LASER PROCEDURES IN OPTOMETRIC PRACTICE

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Disclosures:

- Sun Pharmaceuticals: speakers bureau,
- AbbVie: advisory board
- Thea: advisory board
- Apellis: speakers bureau
- Tarsus: advisory board

- All financial relationships have been mitigated.

Overview

- Why we use lasers

- YAG capsulotomy
- Laser Peripheral Iridotomy (LPI or PI)
- Selective Laser Trabeculoplasty (SLT)
- Laser Floater Removal

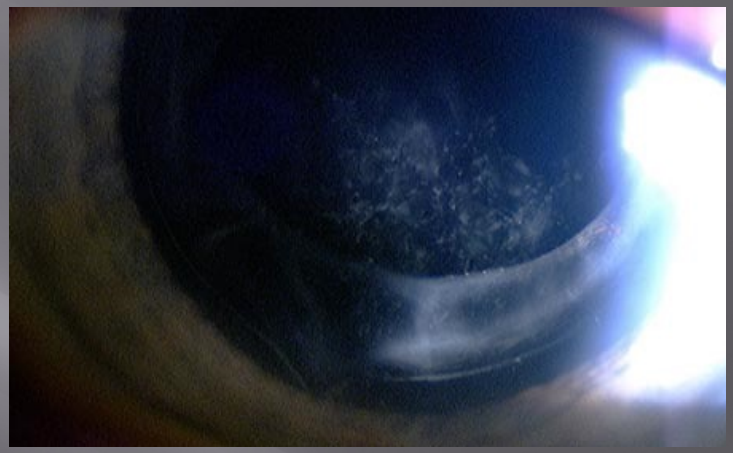
Why do we use lasers?

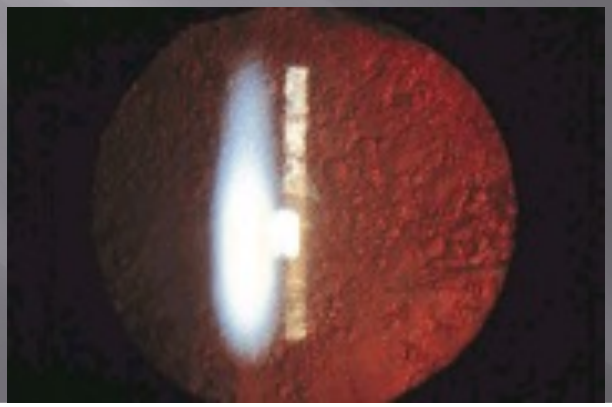
- Vision is decreased from PCO following cataract surgery
- Narrow angles/angle closure
- Glaucoma is progressing in a pt on max meds
  - Something else needs to be done
  - Surgery not wanted yet
- Compliance issues
- Cost issues
- Convenience issues
- Doctor preference

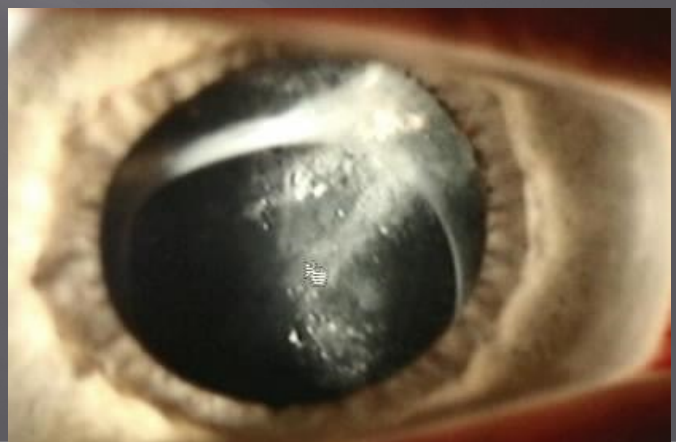
PCO

- Incidence:
  - Most common complication of post extra capsular cataract extraction (ECCE)
  - Time from surgery to visually significant opacification varies from months to years in adults.
  - Almost 100% opacification occurs within 2 years after surgery in younger groups. Rate of opacification declines with increasing age.
  - The incidence of posterior capsule opacification varies with different studies
    - 10-80% of eyes following cataract surgery
    - Can form anywhere from a few days to years post surgery
  - IOL's
    - Silicone > acrylic
- Prevention:
  - Capsulotomy during surgery
  - Posterior capsular polishing

PCO







YAG Laser

- Nd: YAG laser
  - Neodymium: Yttrium aluminum garnet laser

- Tissue interaction: Photodisruptive laser
  - High light energy levels cause the tissues to be reduced to plasma, disintegrating the tissue
  - A large amount of energy is delivered into very small focal spots in a very brief duration of time
    - 4 nsec
  - No thermal reaction/No coagulation when bv's are hit
  - Pigment independent*

YAG Capsulotomy and RD??

- Several studies have shown that YAG capsulotomy does not significantly increase risk of RD
- male gender, young age and low IOL dioptric power corresponding to high myopia were confirmed as risk factors for PRD after phacoemulsification surgery.
- Real world evidence suggests that Nd:YAG capsulotomy does not increase the risk for PRD.
- This raises the question of the need for intensive follow-up after Nd:YAG capsulotomy and supports a more flexible schedule.

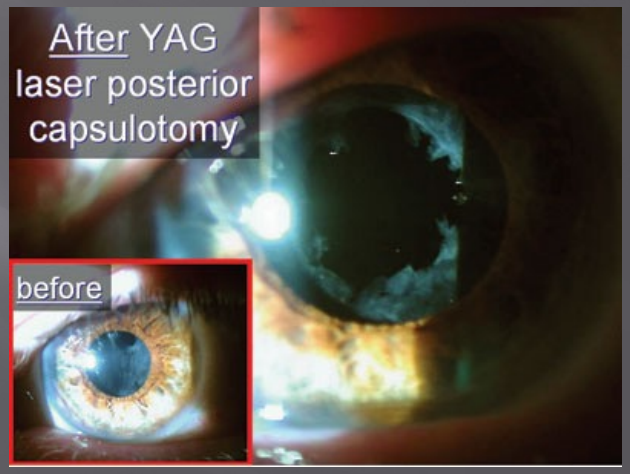
Elbaz U, Hakkala L, Hecht I, Achiron A, Gershoni A, Tuuminen R. Nd:YAG capsulotomy is not a risk factor for retinal detachment after phacoemulsification cataract surgery. Acta Ophthalmol. 2021 Nov;99(7):e1018-e1026. doi: 10.1111/aos.14757. Epub 2021 Jan 10. PMID: 33423371.

YAG by OD's

- Lighthizer N, Johnson S, Holthaus J, Holthaus K, Cherian B, Swindell R, Weber B, Weise K, Cockrell D, Lewis S, Wroten C, Anastasio J, Ellen J, Miller JM. Nd:YAG Laser Capsulotomy: Efficacy and Outcomes Performed by Optometrists. Optom Vis Sci. 2023 Oct 1;100(10):665-669.
- Conclusion: Based on the outcomes of this study, YAG laser capsulotomies are effective treatments to improve patient vision that can be safely and effectively performed by optometrists.

