

MANAGING THE IRREGULAR CORNEA

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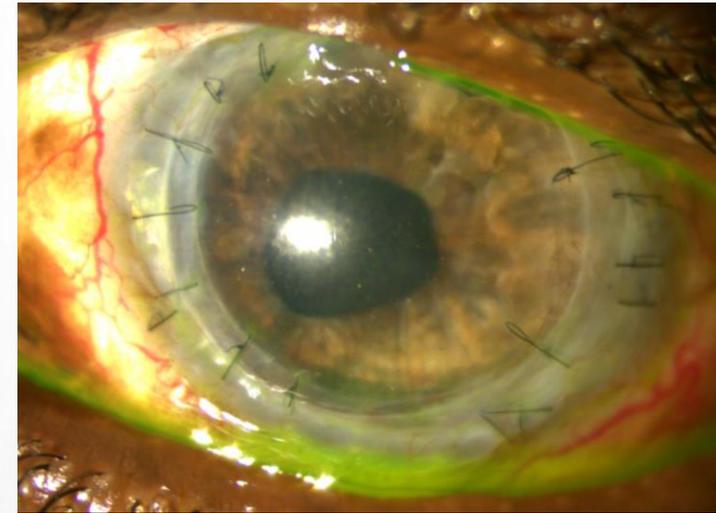
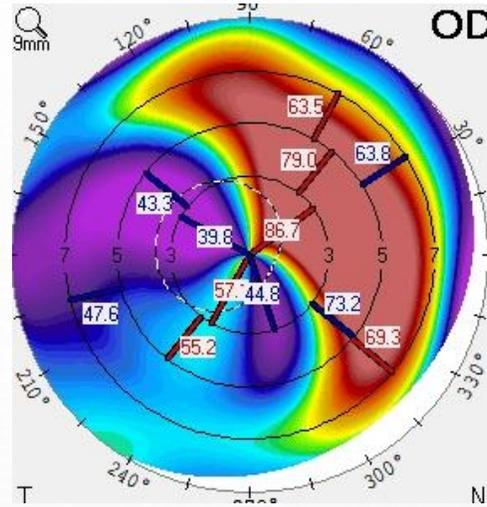
PLAN OF ATTACK

- EVALUATION
- SURGICAL OPTIONS
- OPTICAL INTERVENTIONS



CAUSES OF IRREGULAR CORNEA

- ECTASIA
 - KERATOCONUS/PELLUCID MARGINAL DEGENERATION/KERATOGLOBUS
- TRAUMA
- SURGERY
 - TRANSPLANTS, REFRACTIVE
- INFECTION/INFLAMMATION
- DYSTROPHY

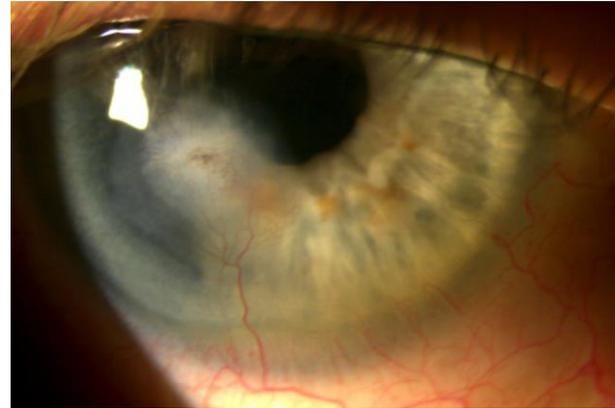


Irregular astigmatism

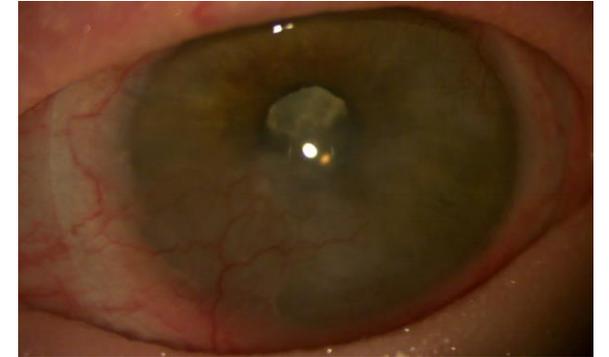
- Two primary corneal meridians are not perpendicular
- Associated with vision loss
- Regularly or Irregularly Irregular Astigmatism
 - Irregularly – is rough or uneven with no recognizable pattern on topography

CAUSES OF IRREGULAR CORNEA

Graft vs Host Disease



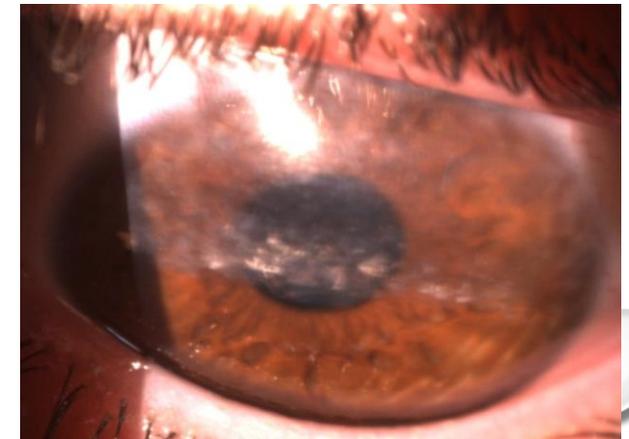
Steven Johnson



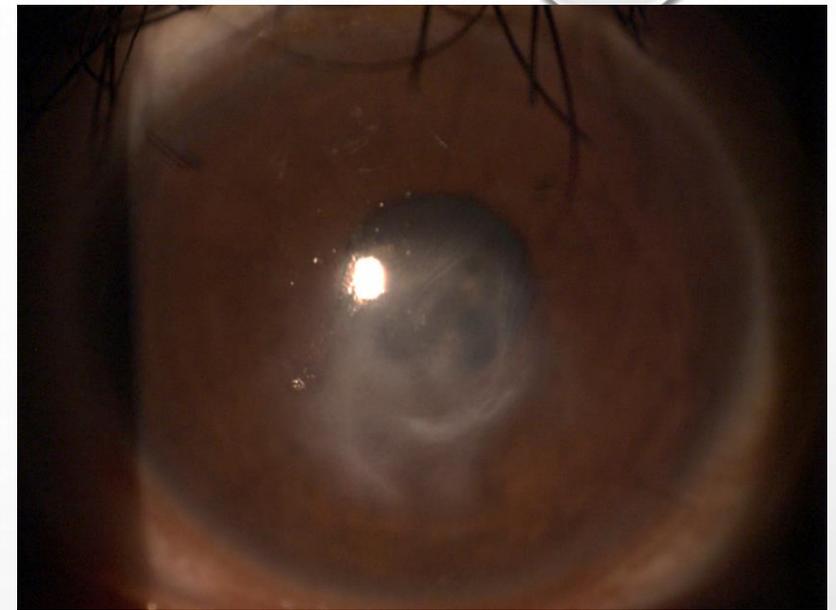
Scarring



Pannus

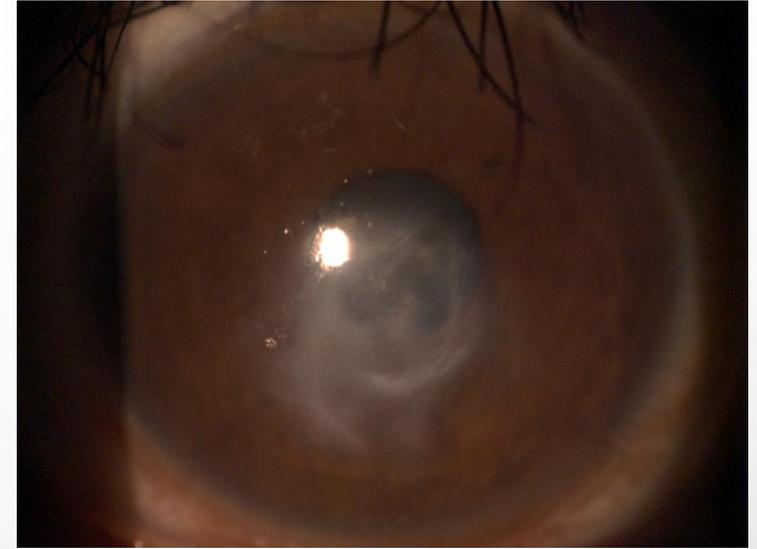


VISUAL ACUITY

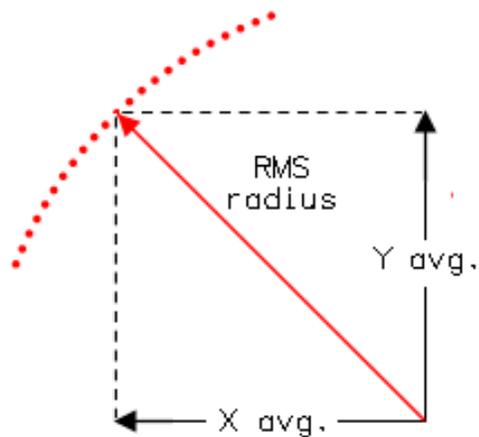


- IMPORTANT FOR BASELINE DATA
- SHOULD ALWAYS CHECK PINHOLE ACUITY
- MAY REPORT MONOCULAR DIPLOPIA OR LETTER SHADOWING
- EXCELLENT MEASURE FOR MONITORING FOR PROGRESSION
- THE LOCATION/DENSITY OF THE IRREGULARITY
 - PERIPHERAL KCN CONE VS CENTRAL KCN CONE
 - SCARRING DENSITY AND LOCATION WILL IMPACT VA
- REDUCED CONTRAST SENSITIVITY (ESP FOR KERATOCONIC PATIENTS)

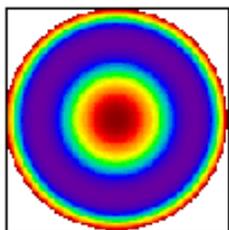
VISUAL ACUITY HIGHER ORDER ABERRATIONS



- INCREASE IN HIGHER ORDER ABERRATIONS
 - PATIENT CAN COMPLAIN OF GLARE, HALOS
 - WILL VARY DEPENDING ON ETIOLOGY OF IRREGULAR ASTIGMATISM
 - **VERTICAL COMA** THE HOA OF GREATEST MAGNITUDE FOR: KCN, KG, PMD, LASIK, PKP AND ICRS
 - FOUND WITH 3, 5, AND 7MM PUPIL SIZES OVERALL IN AN EVALUATED 720 EYES

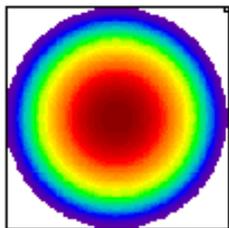


PRIMARY SPHERICAL



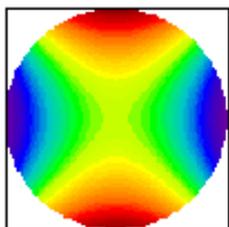
P-V 0.251 RMS 0.07487

DEFOCUS



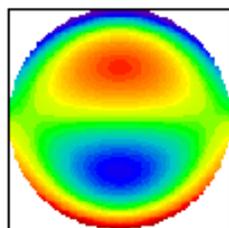
P-V 0.2579 RMS 0.07465

ASTIGMATISM

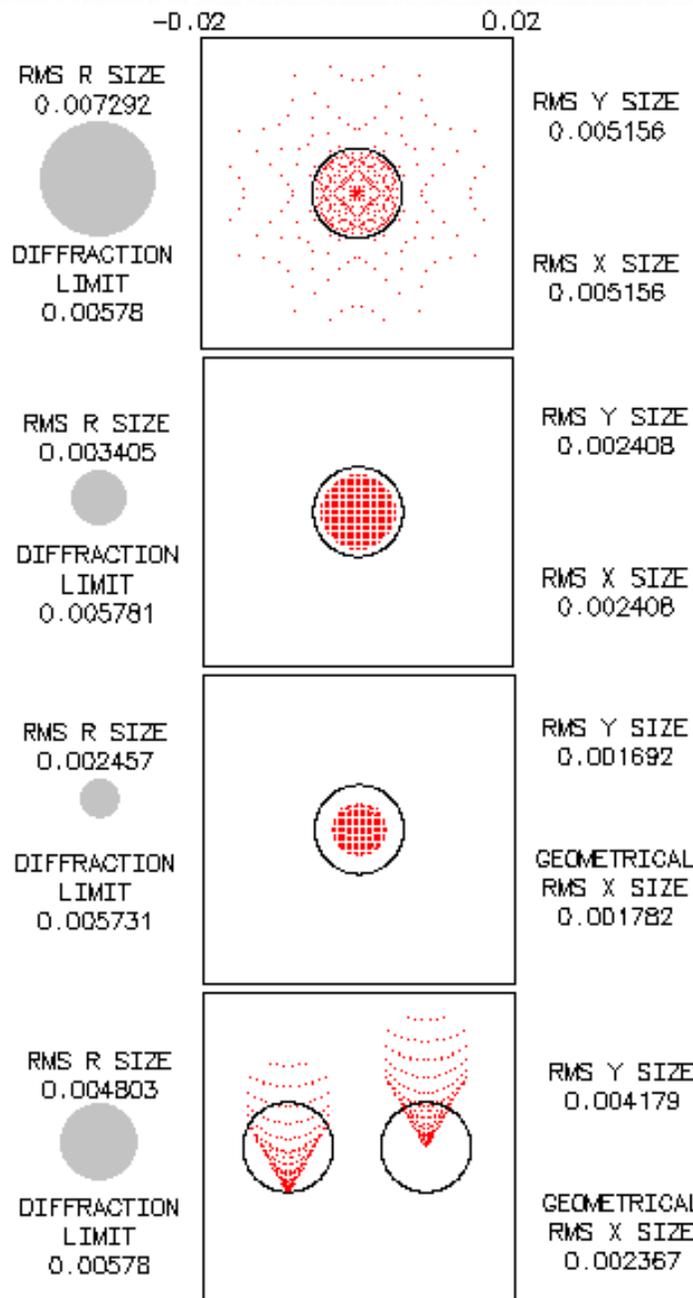
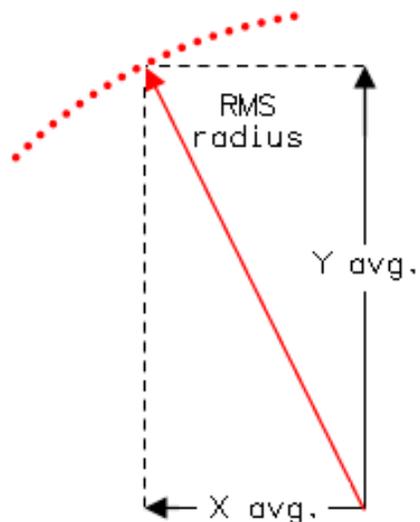


P-V 0.3626 RMS 0.07492

COMA



P-V 0.4181 RMS 0.07489



REFRACTION

- CHALLENGING
- CAN BE USED TO MONITOR PROGRESSION
- MAKE LARGE CHANGES IN SPHERICAL (1 TO 3D CHANGES) AND CYLINDER POWER
 - MAY NEED HANDHELD +/-1.00D JCC, IN FRONT OF TF OR PHOROPTER
- USE LARGE CHART LETTERS
 - 2 TO 3 LINES LARGER THAN BCVA



Myopic shift of $\geq 0.50D$ or Increase in cylinder of $\geq 1.00D$ within 12 months

SLIT LAMP EXAMINATION

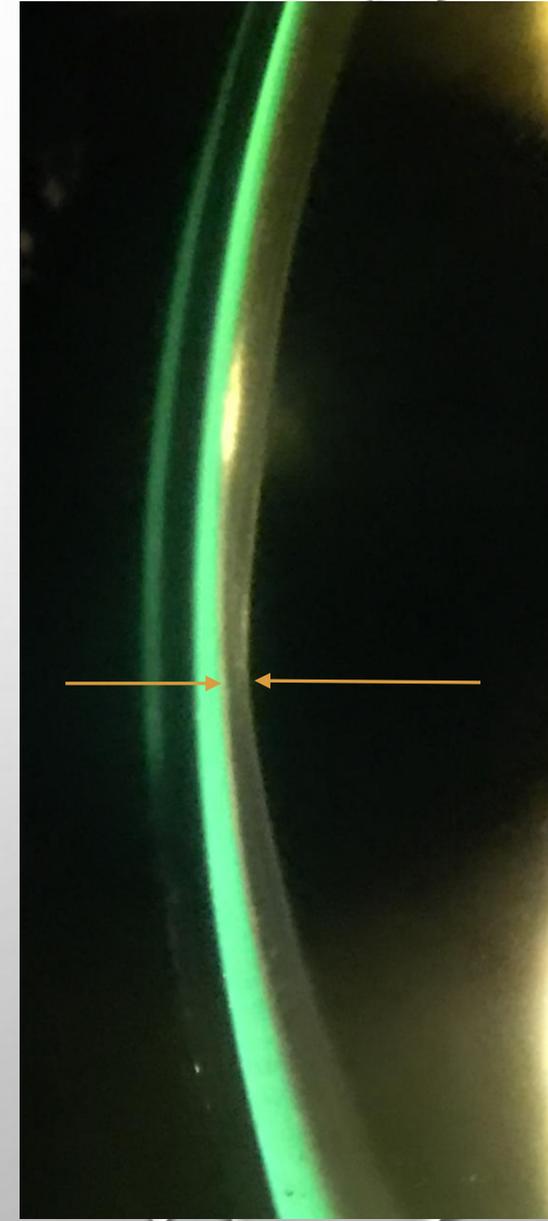
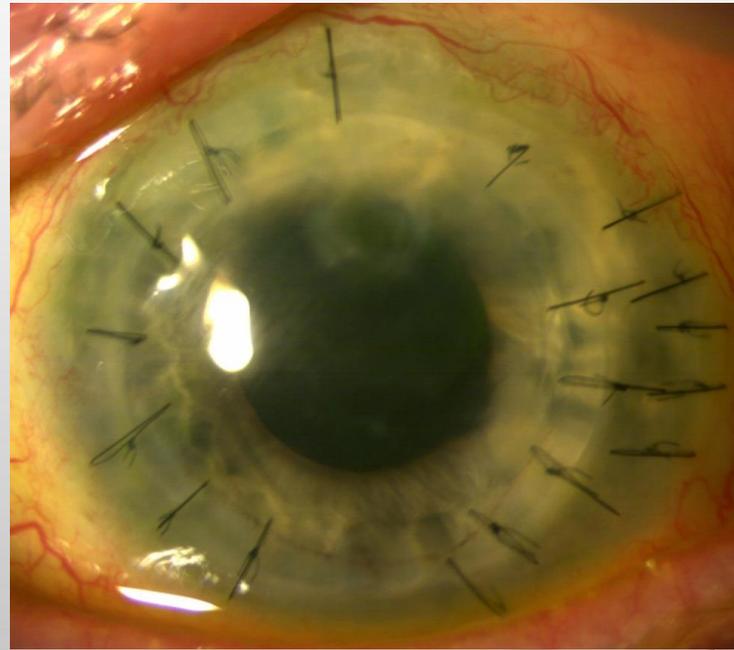
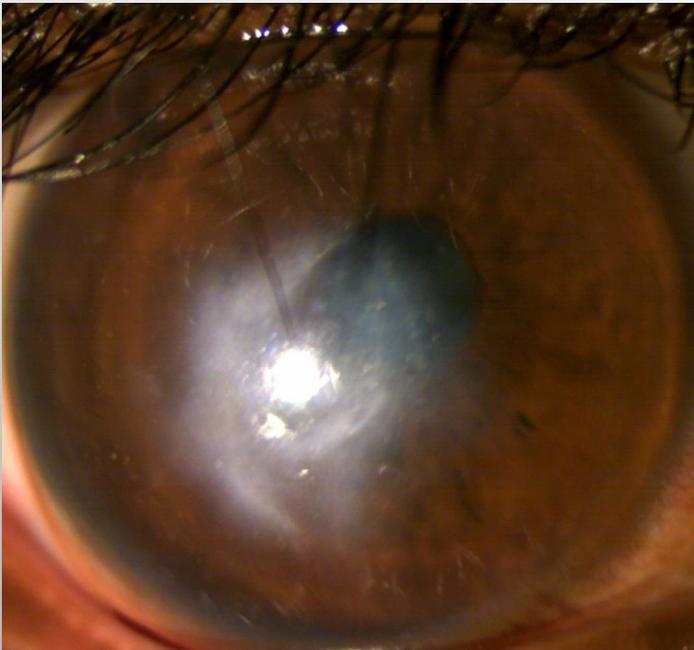
Note location, size, depth of scarring

Look for other signs

Note ectasia

Neovascularization

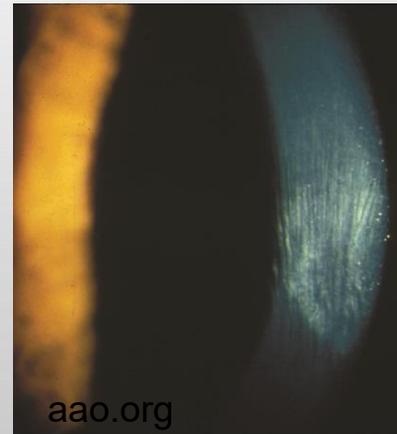
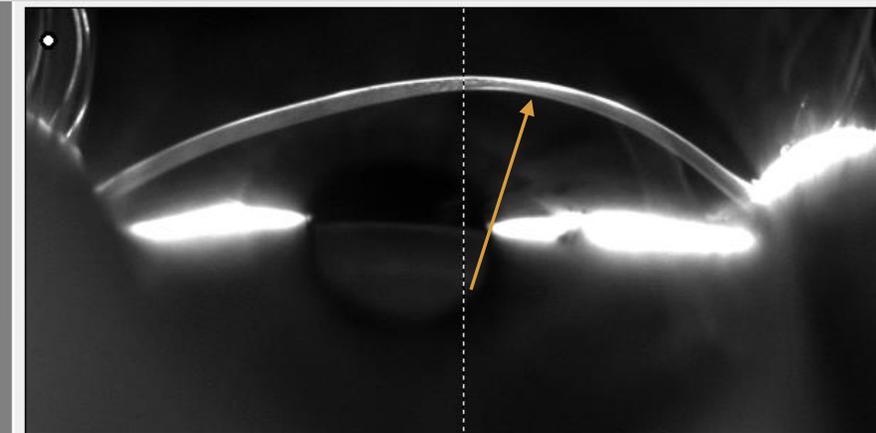
Stitches – number and location



