



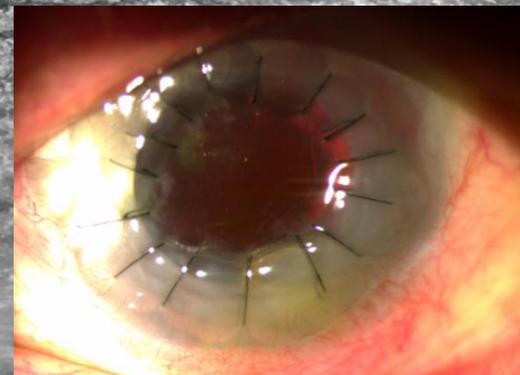
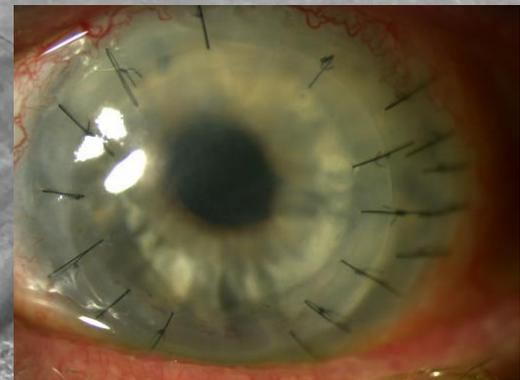
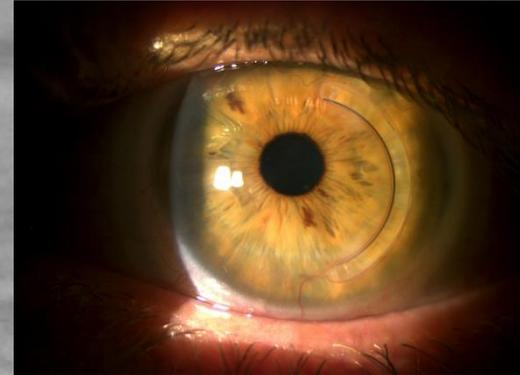
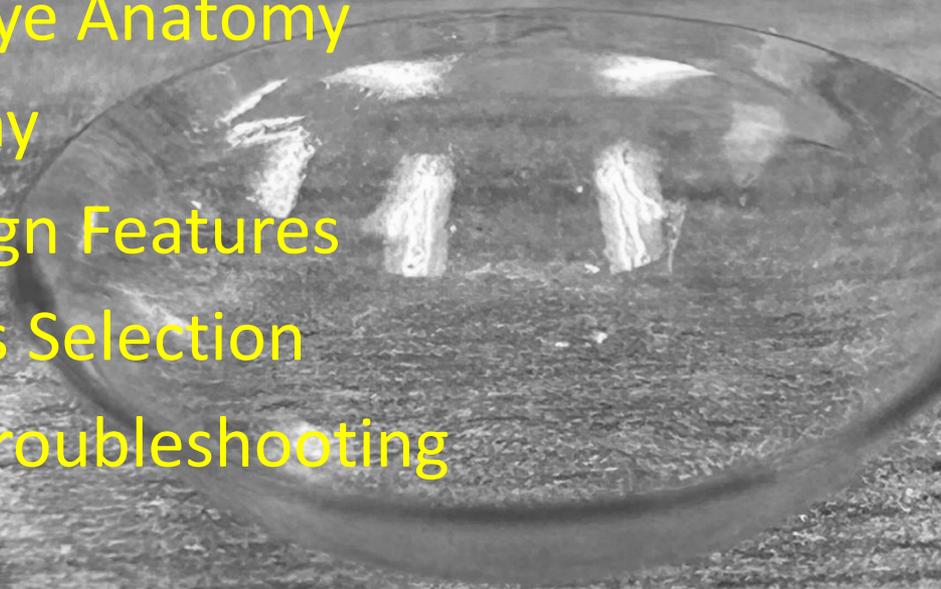
Streamlining the fit:

~Smarter scleral lens selections~

Julie Ott DeKinder, O.D. FAAO, FSLs
Diplomate, CCLRT
Clinical Professor

Overview

- Anterior Eye Anatomy
- Topography
- Basic Design Features
- Initial Lens Selection
- Tips and Troubleshooting



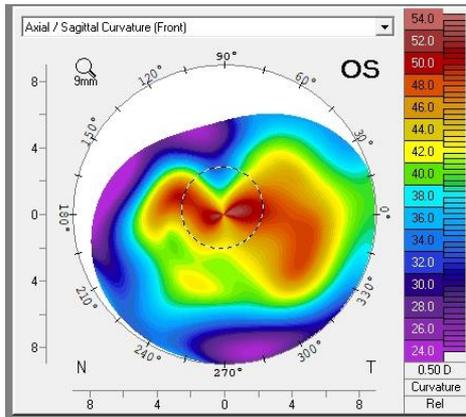
My goals for each of you

- Work Smarter not Harder
- One and Done
 - Exceptions: corneal touch
- Anytime, Anyplace

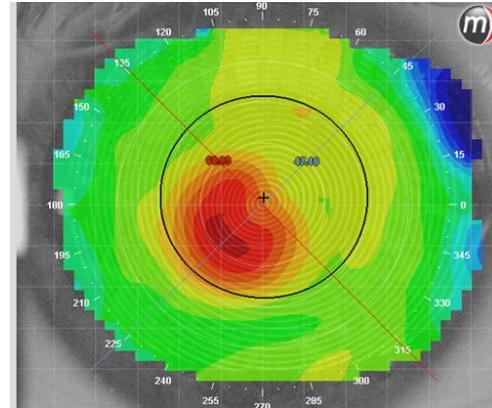
Initial Tips for Success

- Mini-scleral designs
 - I prefer 15.8-16.5mm diameter range
- Key to success is: Peripheral Lens Alignment
 - Always start with a toric lens design
 - Evaluate with WHITE LIGHT
- Be patient before making changes

Corneal Shape



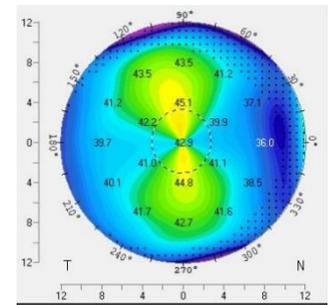
PROLATE



- Lens Design

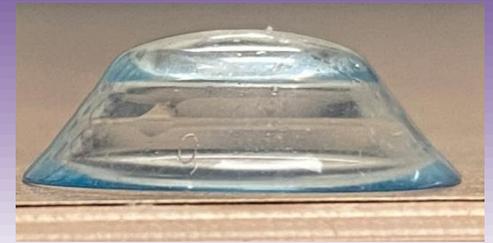
- Steeper back optic zone radius

- Flatter peripheral curves that flattening toward periphery
- Ectasia, high astigmatism, prolate grafts

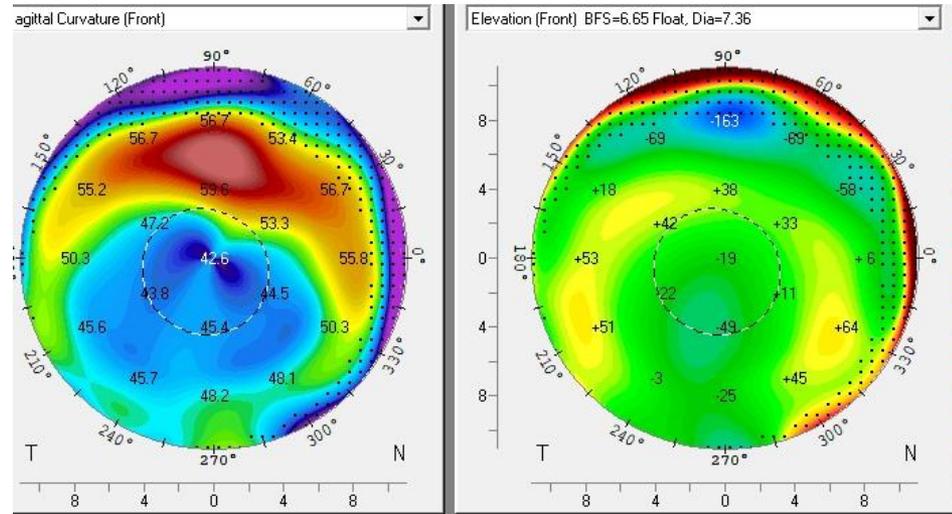
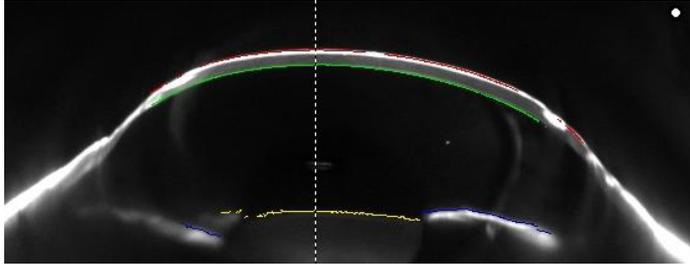


HIGH CORNEAL TORICITY

Corneal Shape



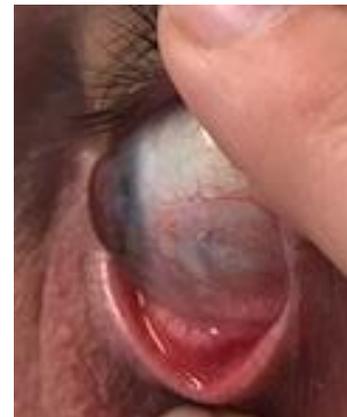
OBLATE



- Lens Design

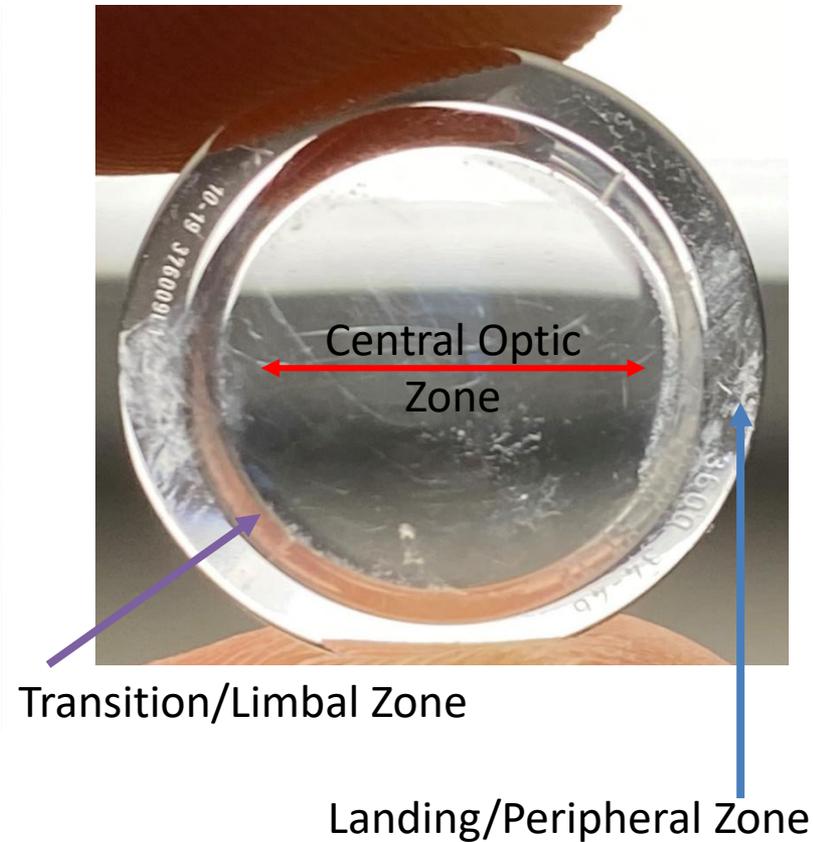
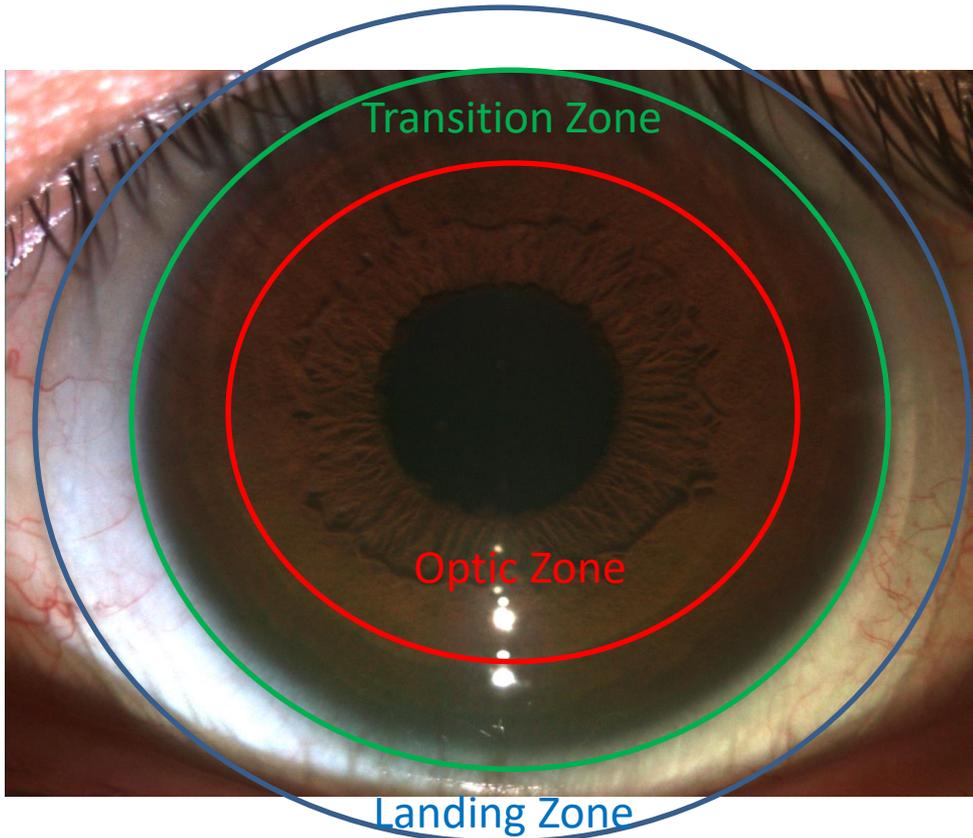
- back optic zone radius is flatter than adjacent peripheral curve

- Steeper secondary curve: “reverse geometry”
- Flatter central cornea compared to periphery
- Post refractive surgery, RK, peripheral ectasias oblate grafts



Spherical Lens

- Concentric symmetrical (spherical) scleral lens



Reverse Geometry Design

Reverse Geometry

- Secondary curve is *steeper* than the lens base curve
 - Allows for clearance over the limbal area and adjustment of sagittal height
 - Good for Oblate corneas
 - Adjust the lens vault without changing the base curve

BASE CURVE	AXIS	SPH	Cyl	AXIS	DIAMETER	MATERIAL LOT # / MFR	
7.50 / 7.50	0	-1.50	-1.00	5	15.00	T014953	
Back optical diameter		6.60	2 Secondary zone radius	6.62	2 Zone Width	1.70	
Intermediate zone radius	8.70	3 Intermediate radius	8.70	3 Zone Width	0.90		
Intermediate zone radius	12.75	4 Intermediate radius	11.75	4 Zone Width	0.50		
Peripheral zone radius	14.25	5 Peripheral radius steep	13.25				
D REVERSE							

6D reverse curve lens

Anterior Ocular Surface Anatomy and Shape

Scleral Shape Study

Temporal sclera
is STEEPER

Nasal sclera is
FLATTER

Corneal Toricity

Does not
typically extend
to sclera

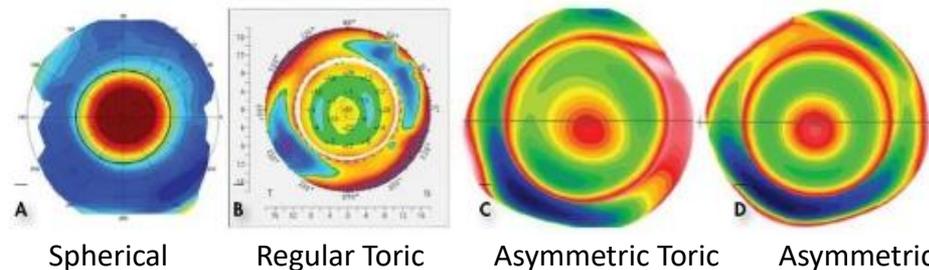
The ocular surface
beyond the cornea
is nonrotationally
symmetrical

Asymmetrical

The entire nasal
portion typically
flatter compared
to the rest

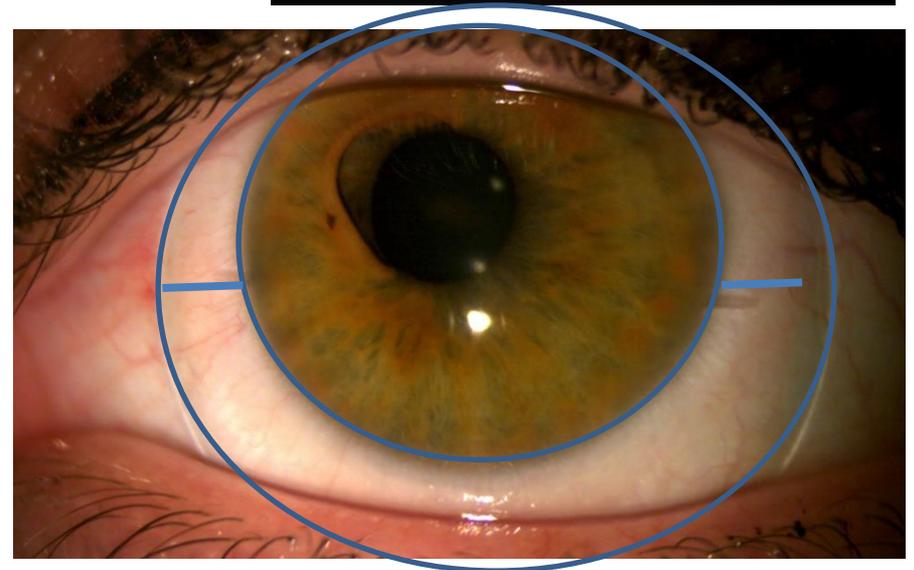
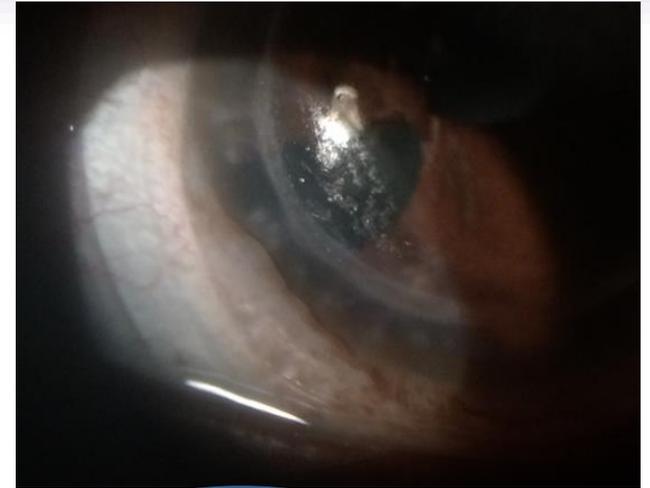
Anterior Ocular Surface Anatomy and Shape

- **Scleral Shape Study Group**
 - Using scleral topography data
 - N=140 eyes
 - Scleral Surface Patterns:
 - 8 spherical
 - 40 toric-regular
 - 57 asymmetric high or low points
 - 35 Periodicity different from 180 degrees



