Ophthalmology Times
Research Scholar
Honoree Program

Fixation distance formula for scleral fixated intraocular lenses

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November 5, 2020

MJH life sciences™

FINANCIAL DISCLOSURES:

No Financial Disclosure

Mentors

- Gary W. Abrams, MD
- Xihui Lin, MD

MY ROLE IN THIS RESEARCH:

✓ Conception

✓ Design and implementation of project:

✓ Acquisition of data:

✓ Analysis and interpretation of data:

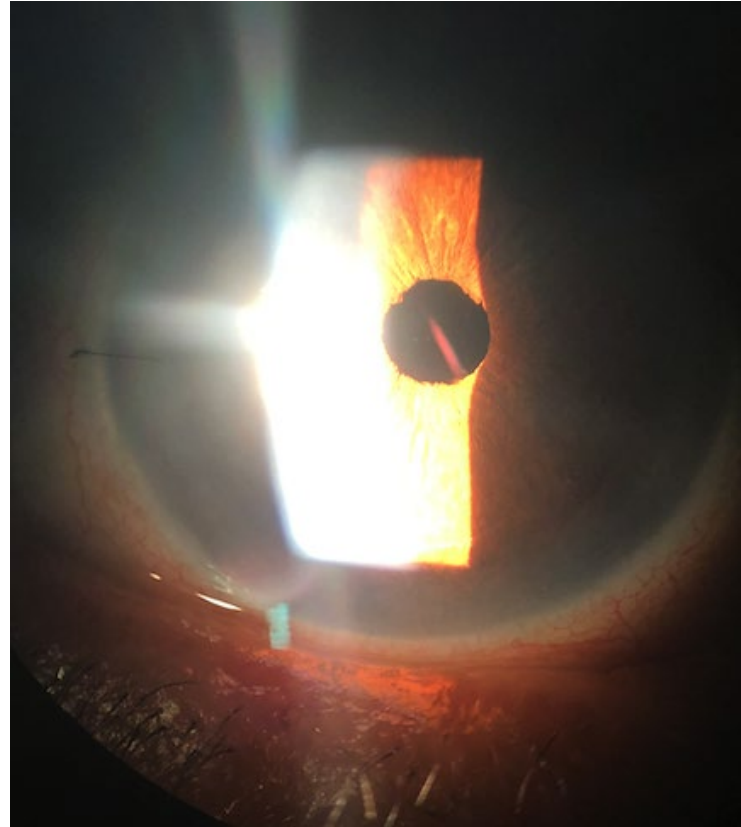✓ Creation and/or critical review of the presentation:

Overview

- Background

- Formula Creation

- Application in the clinical setting.

- Results and Conclusion.

Background (source of idea)

- 79 y.o. female
  - Cataract surgery complicated with PCR.
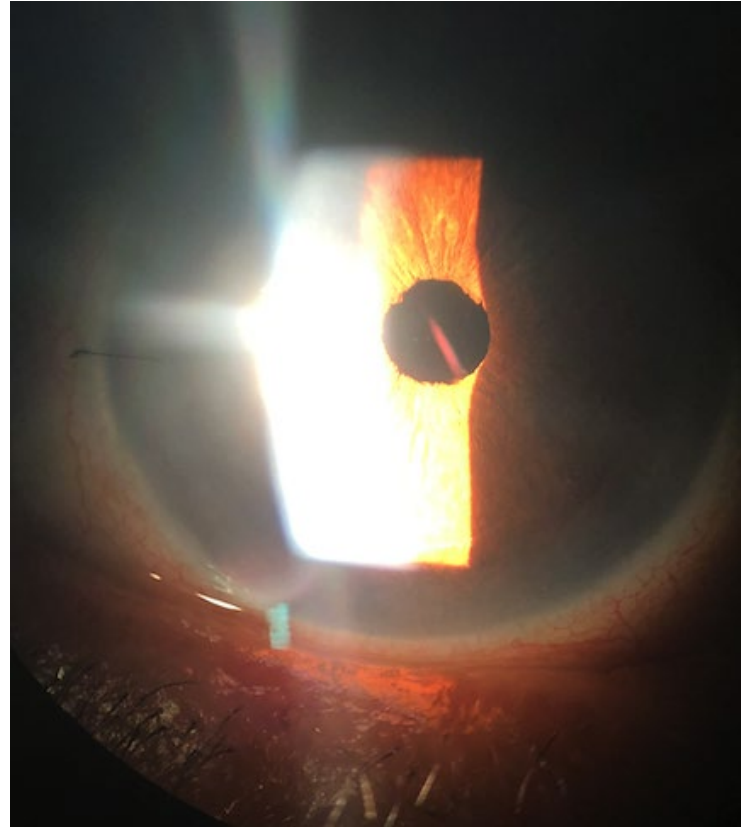 - Sulcus IOL placed.
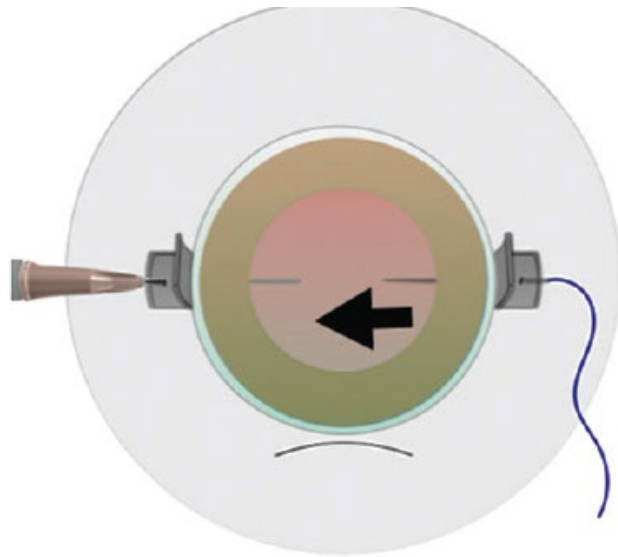
POW1

