**Laser Procedures for the Optometric Physician in OK (and Now in KY Too!): YAG Cap, LPI, ALT & SLT**

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COPE Approved: COPE # 31529-GL

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**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

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**Posterior Capsular Opacification (PCO)**
- Lens capsular bag has an anterior and posterior surface
  - Anterior surface usually removed w/ capsulorhexis
- PCO is the formation of a cloudy membrane on the posterior surface of the capsular bag following ECCE
  - AKA: Secondary cataract

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**PCO**
- **Incidence:**
  - Most common complication of post ECCE
  - 10-80% of eyes following cataract surgery
  - Can form anywhere from a few days to years post surgery
  - Younger patients higher risk of PCO
  - IOL's
    - Silicone > acrylic
- **Prevention:**
  - Capsulotomy during surgery
  - Posterior capsular polishing

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**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
    - 3_nsec
  - No thermal reaction/No coagulation when bv's are hit
  - Pigment independent*
YAG Cap Pre-op Exam
- Visual acuity, glare testing, PAM/Heine lambda
  - Vision 20/30 or worse
- Slit Lamp Exam
- IOP’s
- Dilate – will be able to visualize the PCO much better
- Posterior segment exam
  - Macula
  - Periphery
- Educate Pt
- Informed Consent Signed

YAG Cap Risks, Complications, Contraindications

**CONTRAINDICATIONS**
1. Corneal problems
2. Intraocular inflammation
3. Macular problems
4. Patient unable to hold steady or fixate

**RISKS/COMPLICATIONS**
1. IOP spike/elevation
2. Most often transient
3. Inflammation
   - Pred Forte QID X 1 week
4. Use appropriate laser energy
5. Floaters
6. Retinal detachment
7. Permanent vision loss

YAG Cap Procedure

- Sit patient comfortably
- Adjust laser for your comfort
  - Armrest, oculars, controls
- Instill proparacaine in both eyes
- Place laser lens on eye with goniosol or celluvisc
  - Advantages of laser lens:
    - Stabilizes the eye/lid control
    - Helps prevent eye from drying out
  - Disadvantages of laser lens:
    - Complicates/slow the procedure
    - Reflections & bubbles
    - Some patients can’t tolerate the lens
- Focus HeNe beams on the PCO
- Perform the procedure
  - No pain for patients
  - May feel popping/snap/clap in ears
- Usually done in a cruciate pattern
- Other patterns:
  - Horseshoe
  - Circular

Anytime we put laser energy in the eye, the 2 most commonly encountered side effects are?
1. Retinal detachment & floaters
2. IOP spike & inflammation
3. Floaters & extended eye pain
4. Permanent vision loss & enucleations

Patient Pre-op Drops
- Dilating drops
- 1 drop Alphagan or Iopidine 15-30 minutes prior to

Laser Settings
- Energy 1.2 – 1.4 mJ
- Spot Size fixed
- Duration fixed
- Pulses 1
- Offset 250 microns
**YAG Cap Procedure**

- Post-op Care
  - Remove laser lens
  - 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 operative exam**

- 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

**YAG Cap**

- Reimbursement codes
  - 66821  $295.83
- 90 day global period

**What is the most common cause of narrow angle glaucoma?**

1. Plateau Iris Syndrome
2. Pupillary Block
3. Malignant Glaucoma
4. POAG
5. Phacomorphic glaucoma

**Anatomically Narrow Angles / Angle Closure**

- Anatomic disorder characterized by peripheral iris & TM apposition
- 4 basic forms:
  - Pupillary block
  - Plateau iris
  - Phacomorphic glaucoma
  - Malignant glaucoma

**Pupillary Block Glaucoma Mechanism**
Anatomically Narrow Angles / Angle Closure

- Anatomic disorder characterized by peripheral iris & TM apposition
- 4 basic forms:
  - Pupillary block
  - Plateau iris
  - Phacomorphic glaucoma
  - Malignant glaucoma

PI Indications

- Primary angle closure
- Plateau iris syndrome/configuration
- Secondary pupillary block
  - Phacomorphic, malignant glaucomas
- Pigmentary glaucoma
- Prophylaxis*
  - Narrow angles on gonioscopy
  - Most often reason why PI is done

PI Alternatives

- Surgical Iridectomy
  - Equal results to laser PI
  - Much more invasive
  - More trauma to iris
  - Infection
  - If concurrent surgery not occurring, laser PI is the way to go

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

Which of the following is the most commonly encountered complication of a laser PI?

