WOO UNIVERSITY

Advanced Scleral Lens Designs

Dr. Greg DeNaeyer

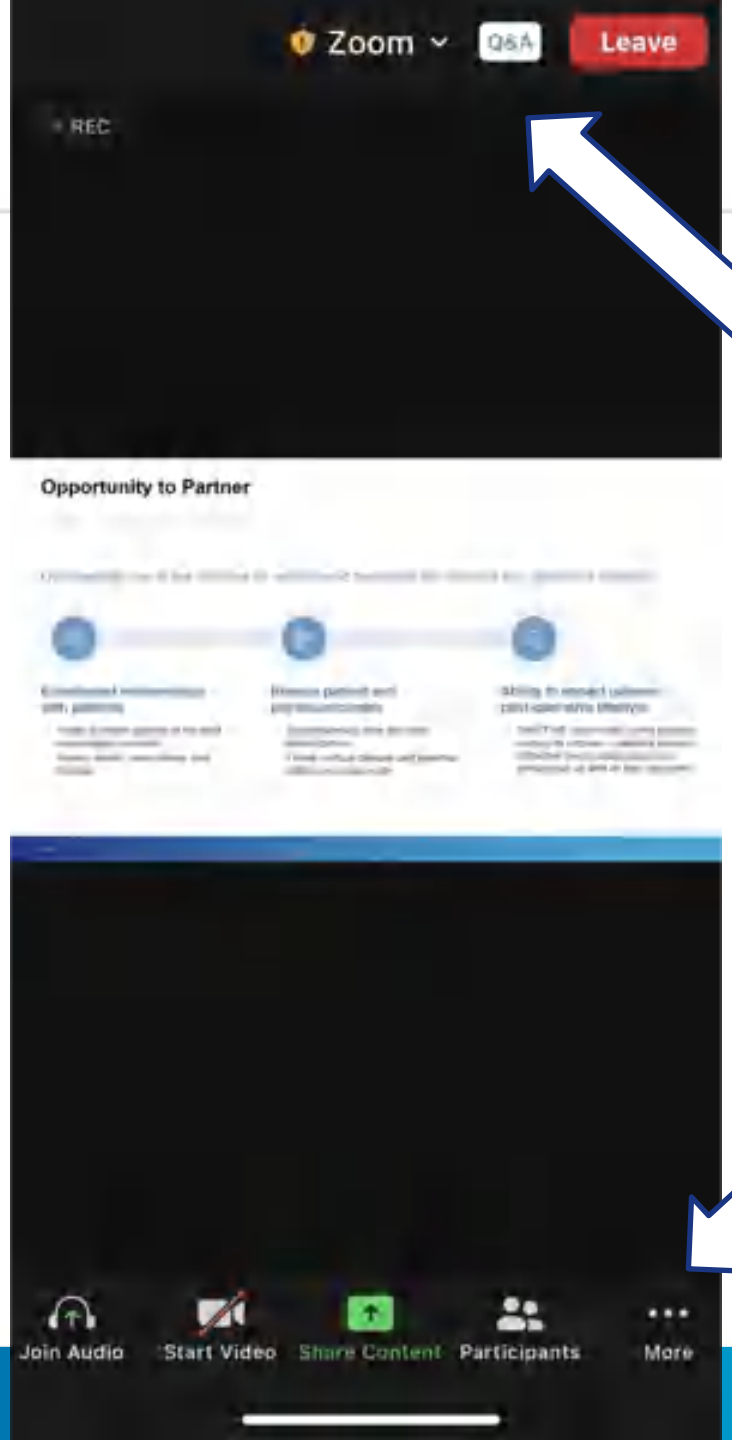
WOO UNIVERSITY

WELCOME!

Host: Dr. Stephanie Woo

This event is supported with an unrestricted educational grant from Bausch and Lomb.

- For a 1-hour webinar attendees must be online for a minimum of 50 minutes
- For a COPE certificate, please fill out the survey link in the chat. Also, the survey link will appear when the webinar ends.
- CE certificates will be delivered by email and sent to ARBO with OE tracker numbers
- **CE certificates will be emailed within 4 weeks**
- Ask questions using the zoom on-screen floating panel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Speaker Bio – Dr. Greg DeNaeyer

Greg DeNaeyer practices at Arena Eye Surgeons with an emphasis on specialty contact lenses.

Dr. DeNaeyer was a co-founder and past president of the Scleral Lens Education Society and is a Fellow of the American Academy of Optometry. He is a contributing editor for Contact Lens Spectrum and a contributor to Review of Cornea and Contact Lenses and Optometric Management. Dr. DeNaeyer has lectured internationally on specialty contact lenses and was previously named GPLI and Scleral Lens Education Society practitioner of the year.

Financial Disclosures

- Visionary Optics
- Precision Ocular Metrology
- Contamac

COURSE OBJECTIVES

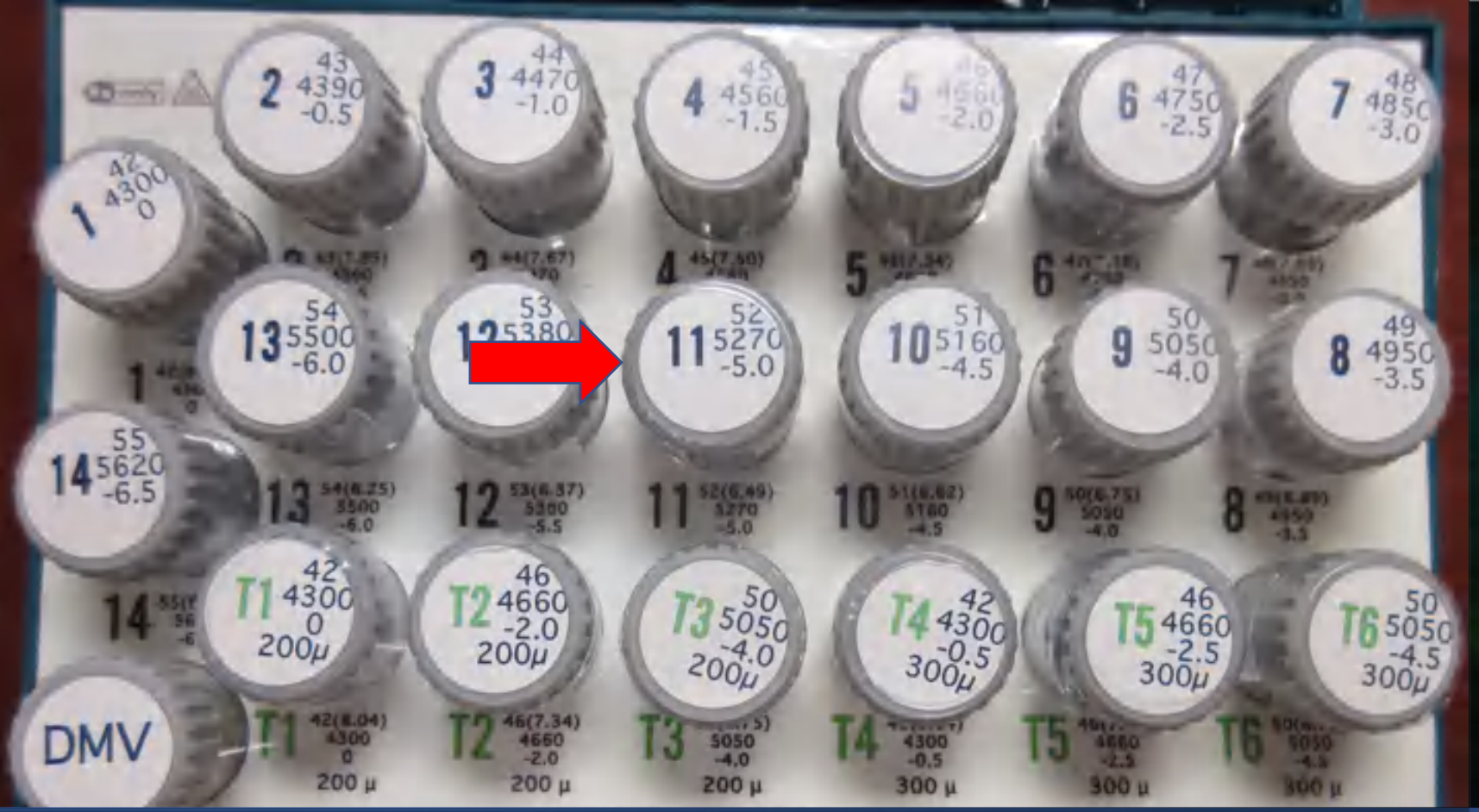
- The participant will understand the importance of instrumentation and data to improve scleral lens fitting efficiency and success.
- The participant will learn the types of instrumentation necessary to advance their scleral lens practice.
- The participant will learn, through case examples, how to implement measurements for improved scleral lens designs and outcomes.

INSTRUMENTATION

- Corneal topography
- Optical Coherence tomography
- Scheimpflug tomography
- Corneo-scleral topography

Diagnostic Lenses

- Scleral Lens
  - Sagittal depth
  - Geometry
  - Landing Zone
  - Power



Diagnostic Lenses

Practitioner Learning Curve in Fitting Mini-Scleral Contact Lenses in Irregular and Regular Corneas using a Fitting Trial

[1]Rute J. Macedo-de-Araújo, [2]Eef van der Worp, [1] Ana Amorim-de-Sousa [1]José M. González-Méijome

[1]Clinical & Experimental Optometry Research Lab (CEORLab), Center of Physics, University of Minho, Braga, Portugal
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SpecialtyLensSymposium

Introduction

There is increasing evidence that scleral supported rigid gas permeable contact lenses (Figure 1) are suitable to compensate a wide range of corneal conditions derived from primary corneal disease, post-surgical complications and even in normal corneas.[1-3] The recent rebirth of scleral contact lens (ScCL) has been accompanied by a more predictable fitting process, but there is still a significant degree of uncertainty due to the few clinical available devices for objective measure anatomical features of the ocular surface beyond the corneal borders.

Fitting recommendations given by several manufacturers use to consider only the clinical features and the degree of severity of the corneal condition to decide the starting point for fitting. Few studies however report the success rate of the fitting process.

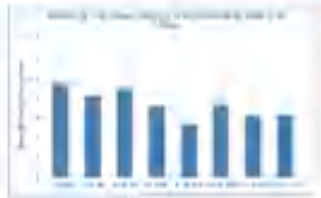
Purpose. To assess the learning curve of a novel practitioner with minor previous experience with ScCL fitting in the initial 156 consecutive scleral contact lenses fittings in irregular and regular corneas using a fitting trial.

Methods

Results

Number of Trial Lenses (Figure 1)

- The average number of trial lens per eye was 1.85±0.71 (1.84±0.60 on Irregular Corneas Group and 1.88±0.77 for Regular Corneas Group) with a range between 1 and 4 lenses per eye in both groups). There were no statistical significant differences between groups ($p=0.970$);
- There was a decrease in the number of trial lenses from 2.28±0.16 lenses in the first 20 fittings to 1.58±0.13 in the last 20 fittings ($p<0.05$);
- After fitting number 60, the mean number of lenses began to be statistically significant lower than the first 20 fittings ($p<0.05$).



Number of Re-orders (Figure 2)

- The average number of re-orders was 0.76±0.77, being 0.73±0.77 (range 0 to 4 lenses) on Irregular Corneas Group and 0.88±0.14 (range 0 to 3 lenses) on Regular Corneas Group. There were no statistical significant differences between groups ($p=0.303$);
- There was a decrease of almost 1 re-order per eye, from 0.95±0.17 in the first fittings to 0.25±0.11 in the last fittings ($p=0.05$);
- After fitting number 60, the mean number of re-orders began to be statistically different than the first 20 fittings ($p<0.05$, Wilcoxon);

Discussion

Many experts mention the steep learning curve in fitting ScCLs however there are no peer-reviewed publications on this theme. Studies with corneal RGP report the need of 1 to 5 lenses, with a mean of 2.3[4] and 1.75[5] trial lenses per eye to achieve the best fit. Assuming to our results, a mild-experienced ScCL fitter will need less trial lenses (1.50 on average), with a reduction of 1 trial lens per eye with experience that could mean also a chair-time reduction.

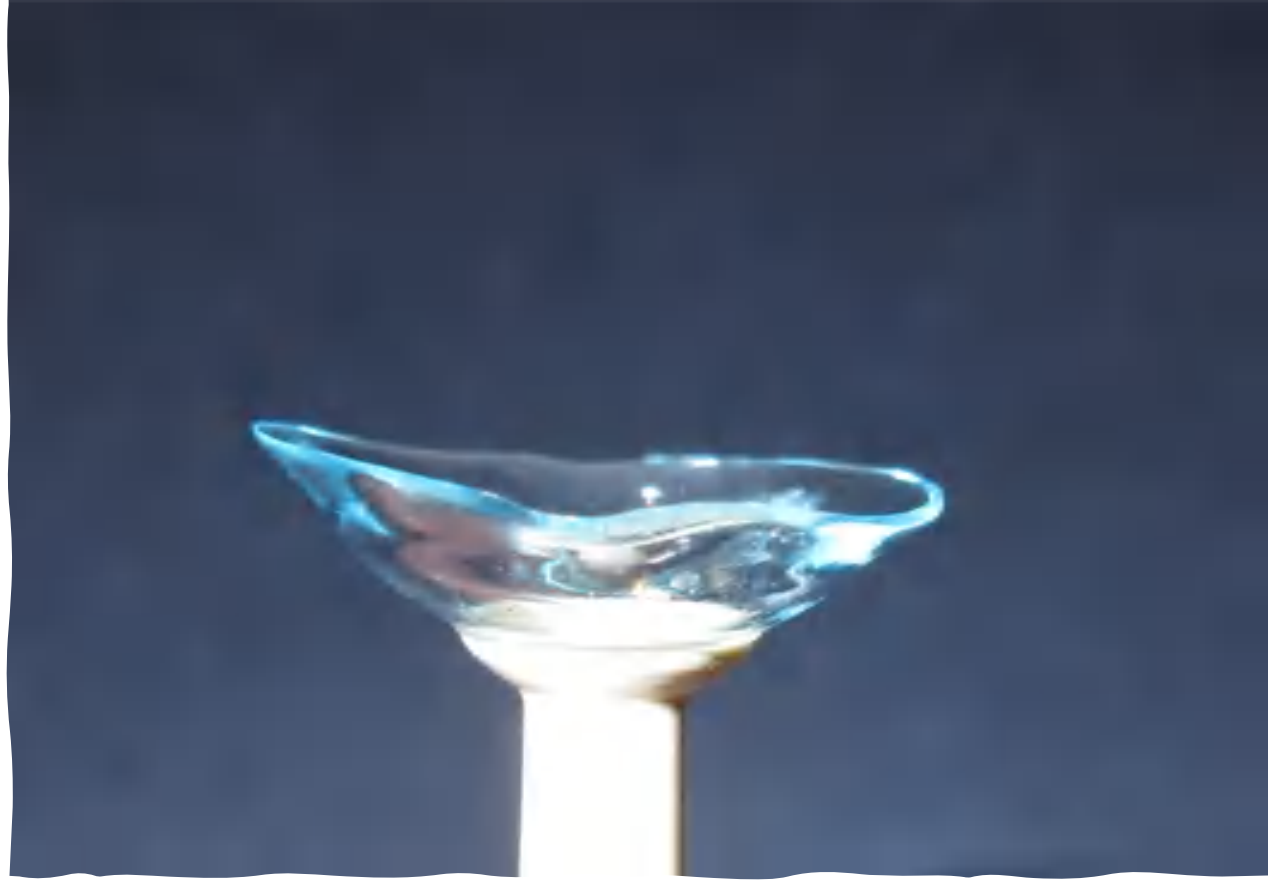
Regarding the re-orders, we found a 44% optimal fit rate in the first lens ordered – with RGPs, others have reported 77%[4] and 33%[5].

Regarding the prescribing pattern of toric landing zone lenses, it could be challenging to prove that the augment in the number of fittings with this design is a change in the practitioner skills, since those subjects with toric cornea could present at any time during clinical trials.

The trends shown in this study could be affected by asymmetry of more challenging or easier to fit cases that might appear at any time during the course of the study. However, the large sample number and uniformity in inclusion and exclusion criteria should contribute to a uniform distribution of cases with different degrees of difficulty.

Conclusions

Approximately 60 cases were required before obtaining a significant reduction in the trial lenses and re-orders necessary. Also, there is a trend towards using toric designs more frequently.



ART VS SCIENCE

Scleral | Scleral Lens Education Society

- The SLS teaches contact lens practitioners the art and science of fitting scleral lenses.

Contact Lens SPECTRUM

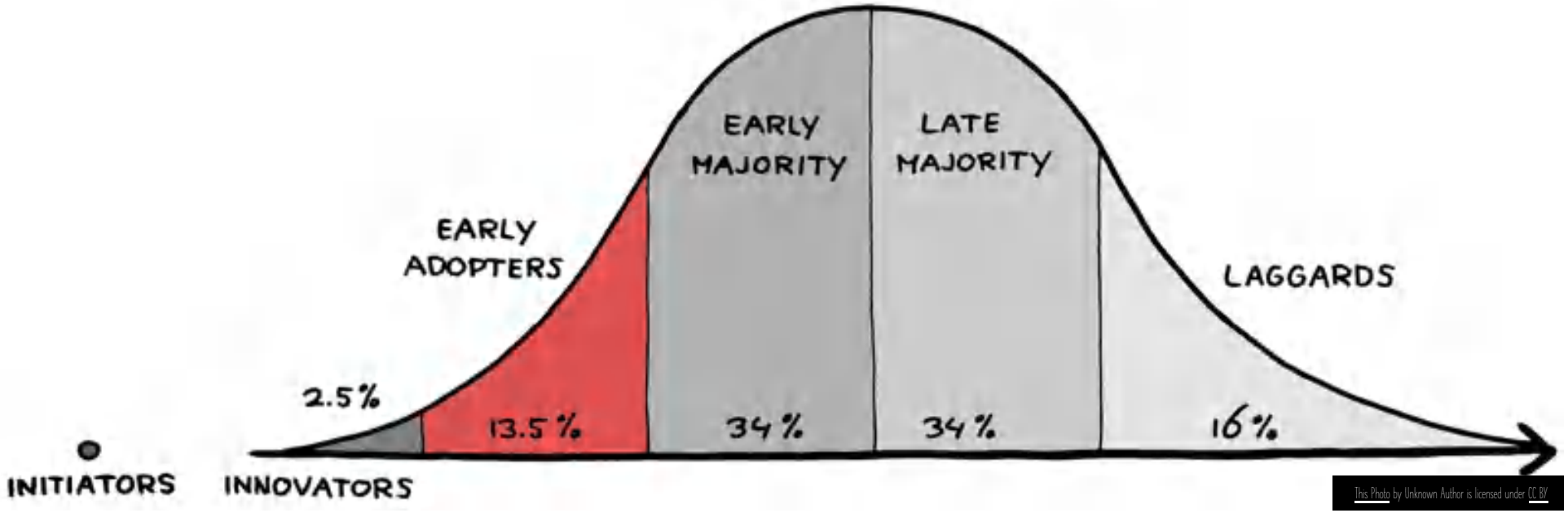
October 2022

- GP AND CUSTOM SOFT ANNUAL REPORT 2021
  - Edward S. Bennett OD, MSED

TABLE 1 EMPIRICAL VERSUS DIAGNOSTIC GP FITTING

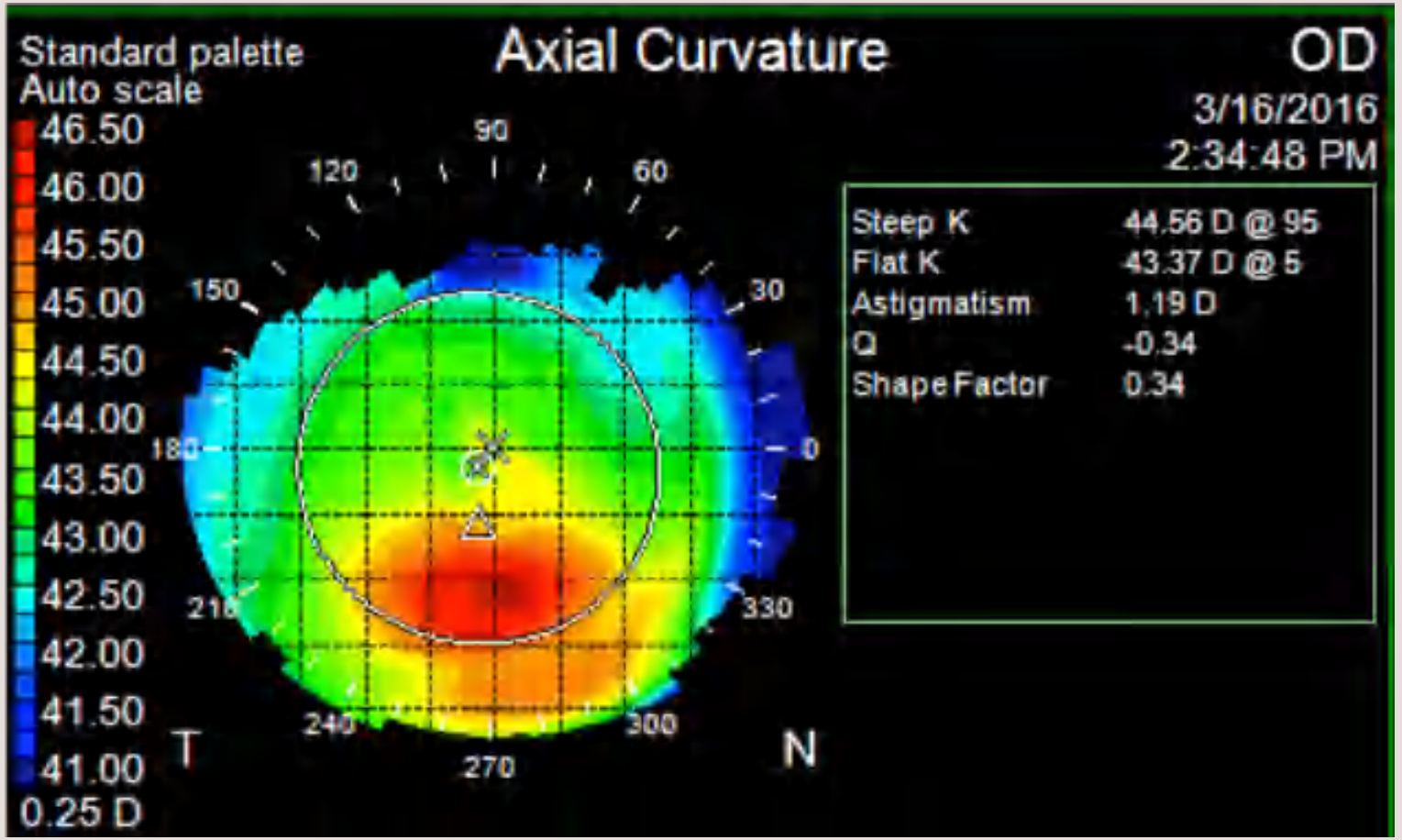
TYPE OF DESIGN	EMPIRICAL (%)	DIAGNOSTIC (%)
Toric	79	21
Multifocal	78	22
Spherical	73	27
Hybrid	55	46
Corneal Reshaping	50	50
Non-Scleral Irregular Cornea GP	30	70
Scleral	10	90

TECHNOLOGY ADVANCEMENTS



CORNEAL TOPOGRAPHY

Diagnostic and follow-up



- Can scleral toricity be predicted from corneal topography?

Corneal Toricity and Scleral Asymmetry…. Are They Related?

Beth Kinoshita OD, Sheila Morrison OD, MS, Patrick Caroline, Randy Kojima and Matthew Lampa OD
Pacific University College of Optometry, Forest Grove, Oregon

Utilizing Corneal Topography to Aid in Predicting Scleral Topography for the Purpose of Fitting Scleral Contact Lenses

Sara Siebert, BS, Jason Jedlicka, OD, FAAO
Indiana University School of Optometry, Bloomington, Indiana

RELATIONSHIP BETWEEN THE STABILIZATION AXIS OF A SCLERAL LENS WITH TORIC PERIPHERALS AND THE AXIS OF CORNEAL ASTIGMATISM

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1.) Faculty of Optics and Optometry. University of Murcia, Spain 2.) CUVI (Clínica Universitaria de Visión Integral) 3.) www.lentesesclerales.com

Relationship of placido corneal topography data with scleral lens fitting parameters

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[a] *Clinical & Experimental Optometry Research Lab (CEORLab), Center of Physics, University of Minho, Braga, Portugal*
[b] *Eye-Contact-Lens Research & Education Amsterdam, The Netherlands*

Scleral Shape and Its Correlations With Corneal Astigmatism

Alejandra Consejo, MSc, PhD,† and Jos J. Rozema, MSc, PhD*‡*

44 eyes- regular corneas

Corneo-Scleral Topography

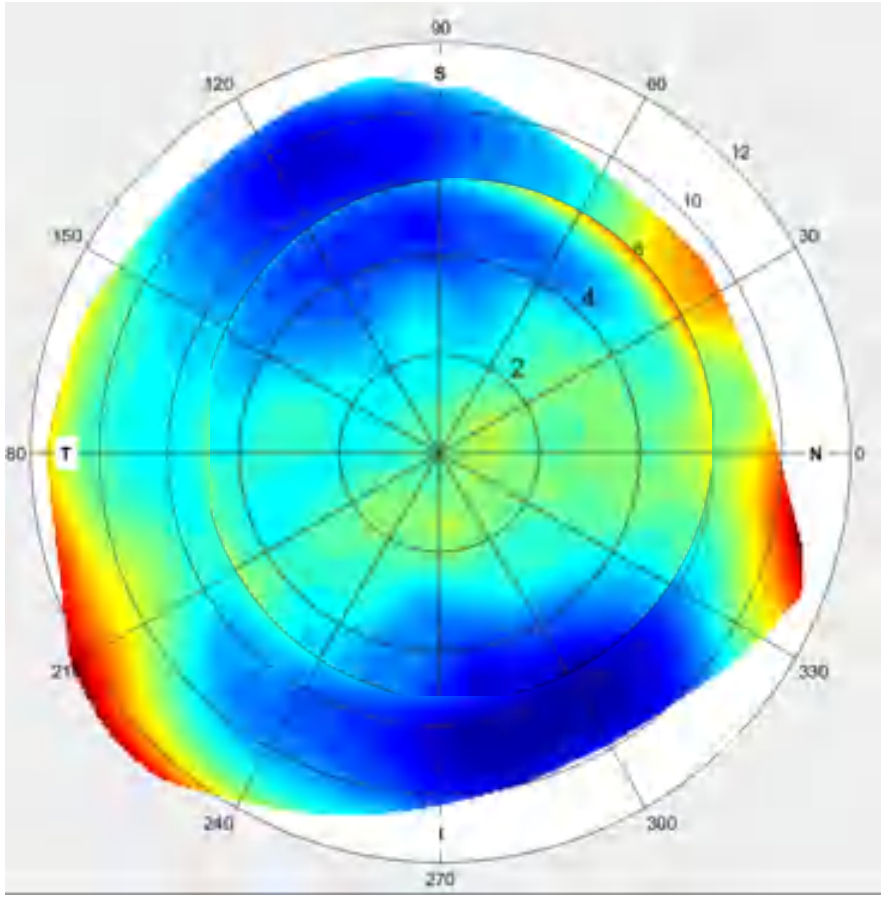
Conclusions: Corneal and scleral shapes are correlated in astigmatic eyes, which suggests that astigmatism is not restricted to the cornea but should rather be considered a property of the entire eye globe.

