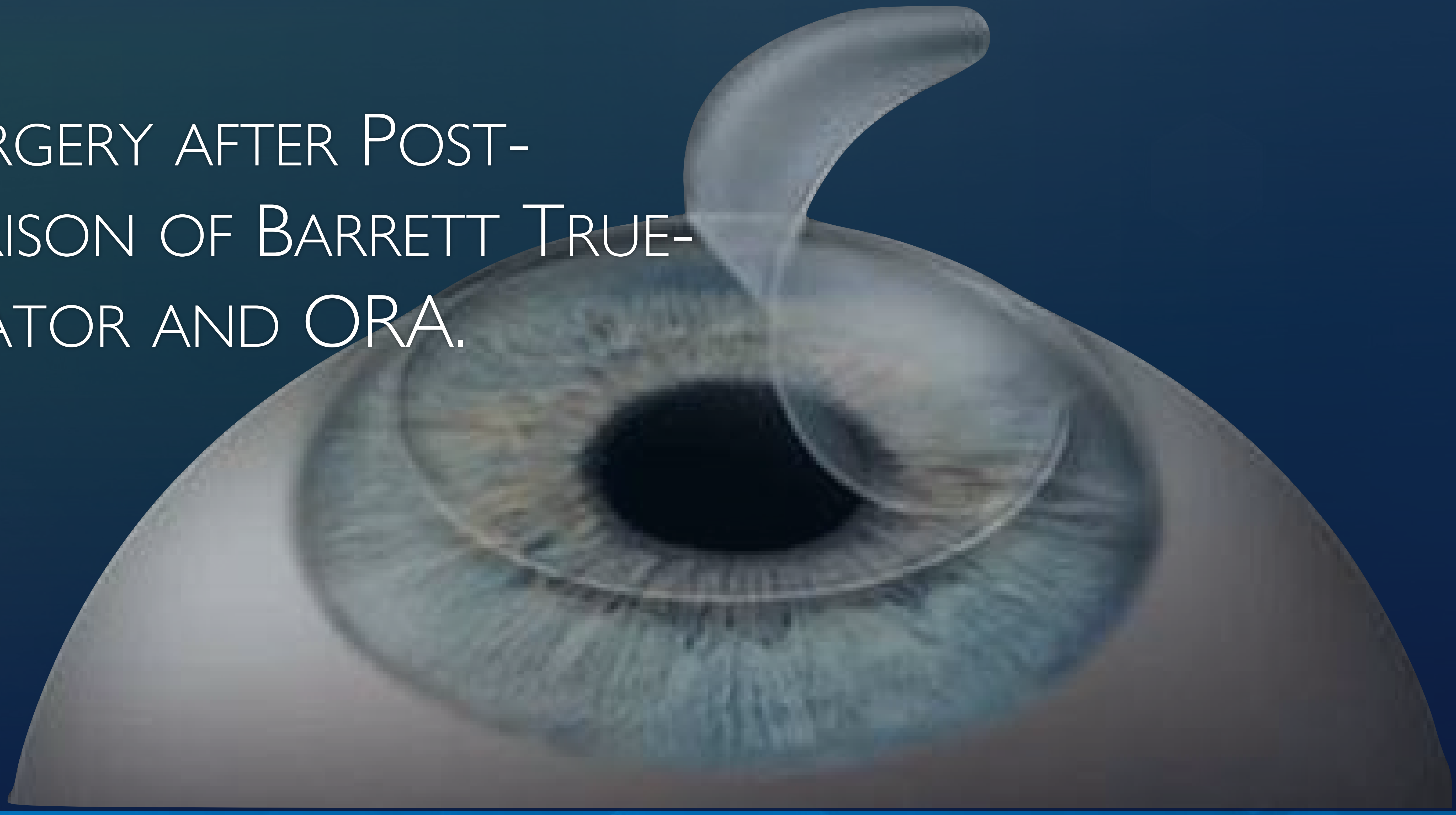
IOL Calculations for Cataract Surgery after Post-Corneal Refractive Surgery: Comparison of Barrett True-K, Barrett True-K TK, ASCRS calculator and ORA.



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Hassan Alsetri, BS-none

Nicole Fram, MD

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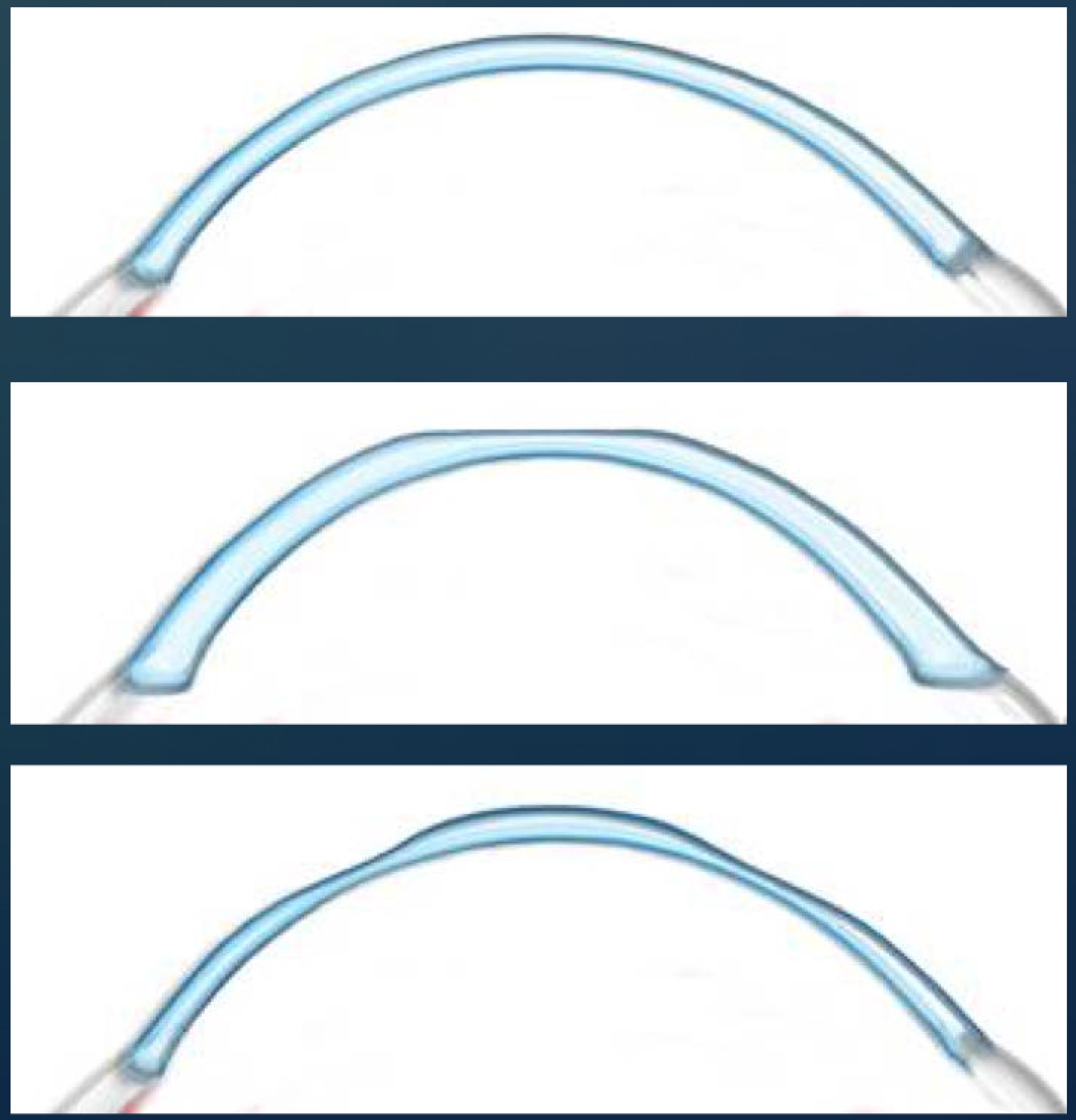
- J&J: S, C
- CorneaGen: S, C, MAB
- Ocular Science: C, MAB
- Zeiss: C, S, Research Grant
- Orasis: S, MAB
- Ocular Therapeutix: S, Research Grant