YAG Procedure

- Create a cruciate opening, beginning superiorly near the 12 o'clock position and progressing downward toward the 6 o'clock position
- The capsulotomy should be as large as the pupil in isotopic conditions, such as driving at night, when glare from the exposed capsulotomy edge is most likely.



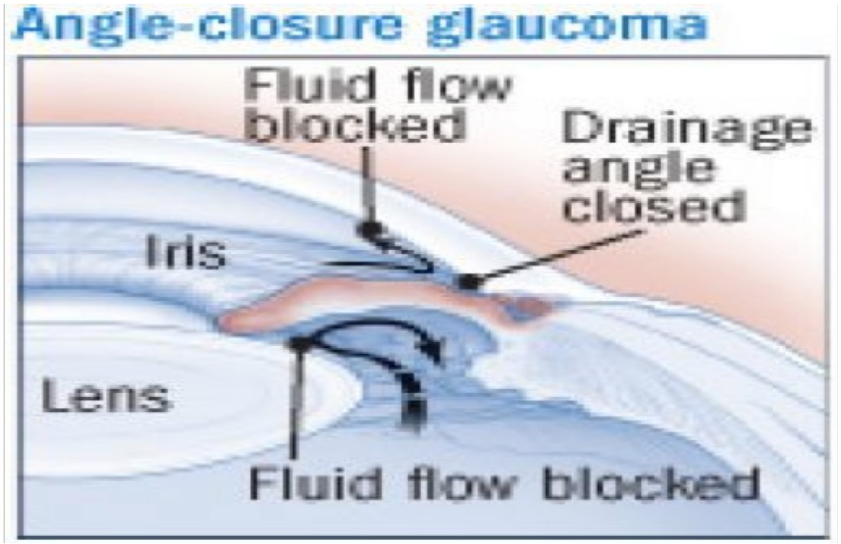
YAG Cap Procedure Post-OP

- Post-op Care
  - Remove laser lens (if used)
  - Rinse Eye/Clean eye
  - 1 drop of Alphagan or Iopidine post-laser
  - IOP measurement 15-30 minutes post-laser
- Post-op drops
  - Pred Forte QID to surgical eye X 1 week
  - Pt ed – S/S of RD
- RTC 1 week for f/u

- 1 Week Post-Op
- VA's
- Anterior segment exam
  - Check for cell/flare
- Check IOP
- Dilate
  - Check for holes/tears/RD's
- D/C Pred Forte
- Release back to referring doc

Primary Angle Closure Etiology

- Pupillary block is the most frequent and important mechanism responsible for angle closure
  - in many cases it is not the only mechanism involved
    - Iris angle-crowding may co-exist with pupillary block to cause the angle closure



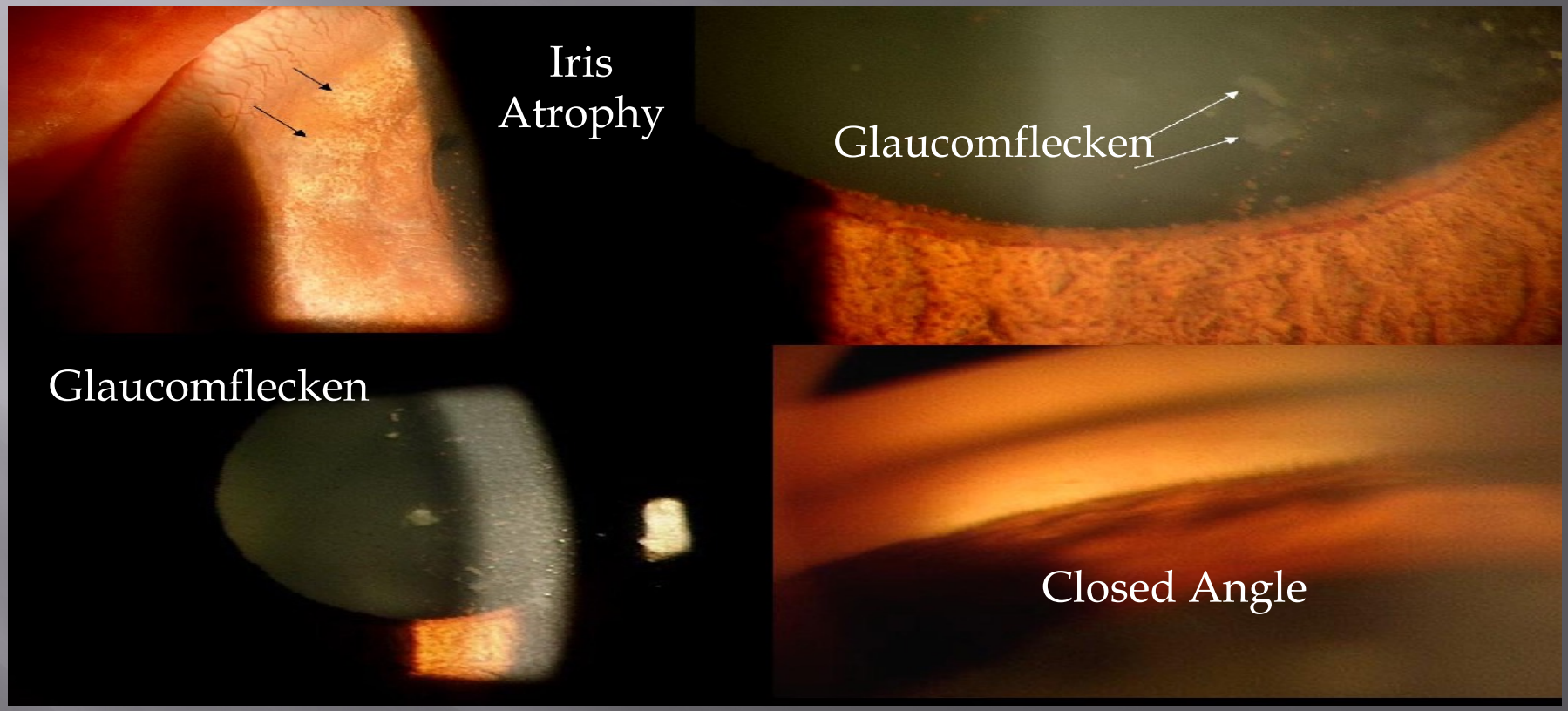
Acute Angle Closure Definition

- acute angle closure is defined as at least 2 of the following symptoms:
  - ocular pain,
  - nausea/vomiting, and a
  - history of intermittent blurring of vision with halos;
- and at least 3 of the following signs:
  - IOP greater than 21 mm Hg,
  - conjunctival injection,
  - corneal epithelial edema,
  - mid-dilated nonreactive pupil, and
  - shallower chamber in the presence of occlusion.

