

# Laser Treatments for Glaucoma

Ian McWherter, O.D., F.A.A.O.

Telasight, Inc.

Bennett and Bloom Eye Centers, Louisville, KY

Head of Optometric Telemedicine and Emerging Technology at the Kentucky College of Optometry, Pikeville, KY

September 2023

[ianmcwherter@gmail.com](mailto:ianmcwherter@gmail.com)

# Administrative

- Financial disclosures: Telasight, inc., Allergan, inc.
- COPE Course ID: 78994-LP

# Anatomy

Non-pigmented trabecular meshwork

Schwalbe's line

Pigmented trabecular meshwork

Scleral spur

Ciliary body band

Schwalbe's Line

TM (non-pigmented)

TM (pigmented)

# Anatomy

OS

EYE FOUNDATIONS.ORG

# Anatomy

# Argon Laser Trabeculopasty

- Mechanism: Photocoagulates and constricts fibers of Trabecular Meshwork to pull open adjacent fibers and increase aqueous outflow

## Argon Laser Trabeculopasty

- Argon green laser (529 nm) or Frequency Doubled Neodymium: Yttrium Aluminum-Garnet (Nd:YAG, 532 nm)
- Power: 600 mw
- Spot size: 50 um
- 50 spots per 180 degrees (50 - 100 um between spots)
- Duration: .1 sec (100 ms)
- Target: Aim at junction of anterior and posterior TM

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## Argon Laser Trabeculopasty

- Glaucoma Laser Trial: ALT at least equal to timolol 0.5% in lowering IOP
- Advanced Glaucoma Intervention Study: African Americans did better with ALT first then Trabeculectomy
- Not repeatable
- Not used much today

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## Selective Laser Trabeculopasty

- Mechanism: selectively targets pigment trabecular meshwork cells and increases aqueous outflow through the trabecular meshwork
  - Activates pigmented endothelial cells in trabecular meshwork to release pro-inflammatory cytokines
  - Cytokines attract macrophages
  - Macrophages phagocytize debris in the meshwork and increase aqueous outflow

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## Selective Laser Trabeculoplasty

- Frequency-doubled, Q-switched Nd:YAG laser
- 532 nm
- 0.3 mj - 2.0 mj
- Fixed 400 micro spot size
- 100 spots per 360 degrees
- Fixed 3 ns pulse

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## SLT Studies

- Comparison of Long-term Outcomes of Selective Laser Trabeculoplasty versus Argon Laser Trabeculoplasty in Open-Angle Glaucoma: SLT equivalent to ALT
- Selective Laser Trabeculoplasty Versus Medical Therapy as Initial Treatment of Glaucoma: SLT at least equal to prostaglandin analog in lowering IOP
- Laser in Glaucoma and Ocular Hypertension (LiGHT) trial: SLT is appropriate first line therapy for glaucoma

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## First all OD Laser Study

The image shows a thumbnail of a research article. The title is "Selective Laser Trabeculoplasty versus Brimonidine Tartrate, 0.2%/Timolol Maleate 0.5% as Adjunct Therapy in Primary Open Angle Glaucoma: A Randomized Prospective Pilot Study". The authors listed are Lee M. Hwang, M. David Lerman, Lee Kaplan, Michael Rabinowitz, Adam Rosen, Kirk Ripstein, Ray Siegel, and Frank Miller. The article is published in the HSOA Journal of Ophthalmology & Clinical Research. The abstract indicates that the study compared SLT with medical therapy (brimonidine tartrate and timolol maleate) as adjunct therapy in primary open angle glaucoma. The study was a randomized prospective pilot study.

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## SLT Indications

- Ocular hypertensives at risk for developing glaucoma
- Newly diagnosed open angle glaucoma
- Uncontrolled glaucoma needing additional IOP lowering
- Patient wishing to reduce drop burden
- Allergies to topical medications or ocular surface disease

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## SLT Contraindications

- Neovascular glaucoma
- Uveitis/CME/Inflammatory glaucoma
- Angle recession glaucoma
- Poor angle visualization (narrow angles, peripheral anterior synechia, or corneal edema/haze)
- Uncooperative patient

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## SLT Contraindications

- Severe uncontrolled glaucoma on maximum medical therapy with a high pretreatment IOP (>30mmHg) and target pressure in the low teens