Graham Barrett, FRANZO

ADVANCED VISION CARE

What's the Dilemma?

- Normal Cornea: 2/3 of power, most K measurements assume a -6.0D posterior corneal contribution
- Post Myopic LASIK: The anterior cornea has been modified and the cornea is overestimated and a hyperopic outcome results
- Post Hyperopic LASIK: The anterior cornea has been modified and the cornea is underestimated and a myopic outcome occurs



- Solution: a total corneal power is obtained to assist with IOL calculations

Literature Review

REVIEW/UPDATE

Metaanalysis of intraocular lens power calculation after laser refractive surgery in myopic eyes

Xu Chen, MD, Fei Yuan, MD, Lianqun Wu, MD

To evaluate the accuracy of intraocular lens (IOL) power calculation methods after laser refractive surgery in myopic eyes, a comprehensive literature search was carried out for retrospective case series studies with data on post-myopic laser surgery IOL power calculations published from January 2000 to May 2014. A metaanalysis of the 9 identified studies was performed using odds ratios in percentage of prediction error within ±0.5 or 1.0 diopter (D) of the target refraction. Compared with the Haigis-L method, the clinical history method, corneal bypass method, and Feiz-Mannis method were associated with lower odds of predication; the Masket method showed higher odds. The subgroup data showed significantly better performance of the Shammas no-history method with the Shammas post-LASIK formula than the Haigis-L method in predication error. The Masket method and the Shammas no-history method with the Shammas post-LASIK formula without historical data had more prediction accuracy than the Haigis-L method. The clinical history method, Feiz-Mannis method, and corneal bypass method, which required historical data, were less accurate in their predictions.

Financial Disclosure: No author has a financial or proprietary interest in any material or method mentioned.

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Supplemental material available at www.jcrsjournal.org.

ARTICLE

Evaluation of intraocular lens power prediction methods using the American Society of Cataract and Refractive Surgeons Post-Keratorefractive Intraocular Lens Power Calculator

Li Wang, MD, PhD, Warren E. Hill, MD, Douglas D. Koch, MD

PURPOSE: To evaluate the accuracy of methods of intraocular lens (IOL) power prediction after previous laser in situ keratomileusis (LASIK) or photorefractive keratectomy (PRK) using the American Society of Cataract and Refractive Surgery IOL power calculator.

SETTING: Cullen Eye Institute, Baylor College of Medicine, Houston, Texas, and private practice, Mesa, Arizona, USA.

METHODS: The following methods were evaluated: methods using pre-LASIK/PRK keratometry (K) and surgically induced change in refraction, methods using surgically induced change in refraction, and methods using no previous data. The predicted IOL power was calculated with each method using the actual refraction after cataract surgery as the target. The IOL prediction error was calculated as the implanted IOL power minus the predicted IOL power. Arithmetic and absolute IOL prediction errors, variances in mean arithmetic IOL prediction error, and percentage of eyes within ±0.50 diopter (D) and ±1.00 D of refractive prediction errors were calculated.

RESULTS: Methods using surgically induced change in refraction or no previous data had significantly smaller mean absolute IOL prediction errors, smaller variances, and a greater percentage of eyes within ±0.50 D and ±1.00 D of refractive prediction errors than methods using pre-LASIK/PRK keratometry (K) values and surgically induced change in refraction (all $P<.05$ with Bonferroni correction). There were no statistically significant differences between methods using surgically induced change in refraction and methods using no previous data.

CONCLUSION: Methods using surgically induced change in refraction and methods using no previous data gave better results than methods using pre-LASIK/PRK K values and surgically induced change in refraction.

Financial Disclosure: No author has a financial or proprietary interest in any material or method mentioned.

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ARTICLE

Accuracy of the Barrett True-K formula for intraocular lens power prediction after laser in situ keratomileusis or photorefractive keratectomy for myopia

Adi Abulafia, MD, Warren E. Hill, MD, Douglas D. Koch, MD, Li Wang, MD, PhD, Graham D. Barrett, MD

PURPOSE: To compare the accuracy of the Barrett True-K formula with other methods available on the American Society of Cataract and Refractive Surgery (ASCRS) post-refractive surgery intraocular lens (IOL) power calculator for the prediction of IOL power after previous myopic laser in situ keratomileusis (LASIK) or photorefractive keratectomy (PRK).

SETTING: Cullen Eye Institute, Baylor College of Medicine, Houston, Texas, and private practice, Mesa, Arizona, USA.

DESIGN: Retrospective case series.

METHODS: The accuracy of the Barrett True-K formula was compared with the Adjusted Atlas (4.0 mm zone), Masket, modified-Masket, Wang-Koch-Maloney, Shammas, and Haigis-L methods to calculate IOL power. A separate analysis of 2 no-history methods (Shammas and Haigis-L) was performed and compared with the Barrett True-K no-history option.

RESULTS: Eighty-eight eyes were available for analysis. The Barrett True-K formula had a significantly smaller median absolute refraction prediction error than all other formulas except the Masket, smaller variances compared with the Wang-Koch-Maloney, Shammas, and Haigis-L, and a greater percentage of eyes within ±0.50 diopter (D) of predicted error in refraction compared with the Adjusted Atlas, Masket, and modified Masket methods (all $P < .05$). In eyes with no historical data, the Barrett True-K no-history formula had a significantly smaller median absolute refraction prediction error and a greater percentage of eyes within ±0.50 D of the predicted error in refraction than the Shammas and the Haigis-L formulas (both $P < .05$).

CONCLUSION: The Barrett True-K formula was either equal to or better than alternative methods available on the ASCRS online calculator for predicting IOL power in eyes with previous myopic LASIK or PRK.