Anterior Ocular Surface Anatomy and Shape

- Clinical Consequences
 - Temporal-Inferior decentration
 - Conjunctival Prolapse
- Clinical Indications
 - Knowledge of scleral and corneal shape will help determine initial lens design

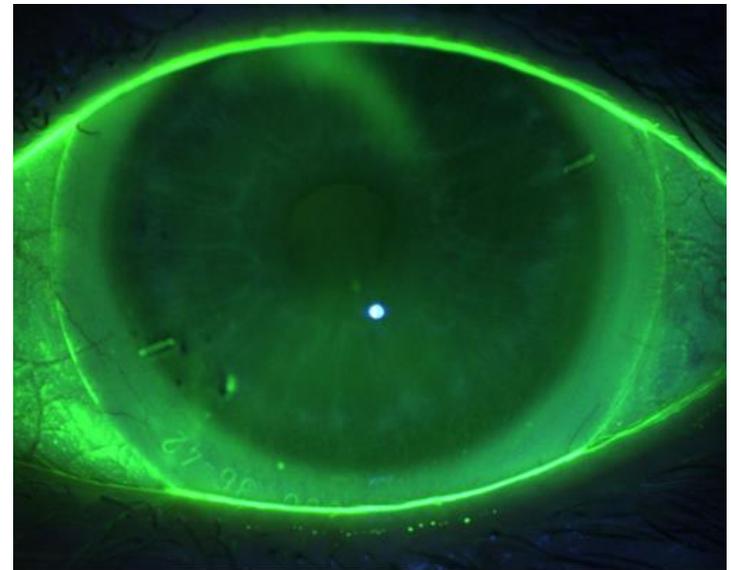
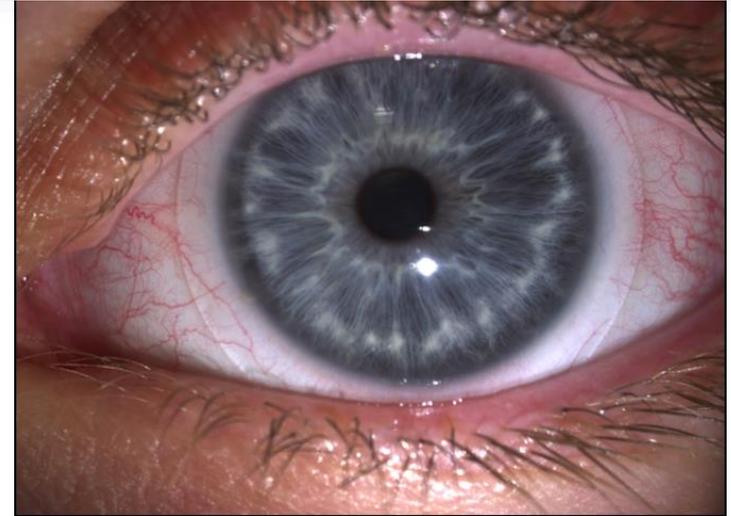
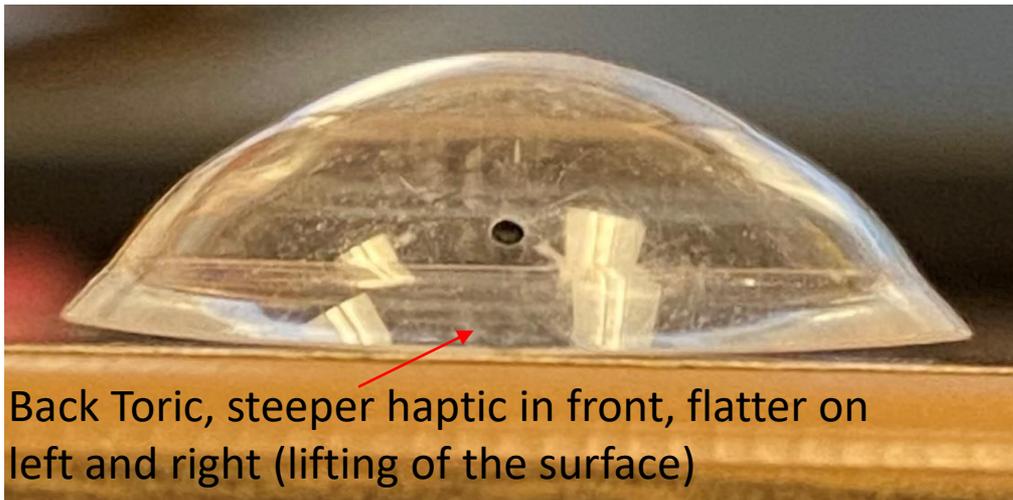
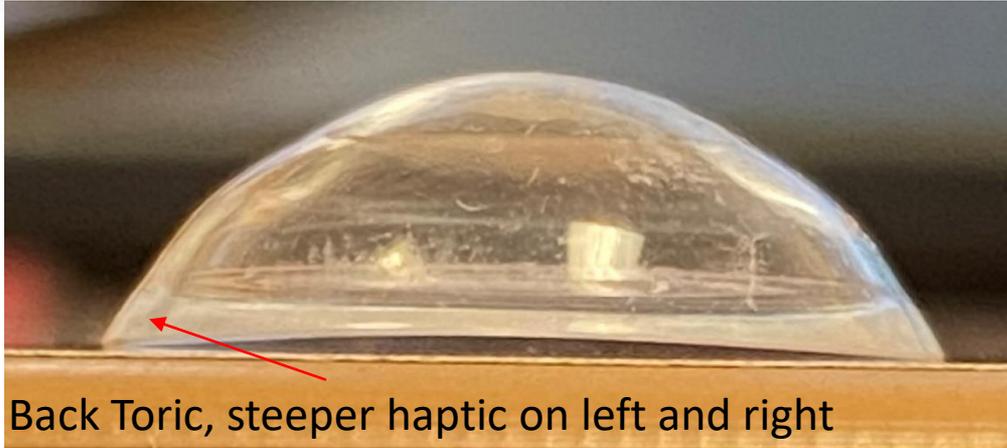


Back Surface Toric Lens Design

- Allows for Lens alignment with sclera
- Will have two BC radii values, 90 degrees apart

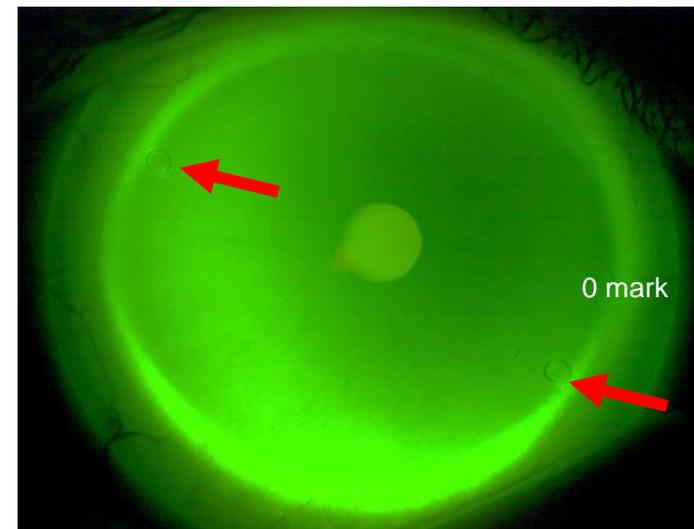
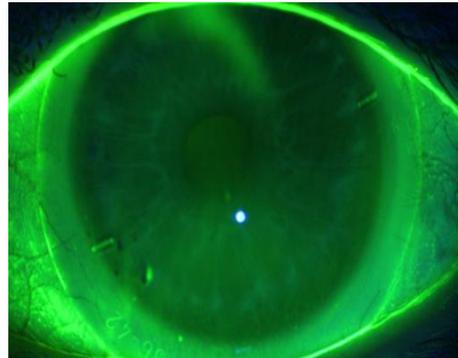
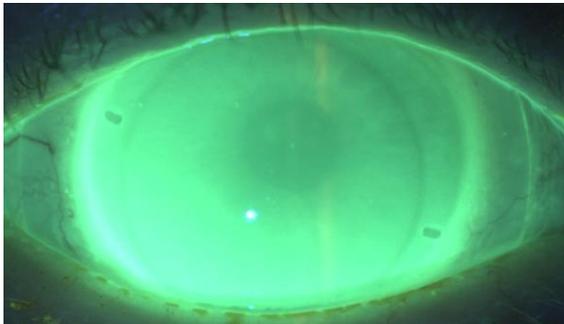


Back Surface Toric Lens Design



Back Surface Toric Lens Design

- Toric Back Surface
 - Allows for more equal pressure distribution
 - Can help center an inferiorly decentered lens
 - Flat and steep meridian
 - Can adjust either independently
 - Flat meridian is typically marked
 - Lens will lock into place



Back Surface Toric Lens Design

- Troubleshooting:

****A well aligned, slightly tight edge is my goal****

- If the edge is flaring away from the eye

- Steepen the periphery by at least 75 to 100 microns
 - This would be around “3 steps” depending on manufacturer

- If the edge is aligned with the eye

- Steepen the periphery by 25-50 microns
 - This would be 1 to 2 steps

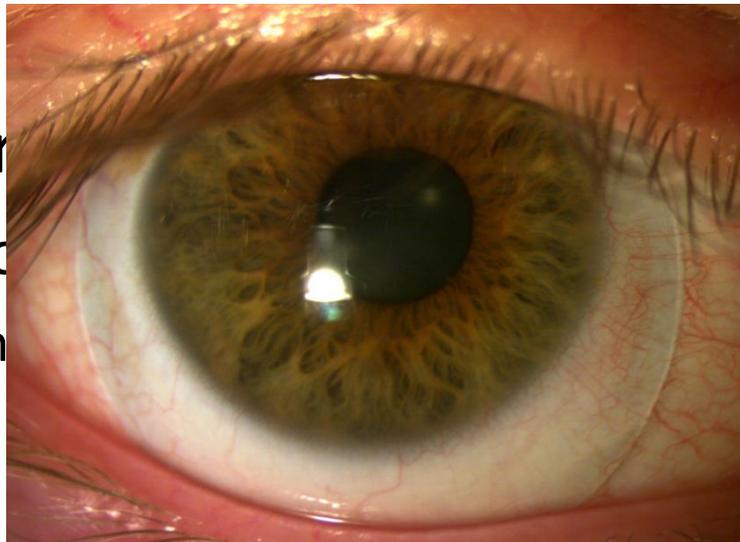
- If the edge is diving gently into the eye or “hugging the eye”

- Congratulations! You have my desired edge to eye relationship!

Fitting Basics

using the anatomy and shape

- **Prolate** Cornea with **Toric** sclera
 - Traditional geometry; prolate lens with toric periphery
- **Oblate** Cornea with **Toric** sclera
 - Reverse geometry/oblate lens with toric periphery
- Highly Toric cornea
 - Traditional geometry
 - Watch for lens toric periphery
 - Watch for lens corneal clearance



Fitting Basics

Diagnostic

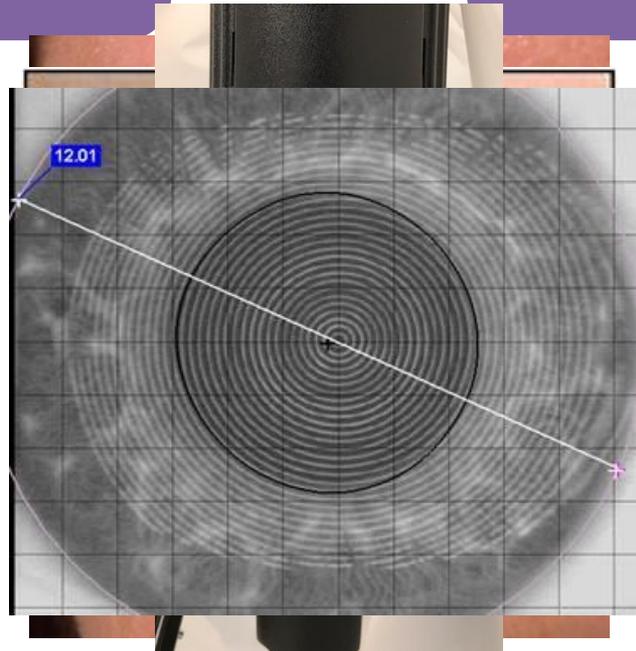
Step 1: Lens Diameter

- HVID
- <12mm
 - select **16.0 mm or smaller** lens
- >12mm
 - Select a **16.0 mm or larger** lens



Considerations:

- Small palpebral fissure
- Low corneal sagittal height
- Difficulty with large lens application
- Conjunctival irregularities



Fitting Basics

Diagnostic

Step 2: Lens Design

- Oblate
- Prolate

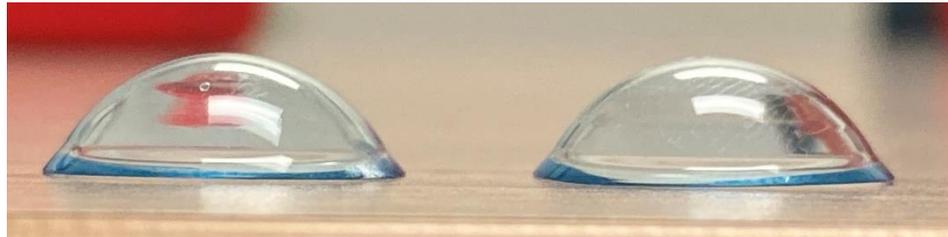


Step 3: Landing zone

- Spherical
- Toric

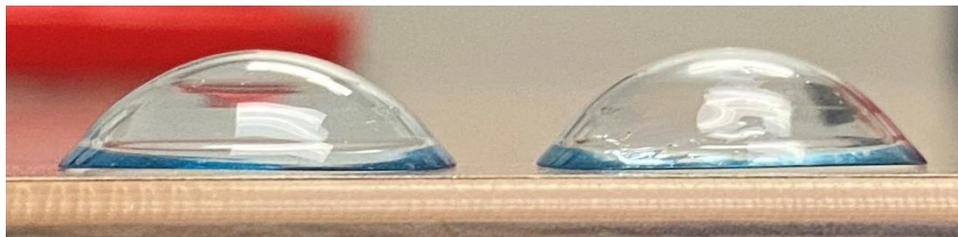
Prolate

Oblate



sag:4410; bc 46.00D

sag: 4510; bc 42.00D



sag:4950; bc 50.00D

sag: 5080; bc 46.00D

Fitting Basics

Diagnostic

Step 4: Base Curve Determination

1. Manufacturer guidelines for the selected lens design

2. Select an initial base curve that is flatter than the flat k value

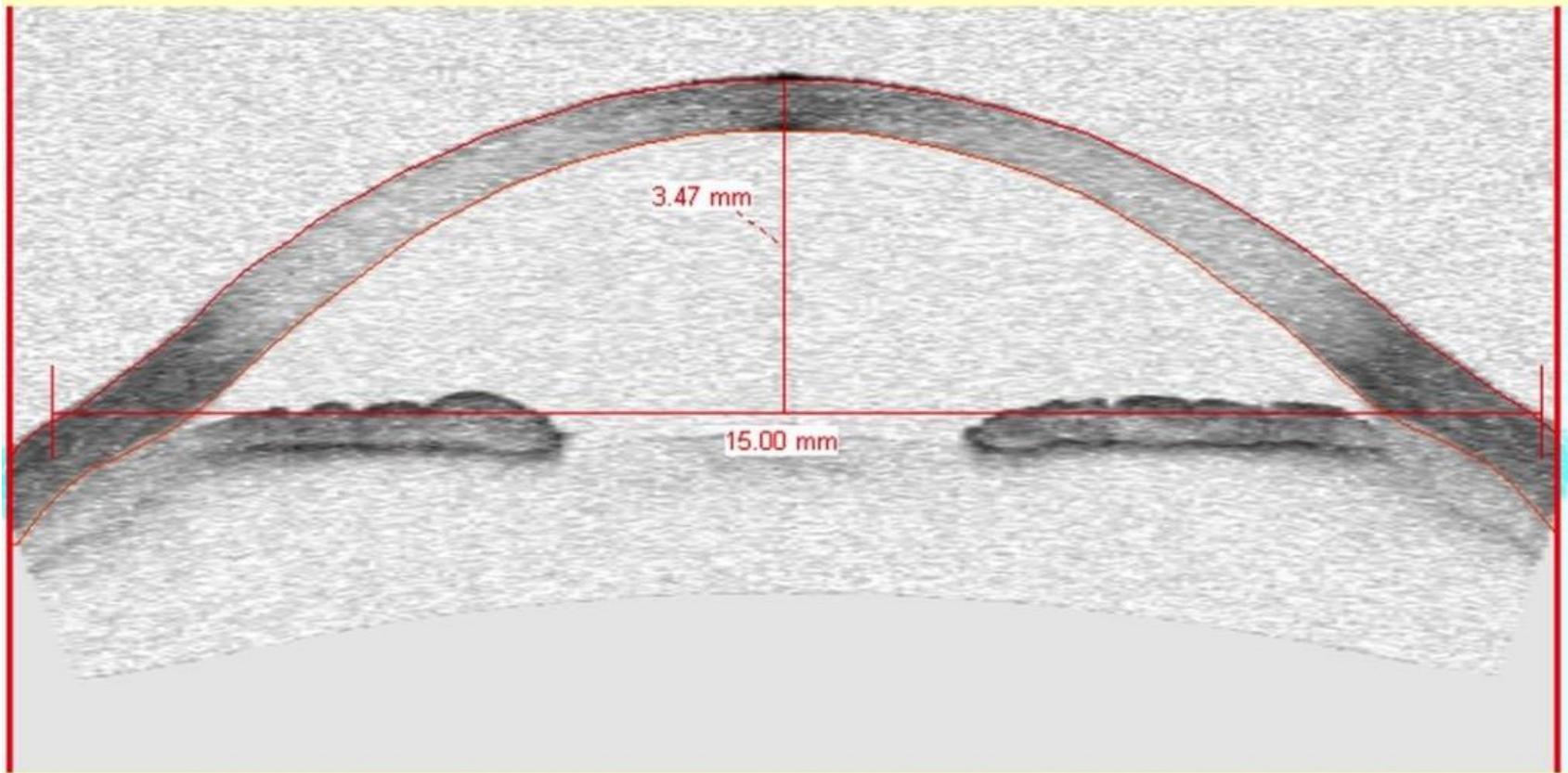
3. Anterior OCT

- Use 15 mm chord OCT to measure sagittal depth
- Add desired central clearance to sagittal depth for initial lens selection
- Increase measured sagittal depth 400 microns for each 1mm increase in lens diameter

