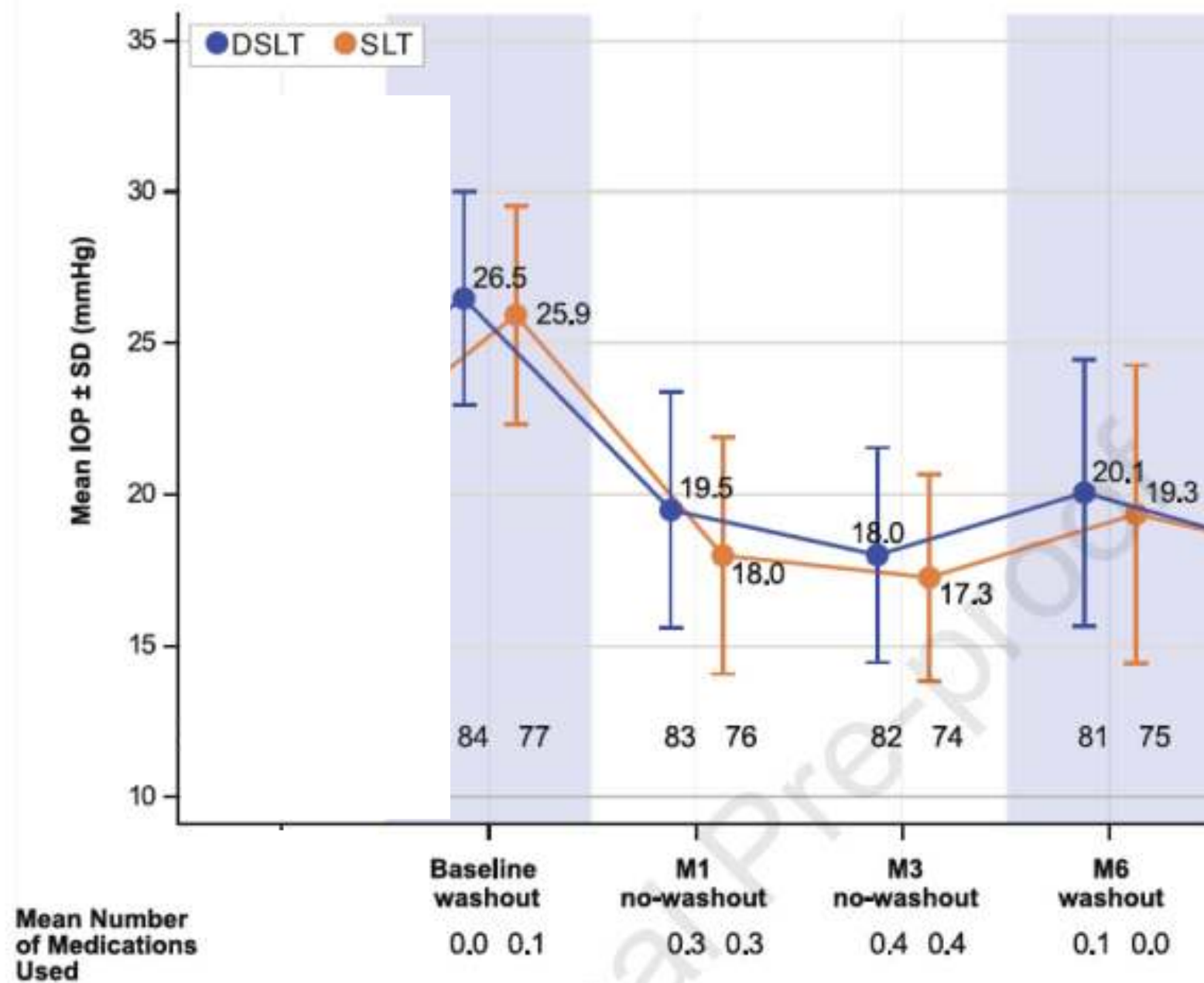


Alcon



BELKIN
VISION

Results



- Most common AE in DSLT group was sub conj haem (20%)



Pros and cons

Pros

- Quick
- Operator independence
- No need for goniolens/gonioscopy

Cons

- Cost
- Limited evidence
- Needs speculum
- Higher energy can cause discomfort
- Conjunctival haem?
- It only delivers DSLT (no YAG laser unlike conventional)
- Trial was funded by the manufacturer!

Micropulse

Clinical & Experimental
Ophthalmology



RANZCO



The Royal Australian
and New Zealand
College of Ophthalmologists

Micropulse transscleral diode laser cyclophotocoagulation in the treatment of refractory glaucoma

Anna M Tan FAMS , Muthuraman Chockalingam FRCS, Maria C Aquino MD, Zena I-L Lim Jovina L-S See FRCS, Paul TK Chew FRCS