Financial Disclosures: Dr. Barrett has licensed the Barrett True-K formula to Haag-Streit. Dr. Hill is a paid consultant to Haag-Streit and Alcon Surgical, Inc. None of the other authors has a financial or proprietary interest in any material or method mentioned.

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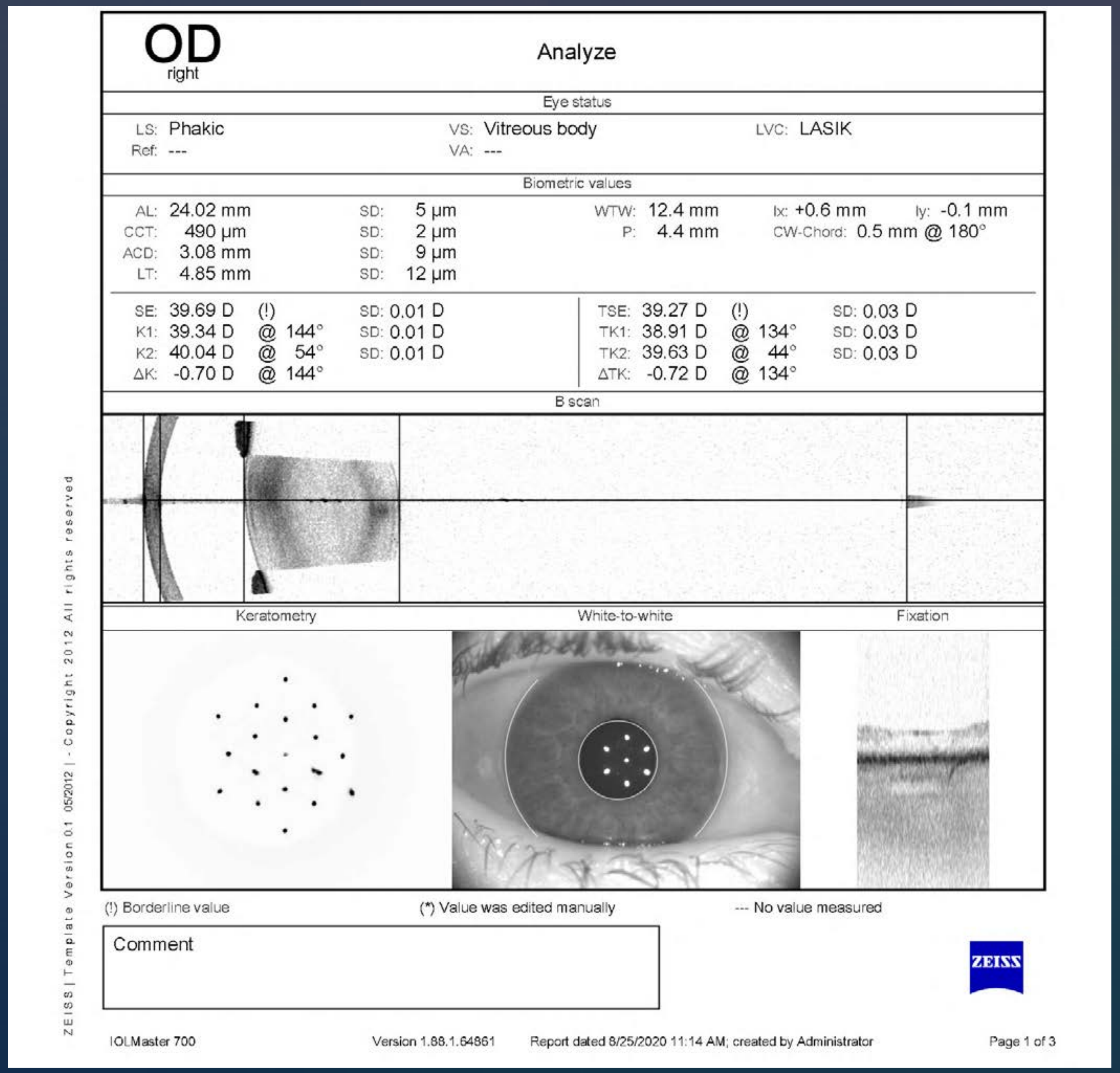
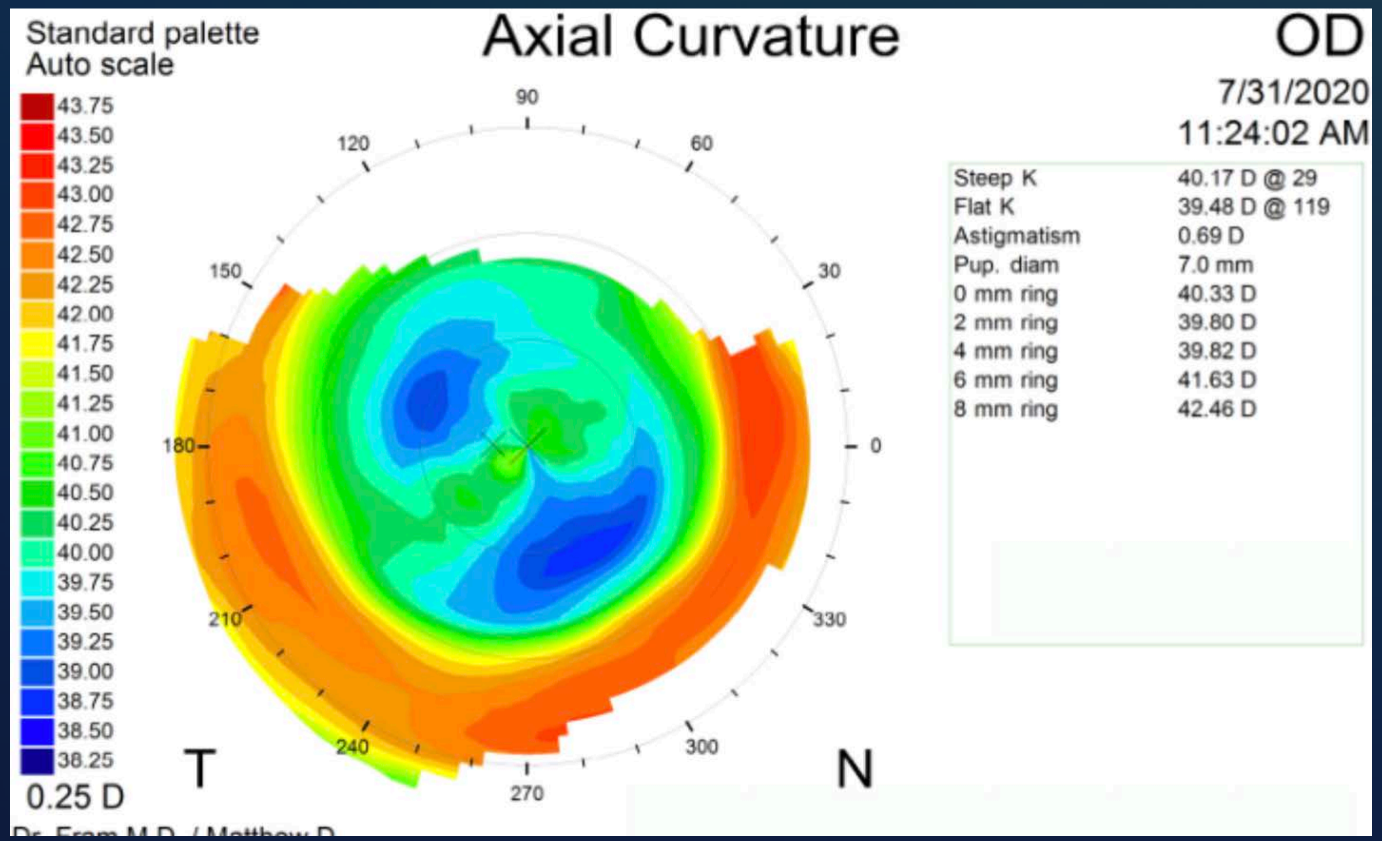
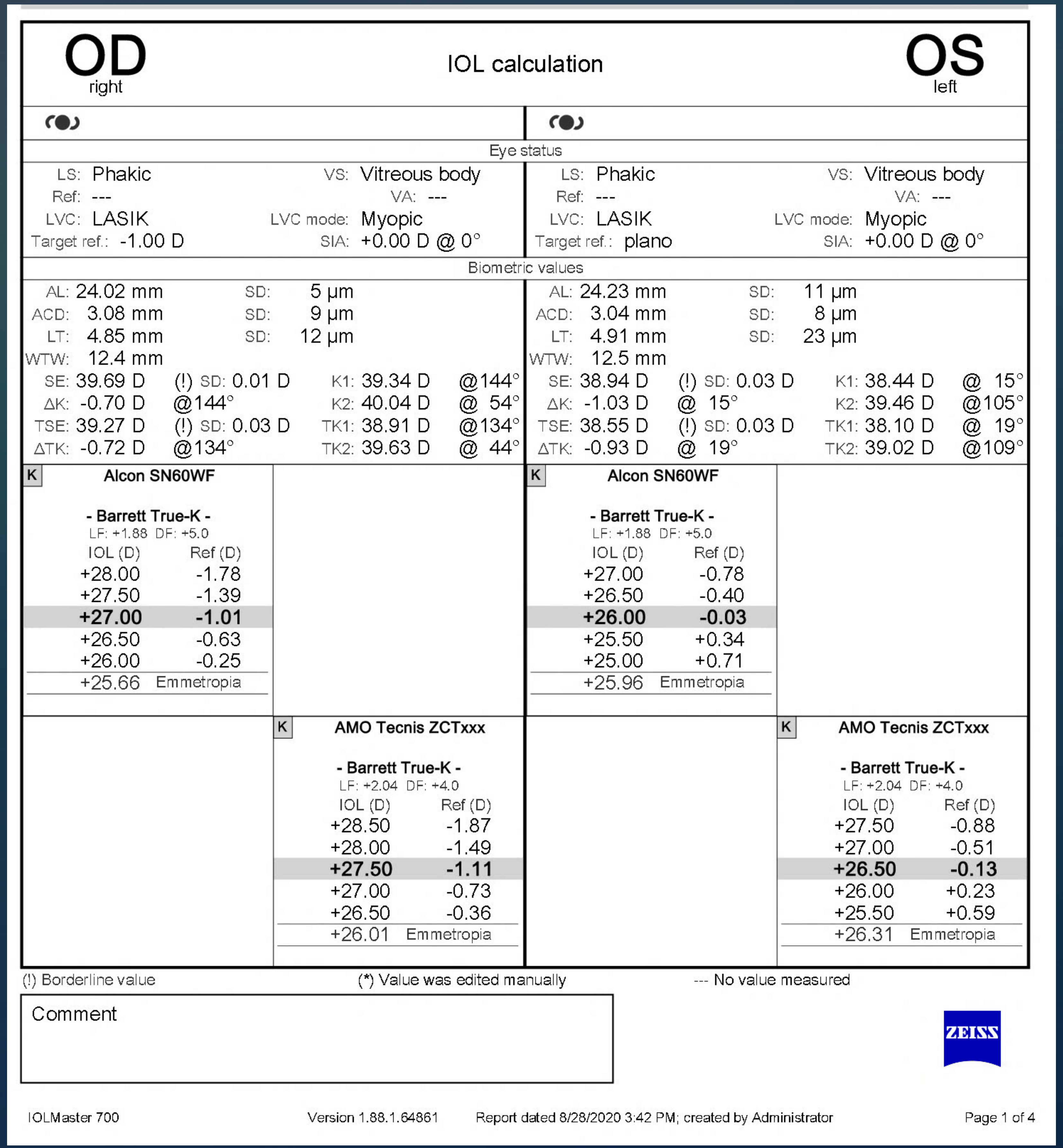
Only within +/-0.50D 65-74% of the time!