Fitting Basics

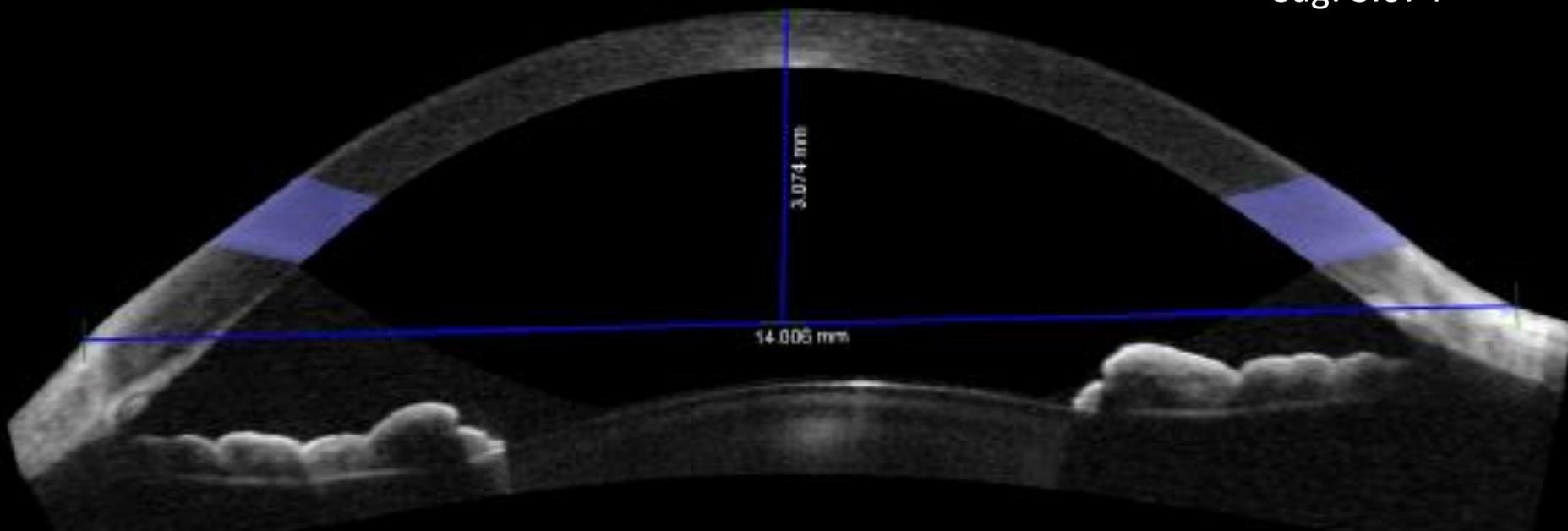
Diagnostic

OCT for Base Curve Determination





OD
Chord: 14.0
Sag: 3.074

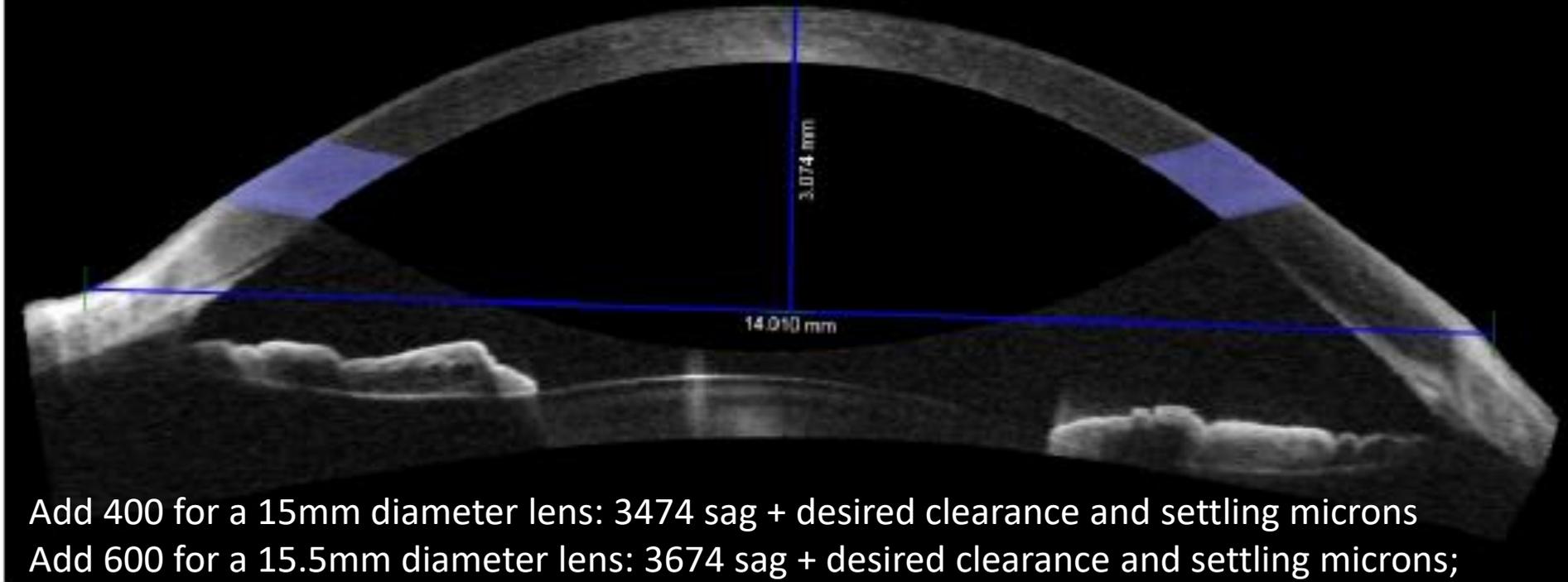


Add 400 for a 15mm diameter lens: 3474 sag + desired clearance and settling microns
Add 600 for a 15.5mm diameter lens: 3674 sag + desired clearance and settling microns;
15.5mm = ~3974 sag

Best fit lens: 8.65 base curve; 15.50 diameter, 3400 sag

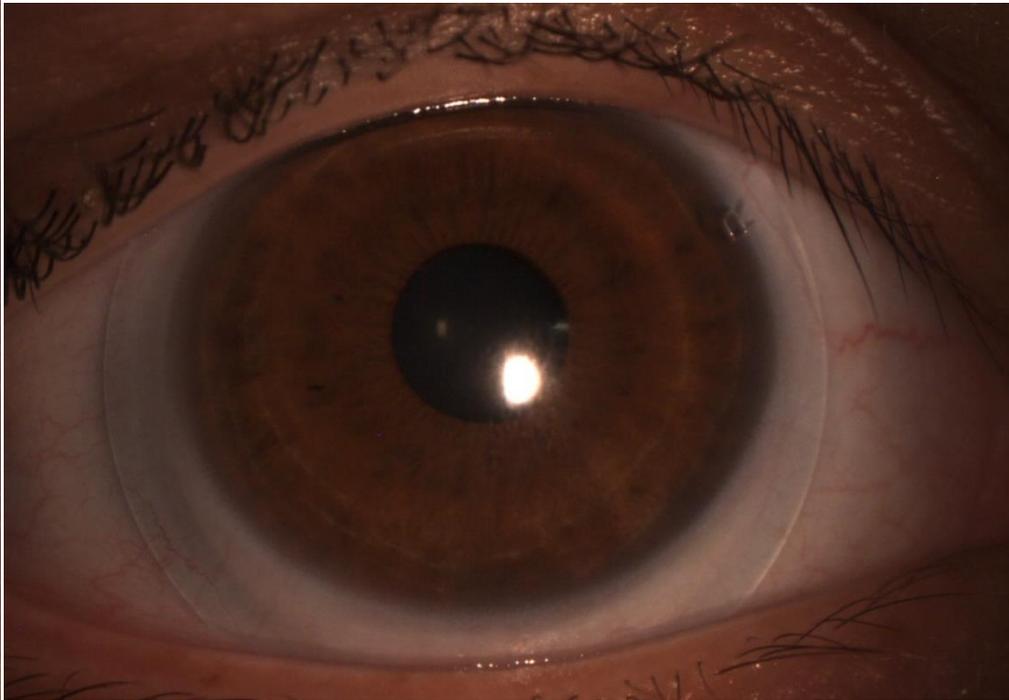
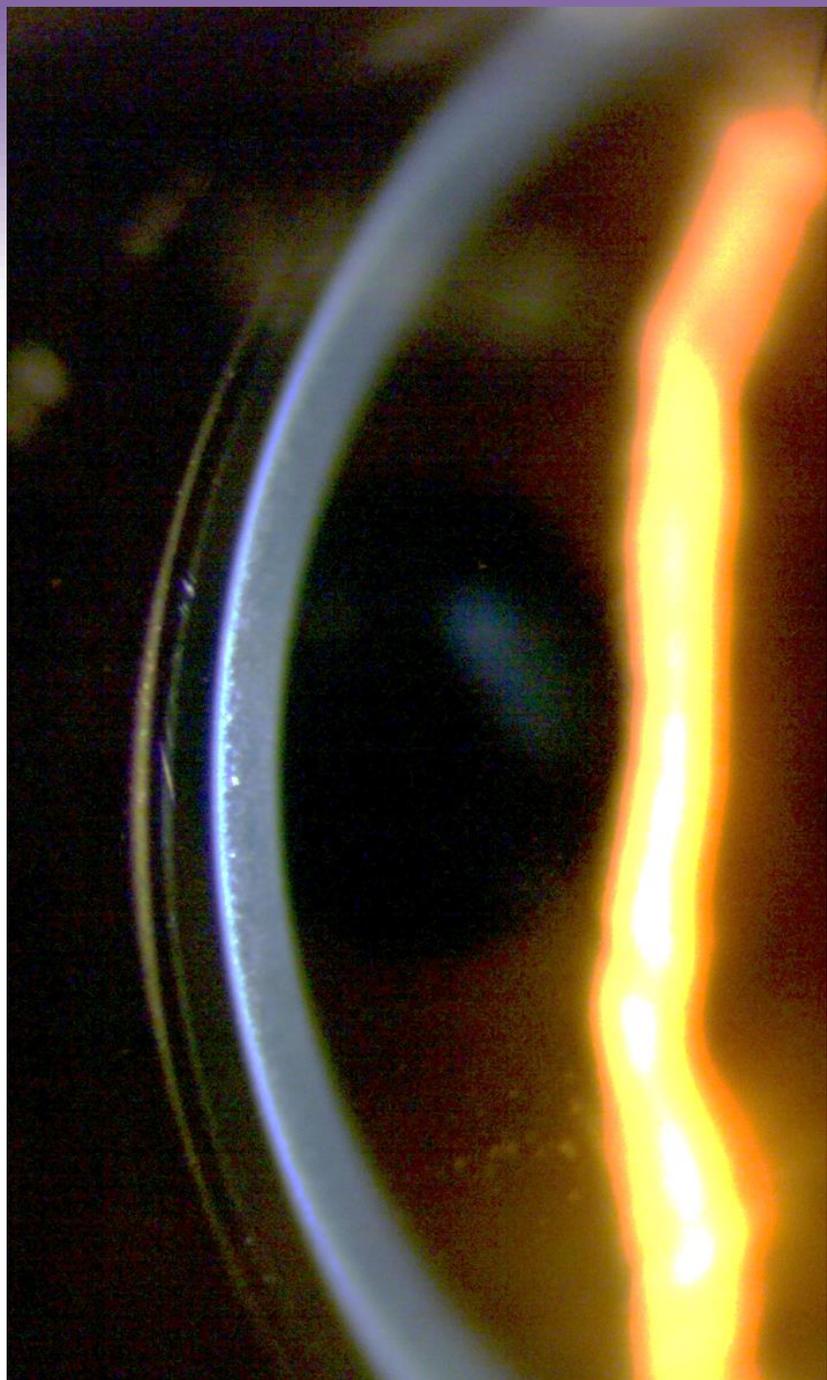


OS
Chord: 14.0
Sag: 3.074



Add 400 for a 15mm diameter lens: 3474 sag + desired clearance and settling microns
Add 600 for a 15.5mm diameter lens: 3674 sag + desired clearance and settling microns;
15.5mm = ~3974 sag

Best fit lens: 8.65 base curve; 15.50 diameter, 3400 sag

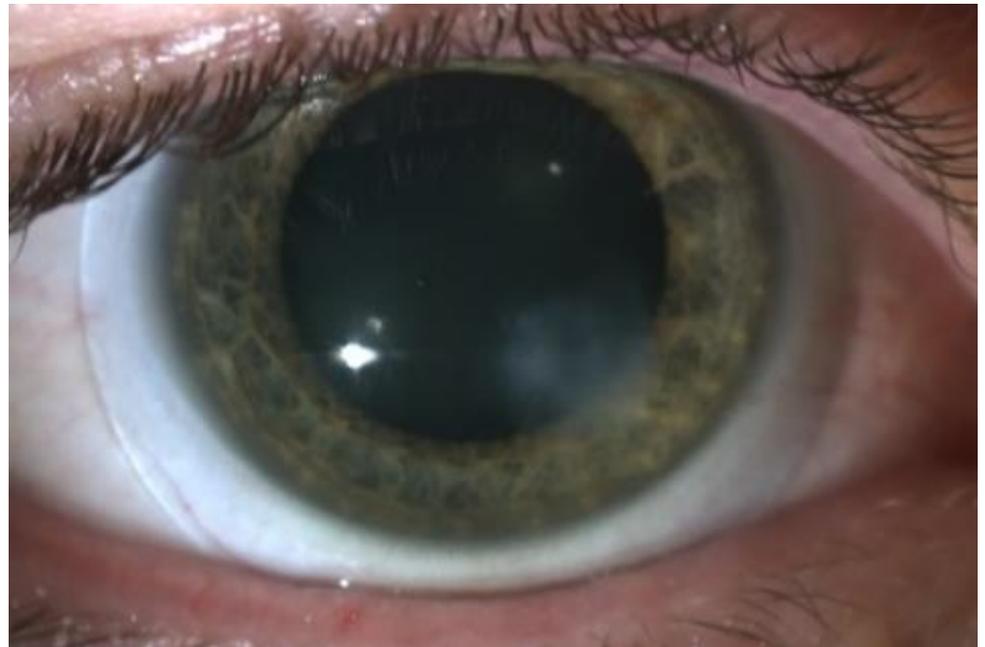


Fitting Tips based on Ocular Condition



Corneal Scarring

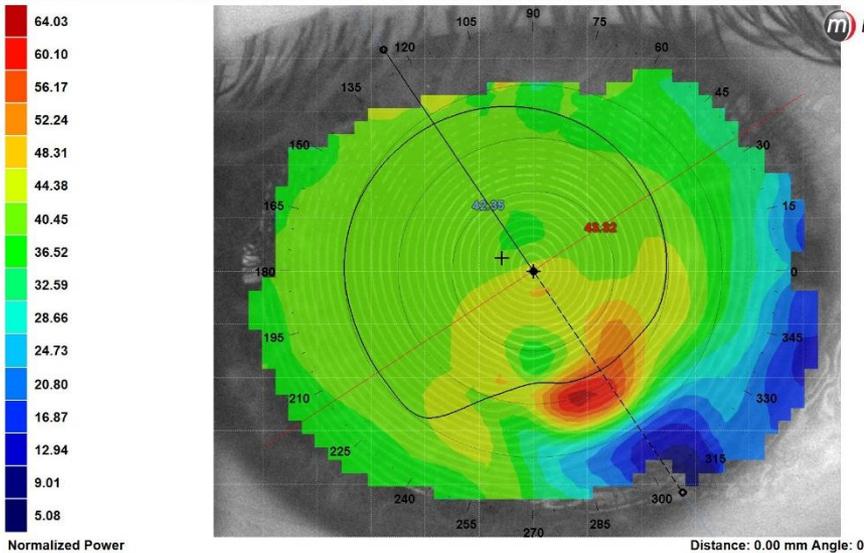
- May be elevated or depressed
- Prolate Design/Mini-scleral
- Minimize clearance over the scar



Corneal Scarring

- Prolate, Mini-scleral

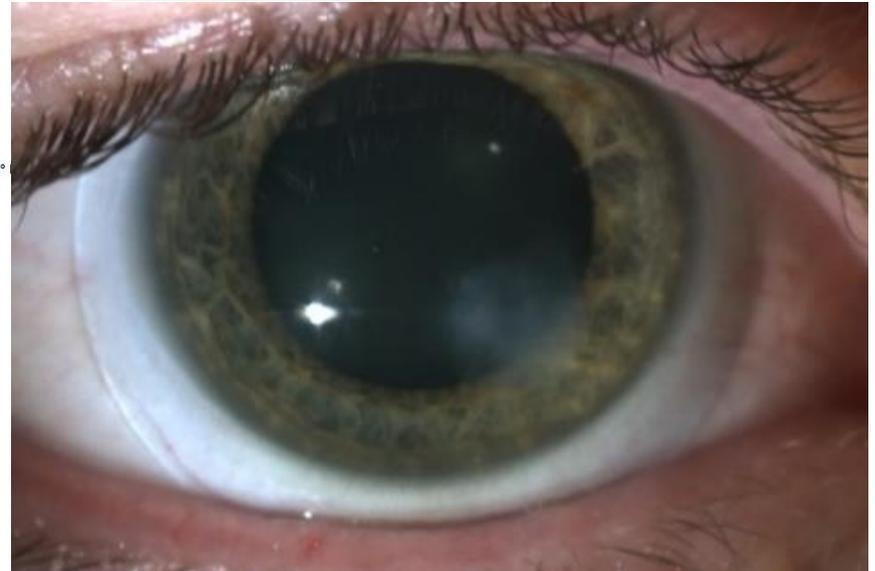
02/23/2016 12:58:17 PM; Right - Tangential Power



medmont

Flat K	42.35 D @ 124 °
Steep K	43.32 D @ 34 °
ΔK	0.97 D
Flat e^2	0.37 @ 124 °
Steep e^2	0.55 @ 34 °
IS Index	3.71 D
SAI	6.99
SRI	1.52
Pupil: Width	6.0 mm
Pupil: Area	26.5 mm ²
HVID	mm
TFSQ	
TFSQ Central	
Sag Differential	um
Flat e	0.63
Steep e	0.76

- 8.4 (40D) base curve
- 16 mm diameter
- 3400 sag



Corneal Scarring



Neovascularization:

- Maximize oxygen with lens
- Prescribe Steroid
- If neovascularization progresses – refer for Laser Treatment