PAC: Hallmark Characteristics

- The most significant clinical hallmarks of an eye with angle-closure are:
  - **Shallow AC** and **Narrow Angle**
    - Decreased AC volume, small corneal diameter, and short axial lengths are all characteristic of eyes with PACG
    - **Mean anterior chamber depth in PAC eyes is 1.8 mm. PAC is rare in AC depths of 2.5 mm or greater.**
- The most satisfactory explanations for the more shallow AC is:
  - age related increase in lens thickness and more anterior position of the lens

Acute Angle Closure

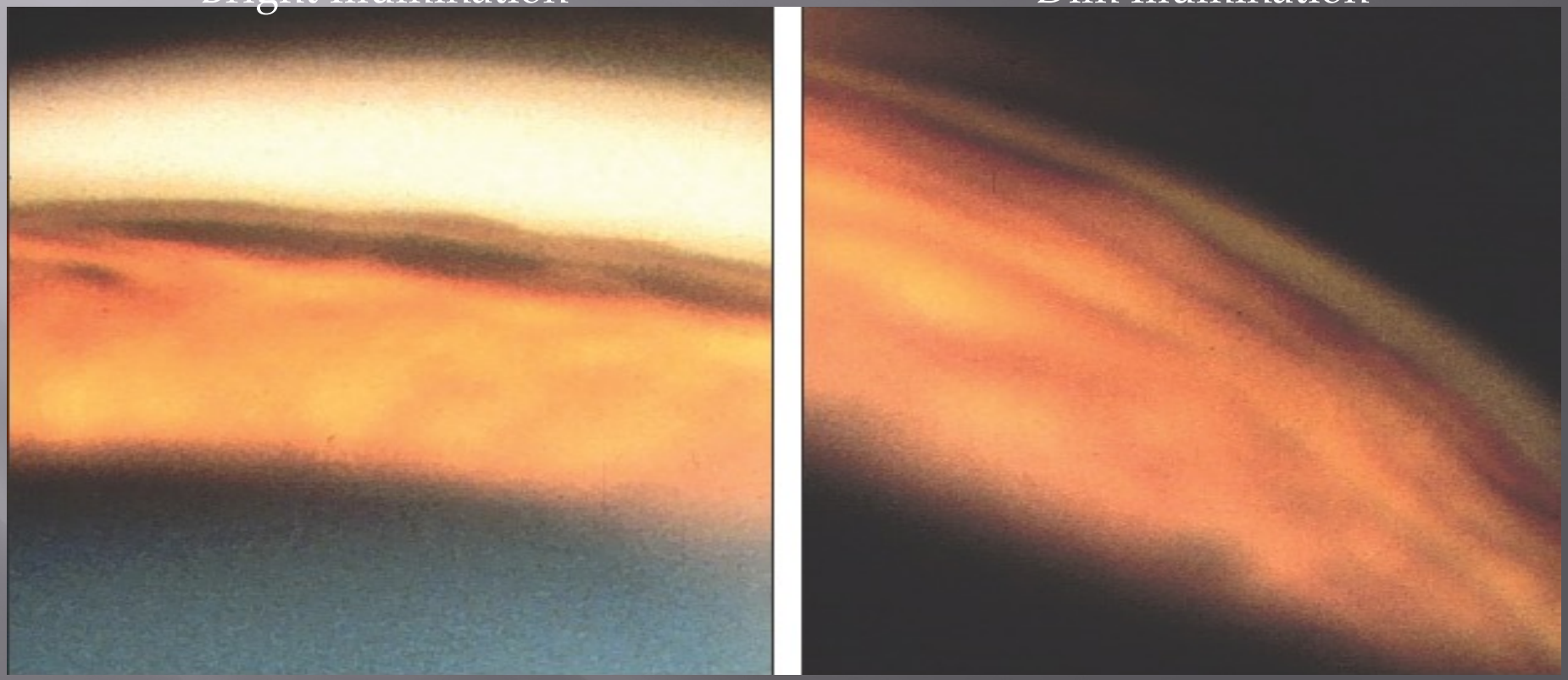


http://www.biomedcentral.com/1471-2415/6/29/figure/F2?highres=y

Angle Structure: Bright/Dim Illumination

Bright Illumination

Dim Illumination



http://www.meduweb.com/showthread.php?t=3667

PI or not to PI……ZAP Study

- ZAP study:
  - Final Conclusions:
    - "Laser peripheral iridotomy had a modest, albeit significant, prophylactic effect"
    - "The number needed to treat was 44 to prevent one case of new primary angle closure disease over 6 years, the vast majority of which were not acute attacks."
      - Treat 44 PACS patients with laser PI to prevent 1 from going to PAC
    - "Assuming that these primary angle closure cases have a 35% risk of developing sight loss from glaucoma over a further 5 years, and assuming that prevention of sight loss would be the ultimate goal of prophylactic laser iridotomy, then the total number needed to treat (over approximately a decade) would be around 126 people."
      - Treat 126 PACS patients with laser PI to prevent 1 from losing vision from PAC or PACG
    - "Widespread prophylactic laser peripheral iridotomy for primary angle-closure suspects is not recommended"

When to Consider an Iridotomy

- ***Those who have symptoms such as pain or headaches.*** These individuals might be good candidates for an LPI because those symptoms suggest that they may already be having intermittent angle closure.
- ***Patients with diabetes.*** The Singapore study showed that diabetes is a risk factor for progressing to angle closure. This might be true in part because these patients are dilated frequently during exams, but it could also be because people with diabetes tend to have some autonomic dysfunction, which could affect the pupil.
- ***People who are being dilated on a regular basis to monitor other conditions.*** Those conditions would include macular degeneration and diabetes. Dilating the pupil can provoke an acute angle-closure attack, so regular dilation puts these individuals at greater risk.
- ***Patients who have poor access to follow-up.*** If a patient may not be able to easily get help should an angle-closure attack occur, it makes sense to lower the risk as much as possible.
- ***Patients whose families have a history of angle closure glaucoma.*** This could indicate a higher-than-average risk.
- The LPI decision also has medico-legal ramifications.
  - No one wants to be sued for not having done the procedure if an angle-closure attack happens later.

Angle-closure suspects and LPI's. Yes or No? Review of Ophthalmology. PUBLISHED 10 OCTOBER 2021

Pacific University Oregon

PI Pre-op Exam

- Visual acuity
- Slit Lamp Exam OU
  - Note lid position
  - Note AC depth
- Gonio OU
  - Pigment in the TM?
  - Neovascularization?
  - Peripheral anterior synechiae?
- IOP's OU

- Educate Pt
- Informed Consent Signed

PI Risks, Complications, Contraindications

CONTRAINDICATIONS

1. Corneal problems
2. Intraocular inflammation
3. Iris in contact with endo
4. Angle closure from NVG or inflammatory glaucoma
5. Patient unable to hold steady or fixate
6. Macular problems?