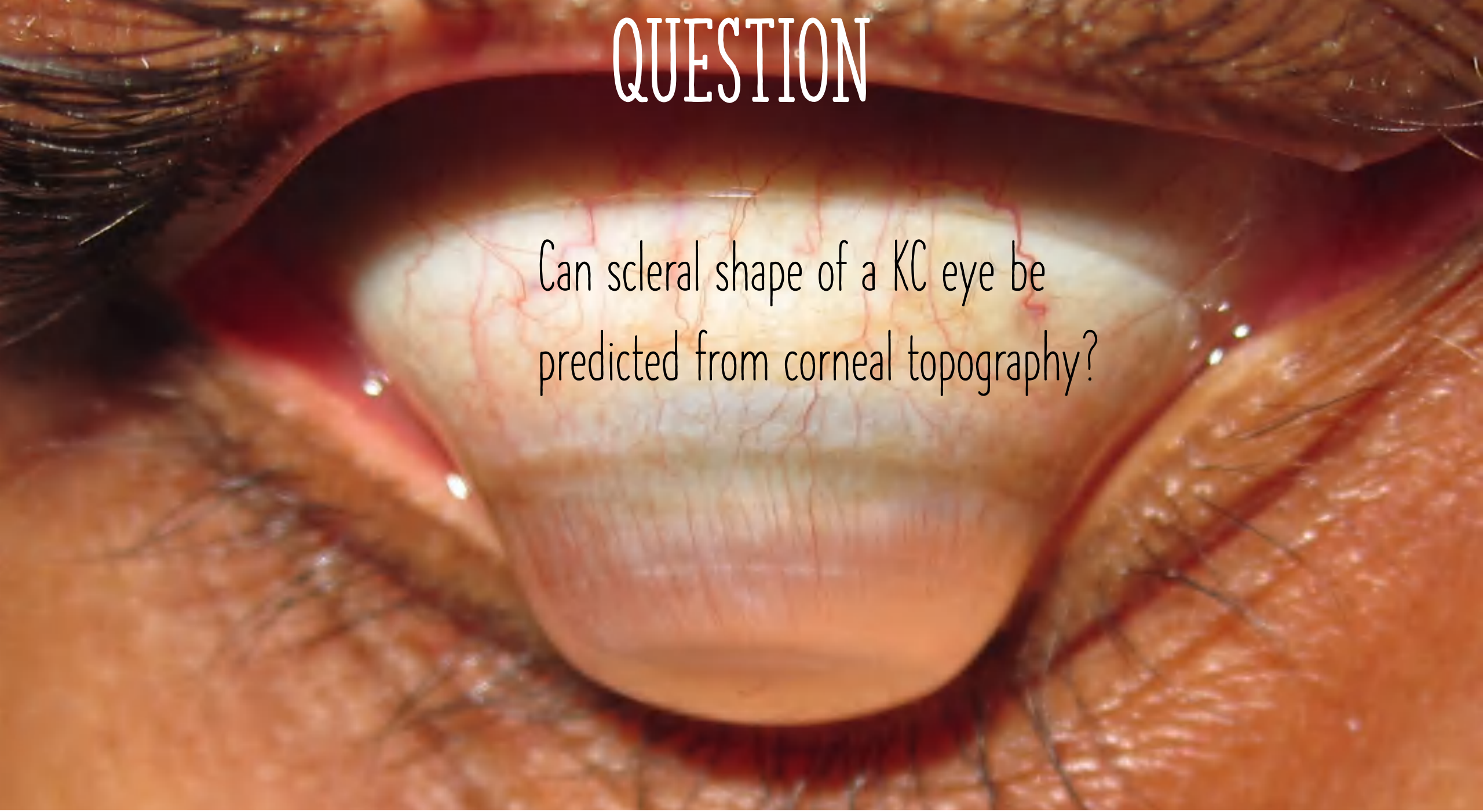
CORNEAL AND SCLERAL TORICITY

Corneas with high

limbus to limbus toricity

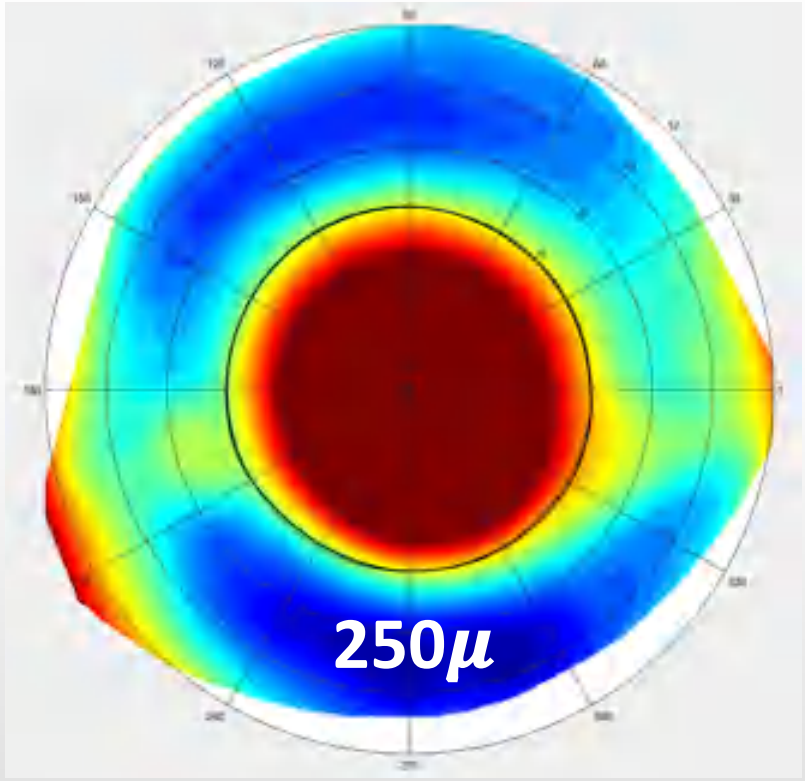
may predict scleral toricity





QUESTION

Can scleral shape of a KC eye be predicted from corneal topography?

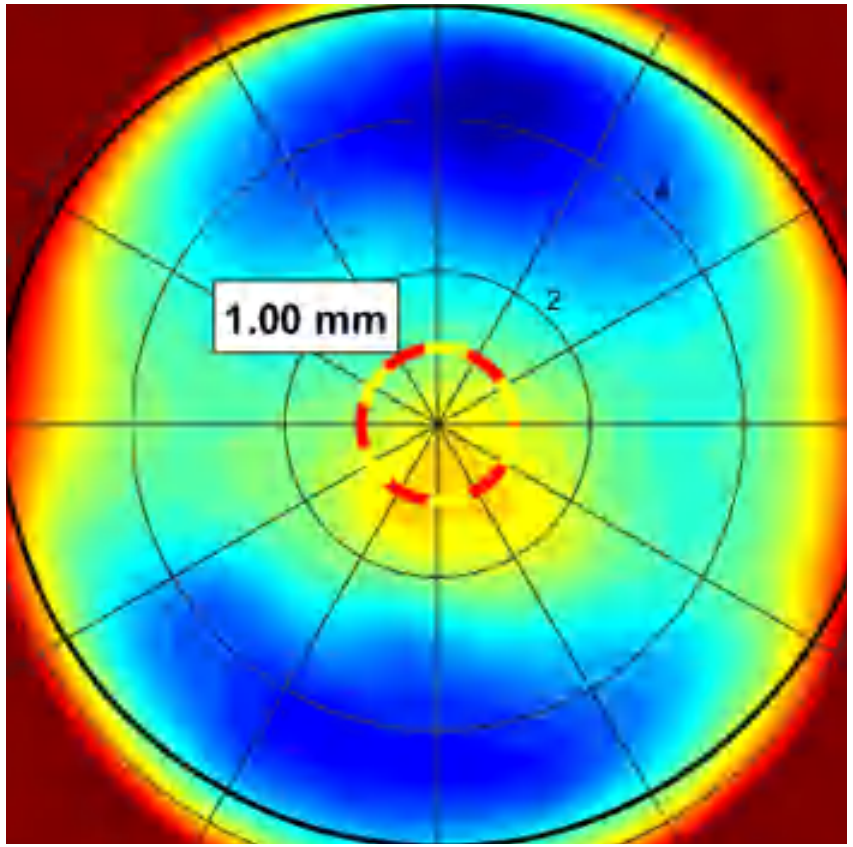


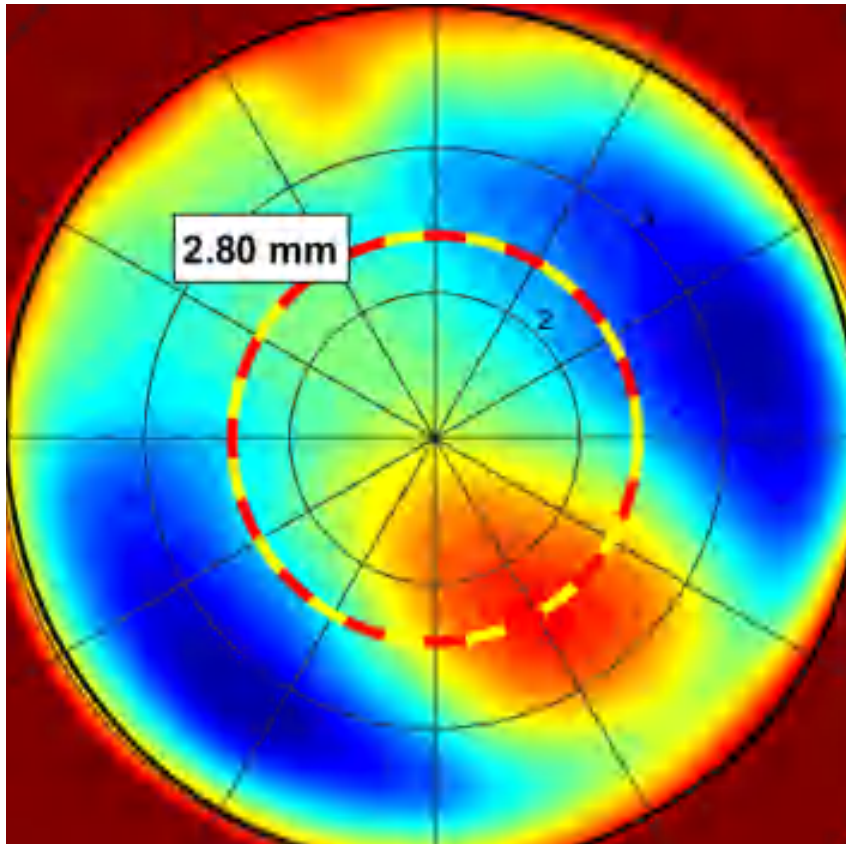
Journal of
CONTACT LENS
RESEARCH & SCIENCE

Original Article
DOI:10.22374/jclrs.v3i1.33

CORRELATION OF CORNEAL AND SCLERAL TOPOGRAPHY IN CASES WITH ECTASIAS AND NORMAL CORNEAS: THE SSSG STUDY

Gregory DeNaeyer OD[1], Donald R Sanders MD, PhD[2], Langis Michaud, OD[3], Sheila Morrison, OD[4], Maria Walker, OD[5], Jason Jedlicka[6], Timothy S. Farajian[7], Eef van der Worp[8]

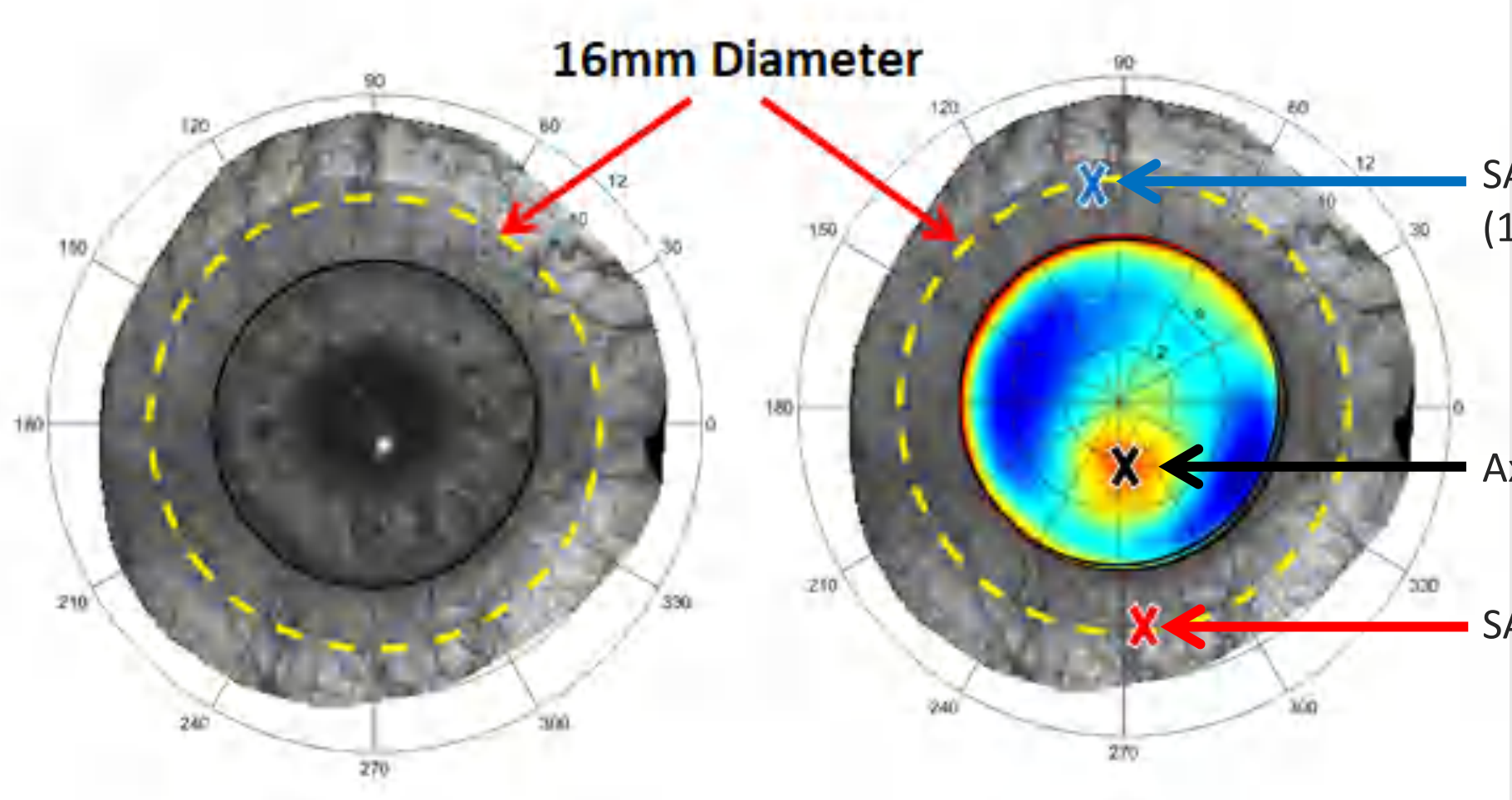




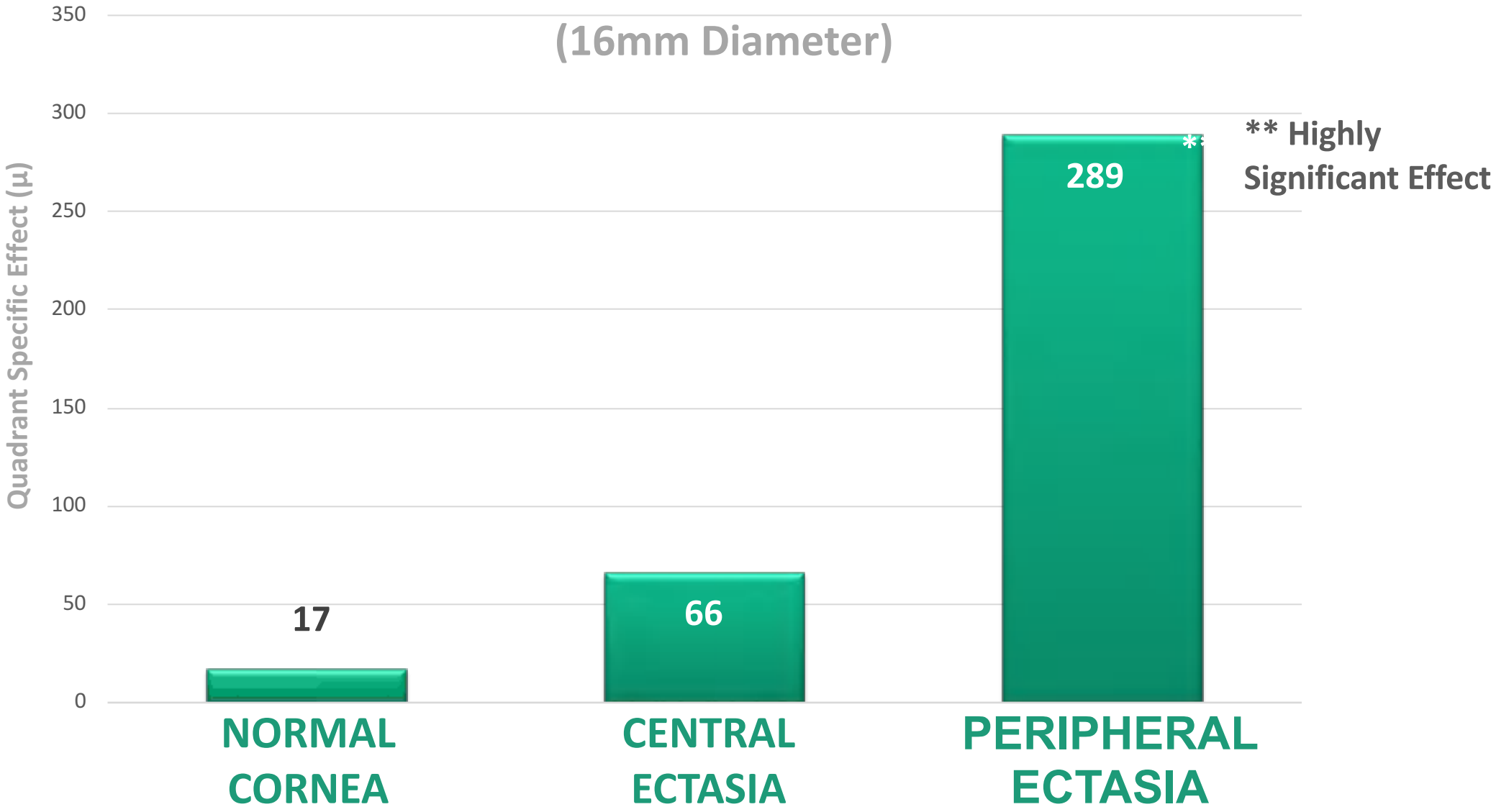
Central	Peripheral
83 eyes	**114 eyes**

Measurements in Ectasia Cases

Difference in the 2 SAGs is the Quadrant Specific Effect

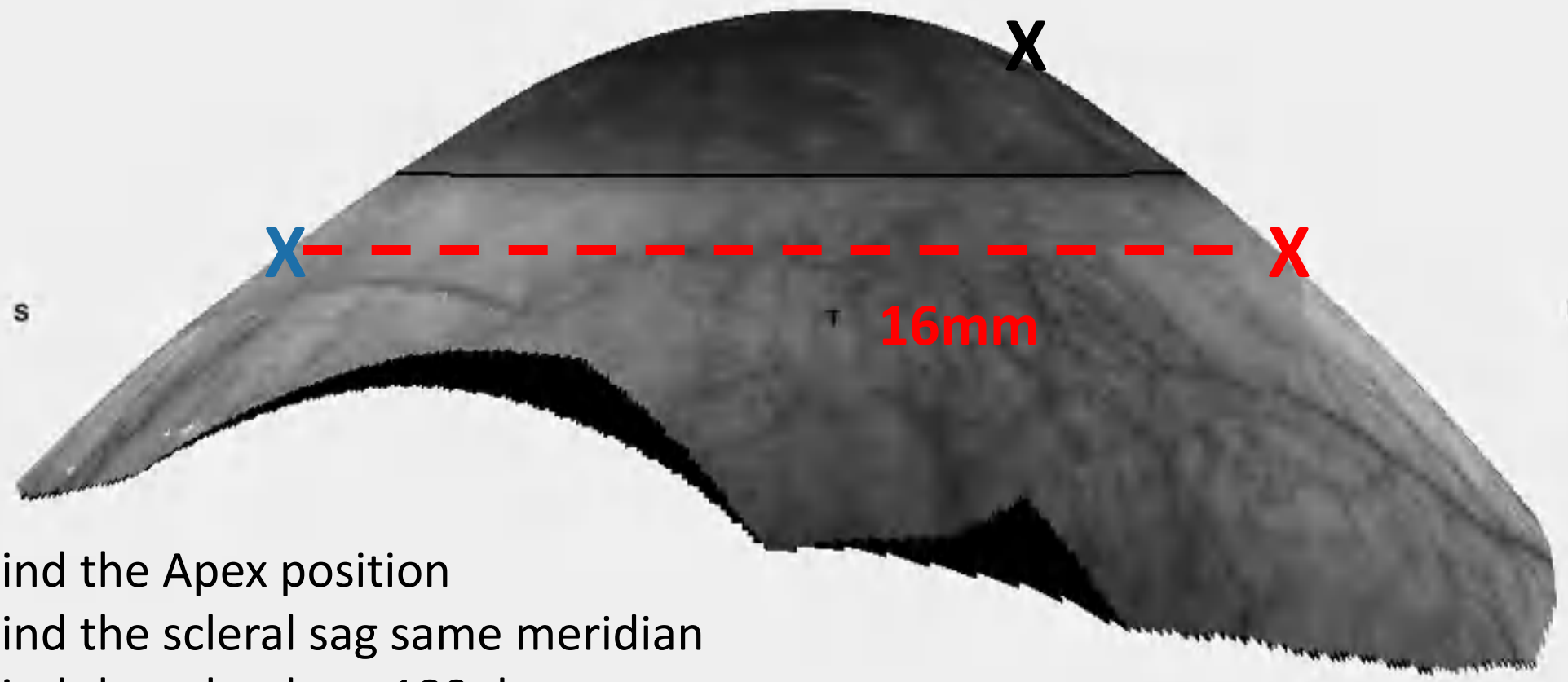


Quadrant Specific Effect



Superior

Inferior

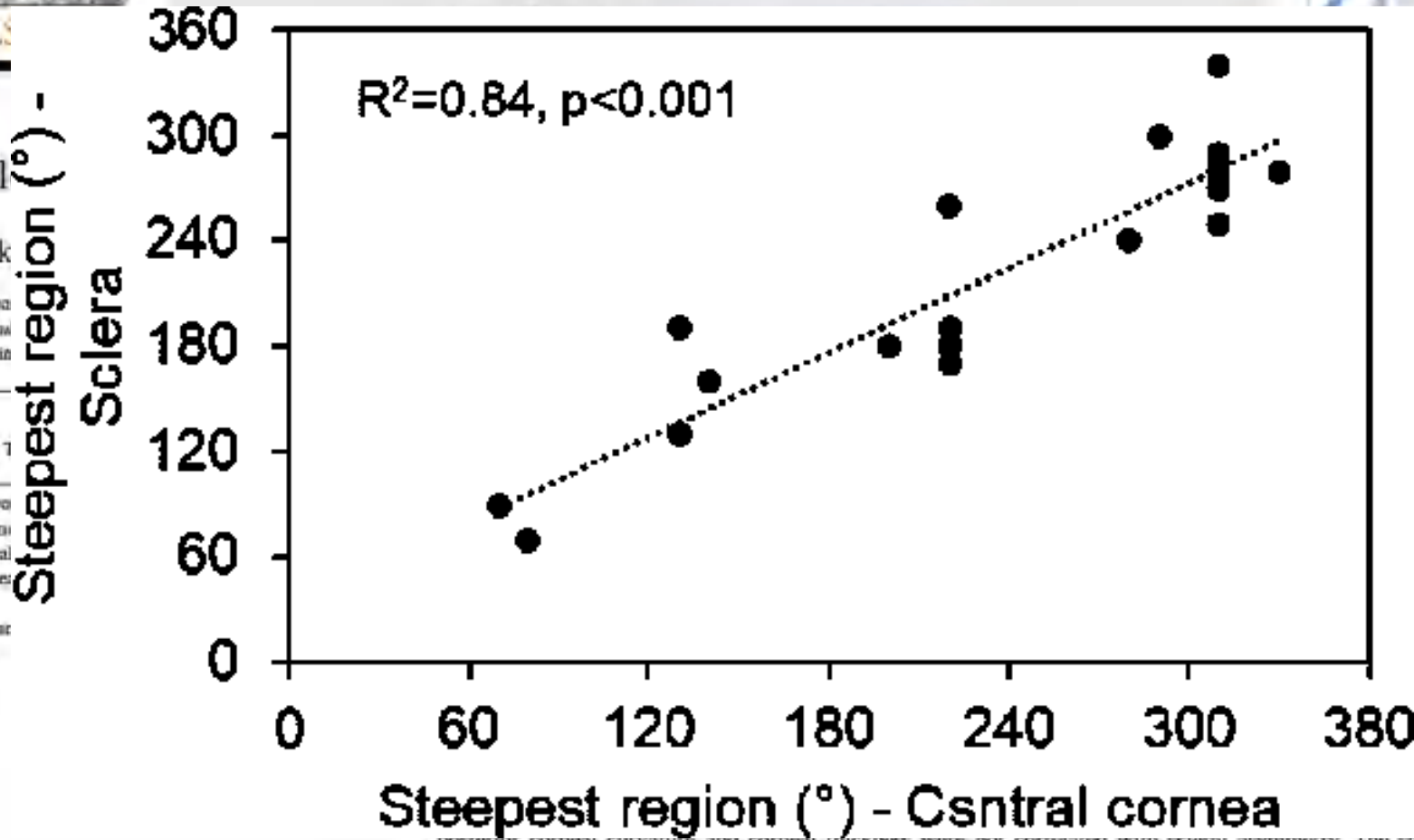


1 Find the Apex position
2 Find the scleral sag same meridian
3 Find the scleral sag 180 degrees away

Contact Lens and Anterior Eye 44 (2021) 101366

Contents lists available at ScienceDirect

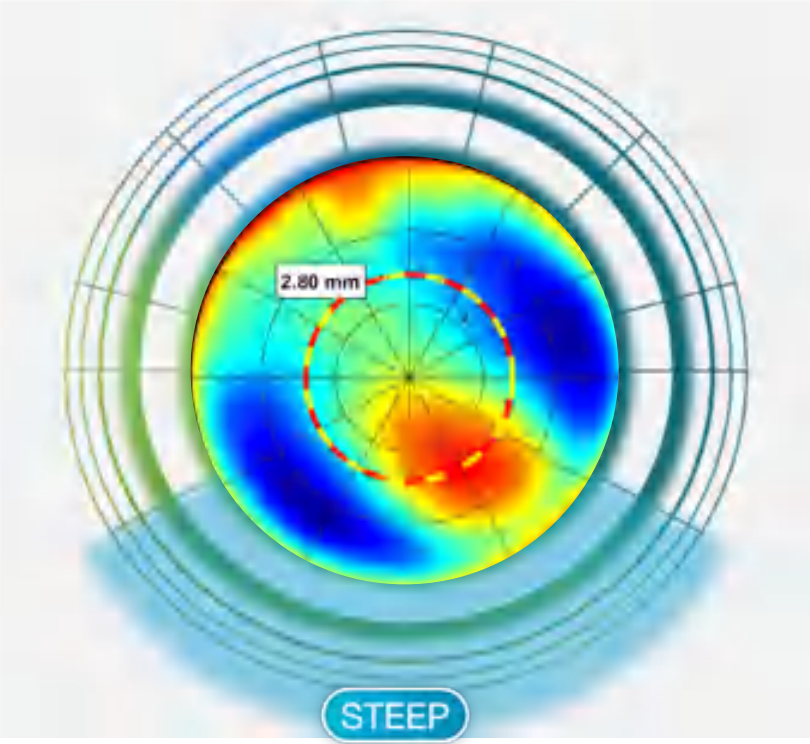
Contact Lens and Anterior Eye

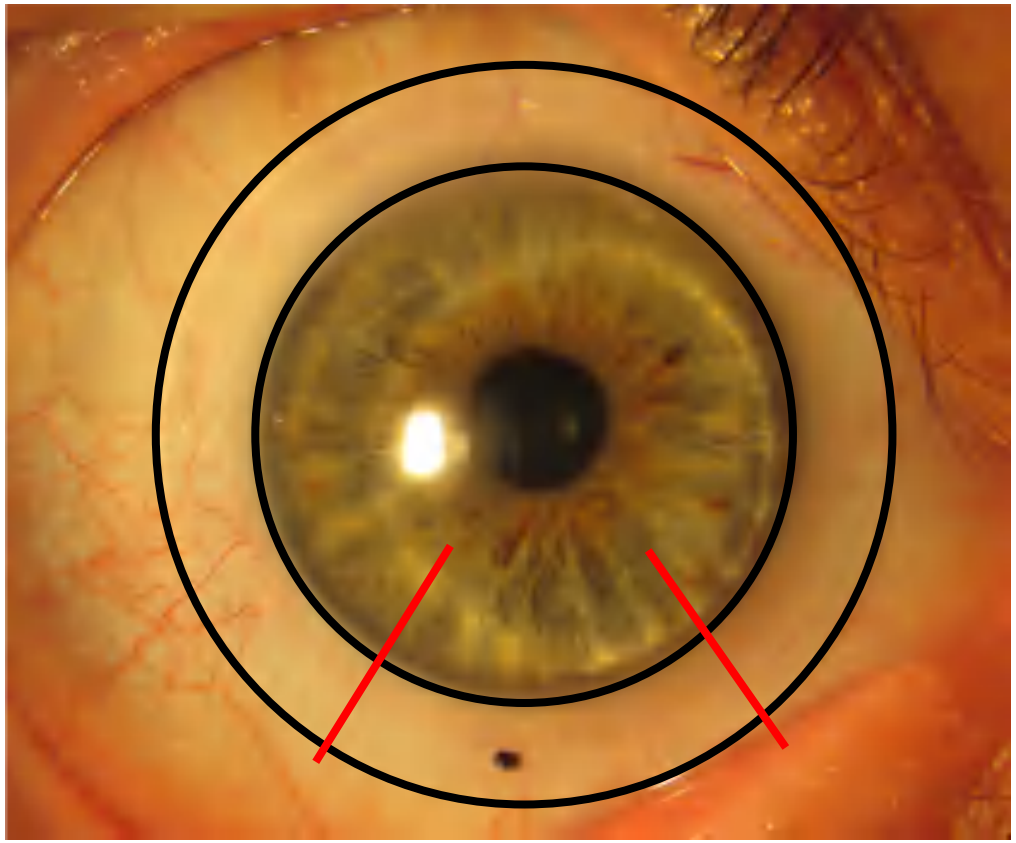


posterior corneal curvature and corneal thickness were not correlated with scleral asymmetry. The steepest regions of the central cornea, peripheral cornea, and sclera tended to share a common angle ($r = 0.92$; $p < 0.001$ for central cornea compared to sclera).

Conclusion: Anterior corneal parameters measured by corneal imaging are associated with the level of scleral asymmetry and the orientation of the steepest area of the sclera in eyes with keratoconus.

