Selective Laser Trabeculoplasty
Clinical Case

• 67 yo WM

• 4 month f/u POAG

• Diagnosed 4 years ago
• Vision stable
• Occasional non-compliance
• IOP pre-tx 24/22
• Meds:
  – Travatan Z q HS Both eyes
  – Cosopt BID Both eyes
• PMH: GERD, HTN, DM, Dyslipidemia
• POH: Cataracts, POAG, DES
• Meds: Ranitidine, Atenolol, Lisinopril, Metformin, Januvia, Simvastatin, MVI
• Allergies: NKDA
• Fam Hx: Negative for ocular disease
• Soc Hx: ½ PPD smoker, Social ETOH
Examination

OD      OS

• $V_{ac}$ : 20/25^{-1}  20/25
• IOP: 18 17
• Motility: Full Full
• Pupils: 4->2, R, R, No APD

• Pachy: 550 550
• Gonio: Grade 3-4 open, tr pigment, no PAS – Both eyes
SLE

- L/L: normal both eyes
- Conj: clear both eyes
- K: clear both eyes
- AC: deep and quiet both eyes
- I: normal both eyes
- Lens: 2+ NSC both eyes
What’s the next step?

- Continue Prior Management
- Reinforce compliance and drop administration
- Add a fourth medication
- Laser
  - SLT vs. ALT
- Surgery
  - Trab
  - ExPRESS
  - Tube
  - Phaco/IOL +/- ECP
Laser Trabeculoplasty

Experimental glaucoma in the rhesus monkey. DOUGLAS GAASTERLAND AND CARL KUPFER.

Repeated, circumferential argon laser photocoagulation of the trabecular meshwork area of the anterior chamber angle of normal Rhesus monkeys causes a sustained elevation of the intraocular pressure and marked reduction of the outflow facility. During the observation period of this study, cupping of the optic nervehead developed. Preliminary histopathologic examination revealed localized scarring of the anterior chamber angle structures. Retinal and optic nerve changes, similar to those seen in human chronic, open-angle glaucoma, were seen. The method to produce this experimental glaucoma is reported.

FIGURE 1. The 50-μ laser beam is carefully focused on the pigmented trabecular band, just anterior to the scleral spur.

Glaucoma Treatment by Trabecular Tightening with the Argon Laser

JAMES B. WISE

Evolution to SLT


• 1998 – Latina et al – Selective Laser Trabeculoplasty

Table 8. Comparison of Selective Laser Trabeculoplasty (SLT) and Argon Laser Trabeculoplasty (ALT) Clinical Trials

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Success Criteria</th>
<th>Baseline IOP (mmHg)</th>
<th>IOP Reduction at 6 mos (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLT</td>
<td>≥3 mmHg reduction from baseline</td>
<td>24.8 (all eyes)</td>
<td>5.0 (all eyes)</td>
</tr>
<tr>
<td>ALT Fink et al</td>
<td>&lt;22 mmHg with no increased disc or field loss</td>
<td>27.4</td>
<td>6.4</td>
</tr>
<tr>
<td>ALT Brancato et</td>
<td>&lt;22 mmHg with no increased disc or field loss</td>
<td>26.1</td>
<td>5.1</td>
</tr>
<tr>
<td>ALT Schwartz et</td>
<td>≥20% IOP reduction from baseline</td>
<td>23.4</td>
<td>5.8</td>
</tr>
<tr>
<td>ALT</td>
<td>≥3 mmHg reduction from baseline with stable visual field and/or disc cupping</td>
<td>25.8</td>
<td>9.0</td>
</tr>
</tbody>
</table>

IOP = intraocular pressure; OAG = open-angle glaucoma.

Figure 1. Mean intraocular pressures over time for all treated eyes (responders and nonresponders), the open-angle glaucoma group and the argon laser trabeculoplasty group.
Selective Photothermolysis

- Key is short duration (3 nanoseconds)
- Thermal relaxation time of chromophores (1 microsecond)
- Time required to convert absorbed electromagnetic energy to heat energy
- If laser pulse is shorter than TRT – no energy is dissipated as heat
Application

• Q-switched, frequency-doubled 532 nm Nd:YAG laser
  – 400 µm spot size
  – 0.4-0.12 mJ (single pulse mode)
  – Titrate to champagne (cavitation) bubbles
  – 40-50 shots per 180° centered on posterior/postpigmented TM
How exactly does LTP work?

• Mechanical theory
  – Thermal burn at time of laser
  – Collagen shrinkage/ Tissue contraction
  – Stretching of TM
  – Widening of Schlemms Canal

  – New, wider openings -> Improved outflow
Are there structural changes in SLT?

ALT

SLT

Kramer & Noecker, 2001 Ophthalmology
Alternate Theories

• Repopulation Theory
  – TM endothelial cell proliferation after laser tx in vitro
  – Normal, healthy TM cells replace diseased ones

• Induction of MMP expression
  – Remodeling of Juxtacannalicular TM

• Cytokine response
  – IL-1, IL-6 induces reversal of SC tight junctions

• Stress Response Pathway
  – NF-κβ -> IL-1 -> ELAM-1

• Recruitment of Macrophages
  – May augment the cytokine response
Future Work

- Will application of cytokines into TM in vivo demonstrate similar results as in vitro?
- Will application of monocytes near TM produce increase in outflow?
- Can we translate these cytokine responses or ELAM-1 into potential targets in pharmacologic development?