RISKS/COMPLICATIONS

1. Non-perforation
2. IOP spike/elevation
   - Most often transient
3. Inflammation
   - Pred Forte QID X 1 week
   - Use appropriate laser energy

- Others: hyphema, synechiae, peaked pupil, floaters, blur, monocular diplopia, RD, permanent vision loss

PI Procedure

- Patient Pre-op Drops
  - 1 drop Pilocarpine 1% or 2% OU
  - 1 drop Alphagan or Iopidine OU
- Laser Settings
  - Depends on which laser you use

PI Procedure

- Sit patient comfortably
- Adjust laser for your comfort
  - Armrest, oculars, controls
- Instill proparacaine in both eyes
- Select PI location
  - Usually superiorly under lid
  - Crypt
  - 11:00 or 1:00
- Place Abraham Iridotomy laser lens on eye with goniosol or celluvisc
  - Orientation of lens matters
  - Button @ 11 or 1 o'clock (for a superior PI)

PI Procedure

- Focus HeNe beams on the iris
- Perform the procedure OU
  - Argon first for pre-treatment
  - YAG to finish PI
  - No pain for patients - usually
  - May feel popping/snap/clap in ears

  - Takes longer than a YAG Cap
    - Occasional bleeding
    - Debris/pigment
      - "pigment plume"

PI Procedure

- Often times it takes 2 visits to finish PI
  - 70-80% through the first visit
  - 150-250 mJ maximum energy for me on 1 visit
- Goals:
  - patent PI ≈ 1mm in size
  - Deepening of the AC
  - IOP control

PI Procedure

- Post-op Care
  - Remove laser lens
  - Rinse Eye/Clean eye
  - 1 drop of Alphagan or Iopidine post-laser
  - IOP measurement 30 minutes post-laser
- Post-op drops
  - Pred Forte QID to surgical eye X 1 week
- Pt ed
- RTC 1 week for f/u

1 week post-operative exam

- VA's
- Anterior segment exam
  - Check for cell/flare
  - Note AC depth
  - Is the PI patent?
- Gonio – did angle deepen?
- Check IOP

- D/C Pred Forte
- Release back to referring doc

Why do we need lasers?

- Glaucoma is progressing in a pt on max meds
  - Something else needs to be done
  - Surgery not wanted yet
- Compliance issues
- Cost issues
- Convenience/quality of life issues
- Systemic side effect issues of drops
- Doctor preference

Selective Laser Trabeculoplasty (SLT)

- Newer form of laser therapy for patients with glaucoma
- Presented as an alternative to filtering surgery for patients whose open angle glaucoma was not controlled by meds
- Exact mechanism of effect is unknown but:
  - Biologic effects with increased inflammatory cells with "clean up" the TM
    - Laser energy causes chemical mediators to attracts macrophages and phagocytes to come and clean up the debris in the TM

Selective Laser Trabeculoplasty (SLT)

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- Traditionally presented as an alternative to filtering surgery for patients whose open angle glaucoma was not controlled by meds
- Exact mechanism of effect is unknown but:
  - Biologic effects with increased inflammatory cells with "clean up" the TM
    - Laser energy causes chemical mediators to attracts macrophages and phagocytes to come and clean up the debris in the TM

SLT Versus PGA Medication Study

Conclusions: IOP reduction was similar in both arms after 9 to 12-months follow-up. More treatment steps were necessary to maintain target IOP in the medication group, although there was not a statistically significant difference between groups. These results support the option of SLT as a safe and effective initial therapy in open-angle glaucoma or ocular hypertension.

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

*Gus Gazzard, Evgenia Konstantakopoulou, David Garway-Heath, Anurag Garg, Victoria Vickerstaff, Rachael Hunter, Gareth Ambler, Catey Bunce, Richard Wormald, Neil Nathwani, Keith Barton, Gary Rubin, Marta Buszewicz; on behalf of the LiGHT Trial Study Group**

Summary

Background Primary open angle glaucoma and ocular hypertension are habitually treated with eye drops that lower intraocular pressure. Selective laser trabeculoplasty is a safe alternative but is rarely used as first-line treatment. We compared the two.

Methods In this observer-masked, randomised controlled trial treatment-naive patients with open angle glaucoma or ocular hypertension and no ocular comorbidities were recruited between 2012 and 2014 at six UK hospitals. They were randomly allocated (web-based randomisation) to initial selective laser trabeculoplasty or to eye drops. An objective target intraocular pressure was set according to glaucoma severity. The primary outcome was health-related quality of life (HRQoL) at 3 years (assessed by EQ-5D). Secondary outcomes were cost and cost-effectiveness, disease-specific HRQoL, clinical effectiveness, and safety. Analysis was by intention to treat. This study is registered at controlled-trials.com (ISRCTN32038223).

Findings Of 718 patients enrolled, 356 were randomised to the selective laser trabeculoplasty and 362 to the eye drops group. 652 (91%) returned the primary outcome questionnaire at 36 months. Average EQ-5D score was 0·89 (SD 0·18) in the selective laser trabeculoplasty group versus 0·90 (SD 0·16) in the eye drops group, with no significant difference (difference 0·01, 95% CI –0·01 to 0·03; p=0·23). At 36 months, 74·2% (95% CI 69·3–78·6) of patients in the selective laser trabeculoplasty group required no drops to maintain intraocular pressure at target. Eyes of patients in the selective laser trabeculoplasty group were within target intracoluar pressure at more visits (93·0%) than in the eye drops group (91·3%), with glaucoma surgery to lower intraocular pressure required in none versus 11 patients. Over 36 months, from an ophthalmology cost perspective, there was a 97% probability of selective laser trabeculoplasty as first treatment being more cost-effective than eye drops first at a willingness to pay of £20 000 per quality-adjusted life-year gained.

Interpretation Selective laser trabeculoplasty should be offered as a first-line treatment for open angle glaucoma and ocular hypertension, supporting a change in clinical practice.

Funding National Institute for Health Research, Health and Technology Assessment Programme.

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*Names listed at the end of the Article