SLIT LAMP EXAMINATION

KERATOCONUS

- CLEK STUDY:
 - 86% PATIENTS HAD FLEISCHER'S RING IN ONE AND 56% OU
 - 65% VOGT'S STRIAE ONE EYE AND 30% OU
 - 53% SCARRING ONE EYE AND 22% IN BOTH

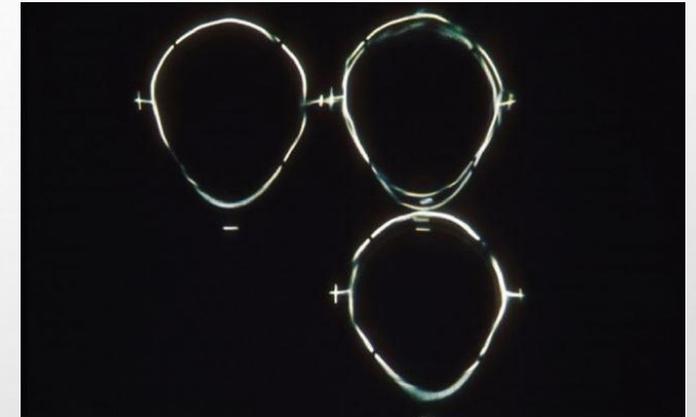


INTRAOCULAR PRESSURE READINGS

- DEPENDING ON THE CAUSE OF THE IRREGULAR CORNEA
- MAY BE ARTIFICIALLY **LOW**
 - WITH THIN AND WEAK CORNEAS
- MONITOR OPTIC NERVE HEALTH FOR GLAUCOMATOUS CHANGES

KERATOMETRY

- HISTORICALLY BENEFICIAL IN DIAGNOSIS AND MONITORING
- HAS LIMITATIONS
- ONLY MEASURES A FEW PARACENTRAL POINTS ON THE CORNEA
- CAN NOTE IRREGULARITY OF MIRES
 - DISTORTED
 - SEE A SHIFT IN ASTIGMATISM TO OBLIQUE AXIS
 - STEEPENING OF CURVATURE



<https://www.opticianonline.net/cpd-archive/5435/>

EXTEND THE KERATOMETRIC RANGE WITH +1.25D MOUNTED ON PATIENT SIDE (ADDS 8D TO RANGE);
+2.25D (ADDS 16D)

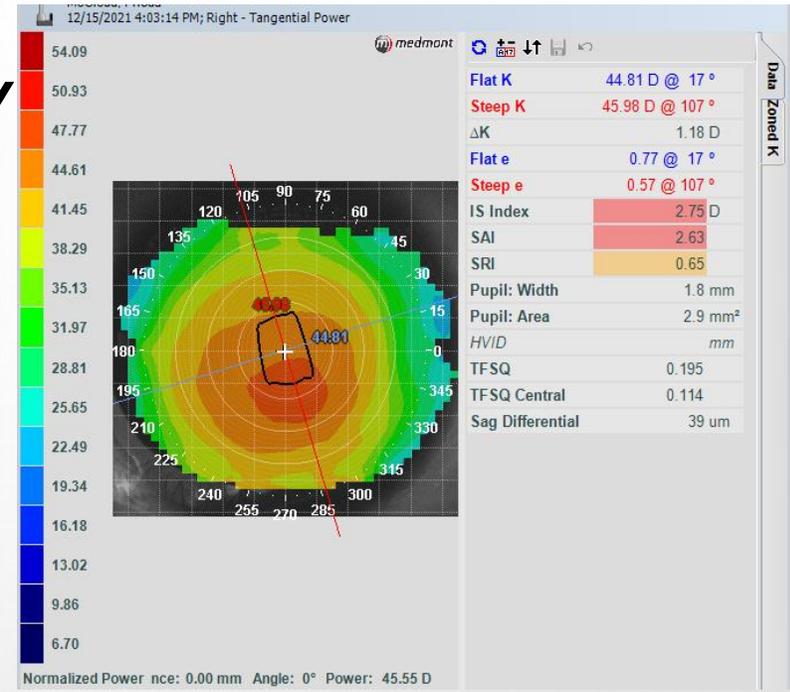
CORNEAL TOPOGRAPHY & TOMOGRAPHY

- BASELINE DATA
- MONITORING OF PROGRESSION OR CHANGE

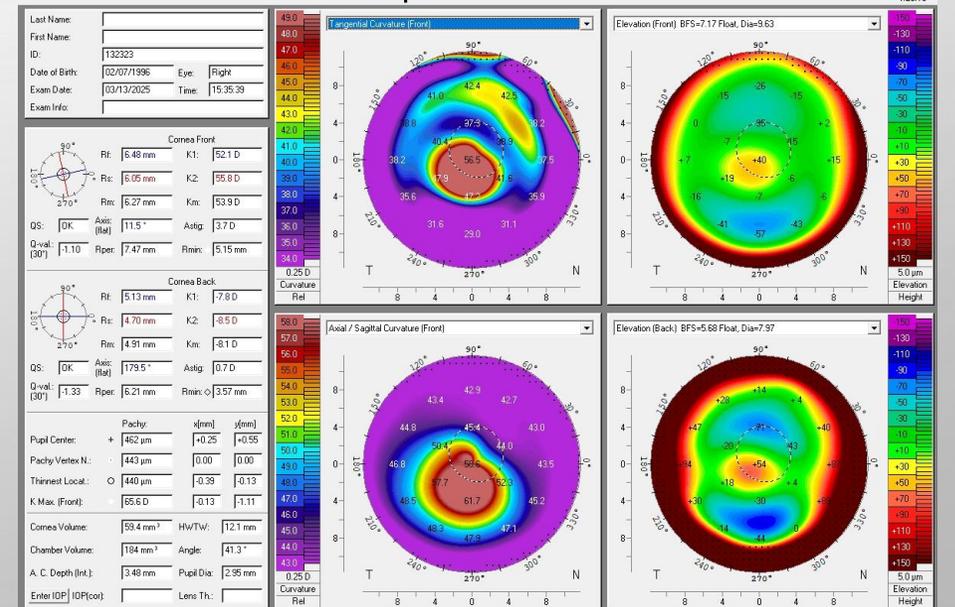
• **TOPOGRAPHY**: 2D MAP OF THE ANTERIOR SURFACE OF THE CORNEA

• **TOMOGRAPHY**: 3D VIEW OF THE ENTIRE SURFACE

- ANTERIOR
- POSTERIOR
- THICKNESS



OCULUS - PENTACAM 4 Maps Selectable



CORNEAL TOPOGRAPHY

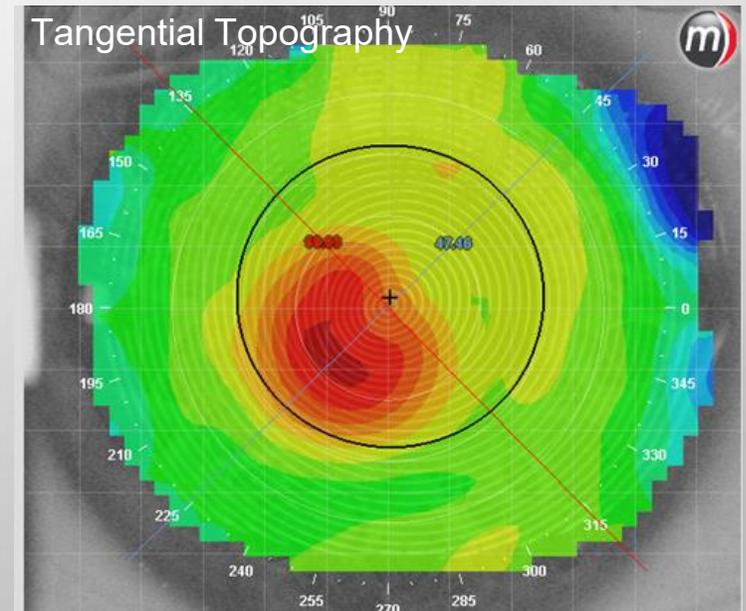
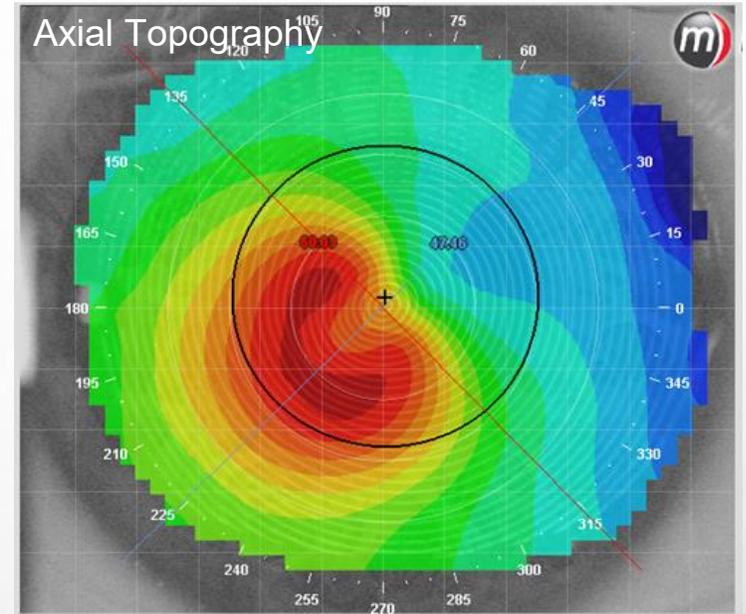
- IMPORTANT MAPS

- AXIAL/SAGITTAL

- ASSUMES THE CENTER OF THE RADIUS OF CURVATURE IS ALWAYS ON THE CENTRAL AXIS
- SMOOTHS OUT THE PERIPHERY, BEST OPTICAL CHARACTERISTICS OF THE CORNEA

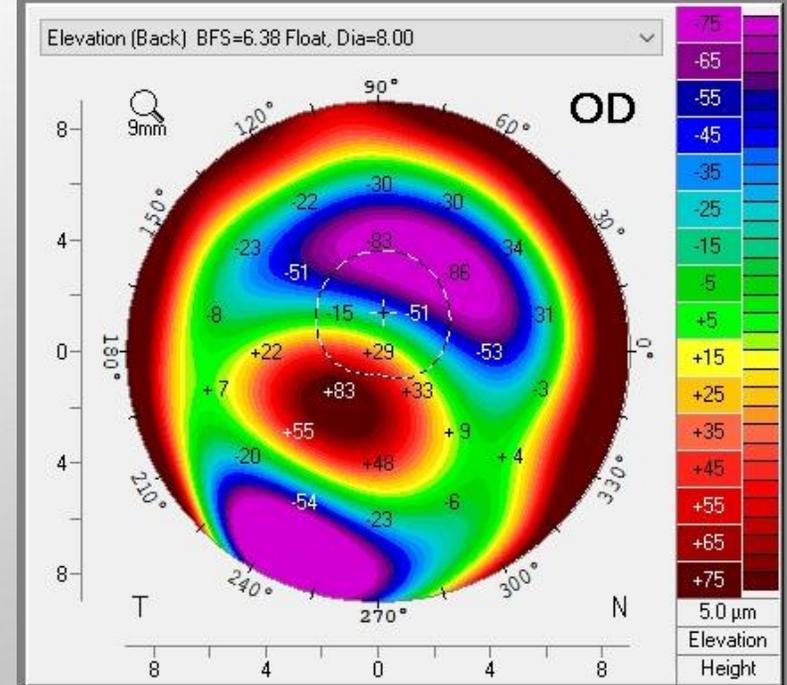
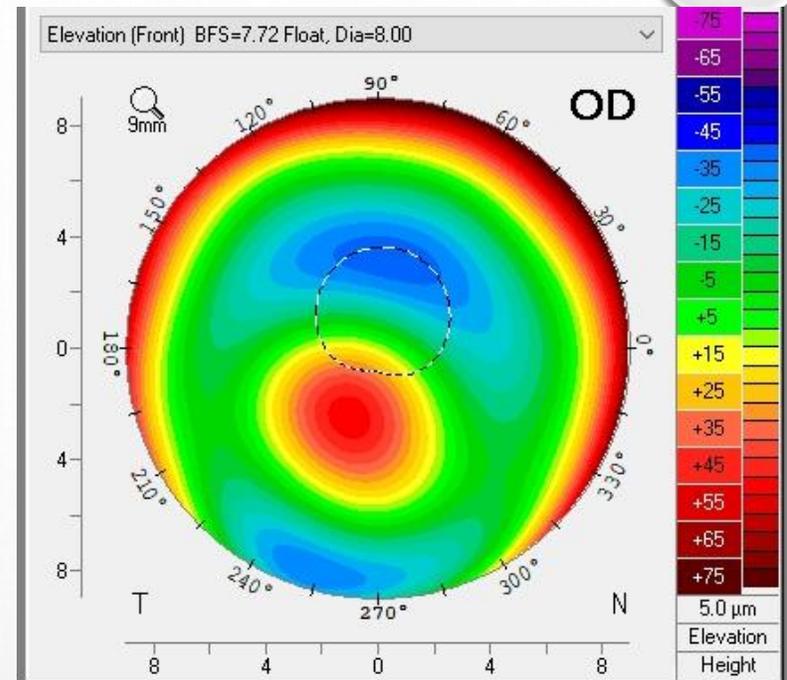
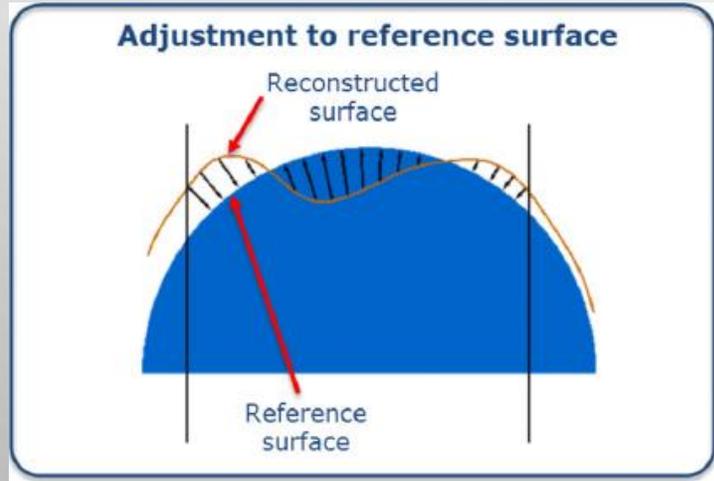
- TANGENTIAL

- MAKES NO ASSUMPTIONS
- LOOKS AT A PART OF THE CORNEA AND MEASURES THE RADIUS AS A TANGENT FROM THAT POINT
- MORE DETAILED REPRESENTATION OF THE CORNEA
 - ESPECIALLY IN THE PERIPHERY



CORNEAL TOPOGRAPHY

- ELEVATION MAP
 - CORNEA COMPARED TO A BEST FIT SPHERE
 - RED – HIGHER THAN THE SPHERE REFERENCE
 - BLUE – LOWER THAN THE SPHERE REFERENCE



CORNEAL TOPOGRAPHY

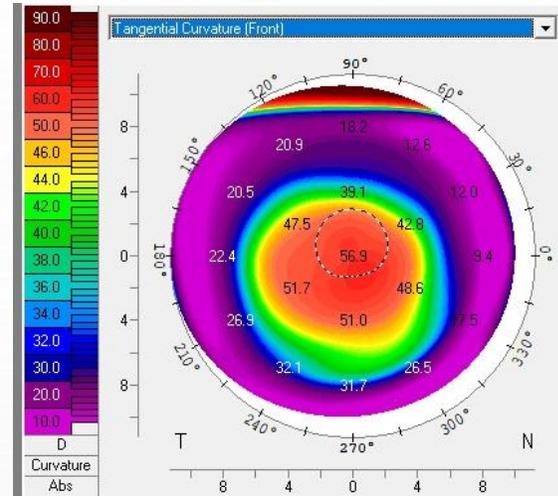
- **ABSOLUTE SCALE**

- REPRESENTATION OF ALL CURVES AVAILABLE IN NORMAL CORNEAS
- COLORS ARE EVENLY DISTRIBUTED OVER THAT RANGE

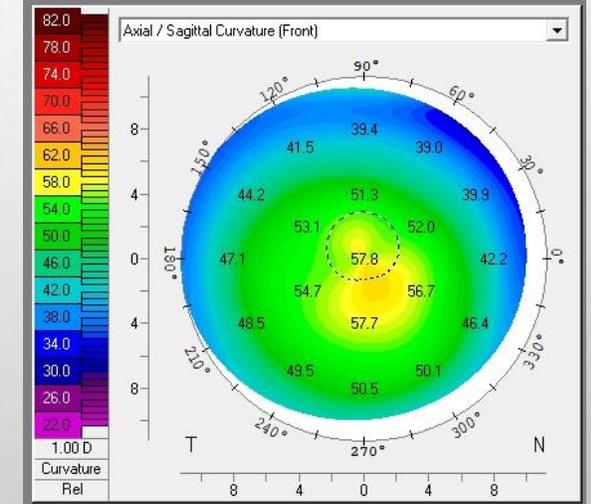
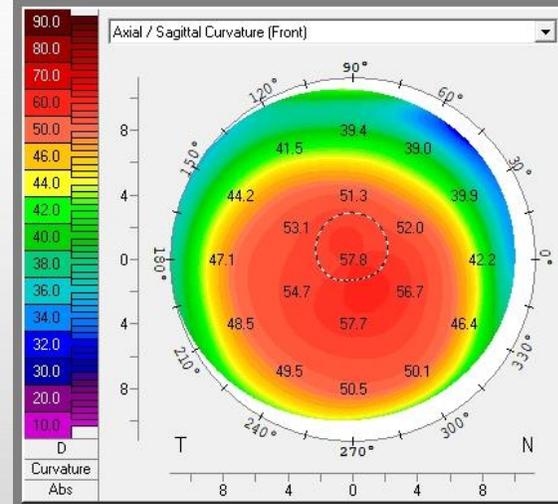
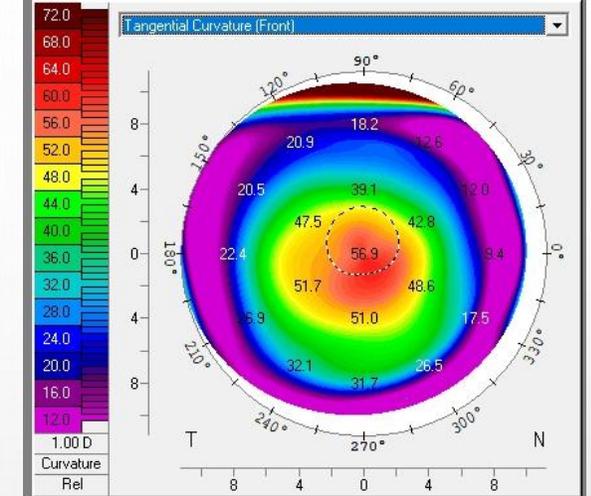
- **RELATIVE SCALE**

- REPRESENTS CURVES THAT ARE AVAILABLE FOR THAT PARTICULAR CORNEA
- COLORS AVAILABLE REPRESENT A MUCH SMALLER RANGE OF CURVES
- MORE DETAIL THAN ABSOLUTE
- CANNOT COMPARE ONE CORNEA TO ANOTHER CORNEA OR ONE CORNEA OVER TIME AS SCALE MAY VARY

