

# YAG Laser Capsulotomy

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# Why do we perform YAG laser posterior capsulotomy?

- Posterior capsular opacification after cataract surgery
- Rate of about 14-18% with modern cataract surgery techniques (most common post-operative complication)
- Much higher rate in younger patients, essentially 100% in the very young (can consider primary surgical posterior capsulotomy)
- Rate decreases with age
- Why not perform primary posterior surgical capsulotomy in everyone?
- Increased risk of RD
- Increased risk of CME
- Increased risk of vitreal prolapse



# PCO

- So what decreases the risk of PCO formation other than advancing age?



- IOL's with square, truncated edges
- In the bag IOL fixation
- Anterior capsulorhexis diameter just slightly smaller than the IOL optic
- Well performed cortical clean up and posterior capsule polish (some studies dispute the effect of capsule polishing)
- Hydrogel IOL's have the highest rate of PCO, then PMMA, then Acrylic IOL's have the lowest rate
- Diabetes may reduce the rate



# PCO

- Lens epithelial cells left behind on the anterior capsule edges and the equatorial regions migrate and cause opacification
- Form membranes
- Transform in to fibroblasts and contract, leading to wrinkles
- Proliferate, leading to pearls
- Collagen deposition

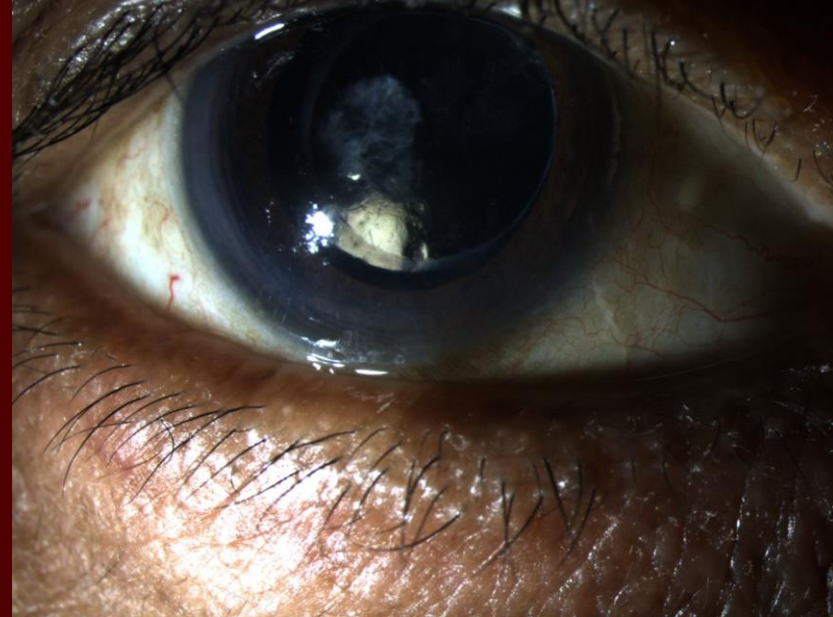


# PCO: Interesting research

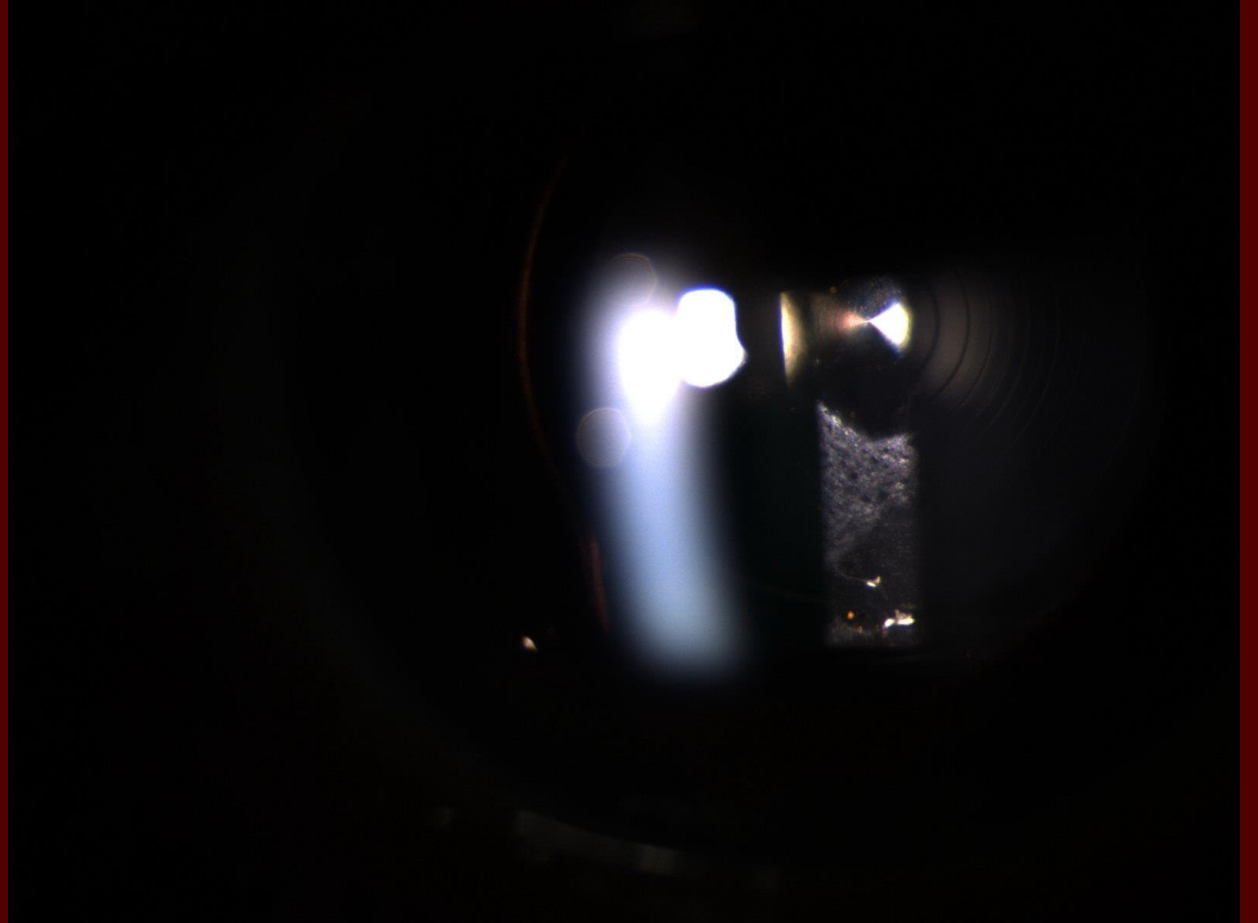
- IOL's that release Erlotinib, a tyrosine kinase inhibitor used in cancer therapy, for a short time
- Sham surgeries performed on 40 cadaver eyes
- IOL's that released Erlotinib substantially decreased PCO formation