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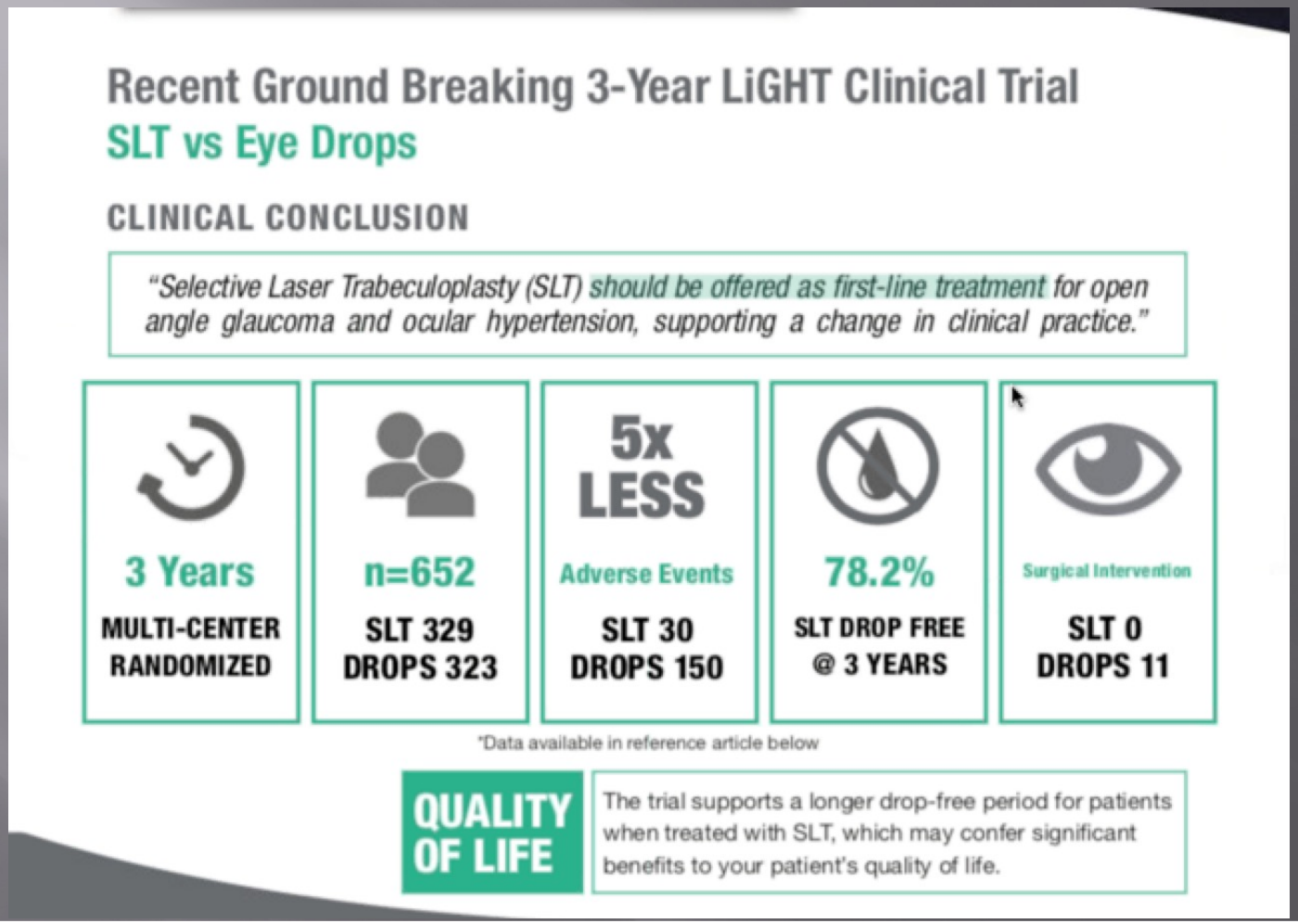
SLT as first line treatment?



LiGHT Trial 6-Year data

- Released Sept 2022
- At 6 years:
  - No significant difference in health-related quality of life (HRQL) in 3 of the 4 questionnaires
  - SLT had better scores in the GSS (glaucoma symptoms scores) quality of life measurement
  - 69.8% of SLT patients remained at or below target without other intervention
  - More eyes in the drop arm exhibited disease progression (26.8% vs 19.6%)***
  - Trabeculectomy required in 32 eyes in drop arm, 13 eyes in SLT arm
  - More cataract surgeries in the drop arm (95 compared to 57) – statistically significant
  - No serious laser related adverse events
- Conclusion
  - SLT is a safe treatment for OAG and OHT, providing better long-term disease control than initial drop therapy, with reduced need for incisional glaucoma and cataract surgery over 6 years.

SLT: OD's versus OMD's

- Lee CN, Delaney A, Richardson JAL, Freeman G, Gunn PJG, Harthan S, Dubois V, Yau K, Hemmerdinger C, Harper R, Vallabh NA. Comparative outcomes of selective laser trabeculoplasty delivered by optometrists compared with ophthalmologists: a UK-based multicentre observational study. BMJ Open Ophthalmol. 2024 Oct 2;9(1)
- **Conclusion:** Outcomes of SLT treatment by optometrists and ophthalmologists are comparable up to 24 months post-treatment. Ophthalmologist-treated eyes may have had more aggressive eye-drop treatment, preventing the need for surgery.

SLT Post-operative Period

- Post-op Care
  - 1 drop of Alphagan or Iopidine
  - Check IOP 15-30 minutes after the procedure
  - Continue all glaucoma meds
  - Give pt post-op med(s): NSAID or Steroid?
  - RTC 1-2 weeks for f/u
- 1-2 week post-op exam:
  - Check IOP
  - Check for A/C reaction
    - Should be minimal to no C&F
- 6 week post-op exam:
  - Check IOP
  - Start to consider reducing glaucoma meds if pressure is reduced

Automated Direct Selective Laser Trabeculoplasty: First Prospective Clinical Trial

Mordechai Goldenfeld[1], Michael Belkin[2], Masha Dobkin-Bekman[3], Zachary Sacks[3], Sharon Blum Meirovitch[1], Noa Geffen[4,5], Ari Leshno[1,4], and Alon Skaat[1,4]

[1] The Sam Rothberg Glaucoma Centre, Goldschleger Eye Institute, Sheba Medical Centre, Tel Hashomer, Israel
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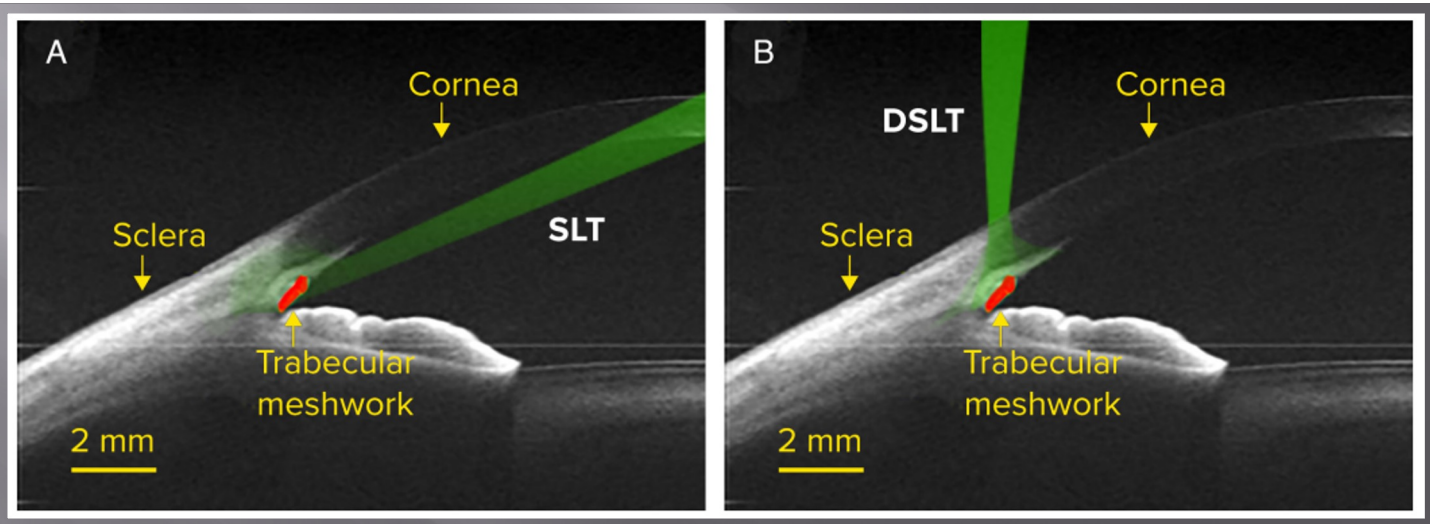


