Missed it by that much

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Disclosures

- No financial disclosures

DoD Disclaimer

- ***"The views expressed are those of the presenter and do not reflect the official views or policy of the Department of Defense or its Components"***

HPI

- 30yo F initially underwent LASIK in 2014. Reports blurred vision OS since POD #1.

Past History

- POHx: LASIK July 2014 OU (details next slide)
- Ocular meds: None
- PMHx: None
- PSHx: None
- Soc Hx: None
- Allergies: NKDA
- Fam OHx: None

Pre-op LASIK: July 2014

	OD	**OS**
UCVA	20/400	20/400
BCVA	20/15	20/15
Manifest Rx	-7.25 – 0.50 x 030	-7.75 – 0.25 x 170
K1/2	44.00 / 45.00	44.12 / 44.87

Treatment: 21 July 2014

	OD	**OS**
Treatment	-7.39 – 0.67 x 027	-7.88 – 0.30 x 001
Optical / Ablation Zones	6.2 x 6.0mm / 8.0mm	6.1 x 6.0mm / 8.0mm
Total ablation depth	123um	120um
ActiveTrak	Enabled, Auto Centering	Not Enabled, Manually tracked
Iris Registration	Enabled, 6.1 Counterclockwise	Not Enabled

Post-op VA 2014

Post-op	OD UCVA	OS UCVA	OS BCVA
Day 1	20/25	20/150	
1 week	20/20	20/100-	20/80
2 weeks	20/20	20/70-	
1 month	20/15	20/70-	20/70-
3 month	20/15	20/80+	20/30
6 month	20/15	20/70-	20/60
11 month	20/15	20/80-	20/70
12 month	20/15	20/60 (scleral lens)	20/40-
4 year	20/15	20/70-	20/40

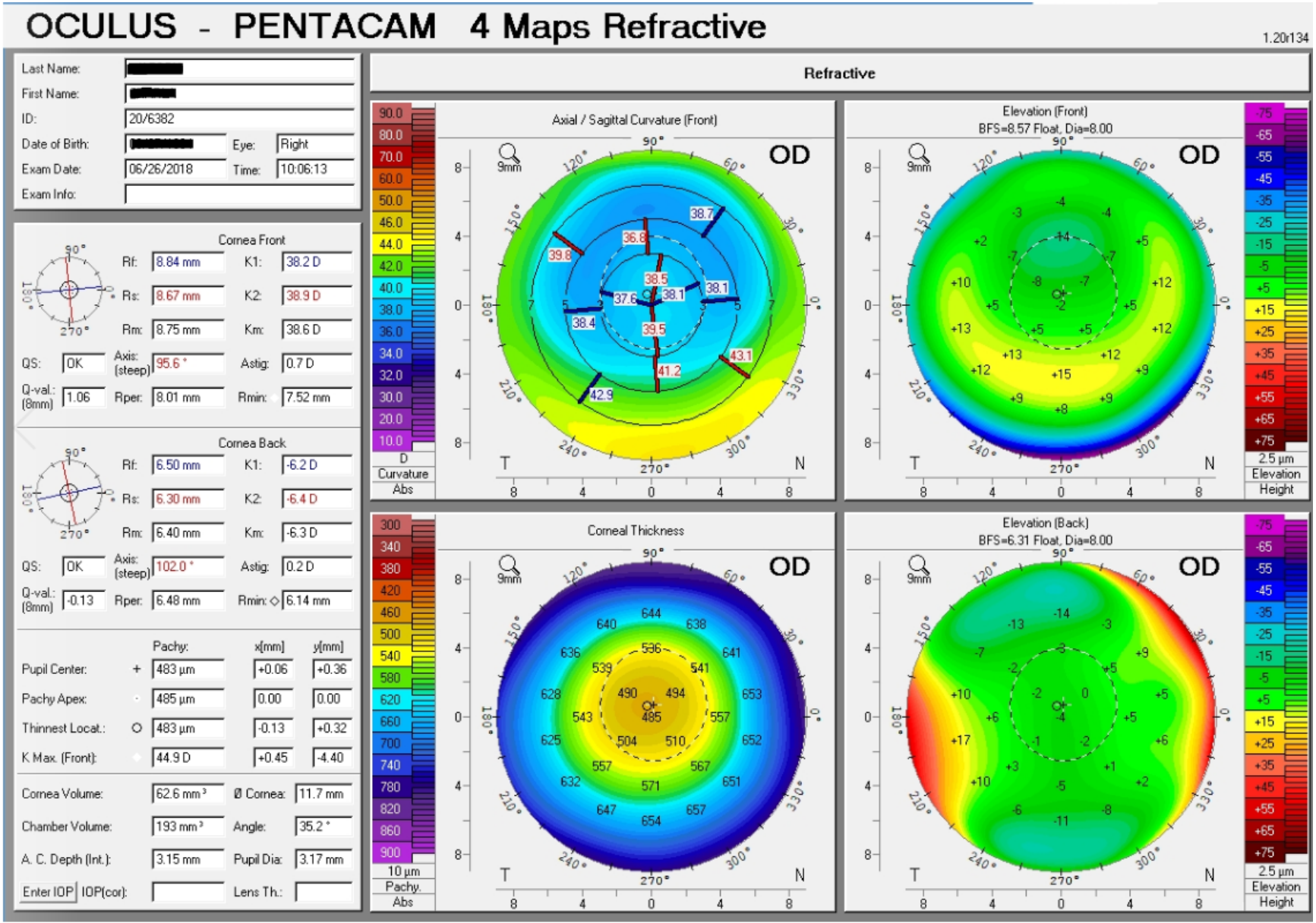
SLE: 26 June 2018

	OD	**OS**
Ext	No ptosis/proptosis	No ptosis/proptosis
LLL	Normal	Normal
C/S	W&Q	W&Q
K	Clear, No haze/scarring	Clear, No haze/scarring
A/C	D&Q	D&Q
I	R&F	R&F
L	Clear	Clear
Vit	Clear	Clear

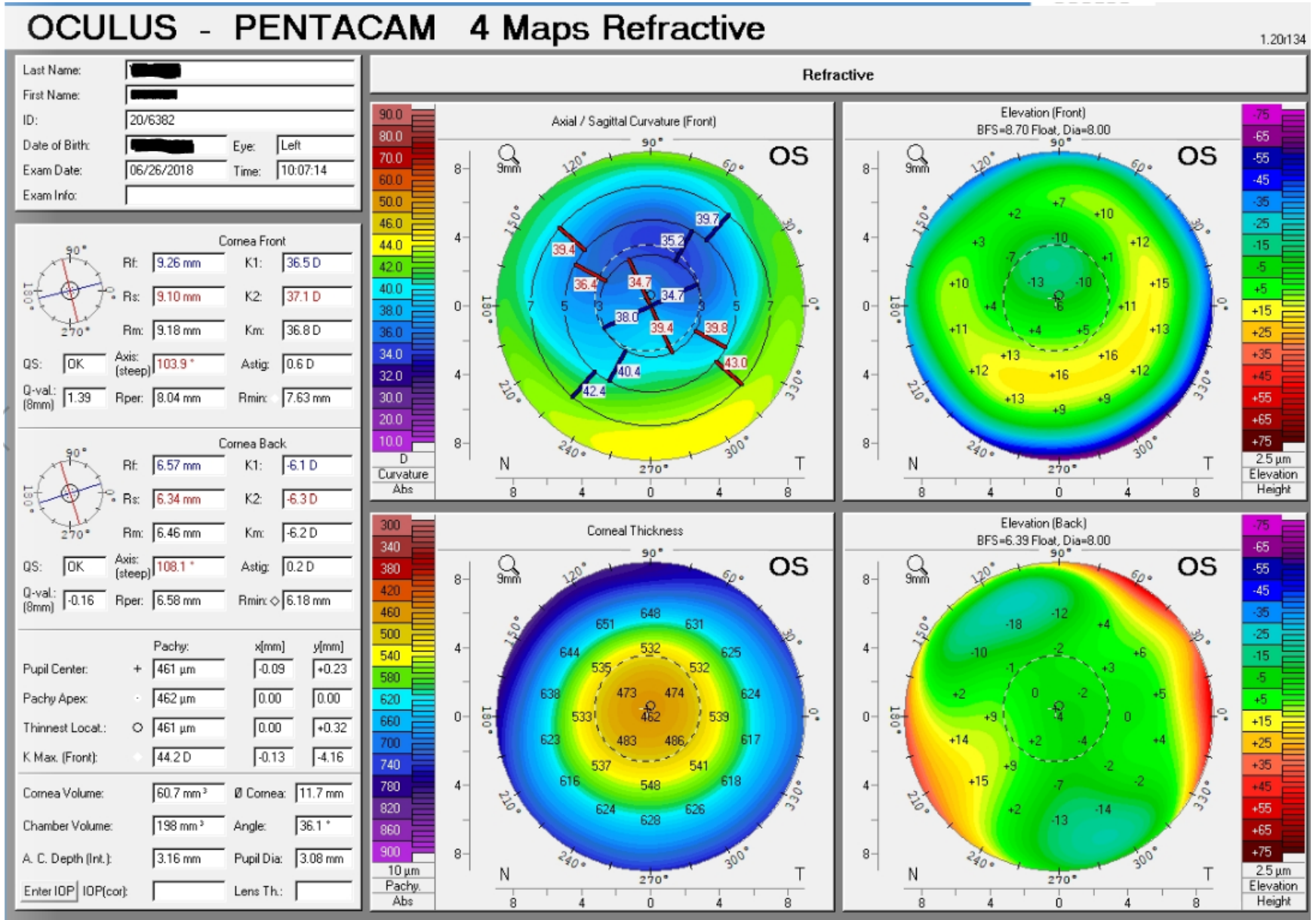
Dilated Fundus Exam

- OD: Disc: C/D 0.30; Vitreous clear; Macula: flat; Vessels: wnl; Periphery: flat 360
- OS: Disc: C/D 0.30; Vitreous clear; Macula: flat; Vessels: wnl; Periphery: flat 360