- No negative impact on corneal endothelium
- How do dead eyes create PCO????



# PCO



# PCO



# PCO

- PCO leads to.....
- Decreased vision
- Decreased contrast sensitivity
- Glare
- Major problems with premium multifocal lenses, even with minor amounts of PCO: YAG often built in to the out of pocket cost of premium IOL's
- Often reported as a film or fog over vision
- Often stated as “it is like my cataract has come back”
- No alternative therapy (drops, pills, etc.)



# YAG laser basics

- What does YAG stand for?
- Neodymium: Yttrium Aluminum Garnet laser
- Solid state
- 1064 nm infrared wavelength. Can not be seen, so utilizes two HeNe (Helium / Neon) aiming beams
- Delivers extremely high light energy in a single pulse to a very small space, for a very short time
- Reduces tissue to plasma
- Temperature rise causes expansion, resulting in a shock wave going forward from the focal point
- Greatest power is just in front of the focal point



# YAG laser basics

- Photodisruptive laser
- No pigment needed for effect
- No thermal reaction
- No photocoagulation of blood vessels



# YAG laser controls / readouts

- On / off switch
- Standard slit lamp controls
- Anterior or posterior offset of zero, 125, or 250 microns (or smaller increments)
- Number of shots
- Pulses per “firing”
- Brightness of HeNe aiming beam
- Power setting in Mj
- Spot size is fixed

Nidek YAG laser



# YAG indications

- Consider YAG capsulotomy when glare or decreased vision impacts daily activities
- Much like cataracts themselves, some of the earliest issues tend to be with night driving, reading small print, fine detail vision, etc.
- Complaint driven
- Consider insurance situation / guidelines