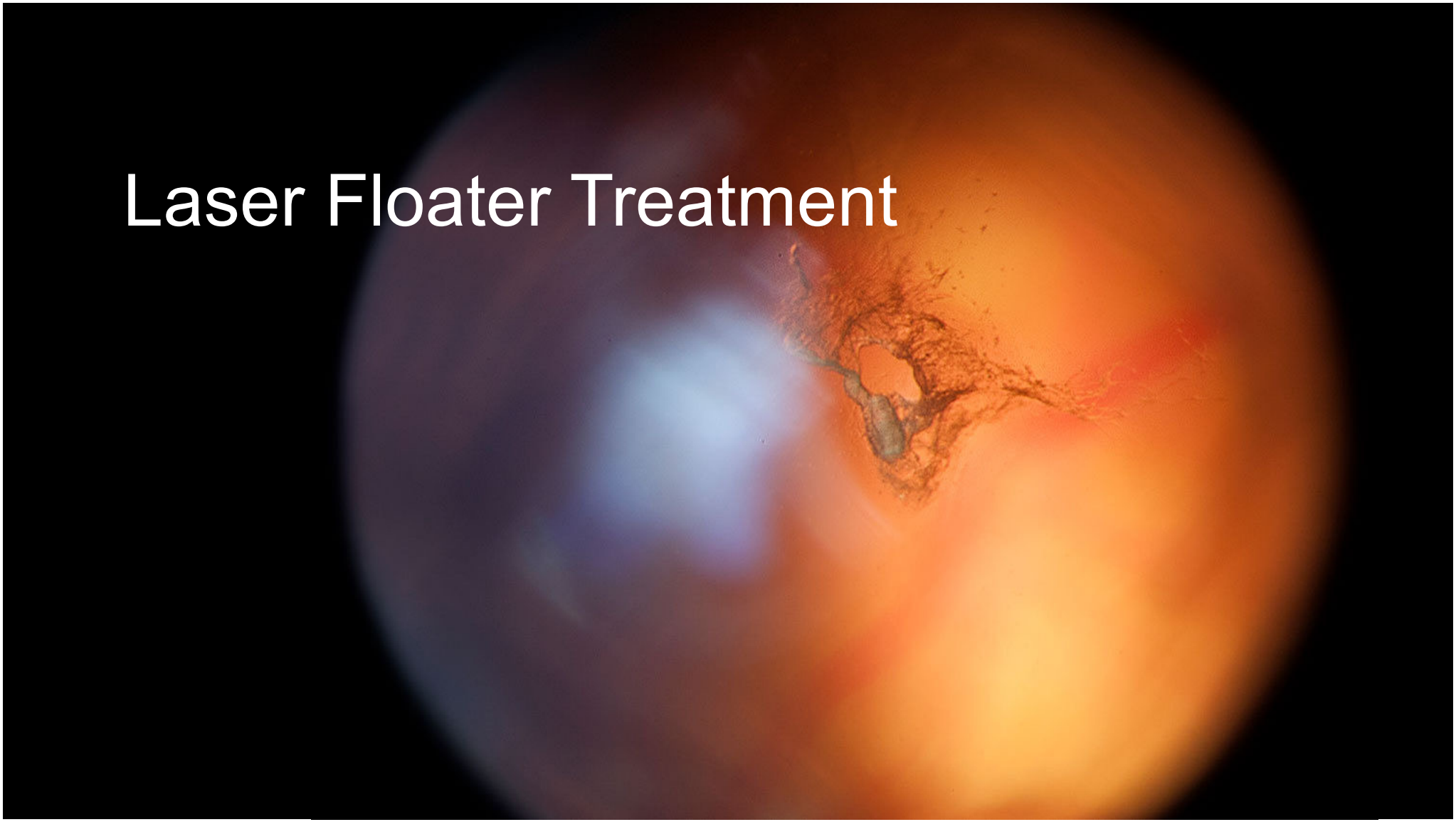
2021

SLT Gonio Lens

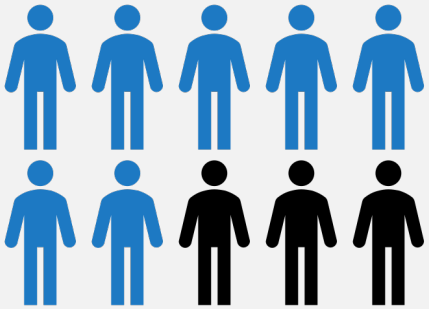
Latina Lens

Rapid Lens

Laser Floater Treatment



Vitreous opacities impact visual function



7 IN 10 **PEOPLE WILL HAVE FLOATERS AT SOME POINT IN THEIR LIVES.**

Vision with Floaters

What causes floaters

Age

During aging, vitreous gel begins to decrease in volume while the amount of liquid vitreous increases. This process of liquefaction induces macromolecular changes in collagen-hyaluronan interaction and lead to structural inhomogeneities throughout the vitreous body, causing floaters to form.

Myopia

Myopic eyes have excessive liquefied corpus vitreous compared to vitreoretinal adhesion, which can lead to anomalous PVD, increasing the incidence of floater formation.

Uveitis

Uveitis causes blood vessels to leak and cause floaters in the vitreous and reduced vision.

Post-cataract surgery

Cataract surgery can sometimes accelerate the detachment of the vitreous, which can lead to floaters. Patients may also become more aware of pre-existing floaters when the cloudy cataract which masked them no longer obscures their vision.

Diabetic eye disease

Studies have demonstrated that hyperglycemia can cause physiochemical changes to vitreous collagen, which may lead to observed vitreous degeneration and liquefaction resulting in cross-linking collagen fibers (floater formation).

