Selective Laser Trabeculoplasty (SLT)

May 20, 2012

Dr. Paul Choinski

Huntington Hilton

Melville, NY

Key Topics

- **SLT Mechanism of Action**
  - The science behind SLT
- **Patient Commitment**
  - Patient adherence and persistence
- **SLT as Primary Therapy**
  - Equivalent efficacy to medication
  - Effective long-term results
- **SLT as Adjunctive Therapy**
  - Benefits of SLT adjunctive to topical medication
- **SLT as Replacement Therapy**
  - SLT benefits beyond achievement of target intraocular pressure (IOP)
    - Patient adherence, eliminating systemic side effects, decreasing patient costs
- **Potential SLT Retreatment Therapy**
  - SLT vs ALT
    - No coagulative or thermal damage to the trabecular meshwork
    - Repeatability

In regards to glaucoma patients:

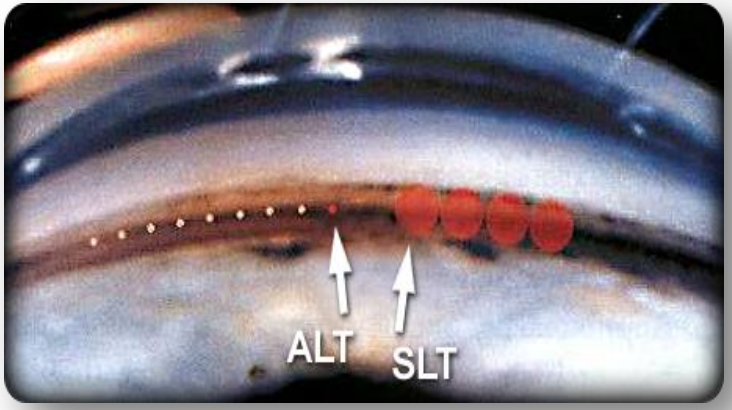
1. **I manage my glaucoma patients medically**
2. **I co-manage glaucoma patients.**
3. **I refer all glaucoma patients and suspects to an ophthalmologist for management**.

SLT Mechanism of Action

The Science Behind SLT

Mechanism of Action

SLT uses a Q-switched, 3 nanosecond pulsed, frequency-doubled Nd:YAG; 532 nm wavelength green laser

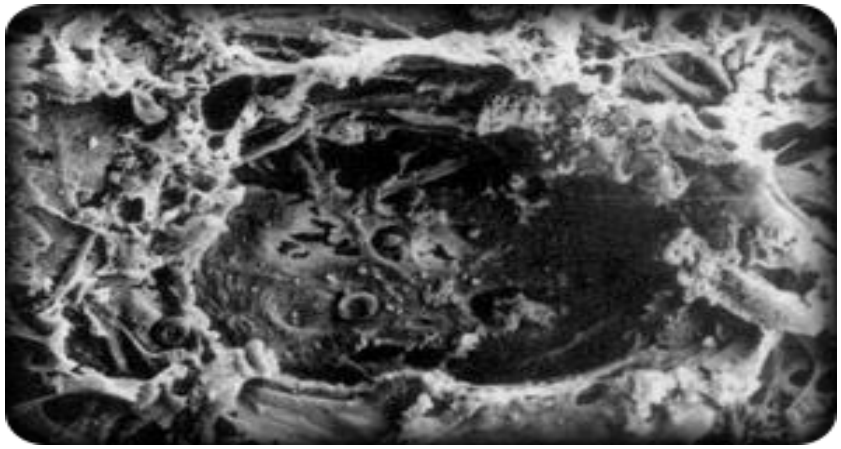


Larger beam diameter with SLT

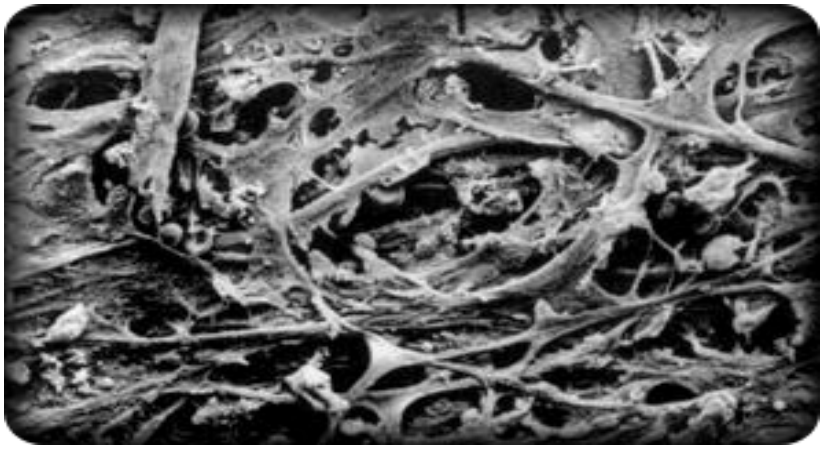
- **Reduces need for focus**
- **Evenly distributes laser energy**

1. Latina MA, Sibayan SA, Shin DH, et al. *Ophthalmology*. 1998;105:2082-2090. 2. Latina MA, Park C. *Exp Eye Res*. 1995;60:359-372. 3. Alvarado JA, Alvarado RG, Yeh RF, Franse-Carman L, et al. *Br J Ophthalmol*. 2005;89:1500-1505. 4. Damji KF, Bovell AM, Hodge WG. *Ophthalmic Pract*. 2003;21:54-58. 5. Kramer TR, Noecker RJ. *Ophthalmology*. 2001;108:773-779.

The Advantages of Selectivity



ALT



SLT

- **SLT uses energies of 0.6 to 1.2 mJ, compared with 40 to 70 mJ per pulse for ALT**
- **ALT causes coagulative damage that leads to scarring of the trabecular meshwork**
- **SLT treatments do not cause the coagulative damage associated with ALT. Therefore, SLT is believed to improve aqueous outflow and regeneration of the trabecular meshwork**

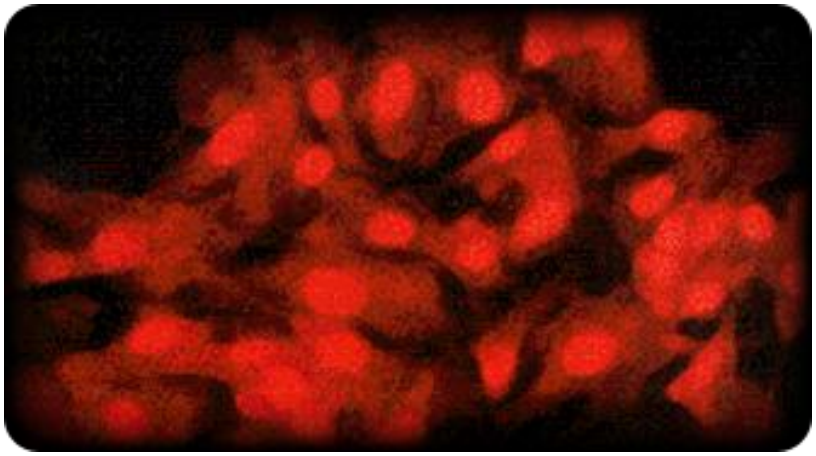
Noecker R. *Glaucoma Today*. 2009;7:2:43.
Kramer TR, Noecker R, et al. *Ophthalmology*. 2001;108:773-779.