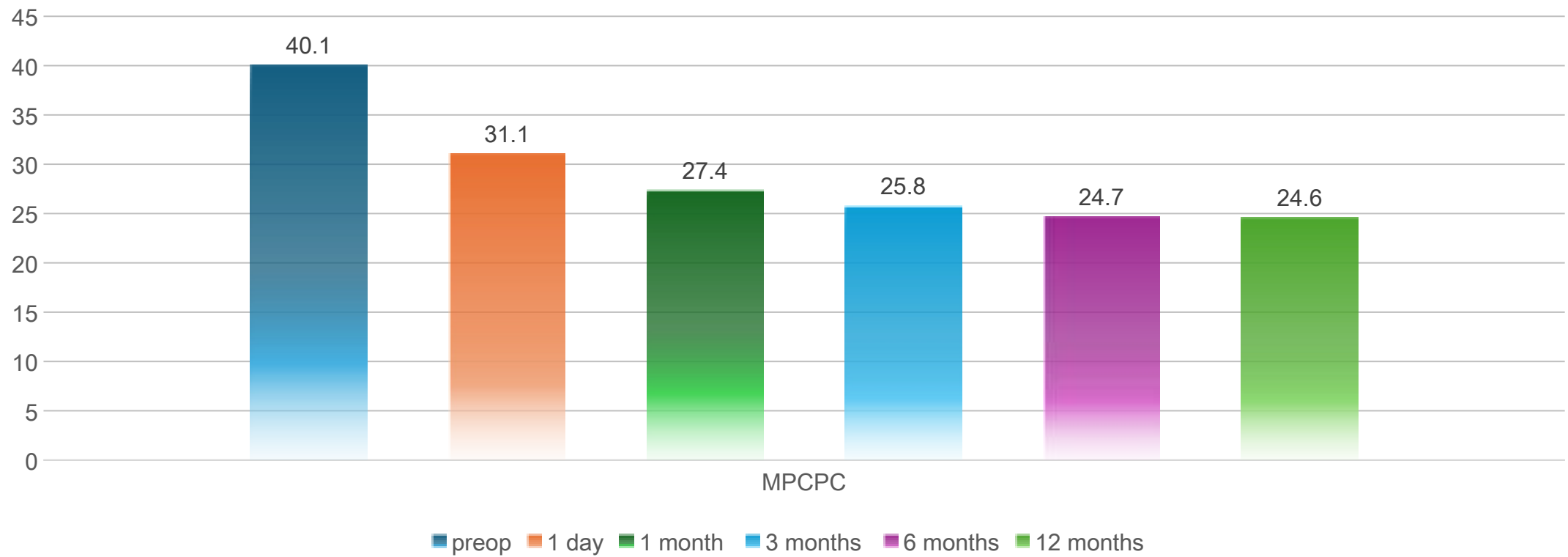
First published: 21 April 2010 | <https://doi.org/10.1111/j.1442-9071.2010.02238.x> | Cita





Feature	Micropulse Laser Photocoagulation (MLP)	Transscleral Cyclophotocoagulation (TSCPC)
Mechanism	Subthreshold laser therapy delivering repetitive short pulses allowing tissue cooling	Continuous or pulsed diode laser causing thermal destruction of ciliary body
Tissue Damage	Minimal – avoids coagulative necrosis	Moderate to severe – tissue ablation of ciliary body
Inflammation Risk	Low	Higher
Pain & Discomfort	Minimal, often performed under topical or local anesthesia	Moderate to significant, usually requires periocular or general anesthesia
Post-op Recovery	Fast, mild inflammation	Slower, more inflammation and discomfort
Repeatability	Highly repeatable due to low tissue damage	Limited repeatability due to cumulative tissue destruction
Indications	Mild to moderate glaucoma; useful adjunct for early disease	Moderate to severe, refractory or end-stage glaucoma
Effectiveness	Moderate IOP reduction (~20-40%)	Stronger IOP reduction (~30-60%)
Complications	Rare; includes transient IOP spikes, minimal inflammation	Hypotony, phthisis bulbi, vision loss, prolonged inflammation
Use in Good Vision Eyes	Safe; preferred for patients with useful vision	Riskier; typically avoided in eyes with good visual potential
Learning Curve	Gentle; standard laser training sufficient	Steeper; requires experience and careful technique
Cost & Availability	Generally higher cost, newer equipment	Widely available, cost-effective

IOP



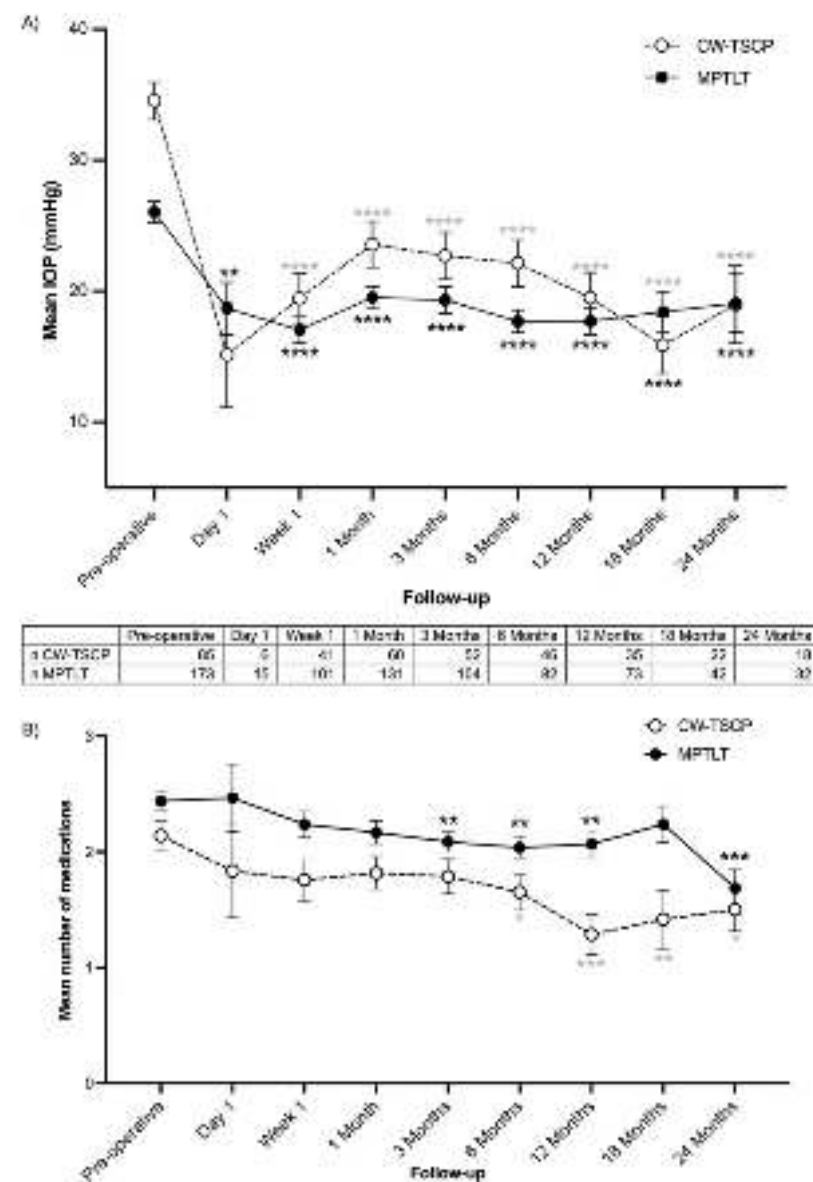
Article | [Open access](#) | Published: 30 January 2024