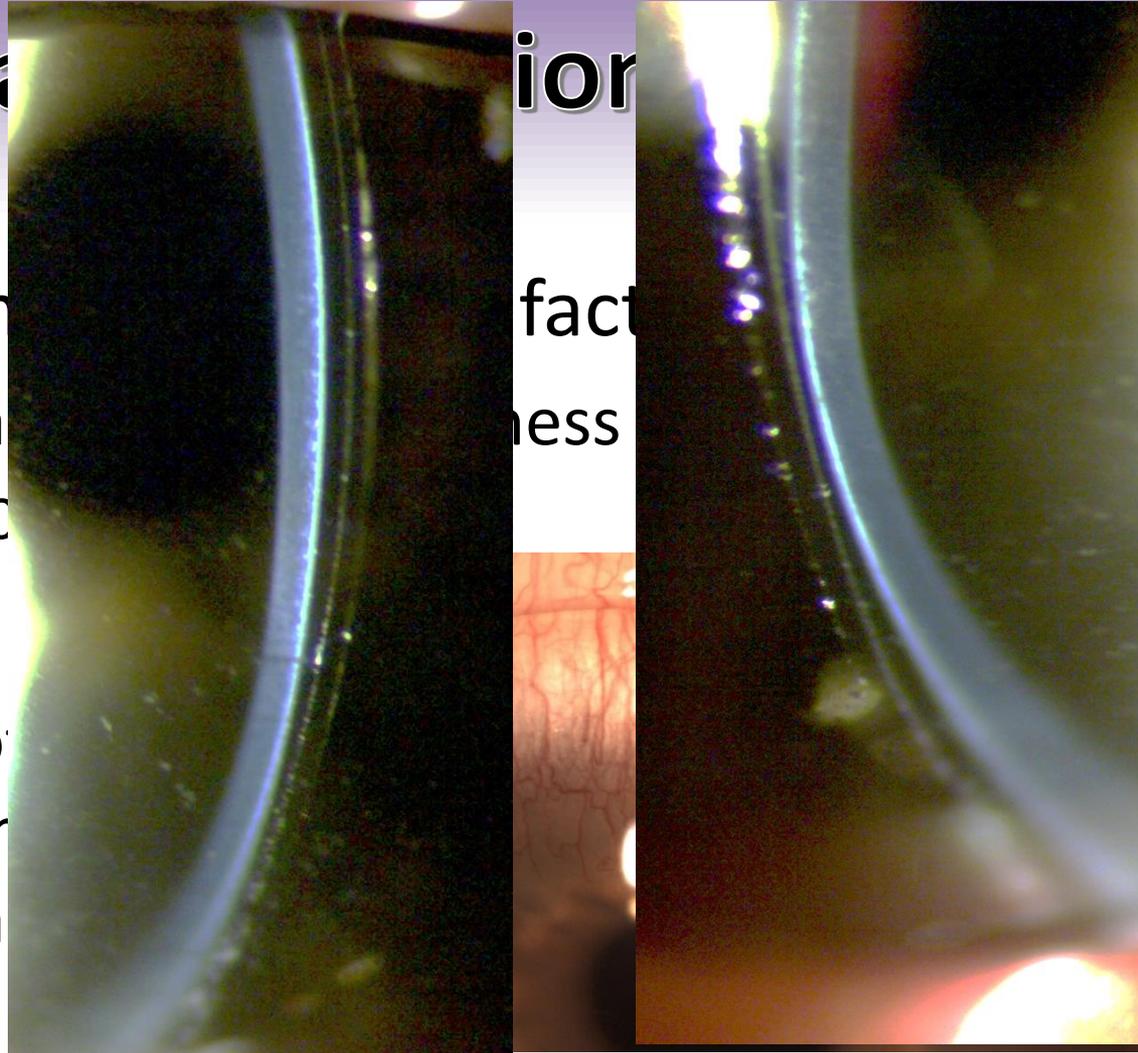


Neovascularization

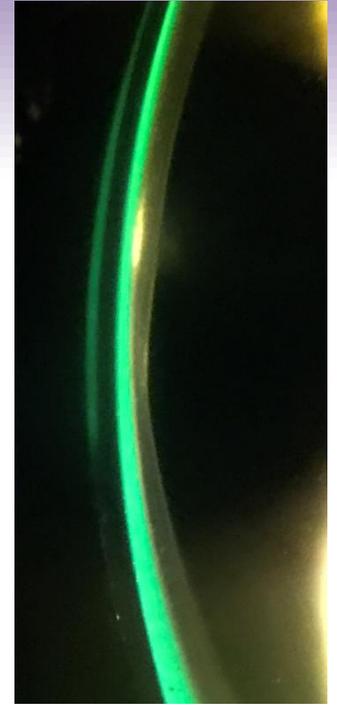
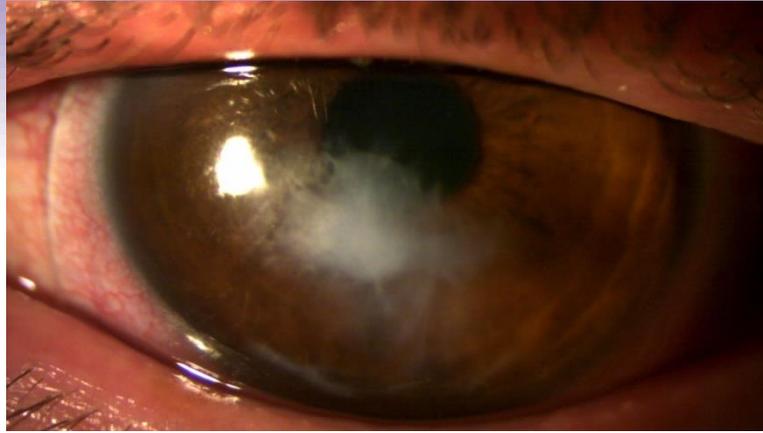
- Lens Material
 - High(est) Dk lens material; plasma or hydra-PEG
 - Considerably thicker when compared to corneal GP
 - 250 microns to 500 microns
 - Optimum Extreme, Menicon Z
- Increasing Oxygen transmissibility
 - 1. high Dk material ($Dk > 125$)
 - 2. minimal tear clearance behind the lens (<200)
 - 3. Reduced center thickness of the lens ($<.250$)

Neovascularization

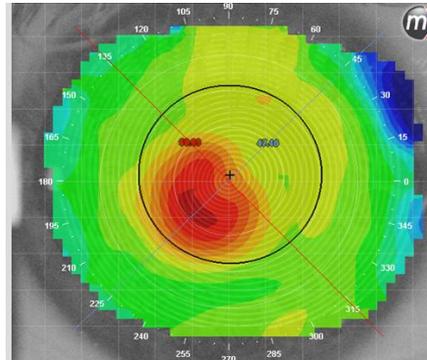
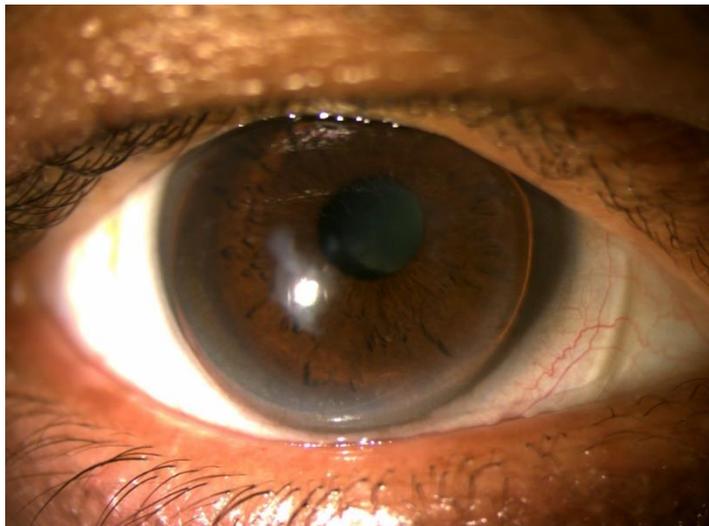
- Tear Film is the most important factor in lens success
 - Minimize the tear film evaporation
 - Recommend 200µm
- Lens thickness
 - Variations did not affect the corneal edema under closed eye to a significant amount



Keratoconus



- Prolate Design/Mini-Scleral
- Scarring may impact visual outcome



OCULUS - PENTACAM 4 Maps Selectable

Last Name:

First Name:

ID:

Date of Birth:

Exam Date:

Exam Info:

[Redacted patient information]



Cornea Front

Rf: 5.81 mm K1: 58.1 D

Rs: 5.62 mm K2: 60.1 D

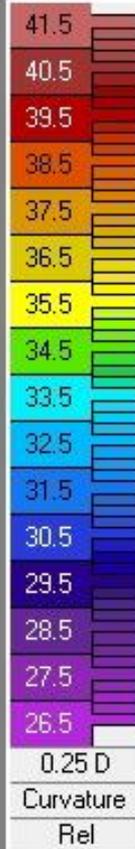
Rm: 5.71 mm Km: 59.1 D

QS: **Align. !** Axis: (steep) 23.2° Astig: 2.0 D

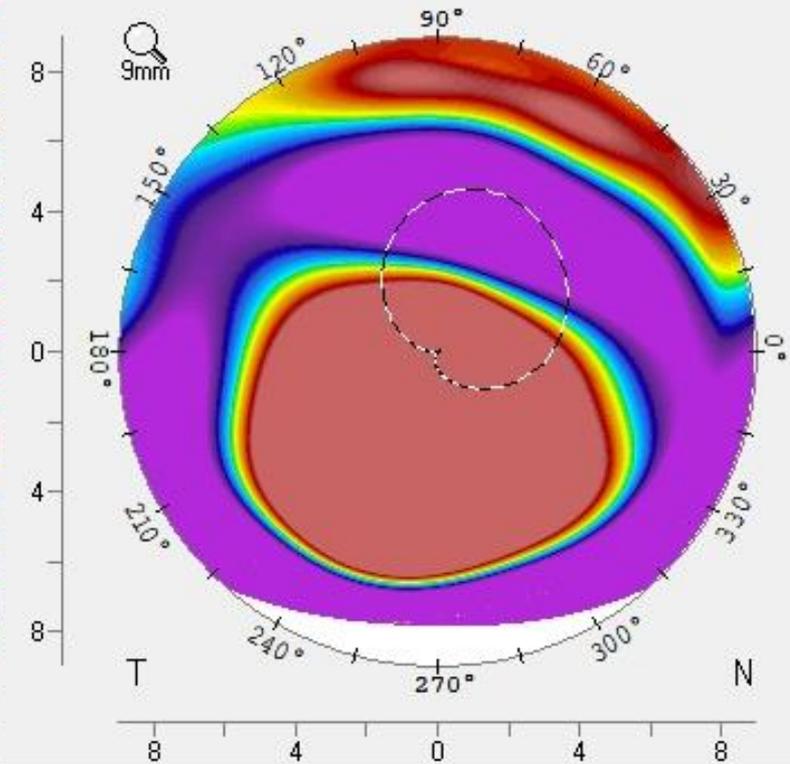
ecc: (8mm) 1.41 Rper: 8.04 mm Rmin: 4.67 mm

Cornea Back

Rf: 4.97 mm K1: -8.1 D



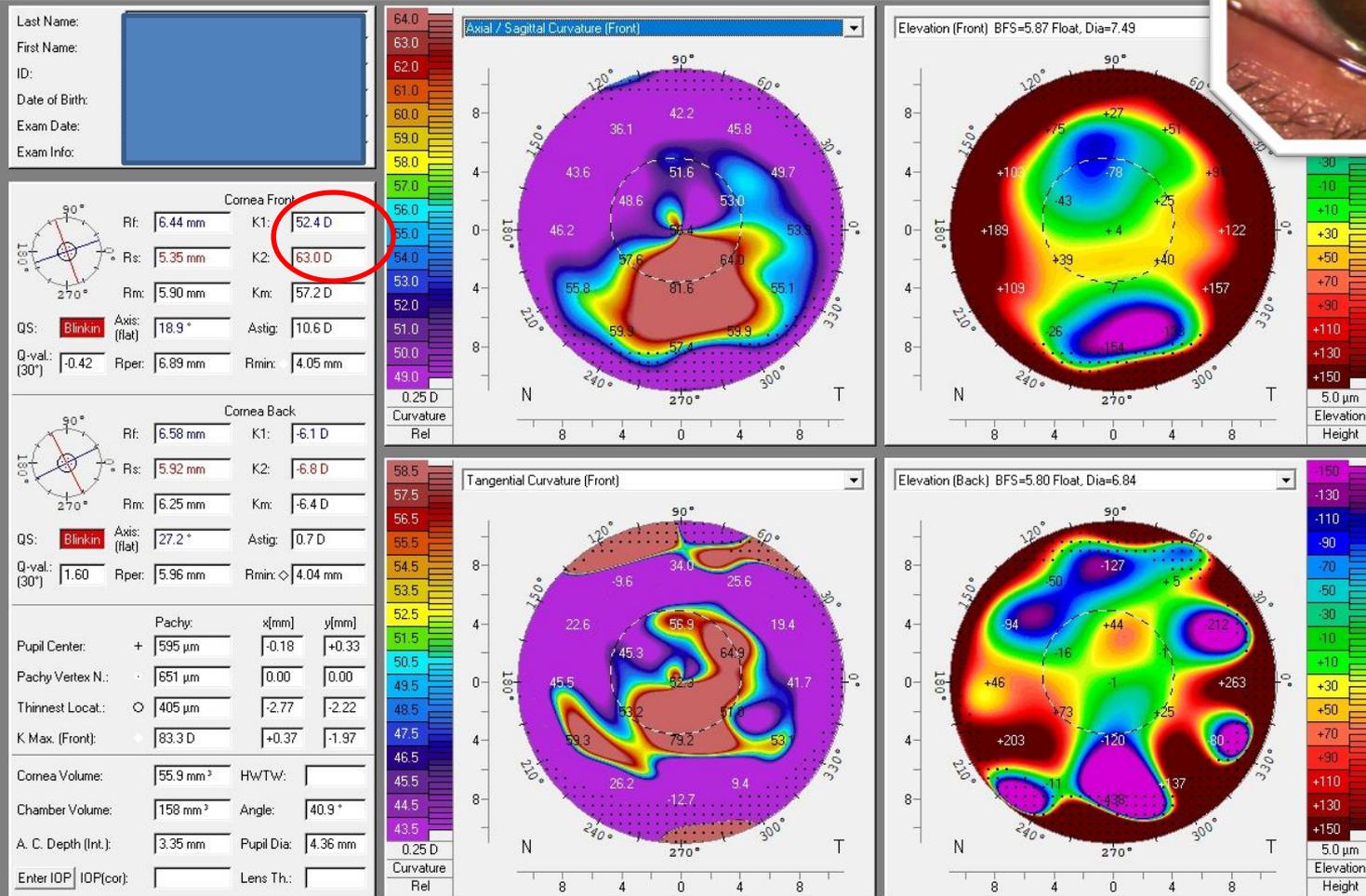
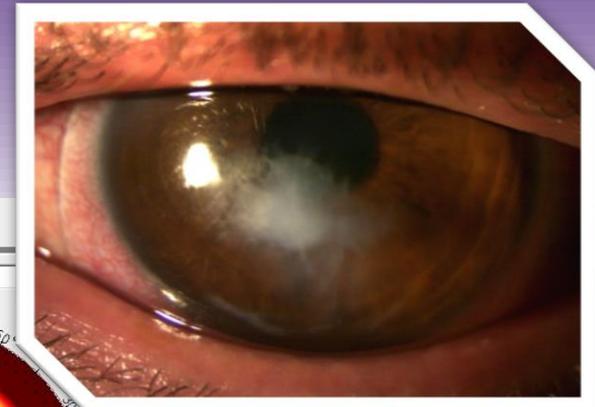
Tangential Curvature (Front)



Kmax:72.2

One and Done

OCULUS - PENTACAM 4 Maps Selectable



Step 1:
Prolate or Oblate

Step 2:
Diameter

Step 3:
Base Curve
selection

Initial Lens: 48.00 base curve, 4670 sag, 15.8 diameter

One and Done

Initial Lens: 48.00 base curve, 4670 sag, 15.8 diameter

- And what did my chart notes say.....
 - *central clearance around 200 **with touch** over the inferior scar, lens is inferiorly decentered, edge is flat in the vertical and slightly flat in the horizontal. Marking at 065*
- Plan:
 - Tighten horizontal 1 step and vertical 3 steps; increase central clearance 300 microns
 - Add OR

One and Done

Ordered Lens: 48.00 base curve, 5043 sag, 15.8 diameter

- And what did my chart notes say at lens dispense:
 - minimal clearance, no touch, good edge alignment
 - Lens is well centered on the eye
- Recheck one week, confirm OR and determine if other parameters need adjustment
 - 1 week follow-up: good centration, clearance 260, edge alignment.

OCULUS - PENTACAM 4 Maps Selectable

1.25r15

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

Cornea Front

Rf: 6.14 mm K1: 54.9 D
 Rs: 5.79 mm K2: 58.3 D
 Rm: 5.97 mm Km: 56.6 D

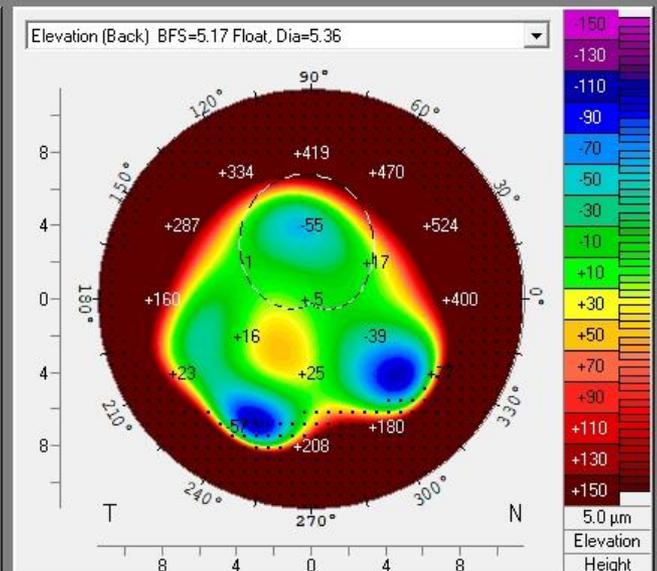
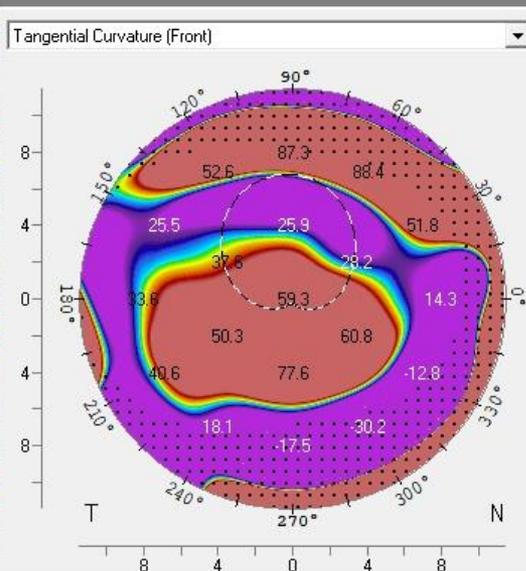
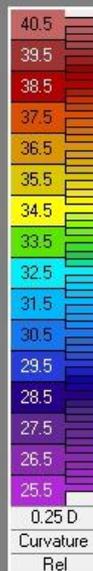
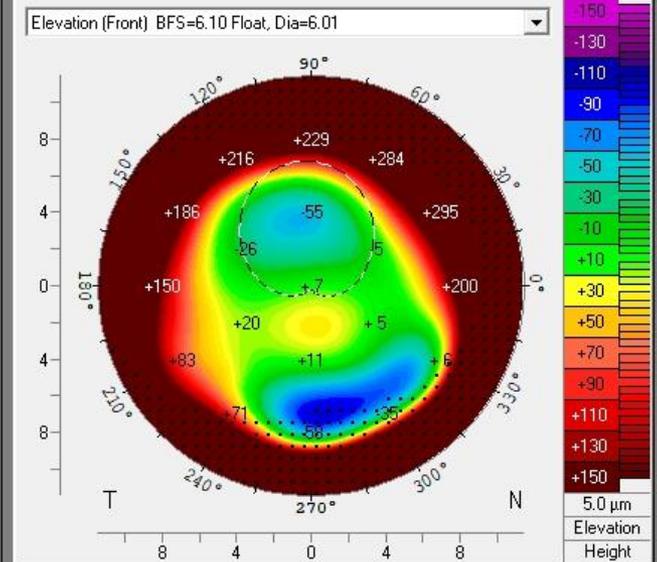
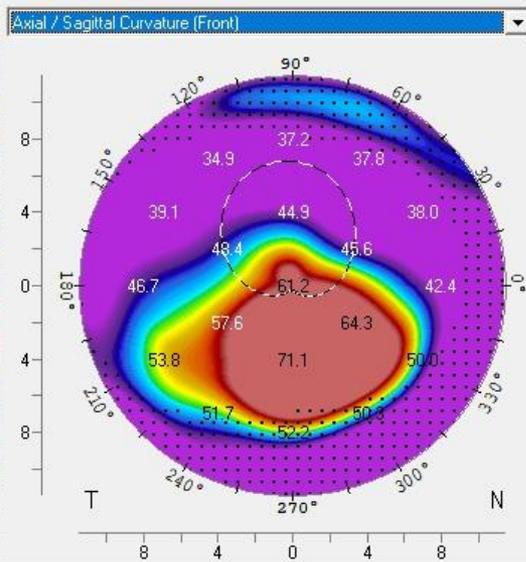
QS: **Blinkin** Axis: (flat) 14.9° Astig: 3.4 D
 Q-val: (-0.63) Rper: 8.01 mm Rmin: 4.66 mm

Cornea Back

Rf: 5.48 mm K1: -7.3 D
 Rs: 4.71 mm K2: -8.5 D
 Rm: 5.10 mm Km: -7.8 D

QS: **Blinkin** Axis: (flat) 33.9° Astig: 1.2 D
 Q-val: (-0.57) Rper: 7.17 mm Rmin: 4.25 mm