# YAG pre-op

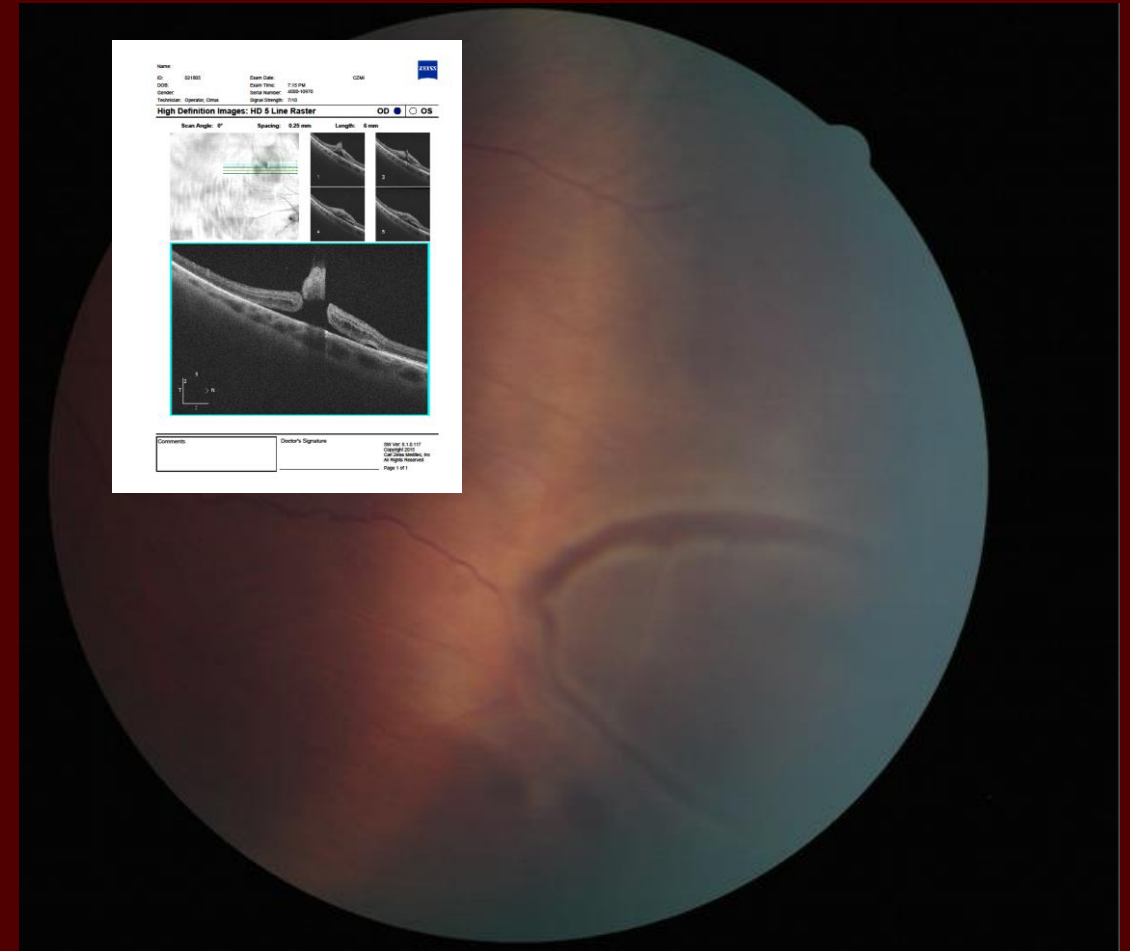


- Comprehensive pre-operative examination
- Must determine that the PCO is the cause of visual symptoms and not something else
- Concomitant issues.....PCO with AMD, for example
- Ability to sit for the procedure
- BCVA
- Glare testing
- Perhaps contrast sensitivity
- IOP
- Slit lamp examination
- Fundus examination



# Contraindications / relative contraindications to YAG

- Corneal scars / opacities
- Corneal edema
- Current ocular inflammation / “hot” eye
- Current or history of CME
- Excessive RD risk (very high myope, history of RD in fellow eye, lattice and / or atrophic holes, etc.)
- Inability to fixate / hold still or get in the instrument



# YAG procedure

- When you have determined that YAG capsulotomy is indicated and necessary.....
- Obtain signed informed consent
- Bring a driver, should not drive after the procedure
- Explain the procedure and any alternative treatments (in this case, only alternative really is no treatment)
- Discuss all risks, including.....
- RD (about 1-2%)
- Inflammation
- IOP spike
- CME
- Vitreal prolapse
- Lens pitting or “dings”
- IOL dislocation



# YAG procedure

- Perform vital signs since this is a minor surgical procedure, especially if being performed in a “facility”
- Allergies and medications
- Pulse
- Blood pressure
- Possibly respiration, temperature



# YAG procedure

- Dilate with 2.5 phenylephrine and 1% Tropicamide
- Instill Proparacaine in both eyes right beforehand to decrease blink reflex (and allow use of contact lens if desired)
- Instill Iopidine or Brimonidine about one hour before the treatment to help lessen chance of significant IOP spike. Especially important in fragile glaucoma



# YAG procedure

- Seat the patient comfortably and inform them.....
- They will need to fixate and remain still
- They will see lights or sparks
- They will hear clicks / snaps / pops
- The procedure is painless
- The procedure takes only a few minutes
- They will experience floaters afterward, and should expect visual improvement by the next day
- Do one eye, then the other later if applicable



# YAG procedure

- Recommend pulse of one (push the button, and the laser fires once). Higher pulse numbers are sometimes utilized with LPI (push the button, and the laser fires multiple times)
- Spot size is fixed
- Duration is fixed
- Power needed ranges from about .8 to 2.0 mj
- Extensive posterior offset in to the vitreous usually requires higher power, typically at least 2.0
- Average is about 1.5 to 1.8 mJ for most capsules
- Start low and go up as necessary
- Goal is to deliver the least total energy in to the eye that is needed to do the job (energy in = power X number of shots)
- Those in the room do not need to wear protective goggles