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## SLT Procedure

- Apply SLT gonio lens with topical anesthesia and gel coupling agent
- Initial power setting 1.0 mj, if dense pigment in angle decrease initial energy setting
- Apply treatment to posterior trabecular meshwork
- Titrate power in 0.2 mj steps until there is a visible response of cavitation bubbles or pigment blanching
- Apply 100 evenly spaced spots over 360 degrees of PTM

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## SLT Video



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## SLT Post Op

- Brimoidine 0.2%
- Recheck IOP in 1 hour
- Diclofenac 0.1% tid x 3 days
- Keep on all glaucoma meds and recheck IOP in 6 - 8 weeks

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## SLT Side Effects

- Redness
- Blurred vision
- Inflammation
- Eye pain
- IOP spike

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## SLT Effectiveness

- 80% success rate
- 20-30% IOP reduction
- Takes up to 6 weeks to lower IOP
- Lasts 2 - 3 years
- Repeatable\*\*

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## SLT Pros

- 100% compliance
- 24 hour IOP control
- No ocular surface toxicity
- No phone calls from the pharmacy asking you to switch lasers

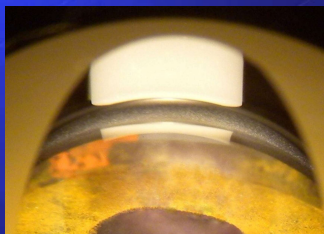
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## SLT Clinical Pearls

- More pigment in Posterior Trabecular Meshwork, decrease power, higher risk for IOP spike
- Pre-Op pilocarpine 1% for better angle visualization
- Lens tilt for better angle visualization
- White band on Latina SLT lens is 45 degrees, count 13 spots per quadrant then rotate lens, gives you 104 spots over 360 degrees

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## SLT Clinical Pearls



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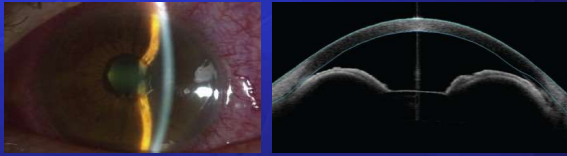
## ALT vs SLT



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## Laser Peripheral Iridotomy

- Mechanism: equalizes pressure gradient between anterior and posterior chamber



## Laser Peripheral Iridotomy

- Argon green laser (529 nm) or Frequency Doubled Neodymium: Yttrium Aluminum-Garnet (Nd:YAG, 532 nm)
  - Power: 600 - 1200 mw
  - Spot size: 50 um
  - Duration: .1 second
- Neodymium: Yttrium Aluminum-Garnet (1064 nm)
  - Power: 4 - 6 mj
  - Offset: 0 um
  - Shot burst: 1 - 3
  - Spot size: fixed (8 um)
  - Duration: fixed (4 ns)

## LPI Indications

- Occludable angle on gonio
- Intermittent, acute, or chronic angle closure with indentable angle on gonio
- Pigment dispersion syndrome?

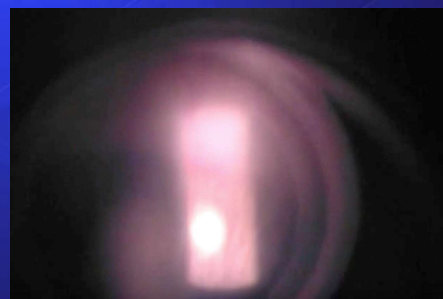
## LPI Contraindications

- Greater than 180 degrees of Peripheral Anterior Synechia
- Completely flat anterior chamber
- Poor visualization of iris (corneal edema/opacity)
- Uncooperative patient

## LPI Procedure

- Pilocarpine 2.0% 20 minutes before procedure
- Apply iridotomy lens with topical anesthesia
- Initial laser energy 4 - 6 mj, 0 um offset, 1 shot burst
- Aim at peripheral iris crypt at 3 or 9 o' clock, avoid major blood vessels.
- "See a flashes, hear a click, feel a snap"
- Watch for plume
- Make LPI about 1 mm

## LPI Video



## LPI Post Op

- Brimoidine 0.2%
- Recheck IOP in 1 hour
- Prednisolone acetate 1% q1h x 2 days then qid x 5 days
- Follow up in 2 weeks for repeat gonioscopy and dilated exam

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## LPI Side Effects

- IOP spike
- Hyphema
- Uveitis
- Corneal edema
- Cataract formation
- Retinal detachment
- CME
- Photopsia/visual disturbances

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## LPI In Fellow Eye

- Do LPI in fellow eye after angle closure attack
- 50% of patients get angle closure in the fellow eye within 5 years.