SCLERAL LENS DESIGN FOR KERATOCONUS

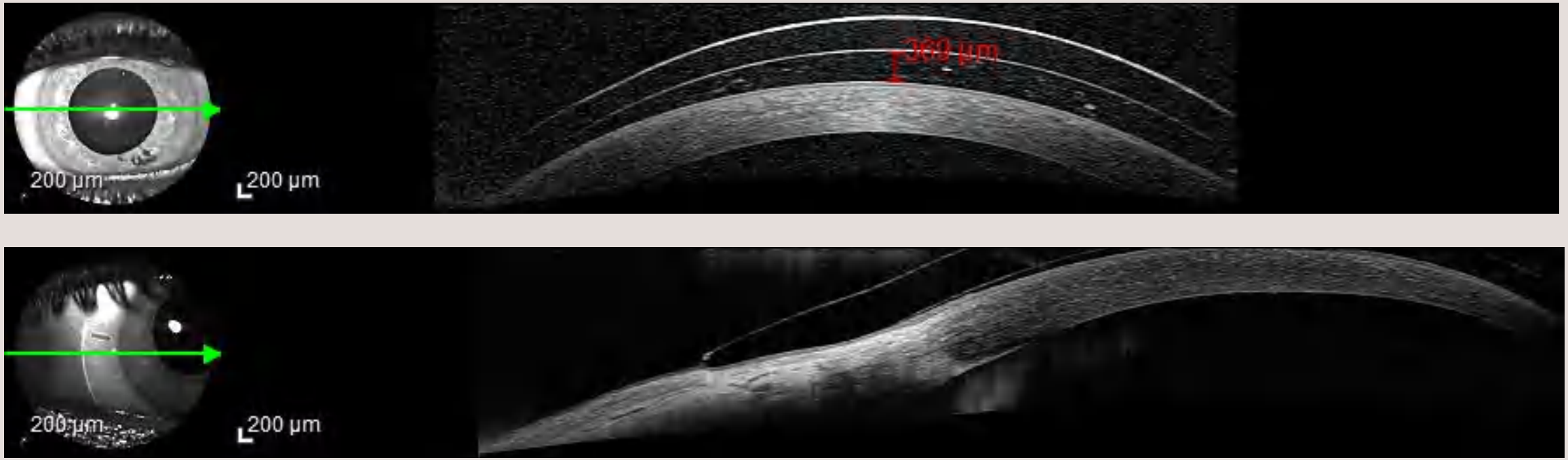




OPTICAL COHERENCE TOMOGRAPHY

- OCT
  - Posterior Segment
    - Macula
    - Optic Nerve head/Nerve Fibers
  - Anterior Segment
    - Cornea
    - Scleral Lenses

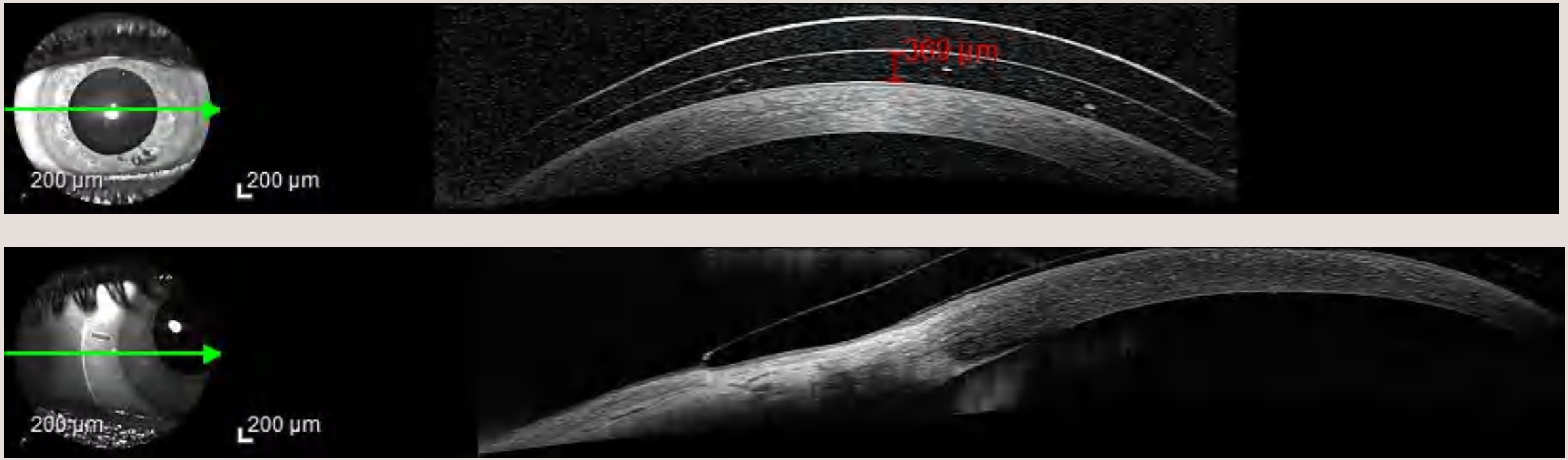
SCLERAL LENSES



OPTICAL COHERENCE TOMOGRAPHY

- Fitting/Evaluation
  - Fluid reservoir
  - Landing Zone

SCLERAL LENSES



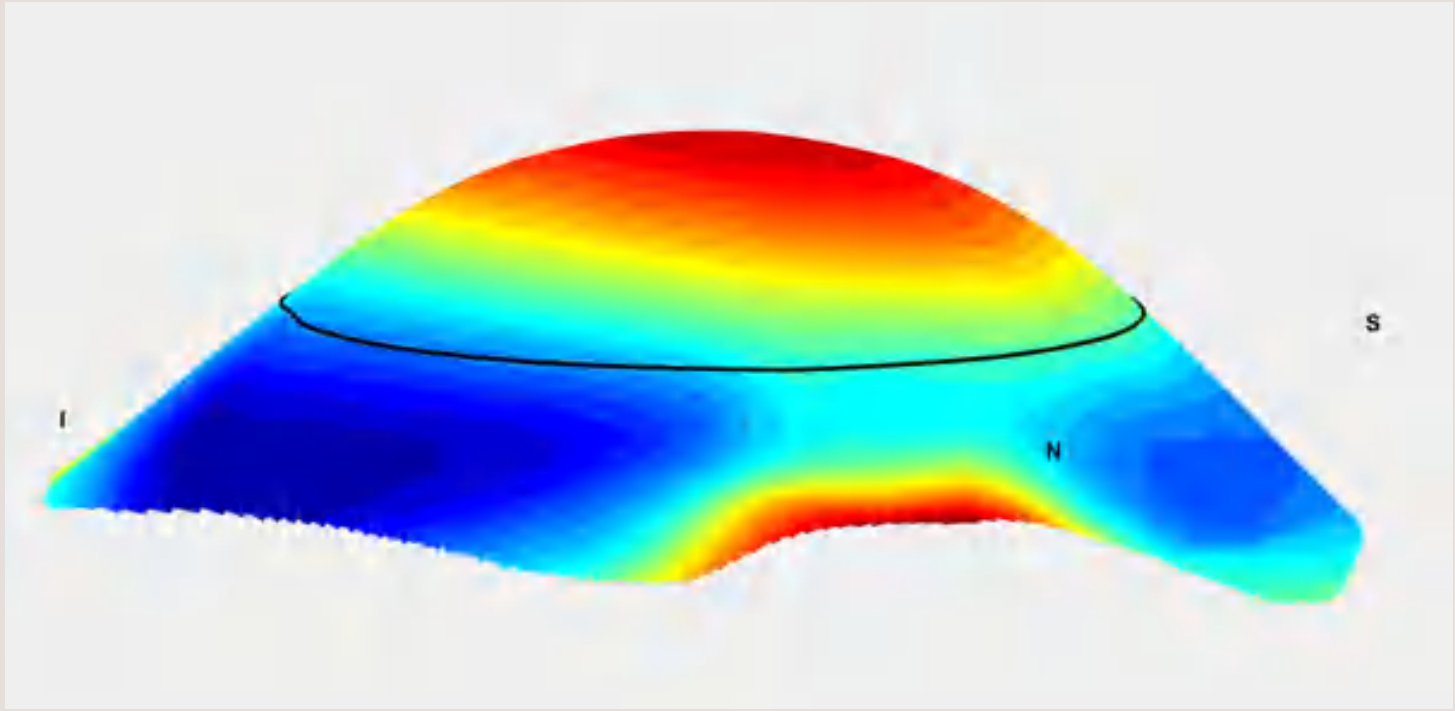
OPTICAL COHERENCE TOMOGRAPHY

- Challenges
  - Single meridian measurements
  - Lack of software modules for lens fitting


OPTICAL COHERENCE TOMOGRAPHY

- Dr. Greg Gemoules
- Laser Fit scleral lenses laserfitlens.com

INSTRUMENT BASED SCLERAL LENS FITTING

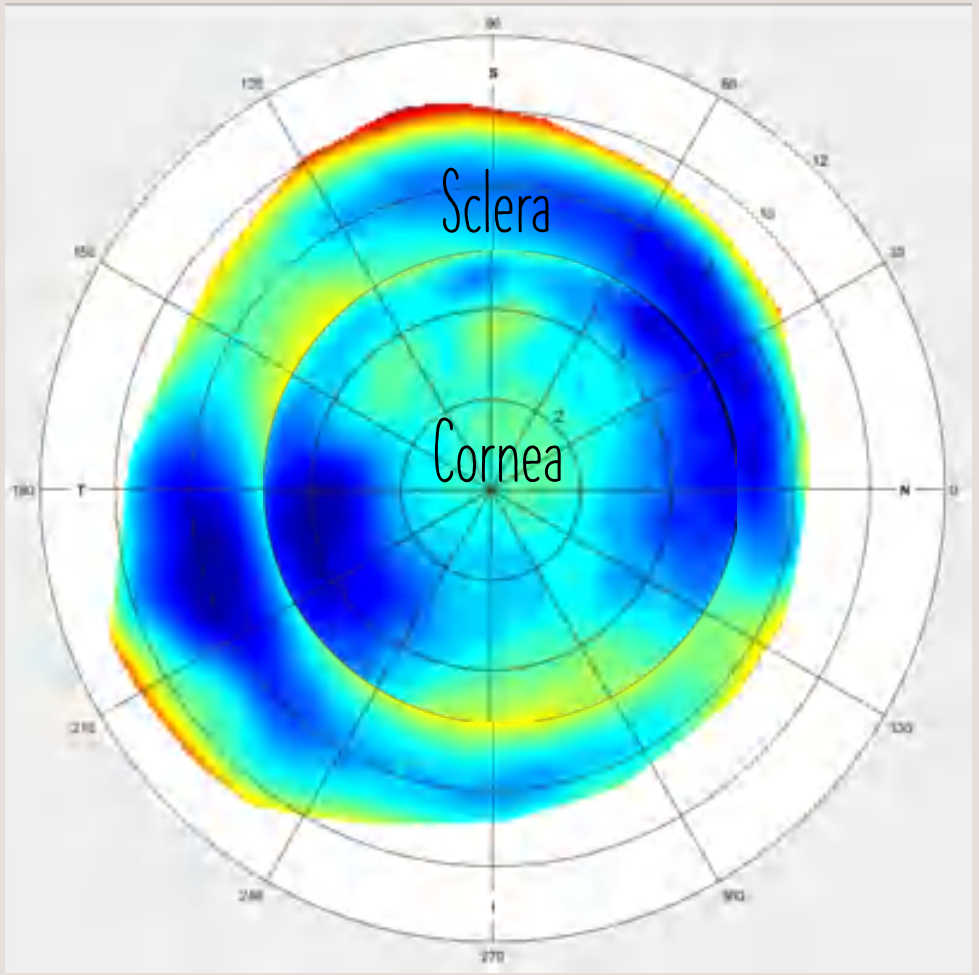


- Corneo-scleral Topography
- Scheimpflug Tomography

FITTING SCLERAL LENSES FROM MEASUREMENT

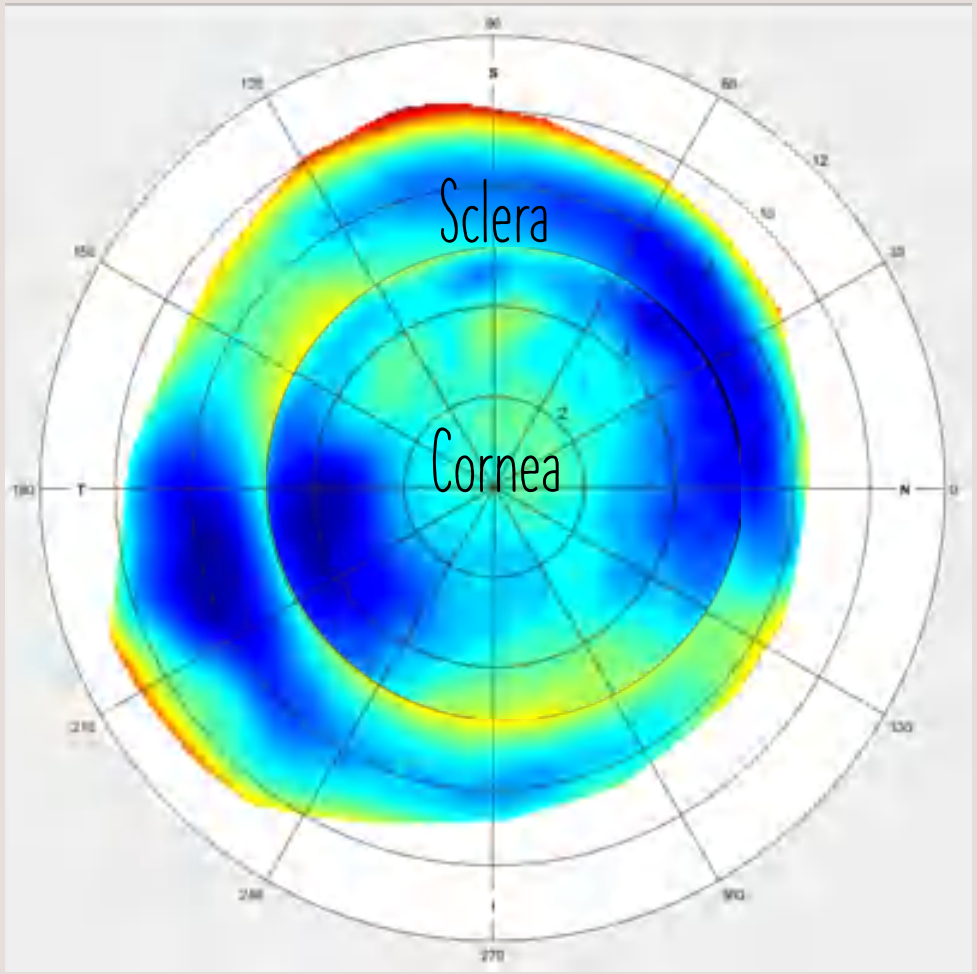
- Match scleral lens design with cornea shape
  - Prolate
  - Oblate
- Match scleral lens LZ design with scleral shape
  - Toricity
  - Scleral obstacles
  - Scleral asymmetry
- Diagnostic lenses
- Software based
  - Branded scleral lens design
  - Free-form

CORNEO-SCLERAL TOPOGRAPHY



CORNEO-SCLERAL TOPOGRAPHY

- Mean Sagittal height
- Sagittal height specified location
- Scleral toricity
- Scleral Asymmetry



sMap 3D

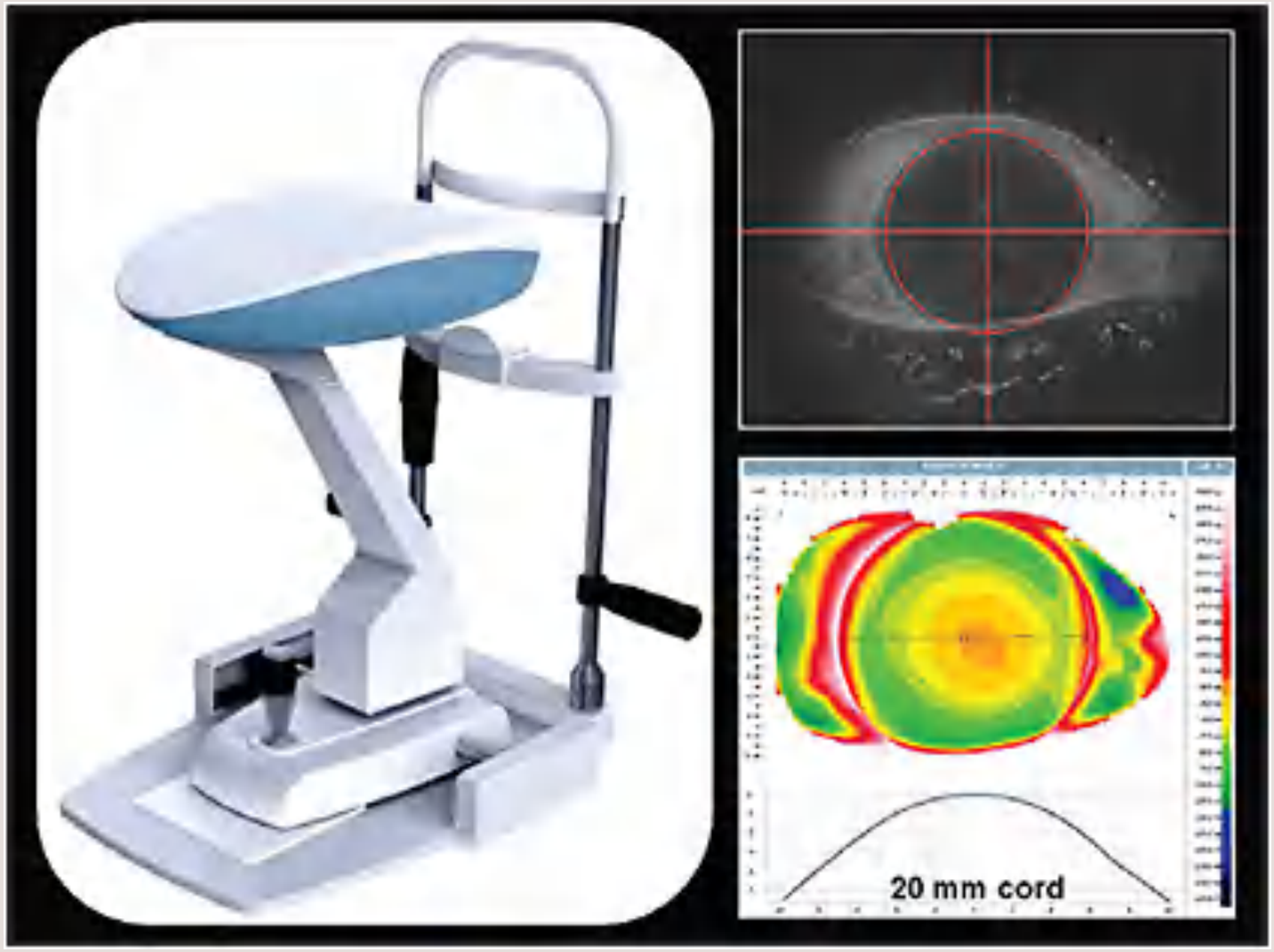
CORNEO-SCLERAL TOPOGRAPHY

- Fluorescein based
- 3 gazes
- Assessment of cornea and sclera 22mm
- Scleral lens design- custom and free-form

CORNEO-SCLERAL TOPOGRAPHY

Eaglet Eye Surface Profiler (ESP)

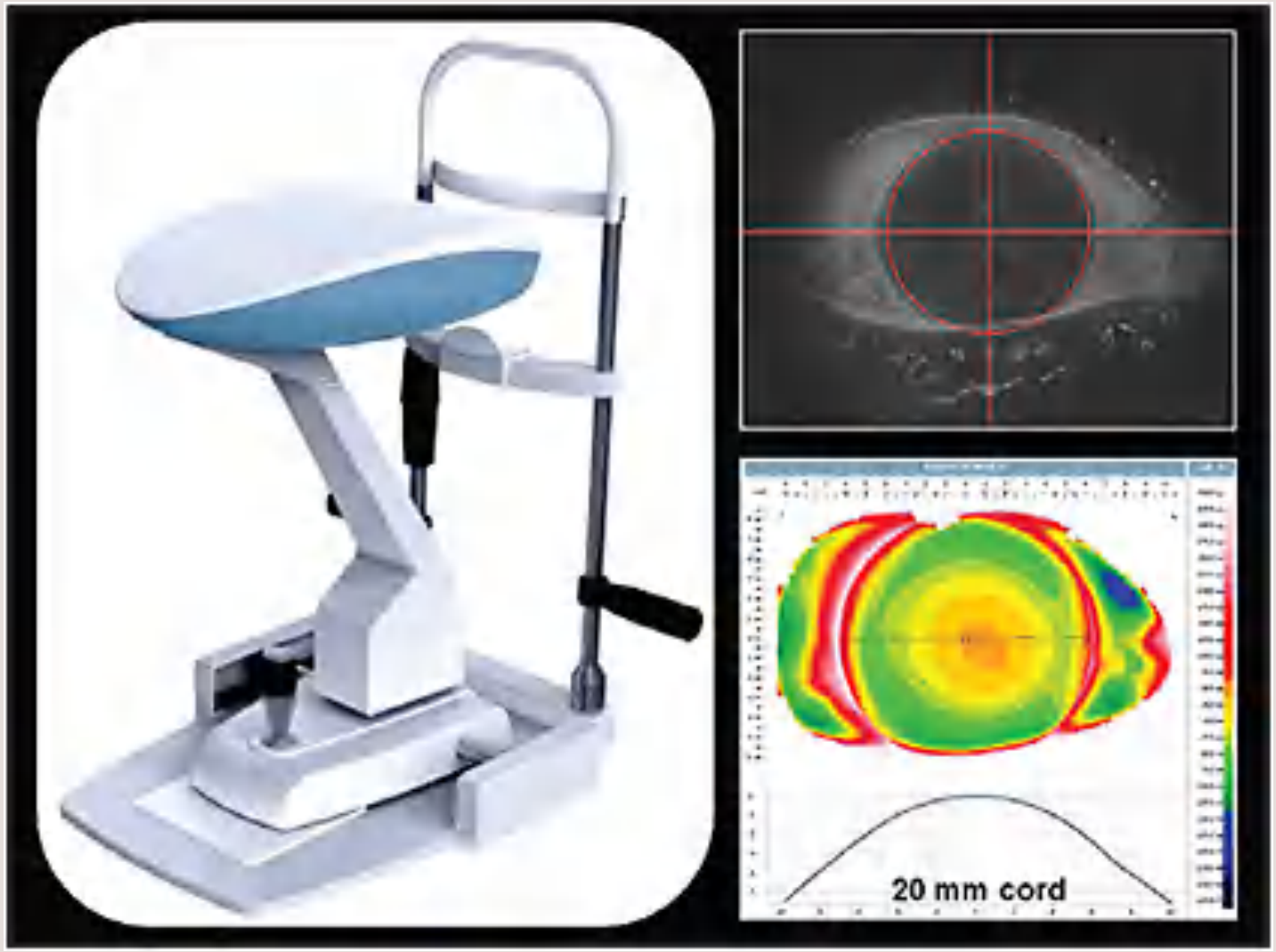
- Fluorescein based
- Assessment cornea and sclera 20mml



CORNEO-SCLERAL TOPOGRAPHY

Eaglet Eye Surface Profiler (ESP)

- Series of scans straight gaze
- Supported various labs (see website)

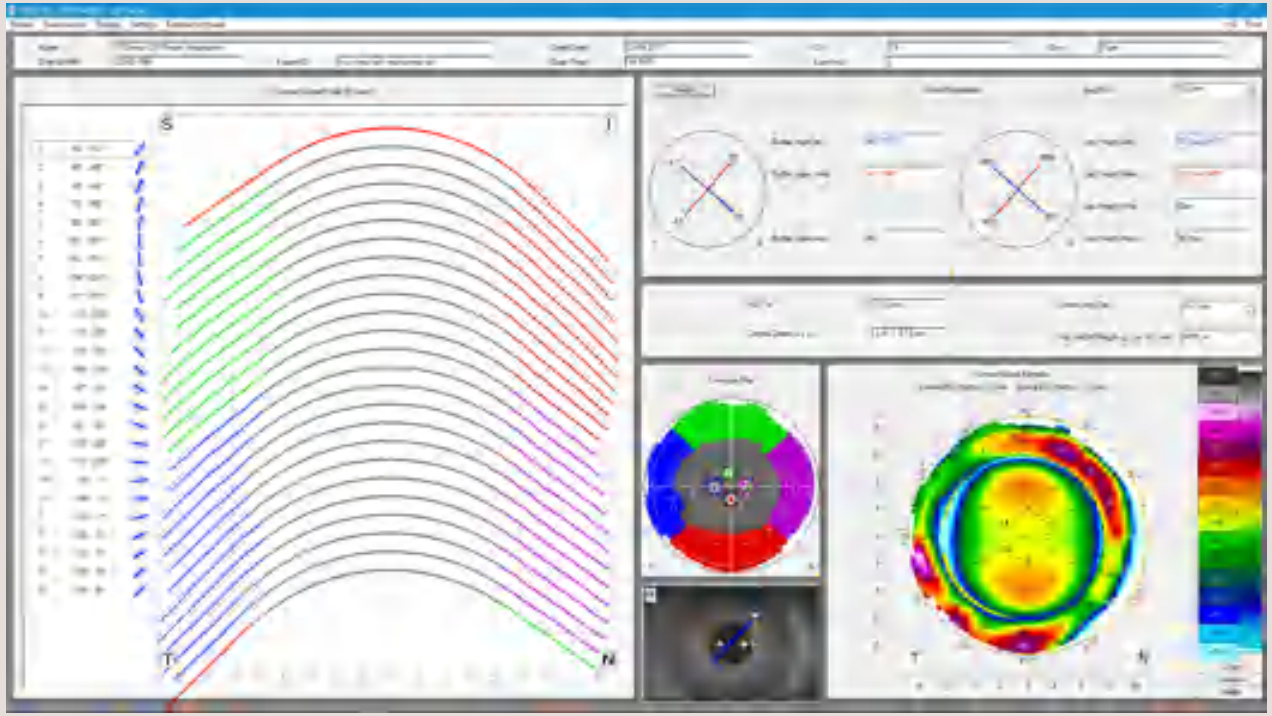


SCHEIMPFLUG TOMOGRAPHY- PENTACAM

- Cornea
  - Front and back surface corneal topography
  - Global pachymetry
- Scleral
  - No Fluorescein- 5 measurements- straight and 4 quadrants
  - Cornea and scleral measurements 18mm

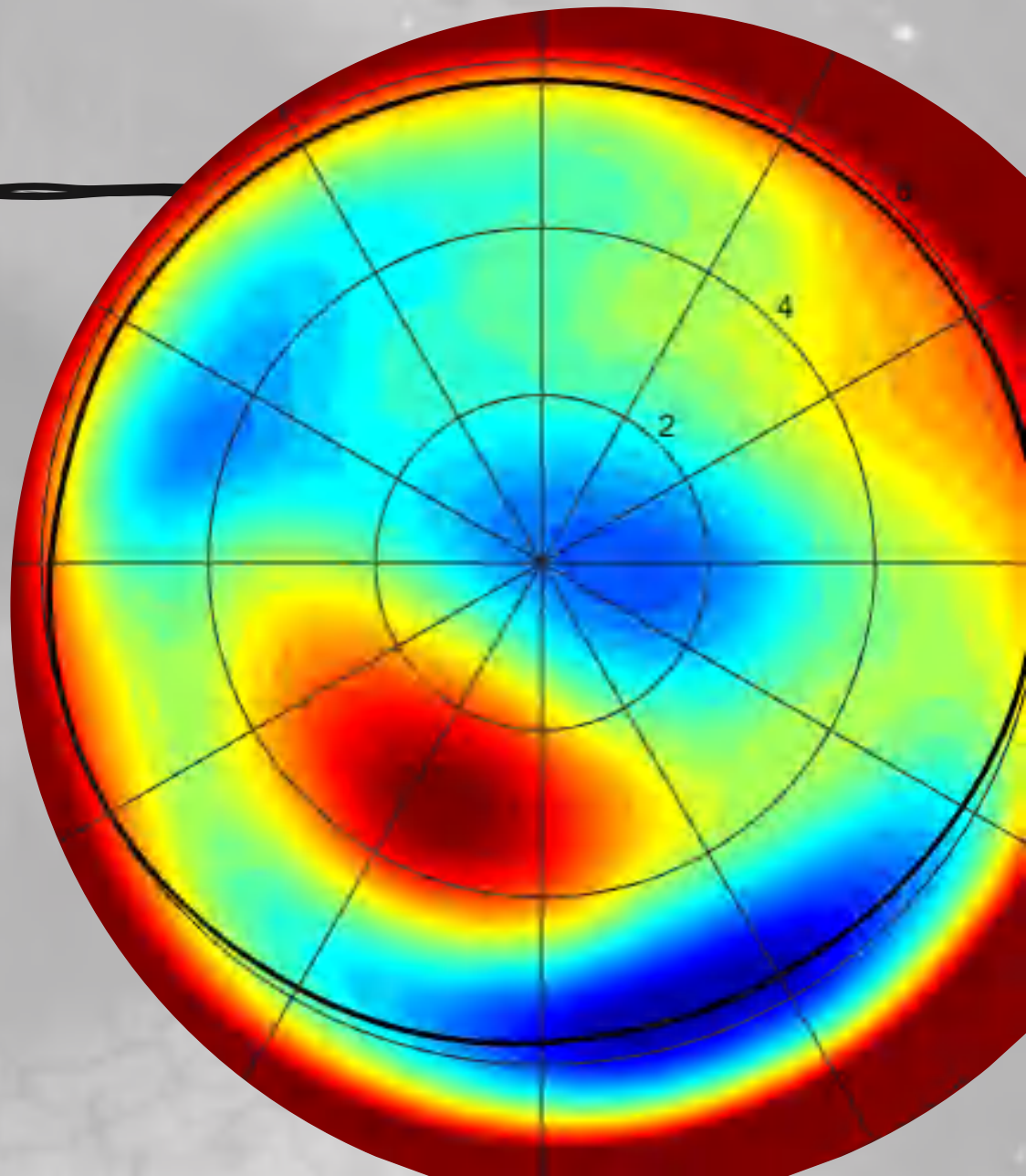
SCHEIMPFLUG TOMOGRAPHY

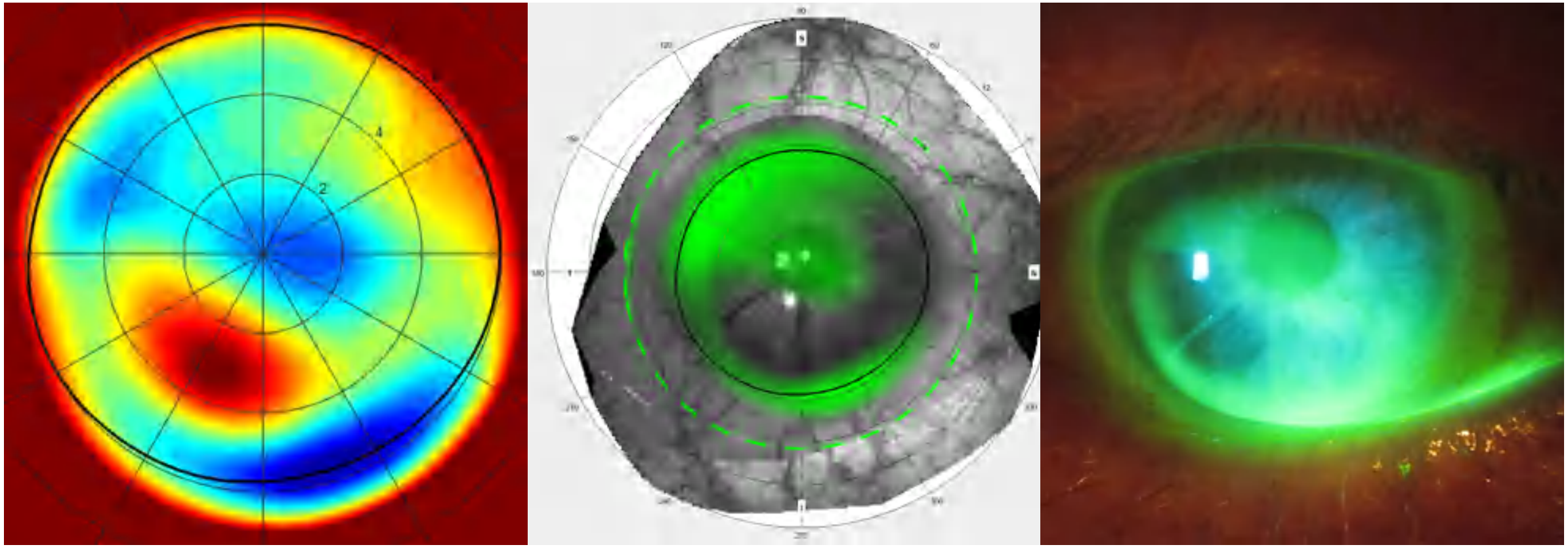
- Scleral lens design- corneal scleral profile (CSP) module
- Used with specific models
- Integrated with various manufacturers/designs