# YAG procedure

- Note pupil size and location in moderately dim illumination
- Can consider a single shot to the capsule in the center of the pupil before dilation to “mark” the pupil (most don’t do this)
- Can use a contact lens or not. Some prefer it, some do not

\$475.00



# YAG procedure

- Advantages of contact lens.....
- Stabilizes the eye and fixation
- Controls the lid
- Eliminates dry eye issues
- Magnifies the target
- Increases the convergence cone angle from 16 degrees to 24 degrees



# YAG procedure

- Disadvantages of contact lens.....
- Bubbles
- Reflections
- Slows the procedure



# YAG procedure

- Different patterns.....
  - Cruciate (most common, a cross)
  - Postage stamp
  - Christmas tree
  - Round
- With cruciate.....
  - Start at the top (12:00) with one shot to assess affect. If lens is pitted, will be out of line of sight
  - Adjust power and offset as needed
  - Go down vertically, then across the horizontal. Each shot adjacent to the last typically
  - Edges will peel back
  - Can try to hit tension lines.....lots of “bang for the buck”
  - Alternate approach is to start with one shot in the middle then, work outward

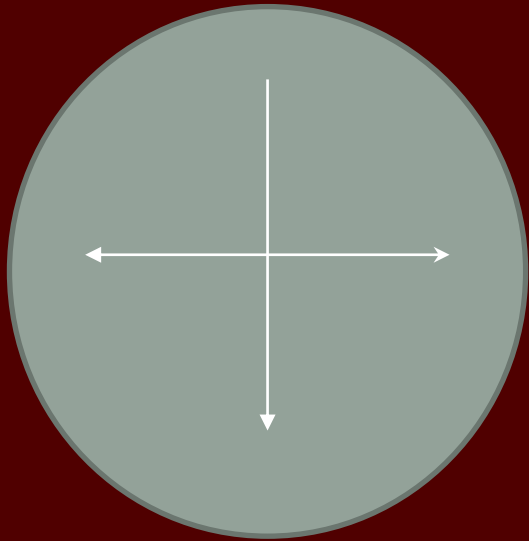


# YAG procedure

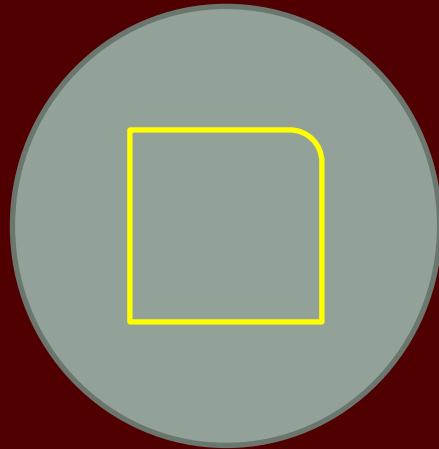
- Remove all “flaps” and “tags” if possible
- Superior ones can be difficult
- Goal is to make the capsulotomy about the same size as the pupil in dark conditions
- Too small: can still get symptoms in the dark
- Too large: jeopardizes the stability of the IOL. Can even “drop” the IOL if made very large