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## LPI Clinical Pearls

- Dark brown iris are thicker, pretreat with argon laser if available
- Debris/pigment/hemorrhage liberated from the iris during the LPI can prevent the YAG laser from concentrating its energy and having a tissue response. If this happens, let the patient sit for 10-15 minutes to allow the debris to settle and then apply more laser spots. If the debris does not settle, move to a different spot on the iris.

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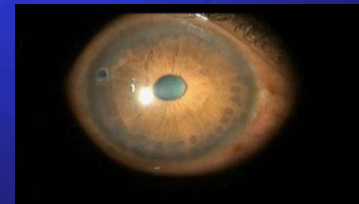
## LPI Clinical Pearls

- If hemorrhage, apply pressure with lens to stop bleeding
- Don't make LPI too far peripherally
- Try to place LPI under upper lid and avoid tear meniscus
- Avoid placing LPI at 12 o'clock due to bubble formation
- If patient will need DSAEK/DMEK make LPI inferiorly

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## Laser Peripheral Iridoplasty

- Mechanism: Photocoagulates and constricts stromal collagen fibers in the peripheral iris to pull the iris away from the iridocorneal angle



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## Laser Peripheral Iridoplasty

- Argon green laser (529 nm) or Frequency Doubled Neodymium: Yttrium Aluminum-Garnet (Nd:YAG, 532 nm)
  - 24 spots per 360 degrees
  - Power: 300 - 500 mw
  - Spot size: 400 um
  - Duration: .5 second

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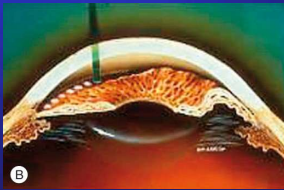
## LPIp Indications

- Residual occludable angle following LPI (plateau iris or angle crowding)
- Acute angle closure if medical therapy contraindicated
- To improve angle visualization for trabeculoplasty

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## LPIp Contraindications

- Neovascular glaucoma
- Uveitis/CME/Inflammatory glaucoma
- Uncooperative patient



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## LPIp Procedure

- Pilocarpine 2.0% 20 minutes before procedure
- Apply Abraham lens with topical anesthesia
- Initial laser energy 400 mw, 400 um spot size, .5 second duration
- Aim for far peripheral iris, end point is visible contraction of iris and deepening of the anterior chamber
- Apply 24 spots per 360 degrees

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## LPIp Video



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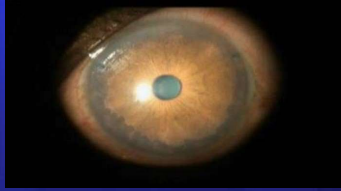
## LPIp Post Op

- Brimoidine 0.2%
- Recheck IOP in 1 hour
- Prednisolone acetate 1% q1h x 2 days then qid x 5 days
- Follow up in 2 weeks for repeat gonioscopy and dilated exam

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## LPIp Side Effects

- IOP spike
- PAS and/or PS
- Uveitis
- Corneal edema



## LPIp Clinical Pearls

- Apply laser outside of cornea arcus
- Avoid large blood vessels, photocoagulation of these blood vessels can lead to iris necrosis
- Decrease power if bubbles or pigment liberation seen

## EndoCycloPhotocoagulation

- Mechanism: ablates ciliary body to reduce aqueous production and lower IOP



## EndoCycloPhotocoagulation

- Minimally invasive
- Fiber-optic endoscope visualizes the ciliary processes
- 810nm diode laser
- 175 watt xenon light

## ECP Indications

- Pseudophakic or visual significant cataract
- Ocular hypertensive at high risk for developing glaucoma
- Mild to moderate glaucoma on 1 or 2 topical medications

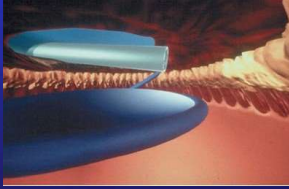
## ECP Contraindications

- Uveitis
- Cystoid macular edema
- Iris or angle neovascularization



## ECP Procedure

- Initial laser setting, 0.25 W with continuous duration
- Power titrated up until visible whitening of ciliary processes occurs
- 360 degrees of the ciliary body is treated



