

Trabectome Surgery: Techniques and New Indications

Nils Loewen, MD, PhD

Director, Glaucoma and Cataract Service

Associate Professor of Ophthalmology

University of Pittsburgh School of Medicine



disclosures: *NL - trabectome trainer*

Overview

- 1) Background
- 2) Technique + Postop Care
- 3) Outcomes
- 4) Case Presentations
- 5) Wet Lab

TRABECTOME

TECHNIQUE + POSTOP CARE

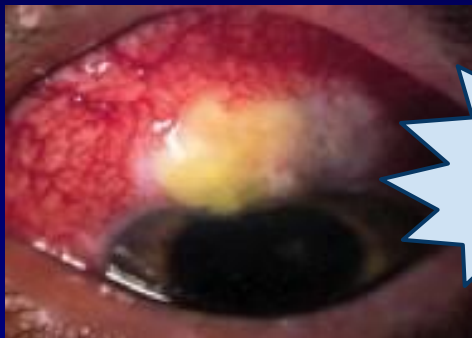
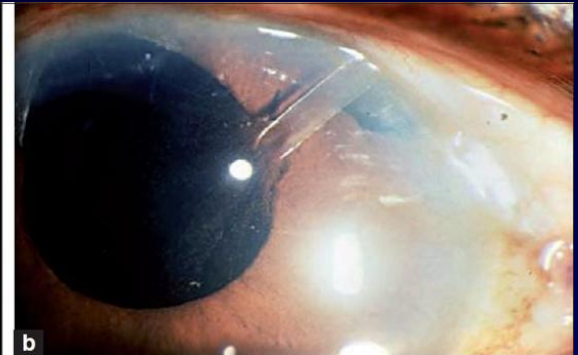
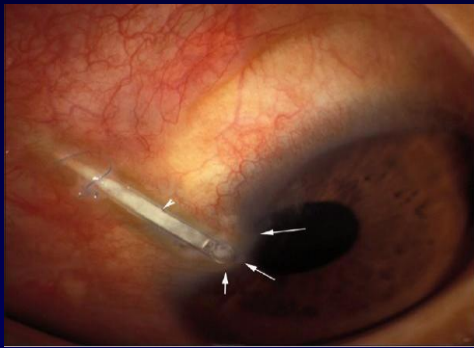
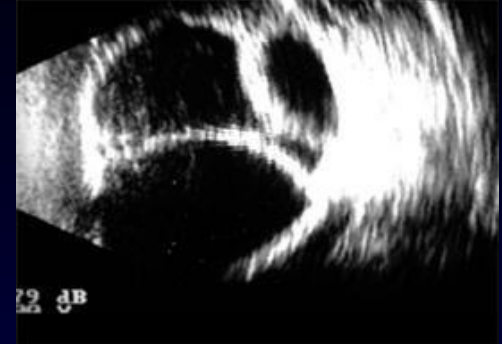
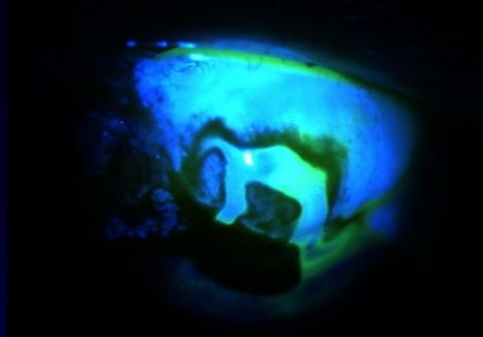
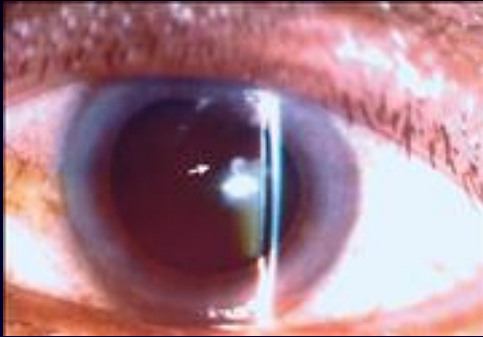
Overview

MIGS vs Trabs/Tubes?

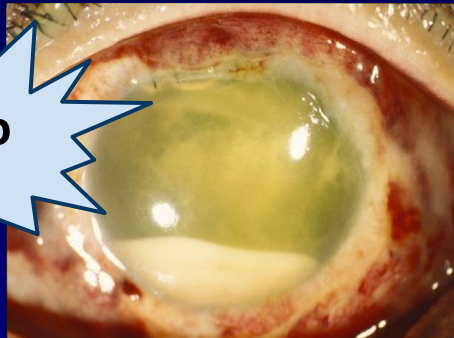
Trabectome Technique + Postop Care

**MINIMALLY INVASIVE GLAUCOMA
SURGERIES (MIGS) VS TRABS/TUBES**

Problems with Hardware and MMC



up to
9%

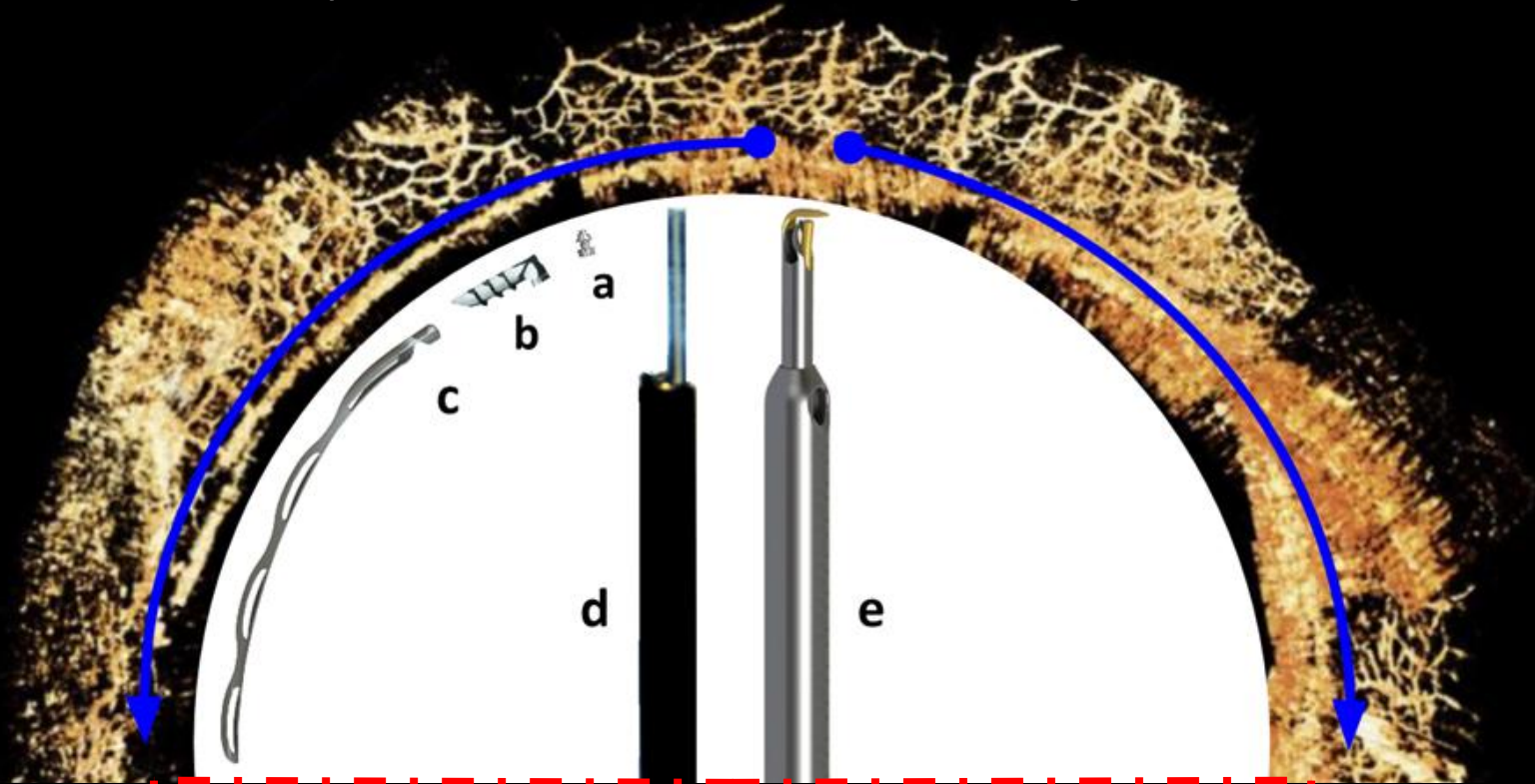


MIGS

240° versus 60°

Single access point devices:

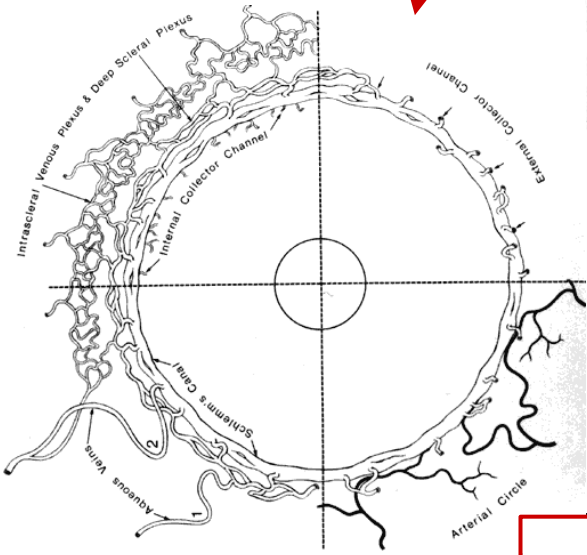
- achieve only 2 clock hours of outflow segment access.



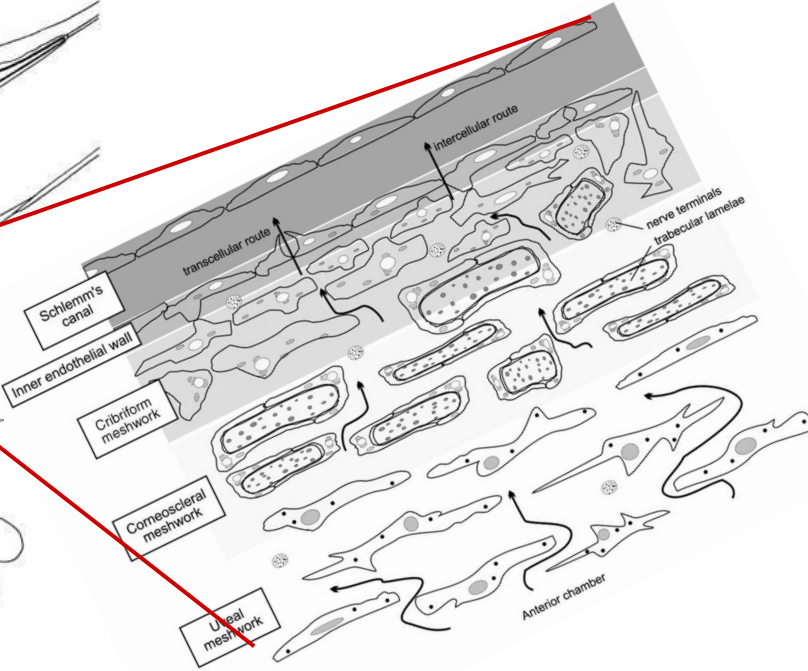
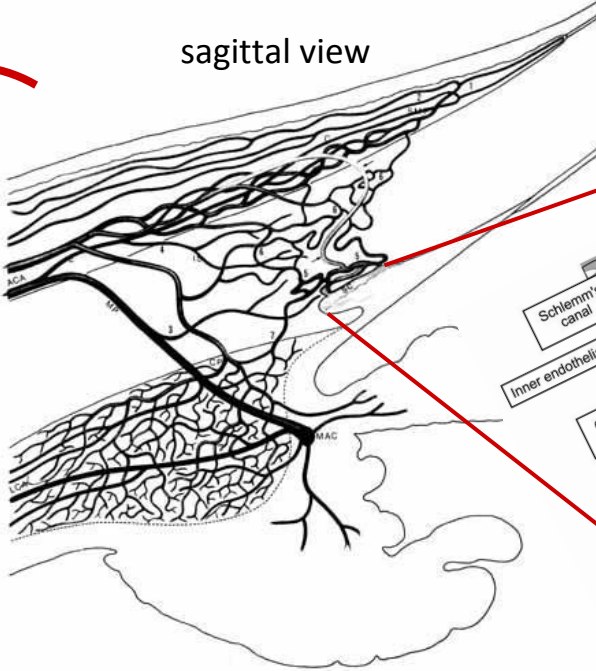
Canalography courtesy of UPMC's
Glaucoma Imaging Group

Outflow Tract Anatomy

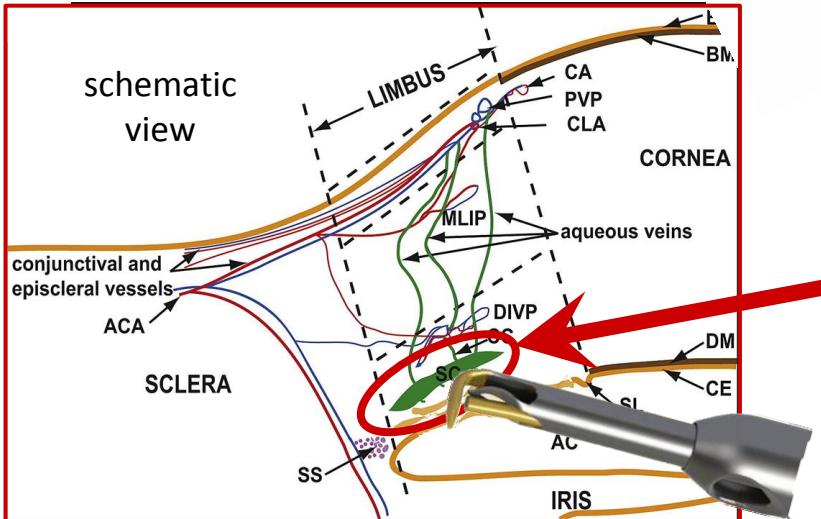
frontal view



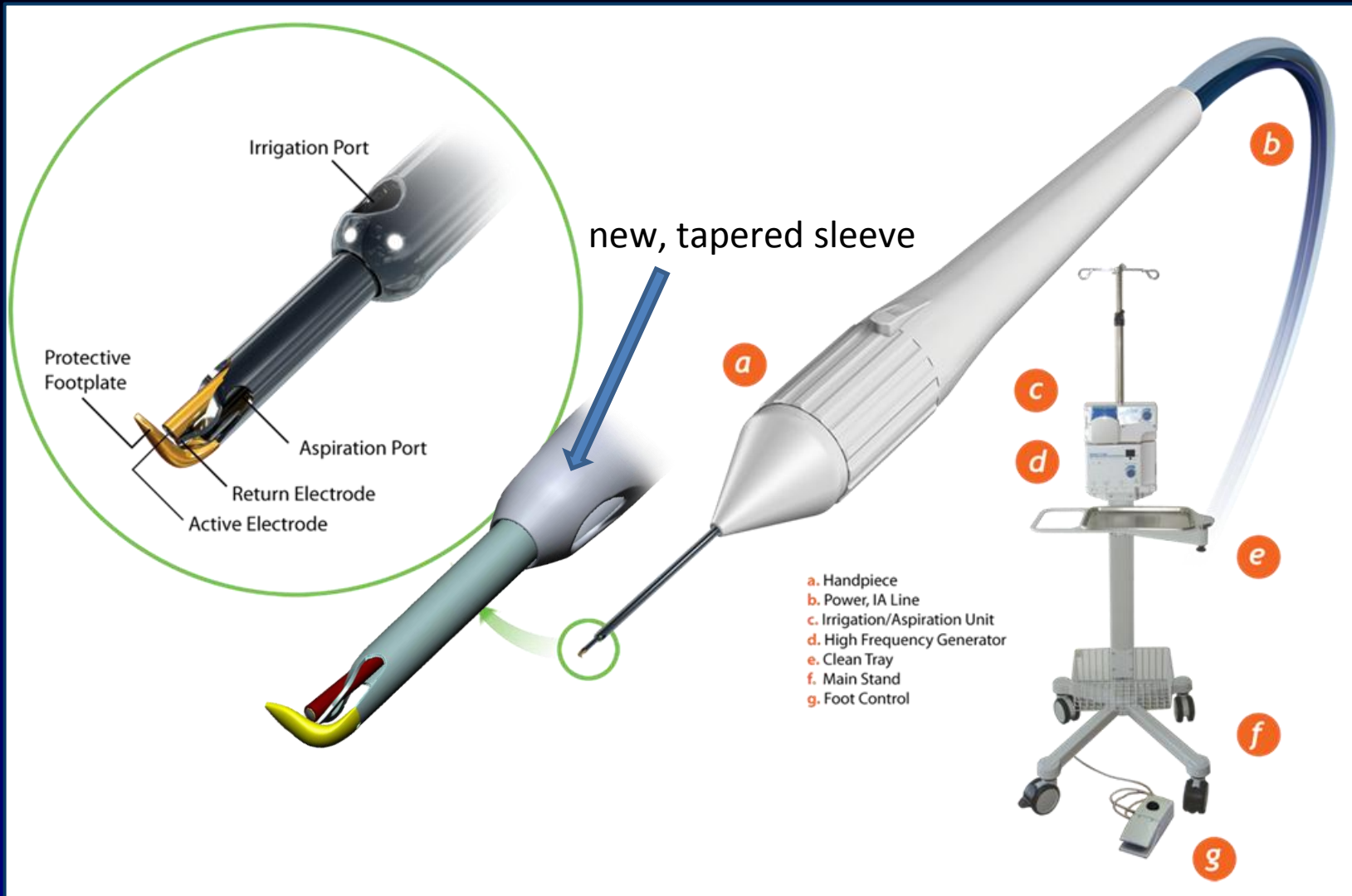
sagittal view



schematic view

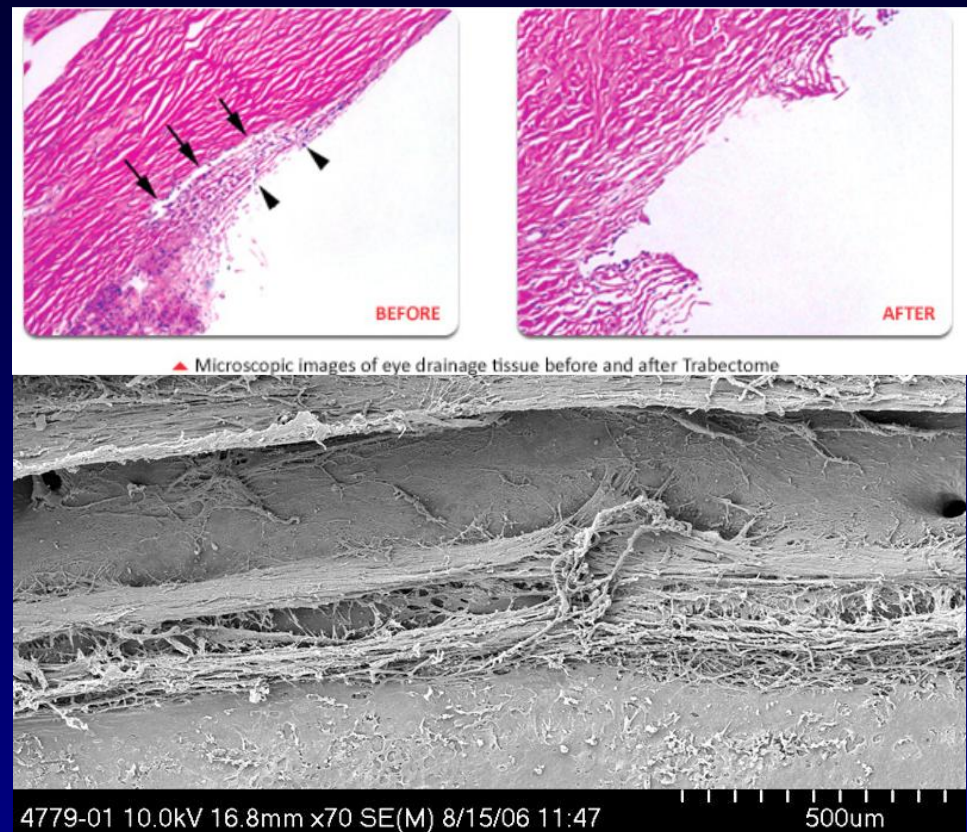
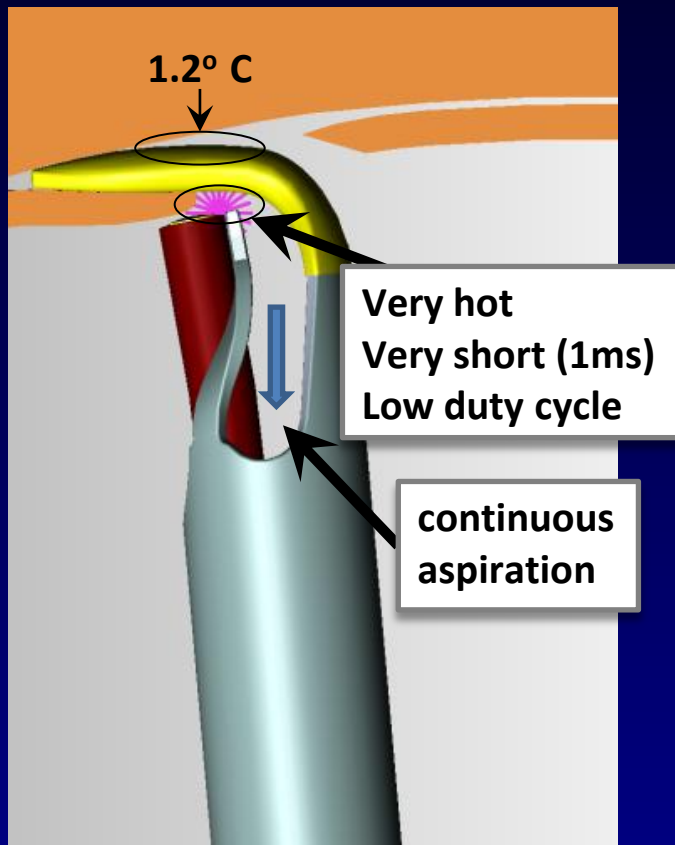


