

18th International Conference of the
Research Institute of Ophthalmology

RIO 2026

22 -23 JANUARY 2026
ROYAL MAXIM PALACE KEMPINSKI, CAIRO

Corneal Biomechanics and Epithelial mapping

Tarek El-Naggar, MD, FRCS (Glasg)

Head Of Refractive surgery unit - Research
Institute of Ophthalmology (RIO)

A. Professor of Ophthalmology

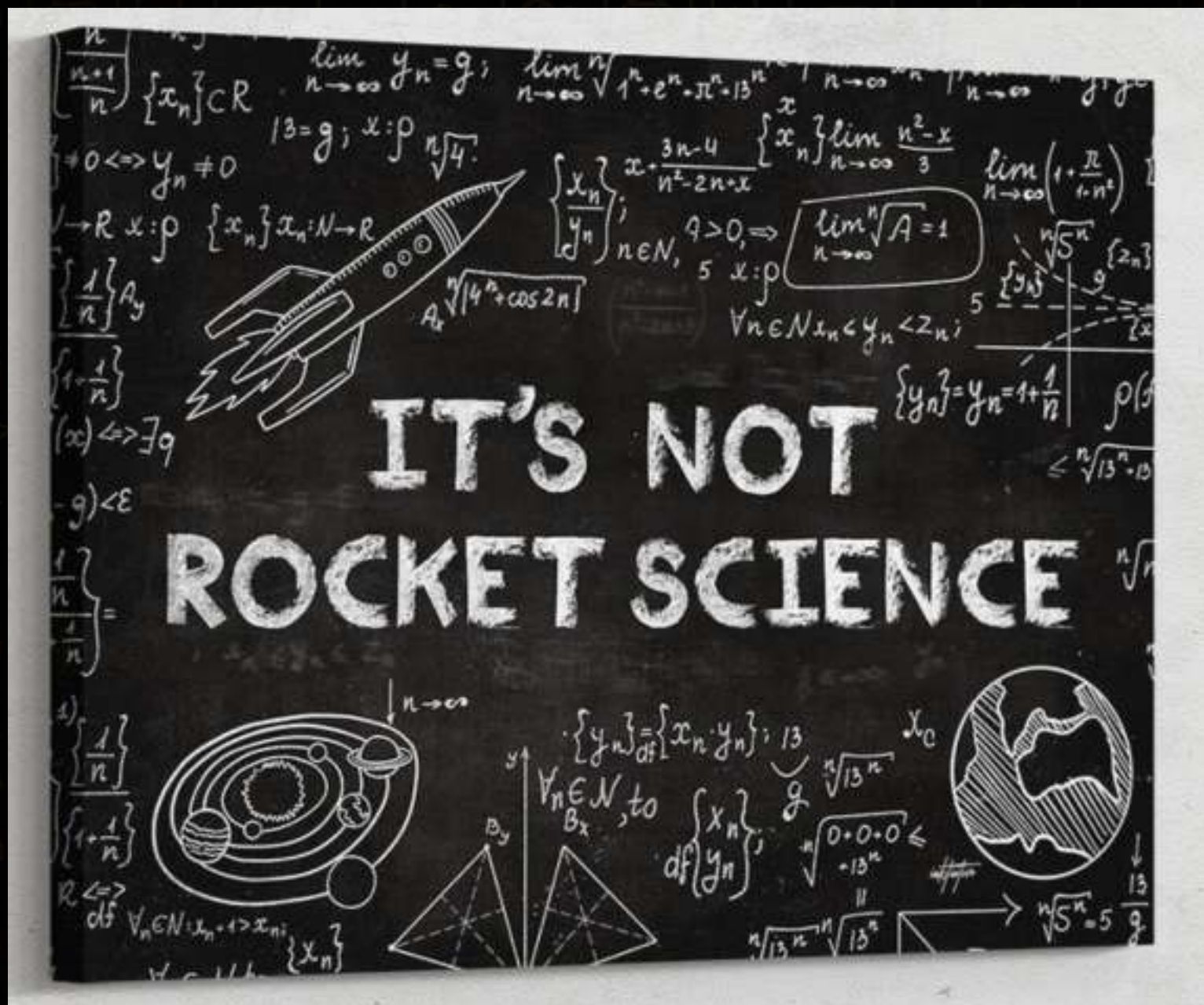
The Speaker Has No Financial Interest

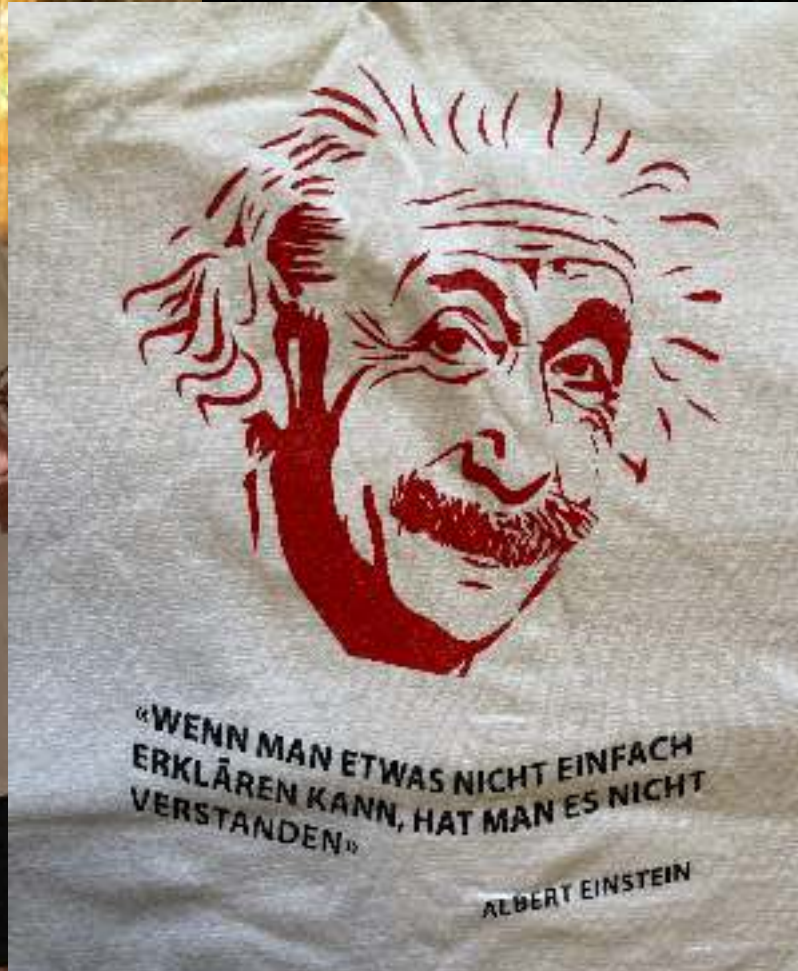




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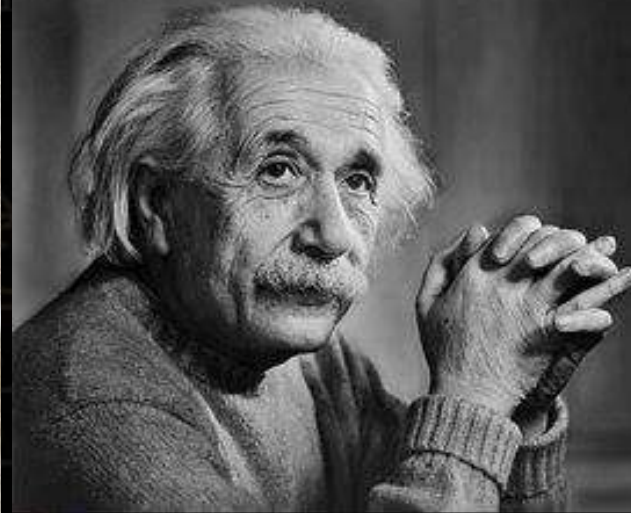
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If you can't explain it **simply**, you don't understand it well enough.

– Albert Einstein



RIO 2020

Corneal Biomechanical Properties

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Stiffness

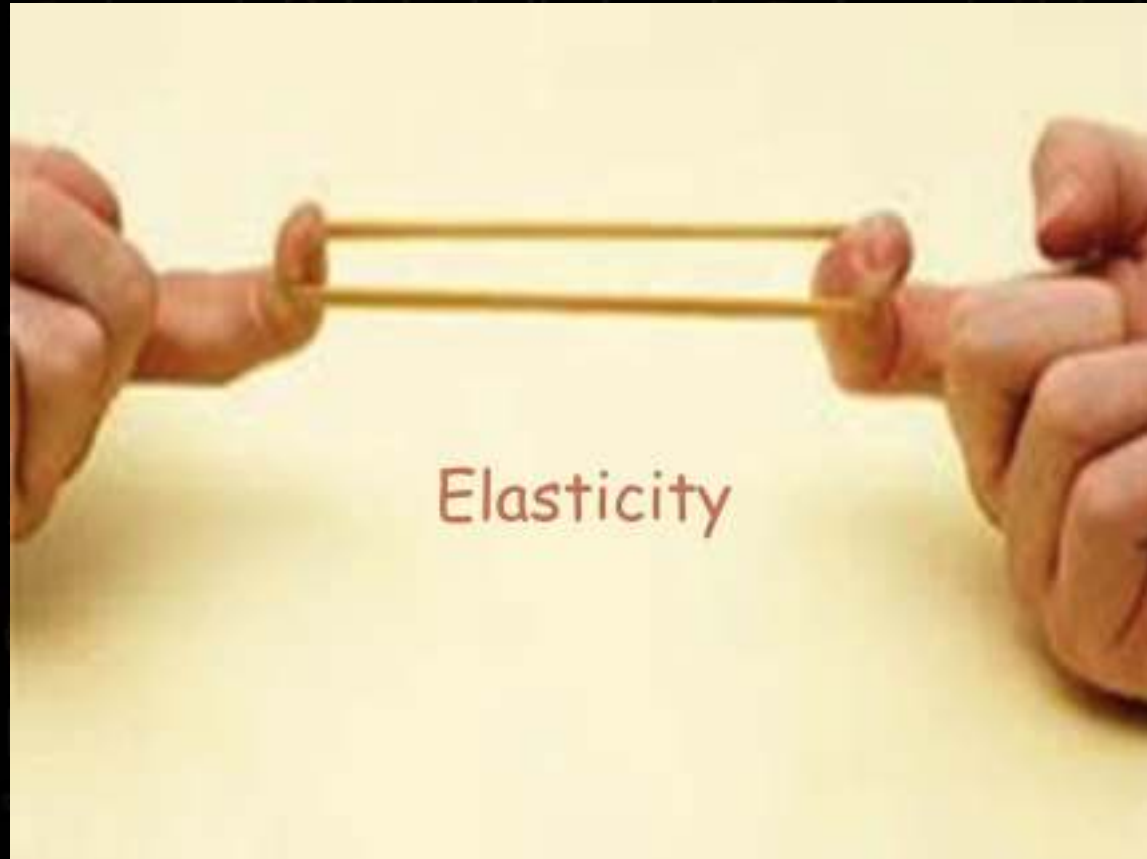
The extent to which an object resists deformation in response to an applied force.



$$\text{Stiffness} = \text{force} / \text{displacement}$$

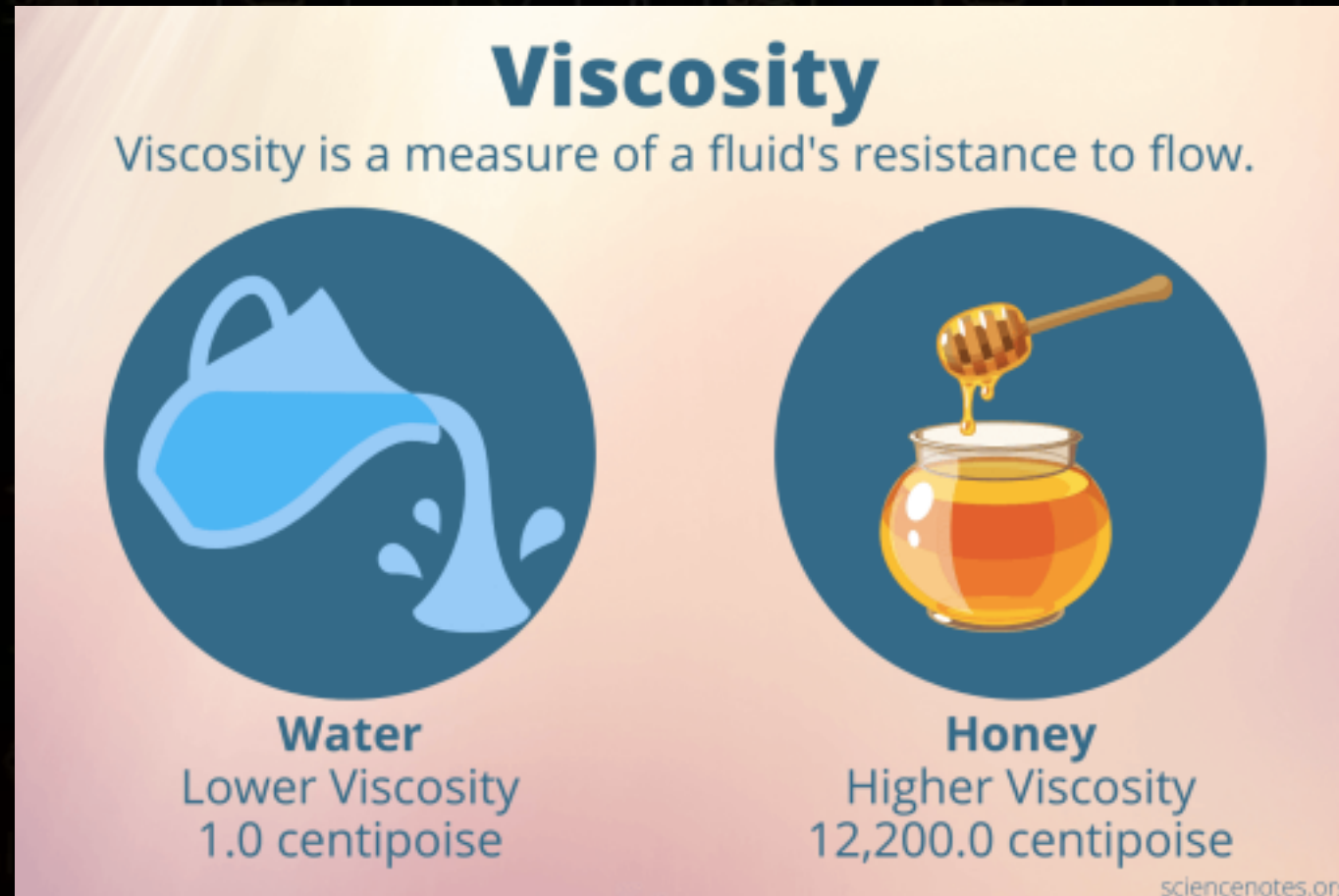
Elasticity

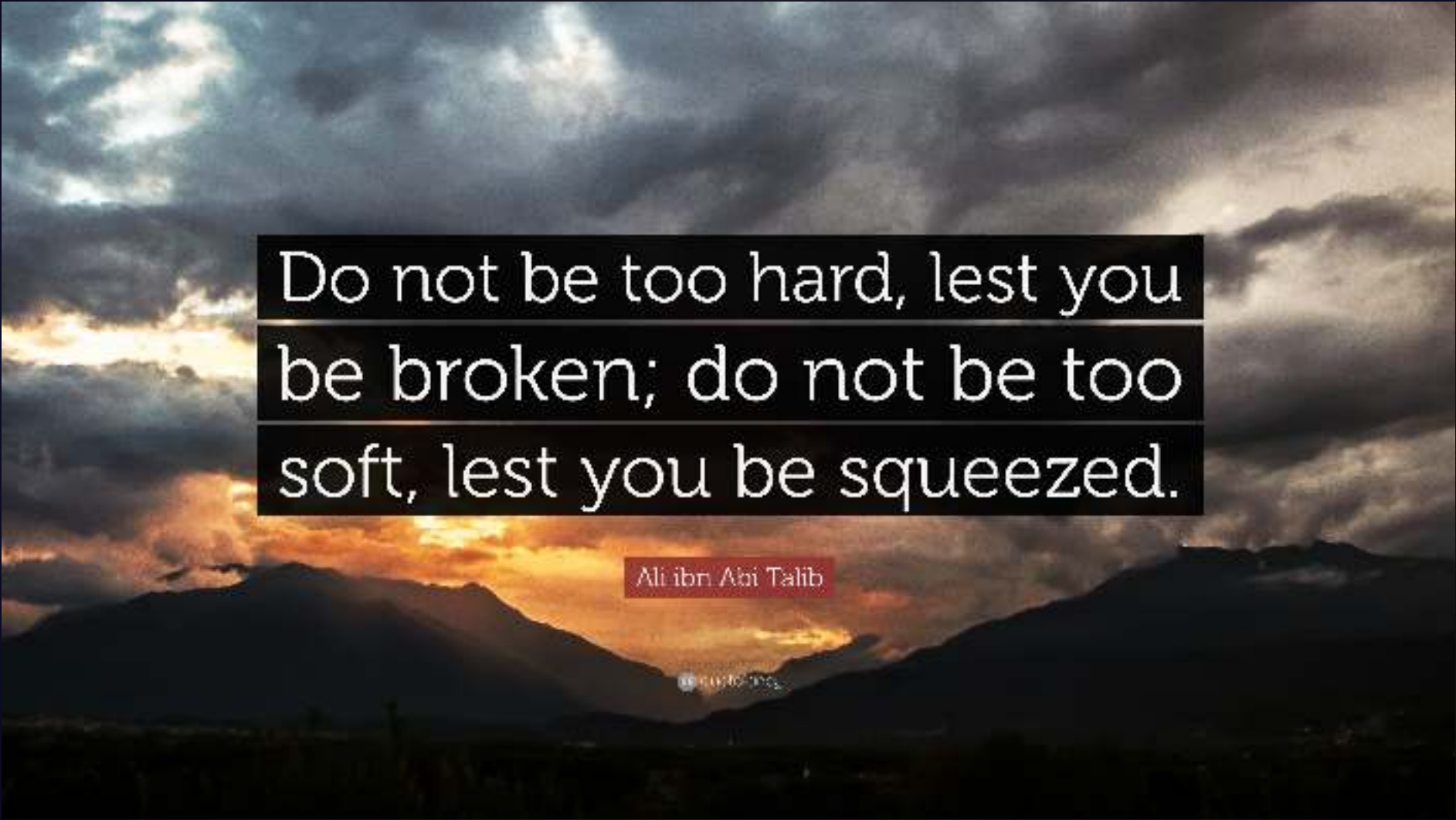
The ability of a substance to deform reversibly under stress



Viscosity

Resistance of material to flow or permanent deformation

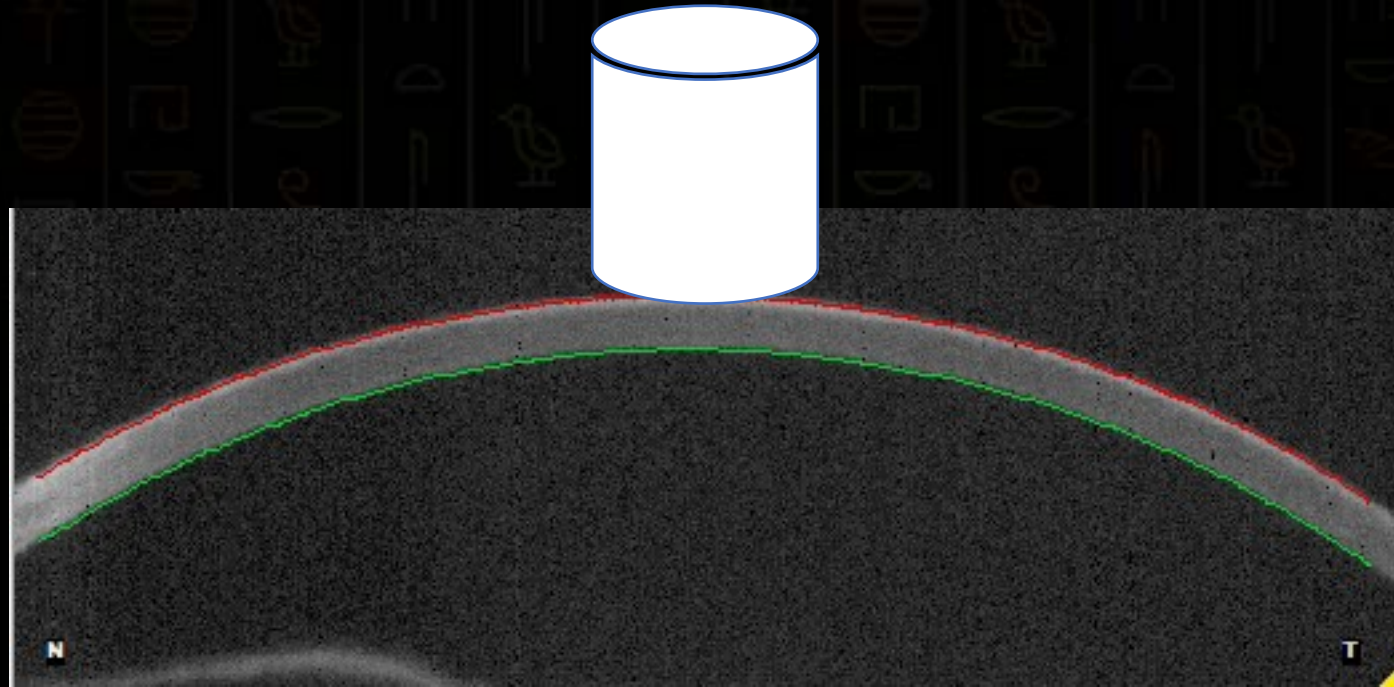


A dramatic landscape featuring dark, silhouetted mountains in the foreground and middle ground. The sky is filled with heavy, dark clouds, with a bright, golden light source (the sun) breaking through near the horizon, creating a strong contrast and illuminating the clouds from below. The overall mood is somber yet hopeful.

Do not be too hard, lest you
be broken; do not be too
soft, lest you be squeezed.

Ali ibn Abi Talib

@cortana

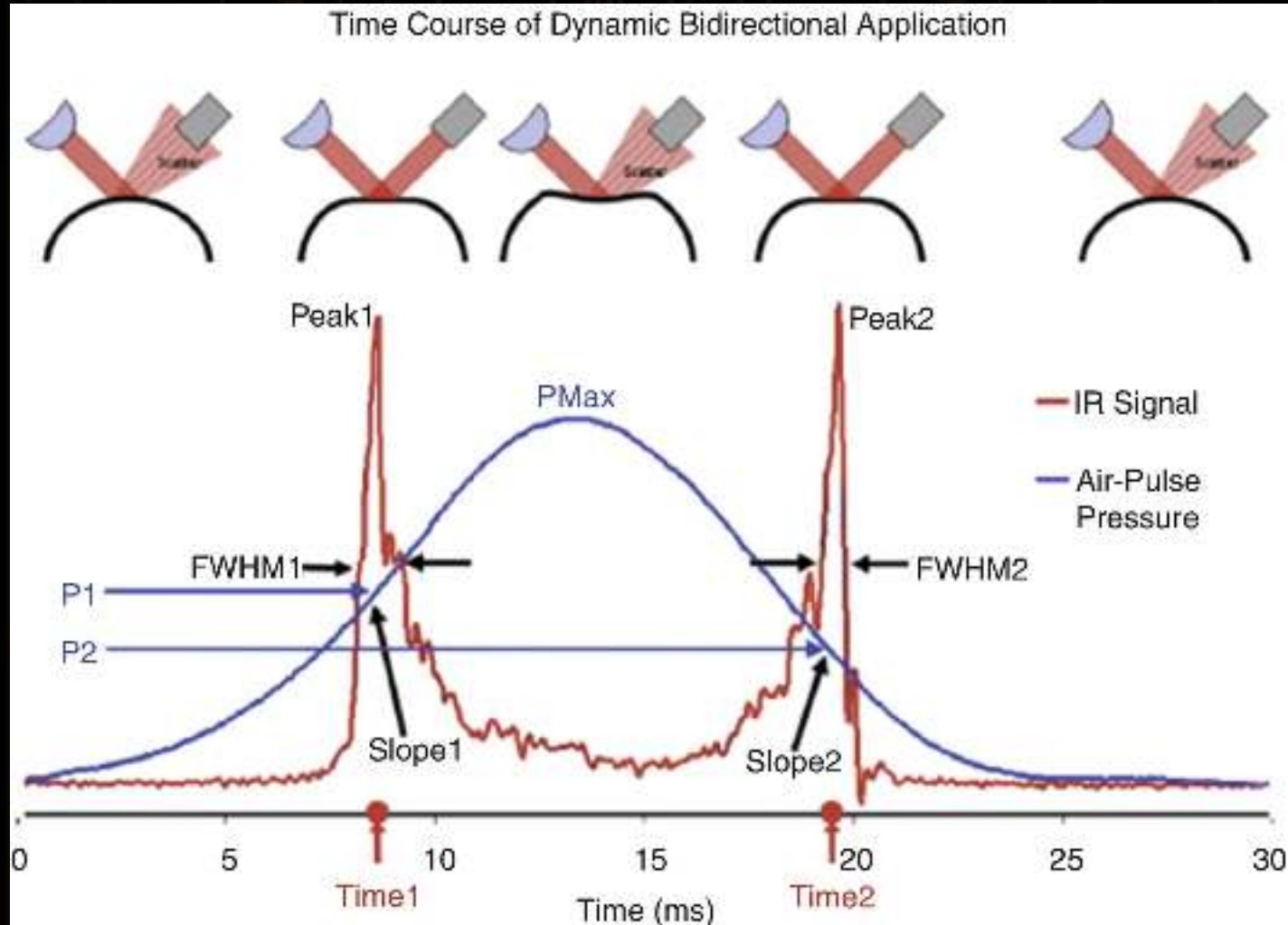


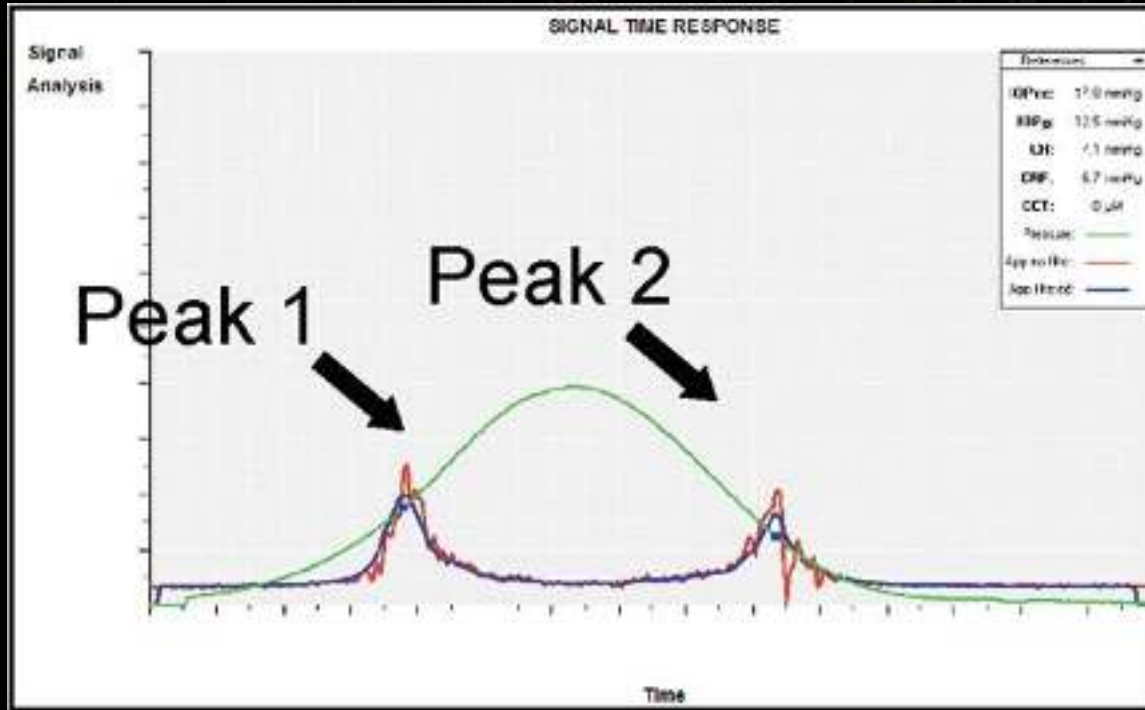
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ORA Ocular Response Analyzer

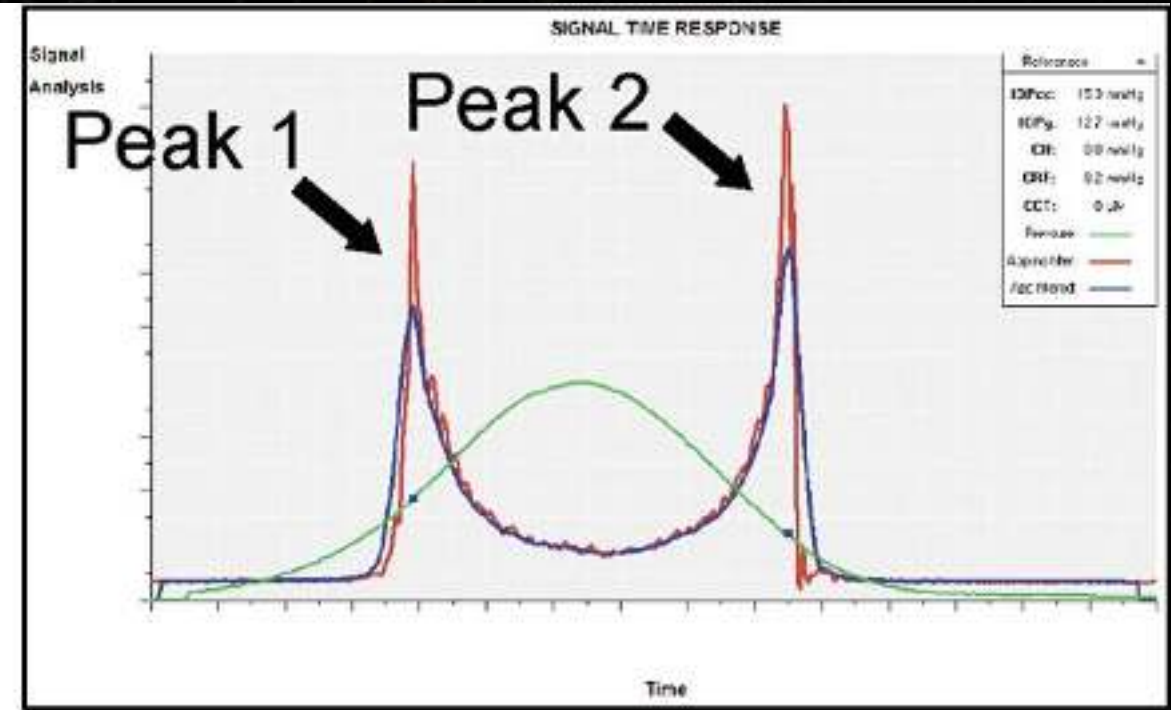
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Time Course of Dynamic Bidirectional Application





Keratoconic cornea



Normal cornea

Glass DH. Characterization of the biomechanical properties of the in vivo human cornea. PhD Dissertation, The Ohio State University; 2008.

CorVis ST

Corneal Visualization Scheimpflug Technology

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DCR



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(UHS) Scheimpflug camera angled at 45° towards the apex of the cornea

140 cross-sectional images in 30 ms

4,330 frames per second

8 mm horizontal coverage

Air puff

60 mmHg

3.05 mm

Corneal Deformation



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Eye: Left (OS)

 ZOCULUS

0.00 ms

R10 2026

Eye: Left (OS)

Exam. Date: 06.02.2023 13:43:45



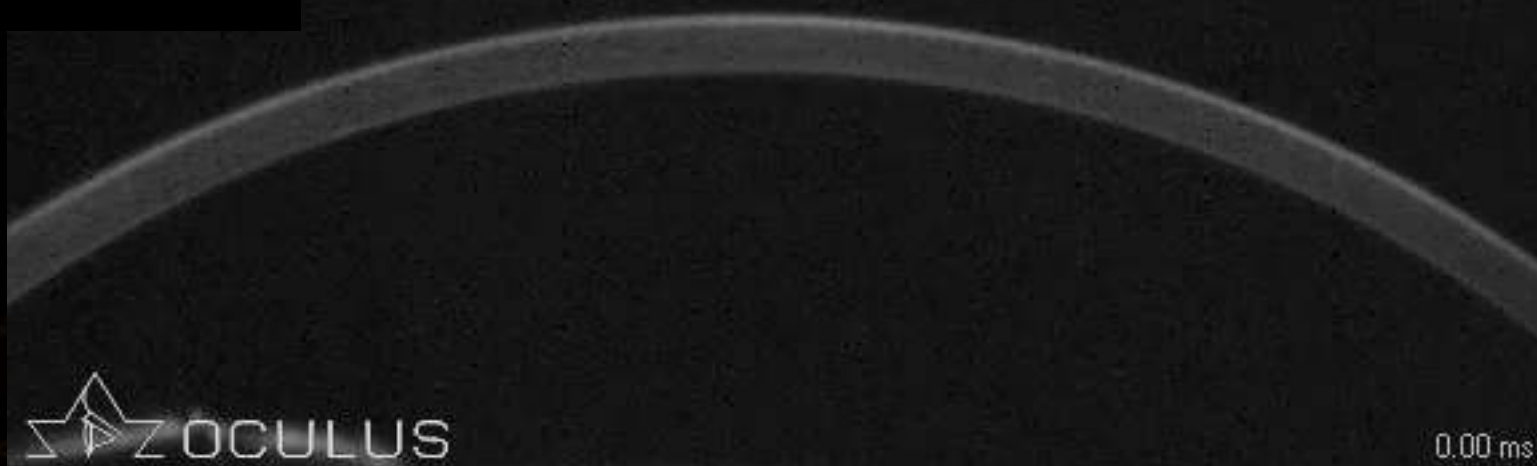
 ZOCULUS

0.00 ms

R10 2026

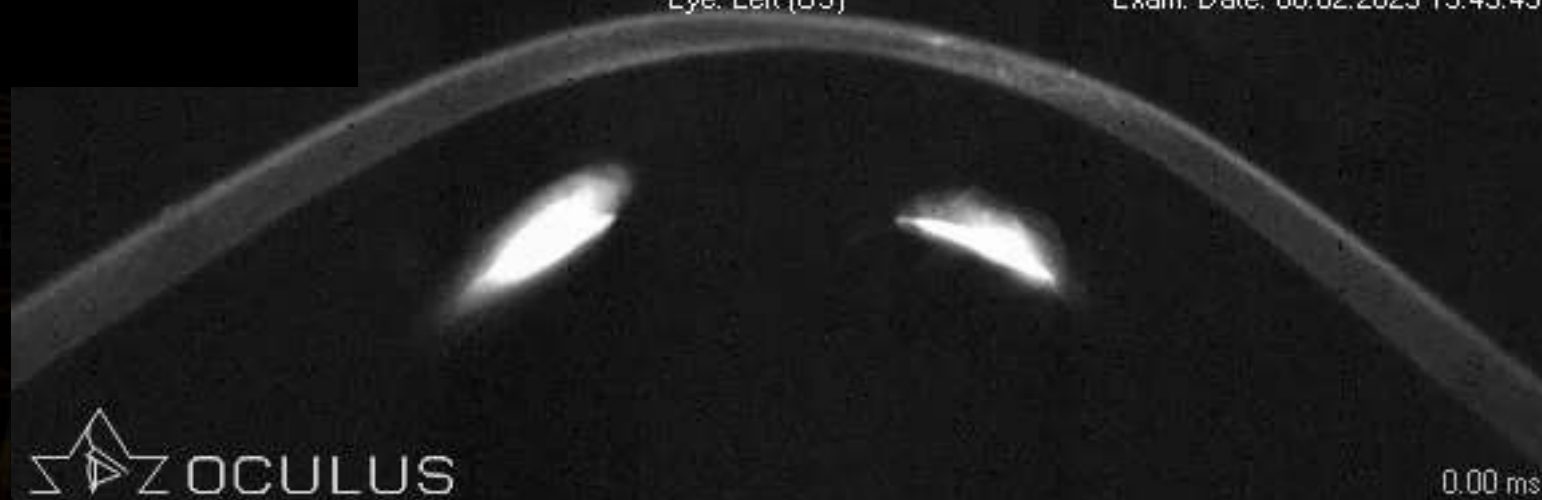
Eye: Left (OS)

Exam. Date: 22.07.2019 13:12:02

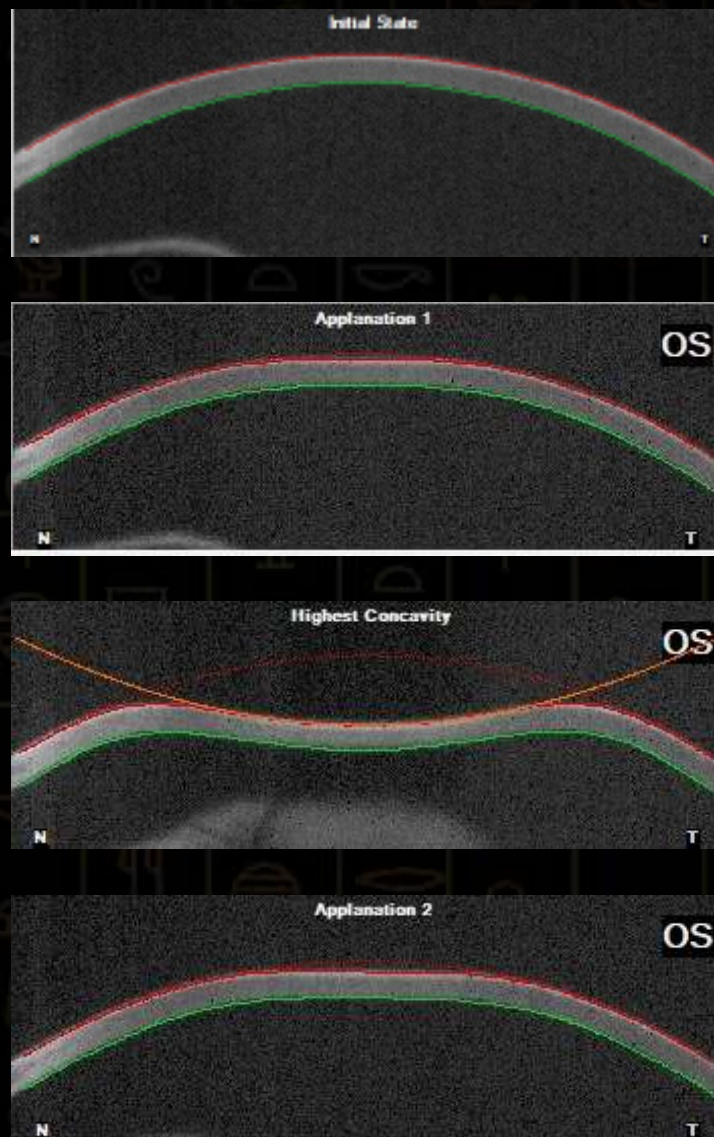


Eye: Left (OS)

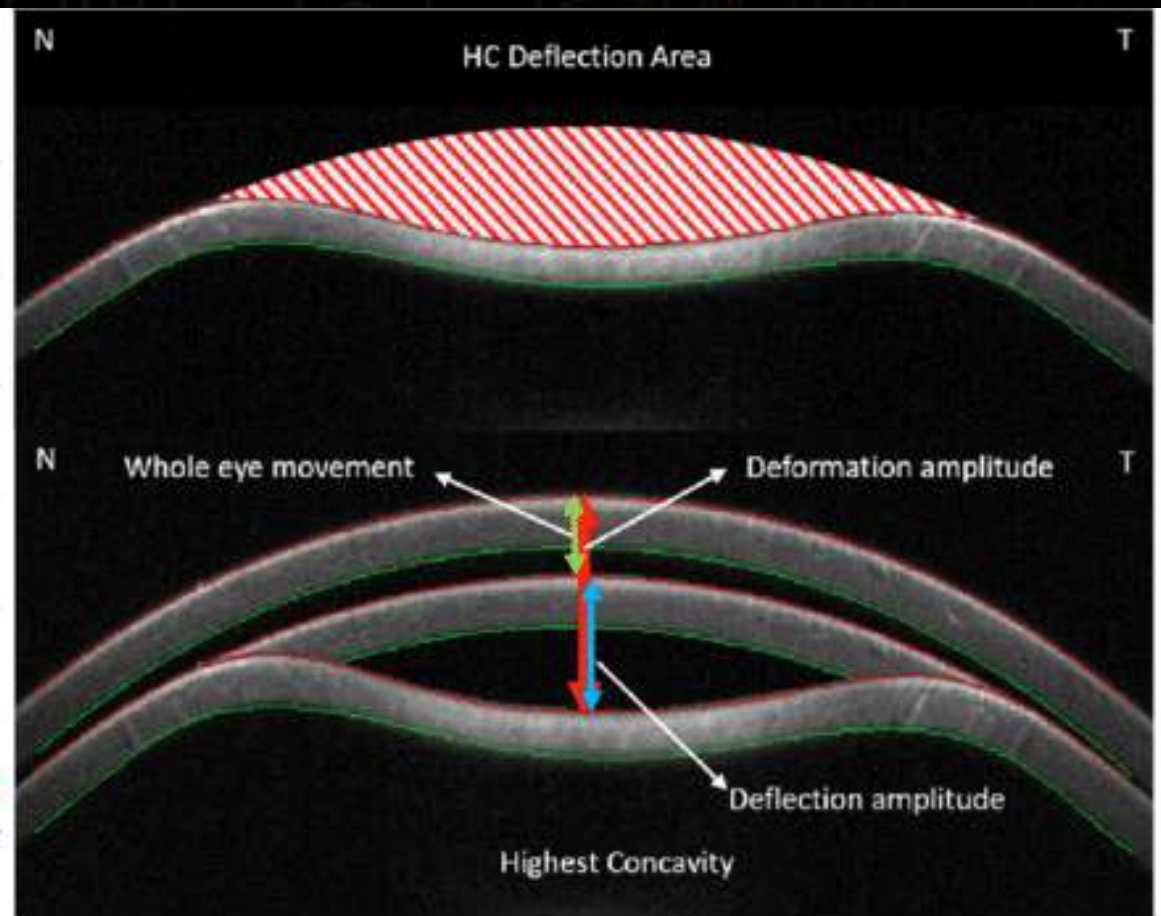
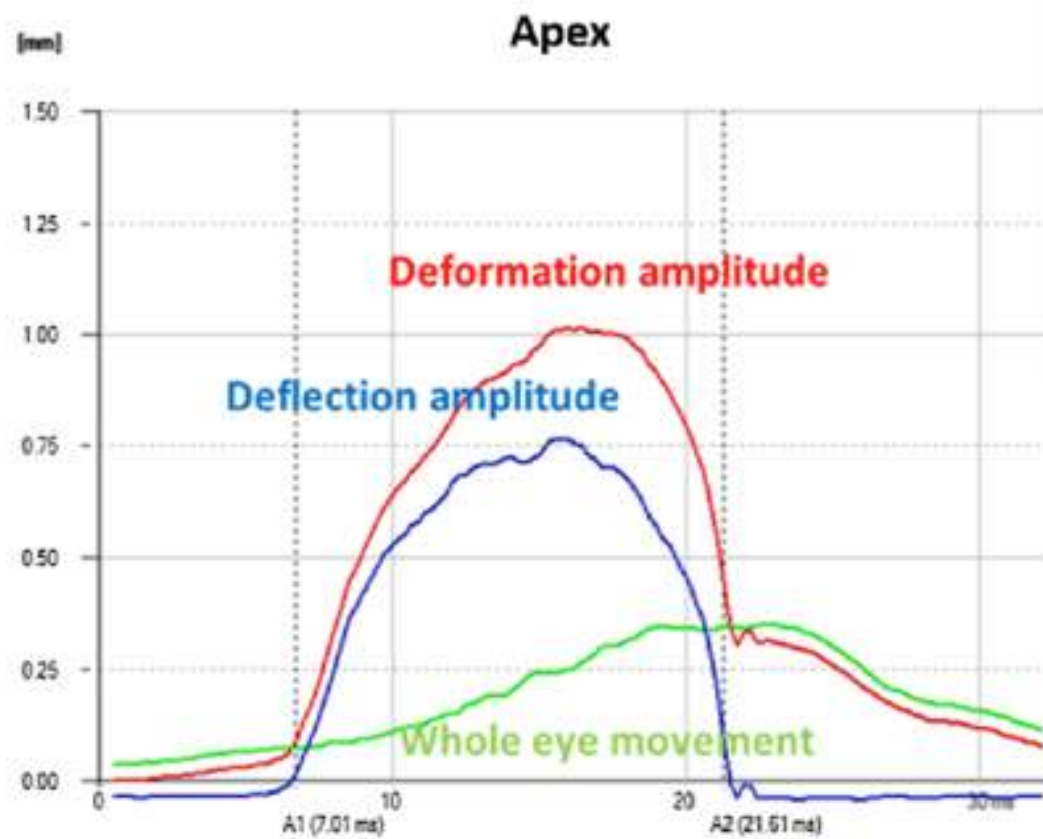
Exam. Date: 06.02.2023 13:43:45



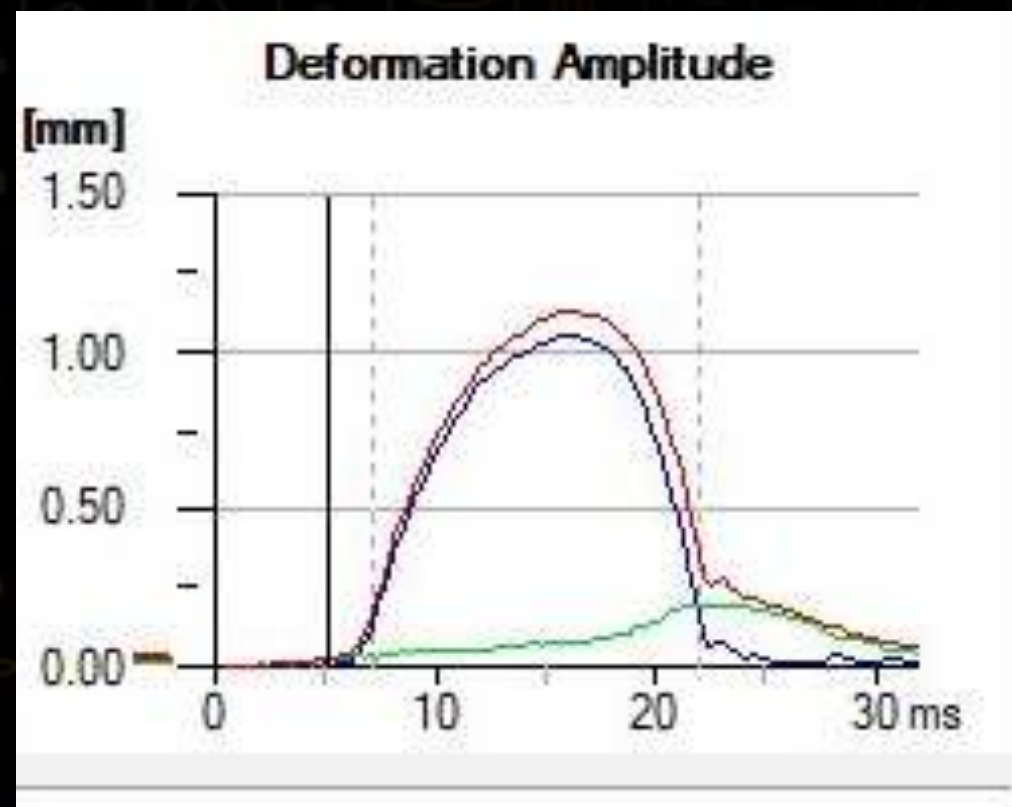
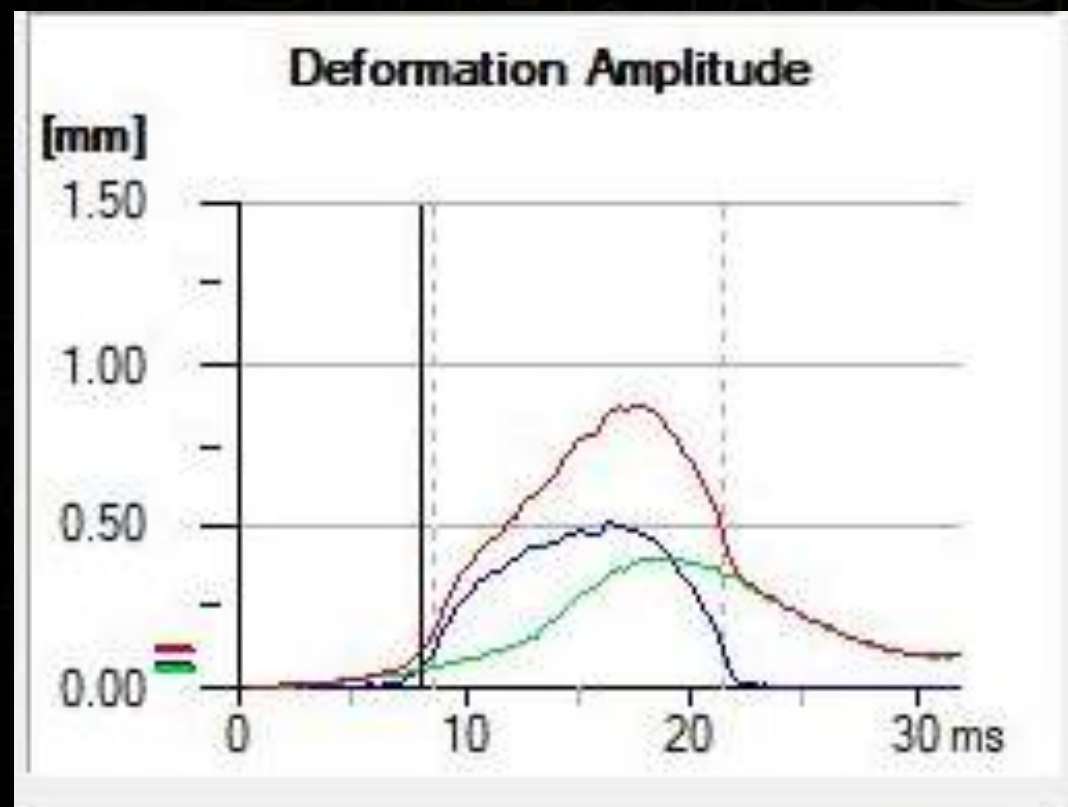
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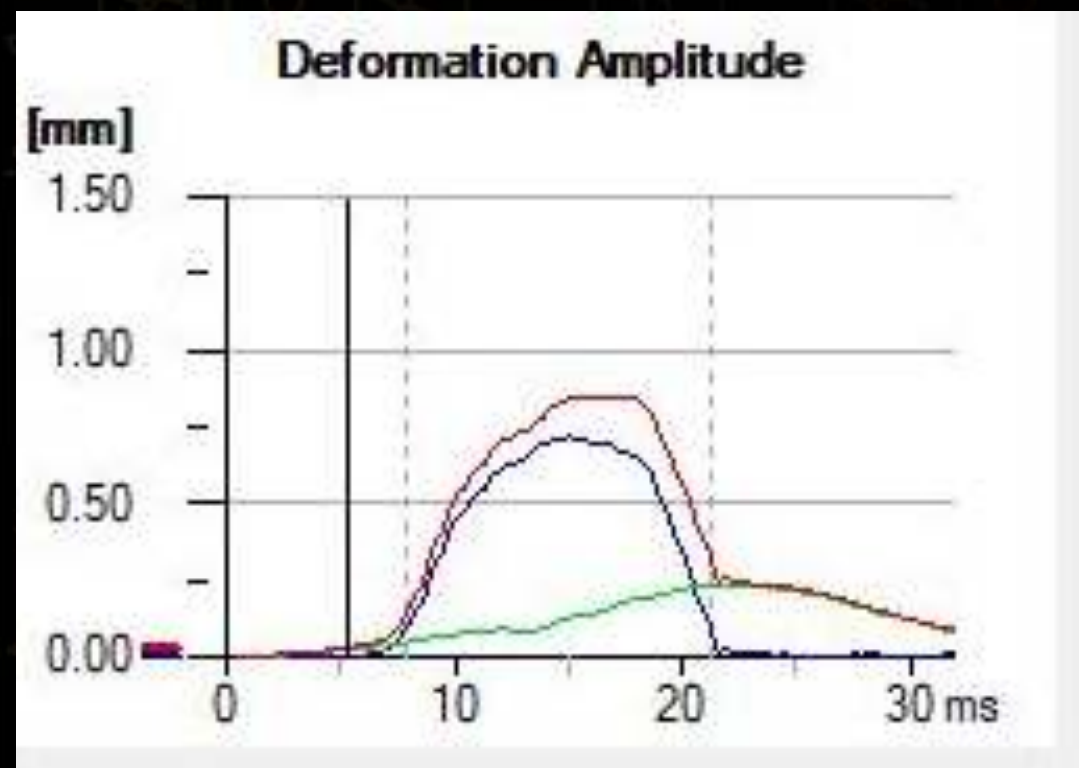
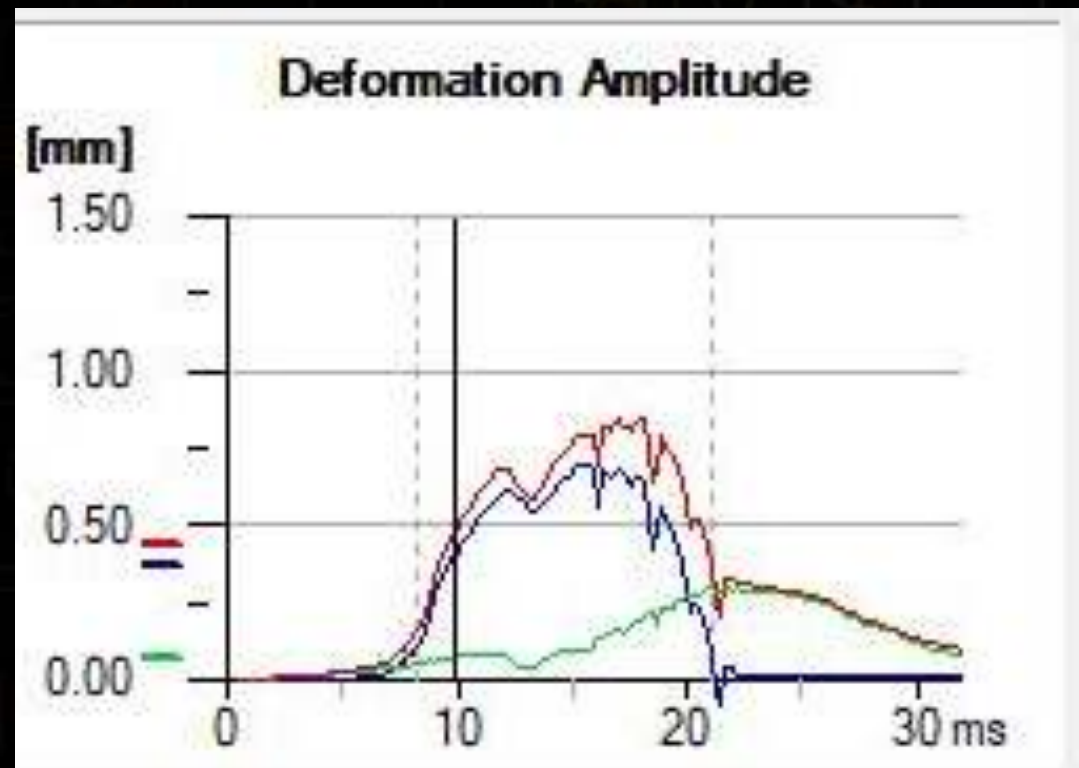
Scheimpflug images of the corneal deformation response on Corvis ST showing the biomechanical parameters derived at each stage. The fixed air puff causes the cornea to flatten (applanation point A1) and then move inwards to reach the point of highest concavity where the deformation amplitude (DA in mm), peak distance (PD in mm), and the radius of curvature (RC in mm) are measured. As the cornea begins to assume its normal, convex shape, it passes through the second applanation point (A2)



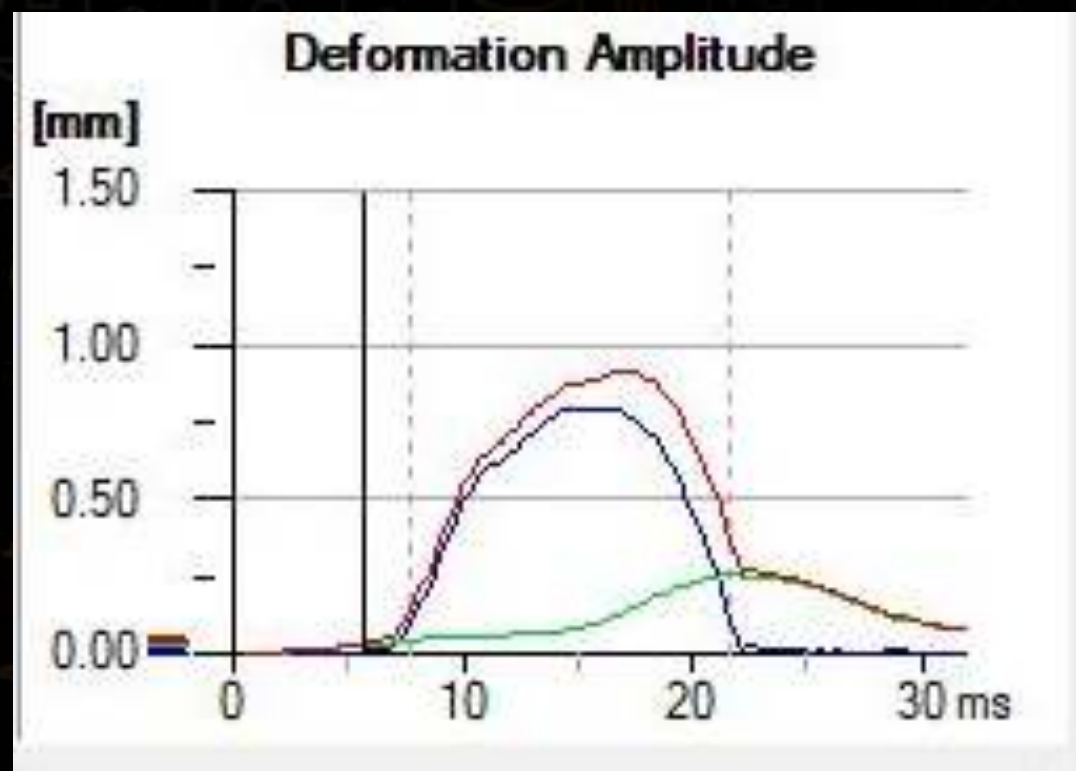
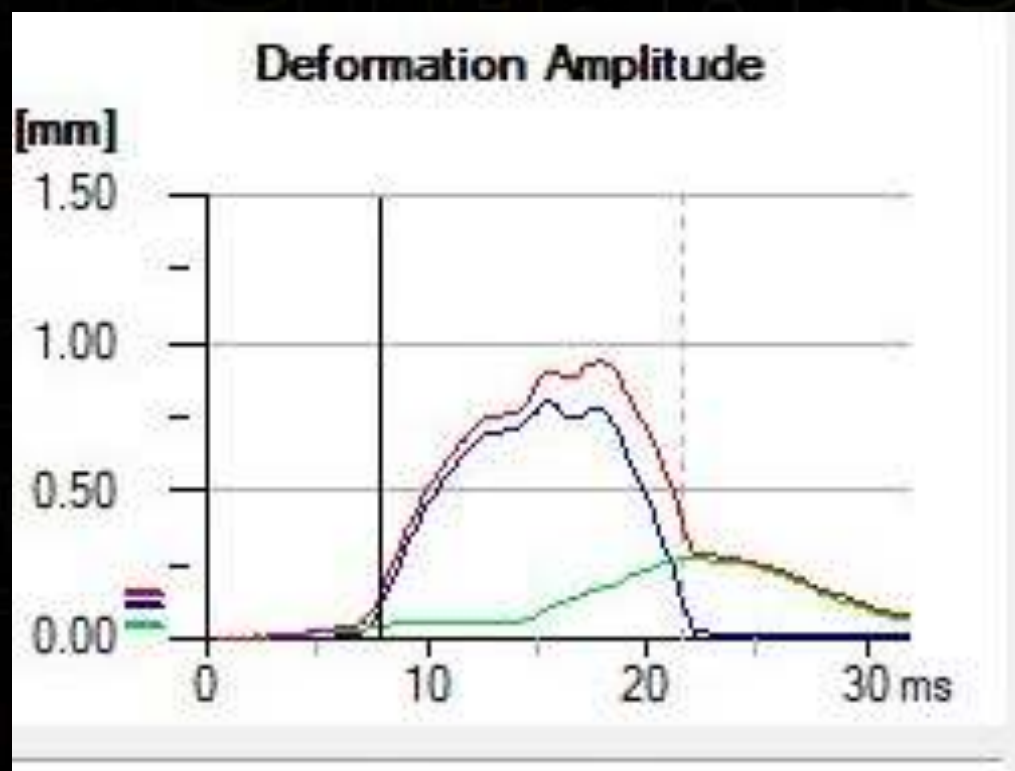
R10 2026



R10 2026



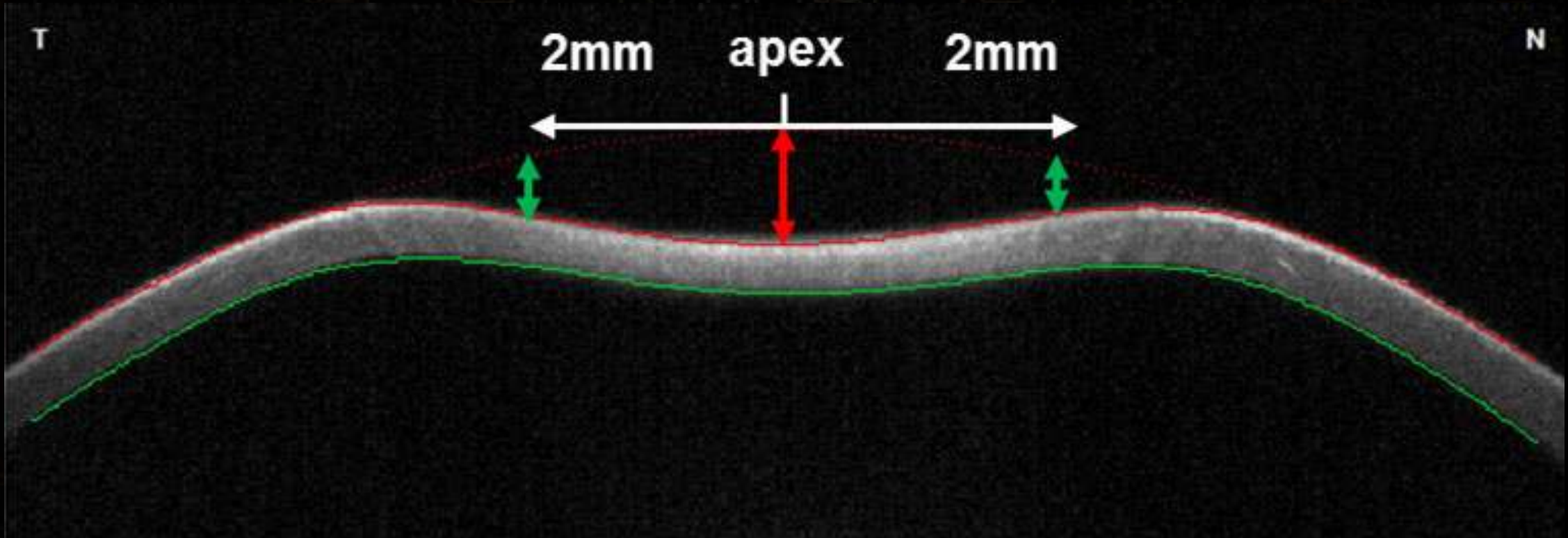
R10 2026



R10 2026

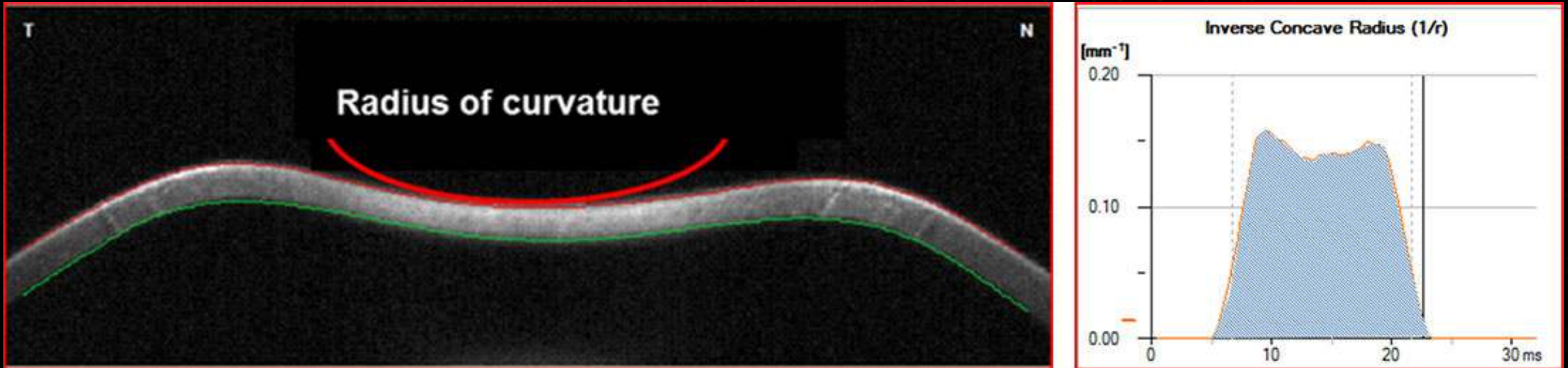
DA Ratio

The ratio between the deformation amplitude at the apex and at 2 mm

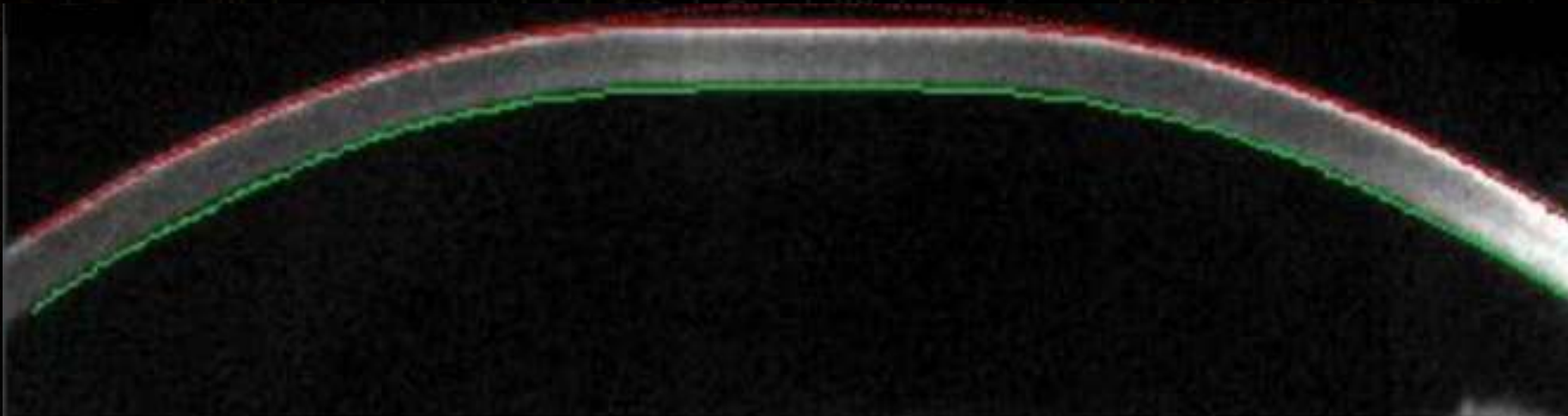


Integrated Radius (IR)

Max Inverse Radius ($1/\text{radius of curvature}$), Integrated Radius (the integrated area under the radius of the inversed curvature during the concave phase)



SP-A1



Stiffness

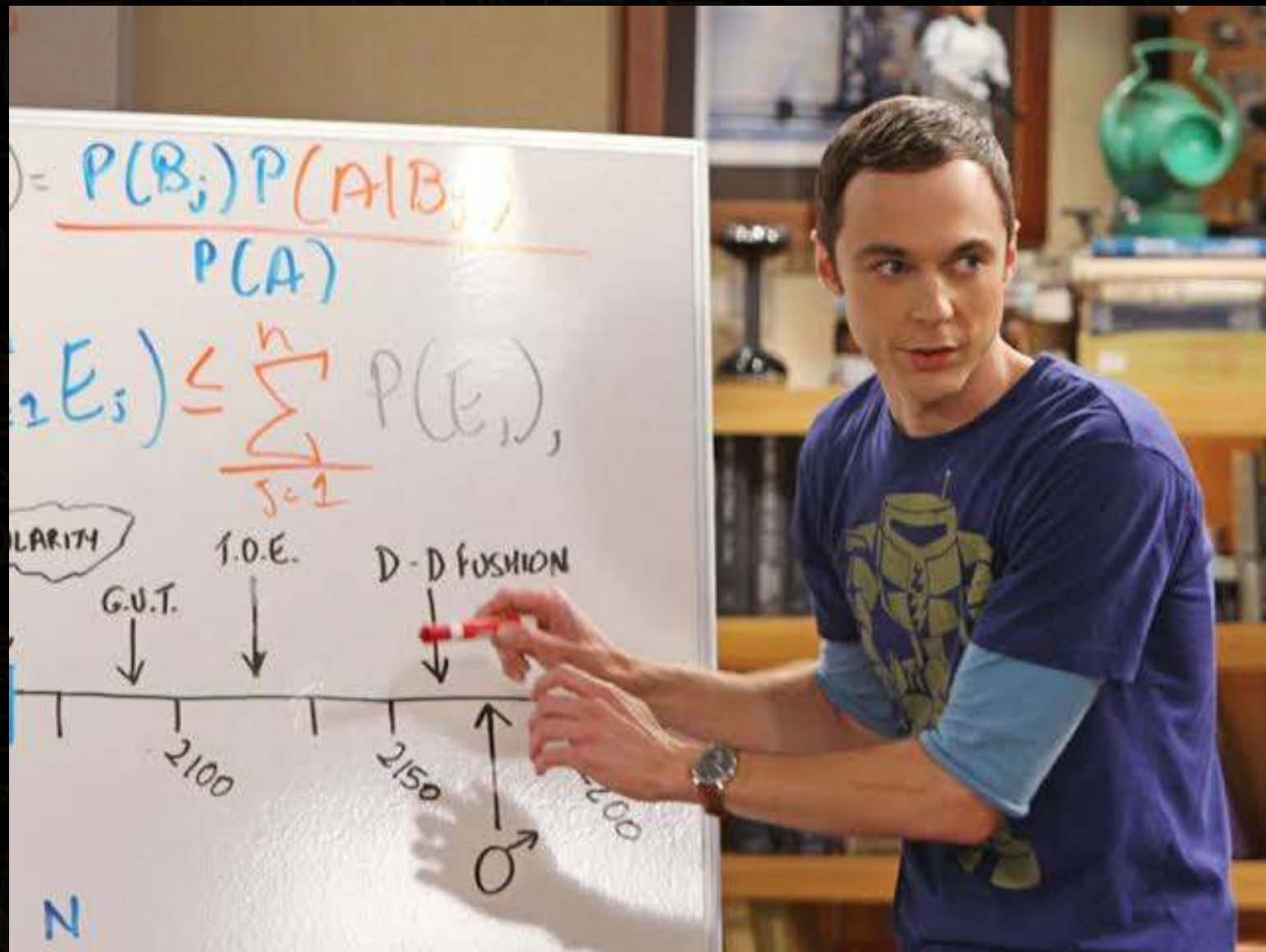
$$= \frac{\text{Force}}{\text{Displacement}}$$

$$= \frac{\text{Adj Air Pulse - bIOP}}{\text{Defl Amplitude}}$$

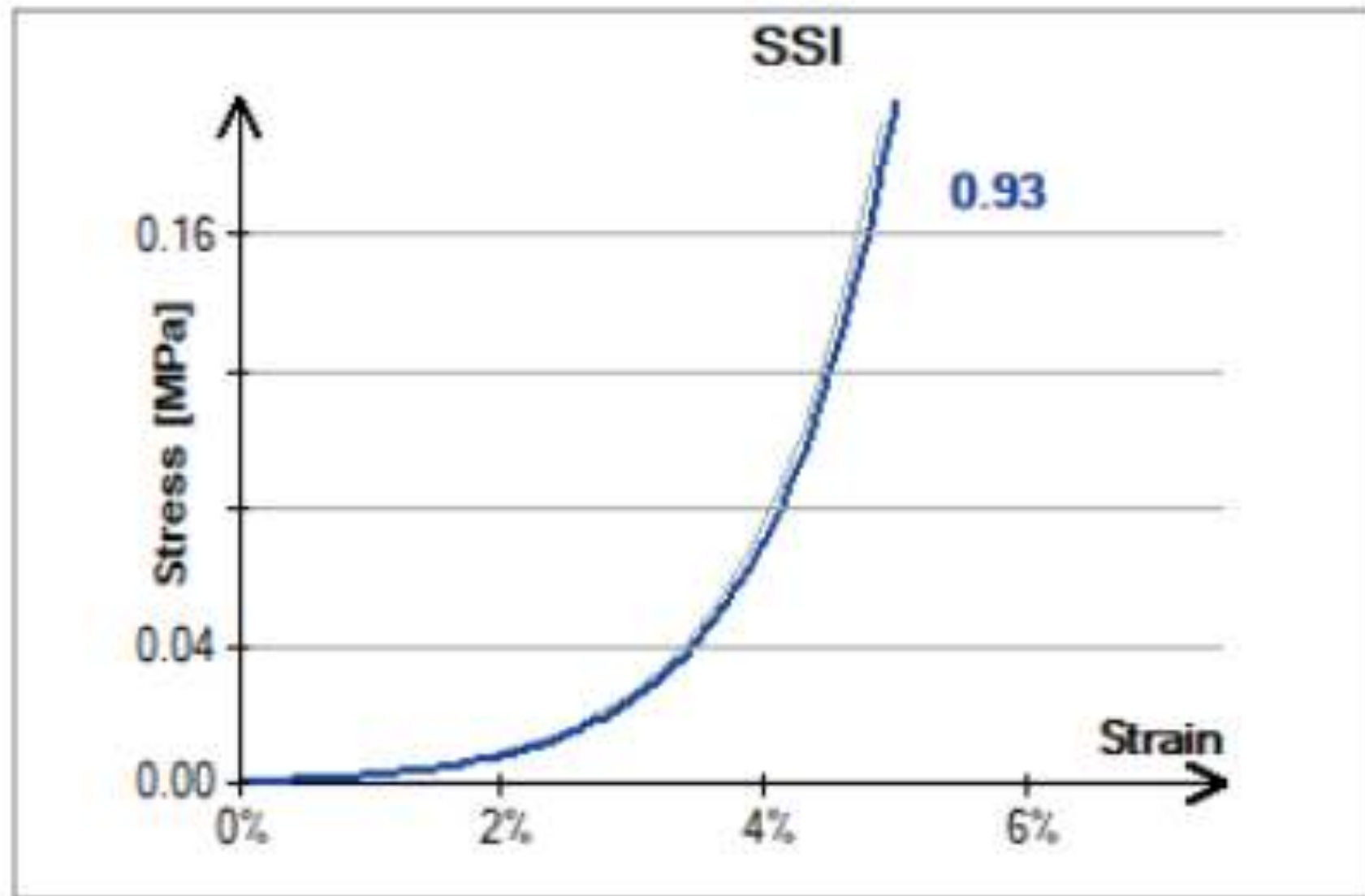
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SS Curve and SSI

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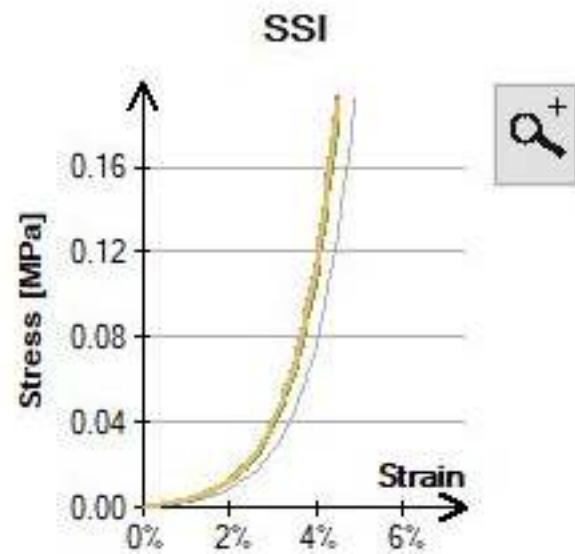


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SS Curve and SSI

- SS curves describe the intrinsic elastic properties of the cornea.
- Shifted to the right if the cornea is softer, and shifted to the left if the cornea is stiffer.
- Less dependent on corneal thickness and IOP.