Absolute scale

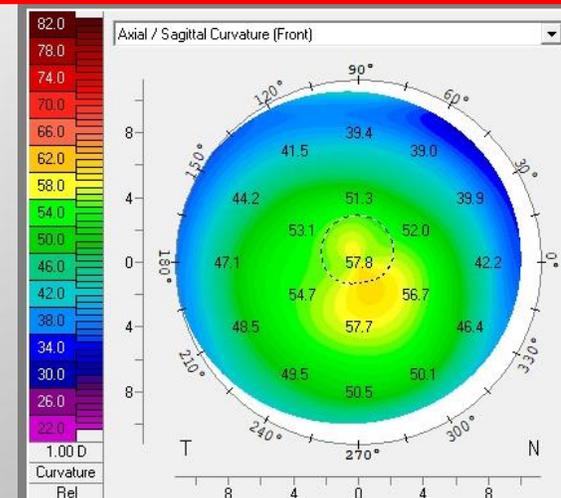
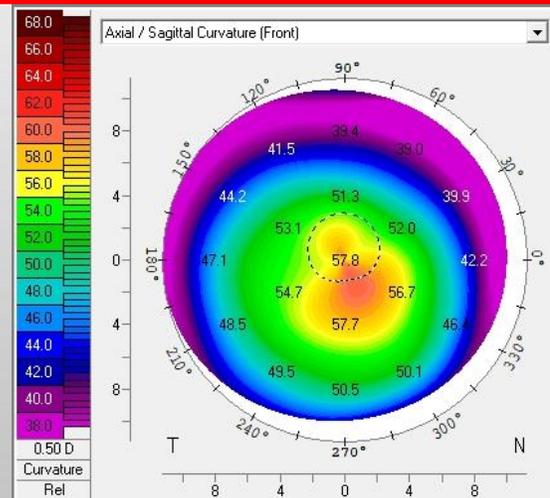
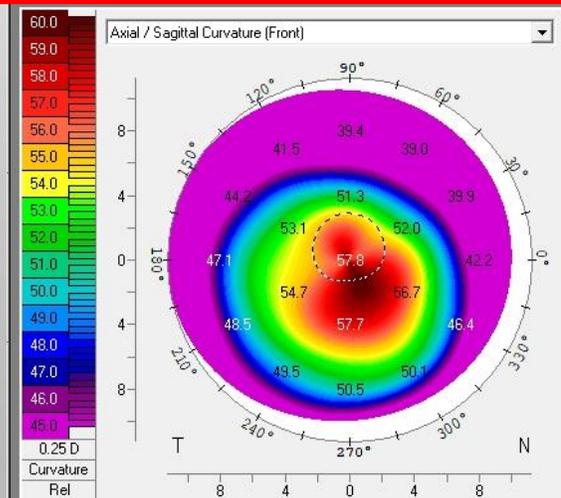
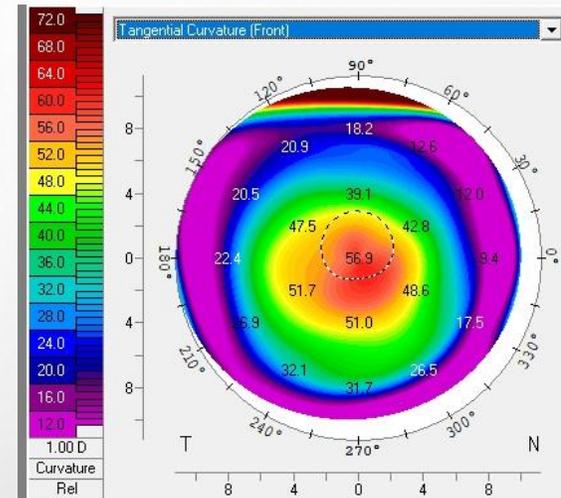
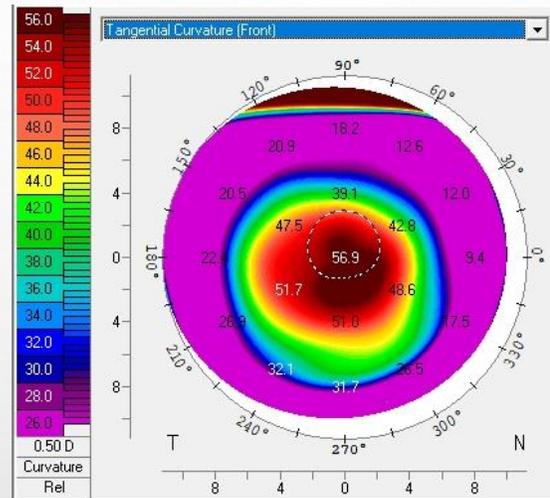
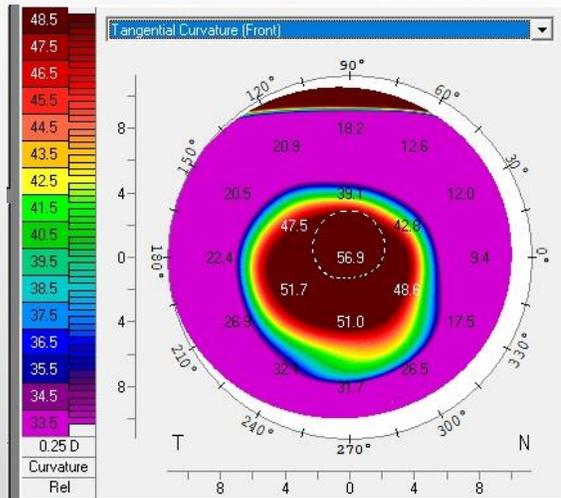


Relative scale



CORNEAL TOPOGRAPHY

- A COUPLE NOTES ABOUT SCALE
 - STEPS REPRESENTING DIFFERENT COLORS ARE TYPICALLY SET AT 0.25D
 - FOR THE IRREGULAR CORNEA INCREASE TO 0.5D OR 1.00D TO OBTAIN A BETTER GENERAL OVERVIEW



0.25D

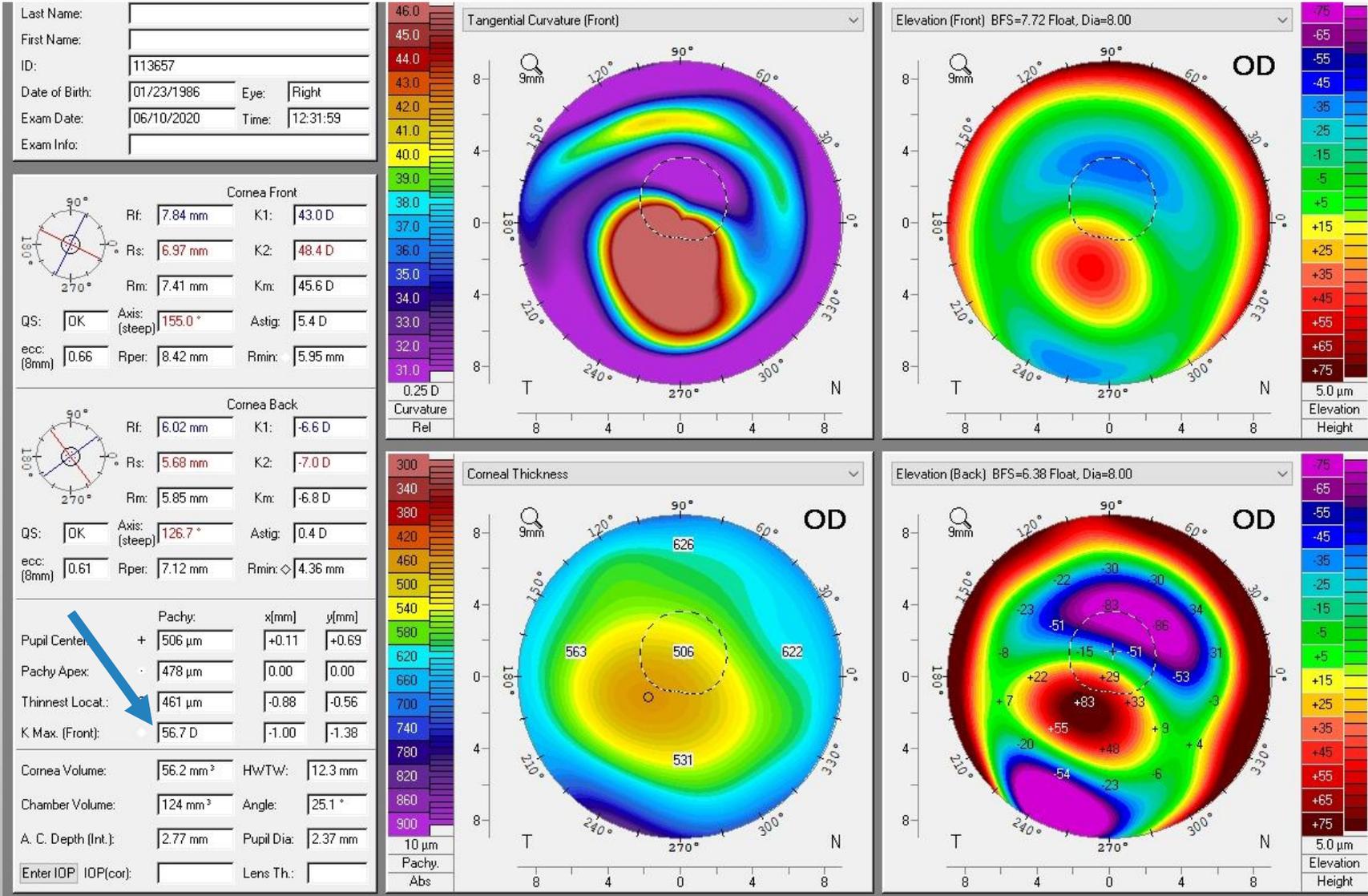
→ 1.00D

CORNEAL TOPOGRAPHY

- A NORMAL CORNEA TYPICALLY HAS A DIOPTRIC RANGE OF 10 DIOPTERS OR LESS
- AN ABNORMAL CORNEA TYPICALLY WILL HAVE GREATER DIOPTRIC RANGE.



CORNEAL TOMOGRAPHY



Kmax should be monitored for progression of ectasia

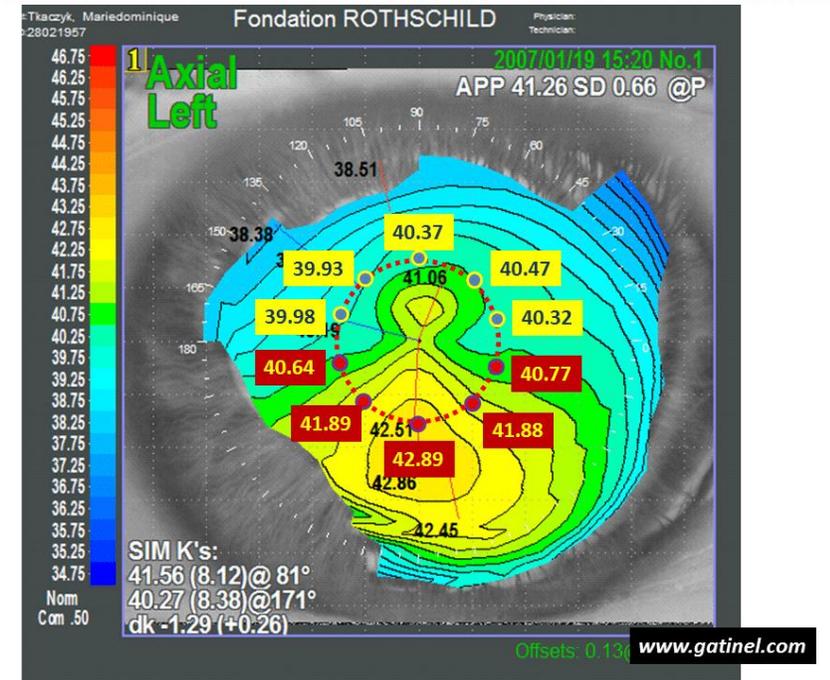
CORNEAL TOPOGRAPHY

- *INFERIOR-SUPERIOR VALUE (I-S)*

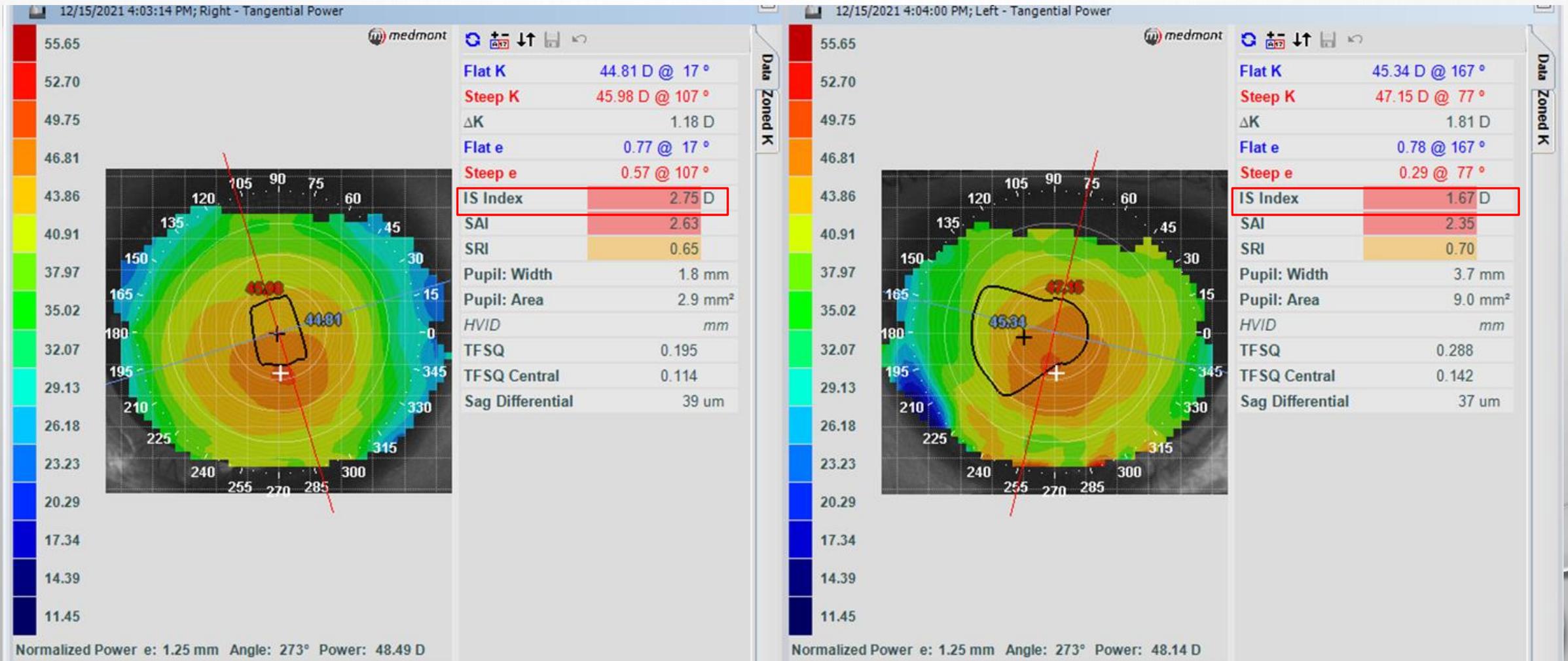
- THE POWER DIFFERENCE BETWEEN:

- FIVE POINTS OF INFERIOR & SUPERIOR HEMISPHERE
- 3 MM FROM THE CORNEAL APEX
- AT SPATIAL INTERVALS OF 30°

- A POSITIVE VALUE INDICATES HIGHER INFERIOR CURVATURE
- A NEGATIVE VALUE INDICATES HIGHER SUPERIOR CURVATURE.
- BETWEEN 1.4 AND 1.8 D ARE SUSPECTED KERATOCONUS
- HIGHER THAN 1.8 D AS CUT-OFF POINT FOR CLINICAL KERATOCONUS

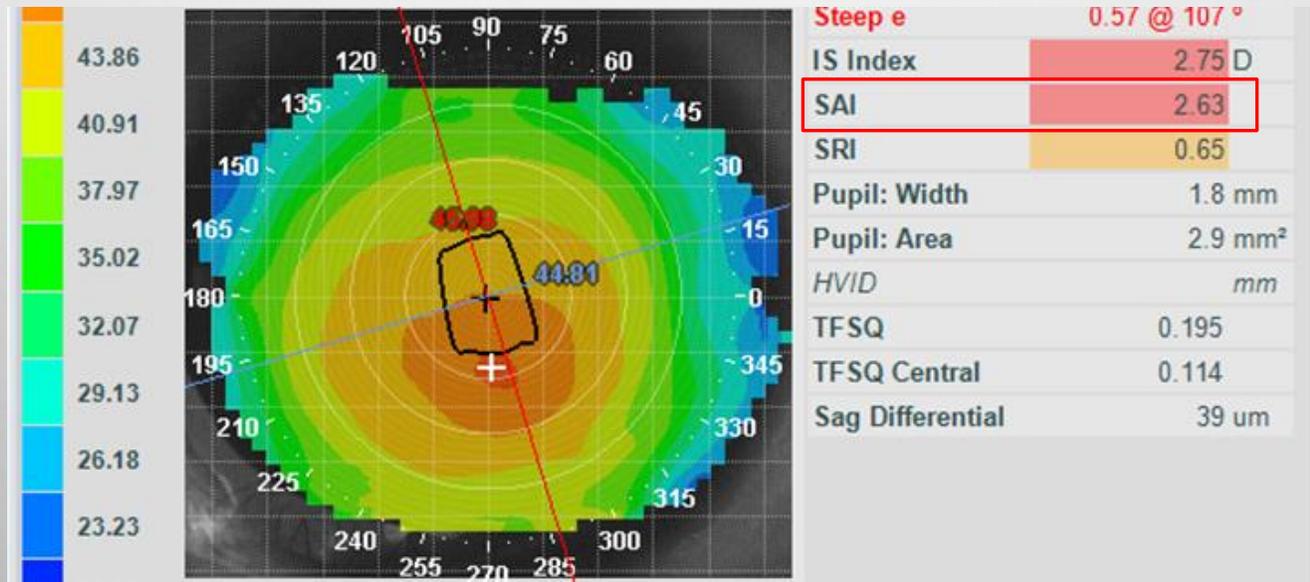


I-S VALUE



CORNEAL TOPOGRAPHY

- SURFACE ASYMMETRY INDEX (SAI)
 - AVERAGE VALUE OF POWER DIFFERENCES:
 - 128 MERIDIANS; 180 DEGREE APART
 - RADIALLY SYMMETRICAL SURFACE HAS A VALUE OF **ZERO**,
 - VALUE INCREASES AS THE DEGREE OF ASYMMETRY IS GREATER.

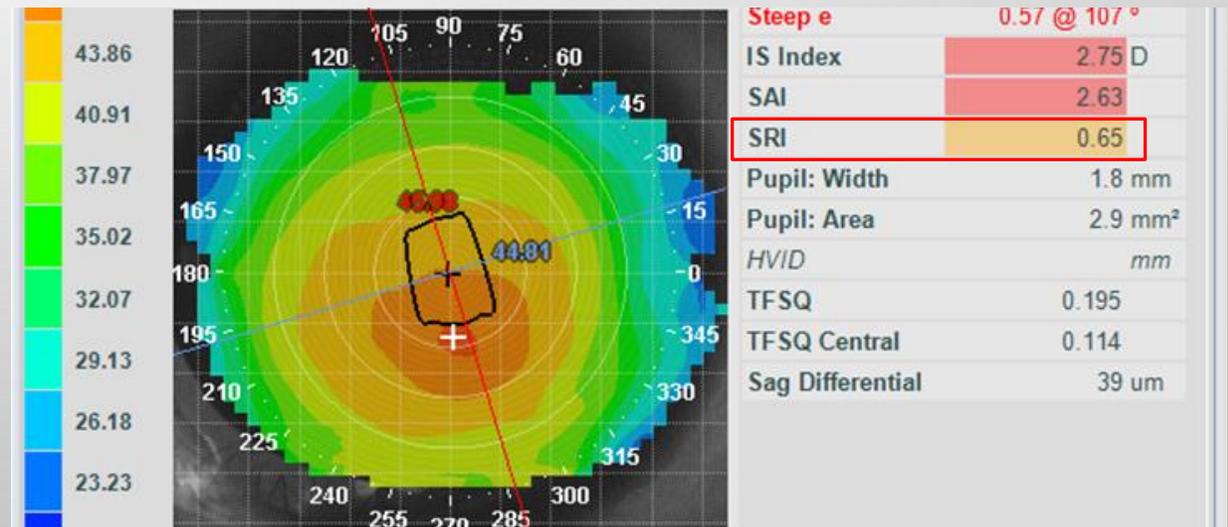


SAI greater than 1 D indicates a diseased or irregular eye

CORNEAL TOPOGRAPHY

- SURFACE REGULARITY INDEX (SRI)
 - LOCAL DESCRIPTOR OF REGULARITY IN A CENTRAL AREA OF 4.5MM OF DIAMETER.
 - QUANTIFIES POWER GRADIENT DIFFERENCE BETWEEN SUCCESSIVE PAIRS OF RINGS.
 - CORRELATES WELL WITH VISUAL ACUITY, ASSUMING THE CORNEA IS THE ONLY LIMITING FACTOR.
 - NORMAL CORNEA: **BELOW 0.56**

BCVA with refraction: 20/20- for this patient.



