

ADVANCED IOL POWER CALCULATIONS

Jack T. Holladay, MD, MSEE, FACS

I. Formulas and Measurements

A. Variables Used to Predict ACD

1. Binkhorst 2 - 1981 - AL
2. Holladay 1 - 1988 - AL, K
3. SRK/T - 1990 - AL, K
4. Hoffer Q - 1993 - AL, K
5. Olsen - 1995 - AL, K, ACD
6. Clarke- 1996 - AL, K1, K2 ACD, LT
7. Holladay 2 - 1996 - AL, K, HWTW, REF, ACD, LT, AG
8. Barrett, Hill RBF, Kane

B. Normal Values for required Measurements

1. Axial Length: mean = 23.5 mm, SD = 1.25 mm
2. Keratometry: mean = 43.81 D, SD = 1.6 D
3. Horizontal White-to-White (Corneal diameter): mean = 11.7 mm, SD = 0.46 mm
4. Preoperative Refraction: mean = plano
5. Anterior Chamber Depth (ultrasonic): mean = 3.1 mm, SD = 0.30 mm
6. Crystalline Lens Thickness (ultrasonic): mean = 4.7 mm, SD = 0.41 mm
7. Age: mean = 72, SD = 12 years

II. Axial length Measurements in Aphakic and Pseudophakic eyes

A. Aphakia - 1532 M/sec

B. Pseudophakia

1. PMMA - 2718 M/sec
2. Silicone - 980 M/sec
3. Acrylic- 2120 M/sec

III. Determination of corneal power following Keratorefractive Sx (PRK, LASIK, RK)

- A. Manual Keratometry
- B. Automated Keratometry
- C. Corneal Topography
- D. Calculation from pre- keratorefractive surgery K's
- E. Determination from hard contact lens trial

IV. Data Screening Techniques on Preoperative Measurements

- A. Probability of unusual measurements (one eye only)
- B. Probability of asymmetrical measurements (both eyes)

V. IOL Calculations requiring Axial Length Measurements

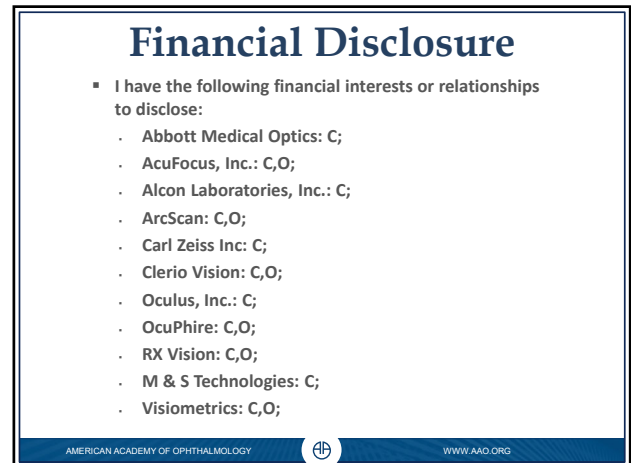
A. Standard Cataract Removal with IOL

1. Piggy-Back IOL's: Use 34 D IOL posterior in bag
2. Multifocal IOL's: Target distance plano, near for -3.00 D.
3. Toric IOL's: IOL Cylinder to Corneal Cylinder ~ 1.46, but not exact for low (1.75) and high (1.20) power IOLs
 - a. Optimization of Cataract Incision Location: Normal 4 locations for zero residual astigmatism
 - b. Back calculation for surprise: 1) P.O. Refraction &, 2) P.O. Ks OR Current IOL axis

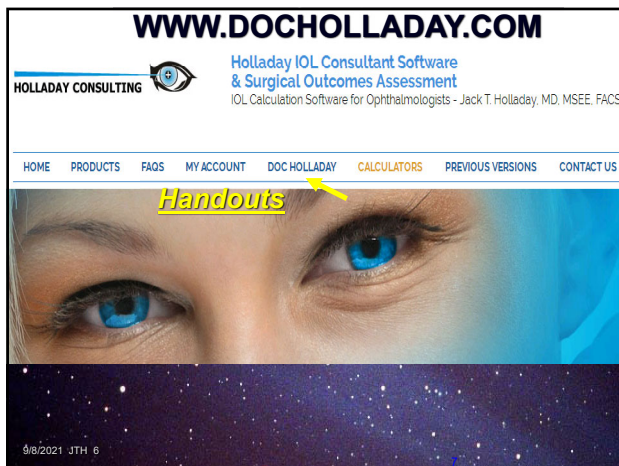
- B. Cataract Removal with IOL and Silicone in Vitreous: use convexplano ~ 3 D more, for biconvex ~ from 5 - 6 D more in IOL.
- VI. IOL Calculations not requiring Axial Length
 - A. Secondary Implant for Aphakia: in sulcus or anterior chamber angle
 - B. AC IOL in phakic patient: High myopia (- IOL) & High hyperopia (+ IOL)
 - C. Secondary Piggy-Back IOL for high hyperopia (or myopia within 1 year)
- VII. Pediatric IOL calculations
 - A. Ideal Postoperative Target Refraction: plano to -1.00 D.
 - B. Expected Myopic Shift with age: 4 D from age 2 to age 21.
- VIII. Minimizing Prediction Error
 - A. Personalizing Formula Constants (A-const, ACD or Surgeon Factor)
 - B. Prediction Error vs. IOL Power
 - C. Creating personalized constants for subgroups
 - 1. Axial Length (< 22 mm or > 26 mm)
 - 2. Keratometry (< 40 D or > 48 D)
 - 3. Preoperative Refraction (< -4 D or > +4 D)
- IX. Calculating SIRC (Surgically induced refractive change)
 - A. From pre and post operative keratometry
 - B. From pre and post operative refraction
- X. Outcomes Analysis
 - A. Prediction Error Analysis: Mean absolute prediction error should be < 0.50 D.
 - B. Formula Comparisons: more predictors, better results in unusual eyes
 - C. SIRC Results: Astigmatic Analysis
 - D. Visual Acuity Results
 - 1. Best corrected
 - 2. Uncorrected
- XI. Back-calculations
 - A. For determining source of error with refractive surprise
 - B. Comparison of back-calculated lens constant and actual lens constant



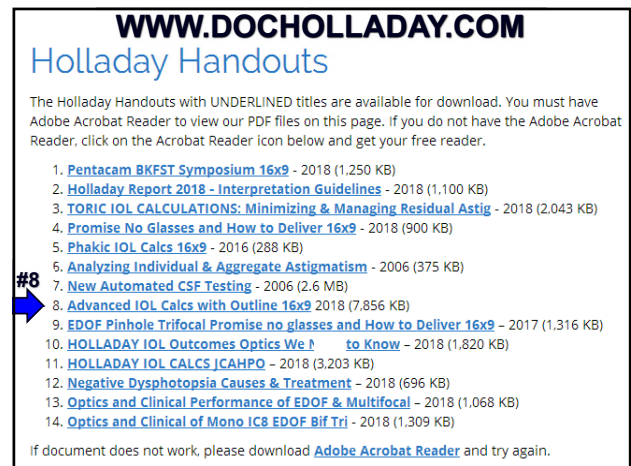
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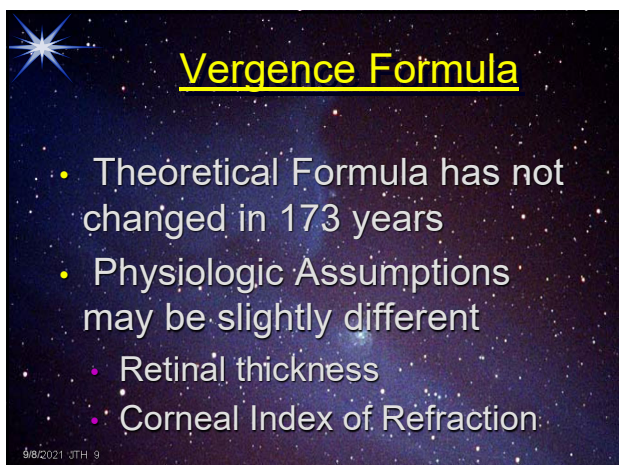
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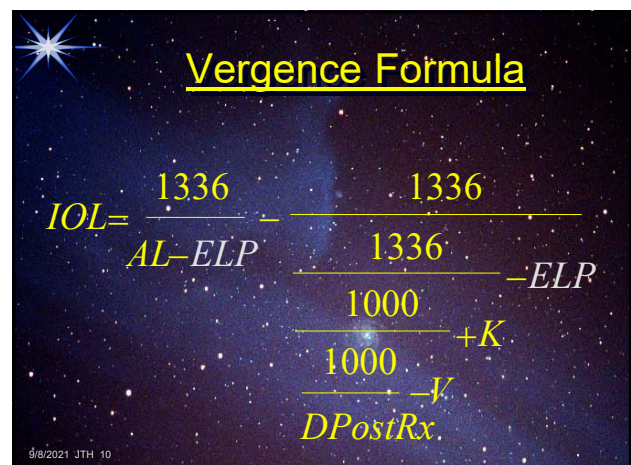
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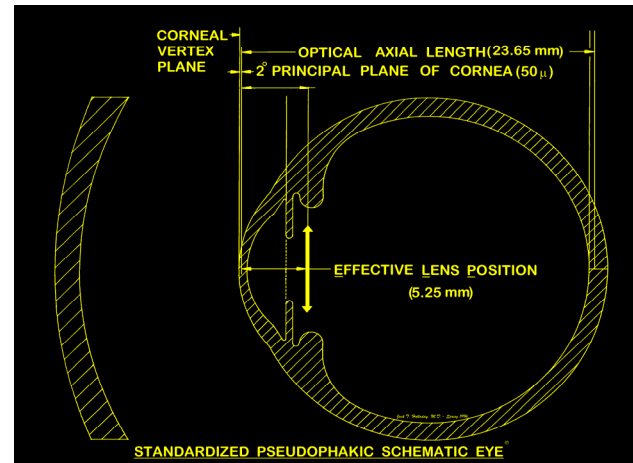
ELP