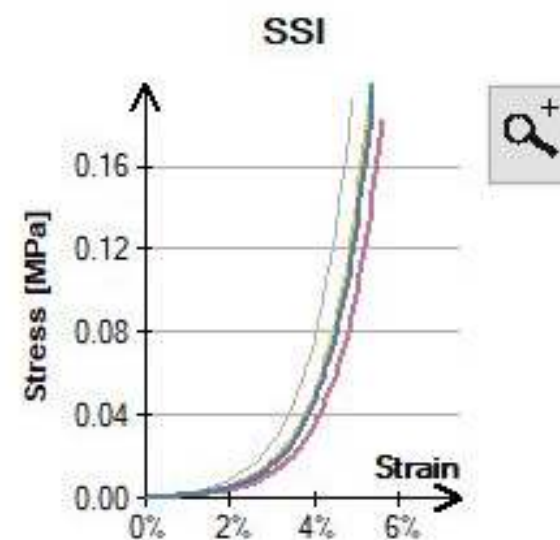


Value:	1.5	1.4	1.5	
SD:	-2.3	-1.9	-2.2	

BaseLine ☒ ☐ ☐ ☐

Changes from baseline exam:

Diff. time:	0.3y	0.5y	
Diff. SD:	0.4	0.1	
Stiffer			
not sign.	✓	✓	
softer			



Value:	0.5	0.6	0.6	0.6
SD:	2.5	1.8	1.6	1.8

BaseLine ☒ ☐ ☐ ☐

Changes from baseline exam:

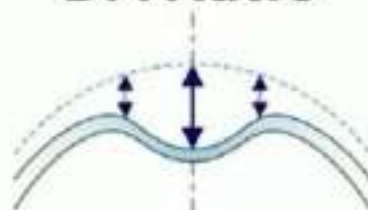
Diff. time:	0.9y	2.8y	3.8y
Diff. SD:	-0.7	-0.9	-0.7
Stiffer	✓	✓	✓
not sign.			
softer			

1 st Applanation	Moment at the first applanation of the cornea during the air puff (in milliseconds). In parenthesis is the length of the applanation at this moment (in millimeters)
Highest Concavity	Moment that the cornea assumes its maximum concavity during the air puff (in milliseconds). In parenthesis is the length of the distance between the two peaks of the cornea at this moment (in millimeters)
2 nd Applanation	Moment at the second applanation of the cornea during the air puff (in milliseconds). In parenthesis is the length of the applanation at this moment (in millimeters)
Maximum Deformation	Measurement (in millimeters) of the maximum cornea deformation during the air puff
Wing Distance	Length of the distance between the two peaks of the cornea at this moment (in millimeters)
Maximum Velocity (in)	Maximum velocity during the ingoing phase (in meters per seconds [m/s])
Maximum Velocity (out)	Maximum velocity during the outgoing phase (in meters per seconds [m/s])
Curvature Radius Normal	Radius of curvature of the cornea in its natural state (in millimeters)
Curvature Radius HC	Radius of curvature of the cornea at the time of maximum concavity during the air puff (in millimeters)
Cornea Thickness	Measurement of the corneal thickness (in millimeters)
IOP	Measurement of the intraocular pressure (in millimeters of Mercury [mmHg])
DARatio 2 mm	Ratio between vertical displacement at apex and at 2 mm
Inverse concave Radius	Inverse of the Radius of curvature during concave phase of the deformation
Integrated Radius	Area under the inverse concave Radius vs. time curve
SP-A1	Parameter reflecting bending stiffness of the cornea as defined by force/replacement
blOP	Biomechanical corrected IOP
CBI	Corvis Biomechanical Index: overall biomechanical index for kc detection
TBI	Tomographic Biomechanical Index: combines tomographic and biomechanical data for enhanced ectasia detection

CBI: Corvis Biomechanical Index

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DA Ratio



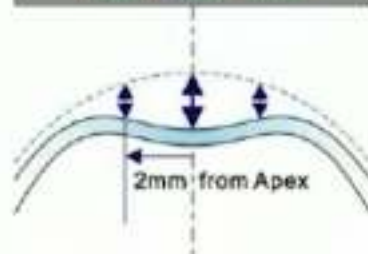
higher index value



Deformation
= Deflection +
Eye movement
Ratio
Apex : 2mm

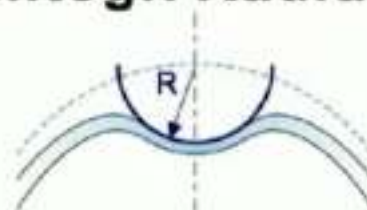


lower index value



The lower the index value, the stiffer the cornea

Integr. Radius



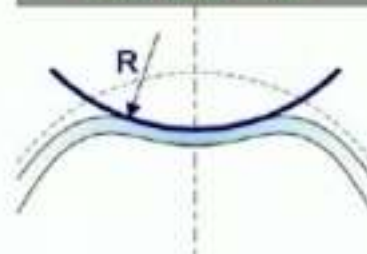
higher index value



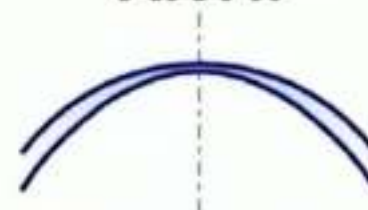
Inverse Concave Radius
= $1/\text{Radius of curvature}$
Integrated Radius
= Area under Inverse
Concave Radius curve



lower index value



ARTh



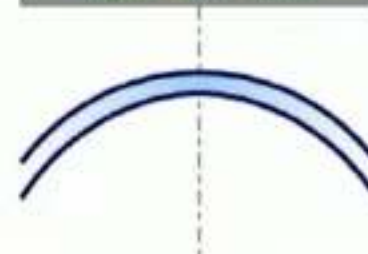
lower index value



**Amblosio Relational
Thickness horizontal**
= $\frac{\text{Pachy (thinnest)}}{\text{Pachy Progression}}$

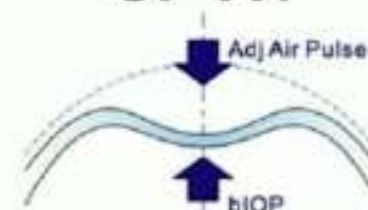


higher index value



The higher the index value, the stiffer the cornea

SP-A1



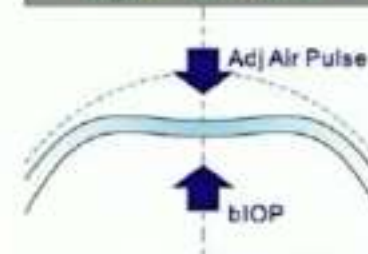
lower index value



Stiffness
= $\frac{\text{Force}}{\text{Displacement}}$
= $\frac{\text{Adj Air Pulse} - \text{bIOP}}{\text{Defl Amplitude}}$



higher index value



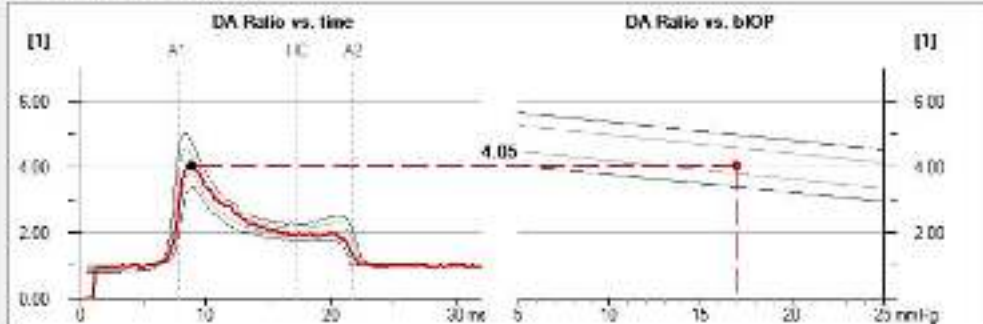
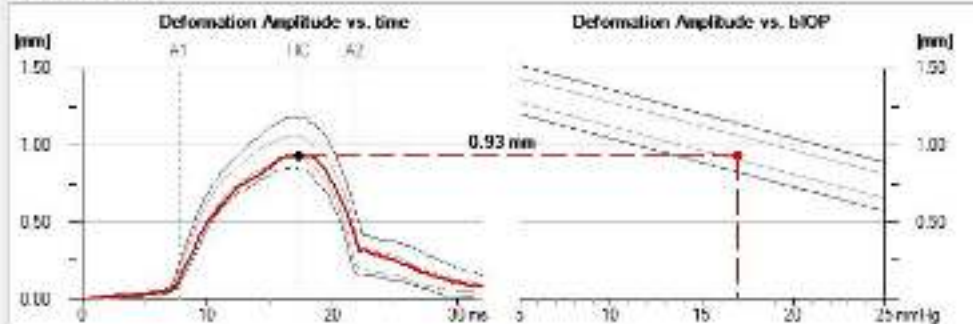
OCULUS Corvis® ST - Vinciguerra Screening Report

1.6.2021

Name: [REDACTED] ID: Unlase KC Date of birth: 28.05.1990 Age: 31
 Exam. Date: [REDACTED] Time: 12:51:37 Eye: Left (OS)
 Info. OS: OK

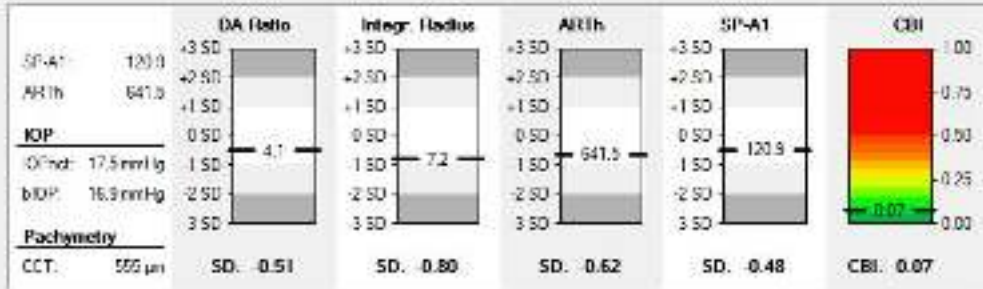
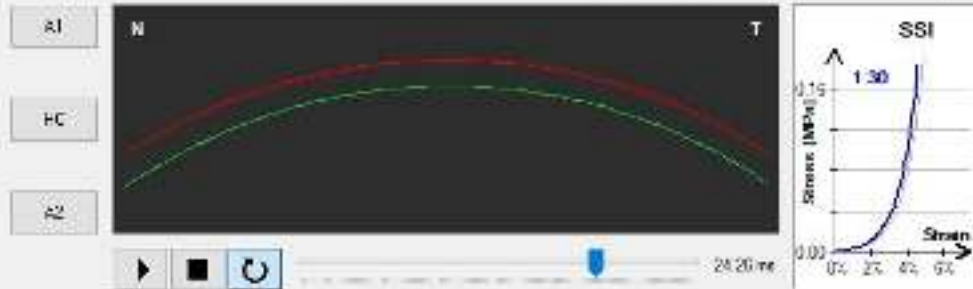
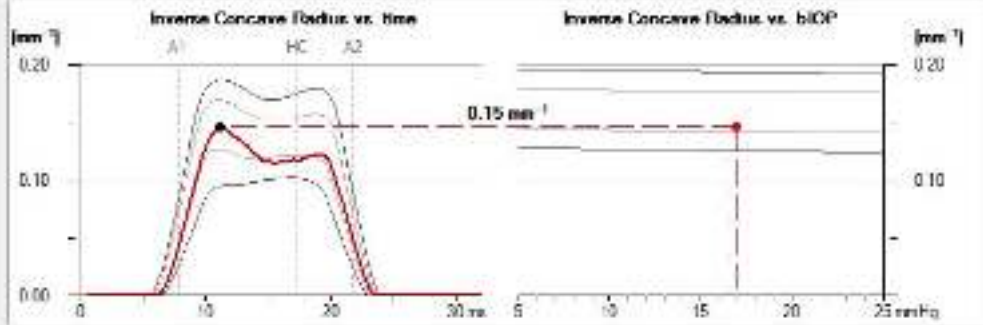
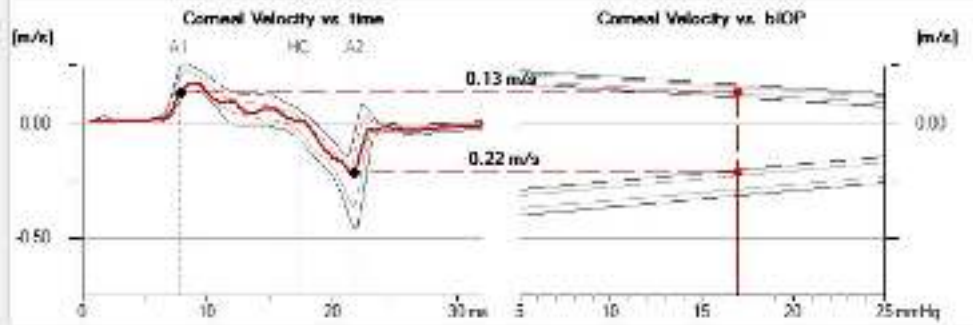
Deformation Amplitude

Deformation Amplitude Ratio (2mm)



Corneal Velocity

Inverse Corneal Radius



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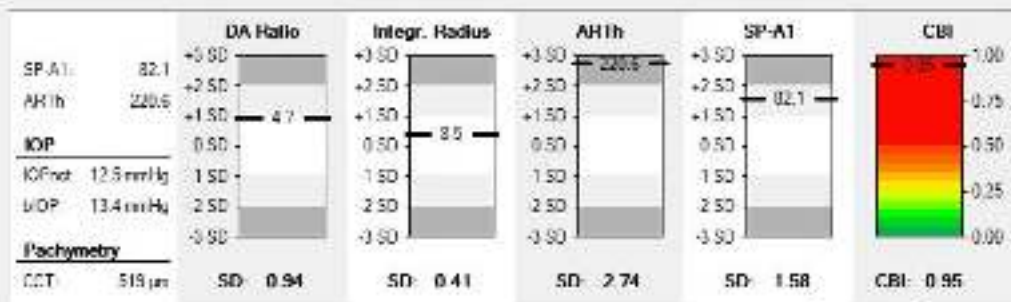
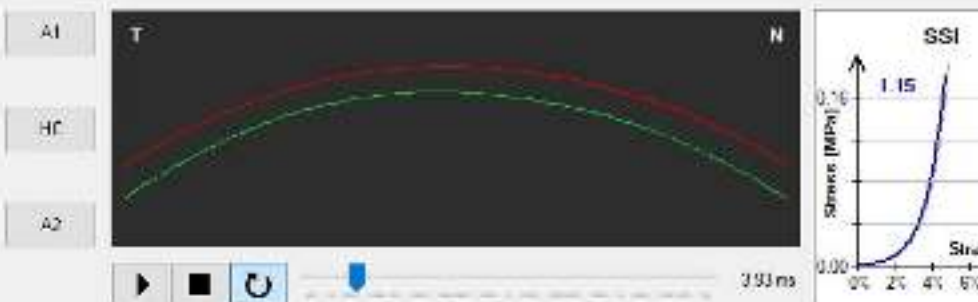
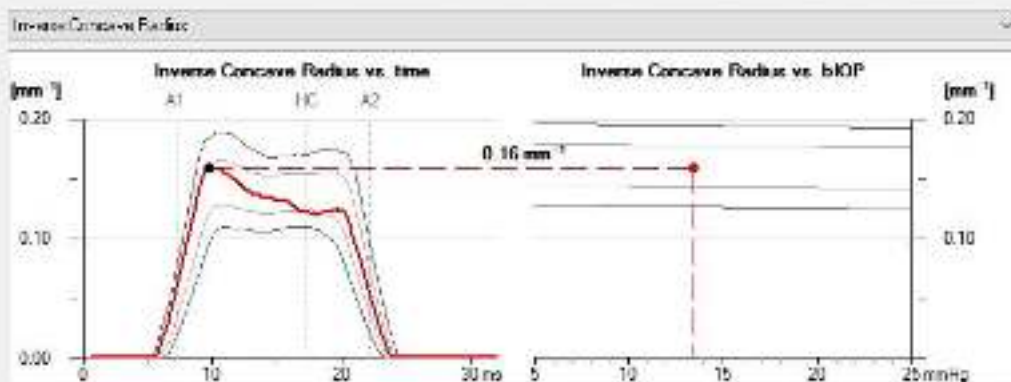
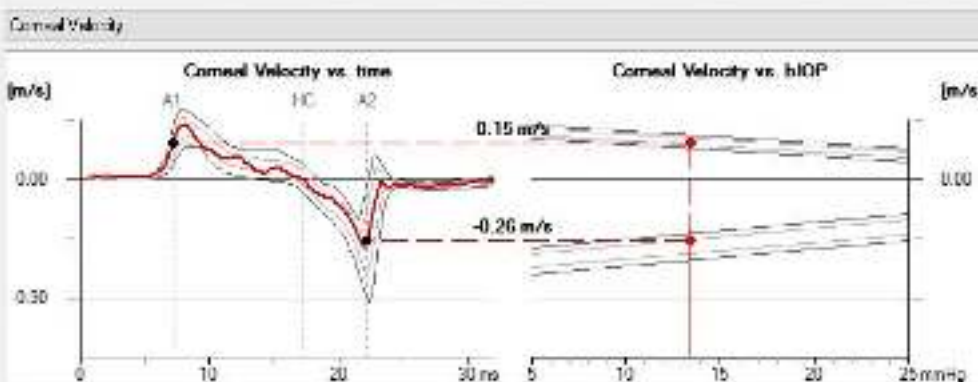
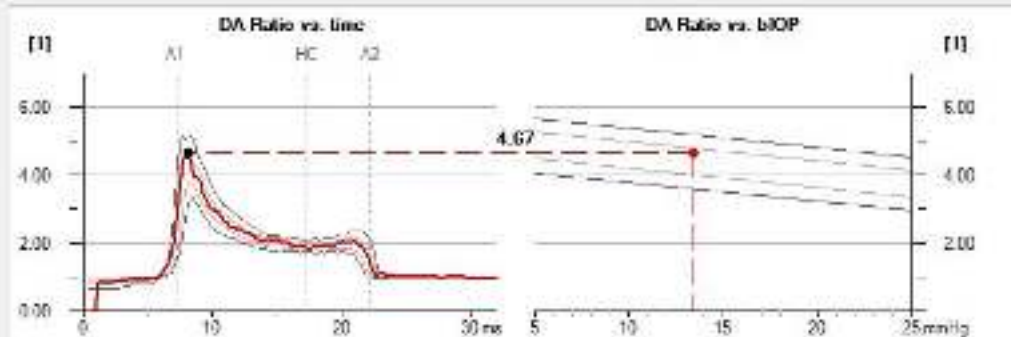
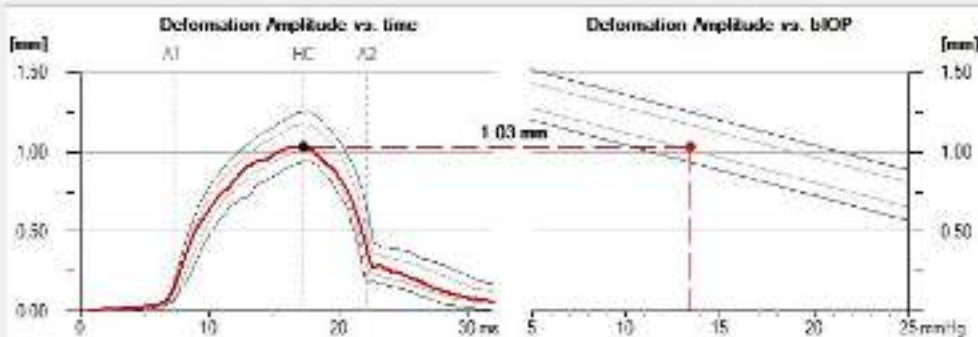
© untreated ○ post-LVC

OCULUS Corvis® ST - Vinciguerra Screening Report

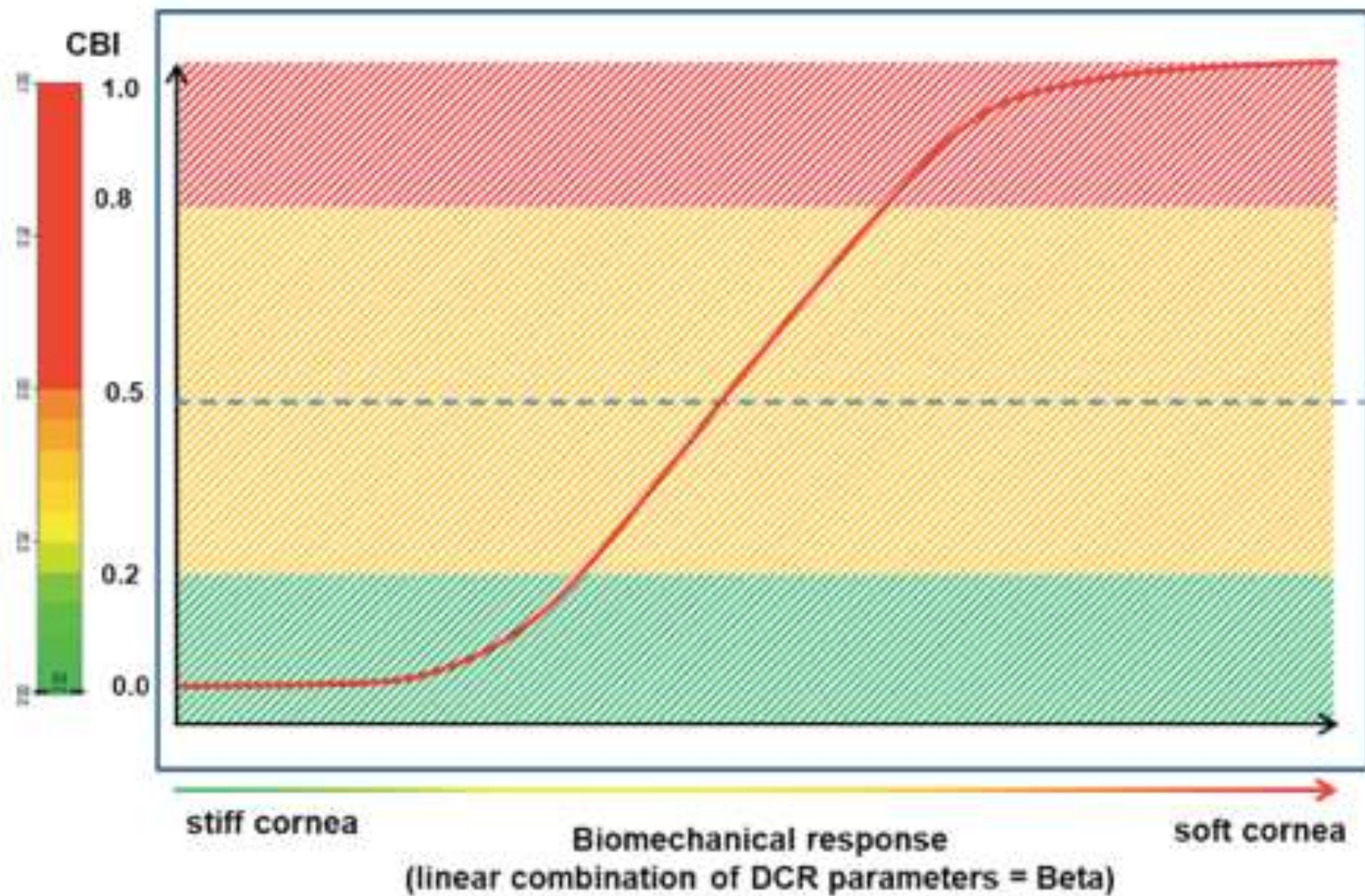
1.6.2018

Name: [REDACTED] ID: UntelKC Date of birth: 28.05.1990 Age: 31
Exam. Date: [REDACTED] Time: 12:51:20 Eye: Right (OD)
Info: QS: OK

Deformation Amplitude [mm] Deformation Amplitude Ratio (2nd)



① untreated ② post IVC



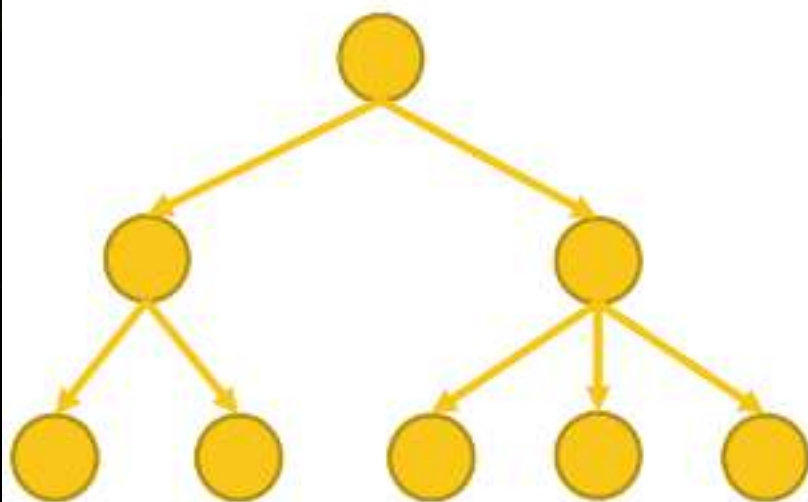
CBI Ethnicity

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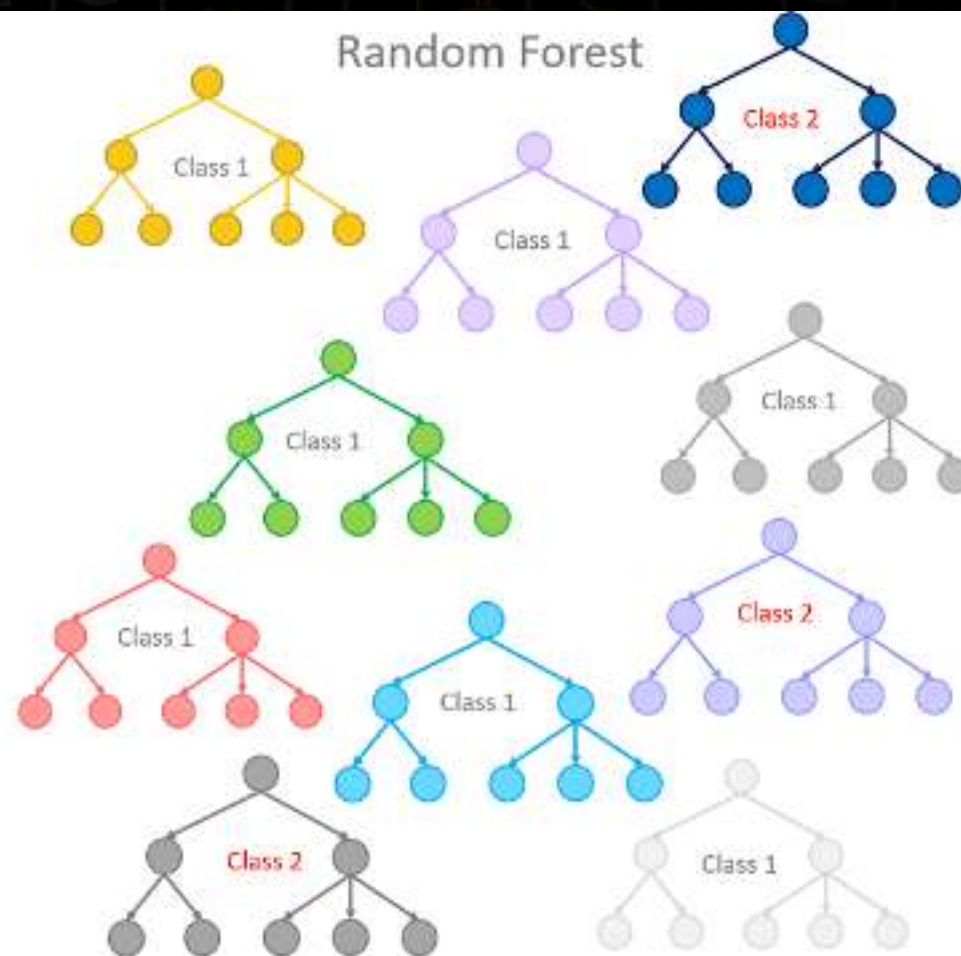
TBI: Tomographic Biomechanical Index

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Single Decision Tree



Random Forest

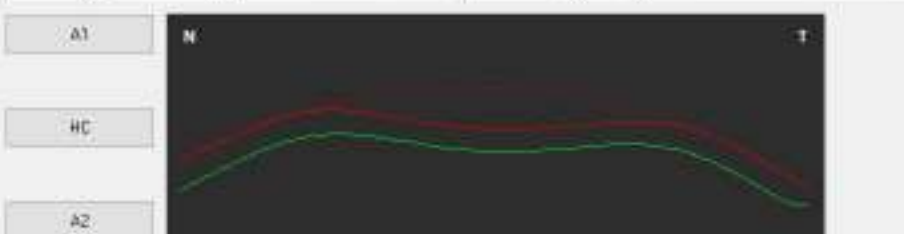
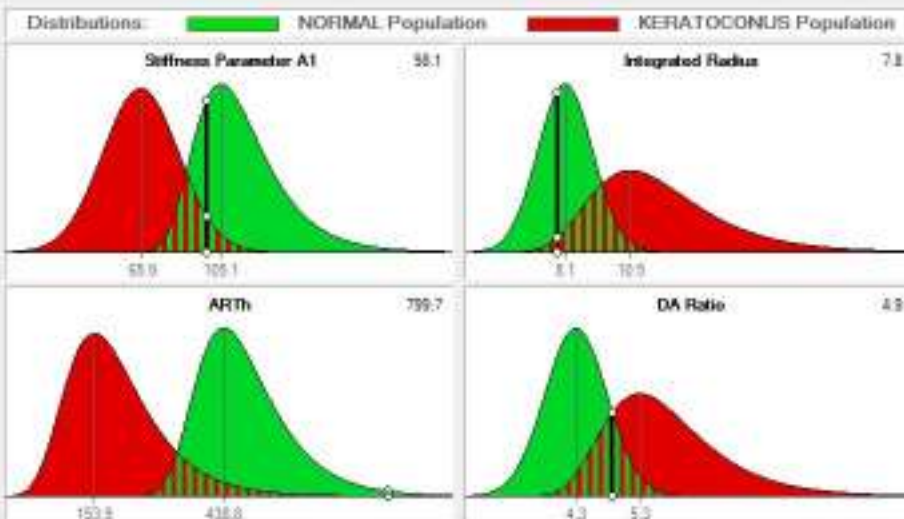


OCULUS Corvis® ST - Biomechanical/Tomographic Assessment (ARV)

1.6.2021

Name: [REDACTED] ID: [REDACTED] Date of birth: 16.10.1962 Age: 38
 Exam. Date: 27.09.2021 Time: 11:47:25 Eye: Left (OS) Exam. Date: 27.09.2021 Time: 11:51:06 Eye: Left (OS)
 Info: QS: OK Info: QS: OK

Corvis ST - Biomechanical Assessment

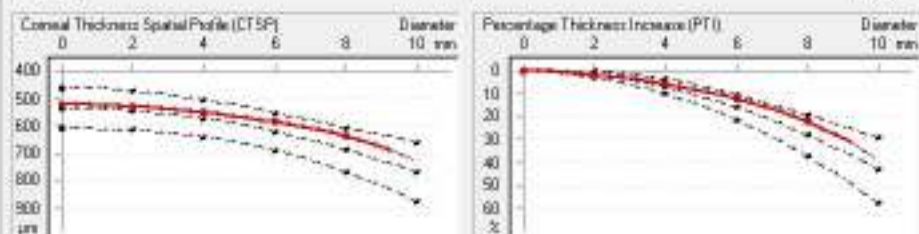
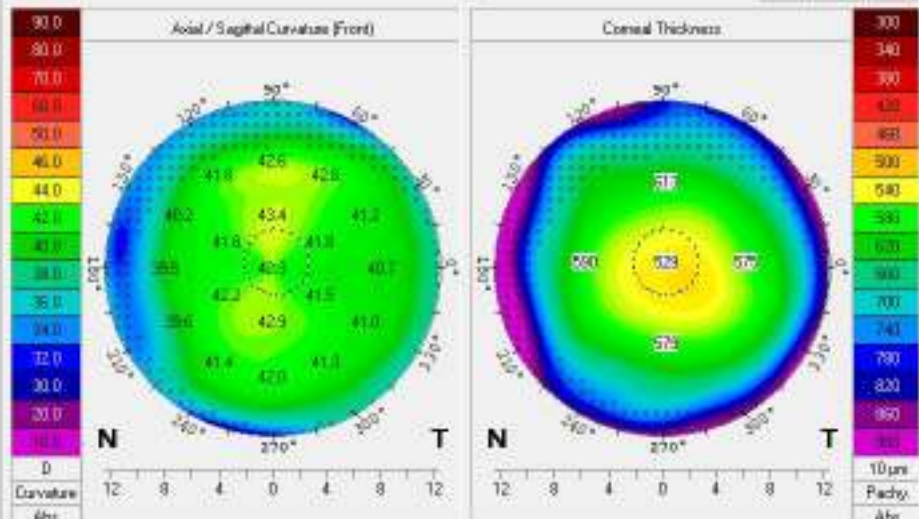


20.10 res IOPmed: 14.5 mmHg bIOP: 14.4 mmHg

CBI ■ ■ 0.14
 @ untreated @ post LVC 0.25 0.50 0.75 1.00

TBI ■ ■ 0.02
 0.00 0.25 0.50 0.75 1.00

Pentacam - Tomographic Assessment



K Max: 43.6 D IS Value: -0.3 D PRFI: 0.04 TNC:

BAD D ■ ■ 0.50
 @ myopic @ hyperopic 1.5 3

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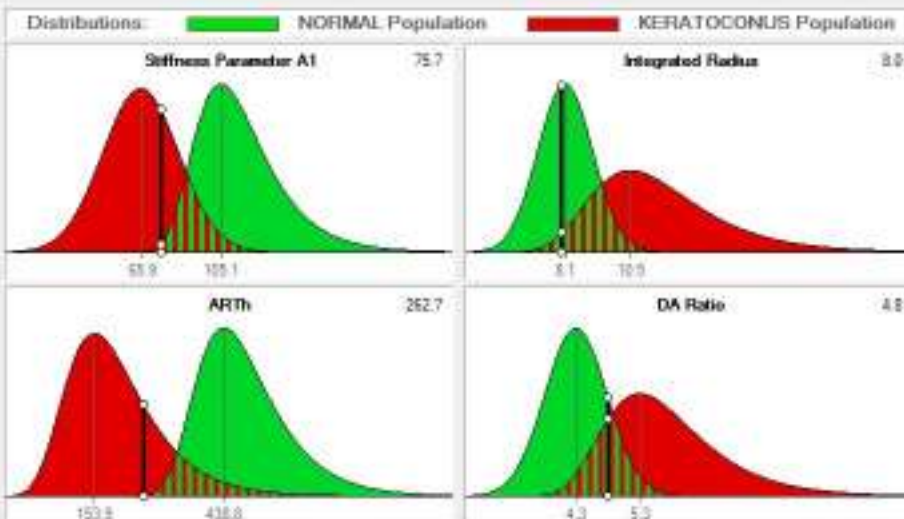


OCULUS Corvis® ST - Biomechanical/Tomographic Assessment (ARV)

1.6.2021

Name: [REDACTED] ID: [REDACTED] Date of birth: 01.12.1998 Age: 22
 Exam. Date: 11.10.2021 Time: 13:05:57 Eye: Right (OD) Exam. Date: 11.10.2021 Time: 12:58:56 Eye: Right (OD)
 Info: QS: OK Info: QS: OK

Corvis ST - Biomechanical Assessment

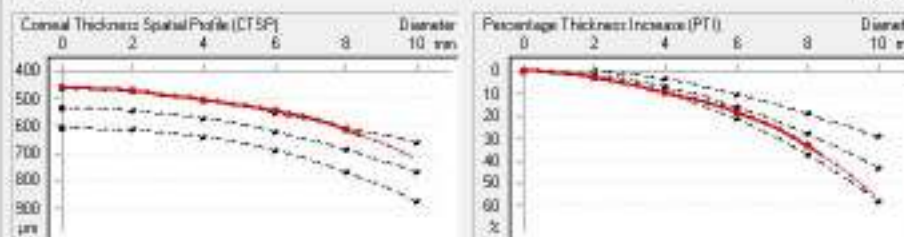
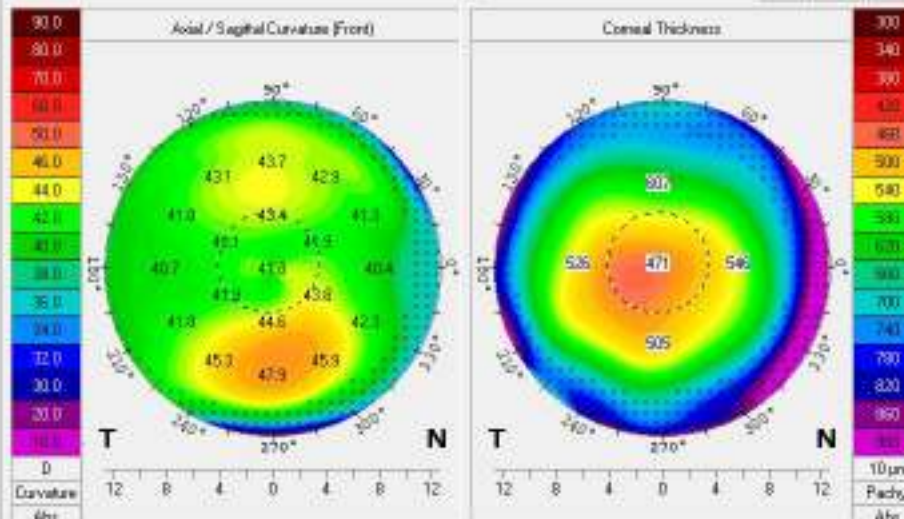


22.87 ms IOP_{Pre}: 13.5 mmHg IOP_{Post}: 15.5 mmHg

CBI ■ ■ 0.92
 @ untreated @ post LVC 0.25 0.50 0.75 1.00

TBI ■ ■ 1.00
 0.00 0.25 0.50 0.75 1.00

Pentacam - Tomographic Assessment



K Max: 48.1 D IS Value: 1.5 D PRI: 0.74 TNC:

BAD D ■ ■ 2.49
 @ myopic @ hyperopic 1.5 3

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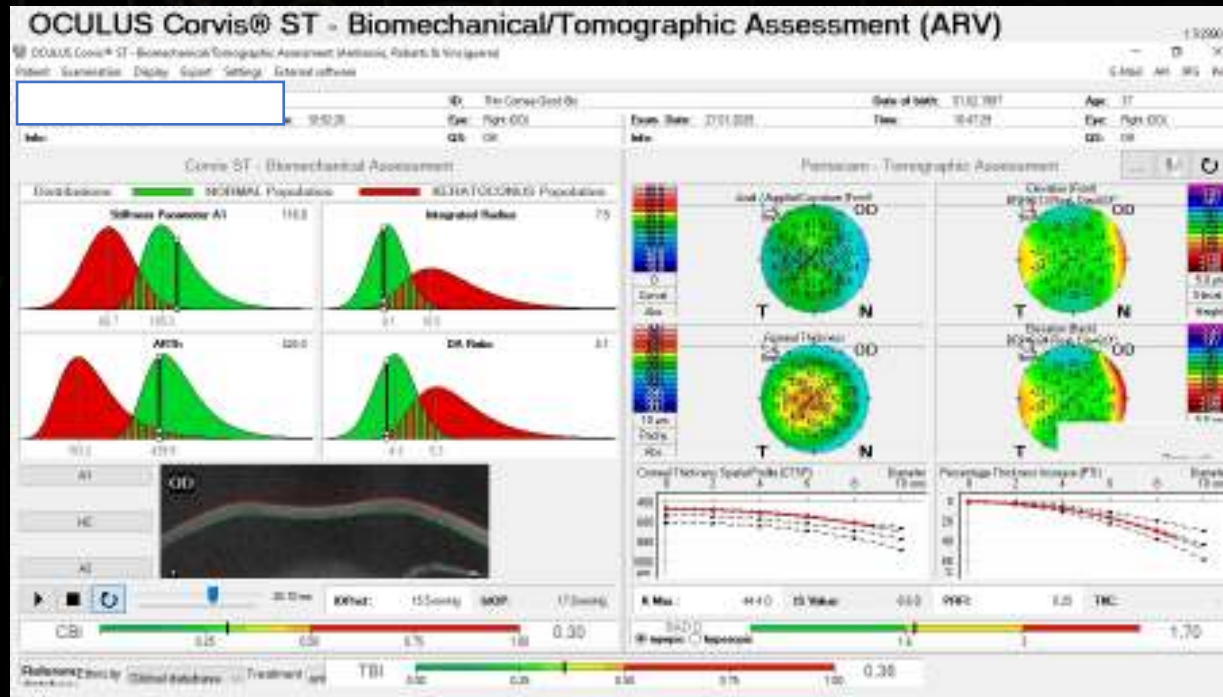
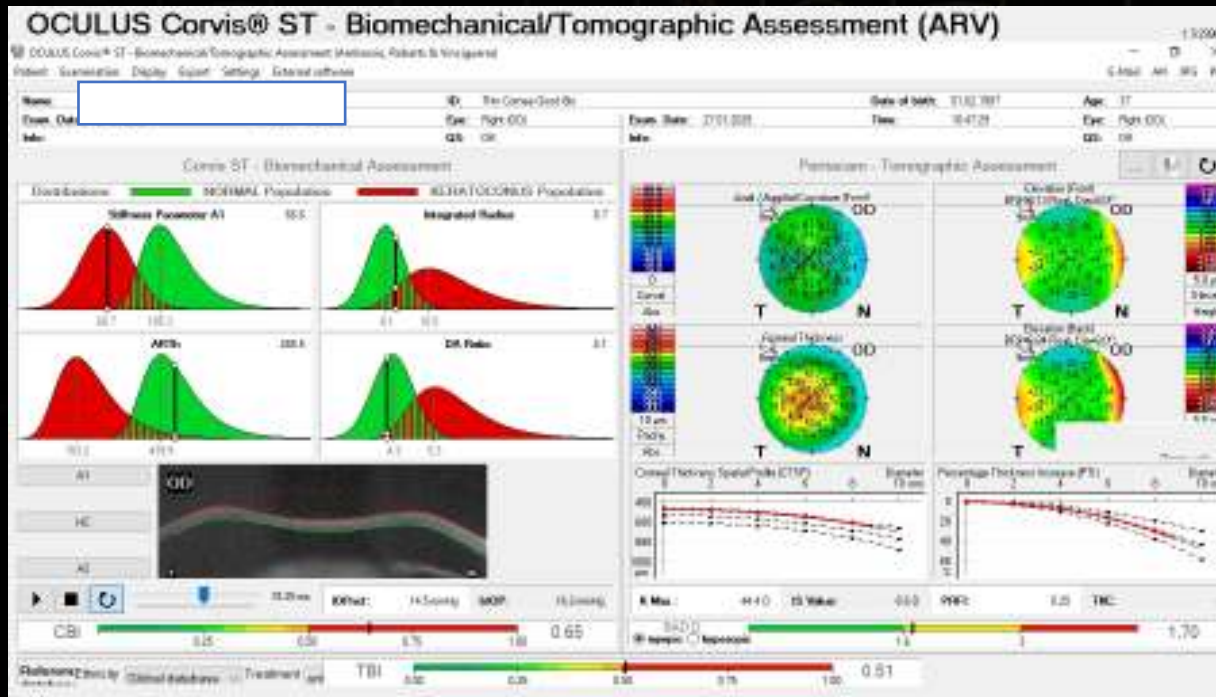
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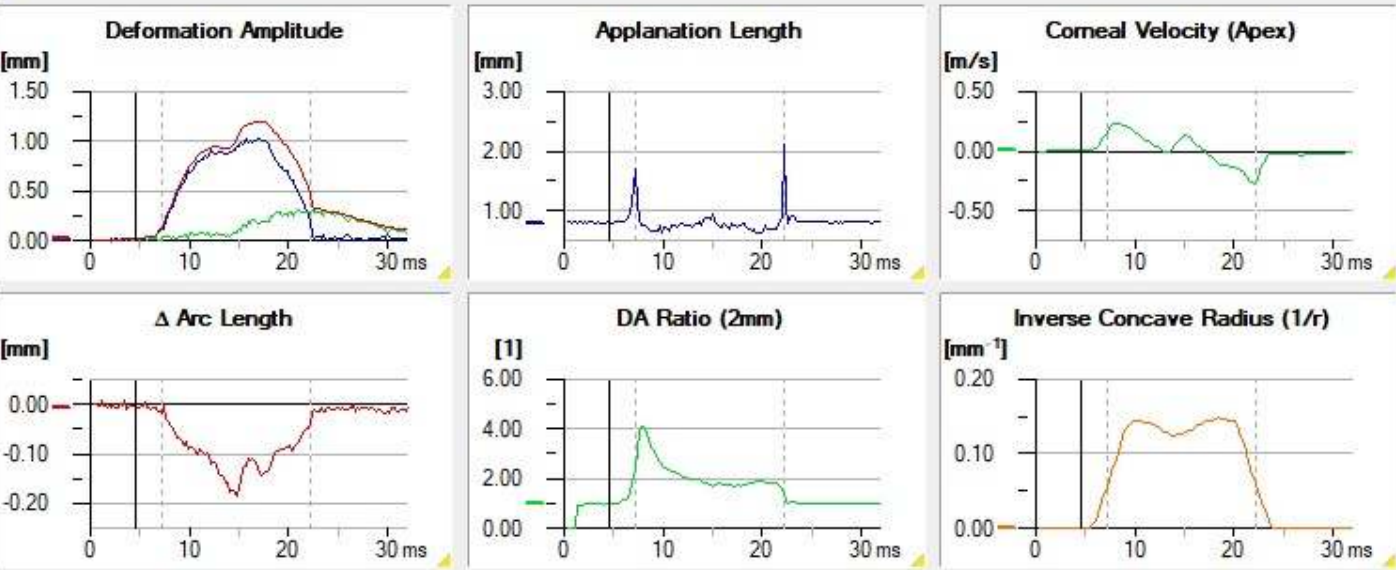


CBI and TBI Repeatability

R10 2026

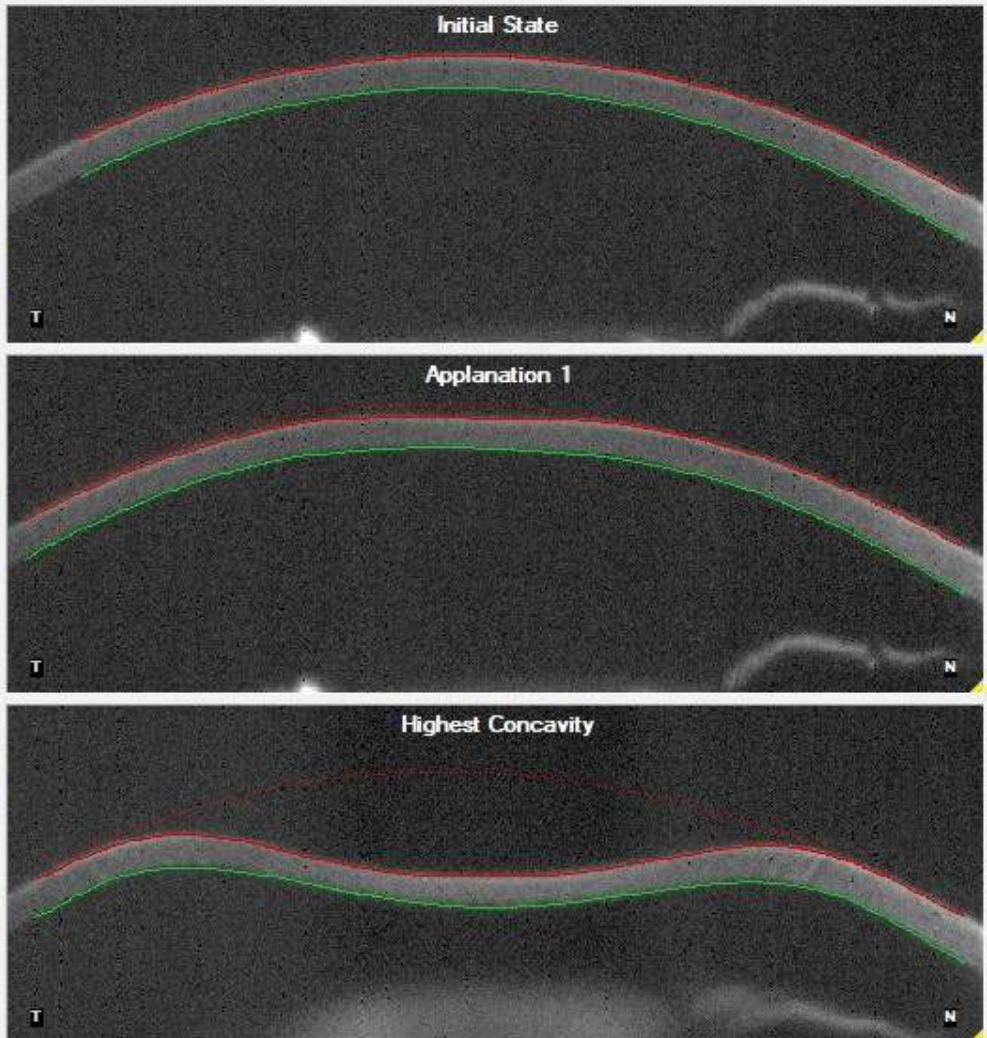
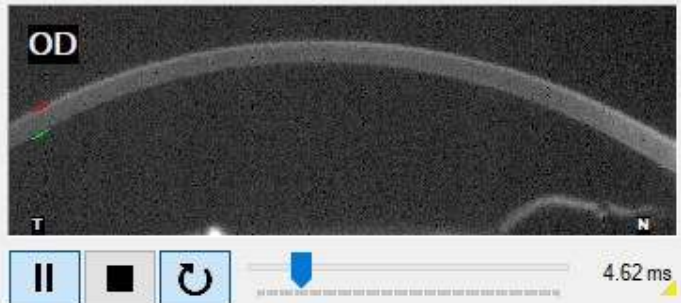


R10 2026



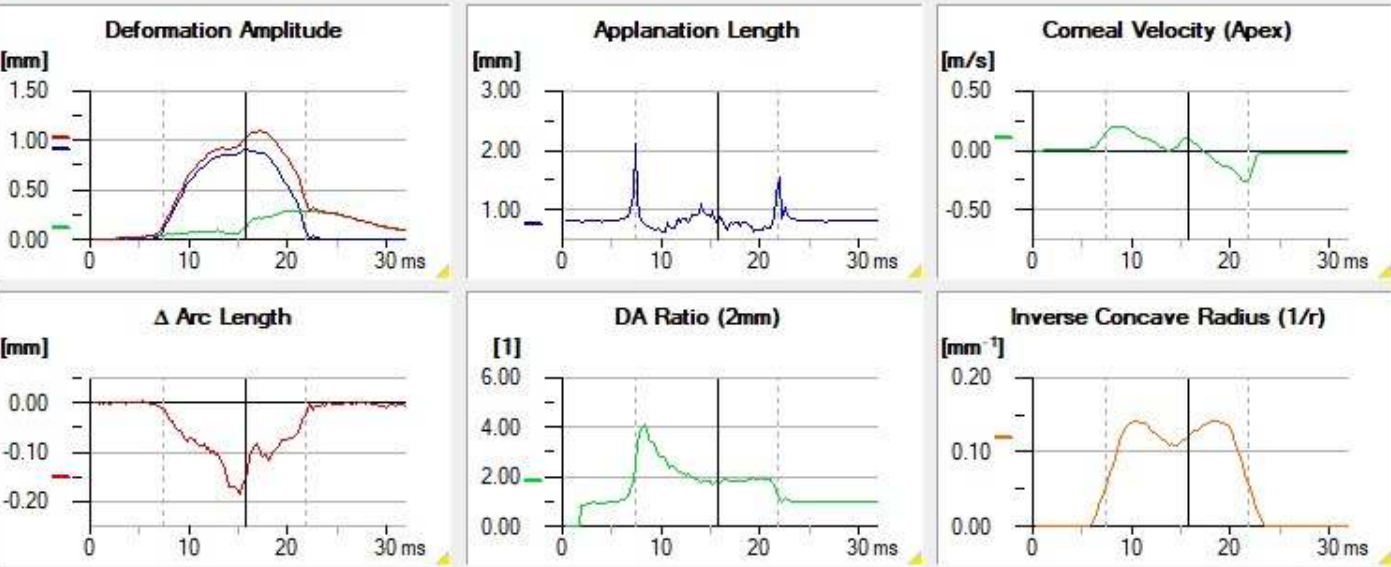
	Length		Velocity	IOP	
Applanation 1	1.65 mm		0.16 m/s	IOPnct (no corr.): 14.5 mmHg	
Applanation 2	1.63 mm		-0.29 m/s		
	Peak Distance	Radius	Deform. Amplitude	Pachymetry	
Highest Concavity	5.50 mm	7.14 mm	1.20 mm	CCT: 475 μm	

- Applanation 1
- Highest Concavity
- Applanation 2



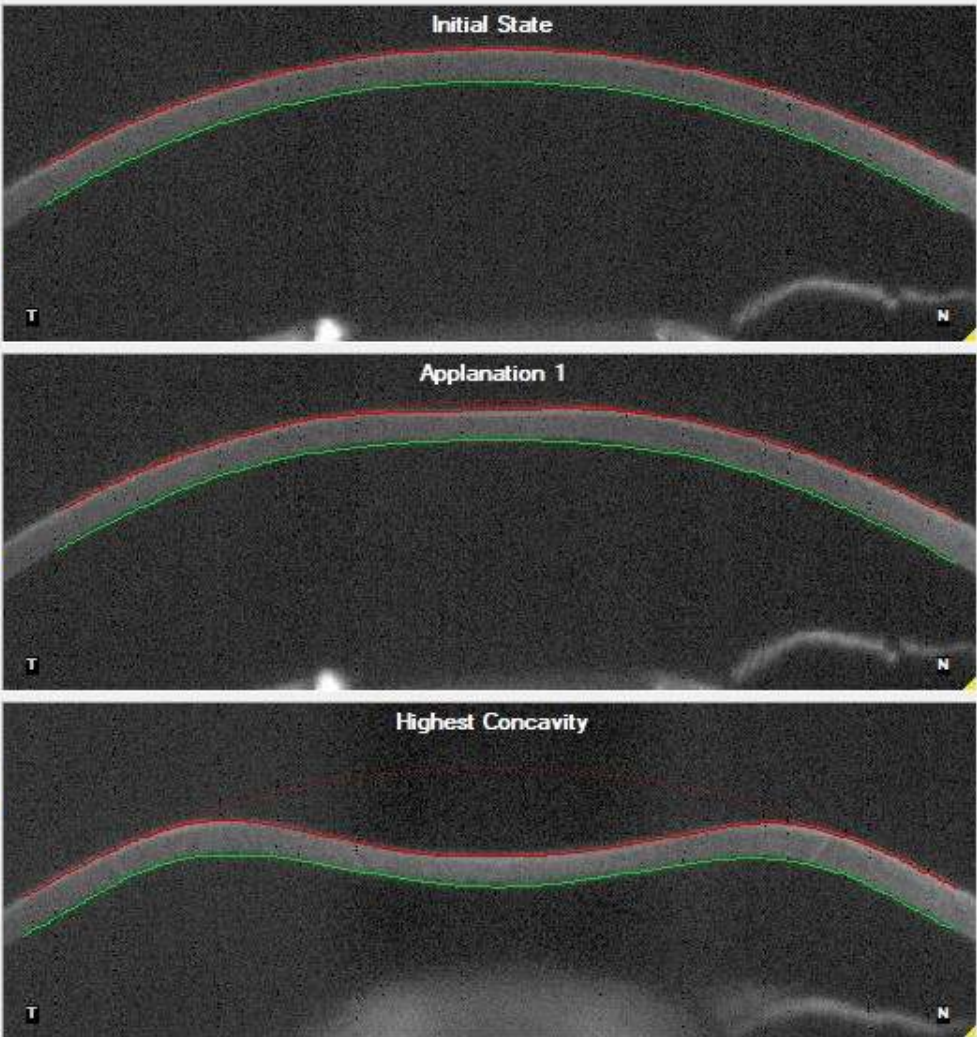
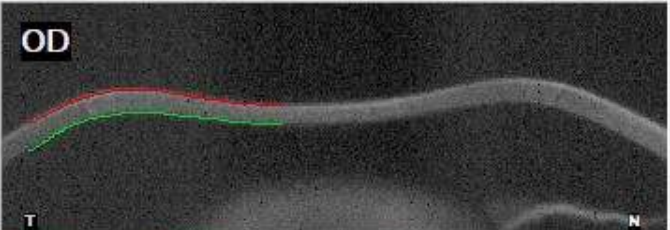
Applanation 1

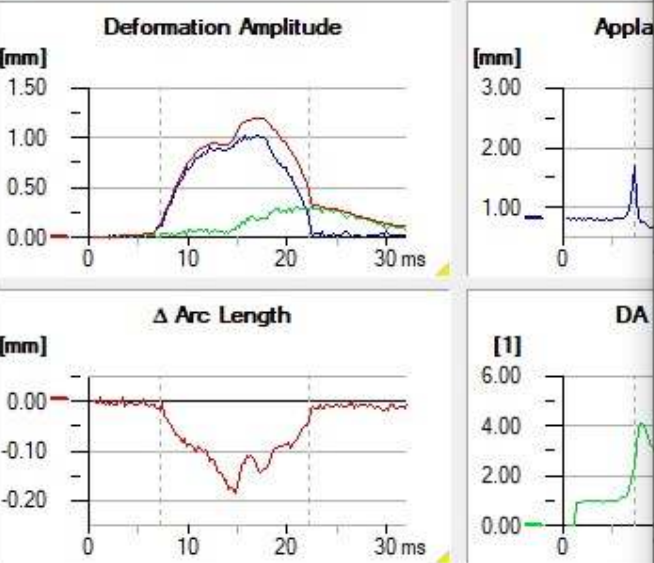
Highest Concavity



	Length	Velocity	IOP
Applanation 1	1.85 mm	0.14 m/s	IOPnct (no corr.): 15.5 mmHg
Applanation 2	1.41 mm	-0.27 m/s	
	Peak Distance	Radius	Deform. Amplitude
Highest Concavity	5.15 mm	7.04 mm	1.10 mm
	Pachymetry		CCT: 474 μm

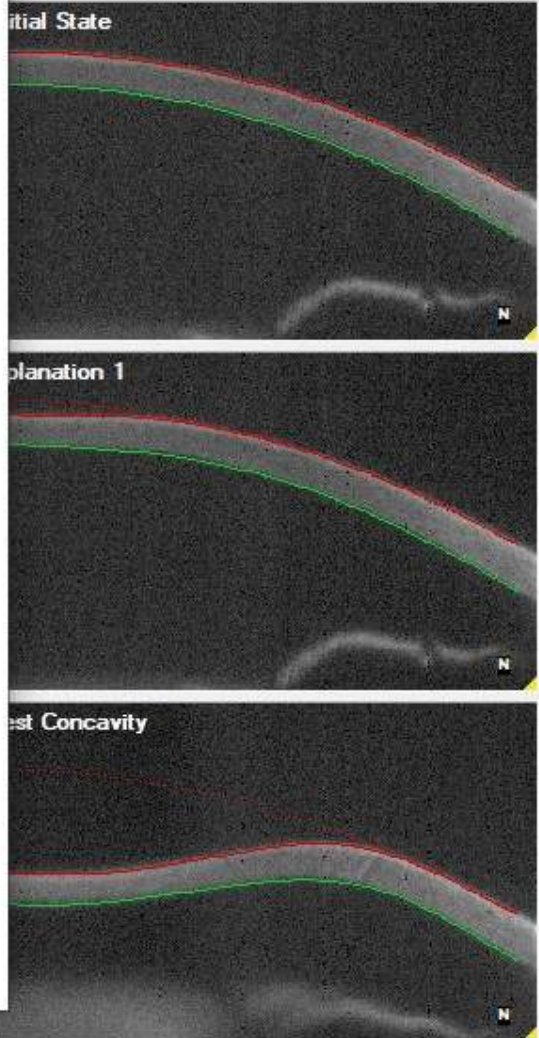
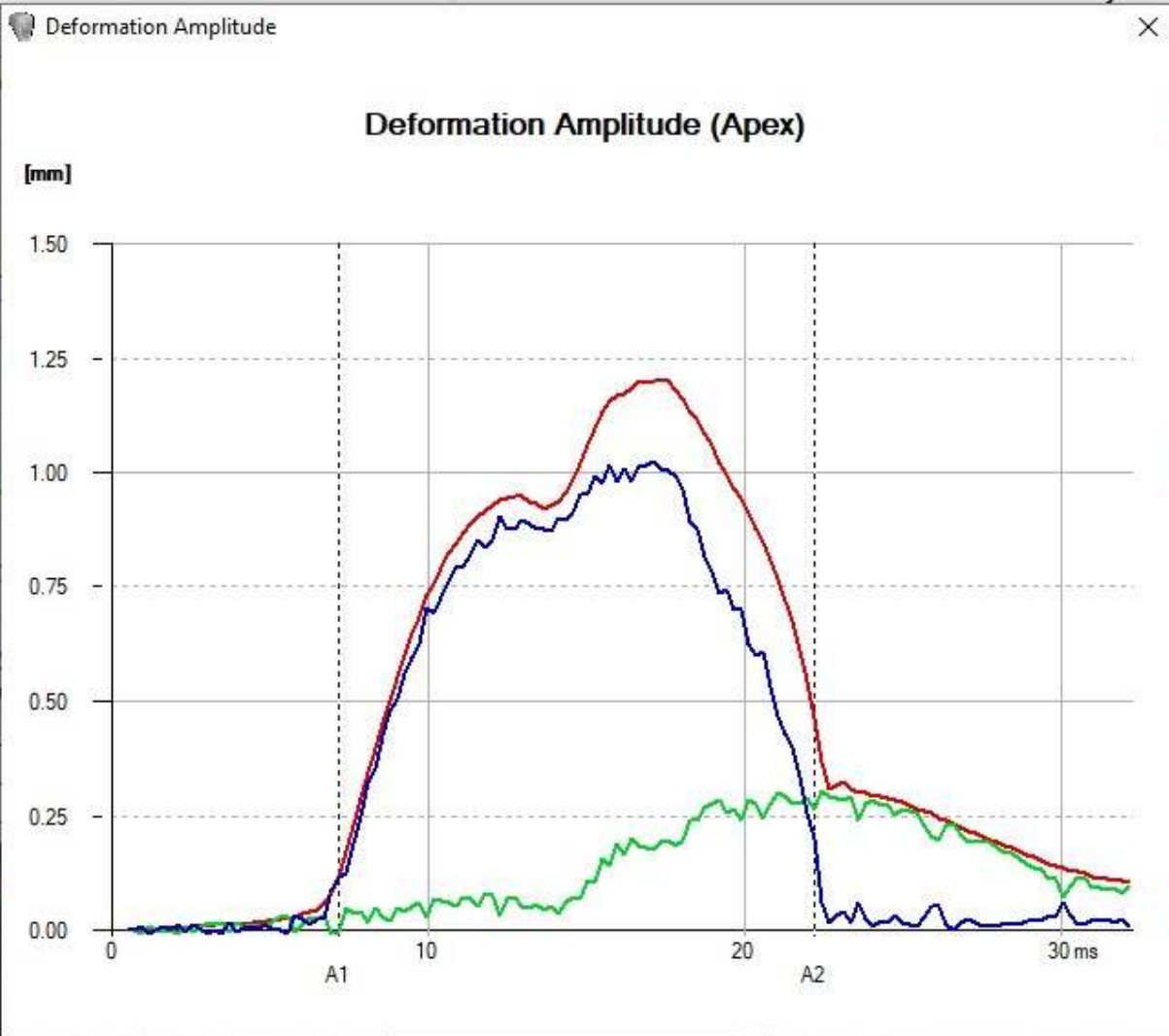
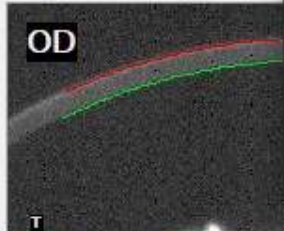
- Applanation 1
- Highest Concavity
- Applanation 2

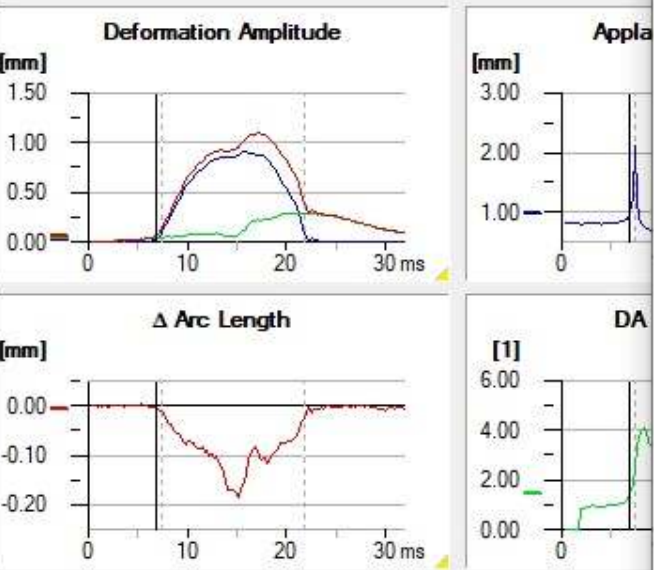




	Length	Velo
Applanation 1	1.65 mm	0.16
Applanation 2	1.63 mm	-0.29
	Peak Distance	Radius
Highest Concavity	5.50 mm	7.14 mm

- Applanation 1
- Highest Concavity
- Applanation 2

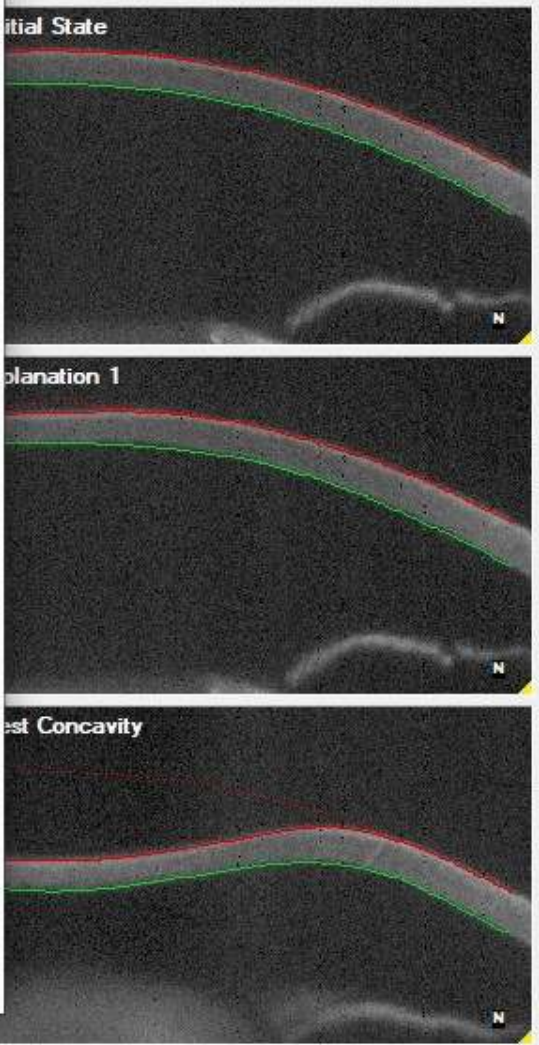
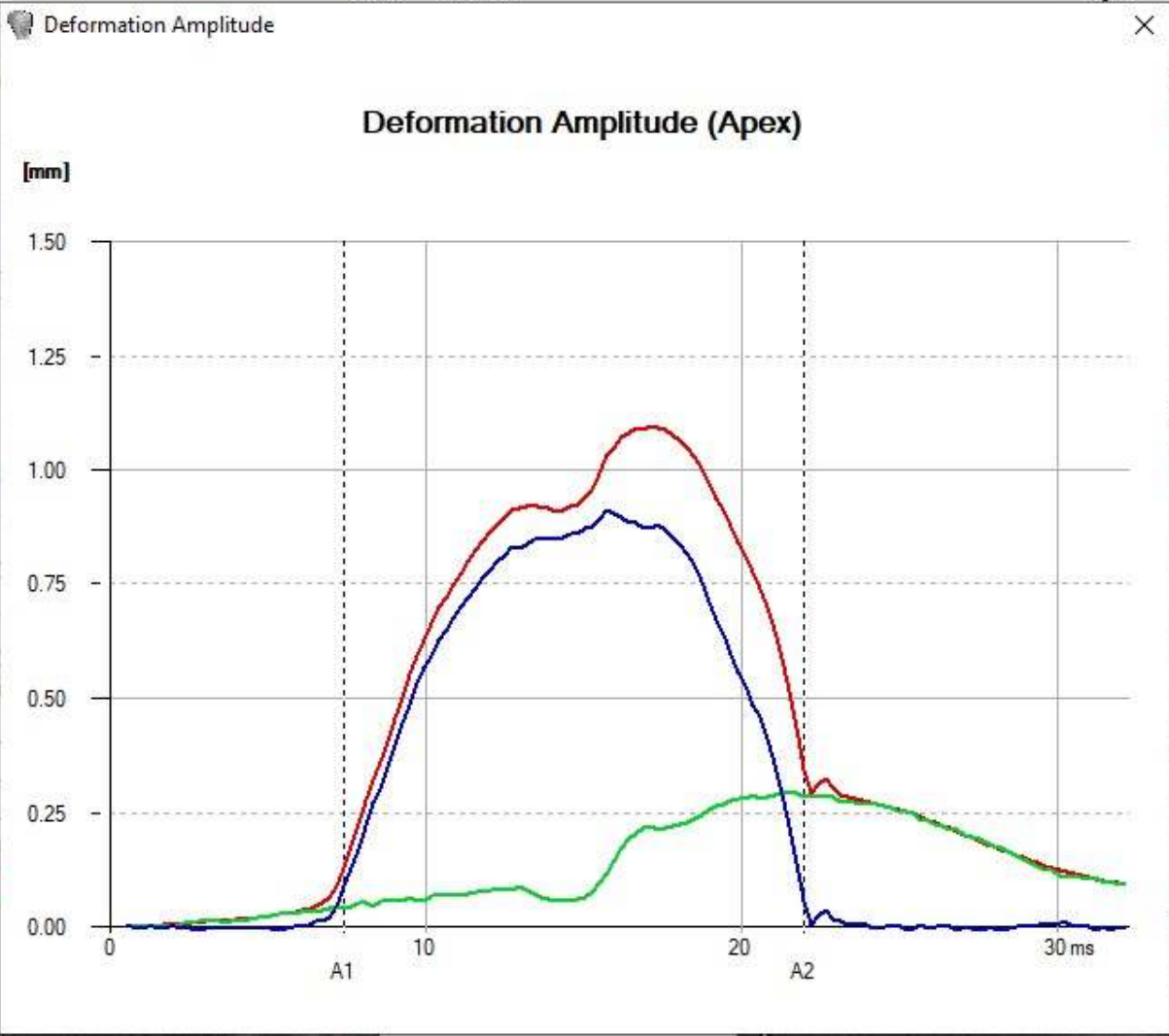
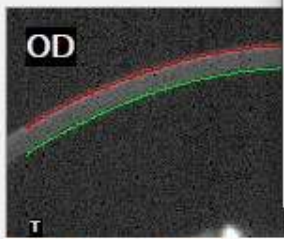


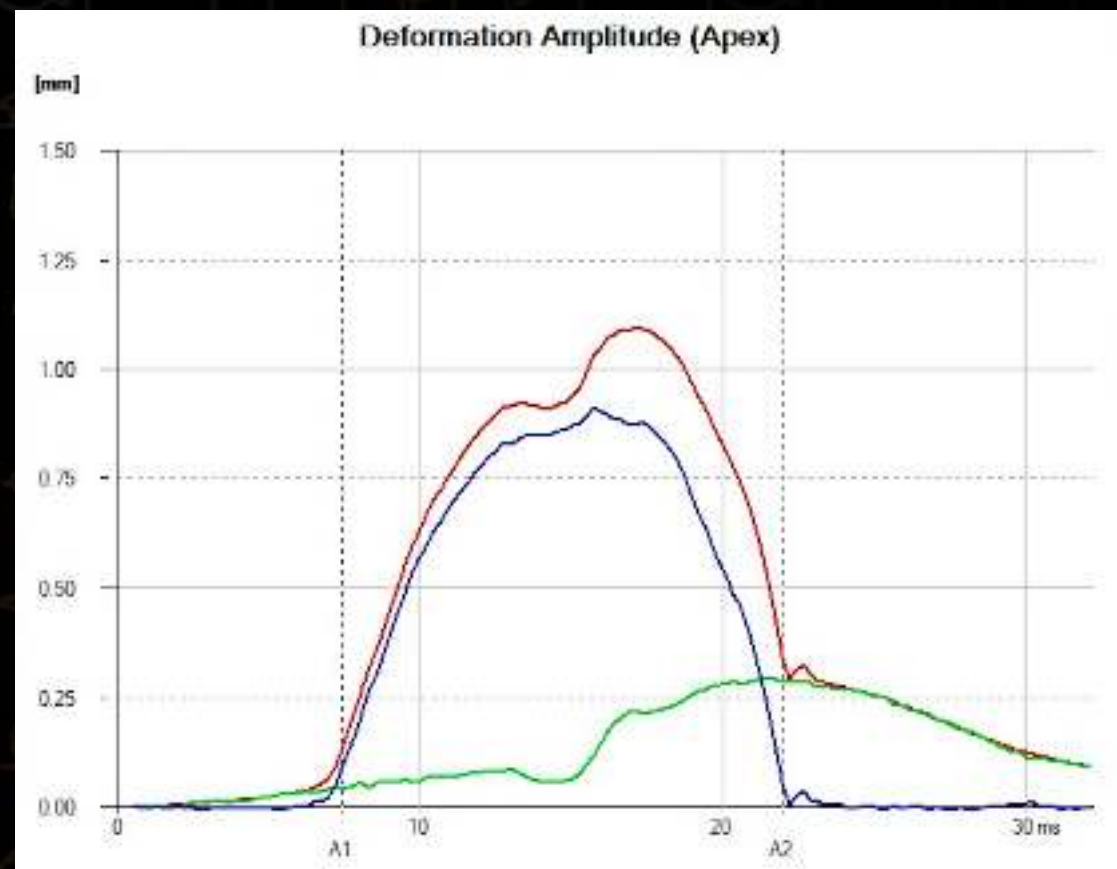
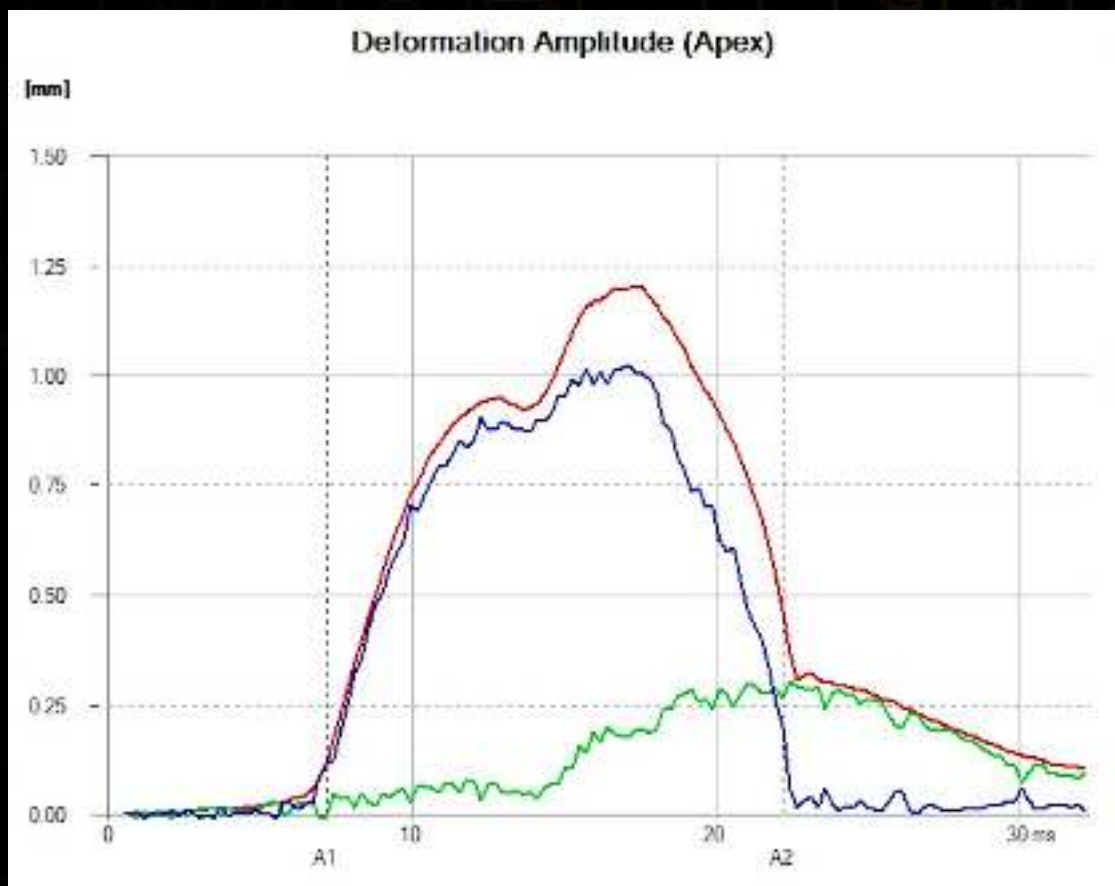