Pupil Center:	+	Pachy: 481 μm	x[mm]: -0.11	y[mm]: +1.75
Pachy Vertex N.:	-	426 μm	0.00	0.00
Thinnest Locat.:	○	374 μm	-0.83	-1.72
K Max. (Front):	◆	72.4 D	+0.25	-2.29
Cornea Volume:		48.2 mm ³	HWTW:	
Chamber Volume:		193 mm ³	Angle:	41.2°
A. C. Depth (Int.):		3.45 mm	Pupil Dia:	3.84 mm
Enter IOP	IOP(cor):		Lens Th.:	



Initial Lens: 48.00 base curve, 4670 sag, 15.8 diameter

One and Done

Initial Lens: 48.00 base curve, 4670 sag, 15.8 diameter

- And what did my chart notes say.....
 - *central clearance around 500 microns, lens is inferiorly decentered, edge is flat in the vertical and slightly flat in the horizontal. Markings at 140*
- Plan:
 - tighten horizontal 1 step and vertical 3 steps;
 - 200 microns decrease in central clearance
 - Add OR

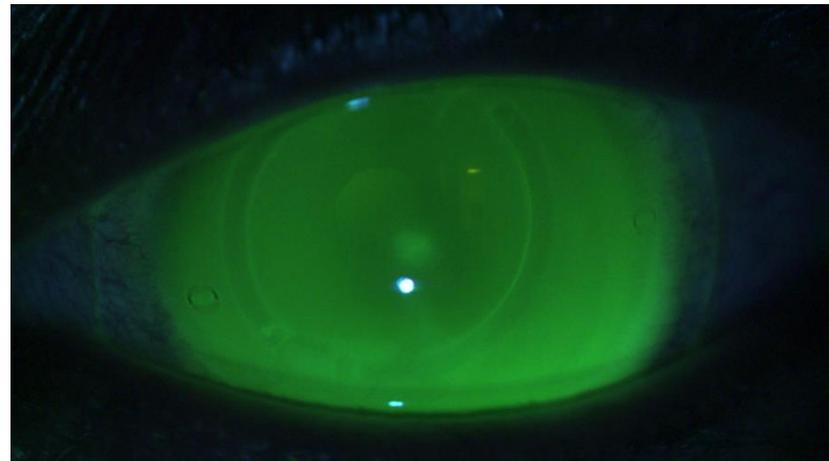
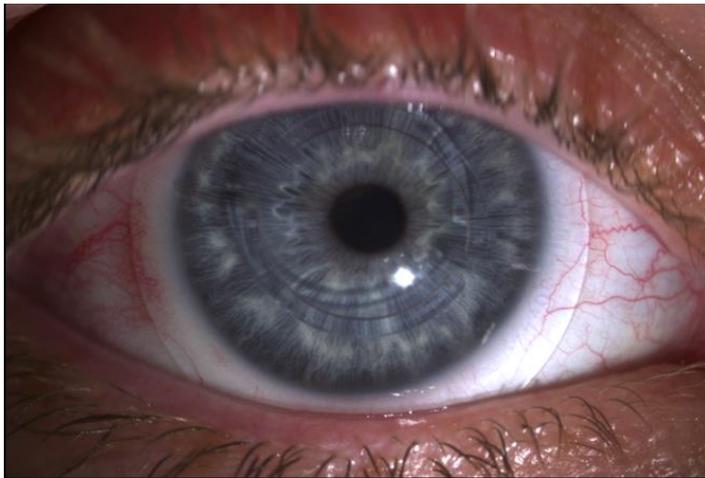
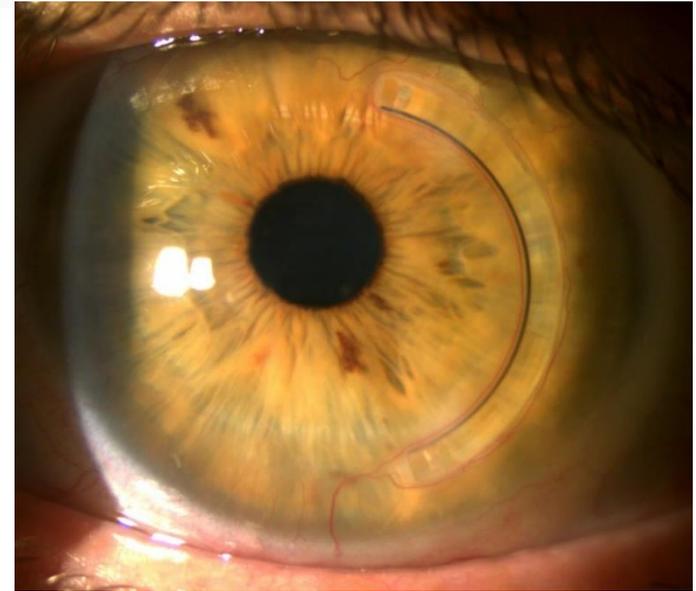
One and Done

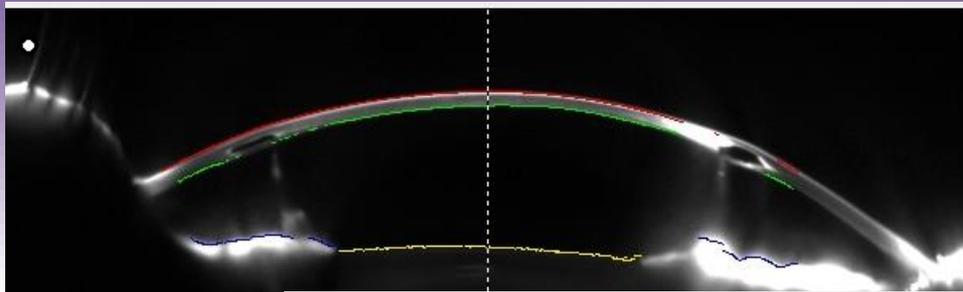
Ordered Lens: 48.00 base curve, 4543 sag, 15.8 diameter

- And what did my chart notes say at lens dispense:
 - minimal clearance, no touch, good edge alignment
 - Lens is well centered on the eye
- Recheck one week, confirm OR and determine if other parameters need adjustment
 - 1 week follow-up: good centration, clearance 280, edge alignment.

Keratoconus with Intacs

- Keratoconus with Intacs
 - Prolate or Oblate/Mini-Scleral
 - Monitor for health





OCULUS - PENTACAM 4 Maps Selectable

1.25r15

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

Cornea Front

Rf: 7.74 mm K1: 43.6 D
 Rs: 7.03 mm K2: 48.0 D
 Rm: 7.39 mm Km: 45.7 D

QS: Data G Axis: 59.9° Astig: 4.4 D
 Q-val: (30°) -0.51 Rper: 8.05 mm Rmin: 6.53 mm

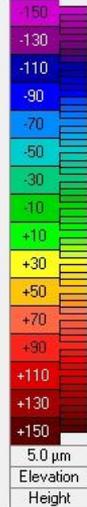
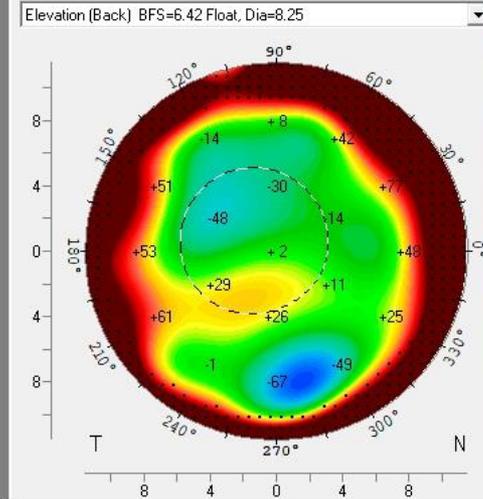
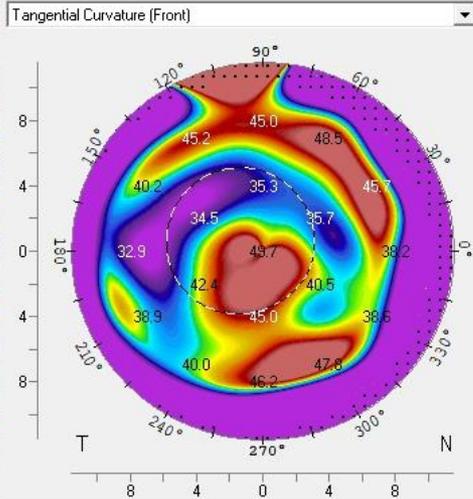
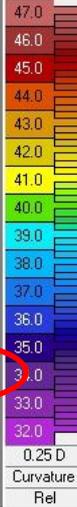
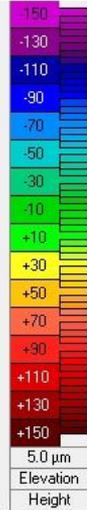
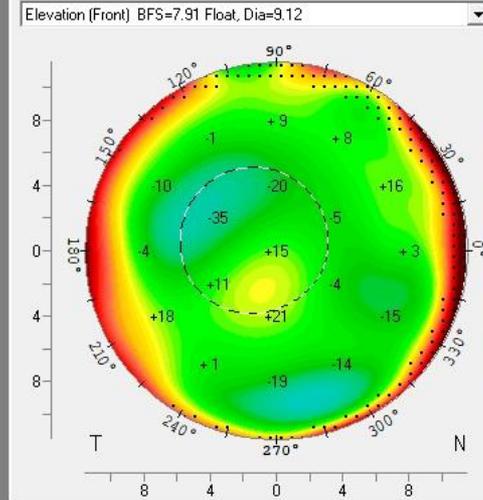
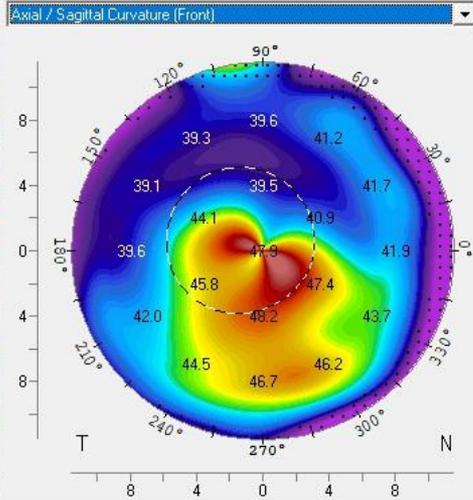
Cornea Back

Rf: 6.74 mm K1: -5.9 D
 Rs: 6.06 mm K2: -6.6 D
 Rm: 6.40 mm Km: -6.2 D

QS: Data G Axis: 61.5° Astig: 0.7 D
 Q-val: (30°) -0.63 Rper: 7.07 mm Rmin: 5.14 mm

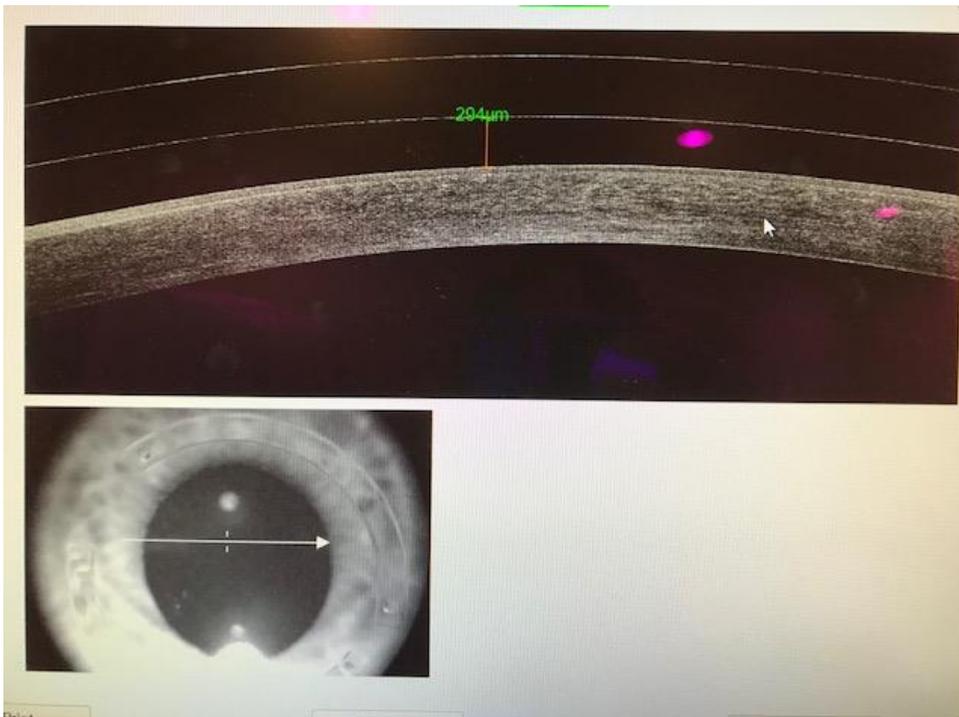
Pupil Center: + 428 μm x[mm] -0.69 y[mm] +0.32
 Pachy Vertex N: - 422 μm 0.00 0.00
 Thinnest Locat.: ○ 404 μm -0.71 -1.09
 K Max. (Front): 51.7 D +0.19 -0.13

Cornea Volume: 49.4 mm³ **AWTW: 12.4 mm**
 Chamber Volume: 222 mm³ Angle: 41.2
 A. C. Depth (Int.): 3.42 mm Pupil Dia: 4.47 mm
 Enter IOP | IOP(cor): Lens Th.:



One and Done

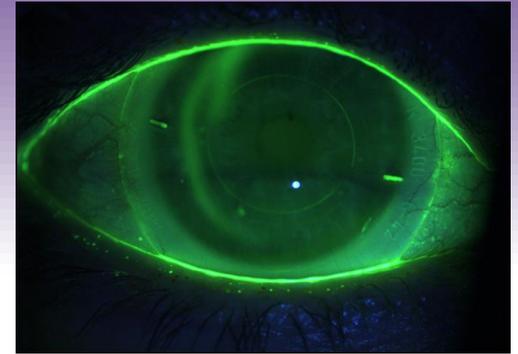
- Based on HVID and lens design selected:
- Prolate, 16.0mm diameter lens
- 8.4 base curve, with 3400 sag, toric periphery



Initial Lens evaluation:
300 microns central clearance
Alignment in periphery
Lens centered on eye
OR -2.25 20/25

Order: OR only change

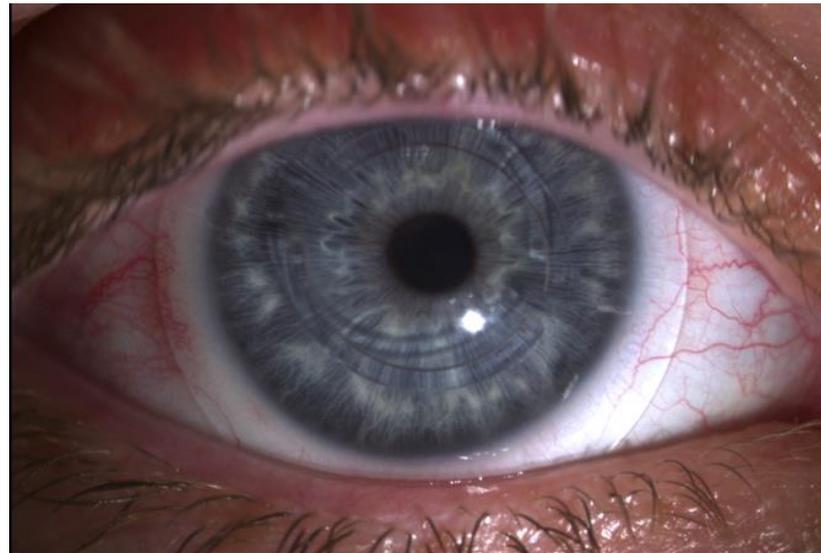
One and Done



- Lens Dispense:
 - OD: 250 microns central clearance (50 at limbus)
 - Markings at 165
 - Alignment in periphery – no blanching or impingement
 - OR pl 20/20

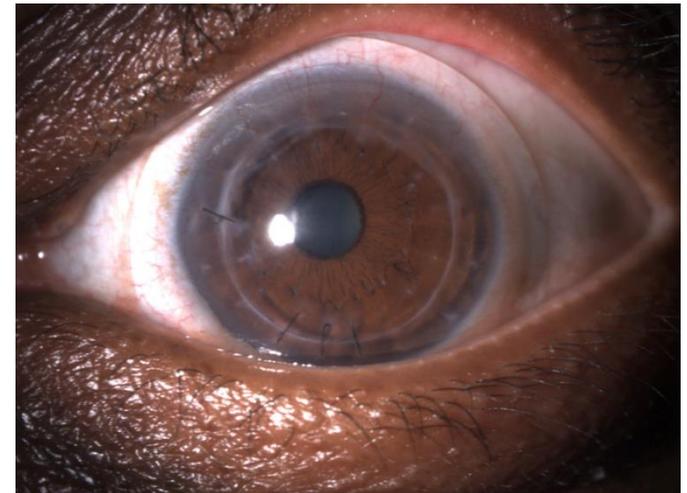
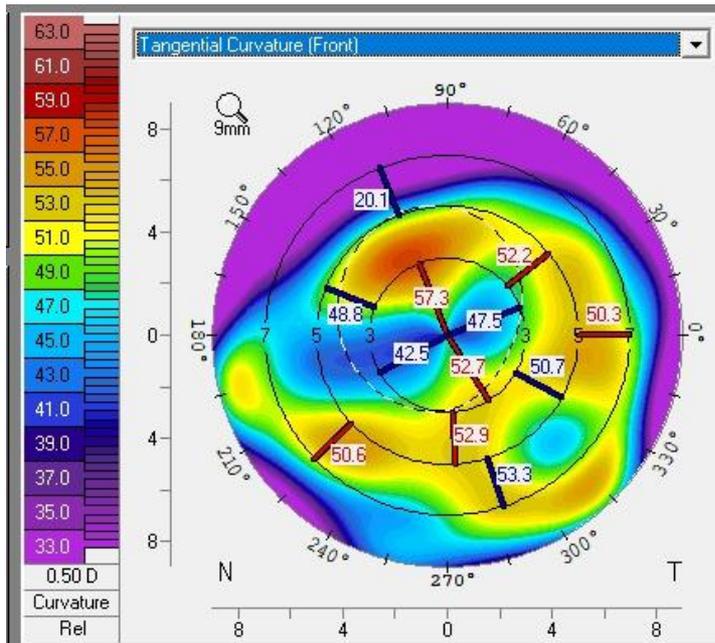
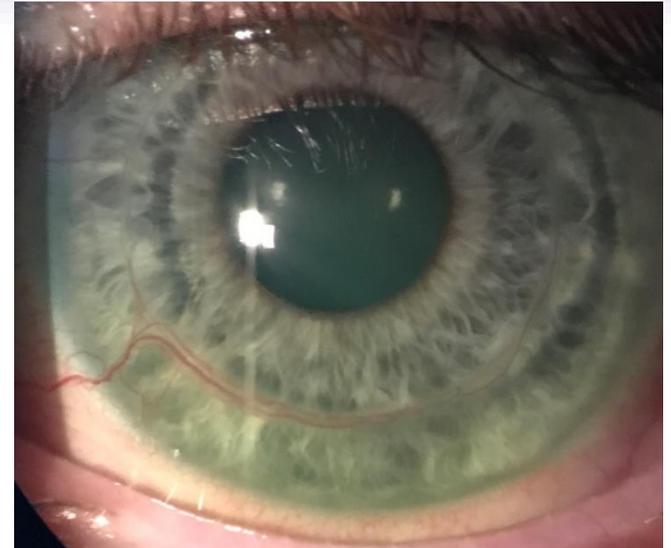
This fit was in 2017

Presently: wearing the same lens parameters.