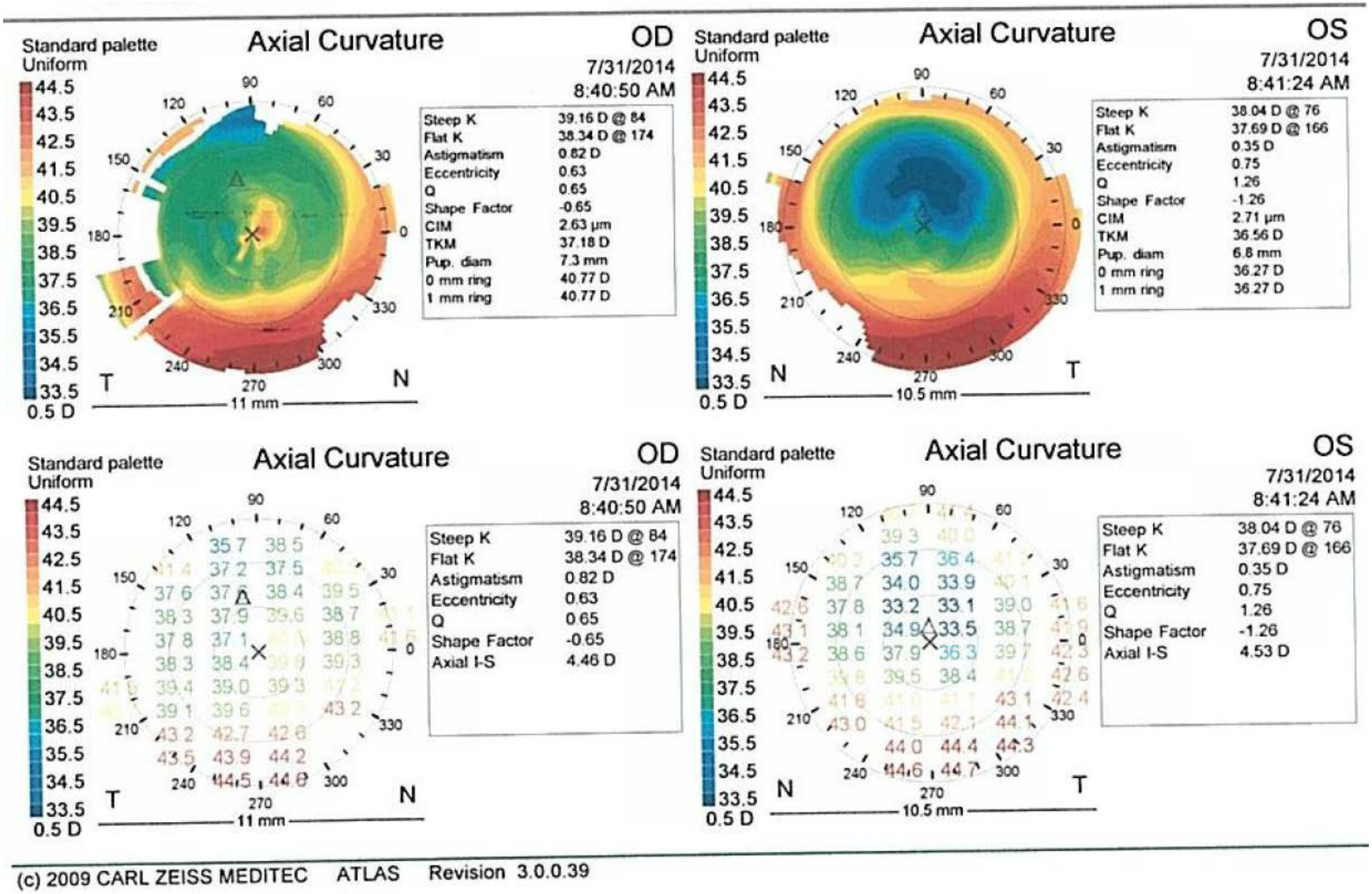
26 June 2018: Topo OD



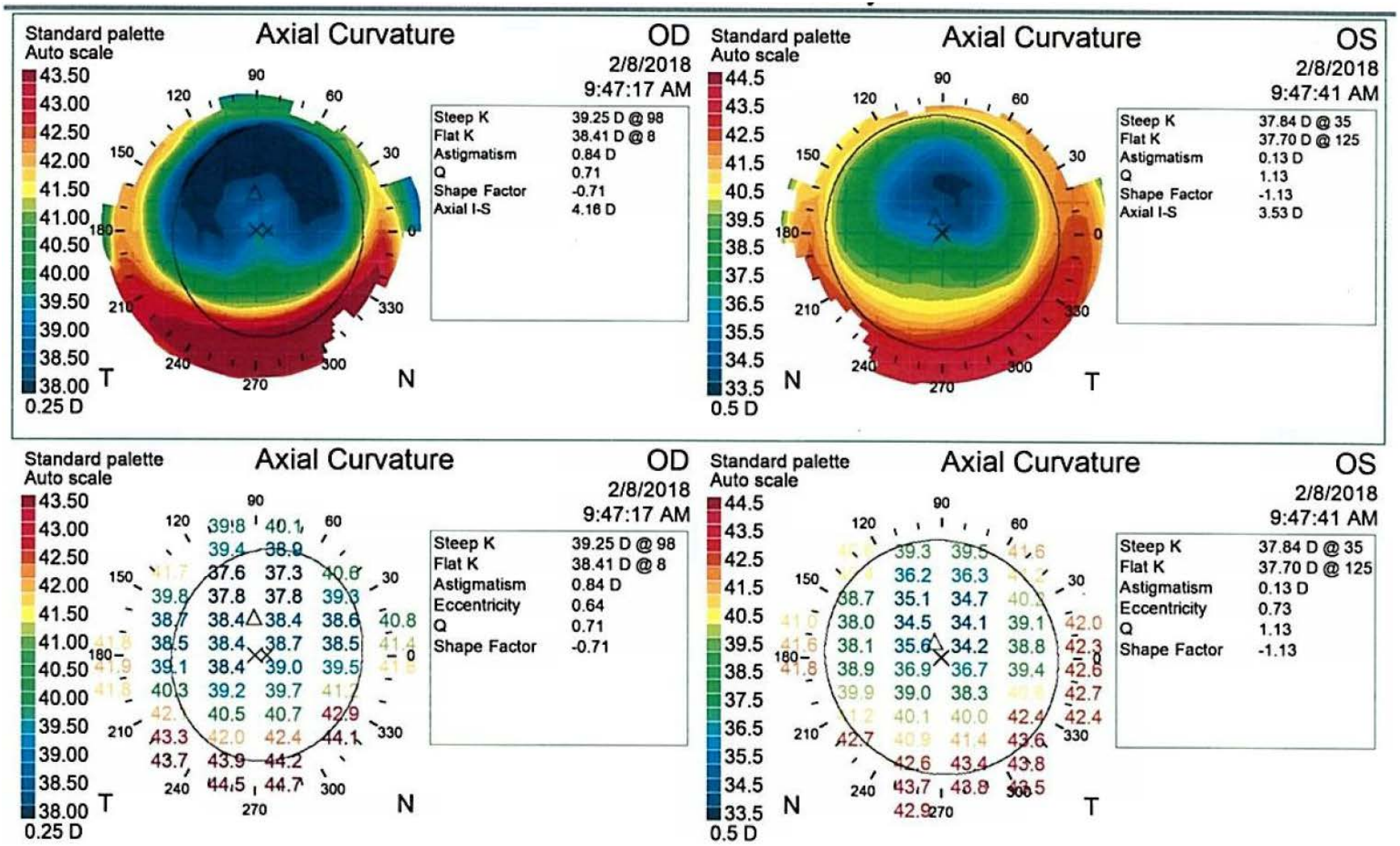
26 June 2018: Topo OS



Immediate Post-op July 2014: Topo



Feb 2018: Topo



DDx ↓ VA s/p LASIK at 4 years out

- Over / under treatment
- Ectasia
- Regression
- Decentered ablation

Over / under treatment?