	Length	Velo
Applanation 1	1.85 mm	0.14
Applanation 2	1.41 mm	-0.27

	Peak Distance	Radius
Highest Concavity	5.15 mm	7.04 mm

- Applanation 1
- Highest Concavity
- Applanation 2





R10 2026

Clinical Cases

R10 2026

Diagnosis of KC

R10 2026

OCULUS - PENTACAM 4 Maps Selectable

1.2209

Last Name:

First Name:

ID:

Date of Birth: 07/01/2001 Eye: Left

Exam Date: 07/12/2021 Time: 11:11:55

Exam Info:

Cornea Front

Rt: 7.43 mm K1: 45.5 D

Rc: 6.63 mm K2: 50.4 D

Rmc: 7.05 mm Kmc: 47.9 D

OS: OK Axis (Rad): 11.5° Astig: 4.8 D

Q-rel: -0.33 Rcor: 7.35 mm Rmin: 6.62 mm

Cornea Back

Rt: 6.13 mm K1: -6.5 D

Rc: 5.42 mm K2: -7.4 D

Rmc: 5.83 mm Kmc: 6.9 D

OS: OK Axis (Rad): 7.5° Astig: 0.9 D

Q-rel: -0.16 Rcor: 6.13 mm Rmin: 5.29 mm

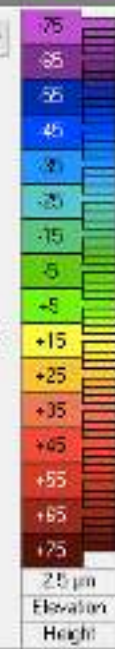
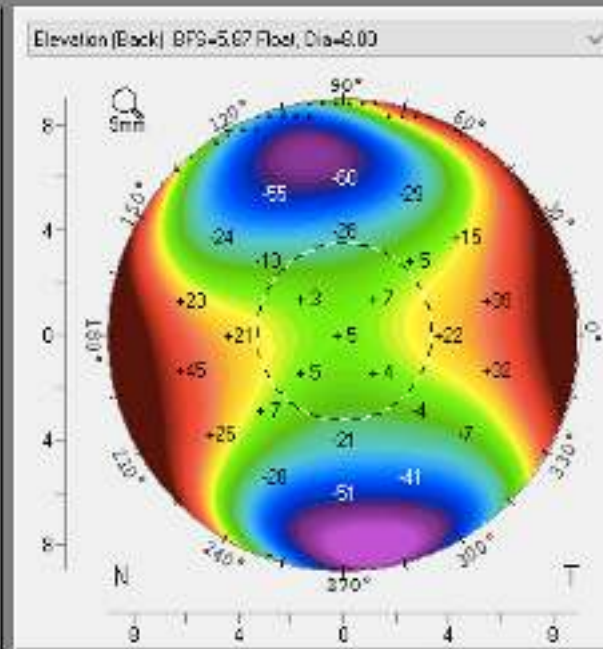
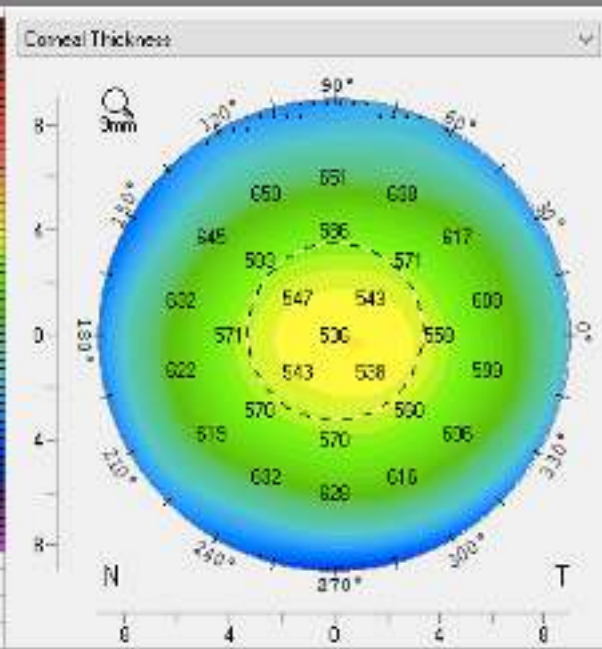
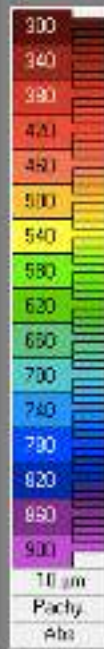
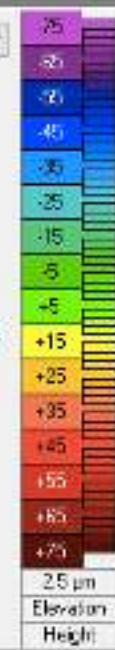
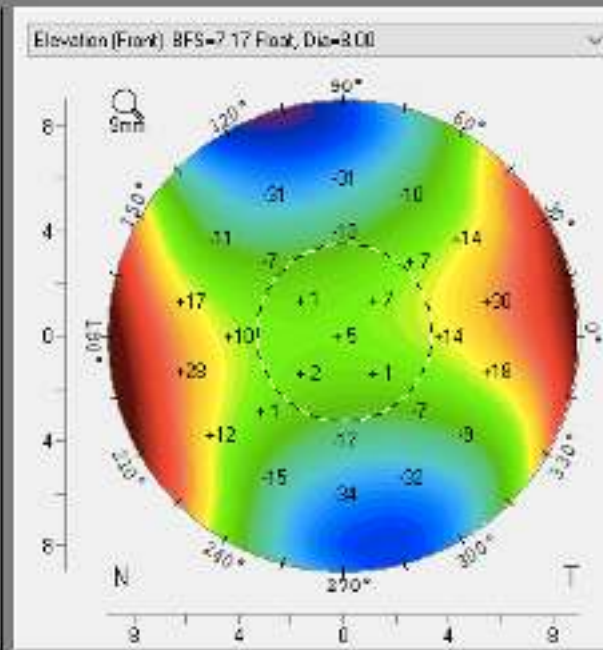
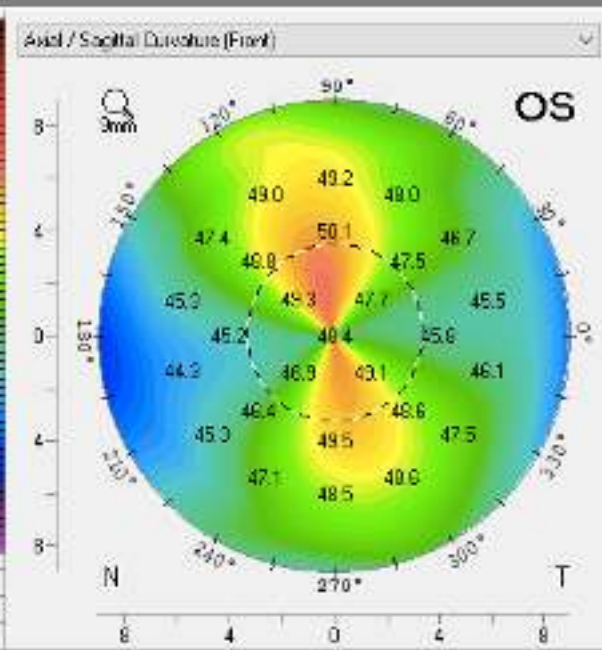
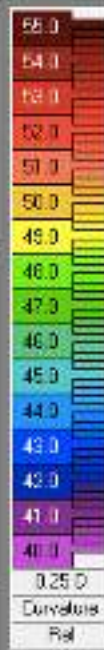
	Pachy:	x(mm)	y(mm)
Pupil Center:	+ 536 μm	+0.02	+0.06
Pachy Apex:	536 μm	0.00	0.00
Thinnest Local:	○ 535 μm	+0.42	-0.18
K. Index (Front):	51.00	+0.12	+0.72

Cornea Volume: 62.9 mm³ HW/TW: 11.2 mm

Chamber Volume: 170 mm³ Angle: 62.0°

A. C. Depth (Int.): 3.23 mm Pupil Dia: 3.96 mm

Enter IOP: IOP(Sun): -0.5 mmHg Lens Th:



10
Years
Old F
referred
for CXL

R10 2

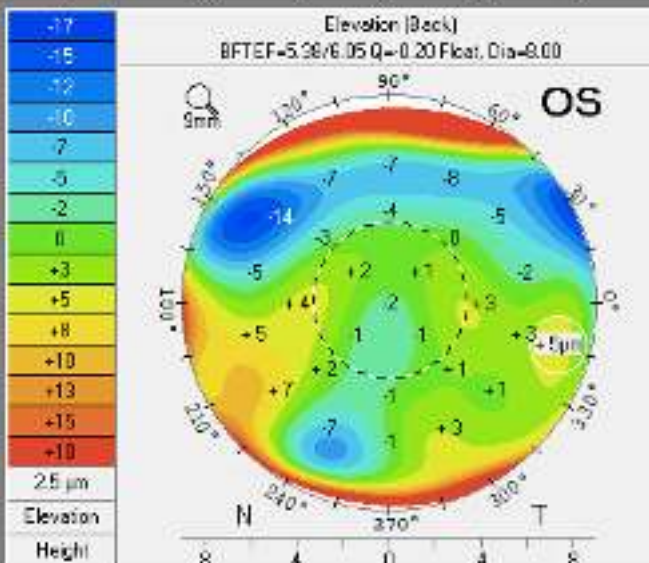
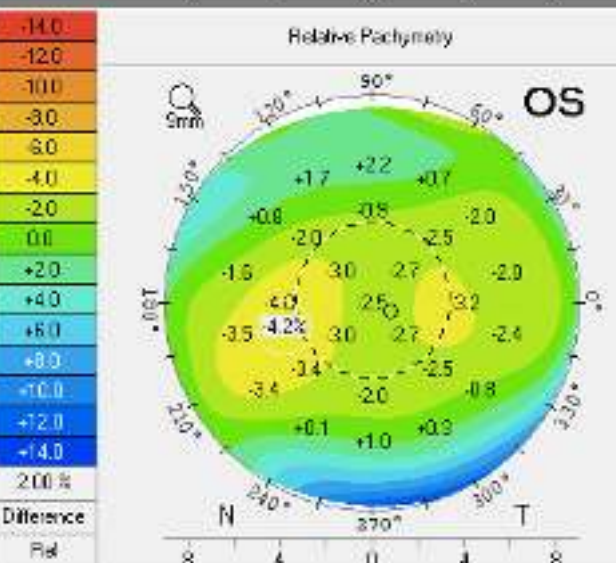
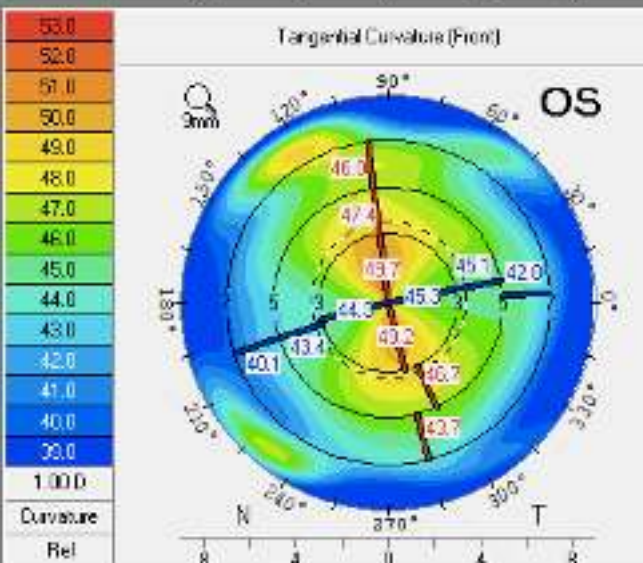
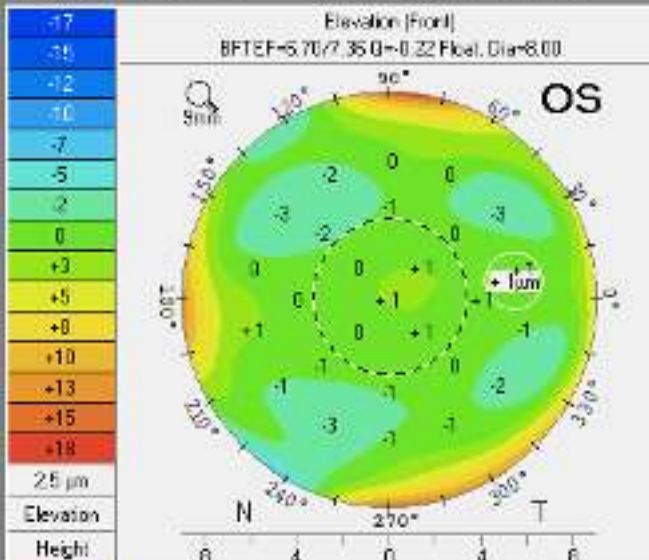
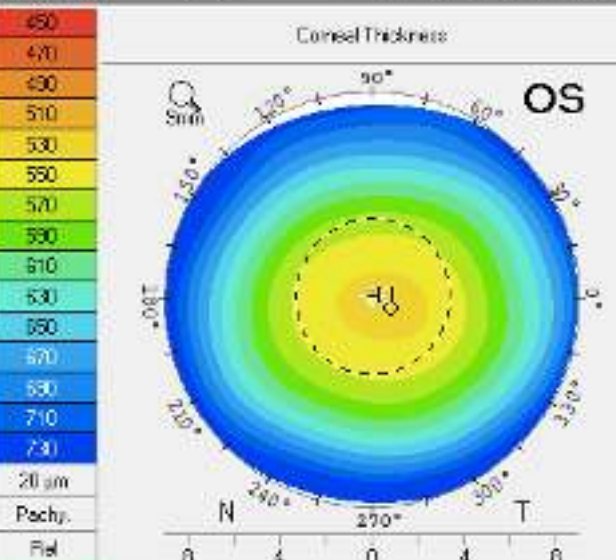
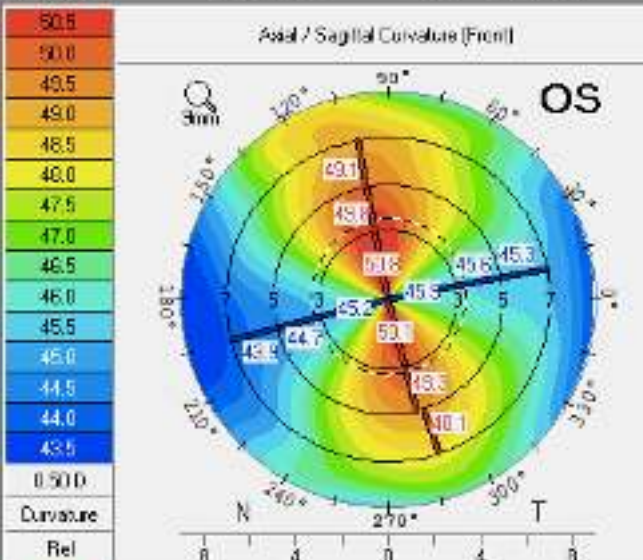
OCULUS - PENTACAM Holladay Report

1.2308

Last Name: XXXXXXXXXX
 First Name: XXXXXXXXXX
 ID: XXXXXXXXXX
 Date of Birth: 01/01/2011 Eye: Left
 Exam Date: 07/12/2021 Time: 11:11:55

Equiv K-Readings 65 (4.5mm Zone)		Details	
EKR65 Flat K1	46.58 D (12.7°)	0 (5.0mm)	-0.31
EKR65 Steep K2	51.10 D (102.7°)	Total SA: Z(4+5+8.0)	+0.173 μ
EKR65 Mean:	48.84 D	Radial Ratio (S/F)	32.1 %
Avg EKR65	4.92 D	RMS HOA W/E (5mm)	0.347 μ m

Pupil Dia:	+ 3.96 mm	x:	0.32 mm T	y:	0.06 mm S	(rel VN)
FWTW:	11	x:	0.20 mm T	y:	0.11 mm S	(rel VN)
Pachy Min:	535 μ m	x:	0.42 mm T	y:	0.18 mm S	(rel VN)
Est. Pre-Rel: K1	47.6 D	Rel. Change:	-0.1 D			
ACD (E+I)	3.73 mm	Chord μ :	0.06 mm	OS:	OK	

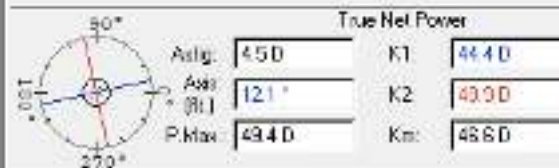
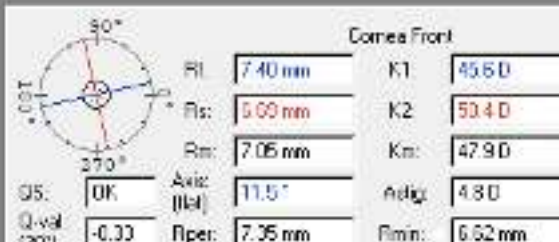


RIO 2

OCULUS - PENTACAM Topometric/KC-Staging

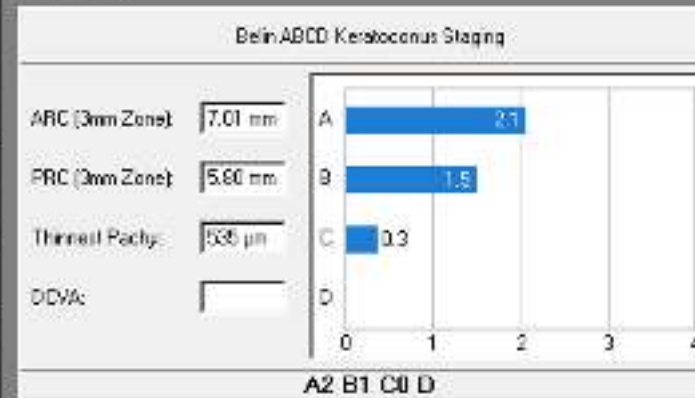
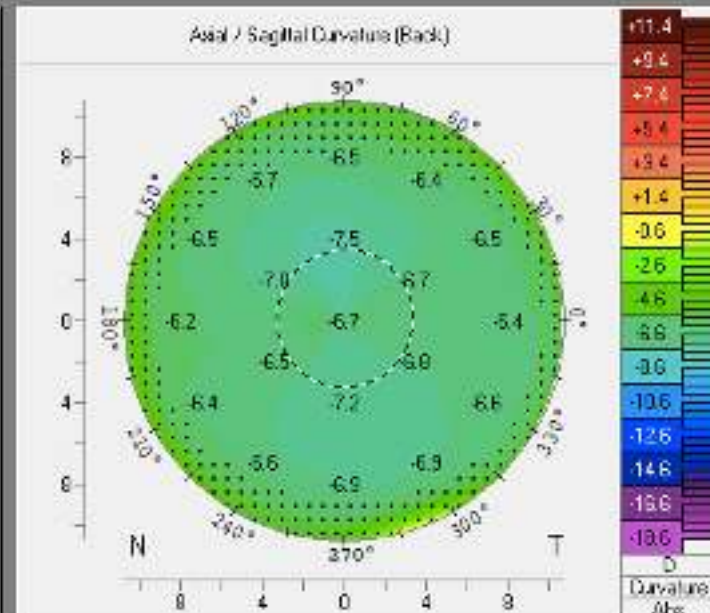
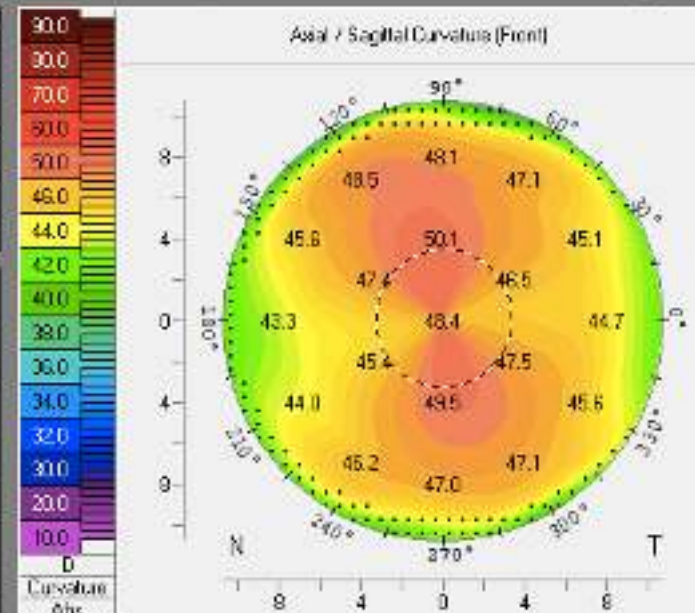
1/23/08

Last Name: XXXXXXXXXX
 First Name: XXXXXXXXXX
 ID: XXXXXXXXXX
 Date of Birth: 01/01/2011 Eye: Left
 Exam Date: 07/12/2021 Time: 11:11:55
 Exam Info:



Pupil Center:	+ 536 µm	x(mm)	-0.02	y(mm)	-0.06
Pachy Apex:	536 µm	x(mm)	0.00	y(mm)	0.00
Thinnest Locat.:	○ 535 µm	x(mm)	-0.42	y(mm)	-0.10
K Max (Front):	51.0 D	x(mm)	0.12	y(mm)	-0.72

Cornea Volume:	52.6 mm³	Hx/Vx	11.2 mm
Chamber Volume:	170 mm³	Angle:	42.0°
A.C. Depth (Int.)	3.20 mm	Pupil Dia:	2.35 mm
IOP(Sun):	+0.6 mmHg	Lens Th:	

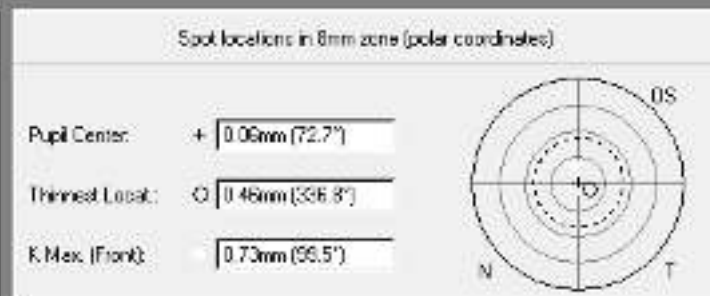
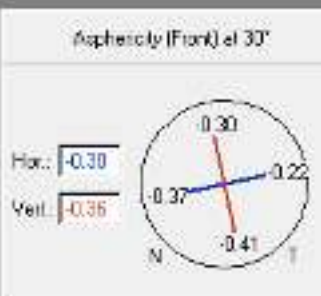


Asphericity (Front) of Major Meridians

Q-val	Degrees peripheral					Front:
	20°	25°	30°	35°	40°	
Nat	-0.35	-0.35	-0.37	-0.37	-0.32	⊙ Asphericity
Temp	-0.14	-0.15	-0.22	-0.30	-0.30	○ Asial/Sag. Curval
Inf	-0.40	-0.40	-0.41	-0.45	-0.43	Back:
Sup	-0.37	-0.34	-0.30	-0.34	-0.42	○ Asphericity
Mean	-0.32	-0.31	-0.33	-0.37	-0.38	○ Asial/Sag. Curval

Indices (in 8mm zone)

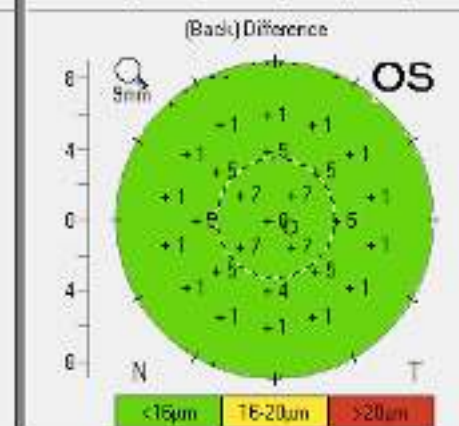
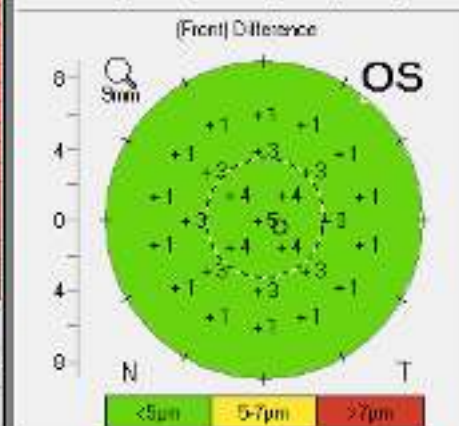
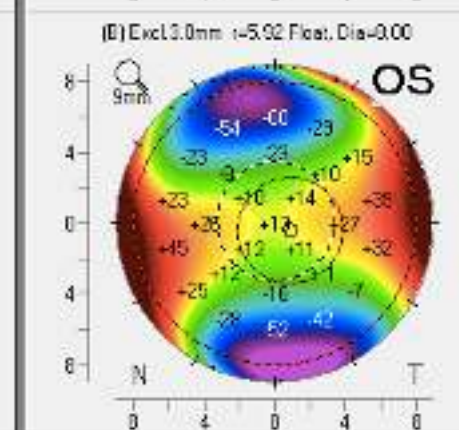
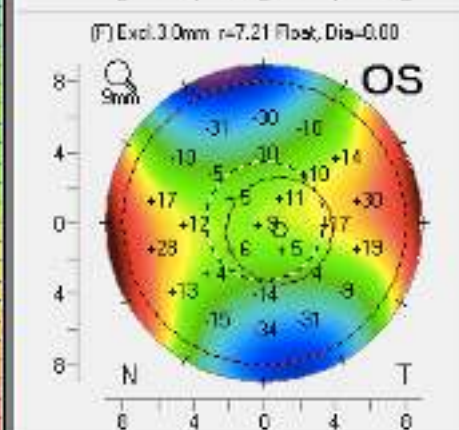
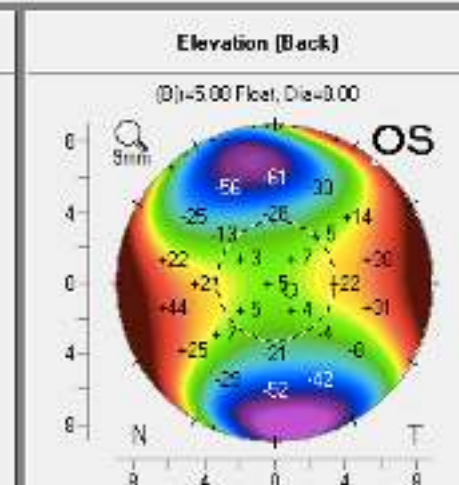
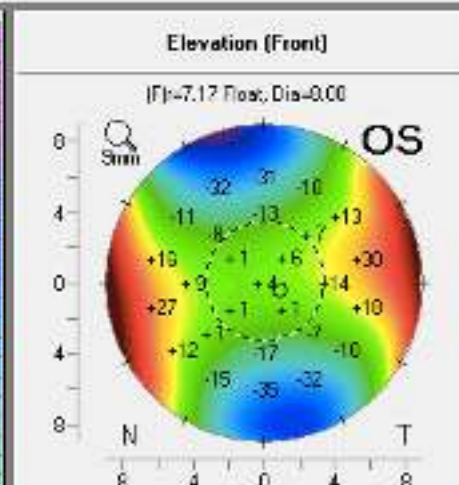
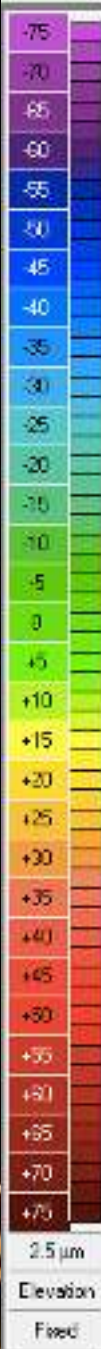
ISV:	36	IHA:	4.9
MA:	0.12	IHD:	0.015
K1:	1.00	RMin:	6.62
CK:	1.01	TKC:	Abnorm.
KISA:	5.721	IS:	-0.64



RIO 2

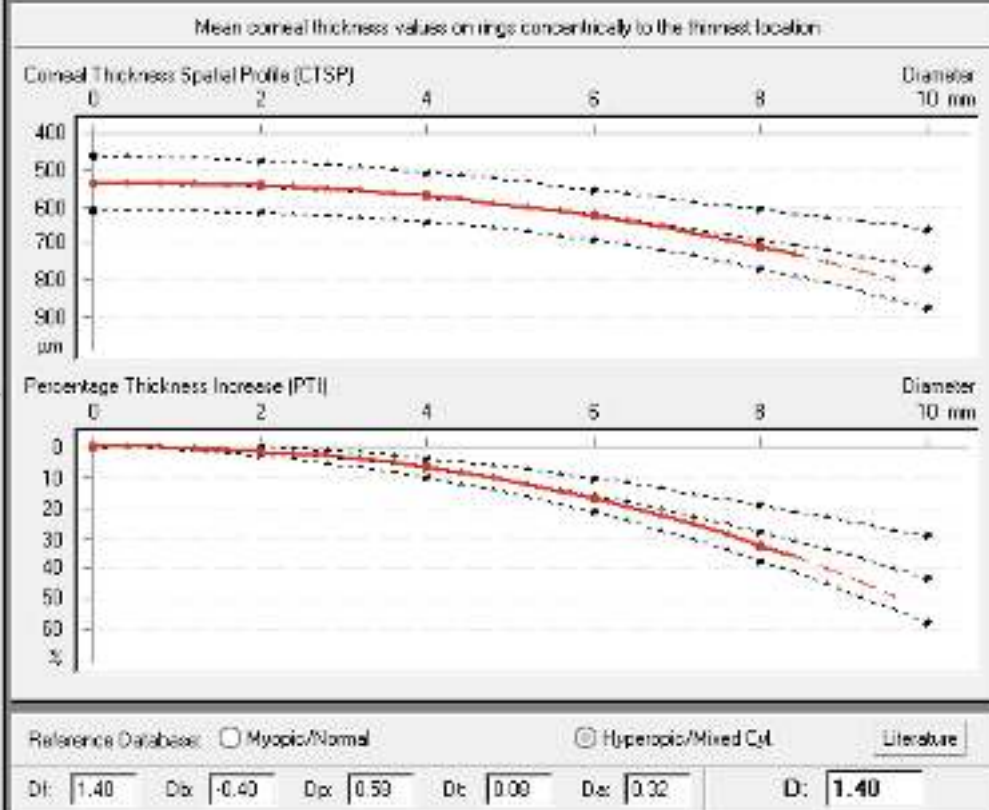
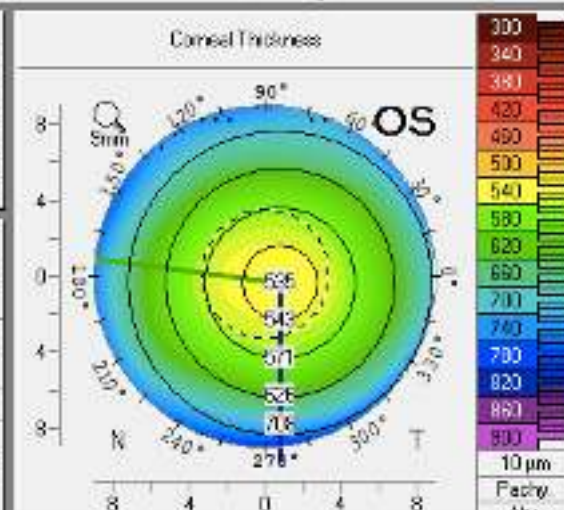
OCULUS - PENTACAM Belin/Ambrósio Enhanced Ectasia Display

1.22.09



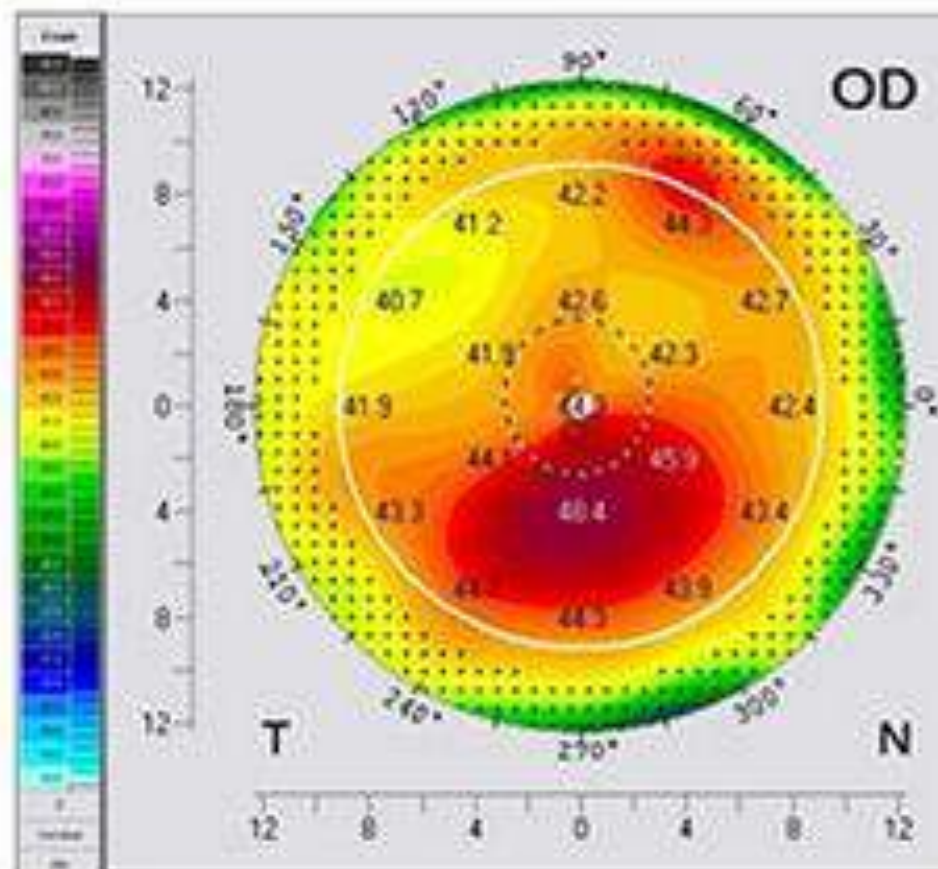
Last Name: [REDACTED]
 First Name: [REDACTED]
 ID: [REDACTED]
 Date of Birth: 01/01/2011 Eye: Left
 Exam Date: 07/12/2021 Time: 11:11:56
 Exam Info:

K1: 45.6D Axis: 11.5°
 K2: 50.4D D-val: -0.33
 KMax: 51.0D OS: OK
 Pachy Thin Local: 535µm
 Dist. Apex Thin Loc: IT 0.45mm
 F.Ele Th: 5µm B.Ele Th: 6µm
 Progression Index
 Min: 0.60 Max: 1.18
 Avg: 0.99 ARTmax: 453

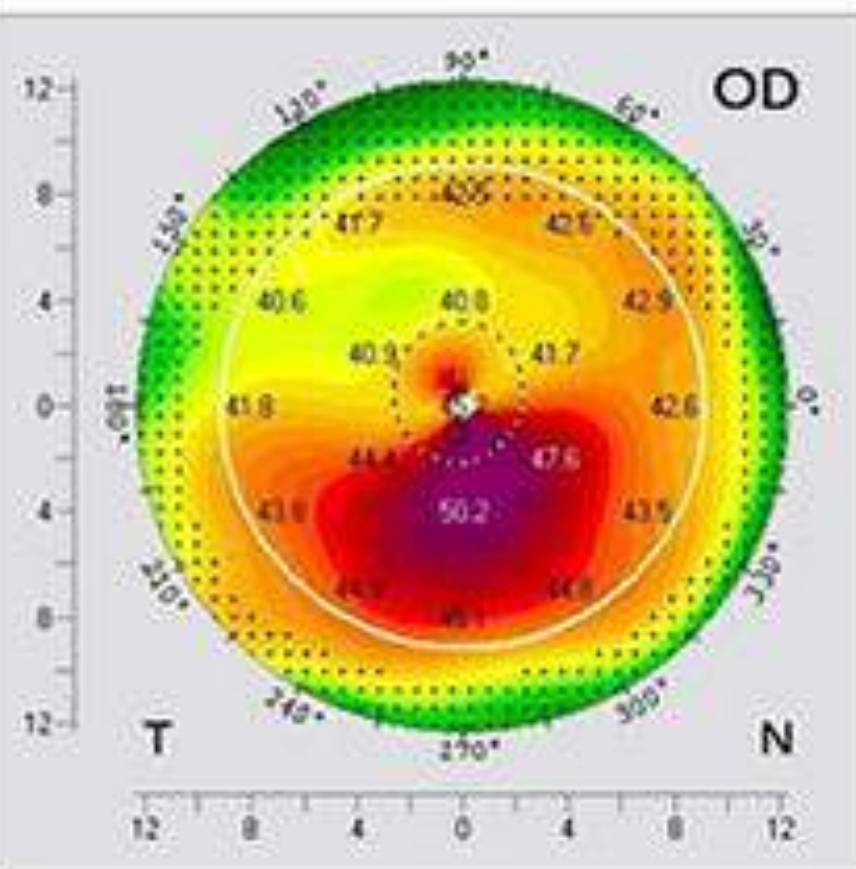


R10 2

May 2009



August 2009



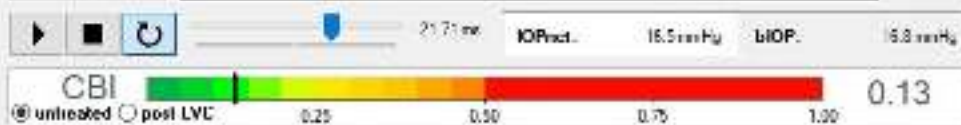
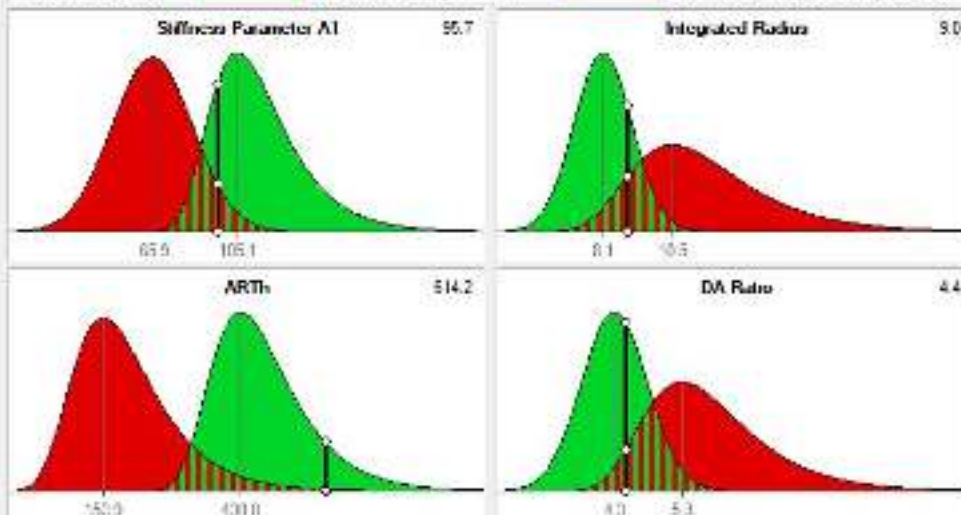
R10 2026

OCULUS Corvis® ST - Biomechanical/Tomographic Assessment (ARV)

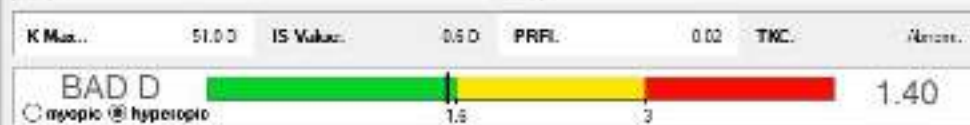
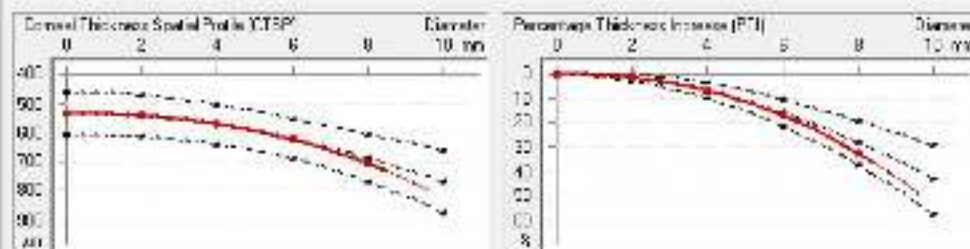
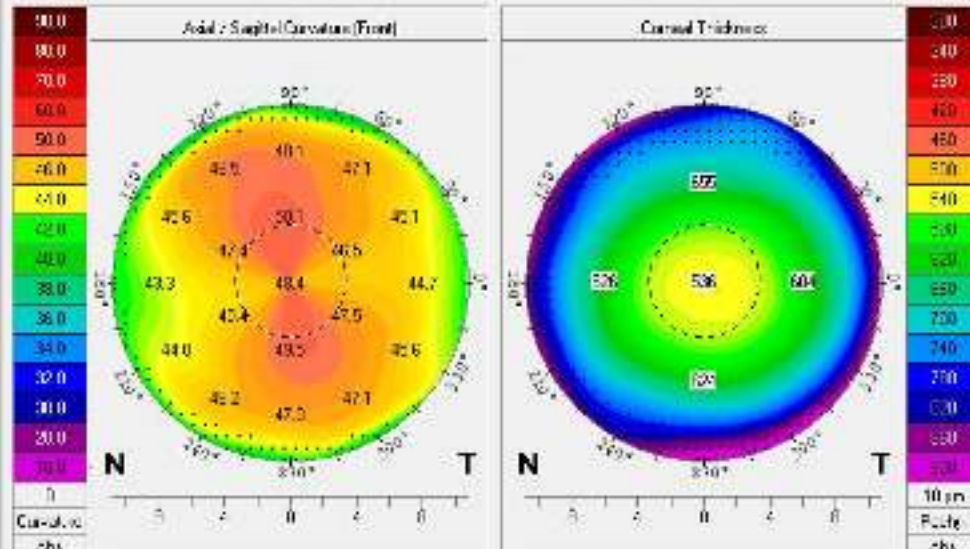
1.512091

Name: [REDACTED] ID: [REDACTED] Date of birth: 01.01.2011 Age: 10
 Exam. Date: [REDACTED] Time: 11:14:57 Eye: Left (OS) Exam. Date: 12.07.2021 Time: 11:11:55 Eye: Left (OS)
 Info: [REDACTED] OS: OK Info: [REDACTED] OS: OK

Corvis ST - Biomechanical Assessment

Distributions: ■ NORMAL Population ■ KRAH/DONUS Population


Pentacam - Tomographic Assessment



Oculus Optikgeräte GmbH
 Münchholzhäuser Str. 29

35582 Wetzlar

Tel: (0641) 20 05-0
 Fax: (0641) 20 05-255

www.oculus.de


R10 2

OCULUS Corvis® ST - Biomechanical/Tomographic Assessment (ARV)

16/2021

Name:



ID:

Date of birth: 01.01.2011

Age: 10

Exam. Date:

Time: 11:14:17

Eye: Right (OD)

Exam. Date: 12.07.2021

Time: 11:10:55

Eye: Right (OD)

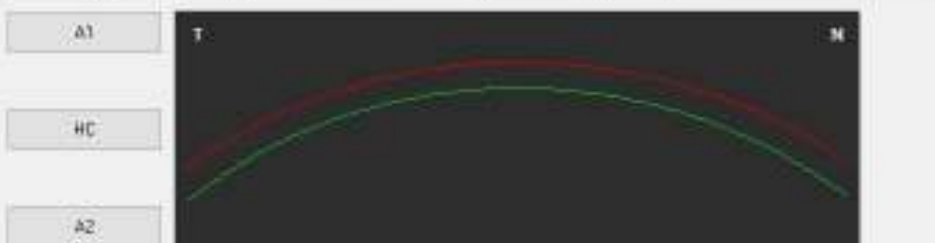
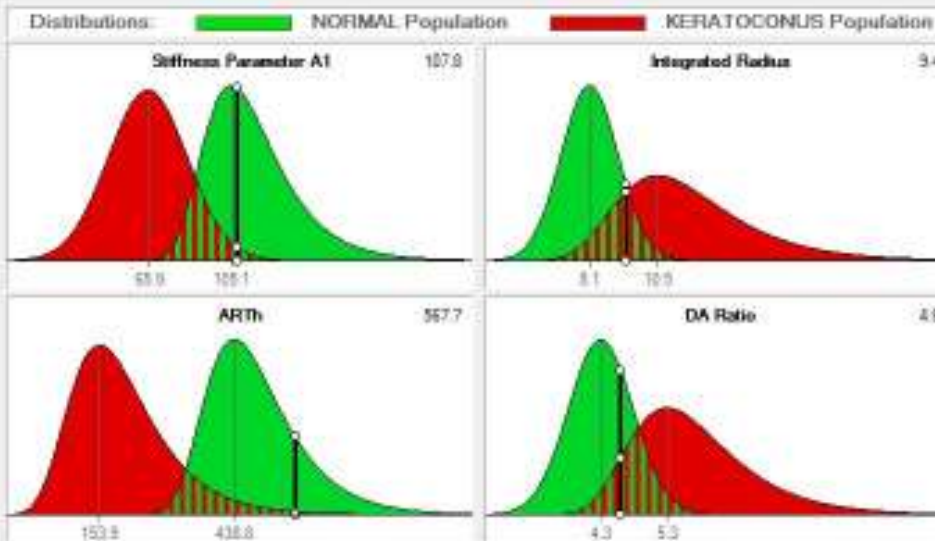
Info:

QS: OK

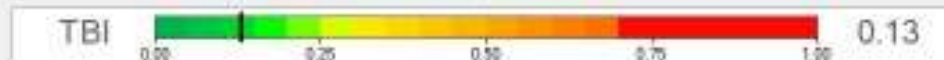
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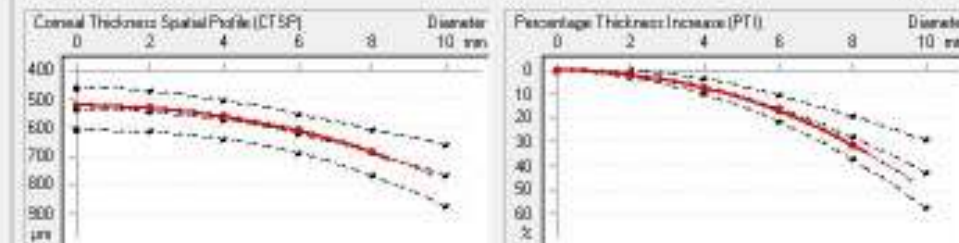
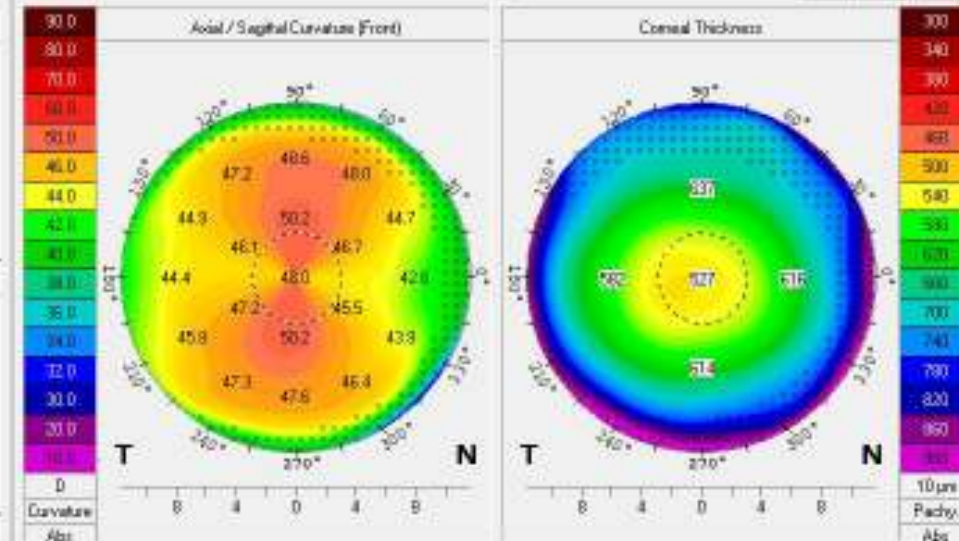
Corvis ST - Biomechanical Assessment



5.01 ms IOPact: 16.0 mmHg bIOP: 16.4 mmHg



Pentacam - Tomographic Assessment



K Max: 51.10 IS Value: -0.10 PRFI: 0.07 TNC: Abnorm



Oculus Optikgeräte GmbH
Münchholzhauser Str. 29

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Fax: (0641) 20 05-255

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R10 20

Steep Cornea

R10 2026

OCULUS - PENTACAM 4 Maps Selectable

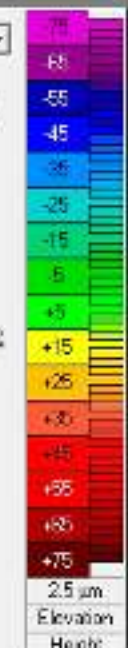
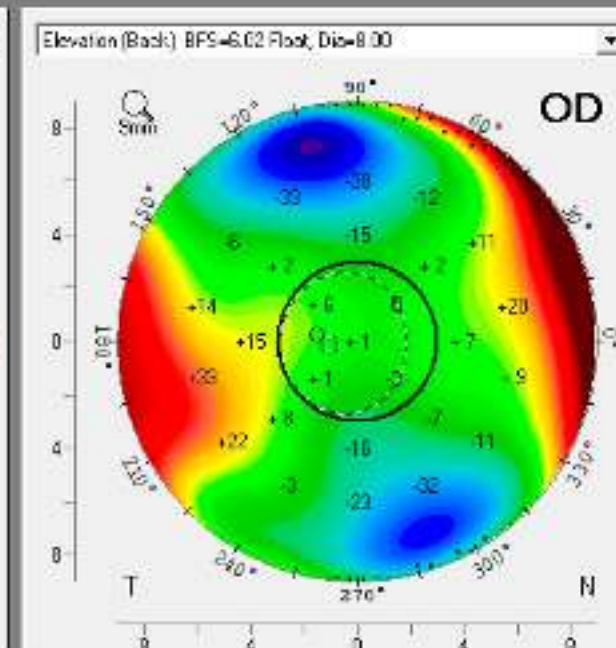
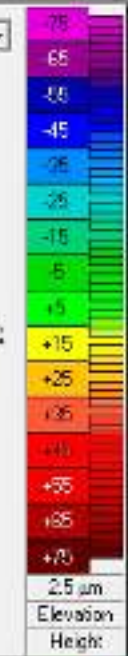
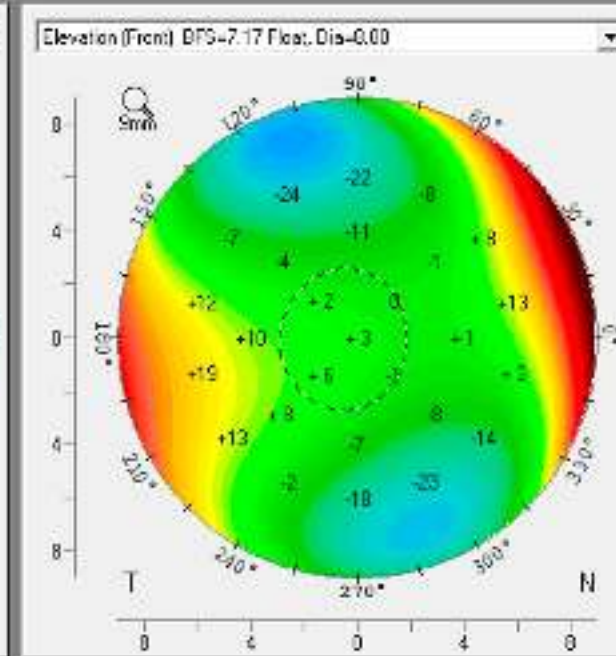
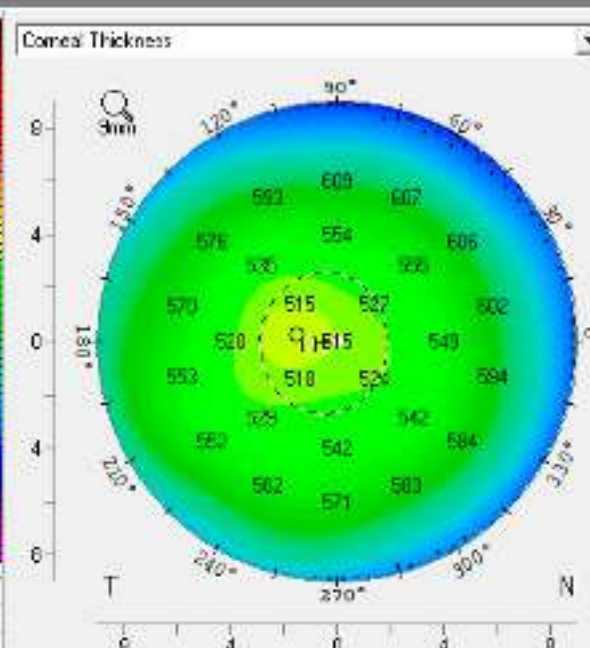
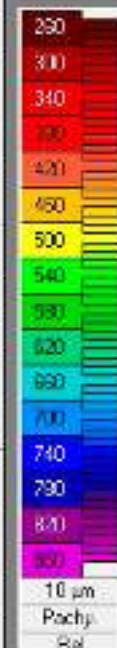
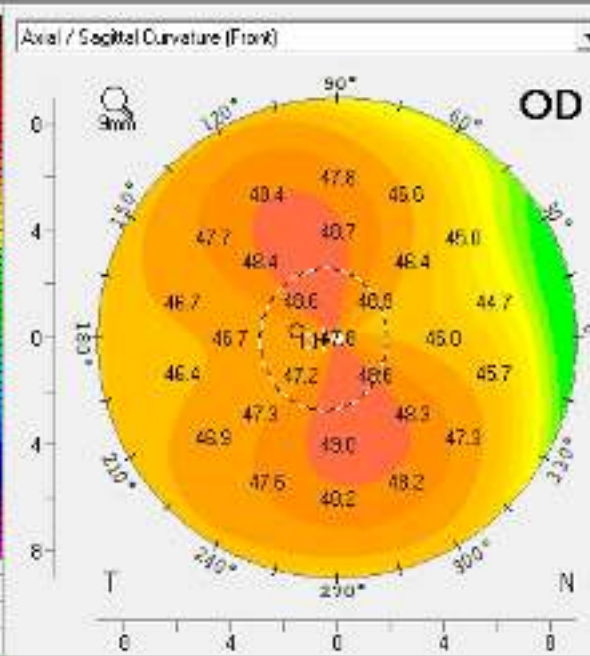
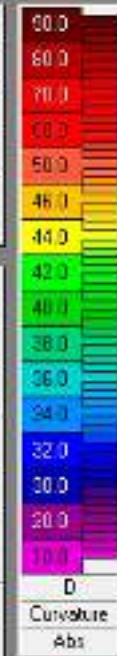
12/05/15

Last Name: XXXXXXXXXX
 First Name: XXXXXXXXXX
 ID: XXXXXXXXXX
 Date of Birth: 12/05/1996 Eye: Right
 Exam Date: 05/14/2023 Time: 09:07:59
 Exam Info:



Pupil Center:	+	Pachy:	513 µm	x(mm)	-0.26	y(mm)	-0.03
Pachy Vertex N.:			515 µm		0.00		0.00
Thinnest Loc.:	○		511 µm		-0.77		+0.10
K Max. (Front):			49.4 D		+0.06		-1.34

Cornea Volume:	59.0 mm³	IRWTW:	11.0 mm
Chamber Volume:	174 mm³	Angle:	41.5°
A. C. Depth (Int.):	3.11 mm	Pupil Dia:	2.51 mm
Enter IOP (IDP/Sum):	+21 mmHg	Lens Th:	

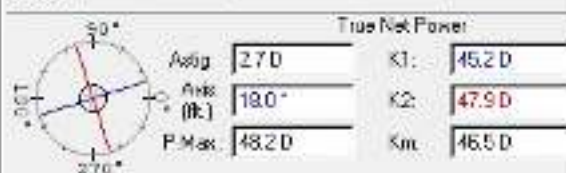


RIO 2

OCULUS - PENTACAM Topometric/KC-Staging

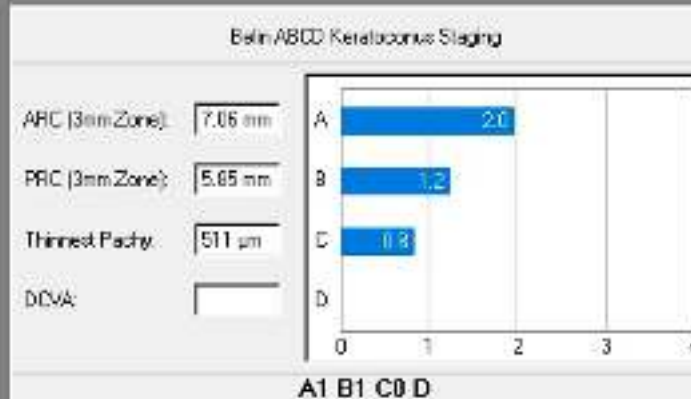
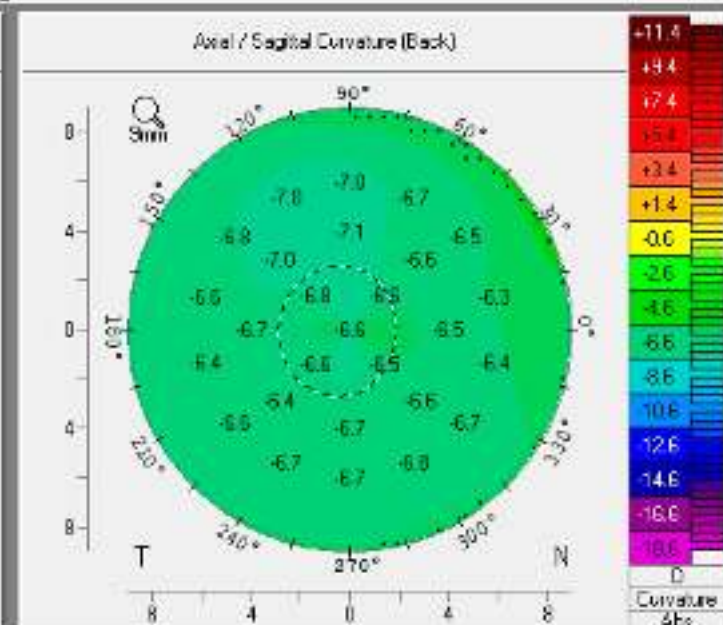
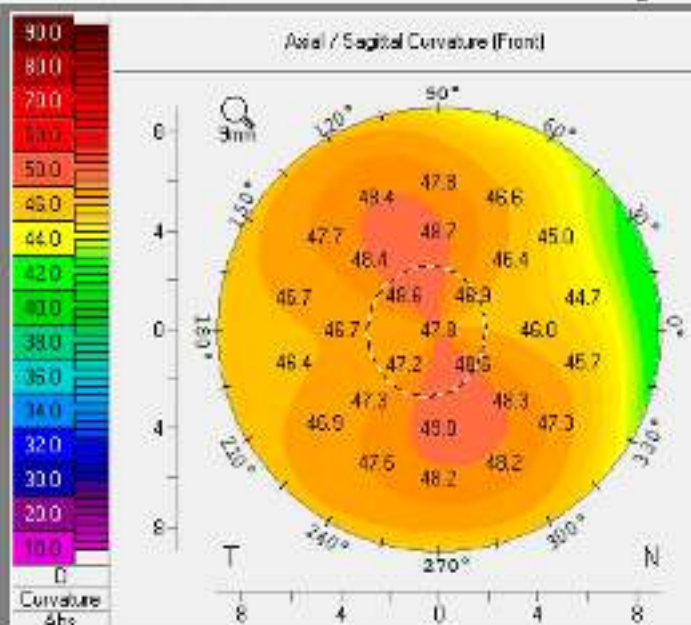
1.2515

Last Name: XXXXXXXXXX
 First Name: XXXXXXXXXX
 ID: XXXXXXXXXX
 Date of Birth: 12/05/1998 Eye: Right
 Exam Date: 05/14/2023 Time: 09:07:59
 Exam Info: XXXXXXXXXX



Pupil Center: + 513 μm x(mm): -0.26 y(mm): -0.03
 Pachy Vertex R: - 515 μm 0.00 0.00
 Thinnest Locat: 511 μm -0.77 +0.13
 K Max (Front): 49.4 D +0.38 -1.34

Cornea Volume: 58.3 mm³ HW/TW: 11.3 mm
 Chamber Volume: 174 mm³ Angle: 41.5°
 A. C. Depth (Int.): 3.11 mm Pupil Dia: 2.51 mm
 IOP(Sum): +21 mmHg Lens Th: XXXXXXXXXX

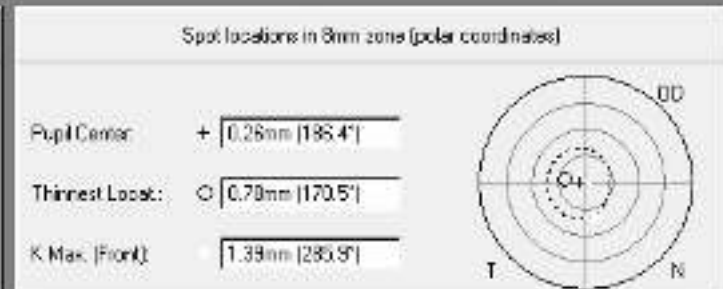
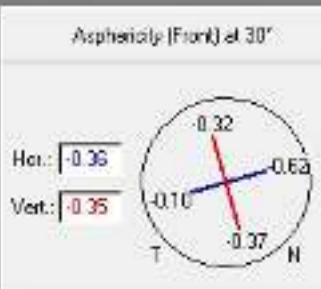


Asphericity (Front) of Major Meridians

	Degrees peripheral					Front
(Q-val)	20°	25°	30°	35°	40°	
Nas	-0.52	-0.58	-0.62	-0.61	-0.52	☒ Asphericity
Temp	-0.07	-0.08	-0.10	-0.12	-0.18	☐ Axial/Sag. Curve
Inf	-0.27	-0.32	-0.37	-0.45	-0.61	Back:
Sup	-0.22	-0.27	-0.32	-0.42	-0.64	☐ Asphericity
Mean	-0.27	-0.31	-0.36	-0.40	-0.49	☐ Axial/Sag. Curve

Indices (in 8mm zone)

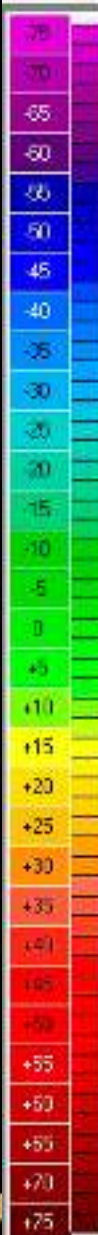
ISV: 29 IHA: 6.1
 IVA: 314 IHD: 0.014
 KI: 1.03 RMin: 6.04
 CKI: 1.01 TKC: XXXXXXXXXX
 KISA: 2688 IS: 0.53



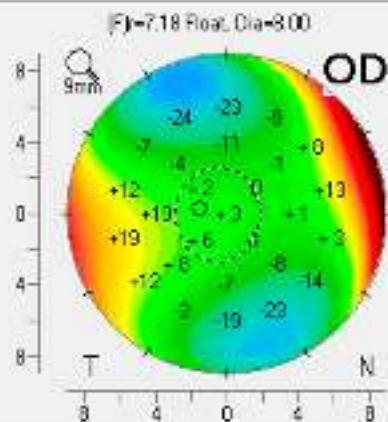
R10

OCULUS - PENTACAM Belin/Ambrósio Enhanced Ectasia Display

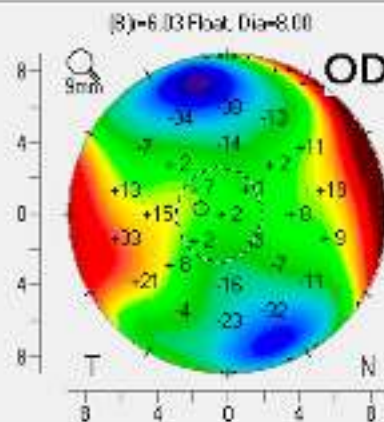
1.25/15



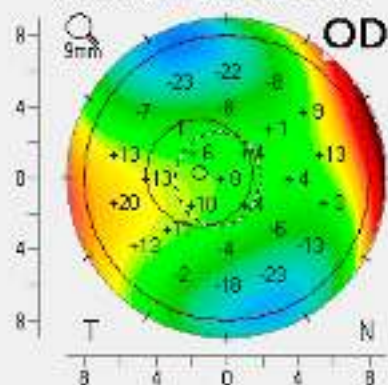
Elevation (Front)



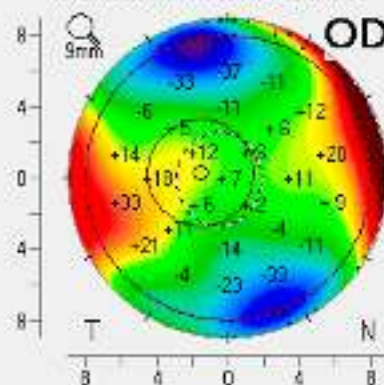
Elevation (Back)



(F) Excl 3.0mm r=7.22 Float. Dia=8.00



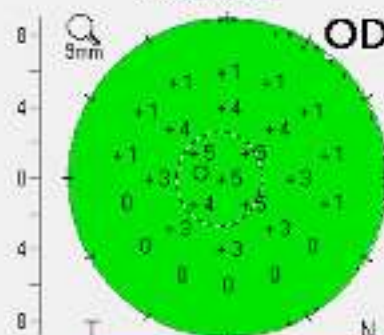
(B) Excl 3.0mm r=6.05 Float. Dia=8.00



(Front) Difference



(Back) Difference



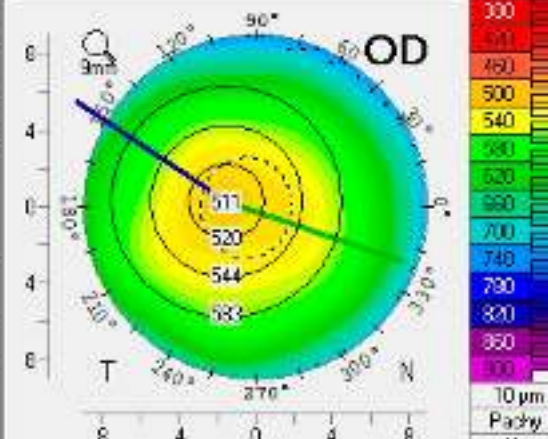
Last Name: XXXXXXXXXX
 First Name: XXXXXXXXXX
 ID: XXXXXXXXXX
 Date of Birth: 12/05/1996 Eye: Right
 Exam Date: 05/14/2023 Time: 09:07:59
 Exam Info:

K1: 45.40 Axis: 16.5°
 K2: 49.20 Q-val: -0.36
 KMax: 49.40 OS: OK

Pachy Thin. Locat: XXXXXXXXXX 511µm
 Dist. Vertex N. Thin Loc.: ST 0.70mm
 F.Ele.Th: 5µm 8.Ele.Th: 8µm

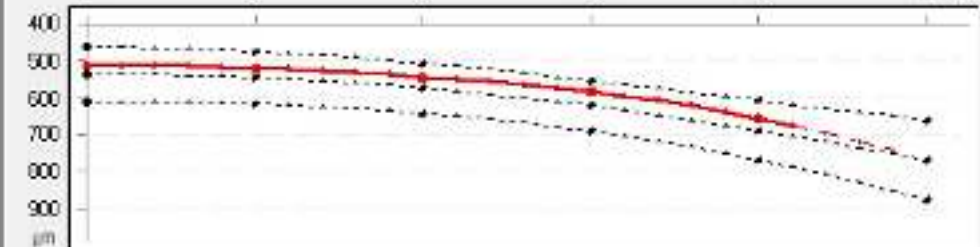
Progression Index:
 Min: 0.58 Max: 1.27
 Avg: 0.92 ARTmax: 402

Corneal Thickness

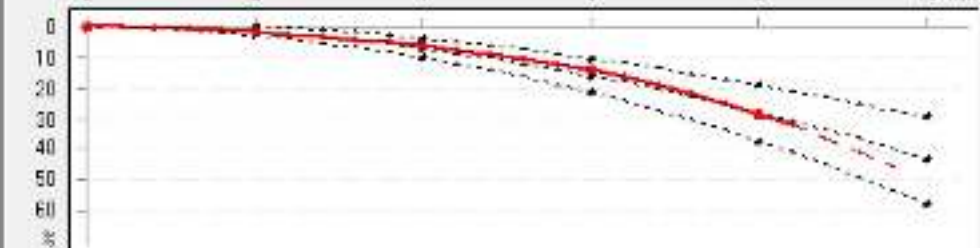


Mean corneal thickness values on rings concentrically to the thinnest location

Corneal Thickness Spatial Profile (CTSP)



Percentage Thickness Increase (PTI)



Reference Database: ☒ Myopic/Normal ☐ Hyperopic/Mixed Cyl ☐ Literature

Dt: 1.31 Dv: -0.17 Dp: 0.09 Dt: 0.60 Dv: 0.78 D: 1.44

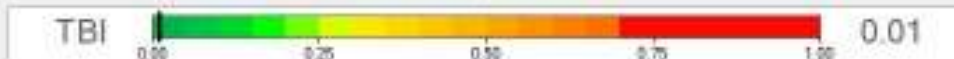
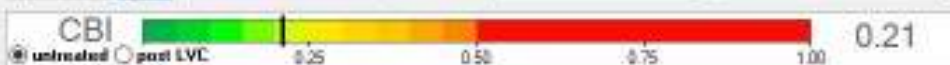
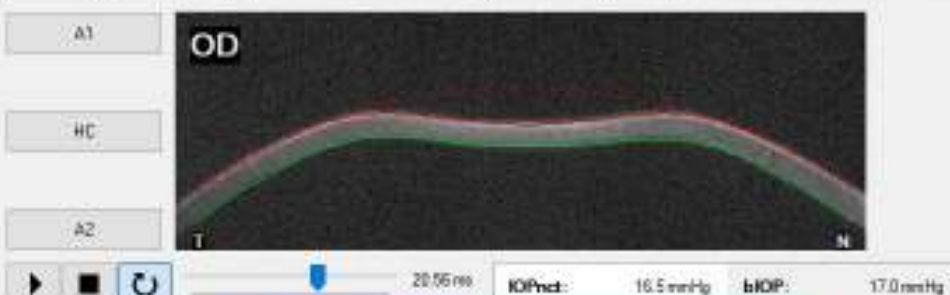
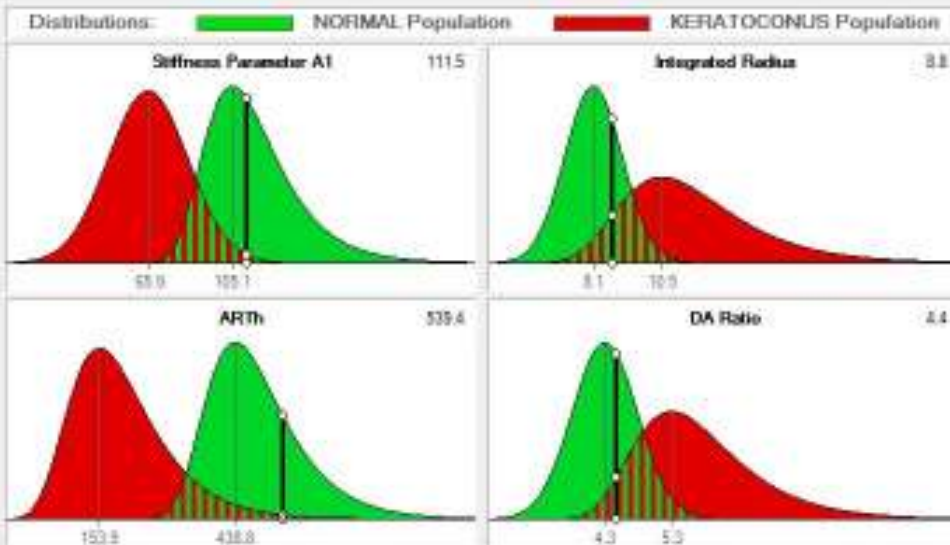
R10

OCULUS Corvis® ST - Biomechanical/Tomographic Assessment (ARV)