RADIAL KERATOTOMY POST

- 62 YO ♂
- RK (8) 1995
- Hyperopia/Irregular (ectasia)
- 211µ

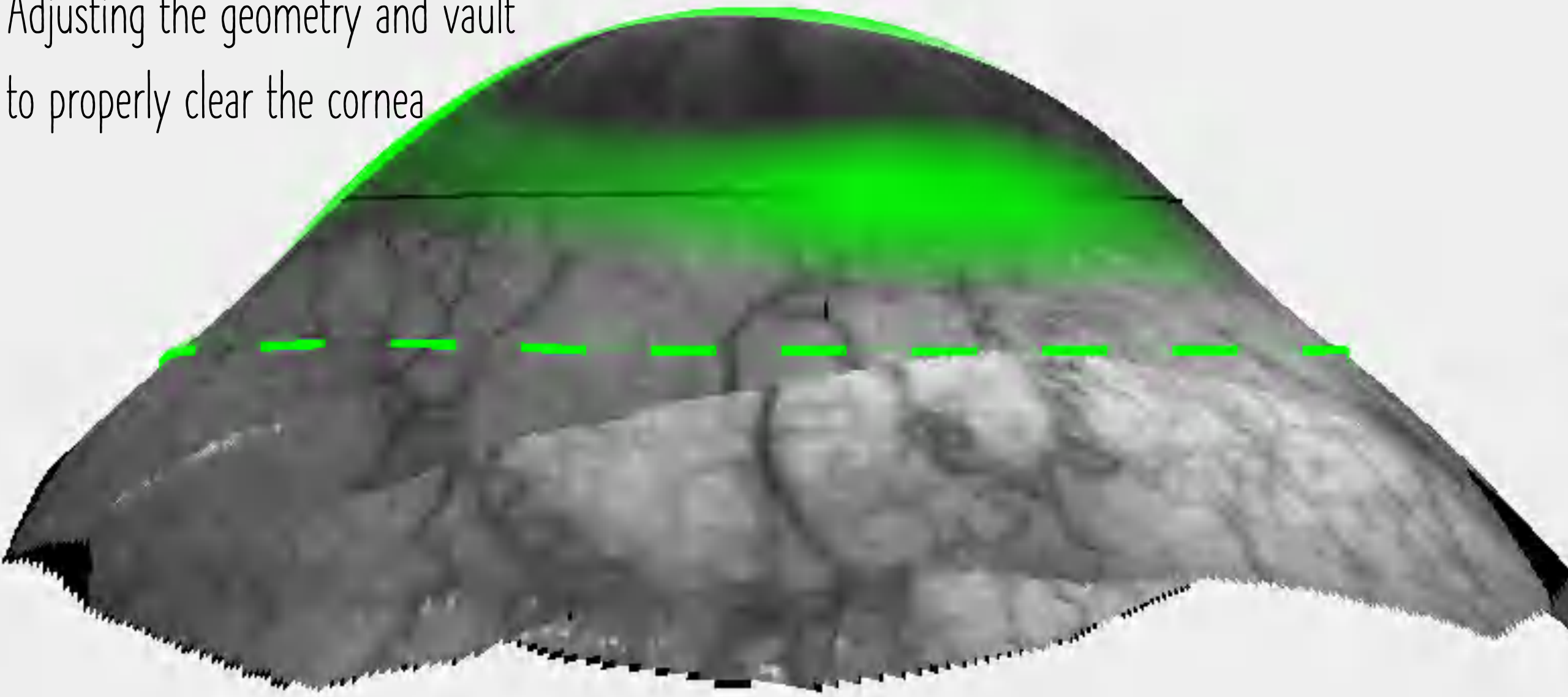




PARA-CENTRAL TOUCH OVER THE AREA OF ECTASIA USING A STANDARD PROLATE SCLERAL DESIGN

3D MODEL

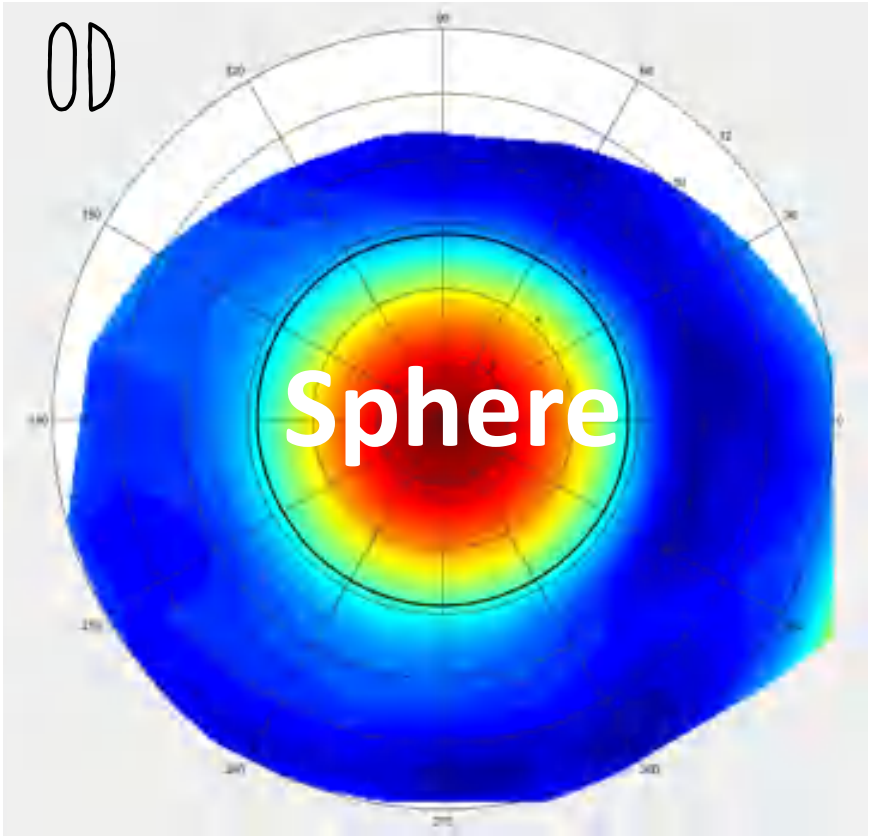
Adjusting the geometry and vault
to properly clear the cornea

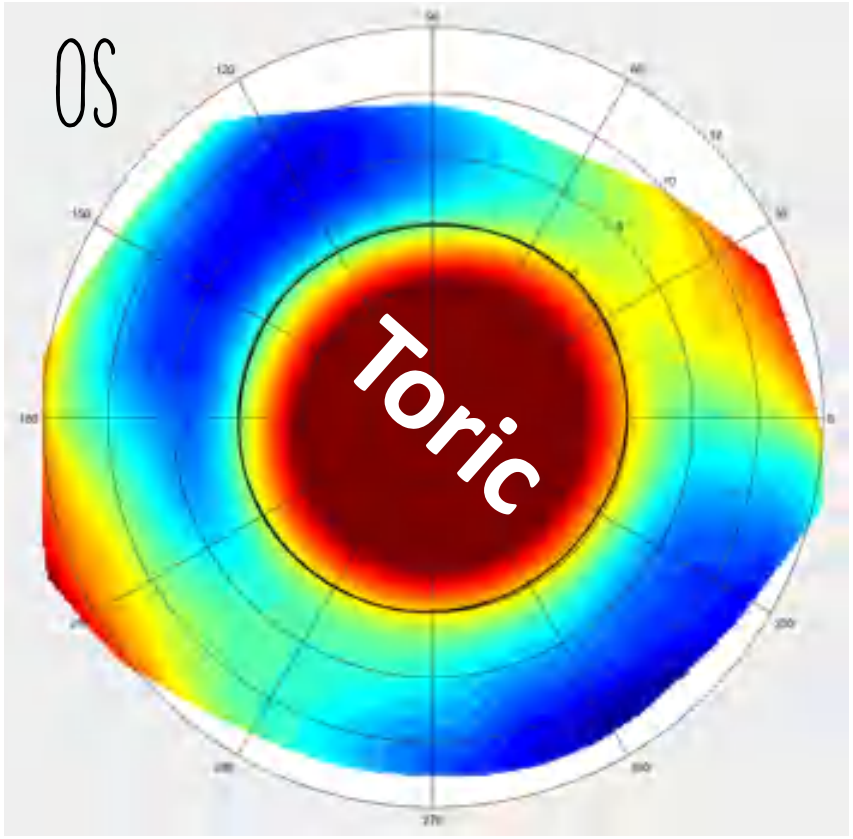


SCLERAL LENS CLEARANCE FOR OBLATE CORNEA WITH ECTASIA VS RK

GRANULAR DYSTROPHY

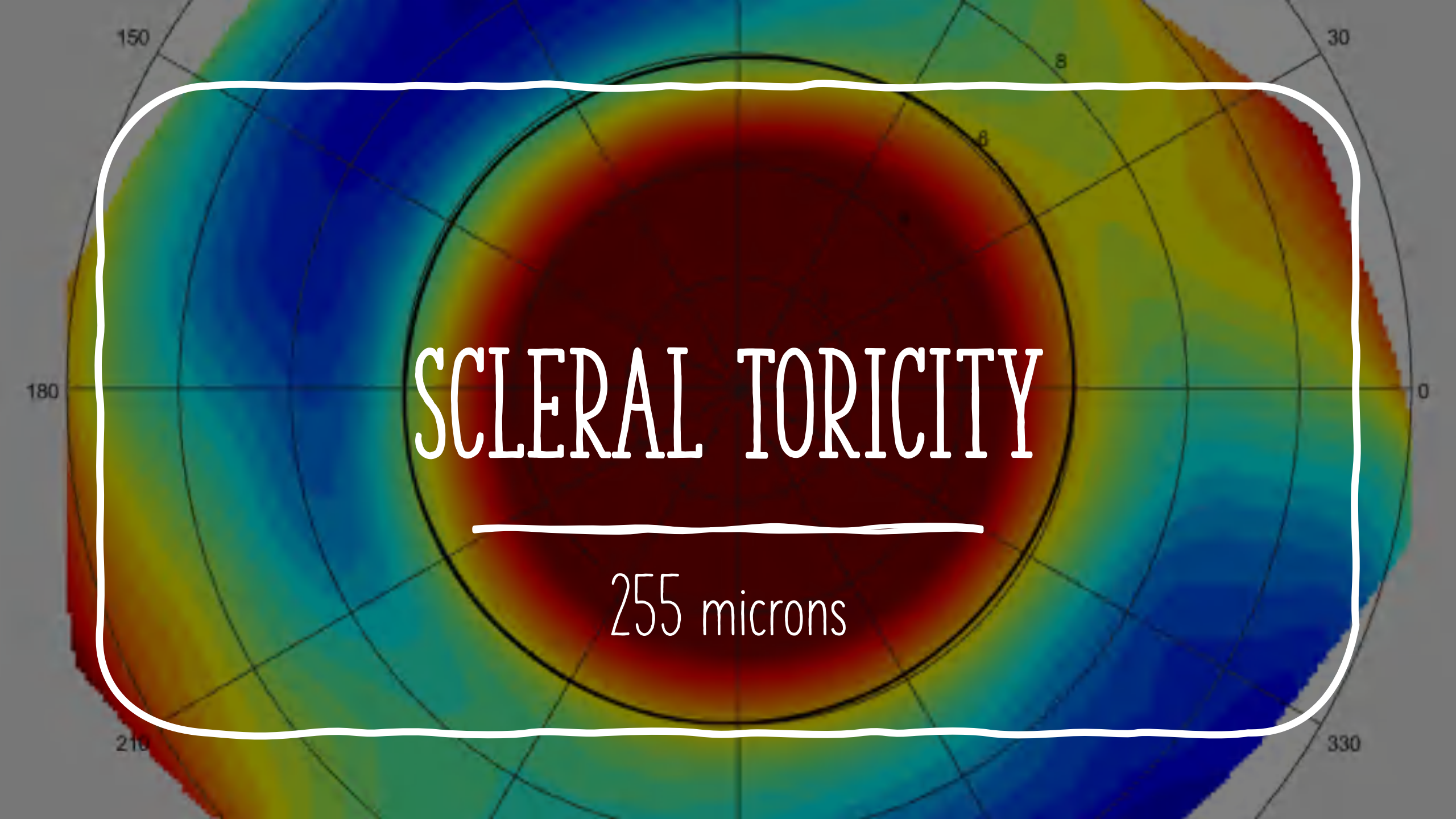
- 52-year-old male
- Granular Dystrophy
- Bandage SCL
  - Protection
  - OD 20/50 OS 20/80





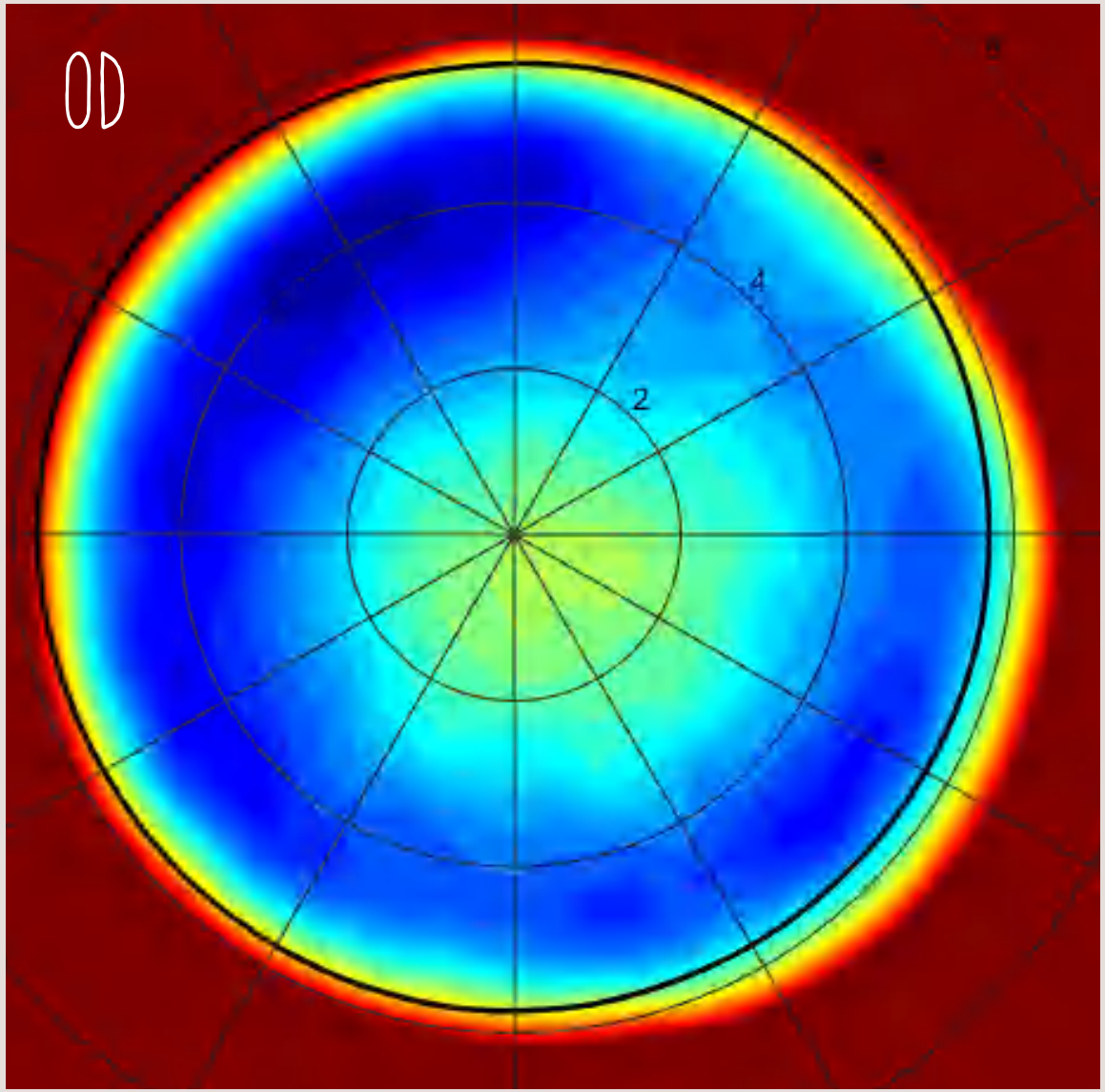
GRANULAR DYSTROPHY
CORNEO-SCLERAL TOPOGRAPHY

- Scleral elevation maps
- Colors based upon a reference sphere
  - Cooler colors represent increased sag/Warmer colors represent decreased sag
  - Observe Patterns


150
30
180
0
210
330
8
6
SCLERAL TORICITY
255 microns

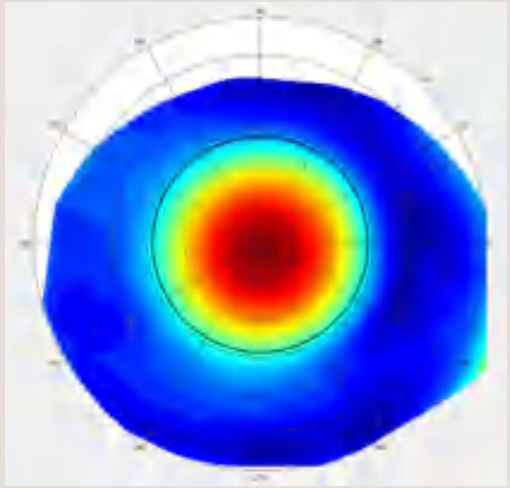
GRANULAR DYSTROPHY CORNEO-SCLERAL TOPOGRAPHY

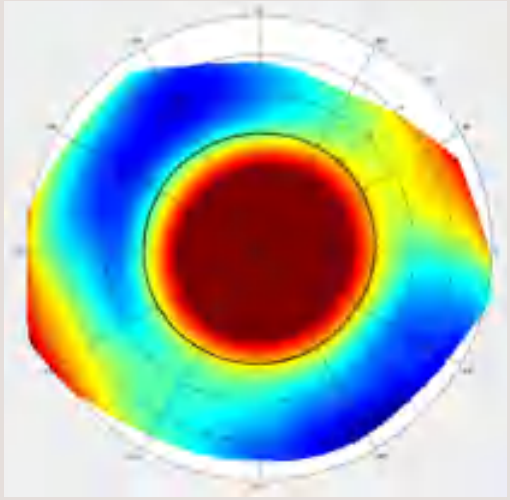
- Diagnostic Scleral Lens fitting
  - Geometry
    - Prolate
    - Oblate



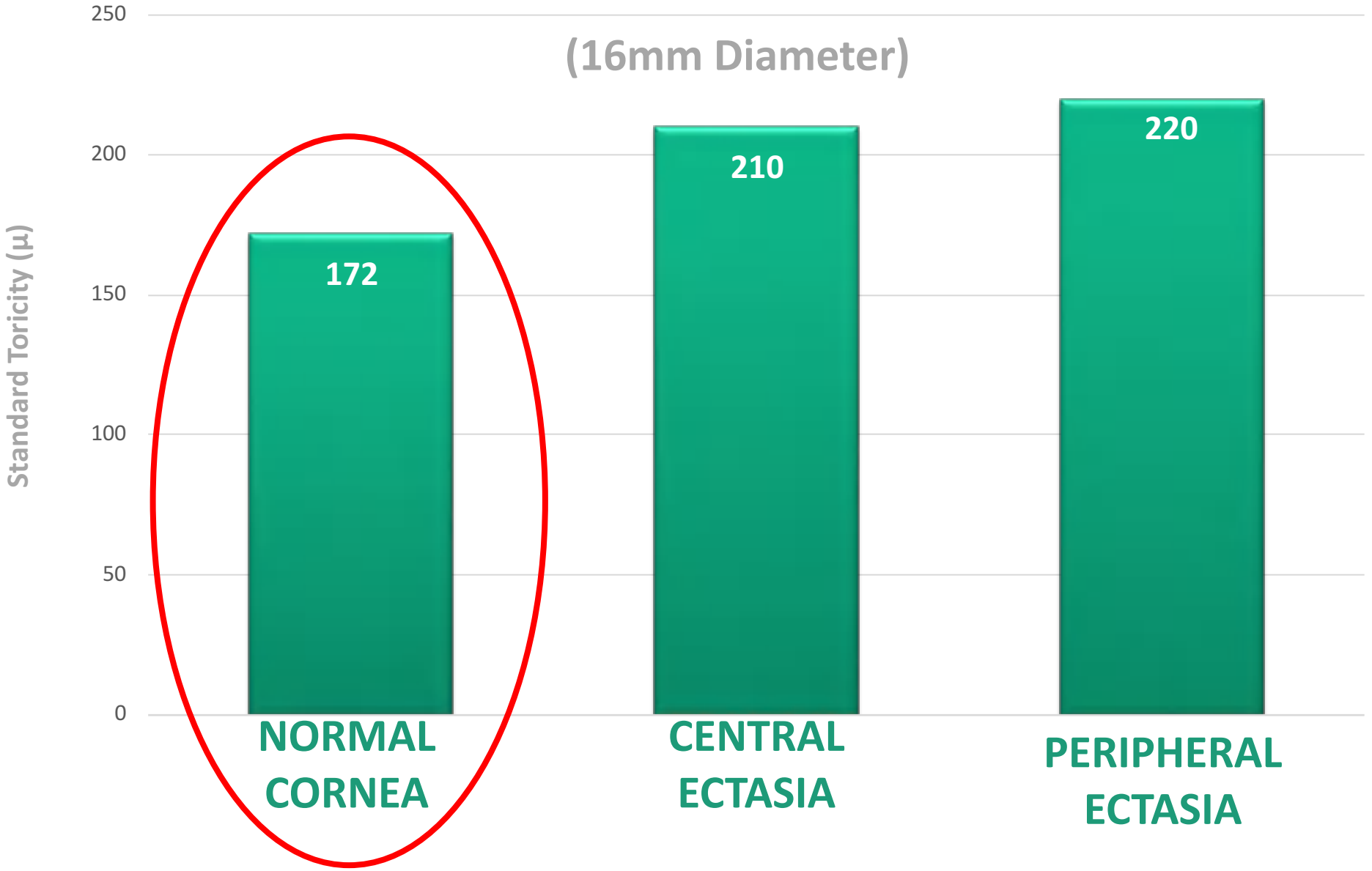
GRANULAR DYSTROPHY
CORNEO-SCLERAL TOPOGRAPHY

- Diagnostic Sleral Lens fitting
  - Landing Zone
    - OD Sphere
    - OS Toric LZ 200µ
  - Sagittal height