Cyclodiode vs micropulse transscleral laser treatment

Monica Kelada , Eduardo M. Normando, Francesca M. Cordeiro, Laura Crawley, Faisal Ahmed, Sally Ameen, Niten Vig & Philip Bloom

Eye 38, 1477–1484 (2024) | [Cite this article](#)

2452 Accesses | 3 Altmetric Metrics



Pros and cons

Pros

- Well-tolerated
- Repeatable

Cons

- Proinflammatory
- Limited evidence
- Efficacy?
- Capital investment for the consol
- Ongoing probes cost

BAUSCH + LOMB

elios

ELIOS LASER CONSOLE

- 308 nm XeCL excimer laser
- Simple intuitive operation
- Compact, robust system requiring minimal maintenance

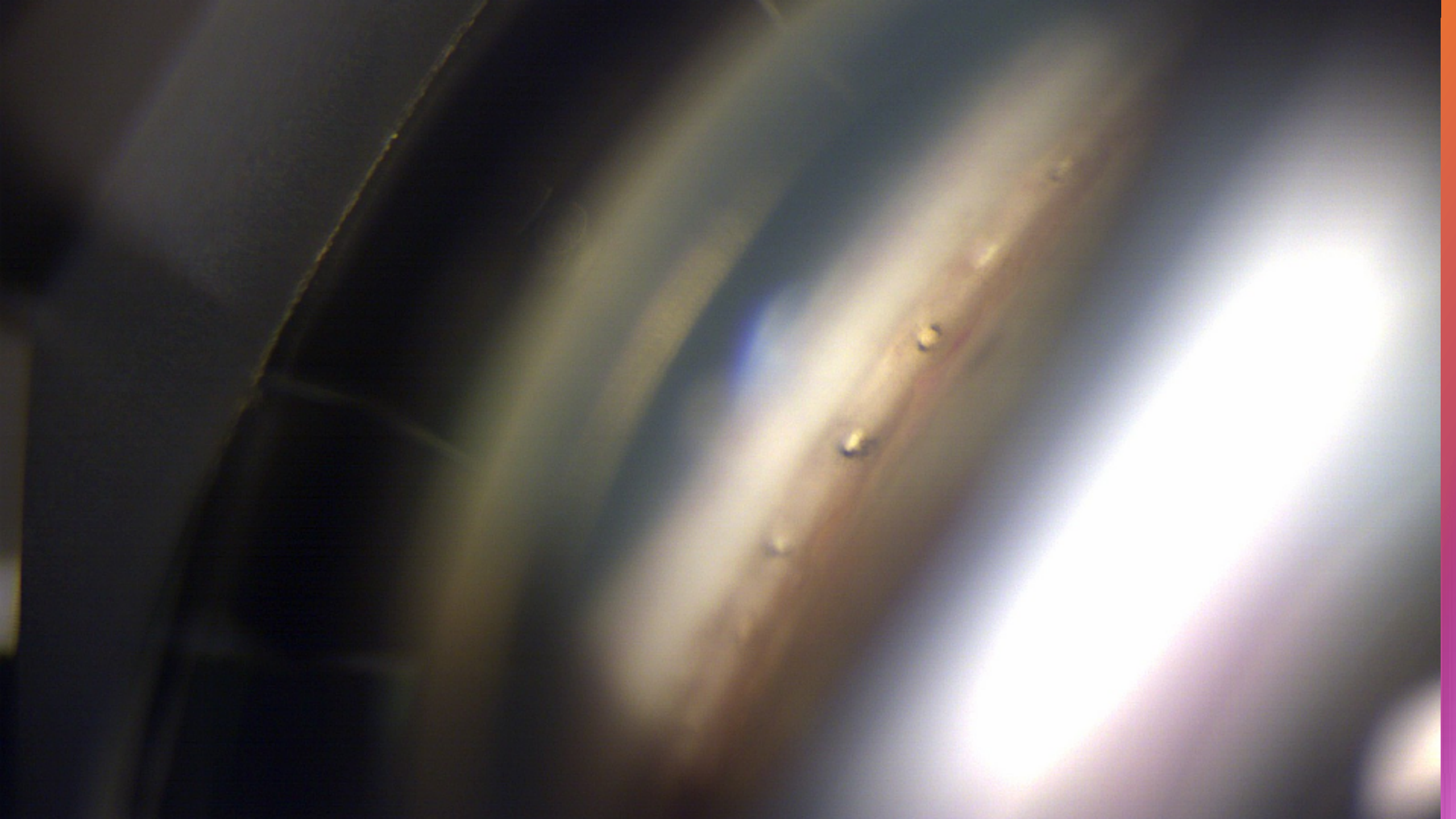


ELIOS – LASER APPLICATOR

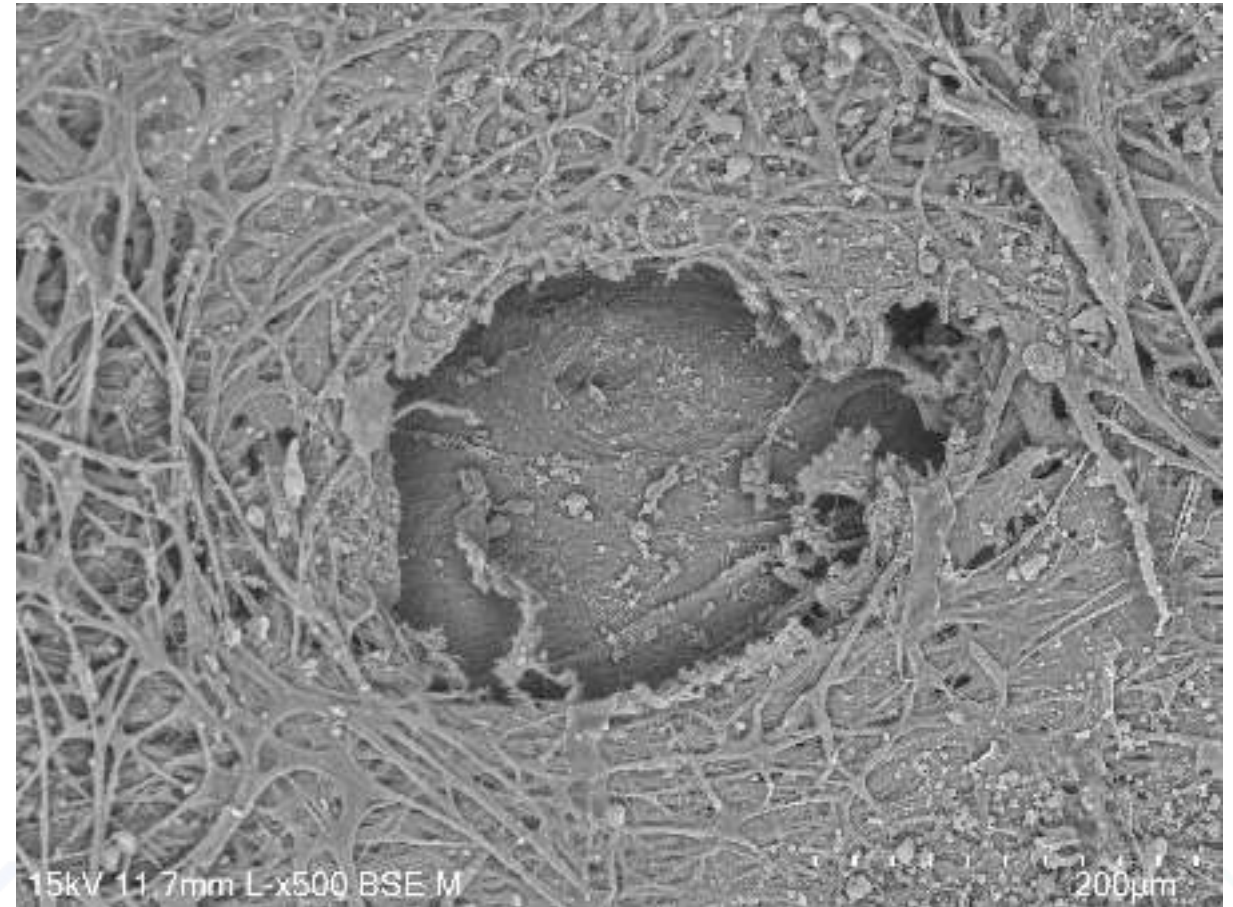
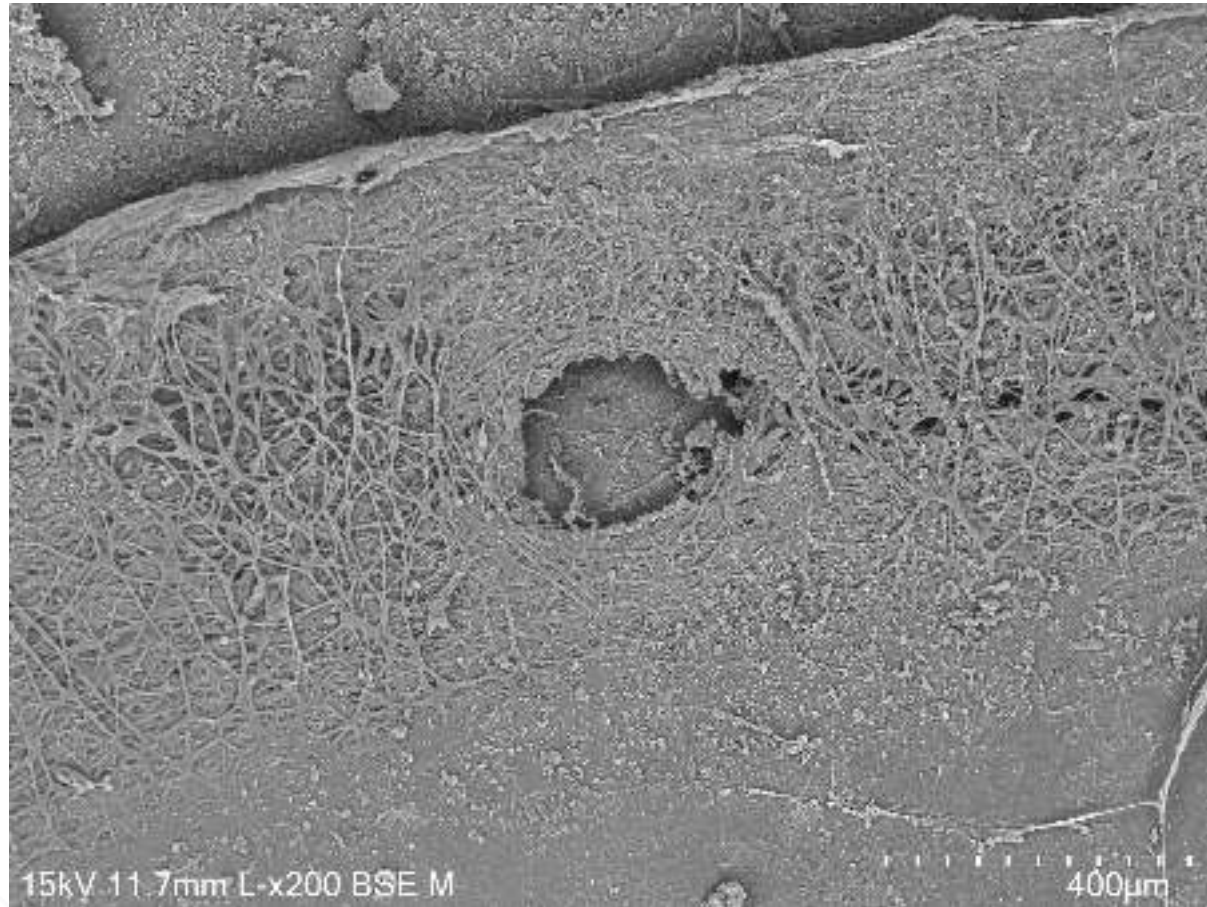
- Easy to use, sterile, disposable handpiece
- Single-use RFID chip technology