- Pt seeing double

POW1

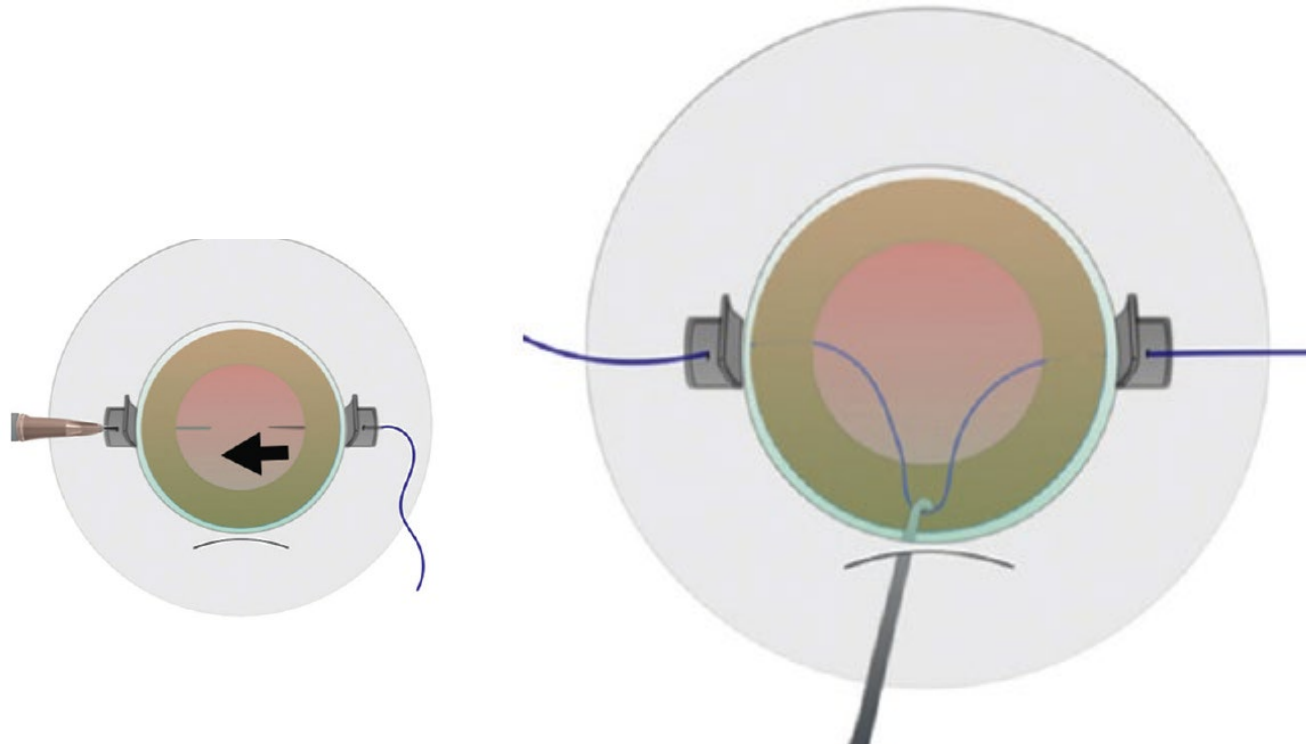- Pt seeing double
- Next Step,
  - Rescuing Scleral Fixated IOL

Dislocated IOL Management
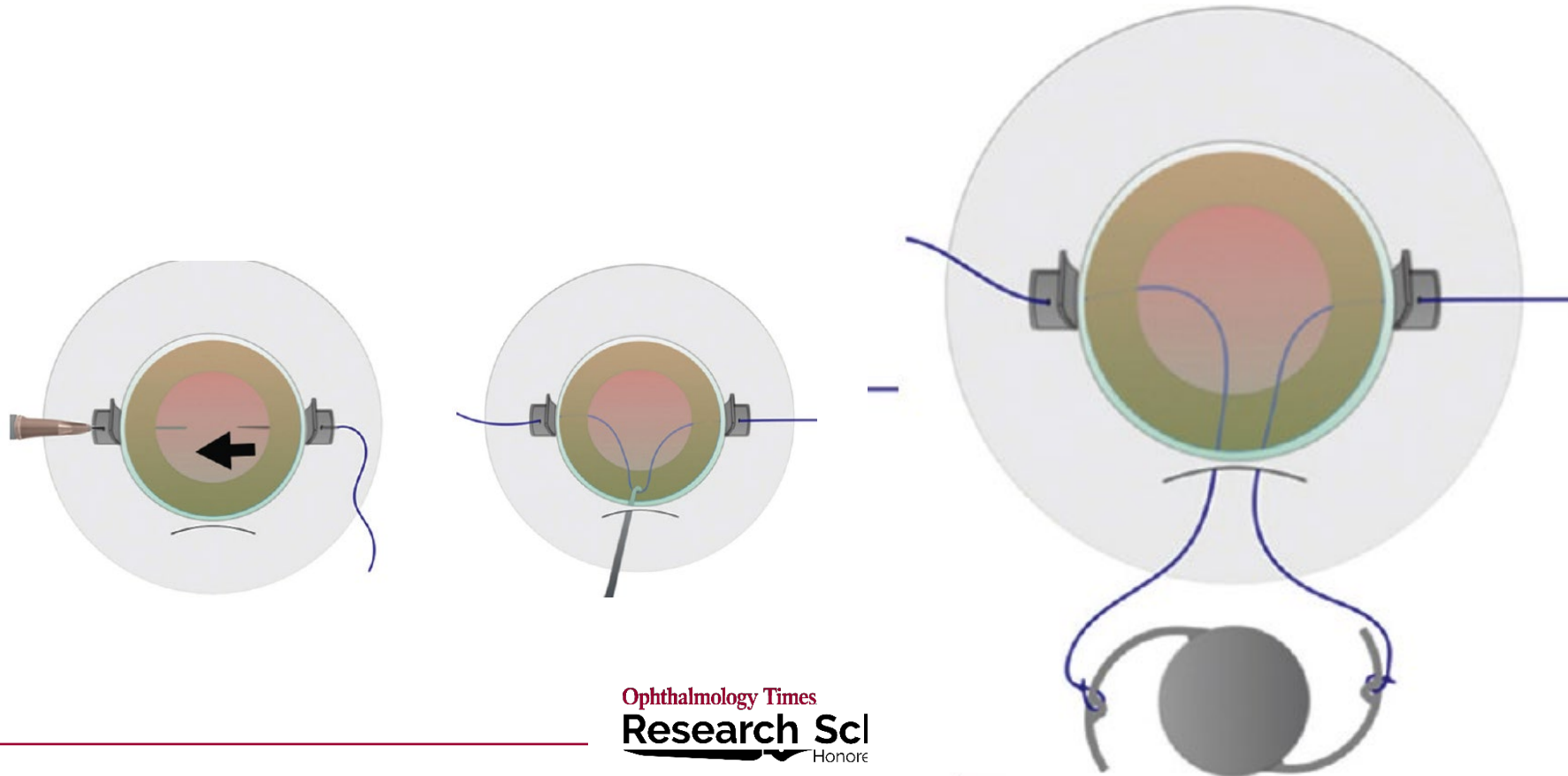
Scleral-fixated IOL.

Dislocated IOL Management

Scleral-fixated IOL.