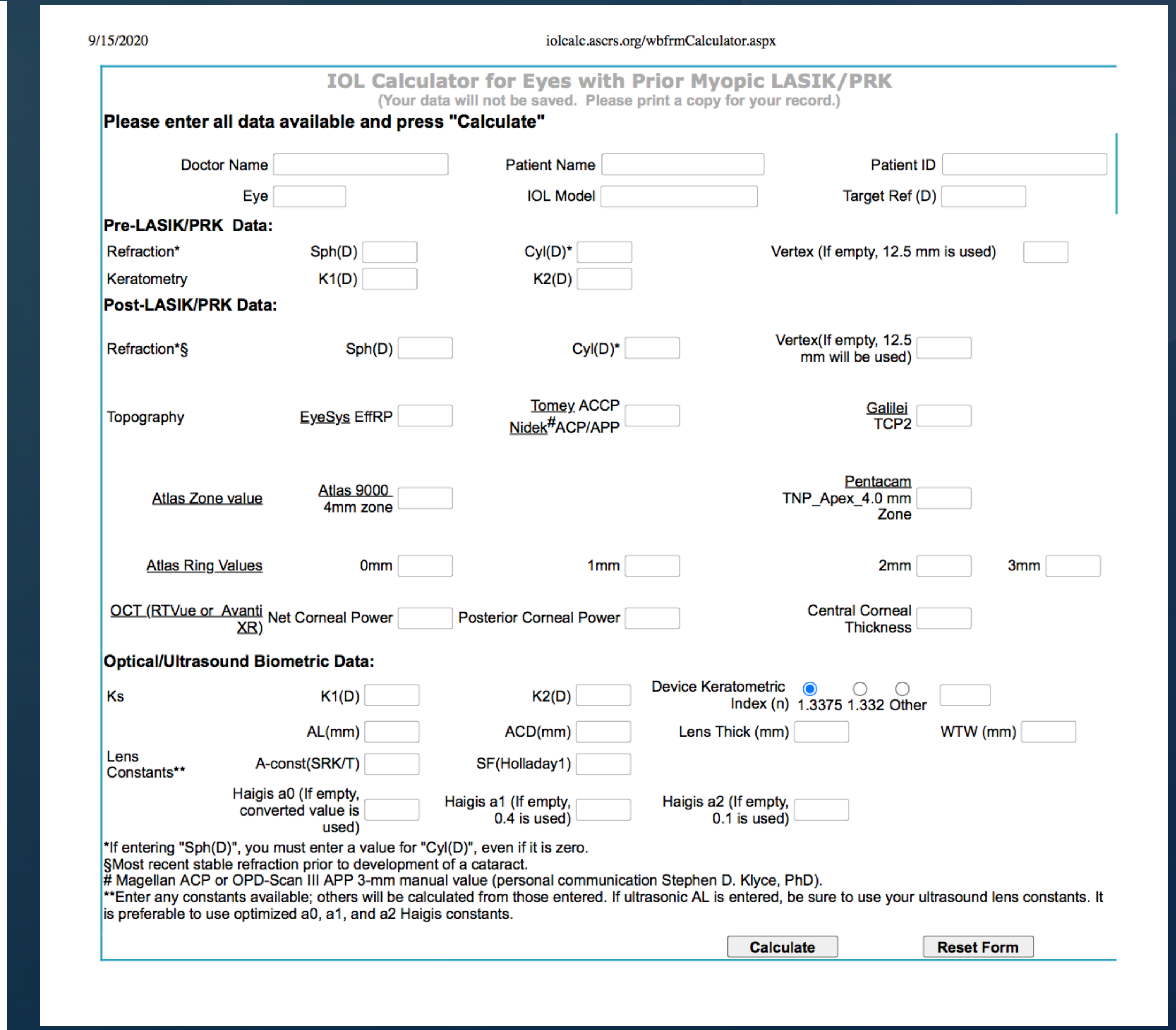
Current Strategy with no prior data







Barrett True K using K1 and K2



ASCRS Calculator

Can we do Better with Barrett True-K TK?

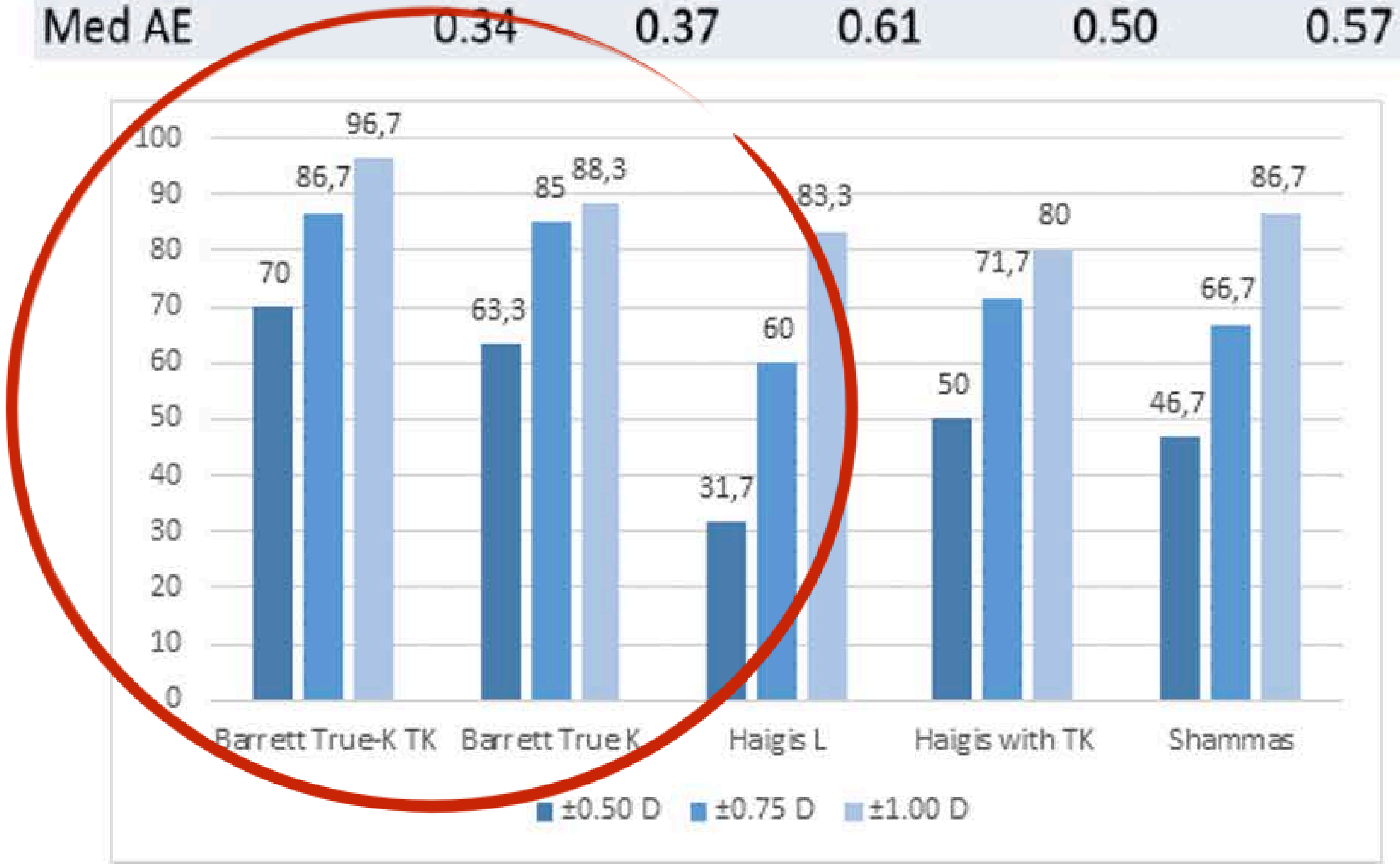
Graham Barrett, Perth, Australia; **Michael Lawless**, Sidney, Australia; **Tun Kuan Yeo**, Singapore

Presentation at ASCRS Annual Meeting 2019, San Diego, USA

- Retrospective Analysis
- 60 post myopic LASIK eyes, measured with ZEISS IOLMaster 700 and TK
- Comparison of no-history formulas: Barrett True K with classic K and the new Barrett True-K with TK to Haigis-L, Haigis with TK

- **Barrett True-K TK improved the outcome prediction compared to the Barrett True-K with classic Ks by 7%. (p=0.02)**