Effective Lens Position

- Distance from corneal vertex to principal plane of thin IOL (no thickness)
- Same as ACD, but avoids confusion with anatomy

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Prediction of ELP

- <1980 Constant (0) 4.5
- 1981 Binkhorst 2 (1) AL
- 1988 Holladay 1 (2) AL, K
- 1995 Olsen (4) AL, K, ACD, LT

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Prediction of ELP

- 1996 Holladay2 (7) AL, K, ACD, LT, HWTW, REF, AGE
- 2012 Olsen II (5) AL, K, ACD, LT, C constant
- 2015 Barrett-Universal II (7) AL, K, ACD, LT, HWTW, REF, Lens Factor

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Measurements taken for Predictors of ELP

- Axial Length
- Average K
- Horizontal WTW
- ACD
- LT
- Pre-op Refraction
- Age

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HWTW Gauge

Horizontal Corneal Diameter

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IOL MASTER 500 – ZEISS Version 7.70

R: 8.04 mm	SE: 41.96 dpt	R: 8.00 mm	SE: 42.18 dpt
ΔD: -1.77 dpt @ 0°		ΔD: -1.86 dpt @ 176°	
R: 8.04 mm	SE: 41.97 dpt	R: 8.00 mm	SE: 42.18 dpt
ΔD: -1.75 dpt @ 0°		ΔD: -1.86 dpt @ 176°	
R: 8.04 mm	SE: 41.97 dpt	R: 8.00 mm	SE: 42.17 dpt
ΔD: -1.73 dpt @ 0°		ΔD: -1.85 dpt @ 176°	
Central corneal thickness			
CCT: 528 μm (SD = 4 μm)		CCT: 523 μm (SD = 4 μm)	
531 μm	531 μm	523 μm	522 μm
528 μm	525 μm	529 μm	525 μm
White-to-white values			
WTW: 12.2 mm	Ix: +0.6 mm	Iy: +0.3 mm	WTW: 12.4 mm
P: 3.2 mm	Px: +0.5 mm	Py: +0.1 mm	P: 3.1 mm
Ix: -0.6 mm	Iy: +0.3 mm	Px: -0.4 mm	Py: +0.2 mm
Reference Image			
Image stored		Image stored	

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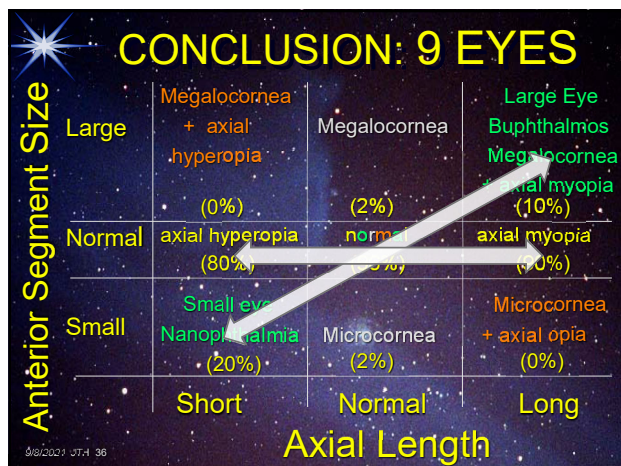
LENSTAR – HAAG-STREIT

White to White	WTW	11.78 mm	±0.083 mm	11.58 mm	±0.054 mm
Iris barycenter	ICX	-0.43 mm	±0.147 mm	0.21 mm	±0.109 mm
	ICY	-0.19 mm	±0.155 mm	-0.22 mm	±0.058 mm
Pupil diameter	PD	3.70 mm	±0.208 mm	3.84 mm	±0.193 mm
Pupil barycenter	PCX	-0.31 mm	±0.032 mm	0.20 mm	±0.029 mm
	PCY	-0.25 mm	±0.039 mm	-0.21 mm	±0.021 mm

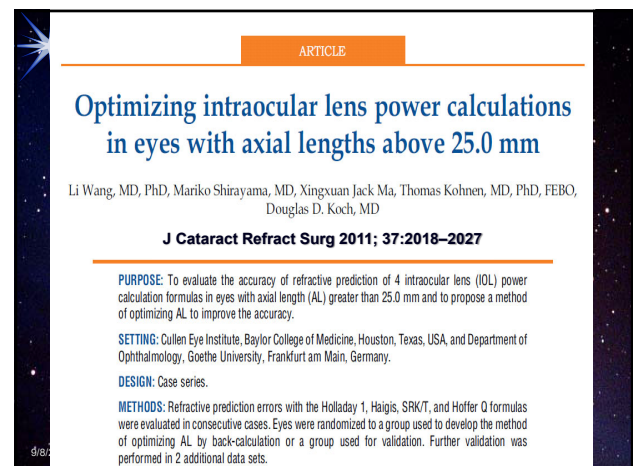
* Value user-defined
 ** System constant
 *** Significant difference between OD and OS
 Δ see detail printout
 □ Analysis