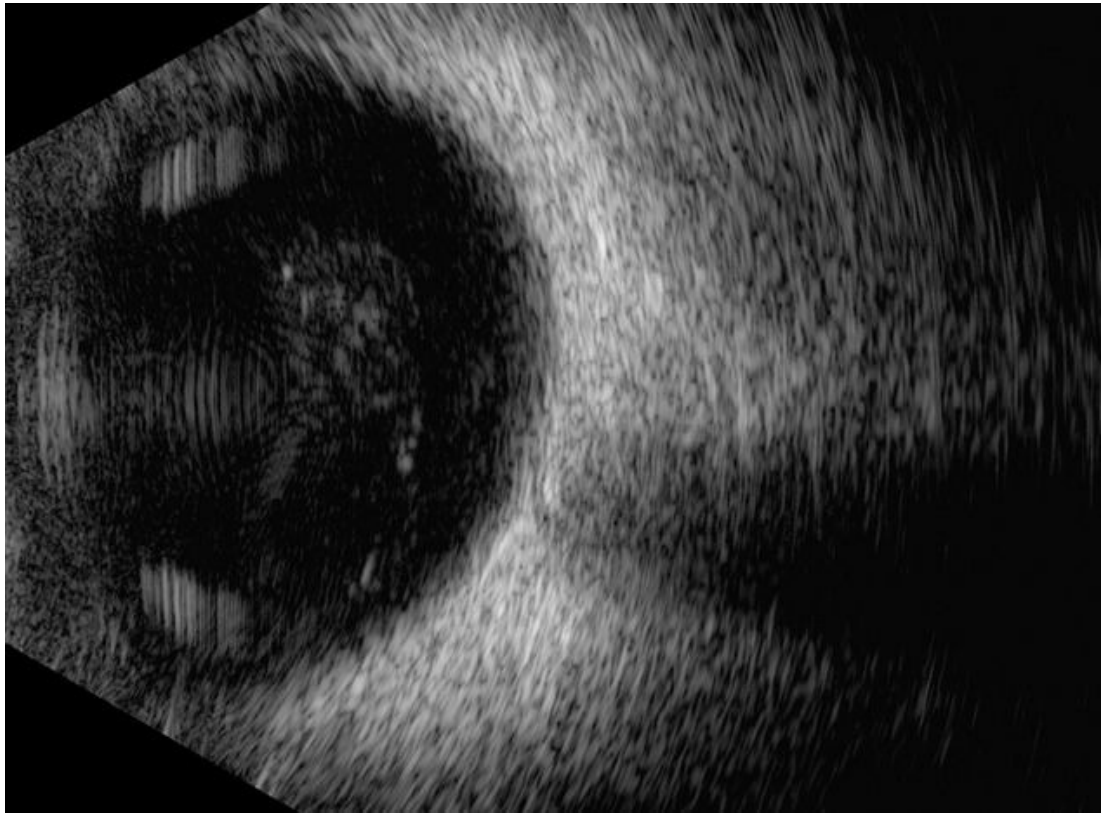
Trauma

Severe eye injuries can potentially change the structure of the vitreous, leading to a greater likelihood of developing floaters.

Assessment of floaters — Slit lamp exam

Slit lamp examination showing floater pre-treatment

Assessment of floaters — B-scan



B-Scan, 12 MHz Posterior
Weiss Ring floater located in mid-posterior vitreous

Treatment for floaters

Treatment Options for Vitreous Opacities

1. Do Nothing. Reassure: “Try to live with it”
2. Perform Laser Treatment for the Vitreous Opacity
3. Refer for Floater-only Vitrectomy

Incidence and nature of complications associated with YAG laser vitreolysis.

RESULTS

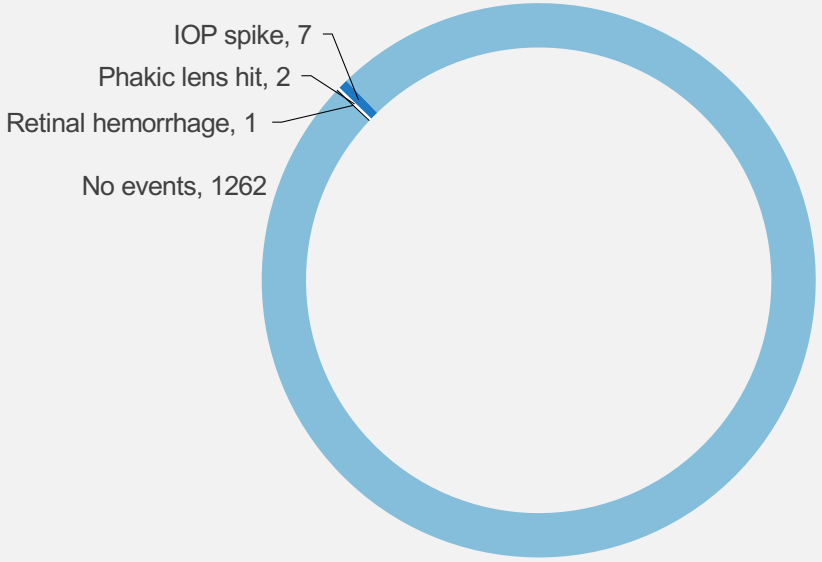
Patients with IOP spikes (28 mmHg – 48 mmHg) were placed on topical antihypertensive medications (average post-medication IOP, 19 mm Hg).

All IOP spikes were seen in pseudophakic post YAG capsulotomy patients.

The case of retinal hemorrhage resolved in 3 months with no long-term negative effects.

No macular pathology was induced or worsened.

No patients complained that their floaters were worse after treatment sessions were completed.



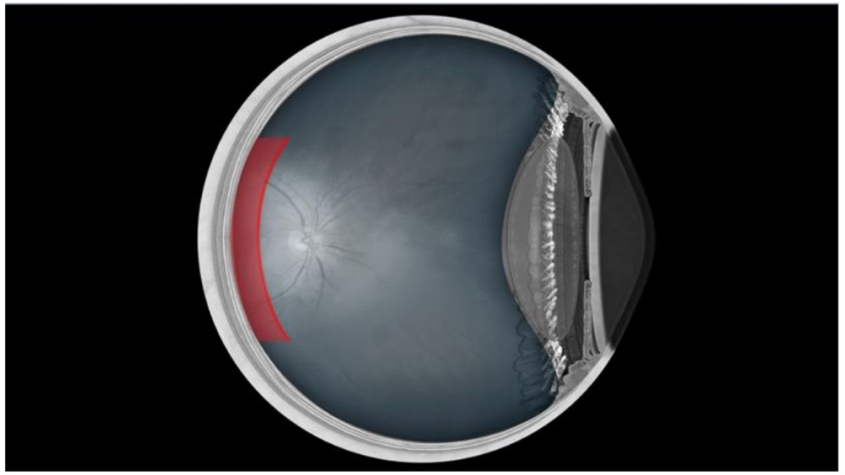
INDICATIONS AND CONTRAINDICATIONS

Patient Exclusions

- x Patients with symptomatic floaters for <3 months
- x Patients complaining of flashes of light
- x Older patients (>45) with sudden onset of symptoms
- x Younger patients with microscopic opacities
- x Patients with high myopia
- x Patients with unrealistic expectations for treatment