Trabectome Surgical System

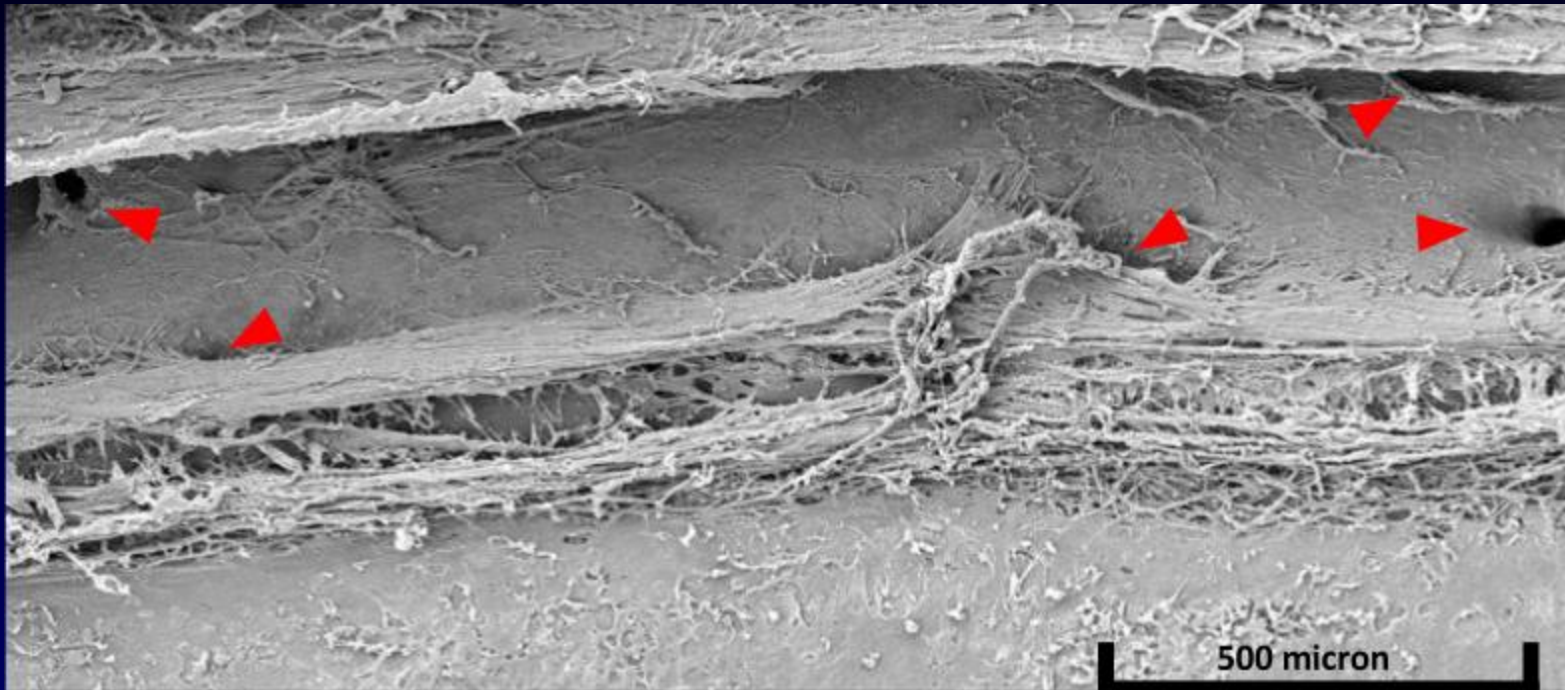


Plasma Surgery: Bipolar 550 kHz Ablation of Trabecular Meshwork

- selective removal of primary pathology
- 200 micron plasma, pico-lightning
- no heat transfer, protective footplate



Location of Collector Orifices

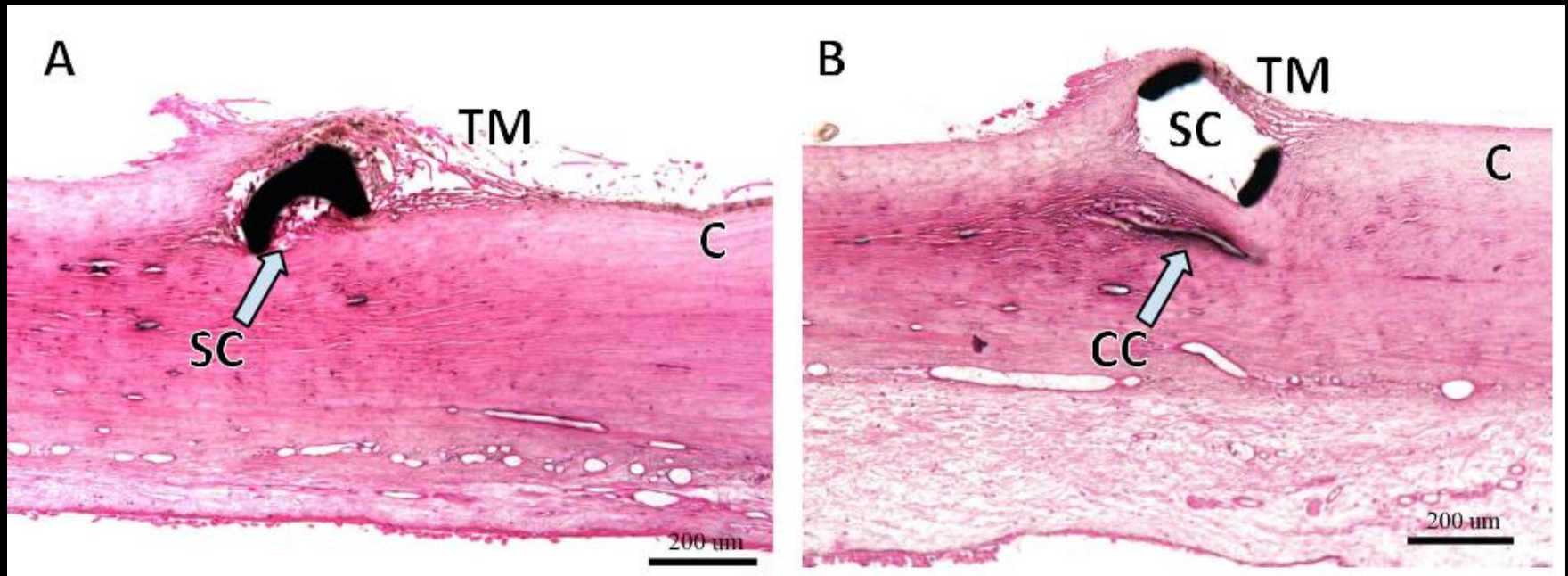


courtesy of Doug Johnson

proximity to anterior and posterior lips may explain high failure rate of goniotomy in adults

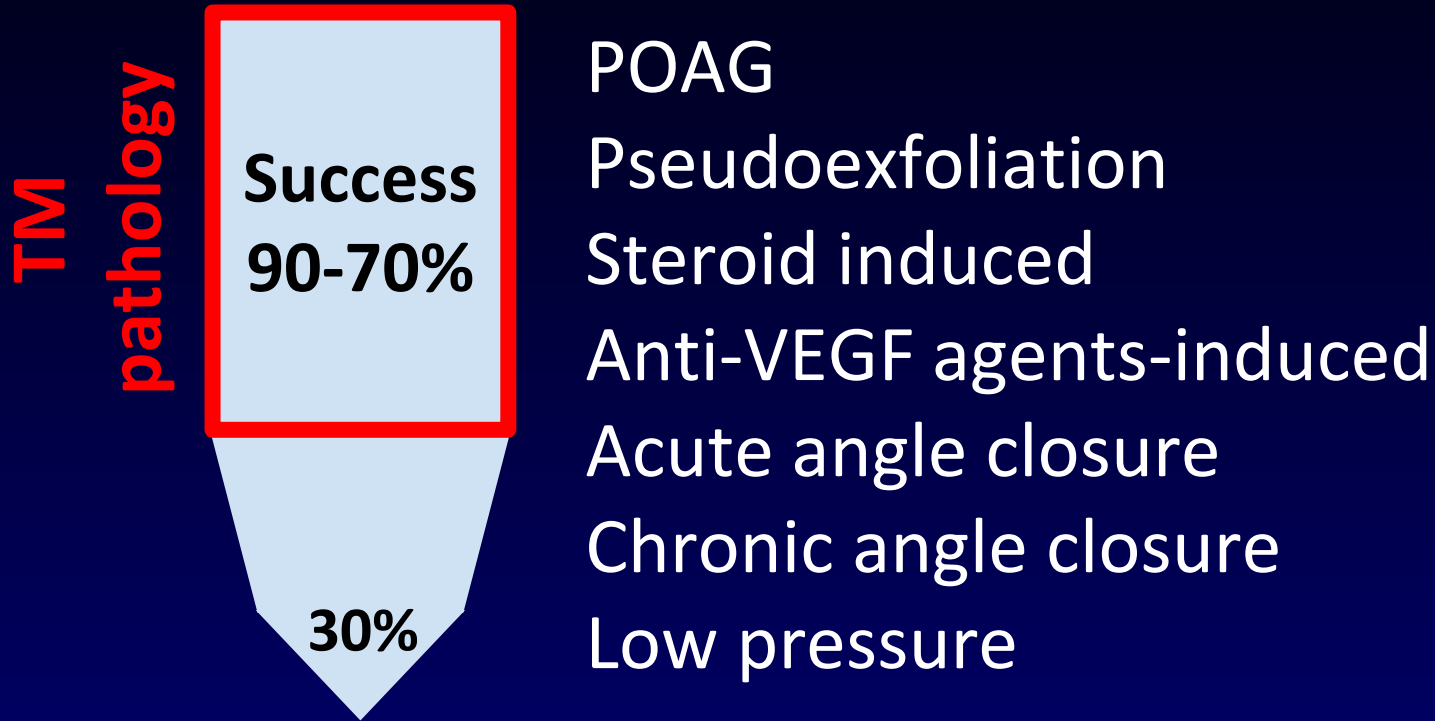
Challenges with Microstents

Fibrosis + Compression of Collector Channels



courtesy of Ivantis Inc., Irvine, CA

Angle Surgery: What Glaucomas?



*Working collector drainage system necessary.
Currently no function test available.*

5 Year Complications

MIGS

- early 10 mmHg IOP elevation that resolves
 - trabectome: 3-10%
- hyphema that resolves
 - more Schlemm's canal access = more hyphema
 - trabectome > hydrus > iStent

Trab/Tube (TVT Study)

- "manipulation needed"
 - trabs: 74%
 - tubes: 27%
- early + late, vision threatening
 - trabs: 39 + 38 = **77%**
 - tubes: 22 + 36 = **58%**

Cost Effective Treatment Algorithm

*Iordanous Y et al. *J Glaucoma*. 2013.

BAT 20/50,
wants to improve vision,
has OHTN to advanced glaucoma



CEIOL + **trabectome**



toric lens



bypass surgery

(tube, trab, suprachoroidal devices)

SLT



PGAs + CAIs

TRABECTOME

TECHNIQUE + POSTOP CARE

Key Surgical Steps

1. Visualization

- excellent microscope (xenon, large tilt)
- no visco at start
- hypotony, identify

1. Technique

- anterior, flared incision
- no outward push
- near 180° ablation

1. Reducing hyphema

- viscoelastic tamponade: after ablation + after phaco
- pressurize well

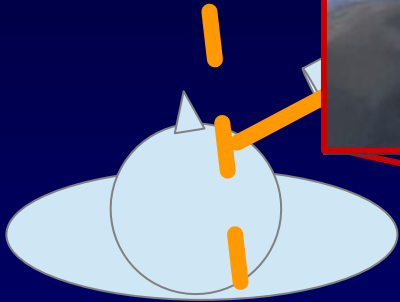
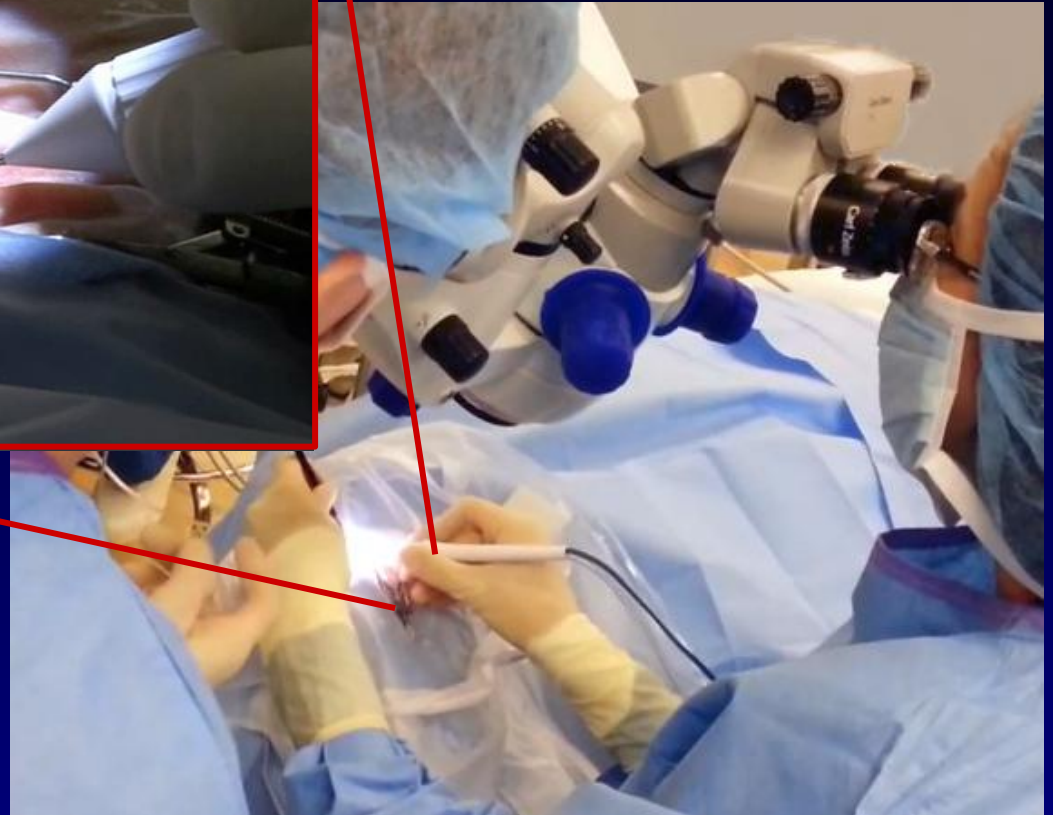
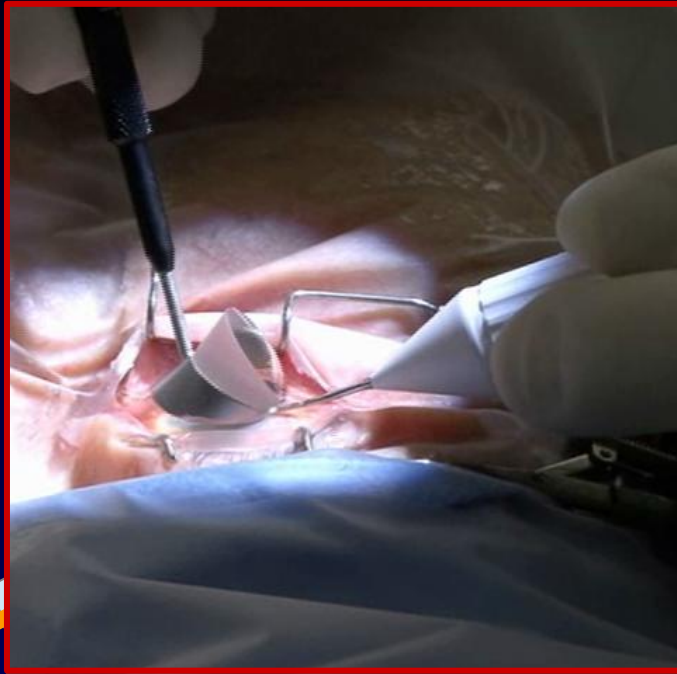
Visualization

xenon light, large tilt



VISUALIZATION

Large Tilt, Xenon Light



Impact of Microscope Quality

- high end, xenon light
- large tilt
- insufficient tilt: requires patient rotation
- yellow light: hard to see lacy tissue



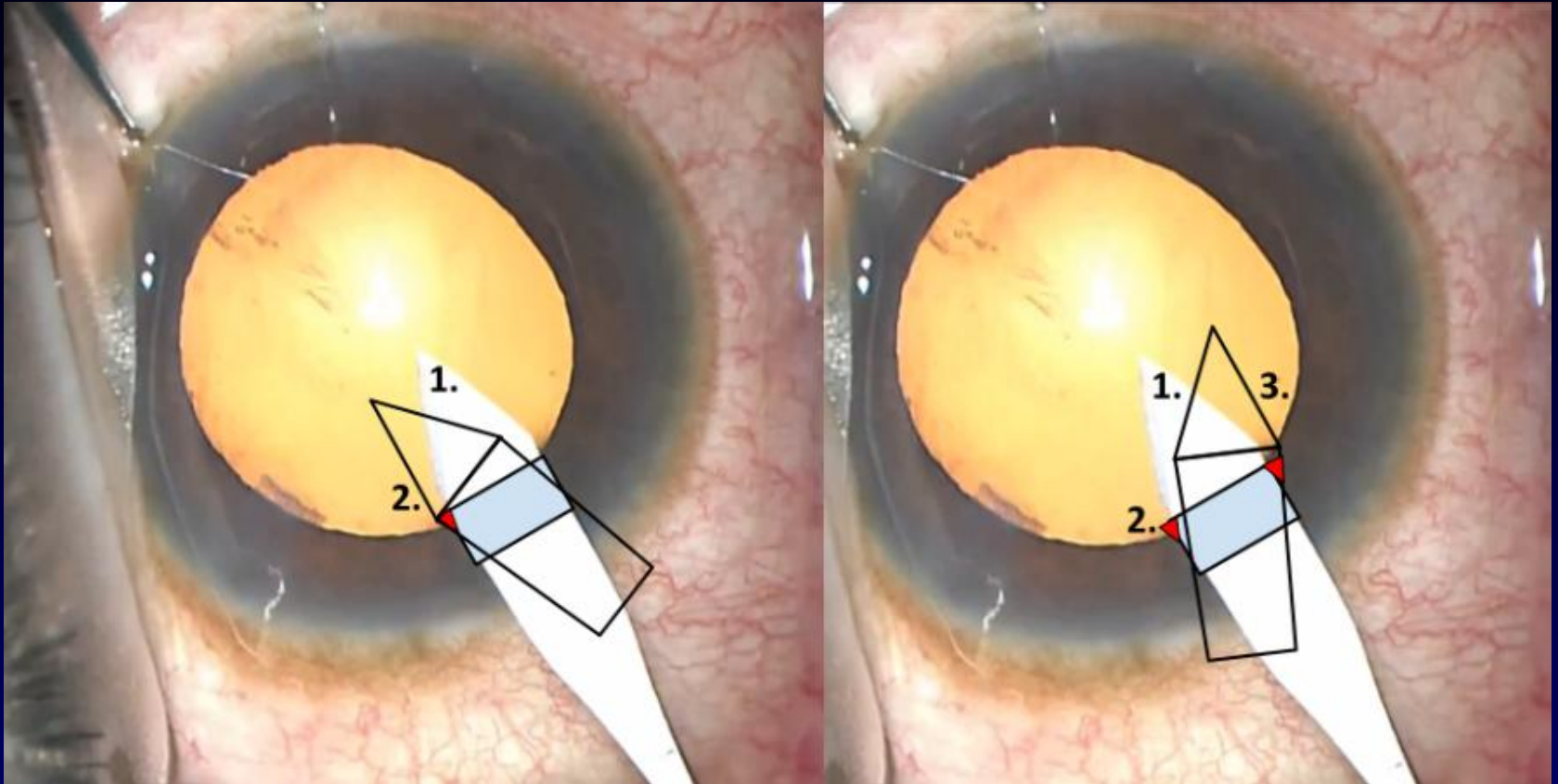
No Viscoelastic Prior to Trabectome

Because viscoelastic:

- traps plasma gas bubbles
- creates blurr from density interfaces
- makes it harder to induce hypotony
to identify Schlemm's canal

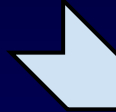
SURGICAL STEPS

2 mm Anterior, Flared Incision

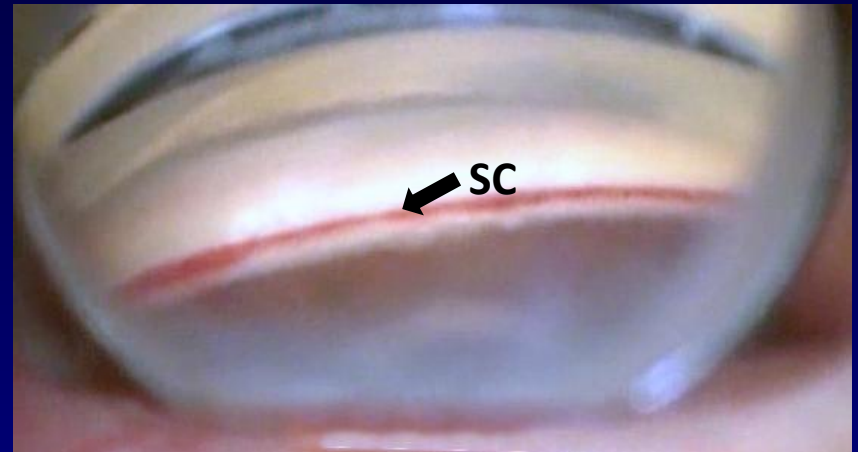


- extend reach, no striae
- prevent iris prolapse

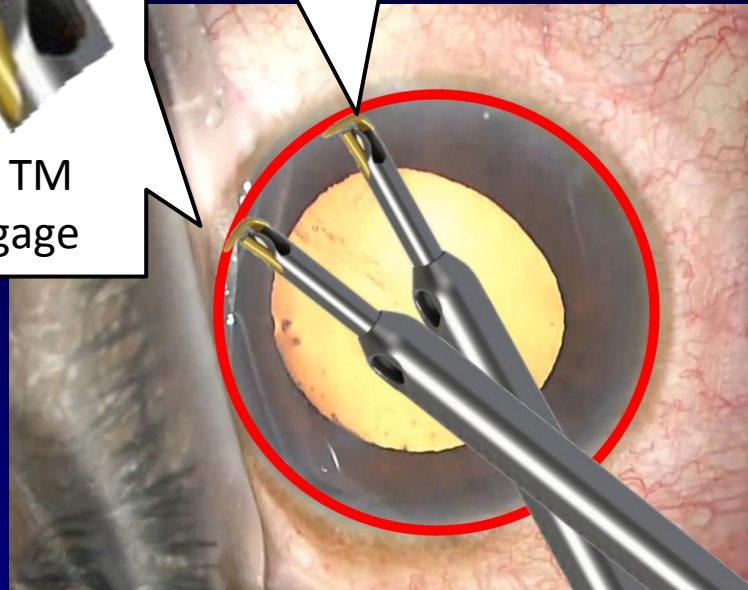
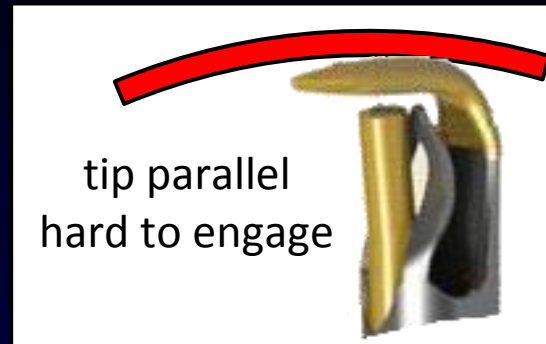
Induce Hypotony to Identify TM



gape incision



Easier Engagement Towards Left

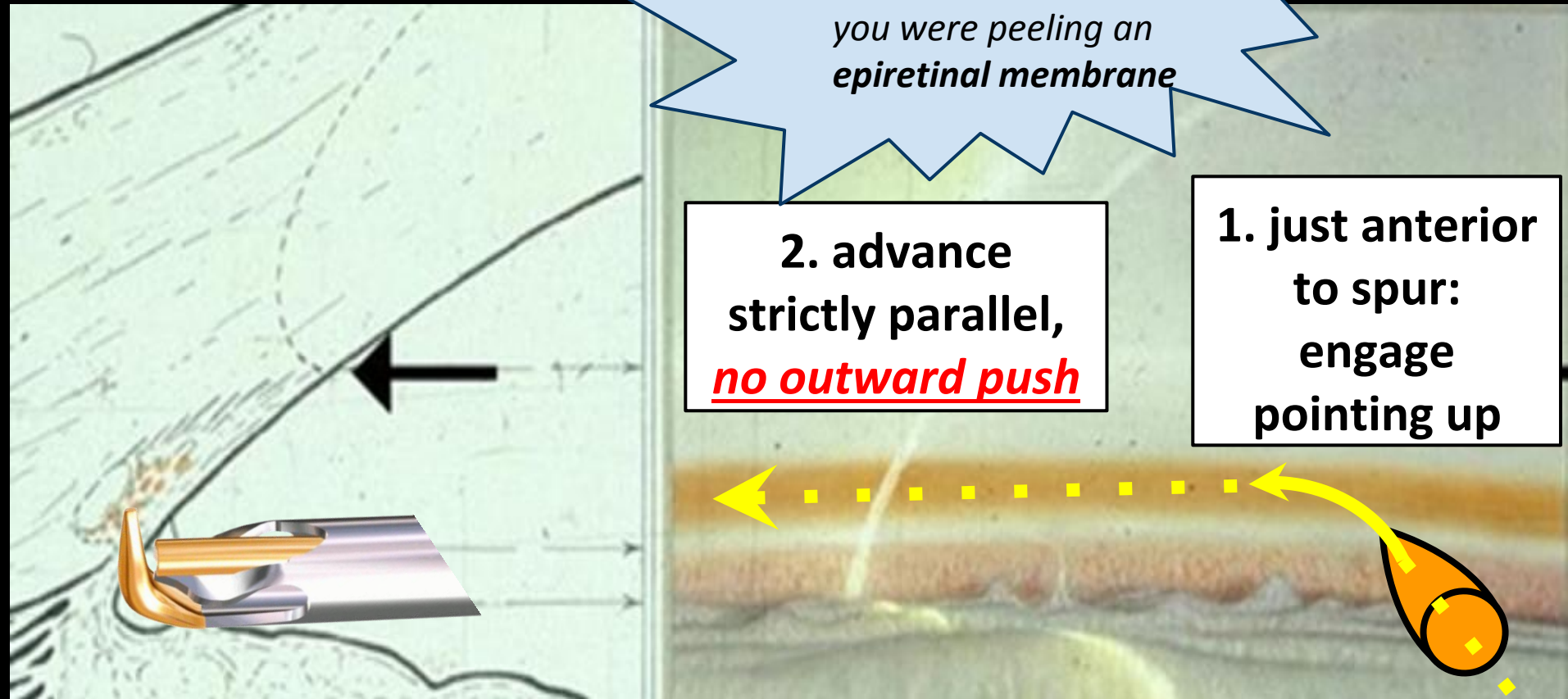


Engaging the spur

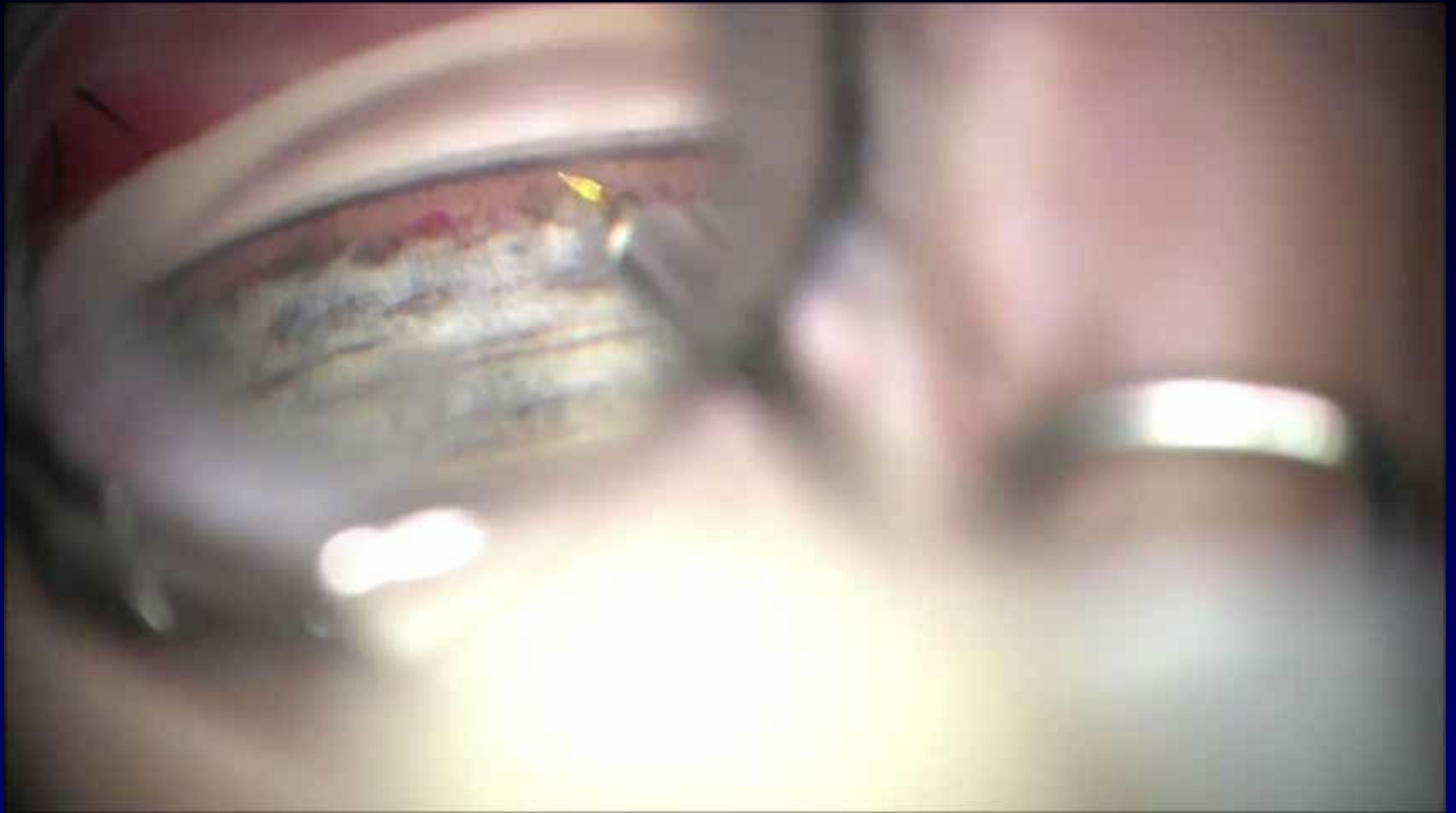
TM removal: careful with outward push as if you were peeling an epiretinal membrane

2. advance strictly parallel, *no outward push*

1. just anterior to spur: engage pointing up

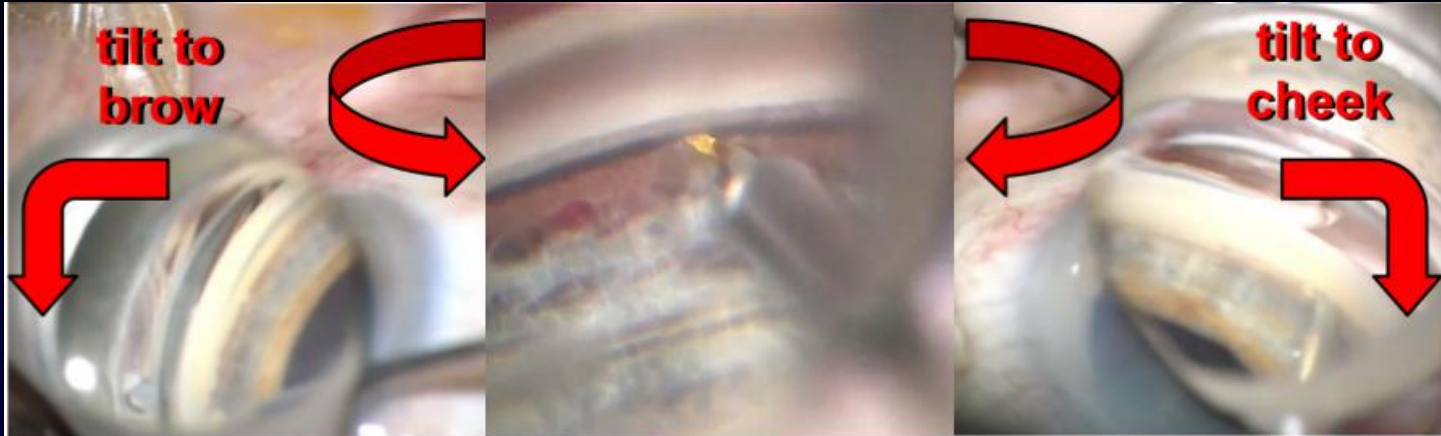


Engaging the TM



180° Ablation

gonio: heel up



gonio: heel up

insertion

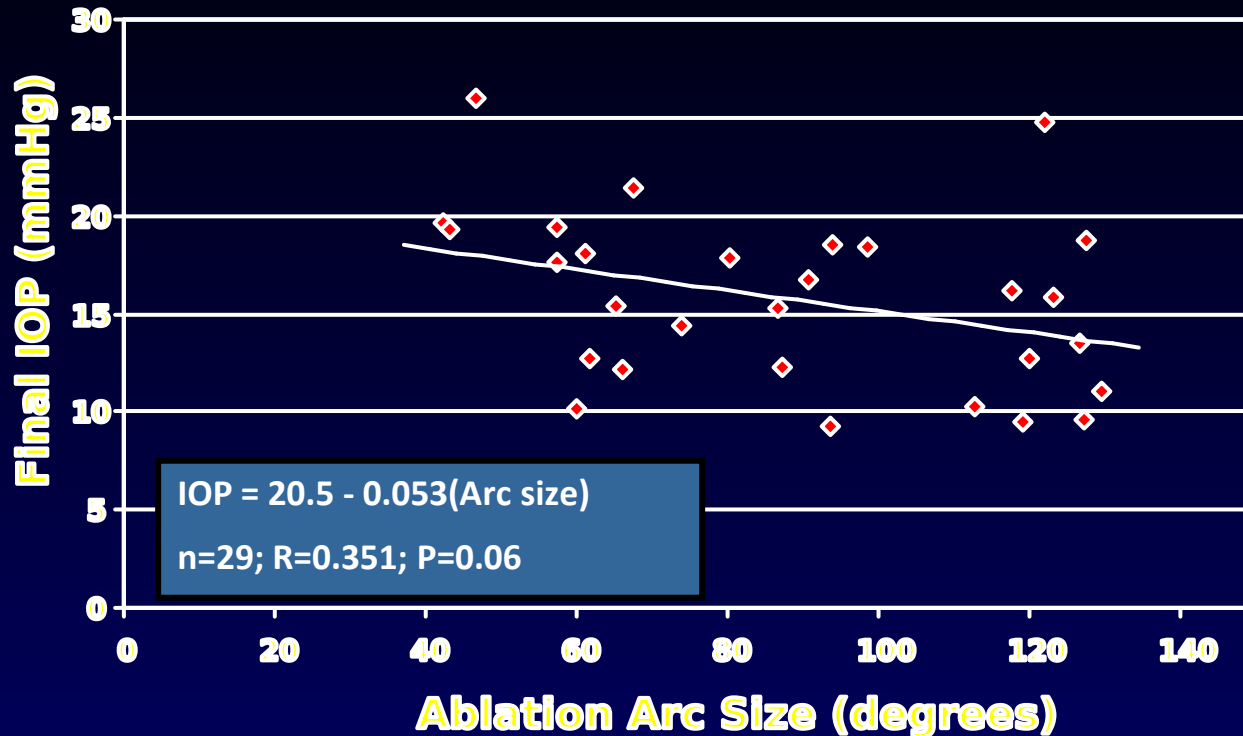
left



right



Larger Arc = More Collectors

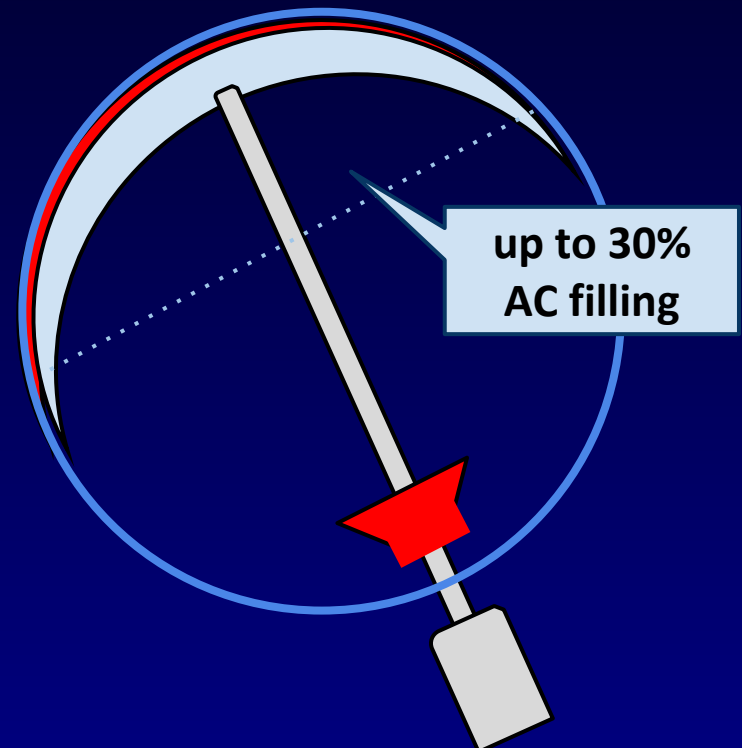


A. Sit, 2011

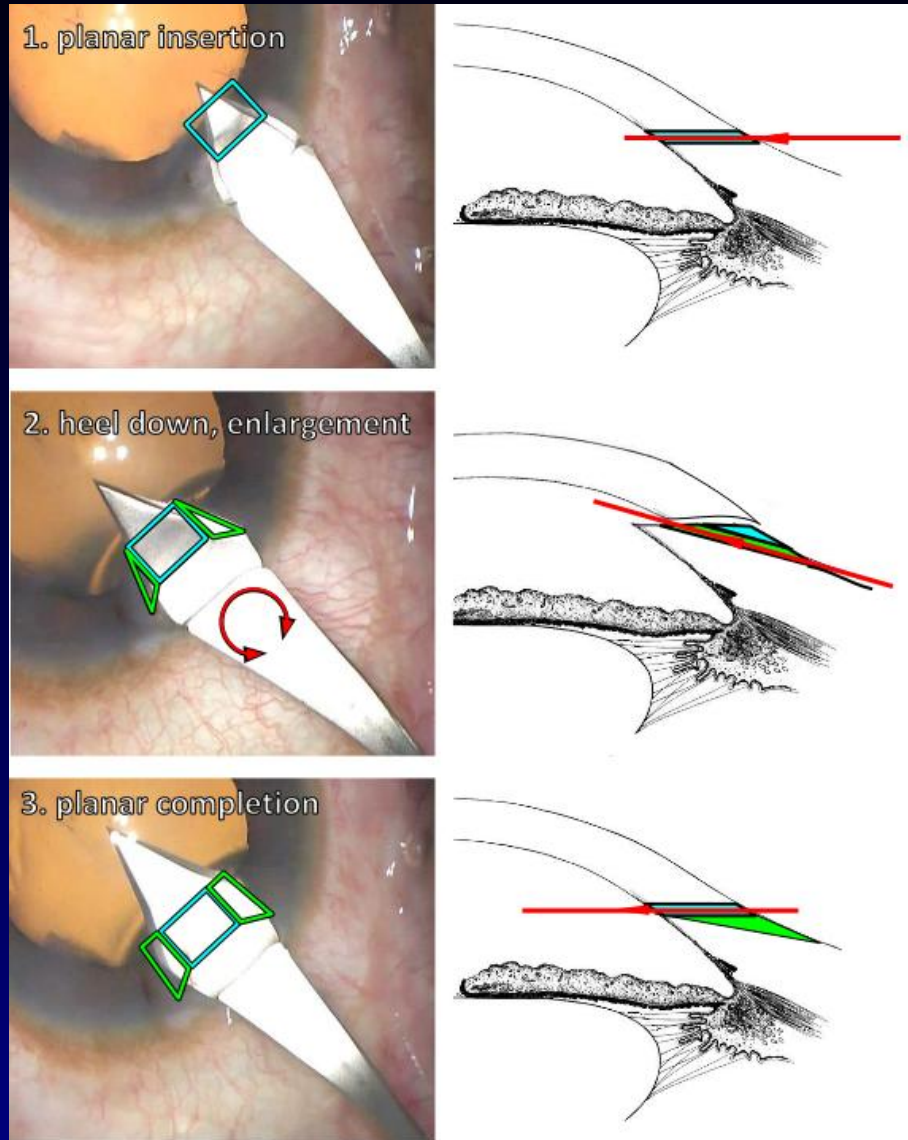
- Marginally significant correlation between:
 - Ablation arc size vs final IOP (P=0.06)
 - Ablation arc size vs final number of medications (P=0.07)