EyeSuite™ Biometry, V2.1.1
 LS 900, SN 2470, V 2.1.0

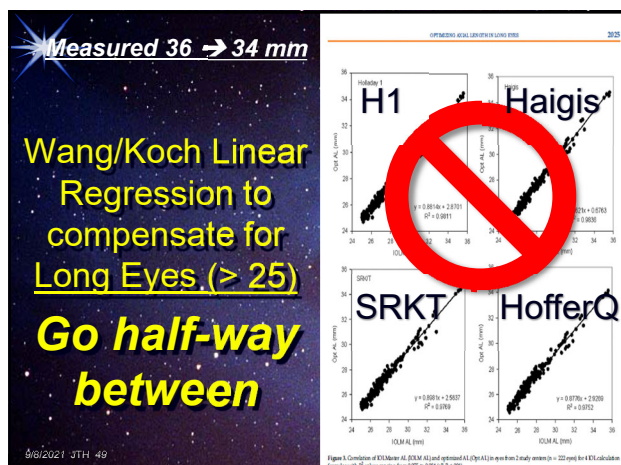
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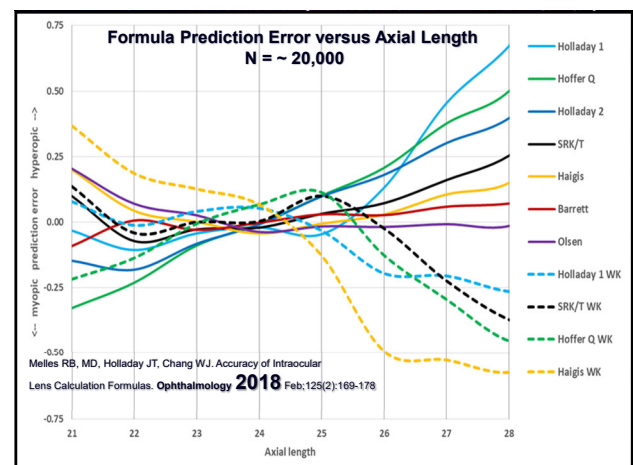
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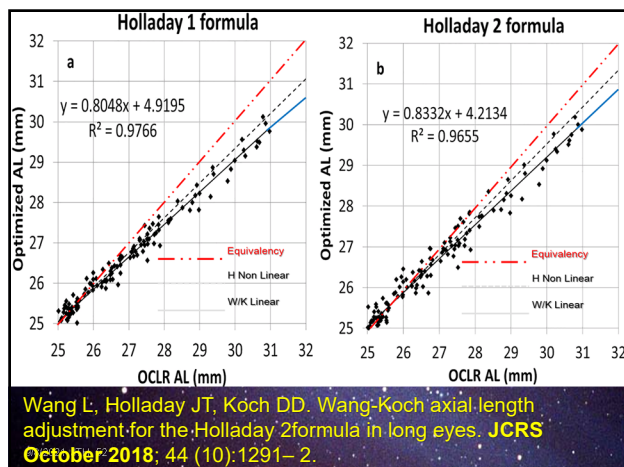
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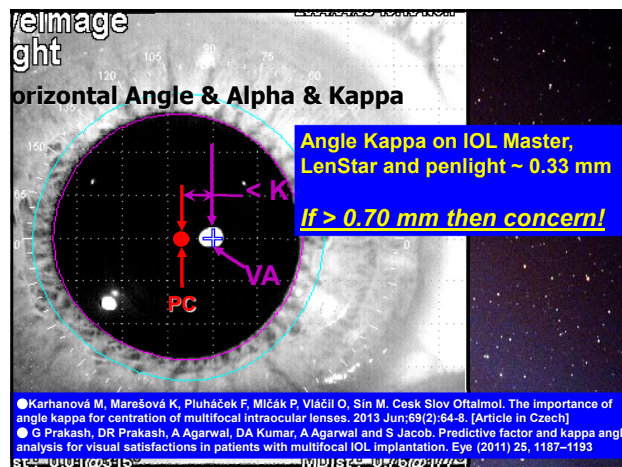
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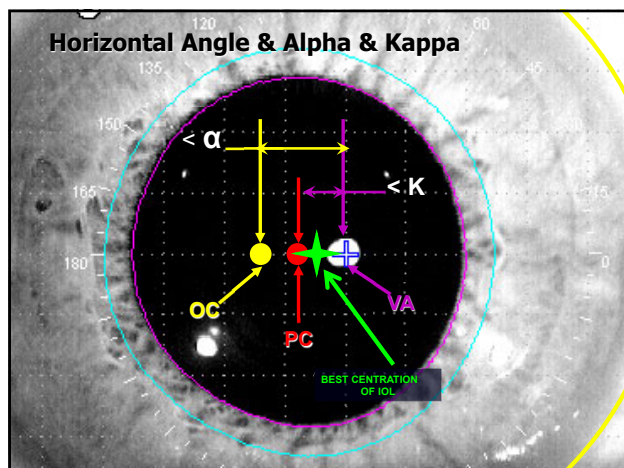
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LENSTAR – HAAG-STREIT					
White to White	WTW	11.78 mm	±0.083 mm	11.58 mm	±0.054 mm
Iris barycenter	ICX	-0.43 mm	±0.147 mm	0.21 mm	±0.109 mm
	ICY	-0.19 mm	±0.155 mm	-0.22 mm	±0.058 mm
Pupil diameter	PD	3.70 mm	±0.208 mm	3.94 mm	±0.193 mm
Pupil barycenter	PCX	-0.31 mm	±0.032 mm	0.20 mm	±0.029 mm
	PCY	-0.25 mm	±0.039 mm	-0.21 mm	±0.021 mm

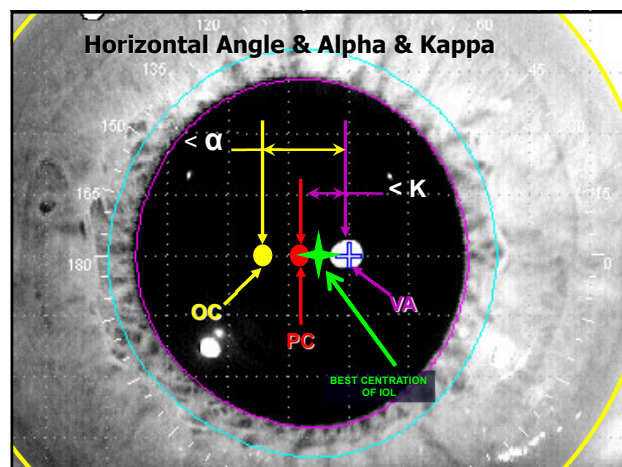
* Value user-defined
 ** System constant
 ⚠ Significant difference between OD and OS
 ⓘ see detail printout
 ⓘ Analysis

LENSTAR EyeSuite™ Biometry, V2.1.1 LS 900, SN 2470, V 2.1.0 HAAG-STREIT DIAGNOSTICS

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IOL MASTER 700 – ZEISS Version ≥ 1.1					
R: 8.04 mm	SE: 41.96 dpt	R: 8.00 mm	SE: 42.18 dpt		
Δ D: -1.77 dpt @ 0°		Δ D: -1.86 dpt @ 176°			
R: 8.04 mm	SE: 41.97 dpt	R: 8.00 mm	SE: 42.18 dpt		
Δ D: -1.75 dpt @ 0°		Δ D: -1.86 dpt @ 176°			
R: 8.04 mm	SE: 41.97 dpt	R: 8.00 mm	SE: 42.17 dpt		
Δ D: -1.73 dpt @ 0°		Δ D: -1.85 dpt @ 176°			
Central corneal thickness					
CCT: 528 μm	(SD = 4 μm)	CCT: 523 μm	(SD = 4 μm)		
531 μm	531 μm	523 μm	523 μm	520 μm	
528 μm	525 μm	529 μm	525 μm	522 μm	
White-to-white values					
WTW: 12.2 mm	Ix: +0.6 mm	Iy: +0.3 mm	WTW: 12.4 mm	Ix: -0.6 mm	Iy: +0.3 mm
P: 3.2 mm	Px: +0.5 mm	Py: +0.1 mm	P: 3.1 mm	Px: -0.4 mm	Py: +0.2 mm
Reference Image					
Image stored			Image stored		

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Data Screening Identifies Measurement Error - Repeat

- Binocular
 - AL difference > 0.3 mm
 - K difference > 1.0 D
 - IOL power difference > 1.0 D
- Monocular
 - AL Signal/Noise (S/N) Ratio < 2.0
 - K Std Dev (σ) > 0.20 D (0.030 mm) or 30 μ

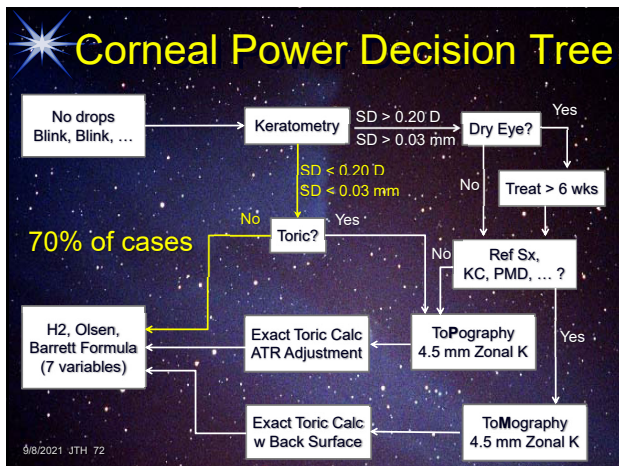
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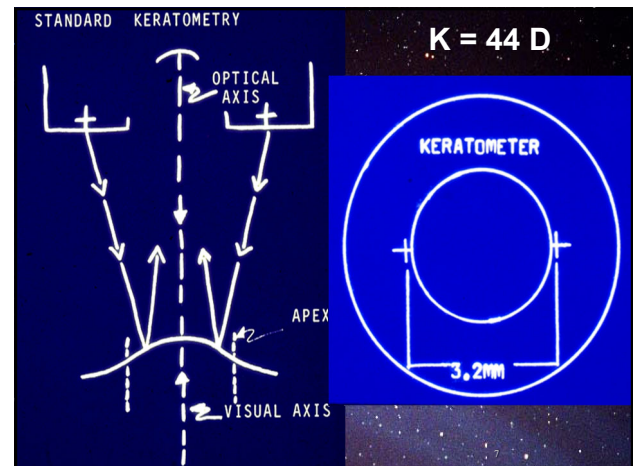
Cataract Surgery ... IOL Power Calculations Following Refractive Surgery

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IOL Master 2.5 mm LenStar 1.7 & 2.3 mm