elios



SEM imaging of ELIOS 'Microchannels'





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Permissions

ORIGINAL STUDY

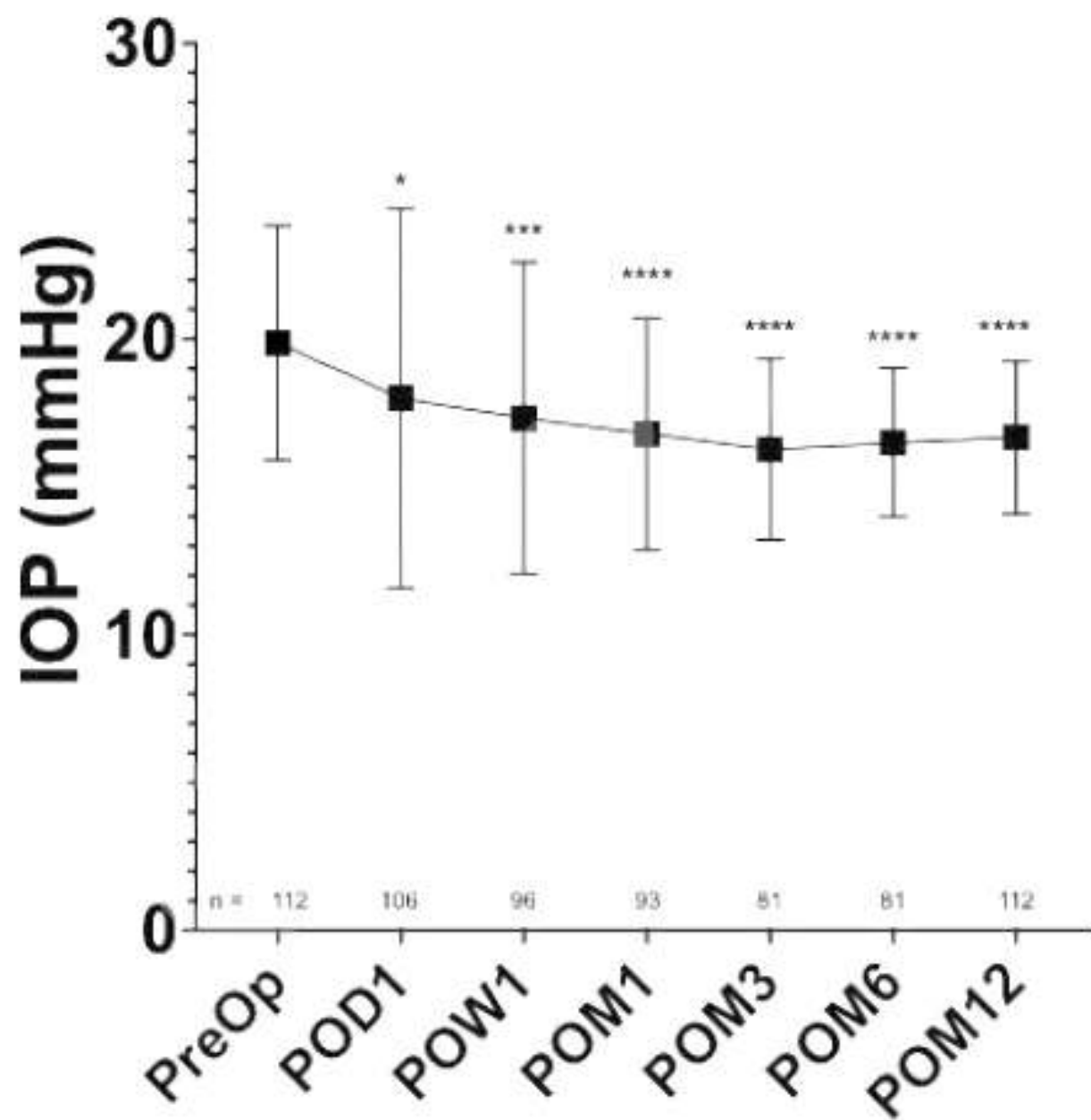
12-month Intraocular Pressure and Hypotensive Medications Outcomes after Phaco-ELIOS Procedure – A Real World Study