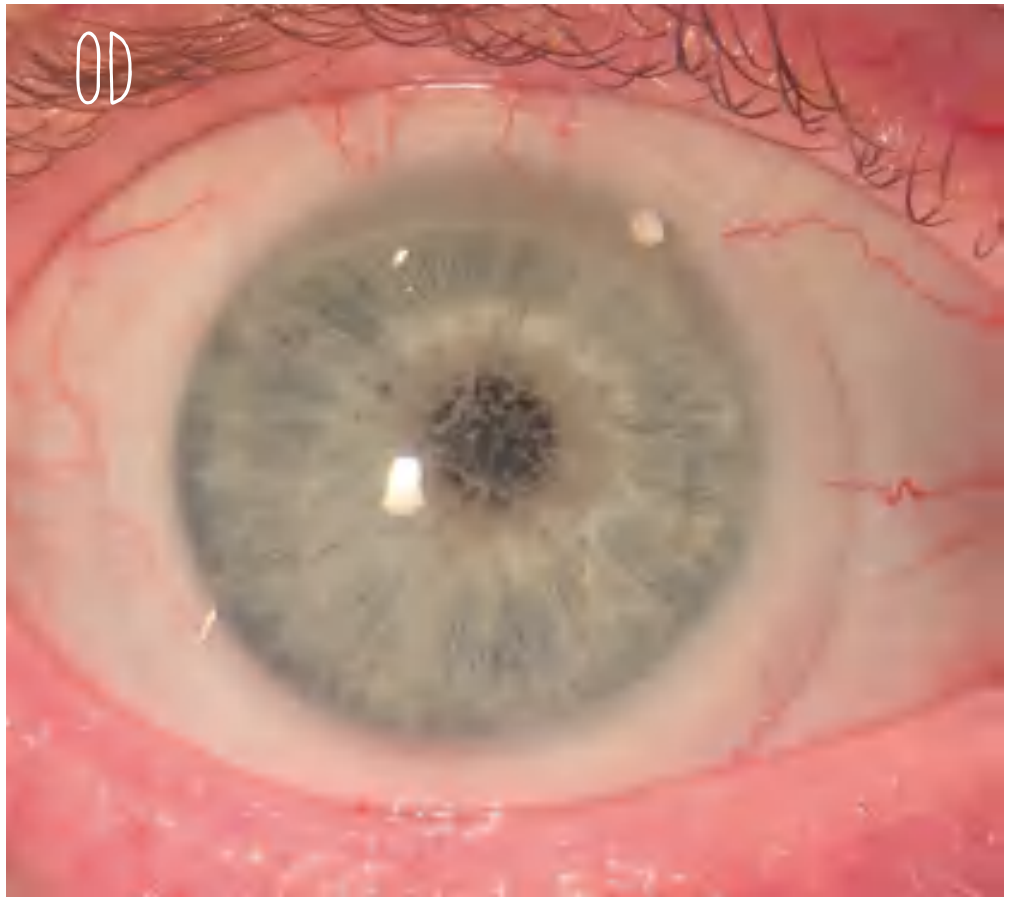


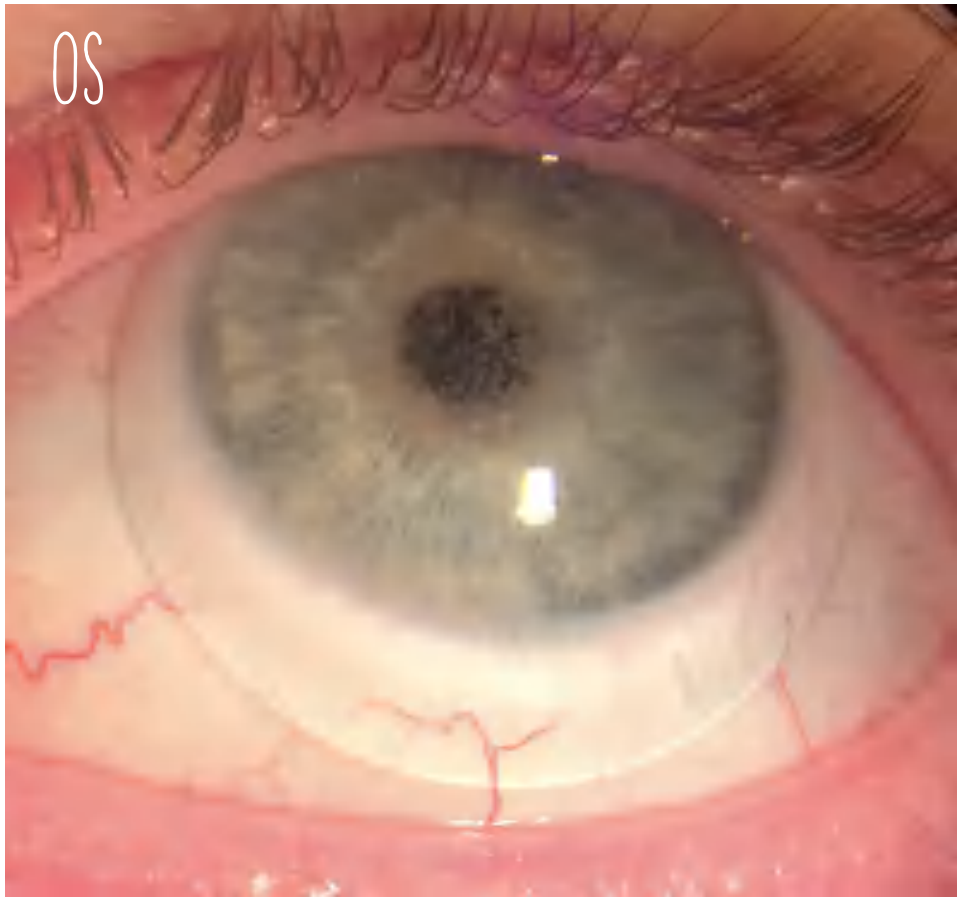


Standard Toricity



GRANULAR DYSTROPHY
CORNEO-SCLERAL TOPOGRAPHY

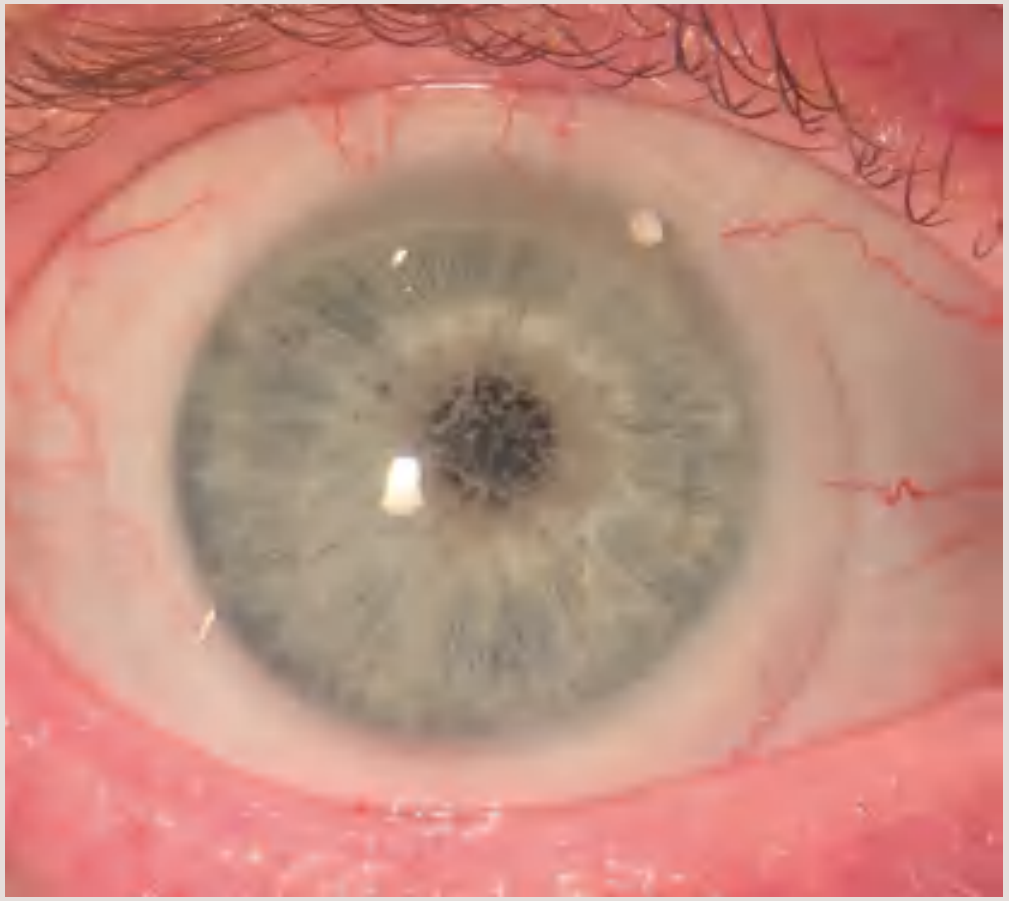




16mm Scleral Lenses 20/40

GRANULAR DYSTROPHY
CORNEO-SCLERAL TOPOGRAPHY

- Diagnostic Lenses
  - Geometry
  - Landing Zone- OD vs. OS
  - Sagittal Height
- Improved efficiency



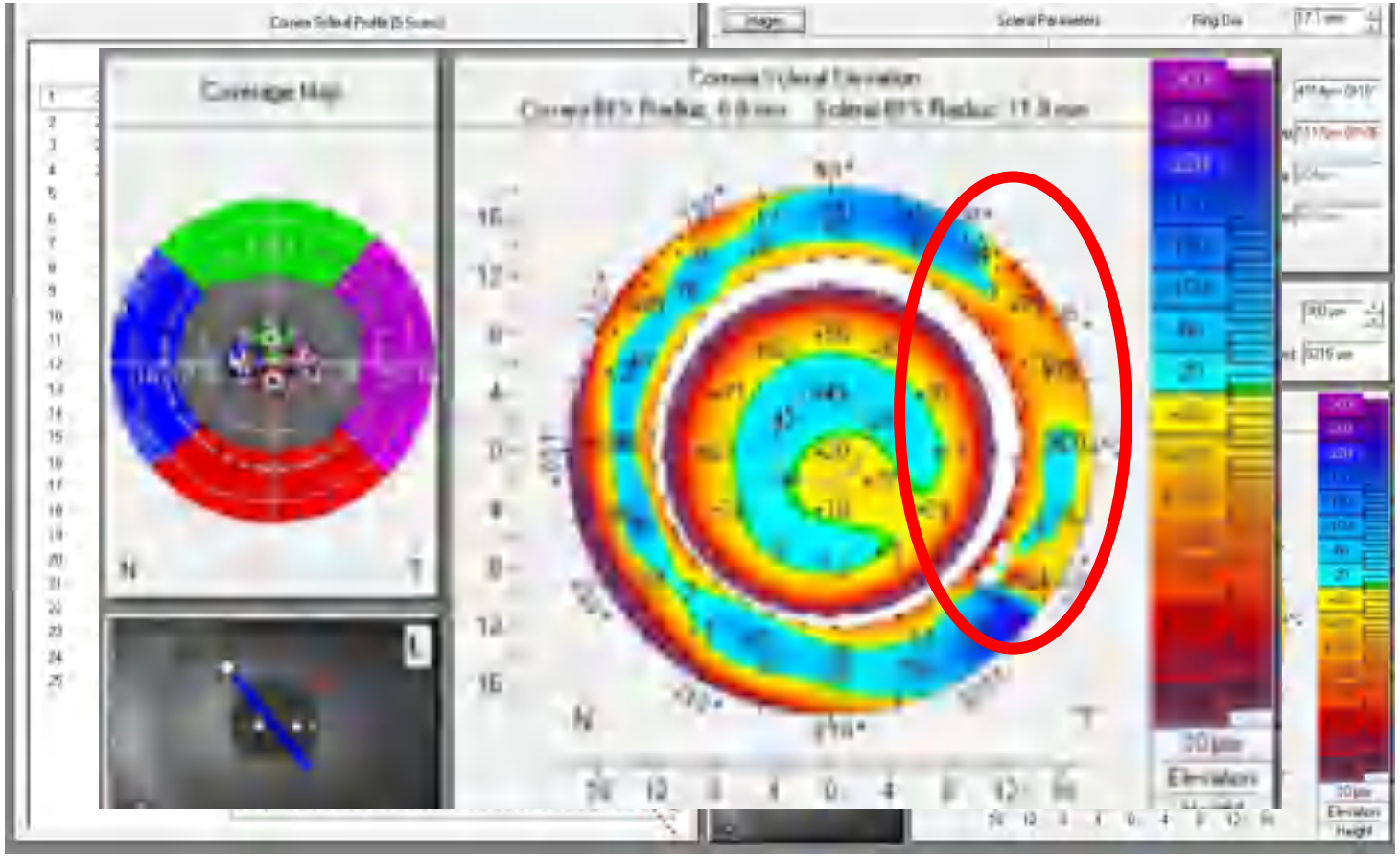
Dr. Jason Jedlicka

TROUBLESHOOTING SCLERAL LENS DESIGN

- 61-year-old scleral lens evaluation
- Wearing scleral lenses X 2 years
- Satisfied with OD, but c/o discomfort and fogging OS
- SLE showed debris flowing through a misaligned LZ
- Offered refit into free-form design from measurement

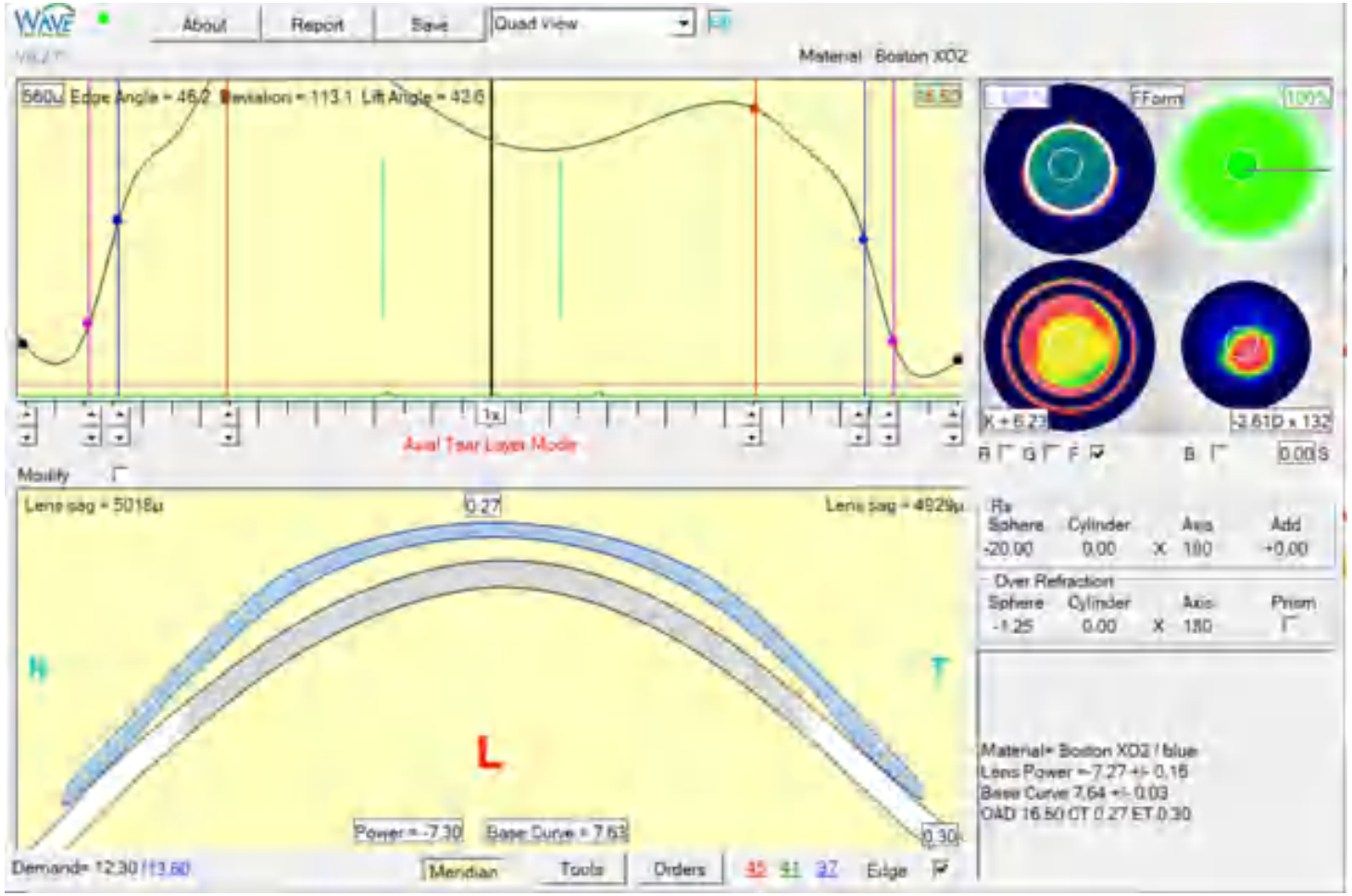
TROUBLESHOOTING SCLERAL LENS DESIGN

- Scleral lens out 48 hours
- Quadrant-specific effect
  - Higher elevation between 1 and 3 o'clock
  - Transition zones between areas of extreme elevation change



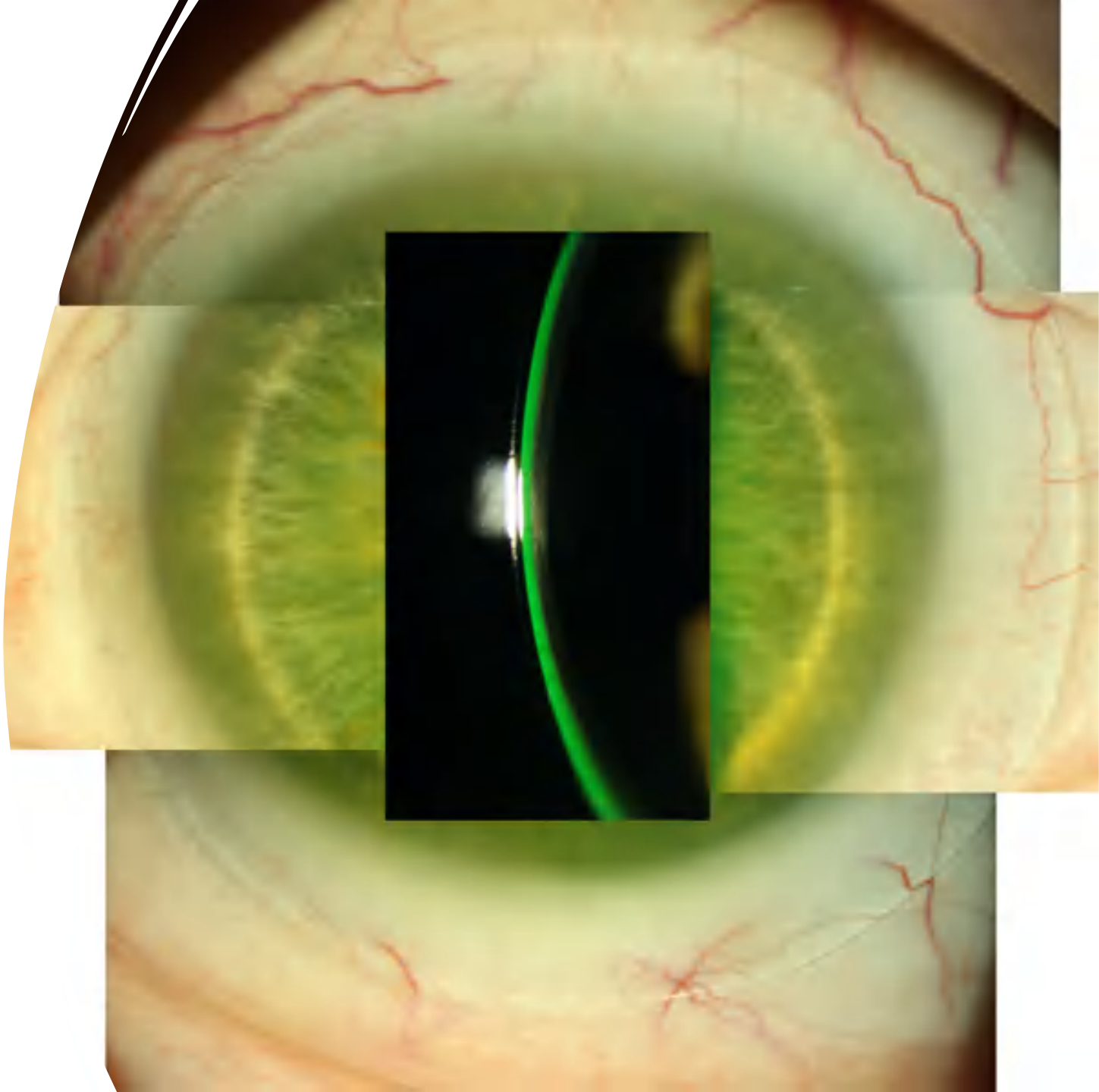
TROUBLESHOOTING SCLERAL LENS DESIGN

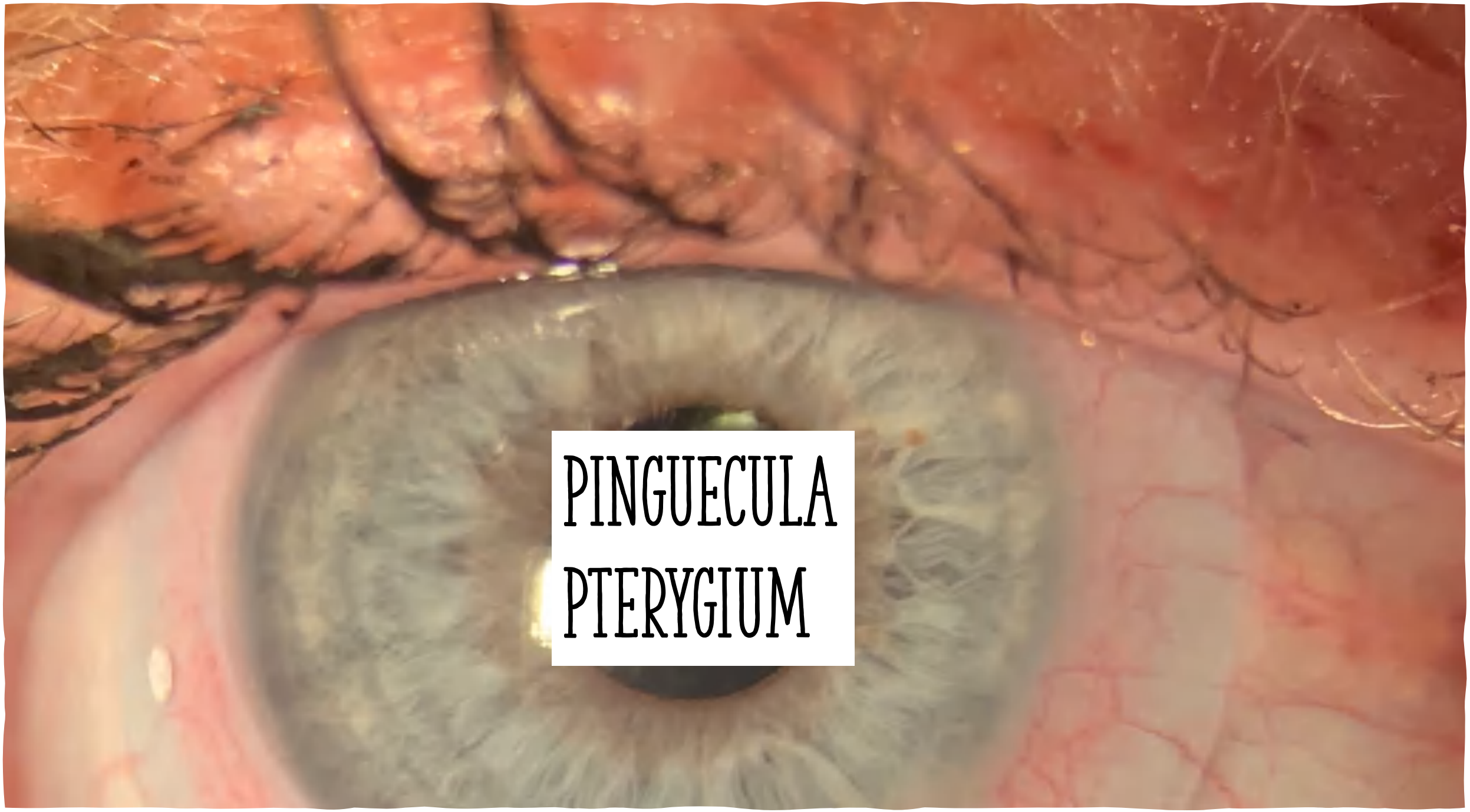
- Software used to generate a free-form design
- Corneal vault
- Base curve, limbal clearance, LZ
- Power- used from previous lens



TROUBLESHOOTING SCLERAL LENS DESIGN

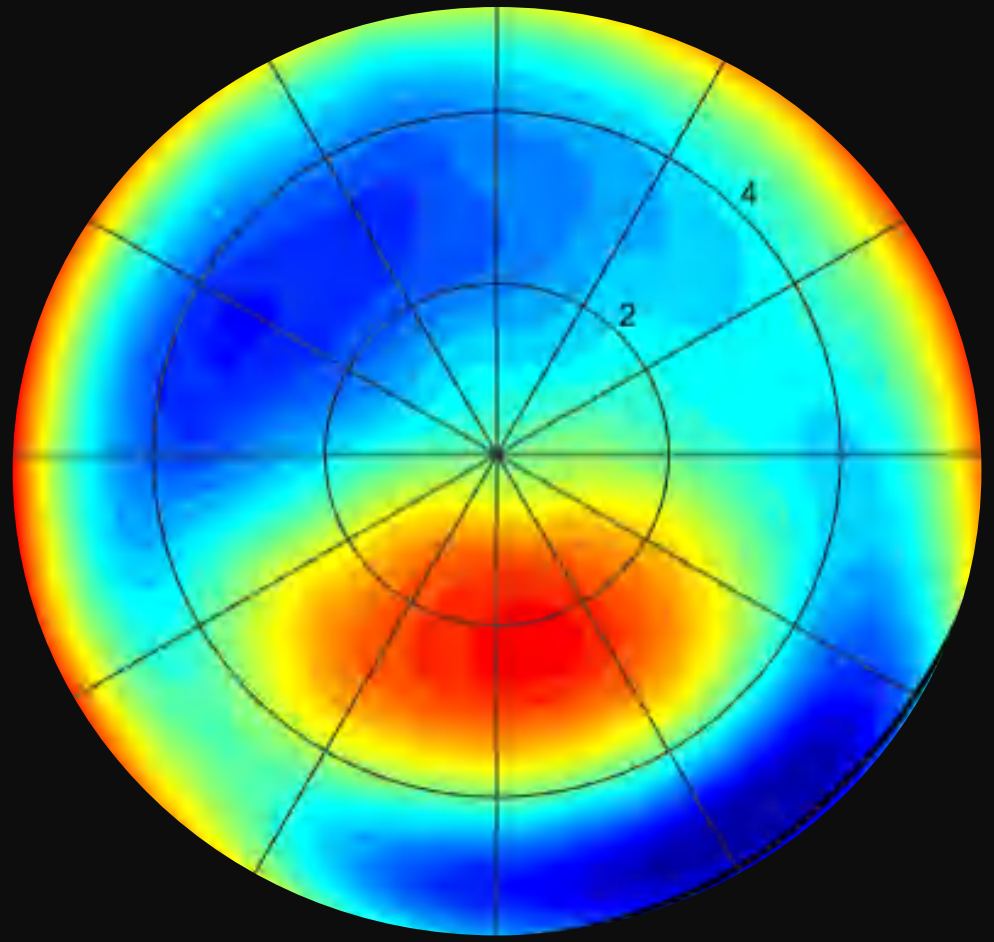
- Electronically ordered
- Fluid reservoir: 300µ
- LZ even alignment
- Improved comfort and function




PINGUECULA
PTERYGIUM

Keratconus

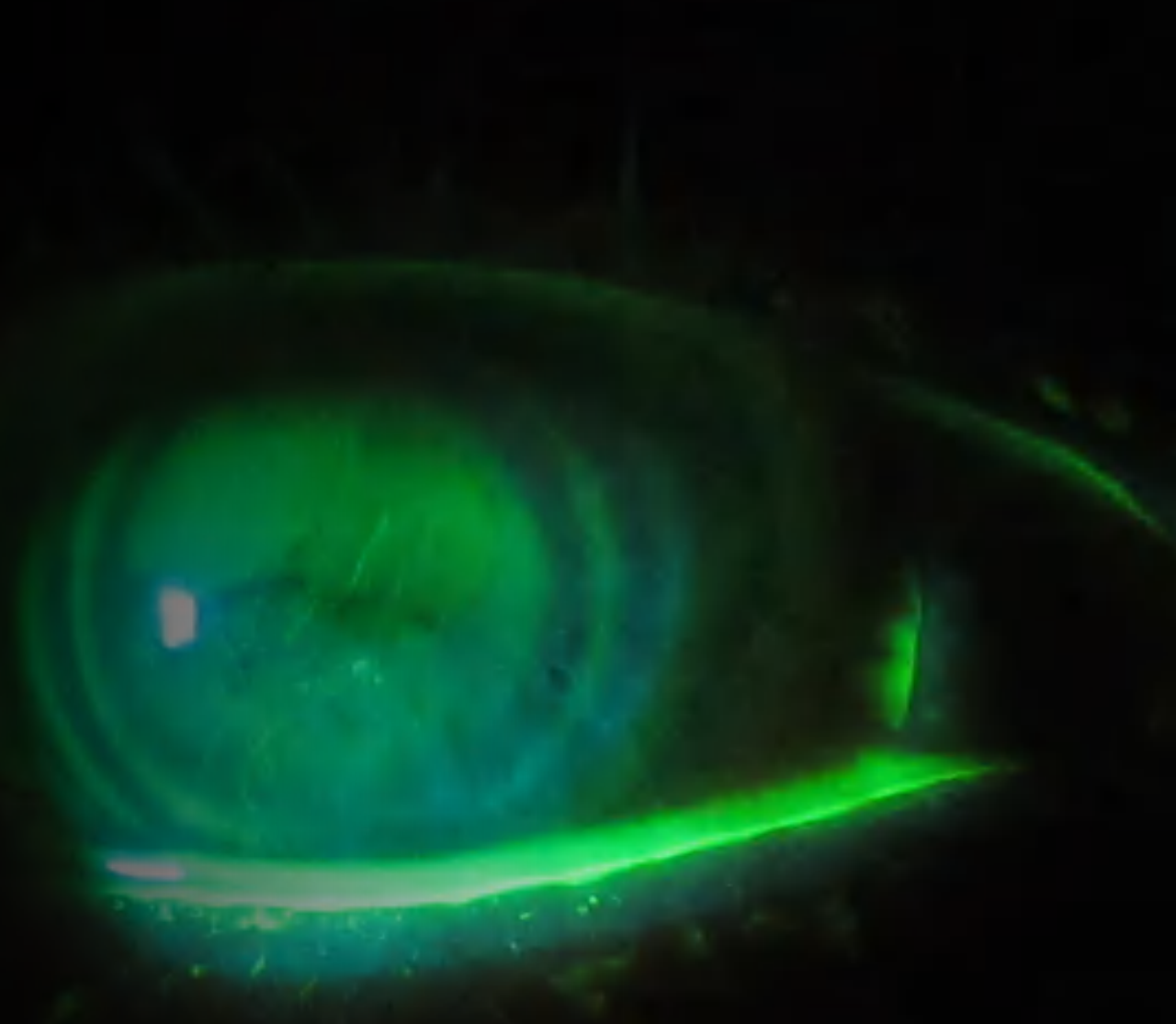
- 53 YO ♂ Keratoconus OD
- Previously failed corneal GP
- Previously failed scleral lens
  - Midday fogging
- Wearing Hybrid lens