K = 44 D

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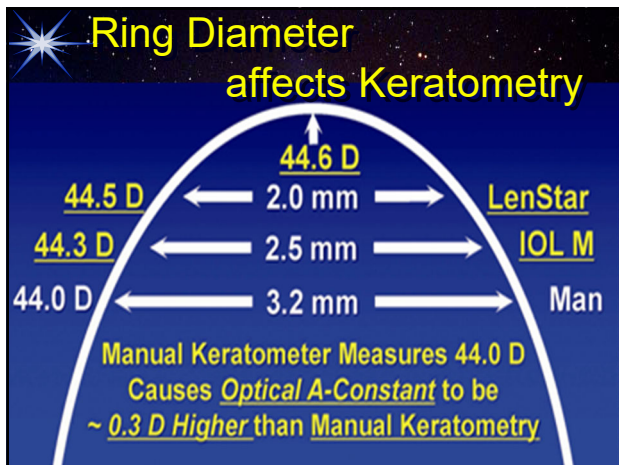
Astigmatism Measurement for a 44 D Cornea

- Manual Keratometer
 - 3.2 mm Diameter
- IOL Master* Keratometer
 - 2.5 mm Diameter
- LenStar* Keratometer
 - 2.35 & 1.65 mm Diameters
(Average 2.0 mm Diameter)

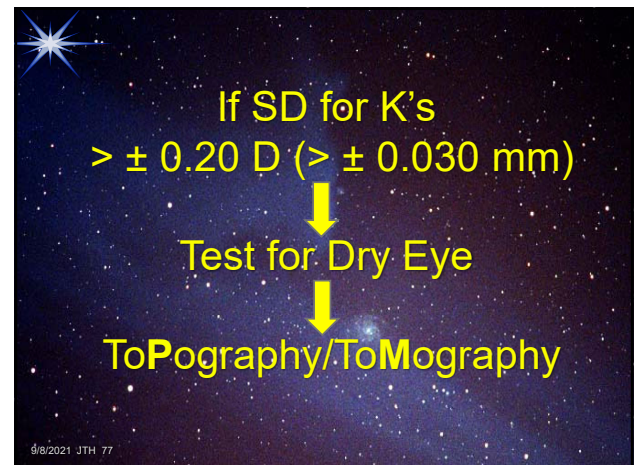
* Carl Zeiss Meditec AG, Goeschwitzer Str. 51-52, 07745 Jena, Deutschland
† Haag-Streit AG, Gartenstadtstrasse 10, 3098 Koeniz, Switzerland

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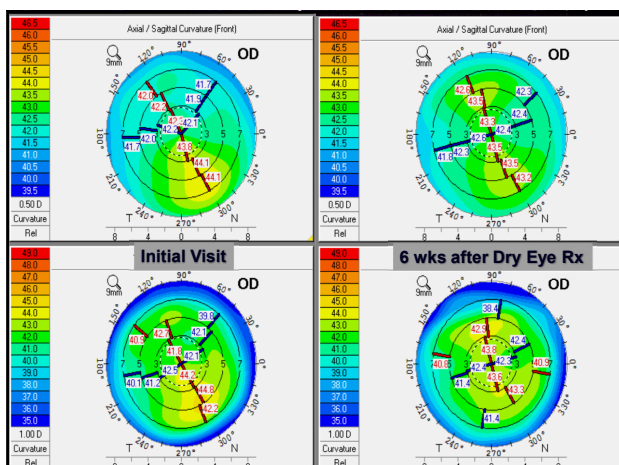
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Keratometer values							
MV: 40.54/42.35 D				MV: 40.69/42.56 D			
SD: 0.00 mm				SD: 0.00 mm			
K1: 40.54 D x 179°	8.19 mm			K1: 40.64 D x 178°	8.17 mm		
K2: 42.35 D x 89°	7.84 mm			K2: 42.56 D x 88°	7.80 mm		
ΔK: -1.81 D x 179°				ΔK: -1.92 D x 178°			
K1: 40.54 D x 179°	8.19 mm			K1: 40.69 D x 177°	8.16 mm		
K2: 42.29 D x 89°	7.85 mm			K2: 42.51 D x 87°	7.81 mm		
ΔK: -1.75 D x 179°				ΔK: -1.82 D x 177°			
K1: 40.54 D x 178°	8.19 mm			K1: 40.69 D x 177°	8.16 mm		
K2: 42.35 D x 88°	7.84 mm			K2: 42.56 D x 87°	7.80 mm		
ΔK: -1.81 D x 178°				ΔK: -1.87 D x 177°			
Anterior chamber depth values							
ACD: 3.13 mm				ACD: 3.24 mm			
3.13 mm	3.13 mm	3.13 mm	3.13 mm	3.24 mm	3.24 mm	3.24 mm	3.24 mm
White-to-white values							
WTW: 12.3 mm				WTW: 12.3 mm			
Pup: 3.6 mm				Pup: 3.9 mm			
Ixz: +0.6mm Iyz: +0.4mm				Ixz: -0.8mm Iyz: +0.4mm			
Pxz: +0.4mm Pyz: +0.2mm				Pxz: -0.5mm Pyz: +0.1mm			

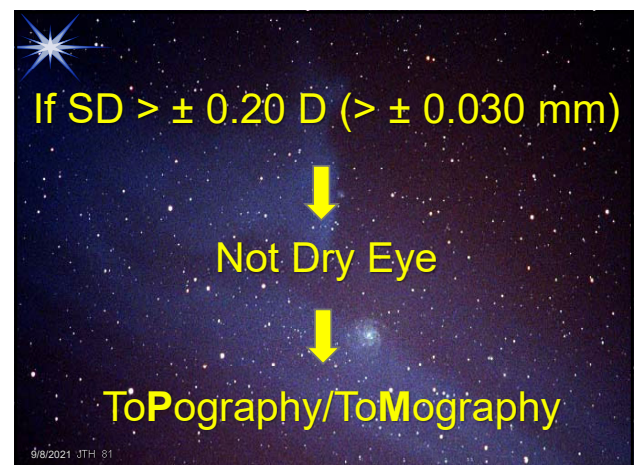
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OD right	Analysis	
	Measured values	Keratometry values
AL: 22.30 mm	(SD = 4 μm)	n: 1.3375
ACD: 2.99 mm	(SD = 5 μm)	R: 7.76 mm
LT: 3.96 mm	(SD = 23 μm)	R1: 7.83 mm @ 156°
		R2: 7.69 mm @ 66°
		Δ D: -0.75 dpt @ 156°
Central corneal thickness		White-to-white values
CCT: 542 μm	(SD = 3 μm)	WTW: 11.9 mm
		P: 4.7 mm

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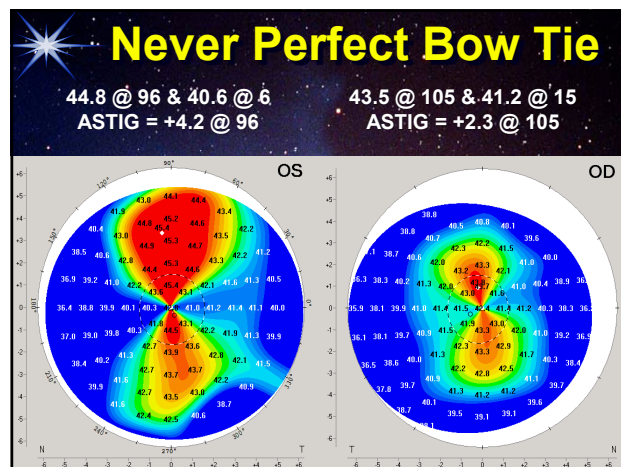
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Corneal Power after LASIK, PRK, RK

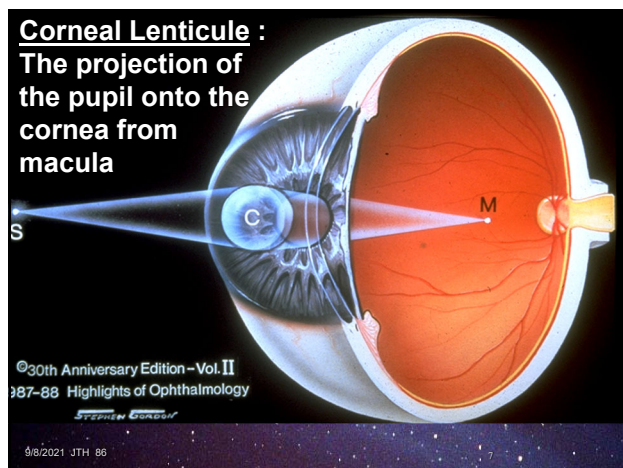
- 1 Ideally, Calculation from both surfaces ...
- 2 Calculation from Prior Data Trial
- 3 Hard Contact Lens
- 4 Corneal Topography
- 5 Automated Keratometry
- 6 Manual Keratometry