Moreno-Valladares, Antonio MD, PhD^{*}; Vinokurtseva, Anastasiya MD^{†,‡}; González-Rodríguez, Johanna Matilde MD[§]; Ahmed, Iqbal Ike K. MD^{†,‡,¶}; Gonzalez-Aquino, Eva MD[#]; Puerto-Amorós, Nieves MD^{*}; Roquet, Esther MD[#]; Soldevila, Anna MD[#]; Canut, María Isabel MD, PhD[#]

Author Information ☺

Journal of Glaucoma ();10.1097/IJG.0000000000002590, May 13, 2025. | DOI: 10.1097/IJG.0000000000002590

IOP in eyes receiving phaco-ELIOS



Pros and cons

Pros

- Implant free
- Minimal trauma

Cons

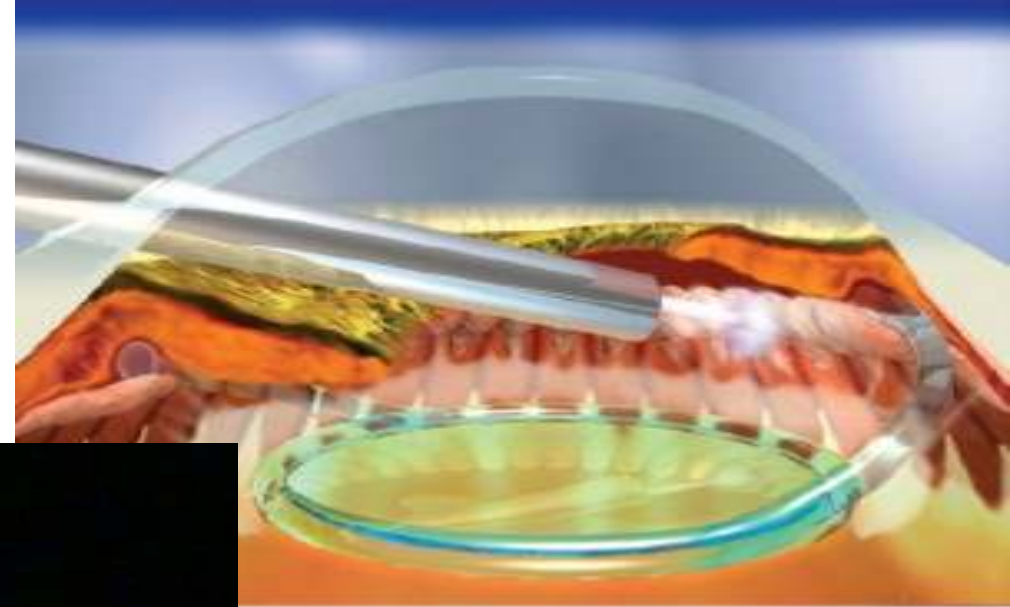
- Limited evidence on long term safety and efficacy (No RCT to date)
- Cost?
- Space occupying consol

ECP/LEOS

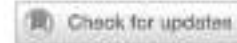
- Endoscopic cyclophotocoagulation (ECP) is a cyclodestructive procedure developed by Martin Uram in 1992



Uram M. Endoscopic cyclophotocoagulation in glaucoma management. Curr Opin Ophthalmol. 1995;6(2):15-29.