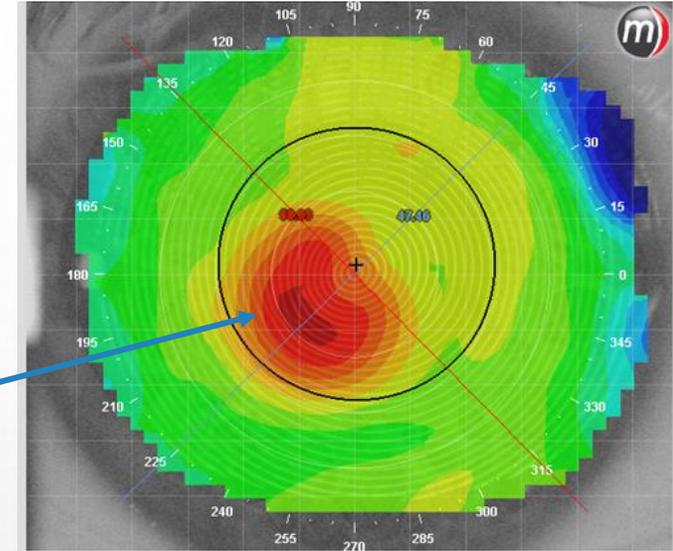
CORNEAL TOPOGRAPHY

- DIAGNOSIS KERATOCONUS WITH CORNEAL TOPOGRAPHY

- POWER AT THE APEX

- 48 TO 49D – CONSIDERED A KCN SUSPECT
- 49 TO 50D – VERY HIGH LIKELIHOOD OF KCN
- >50D – DIAGNOSIS IS ALMOST CERTAIN

53.20D



- ALTERNATIVE METHOD

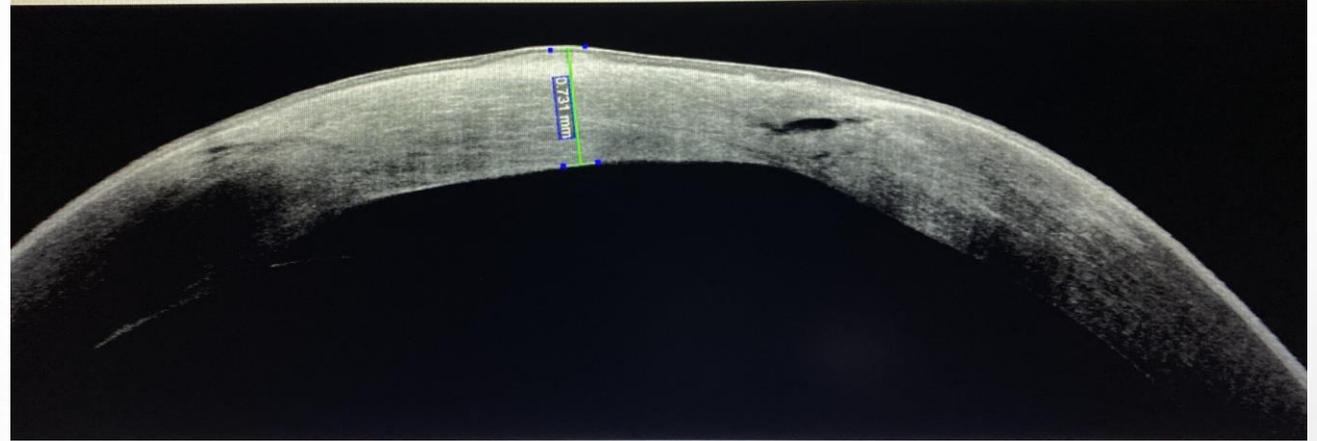
- KCN SUSPECT

- CORNEAL POWER IS GREATER THAN 47.2D OR
- DIFFERENT BETWEEN THE INFERIOR AND SUPERIOR PARACENTRAL CORNEAL REGIONS (I-S VALUE) > 1.4D

- KCN

- CORNEAL POWER IS GREATER THAN 48.7D
- I-S VALUE > 1.8D

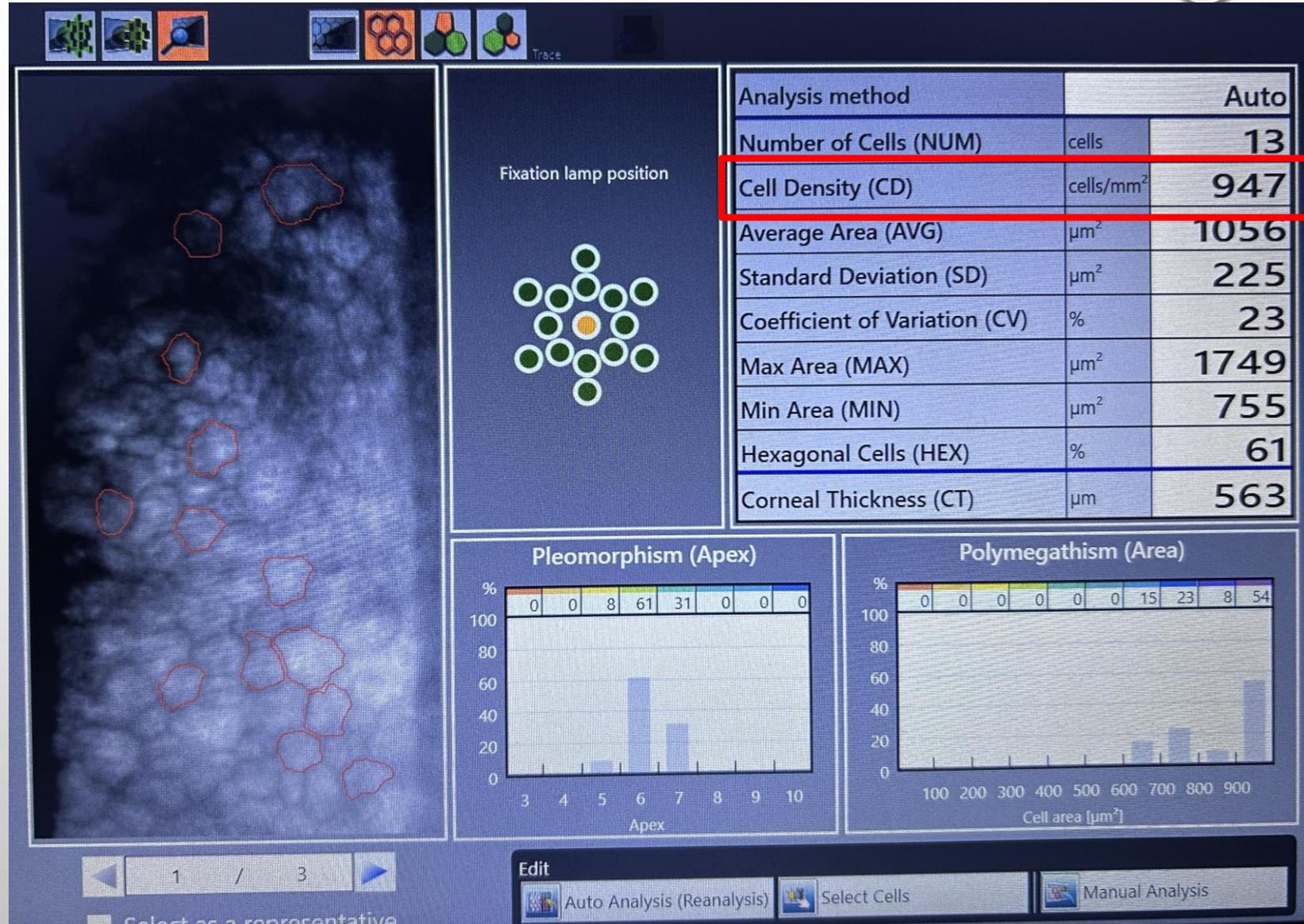
ANTERIOR SEGMENT OCT



- CURRENT REPORTED USES OF AS-OCT IN CORNEAL DISORDERS CAN BE REMEMBERED BY 7 DS:
 - (1) DETERMINING THE THICKNESS OF CORNEA AND CORNEAL FLAPS,
 - (2) DEPTH OF CORNEAL LESIONS INCLUDING DYSTROPHIES,
 - (3) DETAILS OF CORNEAL INFLAMMATION,
 - (4) DESCEMET'S MEMBRANE ASSESSMENT,
 - (5) DEPOSITS IN CORNEA,
 - (6) DRY EYES ASSESSMENT, AND
 - (7) DIAGNOSIS OF SURFACE NEOPLASIA IN EARLY STAGES

ENDOTHELIAL CELL COUNT

- NORMAL RANGE
 - 2000-3000 CELL/MM²
 - DECREASES WITH AGE
- IMPORTANT MEASURE OF POST-SURGICAL CORNEAL HEALTH
- SCLERAL LENS FITTING



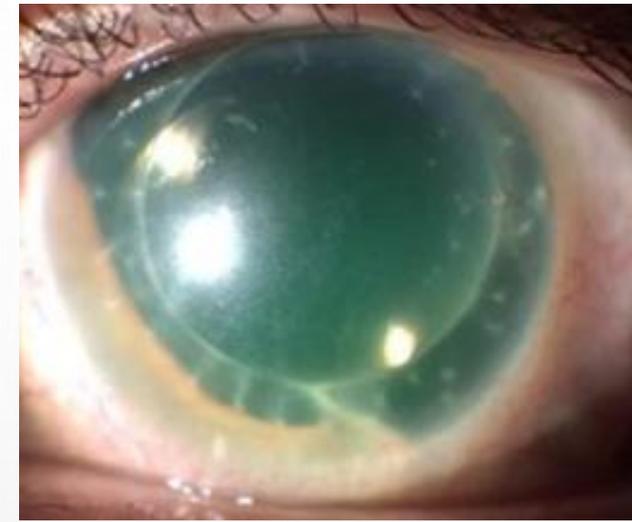
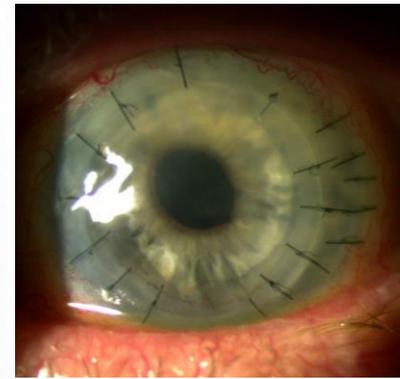
The background of the slide is a light gray gradient with several realistic water droplets of various sizes scattered across it. The droplets have highlights and shadows, giving them a three-dimensional appearance. The text 'SURGICAL OPTIONS' is centered in the middle of the slide in a bold, black, sans-serif font.

SURGICAL OPTIONS

SURGICAL OPTIONS

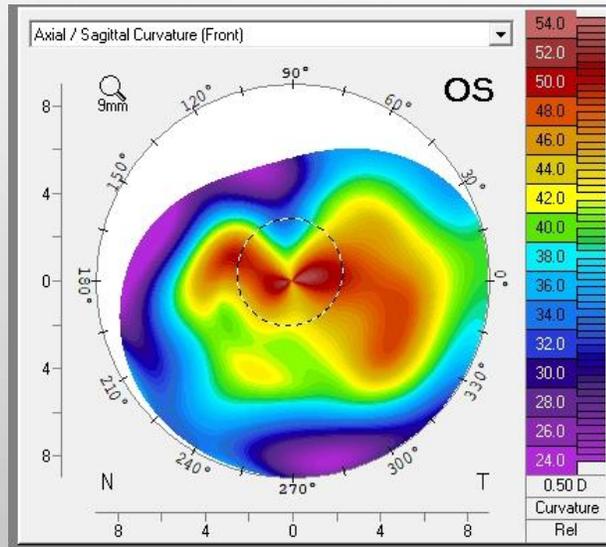
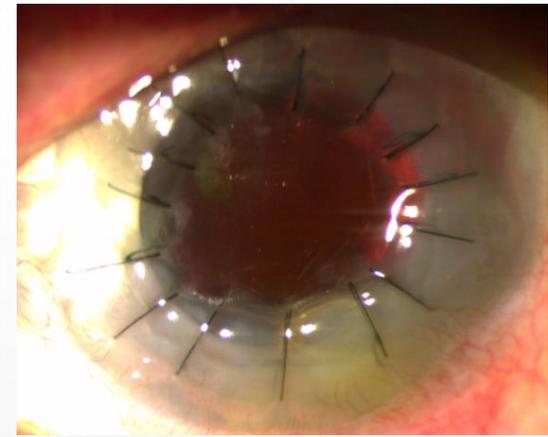
- KERATOCONUS: **CORNEAL CROSSLINKING**
- THE ADDITION OF MOLECULAR BONDS TO INCREASE THE MECHANICAL STRENGTH OF TISSUE
 - CAN STABILIZE THE CORNEA, FLATTEN KMAX, IMPROVE VA
 - SHOULD BE UTILIZED AS AN EARLY MANAGEMENT OPTION FOR PATIENTS WITH KCN.
- MOST INSURANCE CARRIERS ARE COVERING THE DRUGS AND USE THE FOLLOWING CRITERIA FOR APPROVAL:
 - **A ≥ 1.0 D CHANGE IN MAXIMUM KERATOMETRY (KMAX), WITHIN A 24-MONTH PERIOD.**

SURGICAL OPTIONS

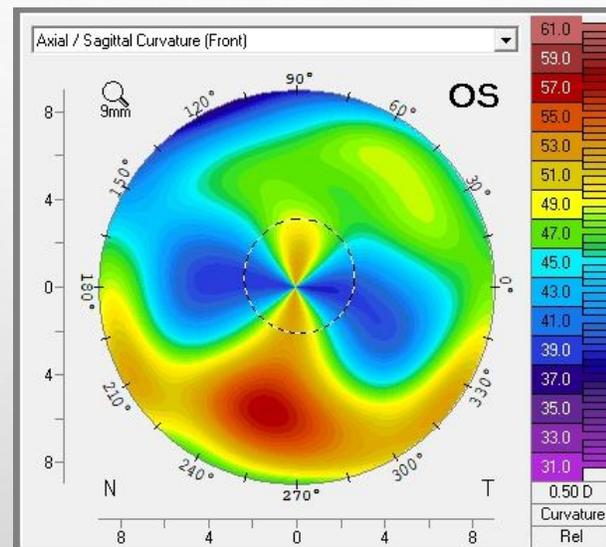


- PENETRATING KERATOPLASTY
- FULL-THICKNESS CORNEAL TRANSPLANT
 - USED WHEN THE CORNEAL DISEASE AFFECTS CORNEAL CLARITY
 - REPLACES ALL CORNEAL LAYERS WITH NO REGARD FOR THE HEALTHY ONES
 - COMPLICATIONS: SUTURES, OCULAR SURFACE PROBLEMS, WOUND DEHISCENCE
 - SLOW VISUAL REHABILITATION, ANISOMETROPIA COMMON, HIGH ASTIGMATISM
- MOST COMMON INDICATIONS:
 - KERATOCONUS, PSEUDOPHAKIC BULLOUS KERATOPATHY, FUCH'S DYSTROPHY, CORNEAL SCARRING, AND APHAKIC BULLOUS KERATOPATHY
- 47% OF PATIENT REQUIRE A CONTACT LENS FOR VISION IMPROVEMENT AFTER SURGERY
 - DUE TO REGULAR AND IRREGULAR ASTIGMATISM

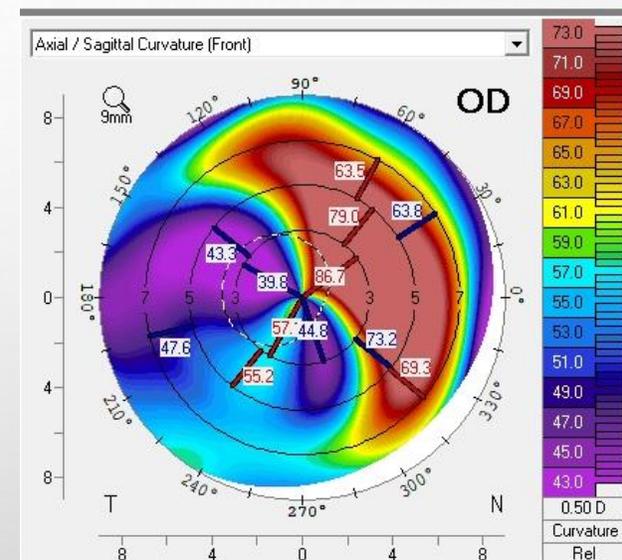
PKP – TOPOGRAPHICAL OUTCOMES



Prolate



Oblate



Steep to flat

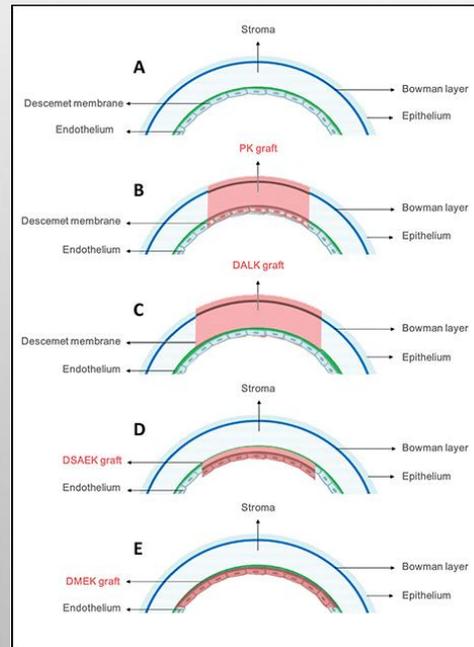
SURGICAL OPTIONS: LAMELLAR KERATOPLASTY

GOAL OF MOST TYPES OF LAMELLAR KERATOPLASTY IS TO REMOVE THE DISEASED PORTION OF THE CORNEA AND SPARE AS MUCH OF THE PATIENTS HEALTHY, FUNCTIONAL TISSUE AS POSSIBLE

- DEEP ANTERIOR LAMELLAR KERATOPLASTY

- DALK

- ENDOTHELIUM AND DESCEMET'S RETAINED.



- ENDOTHELIAL KERATOPLASTY

- DSEK

- DESCEMET'S STRIPPING MEMBRANE ENDOTHELIAL KERATOPLASTY

- DSAEK

- DESCEMET'S STRIPPING AUTOMATED MEMBRANE ENDOTHELIAL KERATOPLASTY

- DMEK

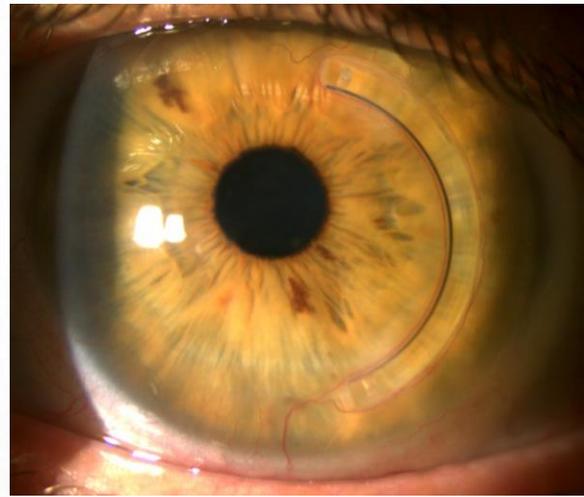
- DESCEMET'S MEMBRANE ENDOTHELIAL KERATOPLASTY

SURGICAL OPTIONS

	Full Thickness	Anterior	Posterior	
	PK	DALK	DSAEK	DMEK
Open Sky Procedure	Yes	No	No	No
Wound/Suture-related problems	Yes	Less	No	No
Endothelial Cell Density decrease	Substantial	Minor	Substantial	Substantial
Risk of allograft rejection	Average	Low	Low	Very low
Refractive-related problems	Common	Common	Rare	Rare
Visual recovery	Slow	Fast	Fast	Very fast

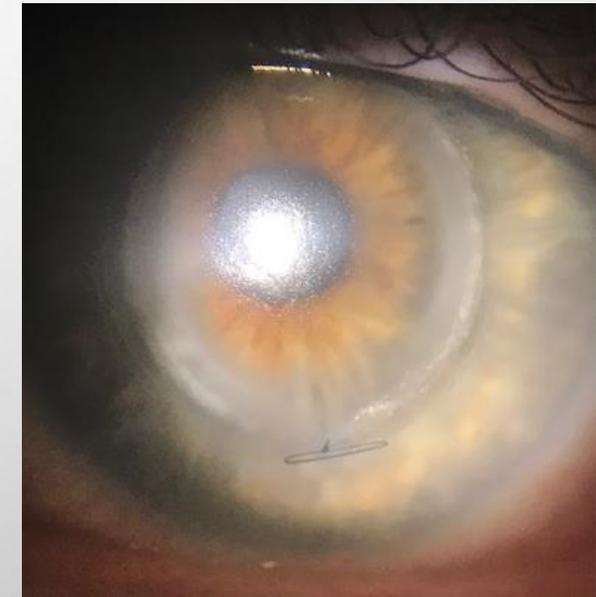
SURGICAL OPTIONS

KERATOCONUS



INTRASTROMAL CORNEAL RING SEGMENTS (ICRS)

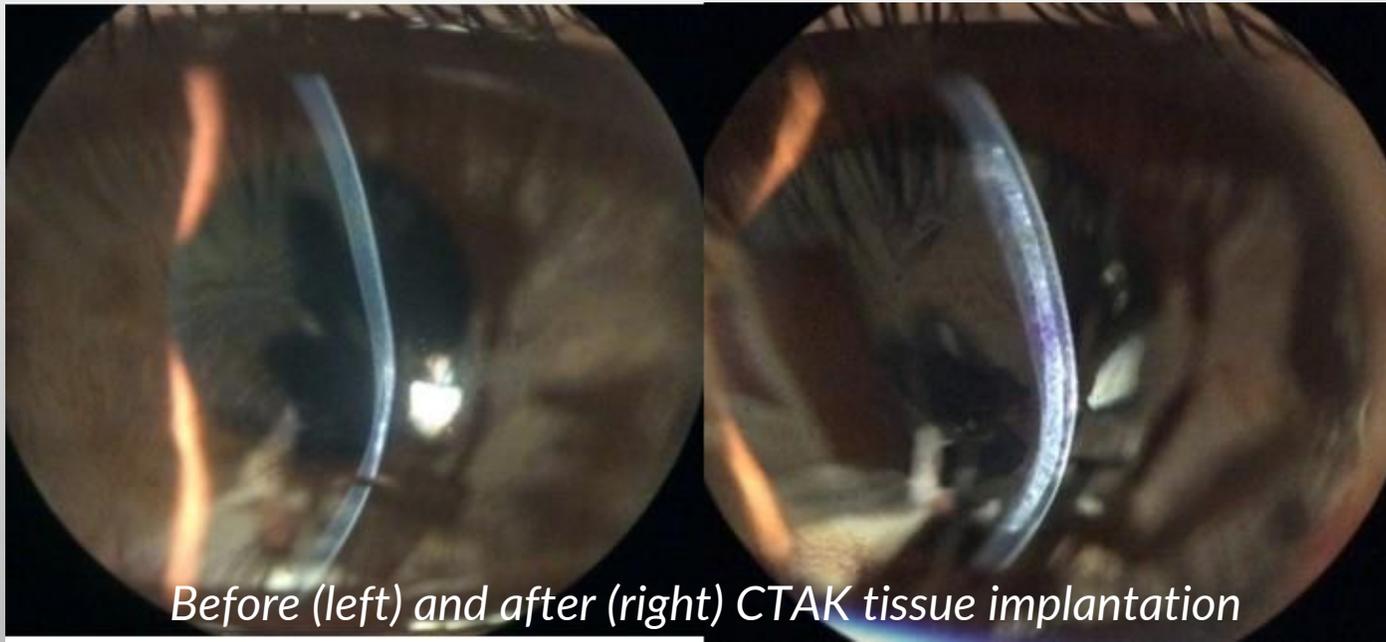
- USED TO FLATTEN THE “CONE” IN KCN PATIENTS.
- IMPROVING VISION
- AIDING IN CONTACT LENS FITTING
- CANDIDATES:
 - MILD TO MODERATE KCN, K'S <MID 50D
 - SPHERICAL EQUIVALENT REFRACTIVE ERROR <5D
 - MINIMUM CORNEAL THICKNESS 450UM