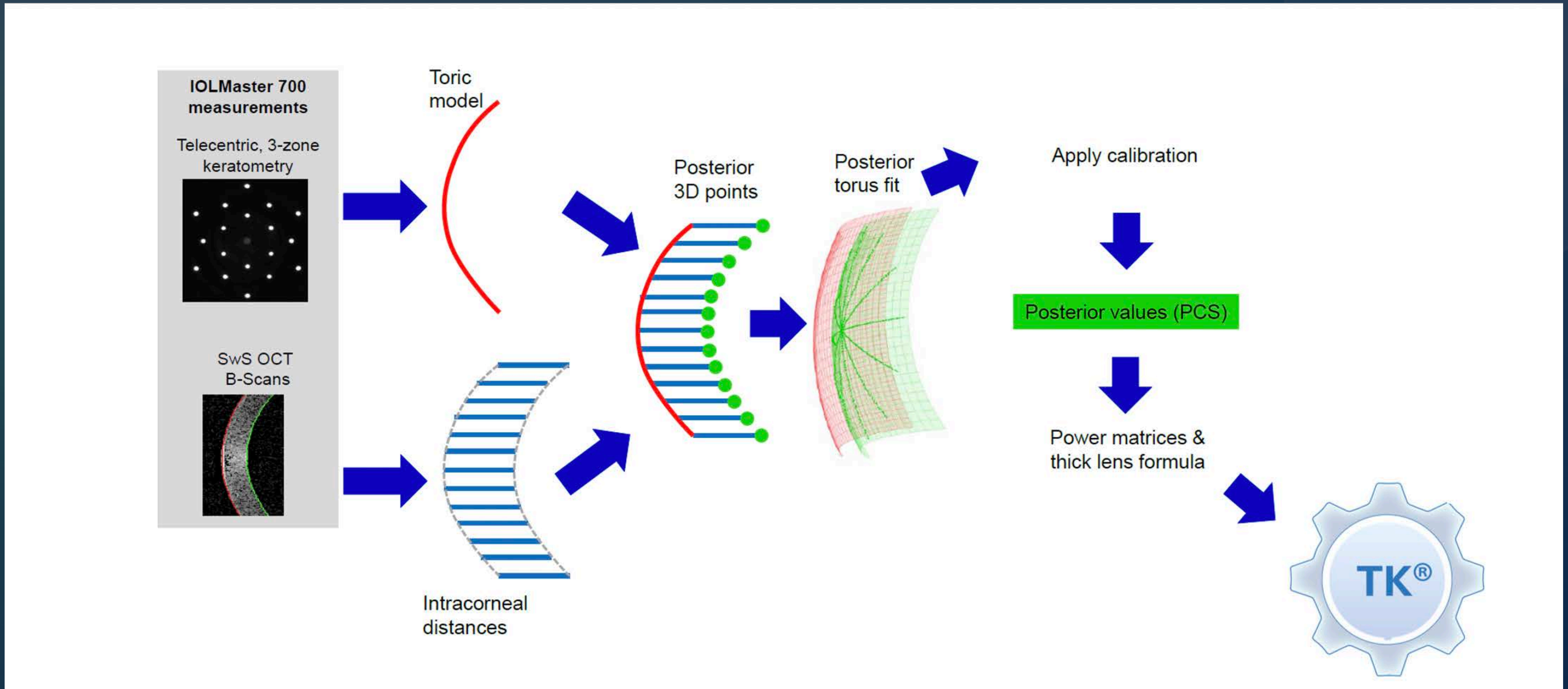
60 Eyes:	True K TK	True K	Haigis L	Haigis TK	Shammas
Mean Error	-0.04	-0.17	-0.45	-0.12	-0.36
STDev	0.51	0.57	0.65	0.67	0.62
MAE	0.41	0.47	0.67	0.56	0.59
Med AE	0.34	0.37	0.61	0.50	0.57



Barrett, ASCRS 2019
Barrett True K TK is currently not available on the IOLMaster 700 but online only.

Study Design

Purpose: This retrospective study will evaluate the use of IOL master 700 Total Keratometry (TK) and the Barrett True-K-TK vs other formulae to improve post-refractive IOL calculations.



Methods

- A retrospective comparative case series was performed for n=31 eyes of 20 post myopic LASIK/PRK patients undergoing uncomplicated cataract surgery.

- The outcome measures:
- Mean and Median Absolute errors
- % eyes within 0.5D, 0.75D and1D of refractive prediction error

	Mean ± SD	Range
Axial Length (mm)	26.22 ± 1.52	24.27 to 29.56
Flat Keratometry (K1, D)	39.78 ± 2.02	36.24 to 42.79
Steep Keratometry (K2, D)	40.54 ± 1.99	37.03 to 43.89
MRSE (D)	-0.74 ± 0.75	-2.5 to 0.25

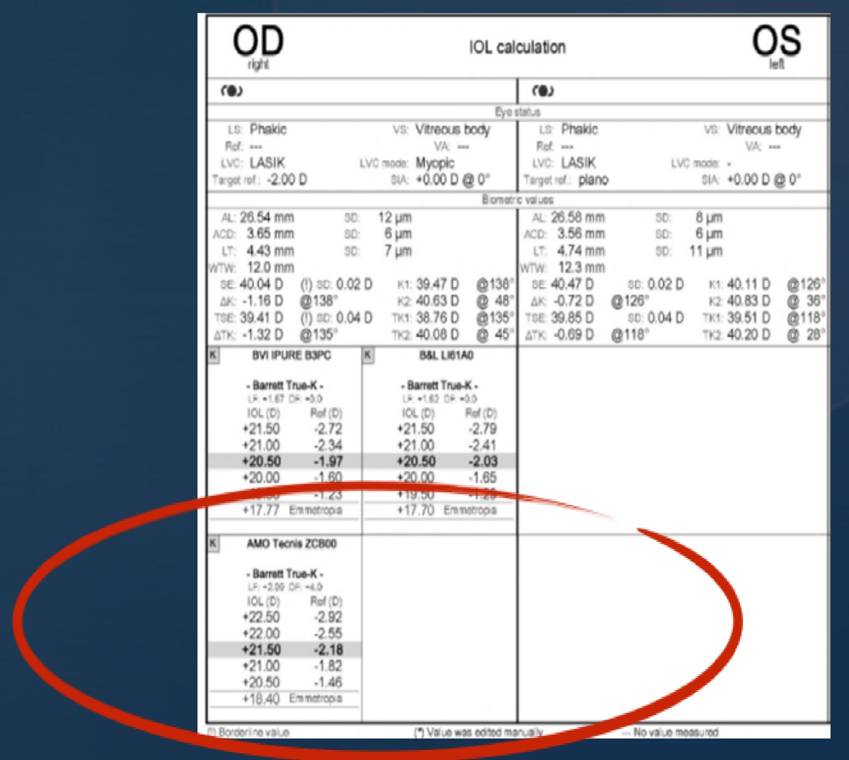
MRSE = Manifest refraction spherical equivalent
SD = Standard Deviation