	OD	**OS**
Manifest Rx	-7.25 – 0.50 x 030	-7.75 – 0.25 x 170
Treatment	-7.39 – 0.67 x 027	-7.88 – 0.30 x 001

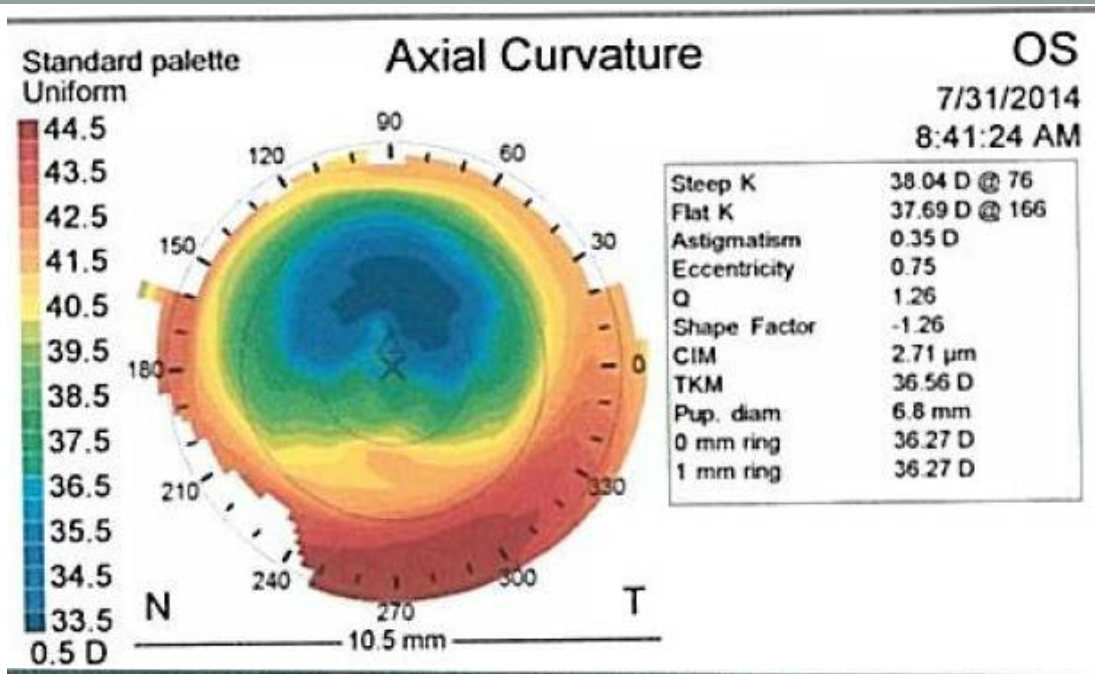
DDx ↓ VA s/p LASIK at 4 years out

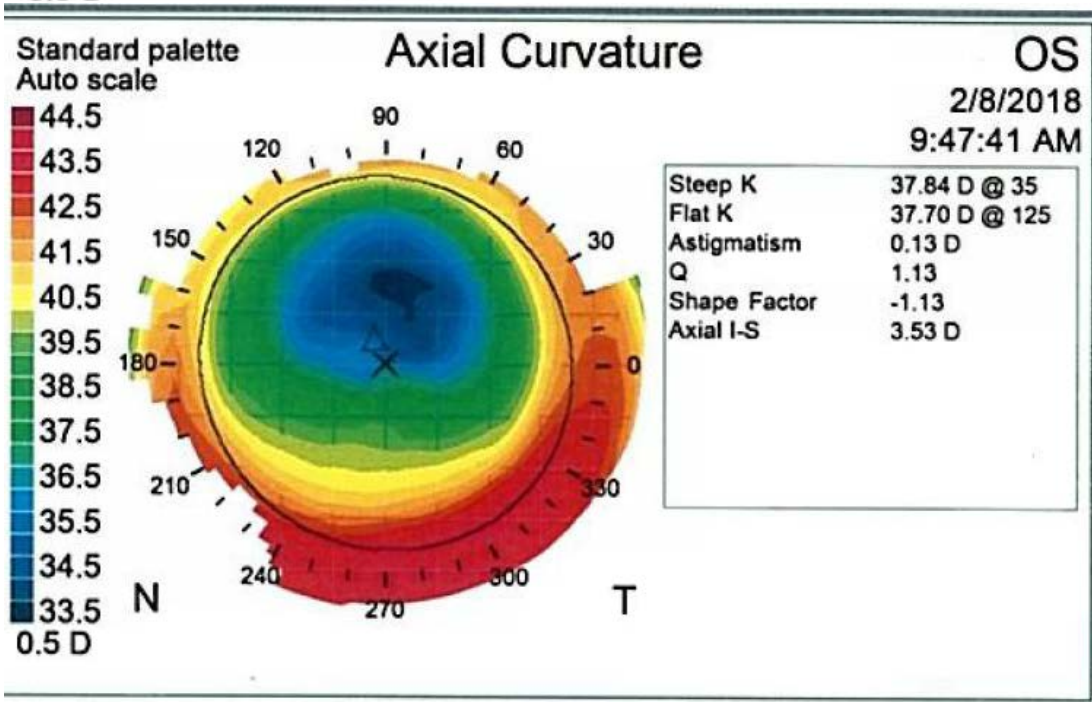
- ~~Over / under treatment~~
- Ectasia
- Regression
- Decentered ablation

Regression / Ectasia?

31 July 2014

08 Feb 2018

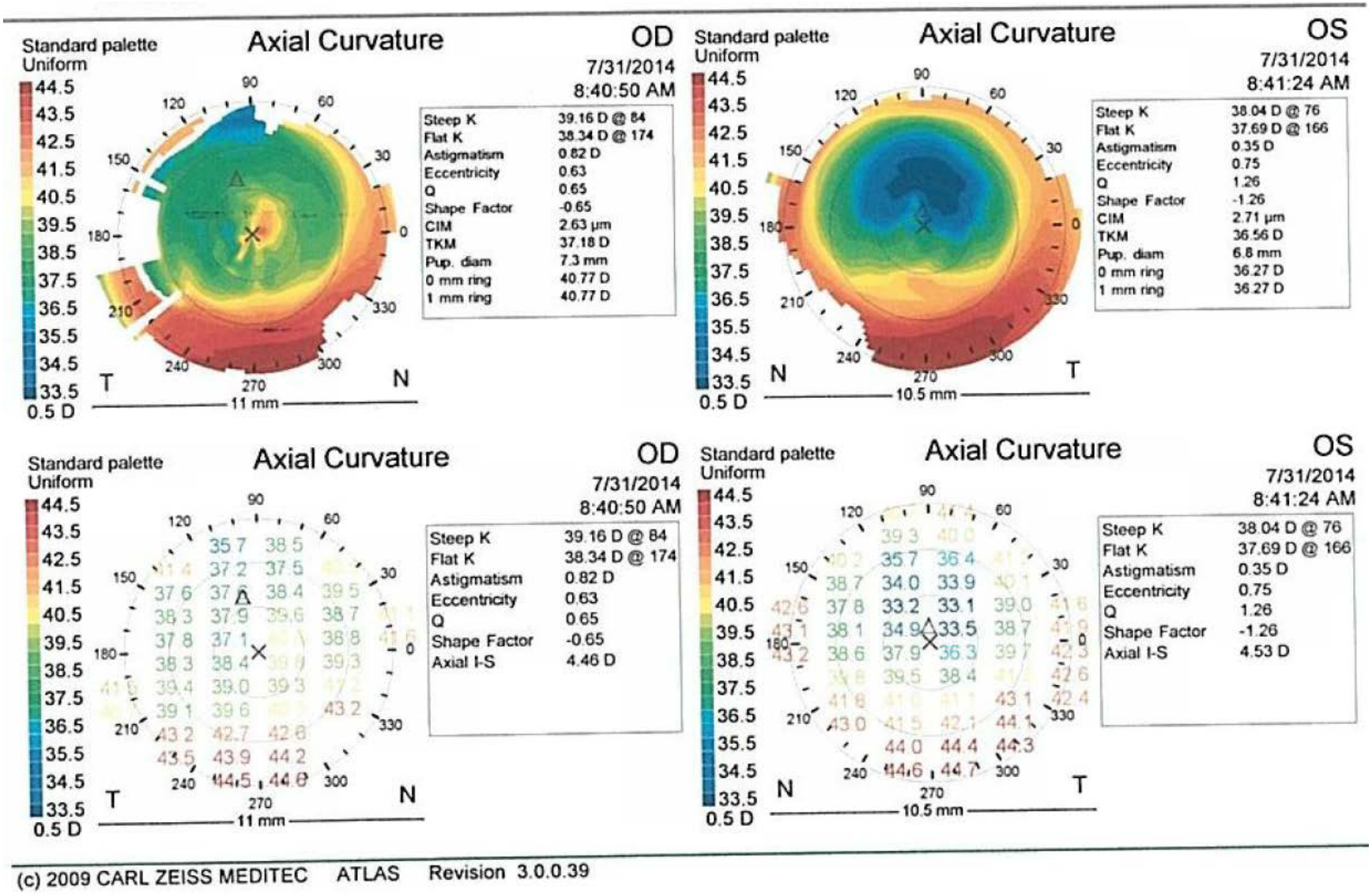




DDx ↓ VA s/p LASIK at 4 years out

- ~~Over / under treatment~~
- ~~Ectasia~~
- ~~Regression~~
- Decentered ablation

Immediate Post-op July 2014: Topo



Decentered Ablation: Signs / Sx

- Sx:
  - Glares / halos
  - Ghost images
  - Blurred vision
- Signs:
  - Ablation zone decentration on corneal topography
  - Increased higher-order aberrations
  - Reduced BCVA improved only with RGP lenses
  - Cylinder on ARx and WF differing from MRx
  - Reduced VA immediately post-op that fails to improve

Decentered Ablation: Etiologies

- Patient factors:
  - Poor patient instruction
  - Anxiety
  - Over-sedation
  - Difficulty seeing target
    - High refractive error
    - Exposed stromal bed
- Technique:
  - Manually tracking the iris
  - Improper stabilization of eye
  - Pupil centroid shift / cyclotorsion

Decentered Ablation: Management

- Historical:
  - Gas permeable lenses
- Present:
  - PRK: Mild decentration
    - Small (3 - 4 mm) ablation at original optical zone edge
    - Series of small ablations at decentered ablation edge followed by PTK
  - LASIK:
    - Conventional enhancement
    - Custom-CAP
    - Topo-guided
    - Wavefront-driven