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## ECP Procedure

Before:



After: Ciliary processes are treated until there is shrinkage and whitening



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## ECP Video

### Endoscopic Cyclophotocoagulation

Limbal Approach  
Aphakic Eye

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## ECP Post Op

- Durazolol 0.05%
  - q2h x 2 weeks
  - tid x 1 week
  - bid x 1 week
  - qd x 1 week
- Standard cataract surgery antibiotic and NSAID medications

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## ECP Side Effects

- Chronic uveitis
- CME
- Hyphema
- IOP spike
- Choroidal Detachment
- Retinal Detachment
- Endophthalmitis

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## ECP Effectiveness

- Effective in 80% of patients
- 30% IOP reduction
- Eliminates on average 1 topical glaucoma drop
- 30% of patients achieved IOP less than 19mmHg without medication

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## ECP Glaucoma Management

- Continue all glaucoma meds until the 1 month post op visit, then consider discontinuing 1 topical med if indicated
- Follow up in 1 month to recheck IOP

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## Trans-Scleral CycloPhotoCoagulation

- Mechanism: ablates ciliary body to reduce aqueous production and lower IOP



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## Trans-Scleral CycloPhotoCoagulation

- Minimally invasive
- 810nm diode laser
  - 18 - 24 spots per 360 degrees
  - Power: 1500 - 2500 mw
  - Duration: 1.5 - 3.0 seconds

Target: Apply laser diode 1.2 mm posterior to limbus overlying the ciliary process on the scleral, avoiding 3 and 9 o'clock

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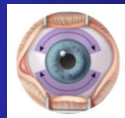
## Trans-Scleral CycloPhotoCoagulation

- Reserved for eyes with limited visual potential (HM or worse) and pain from elevated IOP
- Side effects include, reduced vision, chronic uveitis, hypotony, pain, CME, vitreous hemorrhage, and phthisis

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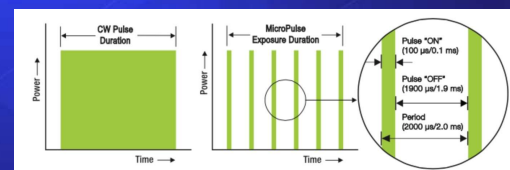
## Micropulse Trans Scleral CycloPhotoCoagulation

- Minimally invasive, uses short bursts of energy to minimize collateral tissue damage
- Less destructive than full power CPC
- 810nm diode laser
  - Continuous application
  - Power: 2000 mw
  - Duration: 120 seconds (60 seconds applied to each hemisphere) avoiding 3 and 9 o'clock
  - Frequency: micropulse, 31.3% Duty cycle



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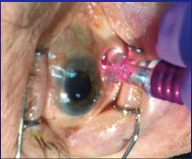
## Micropulse CPC



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## Micropulse CPC

- Reduces IOP around 30%
- Effective 70% of the time
- Less risk of uveitis, hypotony, CME, and phthisis than continuous wave trans scleral cyclophotocoagulation
- Can be considered in eyes with good visual potential
- May be repeatable



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## Micropulse SLT

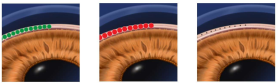
- 532 nm
- 1000 mW
- Fixed 300 micro spot size
- 300 ms
- 15% Duty cycle
- 360 degree confluent applications

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## Micropulse SLT

- Less inflammation
- Less discomfort
- Same initial effectiveness as SLT
- Long term outcomes?
- Repeatable?

	MLT	SLT	ALT
Wavelength	532 nm, 677 nm	532 nm	488/514 nm, 532 nm
Mechanism	Thermally effects - not destroys pigmented TM cells	Selective destruction of pigmented TM cells without thermal or collateral damage	Shrinkage of TM with adjacent atresia
Repeatable	Yes	Yes	No
Treatment Endpoint	No visible tissue reaction	Small bubbles	Bleaching (pink) to bubbles (green)
Post op inflammation	None	Yes	Yes
Spot Size	300 µm Inverts spot to access narrow angles	400 µm	50 µm



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# Questions?

## Thank You.

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