IOLs	Number
ZCB00	16
LI61A0	10
SN60WF	5

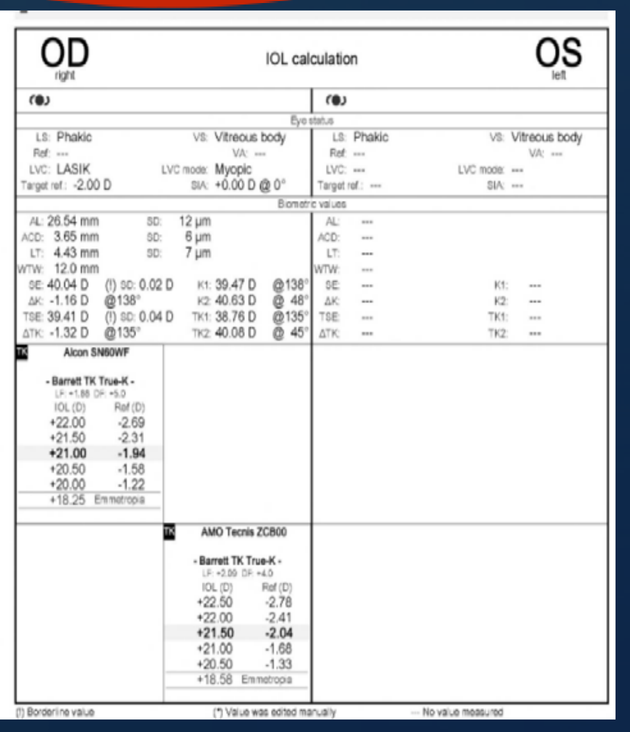
Methods

- The Barrett True-K and Barrett True-K TK formulas were compared to the ASCRS calculator and ORA. Biometry was performed with the IOL master 700.
- The Barrett True K-TK was calculated using the IOL master 700.
- ORA predicted refraction data was obtained for 23/31 of the cataract surgeries.
- ASCRS averaged IOL power predictions were obtained using the ASCRS calculator on the ASCRS website.

Barrett True K-Standard K's



Barrett True K-TK using PK1 and PK2



Incorporates PK1 and PK2

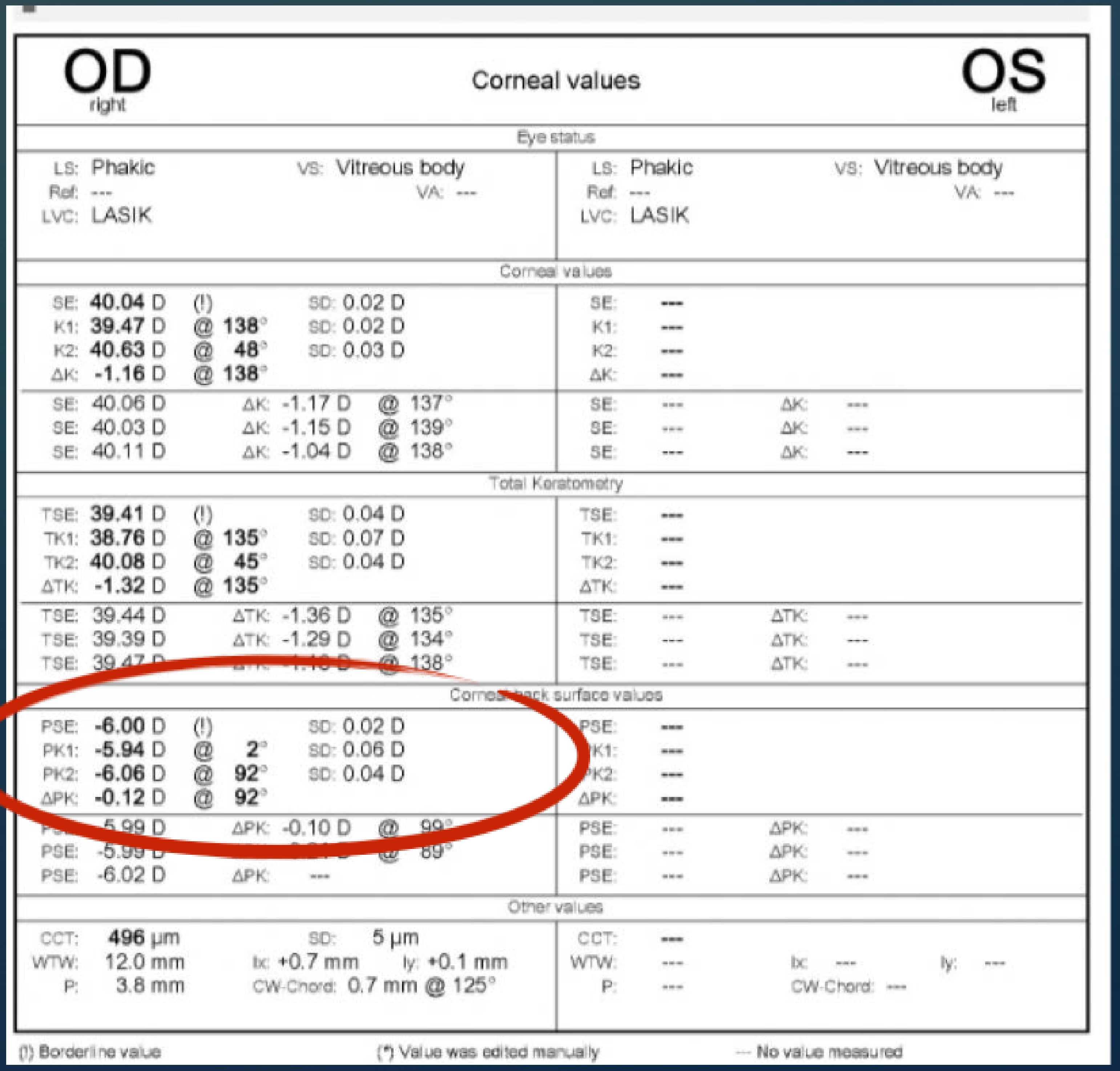
RESULTS

Refractive Prediction Absolute Error (D)			
	Mean ± SD	Median	Range
Barrett True K (Classic K's)	**0.347** ± 0.256	0.27	0.055 to 0.045
Barrett True K TK (Total Keratometry)	**0.31** ± 0.177	0.31	0.045 to 0.69
ORA	**0.307** ± 0.248	0.275	0.01 to 1.09
ASCRS Calculator	**0.236** ± 0.188	0.154	0.007 to 0.714

Results: % Eyes within 0.5D, 0.75D and 1D of refractive prediction error.

Conclusions

- Both the ASCRS calculator and the Barrett True K TK had 87% eyes within 0.5D which is 10% higher than ORA and 16% higher than Barrett True K (classic K's).
- The use of the IOL master 700 total keratometry and calculated posterior corneal curvature (PK1 and PK2) measurements resulted in improved accuracy for post-refractive IOL calculations.