Corneal scarring after INTACS removed from segment extrusion

SURGICAL OPTIONS

- **CTAK – CUSTOMIZED TISSUE ADDITION FOR KERATOCONUS**
 - PROCEDURE IN WHICH A SMALL DISC OF PRESERVED CORNEAL TISSUE OBTAINED FROM THE EYE BANK IS PLACED WITHIN THE CORNEA (DECELLULARIZED CORNEAL TISSUE)
 - DECREASES THE IRREGULARITY OF THE KERATOCONIC CORNEA

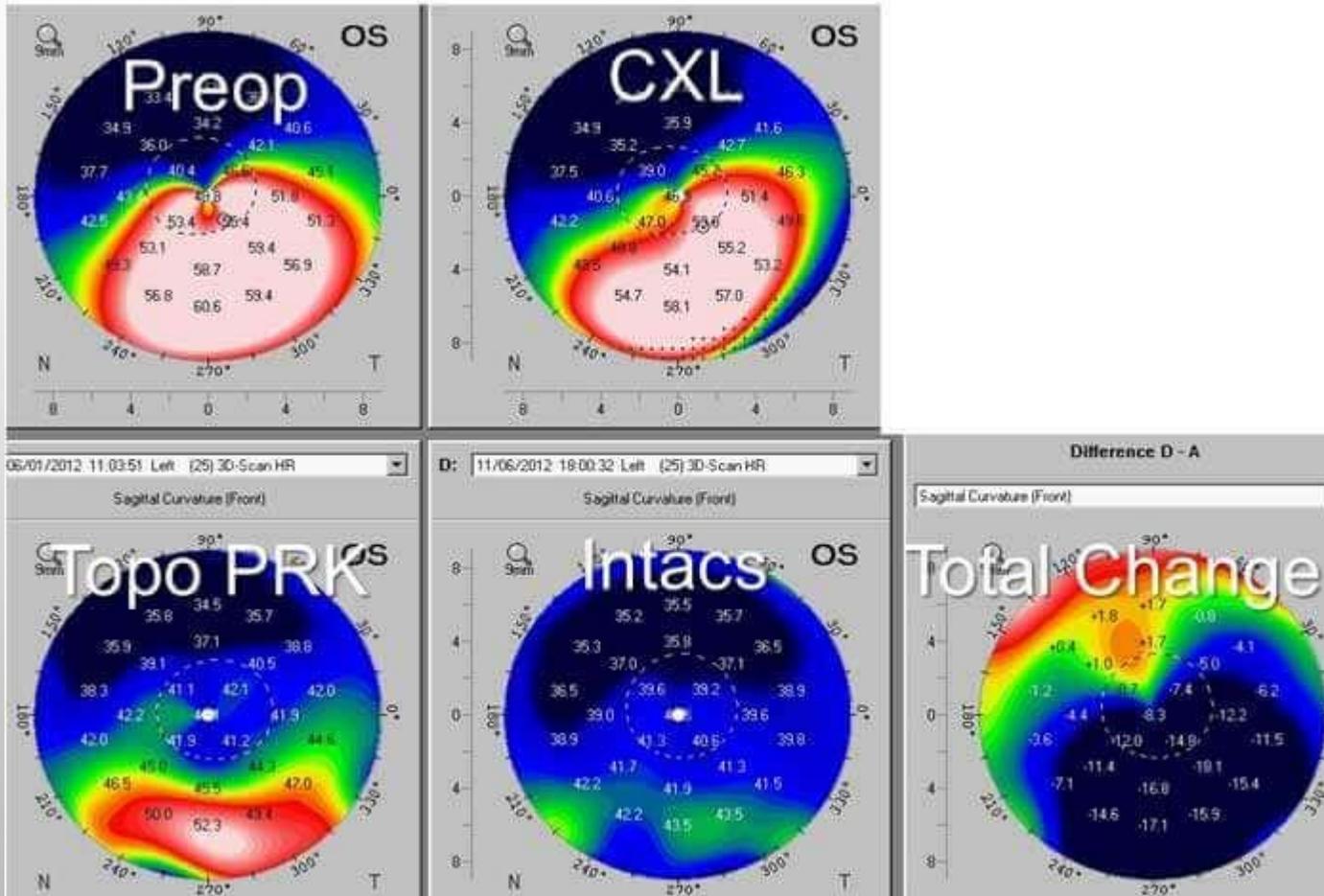


SURGICAL OPTIONS

TOPOGRAPHY-GUIDED PRK (FOR ECTASIA)

- Using the laser to reduce corneal optical irregularities
- Incorporate the individual corneal topography map into the laser treatment.
- The laser reshapes the corneal surface to a more symmetric and rounder shape to improve the corneal optical architecture and visual performance.
- Goal is to improve the corneal shape, improved visual quality with glasses or contact lens fit.
- Some patients may also note general improvement in visual quality.

SURGICAL OPTIONS - COMBINATIONS



Keratoconus on the upper right.

Collagen crosslinking

This patient then underwent topography guided PRK.

In the lower left map, you can see how the high red area has decreased in size.

Intacs were then placed under the remaining elevated area with much improved corneal symmetry (note how the entire cornea has a consistent blue, non-elevated, color).

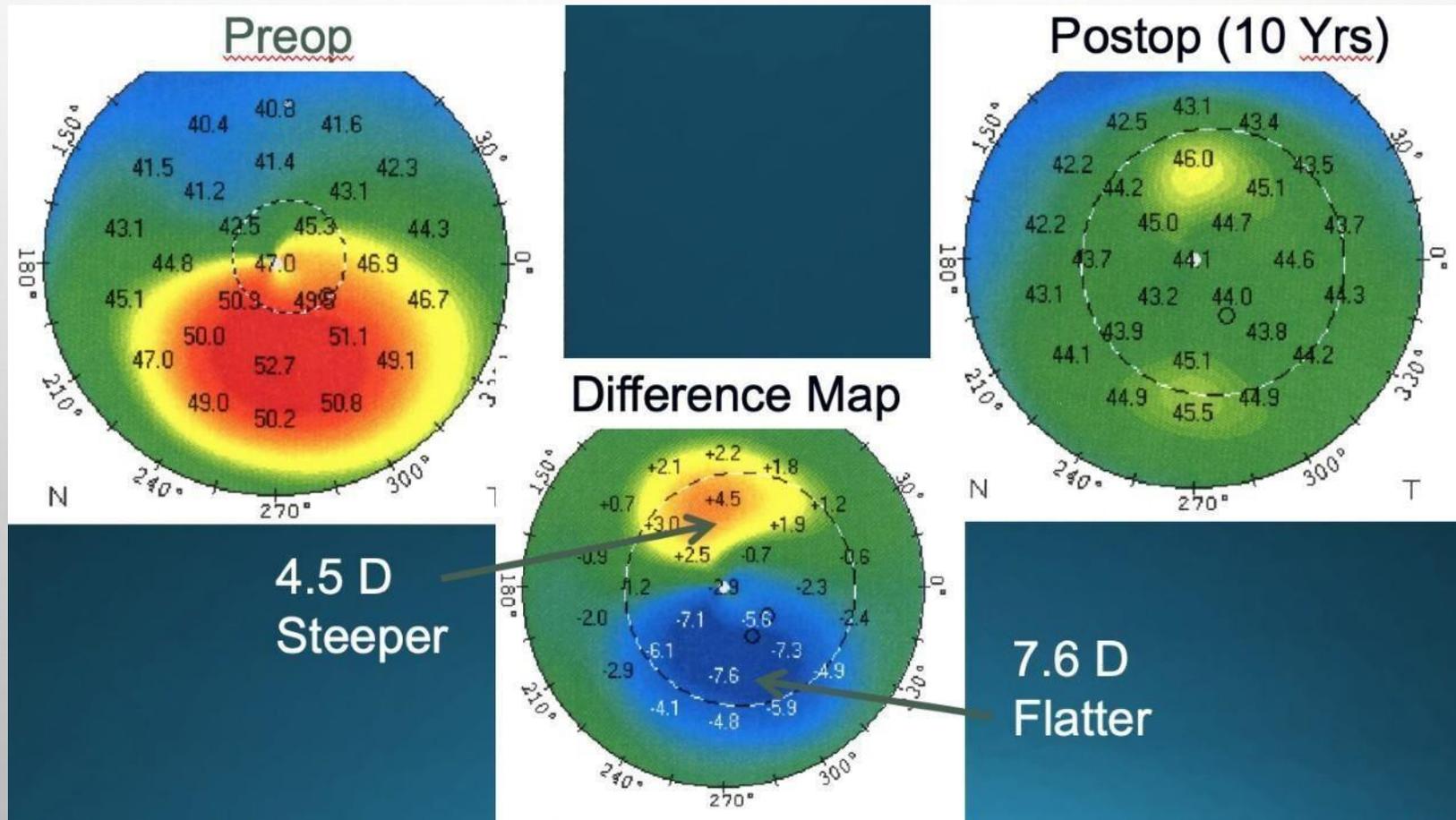
The map on the bottom right is a difference map.

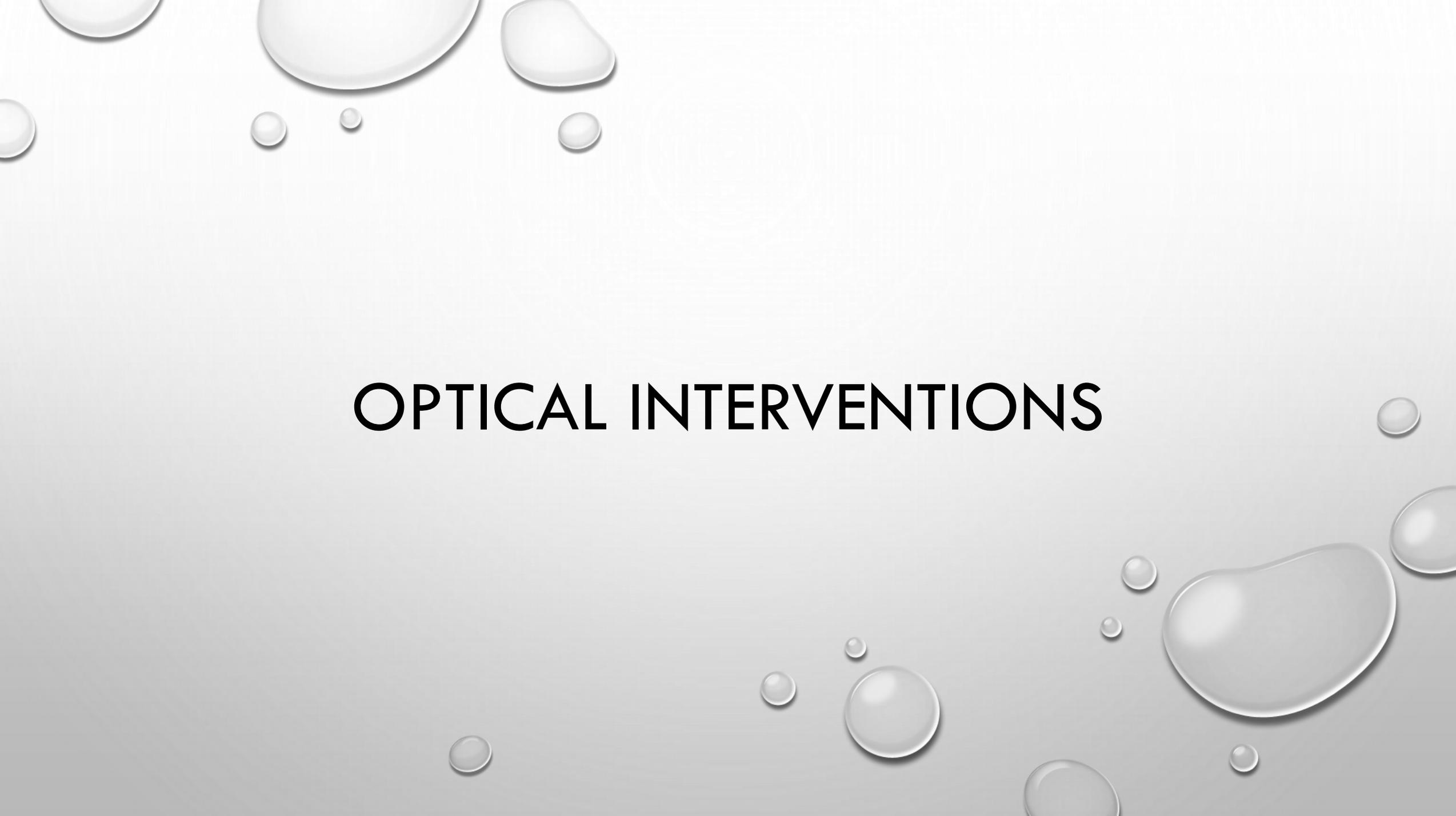
The keratoconic bulge on the bottom has flattened substantially, by 17 diopters in height, whereas the top of the cornea has steepened somewhat, as desired to make the cornea as smooth, optically, as possible.

SURGICAL OPTIONS - COMBINATIONS

- TG-PRK AND CXL

https://clinicaloptometry.scholasticahq.com/article/85116-update-on-corneal-crosslinking-and-topography-guided-prk-in-the-management-of-keratoconus-pellucid-marginal-degeneration-and-ectasia?attachment_id=175869



The background features a light gray gradient with several realistic water droplets of various sizes scattered across the surface. A faint, circular, textured pattern is visible in the upper center of the image.

OPTICAL INTERVENTIONS

OPTICAL INTERVENTIONS

- SPECTACLES
- OCULAR ABERRATIONS
 - DECREASE THE LIKELIHOOD FOR SUCCESS DUE TO HIGHER ORDER APERRATIONS
- CAN BE USED TO CORRECT SPHERICAL AND/OR CYLINDRICAL LOWER ORDER ABERRATIONS
- TRIAL FRAME PRIOR TO PRESCRIBING

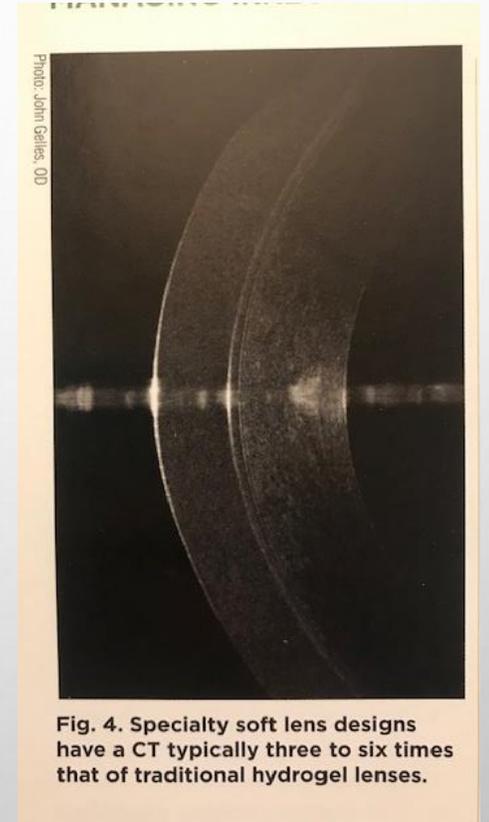


OPTICAL INTERVENTIONS

- **SOFT CONTACT LENSES**
- LIMITED BY HIGHER ORDER ABERRATIONS
- STANDARD SOFT LENS/TORIC LENS
 - LIMITED APPLICATION, UNLESS ADEQUATE VISION IS ACHIEVABLE WITH REFRACTION/SPECTACLES
- CUSTOM SOFT LENSES
 - BEST CANDIDATES: DECREASE IN BCVA WITH SPECS AND STANDARD SOFT TORIC, WITH MILD TO MODERATE IRREGULAR ASTIG
 - PATIENTS WHOSE ANT CORNEAL HOAS ARE PRIMARILY OFFSET BY THEIR INTERNAL OR POSTERIOR CORNEAL HOAS, AS THIS WILL DRAPE OVER THE CORNEA

OPTICAL INTERVENTIONS

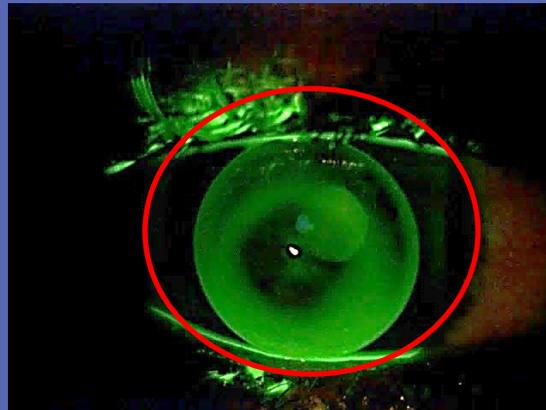
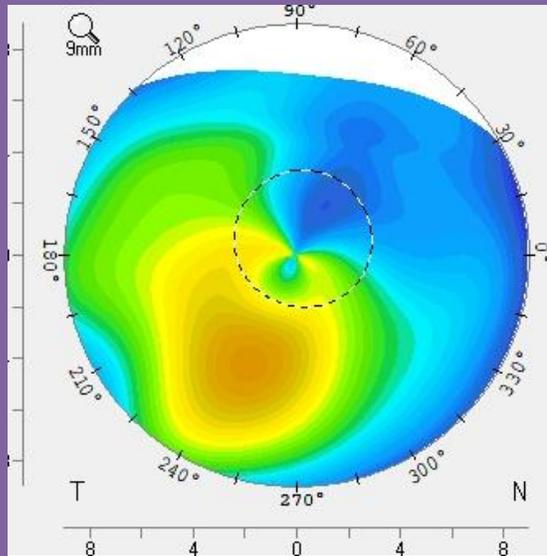
- SOFT CONTACT LENSES
- CUSTOM SOFT IRREGULAR CORNEA DESIGN
 - INCREASE CENTER THICKNESS TO MASK IRREGULAR ASTIG OR
 - ASPHERIC DESIGN TO LIMIT ABERRATIONS
- FITTING TIPS
 - NEED EXCESSIVE MOVEMENT, 1MM OR MORE
 - SAGITTAL DEPTH, HVID, ECCENTRICITY, CORNEAL CURVATURE, AND SCLERAL SHAPE CAN ALL IMPT



Optical interventions

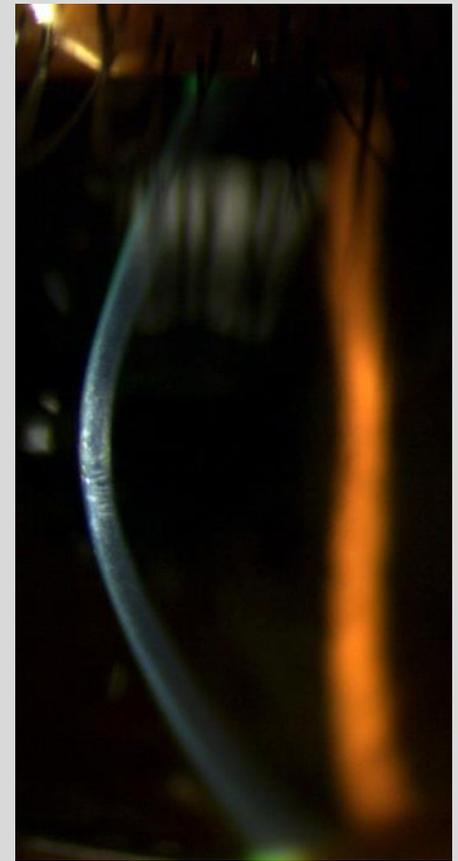
Gas Permeable CL - Provide improved vision by correcting irregular astigmatism and masking HOA that are induced from the irregular astigmatism

Challenges:



Vision is improved with GP lenses:

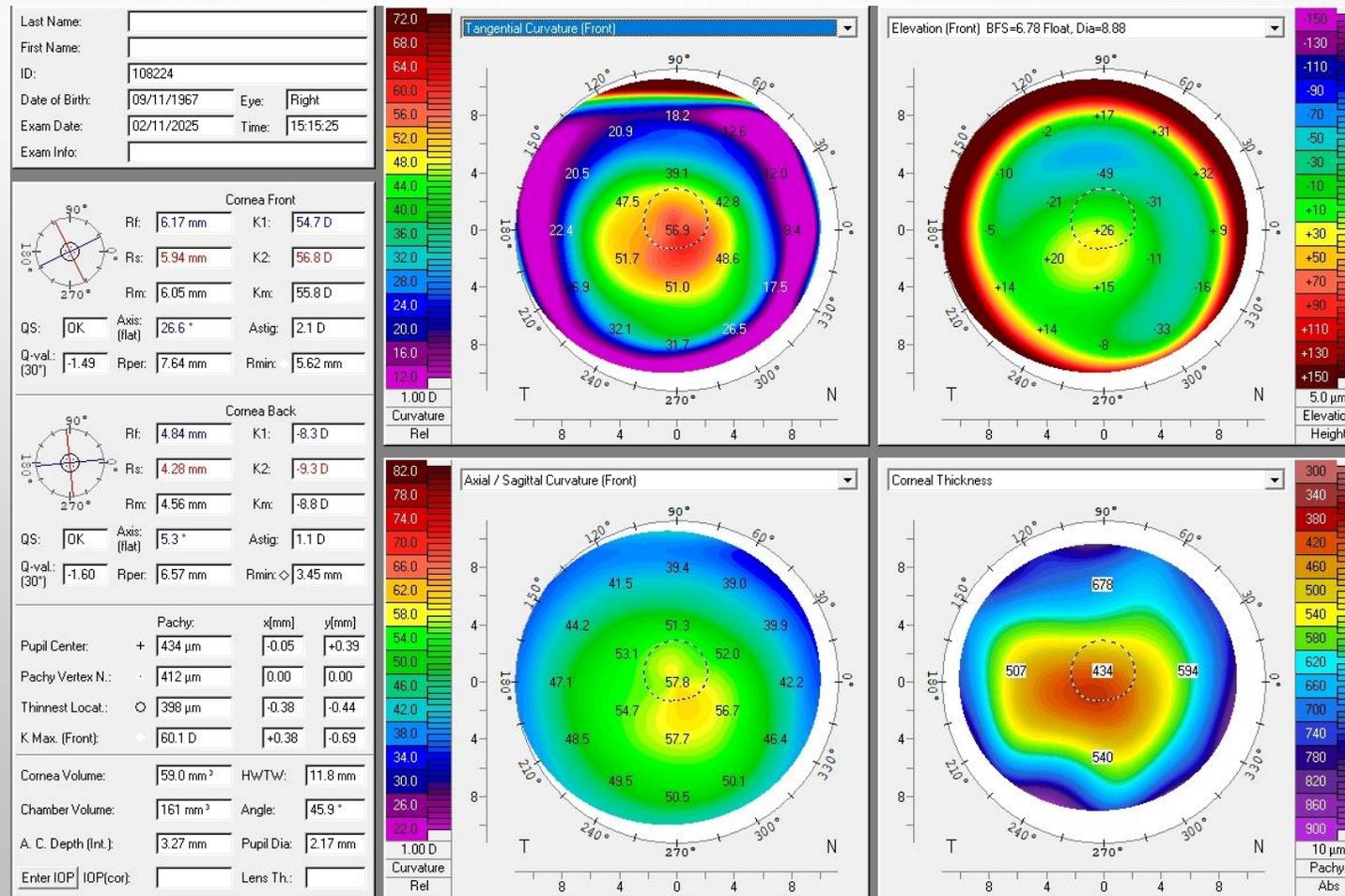
- but visual function or performance is still decreased for KCN patients
- Contrast threshold measurements show a vision loss at low spatial frequencies



OPTICAL INTERVENTIONS

What are the key items the need to be checked prior to fitting a corneal specialty lens?