# Cruciate pattern



# Postage stamp pattern



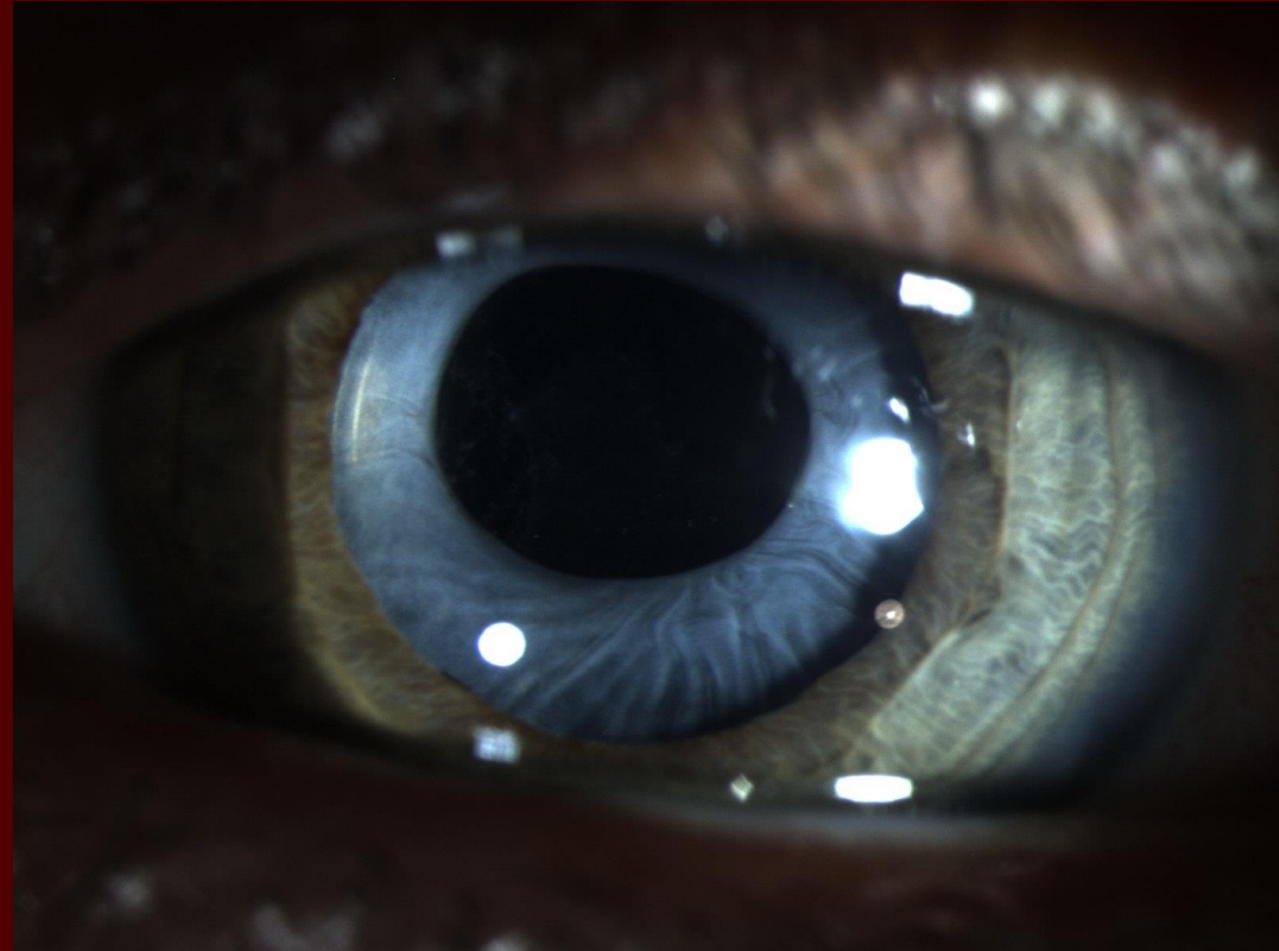
# YAG procedure

- When finished, record in the record.....
- Power level
- Total number of shots
- Energy delivered (power x # of shots)
- Any complications



# Anterior YAG

- Can also use to reduce tension from anterior capsule contraction (phimosis)
- Phimosis can reduce peripheral vision and can make visualization of the peripheral fundus very difficult
- Phimosis can shift the plane of the IOL leading to refractive error changes.



# YAG procedure

- Instill another drop of Iopidine or Brimonidine
- Check IOP about one hour later
- Peak IOP rise at about 3-4 hours later, typically back to normal in 24 hours even with elevation
- Treat IOP spikes in office if needed
- Pred Forte QID for one week (some don't do this)
- Continue any chronic eye drops
- Educate to report any decreased vision / flashes / new floaters after the first day / pain, etc.
- RTC in about one week for VA check / IOP check / DFE



# YAG Billing

- CPT code 66821 for the procedure with 90 day global period. Includes day of or day before evaluation
- Reimbursement around \$340 (full global) if not in a “facility”, and about \$320 to the surgeon / post-op provider if in a facility (facility gets a fee too)
- Can co-manage with modifiers like cataract surgery
- Diagnosis codes:
  - H26.491 : other secondary cataract, right eye
  - H26.492 : other secondary cataract, left eye
  - H26.493 : other secondary cataract, bilateral



