

# Mechanism of Action of SLT

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# Aims

- Does it work?
- How does it work?

**Franks et al ARVO 2007**

**Paradoxical Intraocular Pressure (IOP)  
Rise With Titanium Sapphire Selective  
Laser Trabeculoplasty (TiSaLT)**

# Mechanism of SLT

Most common hypothesis...

- Cell stimulation by SLT triggers cytokine response
- Cytokines recruit macrophage recruitment to remove damaged cells
- Trabecular meshwork cells divide to replace the lost cells

? Increase Trabecular Outflow

# Goldmann's equation

$$F_{\text{total}} = (P_{\text{iop}} - P_{\text{evp}}) \times C + F_u$$

- $F_{\text{total}}$  = Aqueous Flow
- $P_{\text{iop}}$  = pressure in AC
- $P_{\text{evp}}$  = episcleral venous pressure
- $C$  = Outflow facility
- $F_u$  = Uveoscleral Outflow

$$P_{iop} \downarrow = \frac{F_{total} + P_{evp} \times C - F_u}{C \uparrow}$$



$$P_{iop} \downarrow = \frac{F_{total} + P_{evp} \times C - F_u}{C \uparrow}$$



# Changes in Outflow Facility & IOP following SLT in previously untreated OHT/POAG eyes

## Preliminary Results



K. Sheng Lim

S. Goyal

S. Rashid

R. Nath

A.Obi

J. Marshall



**Support: St Thomas' Charity**

**Ellex**

# Purpose

- To assess the effect of SLT on outflow facility of OHT/POAG
- To assess the efficacy of SLT on OHT/POAG
- To assess the difference in on outflow facility and IOP effect of 180 and 360 treatment

# Method

- Untreated POAG & OHT
- IOP between 21 and 35 mmHg
- Age > 21 years
- Randomised to 180° or 360° using random numbers generated by Excel (odd & even)
- 35 each arm (total n=70)

# Methods

Exclusion criteria :

- Other glaucomas
- Advanced glaucomatous optic neuropathy (Cup-disc ratio greater  $\geq 0.9$ )
- Visual acuity of  $\leq 6/36$
- Previous treatment with medications/Laser
- Previous intraocular surgery



# Methods

- IOP (S. Rashid)  
**9:30 – 10: 30 am**
- Tonography (S. Lim)  
**between 9:30 am & 10:30 am**