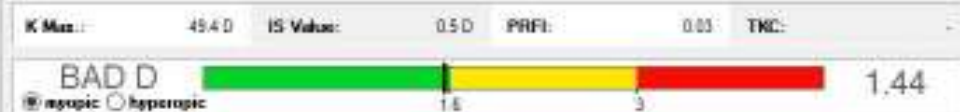
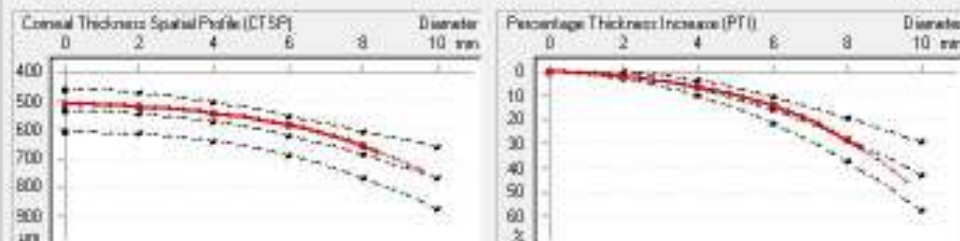
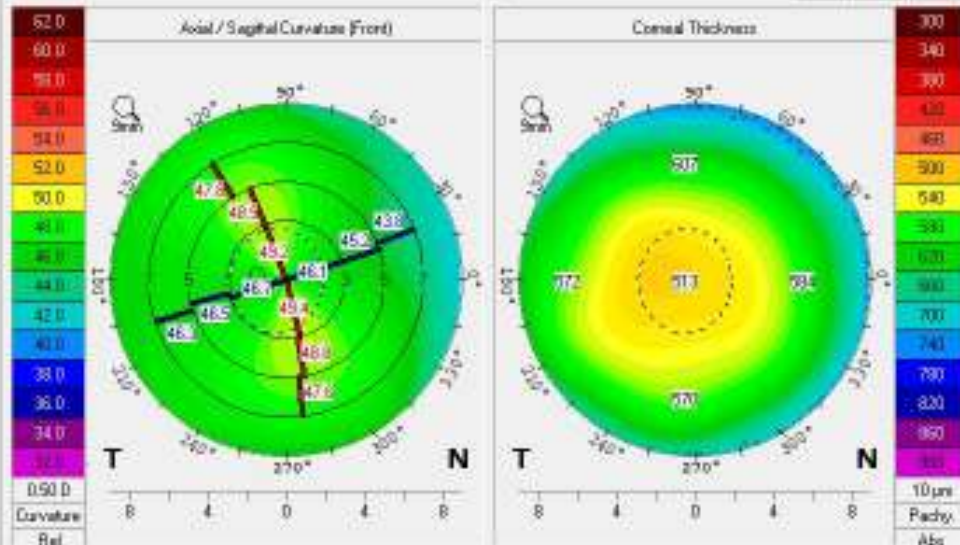
182503

Name: [REDACTED] ID: [REDACTED] Date of birth: 05.12.1996 Age: 26
 Exam. Date: [REDACTED] Time: 09.11.14 Eye: Right (OD) Exam. Date: 14.05.2023 Time: 09.07.59 Eye: Right (OD)
 Info: [REDACTED] OS: OK Info: [REDACTED] OS: OK

Corvis ST - Biomechanical Assessment



Pentacam - Tomographic Assessment



R10 20

Oculus Optikgeräte GmbH
 Münchholzhauser Str. 29

35582 Wetzlar

Tel: (0641) 20 05-0
 Fax: (0641) 20 05-255

www.oculus.de



Steep Cornea

R10 2026

OCULUS - PENTACAM 4 Maps Selectable

1.25x15

Last Name: [REDACTED]
 First Name: [REDACTED]
 ID: [REDACTED]
 Date of Birth: 05/16/2004 Eye: Right
 Exam Date: 07/06/2021 Time: 10:14:37
 Exam Info:

Cornea Front

Rt: 6.83 mm K1: 49.4 D
 Rs: 6.61 mm K2: 51.0 D
 Rm: 6.72 mm Km: 50.2 D

DS: ☒ Axis (Ital): 165.9° Astig: 1.5 D
 D-val: [30°] -0.18 Rper: 6.95 mm Rmix: 6.51 mm

Cornea Back

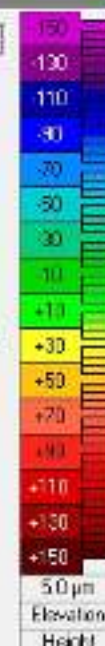
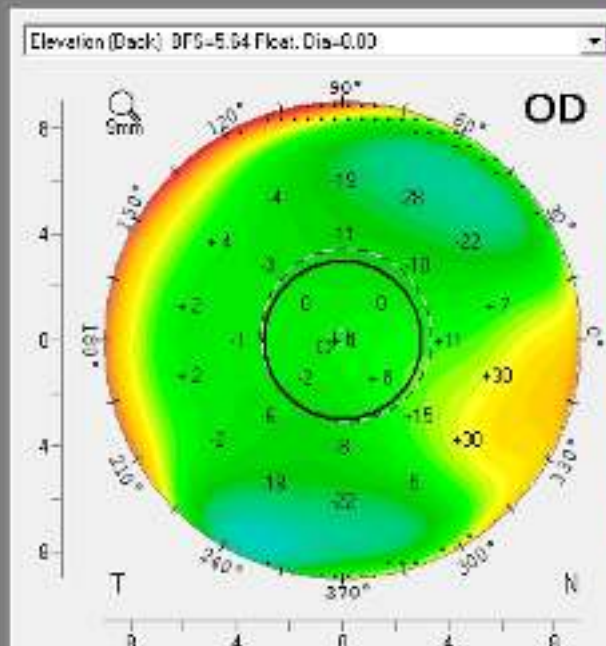
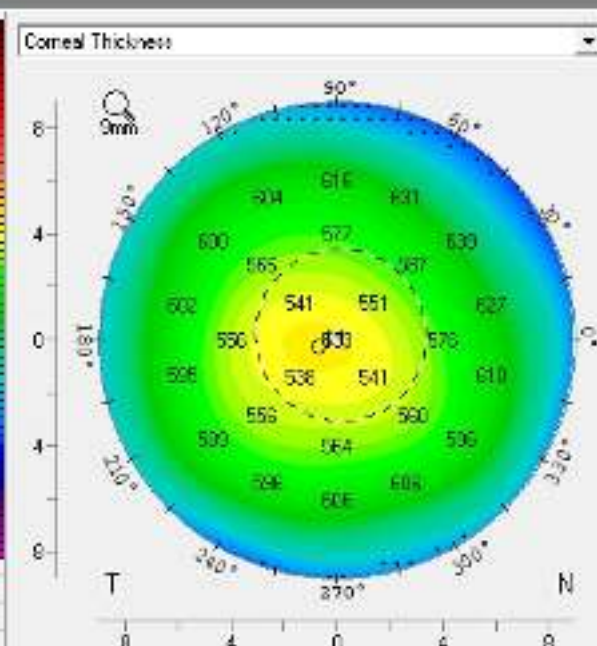
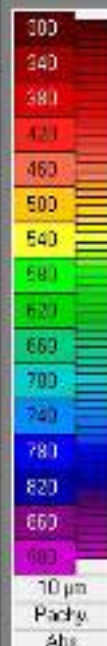
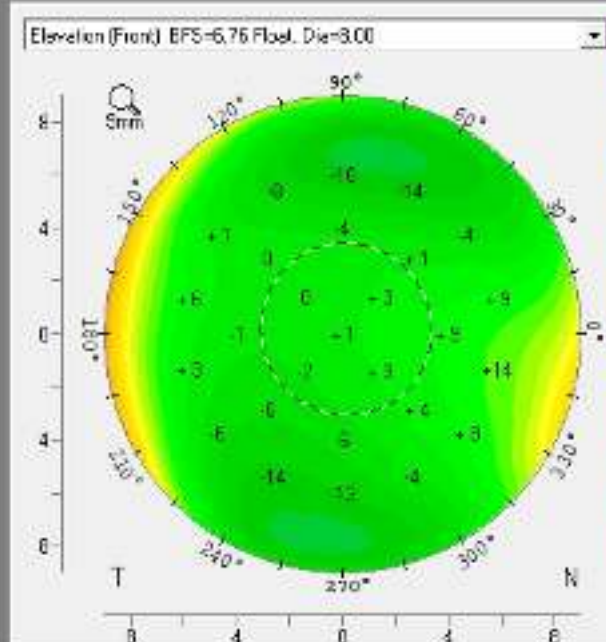
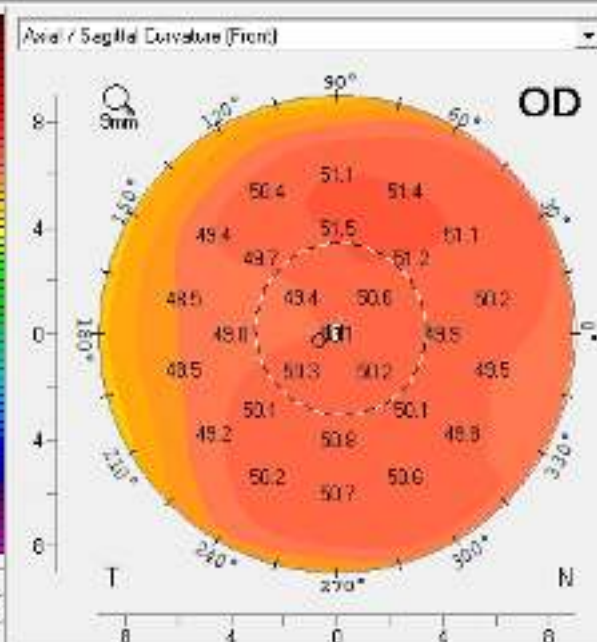
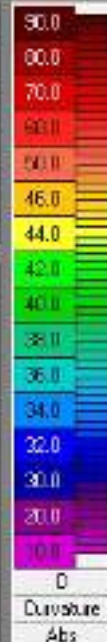
Rt: 5.71 mm K1: -7.0 D
 Rs: 5.42 mm K2: -7.4 D
 Rm: 5.57 mm Km: -7.2 D

DS: ☒ Axis (Ital): 160.0° Astig: 0.4 D
 D-val: [30°] -0.14 Rper: 5.81 mm Rmix: 5.19 mm

Pachy: μ m μ m μ m

Pupil Center: + 534 μ m +0.07 +0.09
 Pachy/Vortex N.: 533 μ m 0.00 0.00
 Thinnest Locat.: 532 μ m -0.35 -0.12
 K Max (Front): 51.8 D +0.59 +2.30

Cornea Volume: 62.2 mm³ Hx/Tw: 11.0 mm
 Chamber Volume: 121 mm³ Angle: 32.5°
 A. C. Depth (Int.): 2.46 mm Pupil Dia: 3.23 mm
 Enter IOP IOP(Sum): +0.9 mmHg Lens Th:



R10 2

OCULUS - PENTACAM Holladay Report

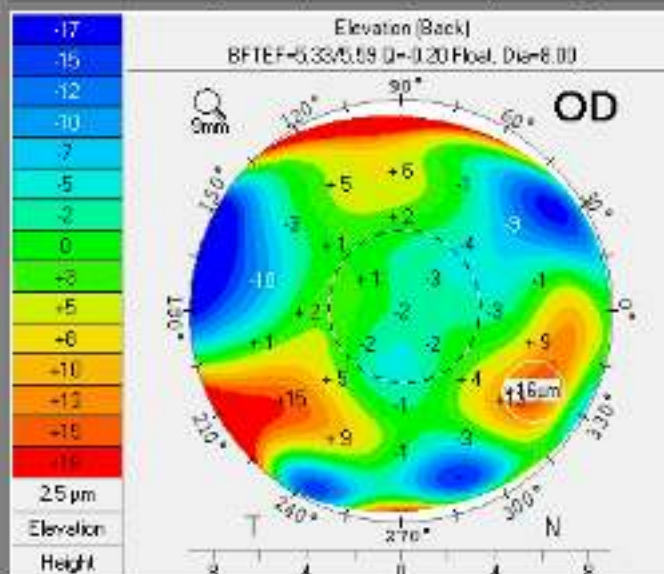
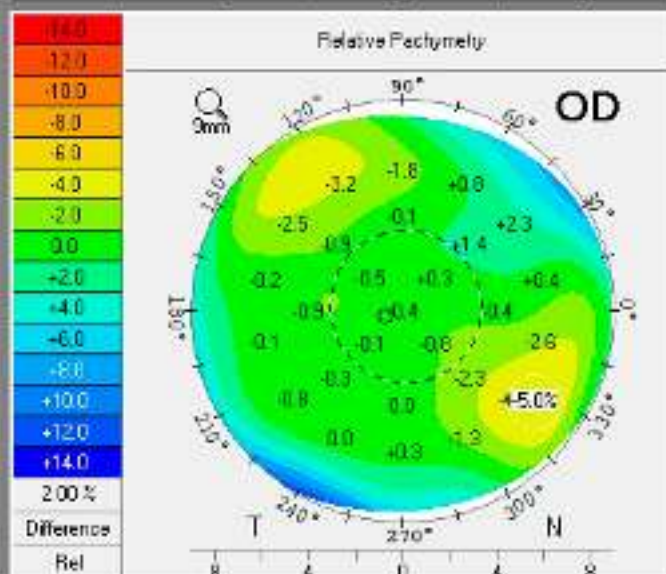
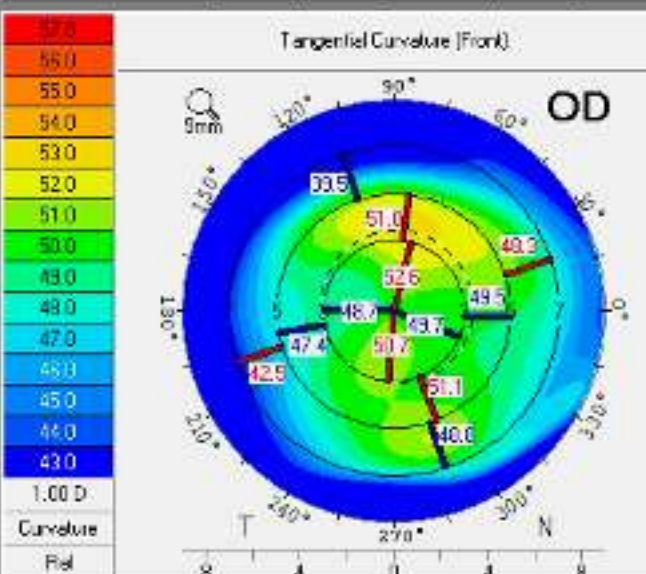
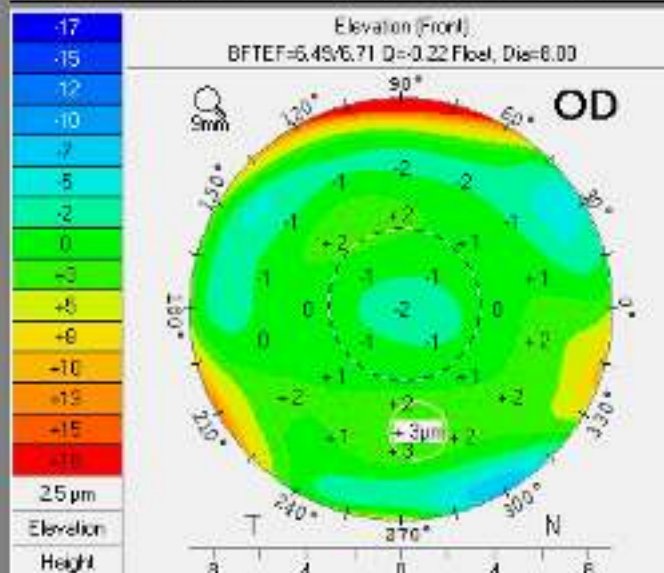
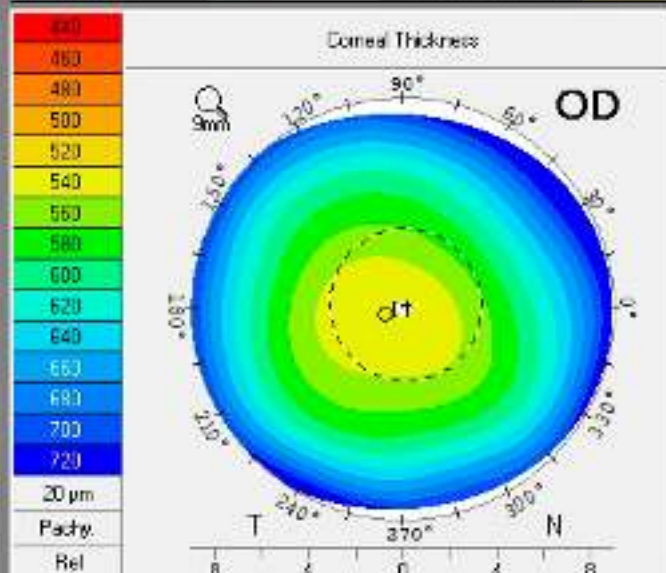
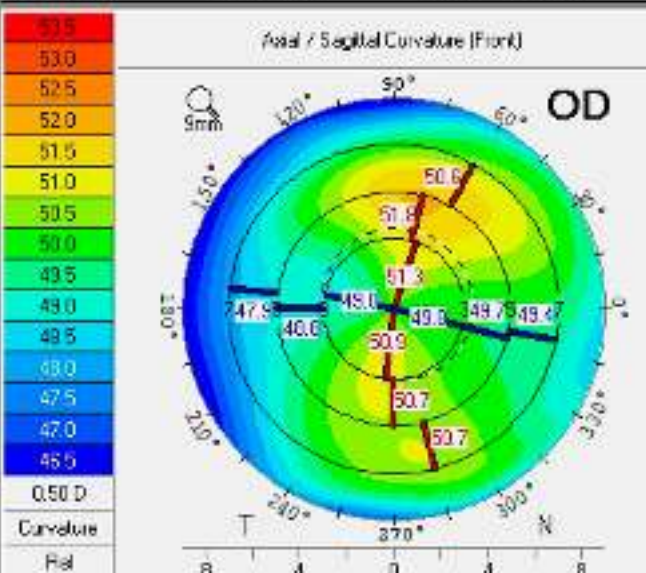
1.25:15

Last Name: XXXXXXXXXX
 First Name: XXXXXXXXXX
 ID: XXXXXXXXXX
 Date of Birth: 05/16/2004 Eye: Right
 Exam Date: 07/06/2021 Time: 10:14:37

Equiv K-Readings 65 (4.5mm Zone) Default

EKR65 Flat K1	43.25 D (169°)	Q (5.0mm)	-0.12
EKR65 Steep K2	50.07 D (79°)	Total SA: Z(4)+G(0.0)	+0.542 μ
EKR65 Mean:	50.06 D	Radius Ratio (B/F)	92.9%
Asig EKR65:	1.62 D	RMS HOA w/E (6mm)	0.742 μ m

Pupil Dia:	+ 3.23 mm	x	0.07 mm H	y	0.09 mm S	(rel.VN)
HWTW:	() 11.0 mm	x	0.03 mm T	y	0.02 mm S	(rel.VN)
Pachy Min:	532 μ m	x	0.35 mm T	y	0.12 mm I	(rel.VN)
Est. Pta-Fish. K1	49.8 D	Rel. Change	-0.4 D			
ADD (Est.)	3.00 mm	Chord μ	0.11 mm	QS	OK	

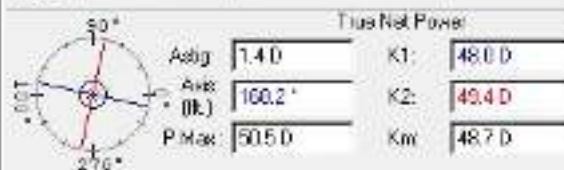


R10

OCULUS - PENTACAM Topometric/KC-Staging

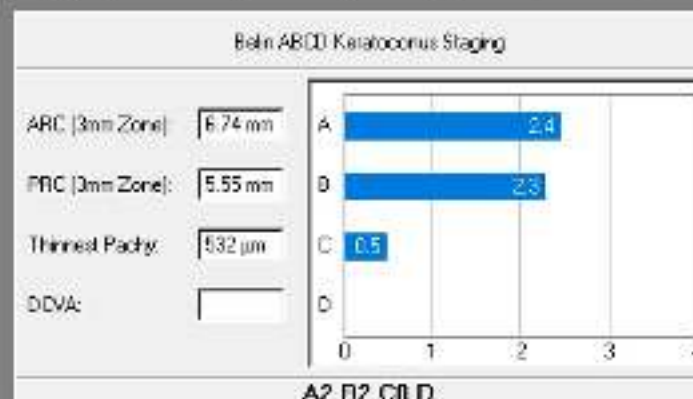
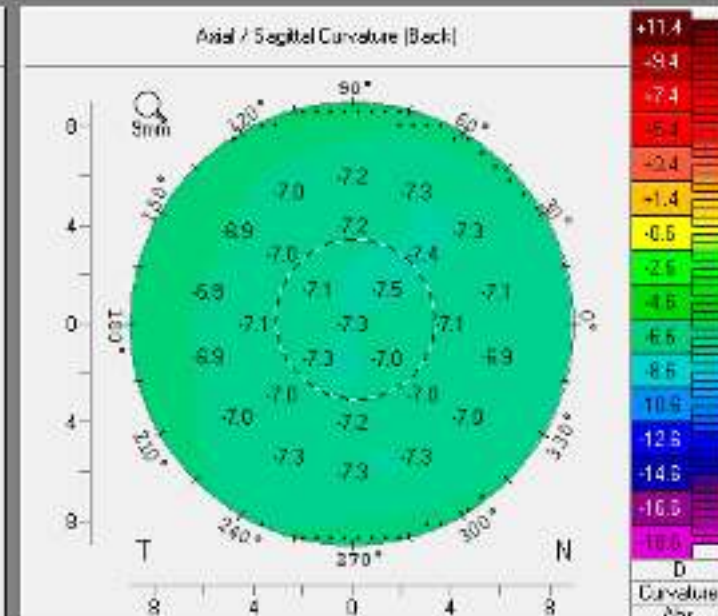
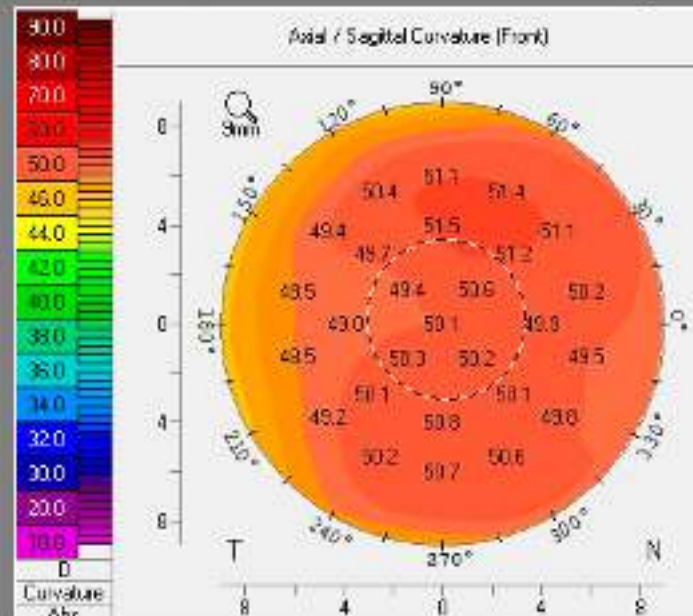
1.25:15

Last Name: [REDACTED]
 First Name: [REDACTED]
 ID: [REDACTED]
 Date of Birth: 05/18/2004 Eye: Right
 Exam Date: 07/06/2021 Time: 10:14:37
 Exam Info:



Pupil Center: + 534 µm x[mm] +0.07 y[mm] +0.09
 Pachy/Vortex N: - 533 µm 0.00 0.00
 Thinnest Local: 532 µm -0.35 -0.12
 K Max (Front): 51.8 D +0.59 +2.30

Cornea Volume: 62.2 mm³ Hw/Hr: 11.0 mm
 Chamber Volume: 121 mm³ Angle: 32.5°
 A.C. Depth (Int.): 2.46 mm Pupil Dia: 3.23 mm
 IOP(Sum): -0.9 mmHg Lens Th:

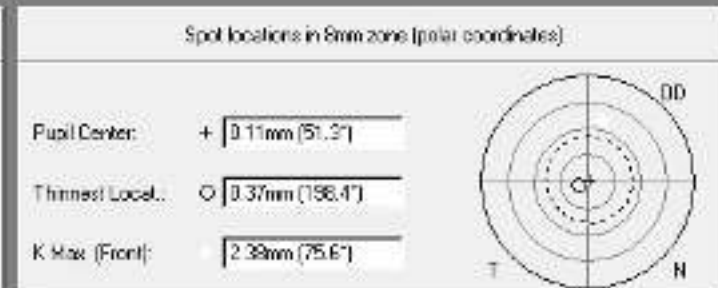
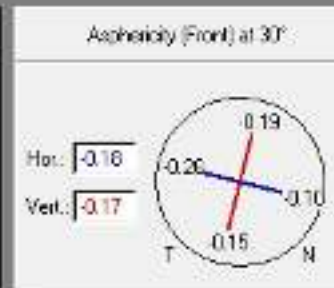


Asphericity (Front) of Major Meridians

ID-val	Degrees peripheral					Front
	20°	25°	30°	35°	40°	
Naz	0.06	0.08	0.10	0.12	0.13	Asphericity
Temp	-0.14	-0.18	-0.26	-0.34	-0.34	Axis/Sag. Curve
Int	-0.00	-0.10	-0.15	-0.27	-0.42	Back
Sup	0.14	-0.03	-0.19	-0.37	-0.53	Asphericity
Mean	-0.04	-0.10	-0.18	-0.27	-0.35	Axis/Sag. Curve

Indices (in 8mm zone)

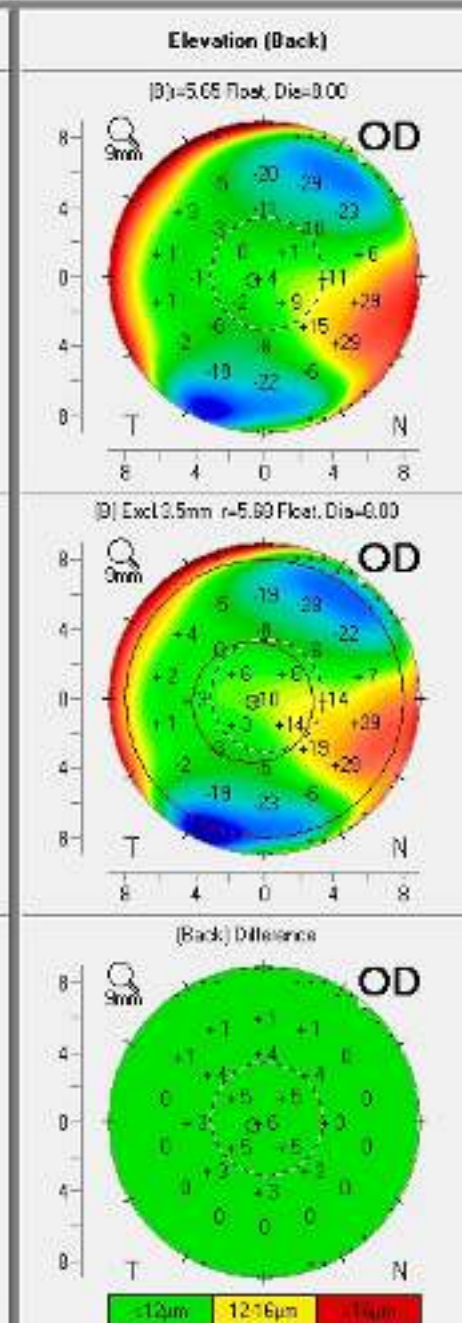
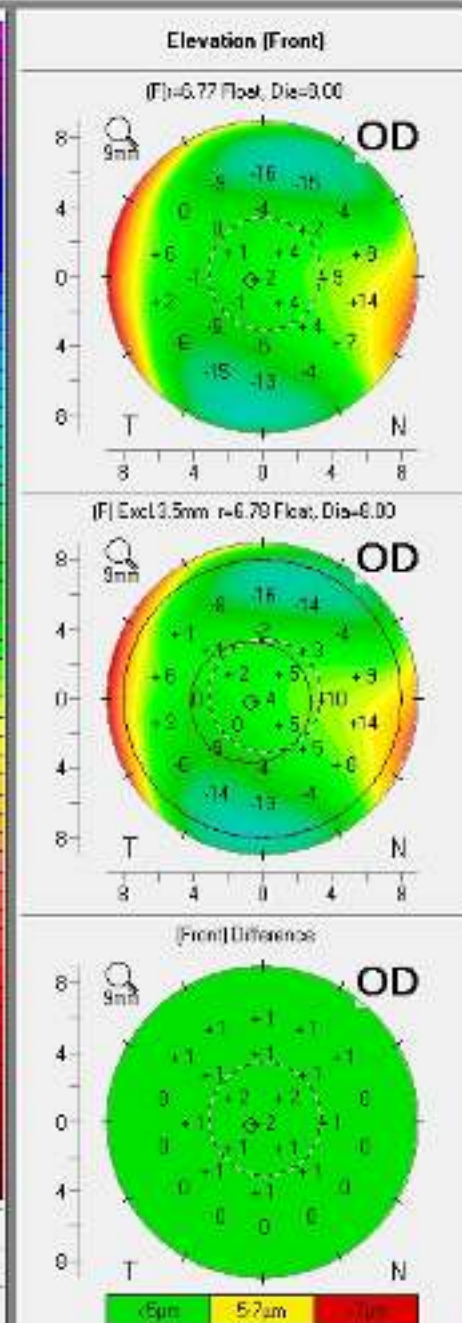
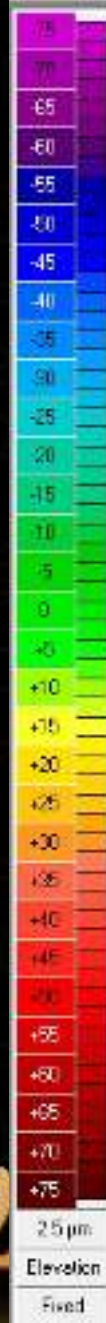
ISV: 30 IHA: 13.7
 IVA: 0.14 IHD: 0.021
 KI: 1.02 RMin: 6.51
 CKI: 1.00 TKC: Abnorm
 KISA: 11.560 IS: 0.59



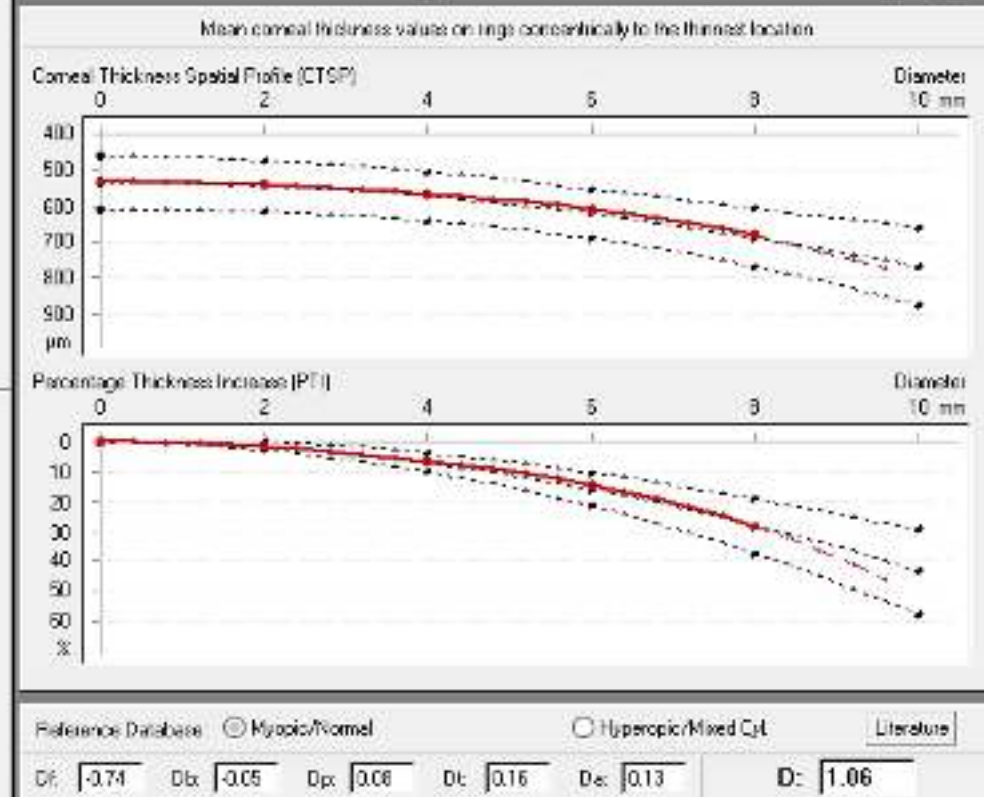
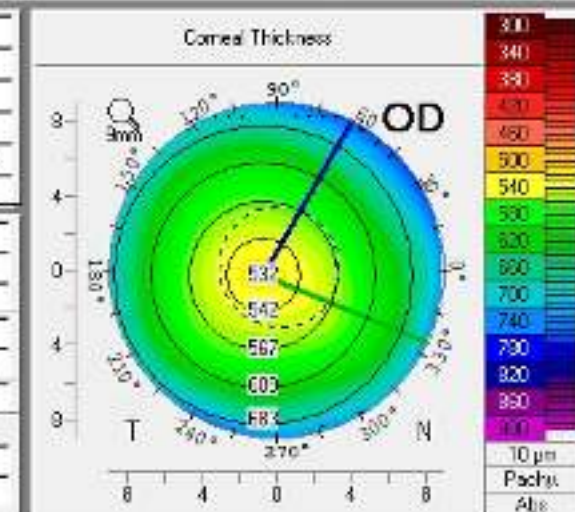
R10

OCULUS - PENTACAM Belin/Ambrósio Enhanced Ectasia Display

1.2209



Last Name:			
First Name:			
ID:			
Date of Birth:	05/16/2004	Eye:	Right
Exam Date:	07/06/2021	Time:	10:14:37
Exam Info:			
K1:	49.40	Axis:	185.9°
K2:	51.00	Q-val:	-0.16
KMax:	51.80	QS:	OK
Pachy Thin Local:		O:	532µm
Dist. Apex Thin Local:		IT:	0.37mm
F.Ele.Th:	1µm	B.Ele.Th:	3µm
Progression Index:			
Min:	0.64	Max:	1.12
Avg:	0.92	AP Max:	474



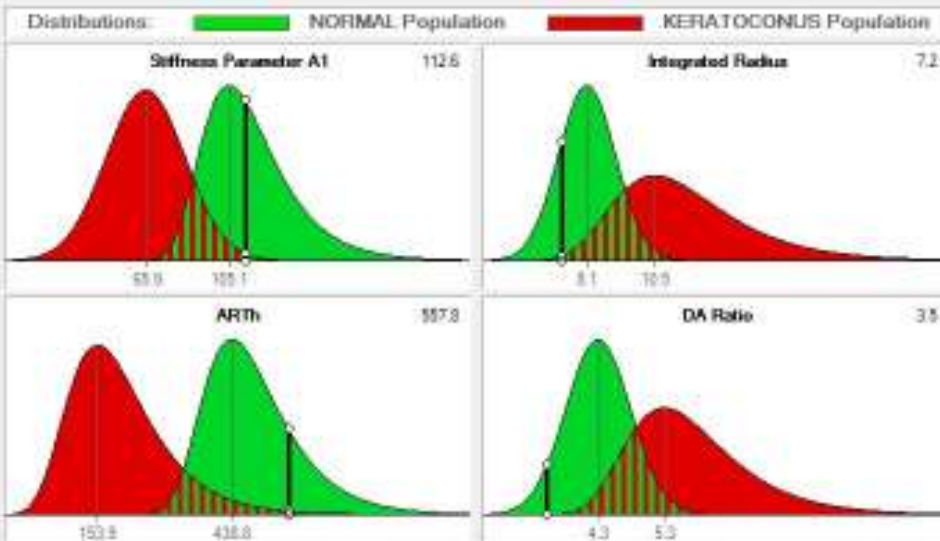
R10 2

OCULUS Corvis® ST - Biomechanical/Tomographic Assessment (ARV)

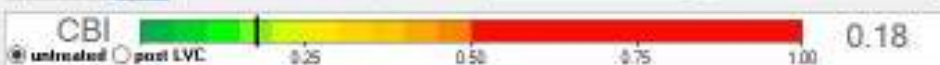
16/2021

Name: [REDACTED] ID: [REDACTED] Date of birth: 16.05.2004 Age: 17
 Exam. Date: [REDACTED] Time: 10:28:45 Eye: Right (OD) Exam. Date: 06.07.2021 Time: 10:14:37 Eye: Right (OD)
 Info: [REDACTED] QS: OK Info: [REDACTED] QS: OK

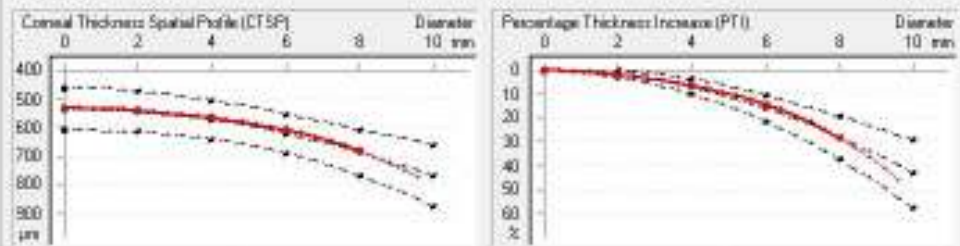
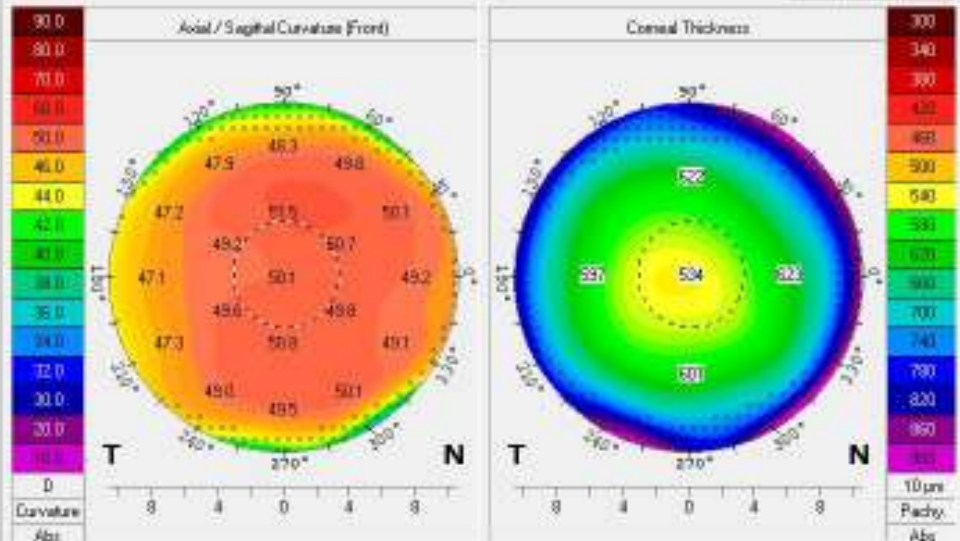
Corvis ST - Biomechanical Assessment



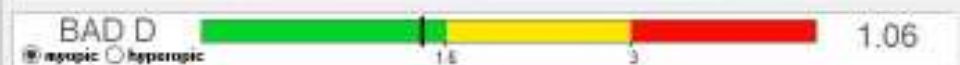
21.25 ms IOP_{Pre}: 25.5 mmHg IOP_{Post}: 24.6 mmHg



Pentacam - Tomographic Assessment



K_{Max}: 51.8 D IS Value: -0.6 D PRFI: 0.01 TNC: Abnorm



Oculus Optikgeräte GmbH
 Münchholzhauser Str. 29

35582 Wetzlar

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 Fax: (0641) 20 05-255

www.oculus.de

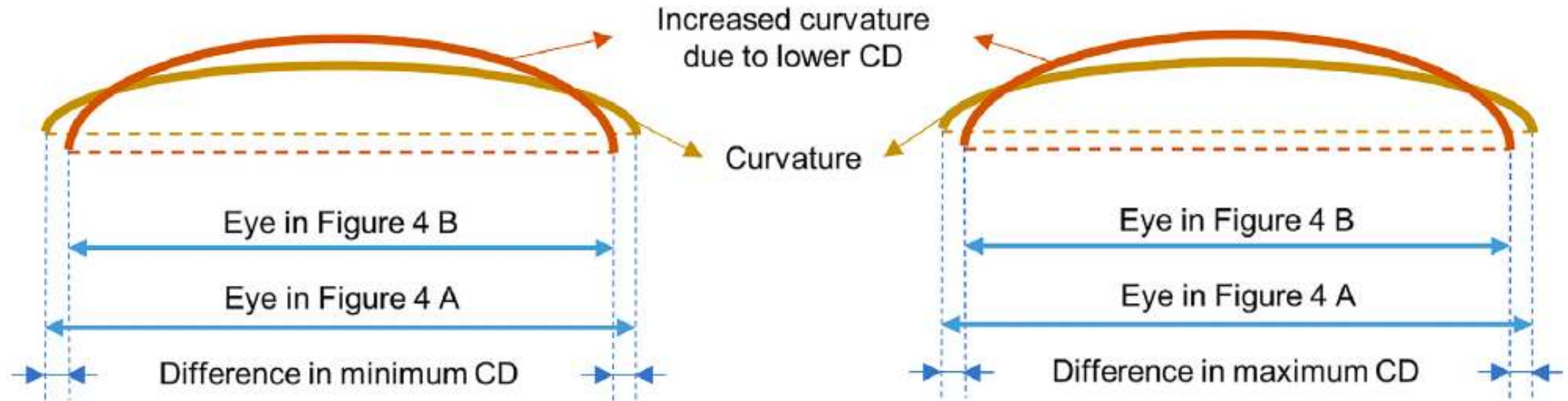


R10 20

Minimum Corneal Diameter and Anterior Steep Axis Curvature Share the Same Meridian: A Novel Finding



MATHEW FRANCIS, HIMANSHU MATAIA, ANSU ANN JOHN, JYOTI MATAIA, NANDINI CHINNAPPAIAH, PRARTHANA BHANDARY, ROHIT SHETTY, RUDY M.M.A. NUIITS, AND ABHIJIT SINHA ROY



Hypothesis: When corneal diameter decreases, elevation and curvature increases.

FIGURE 5. Schematic diagram showing how lower cornea diameter (CD) was causing warping of the cornea, especially along the minimum corneal diameter (minCD) meridian resulting in higher elevation and curvature along the same meridian.

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However, such a measurement of CD would require a clear and simple definition of the external scleral sulcus on Scheimpflug images, which is currently lacking in literature.^{4,11-14} Several approaches were proposed, such as edge detection,¹¹ height or profile data,^{12,14} and on face com-

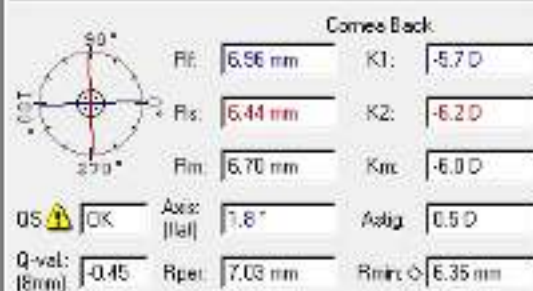
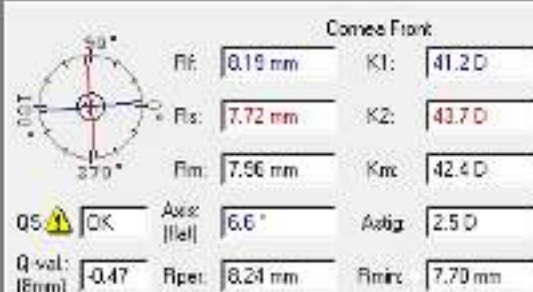
Thin Cornea

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OCULUS - PENTACAM 4 Maps Refractive

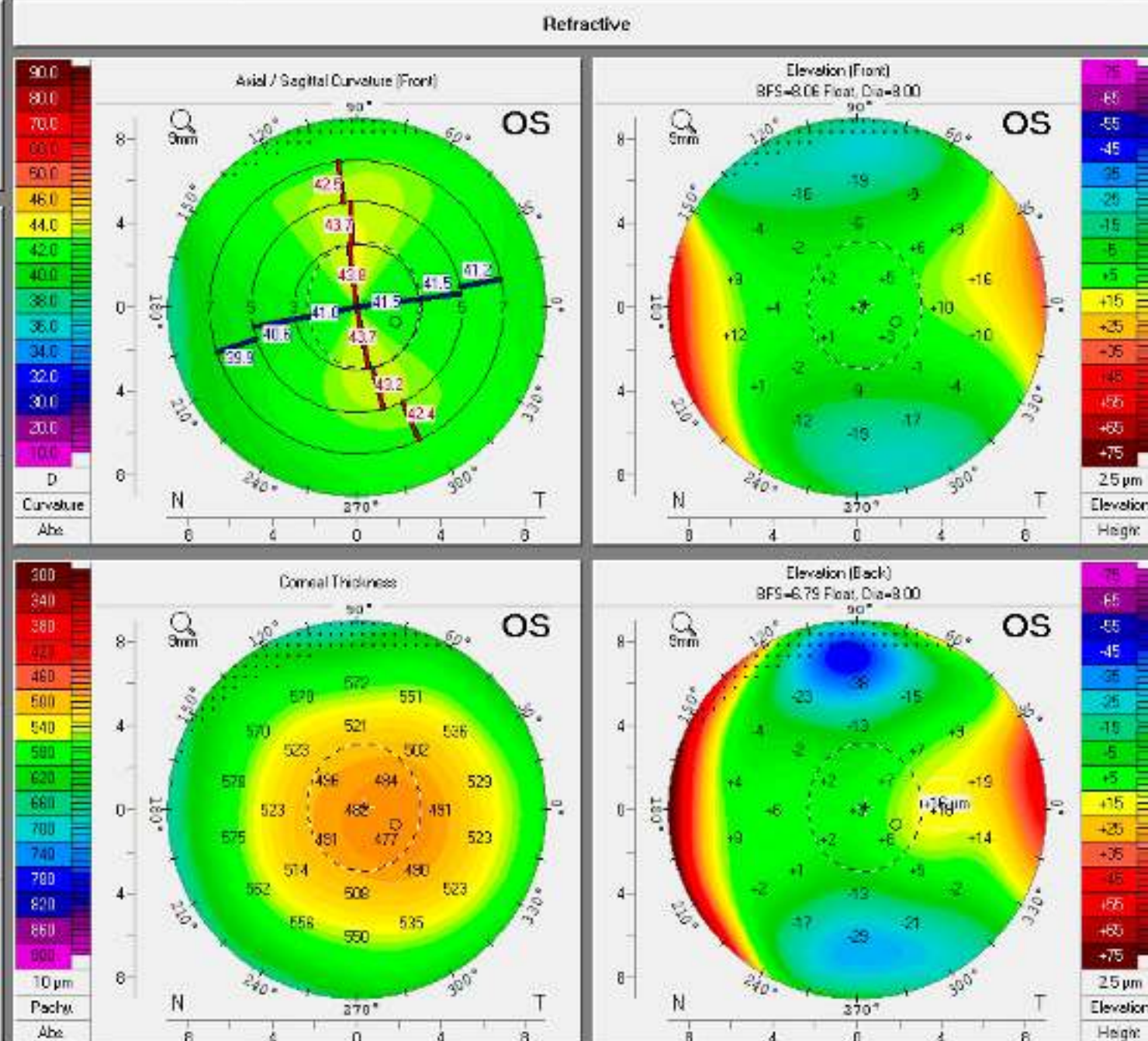
1.30/04

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 First Name: XXXXXXXXXX
 ID: XXXXXXXXXX
 Date of Birth: 02/01/1987 Eyes: Left
 Exam Date: 01/27/2025 Time: 10:48:35
 Exam Info: XXXXXXXXXX



Pupil Center:	+	Pachy:	480 µm	x(mm):	+0.18	y(mm):	+0.05
Pachy Vertex N.:	-		482 µm		0.00		0.00
Thinnest Locat.:	○		476 µm		+0.90		-0.35
K Max (Front):			43.8 D		-0.07		+1.11

Cornea Volume:	52.2 mm³	HW/TW:	11.9 mm
Chamber Volume:	101 mm³	Angle:	41.3°
A.C. Depth (Int.):	3.07 mm	Pupil Dia:	2.85 mm
Enter IDP (ICP/Sund):		Lens Th:	



R10

OCULUS - PENTACAM Holladay Report

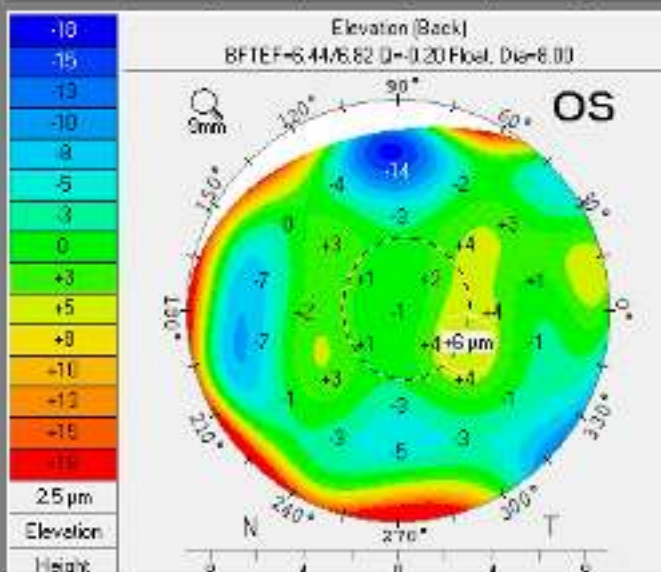
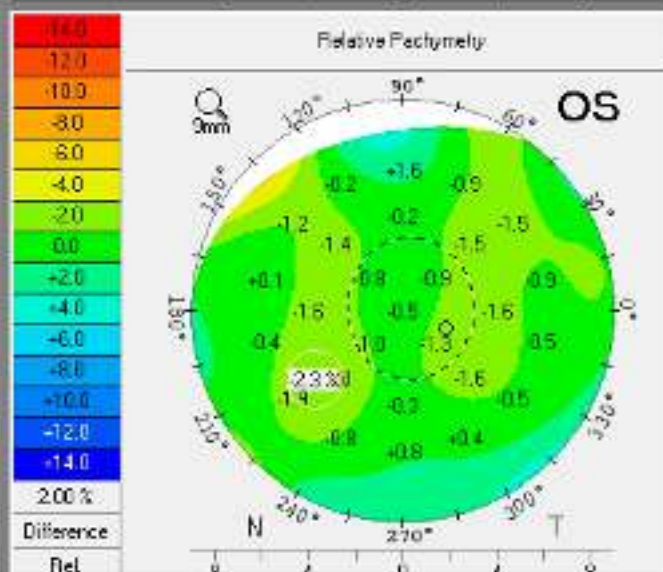
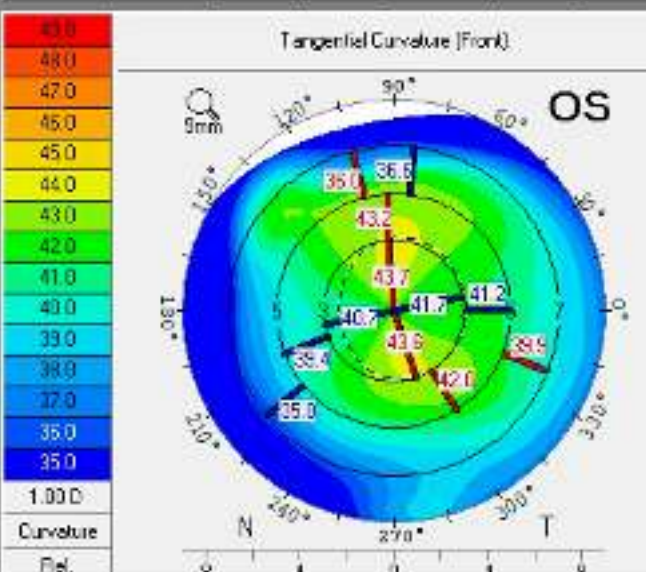
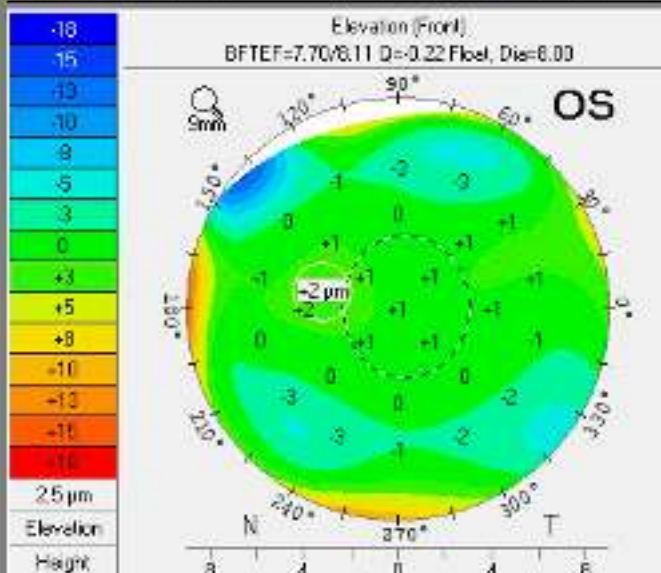
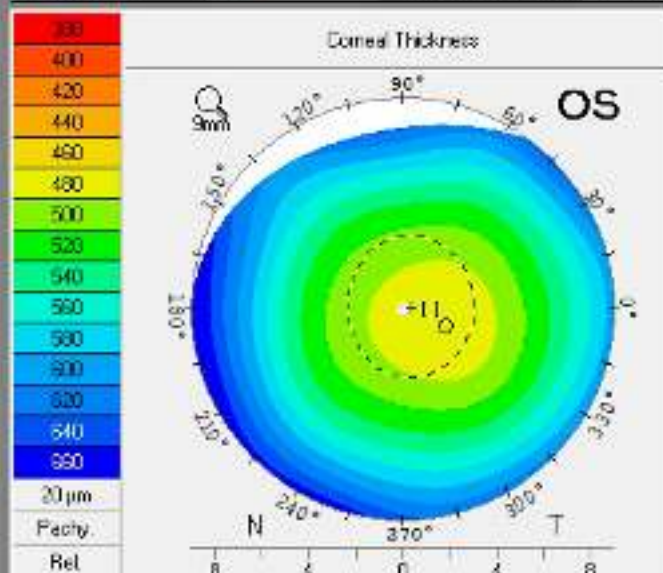
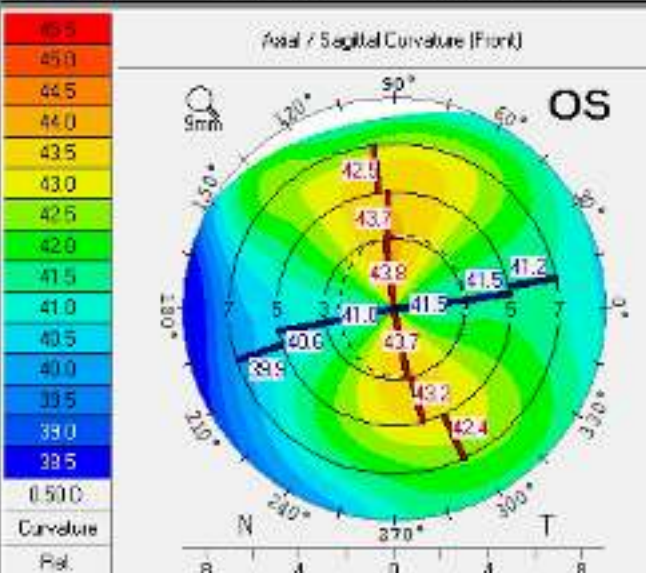
1.30/04

Last Name: XXXXXXXXXX
 First Name: XXXXXXXXXX
 ID: XXXXXXXXXX
 Date of Birth: 02/01/1997 Eye: Left
 Exam Date: 01/27/2025 Time: 10:48:35

Equiv K-Readings 65 (4.5mm Zone)

		Details
EKR65 Flat K1	41.73 D (8°)	D (5.0mm) -0.33
EKR65 Steep K2	44.03 D (96°)	Total SA: Z(4)+G(0.0) +0.106 μ
EKR65 Mean:	42.98 D	Radi Ratio (B/F) 94.5 %
Asig EKR65:	2.30 D	RMS HOA w/E (6mm) 0.358 μm

Pupil Dia:	+ 2.05 mm	x 0.10 mm T	y: 0.05 mm S	(rel.VN)
HWTW:	() 11.9 mm	x 0.55 mm T	y: 0.01 mm S	(rel.VN)
Pachy Min:	○ 475 μm	x 0.50 mm T	y: 0.35 mm S	(rel.VN)
Est. Pta-Fish. K1	41.4 D	Rel. Change	-1.0 D	
ADD (Est.)	3.55 mm	Chord μ	0.19 μm	QS OK

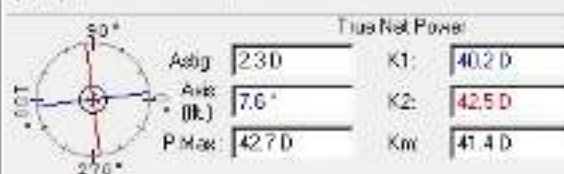


R10

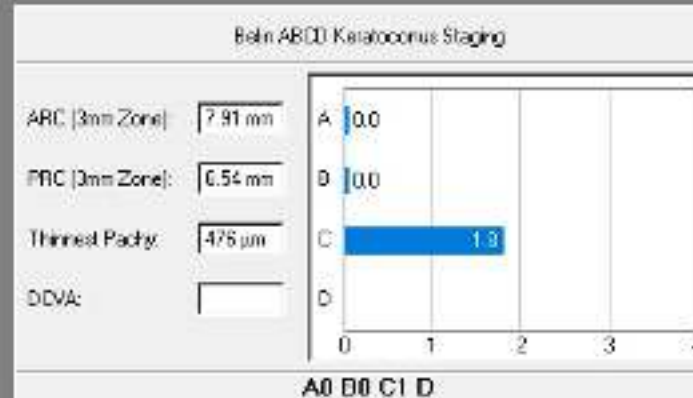
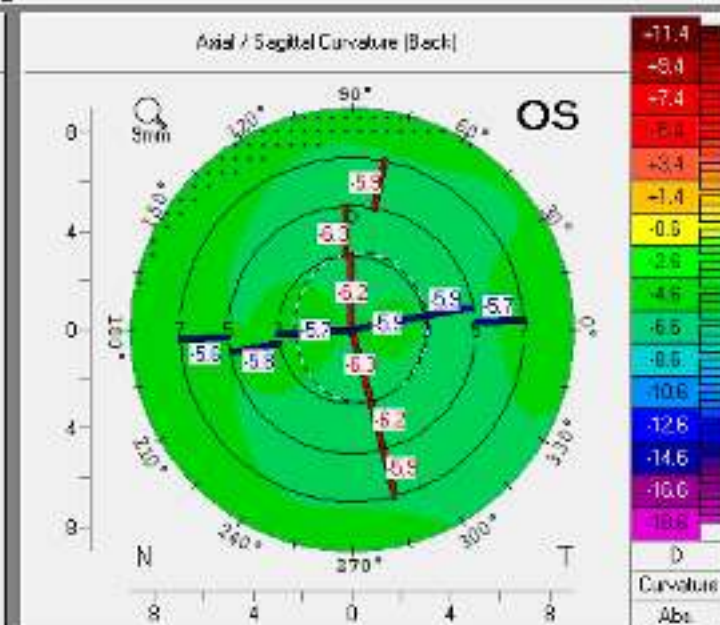
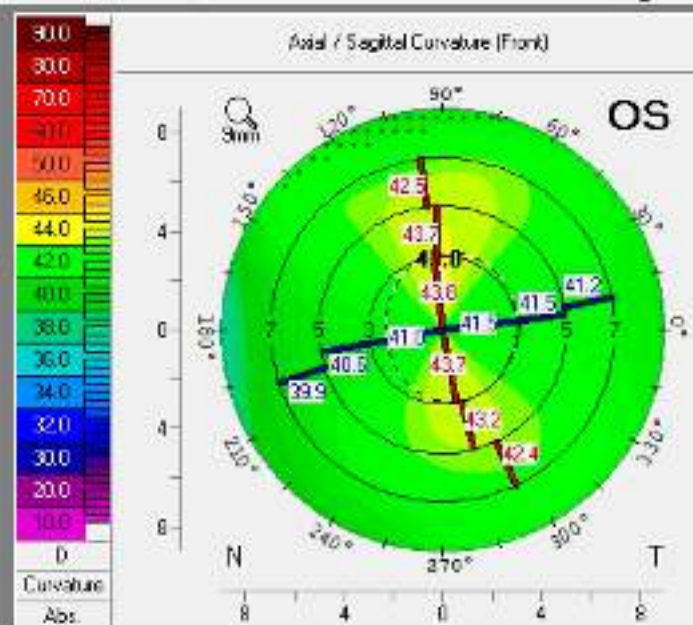
OCULUS - PENTACAM Topometric/KC-Staging

1.30/04

Last Name: XXXXXXXXXX
 First Name: XXXXXXXXXX
 ID: Thin Cornea Good Bio
 Date of Birth: 02/01/1987 Eye: Left
 Exam Date: 01/27/2025 Time: 10:46:35
 Exam Info:



Pachy: 400 µm x[mm] y[mm]
 Pupil Center: + 400 µm +0.10 +0.05
 Pachy/Vortex N: - 482 µm 0.00 0.00
 Thinnest Local: 476 µm +0.90 -0.35
 K Max (Front): 43.8 D -0.07 +1.11
 Cornea Volume: 52.2 mm³ Hw/Hr: 11.9 mm
 Chamber Volume: 101 mm³ Angle: 41.3°
 A.C. Depth (Int.): 3.07 mm Pupil Dia: 2.85 mm
 IOP(Sum): Lens Th:



Asphericity (Front) of Major Meridians

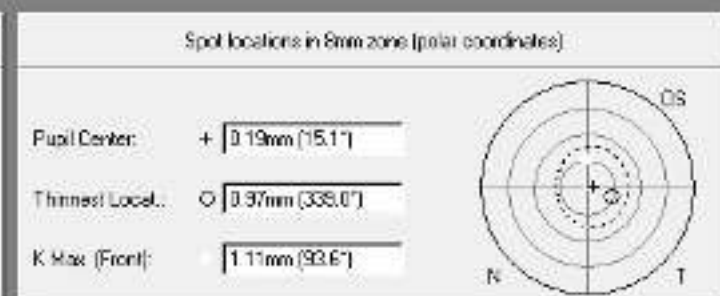
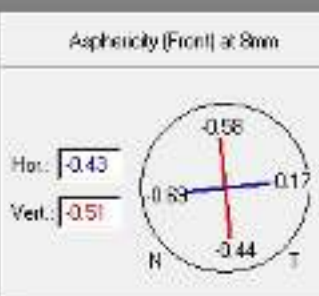
	Peripheral mm-Rings (Dio)					Front:
	5mm	7mm	8mm	9mm	10mm	
Asphericity	0.44	0.55	0.69	0.81	0.79	Asphericity
Axial/Sag. Curva	-0.09	-0.13	-0.17	-0.23	-0.30	Axial/Sag. Curva
Int	-0.45	-0.45	-0.44	-0.42	-0.40	Int
Sup	-0.34	-0.45	-0.50	-0.60	-0.71	Sup
Mean	-0.33	-0.40	-0.47	-0.53	-0.57	Mean

Back:

Asphericity
 Axial/Sag. Curva

Indices (in 8mm zone)

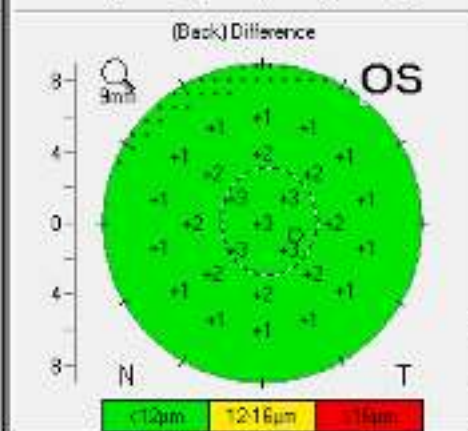
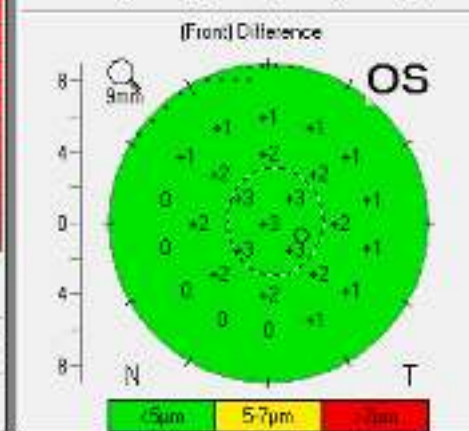
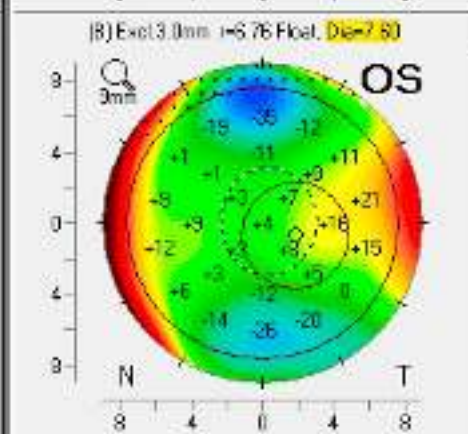
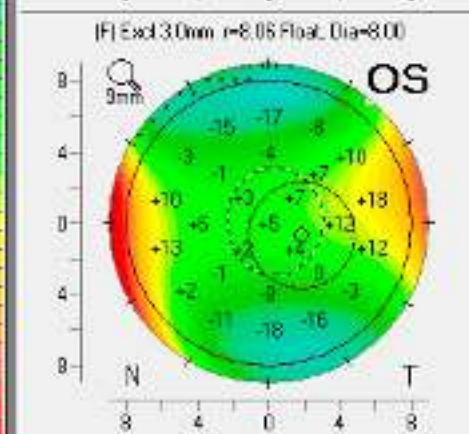
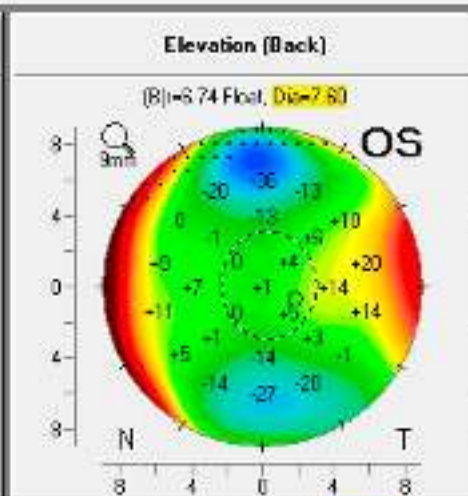
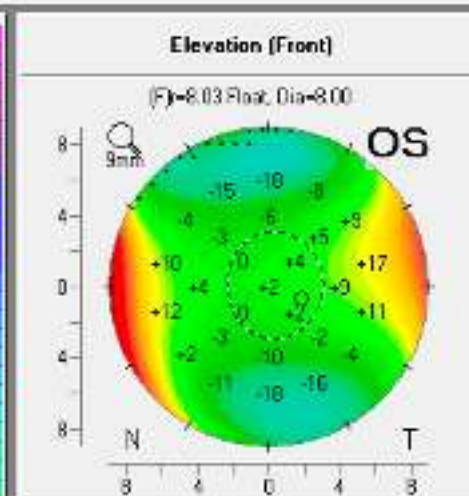
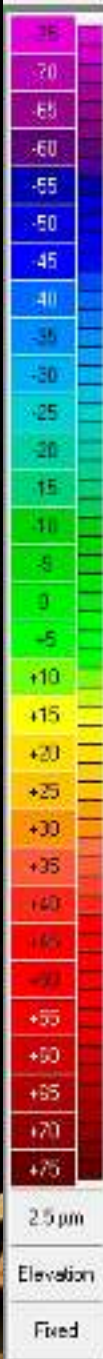
ISV: 24 IHA: 4.1
 IVA: 0.14 IHD: 0.012
 KI: 1.00 RMin: 7.70
 CKI: 1.00 TKC:
 KISA: 3.657 IS: 0.54



R10

OCULUS - PENTACAM Belin/Ambrósio Enhanced Ectasia Display

1.30/04



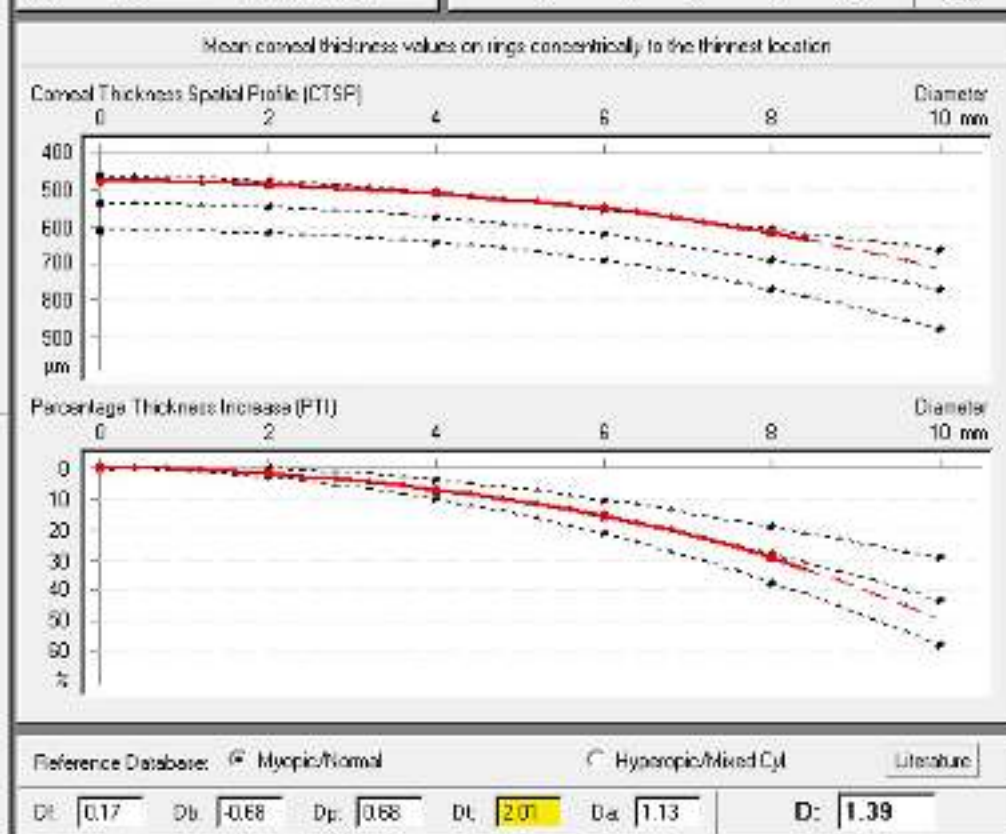
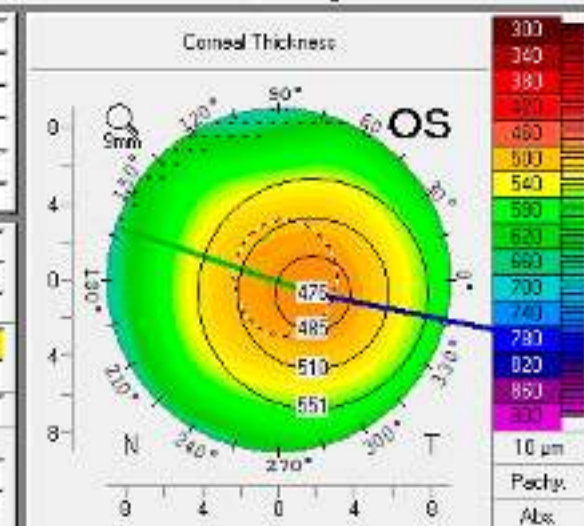
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 First Name: [REDACTED]
 ID: [REDACTED]
 Date of Birth: 02/01/1997 Eye: Left
 Exam Date: 01/27/2025 Time: 10:48:35
 Exam Info: [REDACTED]

K1: 41.20 Axis: 8.6°
 K2: 43.70 U-val: -0.47
 KMax: 43.80 OS OK

Pachy Thin Locat.: 476µm
 Dist. Vertex N. Thin Loc.: IT 0.97mm

F Ele. Th: 4µm B Ele. Th: 8µm

Progression Index
 Min: 0.70 Max: 1.31
 Avg: 1.01 APTmax: 364



OCULUS Corvis® ST - Biomechanical/Tomographic Assessment (ARV)

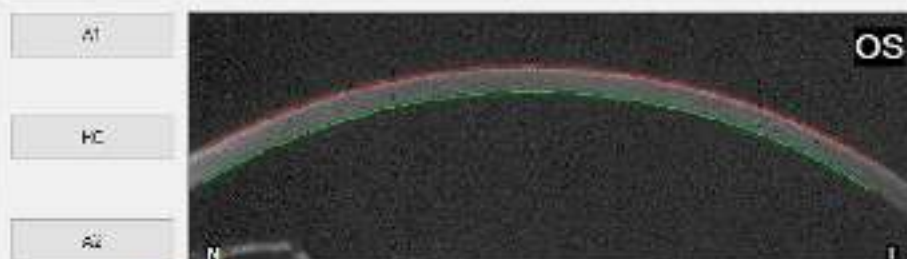
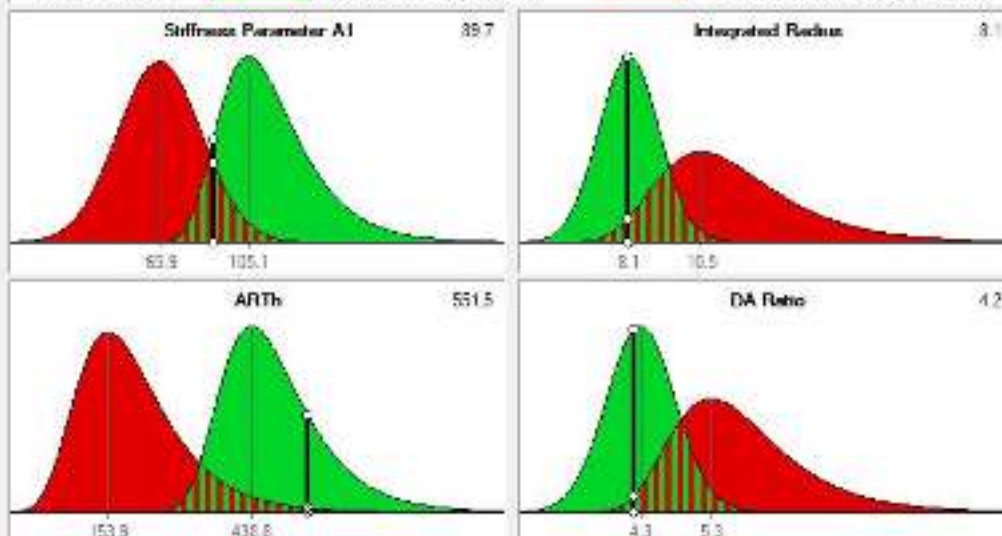
1.7.27.04

Patient Examination Display Export Settings External software

E-Mail AVI JGG

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Exam. Date:		Time:	10:52:02	Exam. Date:	27.01.2025	Time:	10:48:35
Info:		Eye:	Left (OS)	Info:		Eye:	Left (OS)
		OS:	OK			OS:	OK

Corvis ST - Biomechanical Assessment

Distributions: ■ NORMAL Population ■ KERATOCONUS Population


▶ ■ ↺ 3.00 ms IOPact: 16.0 mmHg bIOP: 17.2 mmHg

CBI ■ ■ ■ 0.19

Reference: Ethnicity Global database Treatment Units

TBI ■ ■ ■ 0.24

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Münchholzhäuser Str. 29

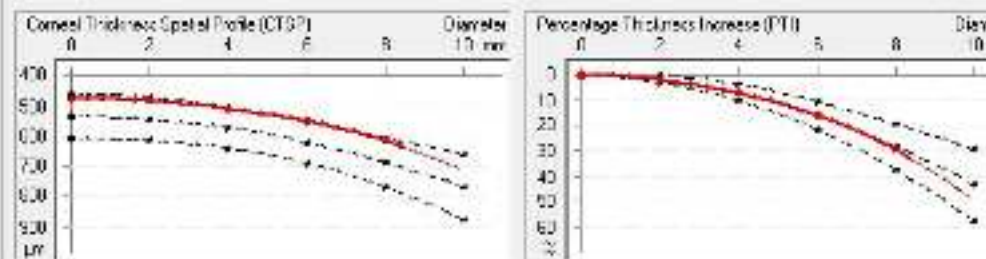
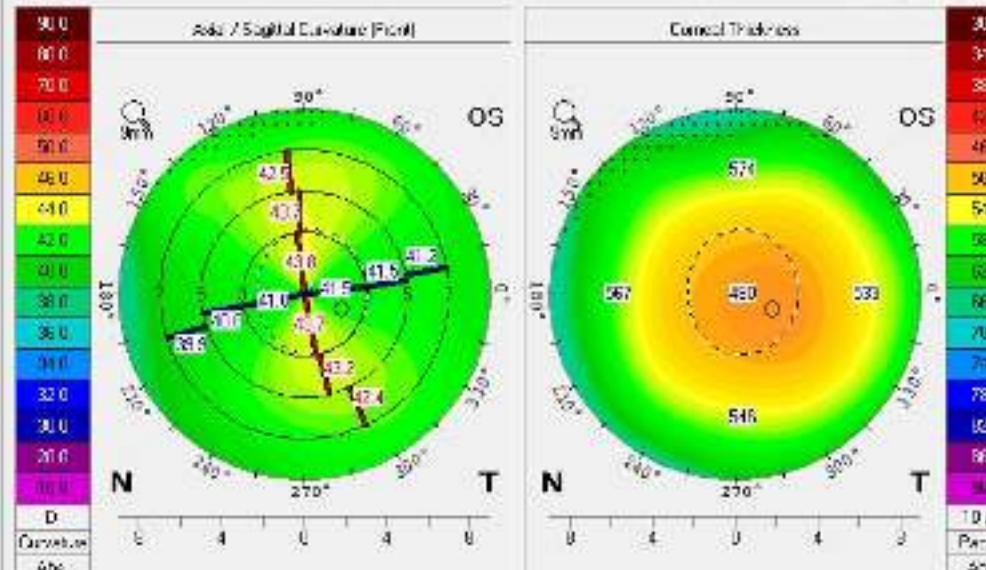
35582 Wetzlar