Mechanism of Action

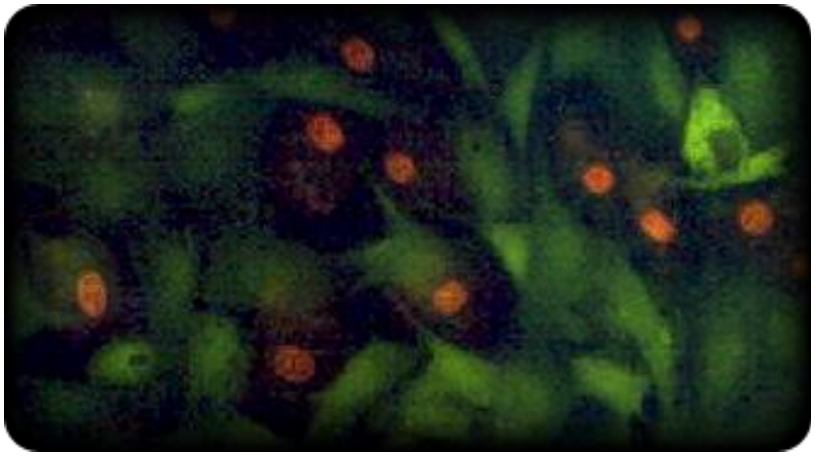
Laser energy selectively targets pigmented trabecular meshwork endothelial cells (TMEs) with no coagulative damage or collateral thermal effects

1. Latina MA, Sibayan SA, Shin DH, et al. *Ophthalmology*. 1998;105:2082-2090. 2. Latina MA, Park C. *Exp Eye Res*. 1995;60:359-372. 3. Alvarado JA, Alvarado RG, Yeh RF, Franse-Carman L, et al. *Br J Ophthalmol*. 2005;89:1500-1505. 4. Damji KF, Bovell AM, Hodge WG. *Ophthalmic Pract*. 2003;21:54-58. 5. Kramer TR, Noecker RJ. O*phthalmology*. 2001;108:773-779.

The Advantages of Selectivity



ALT



SLT

- **ALT: High thermal absorption to all cells**
- **SLT: Selectively targets TME cells**

Latina MA, Park C. *Exp Eye Res*. 1995;60:359-372.

Mechanism of Action

Treated TMEs release cytokines, which bind with the Schlemm's canal endothelial cells (SCEs) and open up the cellular barrier formed by these cells

1. Latina MA, Sibayan SA, Shin DH, et al. *Ophthalmology*. 1998;105:2082-2090. 2. Latina MA, Park C. *Exp Eye Res*. 1995;60:359-372. 3. Alvarado JA, Alvarado RG, Yeh RF, Franse-Carman L, et al. *Br J Ophthalmol*. 2005;89:1500-1505. 4. Damji KF, Bovell AM, Hodge WG. *Ophthalmic Pract*. 2003;21:54-58. 5. Kramer TR, Noecker RJ. *Ophthalmology*. 2001;108:773-779.

Mechanism of Action

The SCE barrier acts as a “control” site for aqueous outflow. The opening of the SCE barrier cells leads to increased aqueous outflow and a decrease in IOP

1. Latina MA, Sibayan SA, Shin DH, et al. *Ophthalmology*. 1998;105:2082-2090. 2. Latina MA, Park C. *Exp Eye Res*. 1995;60:359-372. 3. Alvarado JA, Alvarado RG, Yeh RF, Franse-Carman L, et al. *Br J Ophthalmol*. 2005;89:1500-1505. 4. Damji KF, Bovell AM, Hodge WG. *Ophthalmic Pract*. 2003;21:54-58. 5. Kramer TR, Noecker RJ. O*phthalmology*. 2001;108:773-779.

Mechanism of Action: Summary

SLT has an MOA that is:

- **Safer**
  - SLT is not associated with systemic side effects
- **Selective**
  - *Selective Photothermolysis* specifically targets pigmented cells, leaving trabecular meshwork intact
- **Smart**
  - *Cellular Photoactivation* stimulates the body's natural mechanisms to enhance aqueous outflow
  - When used as primary therapy, SLT is as effective as alternative glaucoma treatments
- **Sensible**
  - Cost issues of medications
  - Compliance issues of medications
  - SLT is typically reimbursed by Medicare

1. Latina MA, Sibayan SA, Shin DH, et al. *Ophthalmology*. 1998;105:2082-2090. 2. Latina MA, Park C. *Exp Eye Res*. 1995;60:359-372. 3. Alvarado JA, Alvarado RG, Yeh RF, Franse-Carman L, et al. *Br J Ophthalmol*. 2005;89.1500-1505. 4. Damji KF, Bovell AM, Hodge WG. *Ophthalmic Pract*. 2003;21:54-58. 5. Kramer TR, Noecker RJ. *Ophthalmology*. 2001;108:773-779. 6. McIlraith I, Strasfeld M, Colev G, et al. *J Glaucoma*. 2006;15:124-130.. 7. Juzych MS, Chopra V, Banitt MR, et al. *Opthalmology*. 2004;111:1853-1859.

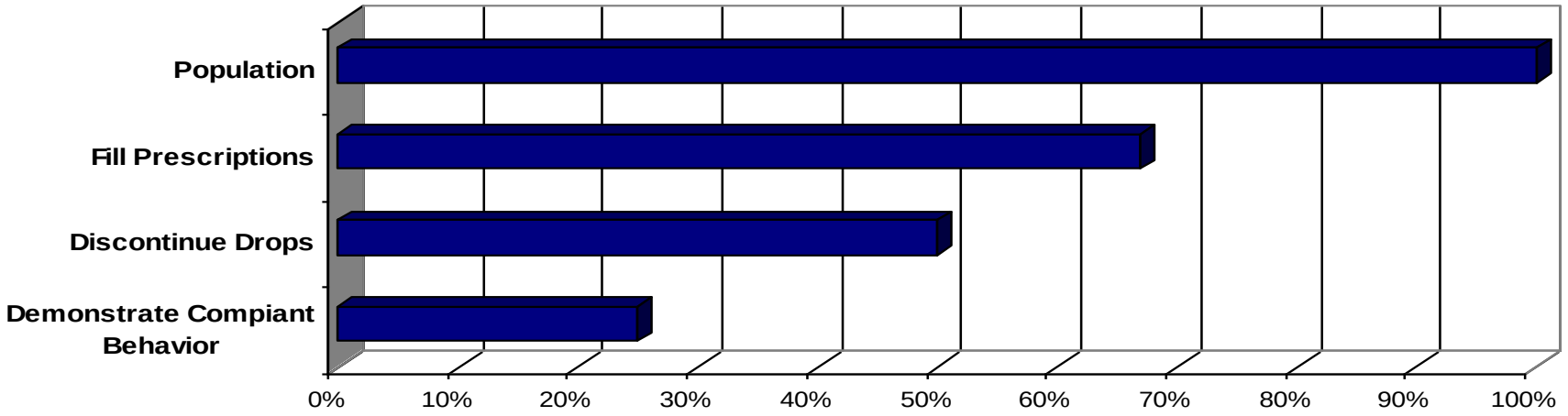
Patient Commitment

Patient Adherence and Persistence

For those who treat glaucoma which is the issue most significant for leading to non-compliance with glaucoma medications?

