Endoscopic Cyclophotocoagulation

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Laser Endoscope

ENDOSCOPIC CYCLOPHOTOCOAGULATION
Martin Uram, M.D., M.P.H.
E2 Laser and Endoscopy System

ENDOSCOPIC CYCLOPHOTOCOAGULATION
Martin Uram, M.D., M.P.H.
4 Skills for ECP

⇒ Watching Video Monitor
⇒ Accessing ciliary processes given approach and lens status
⇒ Inflating ciliary sulcus
⇒ Controlling long duration, invisible wavelength laser
When to do ECP?

- Replacement medical therapy
- Eyes with previous outflow procedures
- Eyes at risk for hypotony i.e. Vitrectomized Eyes
- Poor conjunctiva/sclera
- Plateau iris cases
Fig. 1. Light microscopy of normal ciliary processes showing their lacy contour with normal appearing stroma, pigmented and non-pigmented ciliary epithelium.
Fig. 2. Light microscopy of ECP treated tissue showing loss of the lacy appearance and shrinking of the ciliary processes with destruction of the non-pigmented epithelium and clumping of the pigmented epithelium.
Fig. 3. Light microscopy of TCP treated tissue showing separation of the non-pigmented and pigmented ciliary epithelium, coagulative necrosis of the underlying ciliary stroma (asterisk), and architectural destruction of the treated tissue.
ECP Treatment Principle

- Lens Behind Iris: VISCOELASTIC
- Single Chamber Eye: INFUSION

AVOID HYPOTONY
Inflating the Ciliary Sulcus

ENDOSCOPIC CYCLOPHOTOACOAGULATION
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Sulcus Inflation

ENDOSCOPIC CYCLOPHOTOCOAGULATION
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Combined Procedures:

*Limbal, Over Bag / PC-IOL*

ENDOSCOPIC CYCLOPHOTOCOAGULATION
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Through The Bag

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Curved Probe, Limbal

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No PPL for Phakic Eyes

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Desired Tissue Effect

- Whiten ciliary processes
- Shrink ciliary processes
- Treat entire ciliary process

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Inflating the Ciliary Sulcus

ENDOSCOPIC CYCLOPHOTOCOAGULATION
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Complete Treatment

INADEQUATE TREATMENT
RESULTS IN:

⇒ POOR IOP CONTROL
⇒ ONLY TEMPORARY “GOOD” RESULT

ENDOSCOPIC CYCLOPHOTOCOAGULATION
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Treatment Zone

- Light
- Standard
- Plus
ECP: Post-Op Meds

⇒ SAME AS PHACO ALONE
⇒ IOP SPIKE PROPHYLAXIS
⇒ PARACENTESIS
Intraocular Decadron

A. Formulation: 4mg/cc
B. Dosage: 0.1cc to 1.0cc
C. Site: AC or VIT
Pre-op Regimen

Same as for Cataract Procedure
- Phenylephrine
- Cyclogyl
- NSAID
- 4\textsuperscript{th} Generation Fluoroquinolone
- Lidocaine Gel 2%
- +/- Block
Treatment Steps

- Temporal Clear Cornea Incision 2.6 mm
- If topical, 1% intracameral lidocaine
- Inflate Sulcus with Healon GV
- If Aphakic or Pediatric Eye, use anterior chamber maintainer with continuous BSS Irrigation
- +/- Superonasal Clear Cornea Incision
ECP Technique
Laser Settings

- .25 Watts
- Continuous Mode
- Adjust Illumination to visualize aiming beam
- Endpoint is whitening and shrinkage of ciliary process
- “Paint” over 270 to 360 degrees
- “Pop” is over treatment
Plateau iris -sp angle closure
Post-Procedure

- Thorough viscoelastic removal is important
- Intracameral decadron (0.1cc)
- Post-op drops
  - Prednisolone QID
  - NSAID QID
  - 4th Generation fluoroquinolone QID
Routine post-op protocol is followed when ECP is combined with cataract surgery. Glaucoma meds are restarted and then discontinued as needed. IOP will not drop immediately as it does with Trabs. IOP may fluctuate during the first 2 weeks. The ultimate post-ECP pressure will be identified between the 2nd and 8th week. Retreatment may then be considered.
Commonly Seen Complications