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Fax: (0641) 20 05-255

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Pentacam - Tomographic Assessment



K Max.: 43.0 D IS Value: -0.5 D PRF: 0.20 TKC:

BAD D ■ ■ ■ 1.39
☒ myopic ☐ hyperopic

R10 2

Follow Up of KC

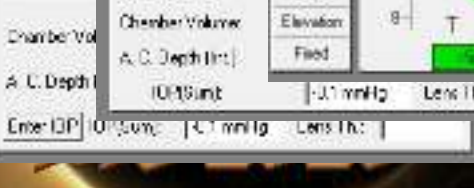
R10 2026

Without treatment

R10 2026

OCULUS - PF

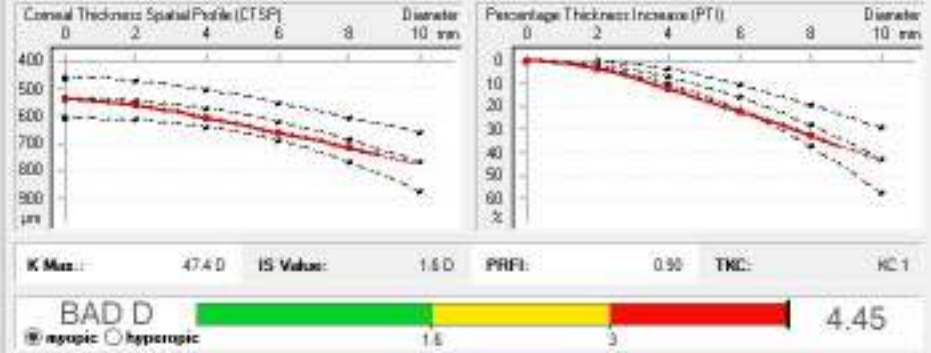
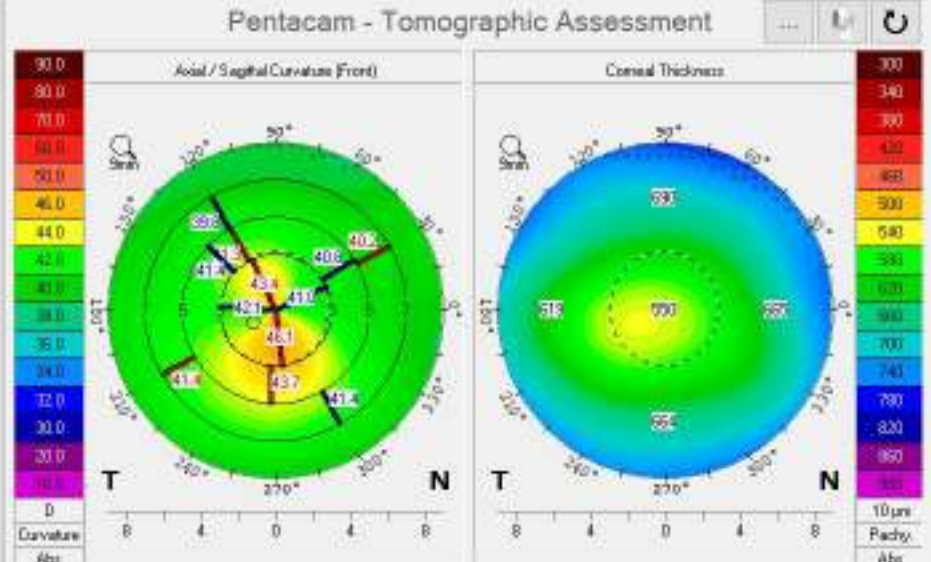
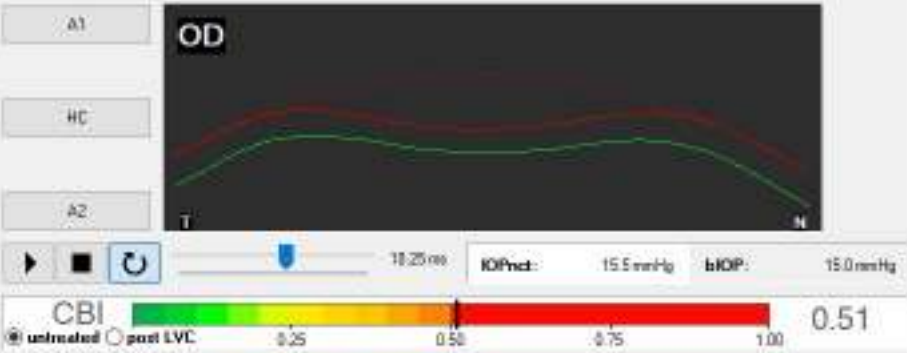
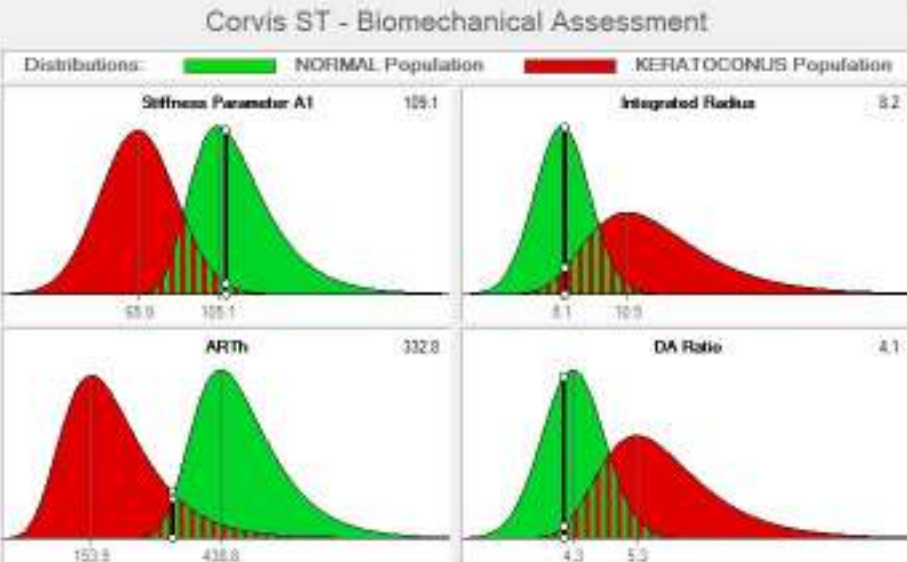
Last Name:
First Name:
ID:
Date of Birth:
Exam Date:
Exam Info:



OCULUS Corvis® ST - Biomechanical/Tomographic Assessment (ARV)

162503

Name:
Exam Date:
Info:
ID:
Time: 13:17:30
Eye: Right (OD)
QS: OK
Date of birth: 05.05.2003
Age: 19
Exam Date: 16.05.2022
Time: 13:14:49
Eye: Right (OD)
QS: OK



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Oculus Corvis® ST - Homburg Biomechanical E-Staging (BEST)

1.62503

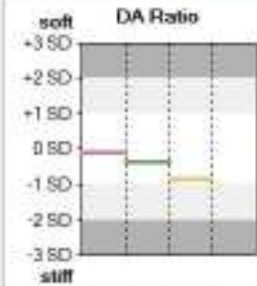
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Select 4
exams:
Right
Eye

Select 4
exams:
Left
Eye

Exam: Right (OD) OS

10.01.2023 OK
12.06.22 OK
16.05.2023 OK
13.17.30
06.02.2023 OK
14.28.25

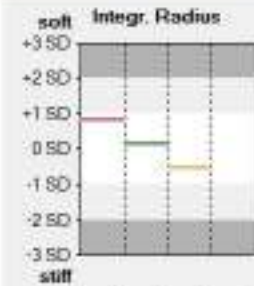


Value: 4.2 4.1 3.9
SD: -0.1 -0.4 -0.9

Baseline ☒ ☐ ☐ ☐

Changes from baseline exam:

Diff. time: 0.3y 1.1y
Diff. SD: -0.3 -0.7
Stiffer: ☒ ☒
not sign. ☒ ☒
softer: ☒ ☒

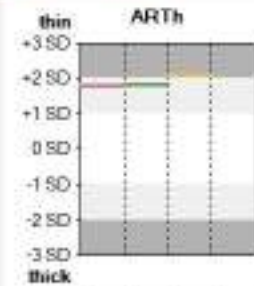


Value: 9.0 8.2 7.5
SD: 0.9 0.2 -0.5

Baseline ☒ ☐ ☐ ☐

Changes from baseline exam:

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Stiffer: ☒ ☒
not sign. ☒ ☒
softer: ☒ ☒

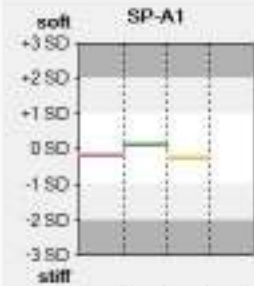


Value: 342 333 302
SD: 1.8 1.8 2.1

Baseline ☒ ☐ ☐ ☐

Changes from baseline exam:

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Diff. SD: 0.1 0.3
Thicker: ☒ ☒
not sign. ☒ ☒
thinner: ☒ ☒

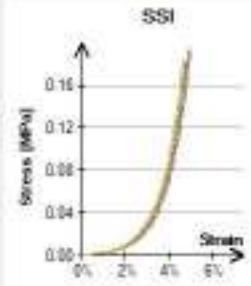


Value: 115 109 117
SD: -0.2 0.1 -0.2

Baseline ☒ ☐ ☐ ☐

Changes from baseline exam:

Diff. time: 0.3y 1.1y
Diff. SD: 0.3 -0.1
Stiffer: ☒ ☒
not sign. ☒ ☒
softer: ☒ ☒



Value: 0.9 1.0 1.2
SD: 0.4 -0.1 -0.7

Baseline ☒ ☐ ☐ ☐

Changes from baseline exam:

Diff. time: 0.3y 1.1y
Diff. SD: -0.6 -1.2
Stiffer: ☒ ☒
not sign. ☒ ☒
softer: ☒ ☒



Baseline ☒ ☐ ☐ ☐

Changes from baseline exam:

Diff. time: 0.3y 1.1y
Diff. Stage: -0.1 -0.2
No Prog. ☒ ☒
Progress: ☒ ☒

R10 2023

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Post CXL

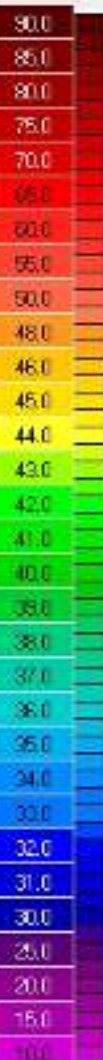
R10 2026

OCULUS - PENTACAM Compare 4 Exams

1.29:11

Name:

Exam



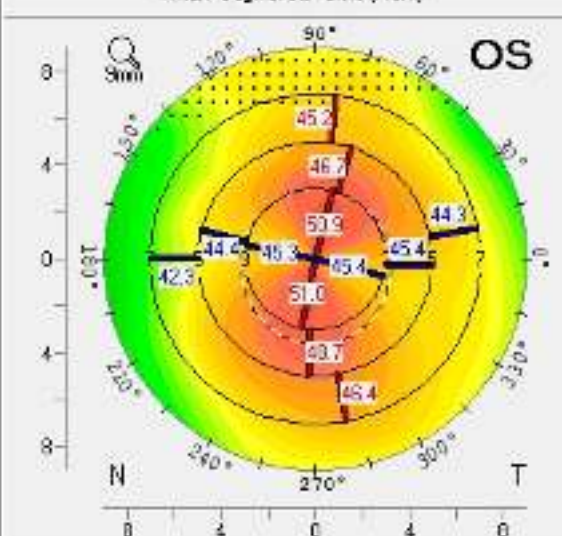
D

Curvature

Abs.

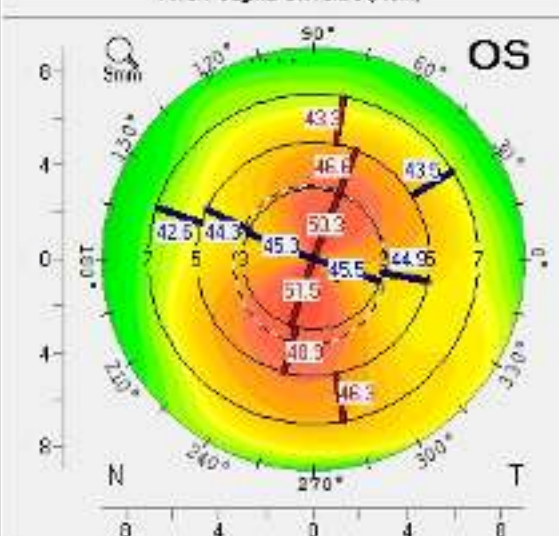
A: A: 01/15/2024 12:24:01 Left (25) 3D-Scan HR

Axial / Sagittal Curvature (Front)



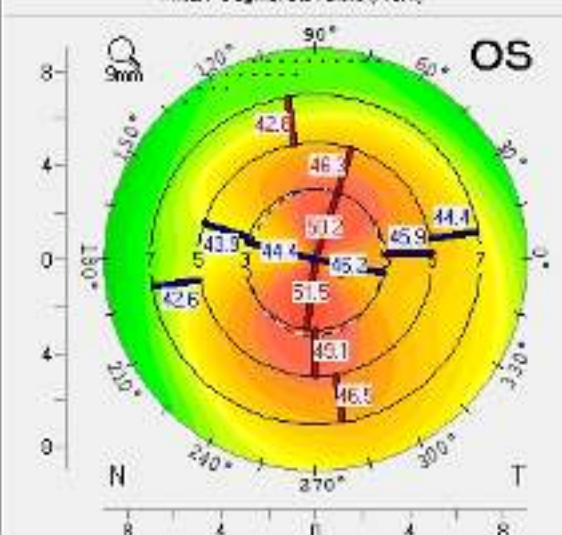
B: B: 12/04/2023 13:23:52 Left (25) 3D-Scan HR

Axial / Sagittal Curvature (Front)



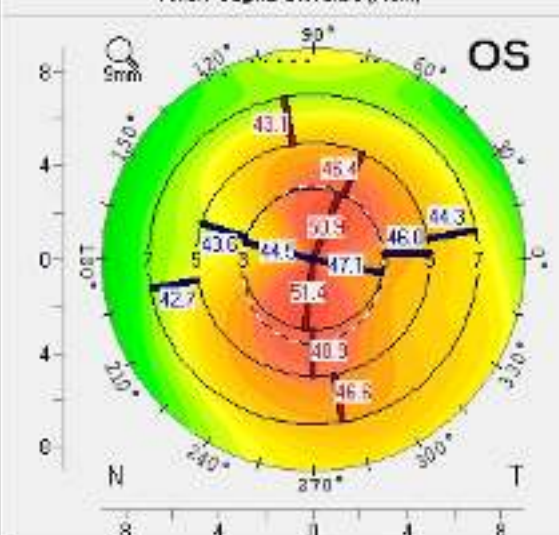
C: C: 05/15/2023 12:49:50 Left (25) 3D-Scan HR

Axial / Sagittal Curvature (Front)



D: D: 03/20/2023 15:37:44 Left (25) 3D-Scan HR

Axial / Sagittal Curvature (Front)



Exam

A

B

C

D

Exam

A

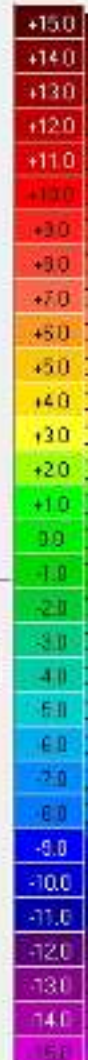
B

C

D

minus

Exam



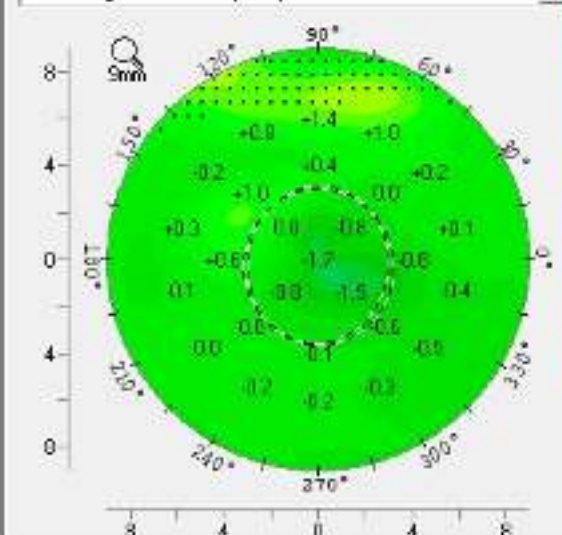
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Curvature

Rel.

Difference A - D

Axial / Sagittal Curvature (Front)



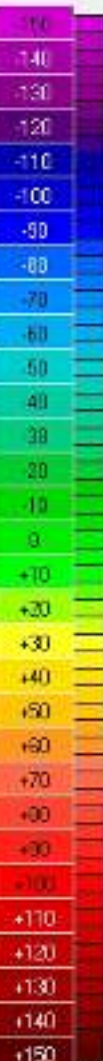
RIO

OCULUS - PENTACAM Compare 4 Exams

1.29.11

Name: _____

Exam



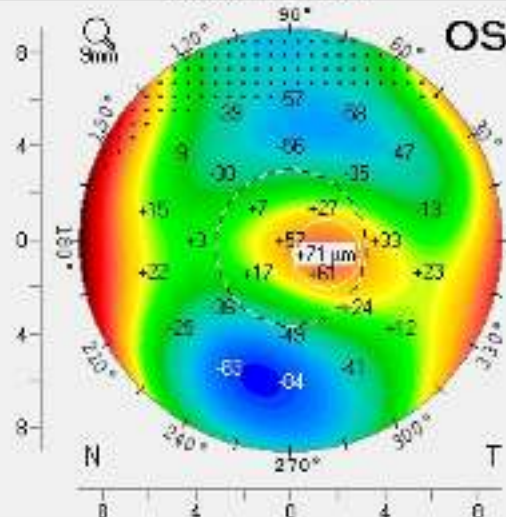
5.0 μ m

Elevation

Height

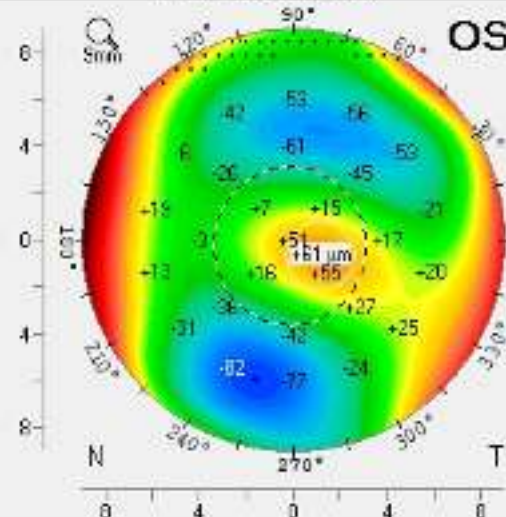
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Elevation (Back)
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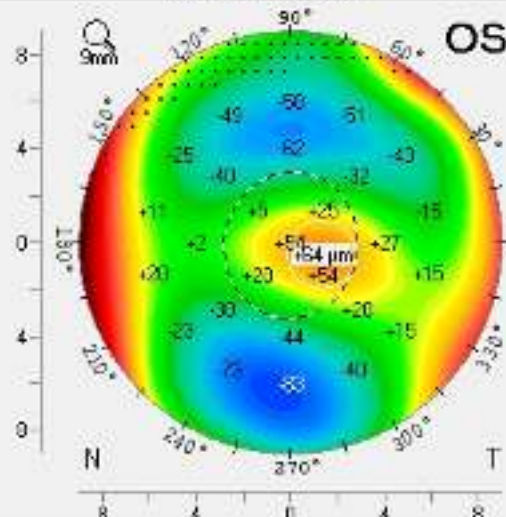
B: 03/12/2023 15:23:52 Left (25) 3D-Scan HR

Elevation (Back)
BFS=6.14 Float, Dia=8.00



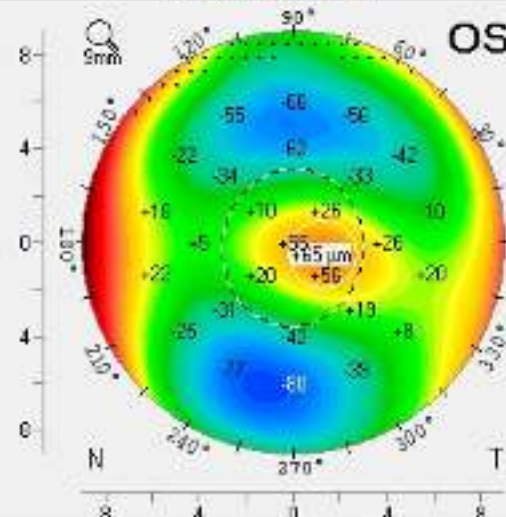
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Elevation (Back)
BFS=6.16 Float, Dia=8.00



D: 03/20/2023 15:37:44 Left (25) 3D-Scan HR

Elevation (Back)
BFS=6.19 Float, Dia=8.00



Exam

A

B

C

D

Exam

A

B

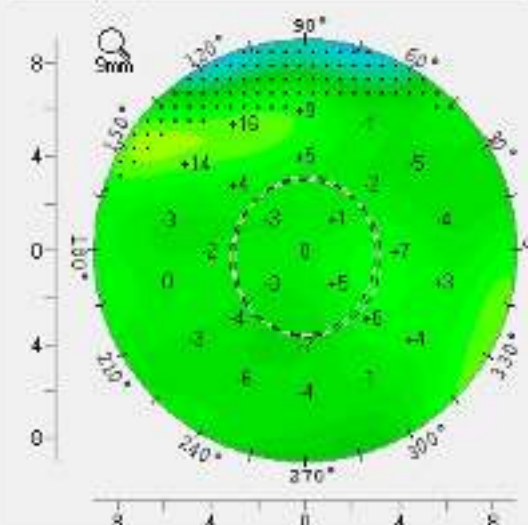
C

D

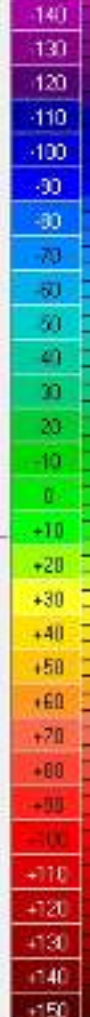
minus

Difference A - D

Elevation (Back)



Exam



5.0 μ m

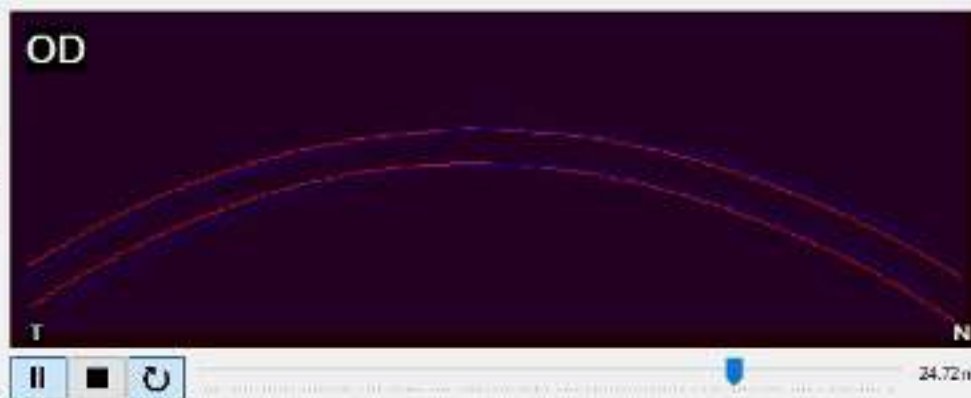
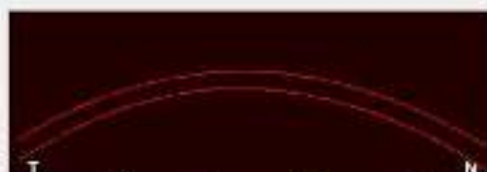
Elevation

Height

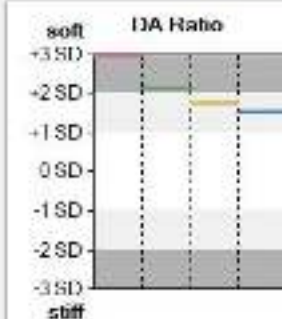
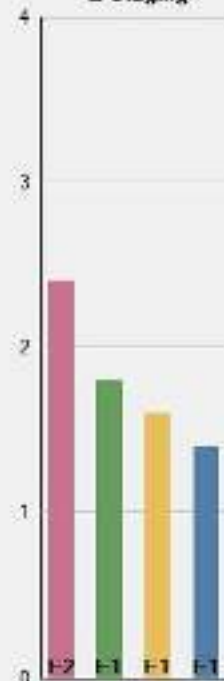
No

Select: 4 exams
Right Eye
Select: 4 exams
Left Eye

Exam Right (OD OS)

20.03.2024 OK
15.40.07
15.05.2023 OK
12.01.45
04.12.2023 OK
13.08.23
15.01.2024 OK
14.25.30


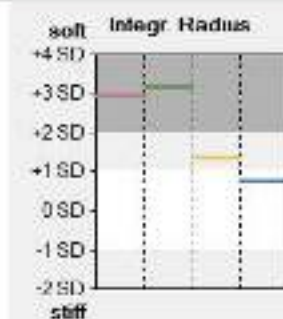
E-Staging


Value: 5.5 5.2 5.0 4.9
SD: 3.0 2.1 1.8 1.5

BaseLine @

Changes from baseline exam:

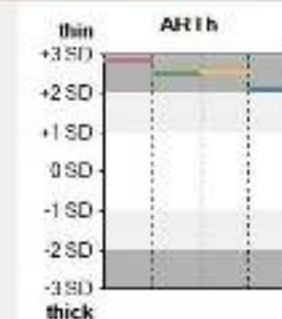
Diff. line:	0.2y	0.8y	0.8y
Diff. SD	-0.3	-1.2	-1.4
Stiffer		✓	✓
not sign.	✓		
softer			


Value: 11.3 11.6 9.5 8.9
SD: 2.9 3.1 1.3 0.8

BaseLine @

Changes from baseline exam:

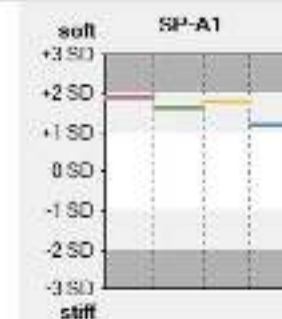
Diff. line:	0.2y	0.8y	0.8y
Diff. SD	0.2	-1.5	-2.2
Stiffer		✓	✓
not sign.	✓		
softer			


Value: 208 252 244 303
SD: 2.8 2.5 2.6 2.1

BaseLine @

Changes from baseline exam:

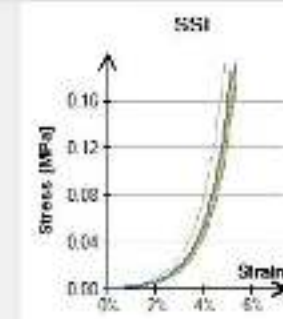
Diff. line:	0.2y	0.8y	0.8y
Diff. SD	-0.3	-0.3	-0.0
Thicker	✓	✓	✓
not sign.			
thinner			


Value: 75 81 70 90
SD: 1.9 1.7 1.0 1.2

BaseLine @

Changes from baseline exam:

Diff. line:	0.2y	0.8y	0.8y
Diff. SD	-0.3	-0.1	-0.7
Stiffer			✓
not sign.	✓	✓	
softer			


Value: 0.6 0.6 0.6 0.7
SD: 1.9 1.9 1.7 1.4

BaseLine @

Changes from baseline exam:

Diff. line:	0.2y	0.8y	0.8y
Diff. SD	0.0	-0.1	-0.5
Stiffer			✓
not sign.	✓	✓	
softer			

CBiF: 5.1 5.4 5.6 5.7
E-Stage: 2.4 1.8 1.6 1.4

BaseLine @

Changes from baseline exam:

Diff. line:	0.2y	0.8y	0.8y
Diff. Stage	0.6	0.3	1.0
No Prog.	✓	✓	✓
Progress			

Referenz: Ethnicity Global database

OCULUS Corvis® ST - Homburg Biomechanical E-Staging (BEST)

1.7.2014

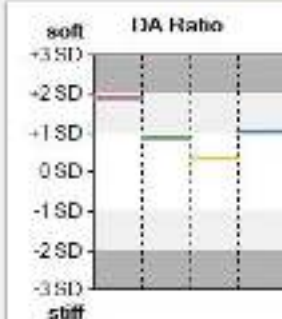
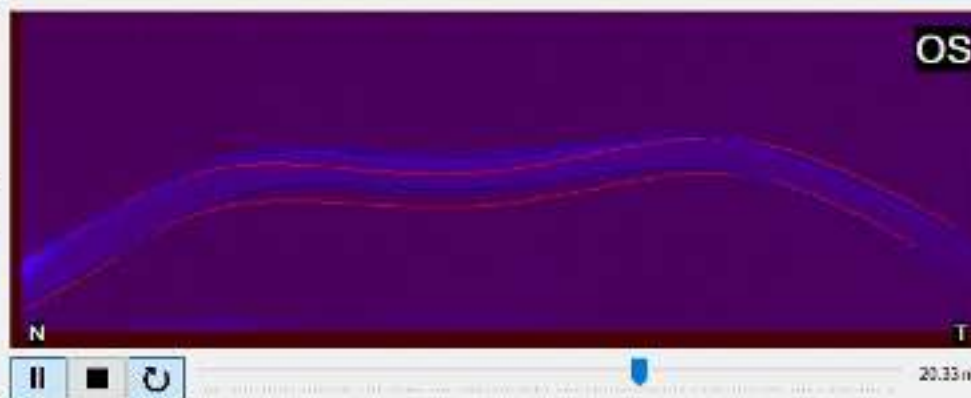
Patient: Examination: Display: Export: Settings: External software:

E-Mail: AVI: JSG:

No:

Select: 4 exams: Right Eye
Select: 4 exams: Left Eye

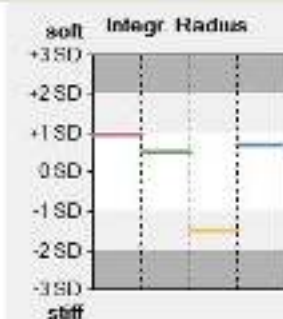
Exam (Left (OS) OS)

28.10.2013 OK
10.05.2014 OK
06.02.2014 OK
14.04.10 OK
05.02.2014 OK
14.02.14 OK
11.11.2014 OK
14.04.15 OK

Value: 5.1 4.6 4.4 4.7
SD: 1.9 0.9 0.4 1.0

BaseLine @ ○ ○ ○ ○

Changes from baseline exam:

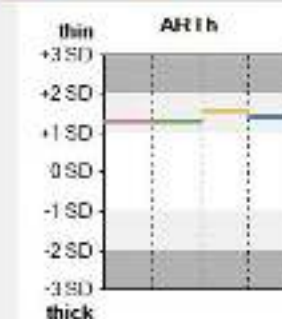
Diff. time:	1.3y	2.3y	3.1y
Diff. SD:	-1.0	-1.5	-0.9
Stiffer		✓	
not sign.	✓		✓
softer			


Value: 9.1 8.6 6.4 8.8
SD: 0.9 0.5 -1.5 0.7

BaseLine @ ○ ○ ○ ○

Changes from baseline exam:

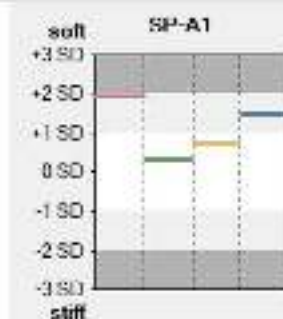
Diff. time:	1.3y	2.3y	3.1y
Diff. SD:	-0.5	-2.5	-0.3
Stiffer		✓	
not sign.	✓		✓
softer			


Value: 402 403 369 387
SD: 1.3 1.3 1.6 1.4

BaseLine @ ○ ○ ○ ○

Changes from baseline exam:

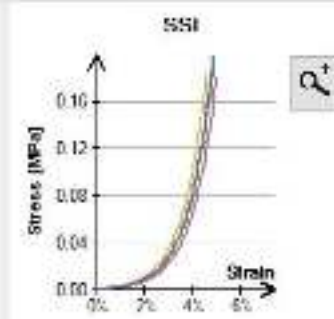
Diff. time:	1.3y	2.3y	3.1y
Diff. SD:	-0.0	0.0	0.1
Thicker			
not sign.	✓		✓
thinner		✓	


Value: 75 106 90 84
SD: 1.9 0.3 0.7 1.5

BaseLine @ ○ ○ ○ ○

Changes from baseline exam:

Diff. time:	1.3y	2.3y	3.1y
Diff. SD:	-1.0	-1.2	-0.5
Stiffer	✓	✓	
not sign.			✓
softer			

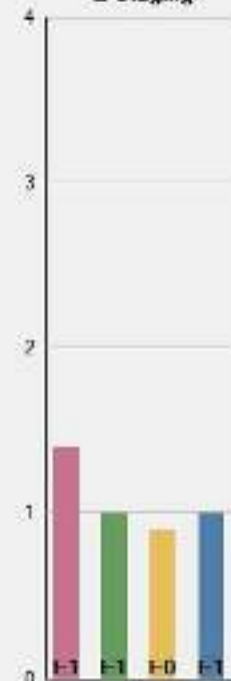

Value: 0.8 1.1 1.3 1.0
SD: 0.7 -0.3 -1.3 -0.1

BaseLine @ ○ ○ ○ ○

Changes from baseline exam:

Diff. time:	1.3y	2.3y	3.1y
Diff. SD:	-1.0	-2.0	-0.0
Stiffer	✓	✓	✓
not sign.			
softer			

E-Staging


CBiF: 5.7 5.9 6.0 5.9
E-Stage: 1.4 1.0 0.9 1.0

BaseLine @ ○ ○ ○ ○

Changes from baseline exam:

Diff. time:	1.3y	2.3y	3.1y
Diff. Stage:	-0.4	0.3	0.4
No Prog.	✓	✓	✓
Progress:			

Referenz: Enrichit: Global database

Oculus Optikgeräte GmbH
Münchholzhäuser Str. 29

35582 Wetzlar

Tel: (0641) 20 05-0
Fax: (0641) 20 05-255

www.oculus.de



R10 2

Post ICRS

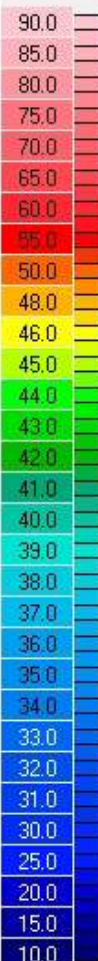
R10 2026

OCULUS - PENTACAM Compare 2 Exams

1.34r01

Name:

Exam


D
Curvature
Abs.

A: A: 02/17/2025 12:17:52 Right (25) 3D-Scan HR

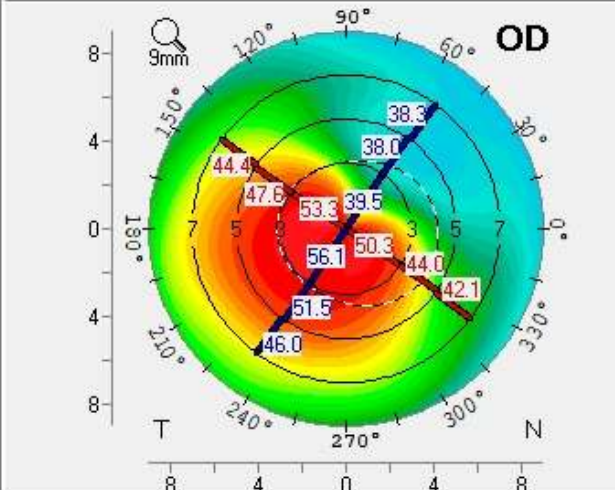

Pachy: x[mm] y[mm]
Pupil Center: + 522 µm +0.29 -0.09
Thinnest Locat.: O 509 µm -0.83 -1.40

Chamber Volume: 206 mm³ Angle: 51.4°

A. C. Depth (Int.): 3.17 mm Pupil (3D): 3.49 mm

IOP(cor): Lens Th.:

Axial / Sagittal Curvature (Front)



B: B: 01/01/2020 13:23:07 Right (25) 3D-Scan HR

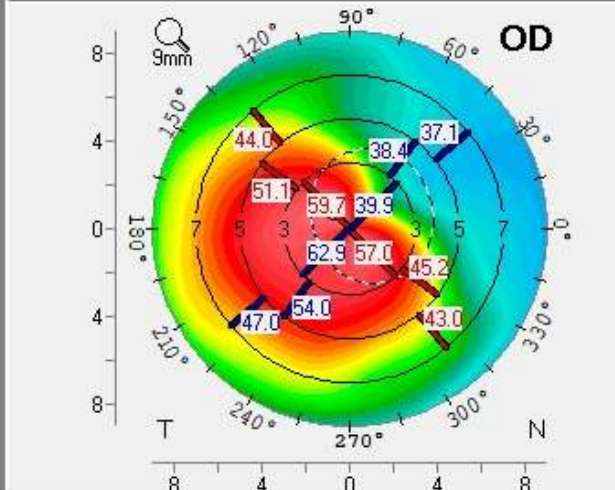

Pachy: x[mm] y[mm]
Pupil Center: + 516 µm +0.53 +0.31
Thinnest Locat.: O 492 µm -0.38 +0.38

Chamber Volume: 232 mm³ Angle: 33.6°

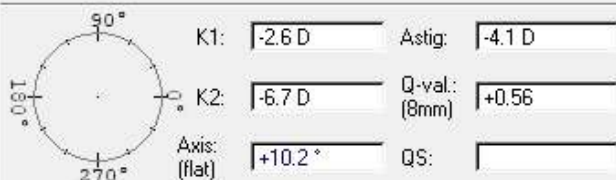
A. C. Depth (Int.): 3.42 mm Pupil (3D): 2.92 mm

IOP(cor): Lens Th.:

Axial / Sagittal Curvature (Front)



Difference A - B

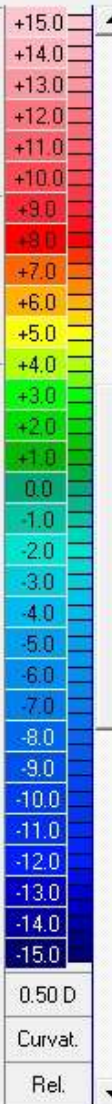
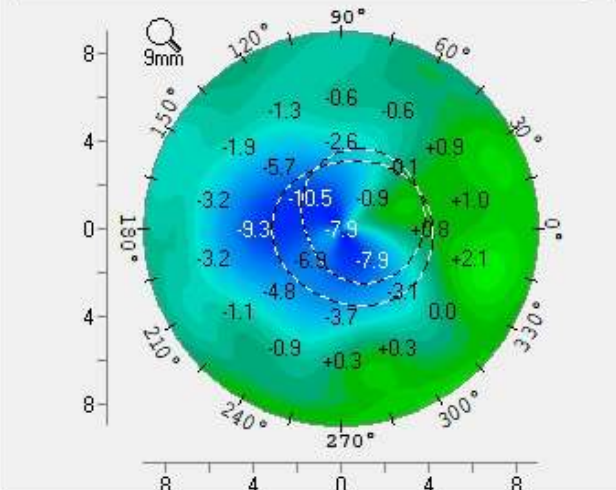

Pachy: x[mm] y[mm]
Pupil Center: + +7 µm -0.24 -0.40
Thinnest Locat.: O +16 µm -0.45 -1.78

Chamber Volume: -26 mm³ Angle: +17.8°

A. C. Depth (Int.): -0.24 mm Pupil (3D): +0.57 mm

IOP(cor): Lens Th.:

Axial / Sagittal Curvature (Front)


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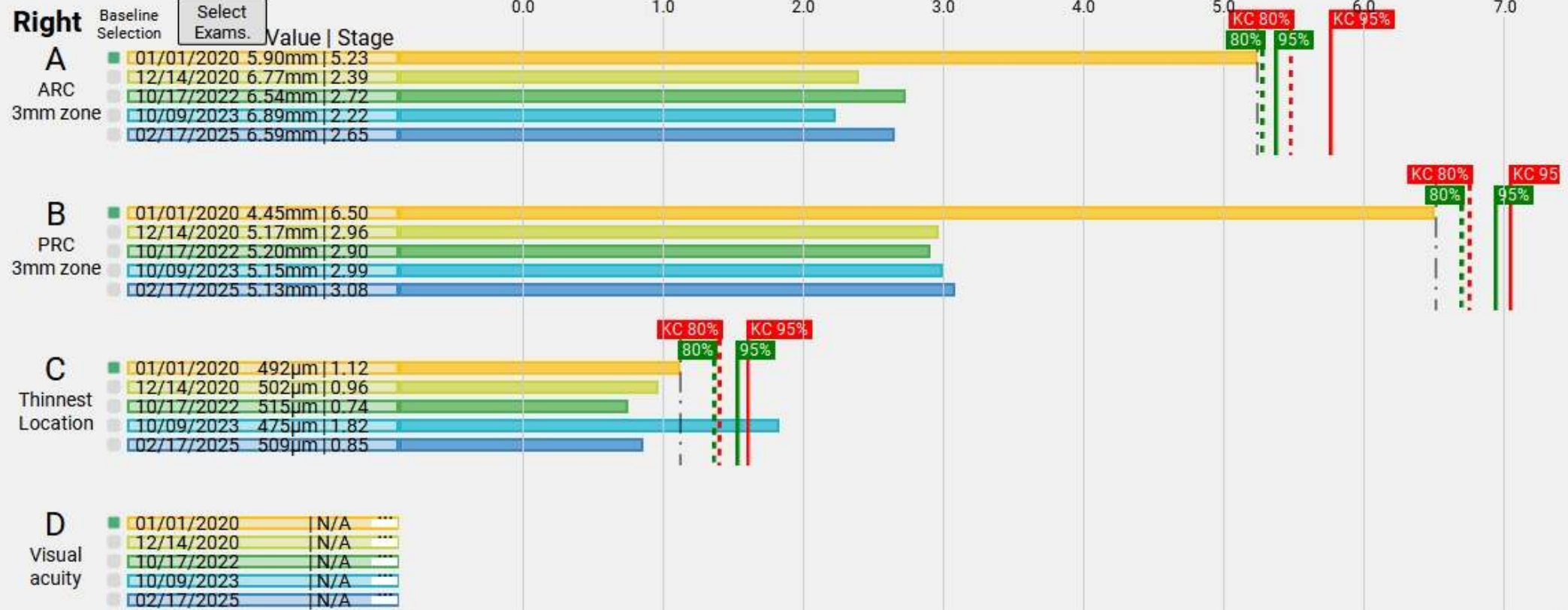


OCULUS - PENTACAM Belin ABCD Progression Display

1.34r01

Name:

Aligned at..



Baseline untreated 80% Confidence Interval Normal Population 95% Confidence Interval Normal Population 80% Confidence Interval Keratoconus Population 95% Confidence Interval Keratoconus Population

Baseline Exam	Date Time	Classification	BAD D	Prog Index Avg	ARTmax	K Max (Ant)	Q [Ant] (6mm)	Q [RF] (6mm)	ISV	IVA	IHA	IHD	QS Tomo	CXL Treatments
Σ	01/01/2020 13:23:07	A4+ B4+ C1 D	12.47	1.02	164	71.4	2.24	2.81	160	1.54	39.2	0.251	✖	
Result / Details	12/14/2020 13:21:28	A2 B2 C0 D	8.16	2.01	158	57.5	-1.20	-1.68	105	1.18	26.1	0.169	✖	
	10/17/2022 12:50:27	A2 B2 C0 D	7.89	1.59	206	56.3	-1.03	-1.40	121	1.48	17.8	0.173	✖	
	10/09/2023 12:47:48	A2 B2 C1 D	8.91	2.42	124	60.0	-1.80	-2.35	110	1.04	28.7	0.167	✖	
	02/17/2025 12:17:52	A2 B3 C0 D	8.59	1.88	182	59.8	-1.46	-1.84	116	1.25	9.1	0.188	✖	

OCULUS Corvis® ST - Homburg Biomechanical E-Staging (BEST)

1.7r2990

OCULUS Corvis® ST - Homburg Biomechanical E-Staging (BEST)

Patient Examination Disposition

E-Mail AVI JPG Print

Name: Nabil Kamel, Mina

ID: G3 VAE

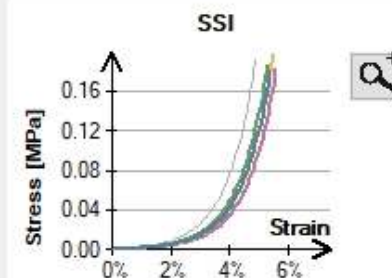
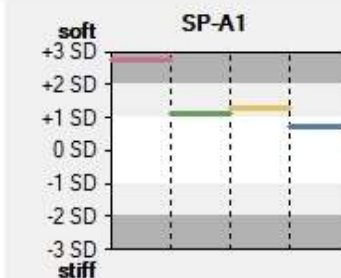
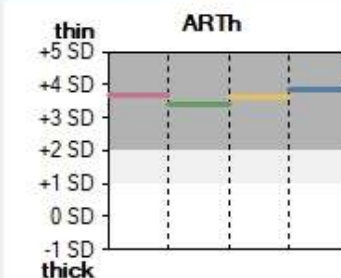
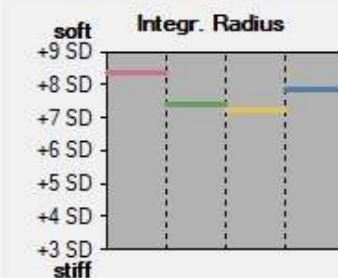
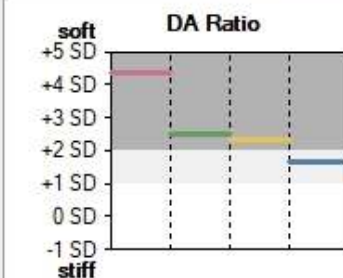
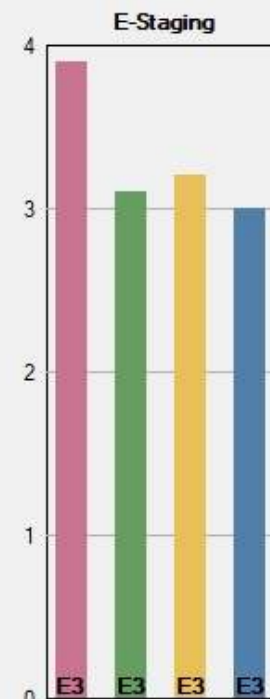
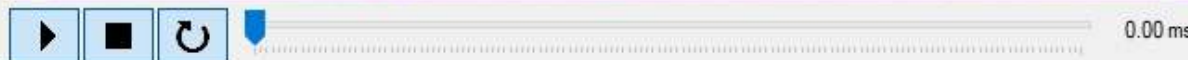
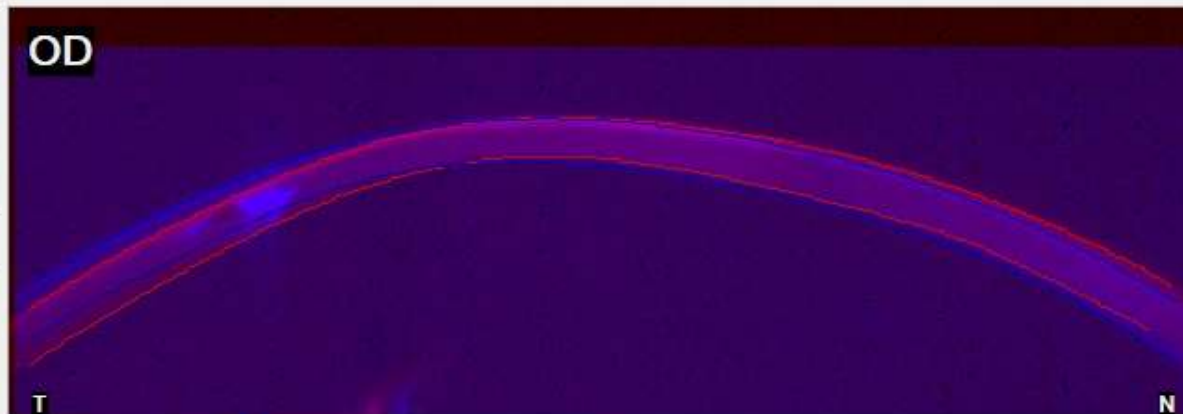
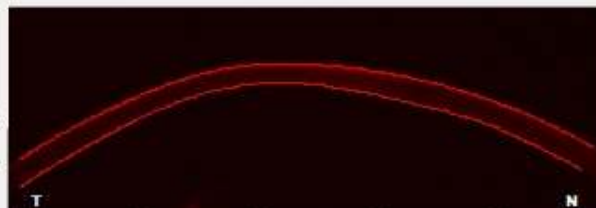
Date of birth: 01.09.1985

Age: 39

Eye: Right (OD)

Select 4
exams
Right
EyeSelect 4
exams
Left
Eye

Exam / Right (OD)	QS
13.01.2020 12:32:02	OK
14.12.2020 13:28:43	OK
09.10.2023 12:50:11	OK
03.03.2025 11:59:13	OK



Value:	6.1	5.3	5.3	5.0
SD:	4.4	2.5	2.3	1.7

Value:	17.4	16.3	16.1	16.8
SD:	8.4	7.4	7.2	7.9

Value:	98	140	112	82
SD:	3.7	3.4	3.6	3.8

Value:	59	90	87	98
SD:	2.8	1.1	1.3	0.7

Value:	0.5	0.6	0.5	0.6
SD:	2.5	1.7	2.1	2.0

CBiF:	4.2	4.7	4.6	4.7
E-Stage:	3.9	3.1	3.2	3.0

BaseLine ☒ ☐ ☐ ☐BaseLine ☒ ☐ ☐ ☐BaseLine ☒ ☐ ☐ ☐BaseLine ☒ ☐ ☐ ☐BaseLine ☒ ☐ ☐ ☐BaseLine ☒ ☐ ☐ ☐

Changes from baseline exam:

Diff. time:	0.9y	3.8y	5.2y
Diff. SD:	-1.8	-2.0	-2.7
Stiffer	✓	✓	✓
not sign.			
softer			

Changes from baseline exam:

Diff. time:	0.9y	3.8y	5.2y
Diff. SD:	-1.0	-1.1	-0.5
Stiffer	✓	✓	✓
not sign.			
softer			

Changes from baseline exam:

Diff. time:	0.9y	3.8y	5.2y
Diff. SD:	-0.3	-0.1	0.1
Thicker	✓	✓	✓
not sign.			
thinner			

Changes from baseline exam:

Diff. time:	0.9y	3.8y	5.2y
Diff. SD:	-1.6	-1.5	-2.0
Stiffer	✓	✓	✓
not sign.			
softer			

Changes from baseline exam:

Diff. time:	0.9y	3.8y	5.2y
Diff. SD:	-0.8	-0.4	-0.5
Stiffer	✓	✓	✓
not sign.			
softer			

Changes from baseline exam:

Diff. time:	0.9y	3.8y	5.2y
Diff. Stage:	-0.8	-0.7	-0.9
No Proa.	✓	✓	✓

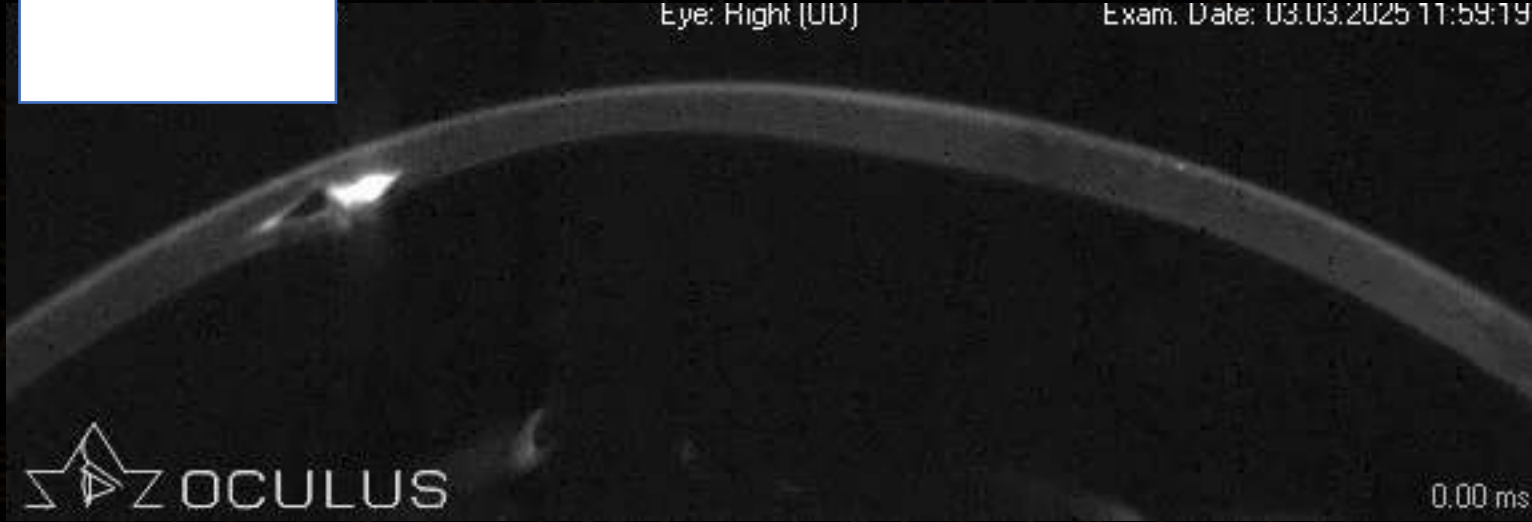
Referenced ethnicity Global database



Eye: Right (UD)

Exam. Date: 03.03.2025 11:59:19

Post ICRS



R10 2026

Diagnosis of Post LVC Ectasia

R10 2026

R10 2026

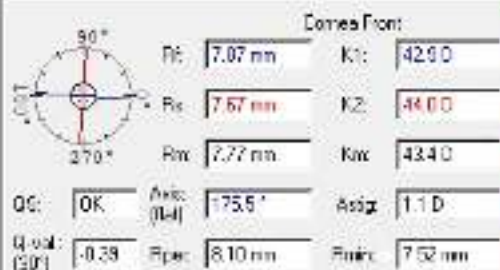
CBI LVC

Post Elevation Post LVC

R10 2026

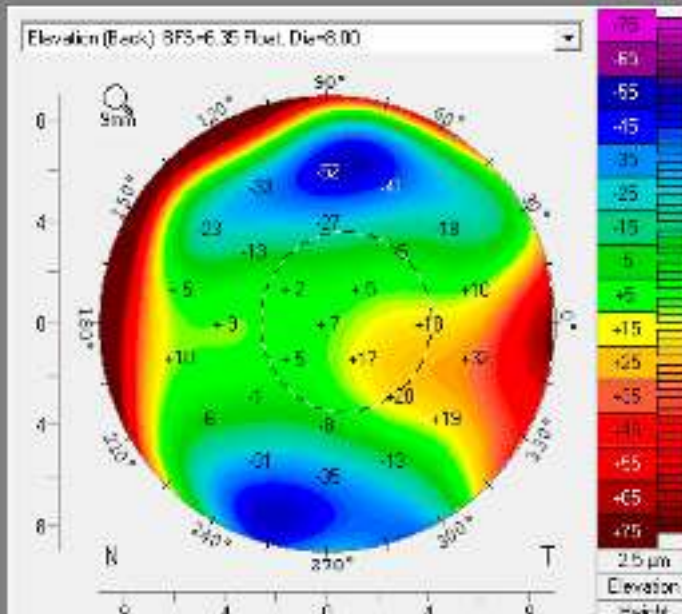
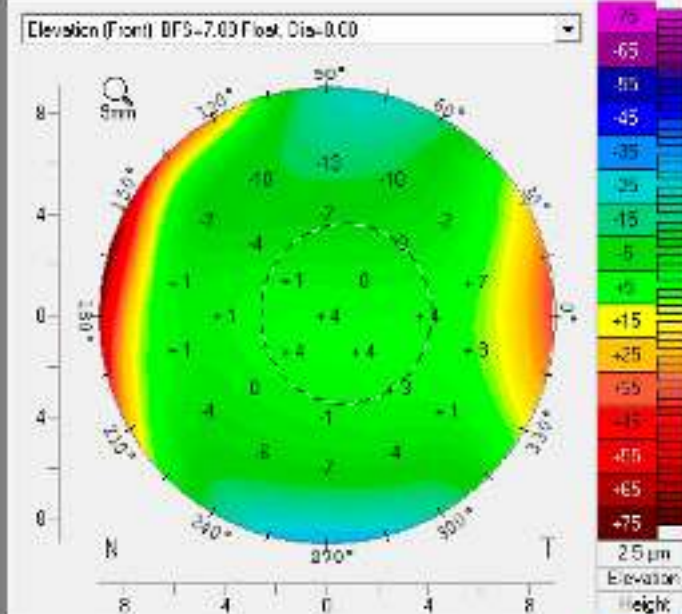
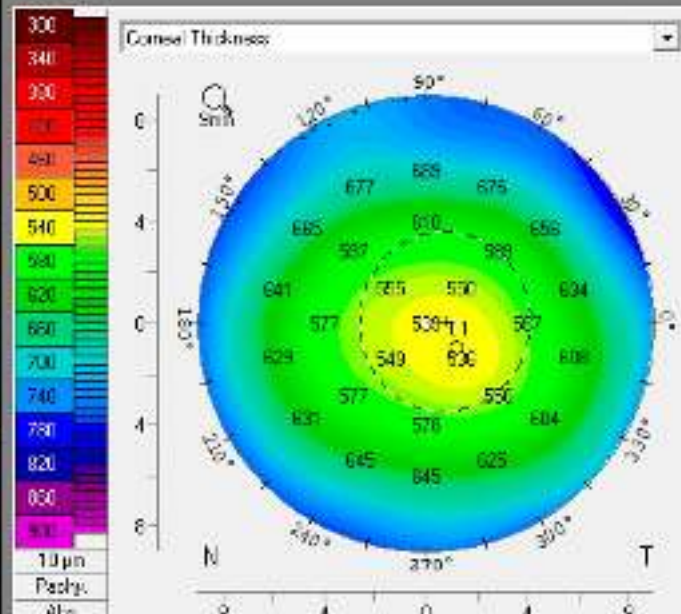
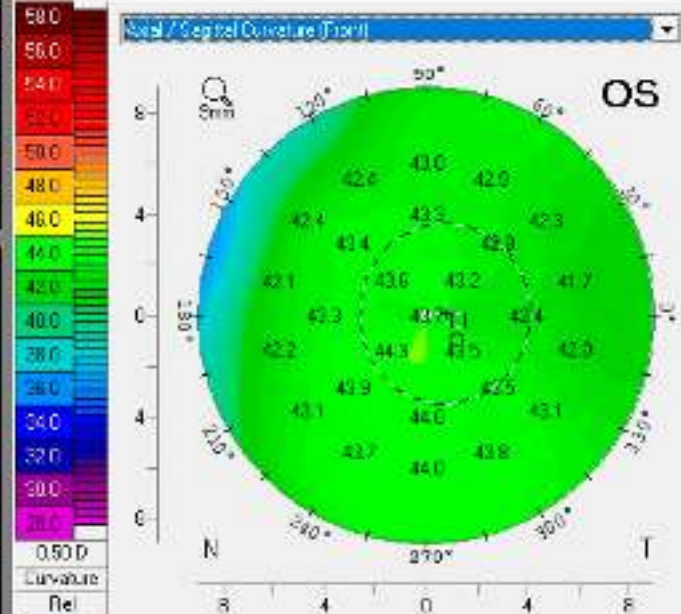
OCULUS - PENTACAM 4 Maps Selectable

Last Name: XXXXXXXXXX
 First Name: XXXXXXXXXX
 ID: 461777
 Date of Birth: 08/31/1993 Eye: Left
 Exam Date: 11/22/2021 Time: 14:25:04
 Exam Info:



	Pachy	x(mm)	y(mm)
Pupil Center	+ 538 µm	-0.38	+0.03
Pachy Vertex N.	533 µm	0.00	0.00
Thinnest Locat.	○ 535 µm	-0.00	-0.47
K Max (Front)	44.9 D	0.07	0.54

Cornea Volume:	62.1 mm ³	HxTW:	11.5 mm
Chamber Volume:	792 mm ³	Angle:	33.6°
A.C. Depth (Int.):	2.91 mm	Pupil Dia:	3.45 mm
Enter IOP (IDP/Sun):	-0.4 mmHg	Lens Th:	



OCULUS Corvis® ST - Biomechanical/Tomographic Assessment (ARV)

162503

Name:

ID: 461777

Date of birth: 01.08.1993

Age: 28

Exam. Date:

Time: 14:35:48

Eye: Left (OS)

Exam. Date: 22.11.2021

Time: 14:25:04

Eye: Left (OS)

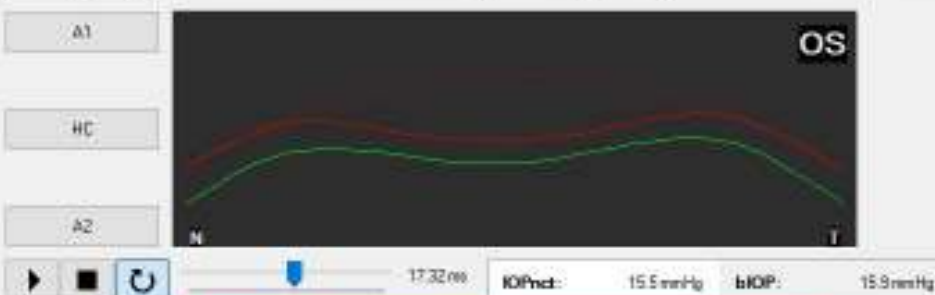
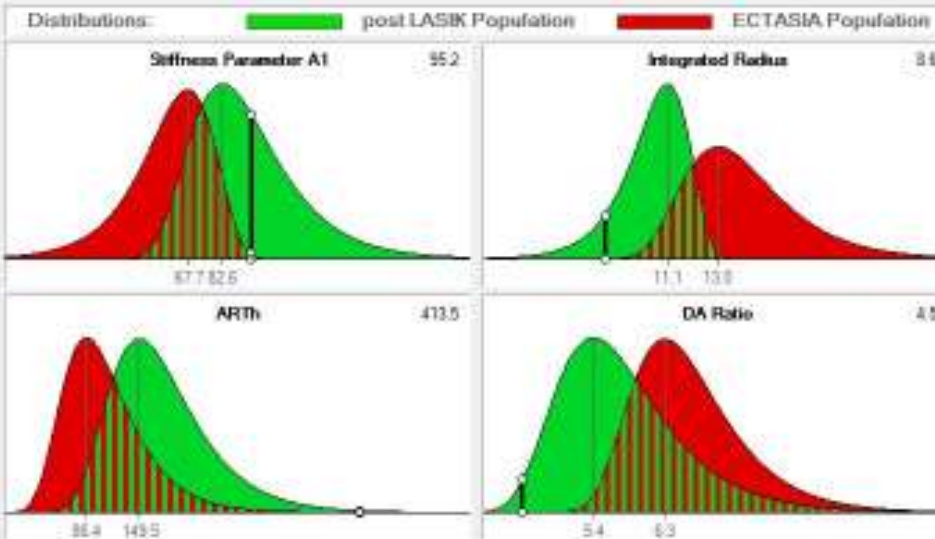
Info:

QS: OK

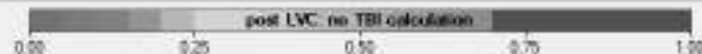
Info:

QS: OK

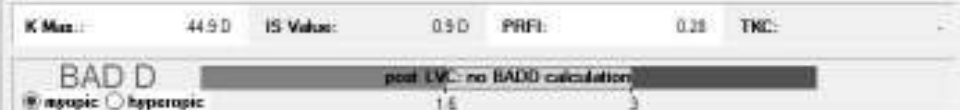
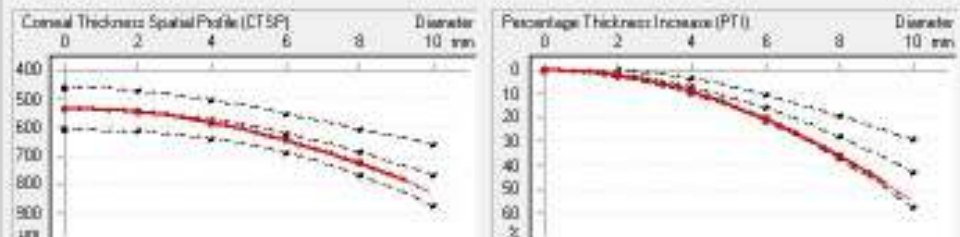
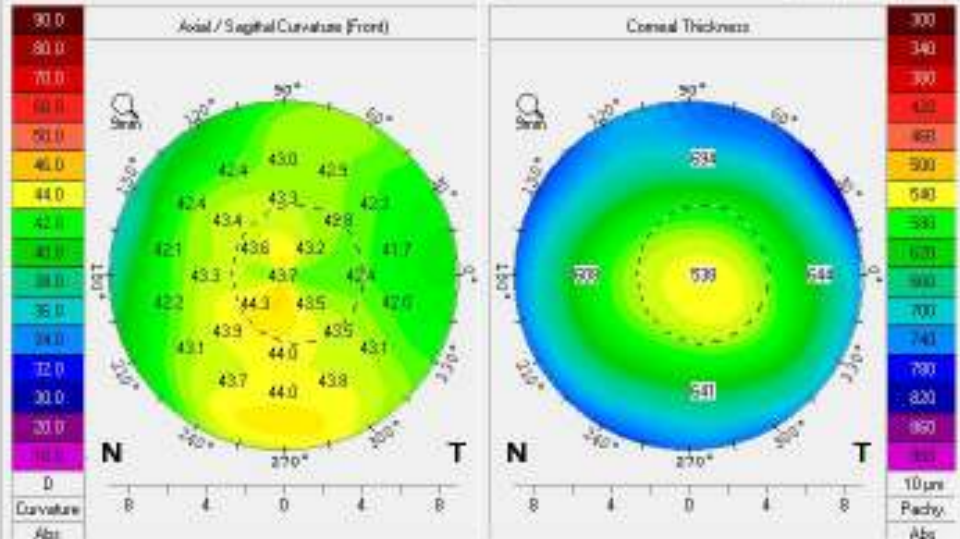
Corvis ST - Biomechanical Assessment



TBI



Pentacam - Tomographic Assessment



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Münchholzhauser Str. 29

35582 Wetzlar

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Fax: (0641) 20 05-255

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R10 20

OCULUS - PENTACAM 4 Maps Selectable

1.2515

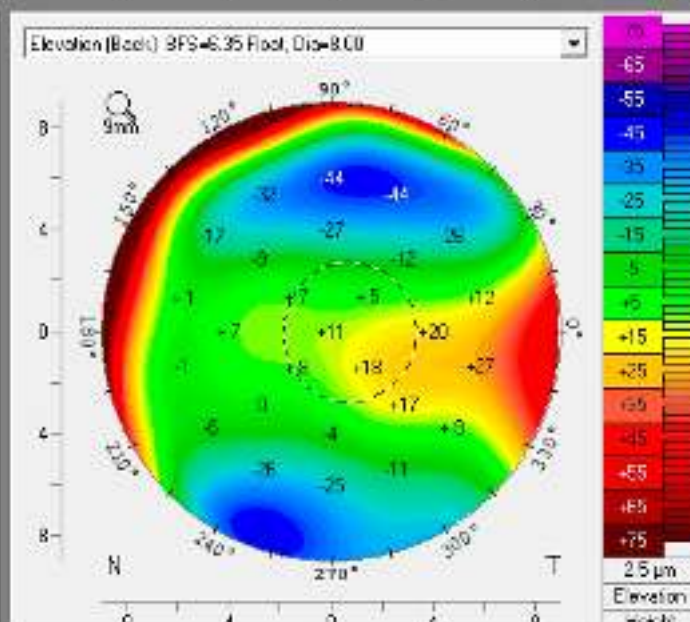
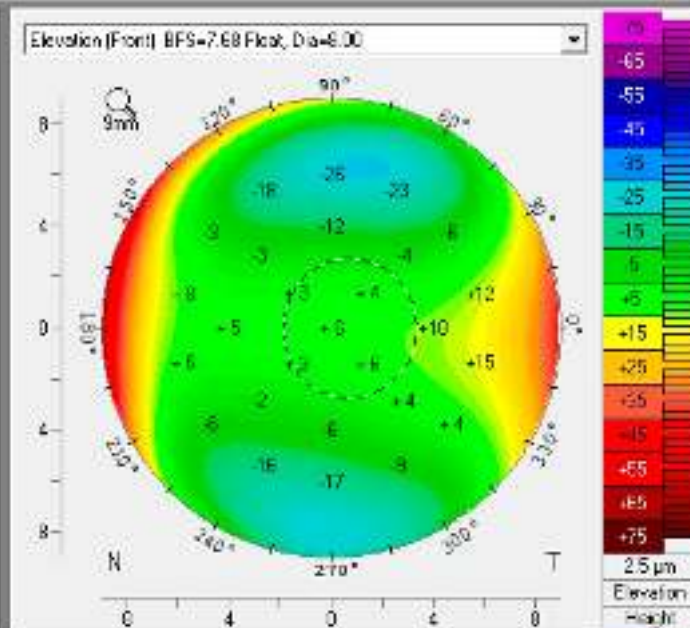
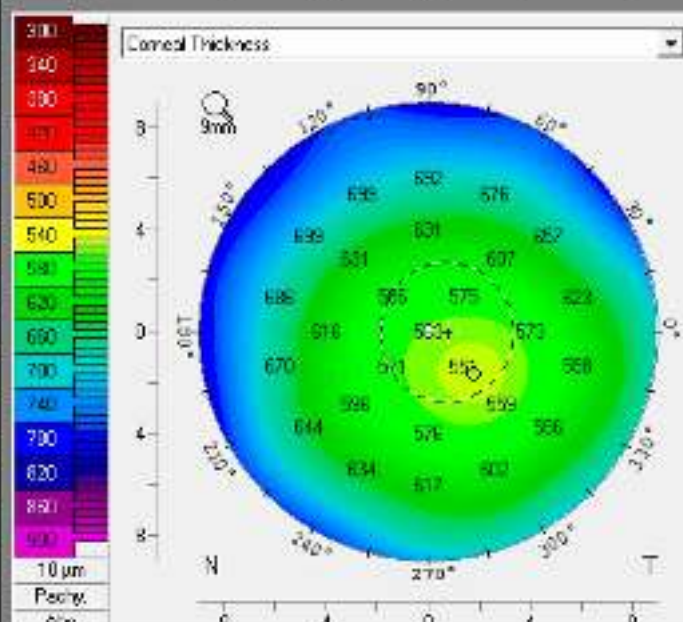
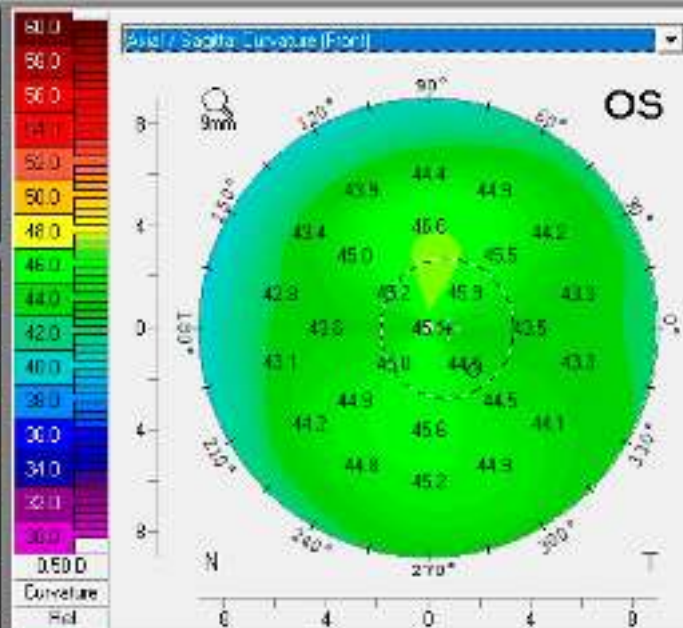
Last Name: [REDACTED]
 First Name: [REDACTED]
 ID: 48777
 Date of Birth: 08/01/1949 Eye: Left
 Exam Date: 12/18/2017 Time: 13:22:12
 Exam Info:

Cornea Front:
 RI: 7.73 mm K1: 43.7 D
 Rr: 7.28 mm K2: 45.4 D
 Rm: 7.58 mm Kmc: 45.0 D
 OS: OK Axis (Rad): 174.2° Axis: 2.7 D
 Q-val (30°): -0.50 Rper: 7.07 mm Rmkr: 7.17 mm

Cornea Back:
 RI: 6.41 mm K1: -6.2 D
 Rr: 5.96 mm K2: -6.6 D
 Rm: 6.14 mm Kmc: -6.5 D
 OS: OK Axis (Rad): 166.0° Axis: 0.6 D
 Q-val (30°): -0.45 Rper: 6.67 mm Rmkr: 6.77 mm

Pachy:
 Pupil Center: + 550 μ m x(mm): +0.37 y(mm): -0.02
 Pachy Vertex R: 502 μ m x(mm): 0.00 y(mm): 0.00
 Thinnest Locat: Q 500 μ m x(mm): +0.89 y(mm): 0.82
 K Max (Front): 47.1 D x(mm): +0.14 y(mm): +1.15

Cornea Volume: 62.9 mm³ KPD: +1.3 D
Chamber Volume: 171 mm³ Angle: 37.1°
A.C. Depth (Int.): 2.98 mm Pupil Dia: 2.97 mm
 Enter IOP: IOP(Sum): 1.3 mmHg Lens Th:



R10 20

OCULUS - PENTACAM Compare 2 Exams

1.2515

Name:

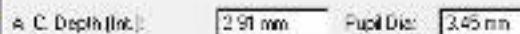
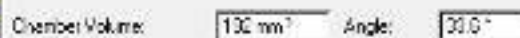
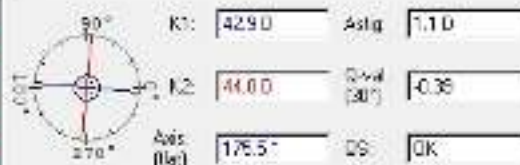
ID: 451777

Date of Birth:

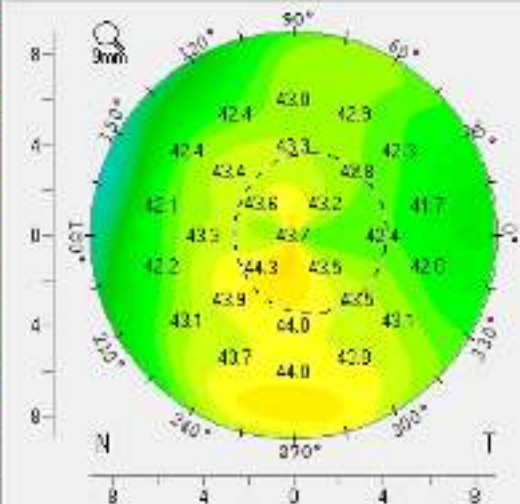
03/01/1993

Exam

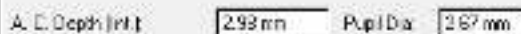
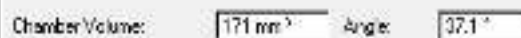
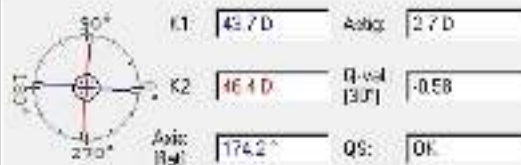
A: 11/22/2017 14:25:04 (L) [25] 3D-Scan HR



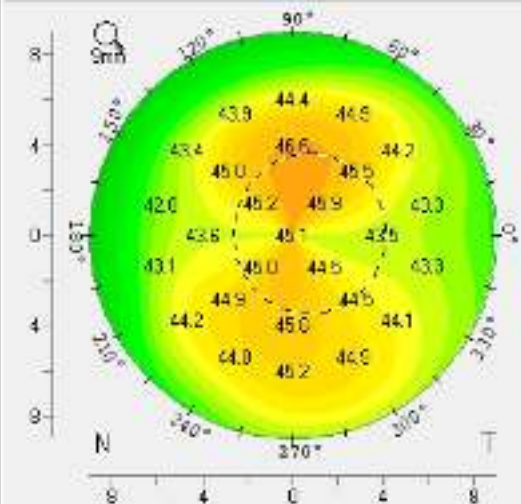
Axial / Sagittal Curvature (Front)



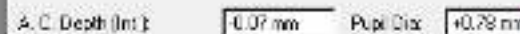
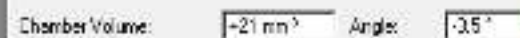
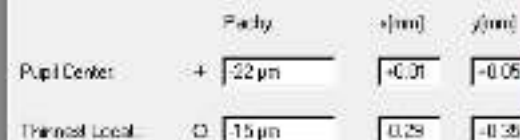
B: 12/18/2017 13:22:12 (L) [25] 3D-Scan HR



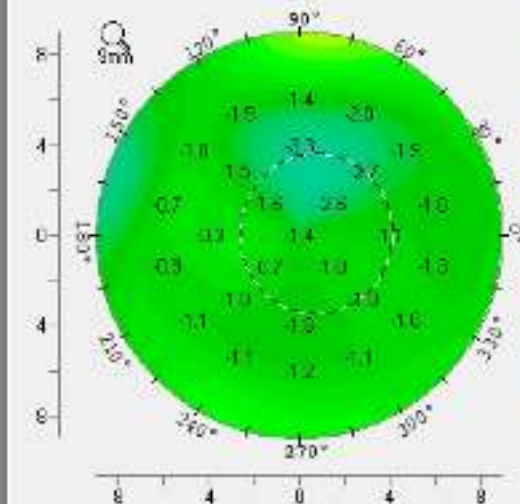
Axial / Sagittal Curvature (Front)



Difference A - B



Axial / Sagittal Curvature (Front)



D

Curvature

Abs

0.50 D

Curvature

Rel

RIO 20

OCULUS - PENTACAM Compare 2 Exams

1.25/15

Name:

ID: 461777

Date of Birth:

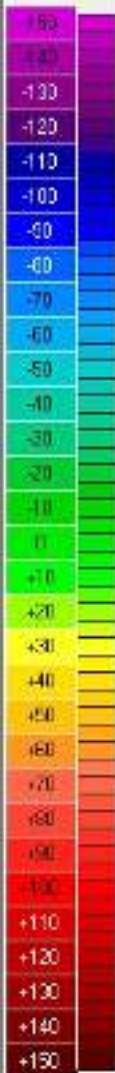
08/01/1993

Exam:

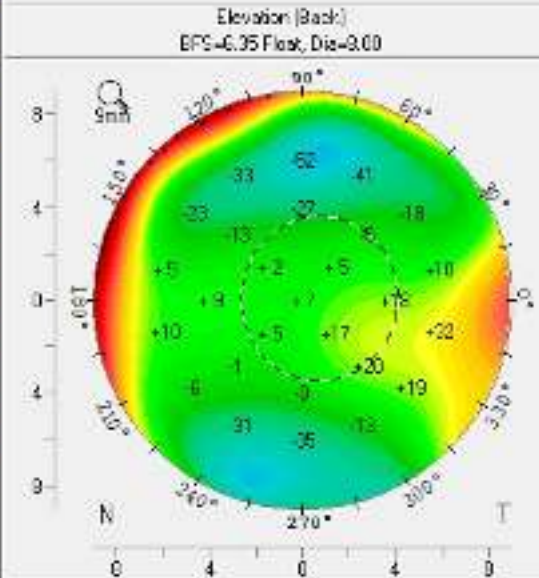
A: [B: 12/10/2017 13:22:12 Left (25) 30-Scan HR]

B: [B: 12/10/2017 13:22:12 Left (25) 30-Scan HR]

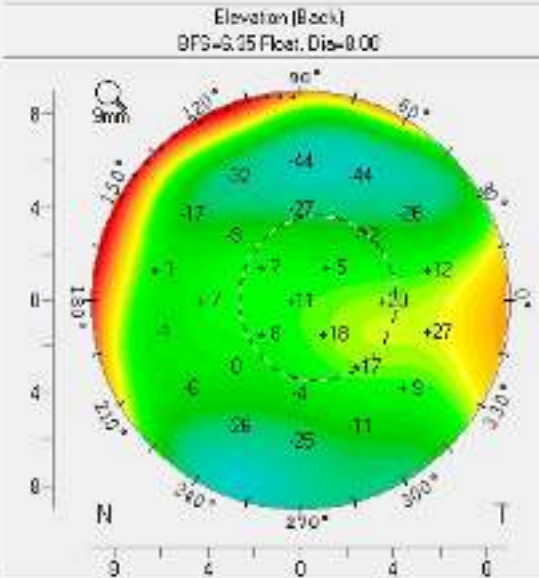
Difference A - B



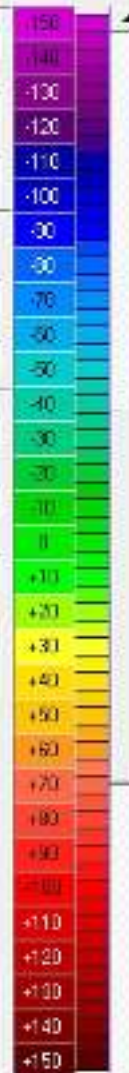
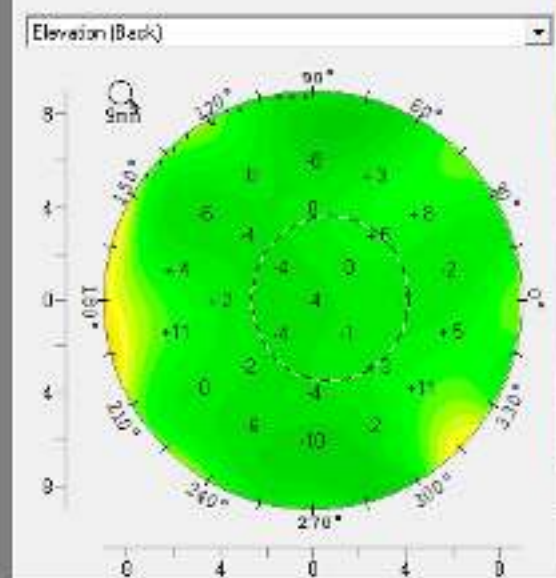
	Pachy:	x[mm]	y[mm]
Pupil Center:	+ 536 µm	+0.33	+0.33
Thinnest Locat.:	○ 535 µm	+0.60	+0.47
Chamber Volume:	192 mm ³	Angle:	32.6°
A. C. Depth (Int.):	2.91 mm	Pupil Dia:	3.45 mm
IOP(cent)		Lens Th:	



	Pachy:	x[mm]	y[mm]
Pupil Center:	+ 560 µm	+0.37	+0.02
Thinnest Locat.:	○ 550 µm	+0.69	+0.62
Chamber Volume:	171 mm ³	Angle:	37.1°
A. C. Depth (Int.):	2.90 mm	Pupil Dia:	2.67 mm
IOP(cent)		Lens Th:	



	Pachy:	x[mm]	y[mm]
Pupil Center:	+ 22 µm	+0.01	+0.35
Thinnest Locat.:	○ 15 µm	+0.29	+0.35
Chamber Volume:	+21 mm ³	Angle:	3.5°
A. C. Depth (Int.):	-0.07 mm	Pupil Dia:	+0.79 mm
IOP(cent)		Lens Th:	


5.0 µm
Elevation
Height

5.0 µm
Elevation
Height

R10 2

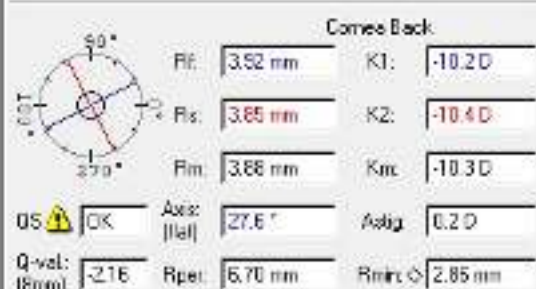
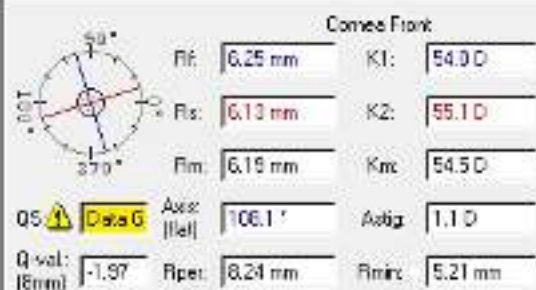
Unilateral Post LVC Ectasia?