1. IOP spike
2. Inflammation
3. Non-penetration/non-patent PI
4. RD
5. Hyphema

PI Risks, Complications, Contraindications

CONTRAINICATIONS
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
4. Others: hyphema, synechiae, peaked pupil, floaters, blur, monocular diplopia, RD, permanent vision loss
**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

**Laser Settings**
- Depends on which laser you use

**ARGON LASER**
- Less commonly used
  - Advantages:
    - Less bleeding
    - Less debris
  - Disadvantages:
    - Less successful compared to YAG laser in penetration
    - Requires more shots
  - Settings:
    - Spot size: 50 microns
    - Duration: 0.1 sec
    - Power: 300-1200 mW

**YAG LASER**
- More commonly used
  - Advantages:
    - Very good penetration rate
  - Disadvantages:
    - More likely to bleed
    - Much more debris
  - Settings:
    - Spot size: fixed
    - Duration: fixed
    - Energy: 2.0 – 5.0 mJ
    - Offset: 0 – 250 microns

**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
  - 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)

**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”

**Post-op Care**
- Remove laser lens
- Rinse Eye/Clean eye
- 1 drop of Alphagan or Iopidine post-laser
- IOP measurement 30-60 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

Peripheral Iridotomy (PI)

- Reimbursement codes
  - 66761 $295.50
  - 10 day global period

In general, how do laser trabeculoplasty’s decrease IOP?

1. Decrease aqueous production
2. Increase aqueous outflow
3. Both
4. Neither

Use of laser light to burn areas of the TM to increase aqueous outflow

Two types
- Argon laser trabeculoplasty (ALT)
- Selective laser trabeculoplasty (SLT)

Both increase aqueous outflow

Laser Trabeculoplasty (LTP)

- Most common laser procedure for OAG
  - ALT in the 90’s and early 2000’s
  - SLT starting to take over
- Usually a Secondary Line of Treatment
  - After meds fail to control IOP
- Some use as Primary Treatment
- Universally Accepted

Laser Trabeculoplasty (LTP)

- Glaucoma Laser Trial (1990)
  - Compared ALT to topical meds in the control of IOP and VF, and ONH status
  - Results:
    - 44% proper IOP control in the ALT group
    - 30% proper IOP control in the meds group
    - Fewer eyes that underwent ALT as first-line therapy ultimately required 2 or more meds postoperatively to control IOP
LTP Indications

- POAG
- Normo-tensive glaucoma
- Pigmentary dispersion glaucoma
- Pseudoexfoliative glaucoma

LTP Contraindications

- Narrow Angle Glaucoma
- Angle Closure (Emergency IOP decrease)
- Inflammatory Glaucoma
- Angle Recession Glaucoma
- Neovascular Glaucoma
- Congenital Glaucoma
- Prior LTP that failed
- Under 40 years of age
- Hazy media

Summary of Predictors

<table>
<thead>
<tr>
<th>Negative Predictors</th>
<th>Positive Predictors</th>
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</thead>
<tbody>
<tr>
<td>Age &lt;40</td>
<td>Age &gt;65</td>
</tr>
<tr>
<td>Little or none</td>
<td>Moderate to Heavy</td>
</tr>
<tr>
<td>Cloudy, Hazy cornea</td>
<td>Clear</td>
</tr>
<tr>
<td>Uveitic glaucoma</td>
<td>Pigmentary glaucoma</td>
</tr>
<tr>
<td>Angle closure</td>
<td>Pseudoexfoliative</td>
</tr>
<tr>
<td>Angle recession</td>
<td>Low-tension glaucoma</td>
</tr>
<tr>
<td>Congenital glaucoma</td>
<td>POAG</td>
</tr>
<tr>
<td>Aphakic or ACIOL</td>
<td>Phakic or PCIOL</td>
</tr>
<tr>
<td>Little effect</td>
<td>Strong effect</td>
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</tbody>
</table>

The main mechanism of action by which ALT works is

1. Burn holes into the TM thru which aqueous flows more easily
2. Laser burns which cause scarring of the TM and mechanically contract TM tissue and open up adjacent areas
3. Biologic activation of inflammatory mediators which “clean up” the TM

Argon Laser Trabeculoplasty (ALT)

- Traditional 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:
  - Mechanical effects from laser burns scarring tissue and causing contracting of tissue and opening of adjacent areas of the TM
  - Biologic effects with increased inflammatory cells with “clean up” the TM

ALT Pre op Exam

- Gonioscopy
  - Rule out angle recession & PAS
- Slit Lamp Exam
  - Rule out NVG & inflammatory glaucoma
- Educate Pt
- Informed Consent Signed
- Take Vitals
  - BP, pulse
**Argon Laser Trabeculoplasty (ALT)**