- IOP spike (retained viscoelastic)
- Transient Hemorrhage
- Inflammation
- Pupil Irregularity (anterior burns)
- Vitreous Prolapse into AC (in eyes with open capsule)
- Any complication associated with anterior segment surgery
Take away points

- ECP is safe, effective and easy when done correctly
- It is minimally destructive and more targeted to ciliary body epithelium
- Mode of delivery of laser energy is trade off between efficacy, safety, and side effects
Adequate IOP Response

IOP response curves to ECP
Adequate IOP Response

IOP response curves to ECP
Inadequate IOP Response

You didn't laser enough of the ciliary epithelium
DO MORE
Phaco-ECP vs Phaco Alone: Mean IOP Over Time

<table>
<thead>
<tr>
<th></th>
<th>Pre-Op</th>
<th>6 Months</th>
<th>1 Year</th>
<th>2 Years</th>
<th>3 Years</th>
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<tbody>
<tr>
<td>Phaco-ECP</td>
<td>19.08</td>
<td>16.03</td>
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<td>Phaco Alone</td>
<td>18.16</td>
<td>17.62</td>
<td>16.28</td>
<td>16.87</td>
<td>18.93</td>
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</table>
ECP in Refractory Glaucoma

Proportion with IOP ≤ 21 mm Hg

Time from Treatment (months)
IOP Over Time

Proportion with IOP ≤ 21 mm Hg

Time from Treatment (months)

NVG
APH/PS
Phakic POAG
Combined
Congenital
ROP
## Post PK Glaucoma and ECP

<table>
<thead>
<tr>
<th>Study and Reference</th>
<th>N</th>
<th>Tube IOP Success %</th>
<th>ECP IOP Success %</th>
<th>Tube Chronic PK Rejection %</th>
<th>ECP Chronic PK Rejection %</th>
<th>F/U (mo)</th>
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<td>------</td>
<td>90</td>
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<td>(AJO 1994 124;787-796)</td>
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<td>Lima</td>
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<td>(J Glaucoma 2004;13:233-237)</td>
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<td>Complication</td>
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<td>IOP Spike</td>
<td>14.5%</td>
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<td>Hemorrhage</td>
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<td>Serous Choroidal Effusion</td>
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<td>IOL Dislocation</td>
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<td>CME</td>
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</table>

5824 patients
Phaco-ECP vs Phaco Alone

Stanley J. Berke, M.D., FACS, et. al.

- 707 Patients
- 626 Randomized to Phaco-ECP Group
- 81 Randomized to Phaco Alone
- 5 Surgeons
- Parameters such as VA, IOP, Meds, & complications were followed
- Mean follow-up was 3.2 years (0.5 to 5.8 years)
Phaco-ECP vs Phaco Alone: Mean IOP Over Time

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A prospective, comparative study between endoscopic cyclophotocoagulation and the Ahmed drainage implant in refractory glaucoma (Lima, J Glaucoma)

- 68 patients
- Mean Follow-up 20 months
- Mean Pre-IOP 41 both groups
- Mean Post-IOP 14 both groups at 24 months
- Complication Rates
  - Choroidal Effusion 18 vs 3%
  - Shallow AC 18 vs 0%
  - Hyphema 15 vs 18%
- Clinical success similar; higher complication rate with Ahmed
A prospective, comparative study between endoscopic cyclophotocoagulation and the Ahmed drainage implant in refractory glaucoma (Lima, J Glaucoma)

- Success rate of initial procedure last follow-up was 34%
- 9 eyes (25%) retreated at least once
- Cumulative success rate after all procedures 43%
- Mean arc of treatment was 260 degrees +/- 58 degrees of ciliary processes
- Postoperative complications
  - 2 retinal detachment
  - 1 hypotony
  - 1 progression of vision loss from HM to NLP
- All 4 complications occurred in aphakic patients
Endoscopic photocoagulation of the ciliary body for treatment of refractory glaucomas  
Alvarado, AJO, 1997