**Repeat at 1 month & 3 month**

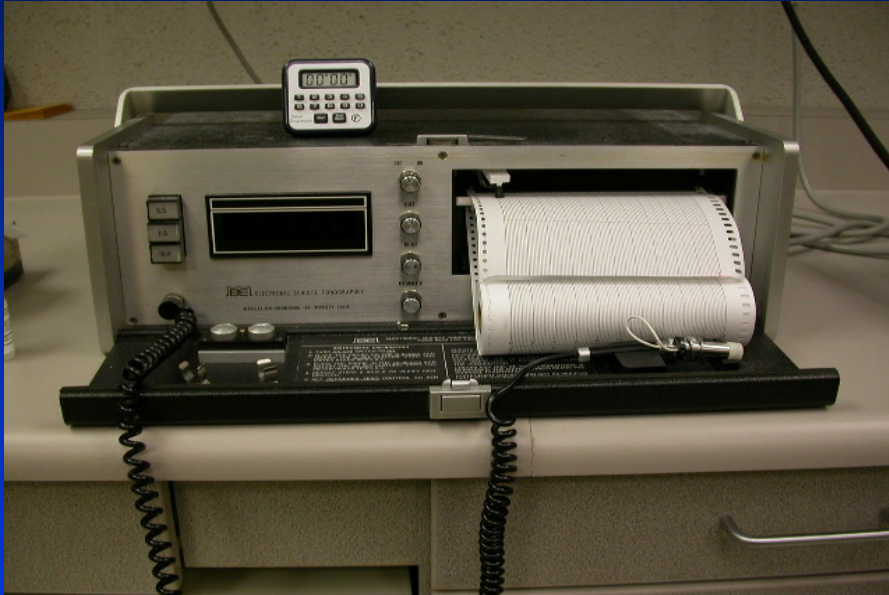
# Treatment Protocol

- Pre-SLT: A drop of Pilocarpine 2% and topical anaesthesia instilled into the eye
- The laser power set to 0.6mJ and increased in 0.1mJ steps until small champagne-like bubbles appear at the treated area
- 180° or 360° treatment 50 or 100 shots  
(S. Goyal)

# Protocol

- IOP check 1 hour & 1 day later
- If IOP > 35 mmHg, Diamox 250 mg BD 5/7
- Post-SLT: The patient was given a one-week course of topical Dexamethasone 1% four times daily
- Review at 1 month
- If IOP does not achieved target IOP then start topical treatment after Tonography

# Schiotz Tonography



**Time: 4 minutes**

**Weights: 5.5 or 7.5 gm**



# Main Outcome Measures

- IOP
- Schiotz Outflow Facility

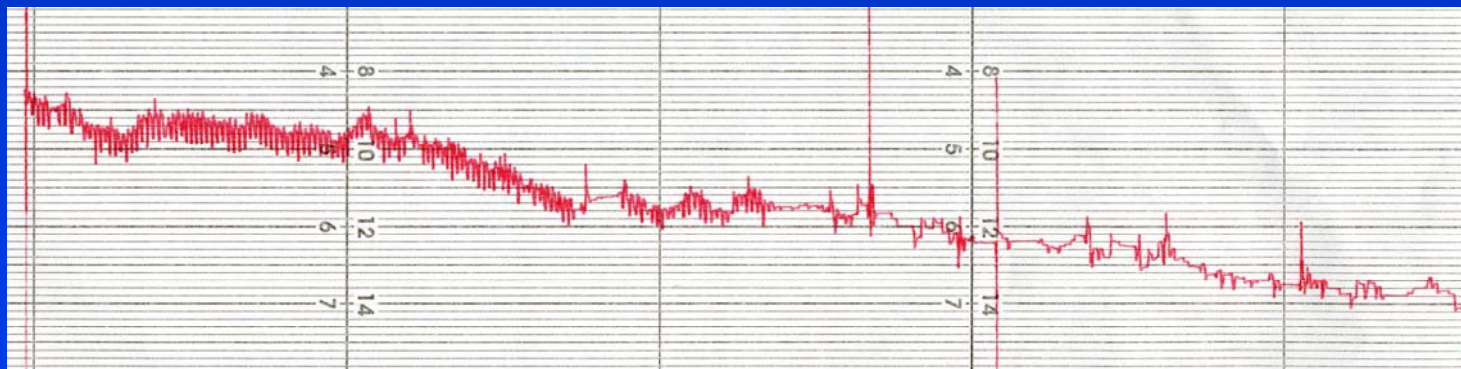
# Results

- 69 eyes of 60 patients enrolled
- Age 43- 74 years (median 63)
- 28 males and 32 females
- 18 White, 40 African, 2 Arabic
- 47 eyes completed the 3 month F/U
- 5 eyes rejected from analysis – “poor tonography”
- Data from 45 eyes analysed at 1 month
- 4 non-responders excluded from 3 month analysis