Clinical Exclusions

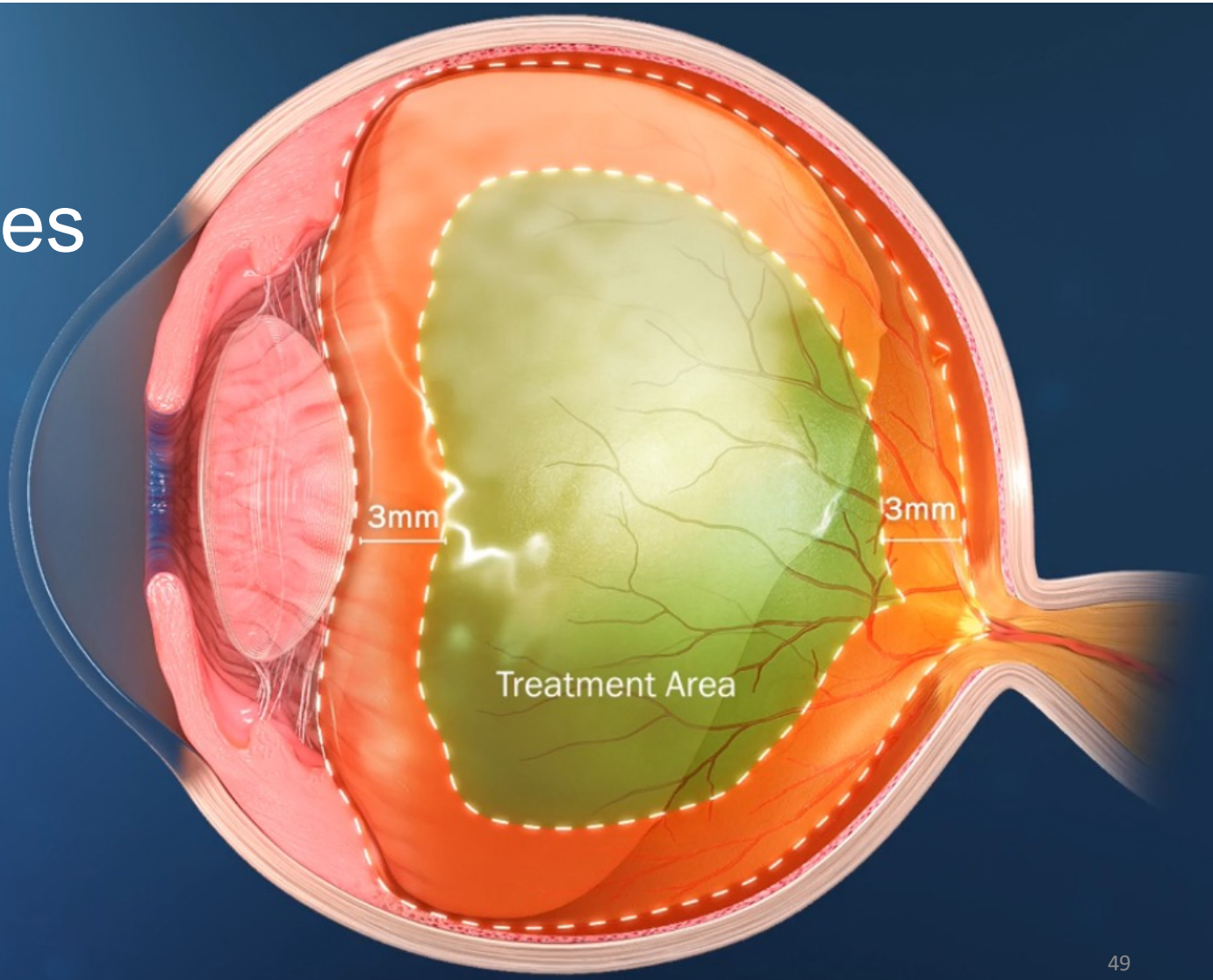
- Active Retinal Pathology
- Phakic Patients (first 10 procedures)
- Vitreous opacities located close to the retina or posterior capsule
- Concurrent procedures (YAG Capsulotomy, SLT etc)
- Group V Vitreous Opacity Classification (Various anatomical origins e.g. infiltrates, asteroid hyalosis, amyloid hyalosis, foreign bodies)



Safety zones

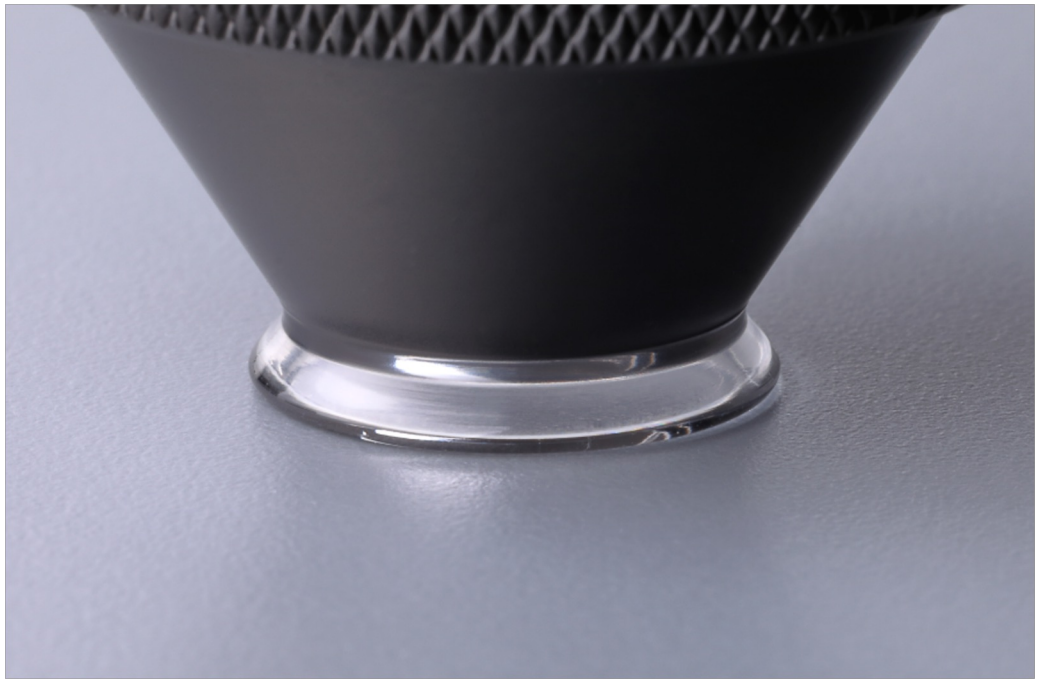
It is recommended to maintain a proximal 3mm distance from the lens and retina.

With Reflex™ True Coaxial Illumination, this is easily achieved due to better visualization with red reflex of the retina for 3-dimensional spatial context.



Laser Floater Treatment (LFT) – the procedure in-office

Contact lenses



Recommendation: use a contact lens with a flange for LFT as it gives more stability during the laser treatment.

Treatment:

1. Place the contact lens on the patient's cornea.
2. Explain to the patient that they will hear the sound of a shutter opening at each shot of the laser and that this is normal.
3. Start with a single pulse and just enough energy to create the optical breakdown in the vitreous (typically 2.5 mJ).

Post-Treatment:

1. Post-treatment medications are not necessary – (? Need for anterior floaters in a post YAG cap patient)
2. No restriction on activities.
3. Patient may see small, dark, specks in the lower field of vision for the first 15-30 minutes after the procedure. These are small micro-gas bubbles at the roof of the globe. They dissolve quickly and disappear.
4. Patients cannot adequately assess the treatment results until the pupils have constricted back to normal

Who are the ideal patients?

- Symptomatic floater patients
- Floater present for at least 6 months
- Floater is a:
  - Structurally distinct floater
  - Weiss ring or amorphous cloud
- Floater symptoms match appearance and location of floater
- Floater safe distance from retina and lens

- Underpromise, overdeliver
  - 60-90% floater improvement

Thank You!

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