# YAG procedure complications:

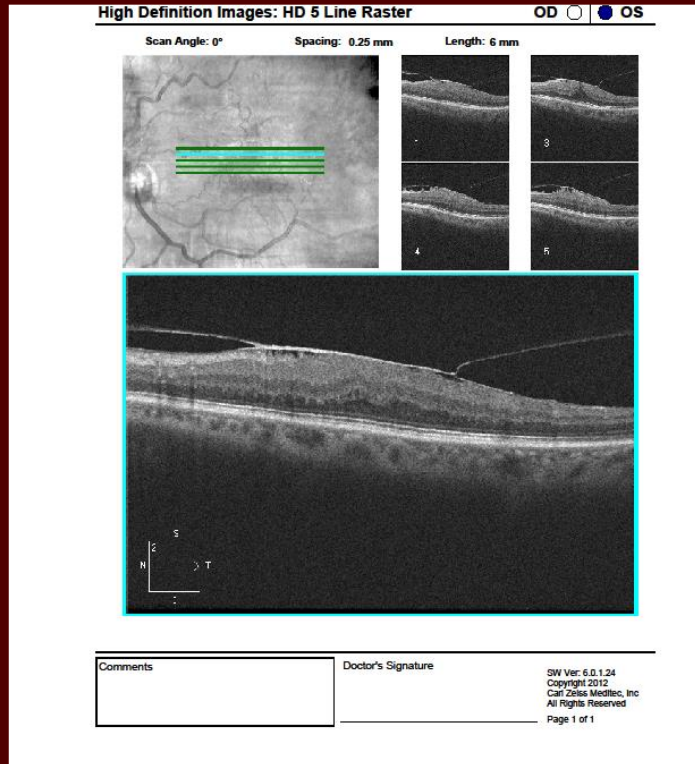
## increased IOP

- Most common post YAG complication, but rarely substantial
- Pre-procedure and post-procedure Iopidine or Brimonidine help to lessen chances
- Peaks at 3-4 hours post-op, usually back to normal by 24 hours, but can persist
- Increasing risk with more total energy delivered
- More likely in pre-existing glaucoma patients
- Due to trabecular meshwork compromise from capsular debris, cells, and shock wave. Perhaps even liquid vitreous



# YAG procedure complications: vitreal prolapse

- Vitreous can prolapse through the open capsule
- If vitreous is still adherent to the retina, leads to increased risk of.....