# Tonography Tracing



**Good**



**Bad**

# Tonography Analysis



**J. McLaren Mayo Clinic**

# Non Responders

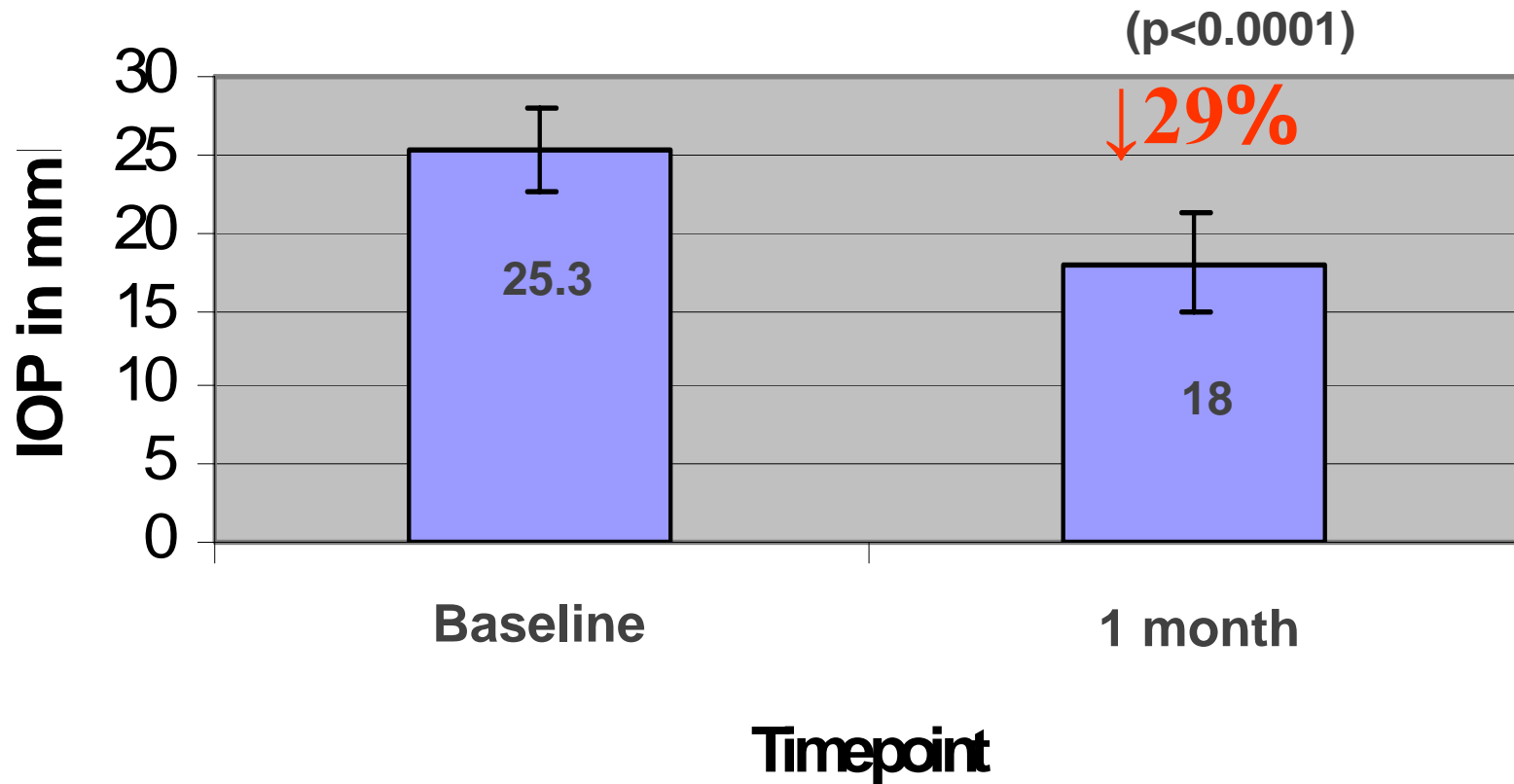
180° Group. 2 out of 22 eyes

Diagnosis	Baseline IOP	1 Month IOP	Baseline Facility	1 Month Facility
POAG	30	24	0.09	0.05
POAG	22	19	0.09	0.14