After Trabectome

1. Tamponade trabectome ablation with **DisCoVisc**
2. Enlarge same incision with keratome heel down (self sealing)
3. Phaco
4. Tamponade ablation again with **DisCoVisc**
5. IOL (+ CTR for torics if phacodonesis)
6. Leave visco in distal half of AC (no hyphema)



Incision Enlargement for CEIOL



Post-Op

- "Changing blurriness for days",
blurry = outflow system present!
- POV 1 day, 1 week, month 1, 2, 3
 - Pilo QID x 1 month, TID 1 month, BID 1 month
 - Pred Forte QID tapered one drop per week
 - discontinue some glaucoma drops

Summary: Key Surgical Steps

1. Visualization

- excellent microscope (xenon, large tilt)
- no visco at start
- hypotony, identify

2. Technique

- anterior, flared incision
- no outward push
- near 180° ablation

3. Reducing hyphema

- viscoelastic tamponade: after ablation + after phaco
- pressurize well

Visualization

xenon light, large tilt



First Trainee Cases



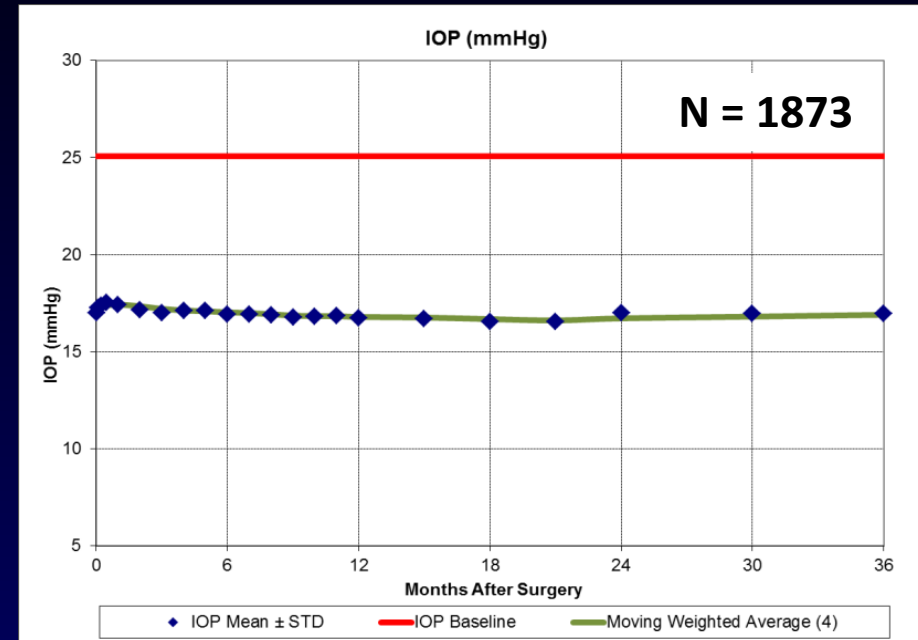
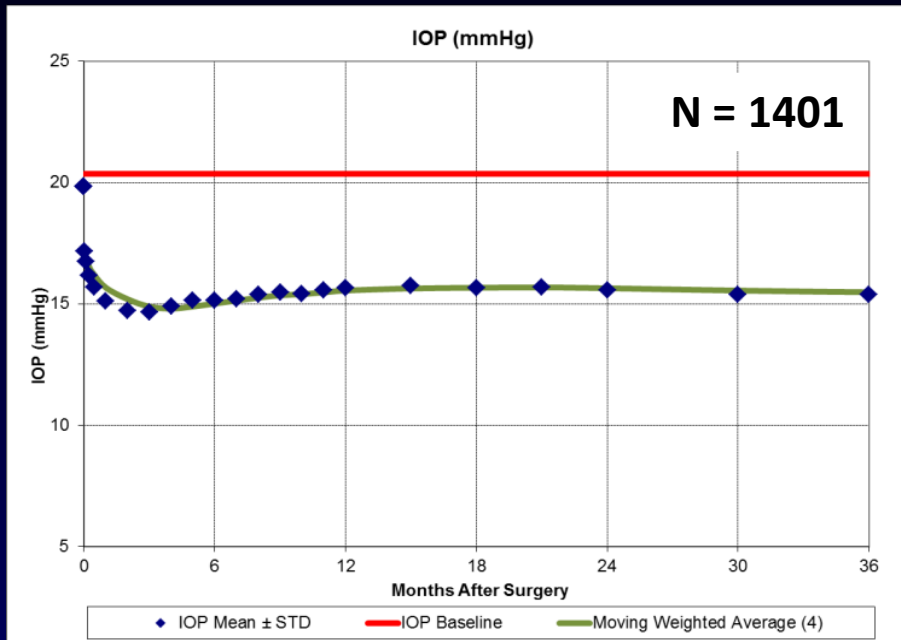
What not to do in
trabectome surgery

OUTCOMES

Global Outcomes

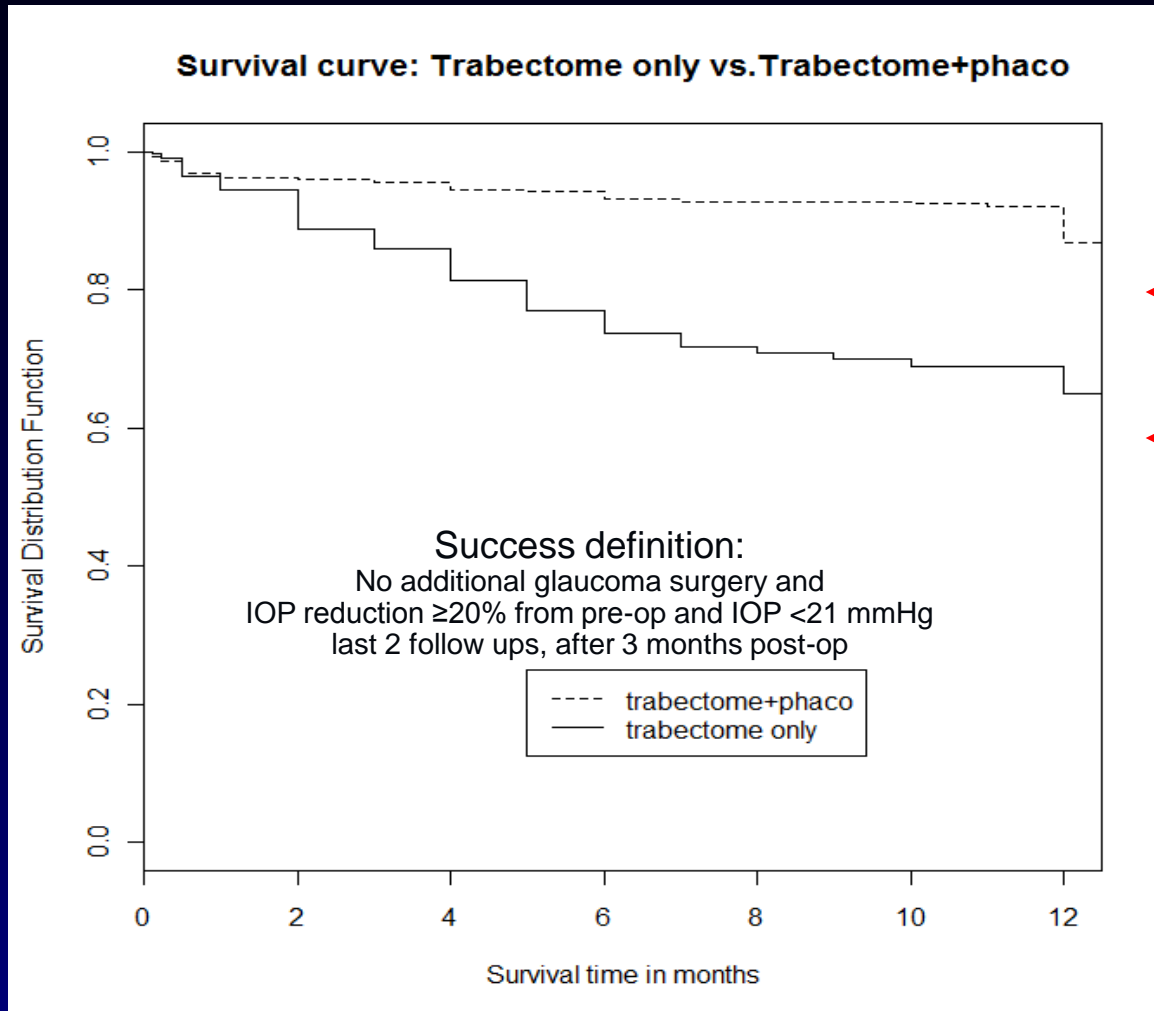
Phaco-Trabectome

Trabectome-only



	# Medications	# Medications
Baseline	2.3±1.2	2.8±1.3
6M	1.6±1.3	2.3±1.4
36M	1.9±1.2 (p=0.1)	2.0±1.4 (p<0.01)

Global Outcomes



Trabectome and PCE
86.9%

Trabectome alone
64.9%

Trabectome-Only Results

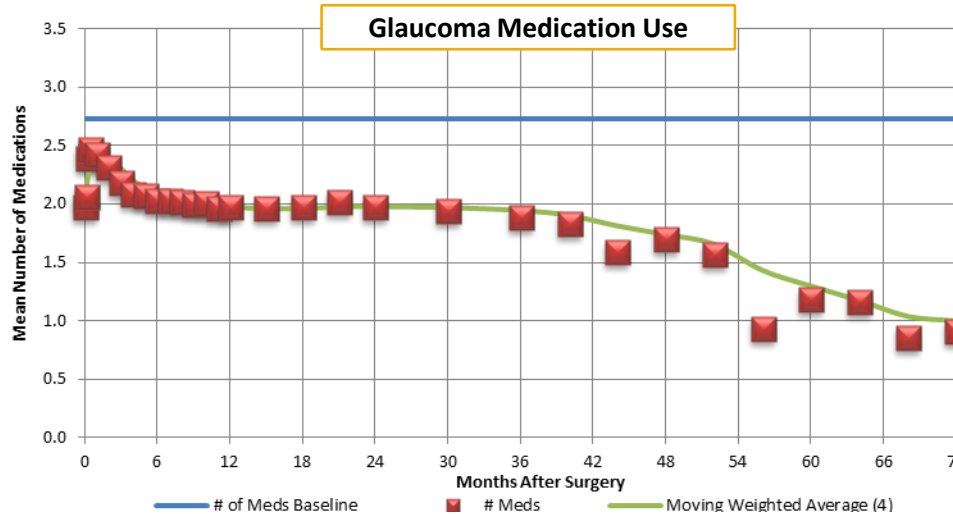
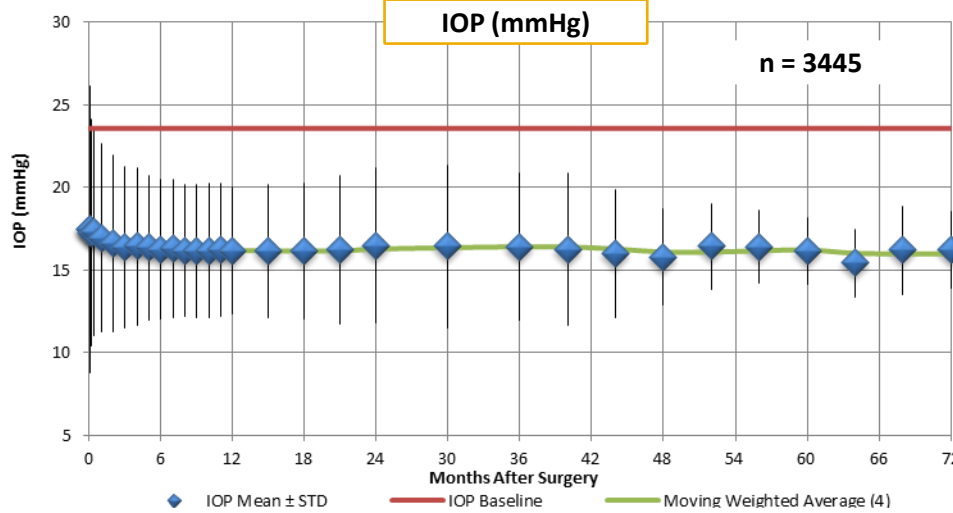
Authors	Study Type	# of pts	pre-sx IOP	% decrease	meds decrease	months
Minckler 2005	Pro	37	28	40 %	0.9	13
Minckler, 2006	Pro	101	28	40 %	n/a	30
Minckler, 2008	Retro	738	26	35 %	1.1	60
Ting, 2012	Pro	450	26	34 %	0.6	12
Ting, 2012	Pro	67	29	44 %	0.9	12
Jea, 2012	Retro	115	28	41 %	1	30
Minckler, 2012	Retro	1151	26	36 %	1.7	60
Mosaed, 2011	Retro	538	26	31 %	0.8	12

Phaco-Trabectome Results

Authors	Study Type	# of pts	pre-sx IOP	% decrease	meds decrease	months
Minckler 2008	retro	366	20	20 %	1.2	60
Francis, 2008	Pro	304	20	25 %	1.2	21
Francis, 2011	Pro	89	22	27 %	1	12
Ting, 2012	Pro	263	20	22 %	0.7	12
Ting, 2012	Pro	45	22	35 %	0.9	12
Minckler, 2011	retro	681	20	21 %	0.9	36
Mosaed, 2011	retro	290	20	18 %	0.8	12
Kaplowitz, Loewen *	retro	192	20	28 %	0.8	24

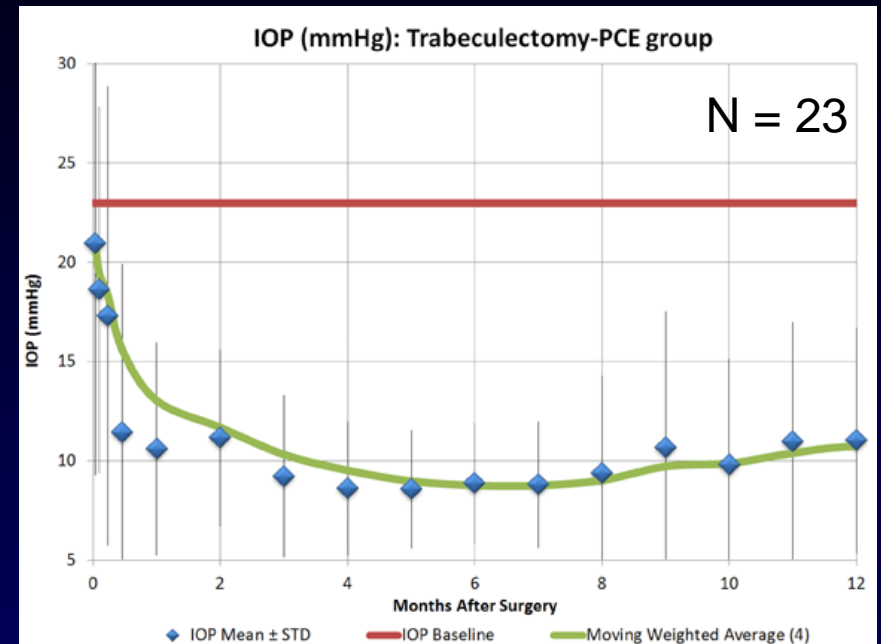
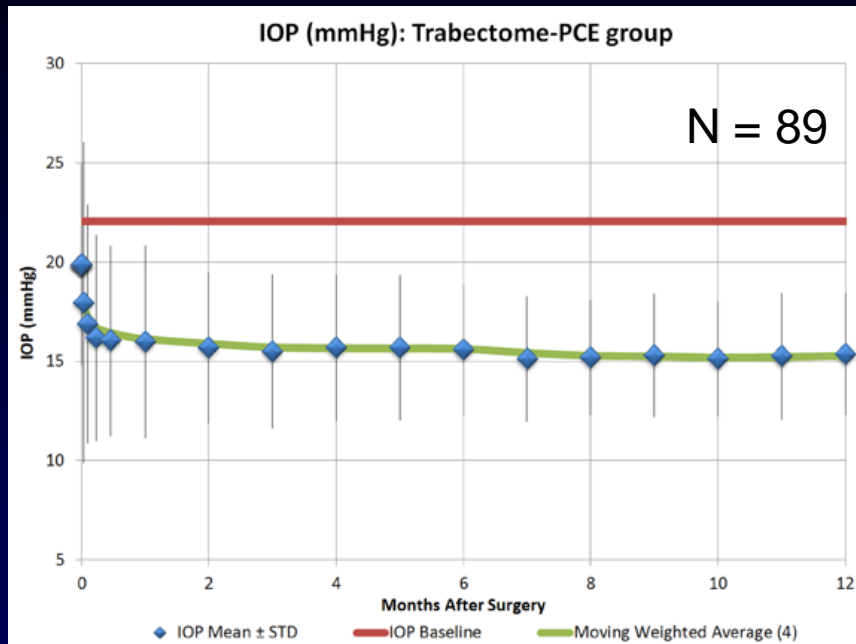
* including ACG, NVG, uveitic, secondary procedures