Dislocated IOL Management
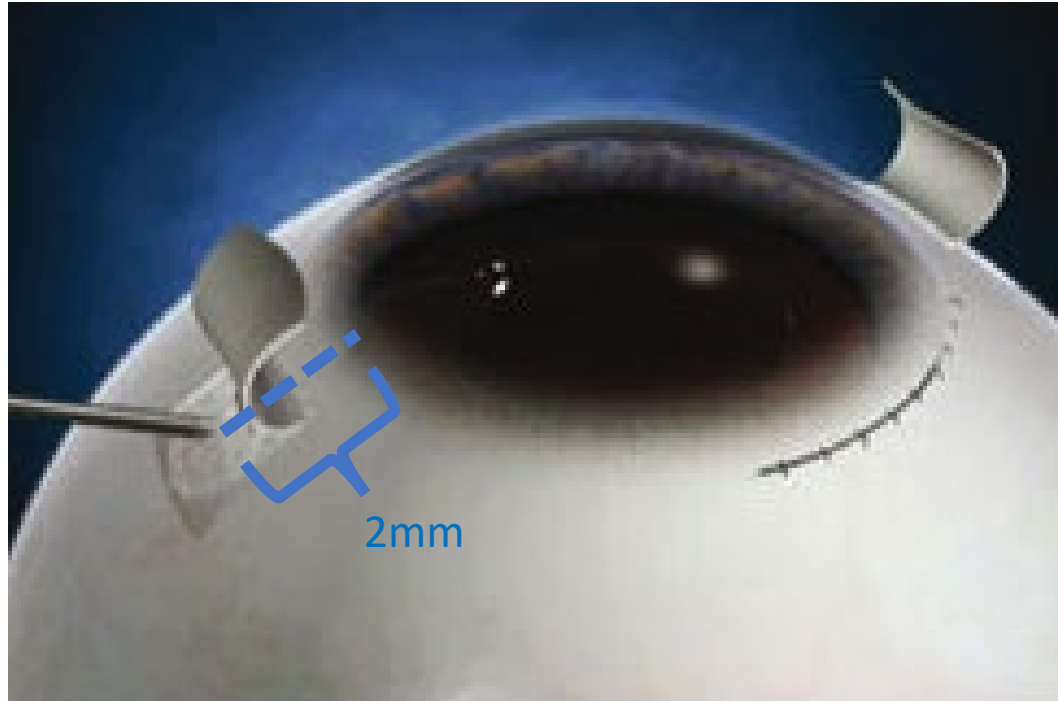
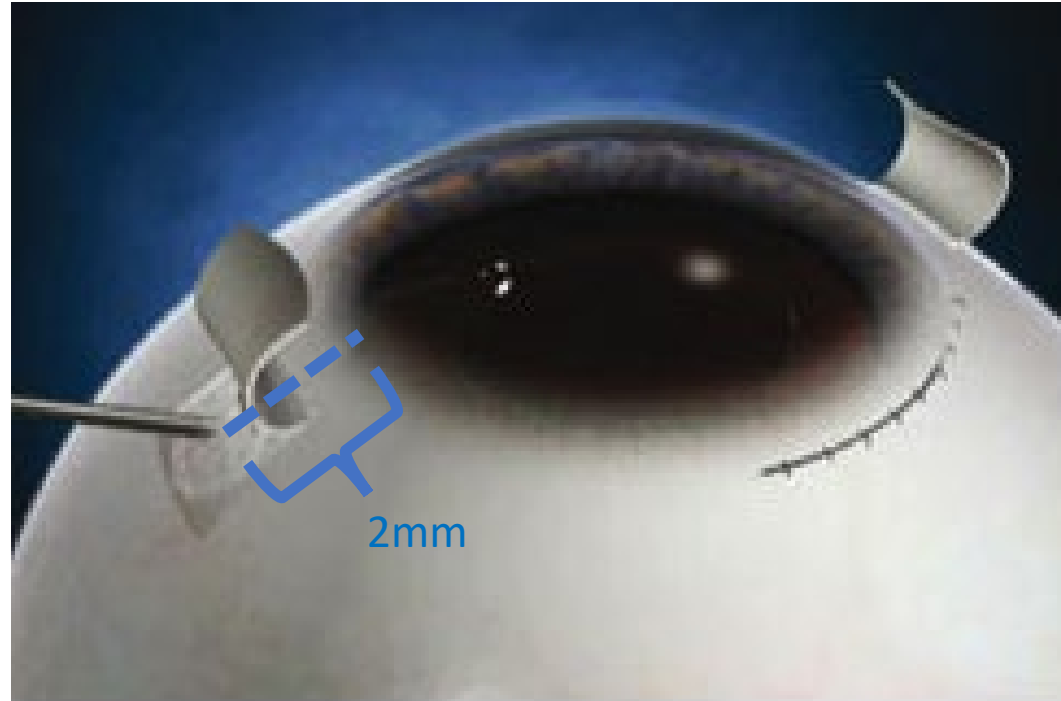Scleral-fixated IOL.

Scleral Fixated IOL

- Possible Indication (in US)
  - Open globe: 12000/year
  - Lens Subluxation : 1 in 5000
  - Capsular bag dislocation : 1 in 4000
  - PCR Rate 1% : 30000 cases/year (based on 3million cataract/year)

SFIOL

2mm

SFIOL

2mm

Q: does 2mm fixation give the optimal refractive outcome?
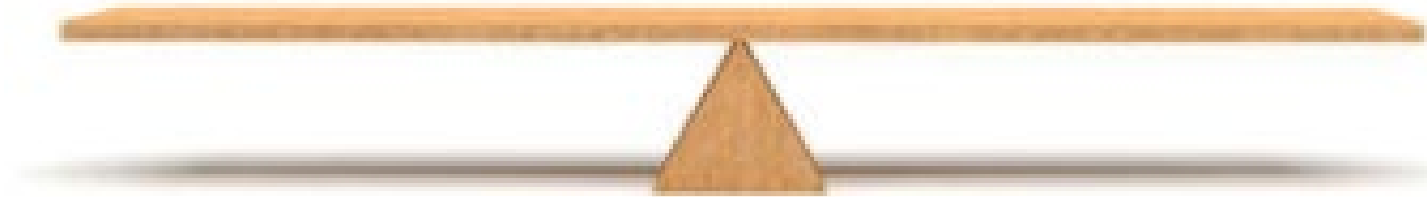
Scleral Fixated IOL Evolution

Technique

Refractive
Outcome

Scleral Fixated IOL Evolution

Sutured

-Malbran(1980)

-Lewis(1991)

-Olsen(2011)

-Khan(2016)

Sutureless

-Scharioth(2010)

-Prenner (2012)

-Yamane(2014)

-Abbey(2015)