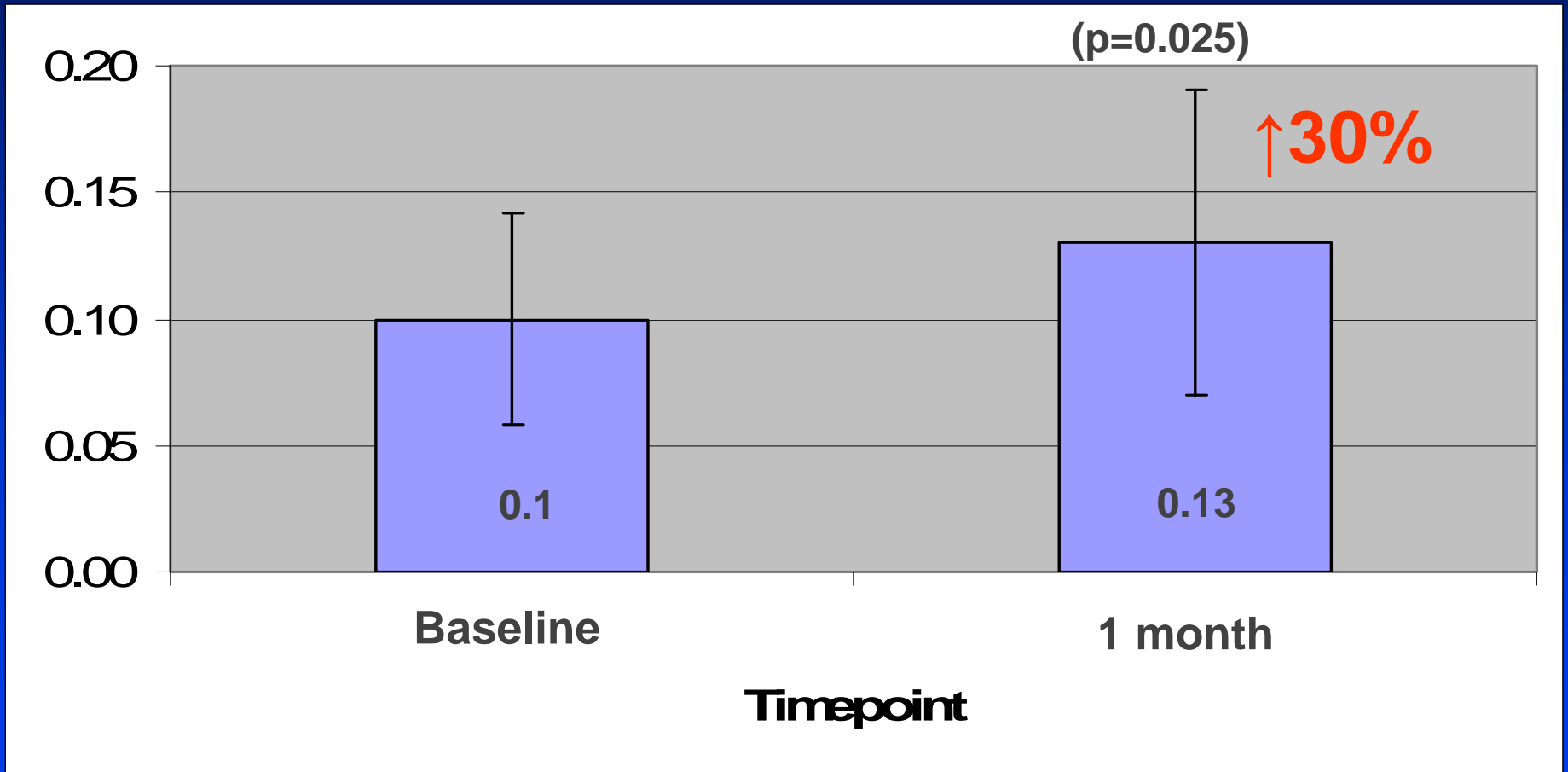
360° Group. 2 out of 23 eyes (same patients!)