1. **ALT complications/risks**
   - **IOP spike/elevation**
     - Most often transient
     - High risk pt – may consider Diamox
   - **Inflammation**
     - Pred Forte QID X 1 week
     - Use appropriate laser energy
   - **Peripheral Anterior Synechie (PAS)**
     - As the scar tissue forms from the laser PAS can form
     - May increase IOP long-term

**ALT Procedure**

- **Patient Pre-op Drops**
  - 1 drop Alphagan or lopidine 15-30 minutes prior to
  - 1 drop pilocarpine 1% (optional)
- **Laser Settings**
  - **Energy** 600 mW
  - **Spot Size** 50 microns
  - **Duration** 0.1 sec
  - **Pulses** 1 (shoots once every time you push the foot pedal)

**ALT Procedure**

- Sit patient comfortably
- Adjust laser for your comfort
  - Armrest, oculars, controls, safety glasses
- Instill proparacaine in both eyes
- Place laser lens on eye with goniosol or celluvisc
- Gonio mirror usually at 3:00 or 9:00
  - Do inferior 180° first (widest angle)

**Placement of Laser Burns**

**ALT Procedure**

- Focus on the anterior aspect of the pigmented TM****
  - Aim is much more critical with ALT than SLT
- Adjust Energy as needed
  - Pigment blanching
  - Small bubble formation
- Treat inferior 180 degrees first
- Space burns approximately 2 spot sizes apart
  - 45-60 burns per 180 degrees

**ALT Procedure**

- **Post-op Care**
  - Remove laser lens
  - Rinse Eye/Clean eye
  - 1 drop of Alphagan or lopidine
1 hour post operative exam
- Check IOP
- Check for A/C reaction
- Check Vitals
- Continue glc meds
- RTC 1 wk for f/u

Which of the following is the most common ALT post operative drop schedule used?
1. Pred Forte QID X 1 week
2. Nevanac TID X 3-4 days
3. Vigamox QID X 5 days
4. No drops are used post-op

How long on average does it take for ALT/SLT to take effect?
1. 2-3 days
2. 2-3 weeks
3. 4-6 weeks
4. 3-4 months

1 week post operative exam
- Check IOP
- Check for A/C reaction
  - Should be minimal to no C&F
- Check for PAS
- D/C Pred Forte
- RTC 3-6 weeks for 4-6 week f/u

1 month post operative exam
- Check IOP
  - Start to consider reducing glaucoma meds if pressure is reduced
  - May consider treating superior 180 degrees
- Not going to treat superior 180 degrees if complications develop

ALT & SLT provide adequate IOP control after 1 year in what % of patients? How about after 5 years?
1. 100%, 75%
2. 95%, 75%
3. 80%, 50%
4. 50%, 25%
**Argon Laser Trabeculoplasty (ALT)**

- Long term outcome
  - 80% effective at 1 year
  - 50% effective at 5 years
  - 30% effective at 10 years

- Retreatments
  - Success rate is much lower
  - More likely to get complications
  - 50% of retreatments require filtering procedure within 6 months to lower IOP

**The main mechanism of action by which SLT works is**

1. Burn holes into the TM thru which aqueous flows more easily
2. Laser burns which cause scarring of the TM and mechanically contract TM tissue and open up adjacent areas
3. Biologic activation of inflammatory mediators which "clean up" the TM

**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 attract macrophages and phagocytes to come and clean up the debris in the TM

**Optimal laser is a Q-switched frequency doubled 532 nm Nd:YAG Laser (Lumenis, formerly Coherent, Selecta II Glaucoma Laser System)**

- Permits selective targeting of pigmented TM cells w/o causing structurally or coagulative damage to the TM

**Thermal Relaxation Time**

- SLT works on the principle of Thermalysis which involves the Thermal Relaxation Time
  - The time required by melanin granules to convert electromagnetic energy into thermal energy
  - Melanin has a TRT = 1 microsecond
  - SLT has a pulse duration = 3 nanoseconds

- Since pulse duration is so quick, melanin cannot convert the laser electromagnetic energy into thermal energy
  - No thermal damage ("cold laser")

**ALT Procedure/SLT Procedure**

Scanning electron microscopy comparison of TM after ALT above and SLT below
Which type of glaucoma is SLT particularly effective against?