OD right — **Corneal values** — **OS** left

Eye status

OD		OS	
LS: Phakic	VS: Vitreous body	LS: Phakic	VS: Vitreous body
Ref: ---	VA: ---	Ref: ---	VA: ---
LVC: LASIK		LVC: LASIK	

Corneal values

OD			OS	
SE: 40.04 D	(!)	SD: 0.02 D	SE: ---	
K1: 39.47 D	@ 138°	SD: 0.02 D	K1: ---	
K2: 40.63 D	@ 48°	SD: 0.03 D	K2: ---	
ΔK: -1.16 D	@ 138°		ΔK: ---	
SE: 40.06 D	ΔK: -1.17 D	@ 137°	SE: ---	ΔK: ---
SE: 40.03 D	ΔK: -1.15 D	@ 139°	SE: ---	ΔK: ---
SE: 40.11 D	ΔK: -1.04 D	@ 138°	SE: ---	ΔK: ---

Total Keratometry

OD			OS	
TSE: 39.41 D	(!)	SD: 0.04 D	TSE: ---	
TK1: 38.76 D	@ 135°	SD: 0.07 D	TK1: ---	
TK2: 40.08 D	@ 45°	SD: 0.04 D	TK2: ---	
ΔTK: -1.32 D	@ 135°		ΔTK: ---	
TSE: 39.44 D	ΔTK: -1.36 D	@ 135°	TSE: ---	ΔTK: ---
TSE: 39.39 D	ΔTK: -1.29 D	@ 134°	TSE: ---	ΔTK: ---
TSE: 39.47 D	ΔTK: [illegible]	@ 138°	TSE: ---	ΔTK: ---

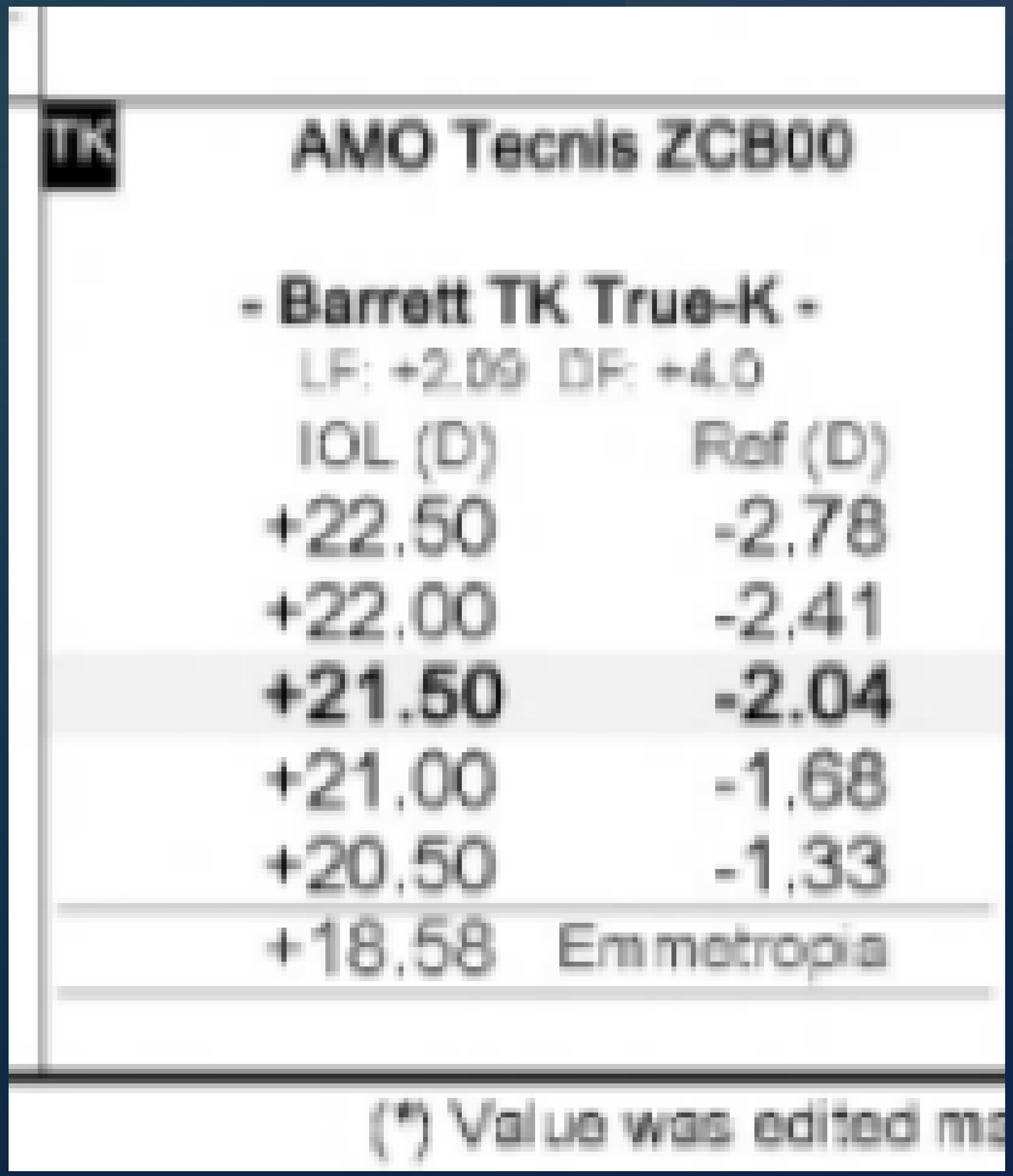
Corneal back surface values

OD			OS	
PSE: -6.00 D	(!)	SD: 0.02 D	PSE: ---	
PK1: -5.94 D	@ 2°	SD: 0.06 D	PK1: ---	
PK2: -6.06 D	@ 92°	SD: 0.04 D	PK2: ---	
ΔPK: -0.12 D	@ 92°		ΔPK: ---	
PSE: -5.99 D	ΔPK: -0.10 D	@ 99°	PSE: ---	ΔPK: ---
PSE: -5.99 D	ΔPK: [illegible]	@ 89°	PSE: ---	ΔPK: ---
PSE: -6.02 D	ΔPK: ---		PSE: ---	ΔPK: ---

Other values

OD			OS		
CCT: 496 µm	SD: 5 µm		CCT: ---		
WTW: 12.0 mm	Ix: +0.7 mm	Iy: +0.1 mm	WTW: ---	Ix: ---	Iy: ---
P: 3.8 mm	CW-Chord: 0.7 mm @ 125°		P: ---	CW-Chord: ---	

(!) Borderline value (*) Value was edited manually --- No value measured



TK AMO Tecnis ZCB00

- Barrett TK True-K -

LF: +2.09 DF: +4.0

IOL (D)	Ref (D)
+22.50	-2.78
+22.00	-2.41
+21.50	-2.04
+21.00	-1.68
+20.50	-1.33
+18.58	Emmetropia

(*) Value was edited ma