R10 2026

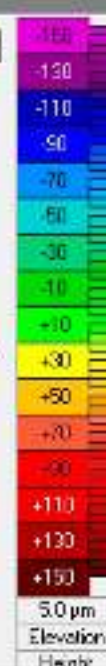
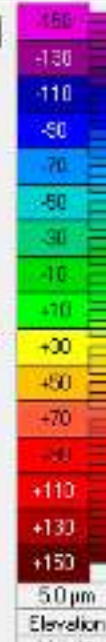
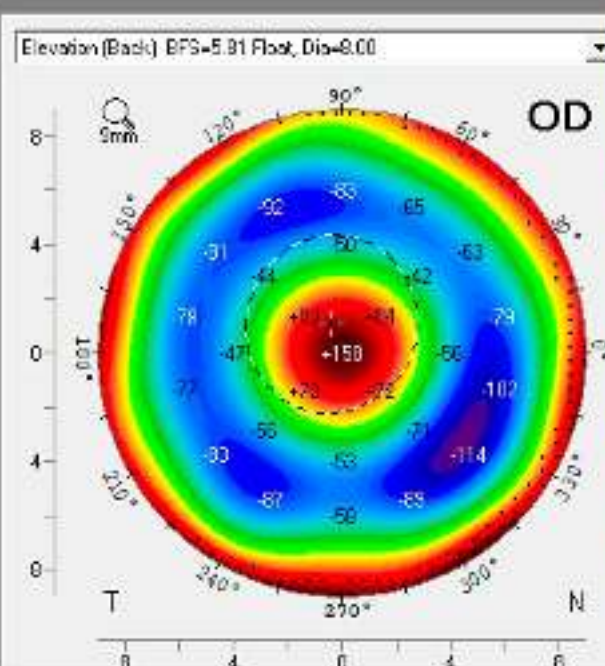
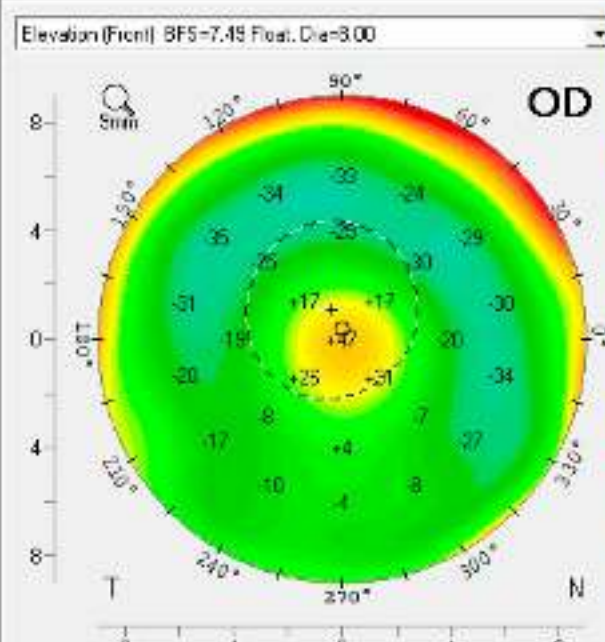
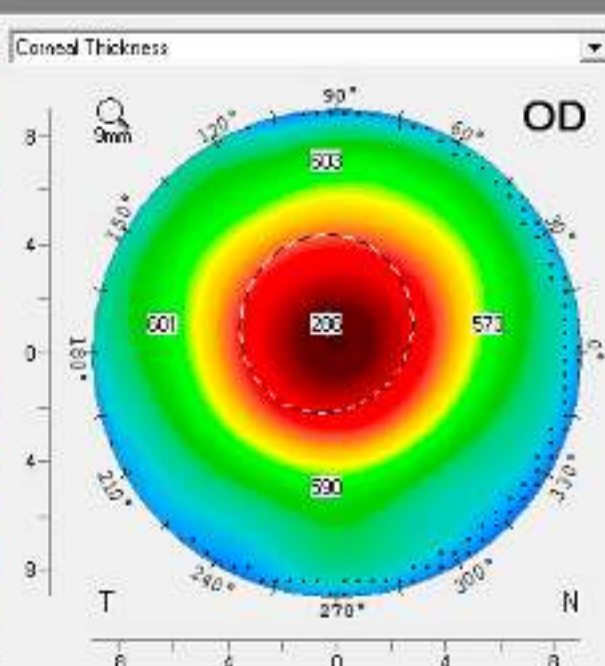
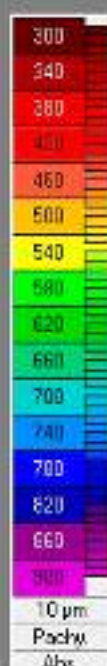
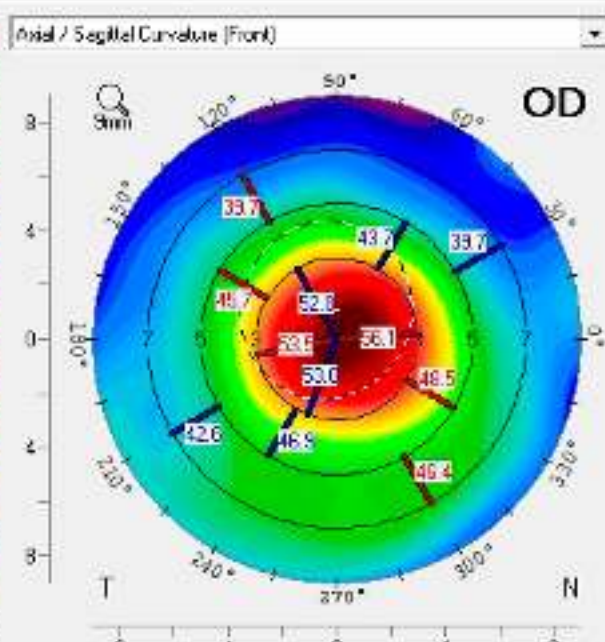
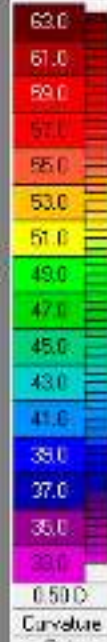
OCULUS - PENTACAM 4 Maps Selectable

1.30.04

Last Name: XXXXXXXXXX
 First Name: XXXXXXXXXX
 ID: XXXXXXXXXX
 Date of Birth: 12/24/1974 Eye: Right
 Exam Date: 12/16/2024 Time: 10:52:29
 Exam Info: XXXXXXXXXX



Pupil Center:	+ 286 µm	x(mm)	0.20	y(mm)	+0.54
Pachy Vertex N.:	275 µm	x(mm)	0.00	y(mm)	0.00
Thinnest Locat.:	276 µm	x(mm)	0.00	y(mm)	+0.19
K Max (Front):	64.8 D		+0.12		+0.12
Cornea Volume:	57.4 mm³	HW/TW:	10.9 mm		
Chamber Volume:	109 mm³	Angle:	35.1°		
A.C. Depth (Int.):	3.48 mm	Pupil Dia:	3.22 mm		
Enter IDP:	ICP(Sum)	Lens Th:			



R10

OCULUS Corvis® ST - Biomechanical/Tomographic Assessment (ARV)

1.72704

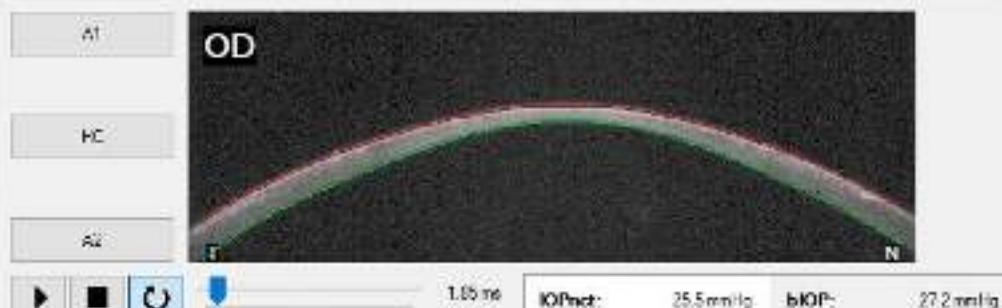
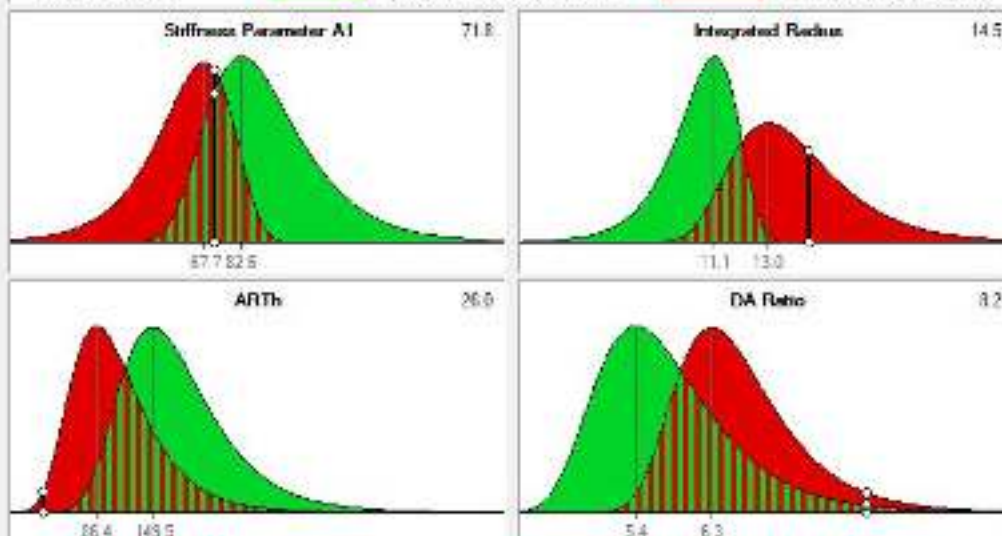
Patient: [REDACTED] Export Settings External software

E-Mail AVI JGG

Name: [REDACTED] ID: Post-LVC Ectasia Date of birth: 24.12.1974 Age: 49
 Exam Date: 16.12.2024 Time: 11:04:59 Eye: Right (OD) Exam Date: 16.12.2024 Time: 10:52:29 Eye: Right (OD)
 Info: OS: Alignment Info: OS: Data Gaps!

Corvis ST - Biomechanical Assessment

Distributions: post LASIK Population ECTASIA Population



CBI LVC 0.25 0.50 0.75 1.00

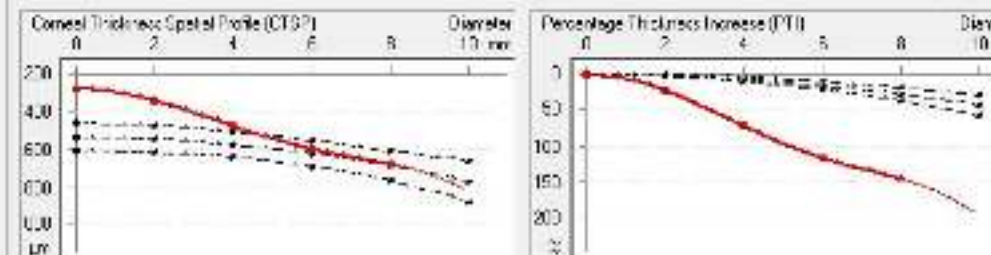
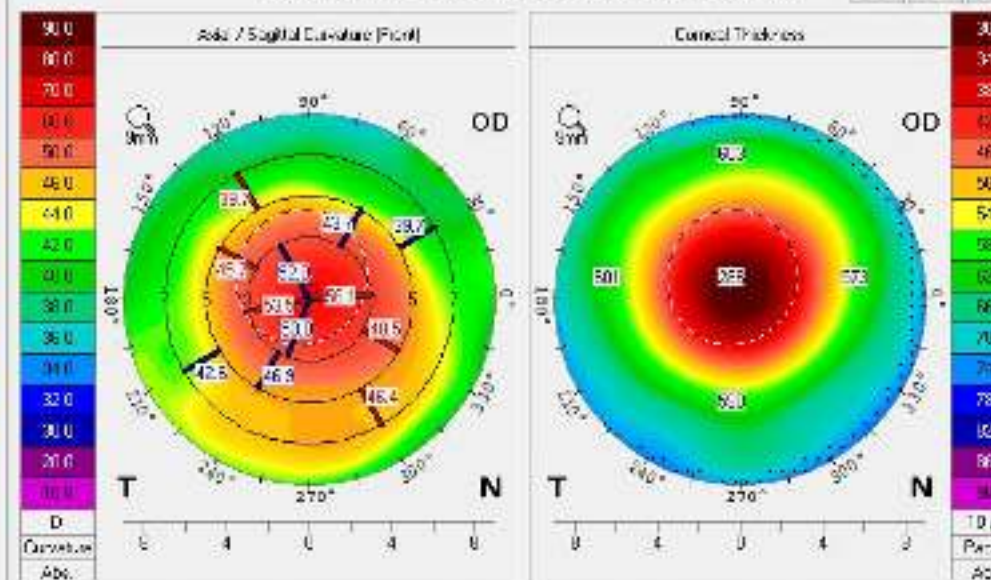
Reference: Ethnicity Global database Treatment: [REDACTED]

TBI

post-LVC: no TBI calculation

35582 Wetzlar

Pentacam - Tomographic Assessment



K Max.: 64.0 D IS Value: 4.00 PRI: 0.57 TWC: 60

BAD D

myopic hyperopic

post-LVC: no BAD D calculation

www.ocus.de



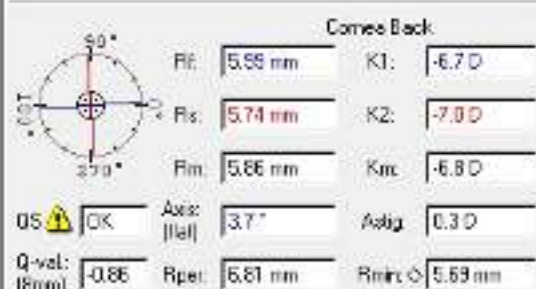
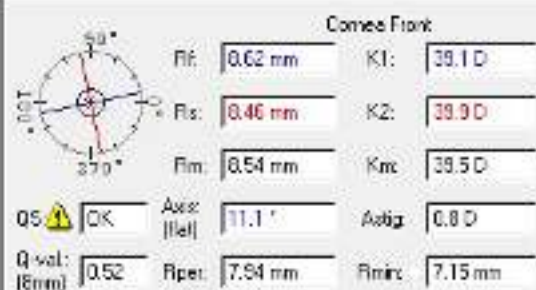
Oculus Optikgeräte GmbH
 Münchholzhäuser Str. 29

Tel: (0641) 20 05-0
 Fax: (0641) 20 05-255

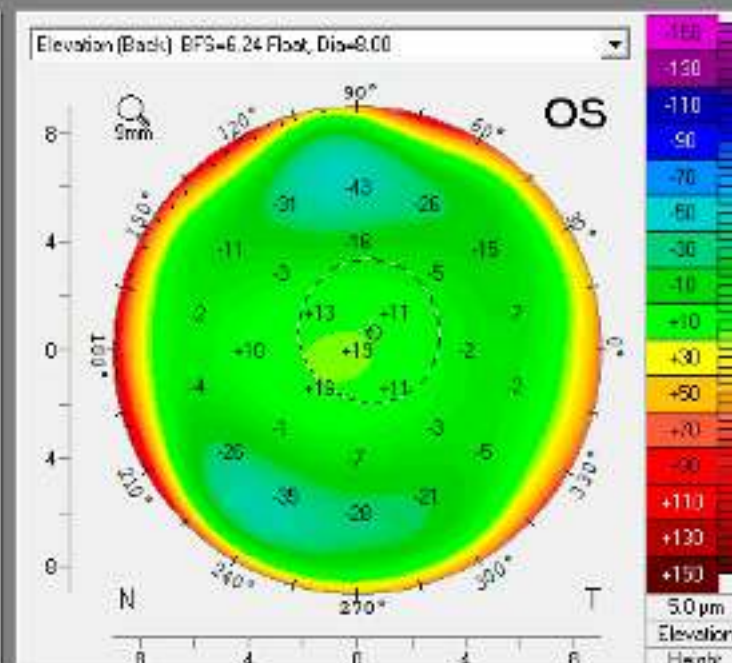
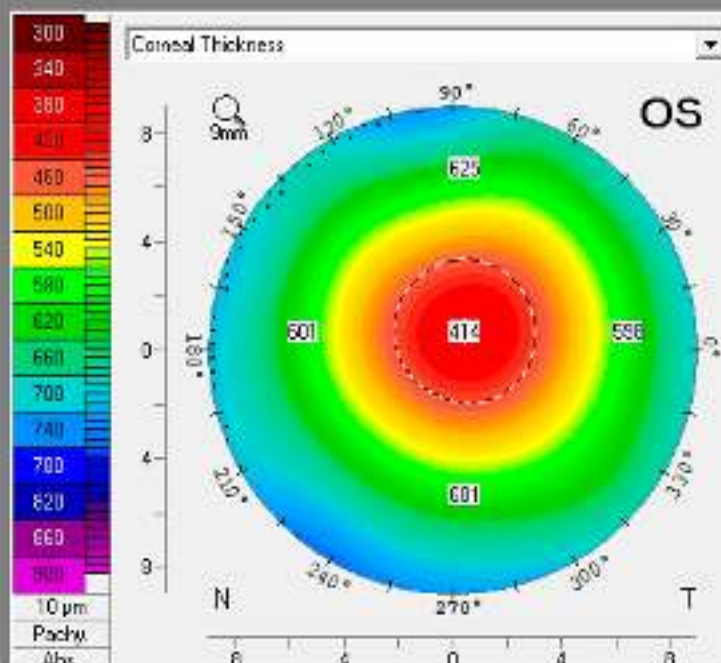
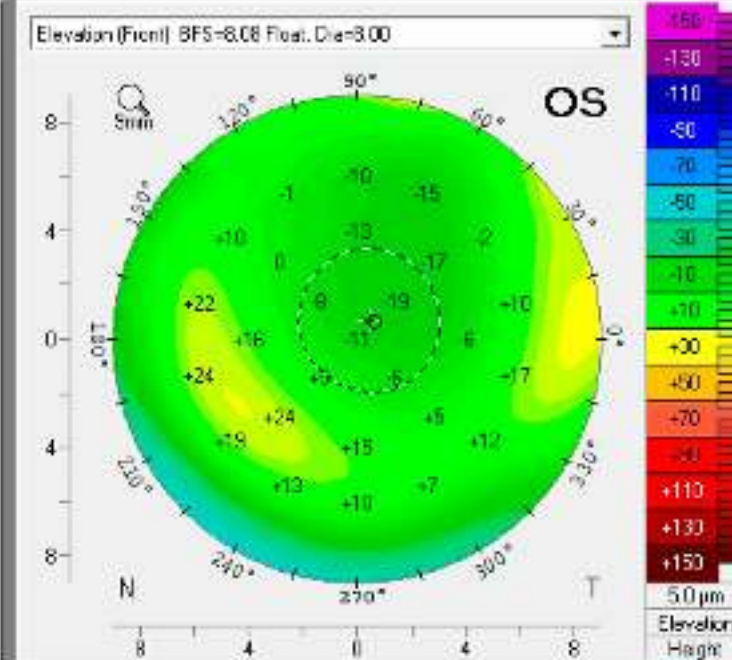
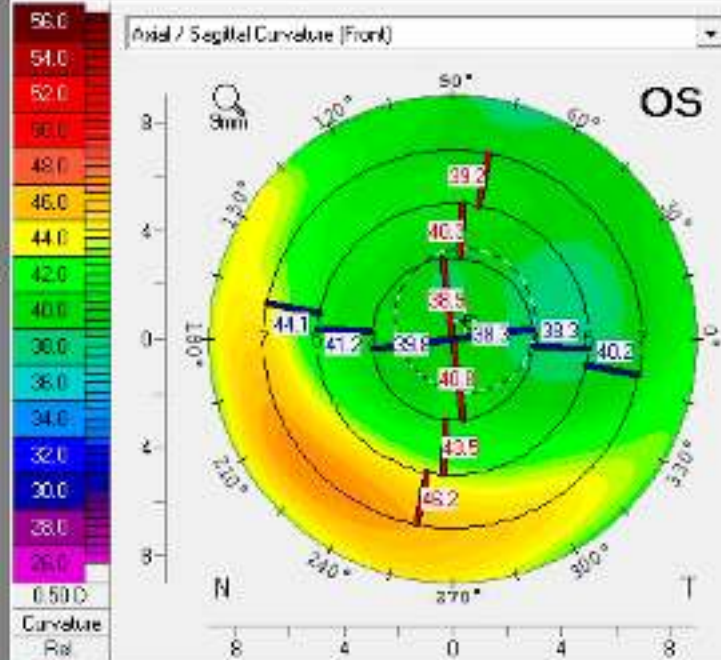
OCULUS - PENTACAM 4 Maps Selectable

1.30/04

Last Name: XXXXXXXXXX
 First Name: XXXXXXXXXX
 ID: XXXXXXXXXX
 Date of Birth: 12/24/1974 Eye: Left
 Exam Date: 12/16/2024 Time: 10:54:11
 Exam Info:



Pupil Center: + 414 µm x(mm): +0.24 y(mm): +0.35
 Pachy Vertex N.: - 415 µm x(mm): 0.00 y(mm): 0.00
 Thinnest Locat.: 0 414 µm x(mm): +0.31 y(mm): +0.31
 K Max (Front): 47.2 D x(mm): -2.52 y(mm): -2.45
 Cornea Volume: 57.1 mm³ HW/TW: 11.0 mm
 Chamber Volume: 199 mm³ Angle: 43.9°
 A.C. Depth (Int.): 3.25 mm Pupil Dia: 2.62 mm
 Enter IDP: ICPSum: Lens Th:



R10

OCULUS Corvis® ST - Biomechanical/Tomographic Assessment (ARV)

1.7.27.04

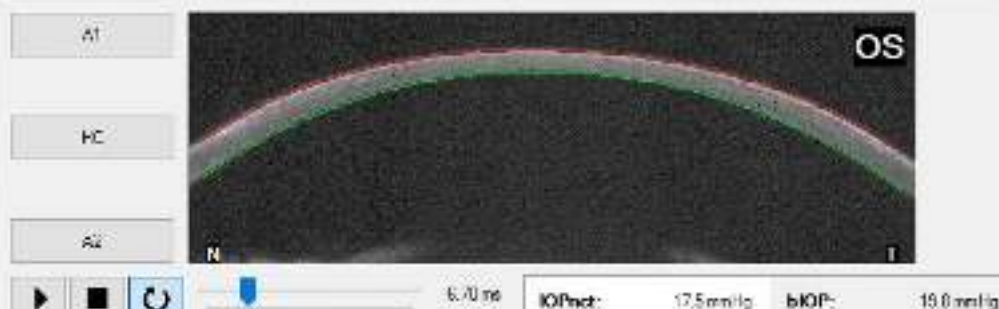
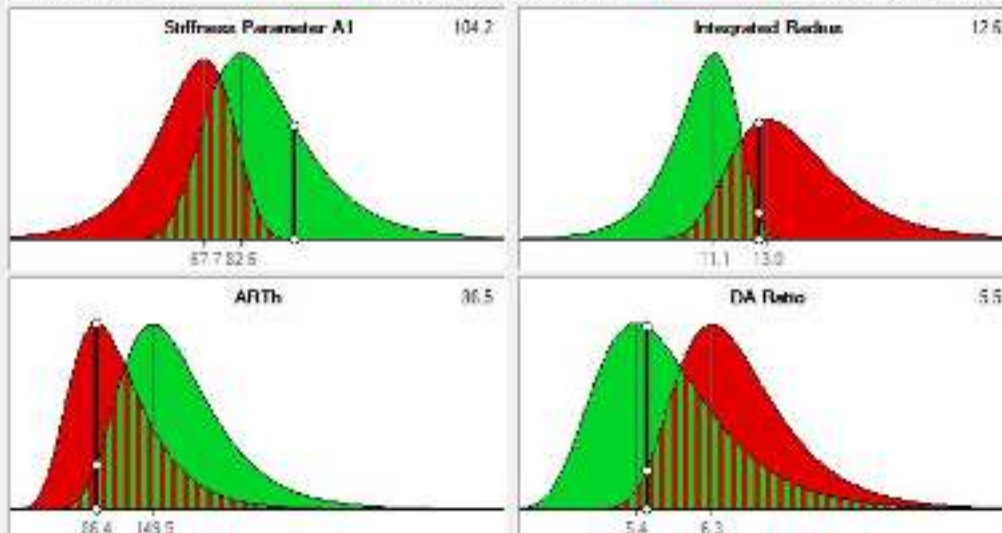
Patient: Examination: Display: Screen: Settings: External software:

E-Mail: AVI: JGG:

Name: [REDACTED] ID: Post LVC Ectasia Date of birth: 24.12.1974 Age: 49
 Exam. Date: 15.12.2024 Time: 10:58:06 Eye: Left (OS) Exam. Date: 15.12.2024 Time: 10:54:11 Eye: Left (OS)
 Info: OS: OK Info: OS: OK

Corvis ST - Biomechanical Assessment

Distributions: post LASIK Population ECTASIA Population



CBI LVC 0.79

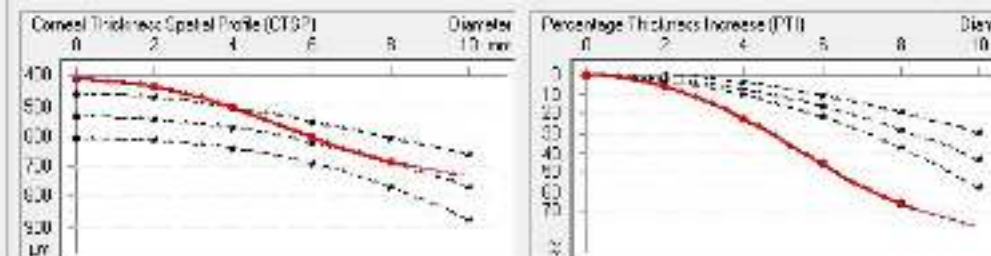
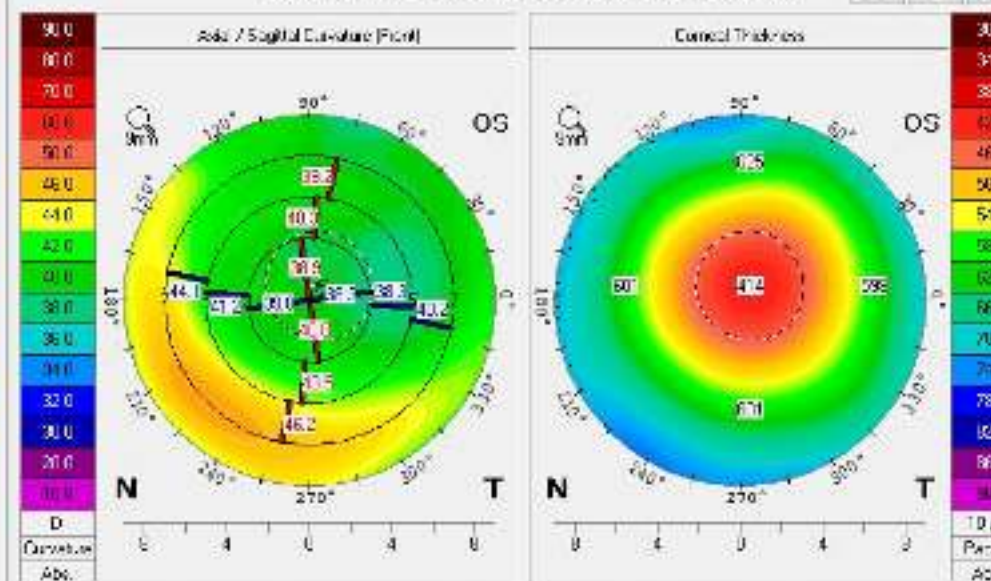
Reference: Ethnicity: Global database Treatment: Local

TBI post LVC: no TBI calculation

Oculus Optikgeräte GmbH
Münchholzhäuser Str. 29

35582 Wetzlar

Pentacam - Tomographic Assessment



K Max.: 47.2 D IS Value: 4.10 PRF: 0.73 TMC: Post Corneal Surgery

BAD D

myopic hyperopic

post LVC: no BAD D calculation

Tel: (0641) 20 05-0
Fax: (0641) 20 05-255

www.oculus.de



Post LVC ectasia?

R10 2026

OCULUS - PENTACAM 4 Maps Selectable

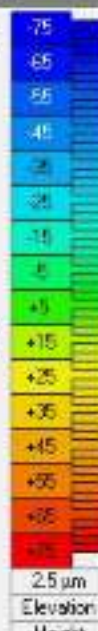
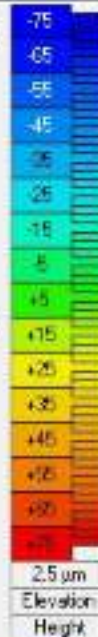
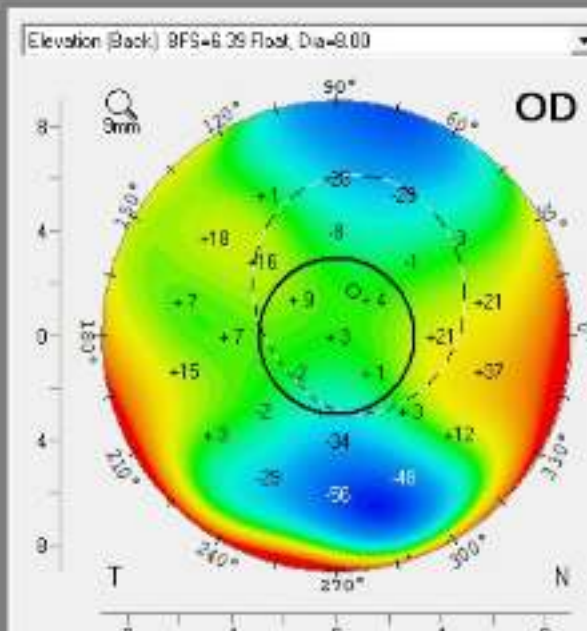
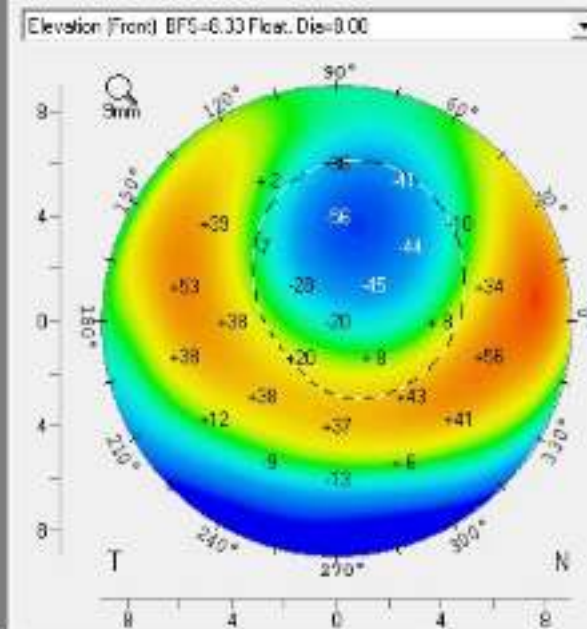
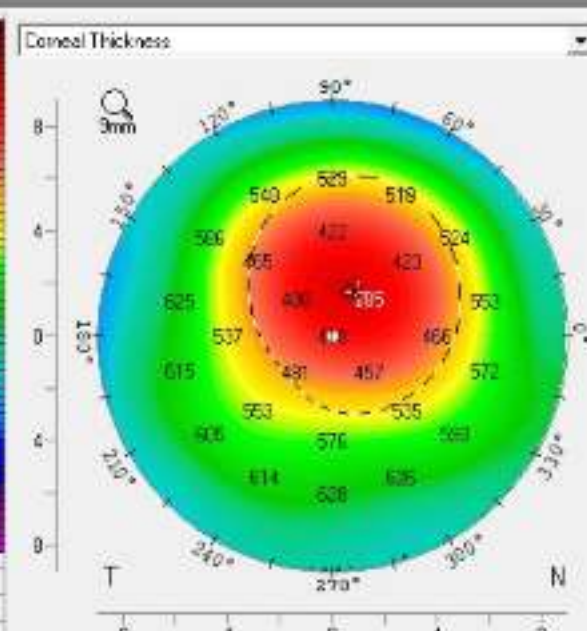
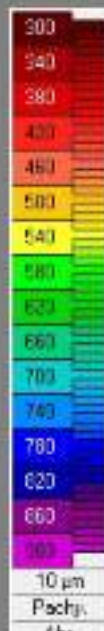
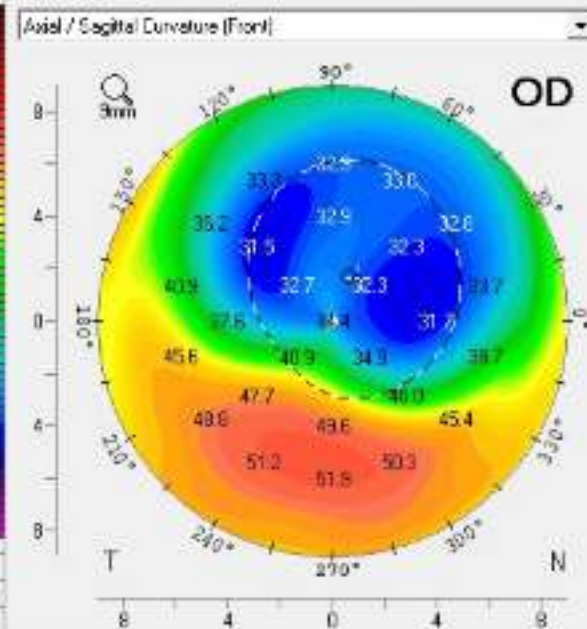
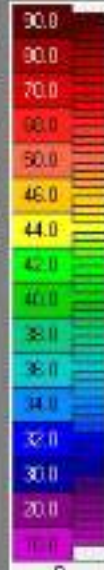
1.25x15

Last Name: XXXXXXXXXX
 First Name: XXXXXXXXXX
 ID: XXXXXXXXXX
 Date of Birth: 01/11/2001 Eye: Right
 Exam Date: 11/05/2022 Time: 12:55:08
 Exam Info: XXXXXXXXXX



	Pachy:	x(mm)	y(mm)
Pupil Center:	+ 301 µm	+0.47	+0.03
Pachy/Vertex N:	410 µm	0.00	0.00
Thinnest Locat:	380 µm	+0.30	+0.85
K Max (Front)	52.4 D	-0.24	-2.68

Cornea Volume:	55.8 mm³	HWTx:	
Chamber Volume:	145 mm³	Angle:	26.0°
A. C. Depth (Int.):	2.00 mm	Pupil Dia:	4.23 mm
Enter IOP IOP(Sun):	+3.6 mmHg	Lens Th:	



R10 2

OCULUS - PENTACAM Topometric/KC-Staging

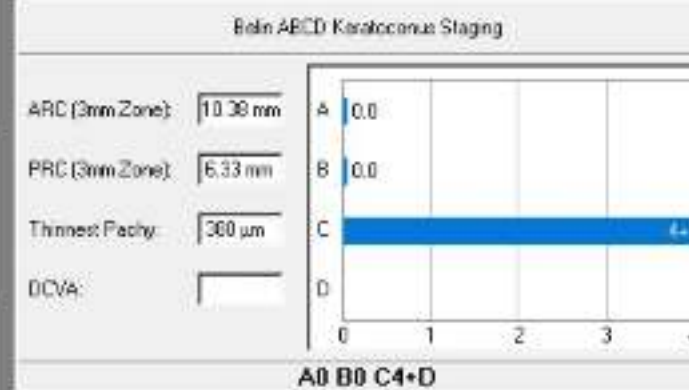
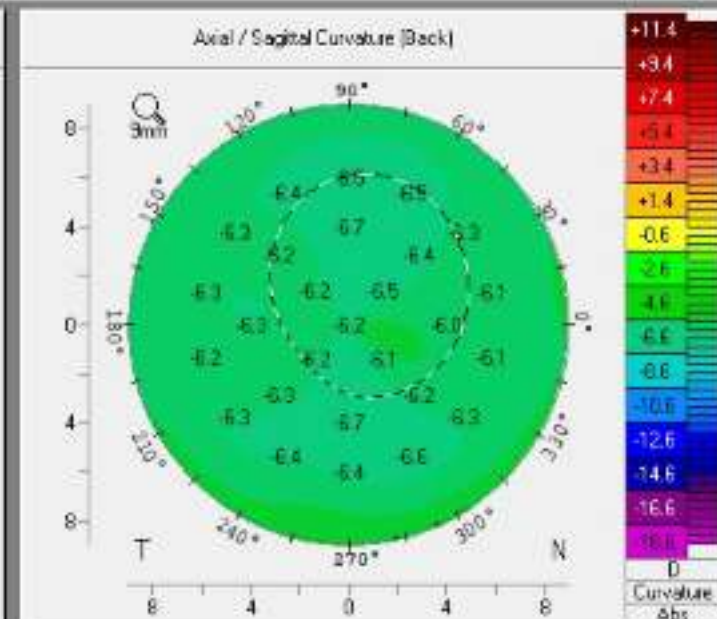
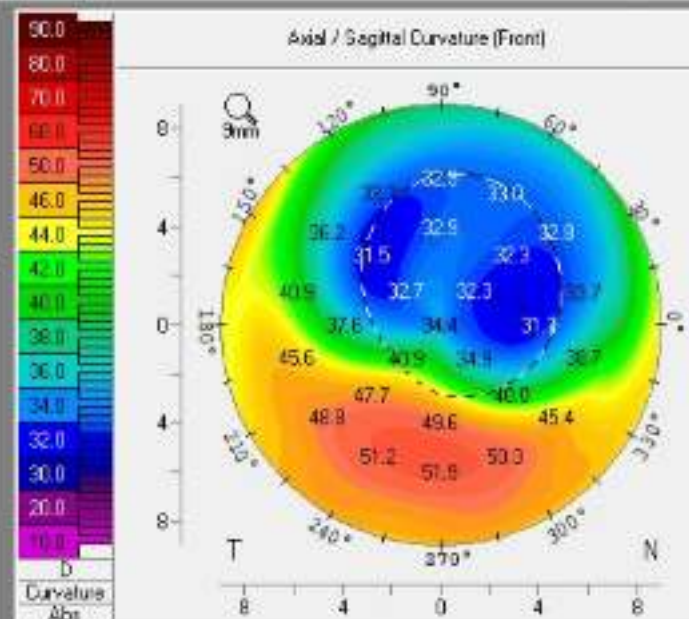
1.25r15

Last Name: XXXXXXXXXX
 First Name: XXXXXXXXXX
 ID: XXXXXXXXXX
 Date of Birth: 01/11/2001 Eye: Right
 Exam Date: 11/06/2022 Time: 12:55:09
 Exam Info:



	Pachy:	x(mm)	y(mm)
Pupil Center:	+ 381 µm	+0.47	+0.83
Pachy/Vertex N.:	410 µm	0.00	0.00
Thinnest Local:	380 µm	+0.30	+0.85
K Max. (Front):	52.4 D	-0.24	-2.99

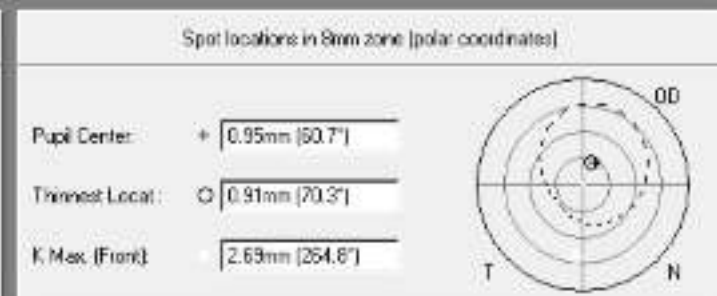
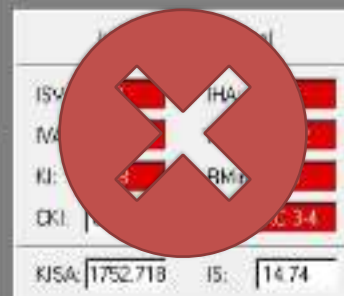
Cornea Volume:	55.9 mm³	HW/Tw:	
Chamber Volume:	145 mm³	Angle:	25.0°
A. C. Depth (Int.):	2.80 mm	Pupil Dia:	4.29 mm
IOP(Sum):	+9.5 mmHg	Lens Th:	



Asphericity (Front) of Major Meridians

	20°	25°	30°	35°	40°
Q-val	4.28	3.65	-0.71	0.00	0.00
Nas	4.08	3.35	0.00	0.00	0.00
Temp	2.48	1.39	0.00	0.00	0.00
Sup	1.00	1.56	1.90	0.00	0.00
Mean	2.95	2.49	0.30	0.00	0.00

Front:
☒ Asphericity
☐ Axial/Sag. Curve
 Back:
☐ Asphericity
☐ Axial/Sag. Curve



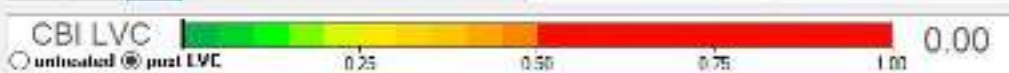
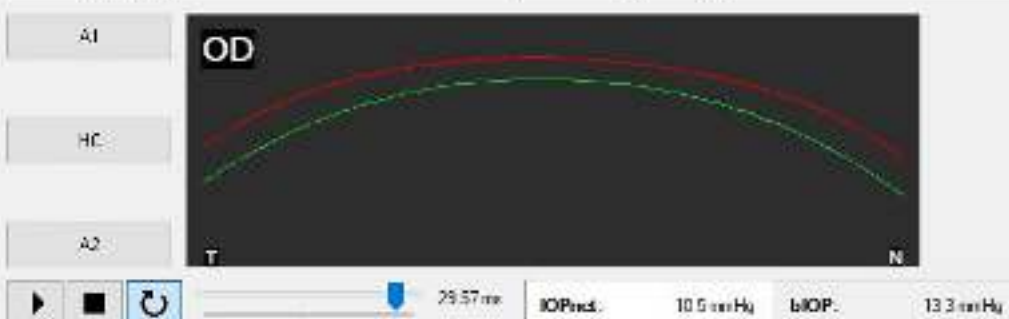
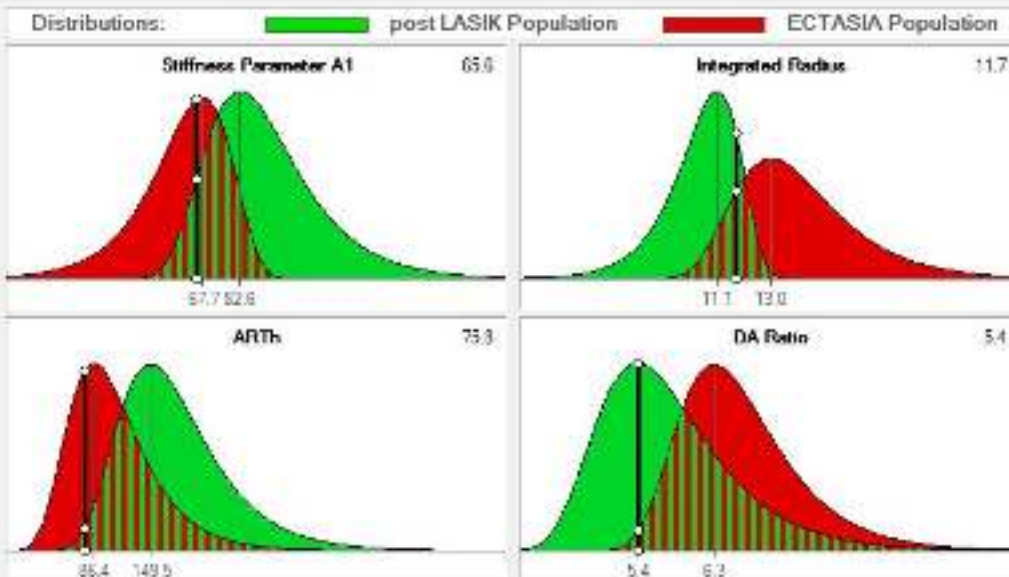
R10 2

OCULUS Corvis® ST - Biomechanical/Tomographic Assessment (ARV)

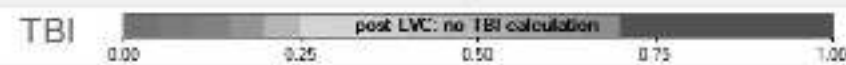
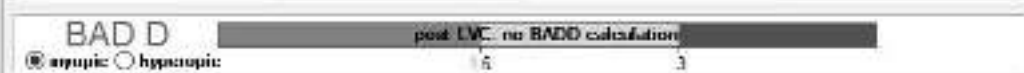
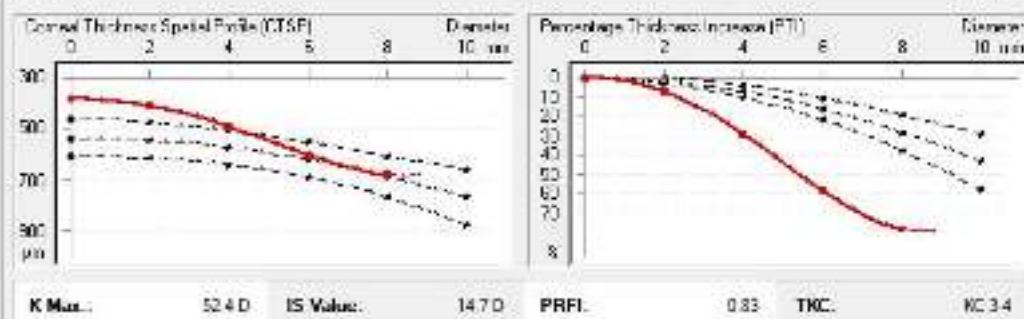
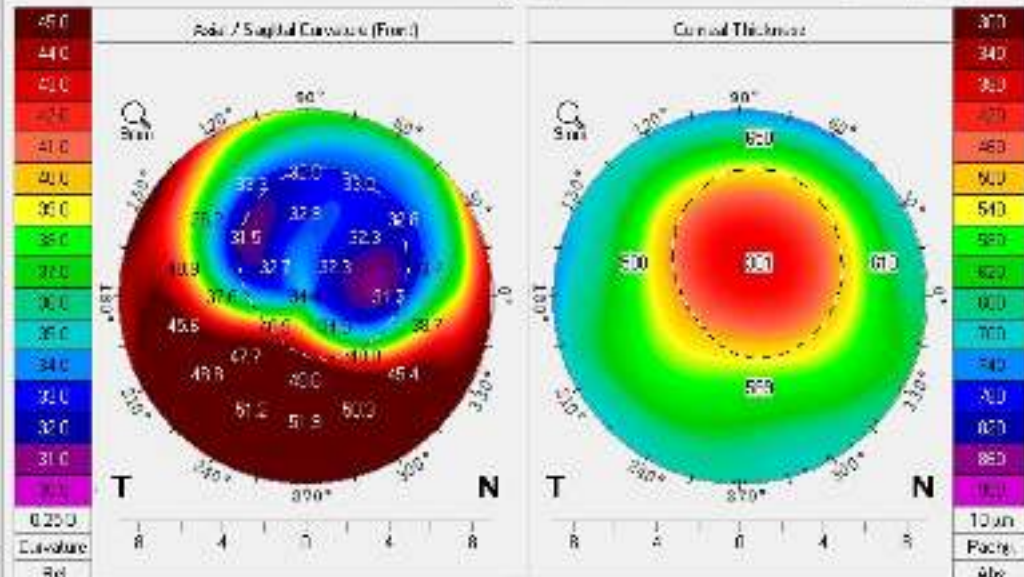
162903

Name:	ID:	Date of birth:	11.01.2001	Age:	21
Exam. Date:	Time: 12:59:43	Eye: Right (OD)	Exam. Date:	Time: 12:55:00	Eye: Right (OD)
Info:	QS: OK	Info:	QS: OK		

Corvis ST - Biomechanical Assessment



Pentacam - Tomographic Assessment



R10

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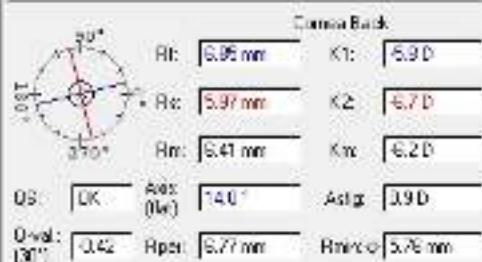
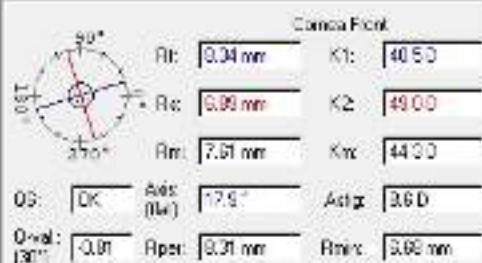


Post LVC ectasia?

R10 2026

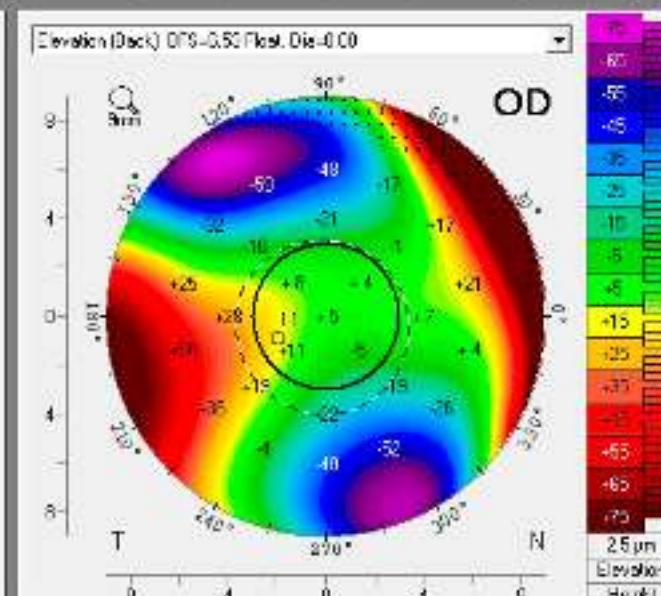
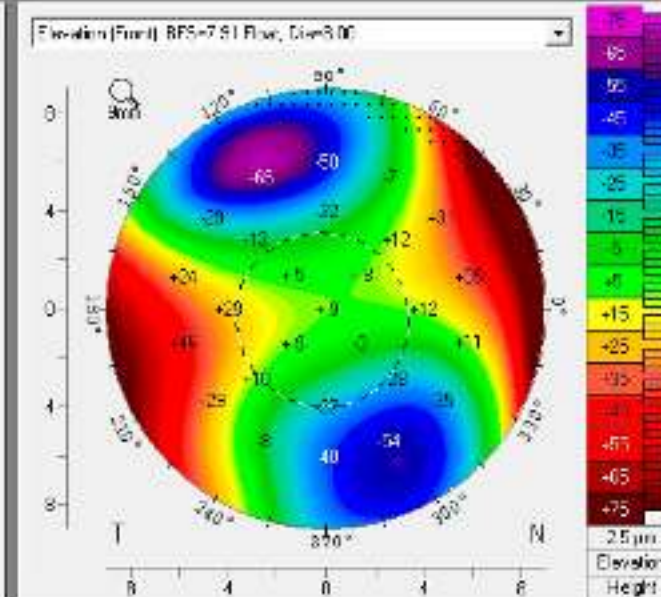
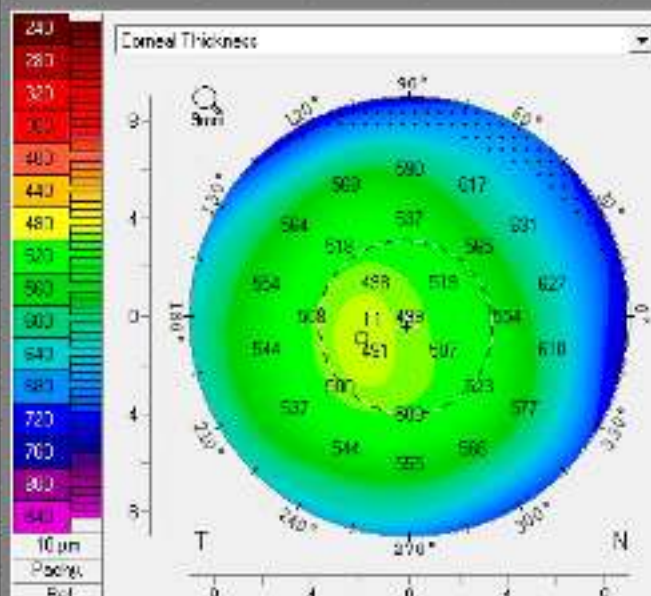
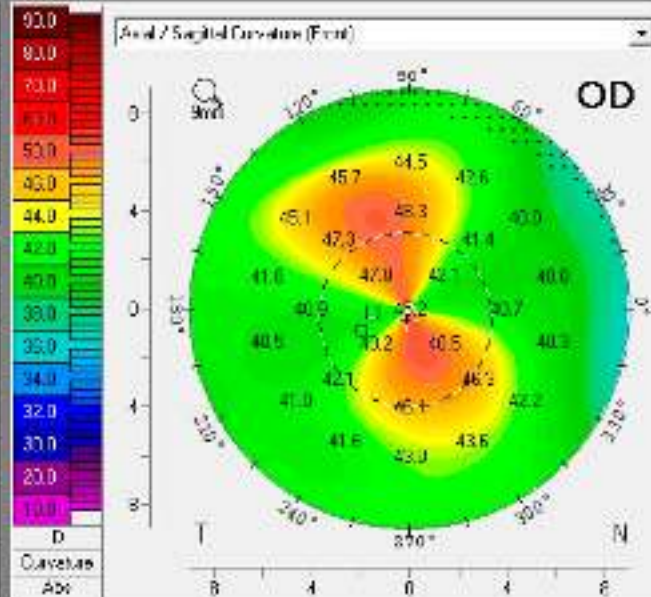
OCULUS - PENTACAM 4 Maps Selectable

Last Name: [REDACTED]
 First Name: [REDACTED]
 ID: [REDACTED]
 Date of Birth: 04/02/1991 Eye: Right
 Exam Date: 04/10/2023 Time: 13:42:37
 Exam Info:



	Pachy	s(mm)	y(mm)
Pupil Center:	+ 490 µm	-0.07	-0.23
Pachy Value N:	499 µm	0.00	0.03
Thinnest Locat:	○ 497 µm	0.97	-0.45
K Max (Front):	50.5 D	-0.13	-0.50

Cornea Volume:	56.2 mm³	HwTwt:	11.0 mm
Chamber Volume:	115 mm³	Angle:	23.3°
A.C. Depth (mm):	2.55 mm	Pupil Dia:	3.54 mm
Enter IOP (ICPS Unit):	13.3 mmHg	Corneal Thk:	



Post LASIK

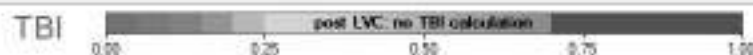
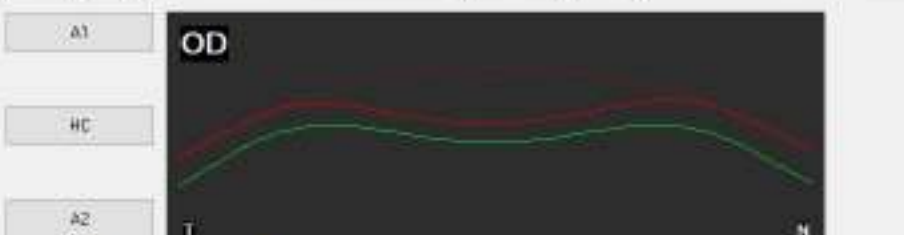
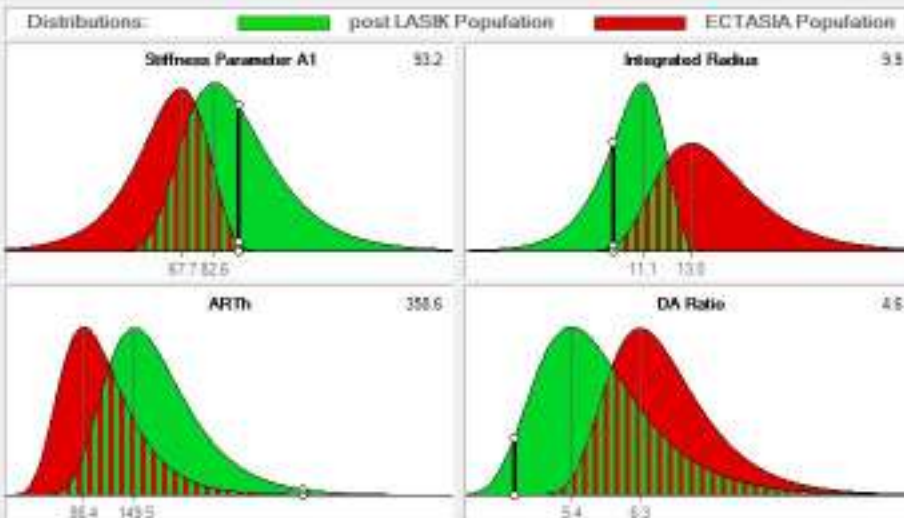
R10 2023

OCULUS Corvis® ST - Biomechanical/Tomographic Assessment (ARV)

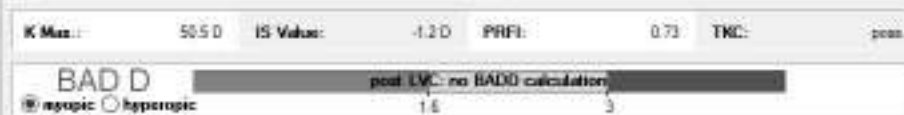
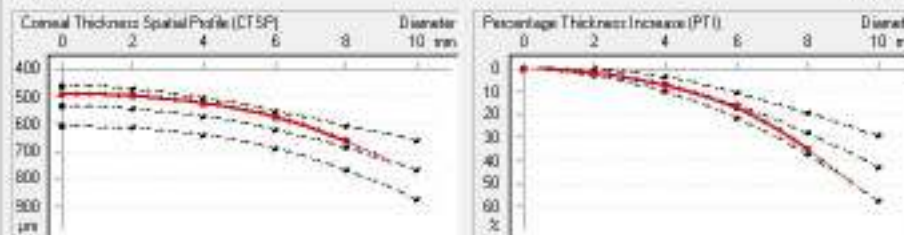
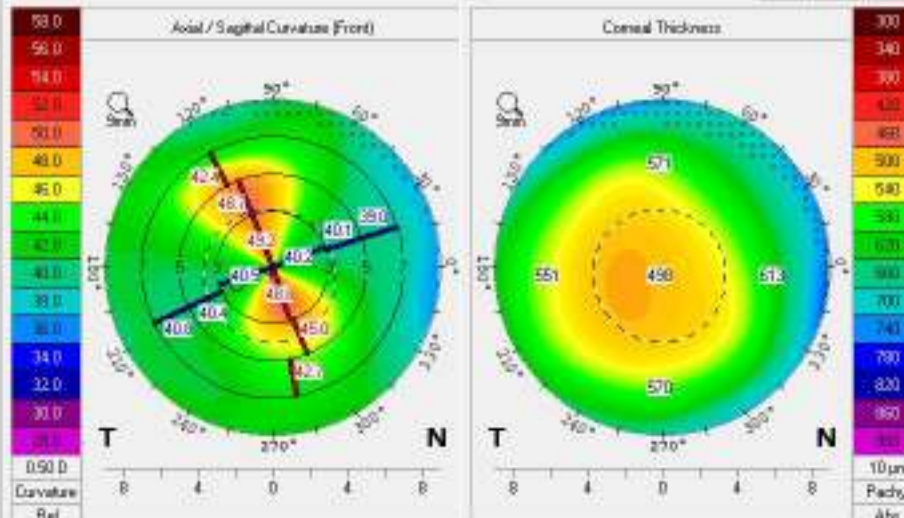
1.62503

Name: [REDACTED] ID: pos femtolasik ou then post p Date of birth: 02.04.1991 Age: 32
 Exam. Date: 10.04.2023 Time: 13:44:18 Eye: Right (OD) Exam. Date: 10.04.2023 Time: 13:42:32 Eye: Right (OD)
 Info: [REDACTED] QS: OK Info: [REDACTED] QS: OK

Corvis ST - Biomechanical Assessment



Pentacam - Tomographic Assessment



R10 2023

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RIO 2026

VAE

2515

OCULUS - PENTACAM 4 Maps Selectable

1.2515

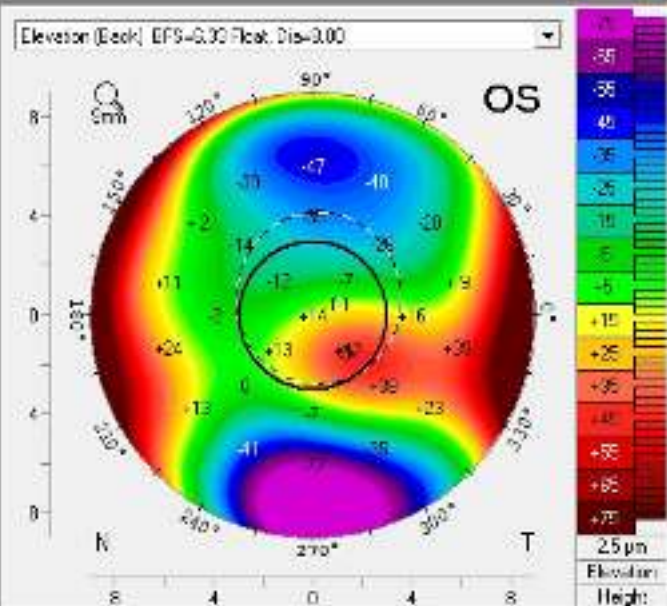
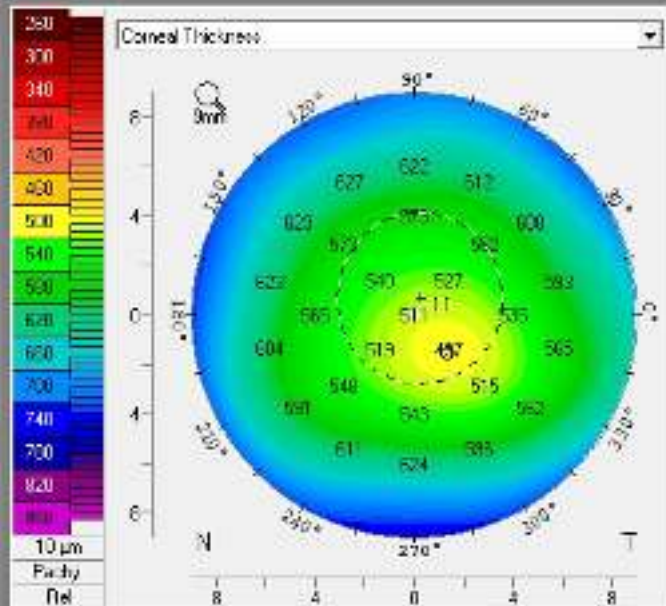
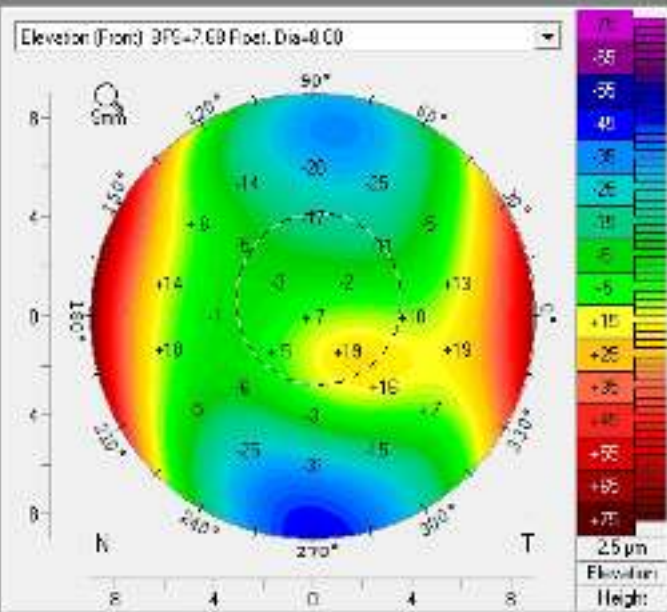
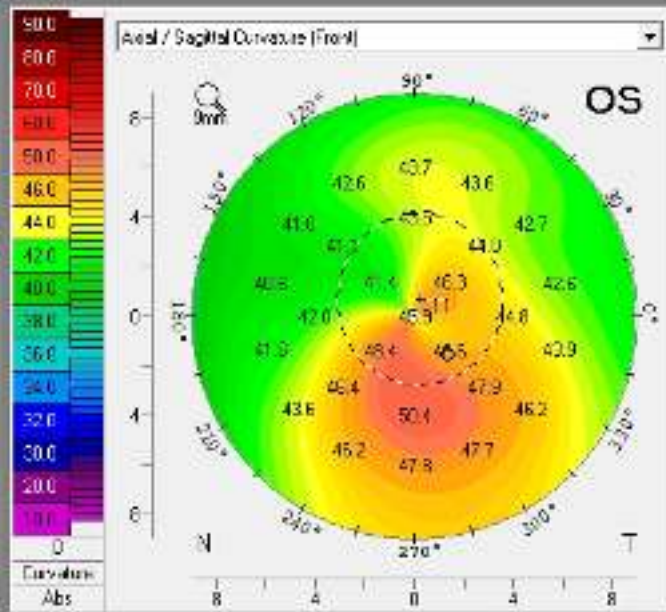
Last Name:
 First Name:
 ID:
 Date of Birth: 04/30/1996 Eye: Left
 Exam Date: 06/15/2023 Time: 0:53:23
 Exam Info:

Cornea Front
 RI: 7.73 mm K1: 43.7 D
 Rr: 7.15 mm K2: 46.0 D
 Rm: 7.46 mm Km: 45.0 D
 QS: OK Astig: 152.3° Astig: 2.3 D
 Q-val: 0.51 Rper: 7.95 mm Rmin: 6.57 mm

Cornea Back
 Ri: 6.47 mm K1: -6.2 D
 Rr: 5.90 mm K2: -6.9 D
 Rm: 6.13 mm Km: -6.5 D
 QS: OK Astig: 153.5° Astig: 0.7 D
 Q-val: -0.47 Rper: 6.71 mm Rmin: 4.32 mm