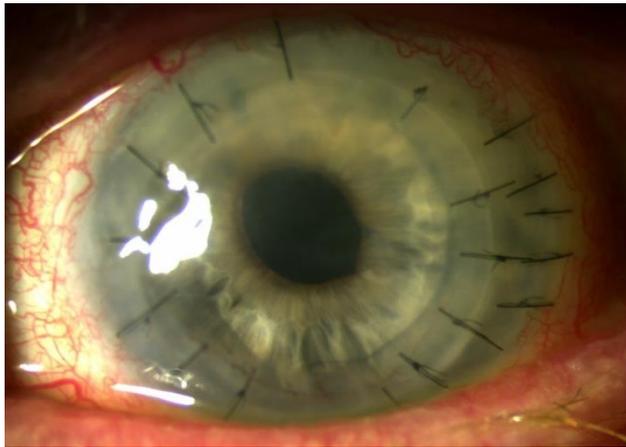
Penetrating Keratoplasty

- Likely need Oblate Design
- Minimal Clearance
- Monitor graft for health



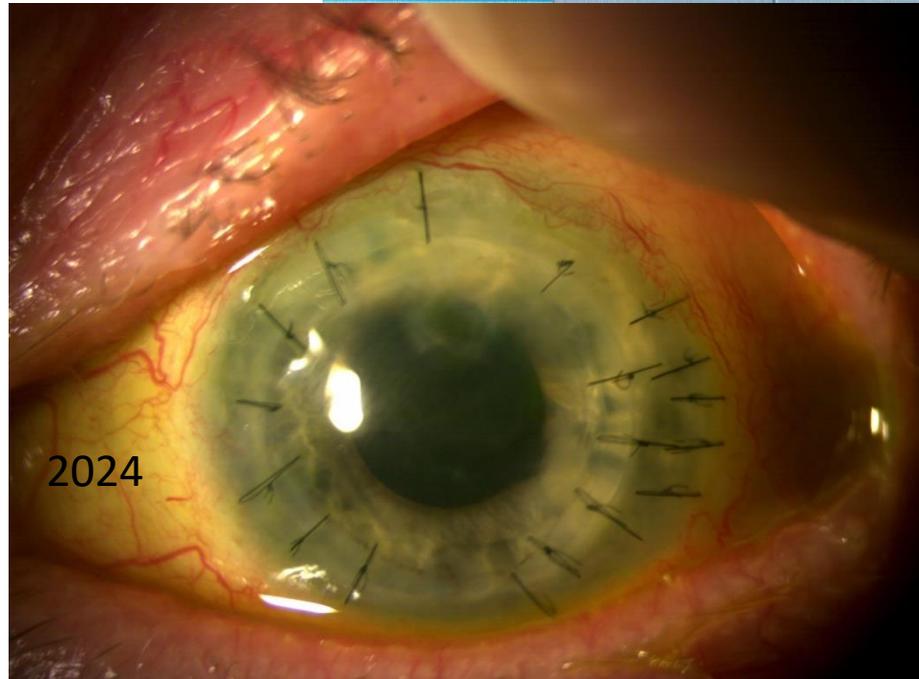
Penetrating Keratoplasty

- Monitor graft for health

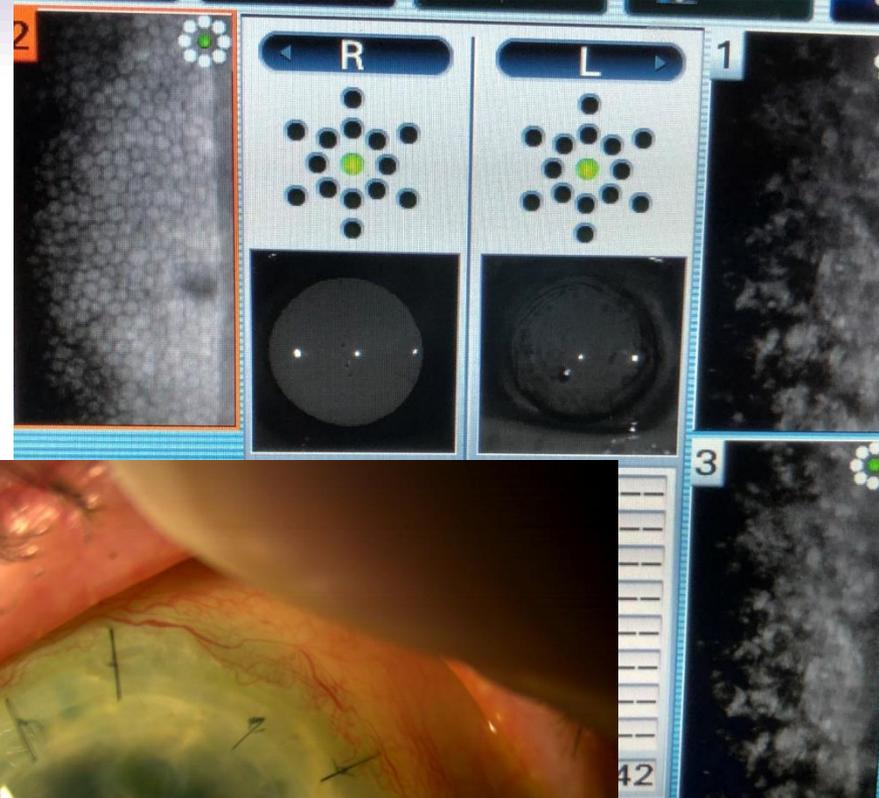


2023

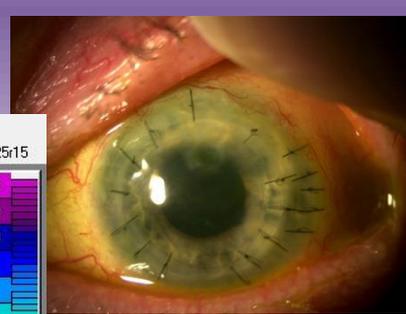
8.65 bc, 15.8 diam; 4135 sag



2024



Penetrating Keratoplasty



OCULUS - PENTACAM 4 Maps Selectable

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

Cornea Front

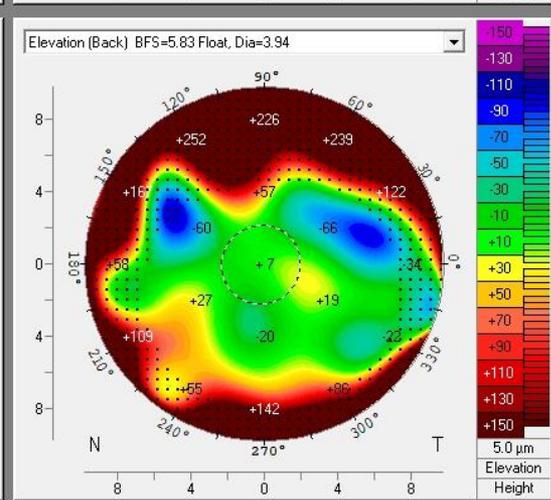
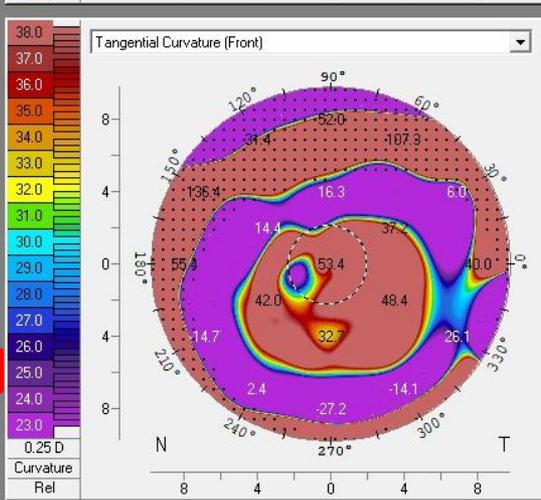
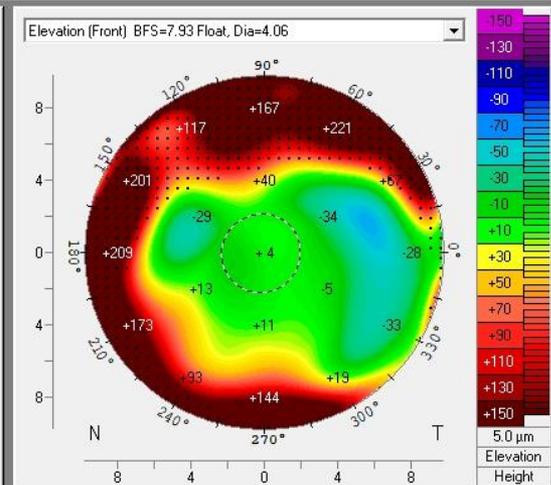
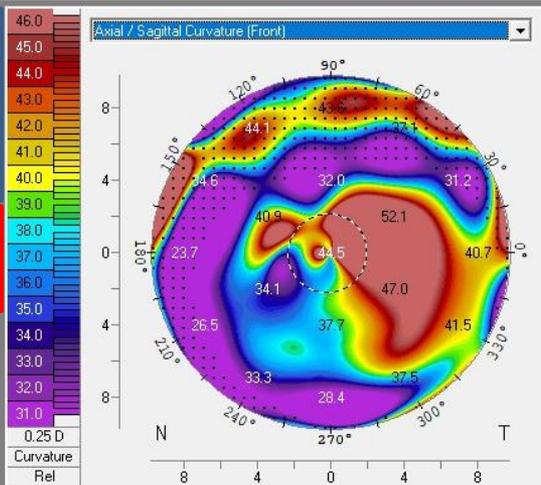
Rf: 9.12 mm K1: 37.0 D
 Rs: 7.78 mm K2: 43.4 D
 Rm: 8.45 mm Km: 39.9 D
 QS: **Align 1** Axis: 99.9° Astig: 6.4 D
 Q-val: [30°] 0.84 Rper: 9.86 mm Rmin: 5.75 mm

Cornea Back

Rf: 5.99 mm K1: -6.7 D
 Rs: 5.72 mm K2: -7.0 D
 Rm: 5.85 mm Km: -6.8 D
 QS: **Align 1** Axis: 128.2° Astig: 0.3 D
 Q-val: [30°] 0.26 Rper: 6.51 mm Rmin: 4.13 mm

Pachy: x[mm] y[mm]
 Pupil Center: + 580 μm [-0.09] [-0.02]
 Pachy Vertex N.: - 581 μm [0.00] [0.00]
 Thinnest Locat.: ○ 561 μm [+0.98] [-0.60]
 K Max. (Front): + 58.7 D [+0.60] [+0.16]

Cornea Volume: 77.1 mm³ **HWTW: 11.0 mm**
 Chamber Volume: 133 mm³ Angle: 38.2°
 A. C. Depth (Int.): 3.09 mm Pupil Dia: 2.17 mm
 Enter IOP IOP(cor): Lens Th.:



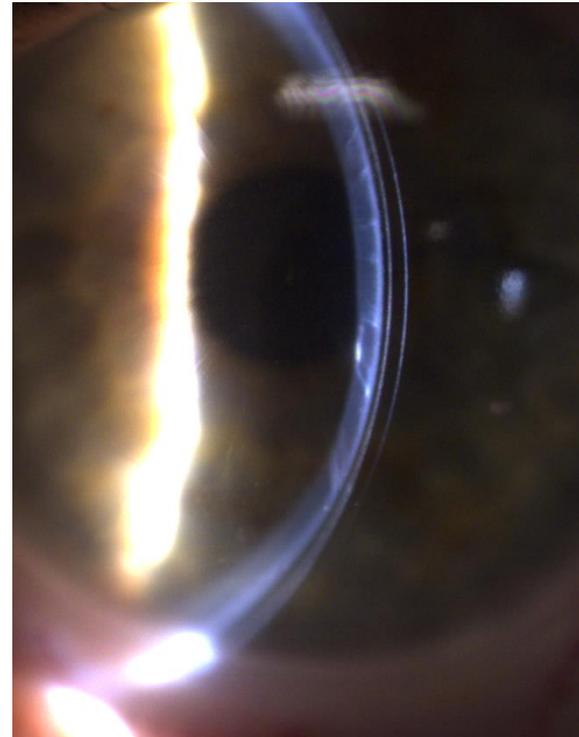
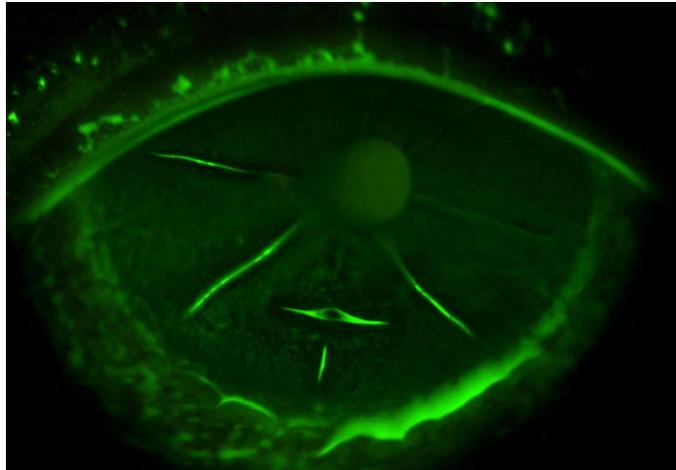
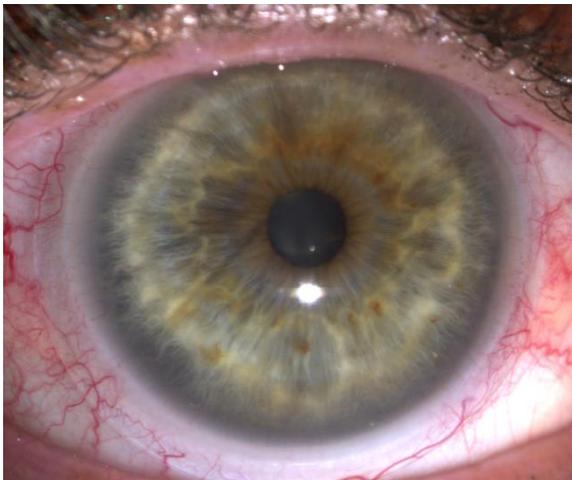
Prolate design; 8.65 (39.00D) bc, 15.8 diam; 4090 sag

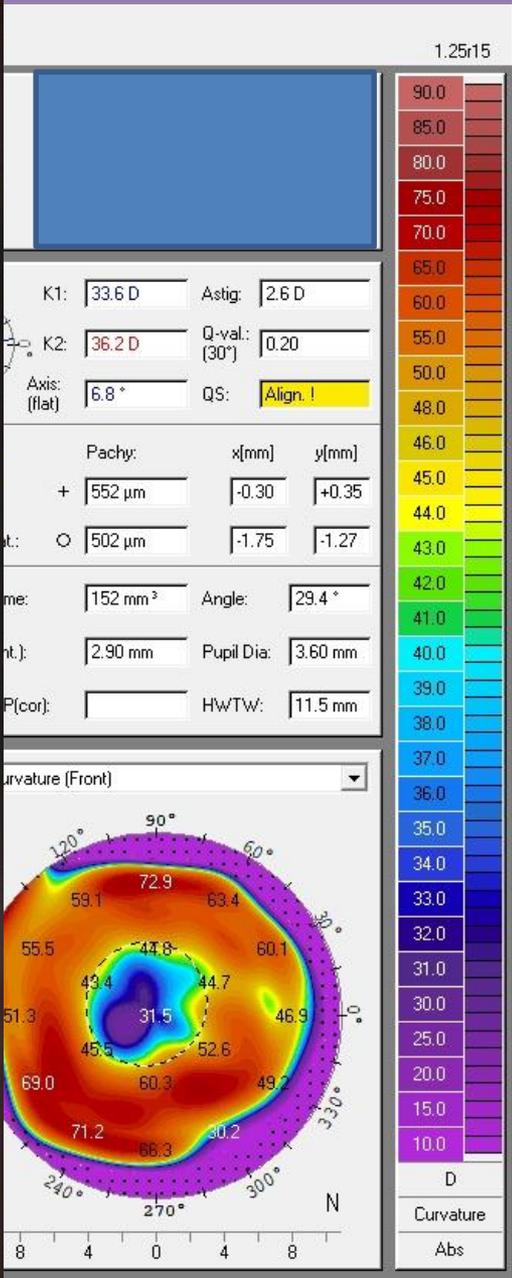
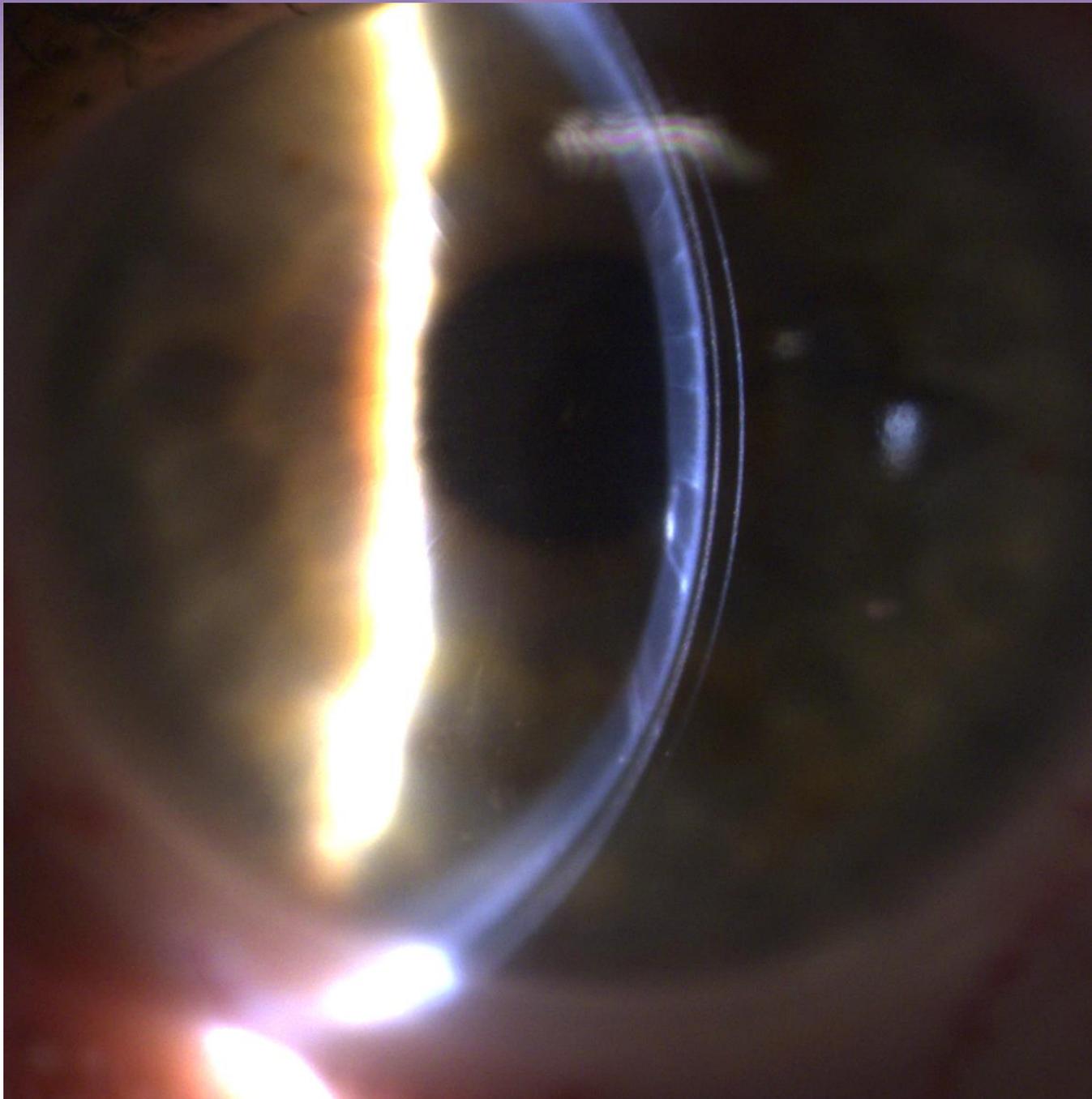
****adequate clearance 350, good limbal clearance, good edge alignment, no blanching, marking at 075 right****