1. **Cost**
2. **Side effects**
3. **Forgetfulness**
4. **Patient not being able to detect any benefit**
5. **Patient denial that they actually have a problem**

Compliance Conundrum

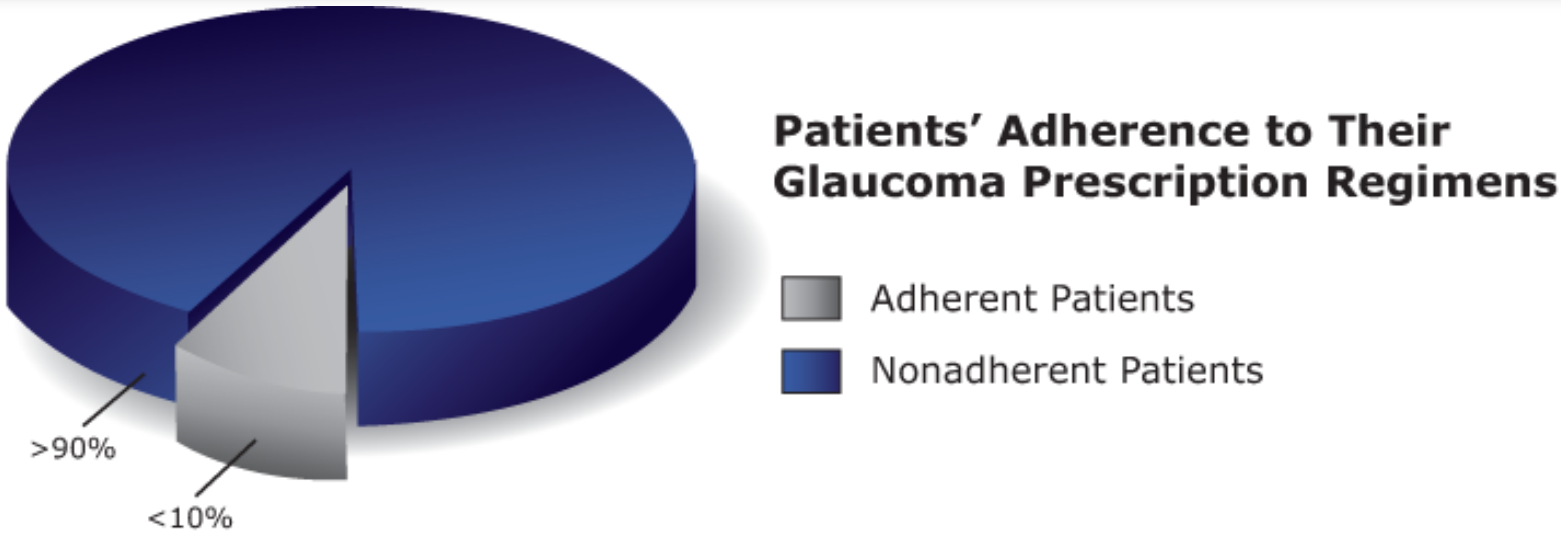


- 67% of patients state they follow physicians instructions “extremely closely”

- Yet:
  - 75% admit to some form of non-compliant behavior
  - 33% don’t fill prescriptions given
  - Nearly 50% discontinue drops within 6 months
  - Poor compliance isn’t bound to income or socio-economic levels

1. National Community Pharmasists Association Web site. Take as Directed: A Prescription Not Followed. December 15, 2006
2. Nordstrom BL, Friedman DS, Mozaffari E, et al. *Am J Ophthalmol.* 2005;140:598-606.
3. Osterberg, L, Blaschke T. Adherence to medication. N Engl J Med 2005 Aug 4;353(5):484-97.Review.

Patient Adherence and Persistence



- Over 90% of patients are nonadherent
  - Adherence: The prevalence of use of the initial medication at various time points
- Nearly 50% of patients are not persistent
  - Persistence: Continuous treatment with initially prescribed medication

Majority of glaucoma patients have trouble staying *committed* to their prescription regimens

Nordstrom BL, Friedman DS, Mozaffari E, et al. *Am J Ophthalmol.* 2005;140:598-606.

Common Reasons for Noncompliance

- Complicated prescription regimens
- Polypharmacy
- Medication costs / ”Donut Hole”
- Unpleasant side effects
- Not following appropriate dosing instructions
  - Too much medication
  - Too little medication
  - Waiting 5 minutes between applications of different medications
- Physical or material barriers
  - Snowfall
  - Problems administering drops due to arthritis
  - Reading small print on label
- Changes in ones routine

Common Reasons for Noncompliance

When measuring intraocular pressure, do you use:

1. Pheumotonometry
2. Applanation tonometry
3. Finger tension
4. A oujia board with the patient clenches their lids

Clinical Application of SLT Therapy

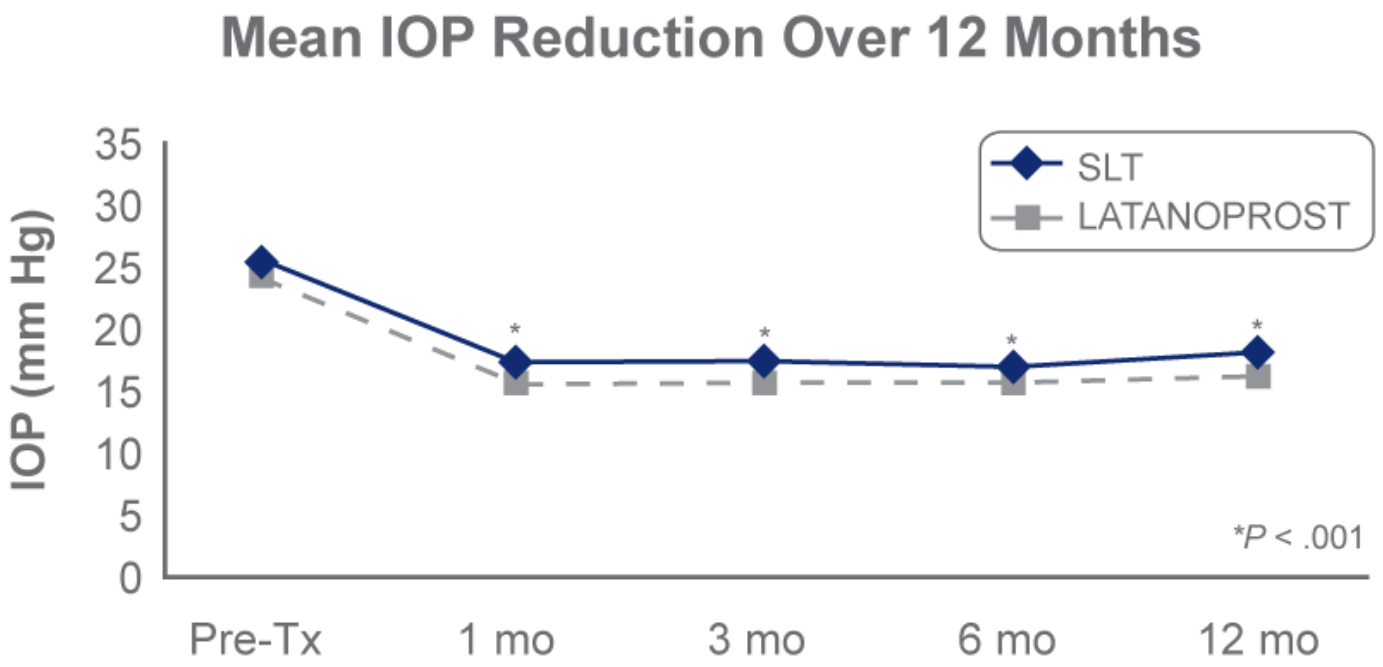
- SLT as Primary Therapy
- SLT as Adjunctive Therapy
- SLT as Replacement Therapy
- Potential SLT Retreatment Therapy