ARTICLE OPEN



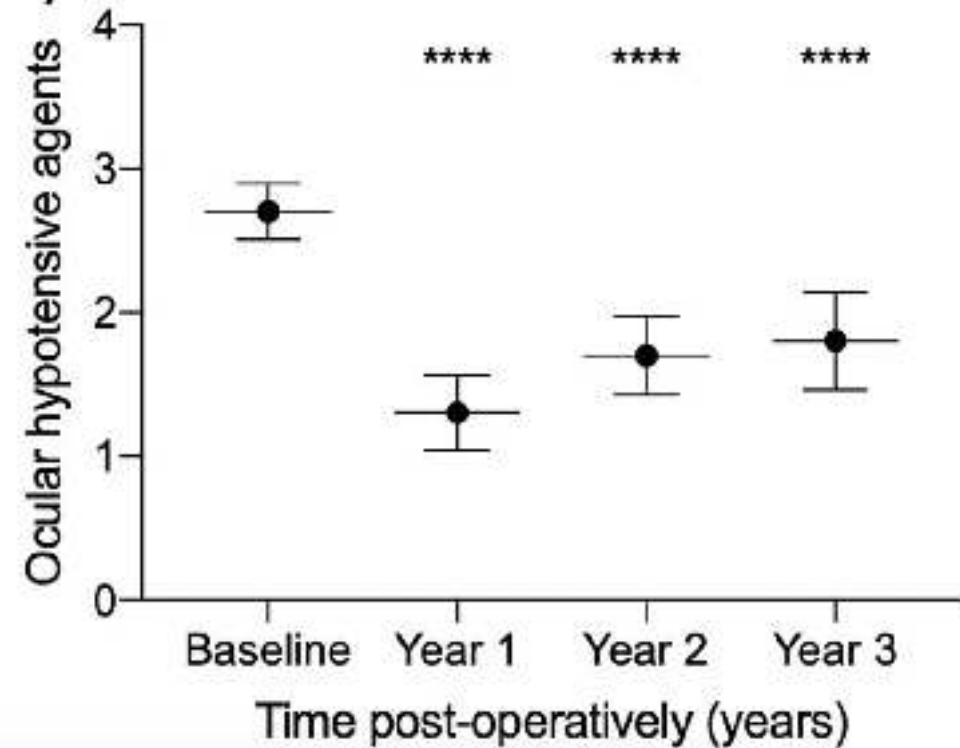
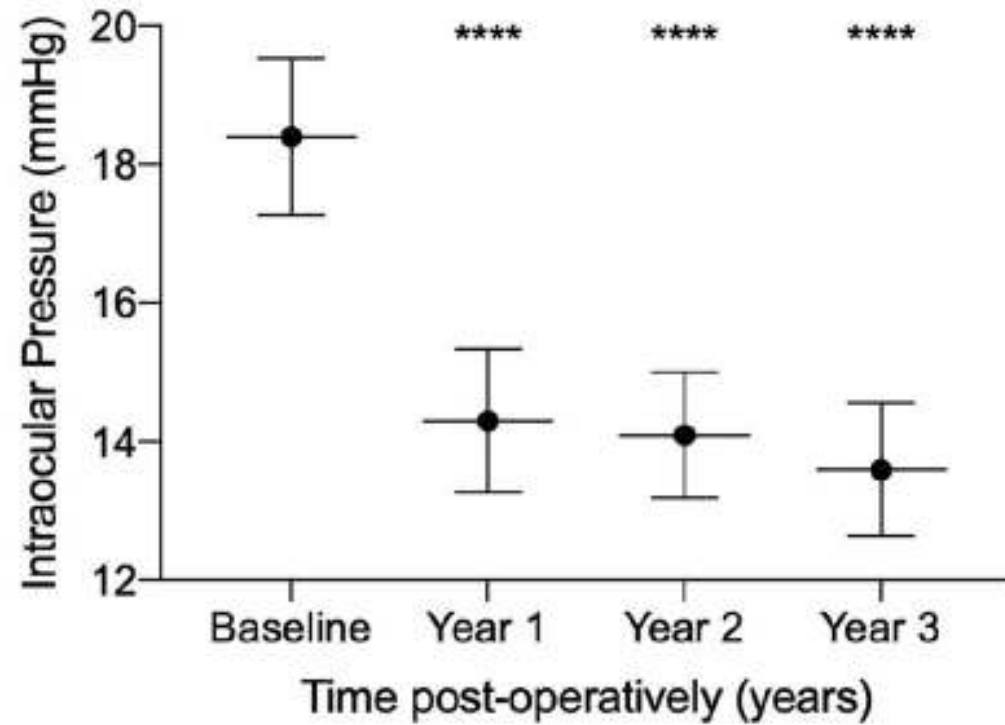
Endocyclophotocoagulation combined with phacoemulsification in surgically naive primary open-angle glaucoma: three-year results

Timothy E. Yap^{1,2}, Piero Zollet^{2,3}, Salman Husein², Mohammad M. M. Murad^{1,4}, Sally Ameen¹, Laura Crawley^{1,2}, Philip A. Bloom^{1,2} and Faisal Ahmed^{1,2} 

Eye **36**, 1890–1895 (2022). <https://doi.org/10.1038/s41433-021-01734-4>

- Retrospective case review of 83 eyes assessing efficacy and safety of ECP
- Complications included
 1. uveitis (6%),
 2. macular oedema (2%),
 3. IOP spikes (1%) and
 4. corneal decompensation (1%)
 5. no episodes of hypotony or retinal detachment

Results





Original Article

Comparing the Effectiveness of Phacoemulsification + Endoscopic Cyclophotocoagulation Laser versus Phacoemulsification Alone for the Treatment of Primary Open Angle Glaucoma in Patients with Cataract (CONCEPT): Study Methodology

Tom Sherman FRCOphth^{1,2}, Ian A.S. Rodrigues FRCOphth², Saurabh Goyal FRCS, FRCOphth², Pouya Alaghband MD, FRCOphth³, Philip Bloom FRCS, FRCOphth⁴, Keith Barton MD, FRCS⁵, Hari Jayaram PhD, FRCOphth⁶, Mohammed Abu-Bakra FRCOphth⁶, Melody Ni PhD⁷, Kin Sheng Lim MD, FRCOphth^{1,2}  

Writing Committee for the CONCEPT Study Writing Group

Pros and cons

Pros

- Affects inflow
(aqueous production)
- Implant free

Cons

- Upfront cost
- Probe cost (can be reused?)
- Pro-inflammatory
(Uveitis, CMO?)