Diagnosis	Baseline IOP	1 Month IOP	Baseline Facility	1 Month Facility
POAG	28	21	0.07	0.09
POAG	23	21	0.10	0.15

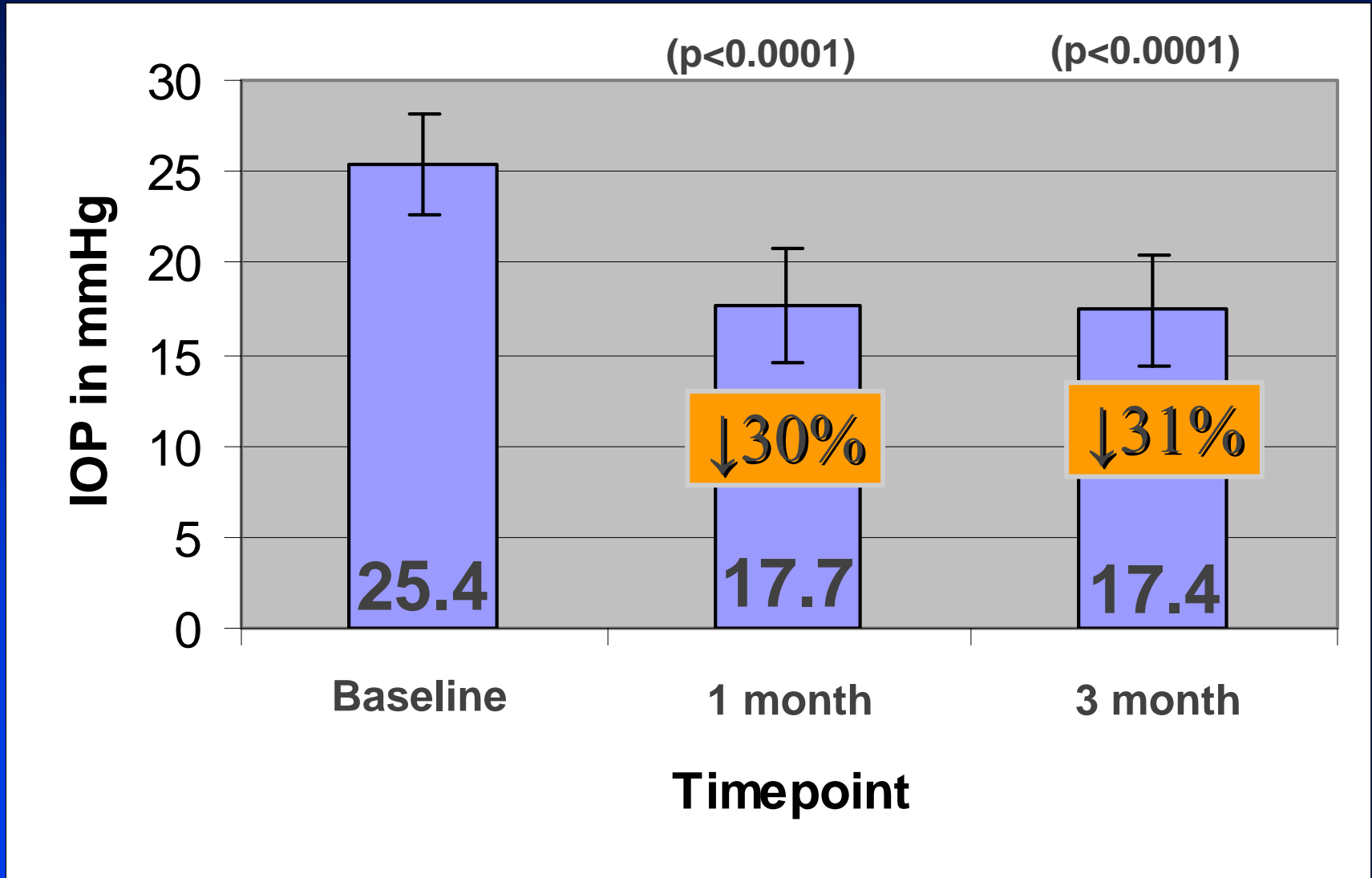
# IOP at 1 Month n=45



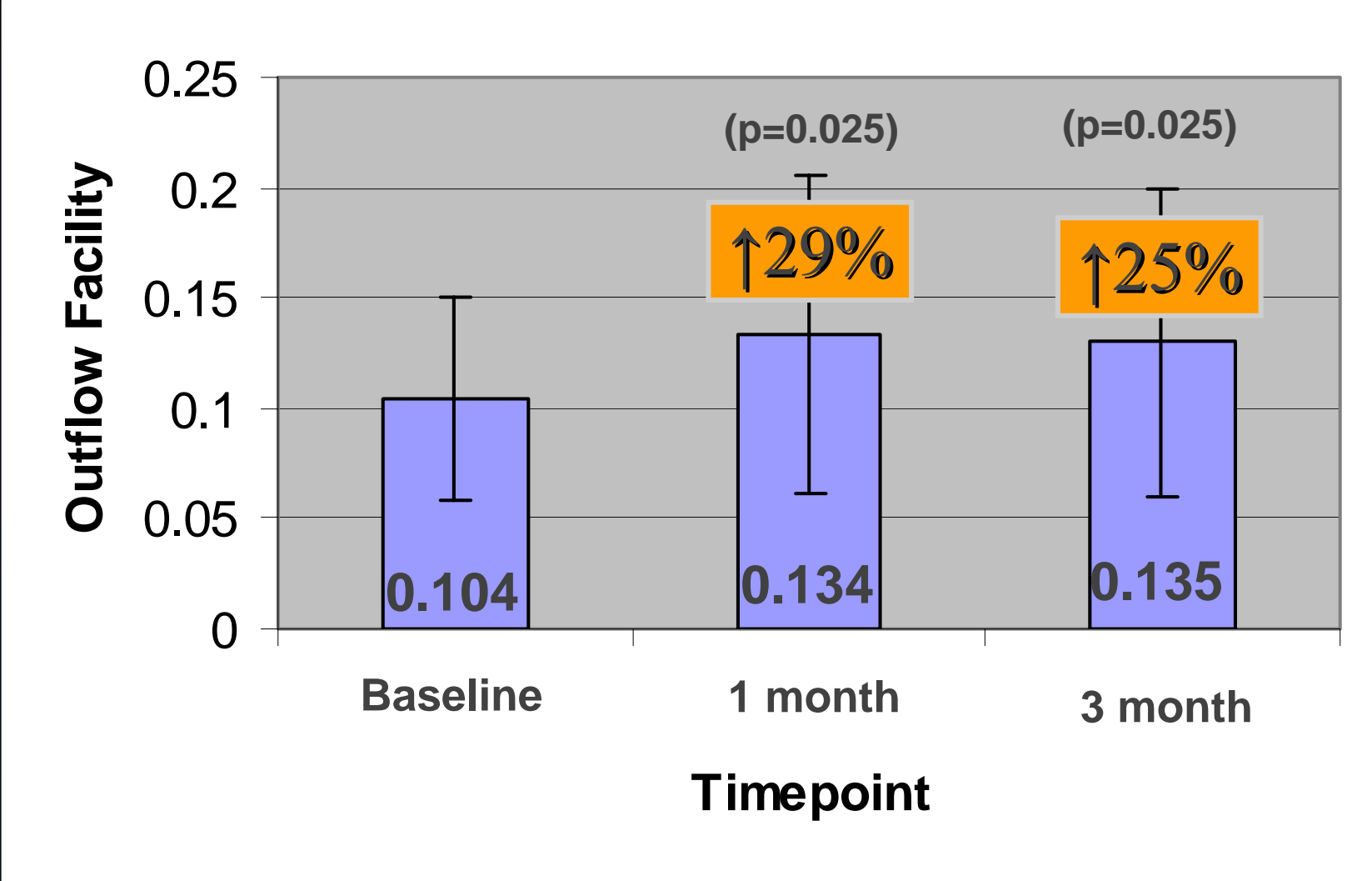
# Outflow Facility at 1 Month n=45



# IOP – 180° & 360° Treatment (n=41)



# Outflow Facility - 180° & 360° Treatment (n=41)



# Summary

## Mechanism of Action

- 30% reduction in IOP
- 30% increased in trabecular outflow facility

# Goldmann's Equation

$$C = (F - U) / (P_i - P_v)$$

F (Aqueous)	2.5	F (Aqueous)	2.5
P <sub>i</sub> (IOP)	25.4	P <sub>i</sub> (IOP)	17.4
P <sub>v</sub> (EVP)	9	P <sub>v</sub> (EVP)	9
<b>C (Facility)</b>	<b>0.104268</b>	<b>C (Facility)</b>	<b>0.203571</b>
U (Uveosclera)	0.79	U (Uveosclera)	0.79
			<b>0.135</b>

# IOP and Outflow Facility

- To achieve 30% drop in IOP, outflow facility must increase by 100%
- In this study, only 30% increase in outflow facility is found

# Improvement of Tonographic Outflow Facility Following SLT in POAG/OHT/PXF

## ARVO 2007 (Prasad & Latina)

### Purpose:

This study evaluated the changes in tonographic outflow facility following SLT in patients with POAG/OHT/PXF