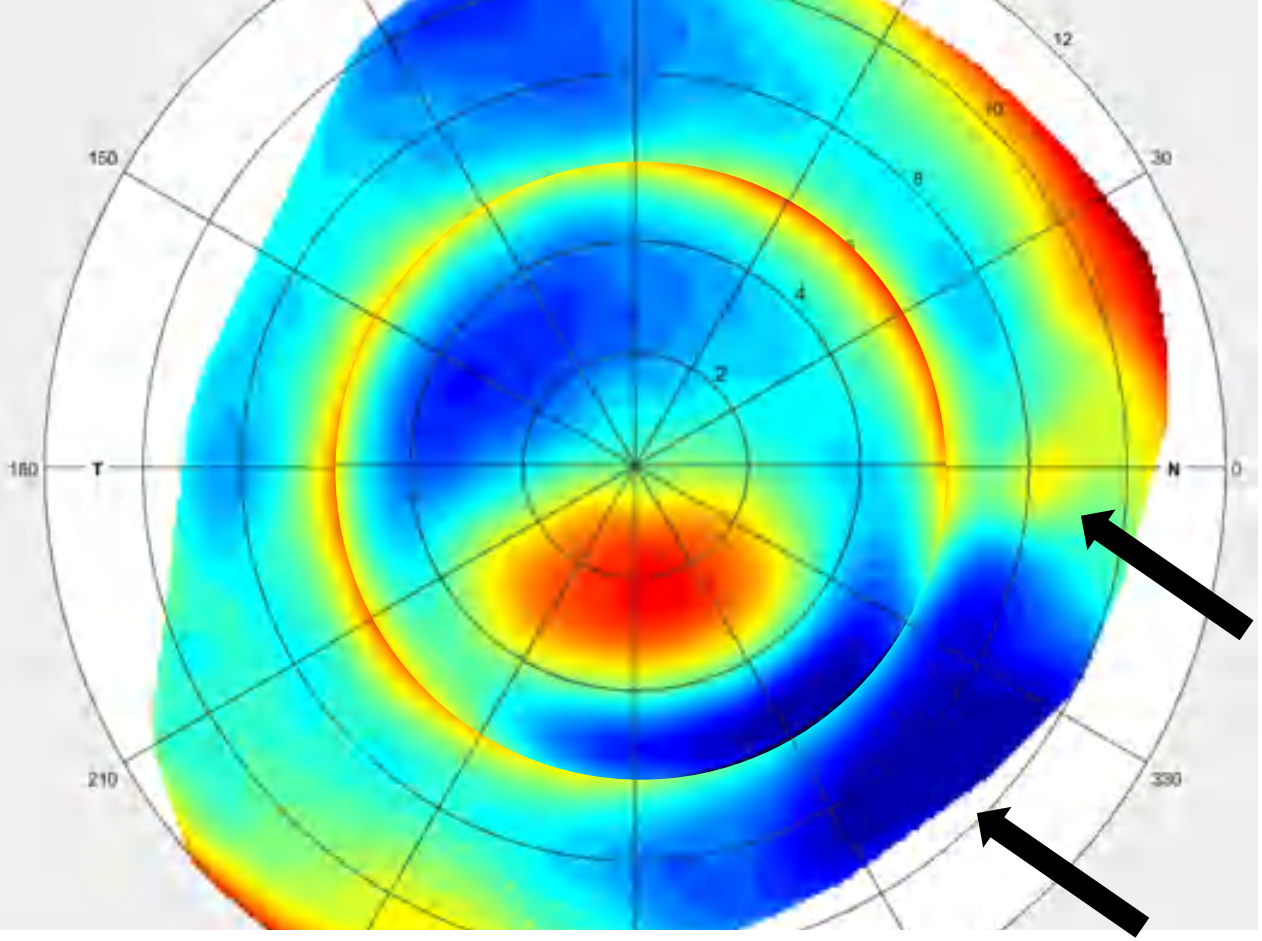


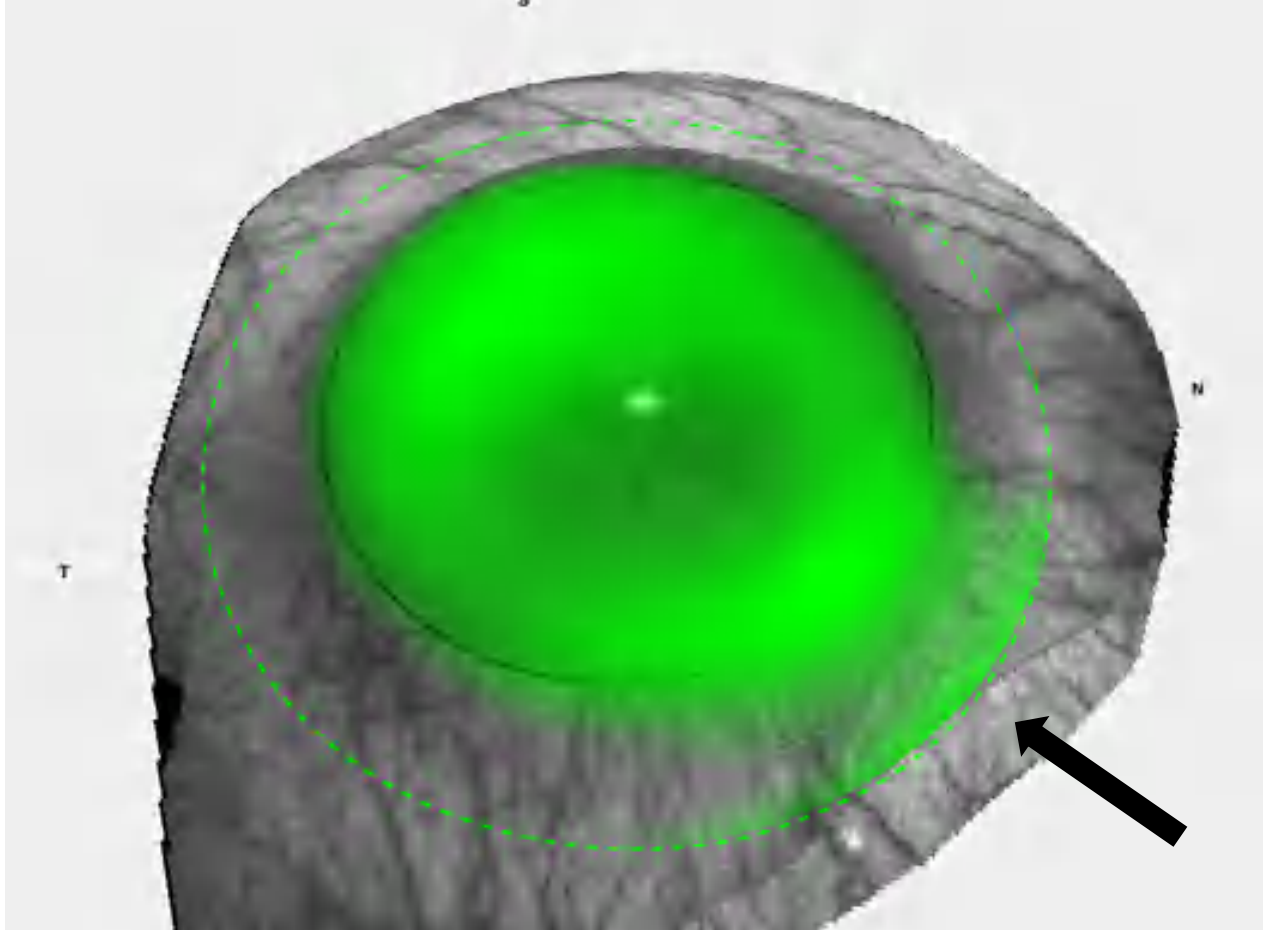
Keratoconus

Compression of the hybrid lens

-resulting in lens failure



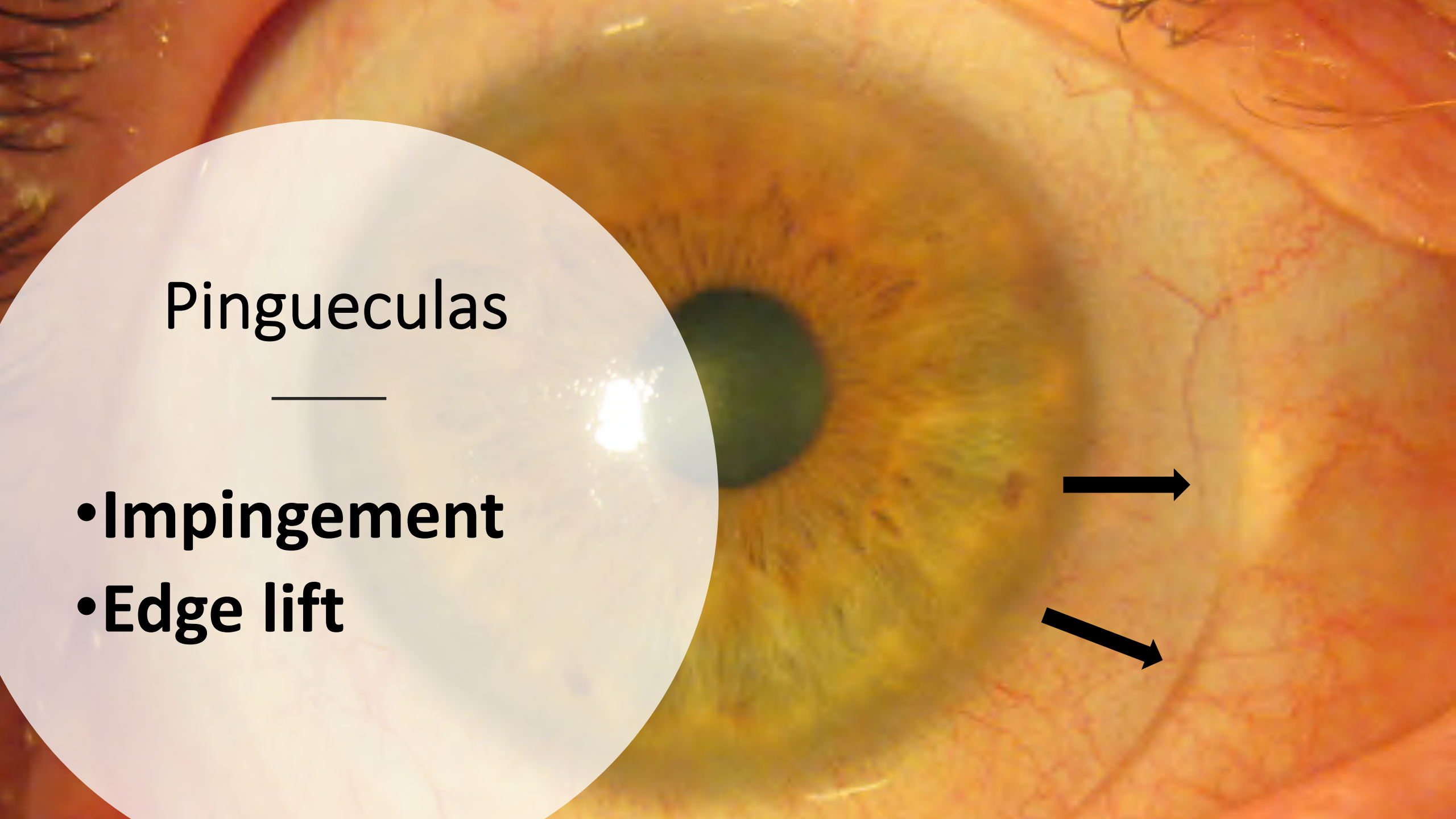




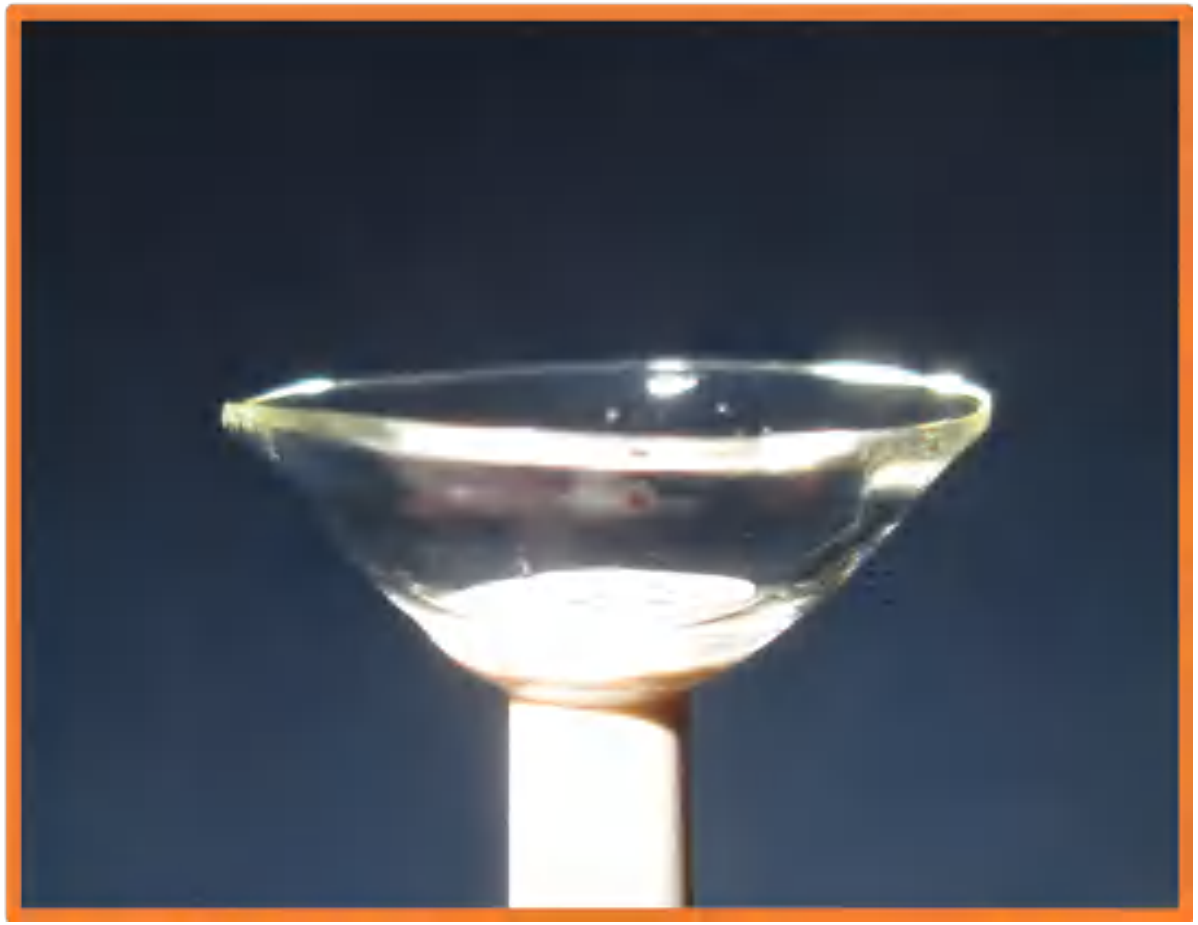
600μ difference between 305°-360°

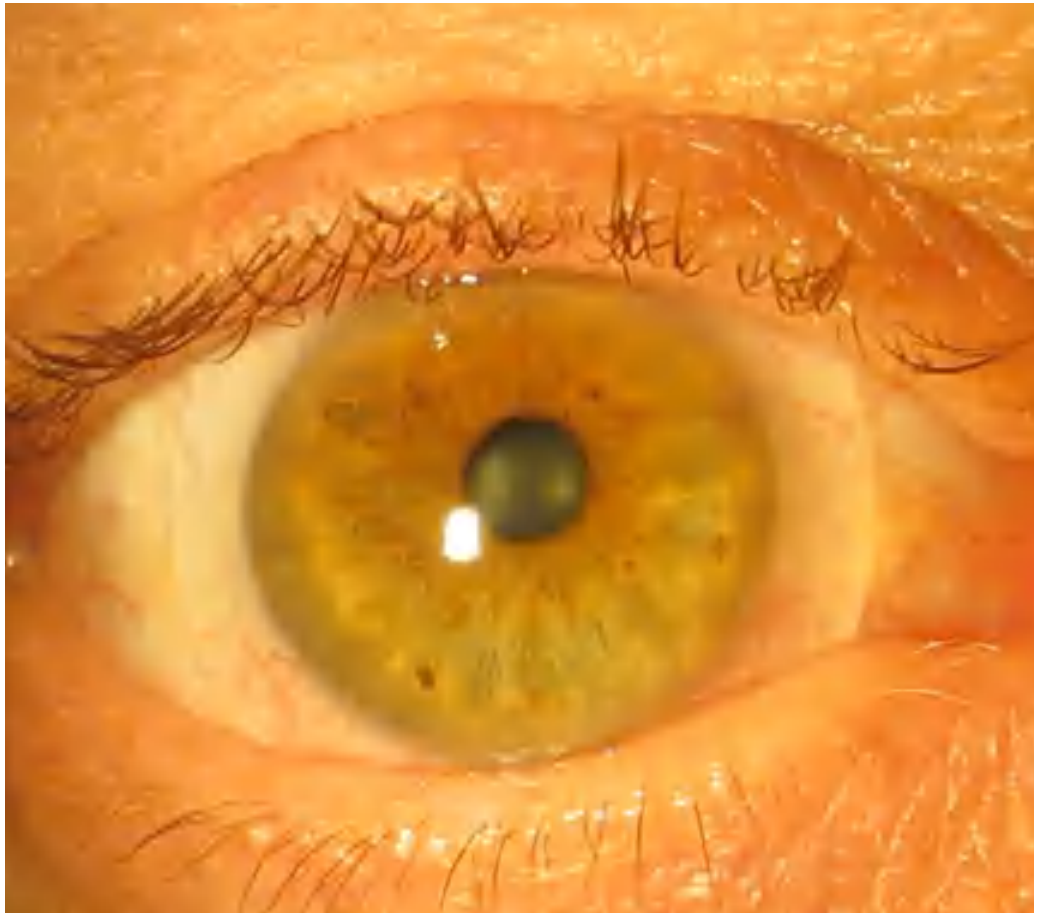
Pingueculas

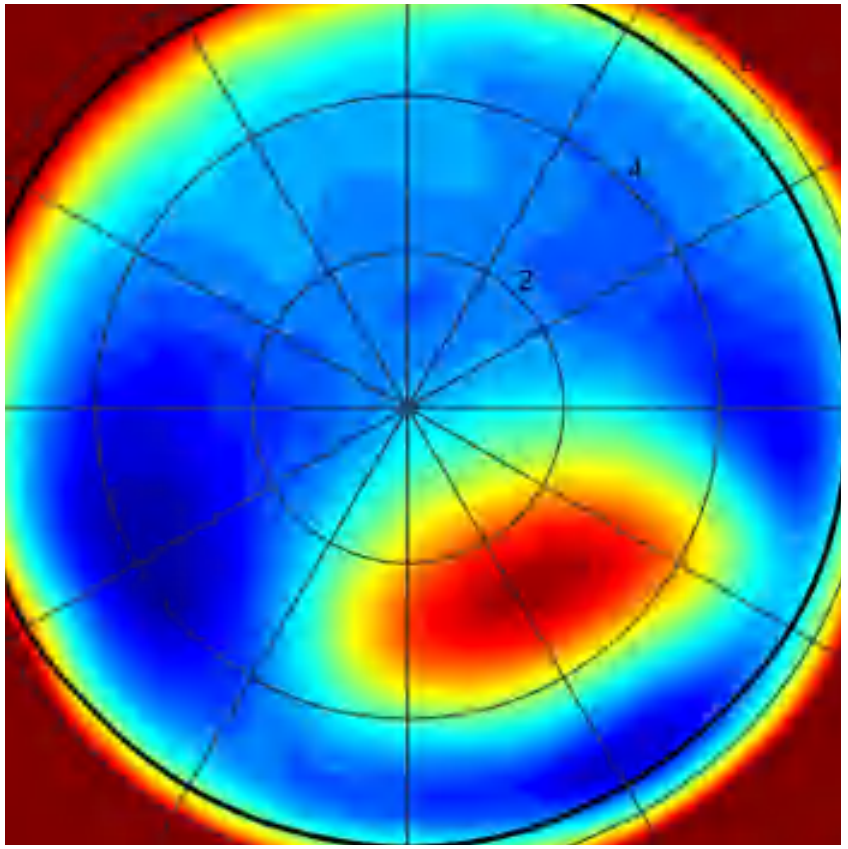
- **Impingement**
- **Edge lift**



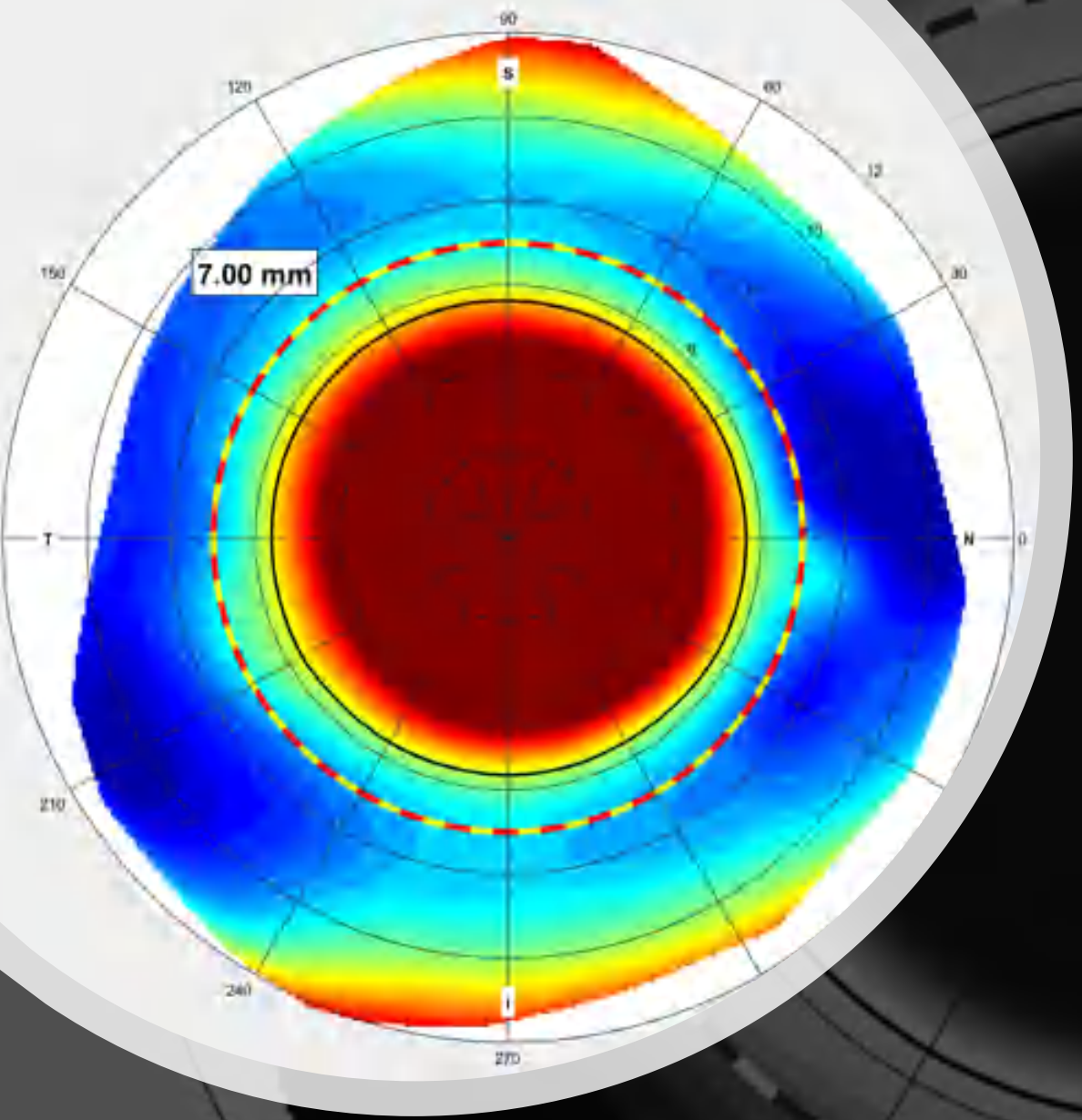
Free-form Scleral Lens- Localized Vault





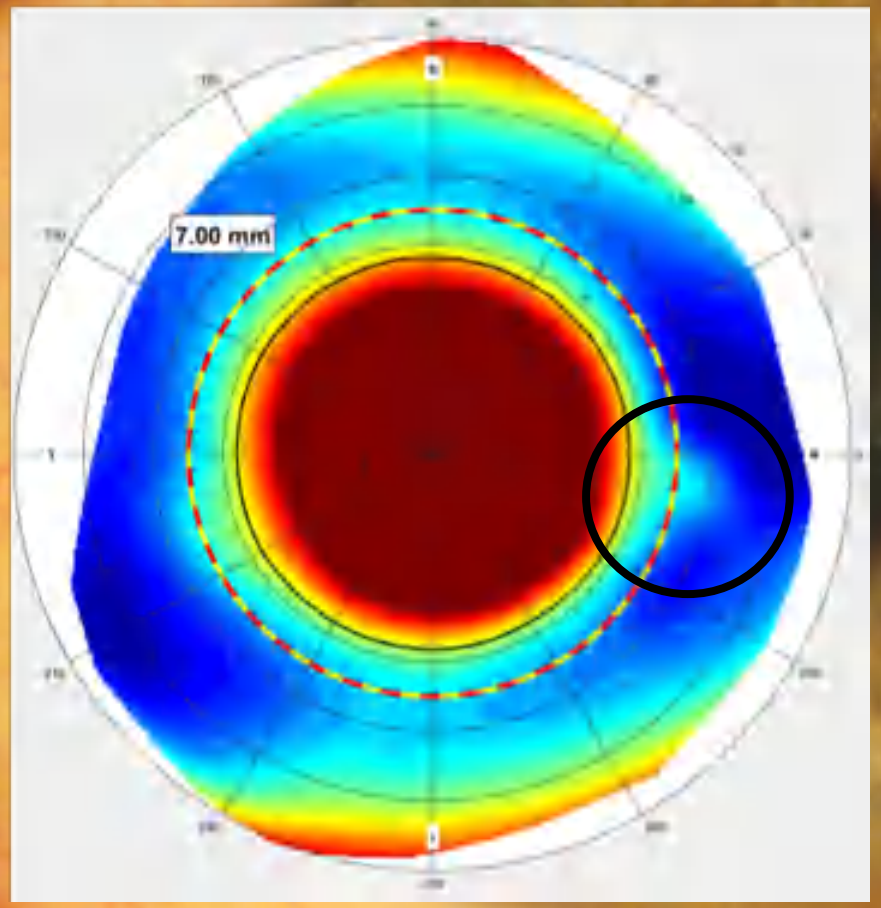


Ectasia/Pinguecula



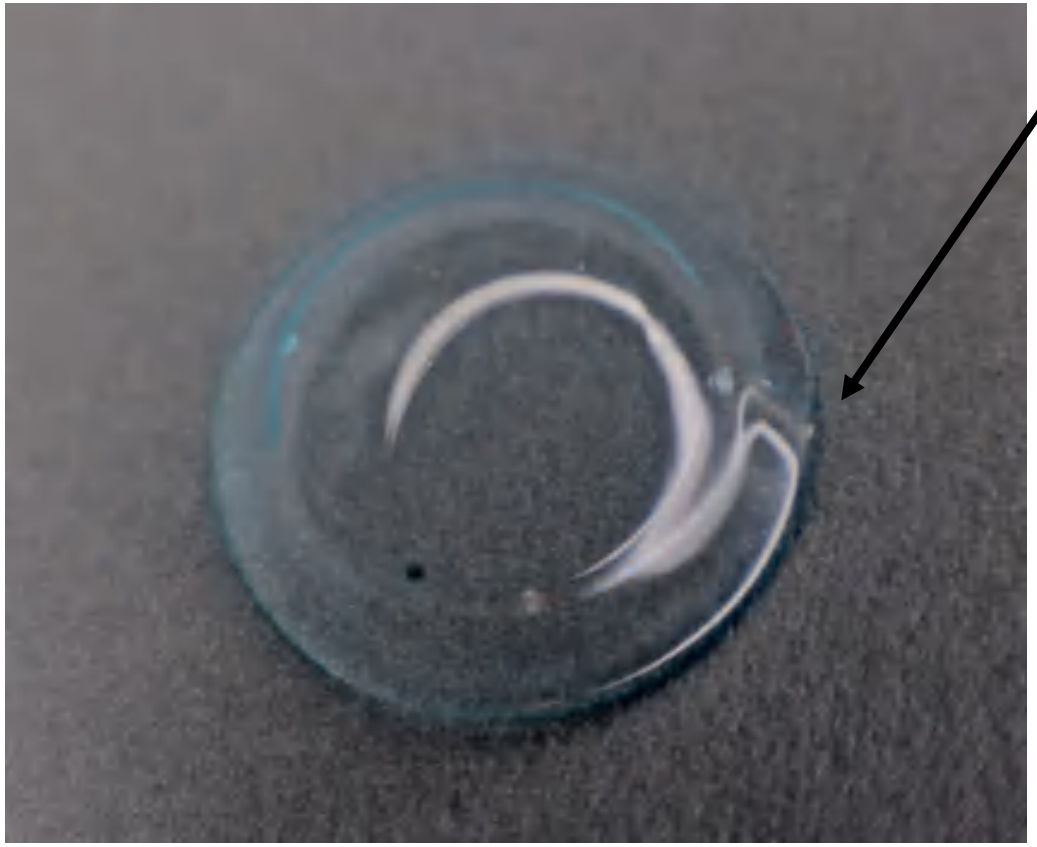
Scleral Elevation Map

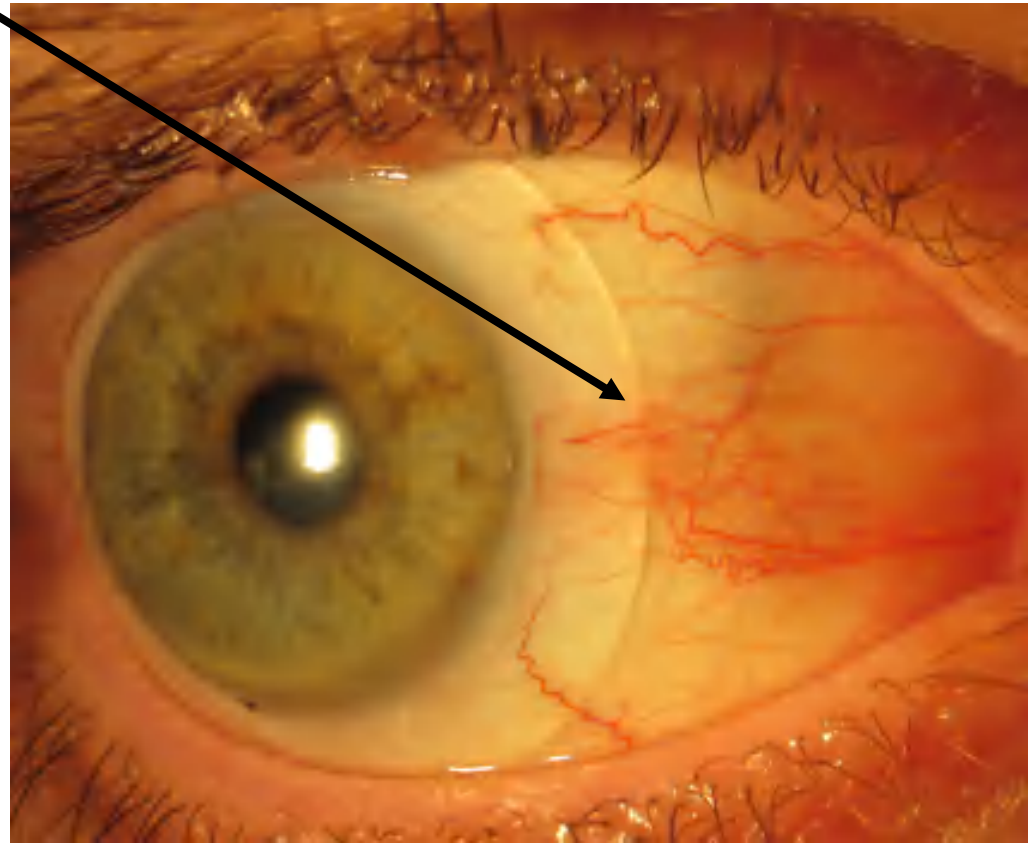
- Scleral toricity
- Nasal pinguecula



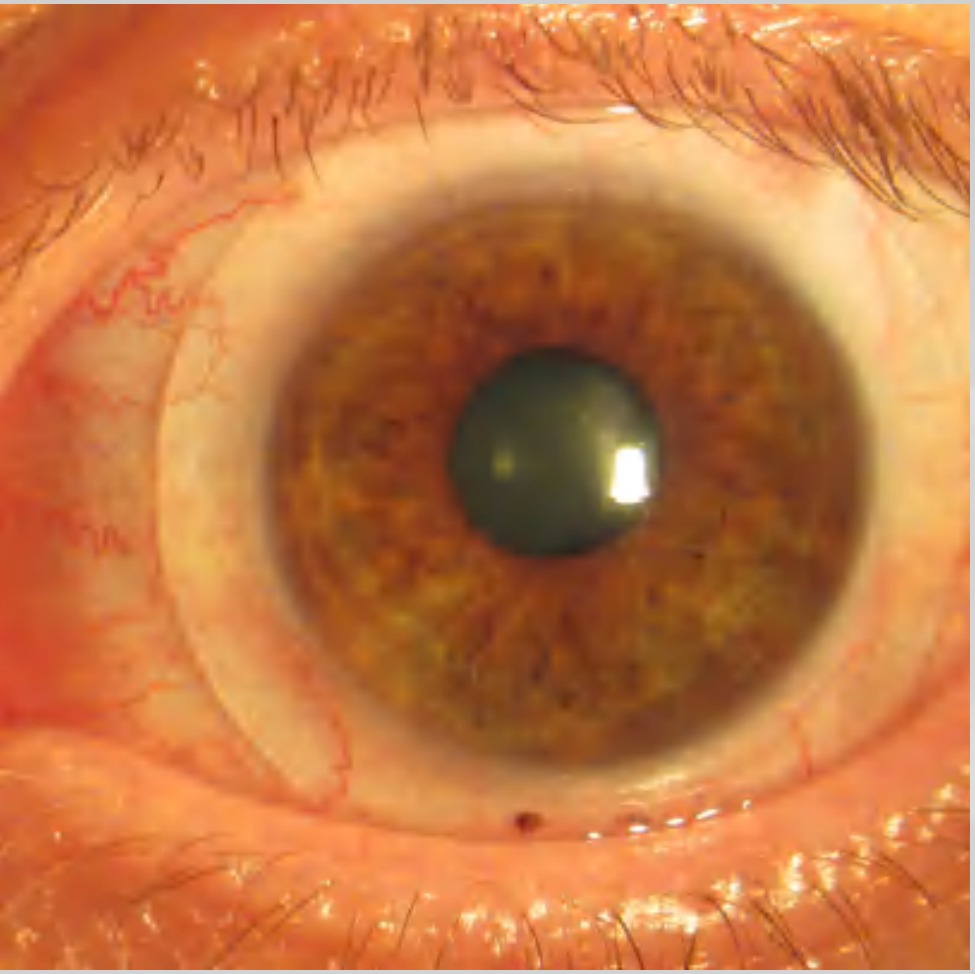
200μ

Localized Vault






+0.62 -1.00 X 104 20/20

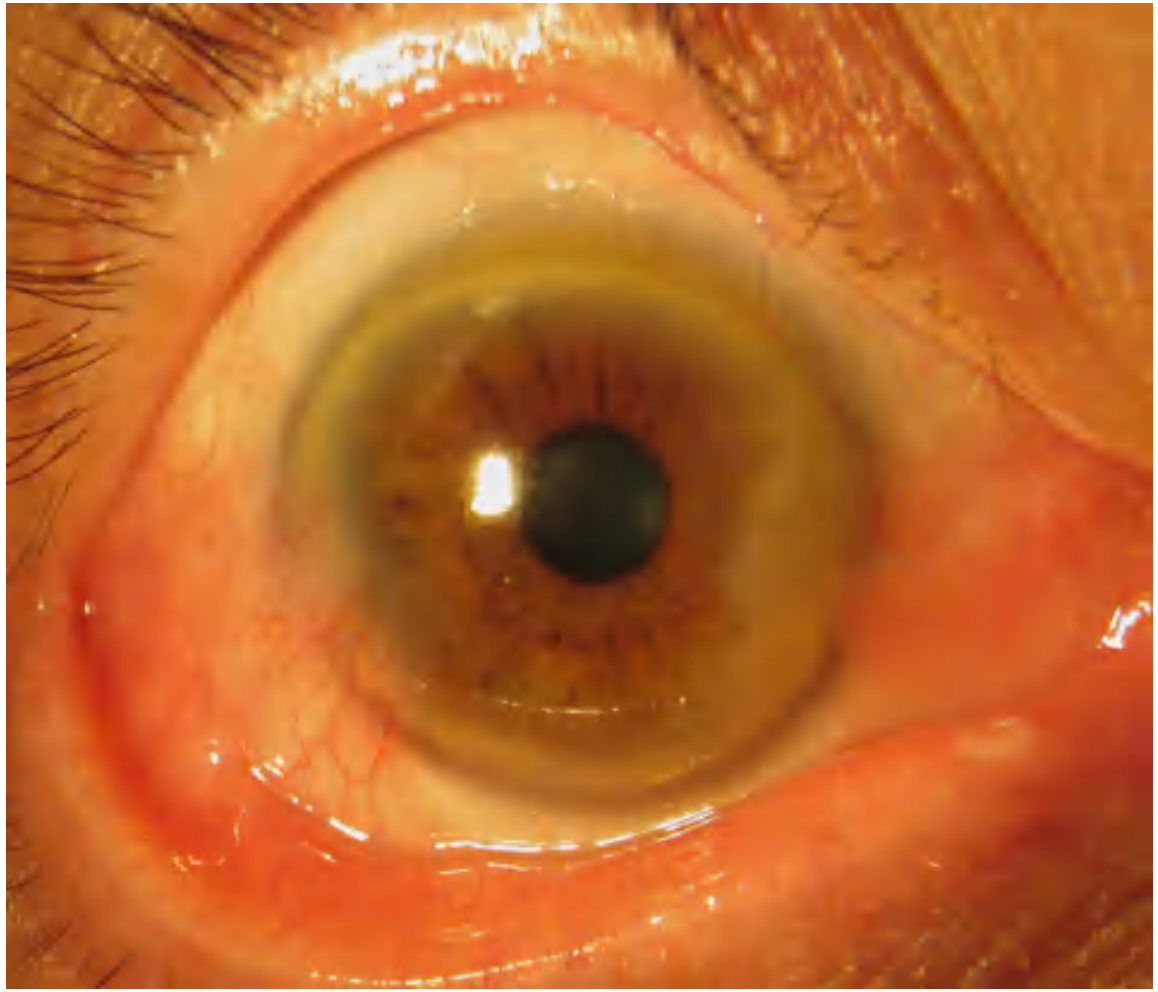


Free-form Design