1. Angle closure glaucoma
2. Pigmentary glaucoma
3. Neovascular glaucoma
4. Normo-tensive glaucoma

SLT Pre-op Exam
- Gonioscopy
  - Rule out angle recession & PAS
- Slit Lamp Exam
  - Rule out NVG & inflammatory glaucoma
- Educate Pt
- Informed Consent Signed
- Take Vitals
  - BP, pulse

SLT Procedure
- Patient Pre-op Drops
  - 1 drop Alphagan or Iopidine 15-30 minutes prior to
  - 1 drop pilocarpine 1% (optional)
- Laser Settings
  - Energy 0.6 - 1.2 mJ (0.8 - 1.0 mJ most often used)
  - Spot Size 400 microns
  - Duration 3 nsec
  - Pulses 1 (shoots once every time you push the foot pedal)

SLT Procedure
- Sit patient comfortably
- Adjust laser for your comfort
  - Armrest, oculars, controls, safety glasses
- Instill proparacaine in both eyes
- Place laser lens on eye with goniosol or celluvisc
- Gonio mirror usually at 3:00 or 9:00
  - Do inferior 180° first (widest angle)

Latina SLT Gonio Lens
The Latina SLT Gonio Laser Lens was designed specifically for Selective Laser Trabeculoplasty. 1.0x magnification maintains laser spot size and 1 to 1 laser energy delivery. Tilted anterior lens surface corrects astigmatism to maintain circular laser beam profile and give sharp images for examination. Suitable for standard laser trabeculoplasty.
Spot Size Comparison

ALT on the left    SLT on the right

SLT Procedure
- Large spot size – cover the entire TM
  - Aim is less critical with SLT compared to ALT
  - Easier to do**
- Adjust Energy as needed (start around 0.8 mJ)
  - Usually don’t want to see pigment blanching w/ SLT
  - Small bubble formation
- Treat inferior 180 degrees first
- Space burns right next to each other
  - 45-60 burns per 180 degrees

1 hour post operative exam
- Check IOP
- Check for A/C reaction
- Check Vitals
- Continue glc meds
- RTC 1 wk for f/u

Which of the following is the most common SLT post-operative drop schedule used?

1. Pred Forte QID X 1 week
2. Nevanac TID X 3-4 days
3. Vigamox QID X 5 days
4. No drops are used post-op
1 week post operative exam
- Check IOP
- Check for A/C reaction
  - Should be minimal to no C&F
- Check for PAS
- RTC 3-6 weeks for 4-6 week f/u

1 month post operative exam
- Similar to ALT - takes 4-6 weeks to see effect
- Check IOP
  - Start to consider reducing glaucoma meds if pressure is reduced
  - May consider treating superior 180 degrees
- Not going to treat superior 180 degrees if complications develop

Selective Laser Trabeculoplasty (SLT)
- Long term outcome
  - 80% effective at 1 year
  - 50% effective at 5 years
  - 30% effective at 10 years
- Tends to be very effective for 12-24 months
  - Effect wanes after that

ALT & SLT Summary
- Positives
  - Work about 80% of the time
  - On average, takes the place of 1 medication
  - ALT & SLT average IOP reduction of 20-30%
  - Doesn’t interfere with other treatments or meds
- Negatives
  - Effect tends to diminish over time

Selective Laser Trabeculoplasty (SLT)
- Retreatments
  - Since no mechanical damage -> can repeat SLT
  - Not a lot of studies that confirm that yet, but
    - One study compared effect of ALT & SLT in patients that had already had ALT
    - SLT found to be better

Comparison of ALT & SLT

<table>
<thead>
<tr>
<th></th>
<th>ALT</th>
<th>SLT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser Used</td>
<td>Argon</td>
<td>Q-switched frequency doubled YAG laser</td>
</tr>
<tr>
<td>No of laser shots/180°</td>
<td>45-60</td>
<td>45-60</td>
</tr>
<tr>
<td>Energy (mJ)</td>
<td>400-600 mJ</td>
<td>0.8-1.4 mJ</td>
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<tr>
<td>Fluence (mJ/mm²)</td>
<td>40-900</td>
<td>6</td>
</tr>
<tr>
<td>Spot Size</td>
<td>50 microns</td>
<td>400 microns</td>
</tr>
<tr>
<td>Duration of laser shot</td>
<td>0.1 seconds</td>
<td>3 nsec</td>
</tr>
<tr>
<td>Mechanism of Action</td>
<td>Mechanical</td>
<td>Biological</td>
</tr>
<tr>
<td>IOP Reduction</td>
<td>20-30%</td>
<td>20-30%</td>
</tr>
<tr>
<td>Repeatable?</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
ALT & SLT Summary

- Code for ALT & SLT is the same
  - 69855

- How much do we get paid?
  - $308.98/eye
  - If you do them on the same day
    - 100% of the first eye
    - 50% of the second eye

- Global Period is the same as well
  - 10 global period
  - Contrast that to YAG capsulotomy
    - 90 days

Questions?