Novel Treatments

- Future:
  - Phorcides / Contura – TCN-guided

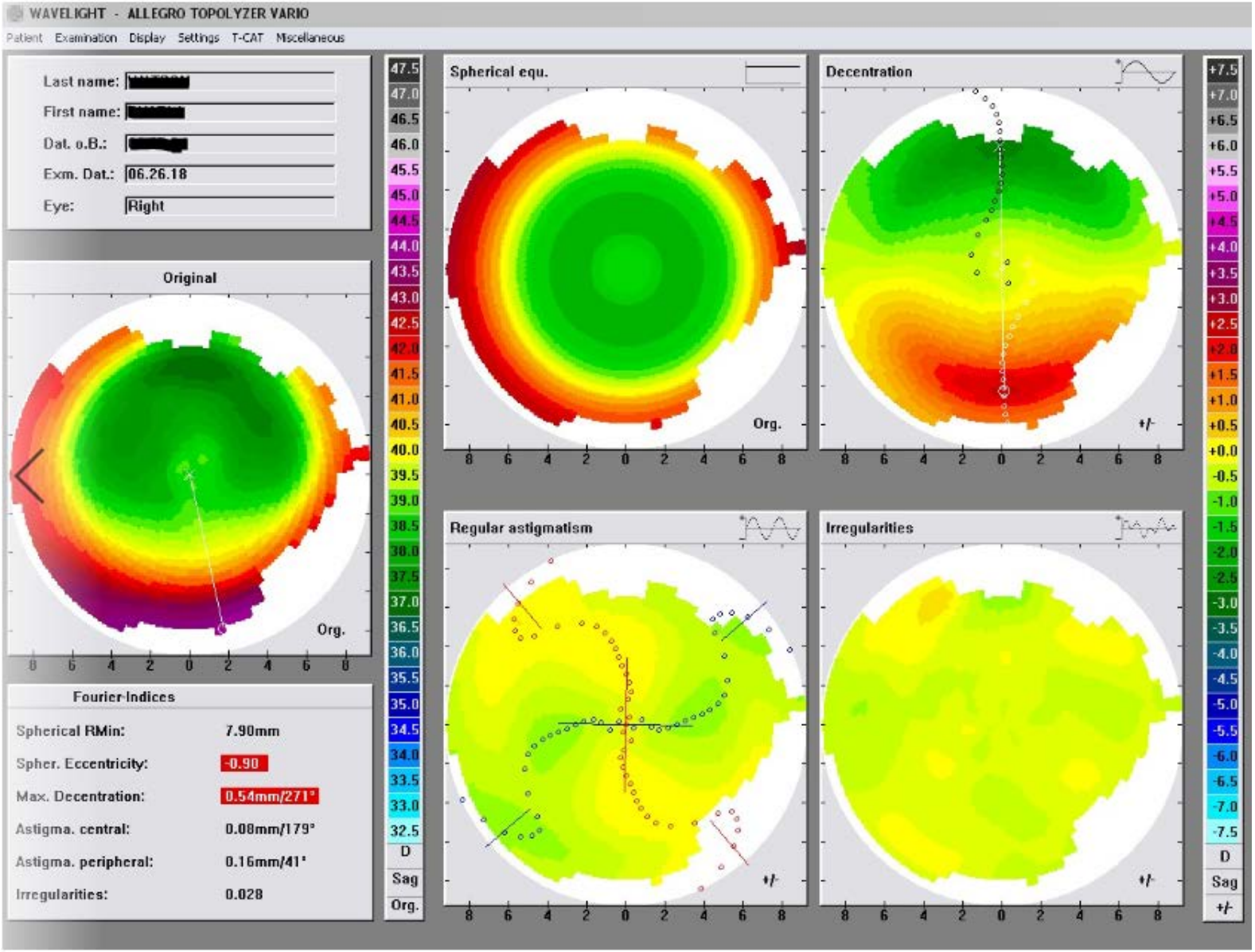
Topography-Cylinder-Nomogram-guided ablation (Phorcides)

- Analytic / Mathematical approach
- Combines topography with true corneal cylinder
- Able to predict significant contributions from posterior cornea and lens

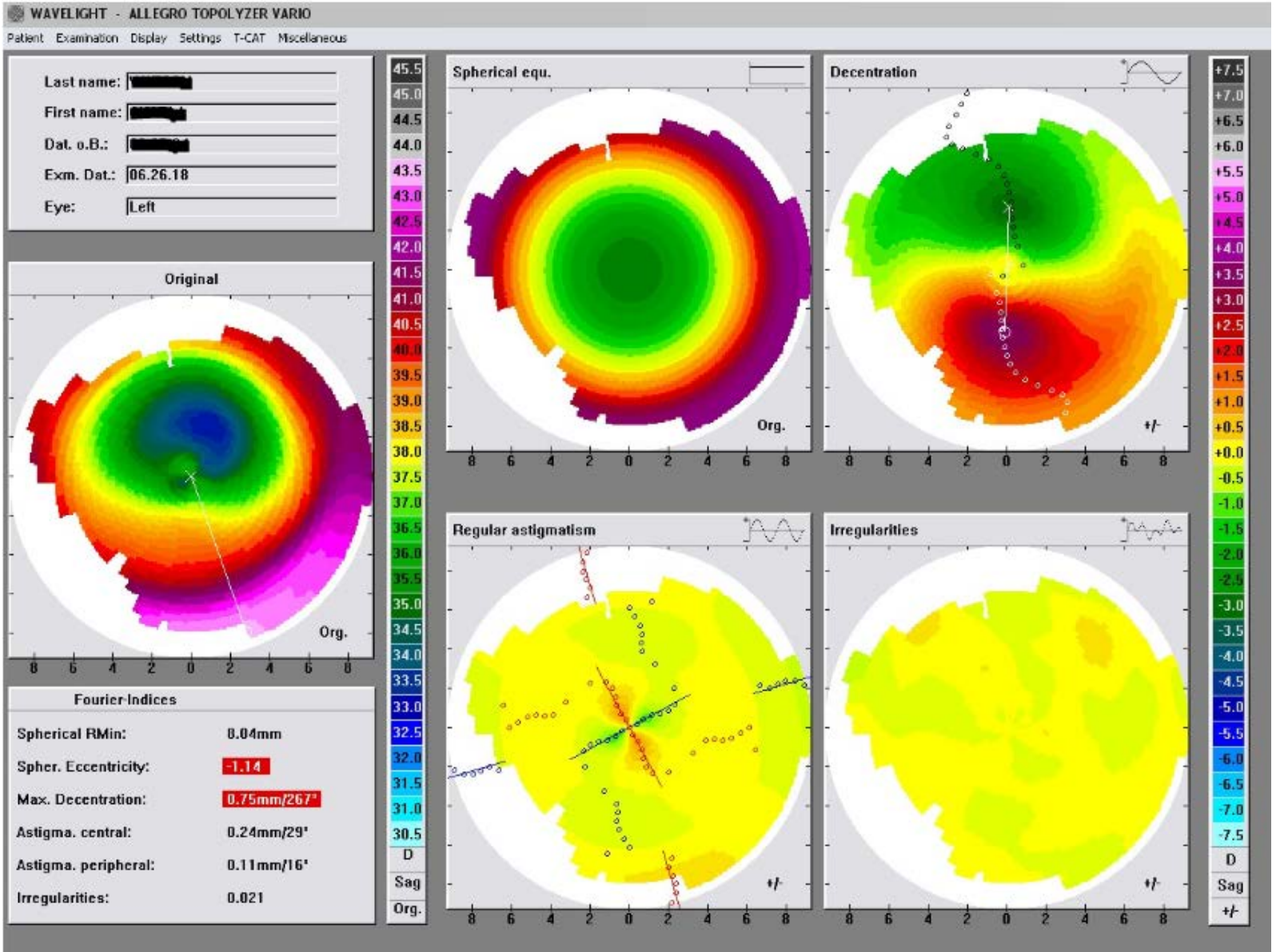
Course Cont.

- Transferred to Civilian provider for LASIK Enhancement using TCN-guided / Contura on 04 Oct 2018.