6 Year Outcomes



Trabectome vs. Trabeculectomy

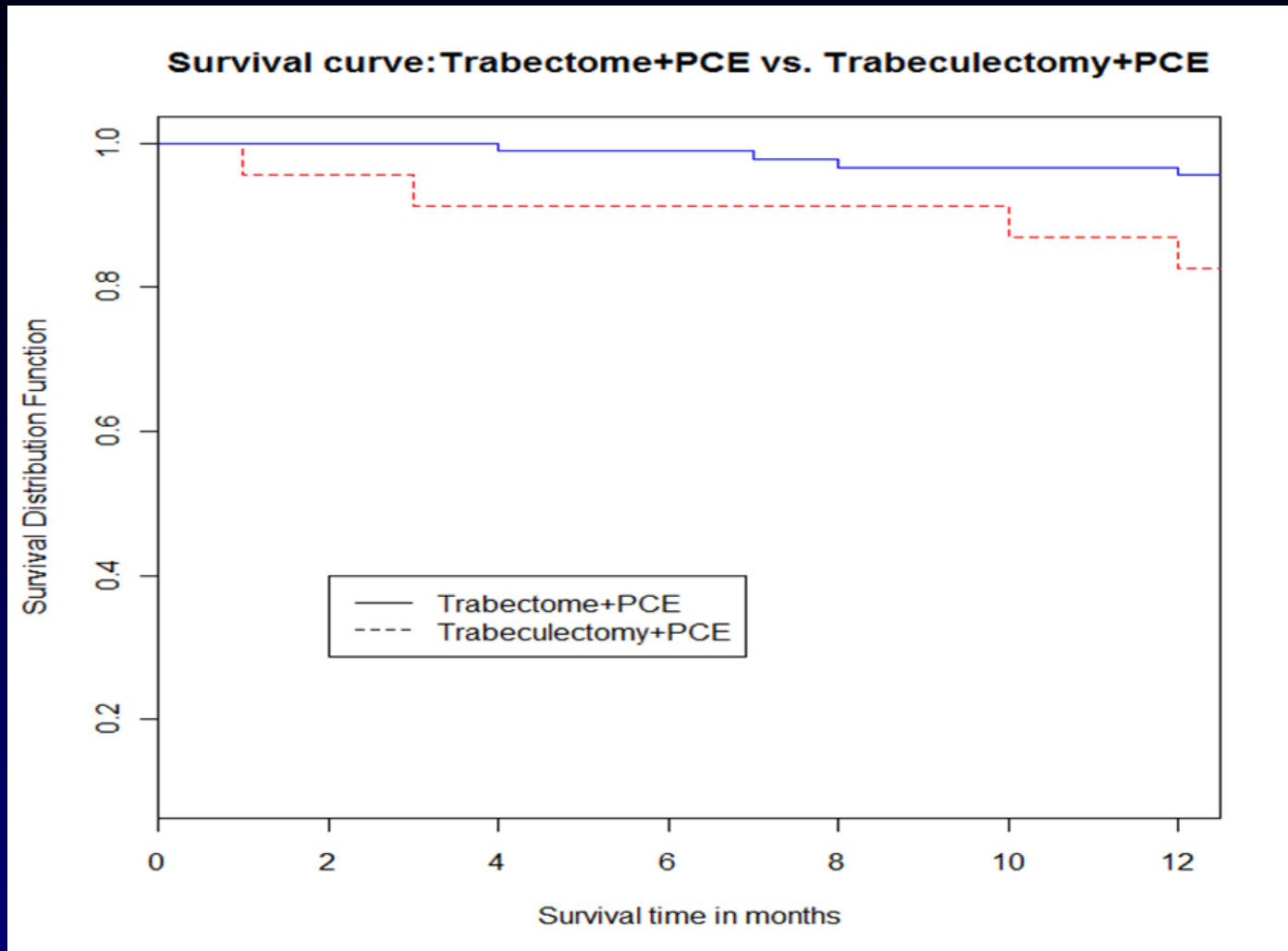
(Dr. Brian Francis)



Major complications: Trabectome-phaco group including subsequent trabeculectomy & tube = 4

Major complications: Trabeculectomy-phaco group including repeat trabeculectomy & tube = 16

Trabectome vs. Trabeculectomy (Brian Francis)



N = 58

Trabectome **AFTER** Trabeculectomy

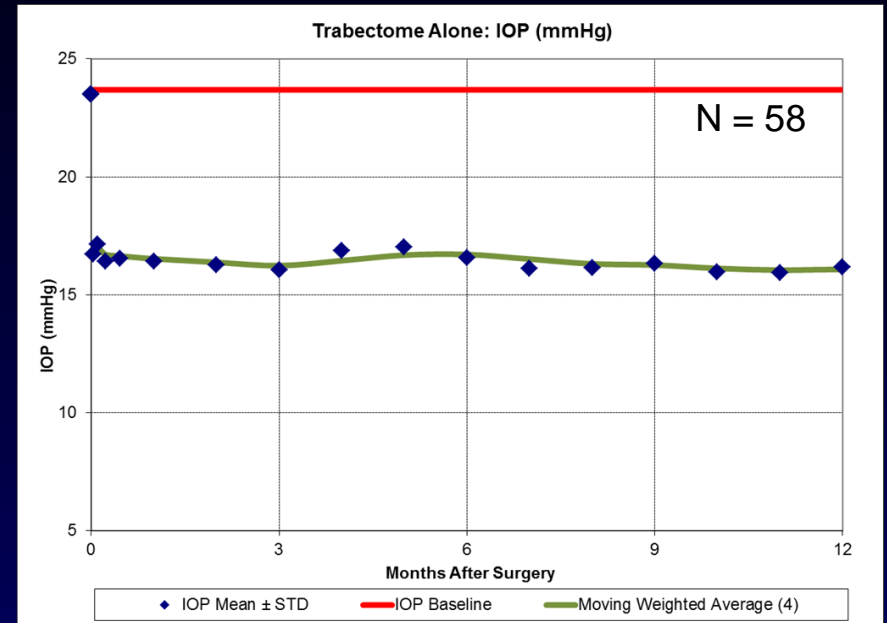
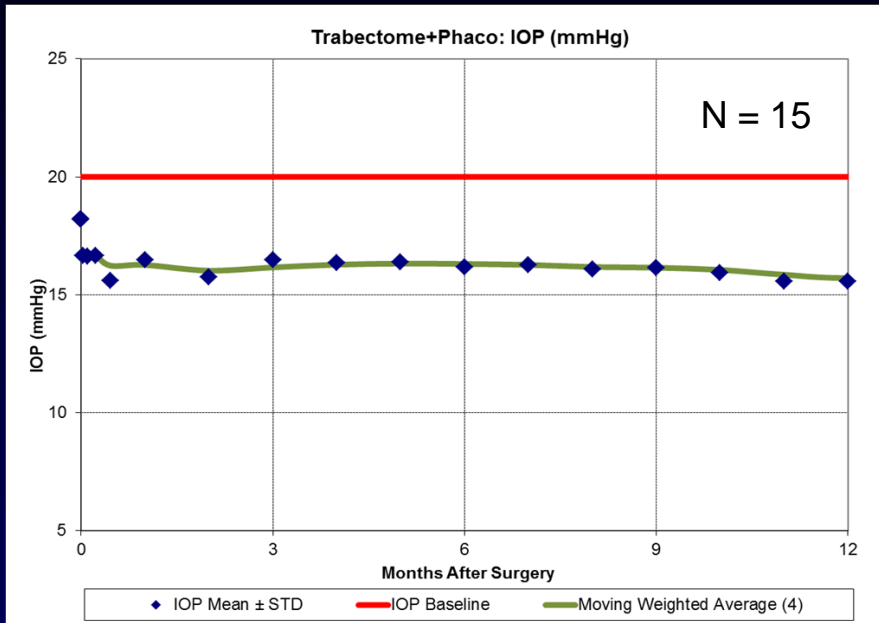
Bussel II, Kaplowitz K, Schuman JS, Loewen NA
Outcomes of ab interno trabeculectomy with the trabectome after
failed trabeculectomy.
Br J Ophthalmol. 2014 Aug 28.

Trabectome **AFTER** Trabeculectomy

Bussel, II et al. BJO (2014)

Phaco-Trabectome

Trabectome-only



	# Medications	# Medications
Baseline	2.5±1.5	2.8±1.2
6M	1.8±1.5	2±1.3
12M	1.6±1.4 (p=0.1)	2±1.3 (p<0.01)

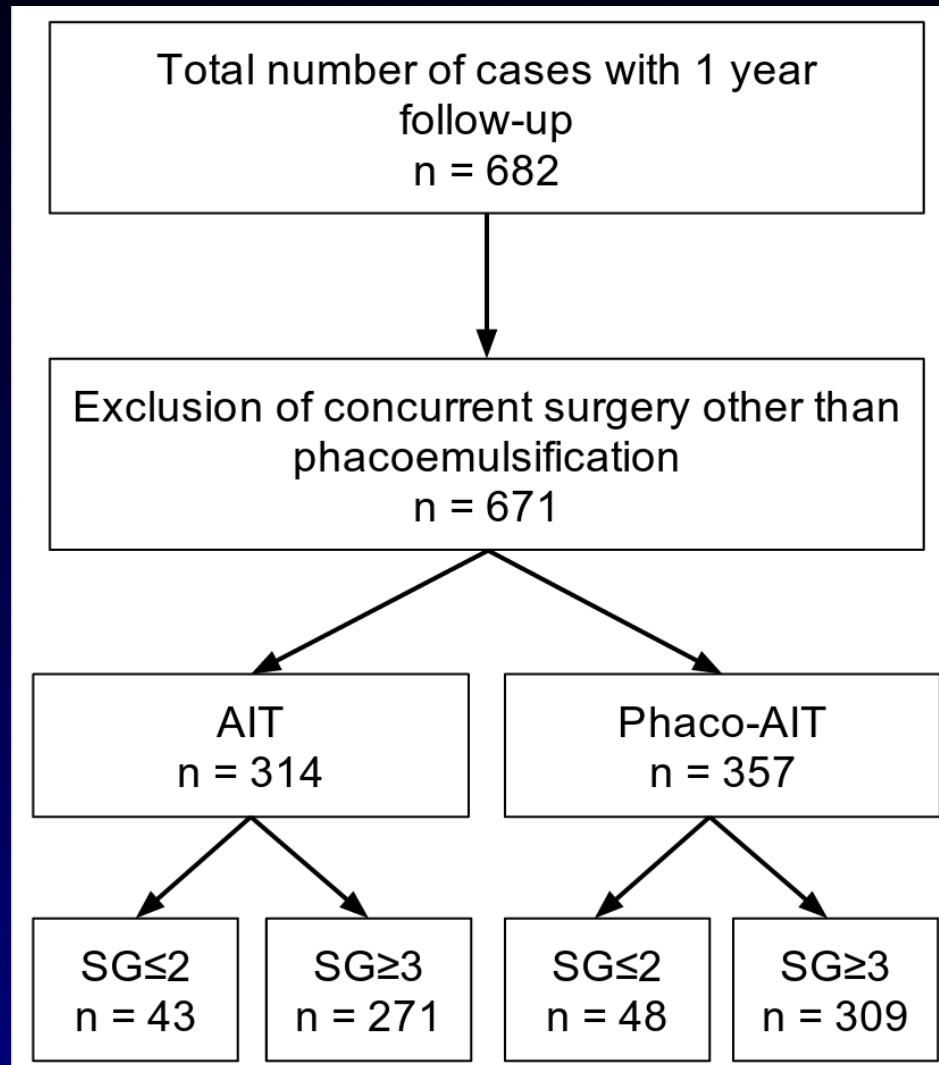
Trabectome by Degree of Angle Opening

Bussel II, Kaplowitz K, Schuman JS, Loewen NA

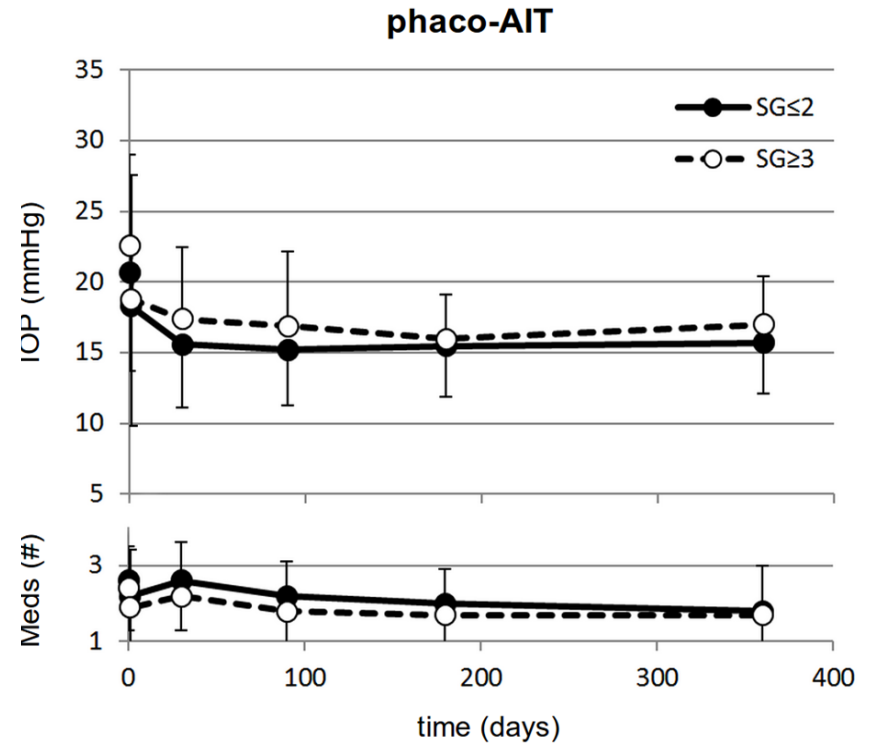
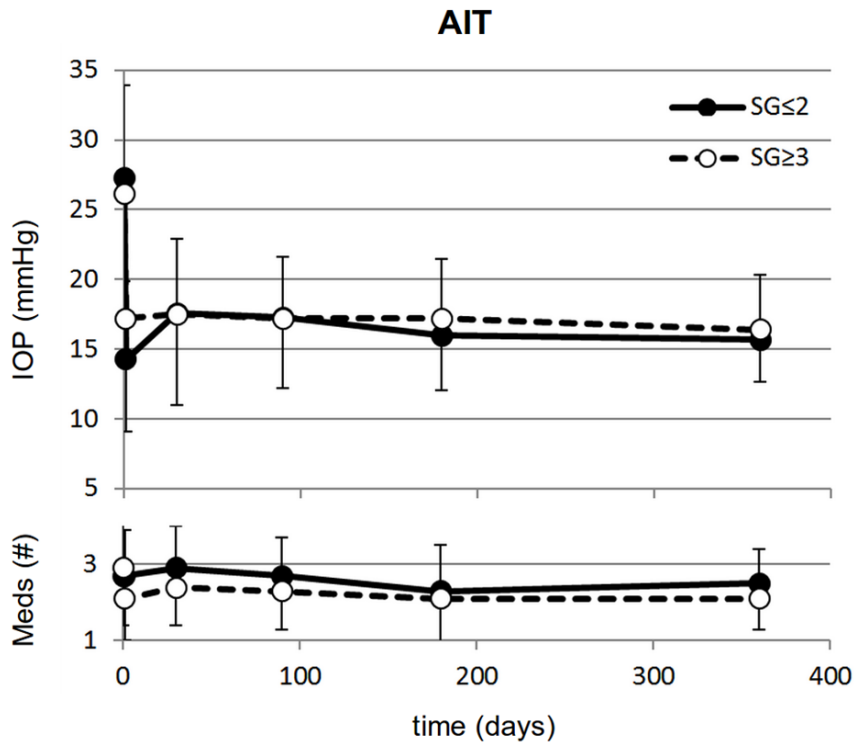
Outcomes of ab interno trabeculectomy with the trabectome by degree of angle opening.

Br J Ophthalmol. 2014 Oct 21.

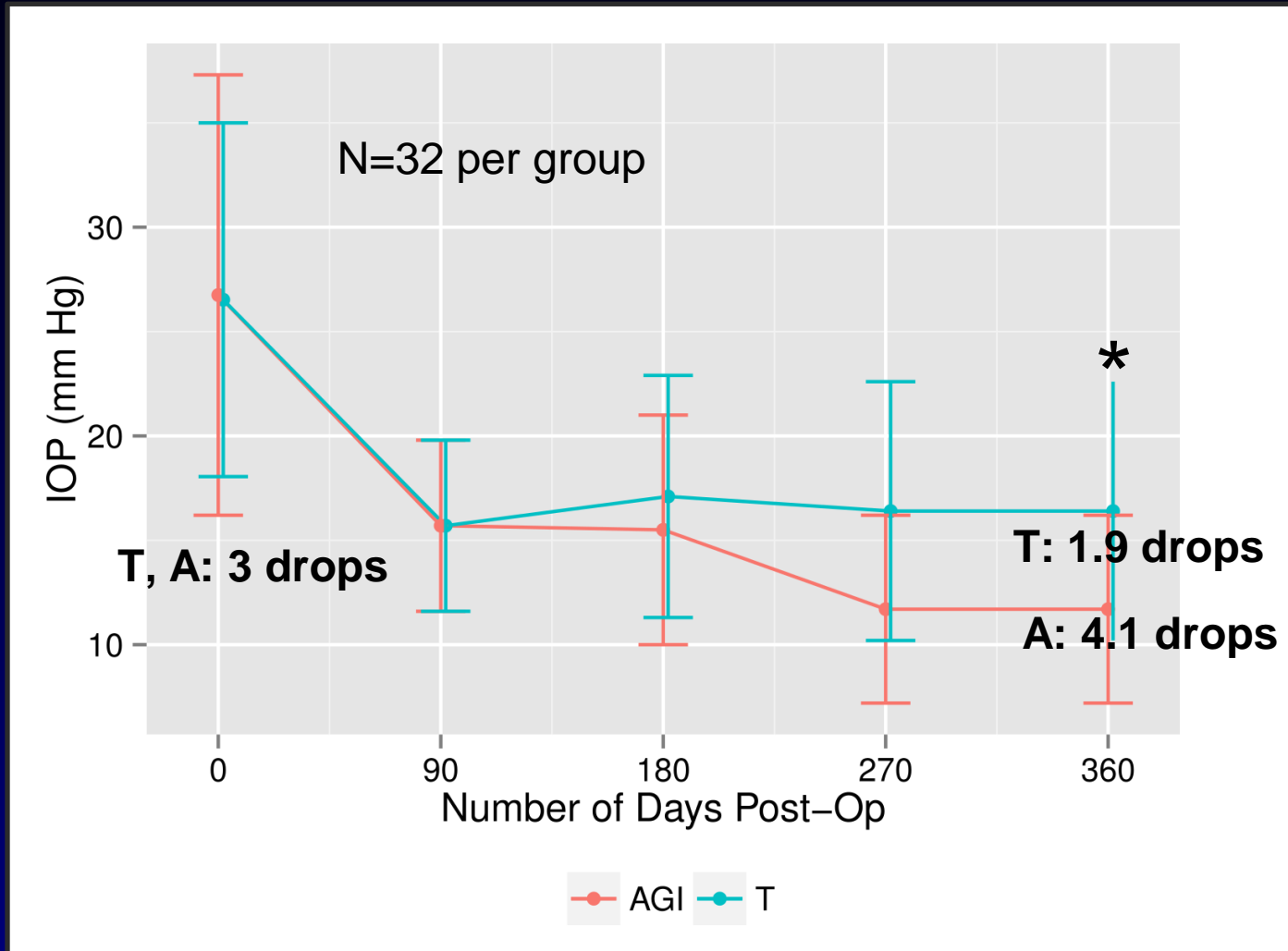
Trabectome by Degree of Angle Opening



Trabectome by Degree of Angle Opening



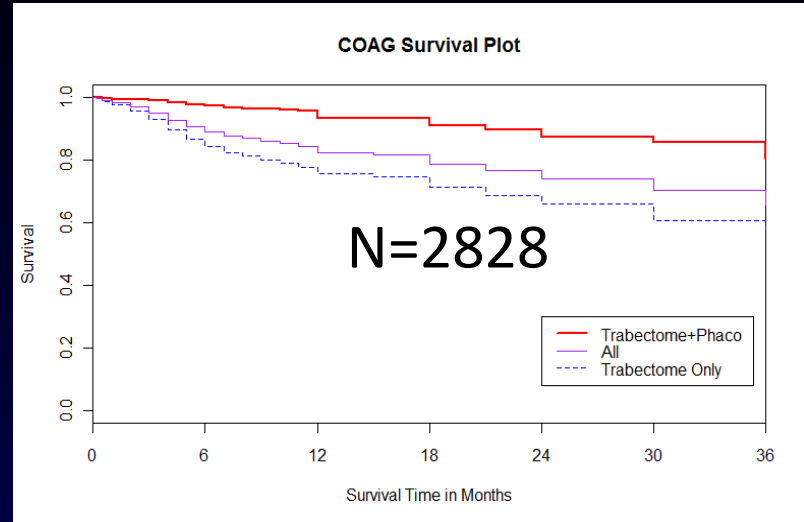
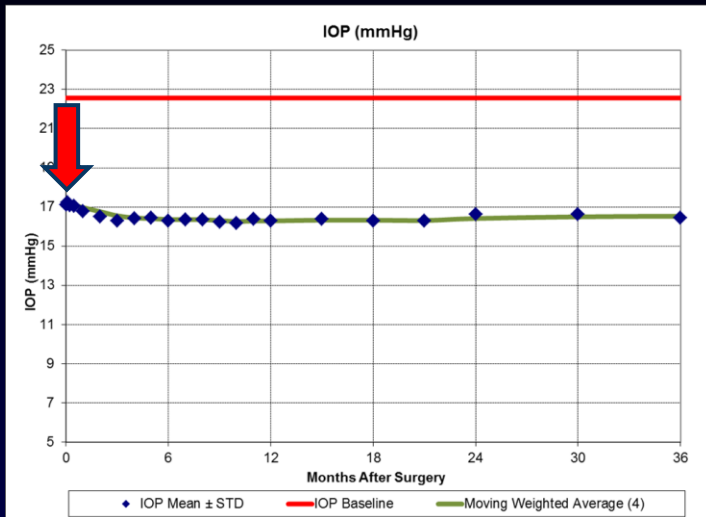
Trabectome Matched to Ahmed Valves