Technique

Refractive
Outcome
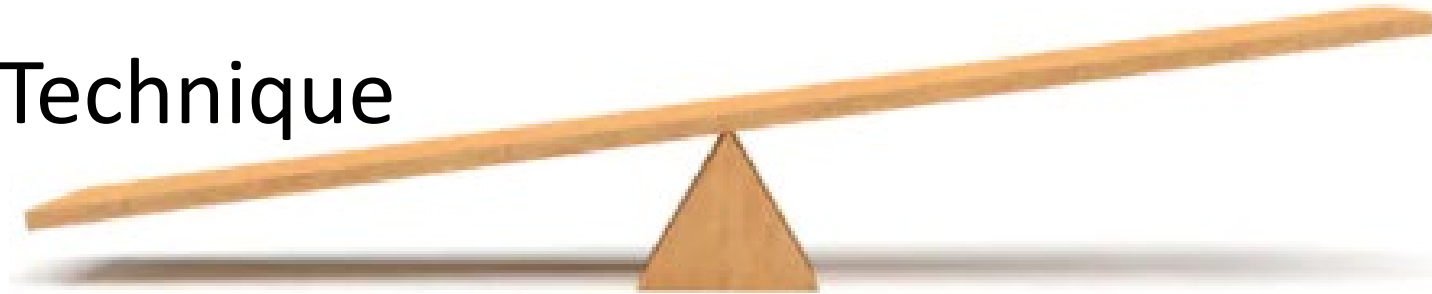
Research Question:

1. Where should we fixate the lens?

Method

- Part 1 (Formula Design)

IOL Master input
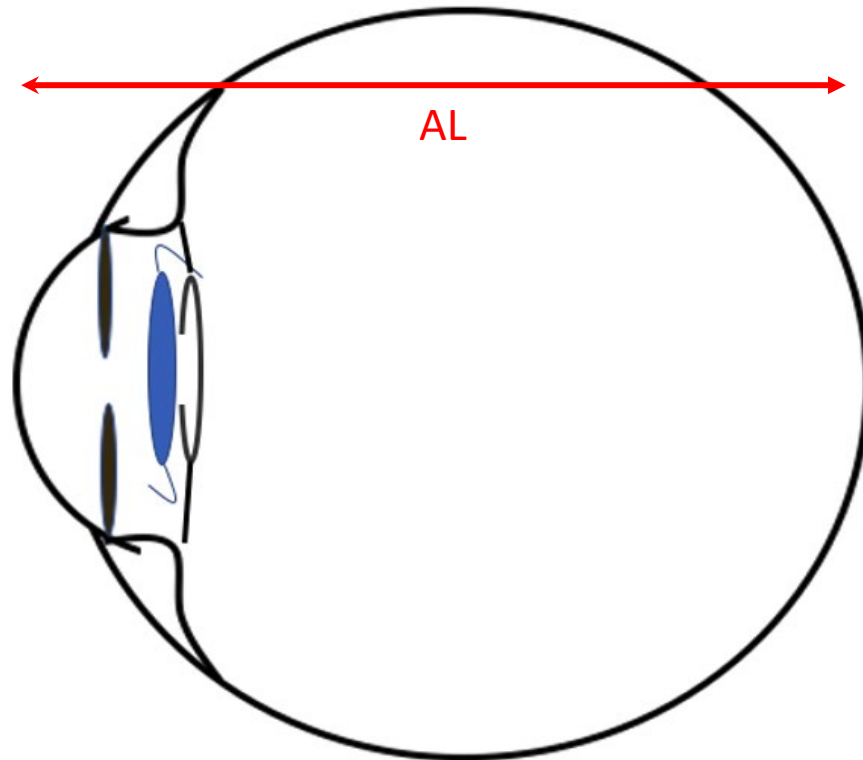
AL

OD right	AL: 23.63 mm (SNR = 220.1)
	K1: 42.45 D / 7.95 mm @ 12°
	K2: 45.79 D / 7.37 mm @ 102°
	R / SE: 7.66 mm / 44.12 D
	Cyl.: 3.34 D @ 102°
ACD: 4.32 mm	
Status: Phakie	