Specialty gas permeable contact lenses

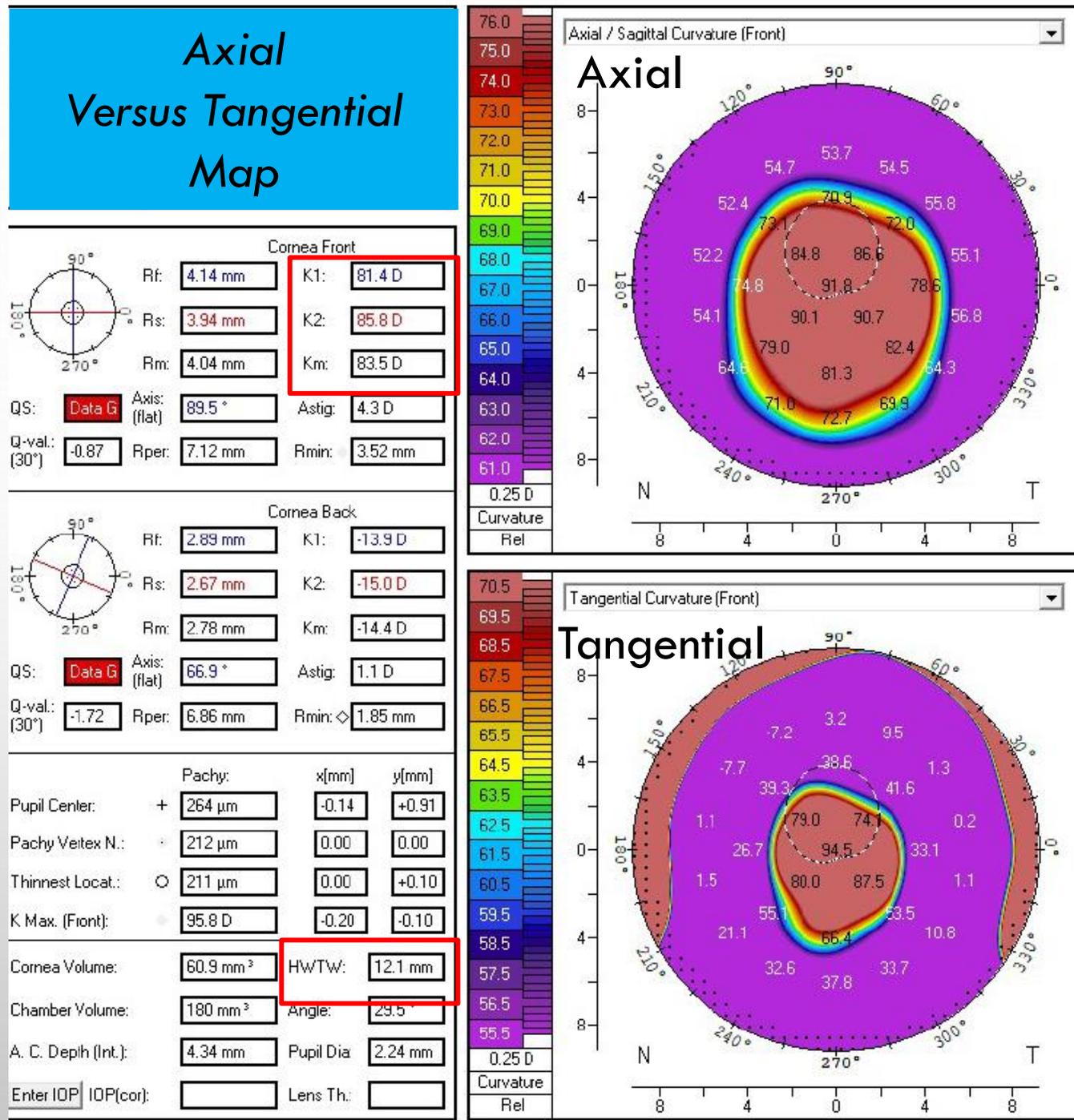


OPTICAL INTERVENTIONS

Size, location, and elevation of the irregularity

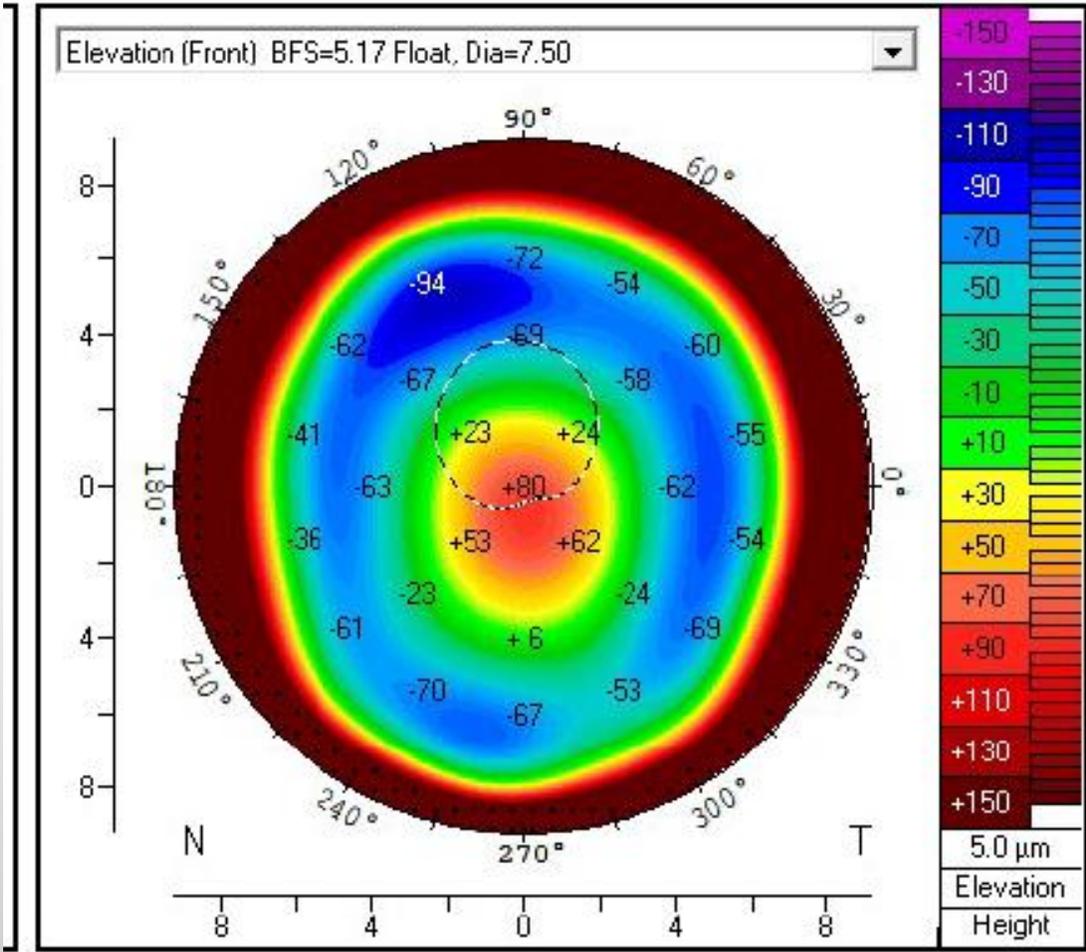
Keratometry values

HVID



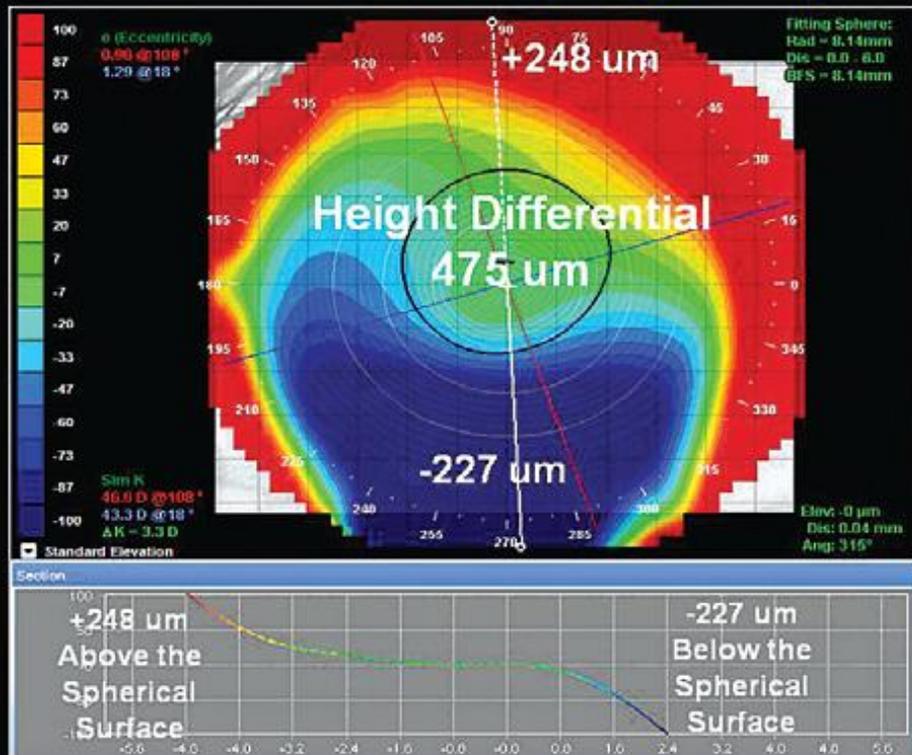
OPTICAL INTERVENTIONS

Elevation Map
Anterior Surface



OPTICAL INTERVENTIONS

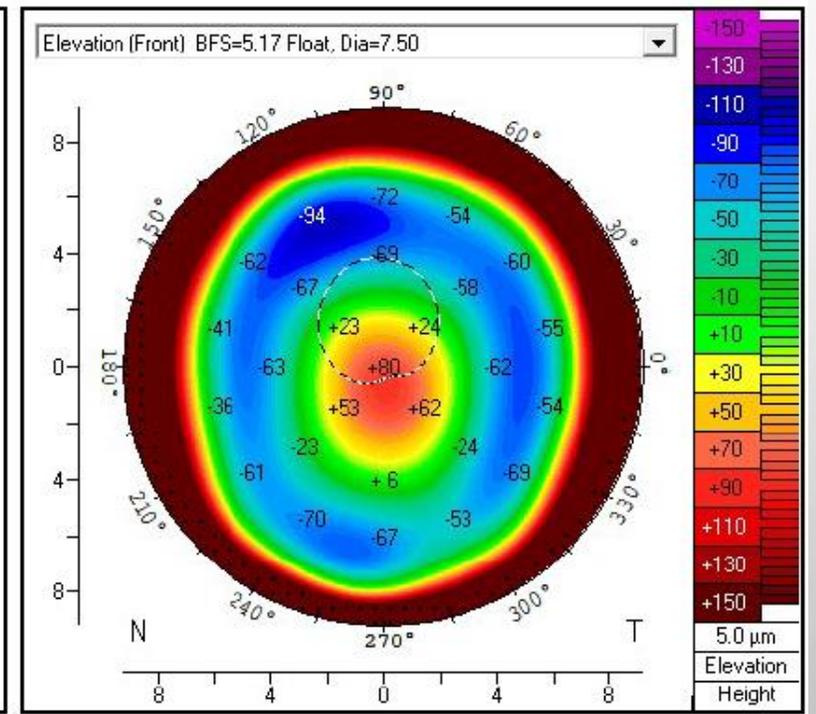
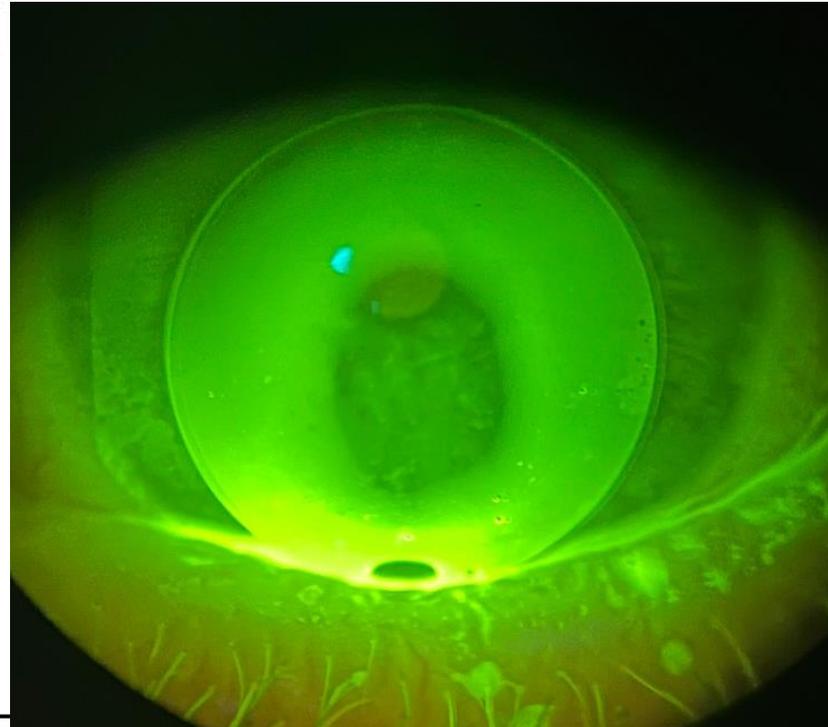
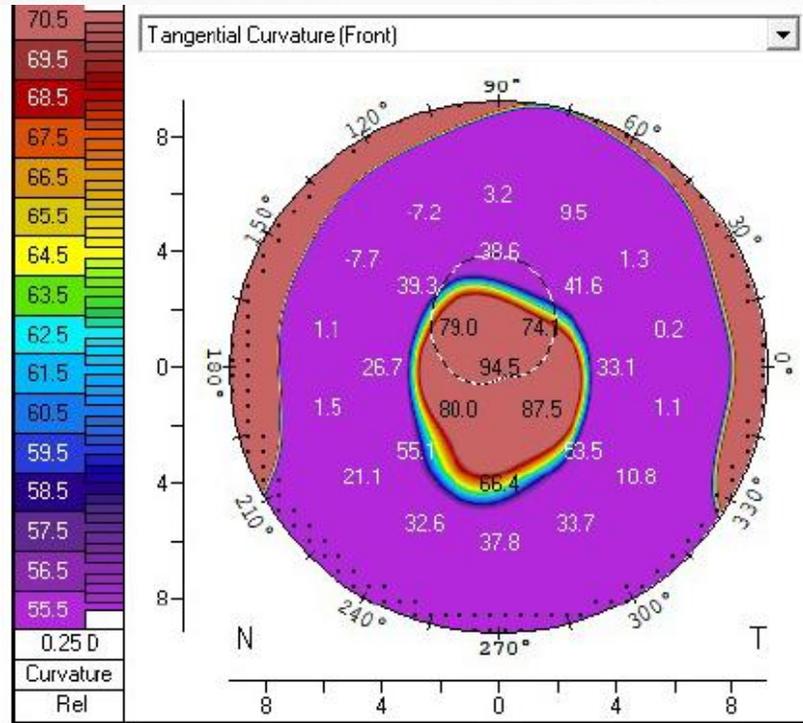
Elevation Display Map



If a patient has less than **350 um** differential between the highest and lowest points along the greatest meridian of change – there is a **88.2%** chance of the patient being **successful** with a **corneal GP lens**.

350 um elevation difference is the guideline when determining between a corneal GP and a scleral lens in HEALTHY cornea.

OPTICAL INTERVENTIONS



The Tangential Map and Anterior Elevation Map are predictive to the fit pattern.

Optical interventions

- Three common GP lens fitting relationships for KCN

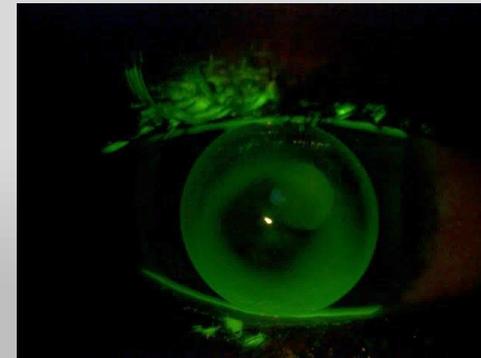
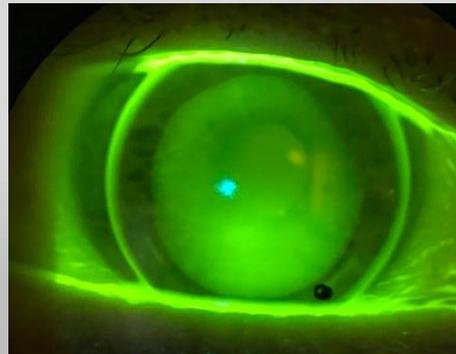
- Apical Bearing

- Previously thought to slow down or halt the progression; this is incorrect.
- This fitting method should not be used, if at all possible



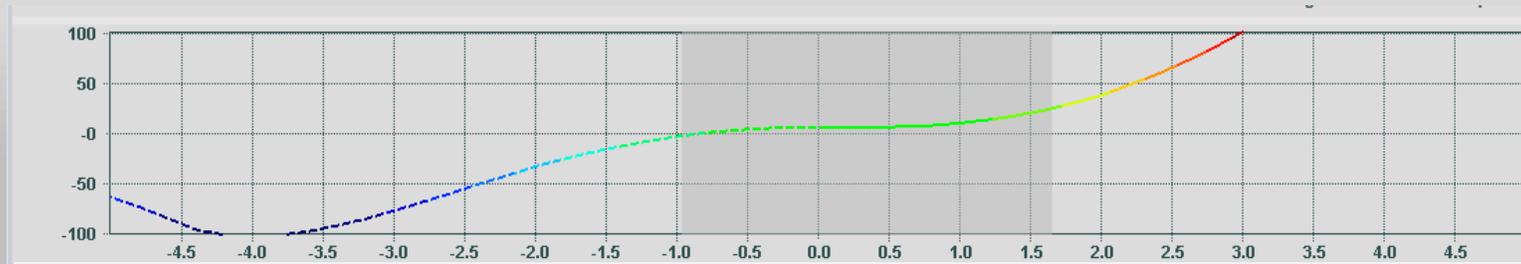
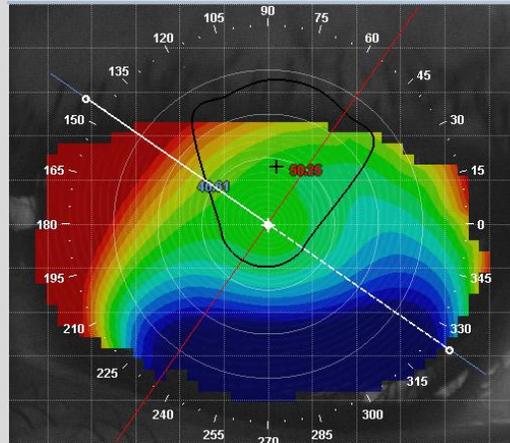
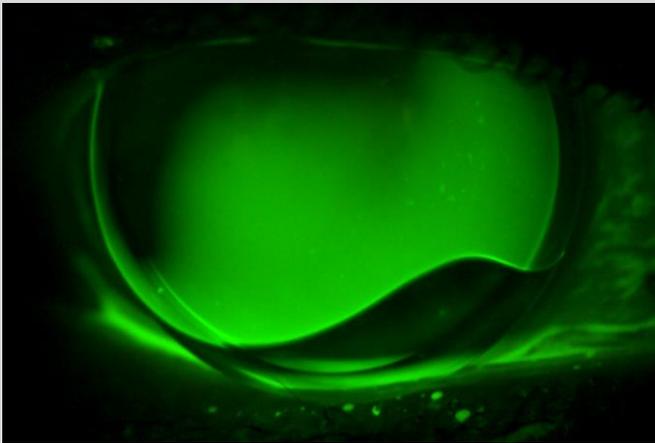
- Apical Clearance