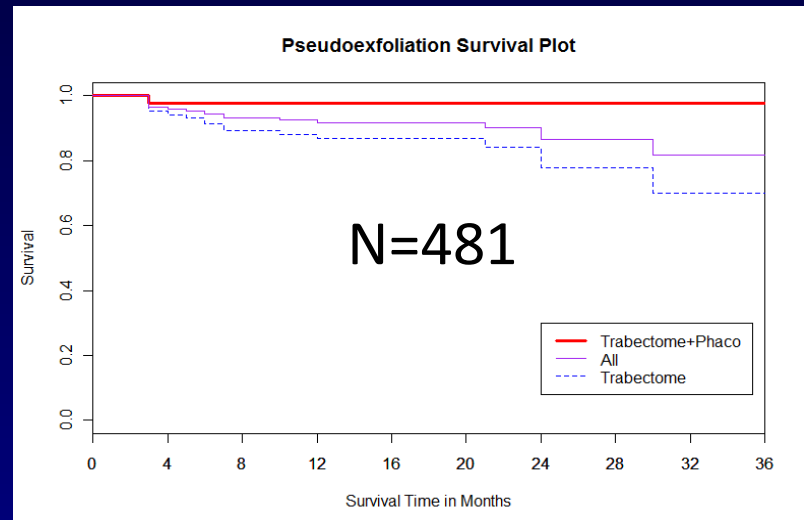
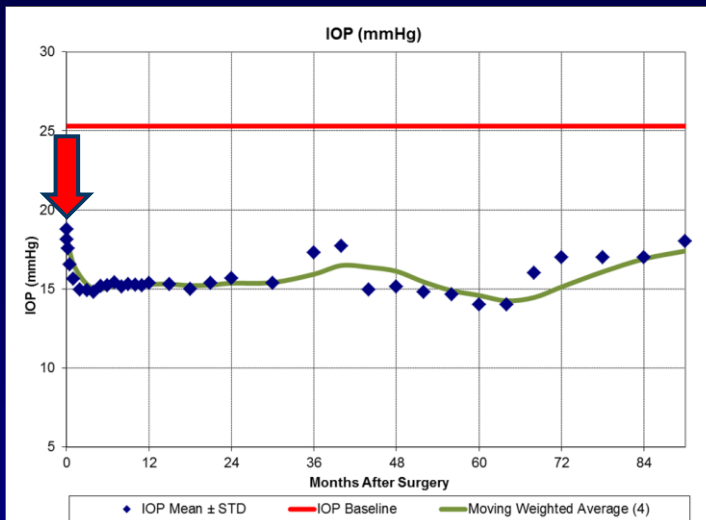
Outcome by Type of Glaucoma

POAG + Pseudoexfoliation

POAG

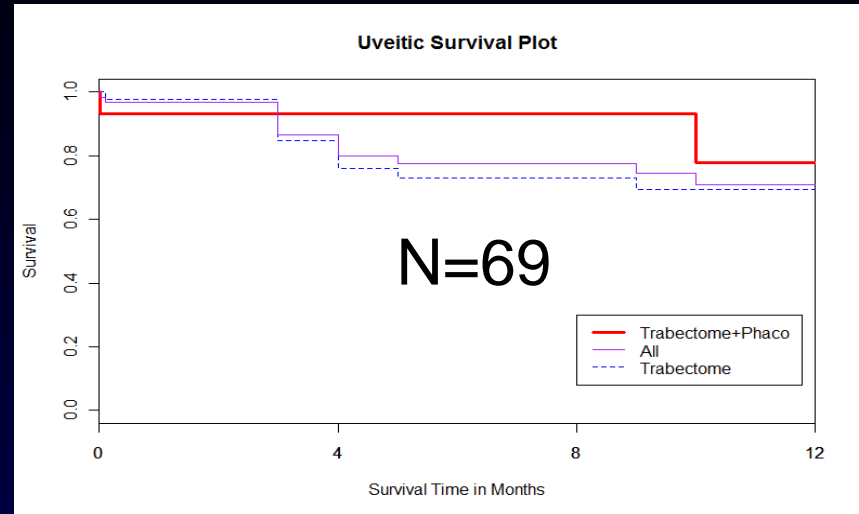
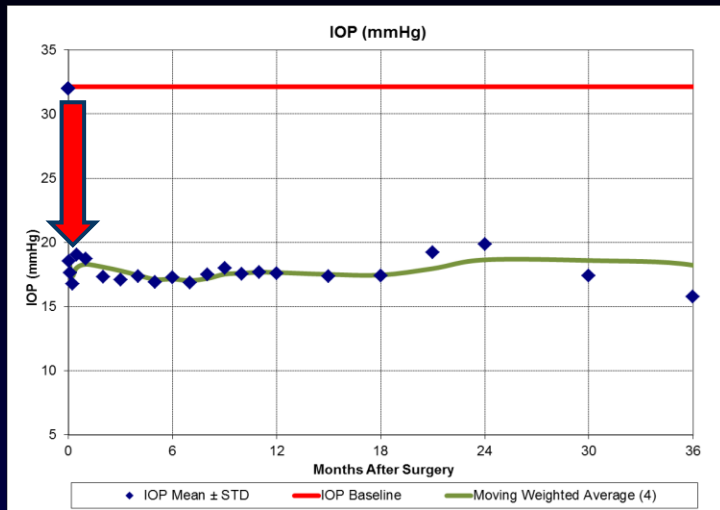


pseudoexfoliation

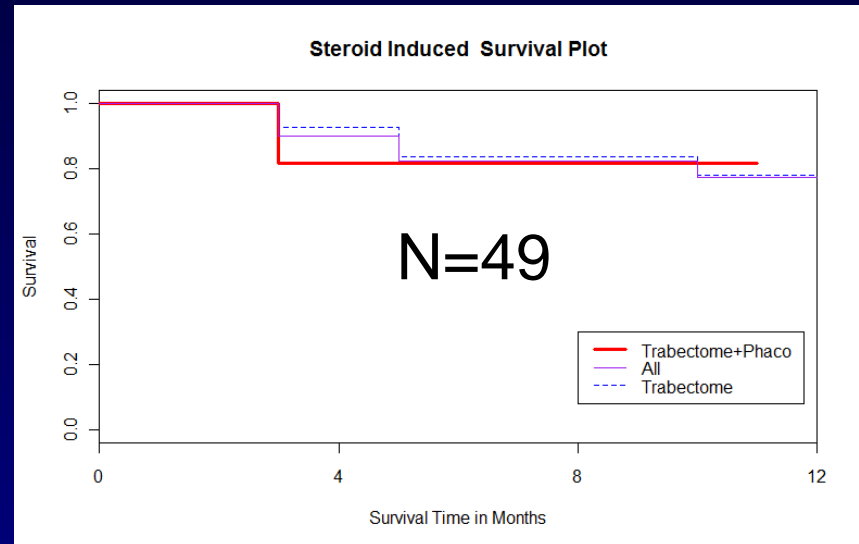
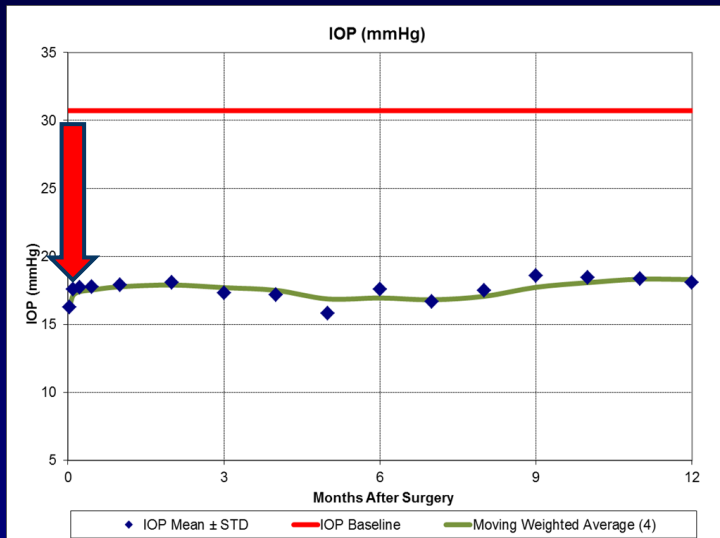


Uveitic + Steroid Glaucoma

uveitic

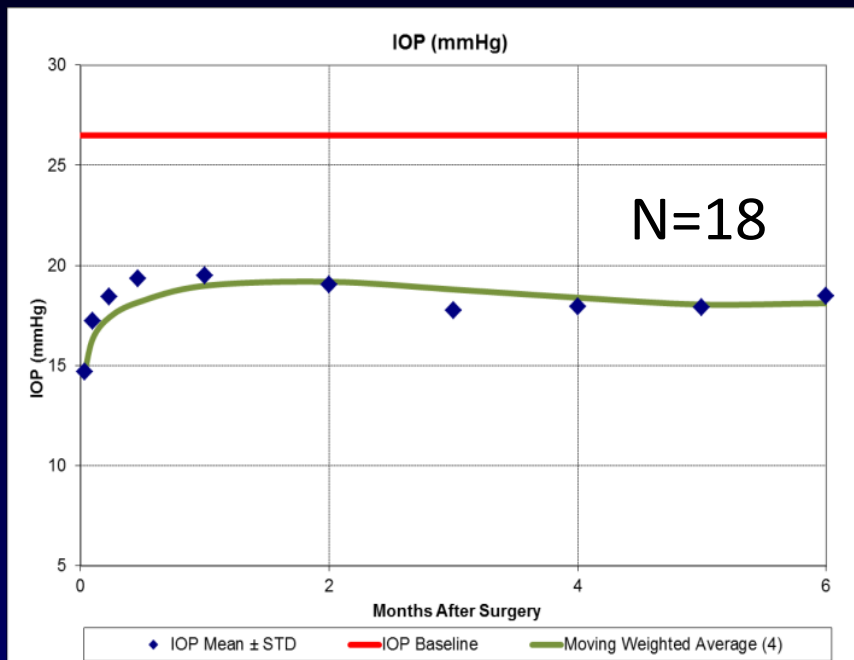


steroid

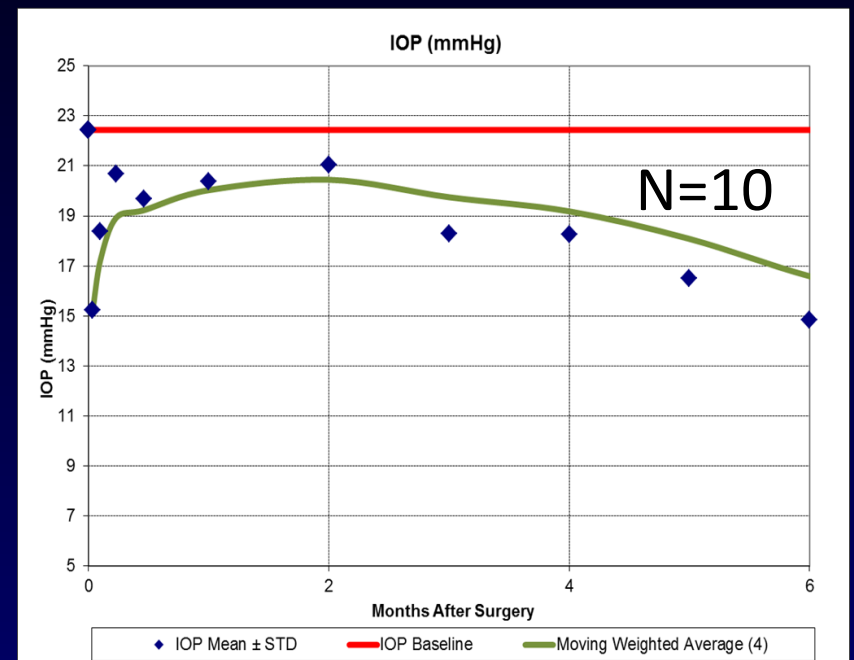


Infantile Glaucoma

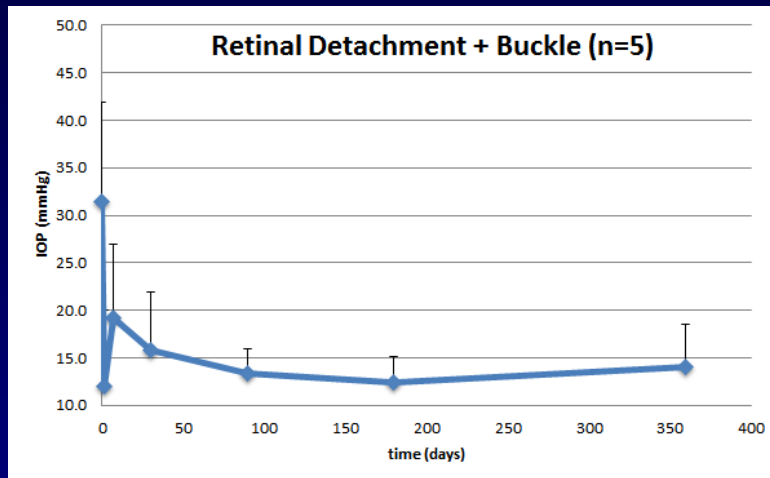
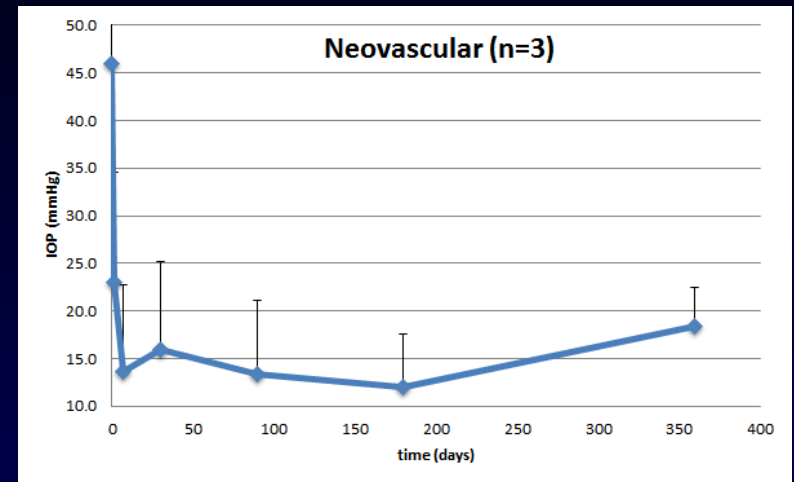
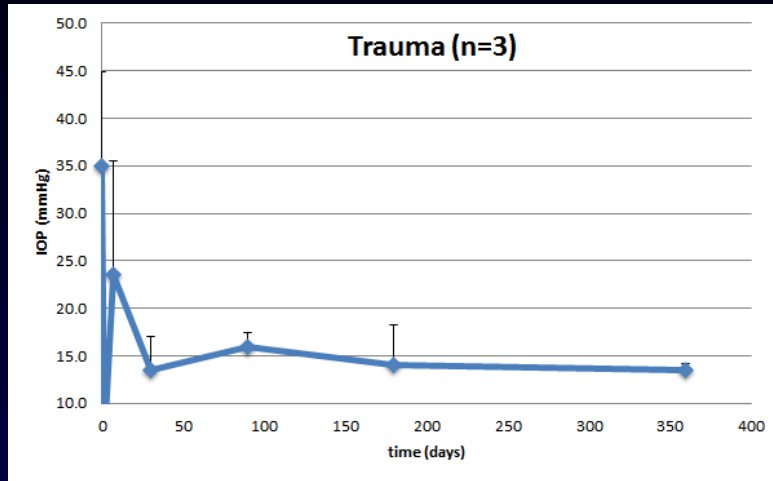
Trabectome only