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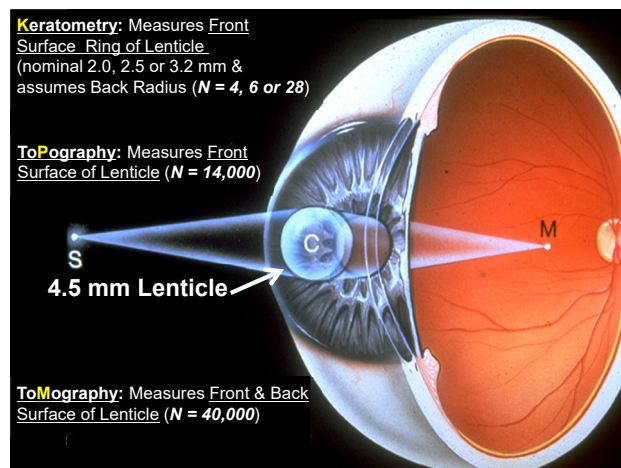
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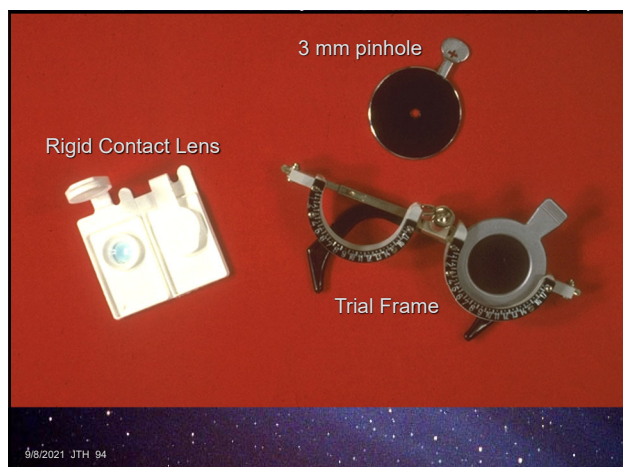
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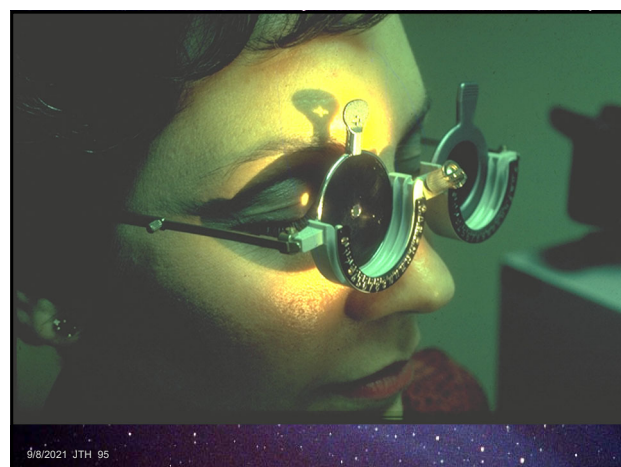
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1. Calculation from Prior Data (Pre K & Δ MR known)

Pre KR Mean K = 44.00 D

Change in SEQ Ref = -4.50 D

Calc Mean K = 39.50 D

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4. Trial Hard Contact Lens (Rigid Contact lens only)

Piano HCL Base Curve = 41.50 D

SEQ Ref without CL = +0.50 D

SEQ Ref with CL = -1.00 D

Front K = 41.50 - 1.50 = 40.00 D

40.00 D - 10% (4.50) = 39.50 D

Mean K = 39.50 D

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5. Multiple K-readings

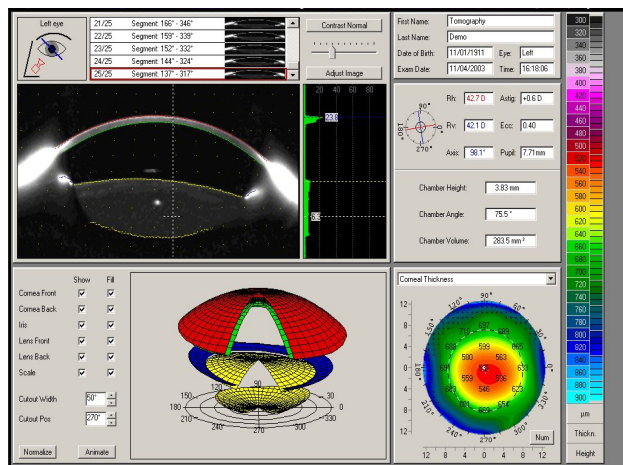
- Right Eye
 - Topcon: 35.13 @ 90° 37.02 @ 180° -1.89D ax90°
 - Galilei: 34.16 @ 94 36.80 @ 4 2.64 D @ 4**
 - JAVAL: 35@80° 37@180° // IRREGULAR
- Left Eye
 - Topcon: 35.06 @ 50° 37.11 @ 140° -2.05D ax50
 - Galilei: 34.99 @ 50 37.44 @ 140 2.46 @ 140**
 - JAVAL: 35:25@45° 38@155° // IRREGULAR

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Accuracy of EKR

Prior	STD 4.5
Sx	(D)
LASIK	0.56
RK	0.94

Holladay JT, Hill WE, Steinmueller A. Corneal Power Measurements Using Scheimpflug Imaging in Eyes With Prior Corneal Refractive Surgery. J Refractive Surgery 2009;25:862-868. (October 2009 Issue of J Refr Surgery)

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ARTICLE

New algorithm for intraocular lens power calculations after myopic laser in situ keratomileusis based on rotating Scheimpflug camera data

Richard Potvin, OD, Warren Hill, MD

J Cataract Refract Surg Feb 2015; 41:339-347

PURPOSE: To develop an algorithm to calculate intraocular lens (IOL) power for eyes with previous laser in situ keratomileusis (LASIK) for myopia based on data from a rotating Scheimpflug camera and to compare calculations with those of current formulas.

SETTING: East Valley Ophthalmology, Mesa, Arizona, USA.

DESIGN: Observational case series.

METHODS: Relevant IOL calculation and postoperative refractive data were obtained for eyes of patients who had previous myopic LASIK and subsequent cataract surgery. Initial screening and correlation analysis identified Pentacam Scheimpflug keratometry (K) values appropriate for use in calculating a "best K" for IOL power calculations in these eyes. Error analysis identified other eye measures to improve results. Final results were compared with results from 9 other calculation methods available on the American Society of Cataract and Refractive Surgery (ASCRS) web site.

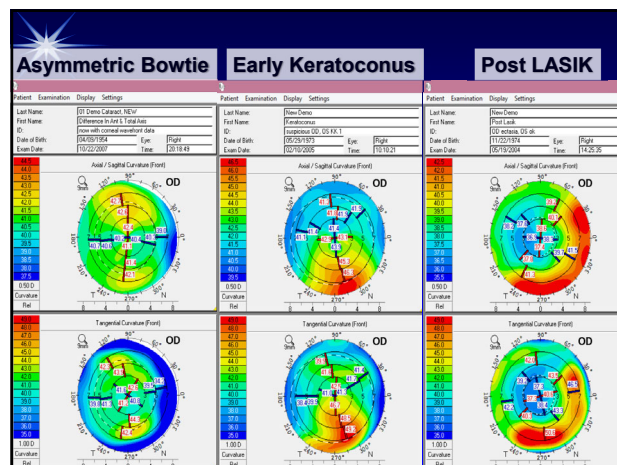
RESULTS: The study obtained data from 101 eyes of 77 patients. More than 200 Scheimpflug K-formula combinations were evaluated for each eye. The true net power in the 4.0 mm zone centered on the corneal apex provided the best adjusted K reading for IOL power calculation in the Shammas no-history formula. The final formula had good outcomes, with 34%, 66%, and 91% of eyes being within ± 0.25 diopter (D), ± 0.50 D, and ± 1.00 D of the refractive target, respectively. These results compare favorably to the best formulas on the ASCRS web site.

CONCLUSIONS: The no-history formula derived using the Scheimpflug device's true net power in the 4.0 mm zone centered on the corneal apex appears to be an accurate method for determining IOL power after LASIK for myopia. Combination with additional data sets is suggested.

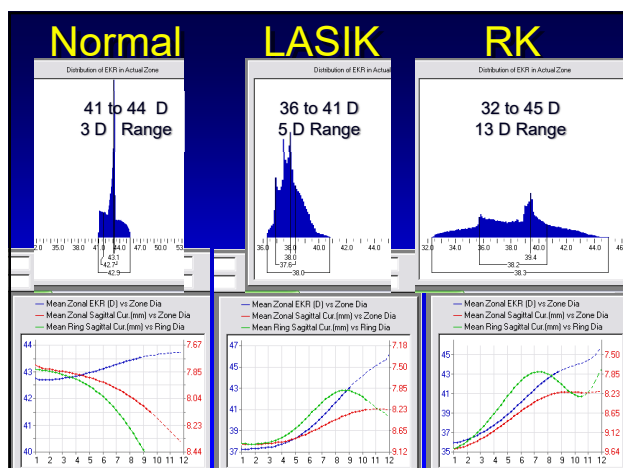
Financial Disclosure: Neither author has a financial or proprietary interest in any material or method mentioned.