Plan: decrease central clearance 100 microns

Post Refractive Surgery

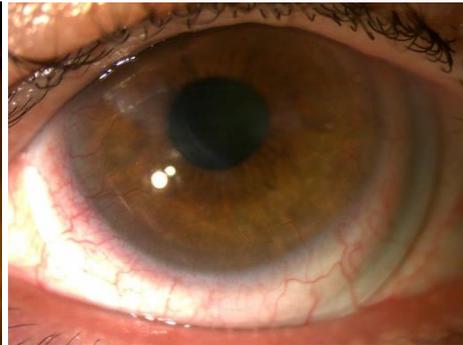
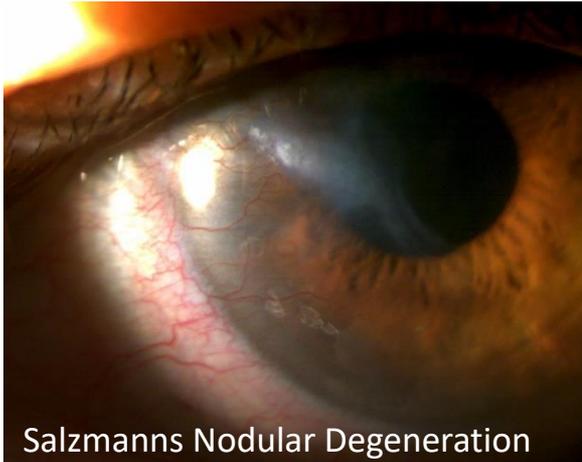
- Likely need Oblate Design
- Minimal Clearance





Corneal Dystrophy

- Corneal Dystrophy
 - Likely Prolate Design
 - Minimal Clearance



15.8 Diameter
Prolate Design
8.65/8.85 Base Curves
Toric Periphery

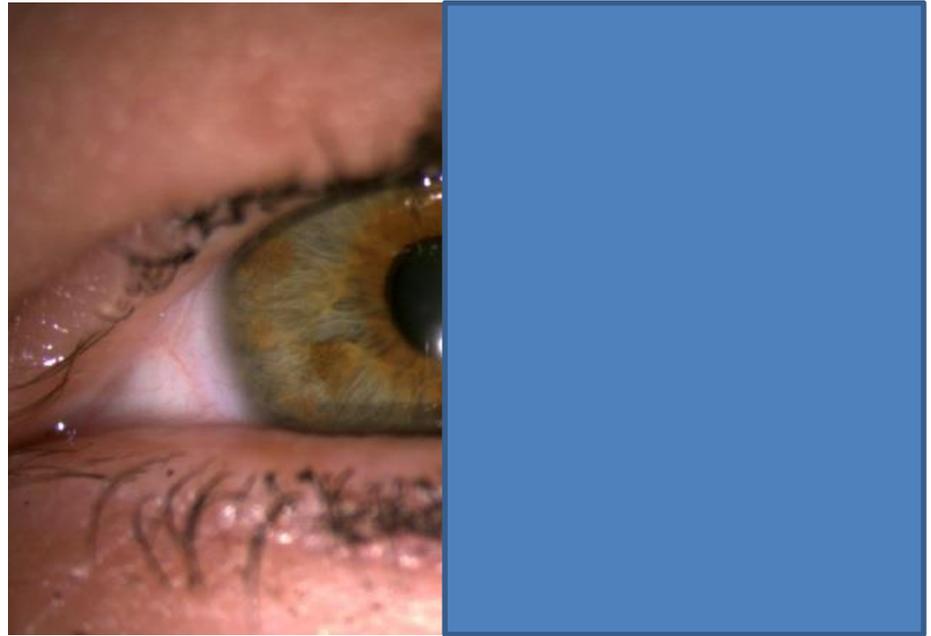


18.2 Diameter
Reverse Curve Design
7.42 Base Curve
Spherical Periphery

Ptosis

- Large, Steep, **Oblate** Design
- Peripheral elevation important to lift upper lid.
- Patient had Bell's Palsy in 2021
- Aberrant Nerve Regeneration, resulting in Ptosis

- Normal Palpebral Fissure: 7mm
- With lens: 10.5mm



18.2 Diameter
7.18mm (47.00D) Base Curve
Reverse Geometry design



Inferior Decentration

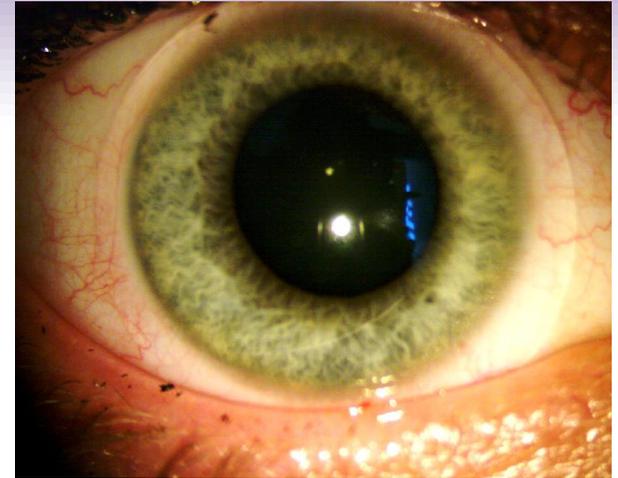
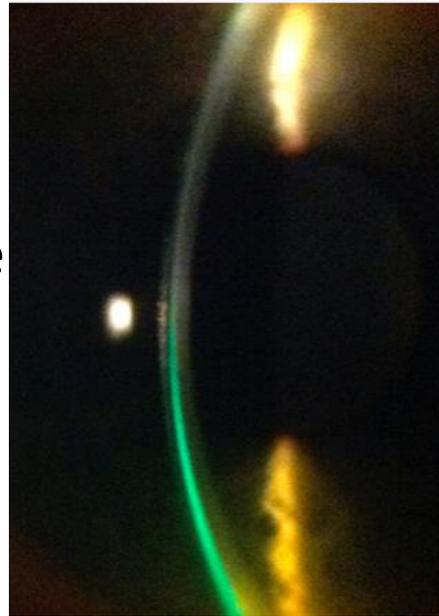
Most Common

– Likely causes:

- Too much corneal or limbal clearance
- Vertical edge lift
- Gravity

– Solutions:

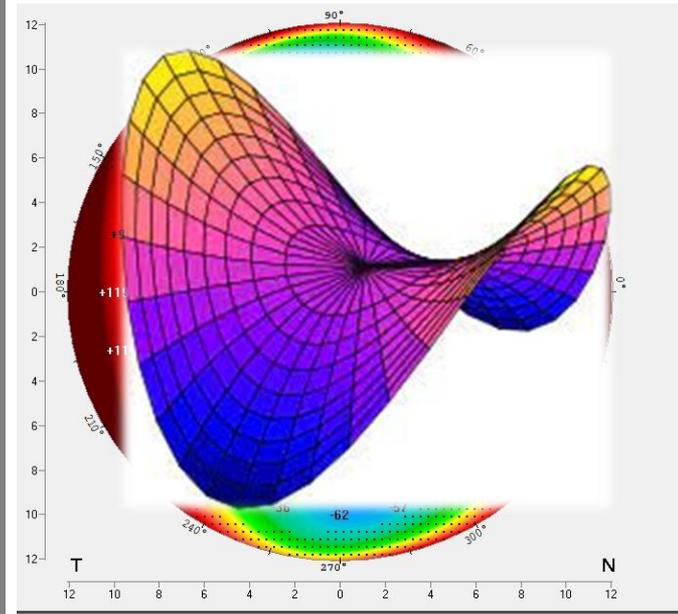
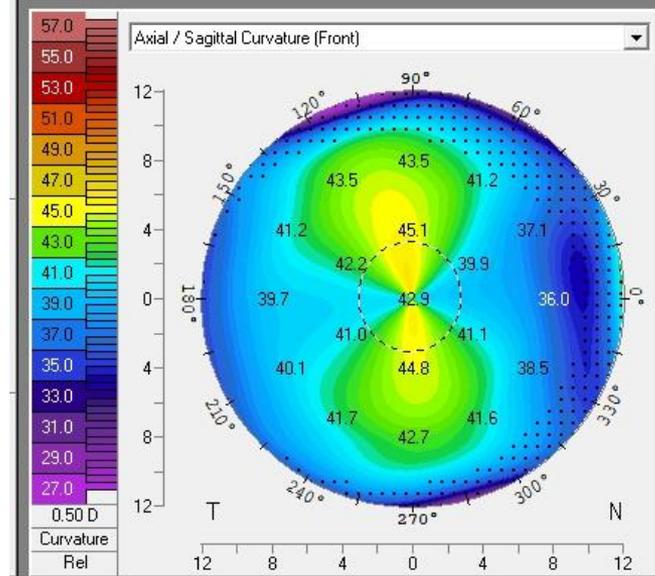
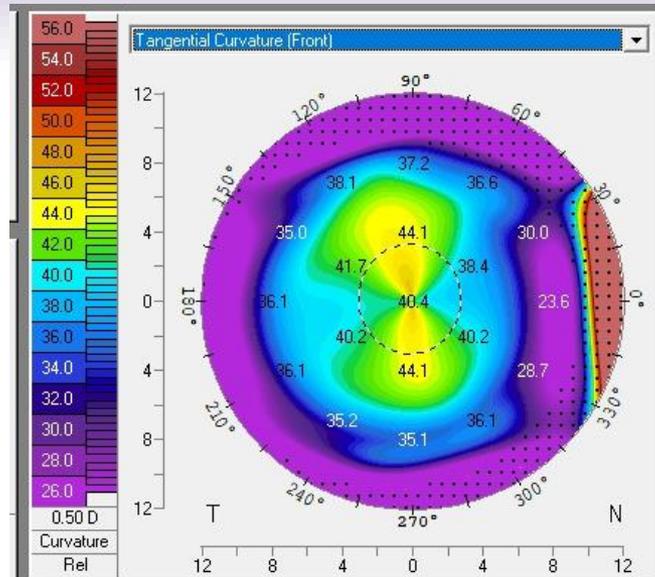
- Excessive Corneal/Limbal Clearance
 - Flatten the base curve
 - Reduce reverse curve
- Vertical Edge Lift
 - *Steepen vertical lens peripheral haptic to improve centration*



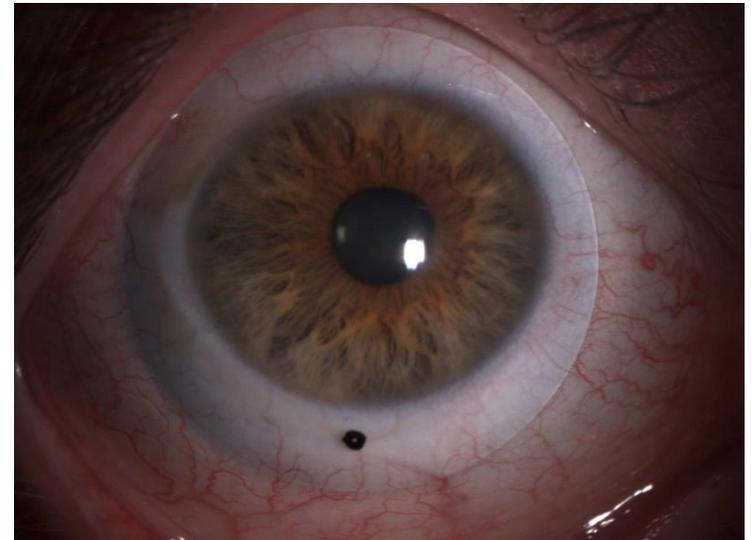
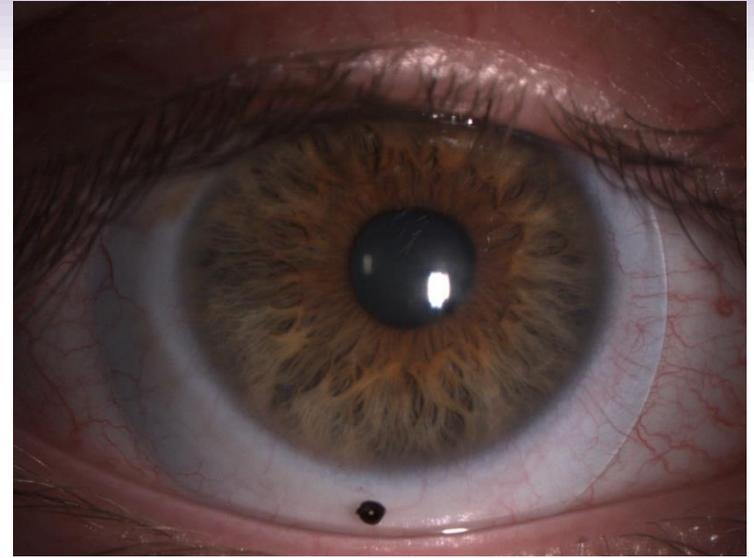
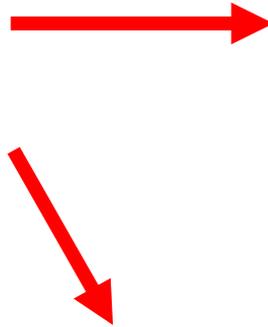
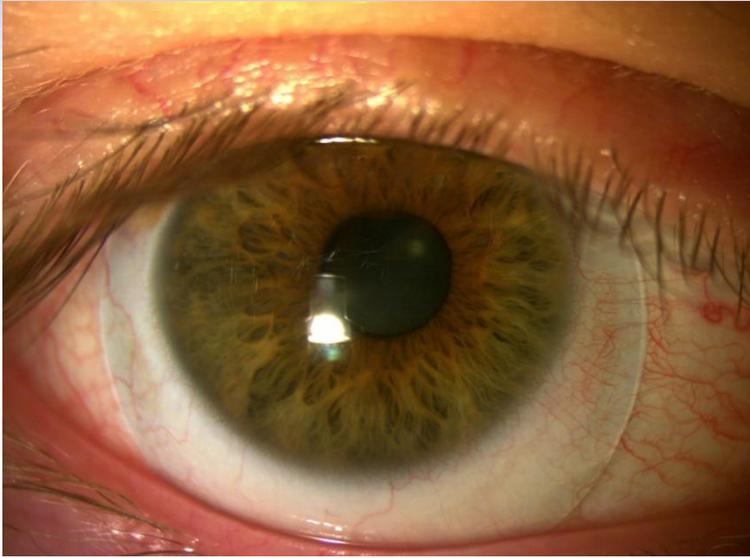
Significant With the Rule Astigmatism

Less Common cause of
INFERIOR DECENTRATION

Cornea Front	
Rf: 8.44 mm	K1: 40.0 D
Rs: 7.45 mm	K2: 45.3 D
Rm: 7.94 mm	Km: 42.5 D
Axis: (flat) 7.2°	Astig: 5.3 D
Rper: 8.36 mm	Rmin: 7.35 mm



Inferior Decentration

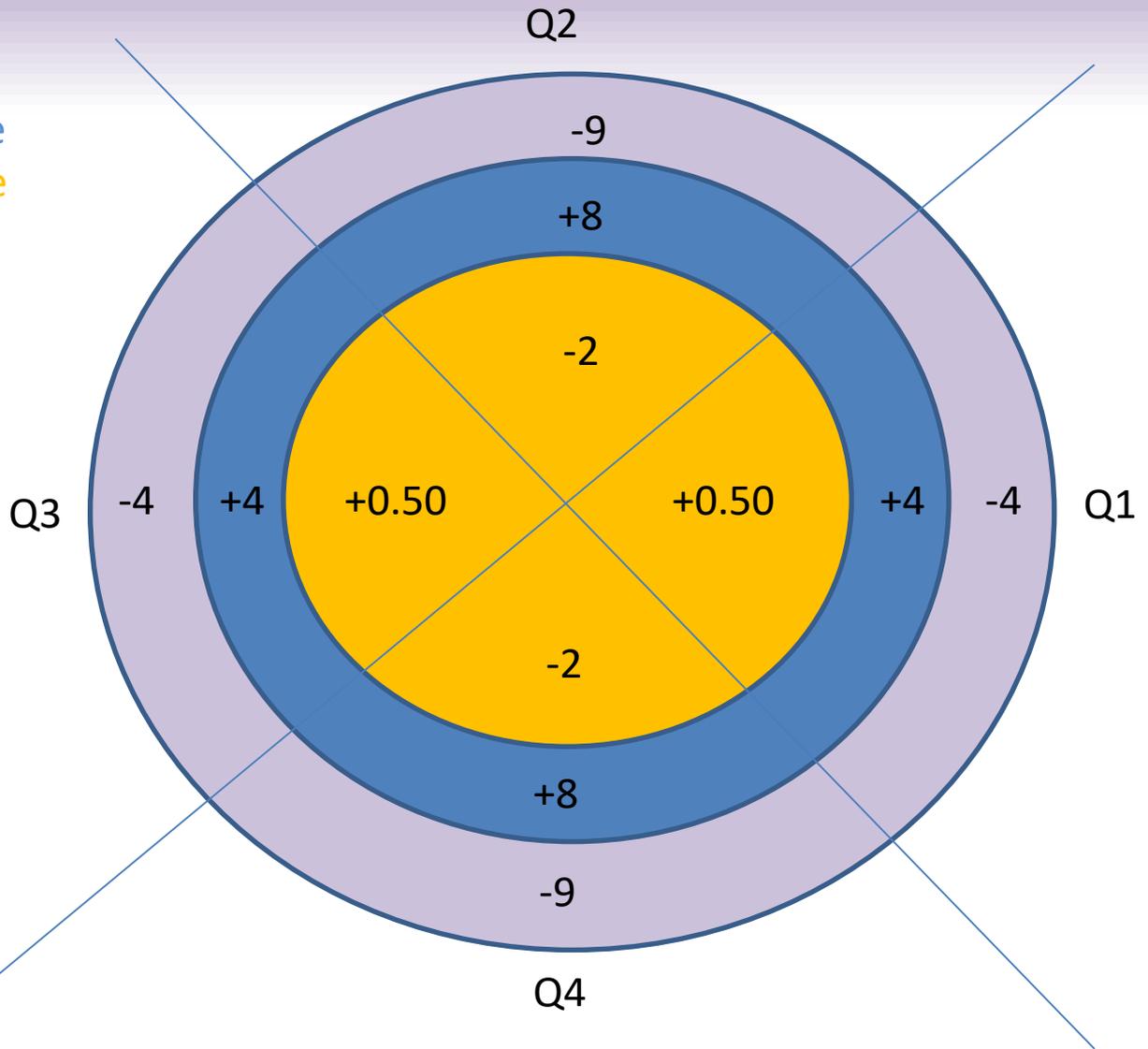
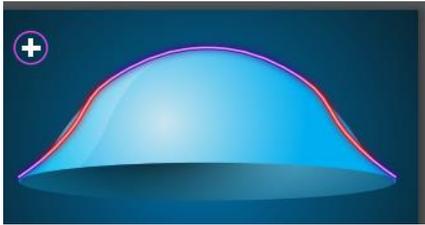


Landing Zone	std	#1	#2	#3	#4	#5
Flat	3	0	1	0	-2	-4
Steep	-4	-7	-9	-11	-13	-13
toricity	210	210	300	330	330	270