- 68 eyes of 68 patients underwent ECP
  - 180 to 360 degrees of the ciliary body
  - limbal incision (56 eyes, 12 concurrent cataract extraction)
  - pars plana incision (12 eyes)
- Second treatment required in 5 eyes (7%)
- Mean follow-up 12.9 months
- IOP decreased from 27.7 +/- 10.3 mm Hg preoperatively to 17.0 +/- 6.7 mm Hg
- Mean reduction 10.7 mm Hg, (34%)

- 61 eyes (90%) achieved IOP <= 21 mm Hg
- Kaplan-Meier successful outcome in 94% of patients after 1 year and 82% after 2 years
- Mean number of medications reduced from 3.0 +/- 1.3 preop to 2.0 +/- 1.3 postop (P < .0001)
- BCVA was stable or improved in 64 eyes (94%), with 4 (6%) losing 2 or more lines of acuity
- No case of hypotony (IOP < 5 mm Hg) or phthisis observed
### Phaco-ECP vs Phaco Alone
#### Glaucoma Medication Cost Analysis

<table>
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<th>Post-Op</th>
<th>Savings/Loss</th>
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<tr>
<td><strong>Phaco-ECP monthly patient cost</strong></td>
<td>$220.08</td>
<td>$94.78</td>
<td>$125.30</td>
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<td><strong>Phaco-ECP annual patient cost</strong></td>
<td>$2,640.92</td>
<td>$1,137.35</td>
<td>$1,503.57</td>
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<tr>
<td><strong>Phaco Alone monthly patient cost</strong></td>
<td>$144.45</td>
<td>$160.28</td>
<td>($15.83)</td>
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<tr>
<td><strong>Phaco Alone annual patient cost</strong></td>
<td>$1,733.40</td>
<td>$1,923.36</td>
<td>($189.96)</td>
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<tr>
<td><strong>Estimated US annual savings</strong>*</td>
<td></td>
<td></td>
<td>$846,765,000</td>
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* 2.5 million cataract procedures annually. 20% of cataract surgery patients concurrently treated with glaucoma medications.
Kaplan Meier Survival Analysis:
Phaco-ECP vs Phaco alone in medically controlled glaucoma
Spaeth study:
Ultra-refractory glaucoma

Patient profile
17 eyes of 12 patients
Mean age 40.5 yrs (31-74)

Mechanism of Glaucoma
Open angle 8
CACG 4
Pigmentary 2
Uveitic 2
Congenital 1
Spaeth study:
Ultra-refractory glaucoma

- Uncontrolled IOP on MMT: 100% (17/17)
- Surgery needed in better eye: 71% (12/17)
- Prior RD or PK surgery in ECP eye: 35% (6/17)
- Blind fellow eye (one-eyed patient): 41% (7/17)
- Mean # previous gl surgeries: 3.0
Spaeth study: Ultra-refractory glaucoma

IOP

- Mean pre-op IOP 25.1 ± 6.4 mmHg
- Mean post-op IOP 10.5 ± 3.8 mmHg

P = .0000000006

Decreased IOP 100%

No eyes increased IOP
Spaeth study:
Ultra-refractory glaucoma
Spaeth study:
Ultra-refractory glaucoma

MEDS

- Pre-op 3.8 ± 1.3
- Post-op 0.9 ± 1.1

P = .0000006

Decreased Meds 82%
Unchanged 18%
Spaeth study:
Ultra-refractory glaucoma

Visual acuity improved 12%

Unchanged 82%

Decreased 6%
Spaeth study:
Ultra-refractory glaucoma

Transient serous choroidal 1
Dislocated old cortex with vitrectomy 1
Development of cataract in the only phakic eye treated 1

Results follow-up
17.5 months (range 2-46)
CONCLUSION

• Satisfactory level of safety and efficacy.
• Consider as reasonable alternative in the setting of uncontrolled glaucoma w/ previously failed surgery.
Thank You

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