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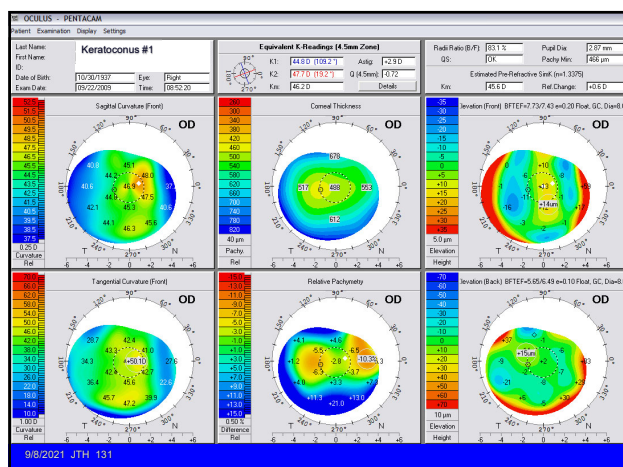
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IOL CALCS in Keratoconus

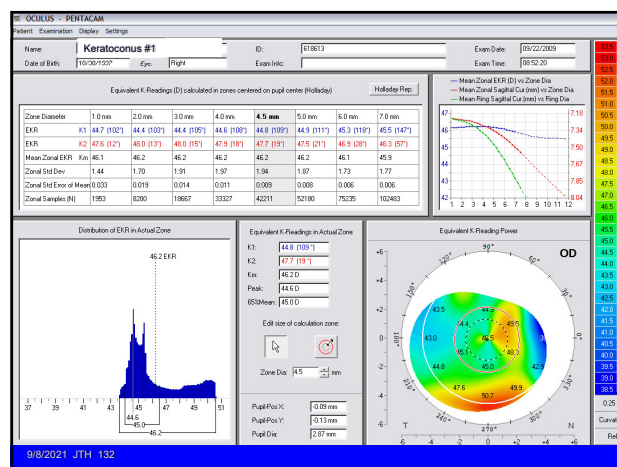
- Corneal is Bifocal
- Patient does not look through cone for distance (may use at 10 cm as magnifier)
- Look at Power Distribution
- Use Paracentral Power (65% Mean Power)

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Toric IOL's

- Calculate IOL power for steep and flat meridian using same ELP
- Difference in IOL powers is the toricity necessary to completely correct corneal astigmatism

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Ideal Toric IOL Calcs

- **Accurate corneal power and astigmatism** ... repeat if SD > 0.020 D (0.030 mm)
- **Exact Toric Calculator** (not a constant ratio of corneal astigmatism to toricity (1.46))
- **Proper Surgically Induced Astigmatism (SIA)** for incision location and magnitude and axis of PreOp astigmatism ... must account for **ATR over 3 to 6 months PostOp**
- Results will be **greater than 80% within 0.50 D**

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Toric IOL's

- Always choose toricity to undercorrect corneal astigmatism – **WRONG!**
- LEAVE MIN RESIDUAL CYL!
- Eg: **Steep** calc yields **24.0 D**
Flat calc yields **27.0 D**
- Ideal Toricity is 3.0 D
- (Use **24.0 D** with < 3.0 D of toricity)

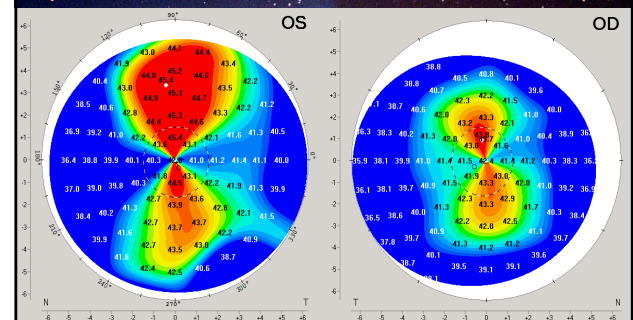
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Never Perfect Bow Tie

44.8 @ 96 & 40.6 @ 6
ASTIG = +4.2 @ 96

43.5 @ 105 & 41.2 @ 15
ASTIG = +2.3 @ 105



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Total Surgically Induced Astigmatism in Toric IOL Calculations

Jack T. Holladay, MD, MSEE, FACS
Clinical Professor of Ophthalmology
Baylor College of Medicine
Houston, Tx

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- 1 **Use Exact Vergence Calculator (not Constant)**
- 2 **Change from Keratometric SIA + Posterior Corneal Astig to Total SIA**

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TORIC IOL Calculators - 2 Types

- Constant** Ratio Calculator uses a constant ratio (1.46) for the corneal cylinder to the IOL cylinder
 - $K = 43 \times 45 = 2 \text{ D astig}$

IOL SEQ = 10D → **3.0 D** Ideal Toricity
 IOL SEQ = 22D → **3.0 D** Ideal Toricity
 IOL SEQ = 34D → **3.0 D** Ideal Toricity

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TORIC IOL Calculators - 2 Types

- Exact** Vergence Calculator depends on IOL SEQ Power and ELP
 - $K = 43 \times 45 = 2 \text{ D astig}$

IOL SEQ = 10D → **3.5 D** Ideal Toricity
 IOL SEQ = 22D → **3.0 D** Ideal Toricity
 IOL SEQ = 34D → **2.4 D** Ideal Toricity

A 1.1 D toricity difference between a 10 and 34 D IOL !

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Toric Calculators

Exact Verg Constant Ratio

- AMO Express On-line
- Holladay On-line
- Open Access (docholladay.com)
- Alcon On-line
- Barrett Calculator
- Holladay AAO
- B & L On-line

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ALCON ONLINE TORIC IOL CALCULATOR

Incorporating the Barrett Toric Calculator!

SURGEON NAME: Dr. Test PATIENT NAME: Test Patient PRODUCT SELECTION: IQ Toric SNGATx

FORMULA: ☒ Barrett ☐ Holladay ☒ TOTAL SIA FOR A SMALL (2.5mm) TEMPORAL CORNEAL INCISION

AXIAL LENGTH: 23.5 mm

K NOTATION: ☒ Diopter ☐ Millimeter

FLAT K: 39.9 D FLAT MERIDIAN: 0°

STEP K: 40.88 D STEP MERIDIAN: 90°

IOL SE POWER: 20.0 D

TOTAL SIA: 0.75 D INCISION LOCATION: 180°

FLATTENING MERIDIAN: 89° K INDEX: 1.3375

NOTES:

Calculate Print Clear Fields

Click here for legend

Select	Results	Anticipated Residual Refractive Astigmatism	Magnitude	Axis
☐	Non Toric	+1.97 D	90°	
☐	SNGAT3	+0.62 D	90°	
☒	SNGAT4	+0.14 D	90°	
☐	SNGAT5	+0.34 D	4.0°	
☒	Recommended lens			
☒	Flipped residual refractive astigmatism axis			

Secure ID: #9F4055731E292988B8052C9D4BE3481

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HOLLADAY CONSULTING International Holladay2 and Toric Calculator

Developed by JTH Systems, Ver 2.0.855A1(2/6/2019)

Surgeon: Test Surgeon Lens: Alcon SA60Tx

Lens ACut: 116.6 ACD: 5.92 mm SF: 1.56

Patient: Brian ToricMD ID: test

Age: 65.55

PreOp Data for Right (OD) eye

Eye: ☒ OD (Right) ☐ OS (Left)

Target RX: -0.25 D

SEQ IOL Calculation

Lens Model: Alcon SA60Tx

Lens: +21.50D SA60TS @180°

Ideal Toricity: 4.20D @IOL

Expected RX: +0.16-0.82 X90°

IOL: RX

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272 J Cataract Refract Surg March 2019; 45:272-283

ARTICLE

Improving toric intraocular lens calculations using total surgically induced astigmatism for a 2.5 mm temporal incision

Jack T. Holladay, MD, MSEE, George Pettit, MD, PhD

Purpose: To determine in cataract surgery the total surgically induced astigmatism (SIA) that accounts for all factors that contribute to the difference between preoperative keratometric and postoperative refractive astigmatism other than any toricity of an intraocular lens (IOL).

Setting: Twenty surgical sites in the United States.

Results: The total SIA vector was a significant contributor to surgically associated astigmatic changes in eyes receiving nontoric IOLs. The total SIA vector was dependent on the preoperative astigmatism, as well as a consistent toricity, although a distribution of

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Total SIA - 2019

IF

Before Sx **Ks: + 0.50 WTR**After Sx **Ref: + 0.50 ATR**

What is Total SIA?