26 June 2018: Pre-op OD



26 June 2018: Pre-op OS



LASIK Enhancement: 04 Oct 2018

	OS
Manifest Rx	+4.20 + 1.25 x 177
Optical / Ablation Zones	6.0mm / 8.7mm
Total ablation depth	110um

SLE: 22 Oct 2018 (Post-op 2.5 wks)

	OD	**OS**
Ext	No ptosis/proptosis	No ptosis/proptosis
LLL	Normal	Normal
C/S	W&Q	W&Q
K	Clear	No epi ingrowth / DLK / microstriae
A/C	D&Q	D&Q
I	R&F	R&F
L	Clear	Clear
Vit	Clear	Clear

S/p LASIK Enhancement

Post-op	OD UCVA	OS UCVA	OS BCVA
POD #1	20/15	20/40-3	
POW #2	20/15	20/50+	20/50
POM #2	20/15	20/40-	20/40

OCULUS - PENTACAM Holladay Report

1.21r43

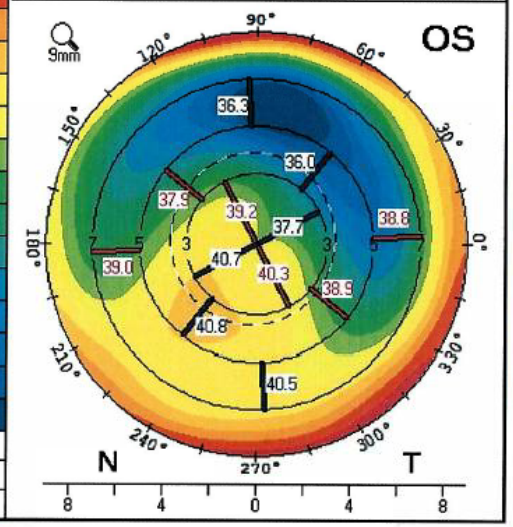
Last Name:	[redacted]		
First Name:	[redacted]		
ID:	447-94-6382		
Date of Birth:	[redacted]	Eye:	Left
Exam Date:	11/29/2018	Time:	10:35:31

Equiv K-Readings 65 (4.5mm Zone) — Details

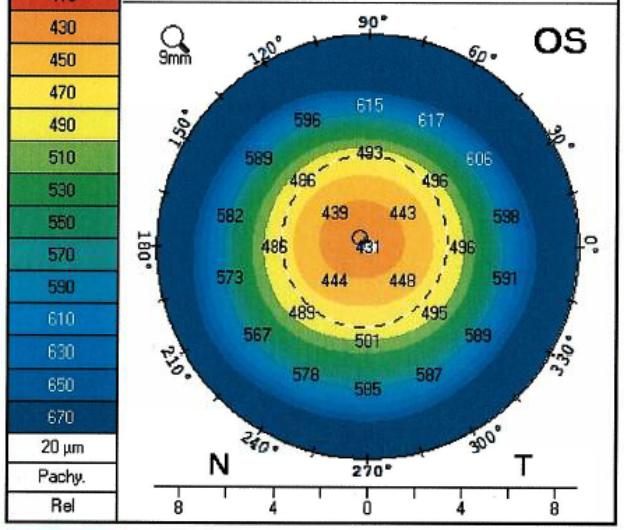
EKR65 Flat K1:	39.27 D (39 °)	Q (6.0mm):	0.05
EKR65 Steep K2:	39.65 D (129 °)	Total SA: Z(4+6+8,0)	-0.215 µm
EKR65 Mean:	39.46 D	Radii Ratio (B/F):	74.7 %
Astig EKR65:	0.38 D	RMS HOA WE (6mm):	1.395 µm

Pupil Dia:	+	3.58 mm	x:	0.08 mm N	y:	0.11 mm S (rel. to VN)
HWTW:	[ ]		x:		y:	(rel. to VN)
Pachy Min:	○	430 µm	x:	0.19 mm N	y:	0.19 mm S (rel. to VN)
Est. Pre-Refr. Km:		43.3 D	Refr.Change	-3.8 D		
A. C. Depth (Ext.):		3.60 mm	Chord µ:	0.13 mm	QS:	OK

Axial / Sagittal Curvature (Front)

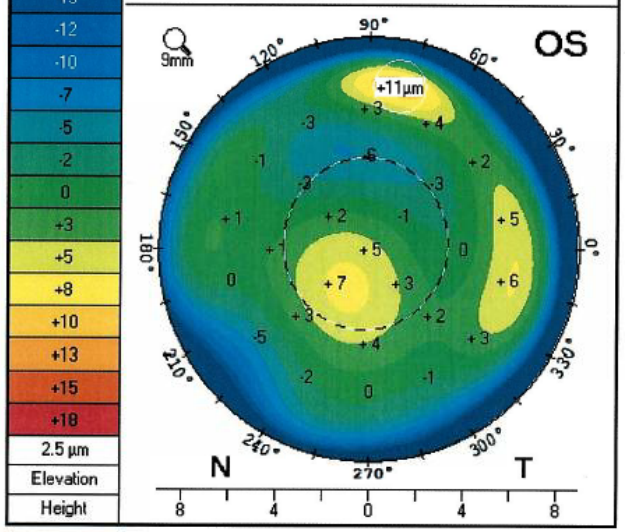


Corneal Thickness

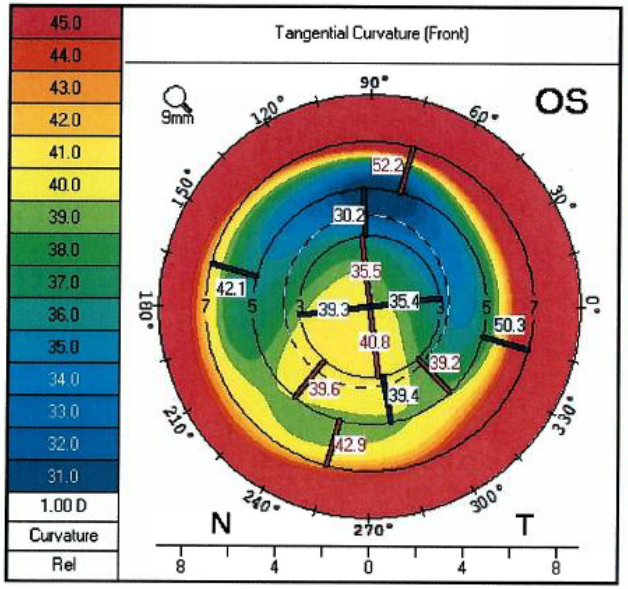


Elevation (Front)

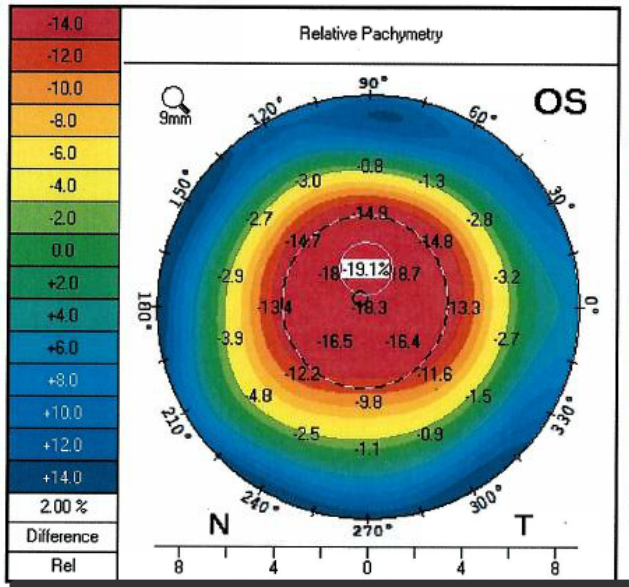
BFTEF=8.48/8.59 Q=-0.22 Float, Dia=8.00



Tangential Curvature (Front)

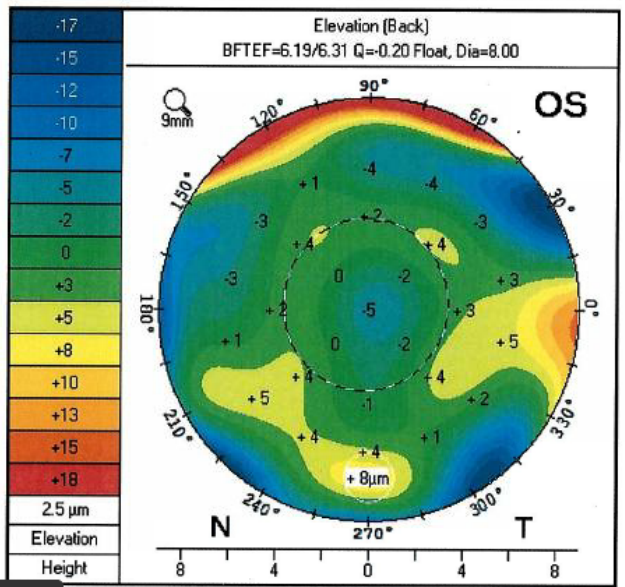


Relative Pachymetry



Elevation (Back)

BFTEF=6.19/6.31 Q=-0.20 Float, Dia=8.00



Conclusion: Decentered ablations

- Numerous etiologies
  - i.e. Manually tracking the iris during treatment
- LASIK enhancements remain difficult
  - Varying outcomes
- Treatment continues to improve
  - TCN-guided ablations: outperformed standard LASIK models
    - Enhancements/complicated patients
    - All comers
  - Phorcides: consistent and reliable outcomes on both enhancements and initial LASIK treatments

Special Thanks

- Dr. Gary Legault
- Dr. Mark Lobanoff

References

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- *Jain AK, Malhotra C, Pasari A, Kumar P, Moshirfar M. Outcomes of topography-guided versus wavefront-optimized laser in situ keratomileusis for myopia in virgin eyes. JCRS 2016; 42:9:1302-1311.*
- *Stulting RD, Fant BS, Bond W, Chotiner B, Durrie D, Gordon M, Milauskas A, Moore C, Slade S, Randleman JB, Stonecipher K. Results of topography-guided laser in situ keratomileusis custom ablation treatment with a refractive excimer laser. JCRS 2016; 42:1:11-18.*

Discussion

- Experience with decentered ablations
  - Treatments utilized
  - Threshold for enhancement
- Military relevance
  - Safety of TCN-guided ablations operationally