SLT as Primary Therapy

Equivalent Efficacy to Medication

Effective Long-term Results

Primary Therapy: SLT vs Medication

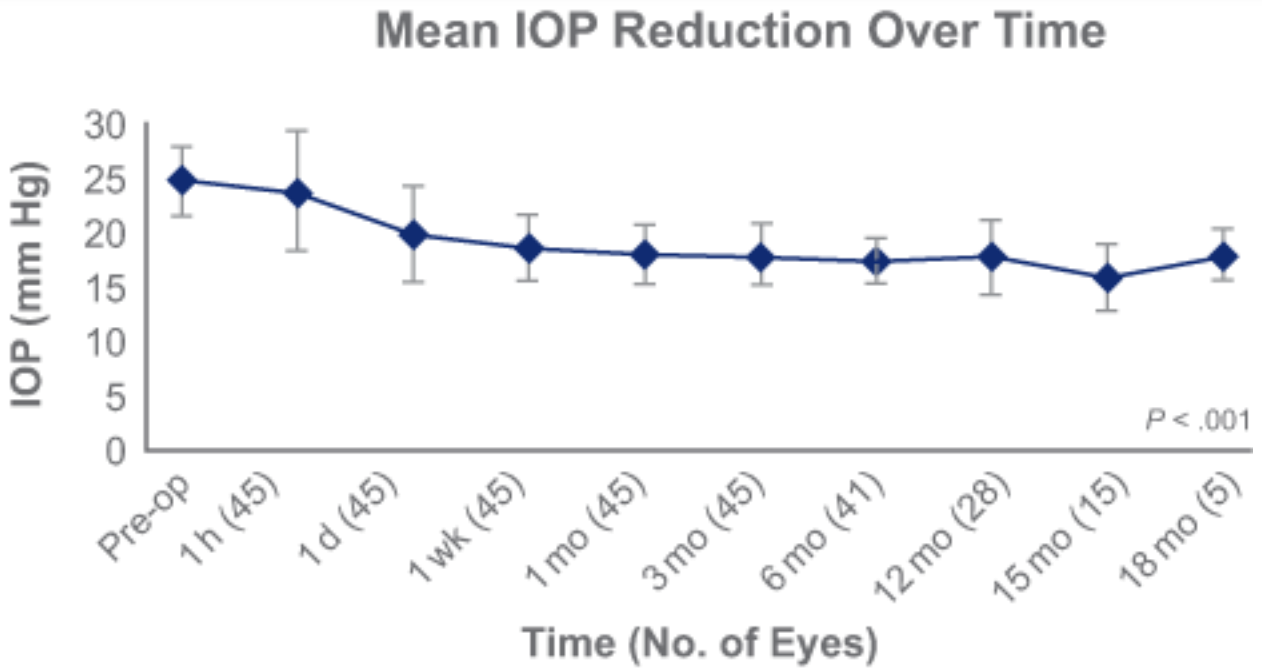


- SLT provided a mean IOP reduction of 31% (vs a mean IOP reduction of 30.6% with LATANOPROST)

SLT therapy provides IOP reduction equivalent to that of medications

McIlraith I, Strasfeld M, Colev G, et al. *J Glaucoma*. 2006;15:124-130.

Primary Therapy: Long-term Efficacy

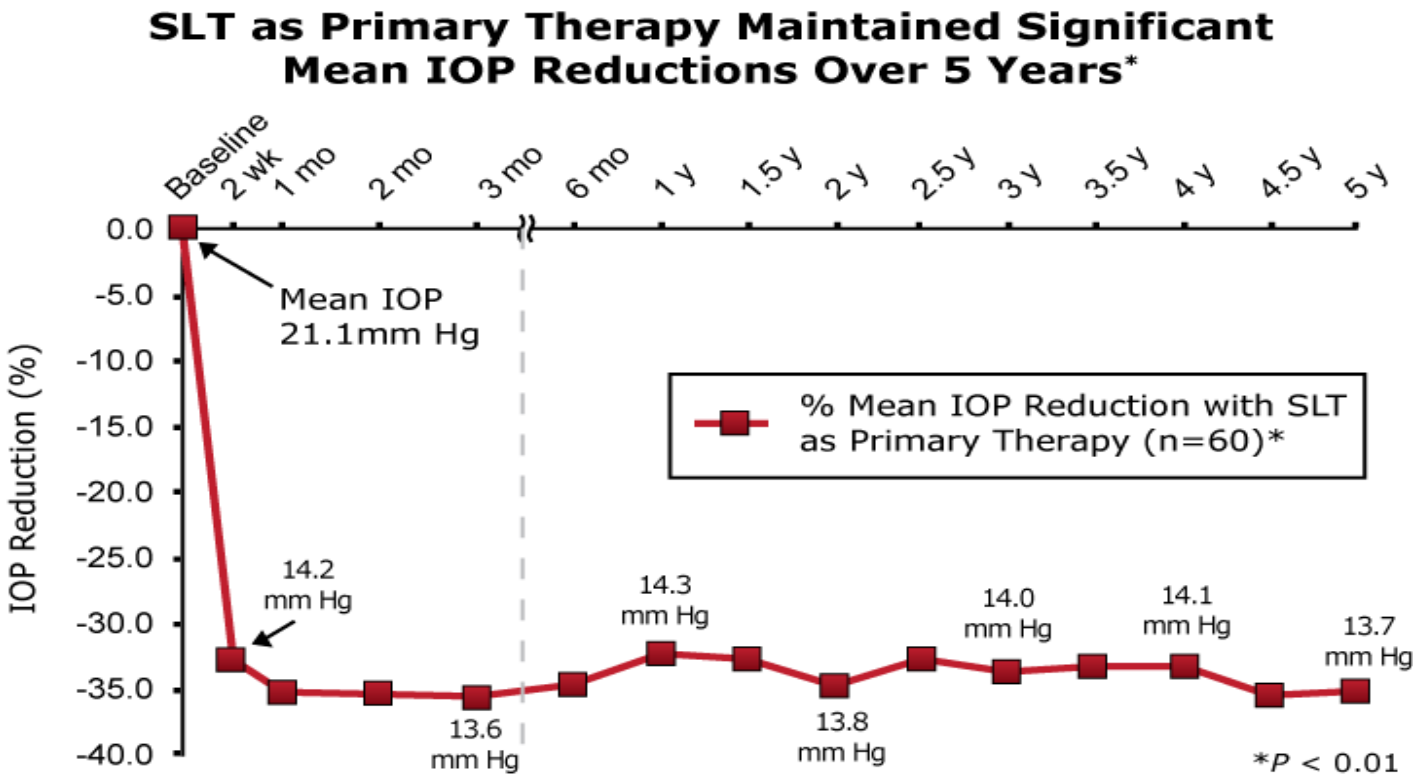


- SLT primary treatment delivered long-term results, with a mean IOP reduction of 30% (7.7 3.5 mm Hg) from baseline

SLT as primary therapy provided sustained IOP reductions

Melamed S, Ben Simon GJ, Levkovitch-Verbin H. *Arch Ophthalmol*. 2003;121:957-960.