1 D ATR

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Total SIA - 2019

$$K_{pre} + \text{Total SIA} = \text{REF Astig}_{post}$$

$$\text{Total SIA} = \text{REF Astig}_{post} - K_{pre}$$

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Total SIA - 2019**Cornea**

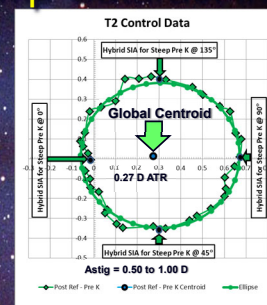
- ① Systematic difference in measured keratometric versus actual corneal refractive astigmatism
- ② Δ Anterior Corneal Astig
- ③ Posterior Corneal Astig (PCA)
- ④ Δ PCA

IOL

- ⑤ Systematic IOL Tilt (~ 0.06 D ATR)
- ⑥ Systematic IOL Decentration (ATR)

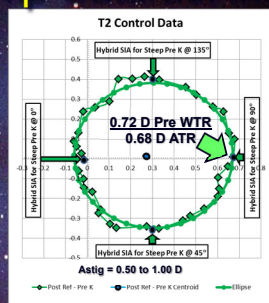
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2.5 mm Temp Cataract Incision**Total SIA**

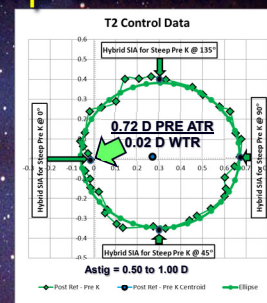
9/8/2021 JTH 197

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2.5 mm Temp Cataract Incision**Total SIA**

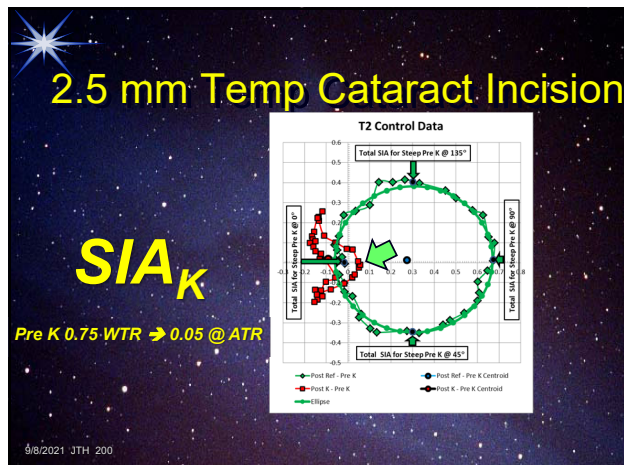
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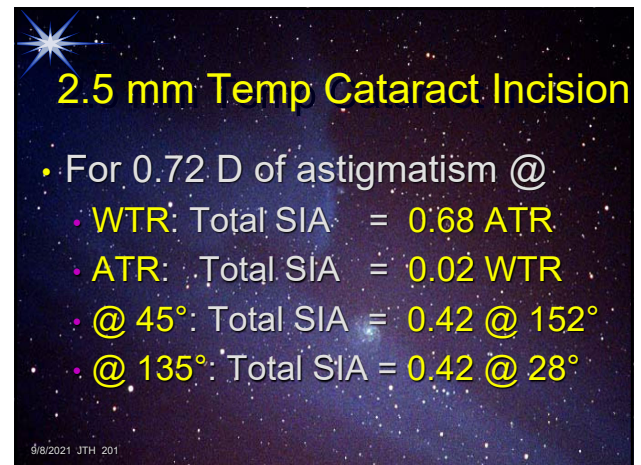
2.5 mm Temp Cataract Incision**Total SIA**

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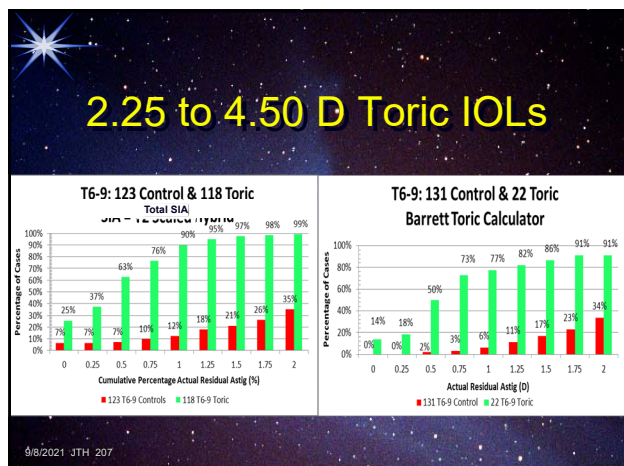
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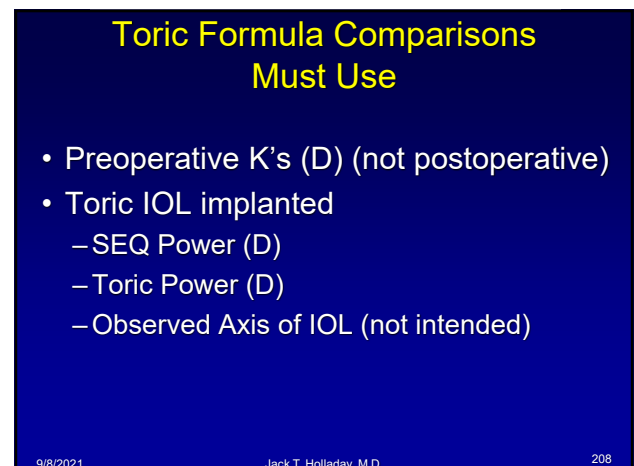
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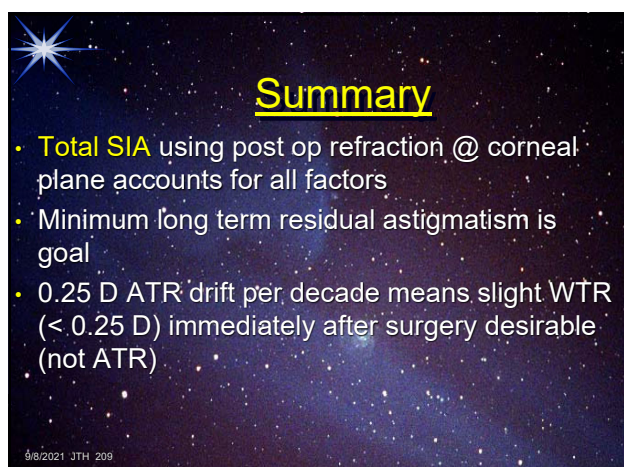
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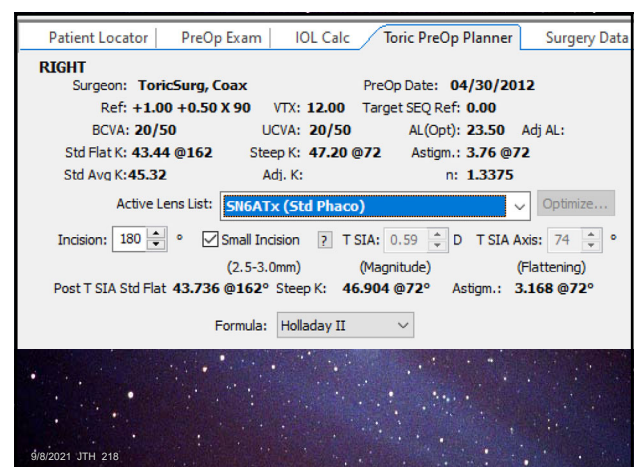
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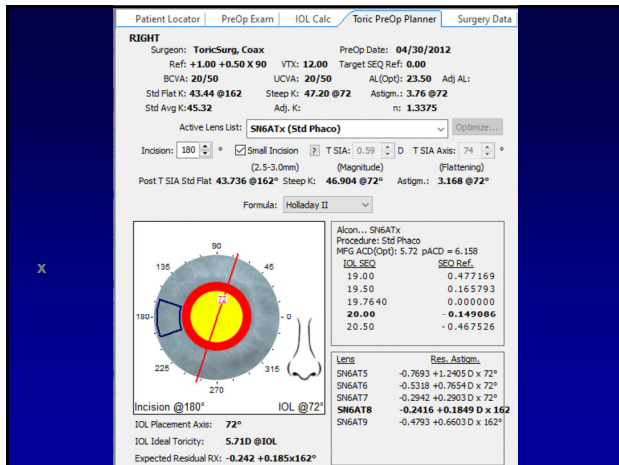
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Post Op Toric Calculators

- Holladay IOL Consultant
 - www.hicsoap.com (exact)
- Berdahl & Hardten Toric IOL Calculator
 - www.astigmatismfix.com (approximate)