Decentered Ablation

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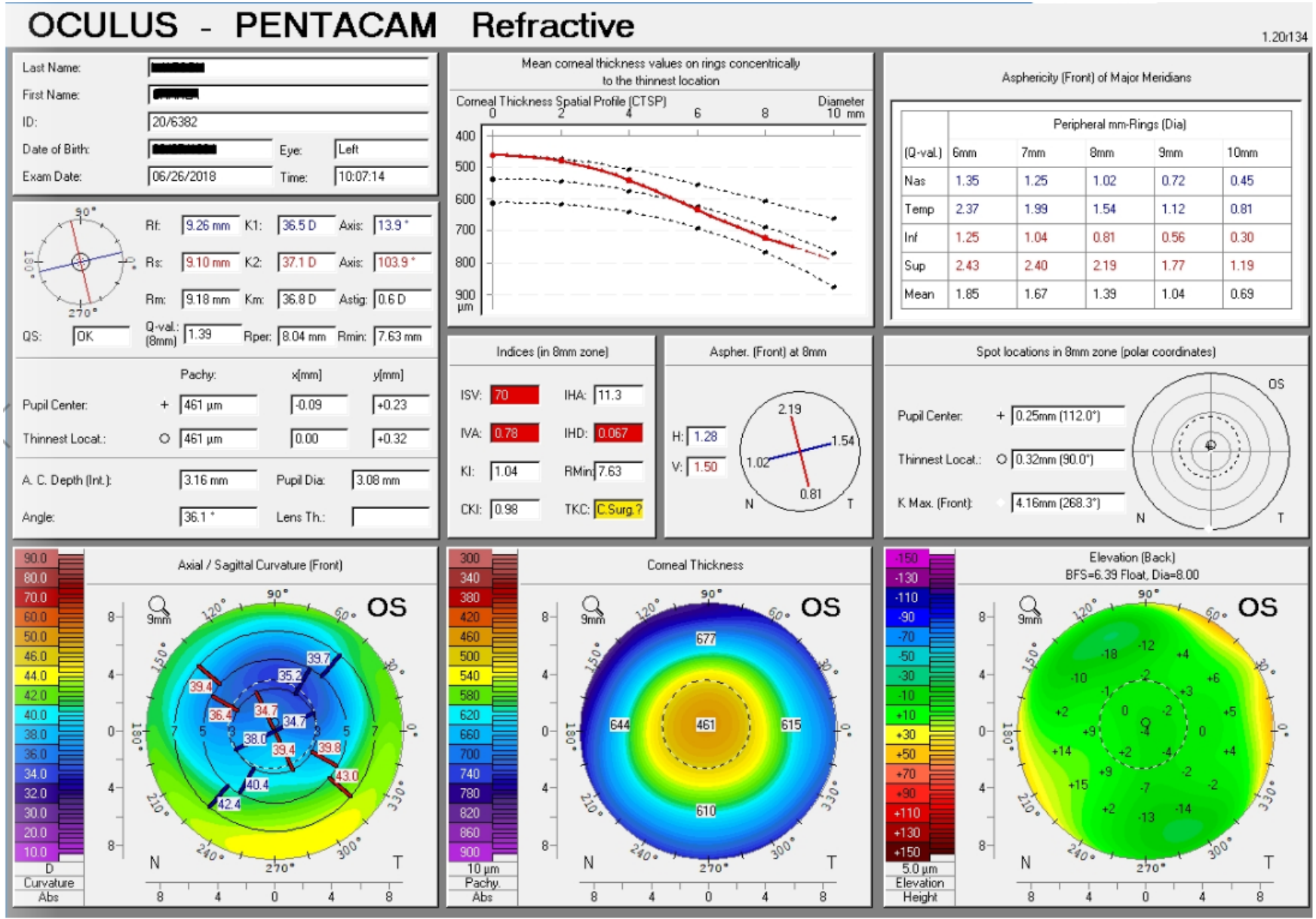
09 Jan 2019