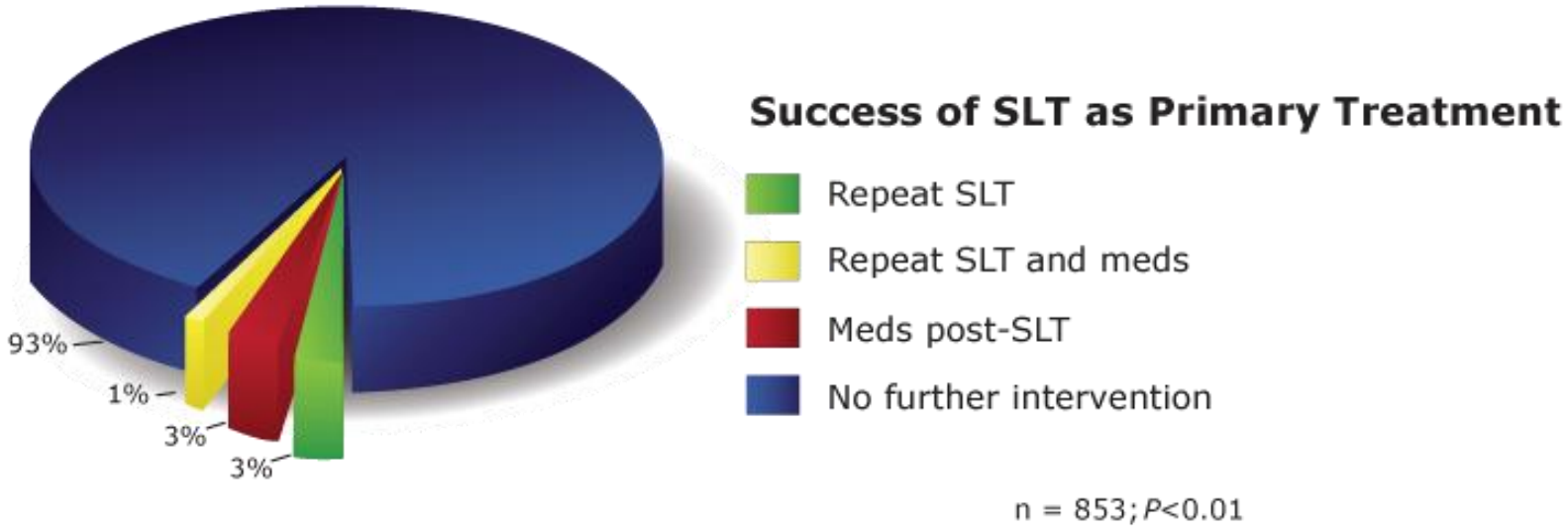
Primary Therapy: Long-term Efficacy (cont'd)



SLT primary treatment had a 31% mean IOP reduction (5.9 ± 3.2 mm Hg) over a 5-year period

Jindra LF, Gupta A, Miglino EM. Poster presented at the American Academy of Ophthalmology Annual Meeting. November, 2007.

Primary Therapy: Long-term Efficacy (cont'd)



- Success rate is defined as patients who needed no further treatment

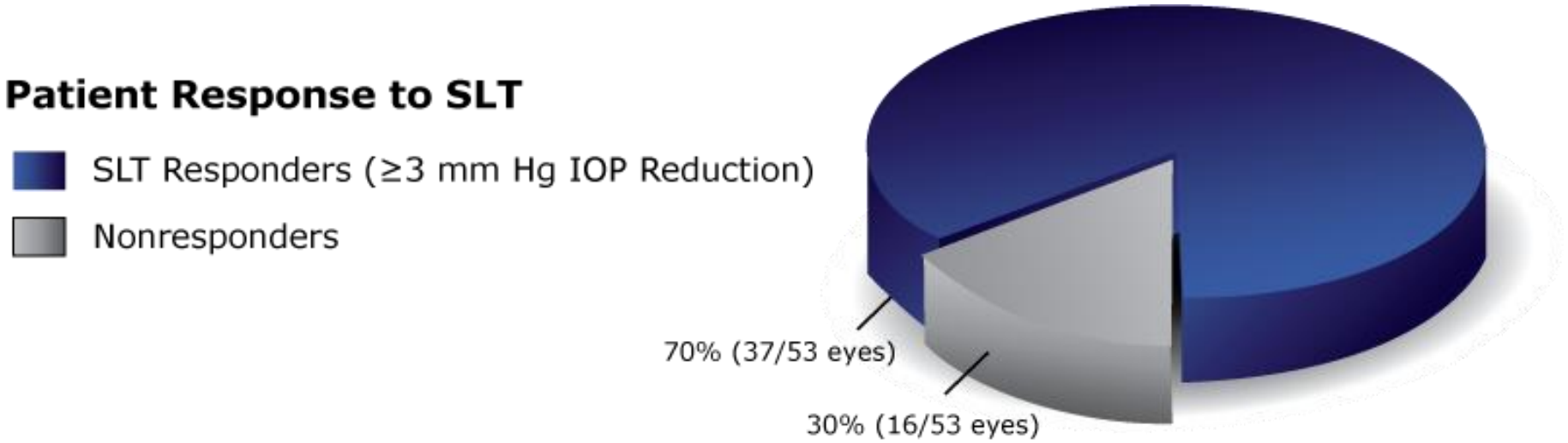
93% success rate of SLT as primary treatment over a 5-year period

Jindra LF, Gupta A, Miglino EM. Poster presented at the American Academy of Ophthalmology Annual Meeting. November, 2007.

SLT as Adjunctive Therapy

Benefits of SLT Adjunctive to Topical Medication

Adjunctive Therapy

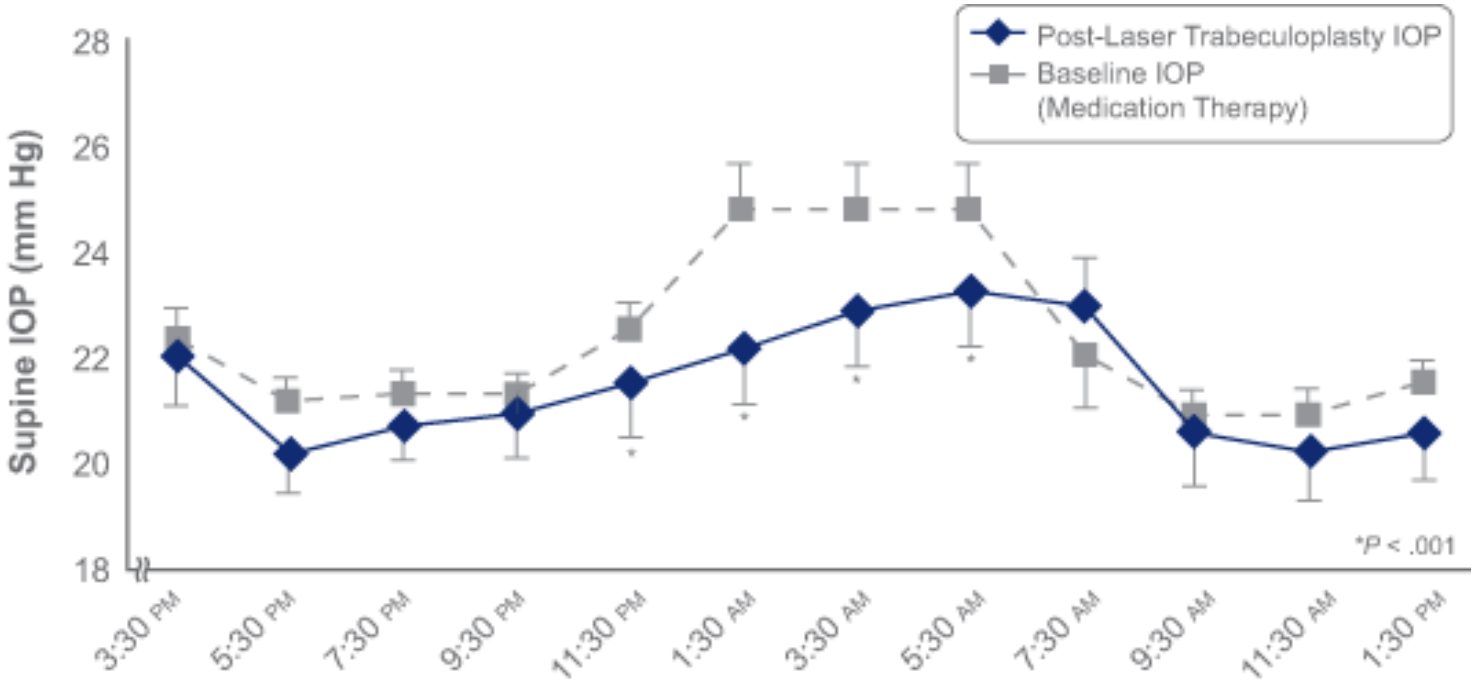


- 70% of all patients treated with SLT had an IOP reduction of ≥3 mm Hg
- SLT performed after maximal medical therapy

SLT adjunctive to medication delivers reduced and controlled IOP

Latina MA, Sibayan SA, Shin DH, et al. *Ophthalmology*. 1998;105:2082-2090.