Phaco-Trabectome



Highly Complex, Mixed Mechanism Glaucomas



Trabectome with glued, tied Baerveldt

Wet Lab

WET LAB



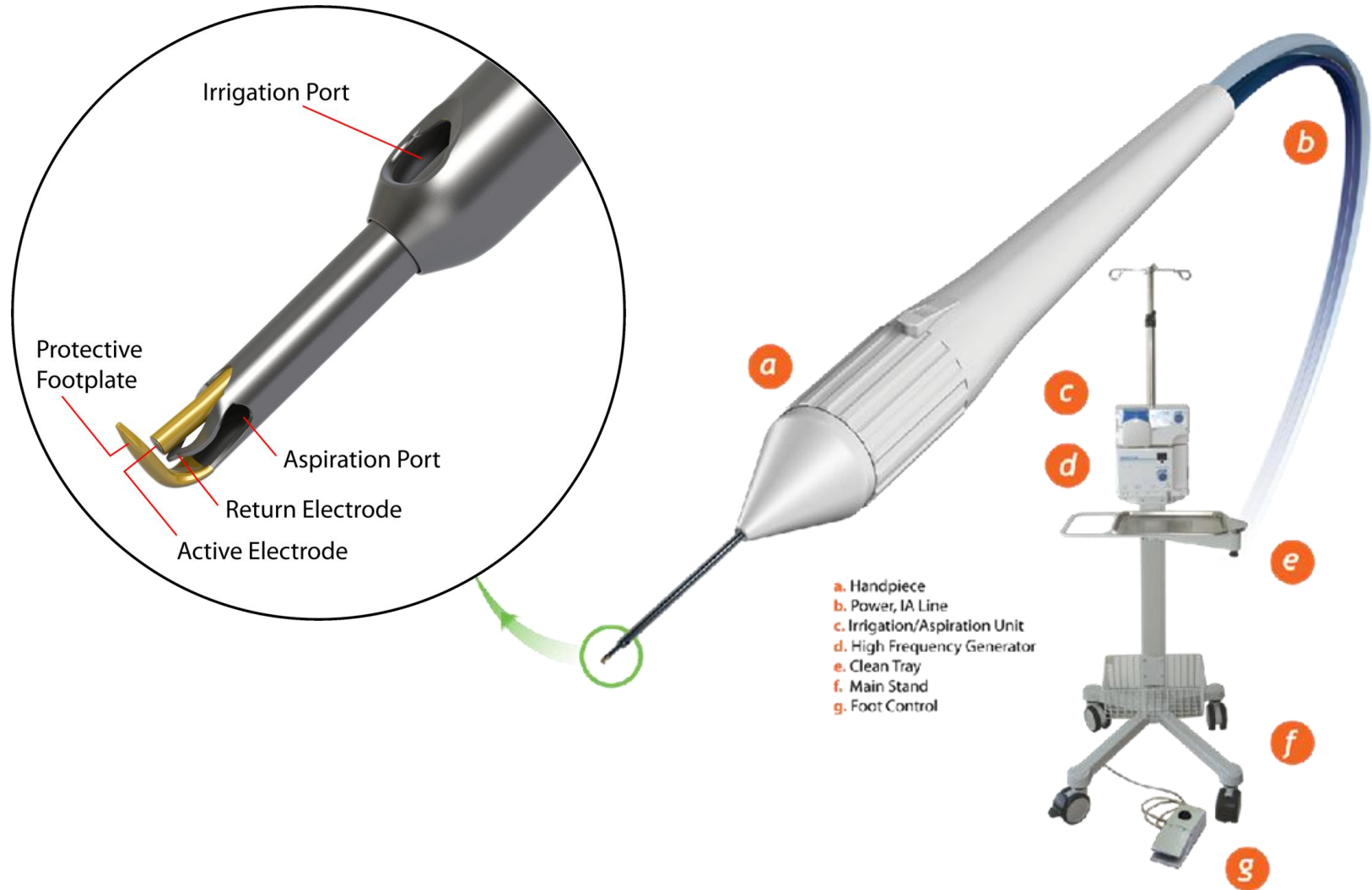
Skills Transfer Course

Wet Lab Introduction

Brian Francis MD, MS

Associate Professor of Ophthalmology
Doheny-USC, Los Angeles, California

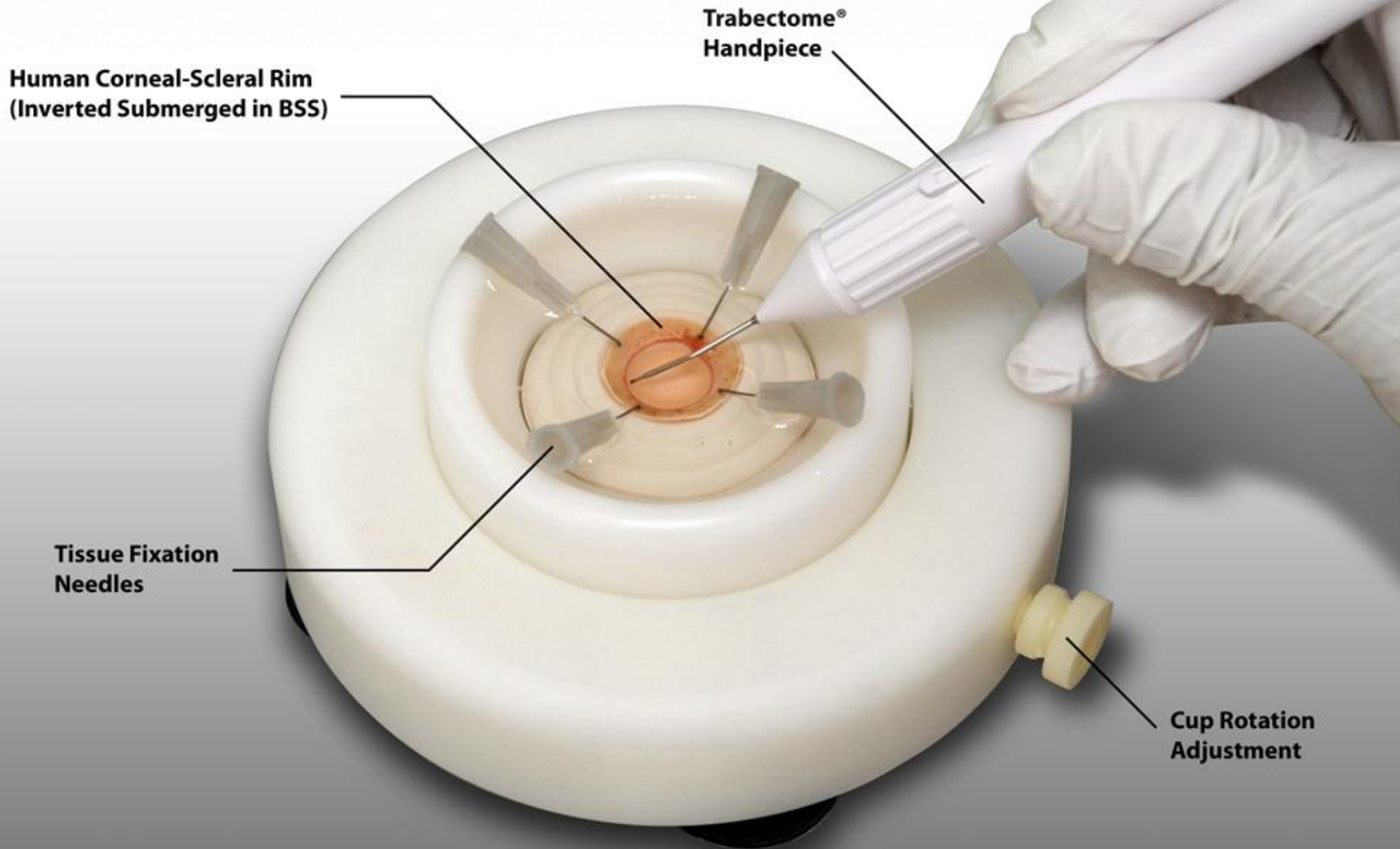
Trabectome Surgical System



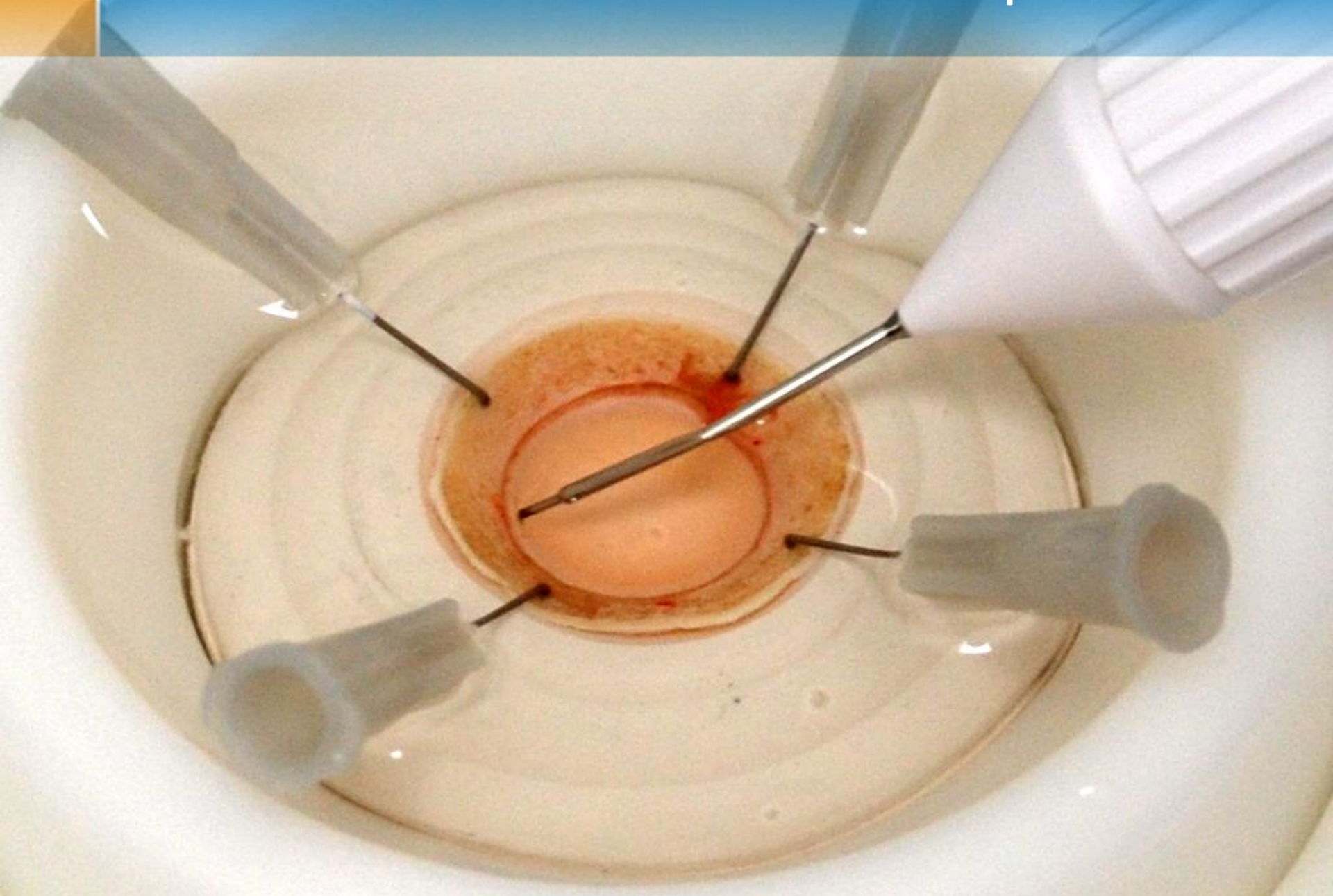
Unique Key Features



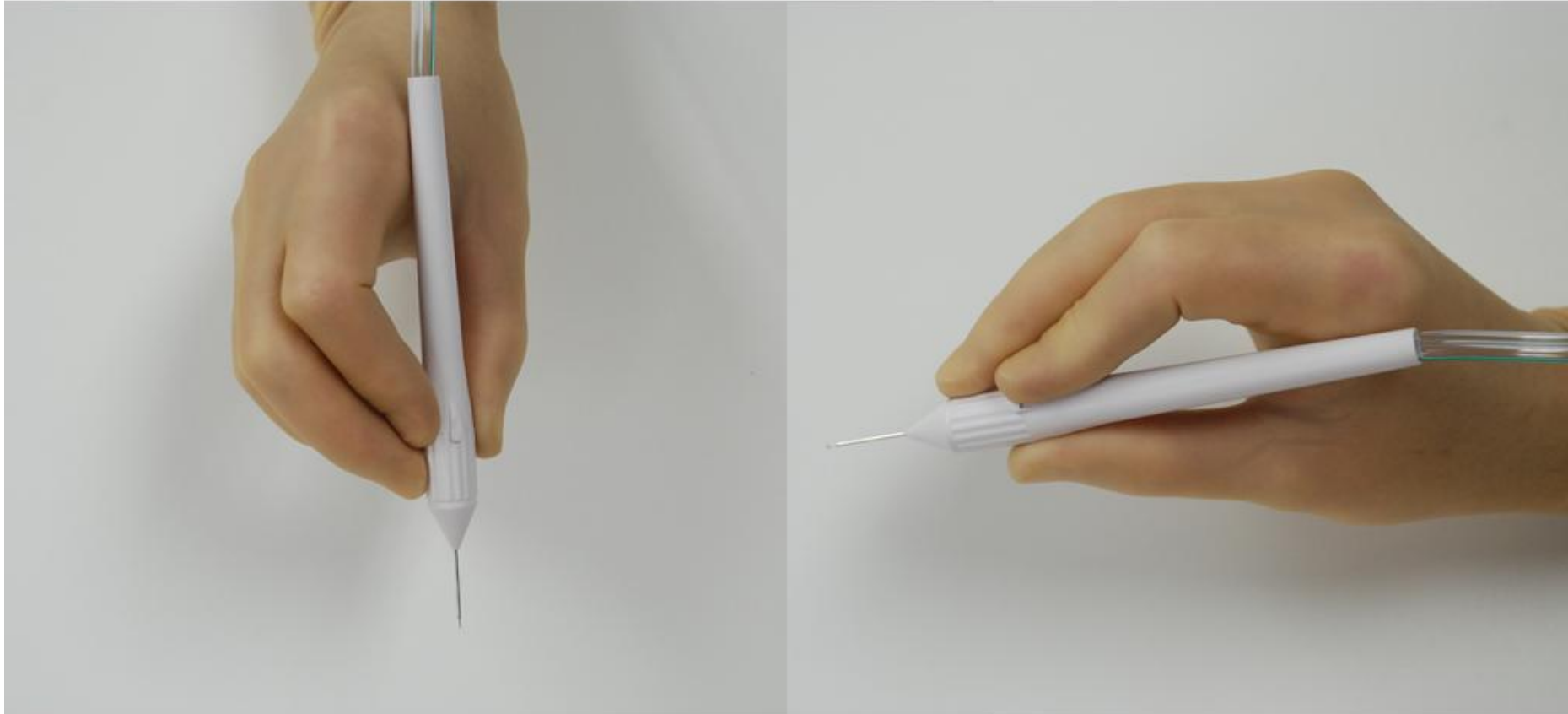
Human Corneal-Scleral Rim Setup



Human Corneal-Scleral Rim Setup



Handpiece Grip Technique



Trabecular Meshwork Removal



George Baerveldt, MD, University of California, Irvine

CASE PRESENTATIONS

Overview

Case Representations

- Sjogren + Steroids
- Corneal Synechiae, Angle Closure
- Pseudoexfoliation

Historical Cases

- phaco-trabectome in POAG
- phaco-trabectome in PXG

CASE 1:

SJOGREN + STEROID GLC

HPI

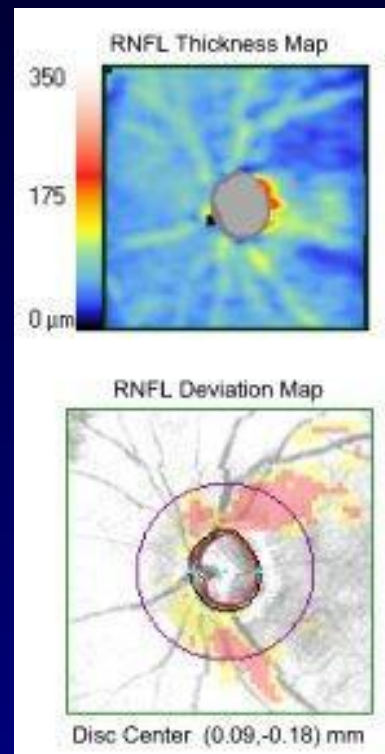
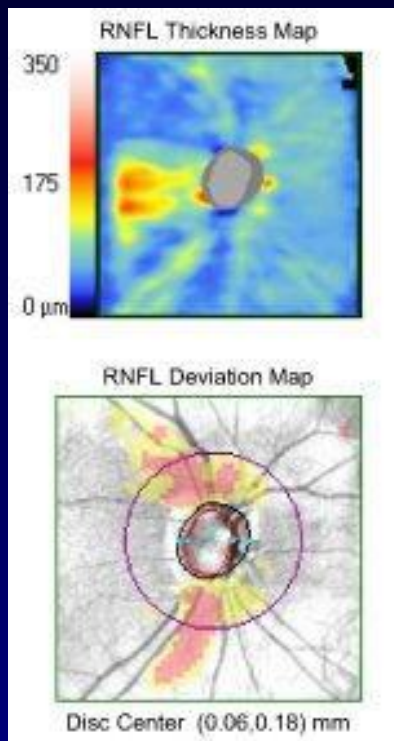
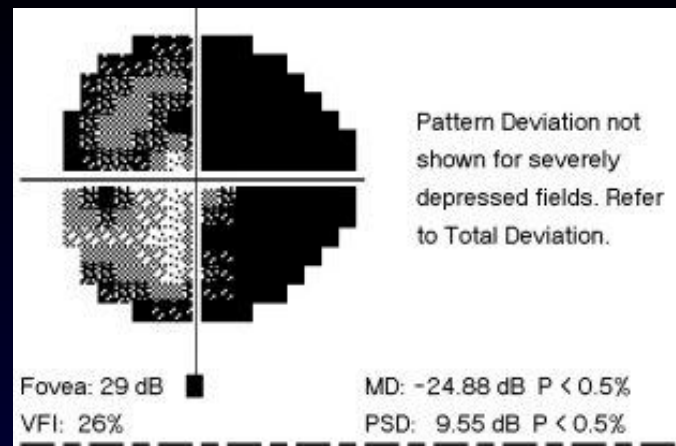
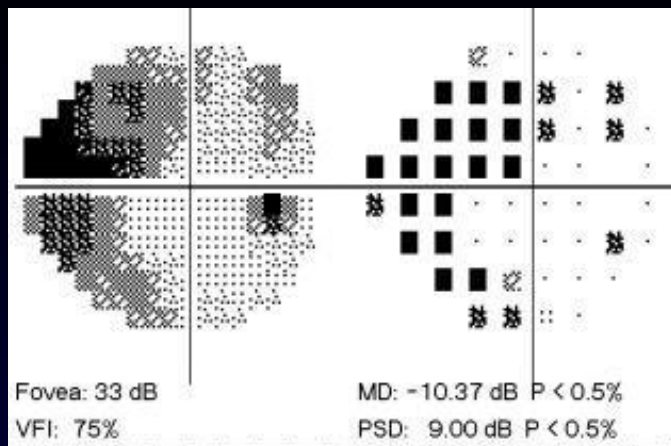
- 73-year-old Caucasian woman
- 35 mmHg on 3 gtts
- Severe Sjogren's Syndrome
 - Severe DES
 - Filamentary keratitis
 - Erosions
 - Xerostomia

HPI

- Prednisone 4 mg QD, KCl 20 mEq QD, Alendronate, Calcium with vitamin D
- Steroid-induced glaucoma OU
 - 50 mmHg max
 - Unnoticed by PMD x 6 months

Exam

	OD	OS
VA (cc)	20/50	20/200
Lids	severe crusting	
Cornea	filaments	
Lens	3+ NS, +1 PSC	
Disc	0.9 C/D	0.95 C/D
	Severe inf, moderate sup thinning	Severe inf + sup thinning



Phaco-Trabectome

OD

- POD #1: VA 20/25-2, IOP 10.
- **POM #12**: VA 20/25+, **IOP 12**. No gtts for IOP

OS

- POV: 10 mm Hg x 5 months
- POM #18: 14 mm Hg (added Travatan Z)

CASE 2:

CORNEAL SYNECHIAE = ACG

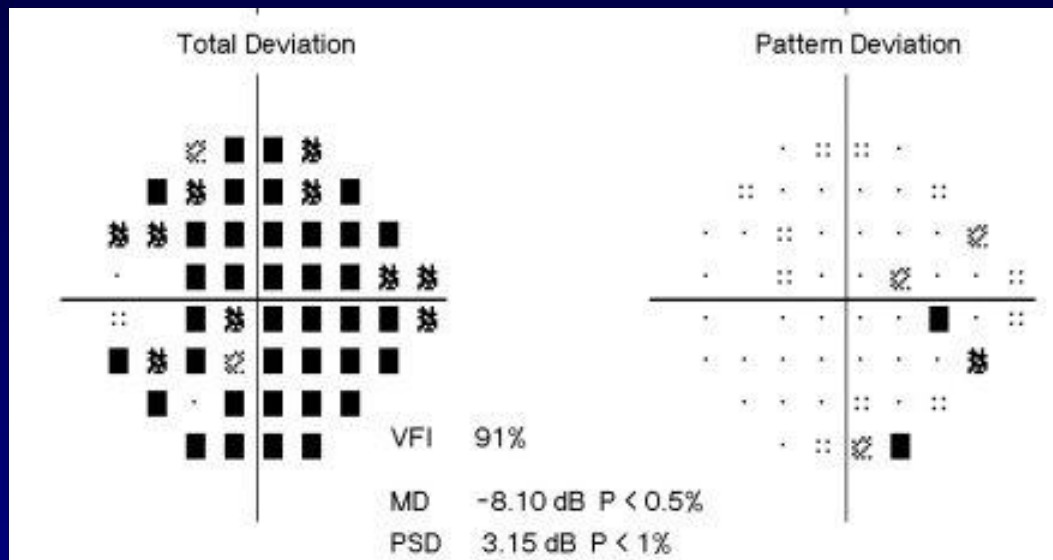
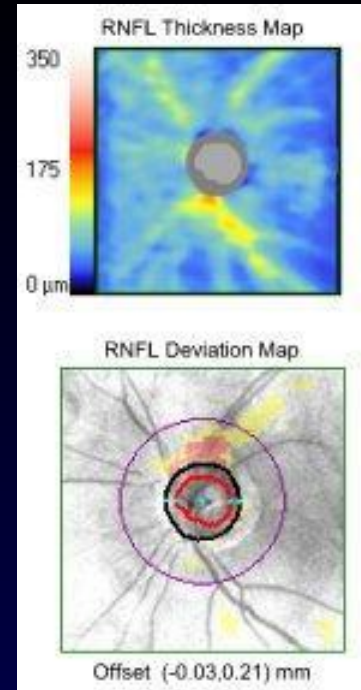
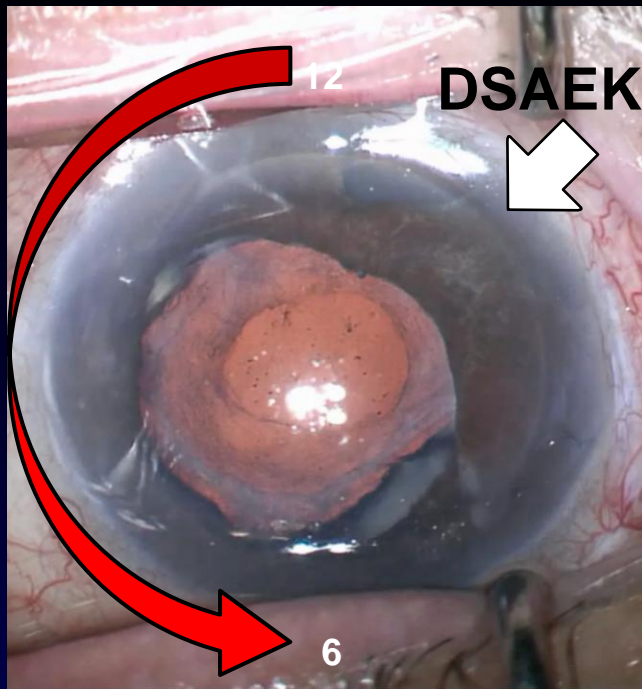
HPI

- 81-year-old Caucasian woman
- Deaf mute
- 20 mmHg on 3 gtts + oral CAI
- DSAEK OS years ago
 - 180 corneal-iris touch
 - drops affecting transplant
 - difficult med adherence