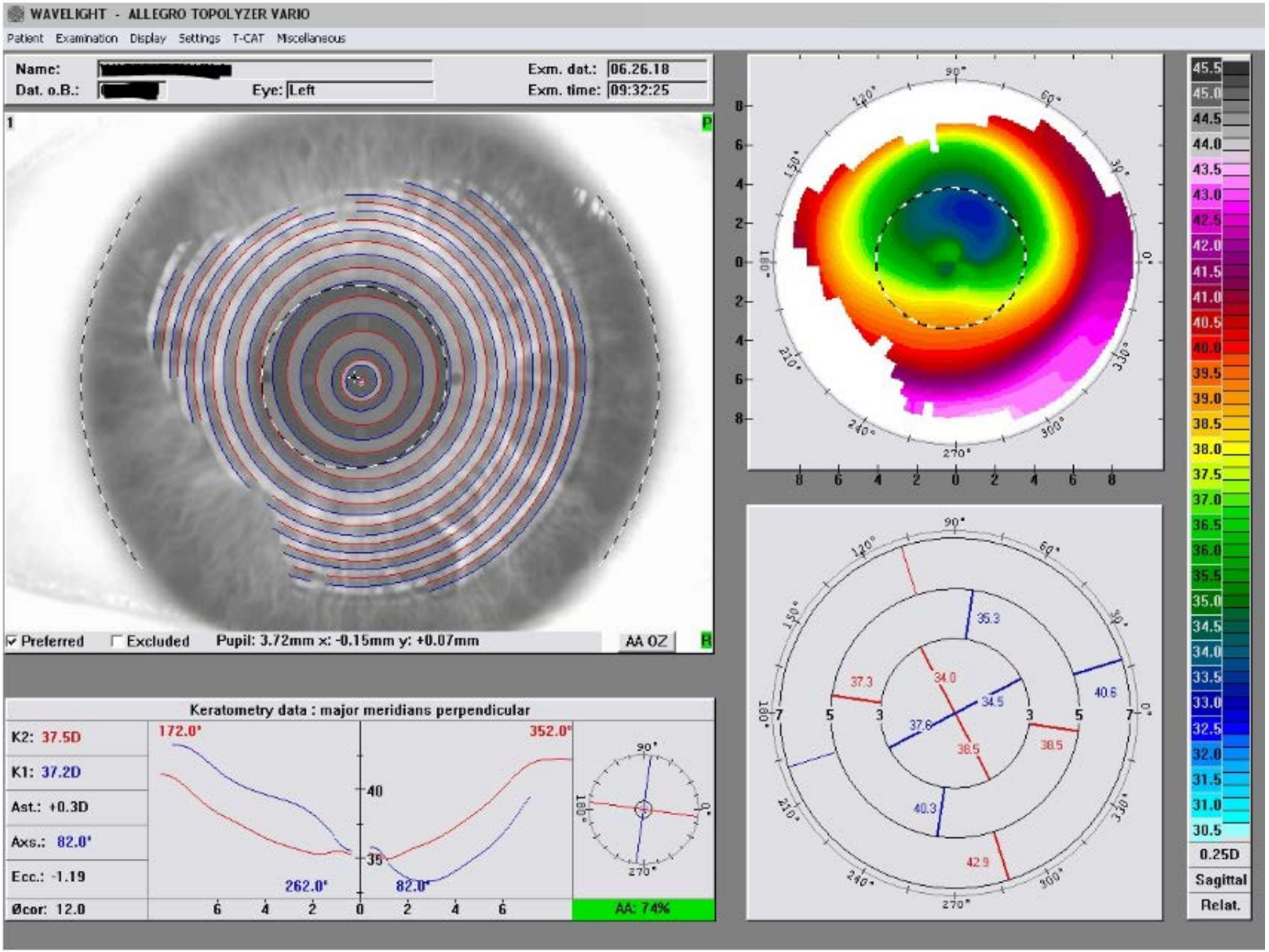
Thank you

Additional slides for reference

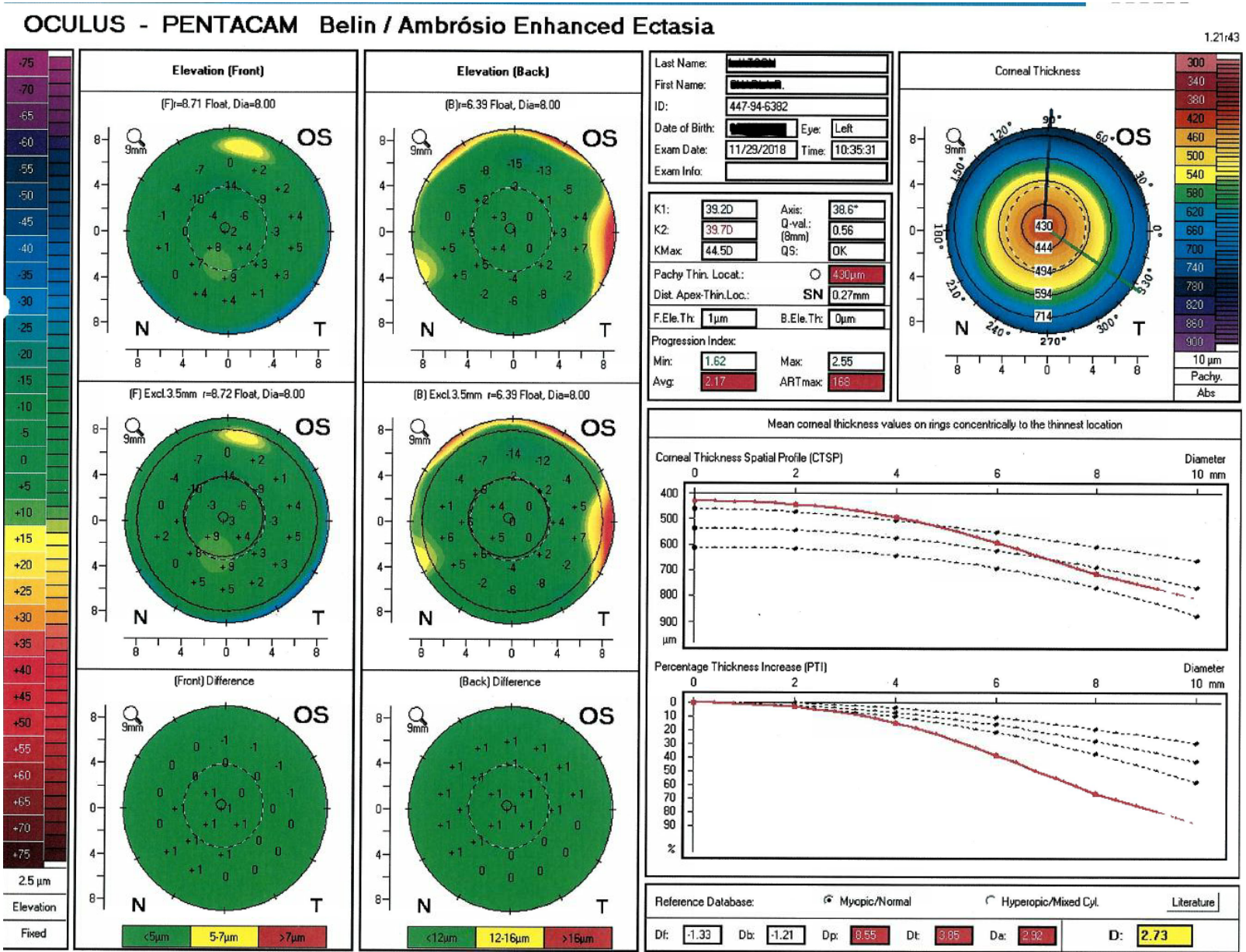
26 June 2018: Topo OS



Pre-op 26 June 2018: OS



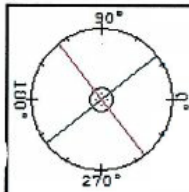
Post-op: 29 Nov 18



OCULUS - PENTACAM Refractive

1.21r43

Last Name:	[redacted]		
First Name:	[redacted]		
ID:	447-94-6382		
Date of Birth:	[redacted]	Eye:	Left
Exam Date:	11/29/2018	Time:	10:35:31

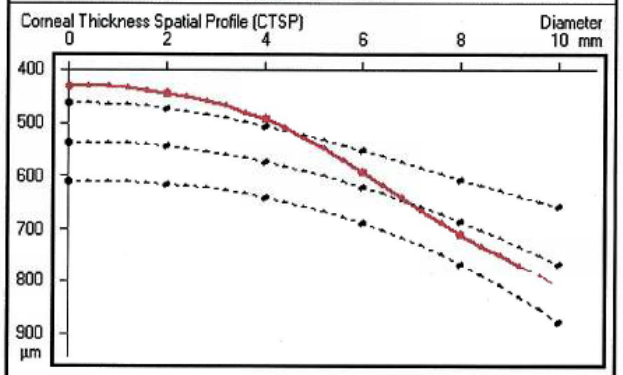


Rf:	8.61 mm	K1:	39.2 D	Axis:	38.6 °
Rs:	8.50 mm	K2:	39.7 D	Axis:	128.6 °
Rm:	8.55 mm	Km:	39.5 D	Astig:	0.5 D
QS:	OK	Q-val. (8mm):	0.56	Rper:	8.37 mm
				Rmin:	7.59 mm

		Pachy:	x[mm]	y[mm]
Pupil Center:	+	430 µm	-0.08	+0.11
Thinnest Locat.:	○	430 µm	-0.19	+0.19

A. C. Depth (Int.):	3.17 mm	Pupil Dia:	3.58 mm
Angle:	36.1 °	Lens Th.:	

Mean corneal thickness values on rings concentrically to the thinnest location



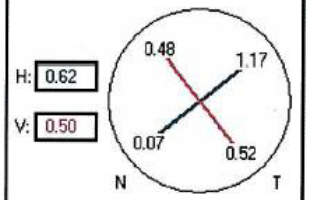
Asphericity (Front) of Major Meridians

(Q-val.)	Peripheral mm-Rings (Dia) 6mm	7mm	8mm	9mm	10mm
Nas	-0.12	-0.03	0.07	0.13	0.13
Temp	0.61	1.02	1.17	1.06	0.77
Inf	0.21	0.41	0.52	0.50	0.37
Sup	-0.50	0.04	0.48	0.66	0.55
Mean	0.05	0.36	0.56	0.59	0.46

Indices (in 8mm zone)

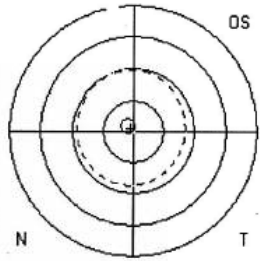
ISV:	42	IHA:	16.8
IVA:	0.56	IHD:	0.056
KI:	1.09	RMin:	7.59
CKI:	1.03	TKC:	Post Cor

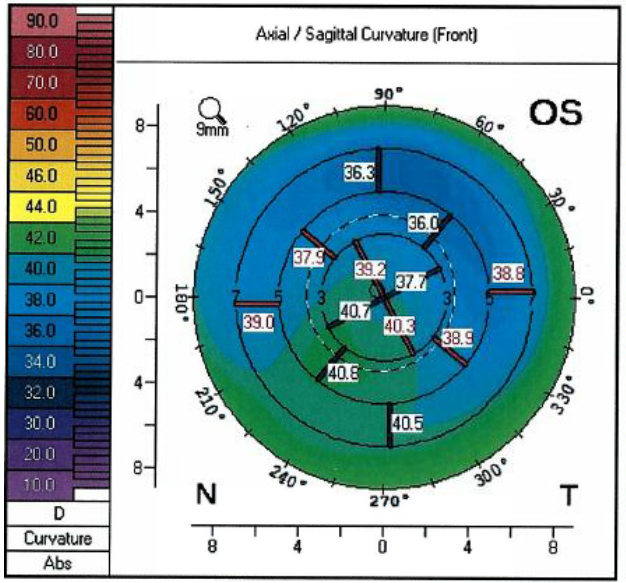
Asphericity (Front) at 8mm

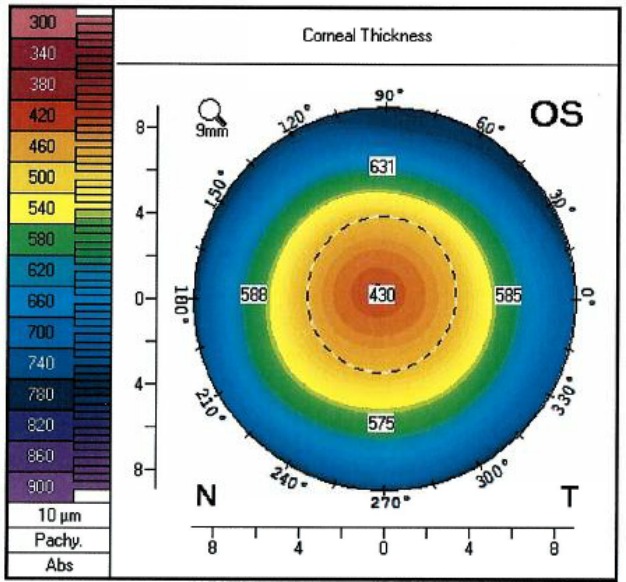


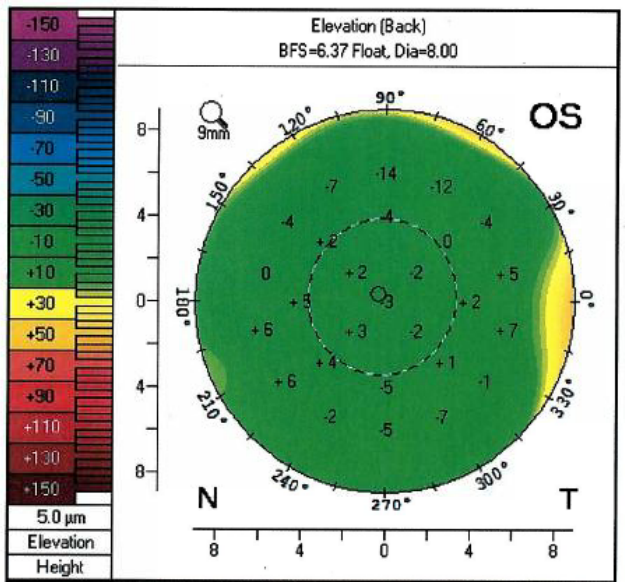
Spot locations in 8mm zone (polar coordinates)

Pupil Center:	+	0.13mm (128.1°)
Thinnest Locat.:	○	0.27mm (135.0°)
K Max. (Front):		4.91mm (100.3°)









OCULUS - PENTACAM Topometric / KC Staging

1.21r43

Last Name:	[redacted]		
First Name:	[redacted]		
ID:	447-94-6382		
Date of Birth:	[redacted]	Eye:	Left
Exam Date:	11/29/2018	Time:	10:35:31
Exam Info:			

Cornea Front

Rf:	8.61 mm	K1:	39.2 D
Rs:	8.50 mm	K2:	39.7 D
Rm:	8.55 mm	Km:	39.5 D
QS: OK	Axis: (steep) 128.6°	Astig:	0.5 D
Q-val.: (8mm) 0.56	Rper: 8.37 mm	Rmin:	7.59 mm