- Free-form scleral lens designs allow you to simultaneously accommodate scleral asymmetry and scleral obstacles.

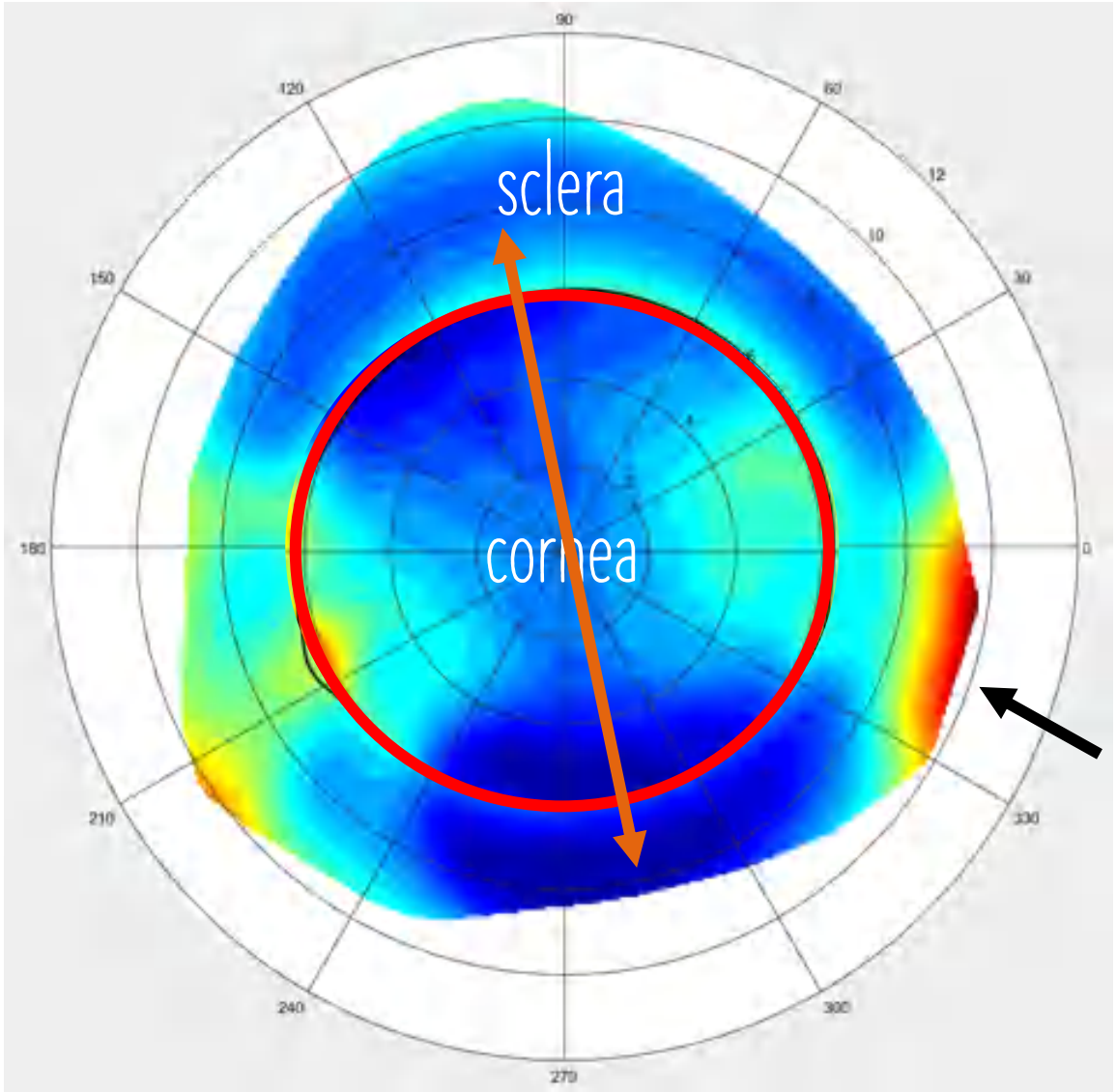
PTERYGIUM
CORNE-SCLERAL TOPOGRAPHY

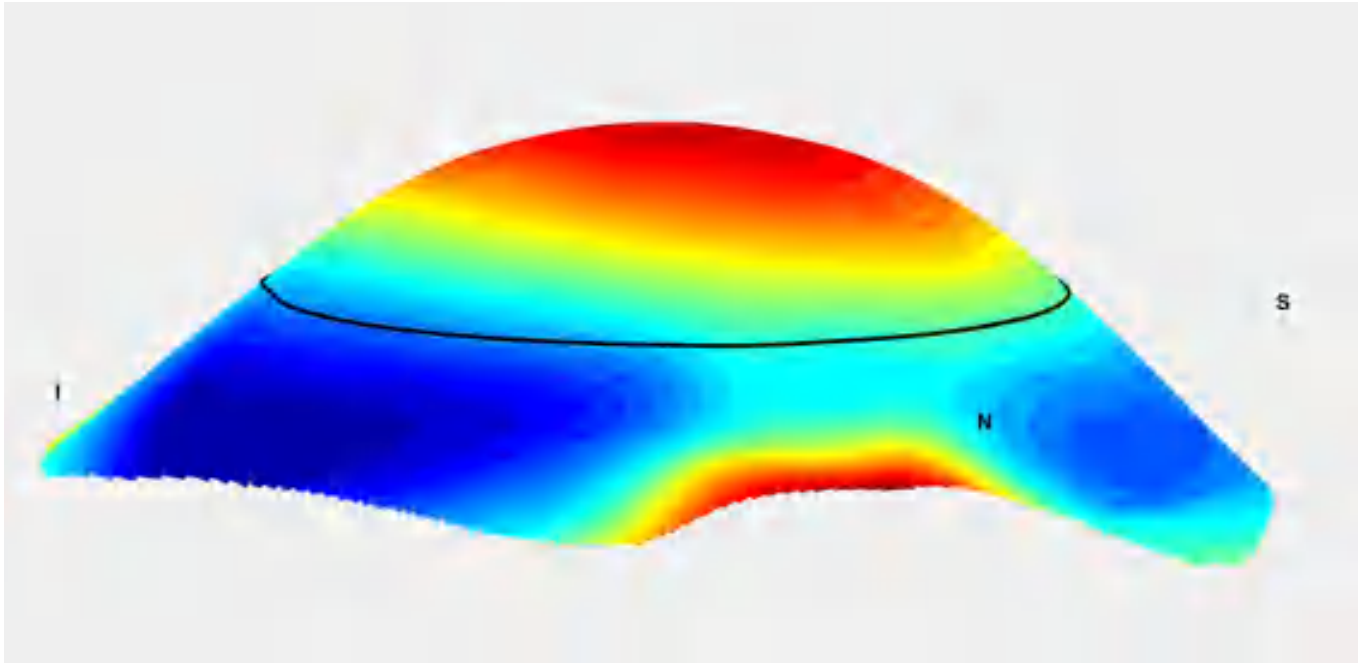
- 61-year-old male with hx pterygium
- OD
  - Sx X 2/amniotic membrane
  - MR +3.75 -4.75 X 002 20/30
  - Failed custom SCL secondary poor Va
- OS successfully wearing a SCL

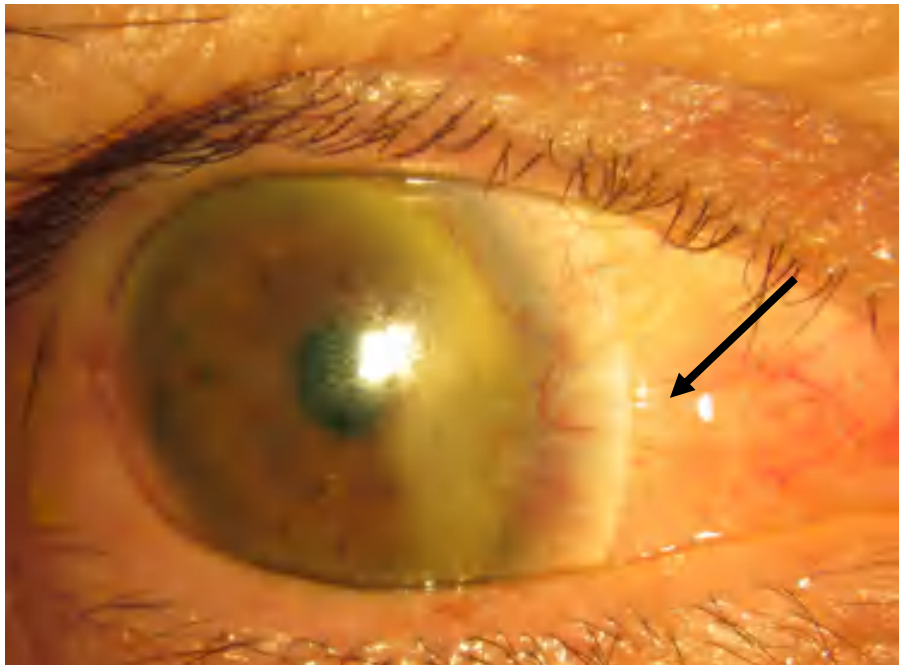


PTERYGIUM
CORNEO-SCLERAL TOPOGRAPHY

- Cornea
  - Prolate
  - Limbal astigmatism
  - +3.75 -4.75 X 002
- Scleral
  - Toric 508µ
  - Asymmetric

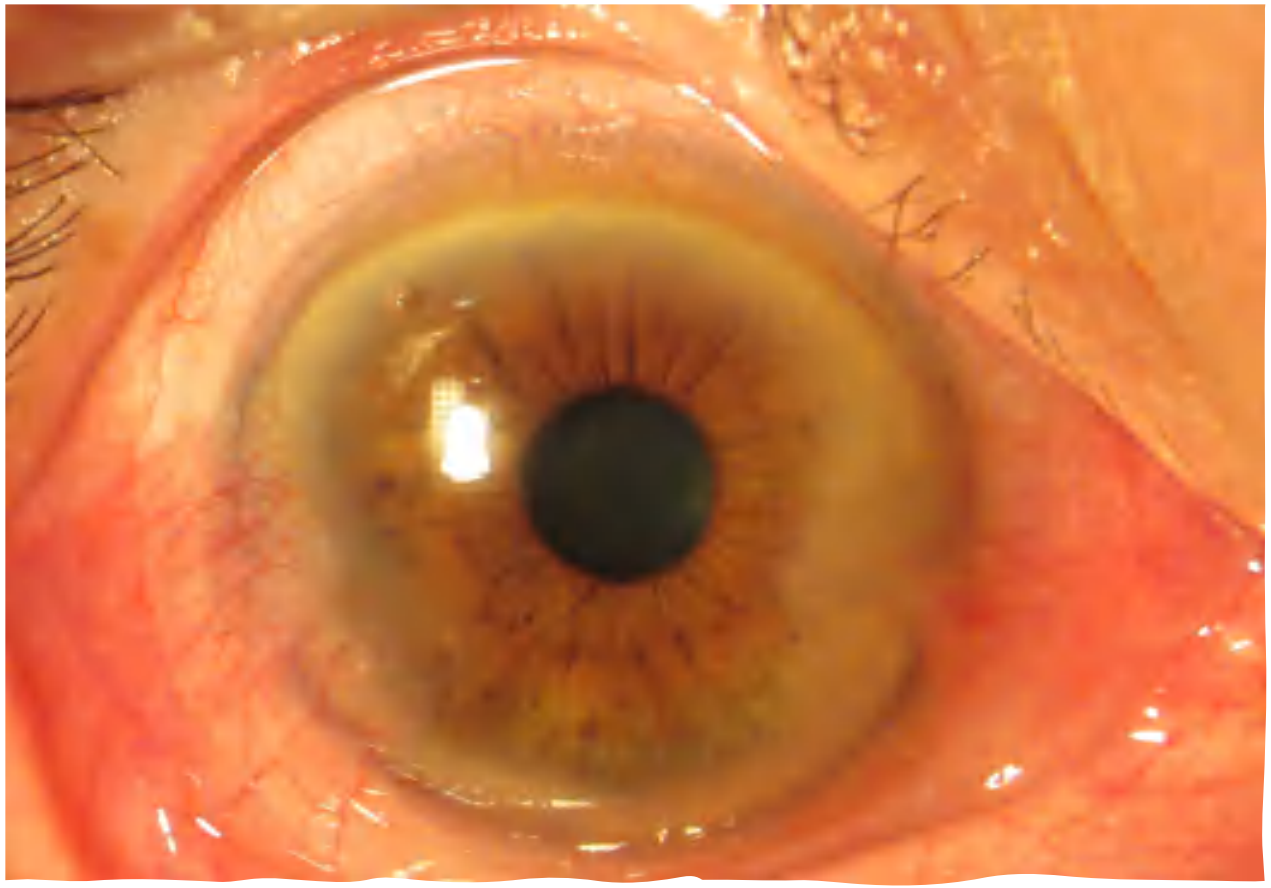






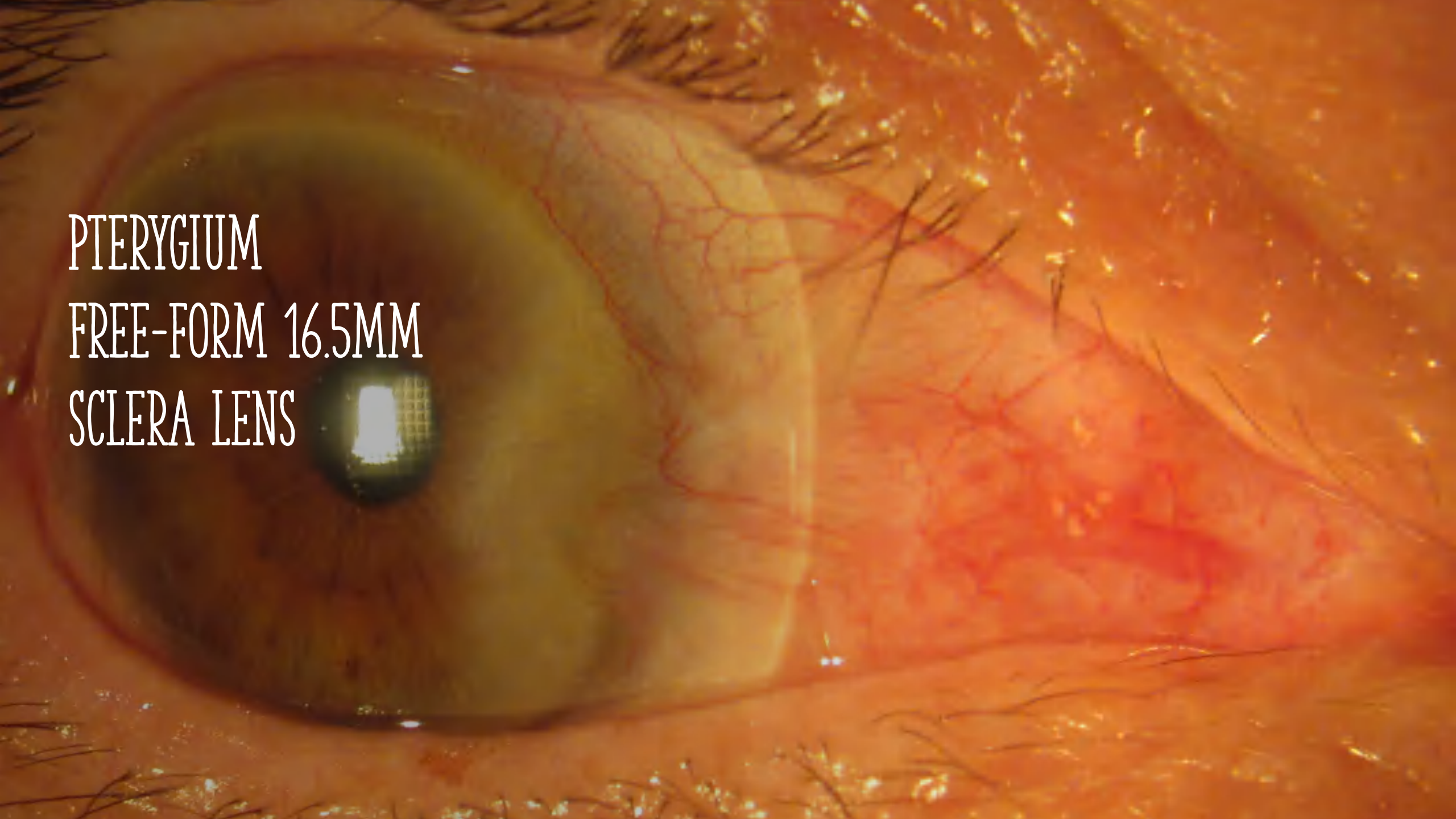
DIAGNOSTIC 16MM 42 DIOPTER

Landing Zone Impingement

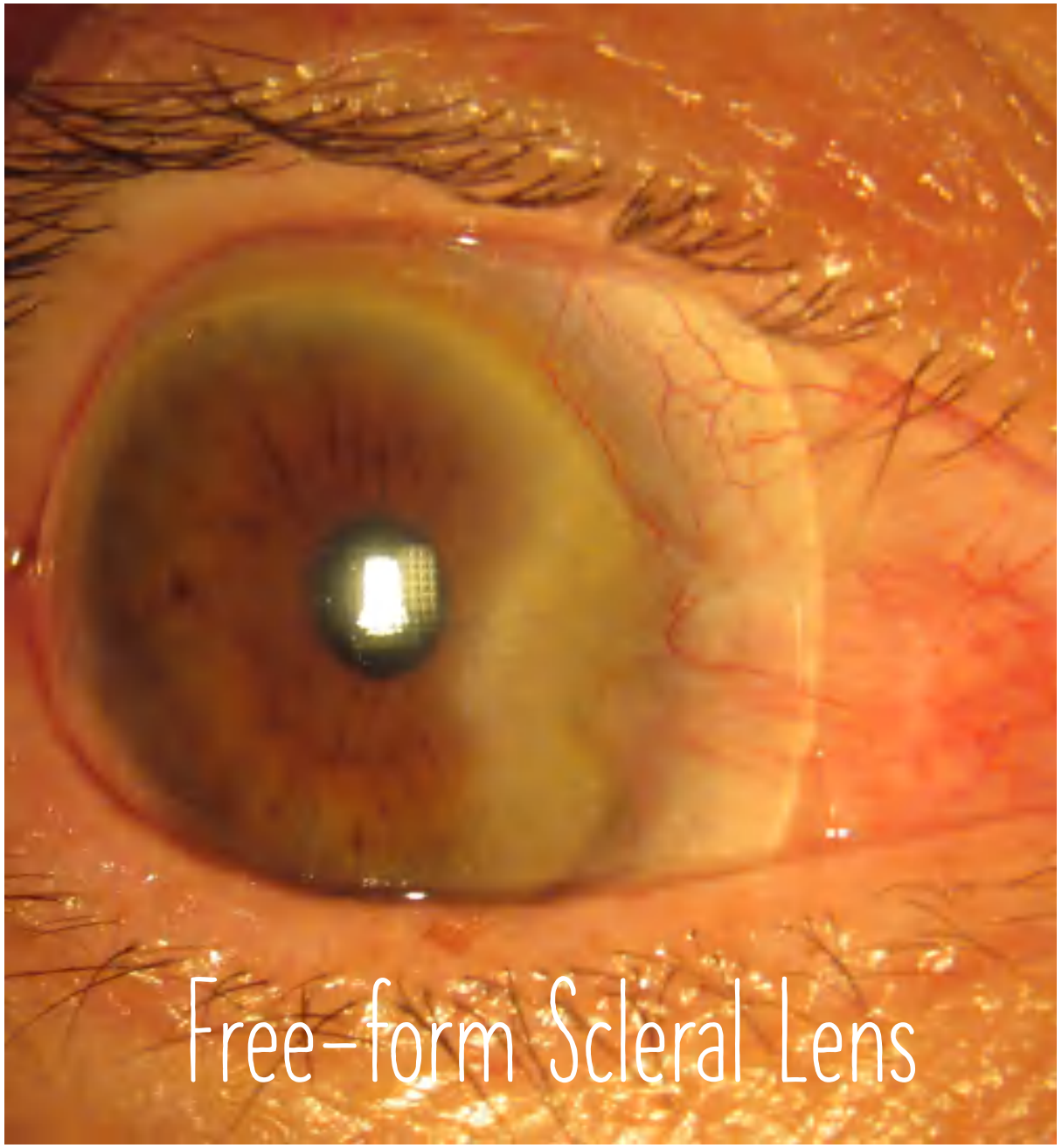


PTERYGIUM
CORNEO-SCLERAL TOPOGRAPHY

- Customized scleral lens design or free-form
  - Topography or Tomography
  - Corneo-scleral topography