Circadian Control



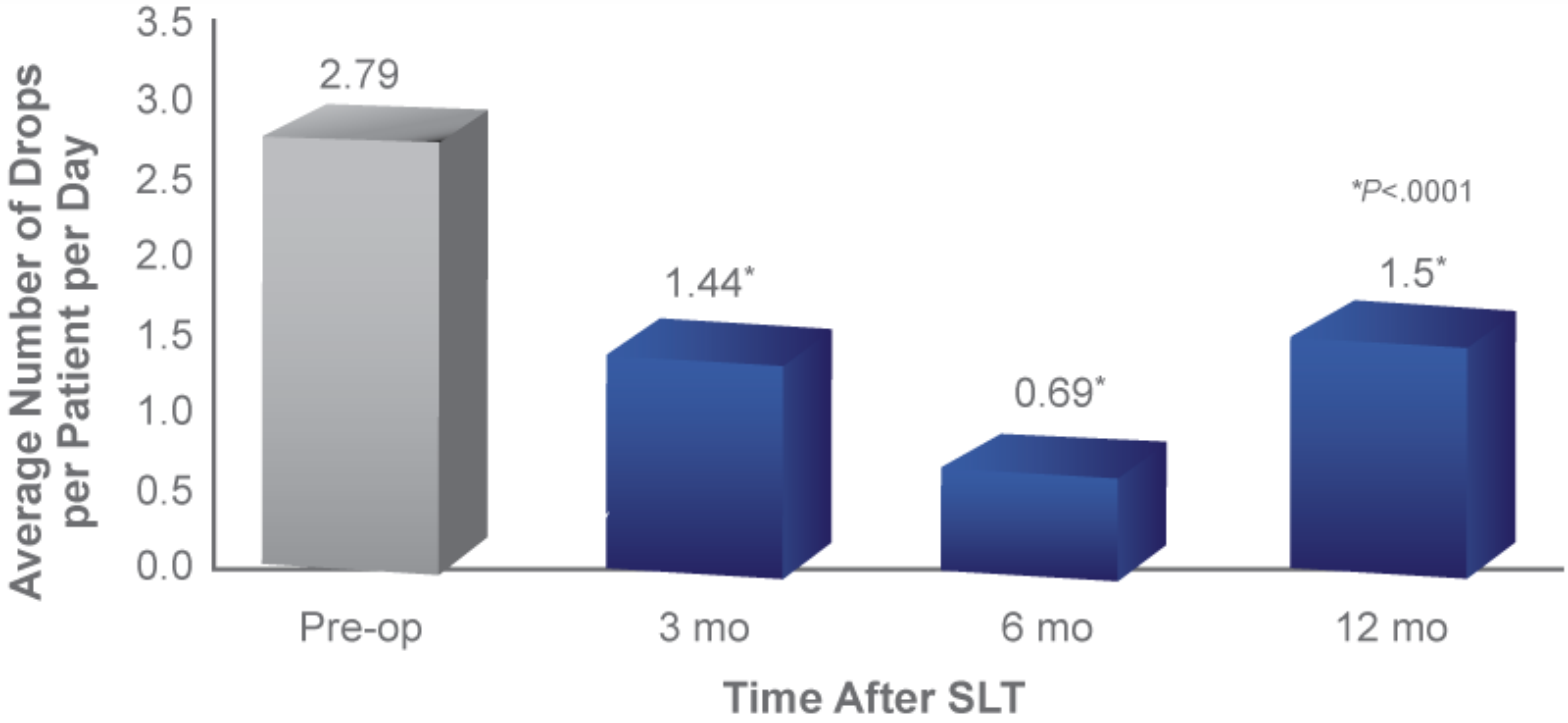
Laser trabeculoplasty adjunctive to medications has shown 24-hour IOP control with significant additive IOP reduction in the nocturnal period

Lee AC, Mosaed S, Weinreb RN, et al. *Ophthalmology*. 2007;114:666-670.

SLT as Replacement Therapy

SLT Benefits Beyond Achievement of Target IOP

Replacement Therapy (cont'd)

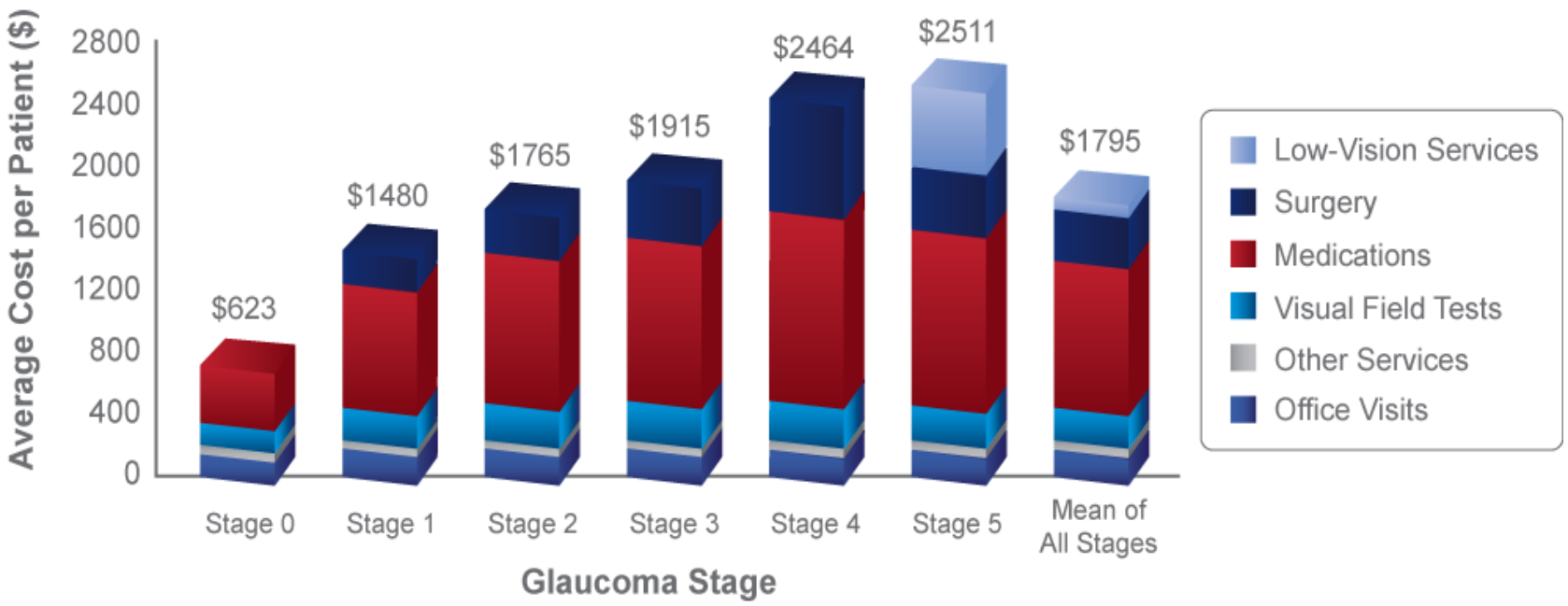


- **87%** of eyes maintained reduction in medication use by at least 1 medication at 12 months

SLT therapy can help reduce patient dependence on topical medications

Francis BA, Ianchulev T, Schofield JK, et al. *Am J Ophthalmol*. 2005;140:524-525.