Pupil Center: 510 µm x: 0.12 y: 0.34
 Pupil Vertex N: 511 µm 0.00 0.00
 Thinned Local: 497 µm +0.68 -0.75
 K-Max (Front): 50.6 D 0.07 -1.63

Cornea Volume: 50.5 mm³ HWTW: 12.1 mm
 Chamber Volume: 203 mm³ Angle: 38.1°
 A. D. Depth (Int): 3.26 mm Pupil Dia: 3.95 mm
 Enter IOP (IOP/Sun): -2.4 mmHg Lens Th:



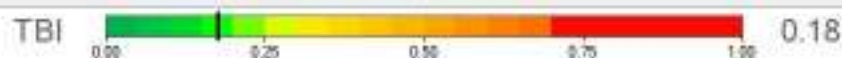
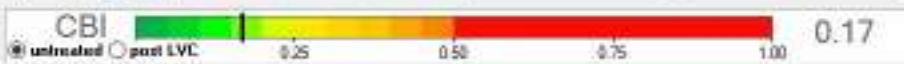
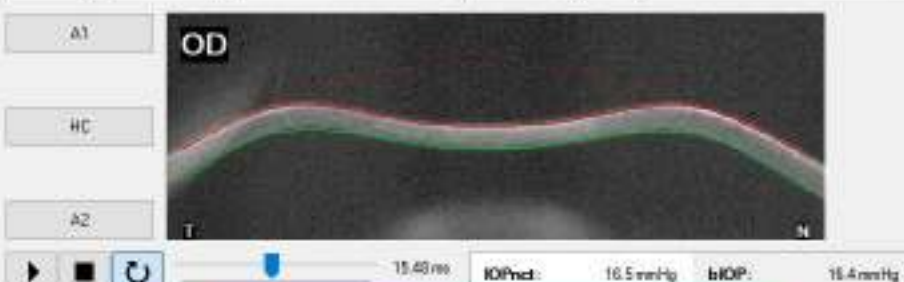
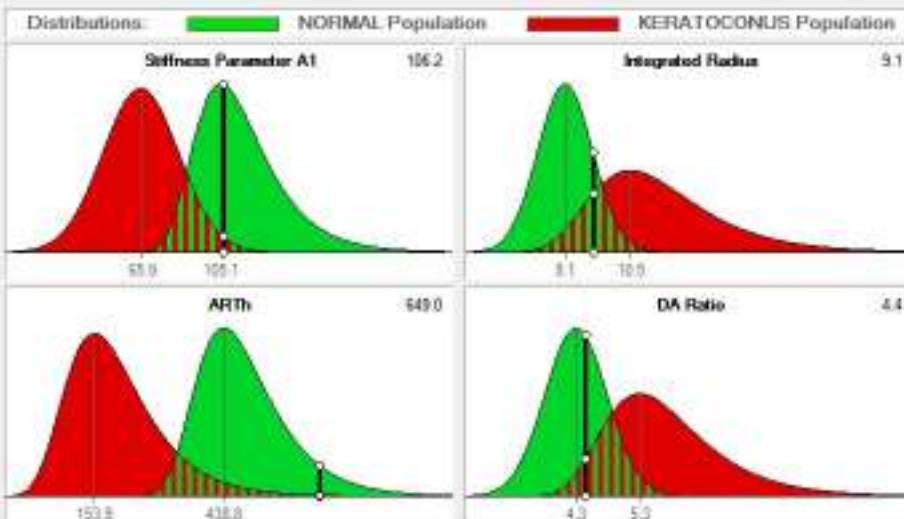
R10 20

OCULUS Corvis® ST - Biomechanical/Tomographic Assessment (ARV)

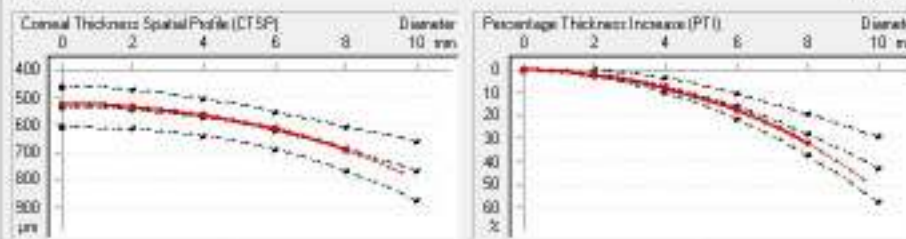
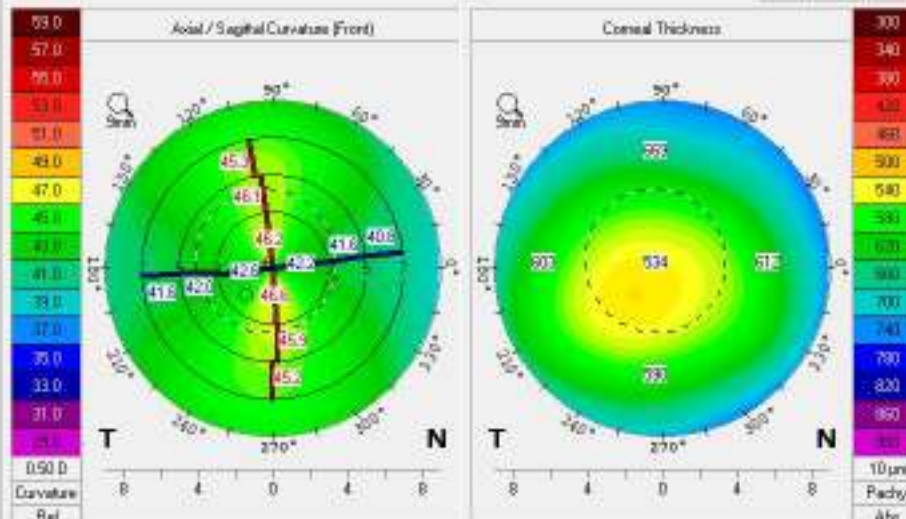
162503

Name: [REDACTED] ID: vae Date of birth: 30.04.1998 Age: 25
 Exam. Date: [REDACTED] Time: 10:57:06 Eye: Right (OD) Exam. Date: 15.05.2023 Time: 12:00:03 Eye: Right (OD)
 Info: [REDACTED] QS: OK Info: [REDACTED] QS: OK

Corvis ST - Biomechanical Assessment



Pentacam - Tomographic Assessment



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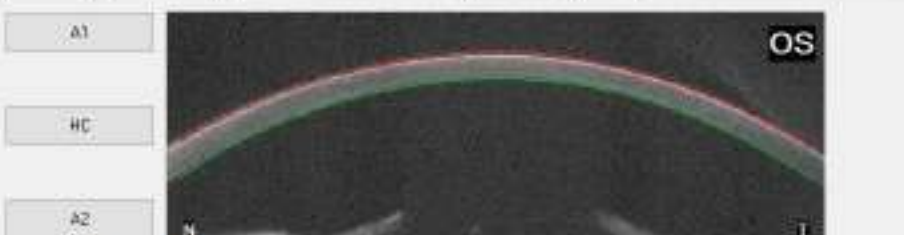
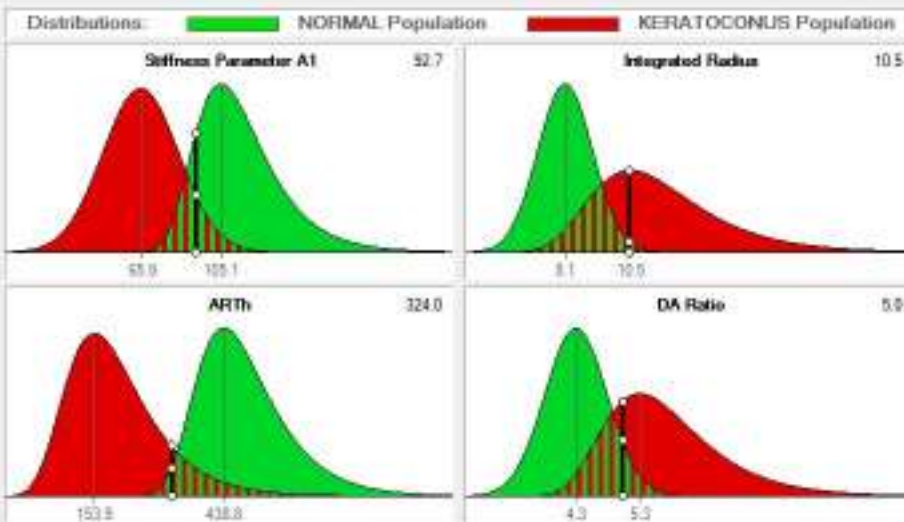


OCULUS Corvis® ST - Biomechanical/Tomographic Assessment (ARV)

162503

Name: [REDACTED] ID: vae Date of birth: 30.04.1988 Age: 25
 Exam. Date: [REDACTED] Time: 10:56:53 Eye: Left (OS) Exam. Date: 15.05.2023 Time: 10:53:29 Eye: Left (OS)
 Info: [REDACTED] QS: OK Info: [REDACTED] QS: OK

Corvis ST - Biomechanical Assessment

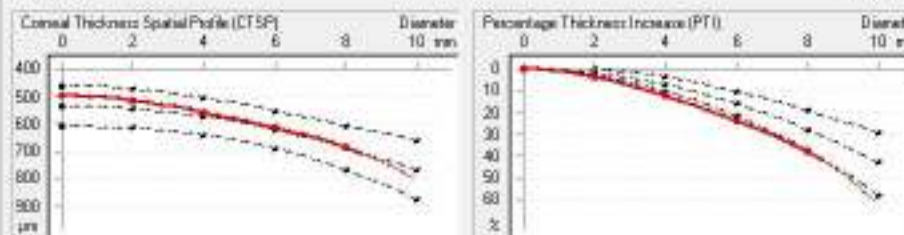
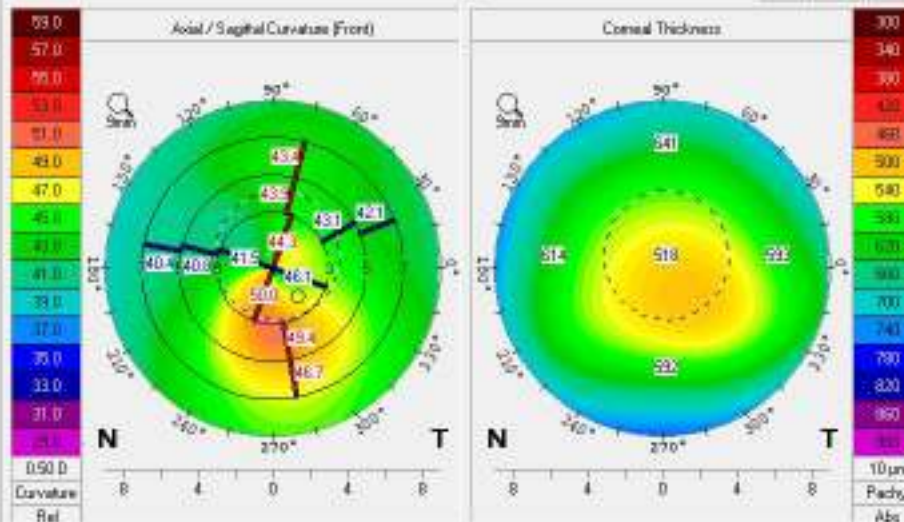


0.00 ms IOPmed: 15.5 mmHg bIOP: 15.9 mmHg

CBI ■ ■ 0.93
 @ untreated @ post LVC 0.25 0.50 0.75 1.00

TBI ■ ■ 1.00
 0.00 0.25 0.50 0.75 1.00

Pentacam - Tomographic Assessment



K Max: 50.6 D IS Value: 3.4 D PRFI: 0.99 TNC: KC 1.2

BAD D ■ ■ 5.51
 @ myopic @ hyperopic 1.5 3

R10 2023

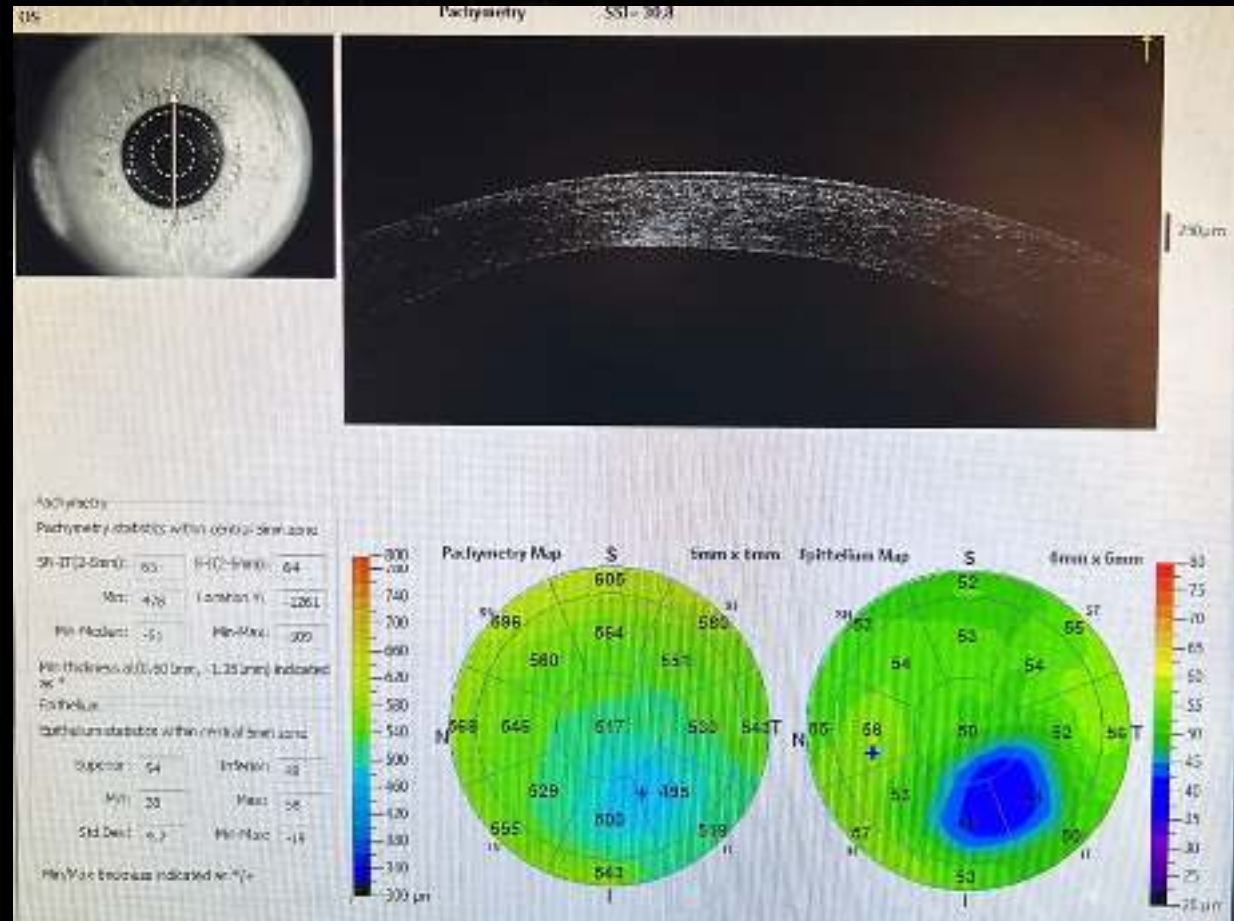
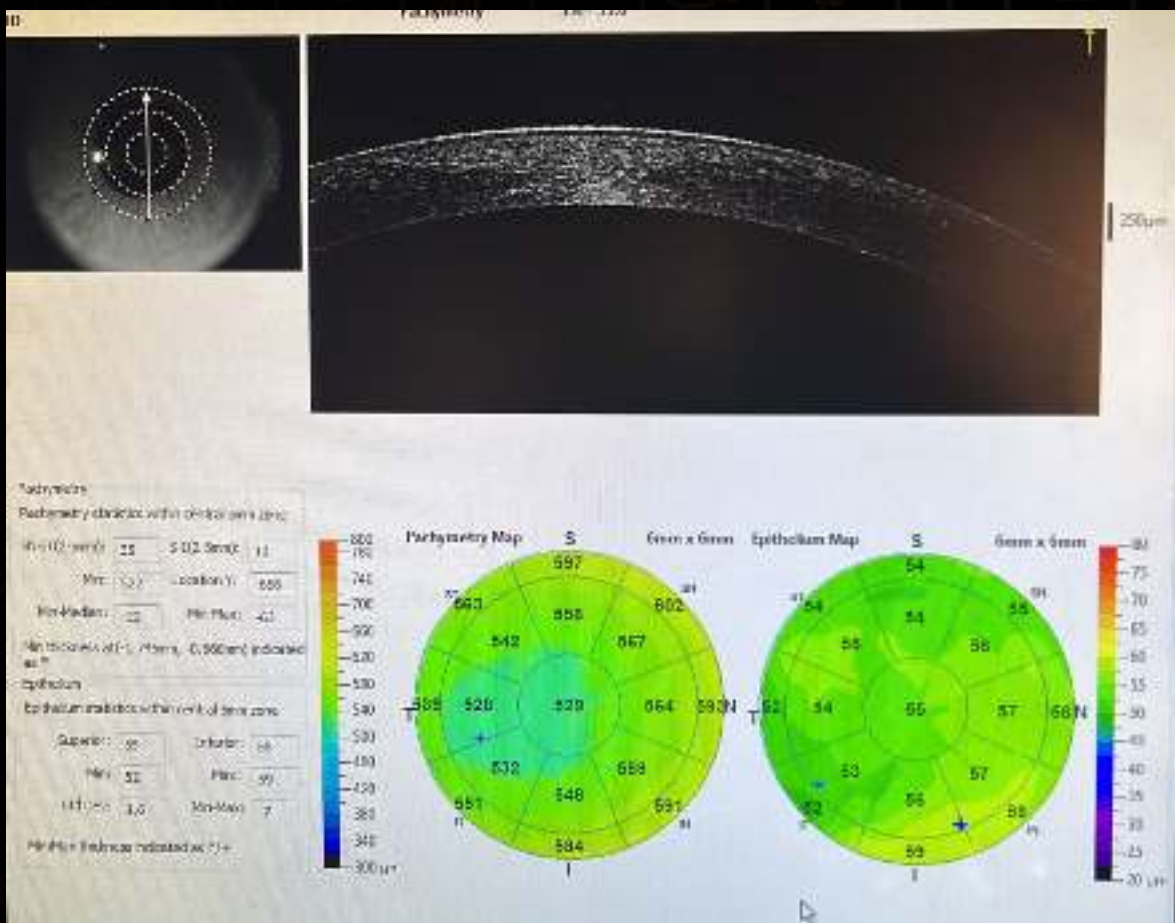
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R10 2026

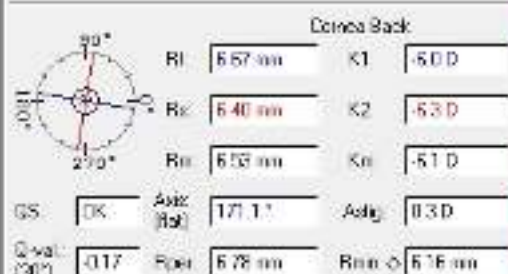
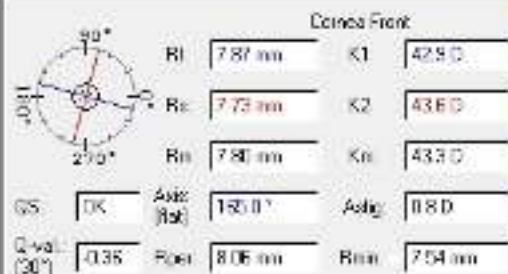
Inferior steep area

R10 2026

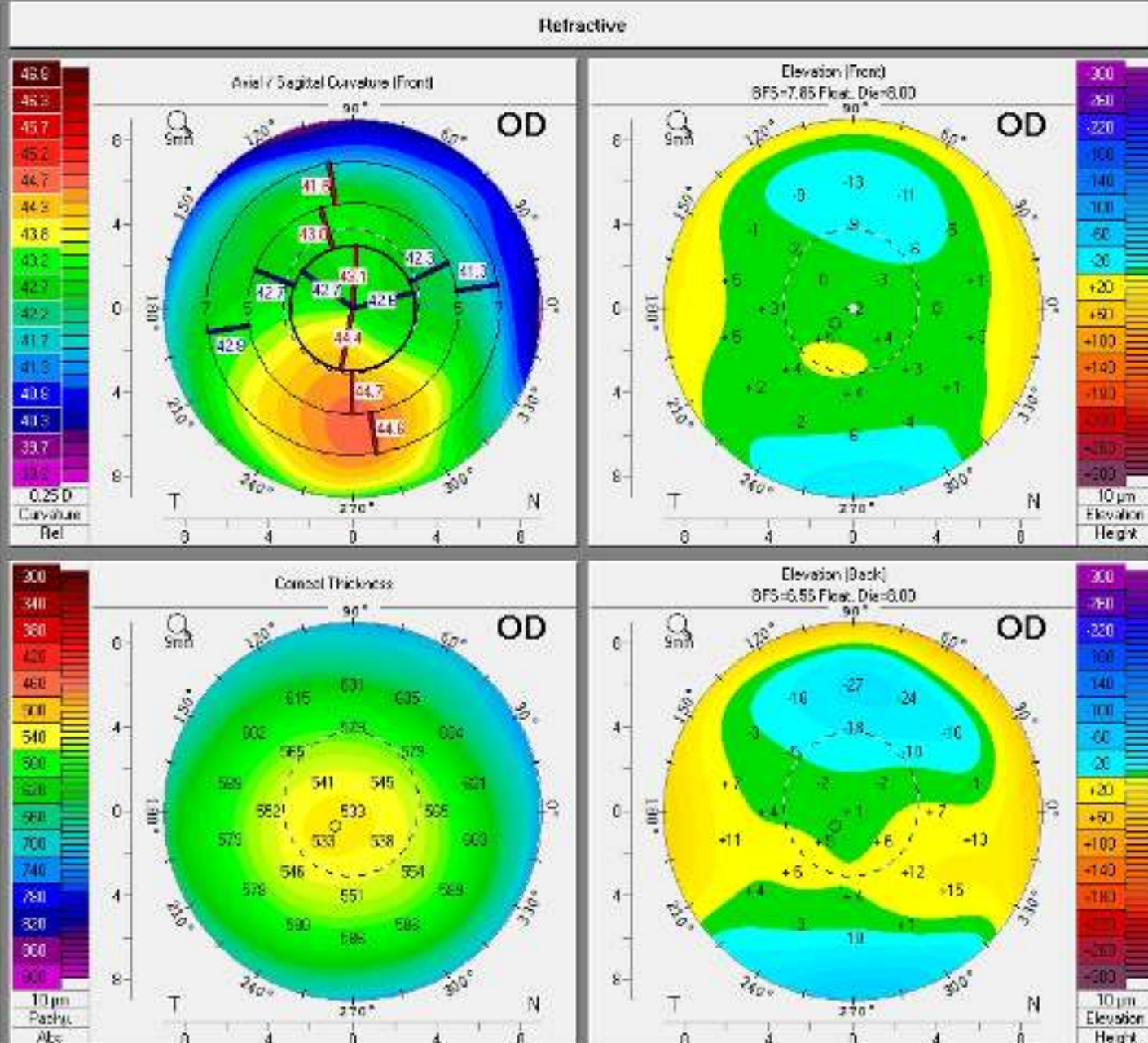
OCULUS - PENTACAM 4 Maps Refractive

1.2209

Last Name: XXXXXXXXXX
 First Name: XXXXXXXXXX
 ID: XXXXXXXXXX
 Date of Birth: 14/04/2001 Eye: Right
 Exam Date: 14/12/2021 Time: 12:41:04
 Exam Info: XXXXXXXXXX



Pupil Center	+	Pachy	533 µm	x(mm)	-0.04	y(mm)	+0.16
Pachy Apex	-		533 µm		0.00		0.00
Thinnest Locat	0		531 µm		-0.40		-0.33
K Max (Front)			44.6 D		+0.13		-2.66
Cornea Volume			57.6 mm³	HW/TW			11.0 mm
Chamber Volume			224 mm³	Angle			42.5°
A.C. Depth (Int)			3.47 mm	Pupil Dia			3.31 mm
Enter IOP	IOP(art)			Lens Th			



R10 20

OCULUS - PENTACAM Topometric/KC-Staging

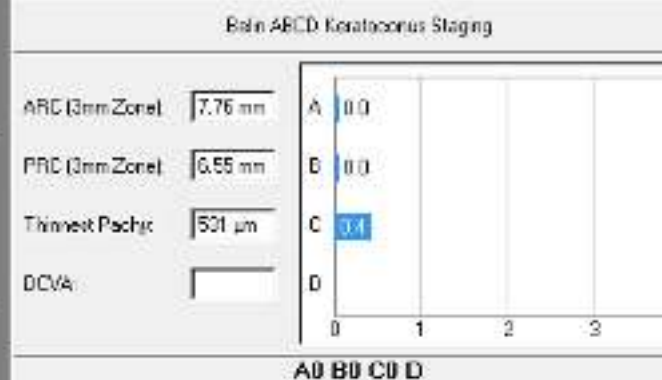
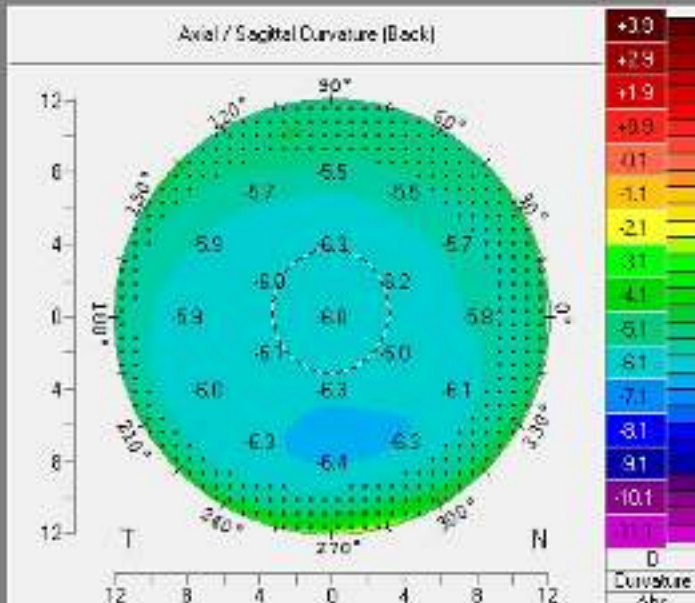
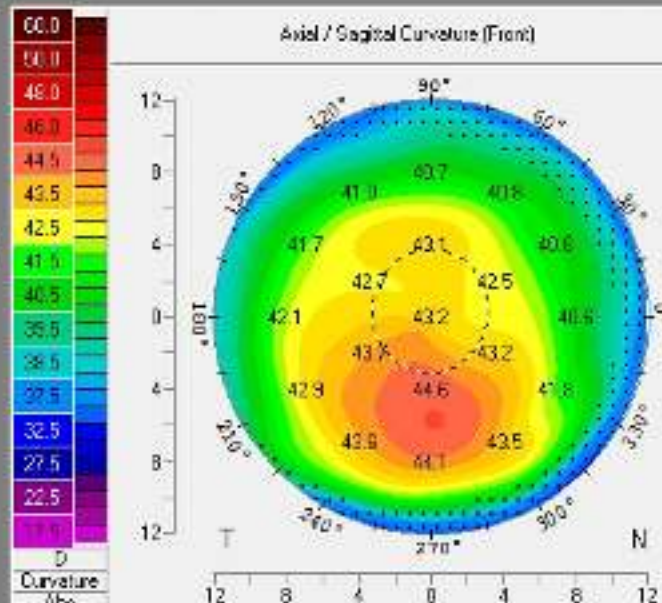
1.22.09

Last Name: XXXXXXXXXX
 First Name: XXXXXXXXXX
 ID: XXXXXXXXXX
 Date of Birth: 04/04/2001 Eys: Right
 Exam Date: 04/12/2021 Time: 12:41:04
 Exam Info:



Pupil Center: + 533 µm x(mm) -0.04 y(mm) -0.16
 Pachy Apex: 533 µm 0.00 0.00
 Thinnest Local: 531 µm -0.40 -0.33
 K Max (Front): 44.6 D +0.13 -2.69

Cornea Volume: 57.6 mm³ HWTW: 11.8 mm
 Chamber Volume: 224 mm³ Angle: 42.5°
 A. C. Depth (Int.): 3.47 mm Pupil Dia: 3.31 mm
 IDP(cat): Lens Th:

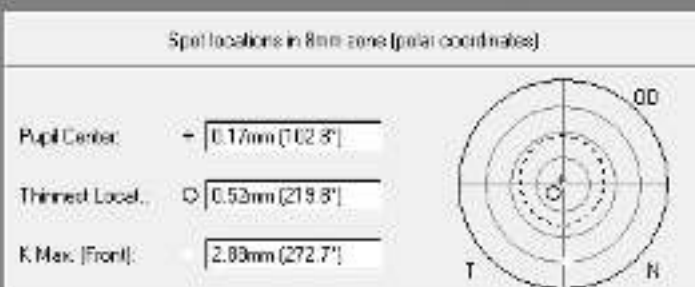
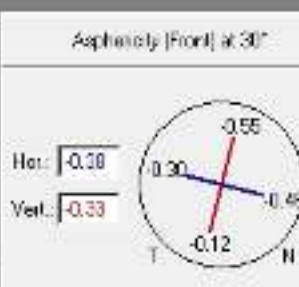


Asphericity (Front) of Major Meridians

(Q-val)	Degrees peripheral					Front: Asphericity
	20°	25°	30°	35°	40°	
Nas	-0.21	-0.36	-0.46	-0.53	-0.52	Asphericity
Temp	-0.14	-0.20	-0.30	-0.40	-0.42	Asphericity
Inf	0.07	-0.02	-0.12	-0.26	-0.58	Asphericity
Sup	-0.37	-0.50	-0.55	-0.56	-0.52	Asphericity
Mean	-0.16	-0.27	-0.35	-0.44	-0.51	Asphericity

Indices (in 8mm zone)

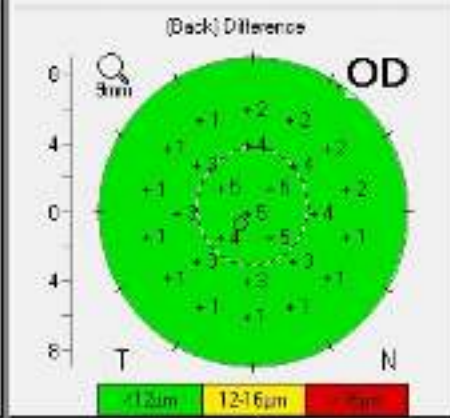
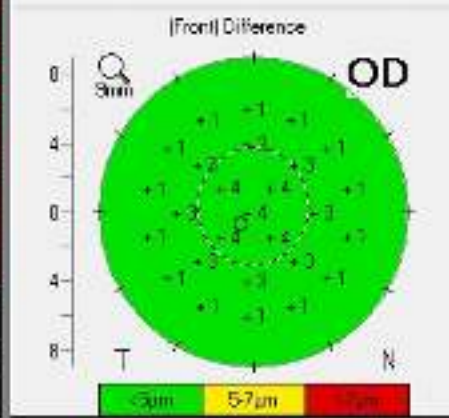
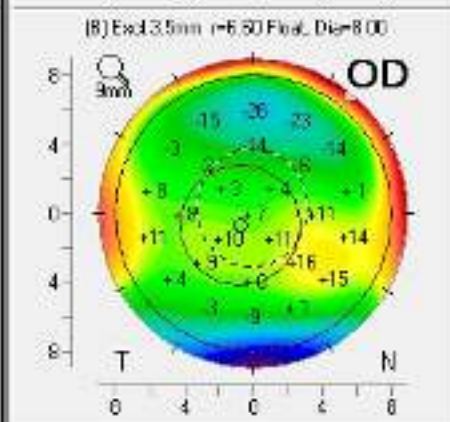
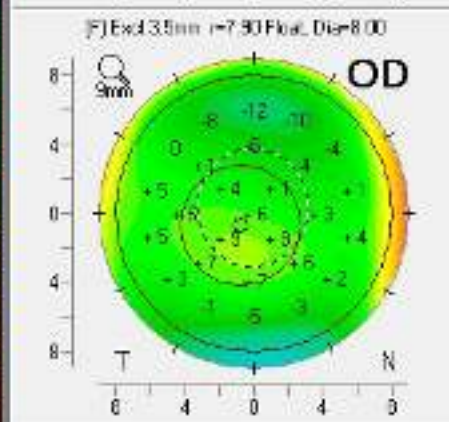
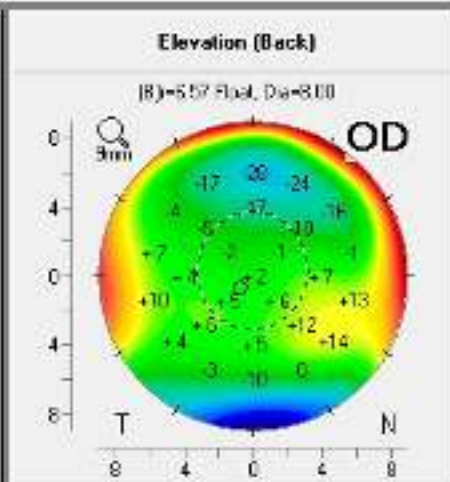
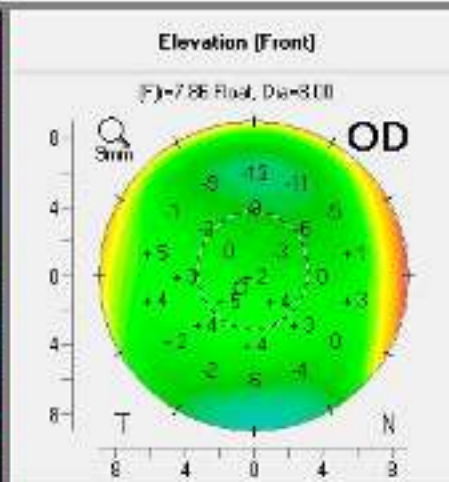
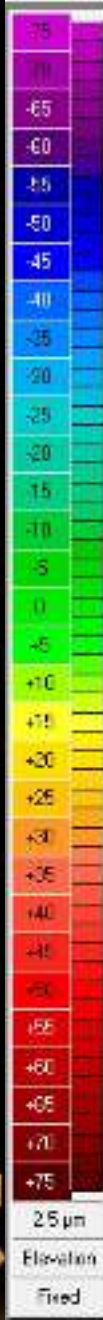
ISV: 23 IHA: 10.3
 IVA: 0.26 IHD: 0.021
 KJ: 1.07 Rmirc: 7.54
 CKI: 1.00 TKC: -
 KISA: 1.644 IS: 1.59



R10 2

OCULUS - PENTACAM Belin/Ambrósio Enhanced Ectasia Display

1.22.03

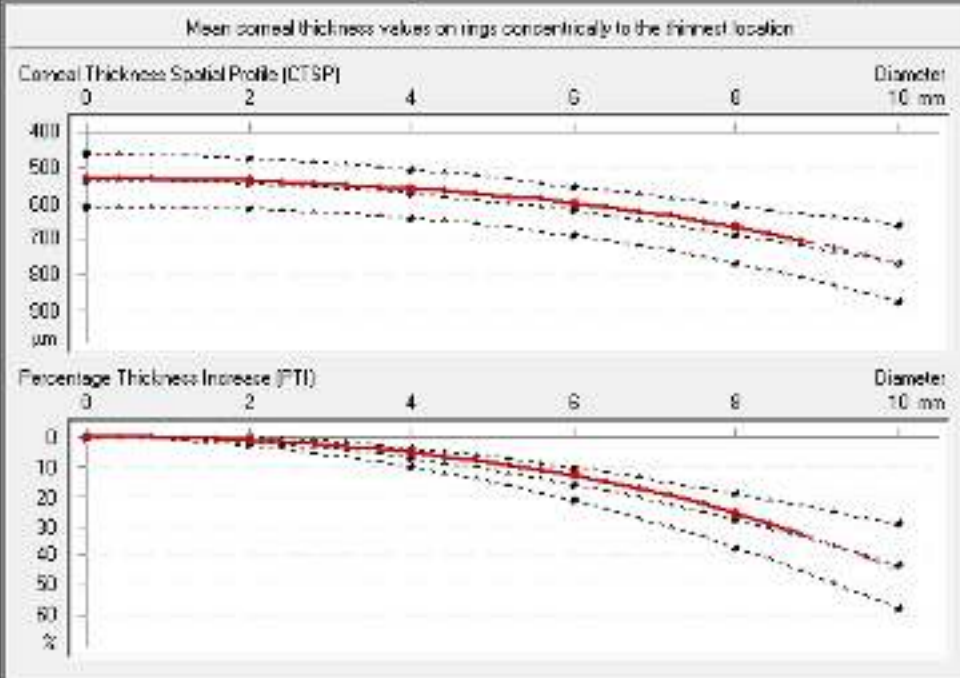
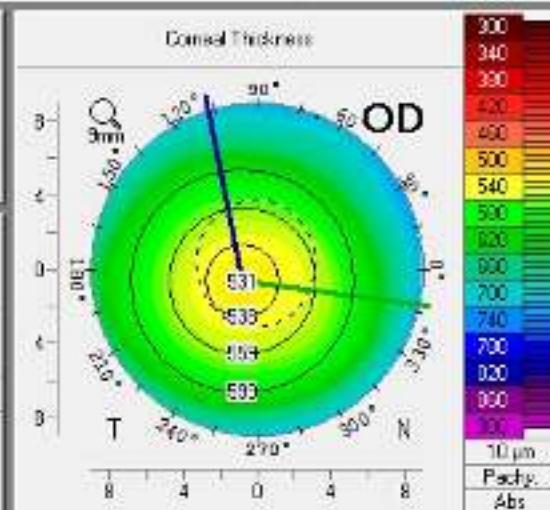


Last Name: [Redacted]
First Name: [Redacted]
ID: [Redacted]
Date of Birth: 04/04/2001 Eye: Right
Exam Date: 04/12/2021 Time: 12:41:04
Exam Info: [Redacted]

K1:	42.8D	Axis:	165.0°
K2:	43.6D	D-vol:	-0.36
KMax:	44.8D	QS:	OK

Pachy Thin Locat: [Redacted] 531µm
Dist. Apax-Thin Loc: IT 0.53mm
F.Ela.Thc: 4µm B.Ela.Thc: 3µm

Progression Index
Min: 0.54 Max: 0.83
Avg: 0.77 ARTmax: 595



Reference Database: ☒ Myopic/Normal ☐ Hyperopic/Mixed Cyl ☐ Lenticular

Dt: 1.11 Db: 0.22 Dp: -0.9t Dc: 0.19 Da: -0.98 D: 0.46

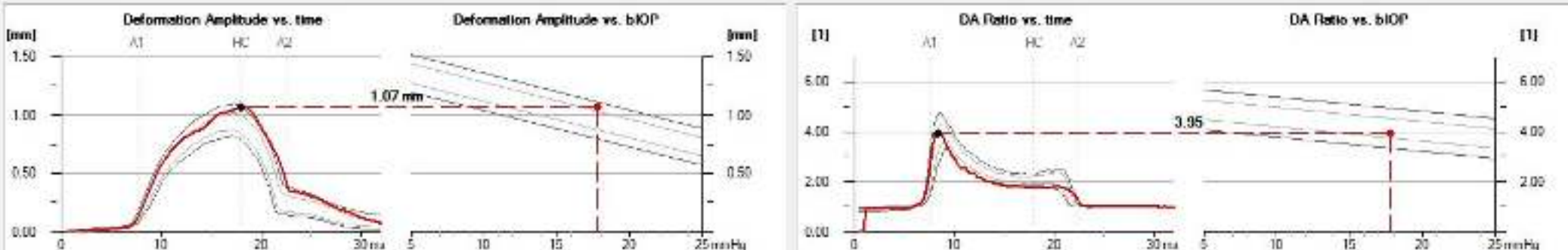
RIO 2

OCULUS Corvis® ST - Vinciguerra Screening Report

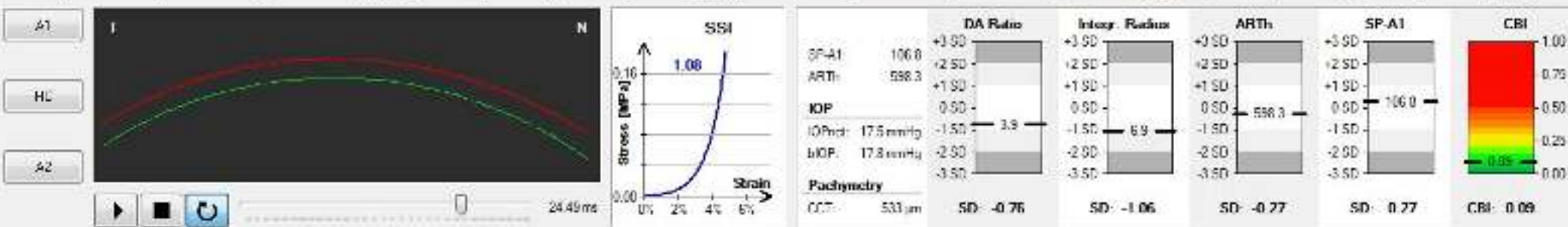
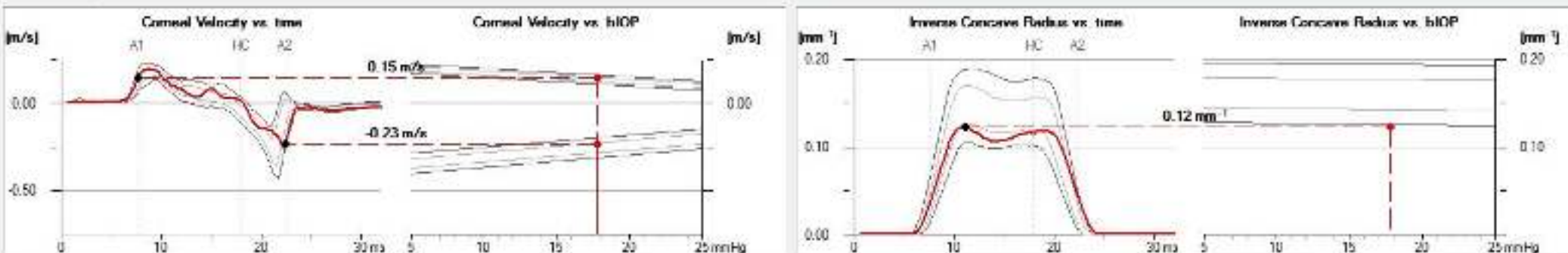
1.6.2021

Name: [REDACTED] ID: [REDACTED] Date of birth: 04.04.2001 Age: 20
Exam. Date: [REDACTED] Time: 12:54:39 Eye: Right (OD)
Info: QS: OK

Deformation Amplitude [mm] Deformation Amplitude Ratio (2mm)



Corneal Velocity [m/s] Inverse Corneal Radius [mm⁻¹]



R10

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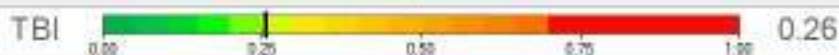
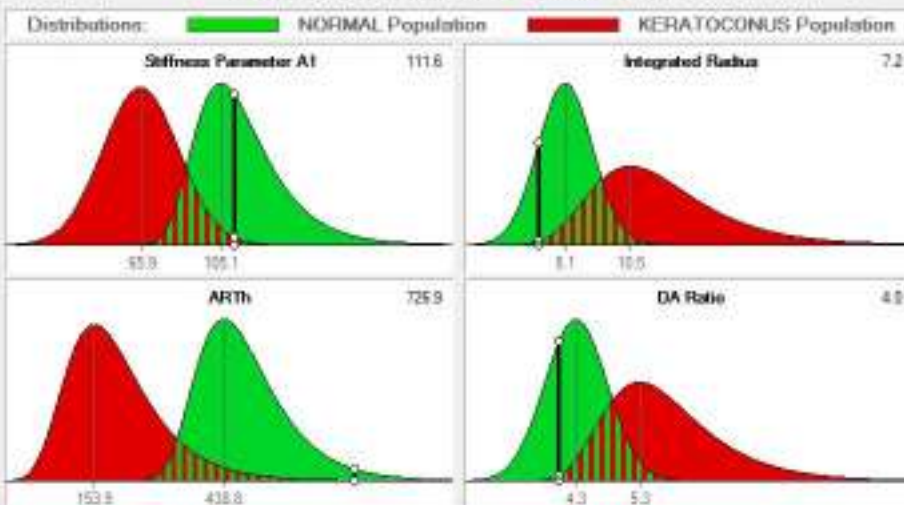


OCULUS Corvis® ST - Biomechanical/Tomographic Assessment (ARV)

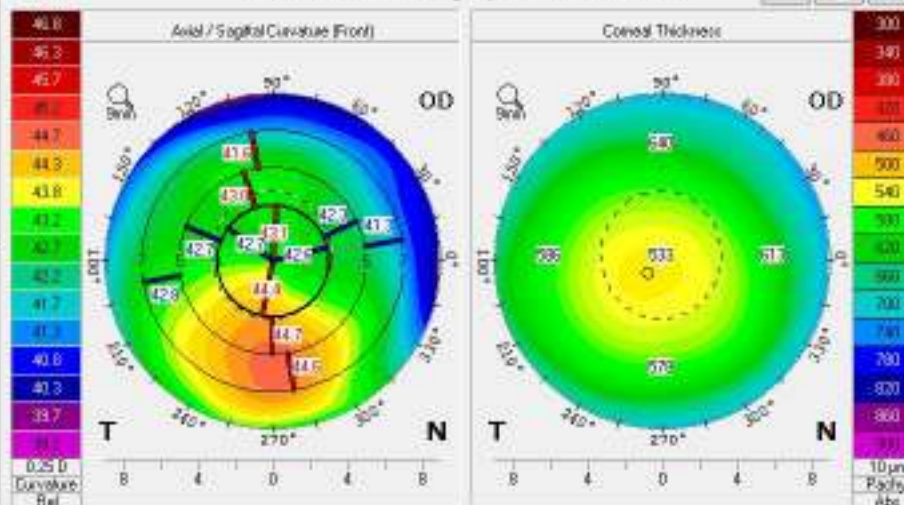
1.6.2021

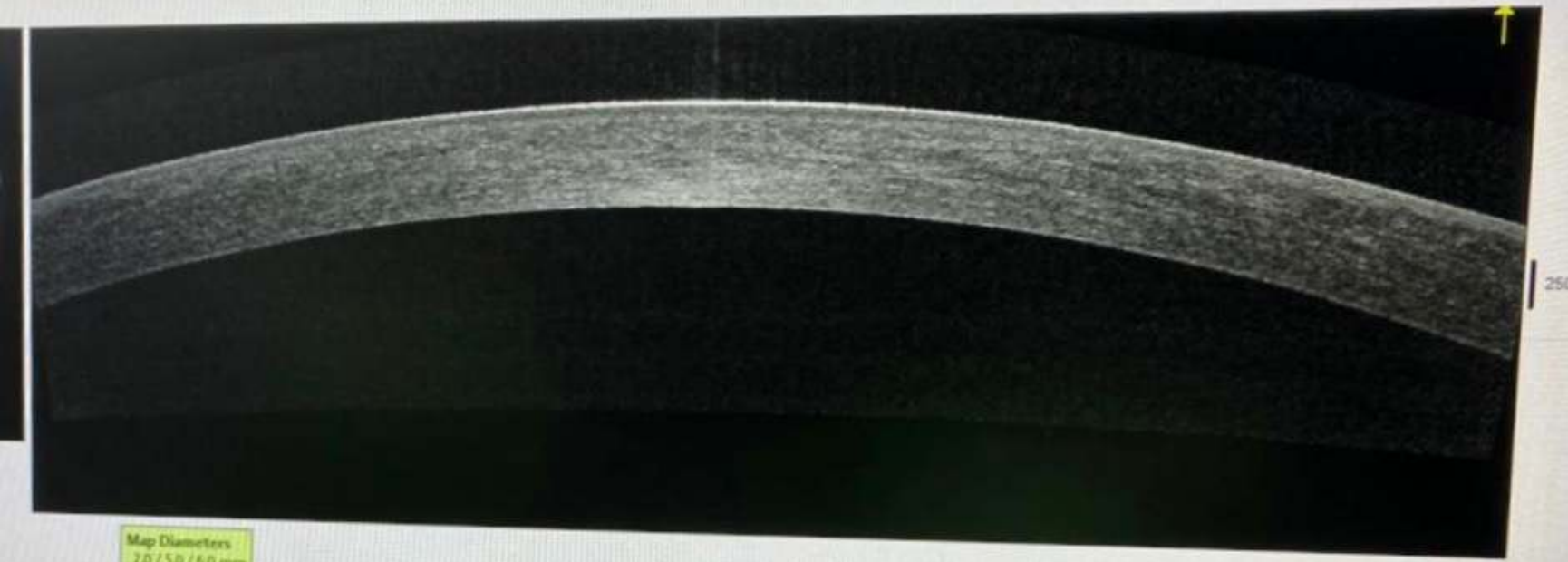
Name: [REDACTED] ID: [REDACTED] Date of birth: 04.04.2001 Age: 20
 Exam. Date: [REDACTED] Time: 12:53:22 Eye: Right (OD) Exam. Date: 12.04.2021 Time: 12:41:04 Eye: Right (OD)
 Info: [REDACTED] QS: OK Info: [REDACTED] QS: OK

Corvis ST - Biomechanical Assessment

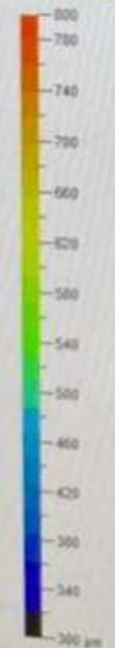


Pentacam - Tomographic Assessment

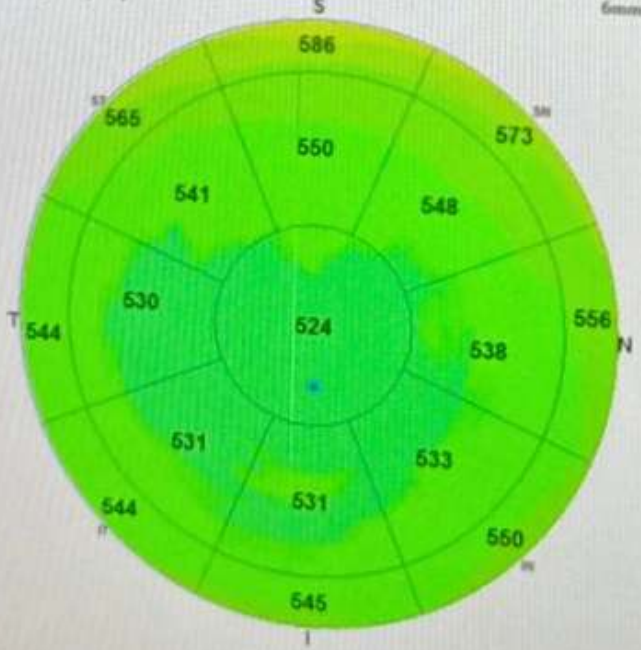




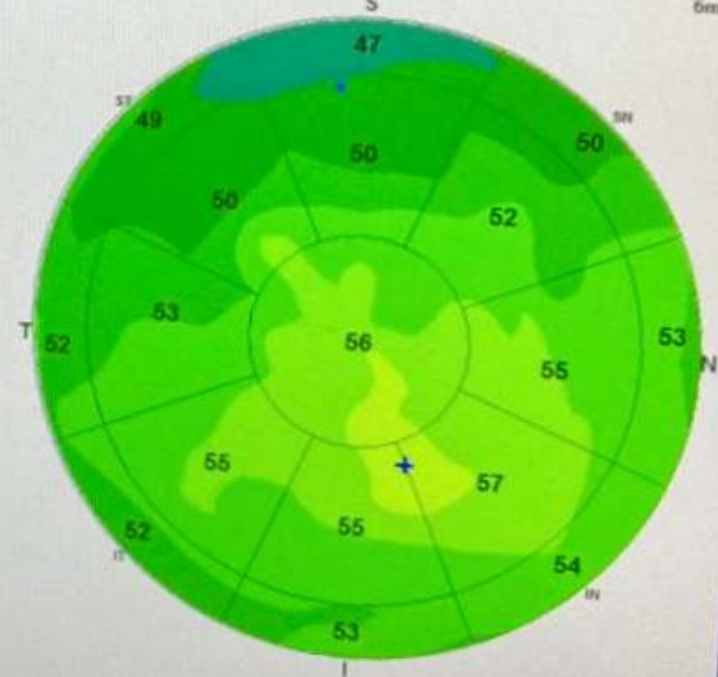
Map Diameters
2.0 / 5.0 / 6.0 mm



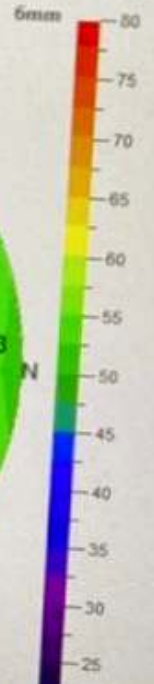
Pachymetry Map



6mm Epithelium Map



Stroma Map



R10 2026

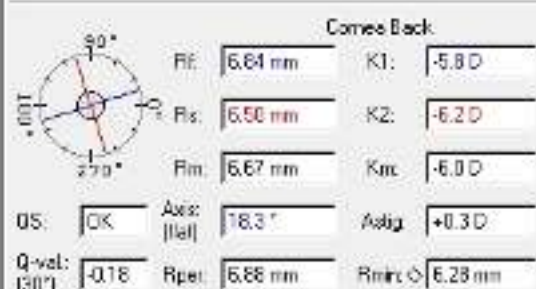
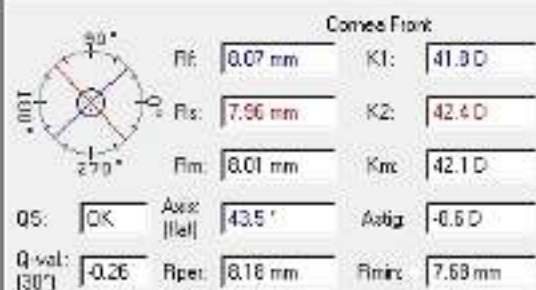
Another inferior steep area

R10 2026

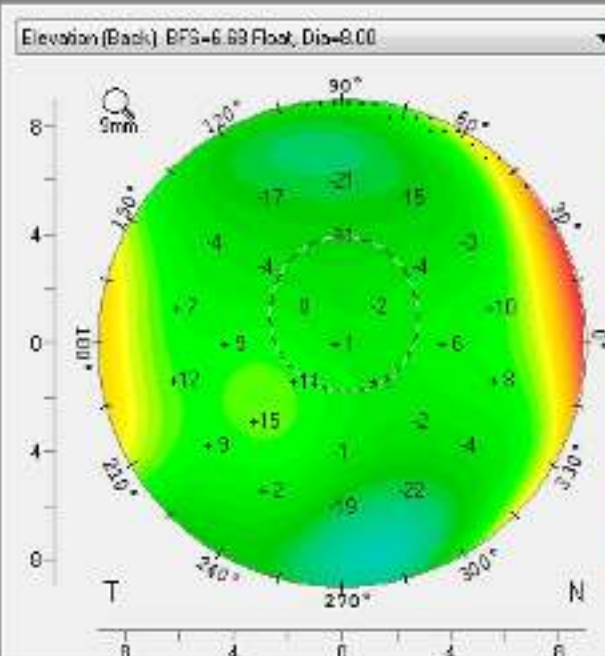
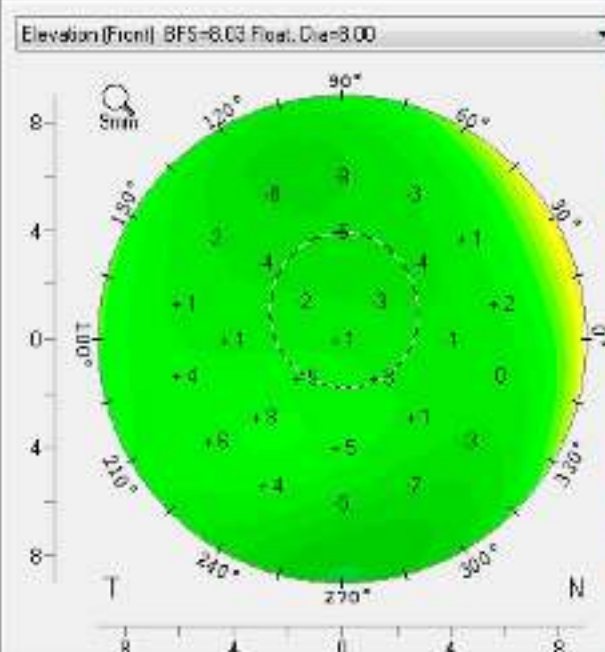
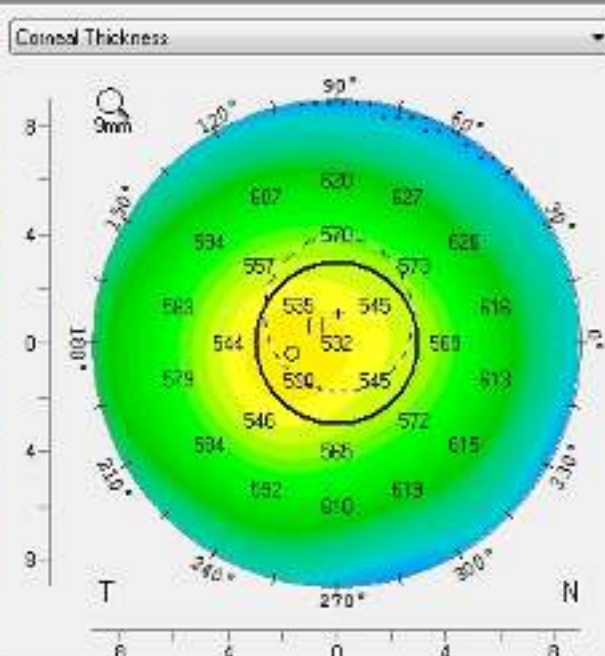
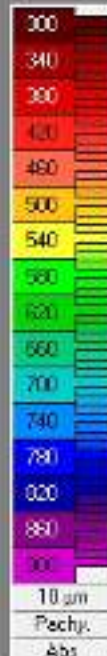
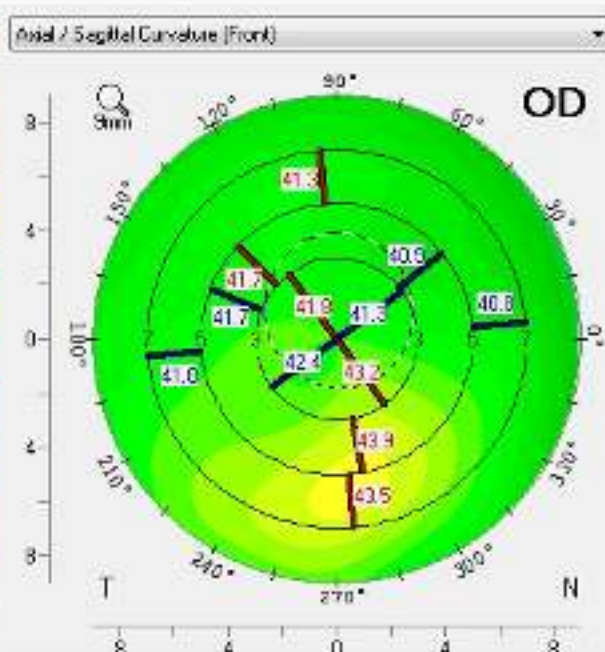
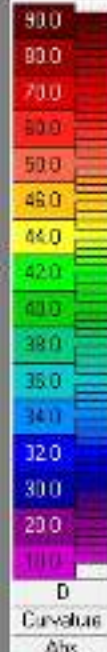
OCULUS - PENTACAM 4 Maps Selectable

1.22/09

Last Name: XXXXXXXXXX
 First Name: XXXXXXXXXX
 ID: XXXXXXXXXX
 Date of Birth: 12/09/1979 Eye: Right
 Exam Date: 13/02/2023 Time: 14:11:20
 Exam Info:



Pupil Center:	+ 536 µm	x(mm):	+0.05	y(mm):	+0.53
Pachy Apex:	: 532 µm	x(mm):	0.00	y(mm):	0.00
Thinnest Locat.:	○ 527 µm	x(mm):	-0.02	y(mm):	-0.21
K Max (Front):	43.9 D	x(mm):	+0.27	y(mm):	-2.73
Cornea Volume:	57.6 mm³	HW/TW:	12.0 mm		
Chamber Volume:	135 mm³	Angle:	34.0°		
A.C. Depth (Int.):	2.57 mm	Pupil Dia:	2.80 mm		
Enter IOP: IOP(Sund):	-0.7 mmHg	Lens Th:			

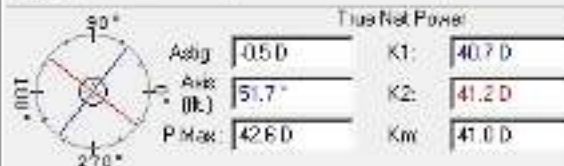


R10

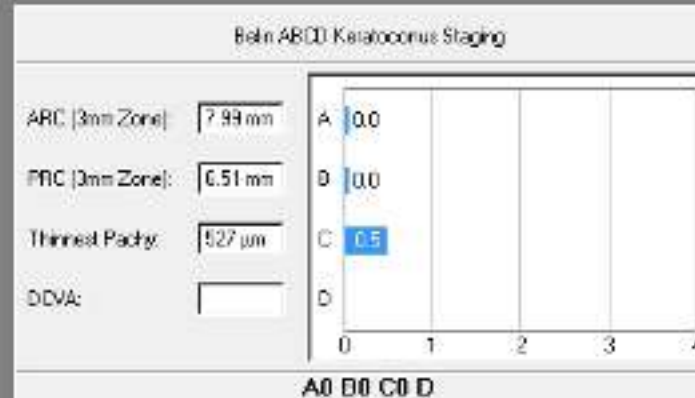
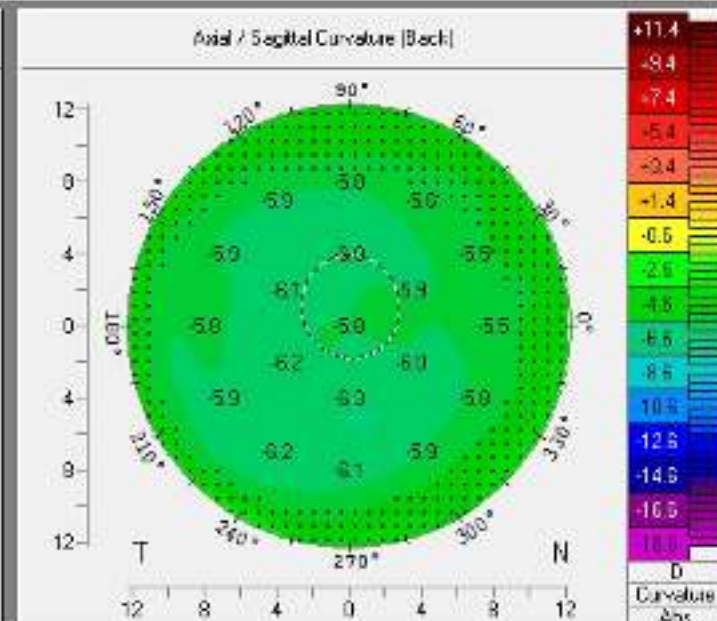
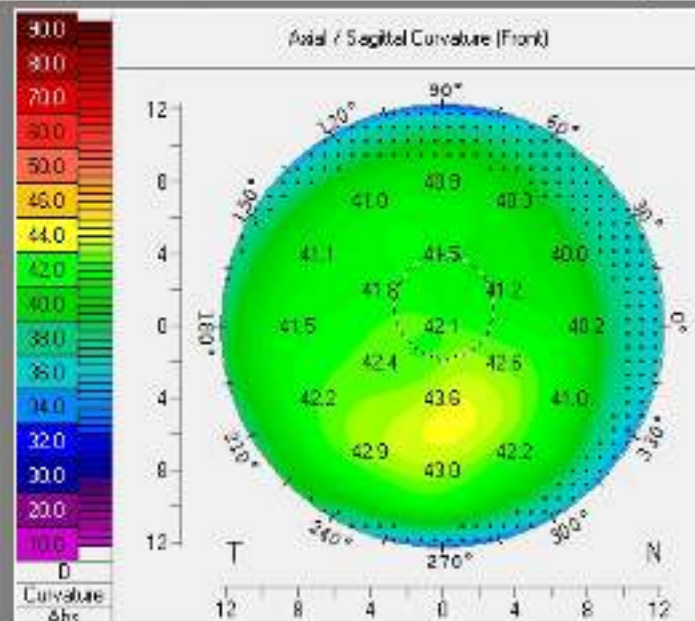
OCULUS - PENTACAM Topometric/KC-Staging

1.22/09

Last Name: XXXXXXXXXX
 First Name: XXXXXXXXXX
 ID: XXXXXXXXXX
 Date of Birth: 12/03/1979 Eye: Right
 Exam Date: 13/02/2023 Time: 14:11:20
 Exam Info: XXXXXXXXXX



Pupil Center:	+ 506 µm	x[mm]	+0.05	y[mm]	+0.53
Pachy Apex:	- 532 µm	x[mm]	0.00	y[mm]	0.00
Thinnest Local:	○ 527 µm	x[mm]	-0.02	y[mm]	-0.21
K Max (Front):	43.9 D	x[mm]	+0.27	y[mm]	-2.73
Cornea Volume:	57.6 mm³	Hw/Hr:	12.0 mm		
Chamber Volume:	135 mm³	Angle:	34.0°		
A.C. Depth (Int.):	2.57 mm	Pupil Dia:	2.80 mm		
IOP(Sum):	+0.7 mmHg	Lens Th:			

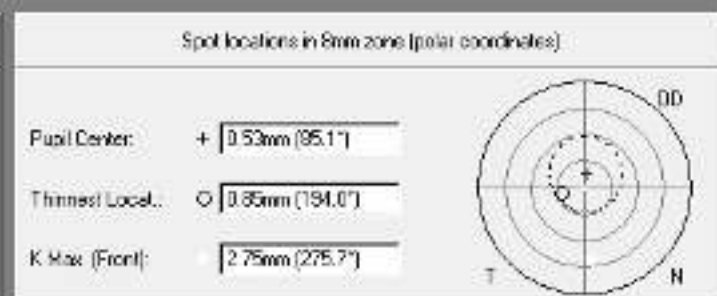
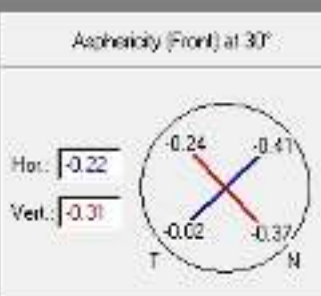


Asphericity (Front) of Major Meridians

	Degrees peripheral					
	20°	25°	30°	35°	40°	
Asphericity	0.21	0.27	0.41	0.53	0.48	Front:
Axial/Sag. Curv	0.13	0.07	0.02	0.14	-0.26	Back:
Int	-0.10	-0.24	-0.37	-0.55	0.00	Asphericity
Sup	-0.12	-0.17	-0.24	-0.40	0.00	Axial/Sag. Curv
Mean	-0.08	-0.15	-0.25	-0.41	-0.18	

Indices (in 8mm zone)

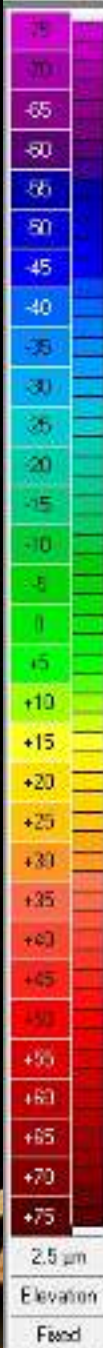
ISV:	21	IHA:	1.2
IWA:	0.26	IHD:	0.027
K1:	1.05	RMin:	7.53
CKI:	1.00	TKC:	pass
KISA:	41.794	IS:	1.72



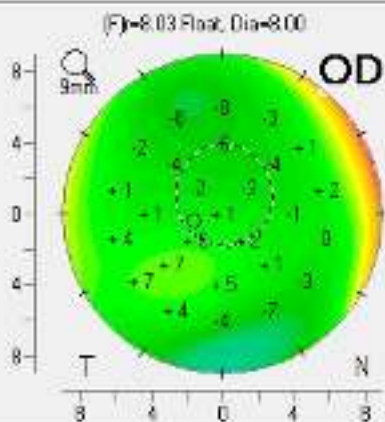
R10

OCULUS - PENTACAM Belin/Ambrósio Enhanced Ectasia Display

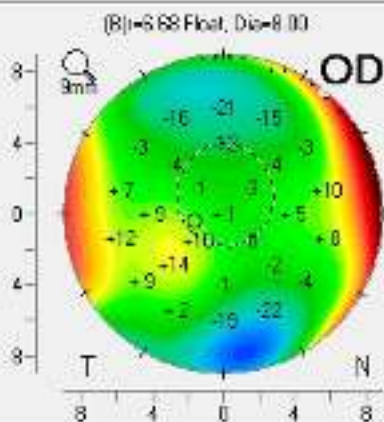
1.22/09



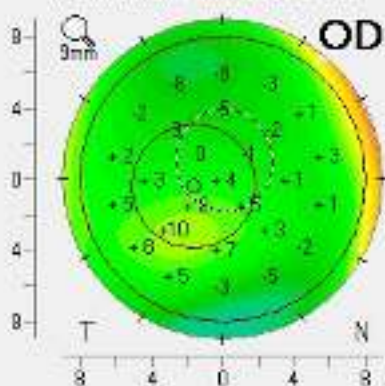
Elevation (Front)



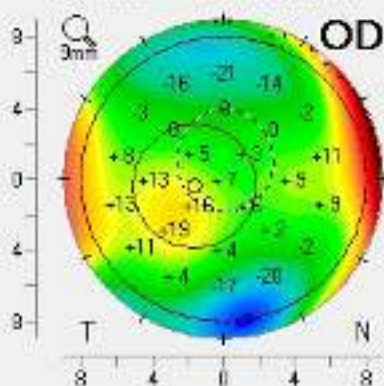
Elevation (Back)



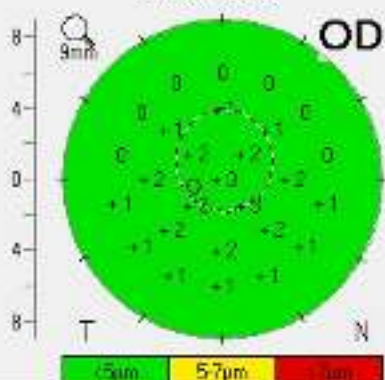
(F) Excl 3.5mm = 8.06 Float, Dia=8.00



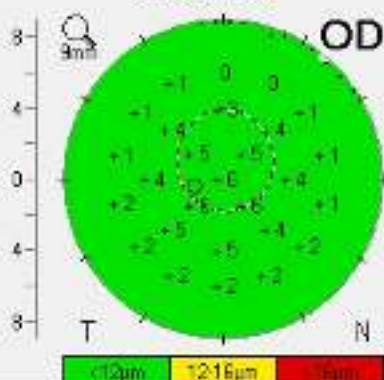
(B) Excl 3.5mm = 6.72 Float, Dia=8.00



(Front) Difference



(Back) Difference



Last Name: [REDACTED]
 First Name: [REDACTED]
 ID: [REDACTED]
 Date of Birth: 12/03/1979 Eye: Right
 Exam Date: 13/02/2023 Time: 14:11:20
 Exam Info: [REDACTED]

K1: 41.80 Axis: 43.5°
 K2: 42.40 U-vel: -0.26
 KMax: 43.50 OS: OK

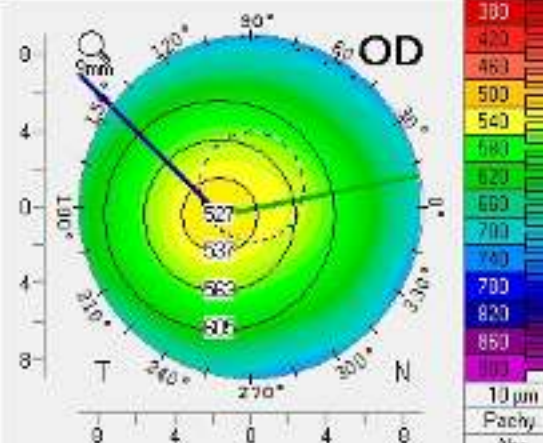
Pachy Thin Loc.: 527µm
 Dist. Apex Thin Loc.: IT 0.65mm

F Ele. Th: 2µm B Ele. Th: 9µm

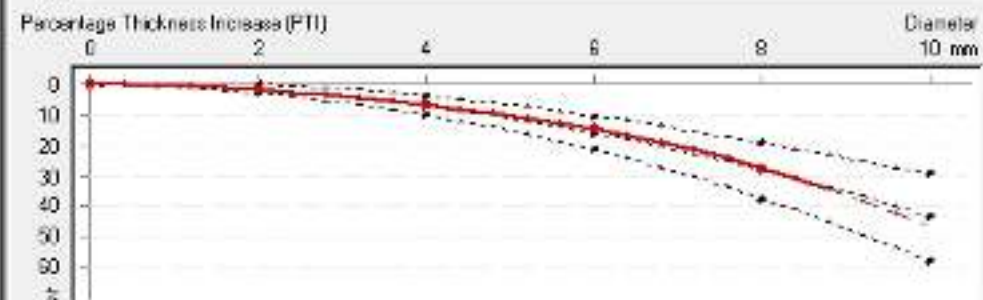
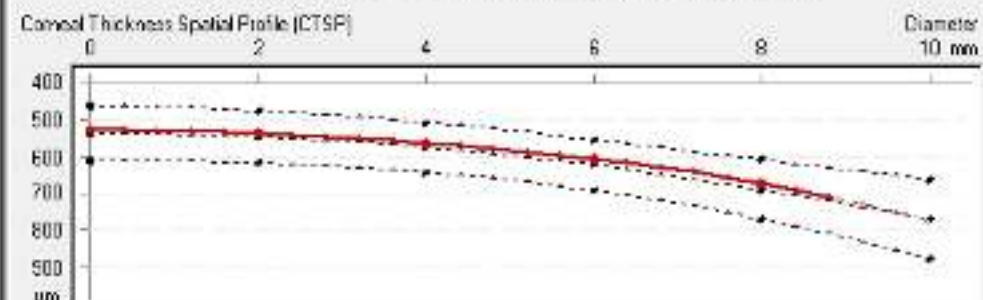
Progression Index

Min: 0.67 Max: 1.14
 Avg: 0.95 APTmax: 462

Corneal Thickness



Mean corneal thickness values on rings concentrically to the thinnest location



Reference Database: ☒ Myopic/Normal ☐ Hyperopic/Mixed Cyl ☐ Literature

Dt: 0.19 Db: 0.07 Dp: 0.31 Dt: 0.31 Da: 0.24 D: 0.90

RIO

OCULUS Corvis® ST - Biomechanical/Tomographic Assessment (ARV)