PTERYGIUM
FREE-FORM 16.5MM
SCLERA LENS

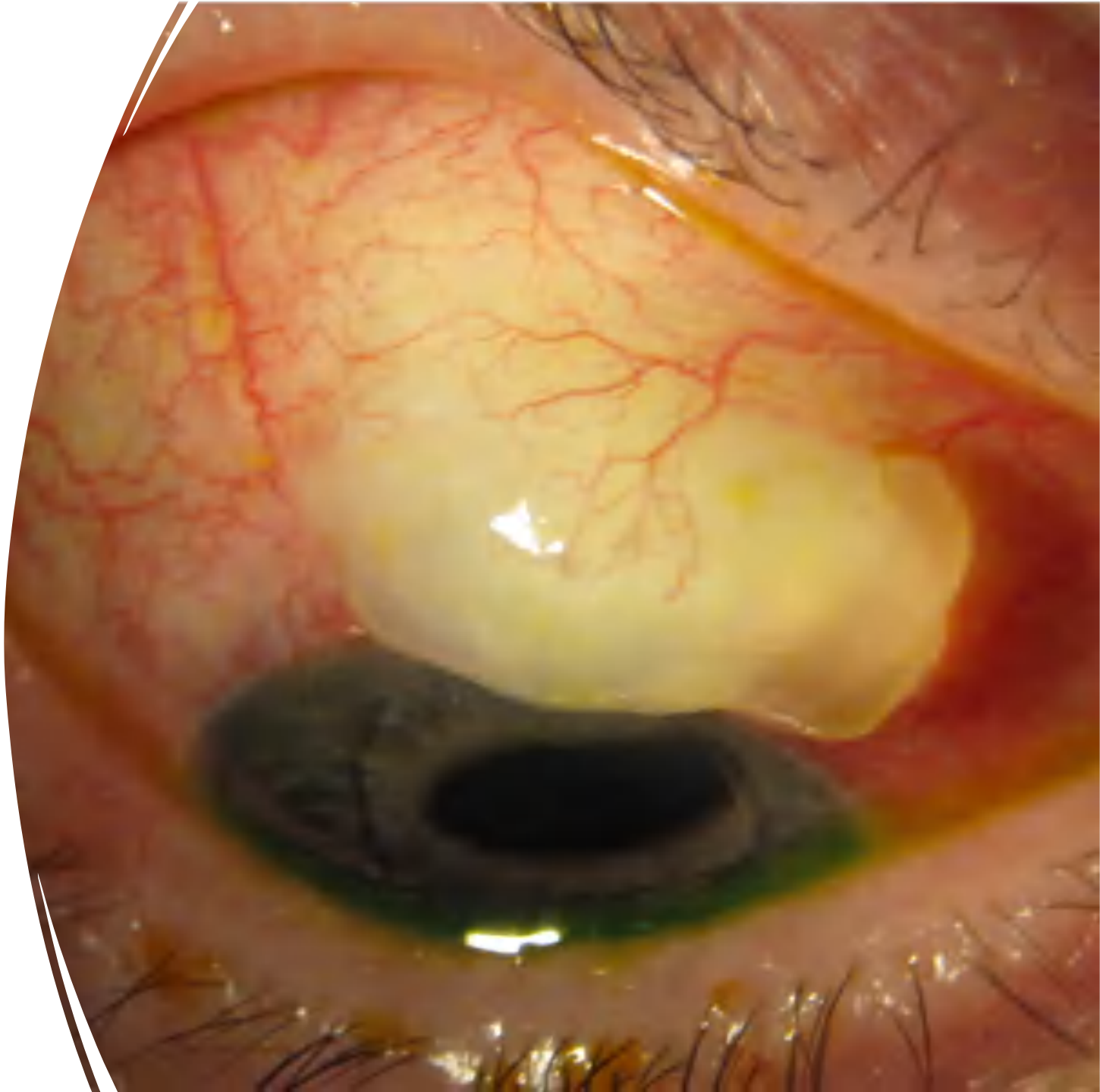

Diagnostic sphere LZ


Free-form Scleral Lens

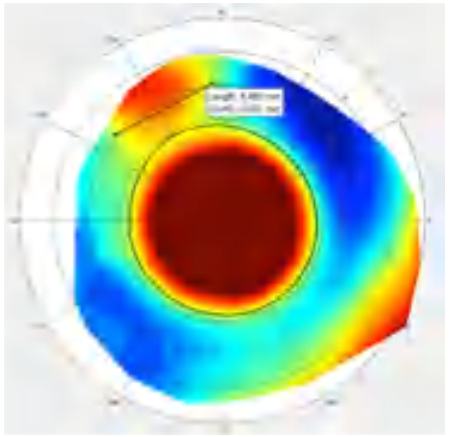
PTERYGIUM CORNEO-SCLERAL TOPOGRAPHY

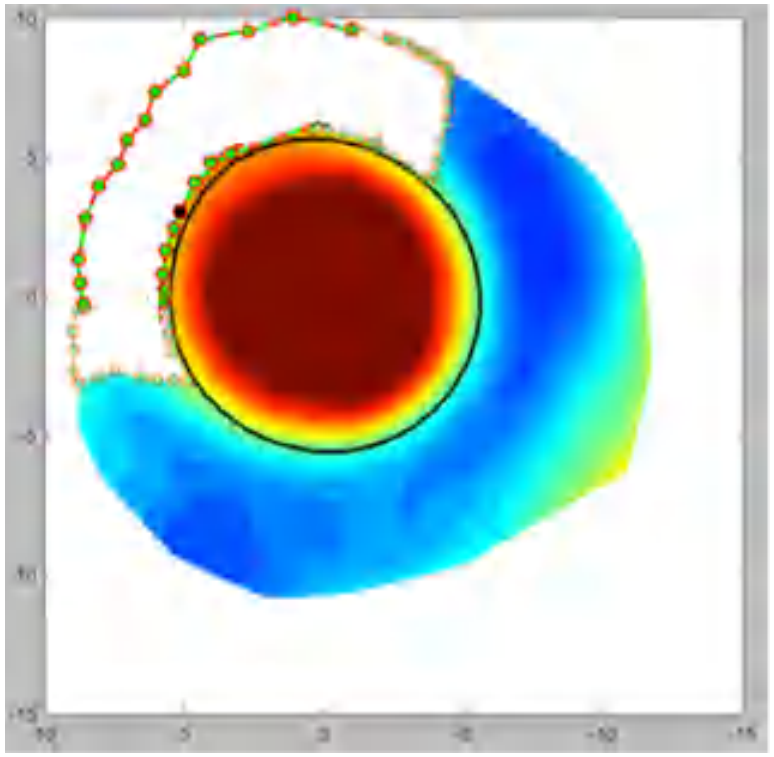
- Two variables LZ
  - High scleral toricity
  - Asymmetry
- Free-form scleral lens
  - 16.5mm

CONJUNCTIVAL BLEBS



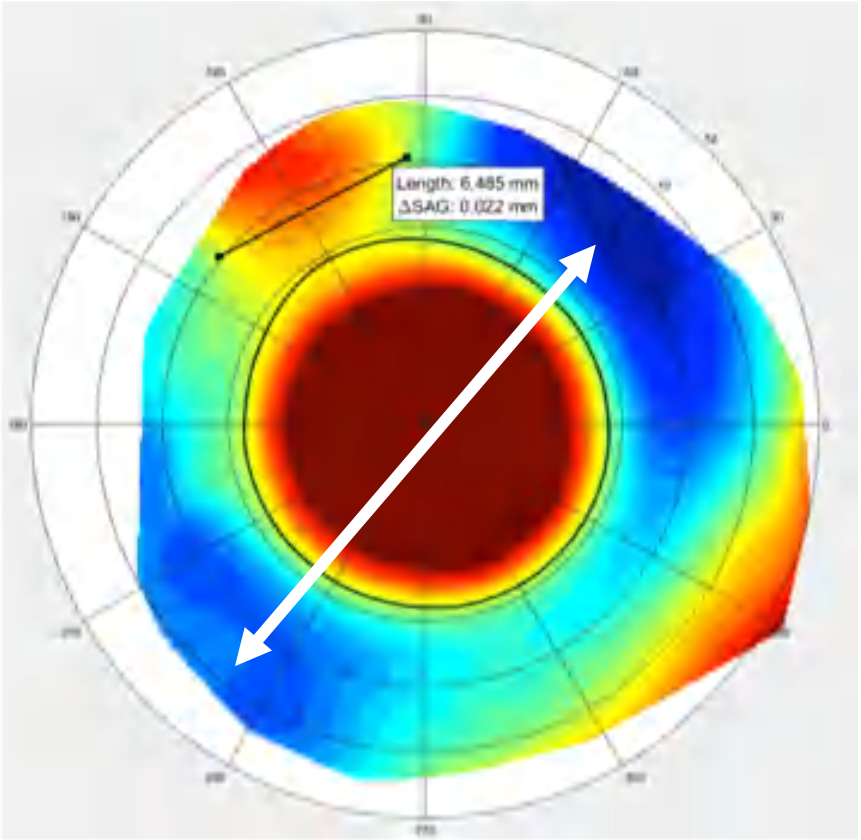
Notched Scleral Lens





Remove para-bleb elevation

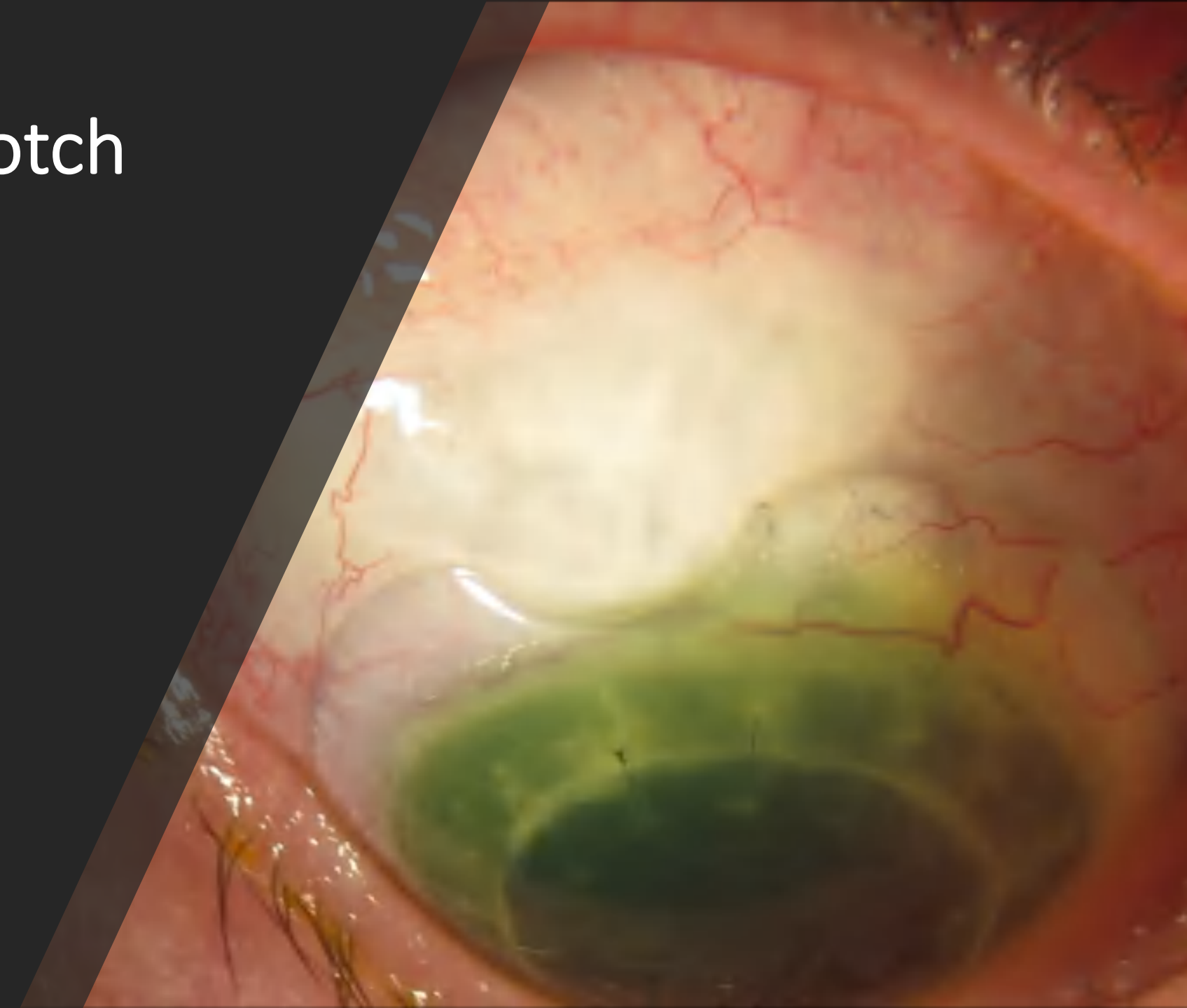
Scleral Obstacles- Lens Notching

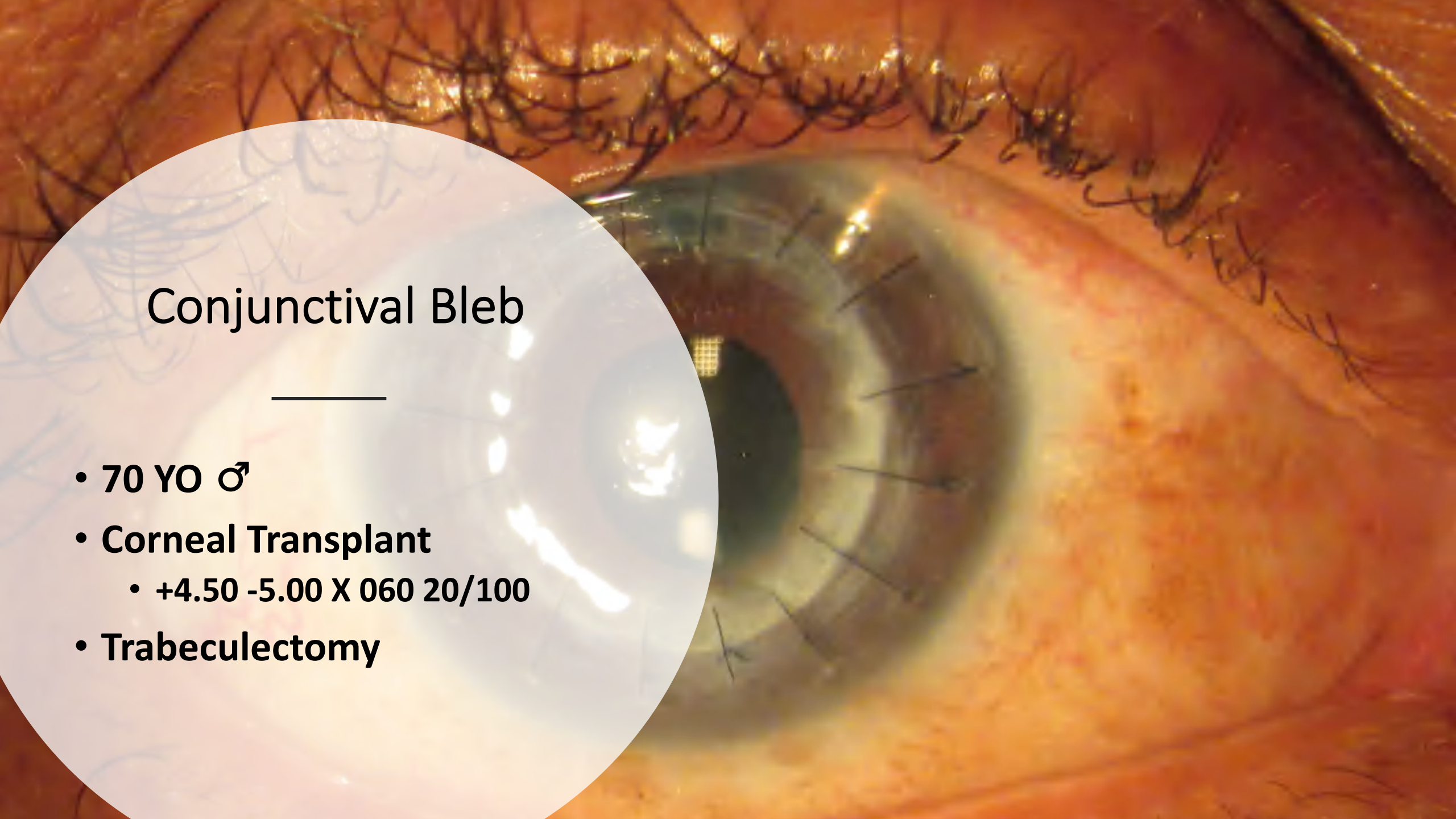


Scleral Elevation Map

Scleral Lens Notch

- 15.5mm
- BC 46
- +2.75 20/40
- Toric LZ



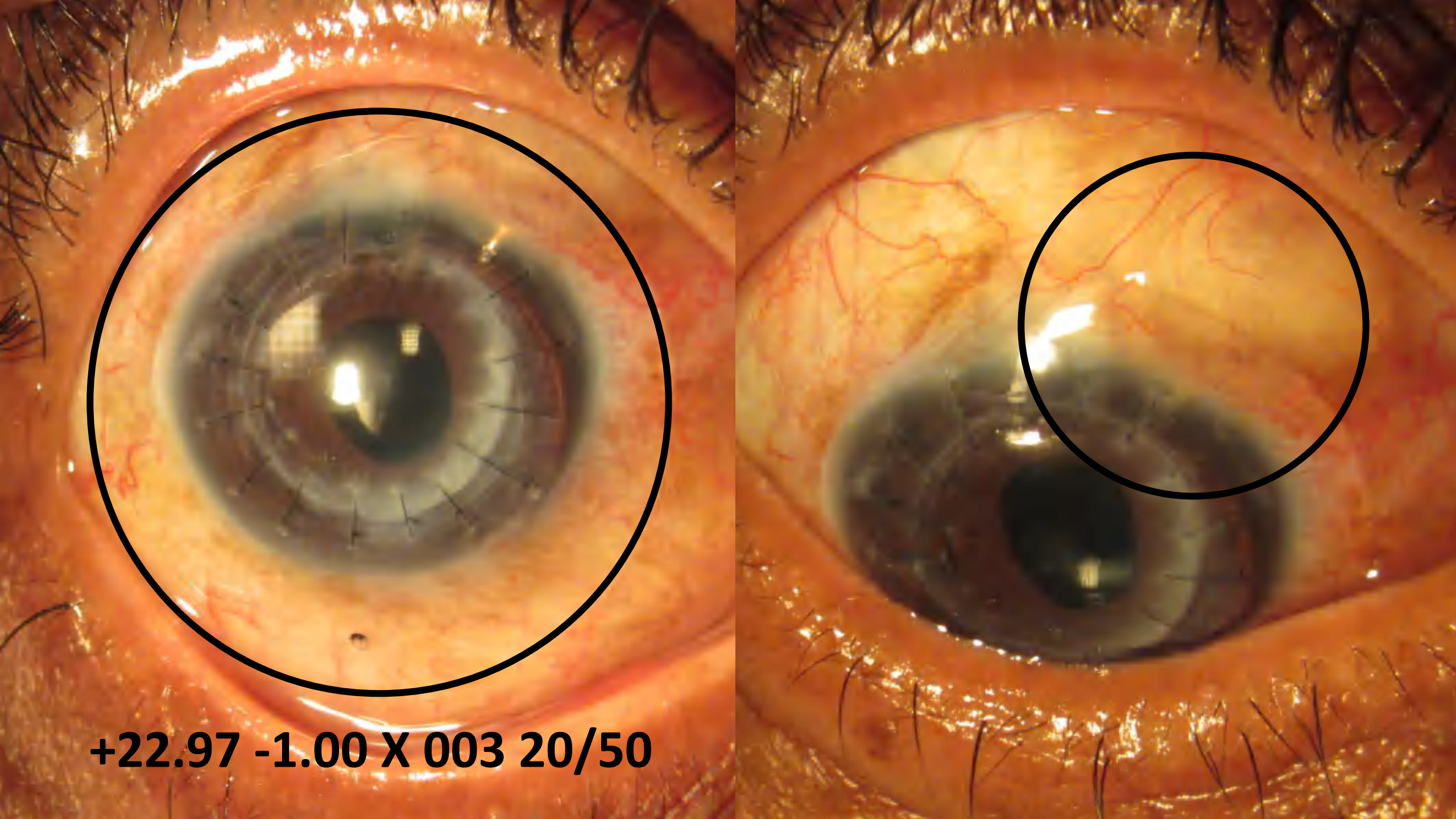


Conjunctival Bleb

- **70 YO ♂**
- **Corneal Transplant**
  - **+4.50 -5.00 X 060 20/100**
- **Trabeculectomy**

Conjunctival Bleb

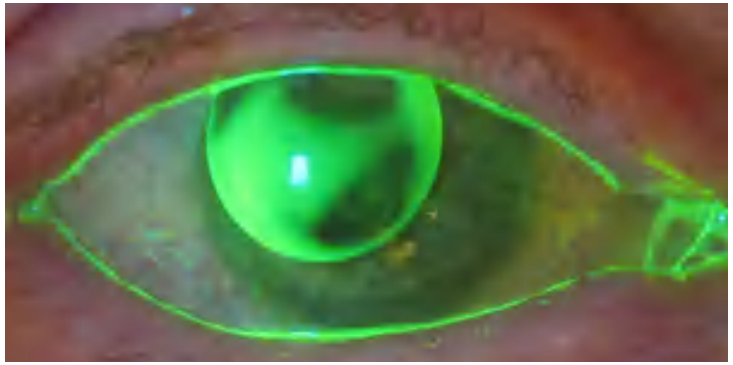
- 16.5mm Scleral Lens
- Customized landing zone
  - Alignment
  - Rotational stability
- 900μ localized vault


+22.97 -1.00 X 003 20/50

CONCLUSIONS

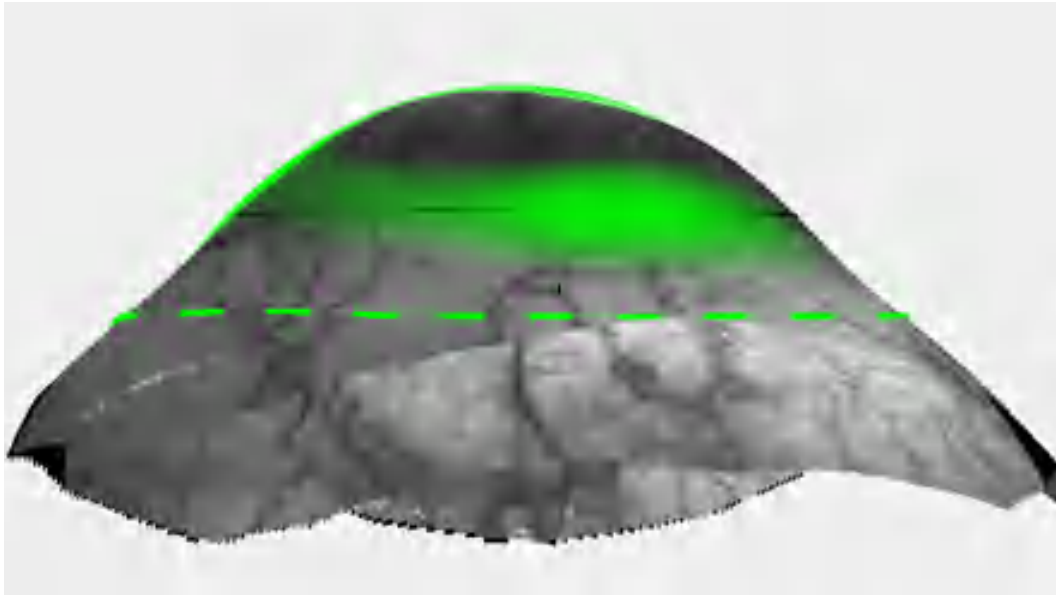
ADVANCED SCLERAL LENS FITTING USING INSTRUMENTATION

2001



CONCLUSIONS

ADVANCED SCLERAL LENS FITTING USING INSTRUMENTATION



2021

ADVANCED SCLERAL LENS FITTING USING INSTRUMENTATION

CORNEAL TOPOGRAPHERS

- Corneal Topography
  - Required
  - Placido based topographers
    - Diagnosis
    - Monitor progression
  - Billable exam
  - Ortho K

Scleral Lens Fitting

- Geometry
- Predicting scleral shape
  - Scleral toricity
  - Scleral asymmetry with KC

Disadvantages

- No direct measurement of the sclera
- Lacking measurement for direct design

ADVANCED SCLERAL LENS FITTING USING INSTRUMENTATION

OCT

- Measurement- anterior/posterior eye
- Billable examinations

Scleral Lens Fitting

- Diagnostic lens fitting/Dispensed lenses
  - Fluid reservoir thickness
  - Assessment LZ

Disadvantages

- One meridian measurements
- Lack software for direct design
- $$$

ADVANCED SCLERAL LENS FITTING USING INSTRUMENTATION

CORNEO-SCLERAL TOPOGRAPHY

- Measurement of the cornea and sclera
- Elevation data/maps
  - Mean data
  - Measurements at

Scleral Lens Fitting

- Diagnostic lens fitting
- Software custom design
  - Branded designed scleral lenses
  - Free-form designs

Disadvantages

- Used exclusively for contact lens fitting
- "space"
- $$

ADVANCED SCLERAL LENS FITTING USING INSTRUMENTATION

SCHEIMPFLUG TOMOGRAPHY

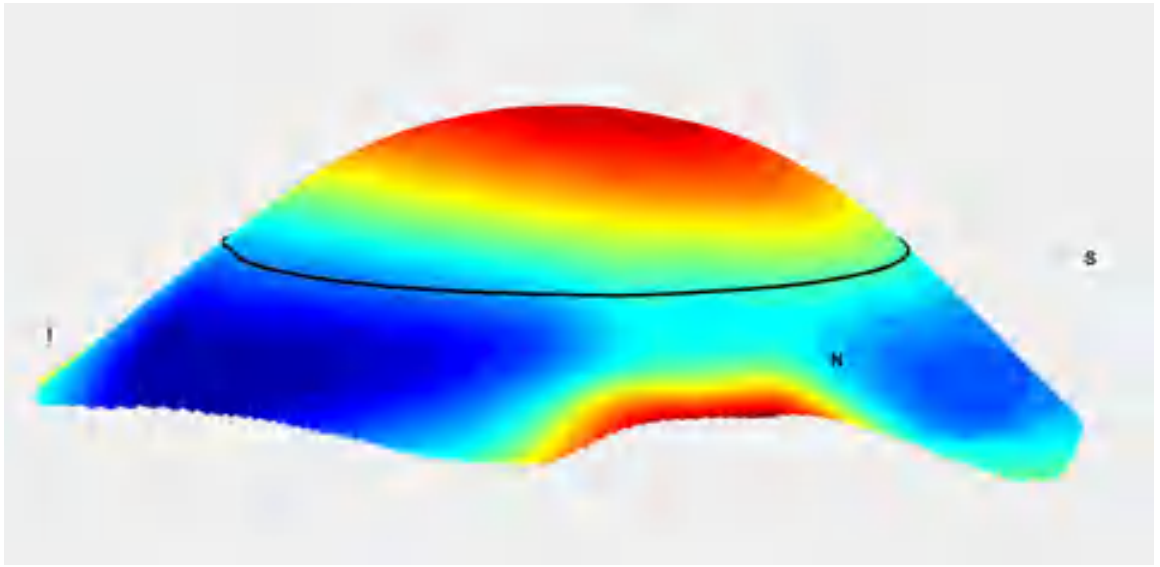
- Measurement of the cornea and sclera
- Cornea
  - Front and back surface
  - Global pachymetry

Scleral Lens Fitting

- Diagnostic lens fitting
- Software custom design
  - Branded designed scleral lenses
  - Free-form designs

Disadvantages

- Difficulty with measurements for small eyes
- $$$$



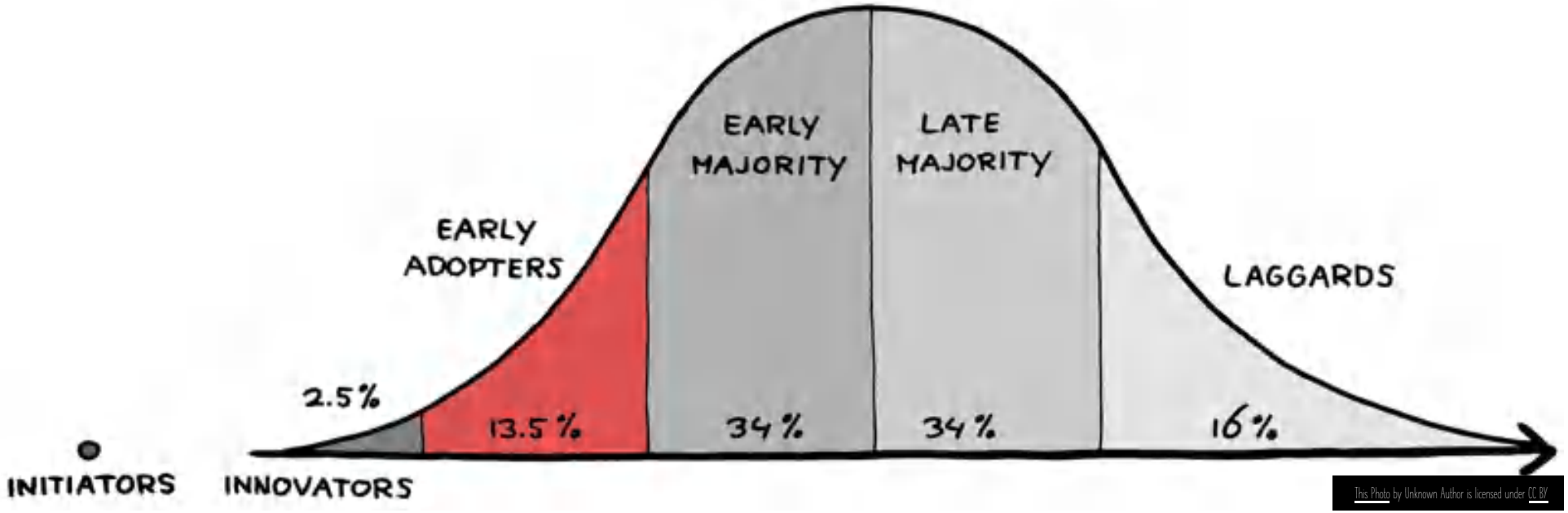
MARKETING

- Technology driven
- Website
- Exam Room

BUSINESS ASPECTS

- Budget
- Billable exams
- Numbers of fits
- Growth Strategy

CONCLUSIONS



ADVANCE SCLERAL LENS DESIGN

Thank you!

gwdenaeyer@gmail.com

Thank you! Please join us for our next COPE event

Date: October 26, 2021
Time: 5:30 PM PST
Speaker: Dr. Paul Karpecki
Topic: Ocular Health, Nutrition, and Wine
COPE: Two hour live CE

Visit WooU.org for a full list of upcoming CE events!

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