Glaucoma Costs

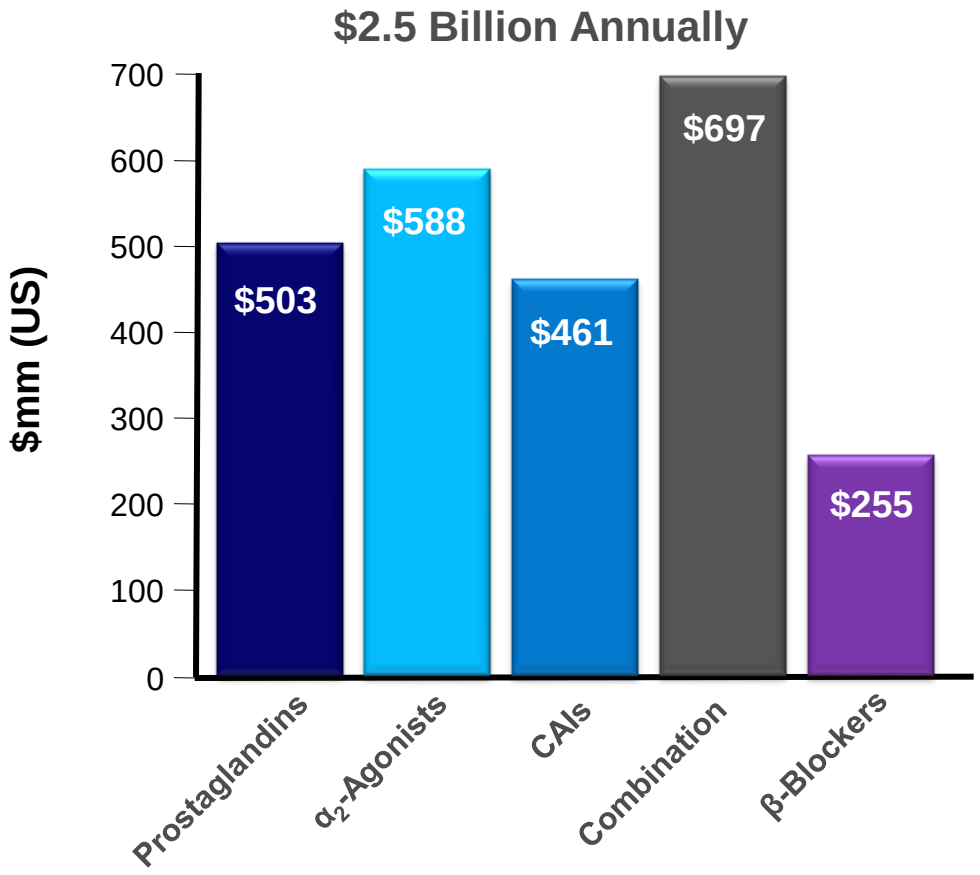


- Glaucoma medications are a major factor toward the total direct cost of glaucoma

- **Early diagnosis and treatment may lead to potential cost savings for both patients and overall health care systems**
- **Over 5 years laser trabeculoplasty had lowest total costs compared to treatment by medication alone or filtering surgery for patients not adequately controlled by two medications**

Lee PP, Kelly SP, Mills RP, et al. *J Glaucoma*. 2007;16:471-478.
Cantor L, Katz LJ, Cheng JW, Chen Er, Tong K, Peabody JW, et al. *Current Medical Research and Opinions*. 2008; 24:2905-2917.

Current Average Yearly Cost of Glaucoma Medications



Prostaglandins
- Lumigan
- Travatan
- Travatan Z
- Xalatan

α_2-Agonists
- Alphagan P
- Brimonidine

CAIs
- Azopt
- Trusopt

β-Blockers
- Betoptic S
- Istalol
- Timoptic
- Timoptic XE
- Betaxolol
- Carteolol
- Levobunolol
- Metipranolol
- Timolol gel
- Timolol maleate

Combination
- Cosopt

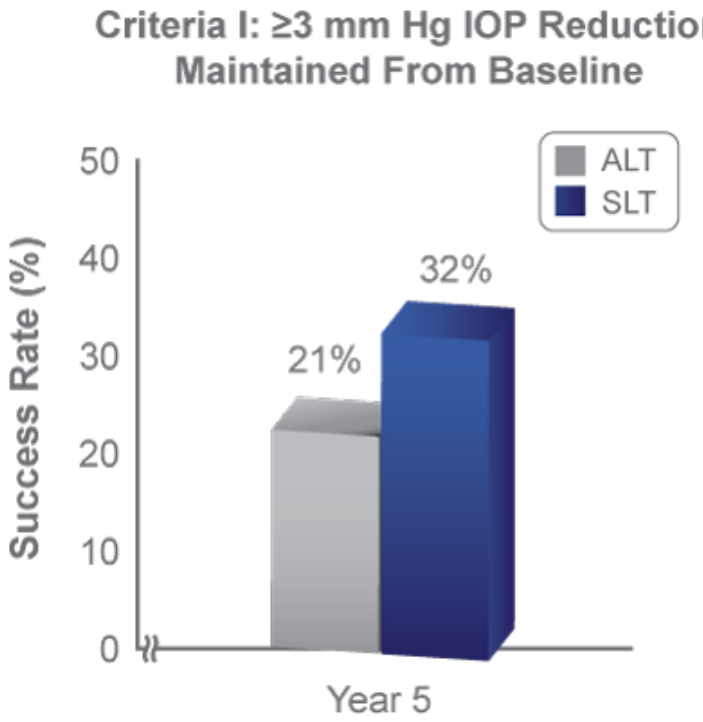
Glaucoma patients are on an average of 2-3 Rx medications

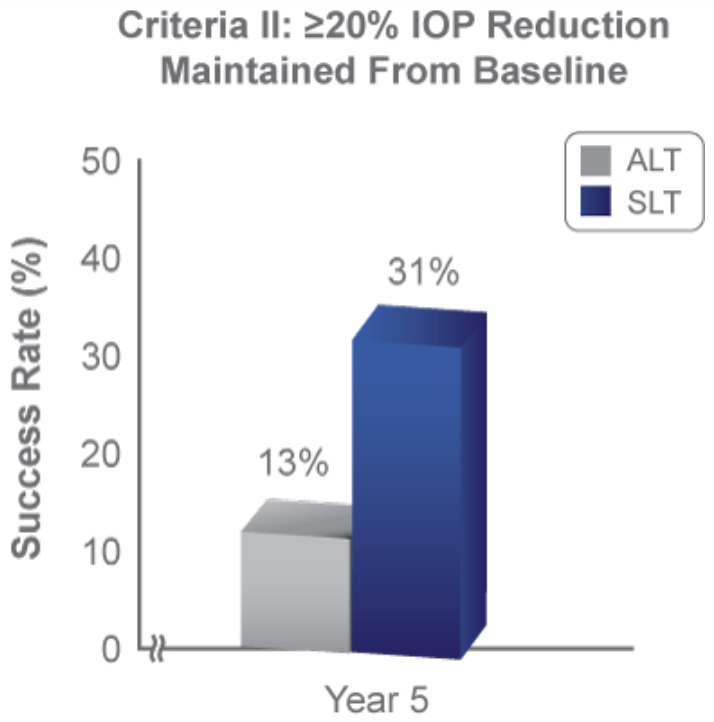
Rylander NR and Vold SD. *Am J Ophthalmol. 2008;145:106-113.*