(-) = steeper

Inferior Decentration

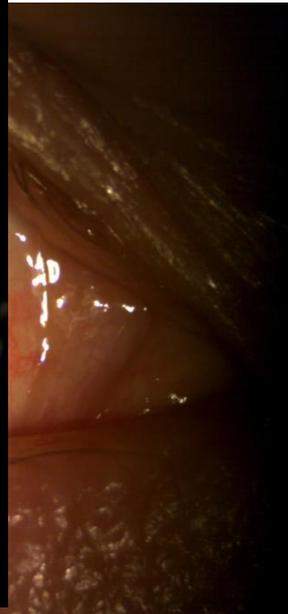
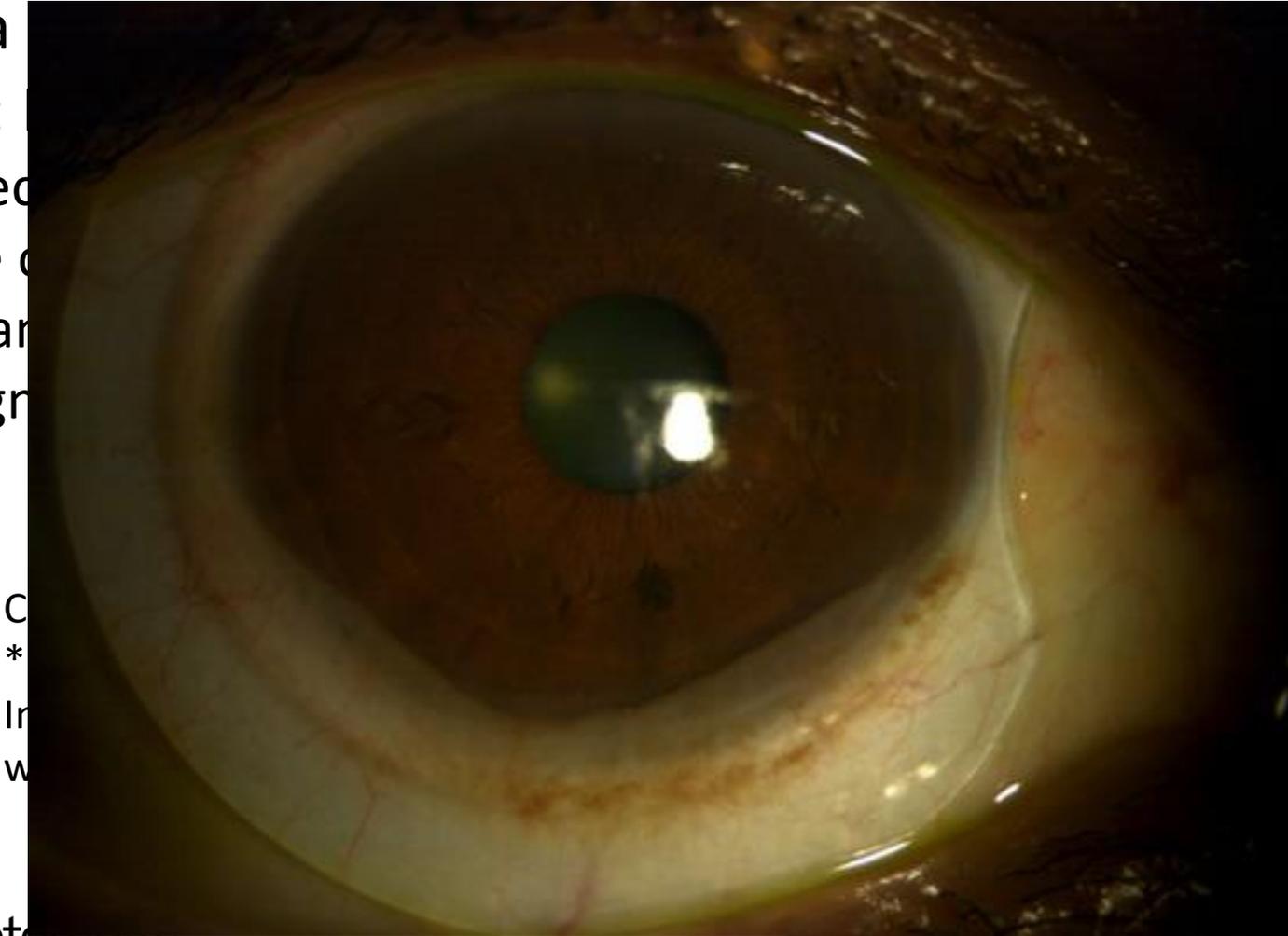
- Scleral (-) steeper
- Limbal (+) less clearance
- Cornea (-) less clearance



Scleral Toricity: 150

Peripheral Obstacles

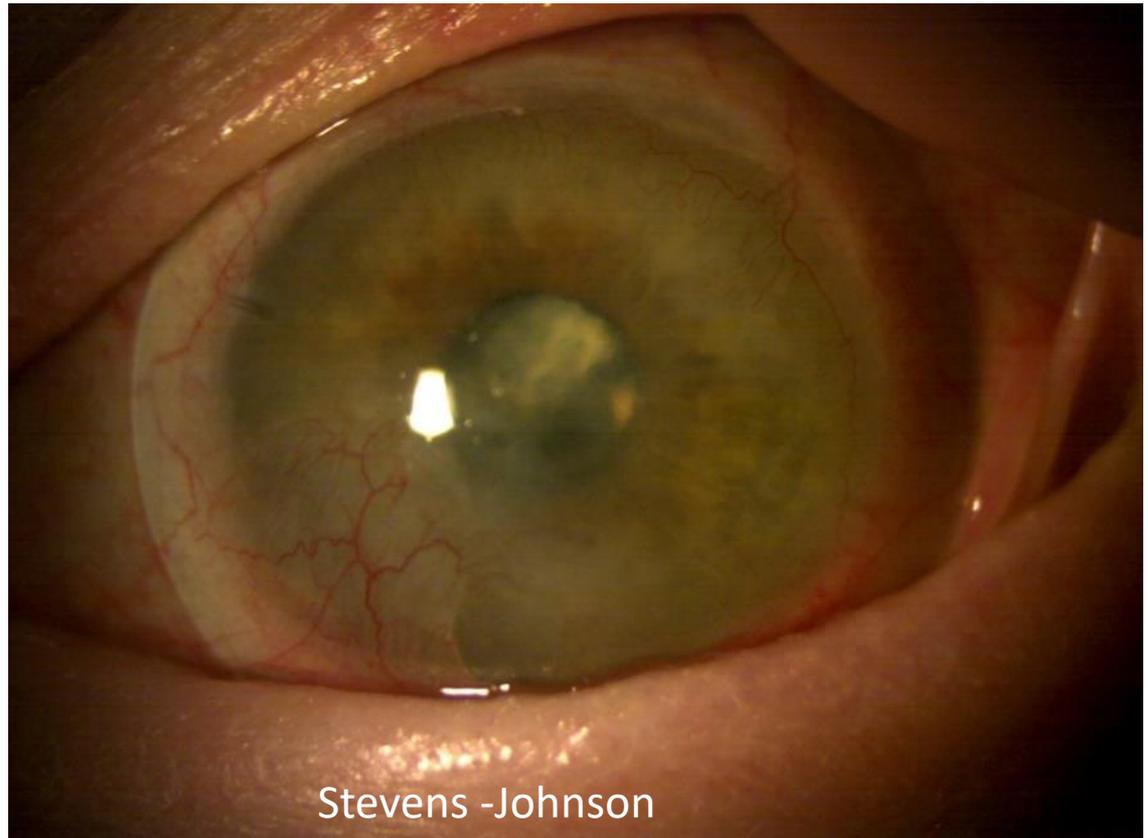
- Streamlining the fit: attempt to avoid the obstacle
- Use a
- Refit:
 - Spec
 - the c
 - Char
 - align



Stevens-Johnson

- Fills lens with Autologous Serum Tears 20%

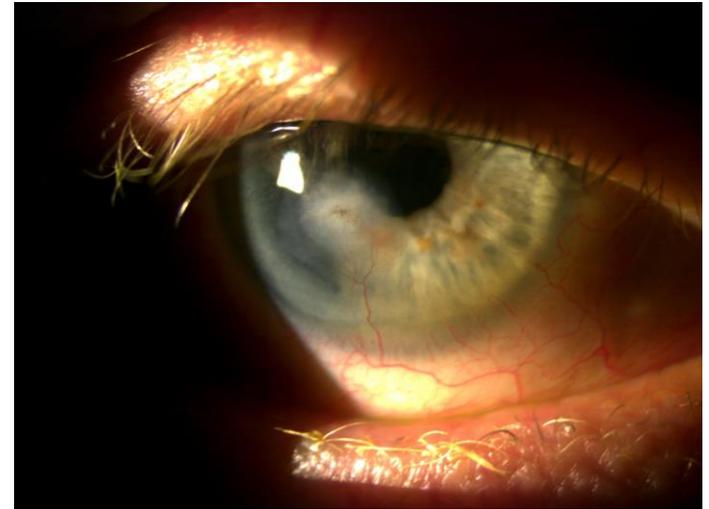
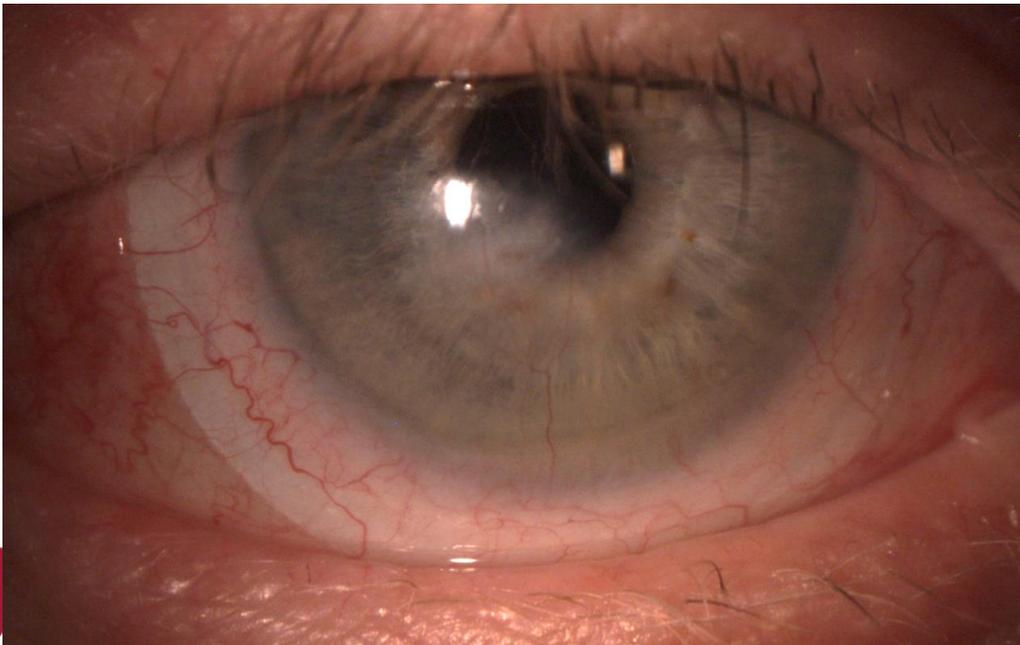
16.0 Diameter
3500 Sagittal Height
8.4 Base Curve
Toric Periphery



Stevens -Johnson

Ocular Surface Disease

- Prolate, Mini-Scleral
 - HydraPEG
 - Clear Care and NutriFill

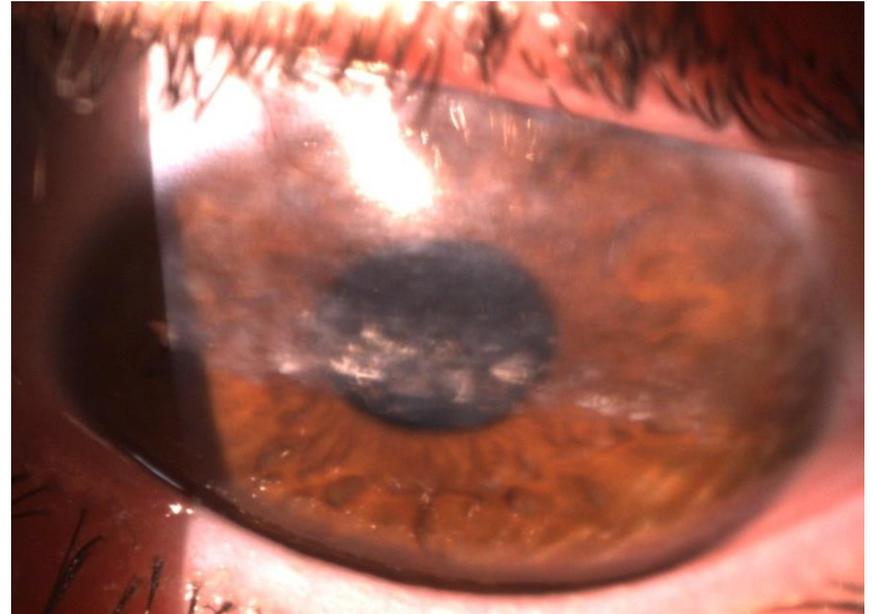


Graft vs Host Disease

15.8 Diameter
Prolate Design, 8.23 base curve lens
4280 sagittal depth

Irregularity - uncommon

- Prolate, Mini-Scleral
 - HydraPEG
 - Clear Care



Superior Pannus, unknown origin

Irregularity - uncommon

OCULUS - PENTACAM 4 Maps Selectable

Last Name:
 First Name:
 ID: 129017
 Date of Birth: 09/19/2007 Eye: Left
 Exam Date: 06/12/2024 Time: 13:25:06
 Exam Info:

Cornea Front

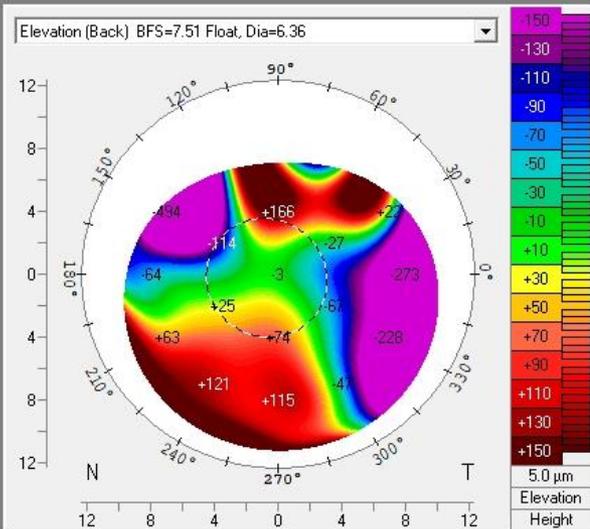
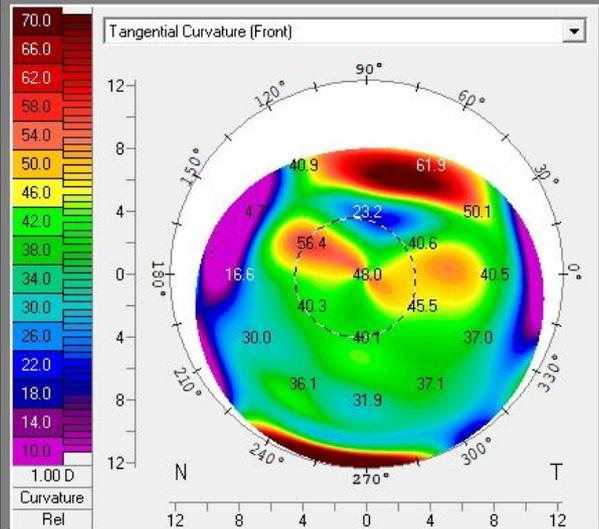
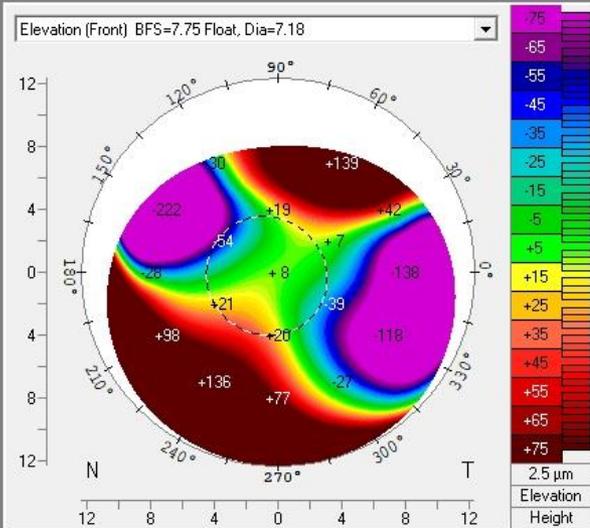
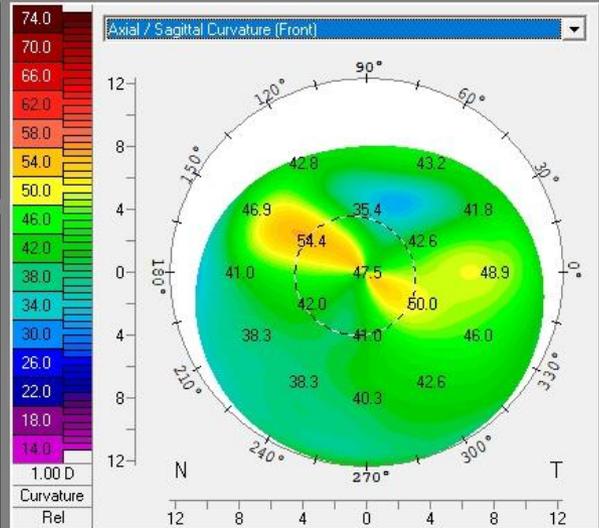
Rf: 8.75 mm K1: 38.6 D
 Rs: 6.42 mm K2: 52.6 D
 Rm: 7.58 mm Km: 44.5 D
 Axis: 57.1° Astig: 14.0 D
 ecc: (30°) 0.12 Rper: 7.97 mm Rmin: 6.18 mm

Cornea Back

Rf: 17.60 mm K1: -2.3 D
 Rs: 5.89 mm K2: -6.8 D
 Rm: 11.75 mm Km: -3.4 D
 Axis: 81.2° Astig: 4.5 D
 ecc: (30°) -1.28 Rper: 7.09 mm Rmin: 4.33 mm

	Pachy:	x[mm]	y[mm]
Pupil Center:	+ 547 μm	-0.36	-0.12
Pachy Vertex N.:	545 μm	0.00	0.00
Thinnest Locat.:	○ 232 μm	-0.41	+2.46
K Max. (Front):	54.6 D	-2.12	+1.23

Cornea Volume: 48.7 mm³ HWTW: 12.4 mm
 Chamber Volume: 185 mm³ Angle: 41.8°
 A. C. Depth (Int.): 3.37 mm Pupil Dia: 3.77 mm
 Enter IOP: IOP(corr): Lens Th.:



One and Done

- Based on HVID and lens design selected:
- Oblate, 15.8mm diameter lens
- 40.00D base curve
- Initial Lens Evaluation:
 - O marks @ 043
 - Good centration, no movement
 - Edge lift 360
 - minimal clearance over superior edge of pannus scar, 200 microns inferior.

Plan for initial order:
Add OR
Increase central clearance
100 microns
3 steps steep 360

One and Done

- Lens Dispense:
 - 20/25-
 - 0 marks @50
 - Good centration, no movement.
 - No edge lift 360 or blanching
 - Limbal clearance 50 microns
 - Central clearance 200 microns

Thank You

- Questions?
- dekinderj@umsl.edu