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First-in-Human Safety Study of Femtosecond Laser Image-Guided Trabeculotomy for Glaucoma Treatment

24-month Outcomes

Zoltan Z. Nagy, MD, PhD,¹ Kinga Kranitz, MD, PhD,¹ Iqbal Ike K. Ahmed, MD,^{2,3} Ticiana De Francesco, MD,^{2,4}
Eric Mikula, PhD,^{5,6} Tibor Juhasz, PhD^{5,6,7}



Select eye you wish to do a procedure on.

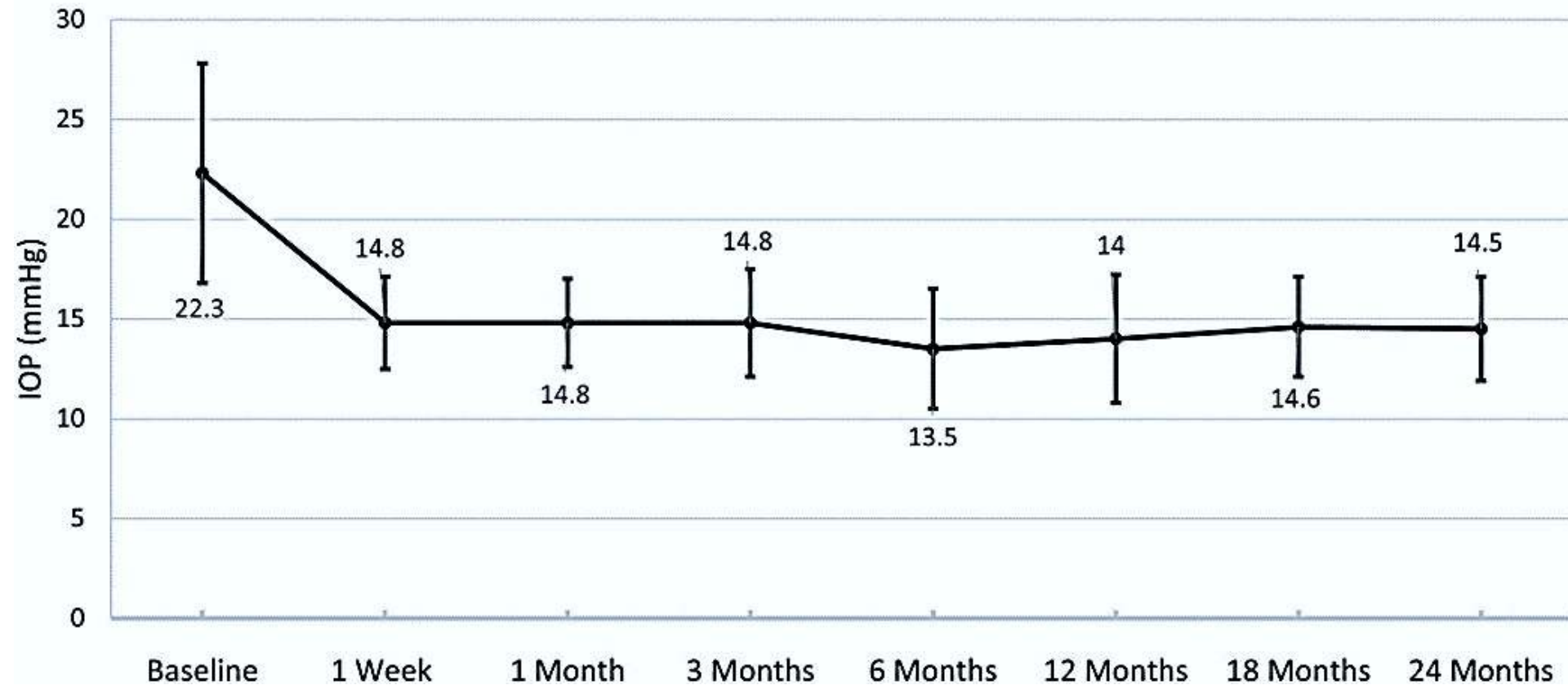
OS - Left

OD - Right



Continue

Results



Single-channel (500 x 200 μ) treatment, no washout (N = 18)

Table 2. Summary of Adverse Events

Adverse Events	Number (%)
Conjunctival hemorrhage	3 (16.7)
Blood reflux	11 (61.1)
VF MD progression ≥ 2.5 dB	2 (11.7)
Loss BCVA ≥ 2 lines	2 (11.7)
Cystoid macular edema	1 (5.5)
IOP spike > 10 mmHg	—
Hyphema	—
Hypotony	—
Peripheral anterior synechiae	—

Pros and cons

Pros

- Implant free
- Non invasive/non-incisional
- Outpatient procedure
- Precision
- Gonio lens free
- Access all 4 quadrants of angle

Cons

- Limited evidence of safety and efficacy
- Cost
- Space occupying consol
- Requires a couch in the laser room in clinic



Conclusion

- There are several new laser procedures available.
- Variety of stent free options are in the market now.
- Limited long-term safety and efficacy data
- Lack of cost-utility analysis
- Lack of head-to-head studies comparing the superiority of different laser treatment
- Varied definition of success limits direct comparison between different procedures



THE FUTURE IS BRIGHT

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