IOL Master input

OD right

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IOL Master input

ACD

OD
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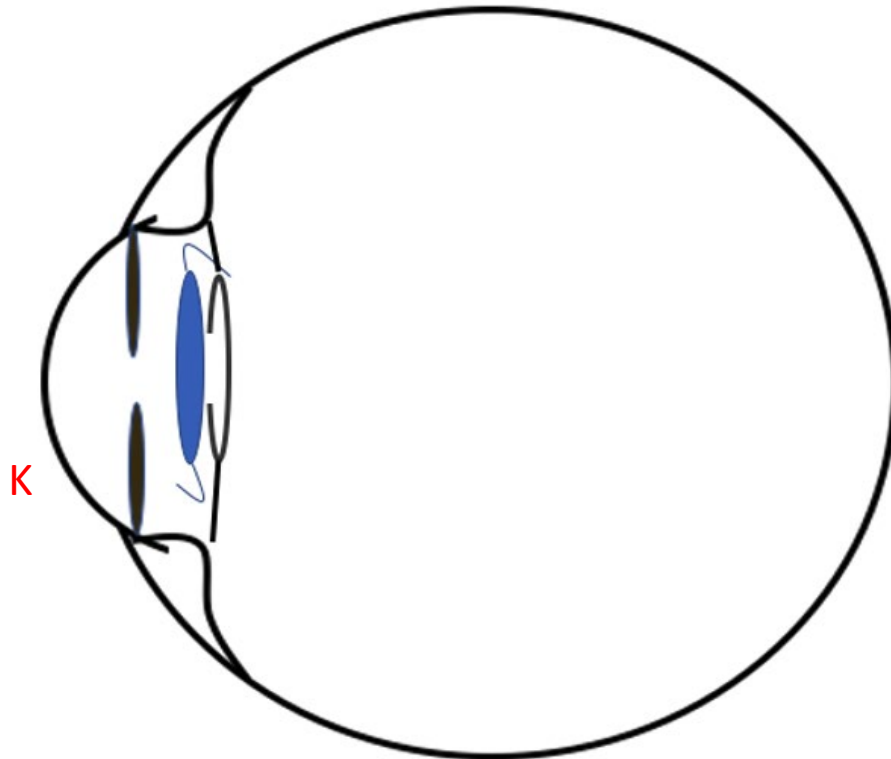Cyl.: 3.34 D @ 102°
→ ACD: 4.32 mm
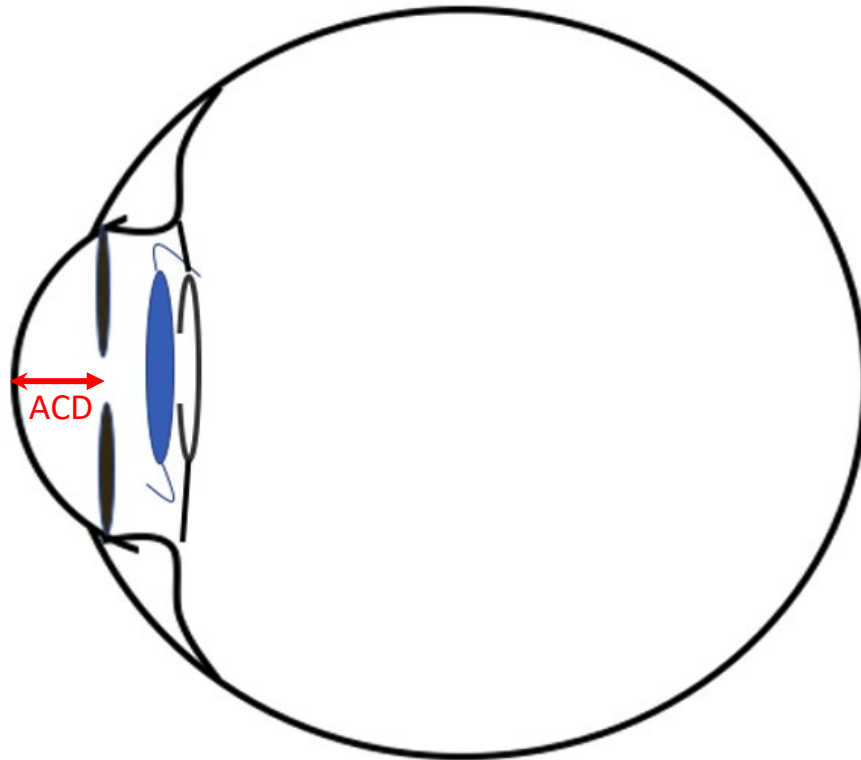
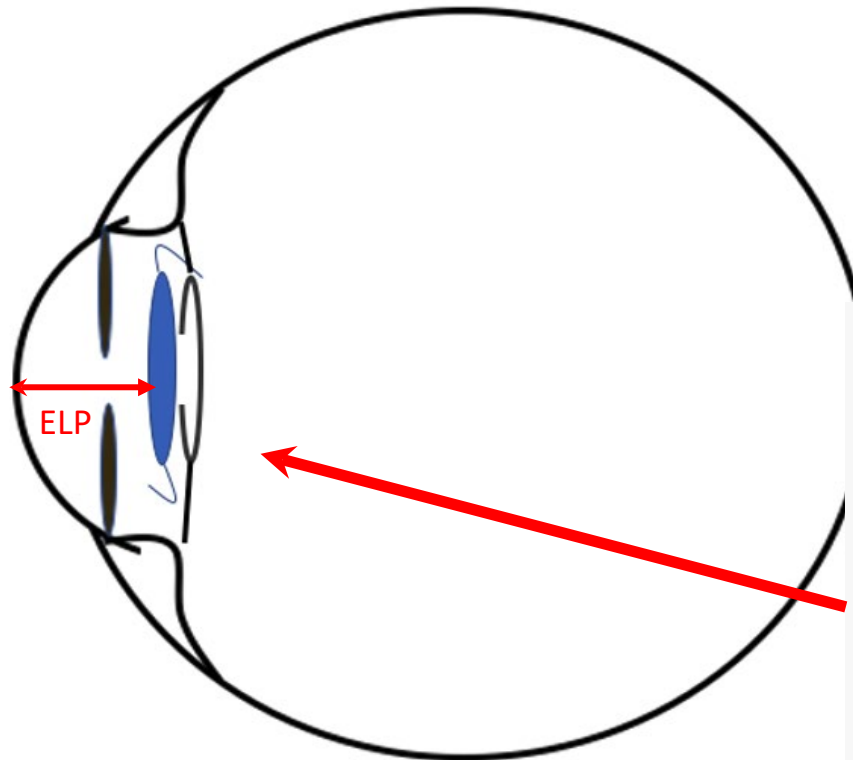Status: Phakie

IOL Master Output(to pick the lens)

OD right
AL: 23.63 mm (SNR = 220.1)
K1: 42.45 D / 7.95 mm @ 12°
K2: 45.79 D / 7.37 mm @ 102°
R / SE: 7.66 mm / 44.12 D
Cyl.: 3.34 D @ 102°
ACD: 4.32 mm

Alcon MA50 & MA60		Alcon SN60WF	
SF:	1.73	SF:	1.85
IOL (D)	REF (D)	IOL (D)	REF (D)
21.5	-0.99	22.0	-1.17
		21.5	-0.83
20.5	-0.31	21.0	-0.49
		20.5	-0.15
19.5	0.36	20.0	0.18
19.0	0.69	19.5	0.51
18.5	1.01	19.0	0.83
Emme. IOL: 20.04		Emme. IOL: 20.27	
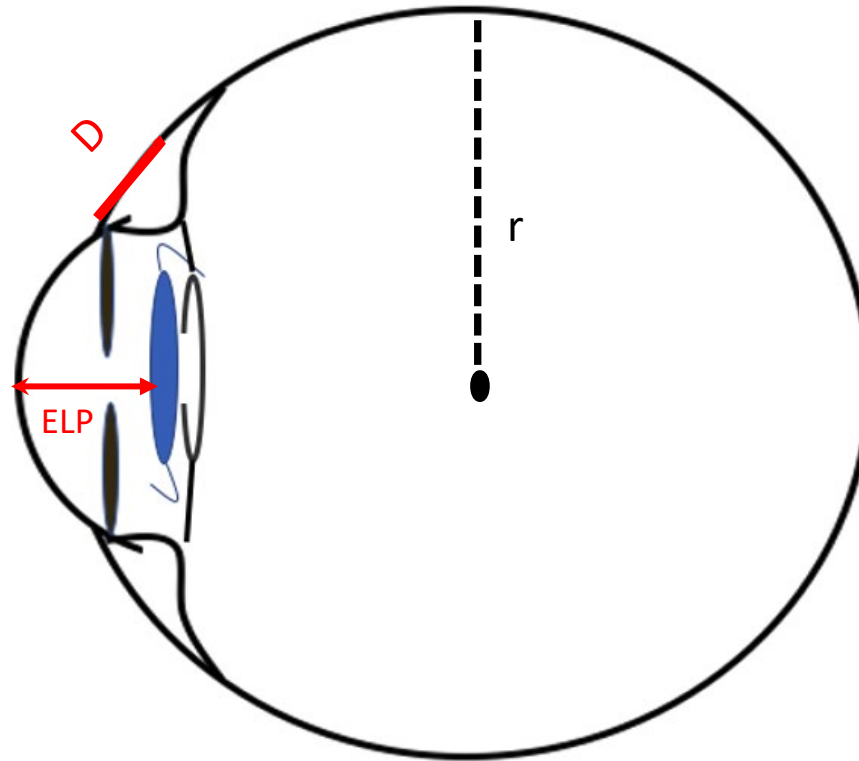
IOL Master Output(to pick the lens)