Cornea Back

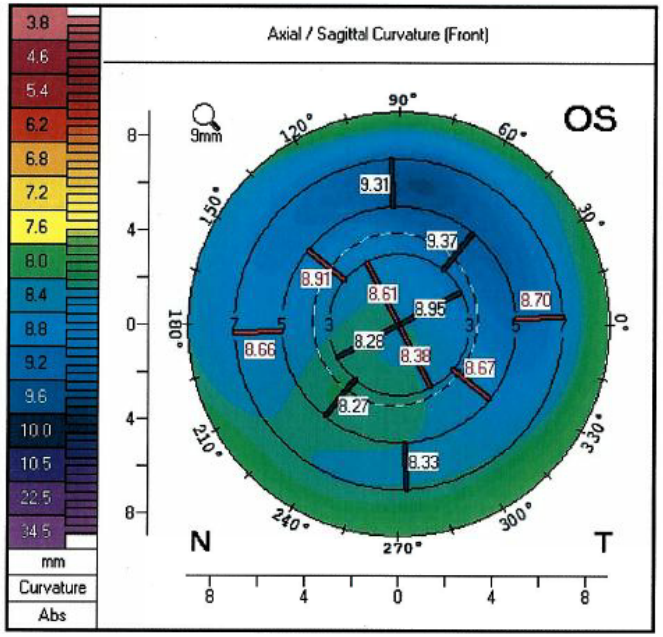
Rf:	6.49 mm	K1:	-6.2 D
Rs:	6.33 mm	K2:	-6.3 D
Rm:	6.41 mm	Km:	-6.2 D
QS: OK	Axis: (steep) 92.7°	Astig:	0.2 D
Q-val.: (8mm) -0.16	Rper: 6.53 mm	Rmin: ◇	6.21 mm

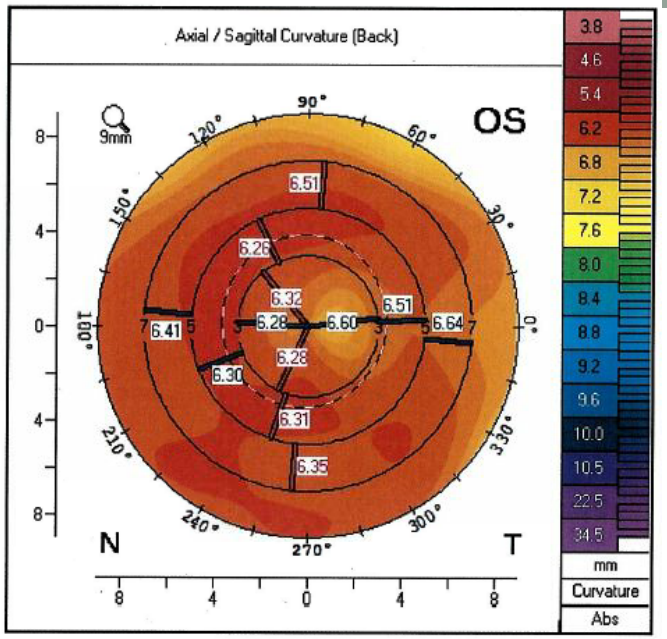
True Net Power

Astig:	0.5 D	K1:	37.6 D
Axis: (stp.)	132.1°	K2:	38.1 D
P.Max.:	41.4 D	Km:	37.8 D

	Pachy:	x[mm]	y[mm]
Pupil Center: +	430 µm	-0.08	+0.11
Pachy Apex: ·	431 µm	0.00	0.00
Thinnest Locat.: ○	430 µm	-0.19	+0.19
K Max. (Front):	44.5 D	-0.88	+4.83

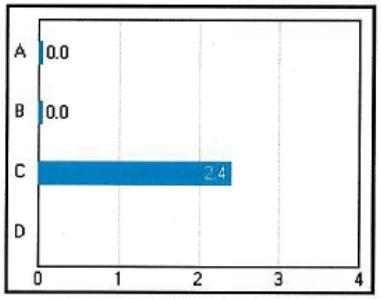
Cornea Volume:	59.0 mm³	KPD:	+1.5 D
Chamber Volume:	206 mm³	Angle:	36.1°
A. C. Depth (Int.):	3.17 mm	Pupil Dia:	3.58 mm
IOP(cor):		Lens Th.:	





Belin ABCD Keratoconus Staging

ARC (3mm Zone):	8.49 mm
PRC (3mm Zone):	6.47 mm
Thinnest Pachy:	430 µm
DCVA:	



A0 B0 C2 D

Asphericity (Front) of Major Meridians

(Q-val.)	Peripheral mm-Rings (Dia) 6mm	7mm	8mm	9mm	10mm
Nas	-0.12	-0.03	0.07	0.13	0.13
Temp	0.61	1.02	1.17	1.06	0.77
Inf	0.21	0.41	0.52	0.50	0.37
Sup	-0.50	0.04	0.48	0.66	0.55
Mean	0.05	0.36	0.56	0.59	0.46

Front:
- (•) Asphericity
- ( ) Axial/Sag. Curvatu

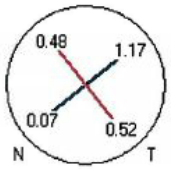
Back:
- ( ) Asphericity
- ( ) Axial/Sag. Curvatu

Indices (in 8mm zone)

ISV:	42	IHA:	16.8
IVA:	0.56	IHD:	0.056
KI:	1.09	RMin:	7.59
CKI:	1.03	TKC:	Post Cor

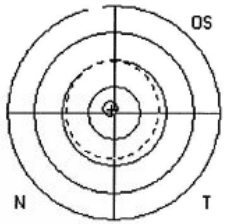
Asphericity (Front) at 8mm

Hor.:	0.62
Vert.:	0.50



Spot locations in 8mm zone (polar coordinates)

Pupil Center:	+	0.13mm (128.1°)
Thinnest Locat.:	○	0.27mm (135.0°)
K Max. (Front):		4.91mm (100.3°)



ZEISS [redacted]

Advance Eye Clinic

Overview

Axial Curvature

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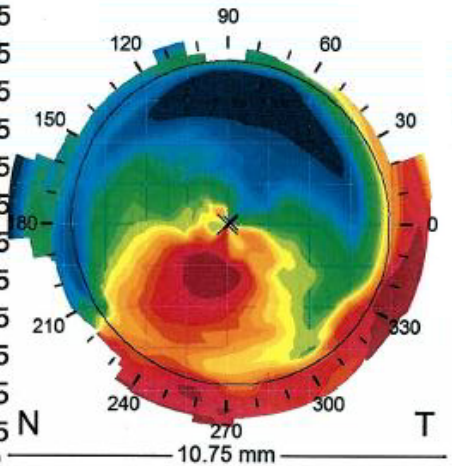
Standard palette
Auto scale
41.75
41.25
40.75
40.25
39.75
39.25
38.75
38.25
37.75
37.25
36.75
36.25
0.25 D



Steep K	39.00 D @ 71
Flat K	38.86 D @ 161
Astigmatism	0.13 D
Q	0.20
Pup. diam	7.8 mm
Axial I-S	3.90 D

Sim Ks (3 mm)
39.00 D (8.65 mm) @ 71
38.86 D (8.68 mm) @ 161

Total astigmatism 0.13 D

Central (0-3 mm)
37.39 D (9.03 mm) @ 46
41.15 D (8.20 mm) @ 226
39.31 D (8.59 mm) @ 136
40.34 D (8.37 mm) @ 316

Midperiphery (3-6 mm)
36.38 D (9.28 mm) @ 46
41.02 D (8.23 mm) @ 226
37.80 D (8.93 mm) @ 136
39.42 D (8.56 mm) @ 316

Periphery (6-9 mm)
38.68 D (8.73 mm) @ 46
40.60 D (8.31 mm) @ 226
37.38 D (9.03 mm) @ 136
40.74 D (8.28 mm) @ 316

Keratometry

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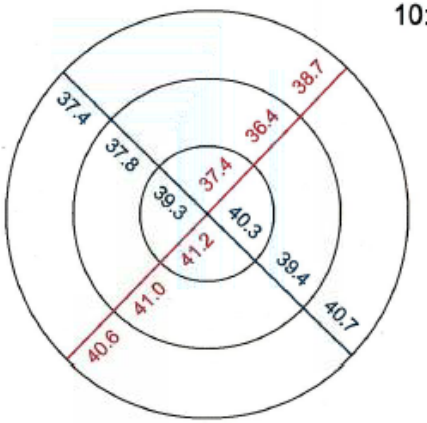

Rings Image

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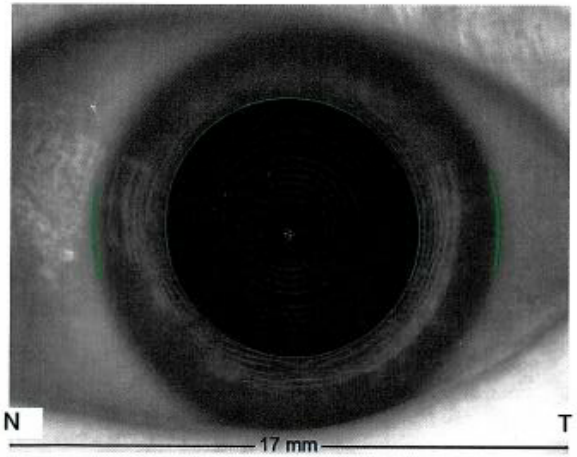

Pup. diam	7.8 mm
HVID	12.3 mm
Pup. center	0.1, 0.0
Pho. pup.	5.26 mm
Sco. pup.	7.77 mm

PathFinder II

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Similarity
0% 50% 100%

Normal
KCN Pattern
Myopic LVC 63%
Hyperopic LVC
Other

Threshold: 25%