- Three-point touch



Optical interventions

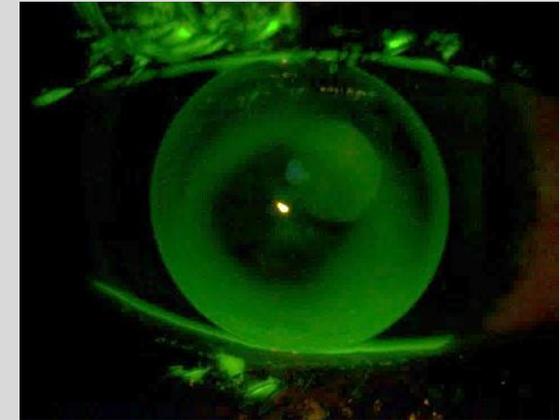
- Most challenging aspects of KCN corneal lens fitting....
Elevation Differences and Inferior Edge lift



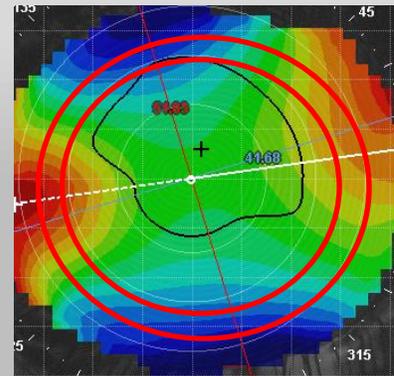
Optical interventions

Troubleshooting Inferior Edge Lift

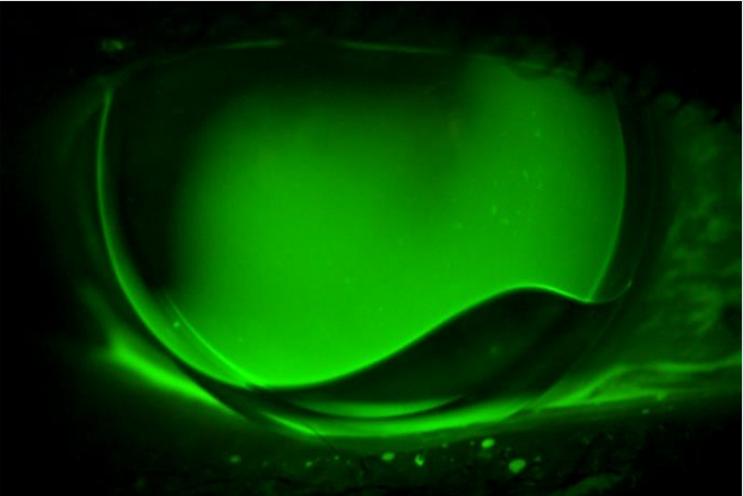
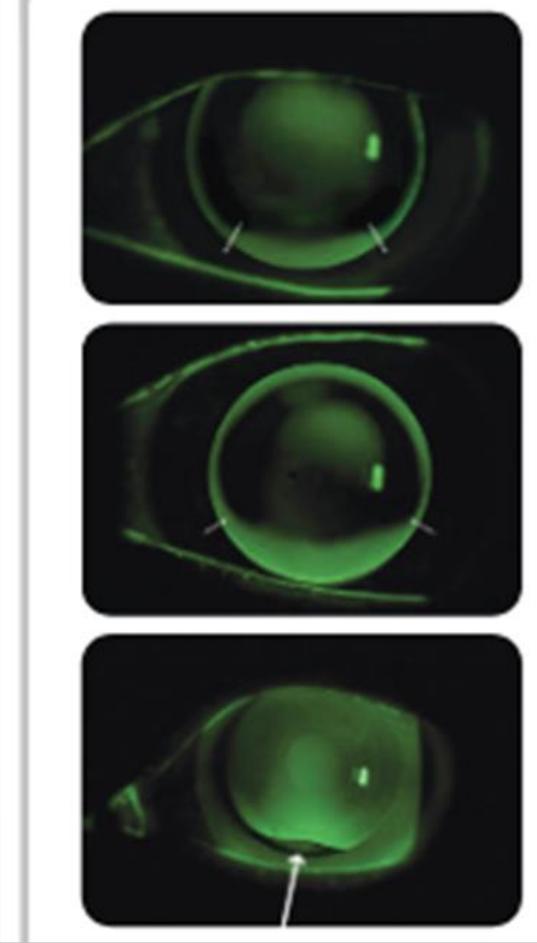
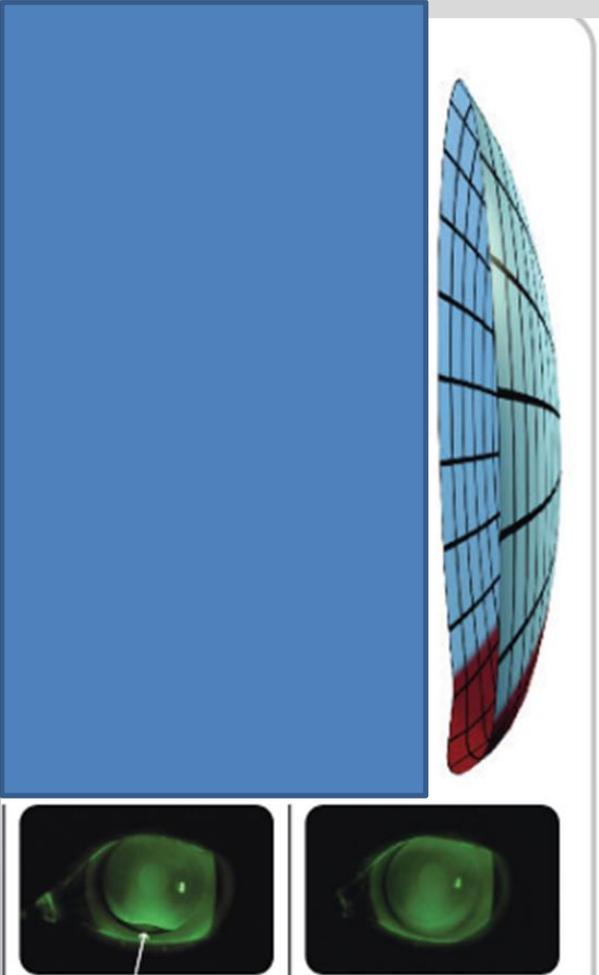
- Steepen the lens base curve
 - Only use when current lens fit is flatter than desired



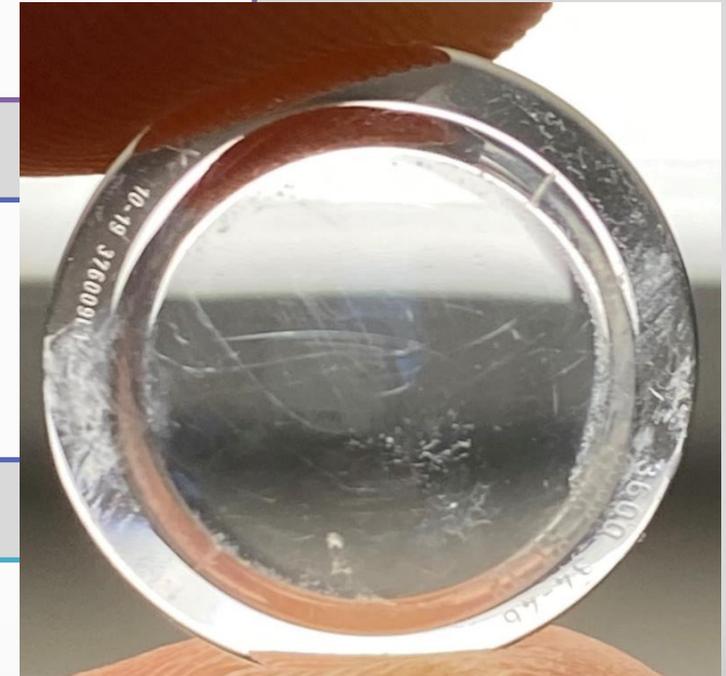
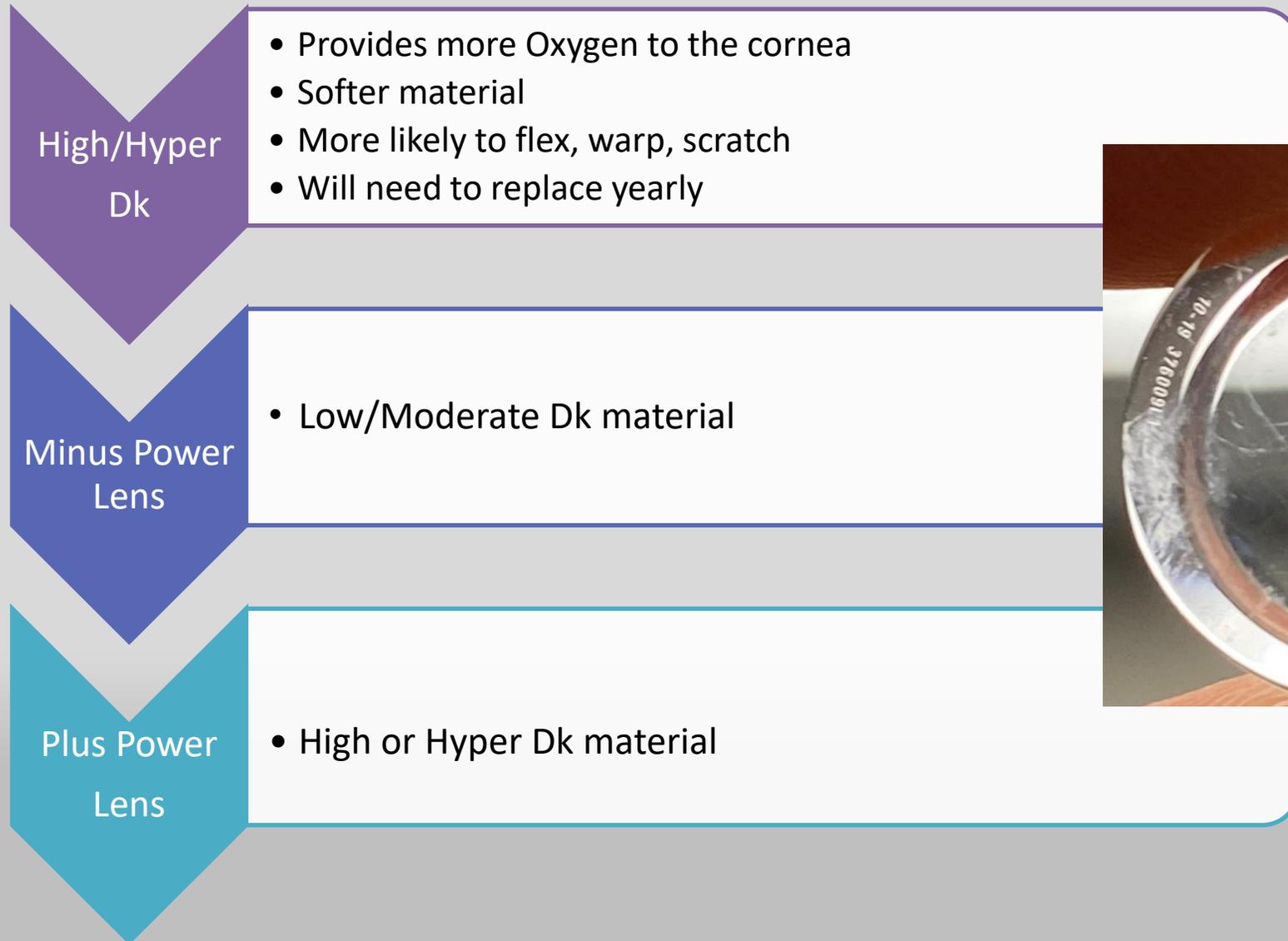
- Add a quadrant specific edge modification to the lens
- Decrease the lens diameter



Optical interventions



A quick comment about GP material

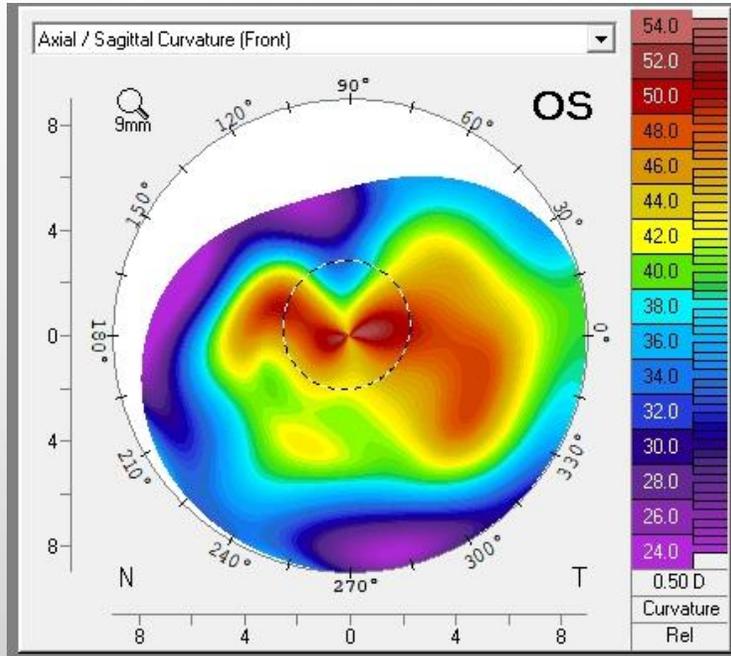


Optical Interventions

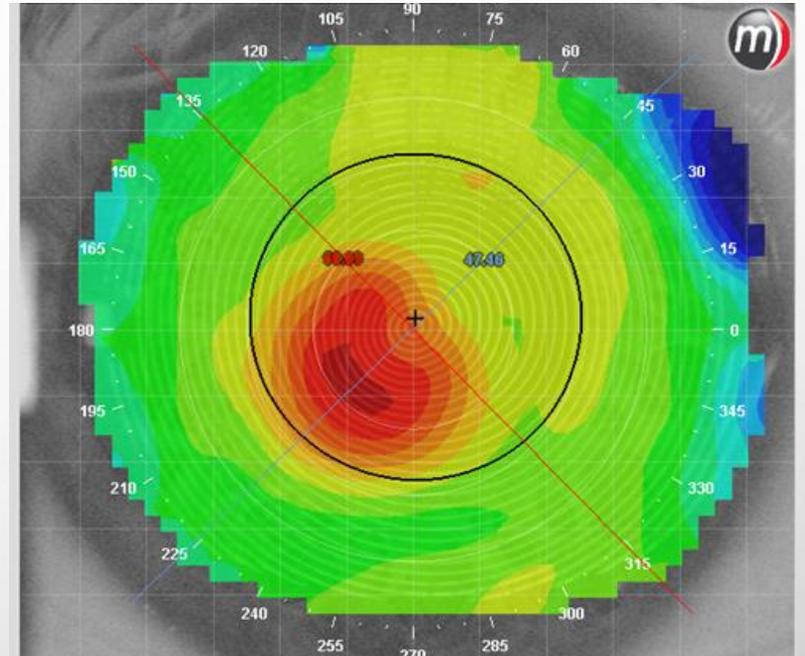
- Scleral Contact Lens
 - Completely vault the cornea
 - And all those irregularities



Scleral lenses



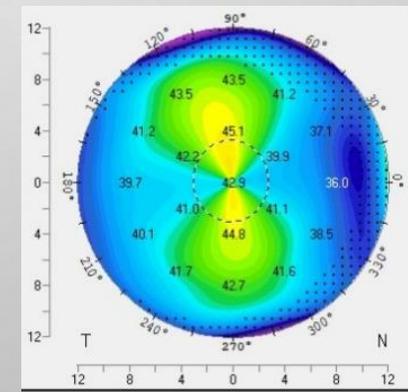
PROLATE



- LENS DESIGN

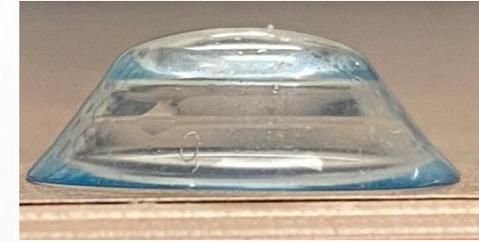
- STEEPER BACK OPTIC ZONE RADIUS

- FLATTER PERIPHERAL CURVES THAT FLATTENING TOWARD PERIPHERY
- ECTASIA, HIGH ASTIGMATISM, PROLATE GRAFTS

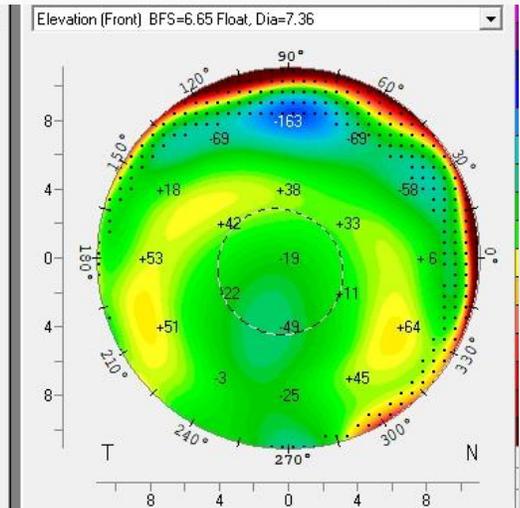
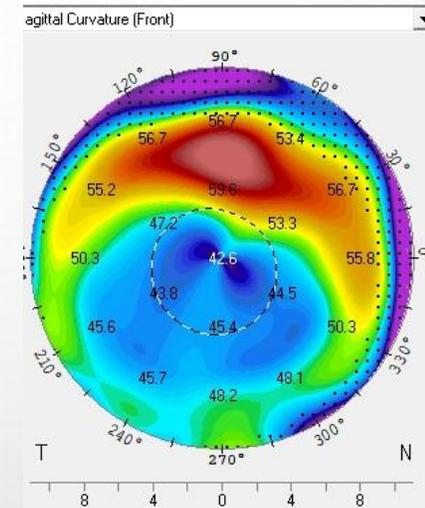
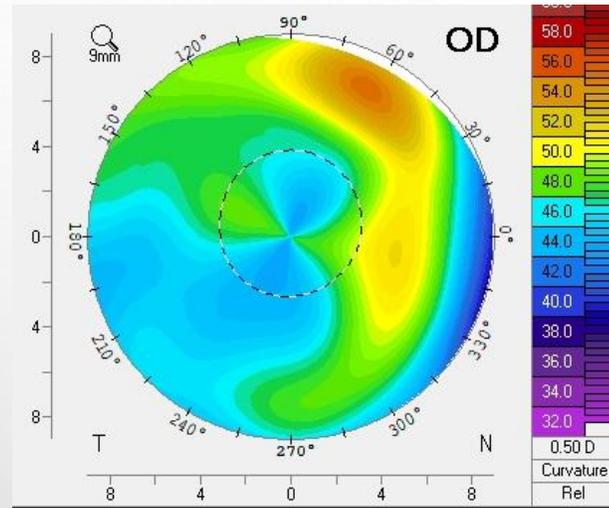
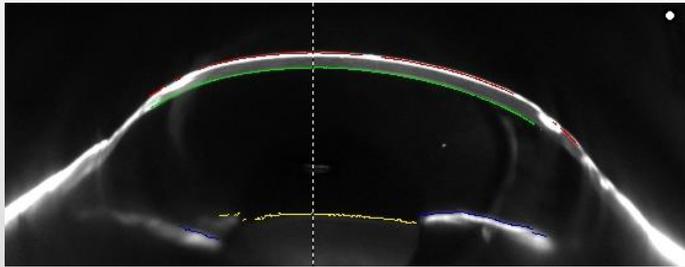