- Retinal break / detachment
- CME
- Macular hole

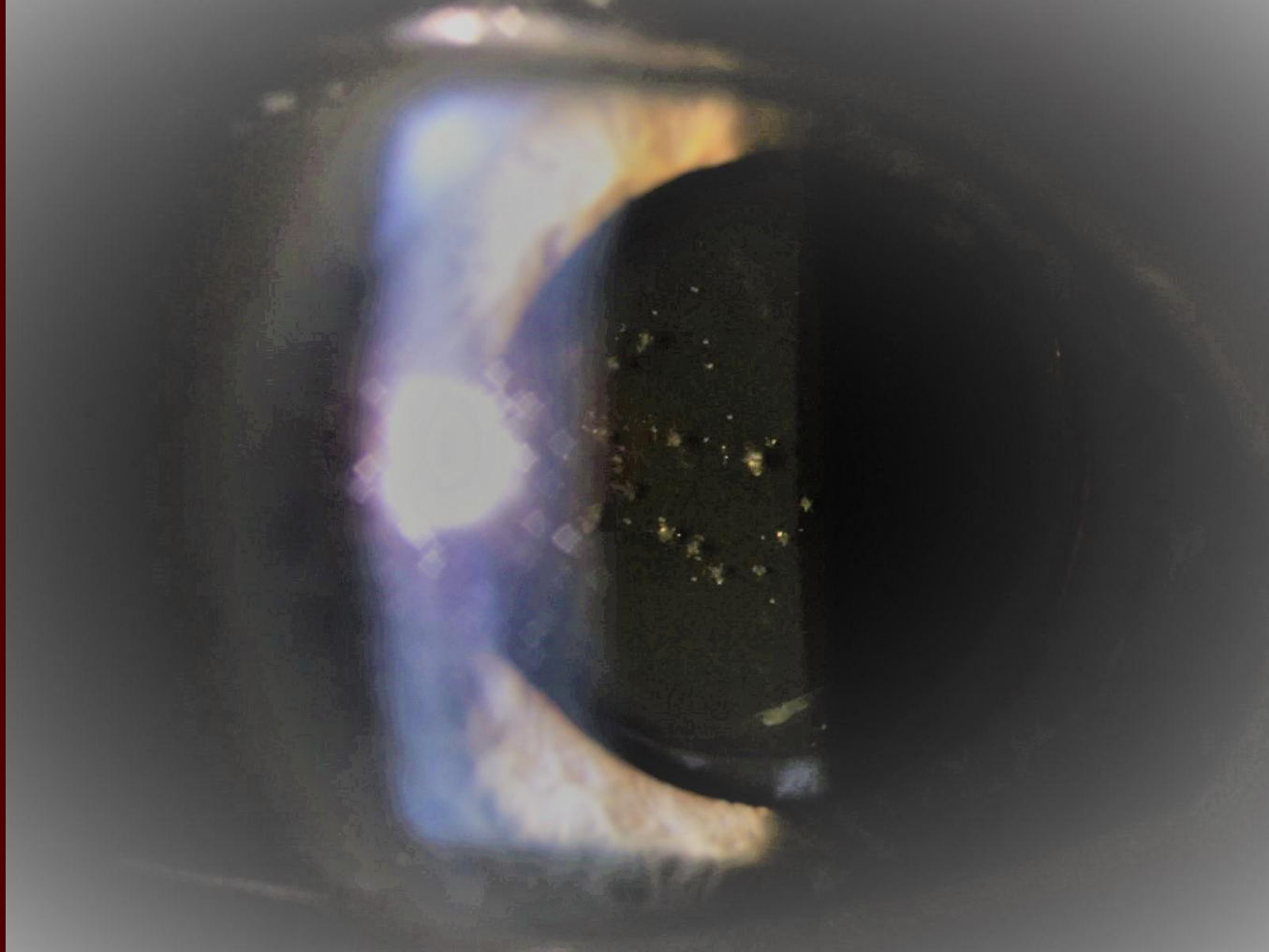


# YAG procedure complications: lens pitting

- Lens pitting (happens to some degree in roughly 20% of cases)
- Laser energy is focused too far anteriorly and damages the IOL
- Rarely visually significant
- Risk can be substantially lessened by using posterior offset (most YAG lasers are already set up to fire just behind the focusing beams, thus having an effect near the focusing beams)
- PMMA IOL's will get cracks, nicks, or fracture lines
- Silicone IOL's get divots/pits surrounded by tiny pits
- Silicone IOL's are the easiest to pit / damage, followed by PMMA. Acrylic IOL's are the hardest to affect
- Can be difficult to avoid if IOL is in very close proximity to the posterior capsule
- In cases where it is completely unavoidable (very rare), avoid the visual axis if at all possible



# Lens pitting



# YAG procedure complications: corneal damage

- Can rarely get damage from the laser beam passing through the cornea
- Mild edema
- More common with a large number of shots
- Not painful
- Heals quickly
- Not typically visually significant



# YAG procedure complications: iris damage

- Can affect the iris if inadvertently “hit”
- Energy setting is usually too low to significantly affect the iris
- Rare



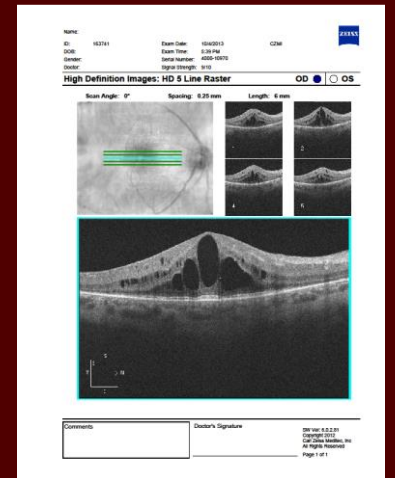
# YAG procedure complications: iritis

- Mild anterior inflammation is common
- Directly related to the total amount of energy delivered
- Increased risk after about 40 shots
- Pred Forte QID for one week
- Longer and more frequent if needed
- Cycloplege in severe cases (rare)



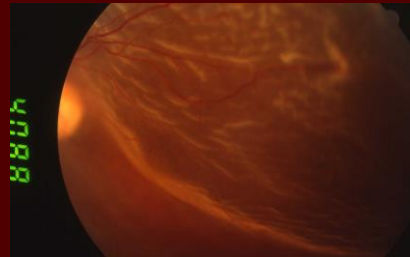
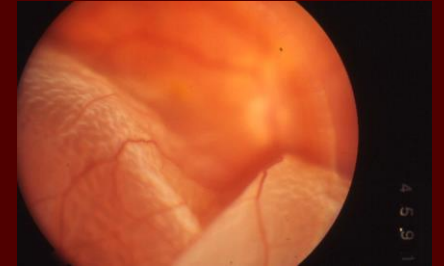
# YAG procedure complications: CME

- Due to both inflammatory mediators and shock waves traveling through the vitreous
- More common when vitreous still attached at the fovea
- Rate of about .55% to 2.5%
- Can occur weeks to months after the procedure
- Treated in the standard manner.....
- Topical steroids and /or NSAIDS
- Steroid injections
- Steroid implants
- Oral steroids