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IOL Master Output(to pick the lens)
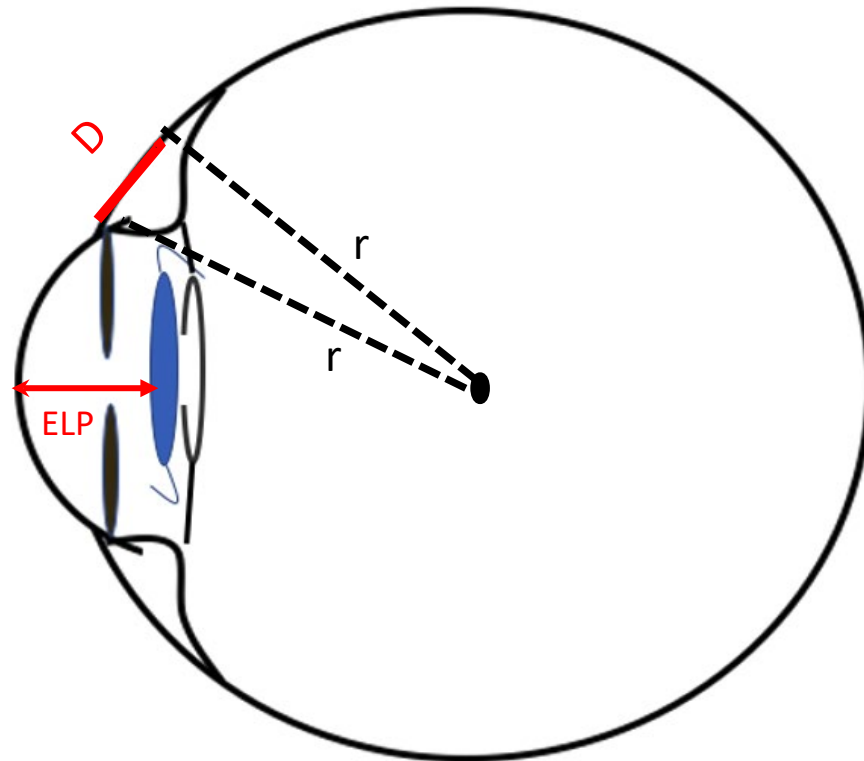
IOL Master Output(to pick the lens)
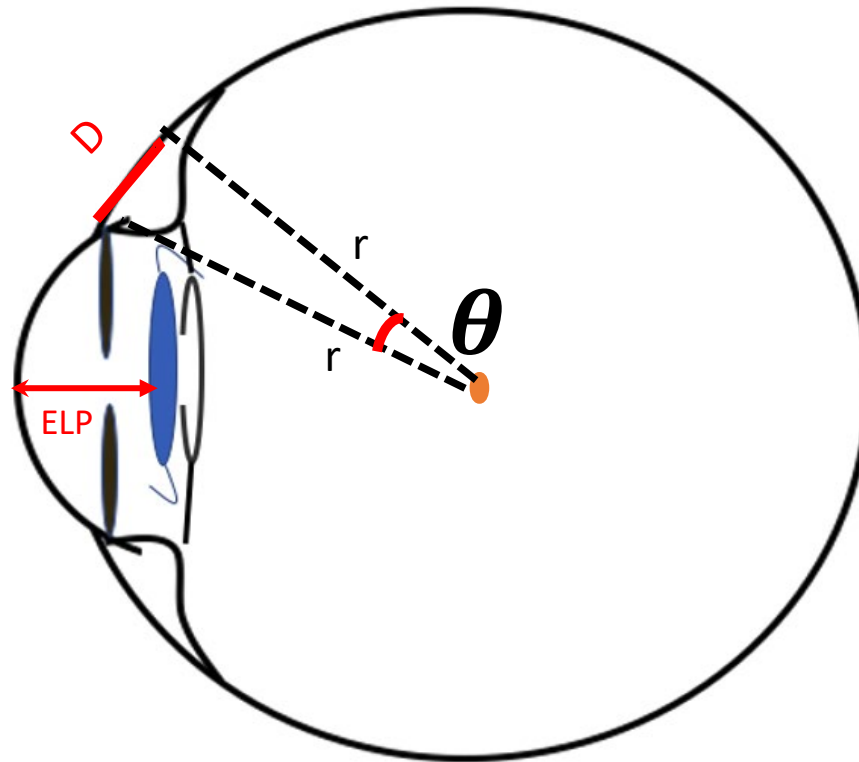
IOL Master Output(to pick the lens)