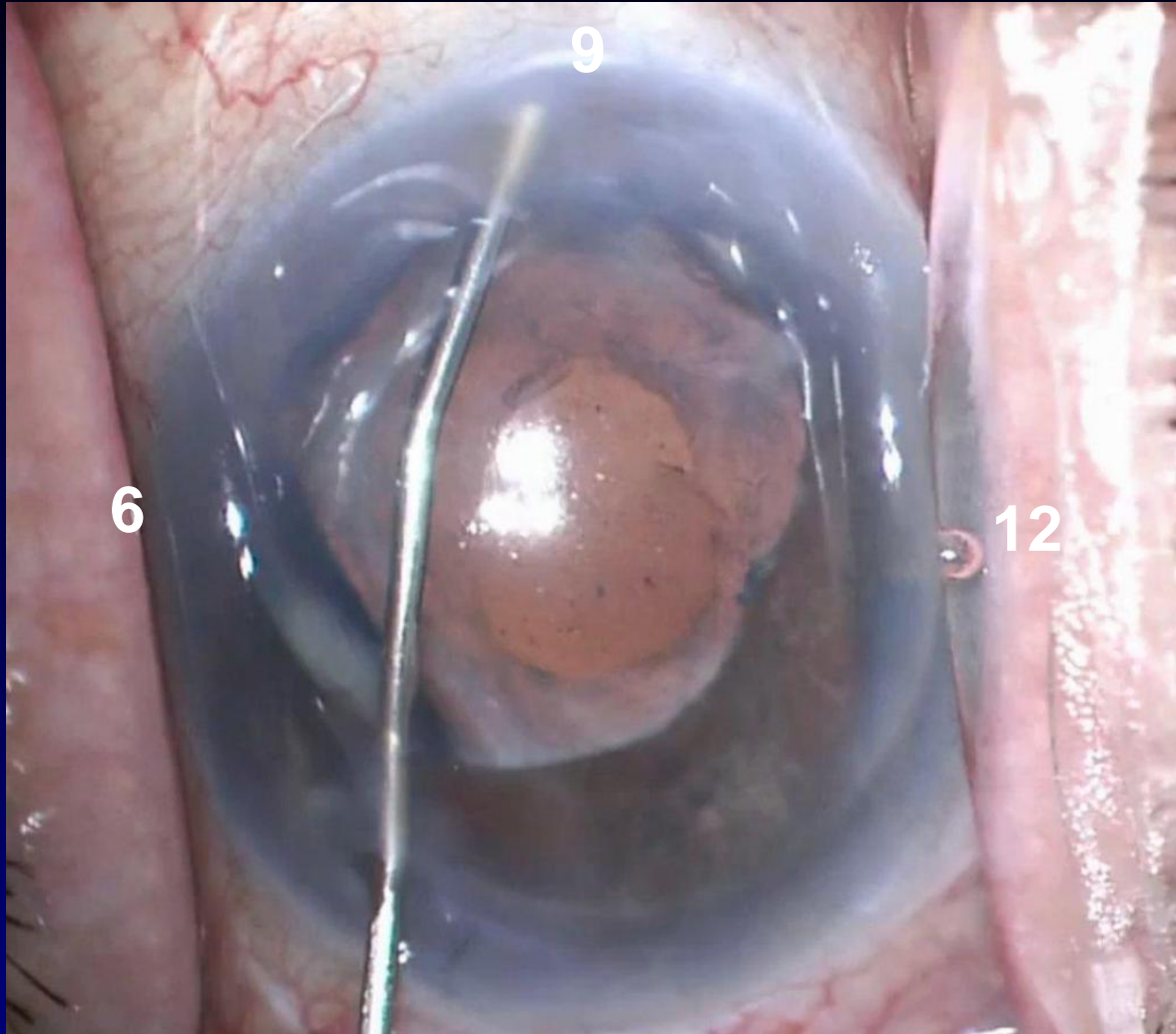
Exam

	OD	OS
VA (cc)	20/70	20/150
cornea		DSAEK
Iris	180° iridocorneal adhesions	
Lens		sulcus PCIOL
Disc	0.4 C/D	0.7 C/D
		Inf thinning

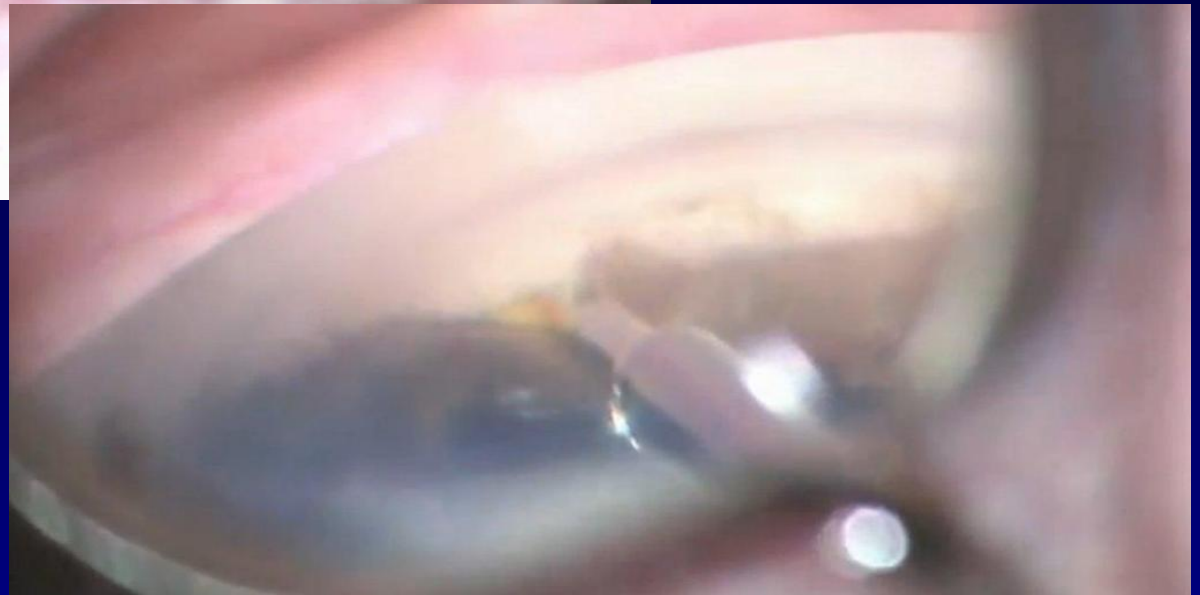
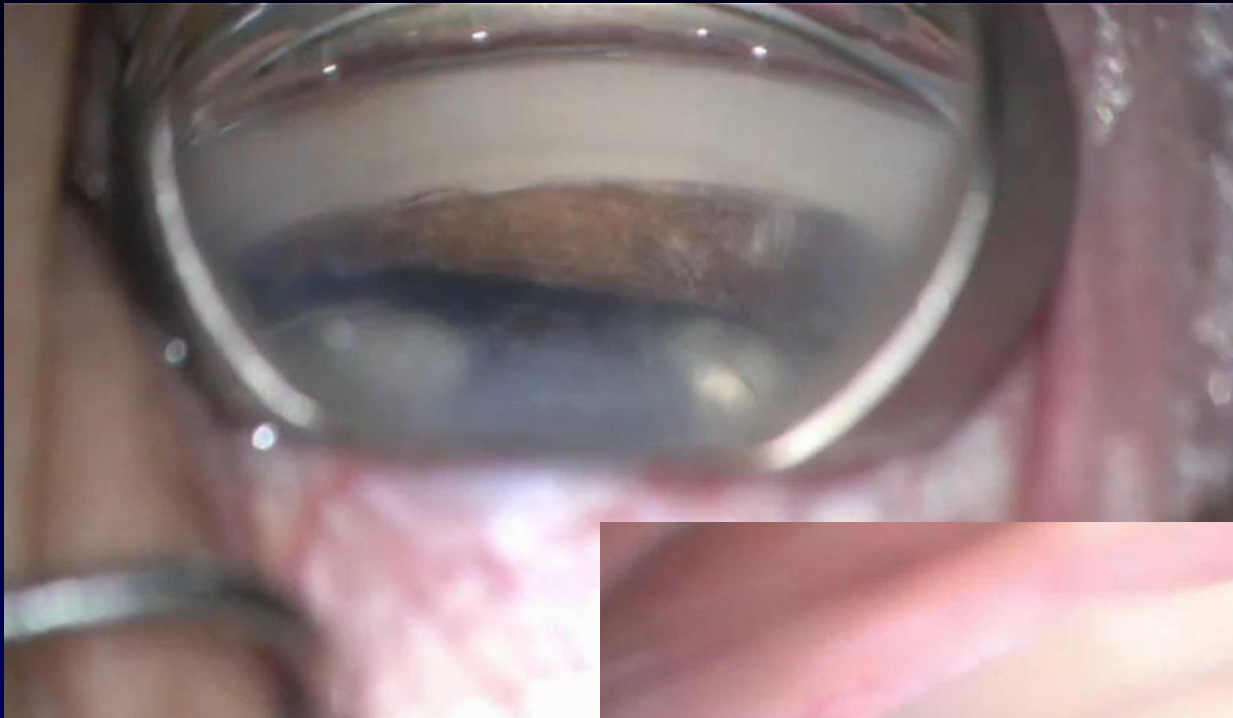
iridocorneal
adhesion



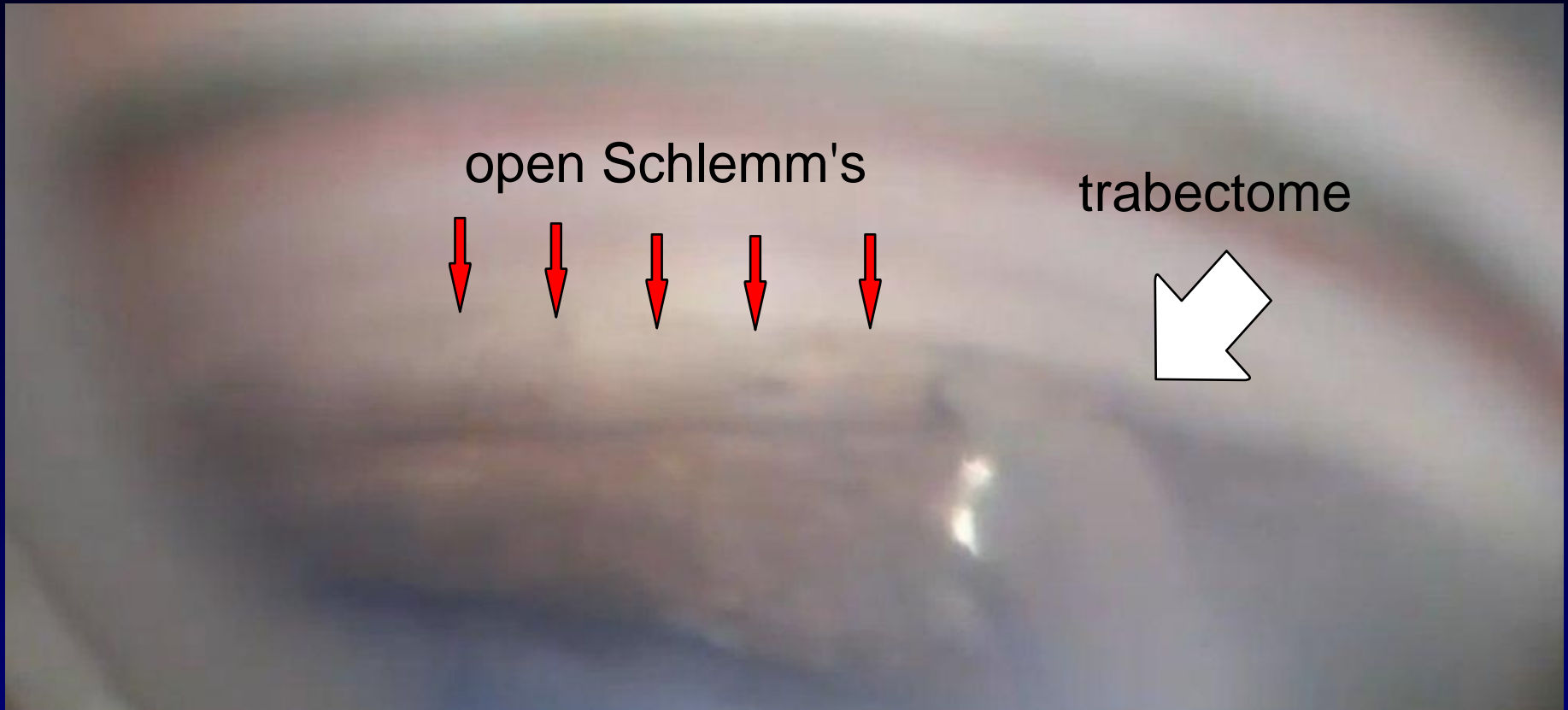
Dissection of Iridocorneal Adhesions



Trabectome Goniosynechiolysis



Trabectome Ablation



Outcome

- POM#18: OS VA 20/60, IOP 12
- timolol QAM

Summary

MIGS vs Trabs/Tubes

Trabectome Technique + Postop Care

Outcomes

Case Presentations

Thank you.

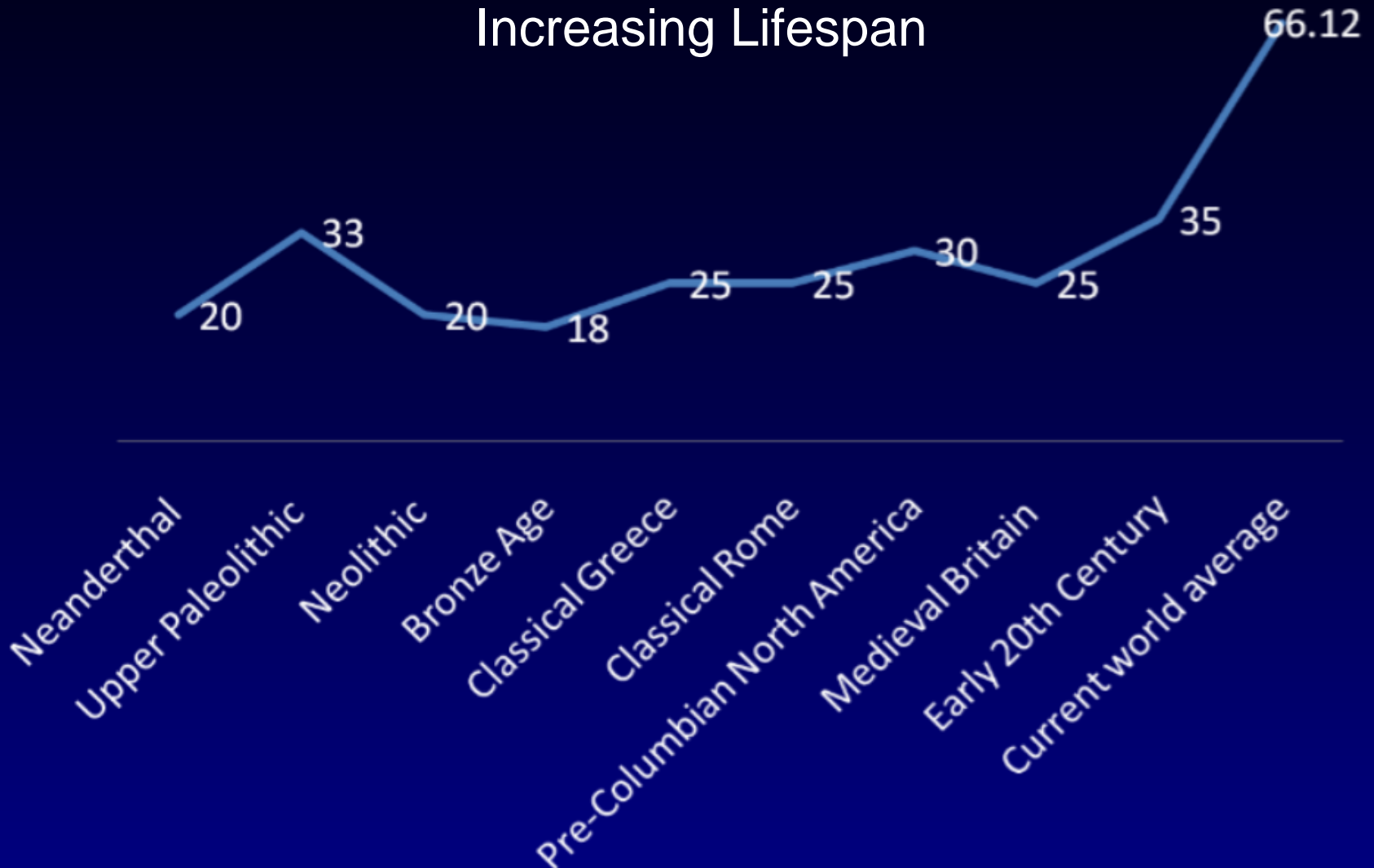
optional:

**COST CONTAINMENT IN
GLAUCOMA**

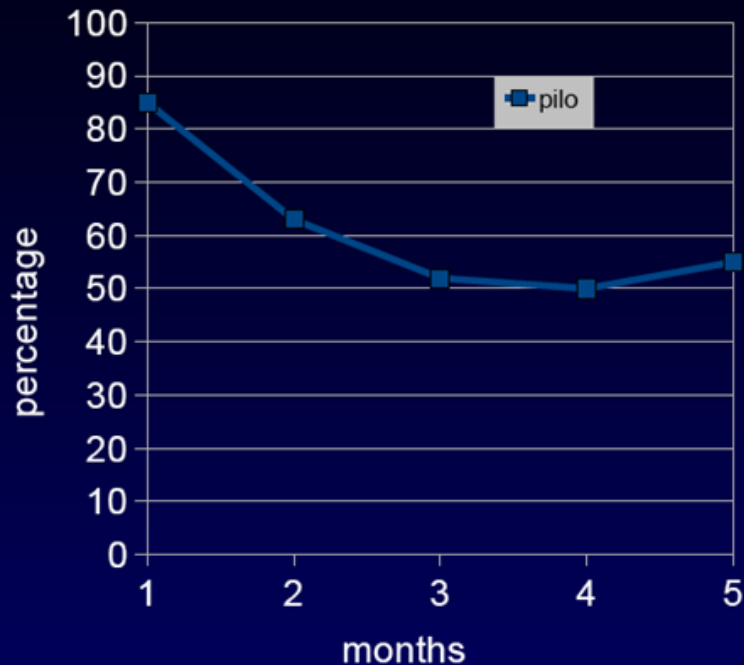
COST CONTAINMENT IN GLAUCOMA

The Cause of Glaucoma

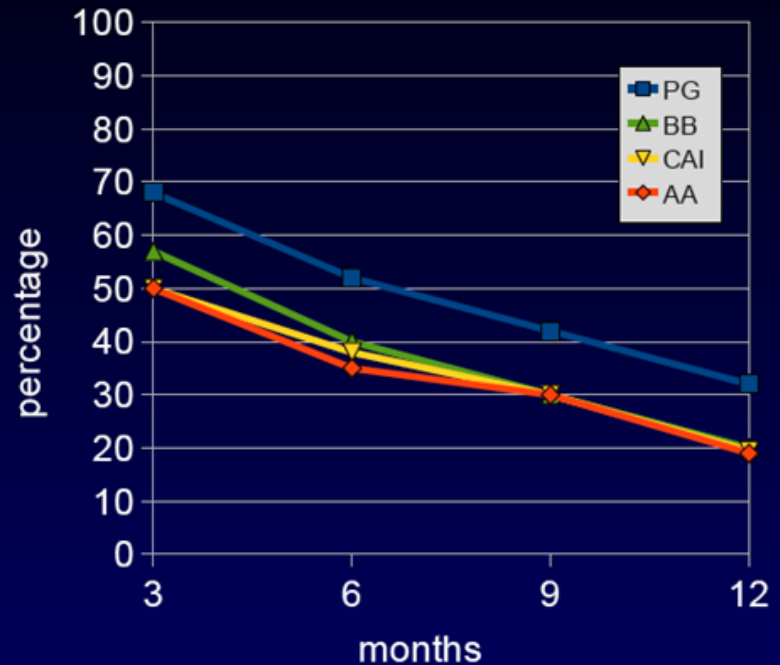
Increasing Lifespan



Persistence with Glaucoma Medications



Kass MA, 1986, AJO. Granstrom PA, 1982, BJO



Reardon G, 2004, AJO

Friedman et al, IOVS, 2007:

- 59% patients had opportunity to fill gtt's at 12 months after initial prescription
- only **10%** actually had medication available continuously

Costs of Glaucoma Treatment

Taylor HR, Ophth, 2009

- \$138,000-150,000 USD/QALY
- But: sequence of **SLT, gtts, trab** is very cost effective (instead of max gtts, SLT, trab):

savings would return

\$2.50 for every \$1.00 spent

Performing trabectome early might also keep costs down and improve vision (if done with CEIOL)