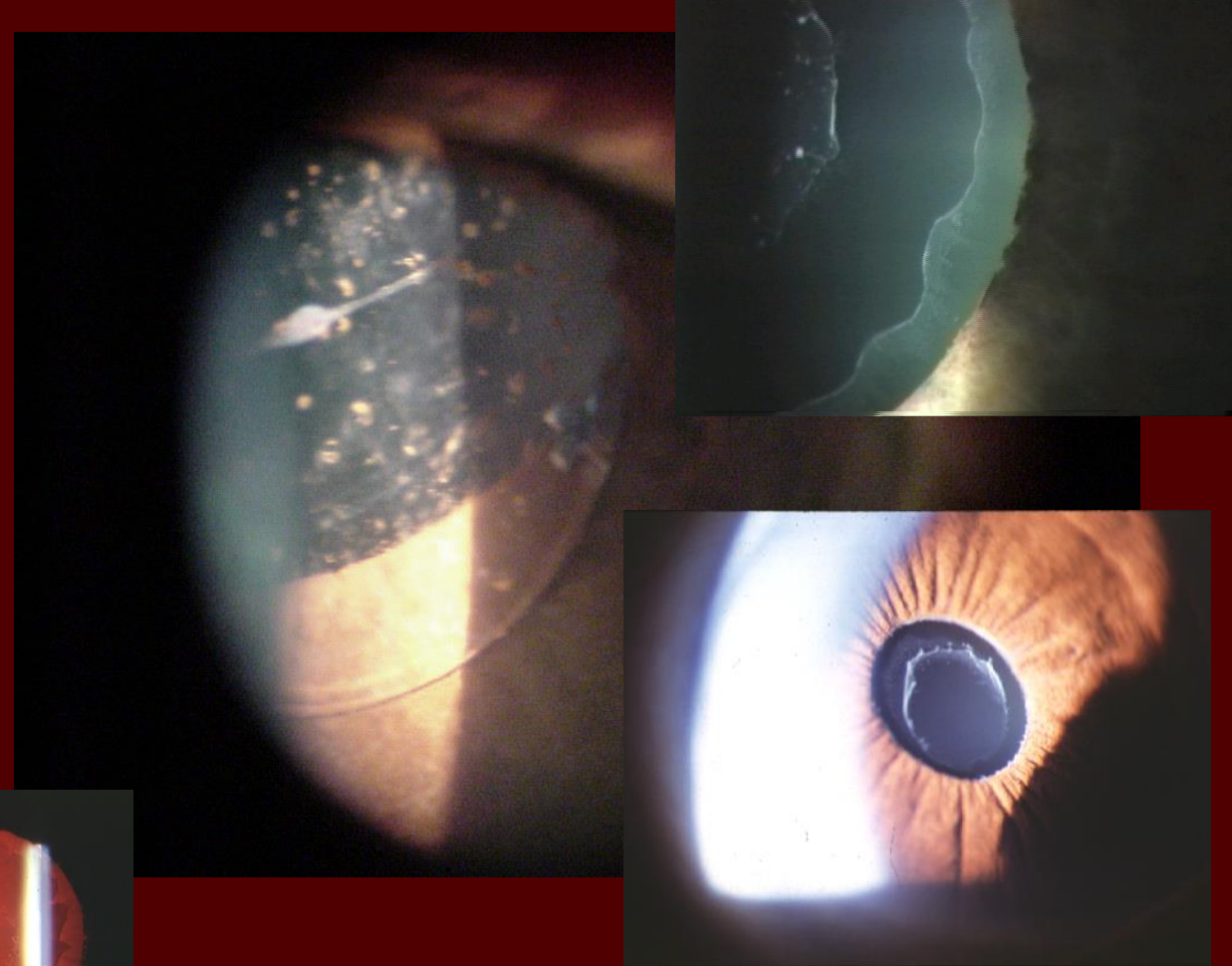
# YAG procedure complications: retinal detachment

- One study found asymptomatic retinal breaks in 2.1% of patients within one month of having had a YAG
- About a 1-2 % risk of RD
- Educate well regarding signs / symptoms of RD
- Extra risk with.....
- High myopes
- Males
- Younger patients (vitreous still attached)
- RD history in fellow eye (or same eye)
- Lattice / atrophic holes
- Axial length over 24.0 mm
- Larger capsulotomy
- Higher number of shots / more total energy delivered



# YAG procedure complications: dislocation or capture of the IOL

- A very large capsulotomy can result in a weakened capsular bag
- Caution with pseudoexfoliation syndrome
- Can lead to movement of the IOL, capture of the IOL after dilation, and even “dropping” of the IOL if very severe



# YAG procedure complications: endophthalmitis

- Extremely rare due to being a “closed eye” procedure
- Very specific circumstance
- Propionibacterium acnes bacteria trapped within whitish plaques on the capsule
- Generally not distinguishable from PCO
- YAG then frees the bacteria, leading to infection



# Horror story

- Case Reports in Ophthalmology
  - 2019; 10: 111-115
- 
- Corneal perforation after YAG capsulotomy
  - Report out of Israel



# Horror story

- 69 year-old woman with systemic scleroderma
- Underwent uneventful YAG capsulotomy OS (without a contact lens)
- BCVA prior to procedure 6/24 (20/80)
- Cornea was clear post procedure, capsule was open, IOP was 17
- Dexamethasone drops QID for 4 days



# Horror story

- Patient returned 2 weeks later with a complaint of pain and blurry vision
- She admitted to using the dexamethasone liberally to help with the pain



# Horror story

- Examination revealed a central, full thickness .5mm x .5mm corneal perforation, flat chamber, and Seidel's sign
- Vision was 1/120 (20/2400)
- Treatment consisted of topical antibiotic, cycloplegia, and hypotensive medications as well as a bandage soft contact lens



# Horror story

- One week later:
- Decreased perforation size, deepened AC, still Seidel positive. BCVA 6/36 (20/120)
- Added doxycycline, vitamin C, autologous serum drops



# Horror story

- At final follow-up 10 weeks later....
- Perforation fully healed with scar, no pain, normal AC depth, negative Seidel sign
- BCVA 6/18 (20/30)



# Horror story

- Was this about.....
- Liberal use of steroid drops?
- Scleroderma?
- “lack of experience of the operator”, as quoted in the article
- All three?