$$D = r * \theta/180 * pi,$$
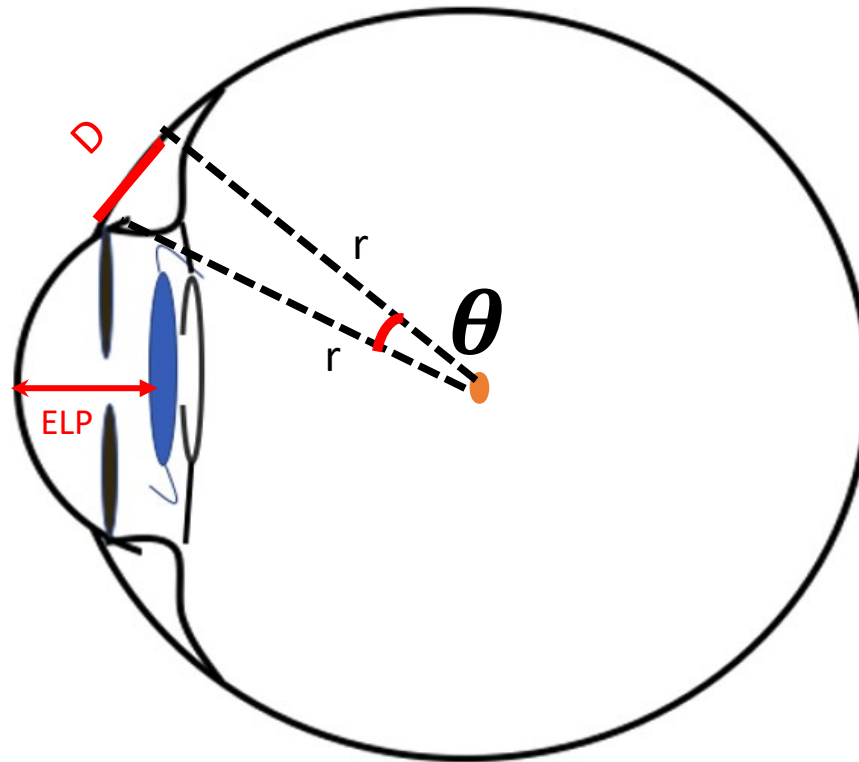
IOL Master Output(to pick the lens)
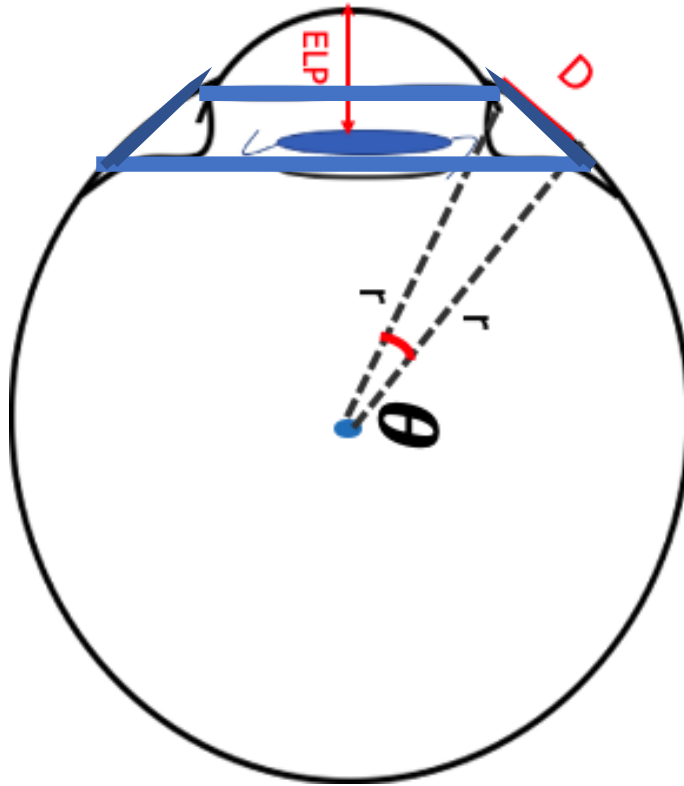
IOL Master Output(to pick the lens)
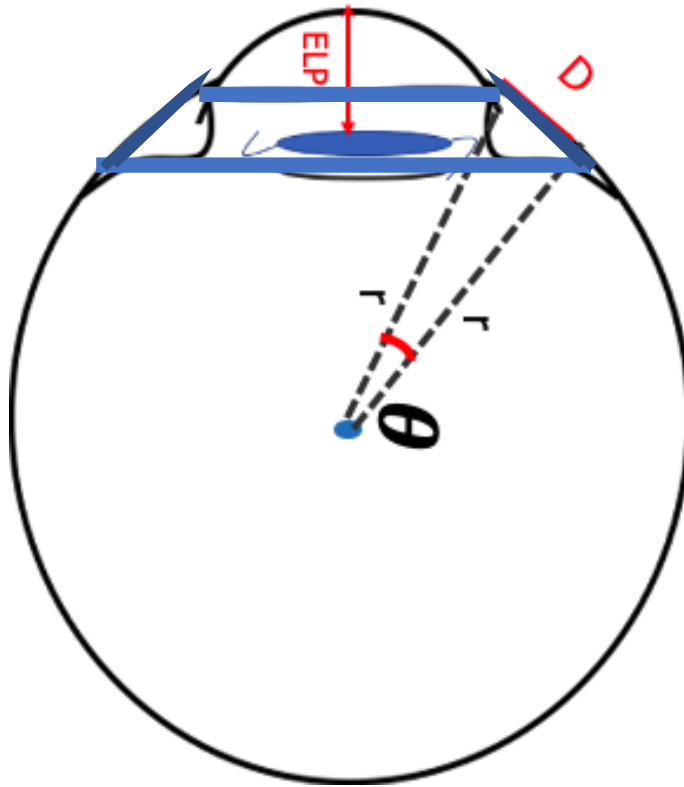
$$V = \frac{\pi \text{-} h}{6}\left(3a^2 + 3b^2 + h^2\right)$$

$$A = 2\pi rh$$

$$AT = \pi\left(2rh + a^2 + b^2\right)$$

$$h = \sqrt{r^2 - b^2} - \sqrt{r^2 - a^2}$$

$$r = \sqrt{a^2 + \left(\frac{a^2 - b^2 - h^2}{2h}\right)^2}$$
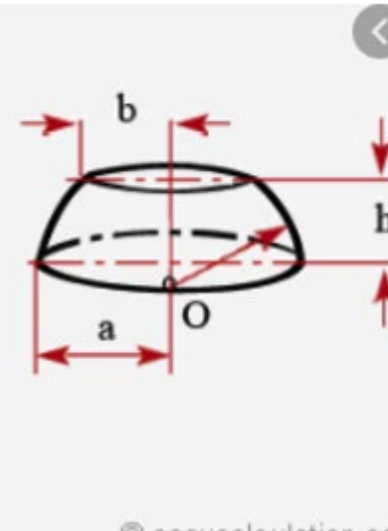
Formula Based Optimal Distance
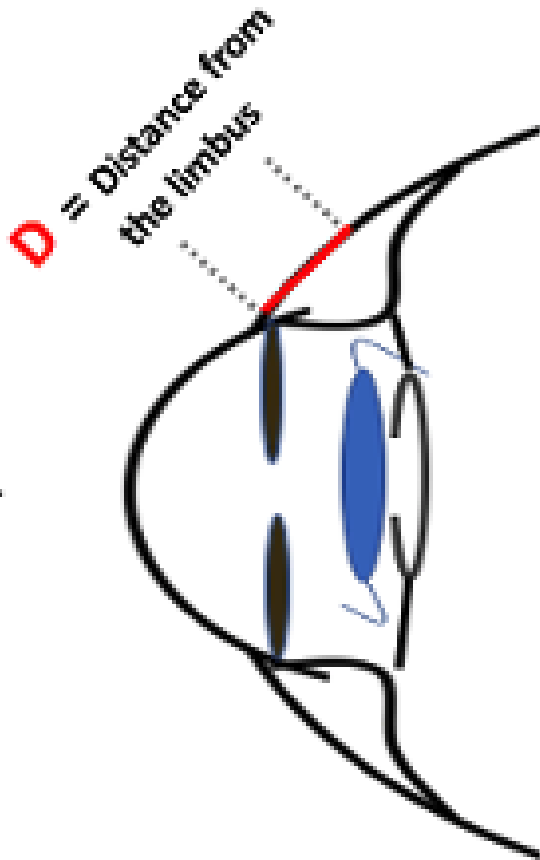
$$ELP = \frac{(SF + 3.595)}{0.9704}$$

$$h = ELP - ACD$$

$$b = \frac{WTW}{2}$$

$$\theta = 2\sin^{-1}\left(\frac{\sqrt{\left(\frac{wtw}{2}\right)^2 - 2(ELP - ACD)\sqrt{\left(\frac{AL}{2}\right)^2 - \frac{wtw^2}{4}}}}{AL}\right)$$

$$D_{(fixation\ distnace)} = \theta \cdot AL$$

D = Distance from the limbus

Method

- Part 1 (Formula Design)