1.32742

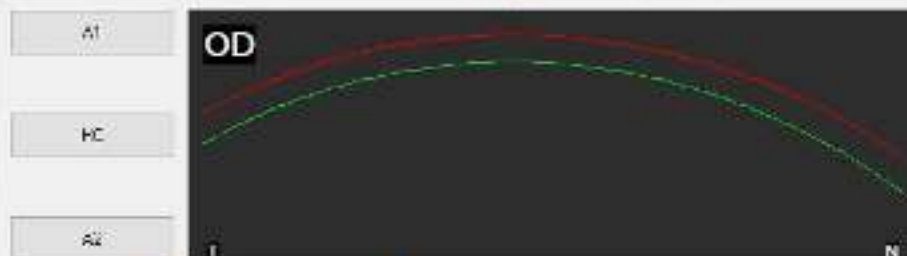
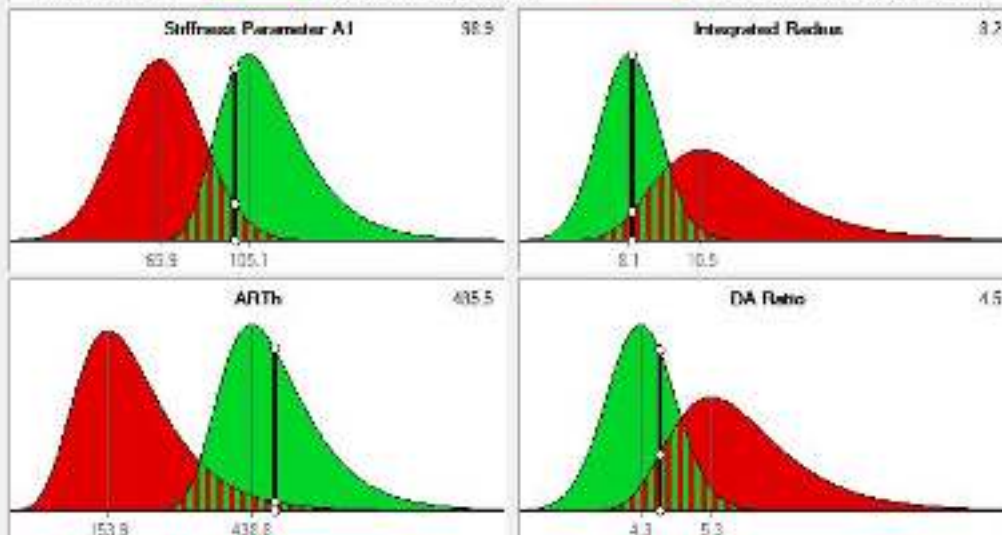
Patient: Examined: Settings:

E-Mail: AVI: JGG

Name: ID: vac Date of birth: 12.03.1979 Age: 43
Exam. Date: 22.11.2022 Time: 11:03:39 Eye: Right (OD) Exam. Date: 22.11.2022 Time: 11:01:54 Eye: Right (OD)
Info: OS: OK Info: OS: OK

Corvis ST - Biomechanical Assessment

Distributions: NORMAL Population KERATOCONUS Population



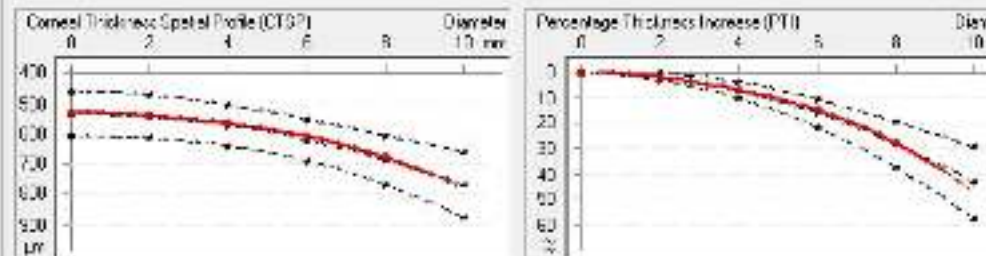
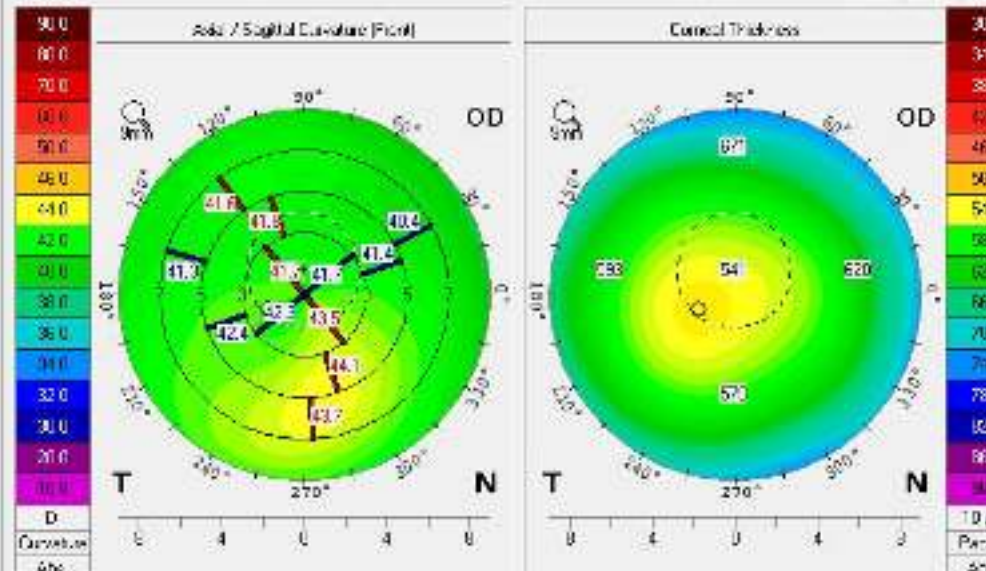
▶ ■ ↺ 28.57 ms

CBI 0.60

Reference: Ethnicity: Global database Treatment: Ortho

TBI 0.61

Pentacam - Tomographic Assessment



K Max.: 44.1 D IS Value: 1.30 PFI: 0.16 TNC: 1.13

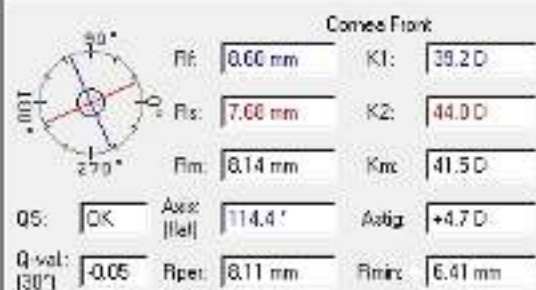
BAD D 1.13

myopic hyperopic

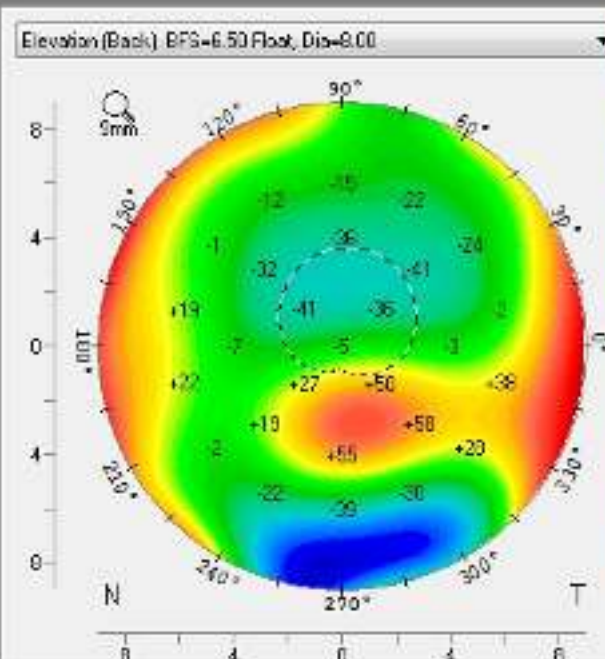
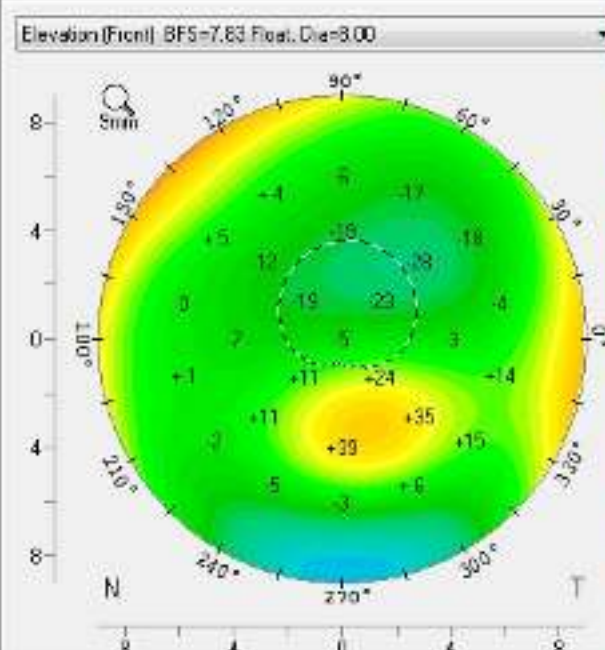
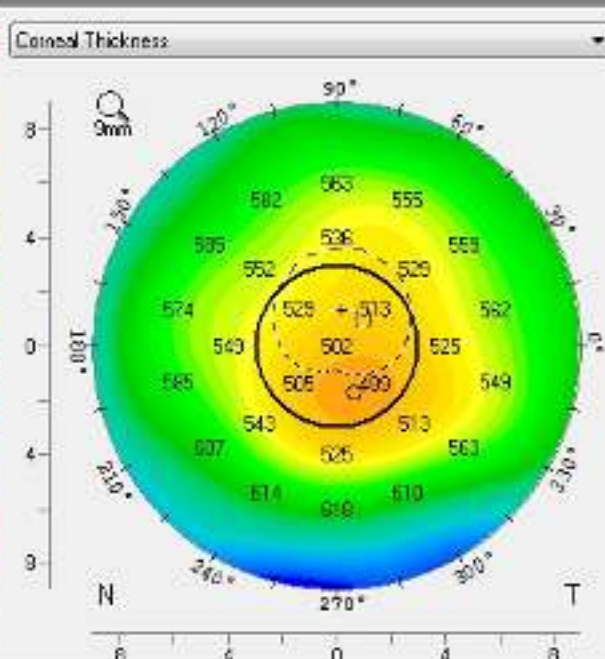
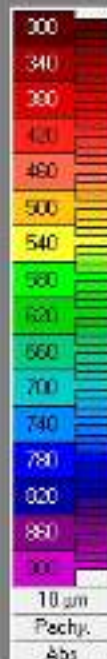
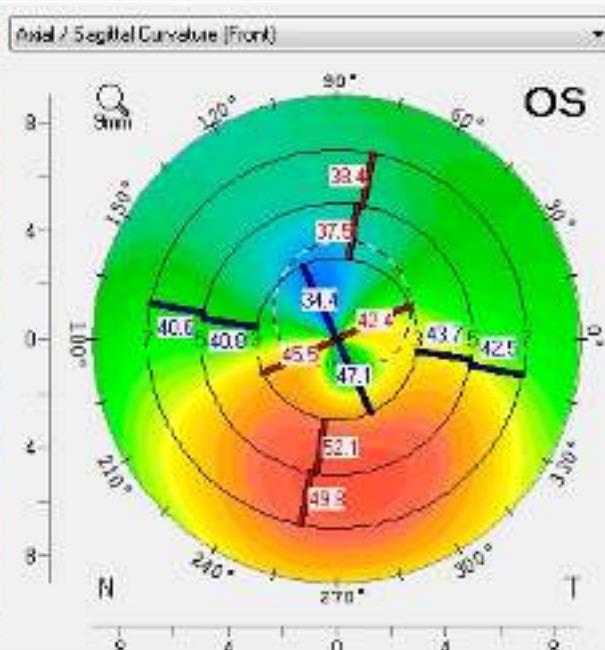
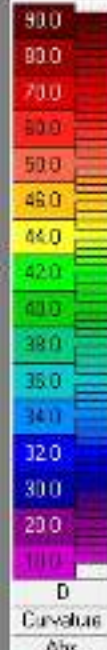
OCULUS - PENTACAM 4 Maps Selectable

1.22/09

Last Name: XXXXXXXXXX
 First Name: XXXXXXXXXX
 ID: XXXXXXXXXX
 Date of Birth: 12/09/1979 Eye: Left
 Exam Date: 22/11/2022 Time: 11:02:24
 Exam Info:



Cornea Volume: 55.5 mm³ HW/TW: 12.2 mm
 Chamber Volume: 137 mm³ Angle: 34.6°
 A.C. Depth (Int.): 2.73 mm Pupil Dia: 2.45 mm
 Enter IOP: IOP(Sund) -1.5 mmHg Lens Th:



R10

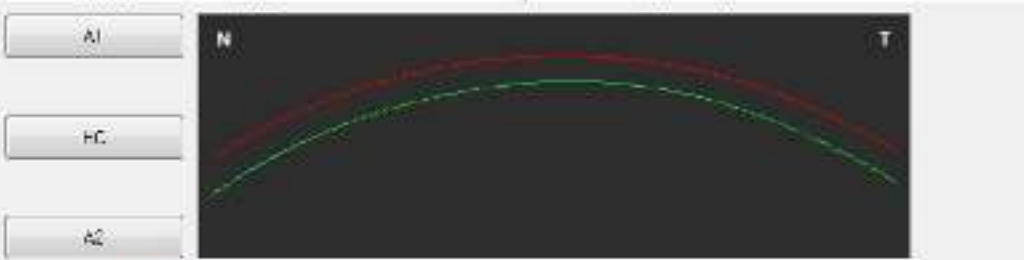
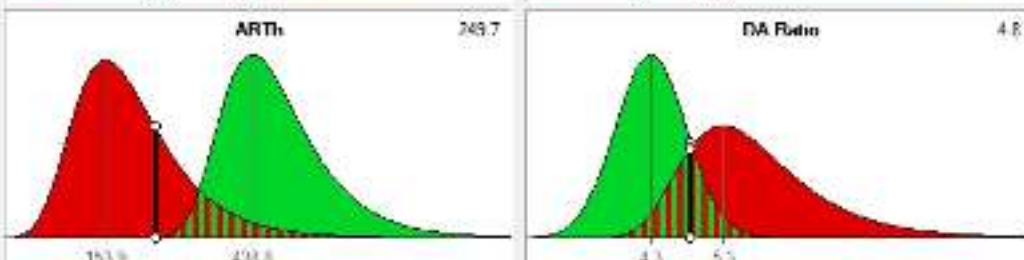
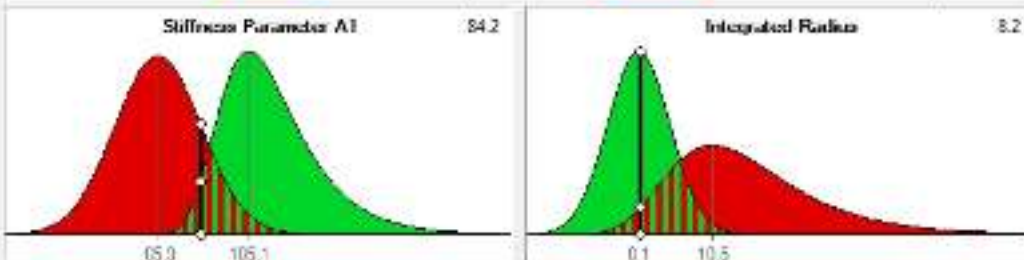
OCULUS® ST - Biomechanical/Tomographic Assessment (ARV)

1.6.2021

Name: Mustafa, Fikret ID: Date of birth: 12.03.1979 Age: 43
 Exam. Date: 22.11.2022 Time: 11:04:53 Eye: Left (OS) Exam. Date: 22.11.2022 Time: 11:02:34 Eye: Left (OS)
 Info: QS: OK Info: QS: OK

Corvis ST - Biomechanical Assessment

Distributions: NORMAL Population KERATOCONUS Population

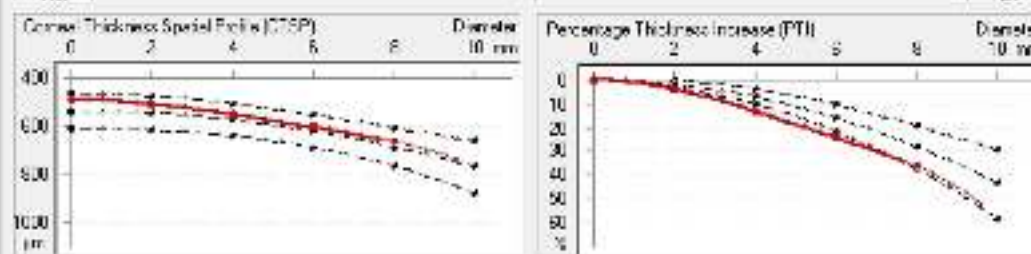
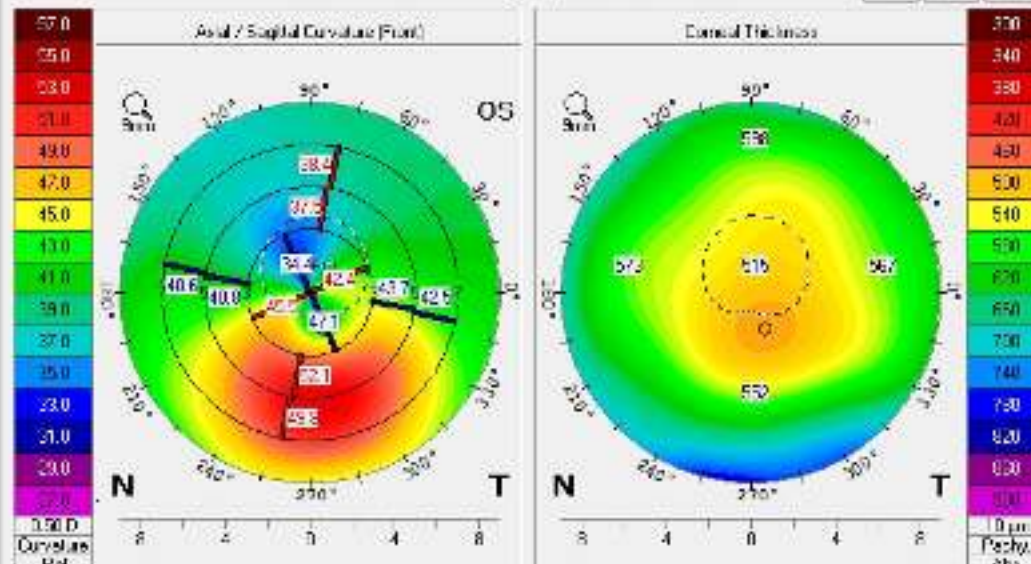


3.70 ms IOPnet: 14.5 mmHg bIOP: 14.9 mmHg

CBI 0.97
 @ uncontacted @ post IVC

TBI 1.00

Pentacam - Tomographic Assessment



K Max.: 52.7 D IS Value: 9.9 D PRFI: 0.98 TKC: 82.3

BAD D 7.58
 @ myopic @ hyperopic

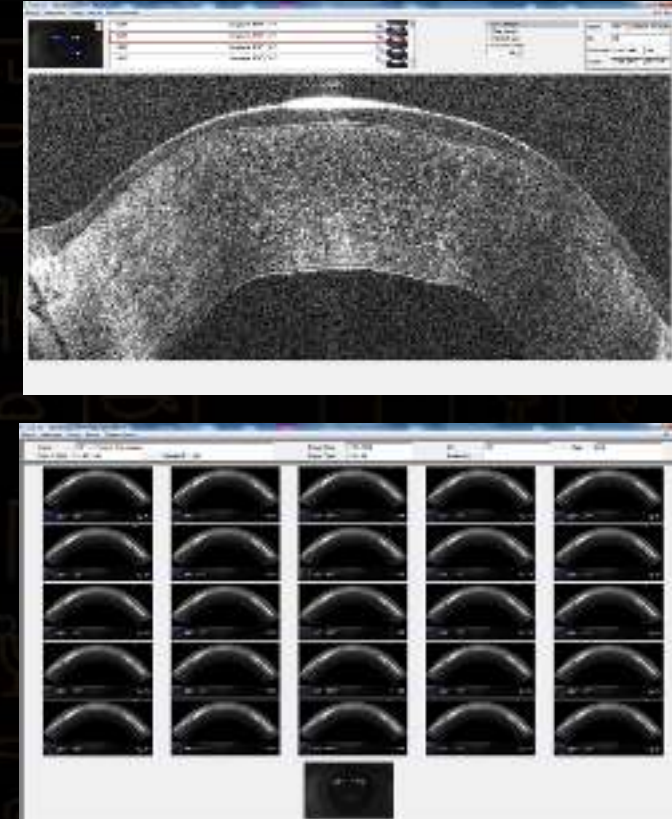
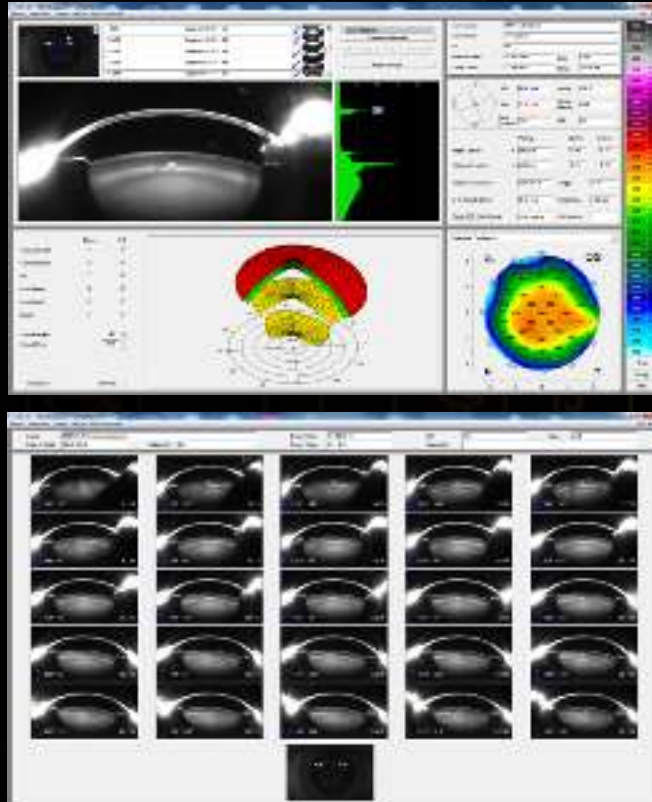
1.00

R10

Pentacam OCT

R10 2026

Pentacam® Cornea OCT: Scheimpflug + OCT



R10 2026

The best of two worlds:

Simultaneous measurement with Scheimpflug and cornea OCT

- Pentacam®:

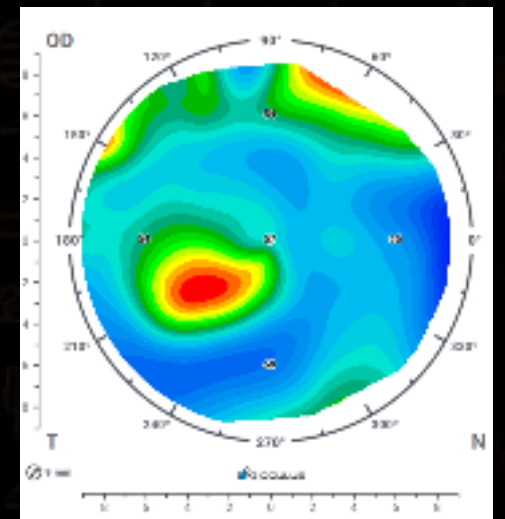
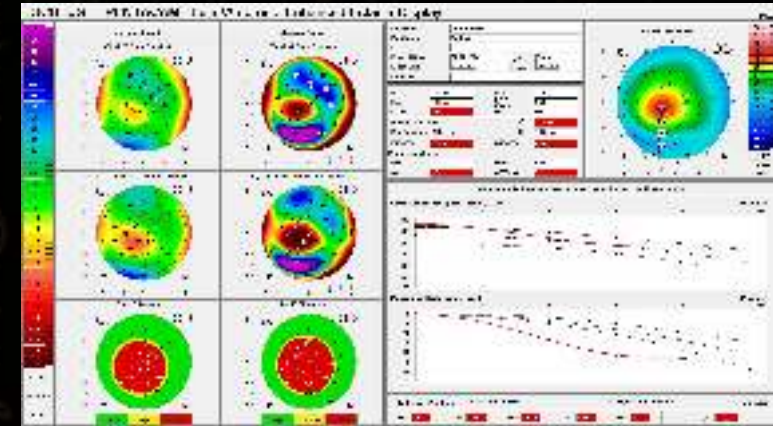
- 20 years of proven success in surgery

- Normative data, clinically validated many times, safe and fast decision making pre-op, backwards compatibility

- +

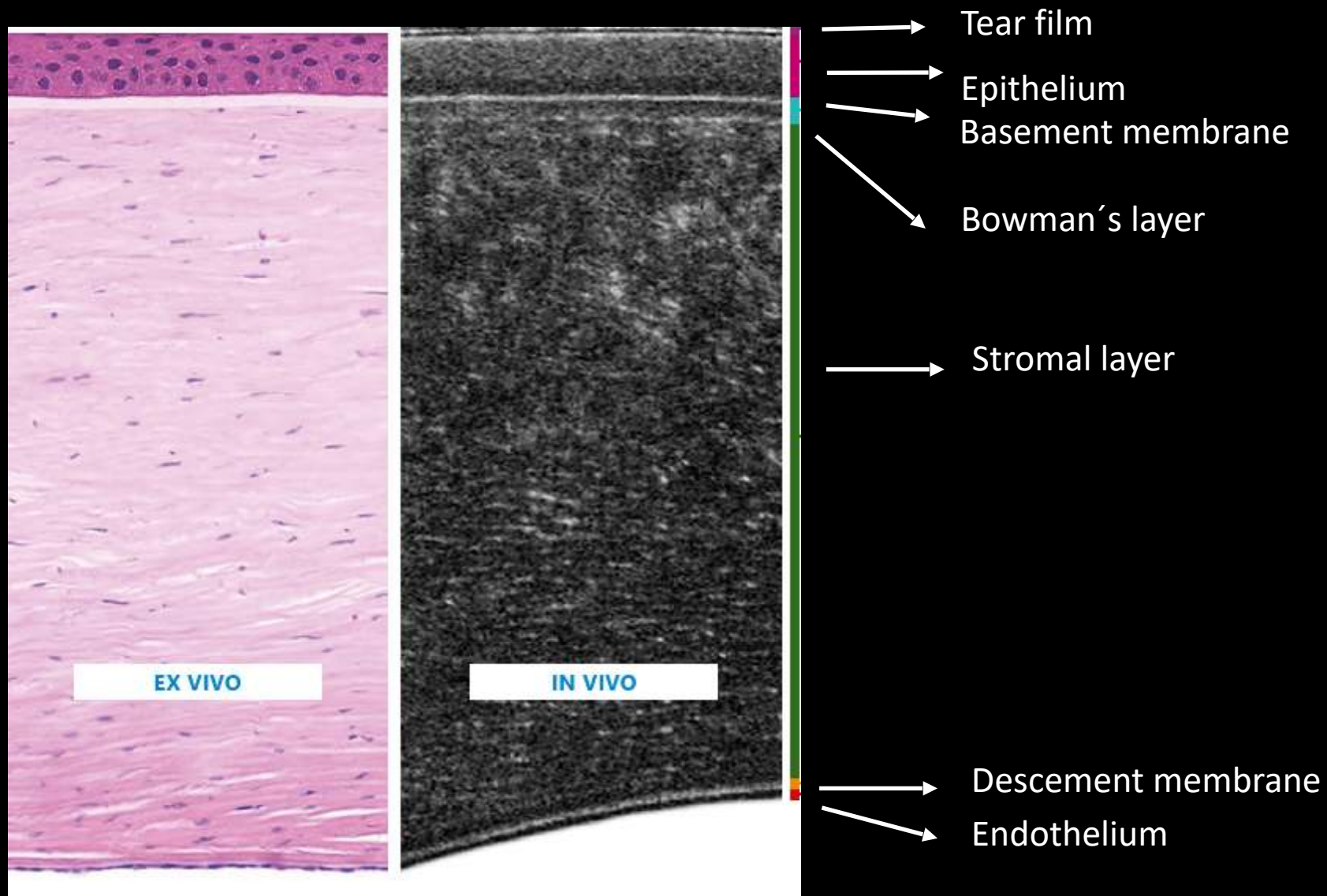
- High-resolution corneal OCT

- Epithelial map + other sublayers and high-resolution imaging

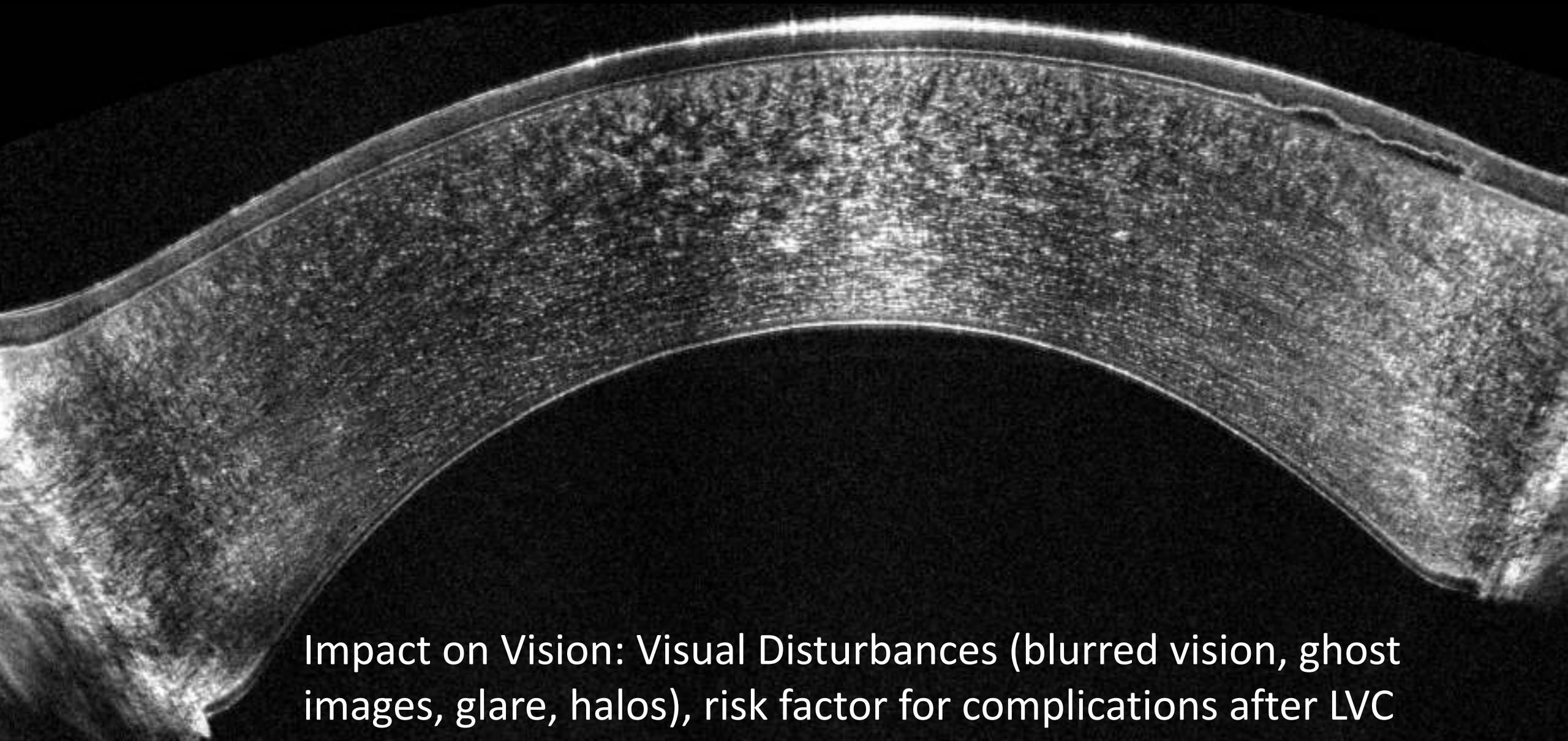


R10 2026

Turning the light on: optical biopsy

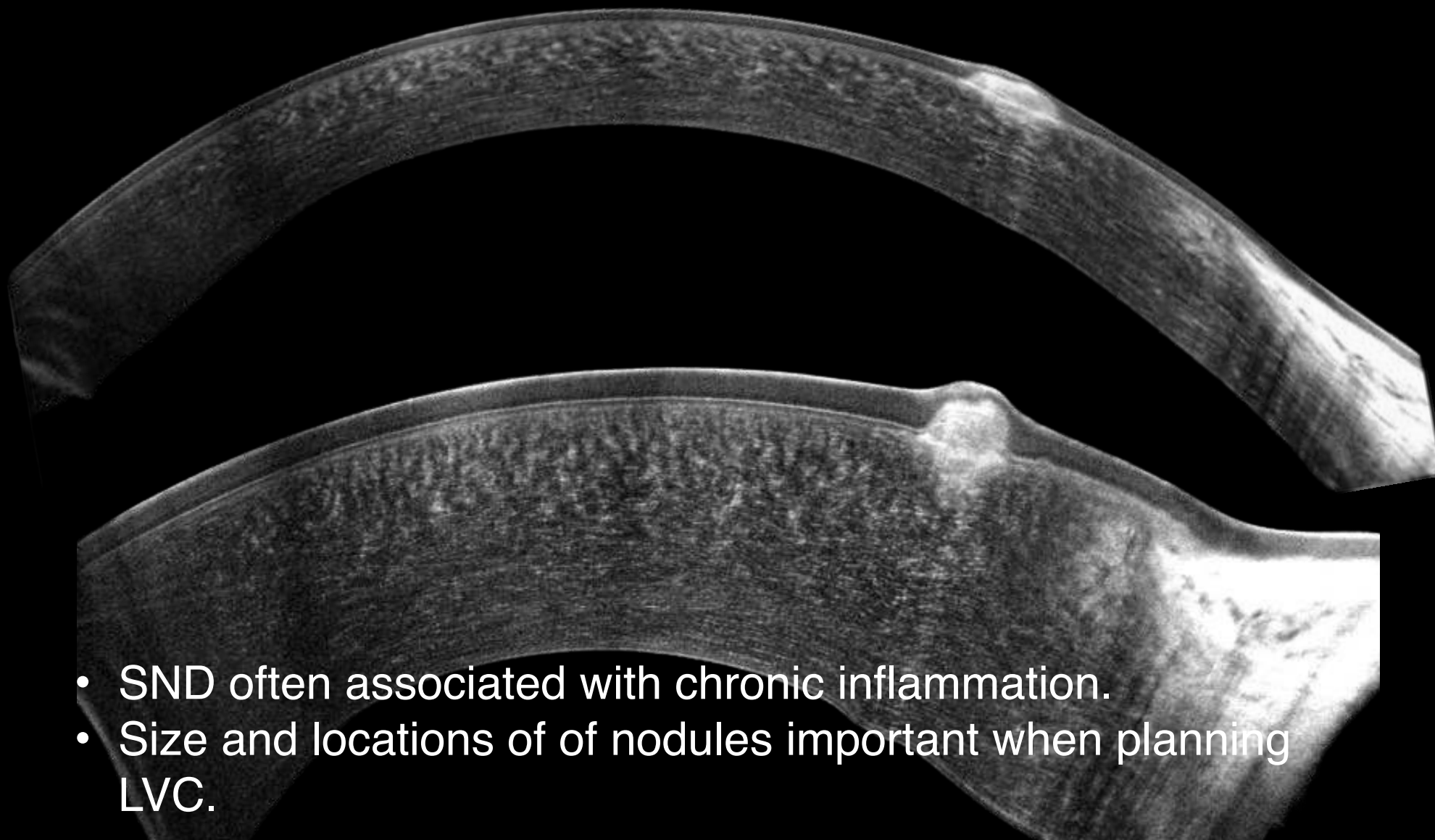


Knowing the Unknown: Map-dot fingerprint



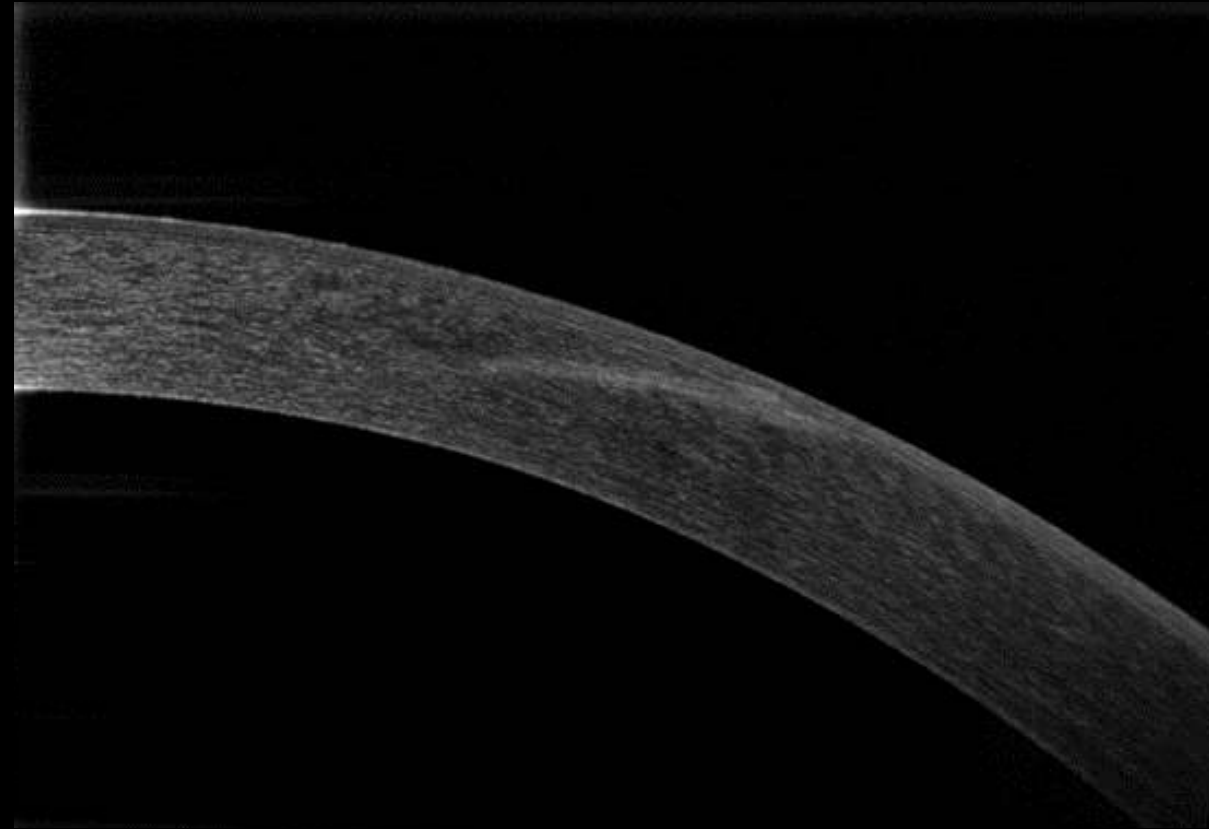
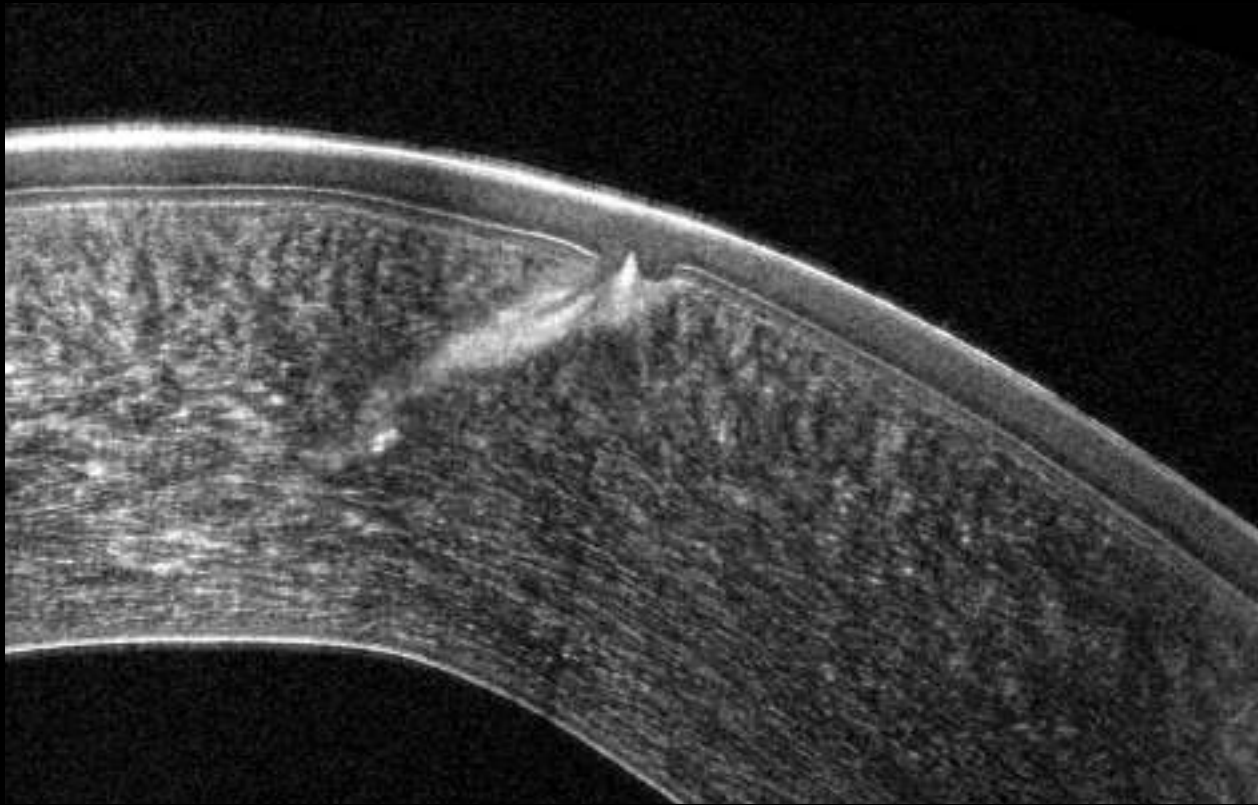
Impact on Vision: Visual Disturbances (blurred vision, ghost images, glare, halos), risk factor for complications after LVC

Salzmann's nodular degeneration



- SND often associated with chronic inflammation.
- Size and locations of of nodules important when planning LVC.

Image comparison with standard OCT

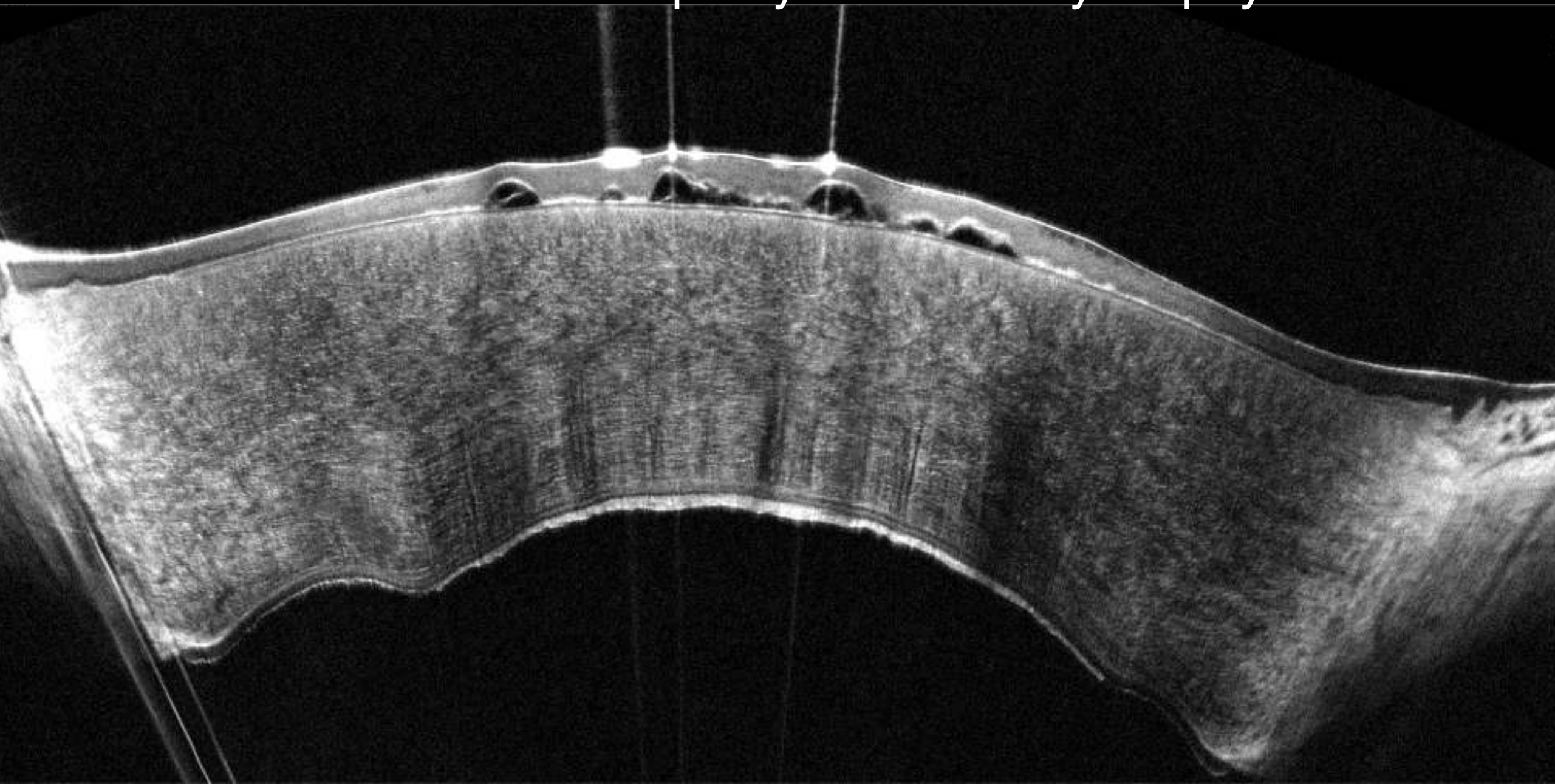


Turning the light on the endothelium: Fuchs' dystrophy

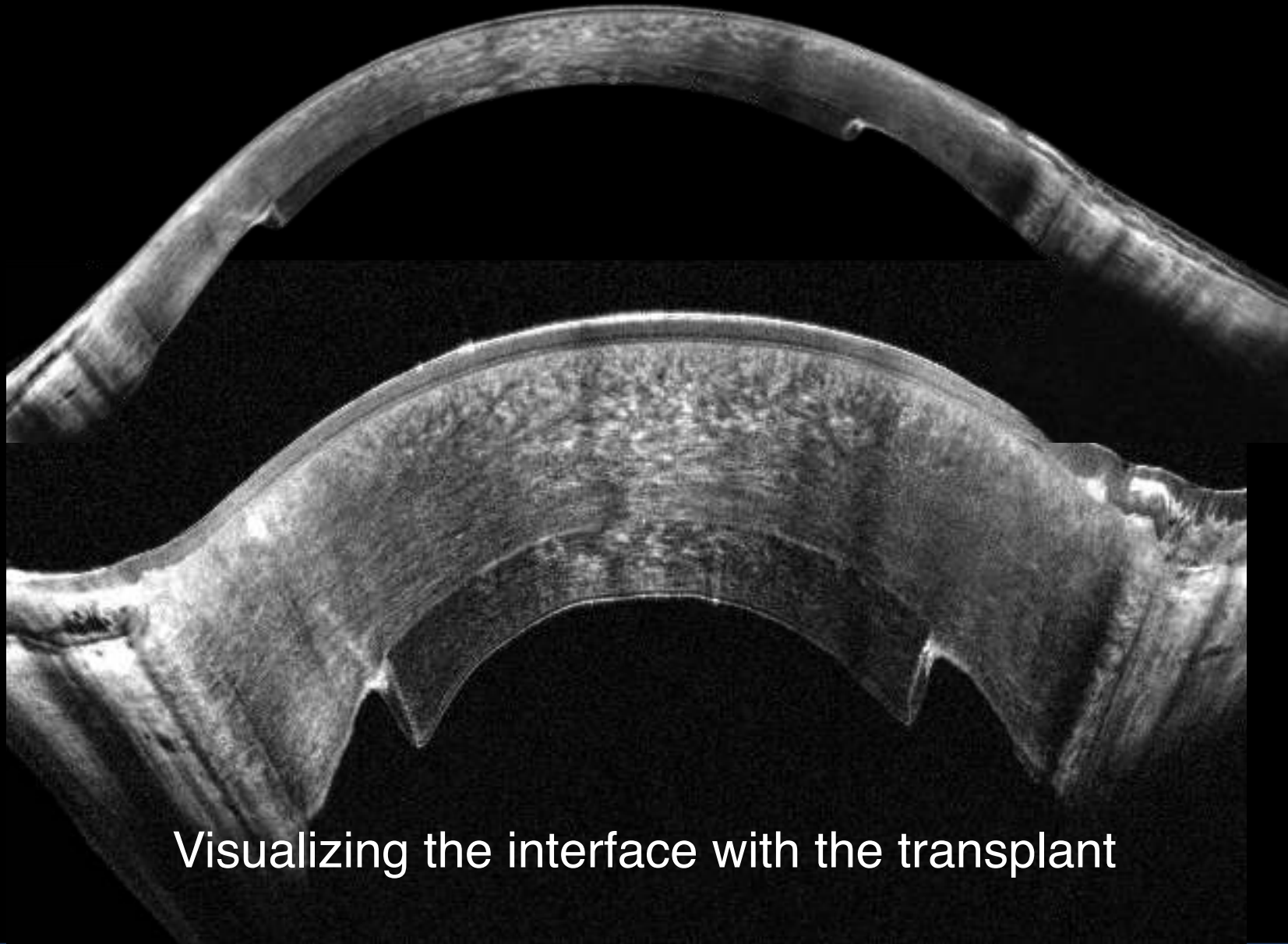


DSAEK planning, Cataract Surgery planning, IOL
selection

Bullous keratopathy in Fuchs' dystrophy

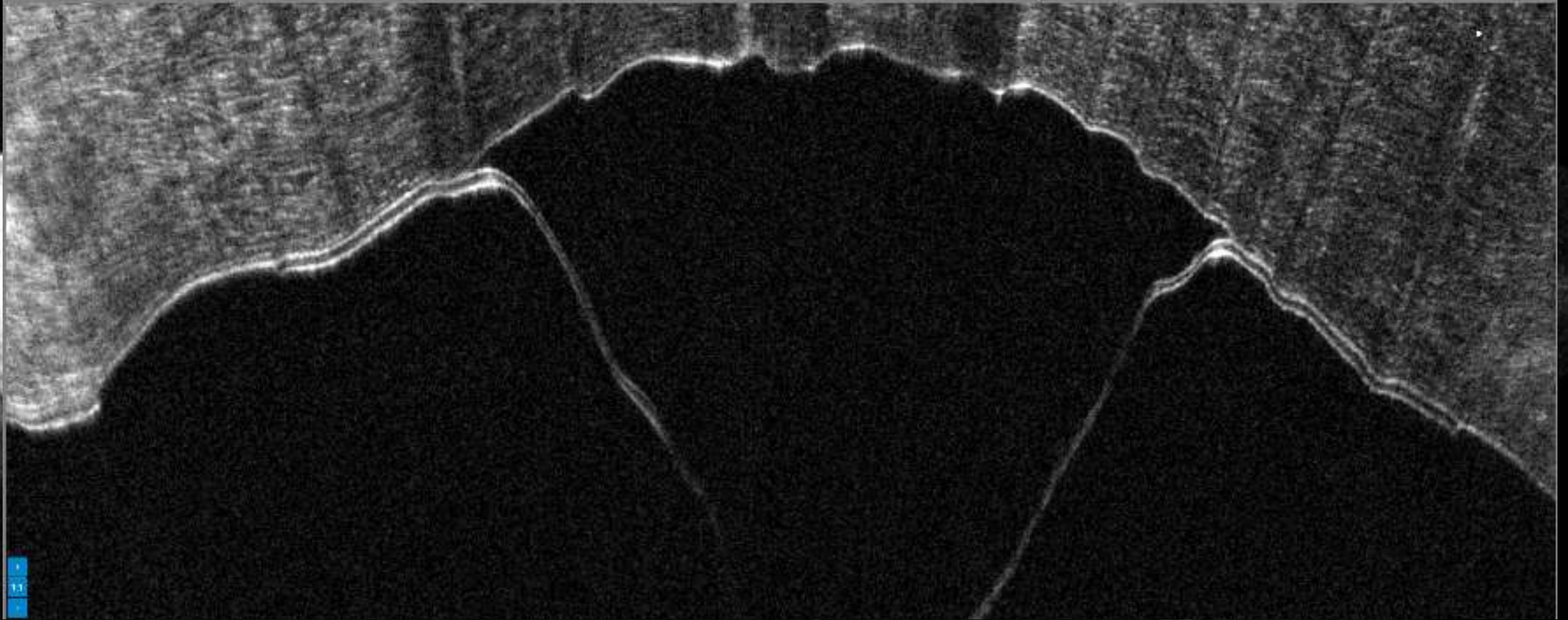


Post-op Control: DSAEK



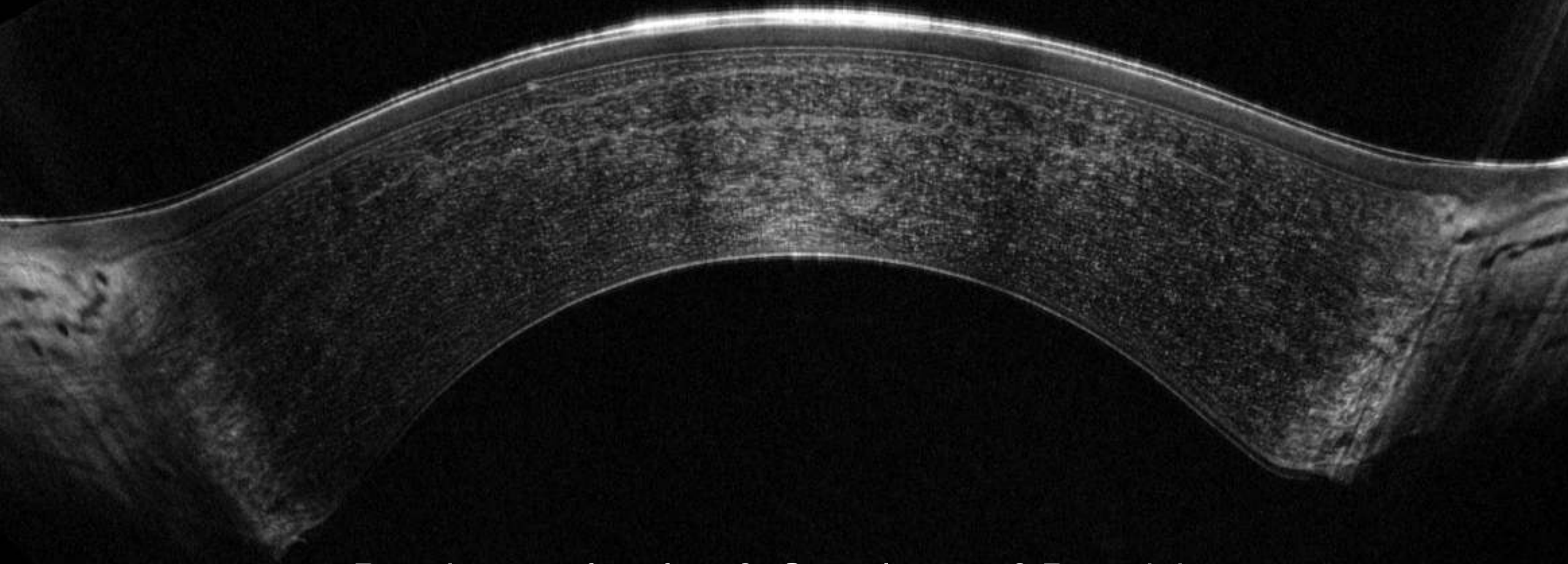
Visualizing the interface with the transplant

Turning the light on: post-op Complication management



Endothelial detachment after DMEK! Monitoring re-attachment after bubbles!

Post-op Control: lenticule before removal



Roughness of surface? Complete cut? Remaining tissue?

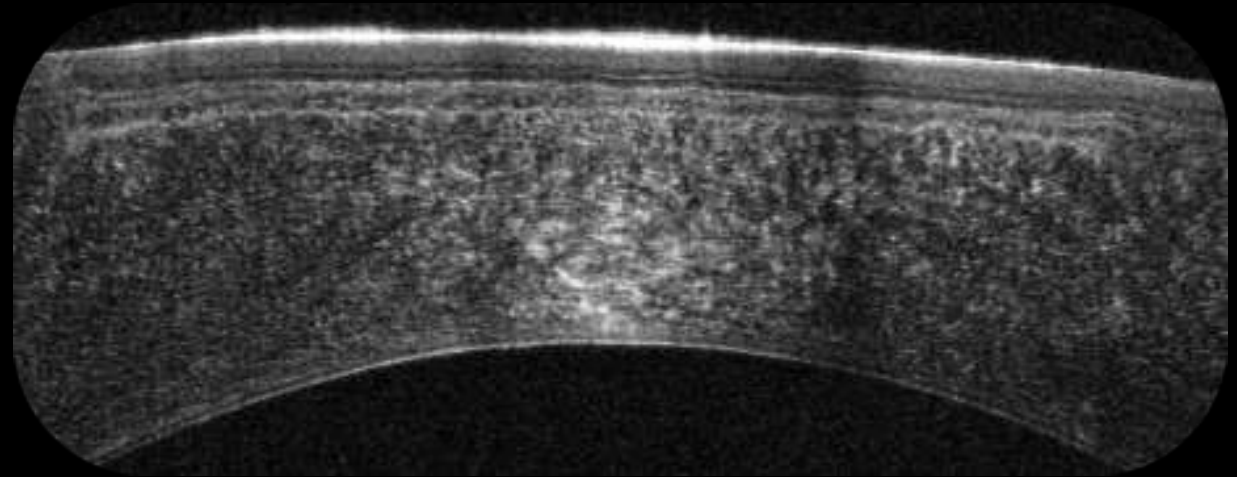
Incomplete flap creation after LASIK

10 minutes

30 minutes

75 minutes

180 minutes



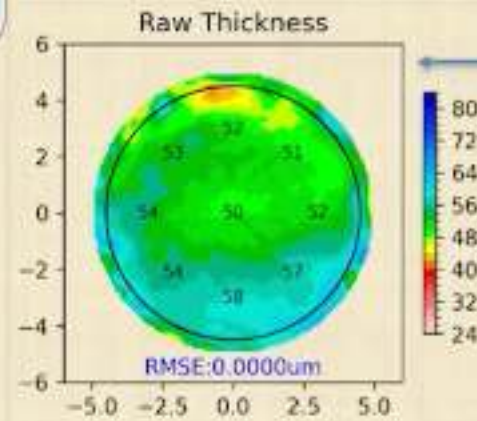
After retreatment with deeper flap!
OU VA 20/20

Device specifications for Epithelium Thickness Measurement

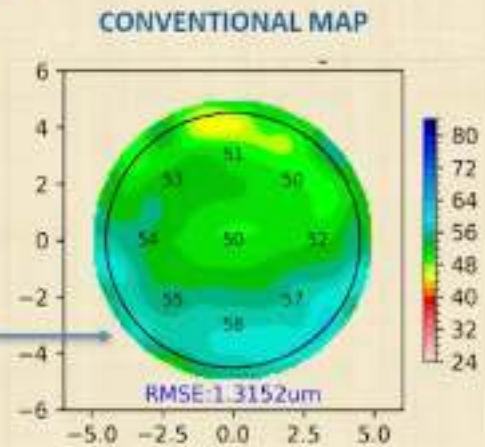
	Solix (Optovue)	CSO MS-39	Pentacam OCT
Wavelength (nm)	840	850	800
Bandwidth (nm)	-	80	200
Axial resolution (μm) in tissue	5	3.5	1.9
Imaging depth (mm)	3	10	3.5
No. of B-Scans (Radial)	16	12 x 5 (averaged)	25
No. of A-Scans	1700	600	2000
Acquisition Time (sec.)	-	1.5	1.1
Rate (A-Scan/sec)	120,000	-	50,000
scan length (mm)	10	10	17
Pachymetry map size (mm)	10	8	9

**CASE 1:
HEALTHY**

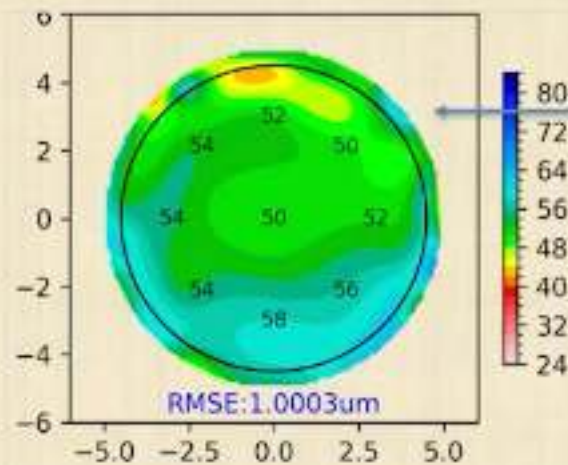
NEED EXAMPLES: NORMAL CORNEA



Raw data shows
variability of
epithelium thickness



Conventional maps
smoothen the thickness
maps introducing a fitting
error of 1.31 micron

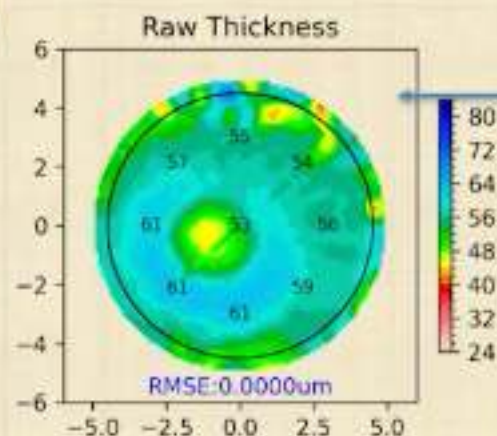


**NEED THICKNESS MAP DEVELOPED BY IBMS,
NNF**

Smoothened Data With A Reduced Fitting Error Of
1 Micron (A 30% Improvement Over Conventional
Maps)

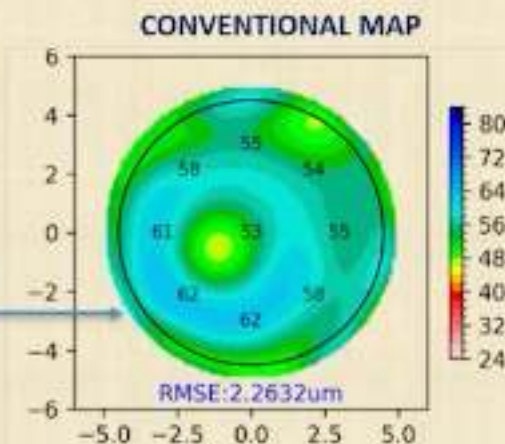
CASE 2:
KERATOCONUS

NEED EXAMPLES: MODERATE KERATOCONUS CORNEA

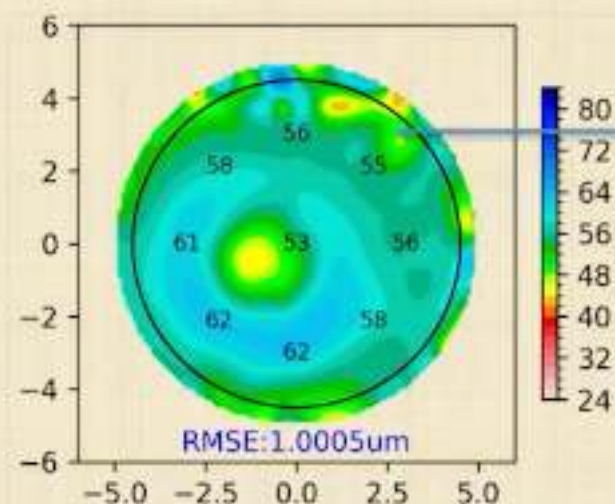


Raw Data Shows
Variability Of Epithelium
Thickness

Conventional Maps Smoothen
The Thickness Maps
Introducing A Fitting Error Of
2.26 Micron



Fitting Error Increased Relative
To Normal Cornea



NEED THICKNESS MAP DEVELOPED BY IBMS,
NNF

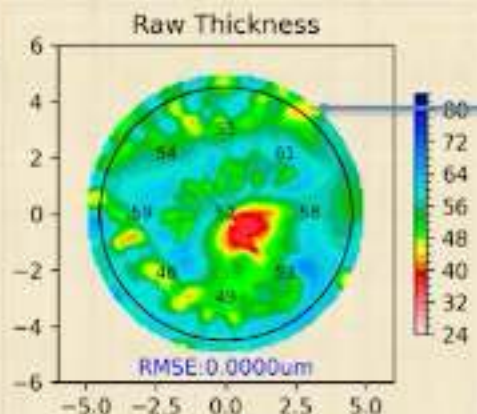
Smoothened Data With A Reduced Fitting Error Of 1 Micron (A 2-fold
Improvement Over Conventional Maps)

A More Accurate Or Patient-specific Visualization Is Evident

A Game Changer For Development Of Ai/ML Diagnostics

CASE 3: KERATOCONUS

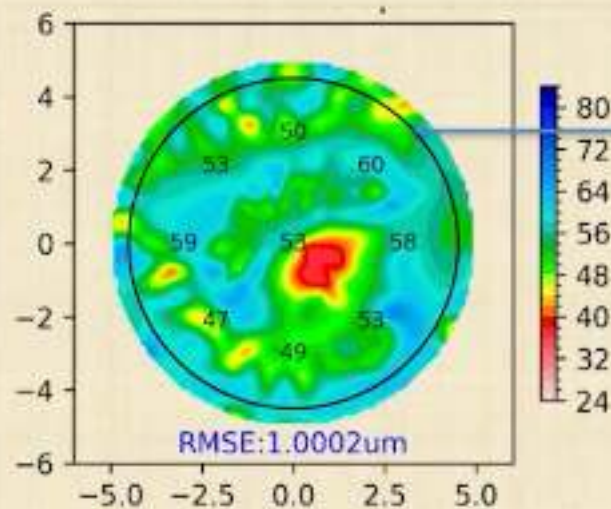
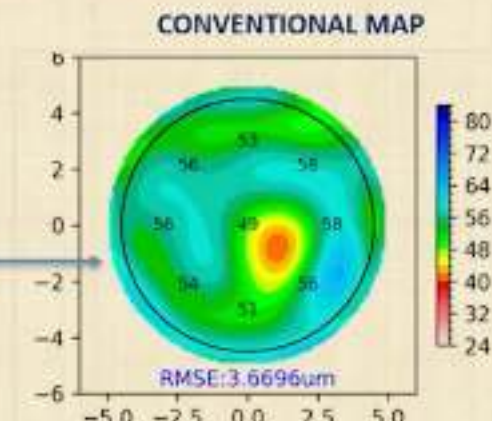
NEED EXAMPLES: ADVANCED KERATOCONUS CORNEA



Raw data shows variability of epithelium thickness

Conventional maps smoothen the thickness maps introducing a fitting error of 3.67 micron

Fitting error increased relative to normal cornea (300% increase)
Regional variations removed



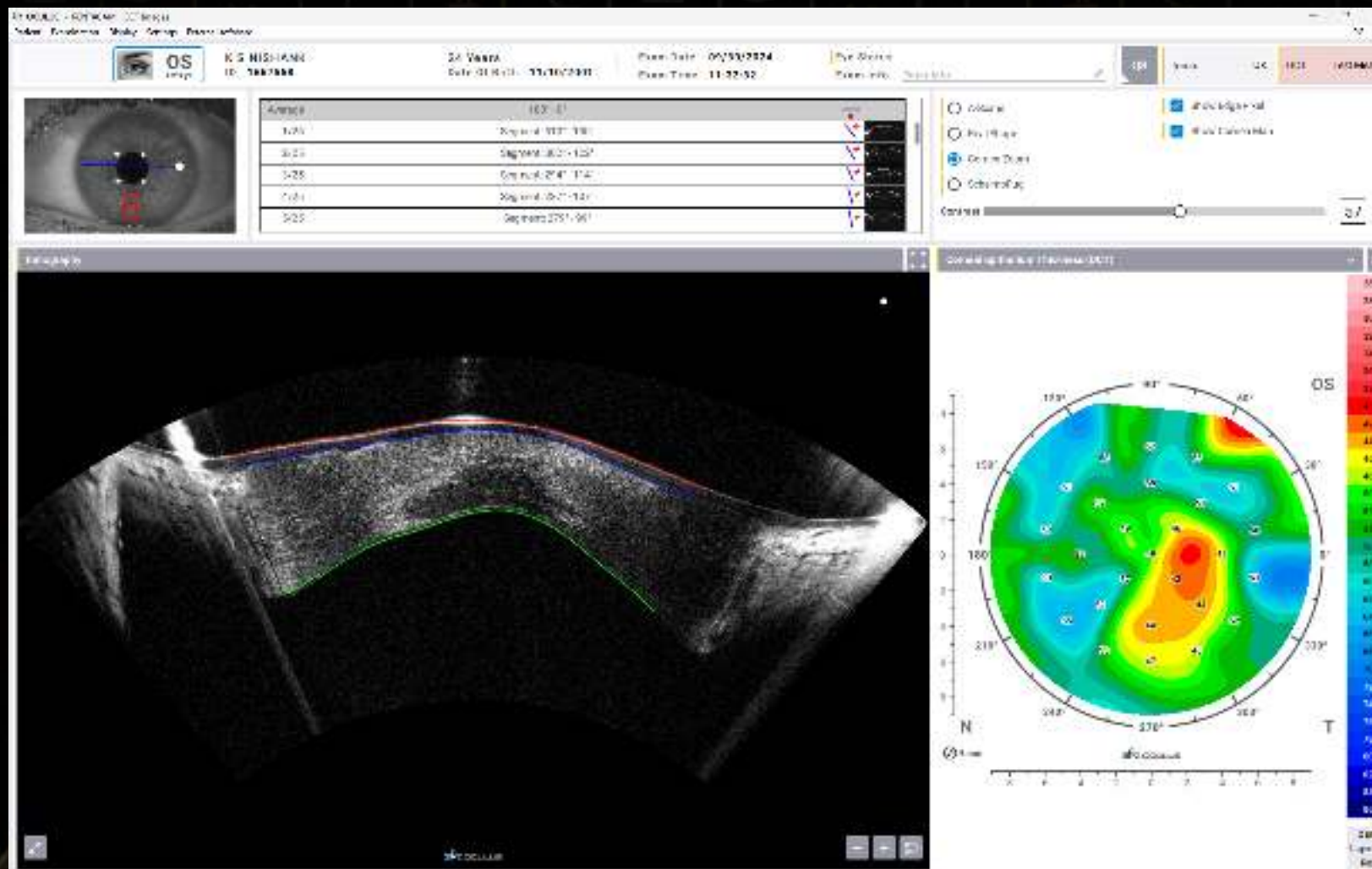
NEED THICKNESS MAP DEVELOPED BY IBMS, NNF

Smoothened data with a reduced fitting error of 1 micron (a 3-fold improvement over conventional maps)

A more accurate or patient-specific visualization is evident

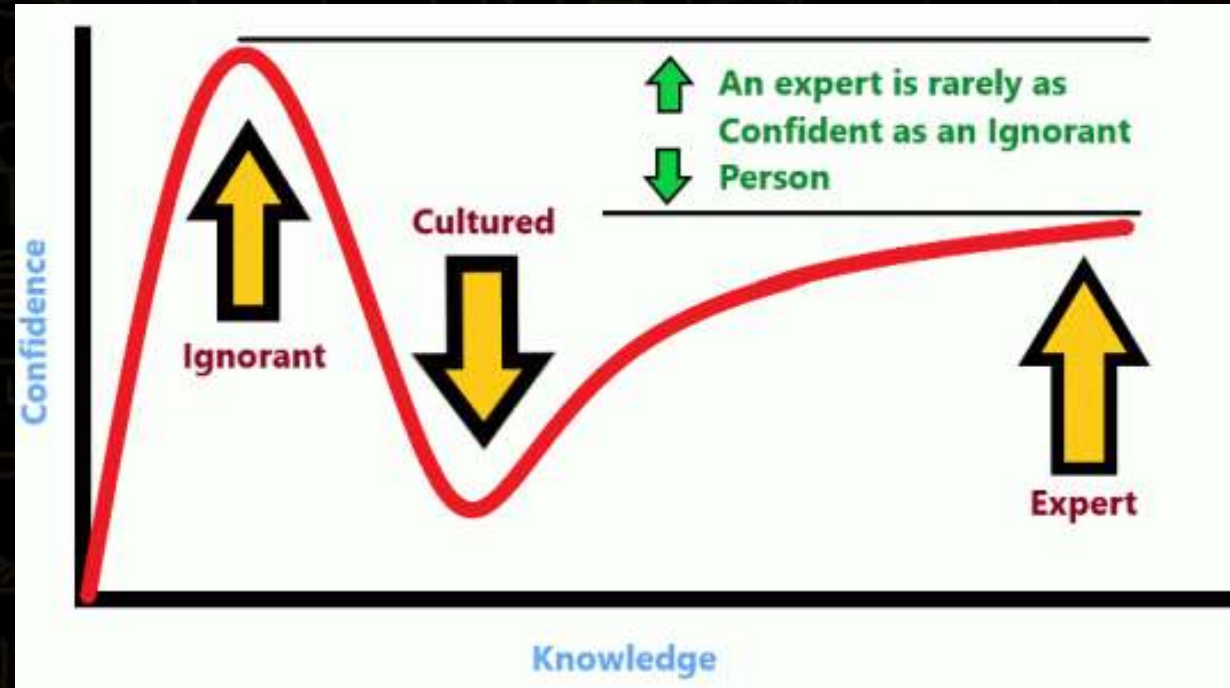
Both moderate and advanced KC map had the same fitting error of 1 micron

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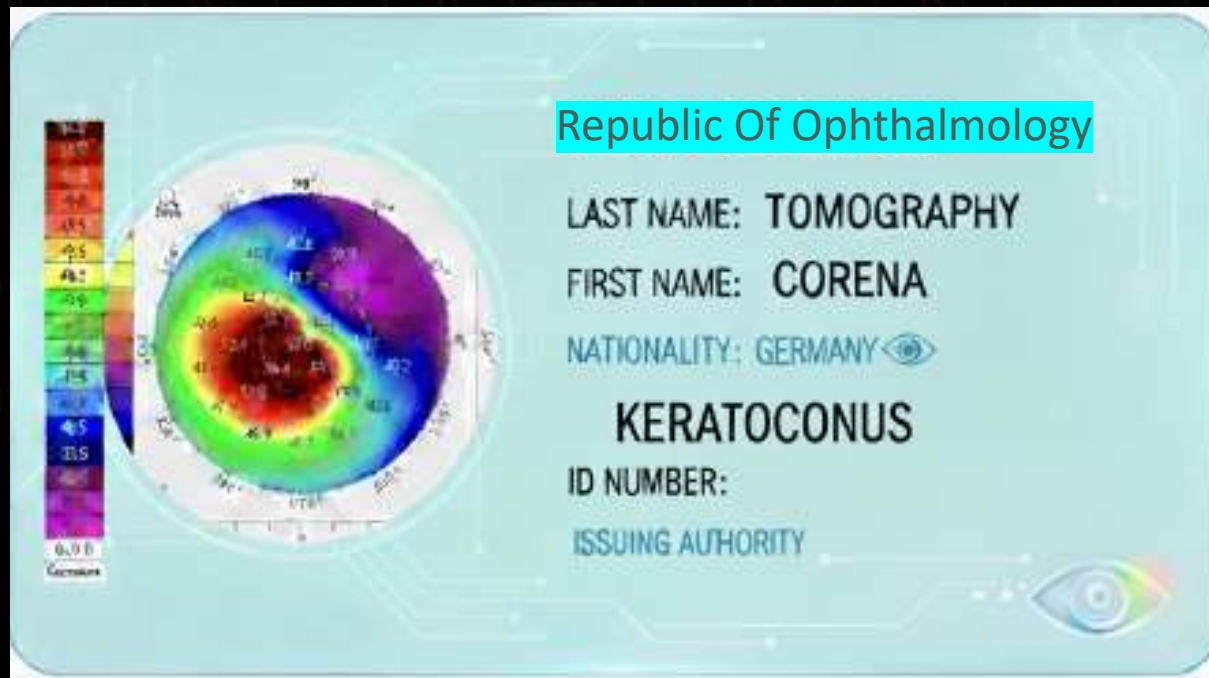
Take Home Message

Dunning-Kruger effect



- The more knowledge you get, the better decision you can make
- Decision quality is directly proportional to the depth of knowledge.
- The acquisition of reliable knowledge refines judgment and optimizes decision outcomes.

Identity



Personality



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Take home message

- Multimodal Corneal Imaging including Biomechanical assessment and epithelial mapping is essential to increase sensitivity and specificity of the ectasia diagnosis and avoid post LVC Ectasia

Thank you

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