HIGH CORNEAL TORICITY

Scleral lenses



OBLATE

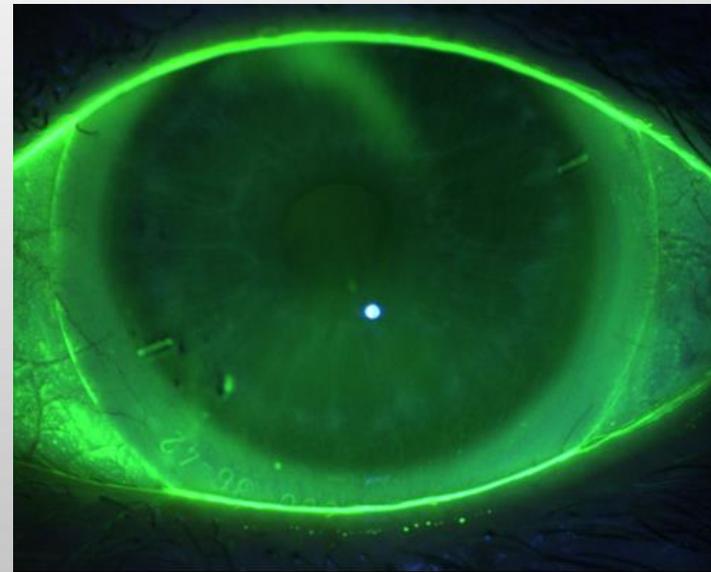
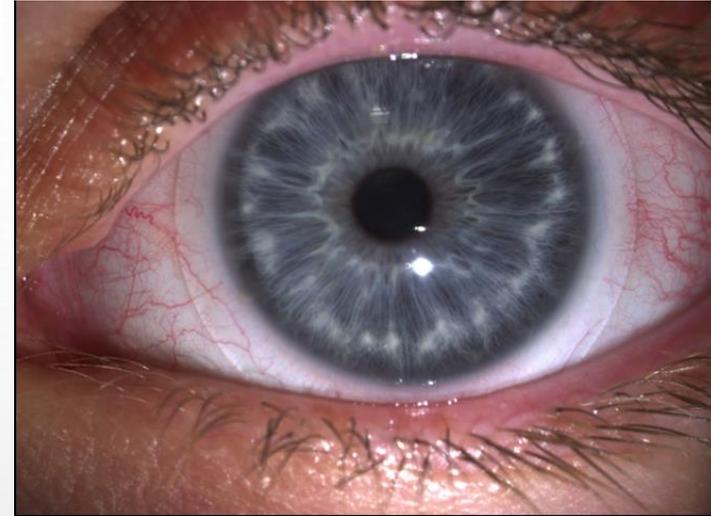
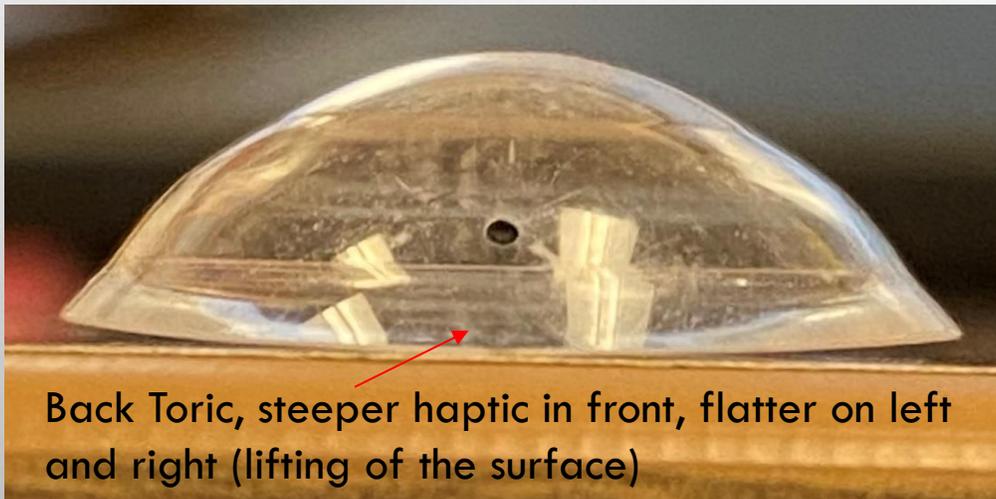
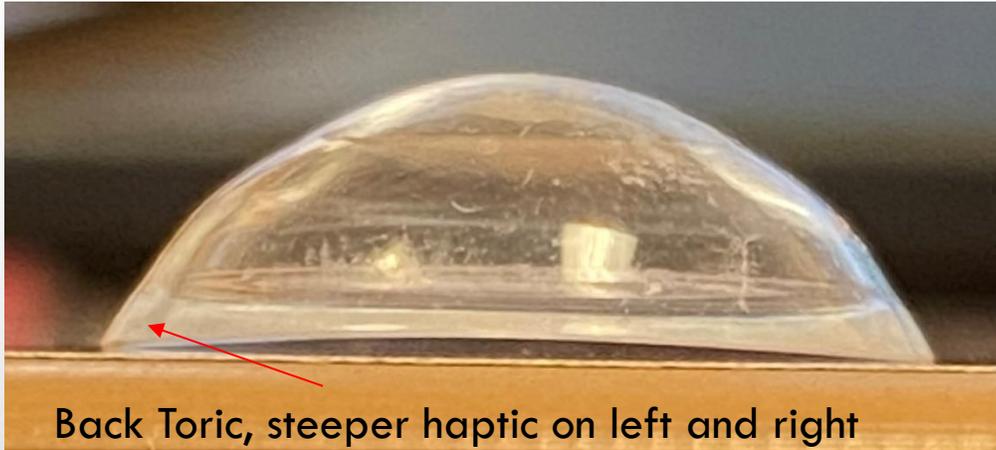


- LENS DESIGN

- 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



SCLERAL LENSES



SCLERAL LENSES

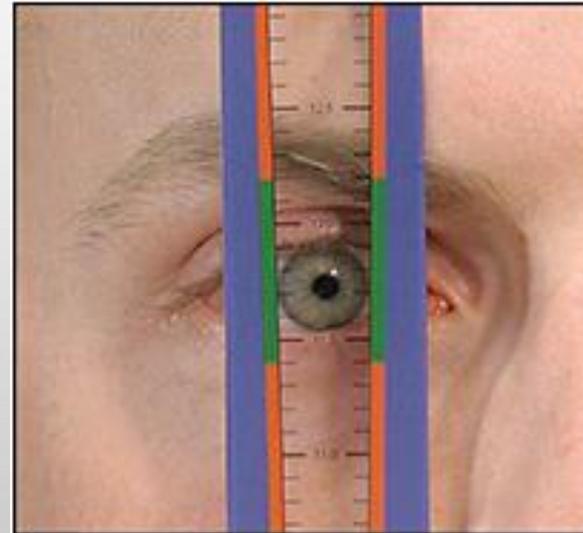
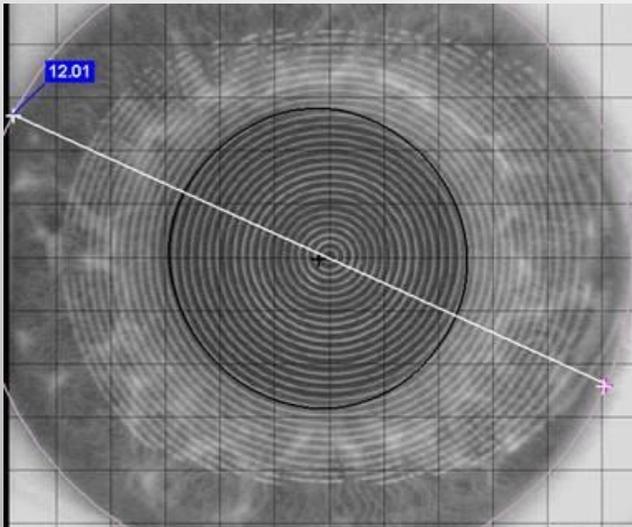
Step 1: Lens Diameter

- 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



SCLERAL LENSES

Step 2: Lens Design

- Oblate
- Prolate

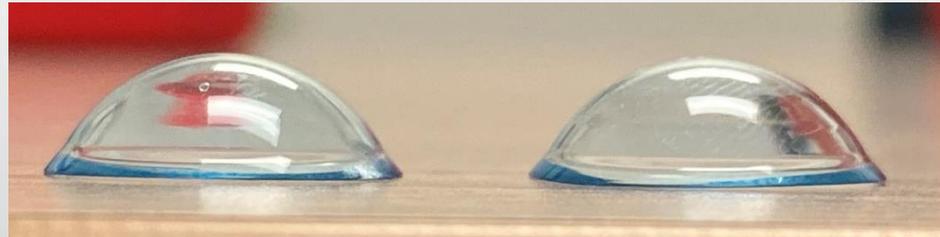


Step 3: Landing zone

- Spherical
- Toric

Prolate

Oblate



sag:4410; bc 46.00D

sag: 4510; bc 42.00D



sag:4950; bc 50.00D

sag: 5080; bc 46.00D

SCLERAL LENSES

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

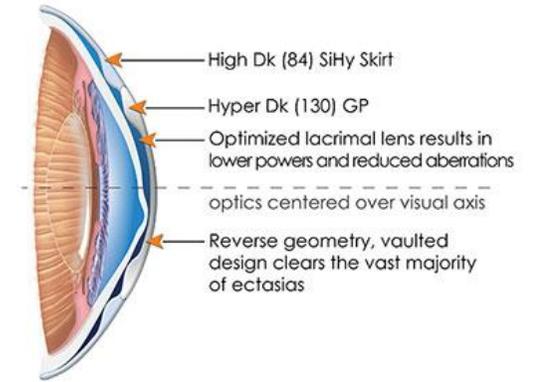
3. Anterior OCT

- 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 1 mm increase in lens diameter

HYBRID LENSES

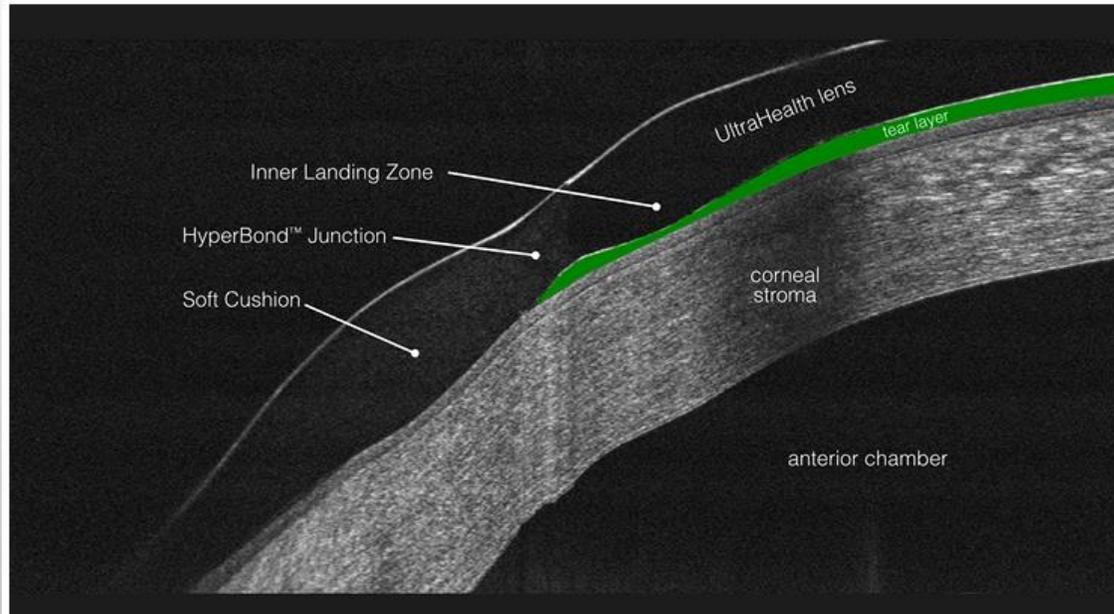
- ULTRAHEALTH (SYNERGEYES)
 - DESIGNED TO VAULT CORNEAL ECTASIA
 - INDICATED FOR PATIENT WITH IRREGULAR CORNEA
 - KCN, POST-SURGICAL, ETC
 - ASPHERIC REVERSE GEOMETRY GP CENTER (8.5MM)
 - 14.5MM TOTAL WITH SYHY SKIRT; HYDRAPEG OPTION
 - FIT WITH DIAGNOSTIC SET
- ULTRAHEALTH FC (FLAT CORNEA, OBLATE DESIGN)

UltraHealth® Vaulted Lens Design



HYBRID LENSES

- ULTRAHEALTH



ULTRAHEALTH
CONTACT LENSES

Ideal Diagnostic Lens

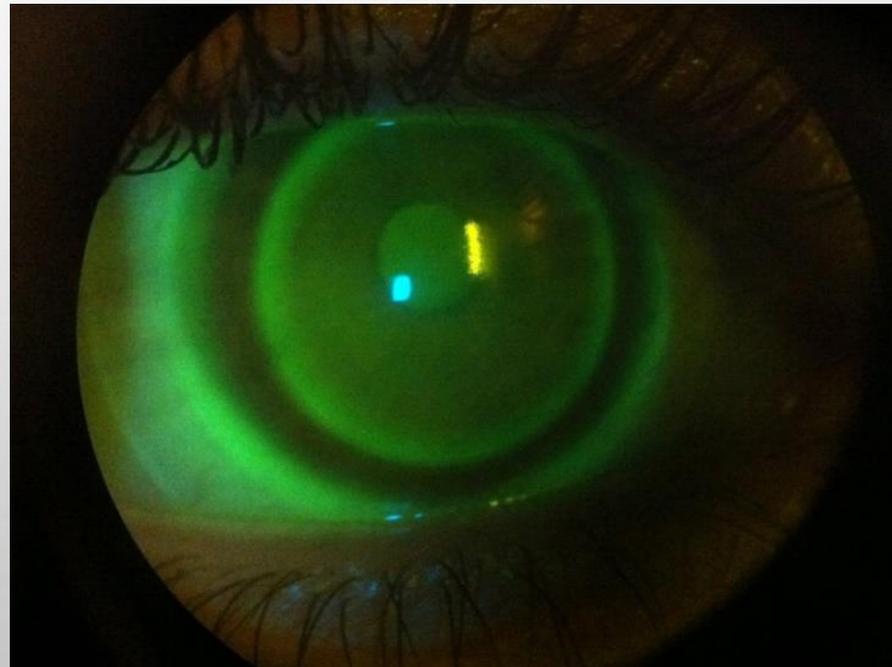
1. Apical clearance 100 μ to 150 μ above the corneal apex
2. Thin tear layer beneath the inner landing zone (ILZ)
3. Centered lens with $\frac{1}{2}$ to 1mm movement with each blink

Decreases by 50 microns within 3-5 minutes

The diagram shows a cross-section of an eye with a lens in place. The corneal apex is labeled. A small inset shows a lens with the Synergistix logo.

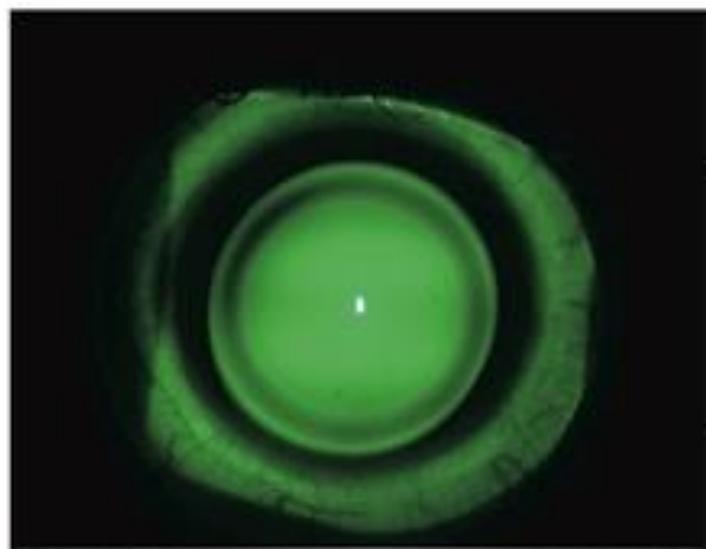
HYBRID LENSES

- ULTRAHEALTH (SYNERGEYES)
 - INITIAL LENS: 250 VAULT; 8.4 FLAT SKIRT; WAIT 5 MINUTES
 - BEARING – INCREASE VAULT 100 MICRONS
 - POOLING – DECREASE VAULT 100 MICRONS
 - TIPS
 - MAKE SURE YOU SEE TOUCH/BEARING, THEN GO BACK UP
 - USE NAFL



1 Central Vault Determination

Start with the 250 μ vault and 8.4 radius (flat skirt) diagnostic lens



Ideal Fit



Light Bearing

Add 100 μ to lens



Heavy Bearing

Add 150 μ to lens



HYBRID LENSES

- ULTRAHEALTH FC
 - POST-REFRACTIVE SURGERY LENS
 - OBLATE CORNEAL SURFACES

ULTRAHEALTH[®]
CONTACT LENSES

The Most Advanced Hybrid Lens for Oblate Corneas *Requires a Diagnostic Set*

Diameter	14.5mm
Vault Values	55 to 505 in 50 μ steps
Skirt Curves	8.4 Flat, 8.1 Medium, 7.9 Steep
Lens Powers	+10.00D to -20.00D +10.00 to +2.50D in 0.50D steps +2.00 to -8.00D in 0.25D steps -8.50 to -20.00D in -0.50D steps
Materials	84 Dk SiHy skirt, 130 Dk GP center
Class II UV blocker	UVA and UVB

UltraHealth Vaulted Lens Design

Reverse Geometry Aspheric Base Curve

GP

Lift Curve

Rigid Inner Landing Zone

SoftCushion™ Outer Landing

Overall Lens Diameter 14.5mm

Variable reverse curve GP lens design with soft outer landing zone. Fits a wide majority of corneal ectasia.

Upper Vault Group Shown

HYBRID LENSES

- ULTRAHEALTH FC
- INITIAL LENS:
 - 225 VAULT
 - 8.1 MED SKIRT

Initial Lens Order

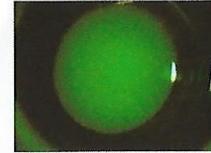
Step 1: GP Vault Determination

The final lens selected should provide 50 μ clearance above the apex of the cornea. Begin with a 255 vault lens with an 8.1 medium skirt using fluorescein. Check for bubbles under the lens with the blue pen light. Reinsert if you see bubbles.

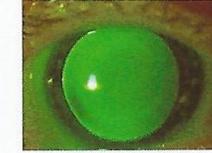
- If you observe pooling (lens is clearing the cornea), decrease the vault in 100 μ increments until bearing is observed. Once you observe bearing, add 50 μ for final vault.
- If you observe apical touch (lens is touching the cornea), increase vault by 100 μ until pooling is observed providing the recommended vault.



Vault is too flat showing fluorescein bearing



Vault is too steep showing fluorescein pooling

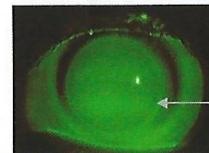


Vault is showing optimal fluorescein pattern

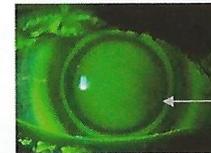
Step 2: Skirt Determination

Once the correct vault is determined, examine the skirt radius fluorescein pattern, and observe movement and comfort of the diagnostic lens. Examine the corneal clearance of the inner landing zone (ILZ) 3-4 minutes after insertion. A thin layer of fluorescein indicating light touch, with a little bearing indicates an ideal skirt fit.

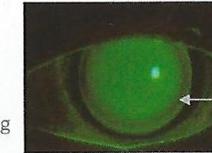
- If there is no defined inner landing zone, this indicates that the skirt may be too steep. Order a lens with an 8.4 flat skirt.
- If there is excessive movement, skirt fluting and/or heavy bearing at the inner landing zone, this indicates that the skirt is too flat. Order a lens with a 7.9 steep skirt.



Skirt is too steep showing fluorescein pooling in the ILZ



Skirt is too flat showing bearing in the ILZ



Skirt curve is correct showing optimal fluorescein pattern and slight clearance in the ILZ

Step 3: Power Determination

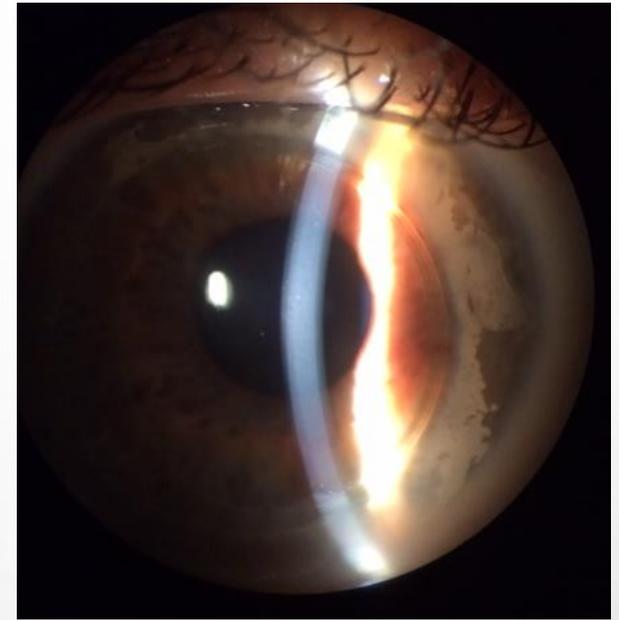
Over-refract the final diagnostic lens. Add the spherical over-refraction to the diagnostic lens power on the Vault & Power Chart.

Step 4: Order Lenses

Order on-line at www.SynergEyes.com/Professional, call Customer Service at 877.733.2012 option 1. Or call Technical Consultation at 877.733.2012 Option 2. Outside USA & Canada, call +1 760.476.9410 option 1, or email: intorders@synergieyes.com.

HYBRID LENSES

- *LENTICULAR CYLINDER*
 - 1.00D OR GREATER **NOT A CANDIDATE**
- *RECOMMENDED SOLUTIONS*
 - LOBOB EXTRA STRENGTH CLEANER, CLEAR CARE, BIOTRUE
- *WHITE DEPOSIT RING ON SOFT SKIRT*
 - TEAR CHEMISTRY OF SOME PATIENTS MAY REACT WITH THE PEROXIDE TO CAUSE A PERMANENT WHITE RING AT THE JUNCTION OF THE GP LENS/SOFT SKIRT





MANAGING THE IRREGULAR CORNEA

- THANK YOU
- DEKINDERJ@UMSL.EDU