- Part 2 (retrospective study)
  - Goal
    - To predict the refractive outcome and compare with actual refraction.
  - Criteria:
    - Same surgeon (Yamane)
    - No cornea/retina pathology.
    - VA > 20/40, Axial Length (>22mm and < 25mm), availability of refraction.

Results

- Criteria:
  - Received SFIOL (Yamane)
  - No retinal pathology.
  - VA > 20/50, Axial Length (>22mm and < 25mm), availability of refraction.

Since 2019, 10 eyes met the criteria

Results from ten patients

A	B	C	D	E
Pt #	ACD	WTW	AL	Target Refraction (from IOL)
1	3.39	12.50	24.16	-0.54
2	3.03	11.70	23.14	-0.55
3	5.13	12.20	24.85	-0.48
4	3.78	12.30	20.70	0.7
5	2.88	10.90	23.76	-0.42
6	3.63	12.1	24.29	0.16
7	3.47	11.5	22.58	-0.4
8	3.03	11.8	23.07	-0.37
9	2.4	11.9	22.89	-0.68
10	2.21	11.6	23.87	-0.45

Results from ten patients

A	B	C	D	E	F
Pt #	ACD	WTW	AL	Target Refraction (from IOL)	Formula Recommended Fixation
1	3.39	12.50	24.16	-0.54	3.06
2	3.03	11.70	23.14	-0.55	3.09
3	5.13	12.20	24.85	-0.48	3.18
4	3.78	12.30	20.70	0.7	2.74
5	2.88	10.90	23.76	-0.42	3.3
6	3.63	12.1	24.29	0.16	3.14
7	3.47	11.5	22.58	-0.4	3.06
8	3.03	11.8	23.07	-0.37	3.06
9	2.4	11.9	22.89	-0.68	3.03
10	2.21	11.6	23.87	-0.45	3.18

Results from ten patients

A	B	C	D	E	F	G
Pt #	ACD	WTW	AL	Target Refraction (from IOL)	Formula Recommended Fixation	Actual Fixation
1	3.39	12.50	24.16	-0.54	3.06	2
2	3.03	11.70	23.14	-0.55	3.09	2
3	5.13	12.20	24.85	-0.48	3.18	2
4	3.78	12.30	20.70	0.7	2.74	2
5	2.88	10.90	23.76	-0.42	3.3	2
6	3.63	12.1	24.29	0.16	3.14	2
7	3.47	11.5	22.58	-0.4	3.06	2
8	3.03	11.8	23.07	-0.37	3.06	2
9	2.4	11.9	22.89	-0.68	3.03	2
10	2.21	11.6	23.87	-0.45	3.18	2

Results from ten patients

A	B	C	D	E	F	G	H
Pt #	ACD	WTW	AL	Target Refraction (from IOL)	Formula Recommended Fixation	Actual Fixation	More Myopic
1	3.39	12.50	24.16	-0.54	3.06	2	No
2	3.03	11.70	23.14	-0.55	3.09	2	Yes
3	5.13	12.20	24.85	-0.48	3.18	2	Yes
4	3.78	12.30	20.70	0.7	2.74	2	Yes
5	2.88	10.90	23.76	-0.42	3.3	2	Yes
6	3.63	12.1	24.29	0.16	3.14	2	Yes
7	3.47	11.5	22.58	-0.4	3.06	2	No
8	3.03	11.8	23.07	-0.37	3.06	2	No
9	2.4	11.9	22.89	-0.68	3.03	2	Yes
10	2.21	11.6	23.87	-0.45	3.18	2	Yes

7/10 Pts had expected myopic shifts

Results from ten patients

A	B	C	D	E	G	J
Pt #	ACD	WTW	AL	Target Refraction (from IOL)	Actual Fixation	Formula Predicted refraction (at 2mm)
1	3.39	12.50	24.16	-0.54	2	-1.27
2	3.03	11.70	23.14	-0.55	2	-1.22
3	5.13	12.20	24.85	-0.48	2	-1.26
4	3.78	12.30	20.70	0.7	2	0.2
5	2.88	10.90	23.76	-0.42	2	-1.22
6	3.63	12.1	24.29	0.16	2	-0.6
7	3.47	11.5	22.58	-0.4	2	-1.2
8	3.03	11.8	23.07	-0.37	2	-1.1
9	2.4	11.9	22.89	-0.68	2	-1.39
10	2.21	11.6	23.87	-0.45	2	-1.2

Calculate refraction when fixated at 2mm

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Results from ten patients

A	B	C	D	E	G	J	I
Pt #	ACD	WTW	AL	Target Refraction (from IOL)	Actual Fixation	Formula Predicted refraction	Actual refraction
1	3.39	12.50	24.16	-0.54	2	-1.27	-0.5
2	3.03	11.70	23.14	-0.55	2	-1.22	-2.25
3	5.13	12.20	24.85	-0.48	2	-1.26	-1
4	3.78	12.30	20.70	0.7	2	0.2	-0.75
5	2.88	10.90	23.76	-0.42	2	-1.22	-1.25
6	3.63	12.1	24.29	0.16	2	-0.6	plano
7	3.47	11.5	22.58	-0.4	2	-1.2	+0.25
8	3.03	11.8	23.07	-0.37	2	-1.1	+1
9	2.4	11.9	22.89	-0.68	2	-1.39	-1.25
10	2.21	11.6	23.87	-0.45	2	-1.2	-0.75

Formula predicting
Within a mean value
of +/- 0.7 Diopter.

Conclusion

- Individualized fixation distance.
  - Can be used in any technique.
  - Preliminary results look promising.
    - 70% : myopic shifts
    - Within +/- 0.7 diopter.

Conclusion

- Individualized fixation distance.
    - Can be used in any technique.
    - Preliminary results look promising.

- Limitation
    - Retrospective Study
    - Small sample size
    - Variation in refraction (different personnel).

Thank You.