### Methods:

Retrospective review of charts

9 eyes of 7 subjects

2-minute pneumotonography (Meditronic Solan Model 30):  
1 week before and 6 weeks after SLT.

The change in IOP, coefficient of facility of aqueous outflow (C-value,  $\mu\text{l}/\text{min}/\text{mm Hg}$ )

# Improvement of Tonographic Outflow Facility Following SLT in POAG/OHT/PXF

## ARVO 2007 (Prasad & Latina)

### Results:

4 OHT, 3 PXF and 2 POAG. Mean age of  $69 \pm 9.9$  years.

6 eyes received SLT as a primary therapy and 3 eyes received SLT as a secondary therapy

5 received 360 degree and 4 received 180 degree of SLT.

Mean baseline IOP prior to SLT therapy was  $24.8 \pm 1.8$  mm Hg which decreased to  $16.8 \pm 3.3$  mm Hg (mean IOP reduction of  $8.2 \pm 4$  mm Hg or  $31\% \pm 14\%$ ) at 6 weeks after SLT therapy.

The outflow facility (C value) improved in all eyes except one eye of OHT in which it remained unchanged despite reduction in IOP by 33%.

Prior to SLT therapy the mean value of outflow facility (C value) was  $0.24 \pm 0.11$ .

At 6 weeks following SLT therapy the mean C value improved to  $0.35 \pm 0.08$  (or by 66%) statistically significant (P value 0.04).

# Improvement of Tonographic Outflow Facility Following SLT in POAG/OHT/PXF

## ARVO 2007 (Prasad & Latina)

### Conclusions:

SLT treatment significantly improved tonographic outflow facility in 8/9 eyes.

This supports the hypothesis that SLT reduces IOP most likely by an effect on trabecular outflow. Given that one patient showed a decrease in IOP without a change in outflow facility suggests other mechanisms of IOP reduction may also occur, such as uveoscleral outflow, which was not measured in this study.

**What other possible explanation for the drop in IOP?**

**Increase Uveoscleral Outflow**

**Decrease Aqueous Production**

**Decrease Episcleral Venous Pressure**

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**Increase Uveoscleral Outflow**

Decrease Aqueous Production

Decrease Episcleral Venous Pressure

# Conclusions

**Primary SLT therapy for POAG/OHT:**

**Decrease IOP by 30%**

**Increase Outflow Facility by 30%**

**Non-responder rate 10%**

**SLT affects other Aqueous Dynamic Parameters**

# Richard Brubaker, MD



# Thank You

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