Potential SLT Retreatment Therapy

SLT vs ALT

SLT vs ALT: Comparing Long-term Results



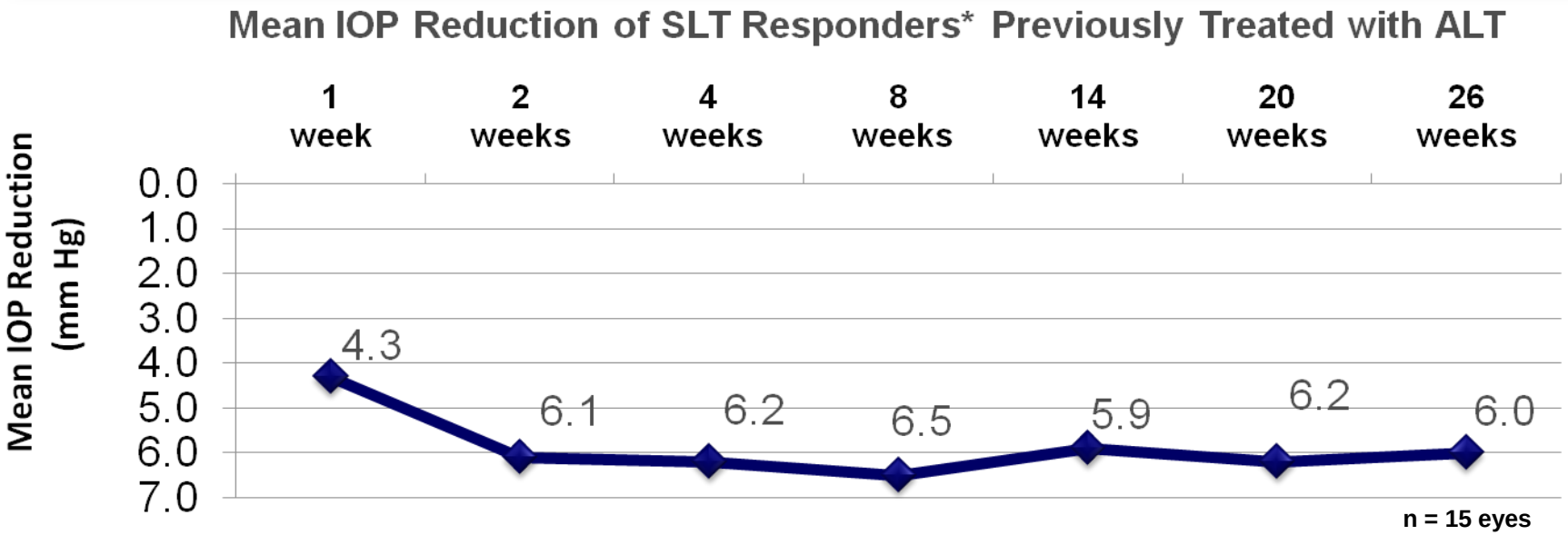


These data were not statistically significant

SLT vs ALT had comparable success rates for IOP reduction, with a trend showing SLT having a better overall success rate over a 5-year period

Juzych MS, Chopra V, Banitt MR, et al. *Ophthalmology*. 2004;111:1853-1859.

SLT Patients Previously Treated with ALT



- 57% of SLT responders previously treated with ALT achieved a mean IOP reduction of ≥5 mm Hg

*Achieved an IOP reduction of ≥3 mm Hg

The safety profile and clinical data suggest that SLT may be an effective retreatment therapy, in contrast with ALT

Latina MA, Sibayan SA, Shin DH, et al. *Ophthalmology*. 1998;105:2082-2090.

Side Effects

SLT and Commonly Used Glaucoma Medications

SLT Side Effects

- Initial IOP spike*
- Slightly blurred vision
- Minimal pain or discomfort
- Minimal inflammatory reaction†

*Can be seen at 1 hour post-therapy and may not be statistically significant (>2 mm Hg)

†1 + cells and flare

McIlraith I, Strasfeld M, Colev G, et al. *J Glaucoma*. 2006;15:124-130.
Latina MA, Sibayan SA, Shin DH, et al. *Ophthalmology*. 1998;105:2082-2090.

Common Side Effects of Glaucoma Medications

- **Adrenergics**
  - Allergic reactions; blurred vision; burning of the eyes; headaches
- **Alpha Agonists**
  - Burning and stinging; fatigue; headaches; drowsiness; dry mouth and dry nose
- **Beta Blockers**
  - Low blood pressure; reduced pulse rate; fatigue; shortness of breath in people who have asthma or other respiratory disorders
- **Carbonic Anhydrase Inhibitors (CAIs)**
  - Burning; stinging; other eye discomfort
- **Cholinergics (Miotic)**
  - Dim vision
- **Combinations**
  - Burning; stinging; changes in sense of taste
- **Prostaglandin Analogs**
  - Increased pigmentation of iris, eye tissue (eyelid), and eye lashes; burning; stinging; eye redness (hyperemia); itching

Moderate hyperemia*

Severe hyperemia*

*Images from: Xalatan® Web site. Available at: www.xalatan.com/hcp/tolerability.asp. Accessed March 19, 2008.

Glaucoma Research Foundation. Available at: www.glaucoma.org/treating/medication.php. Accessed March 19, 2008.

SLT Best Practices

Consensus on SLT Therapy

Appropriate Patient Types

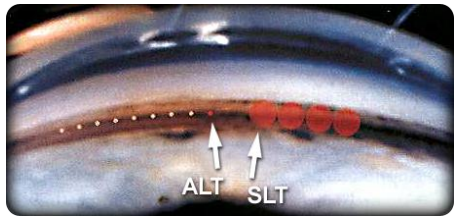
Patient type:

- Selective laser trabeculoplasty is indicated for the reduction of intraocular pressure (IOP) in patients with open-angle glaucoma (OAG)
- Highest success rate when used as primary therapy
- Effective results as adjunctive therapy
  - Patients on medications who need further IOP control
- Effective results as replacement therapy
  - Patients with controlled IOP who want to reduce medications
- If a patient responds favorably to meds (i.e. PGA's) then patient should respond favorably to SLT
- Success rate tends to decrease when performed later in the glaucoma treatment algorithm (as with all therapies)

Laser Settings and Contact Placement

Laser settings:

- Duration: 3 nanoseconds (preset)
- Spot Size: 400 microns (preset)
- Energy: 1.0 mJ/pulse
- Aim to cover angle (not on iris)
- Plan to treat 360 degrees (100 applications total or 25/quadrant)



Contact placement:

- NO (1X) magnification
  - Latina SLT
  - Goldmann 3 mirror
  - Ritch (small x mirror)
- Changes in magnification will alter beam diameter and energy

SLT Therapy Procedures

Therapy degrees:

- 360 provides best results for primary therapy
  - 180 can be effective for primary therapy

Therapy energy level:

- Starting at .8 millijoules and leading up to higher energy as needed
- Titrate energy per pigment

Black:	0.8–1.0 millijoules
Brown:	1.0–1.2 millijoules
Green:	1.2–1.4 millijoules
Blue:	1.4–1.6 millijoules

Pigmentary glaucoma cases need to be treated conservatively:

- Degrees: 90
- Energy: 0.4 millijoules

Therapy endpoint:

- “Champagne bubbles”

Recommended SLT
Pre- and Post-Therapy

Pre-therapy medications:

- Depends on physician preference
  - NSAID
  - Do not use a steroid
  - If patient on glaucoma meds perform washout technique (Recommended)
    - **From 3 days to 8 weeks (dependent upon drug class)**

Post-therapy medications:

- Depends on physician preference
  - Patients may not need medications based on specific patient comfort
  - One drop of brimonidine (0.2% or 0.15%)
  - One drop of NSAID immediately after surgery; 1–2 drops on the next day if needed (mostly to ease patients' minds about mild irritation)
  - Do not use a steroid (recommended)

SLT Patient Follow-up

Patient follow-up:

- One hour after therapy to check IOP
- Two weeks after therapy to check IOP reduction
- One month after therapy to check for target IOP reduction
  - It may take up to 3 months after therapy to reach individual target IOP reductions (advised to wait before switching to new therapy)

Questions or Comments?

Open Discussion on SLT Therapy