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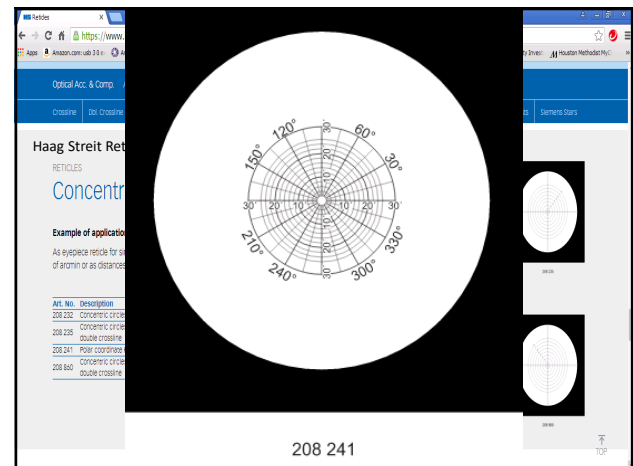
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Two Sources of Error

- IOL misaligned (wrong axis)
- IOL Toricity wrong (over/under)
 - Or
- Both
 - Measuring Current Axis**

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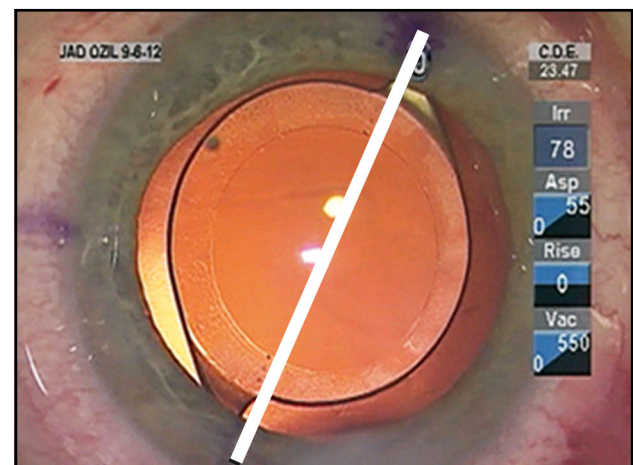
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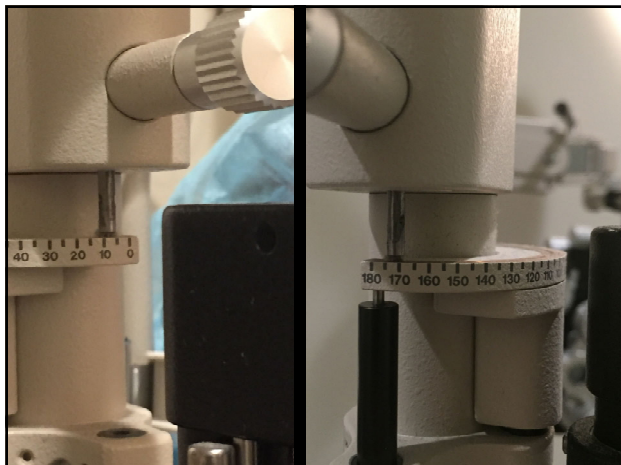
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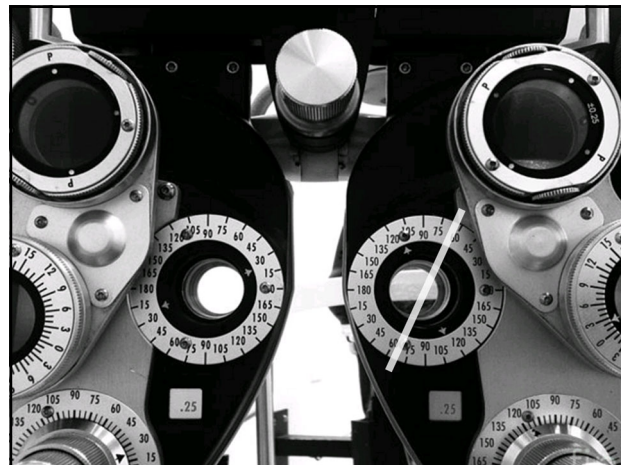
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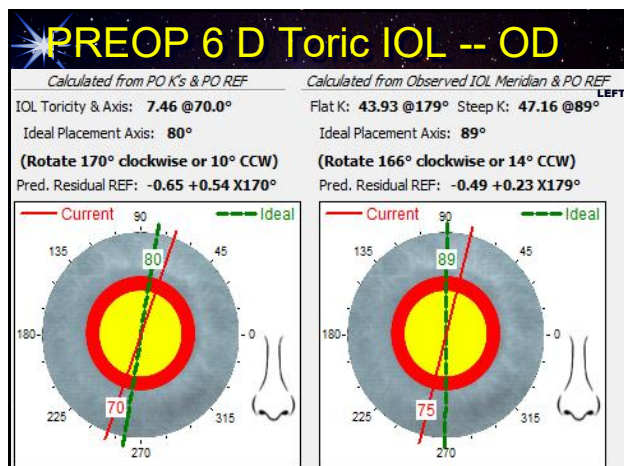
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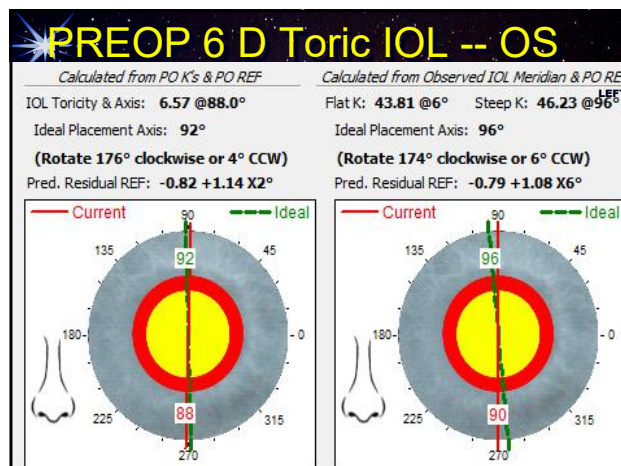
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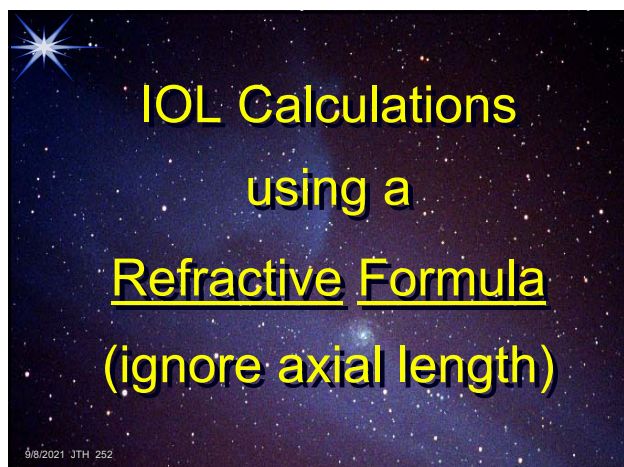
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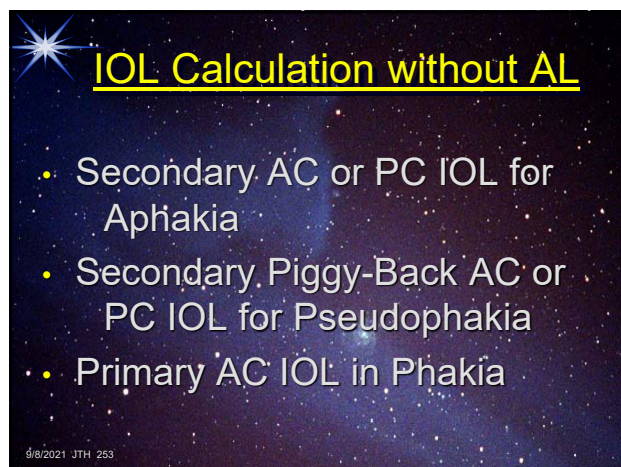
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REFRACTION FORMULA

$$IOL = \frac{\frac{1336}{\frac{1000}{PreRx} - V} + K - ELP}{\frac{1336}{\frac{1000}{DPostRx} - V} + K - ELP}$$

Holladay JT. Refractive power calculations for intraocular lenses in the phakic eye.
Am J Ophthalmol. 1993; 116: 63-6.

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Refractive Surprises

- ❶ Previous RK, PRK, LASIK
- ❷ Bad axial length - short/long
- ❸ Mislabeled IOL
- ❹ Axially displaced
- ❺ Misc.

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Secondary Piggy-Back Calc Advantages over Exchange

- ❶ Mislabeled IOL irrelevant
- ❷ Less risk to capsule or zonules
- ❸ Mismeasured AL irrelevant
- ❹ No AP shift of existing IOL
- ❺ Fewer unknown variables

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