STATE BOARD OF OPTOMETRY
2450 DEL PASO ROAD, SUITE 105, SACRAMENTO, CA 95834
P (916) 575-7170 F (916) 575-7292 www.optometry .ca.gov

Continuing Education Course Approval Checklist

Title: Collagen Cross Linking

Provider Name: USC Roski Eye Institute c/o Ms. Marithel Tesoro

☑Completed Application
Open to all Optometrists? ☑Yes ☐No
Maintain Record Agreement? ☑Yes ☐No

☑Correct Application Fee

☑Detailed Course Summary

☑Detailed Course Outline

☑PowerPoint and/or other Presentation Materials

☑Advertising (optional)

☑CV for EACH Course Instructor

☑License Verification for Each Course Instructor
Disciplinary History? ☐Yes ☑No

OPTOMETRY

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CONTINUING EDUCATION COURSE APPROVAL APPLICATION

$50 Mandatory Fee

Pursuant to California Code of Regulations (CCR) § 1536, the Board will approve continuing education (CE) courses after receiving the applicable fee, the requested information below and it has been determined that the course meets criteria specified in CCR § 1536(g).

In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title	**Course Presentation Date**
Collagen Cross Linking	02/13/2017

Course Provider Contact Information

Provider Name

Lina (First) Poyzner (Last) (Middle)

Provider Mailing Address

Street 1450 San Pablo St **City** Los Angeles **State** CA **Zip** 90033

Provider Email Address lina.poyzner@med.usc.edu

Will the proposed course be open to all California licensed optometrists?	☑ YES ☐ NO
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation?	☑ YES ☐ NO

Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name

James (First) Randleman (Last) Bradley (Middle)

License Number 143864	**License Type** MD
Phone Number (323) 442-6383	**Email Address** lina.poyzner@med.usc.edu

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

Lina Poyzner
Signature of Course Provider

02/01/2017
Date

Corneal Cross-Linking – 2 hours

Corneal cross-linking represents a physiologic principle of tissue biomechanical alteration that may affect every facet of corneal disease, from ectatic corneas and cornea-based refractive surgical procedures to corneal transplantation, infectious keratitis management, corneal edema management, resistance to collagenase activity, and beyond. Crosslinking represents a testament to translational science, and this rigorous basic science foundation has allowed the cross-linking principle to permeate our treatment regimens and inspire novel approaches.

Using a combination of ultraviolet-A light and a chromophore (vitamin B2, riboflavin), the cornea can be stiffened, usually with a single application, and progressive thinning diseases such as keratoconus arrested. Despite being in clinical use for many years, some of the underlying processes, such as the role of oxygen and the optimal treatment times, are still being worked out, and new indications are continuously being evaluated.

Corneal Cross-Linking (CXL)

2 hours

CXL Basic Principles

CXL Primary Indications

- Ectatic Corneal disorders

CXL Secondary indicators

- Infectious Keratitis
- Refractive interventions: CXL Plus

CXL Complications & Controversies

I. Crosslinking for Keratoconus (KC)
II. Goals for CXL in Ectasias
    a. Stabilize ectatic process
    b. Reduce corneal steepening
    c. Improve CTL fitting
    d. Provide alternatives for visual rehabilitation
    e. Avoid corneal transplantation
III. US Phase III CXL Trials
    a. Two prospective, randomized clinical trials
        - Progressive Keratoconus
        - Corneal Ectasia post-LASIK
    b. Outcome Measures
        - K Max (measured on Pentacam)
        - BSCVA, UCVA
IV. CXL: Step by Step
    a. Procedure: Standard Dresden Technique
    b. CXL for Corneal Ectasias
    c. Measuring CXL Changes: Challenges
    d. ORA Changes with CXL in post-LASIK ectasia
    e. What constitutes success in CXL?
    f. How changes are best measured?
    g. Complications
        - Delayed healing
        - Corneal melt
        - Peripheral infiltrates
        - Endothelial damage

    h. CXL Protocols
V. CXL: Advancing Indications
VI. Failed Remodeling
VII. CXL Clinical Efficiency
VIII. CXL for Corneal Infections
IX. CXL Combined with Refractive Procedures: CXL Plus
X. CXL + CK
XI. Measuring therapeutic success after CXL
XII. Measuring CXL Changes: Challenges
    a. Variability of measurements in Keratoconic Cornea
    b. Variability of response
    c. Variability of measurable parameters
    d. Variability of measurement devices
XIII. Topographic Changes after CXL
XIV. Case presentations
XV. Conclusions

CORNEAL CROSS-LINKING (CXL)

Presenter Introduction

- **J. Bradley Randleman, MD**
- Professor of Ophthalmology, Keck School of Medicine of USC
- Director, Cornea & Refractive Surgery Section, USC Roski Eye Institute
- Editor-in-Chief, *Journal of Refractive Surgery*



randlema@usc.edu

No Financial Disclosures



Corneal Collagen Cross-Linking

Farhad Hafezi
J. Bradley Randleman

SLACK Incorporated

Major review

Corneal cross-linking

J. Bradley Randleman, MD[a,b,*], *Sumitra S. Khandelwal, MD*[c], *Farhad Hafezi, MD, PhD*[d,e,f,g]

[a] *Department of Ophthalmology, Emory University, Atlanta, Georgia, USA*
[b] *Emory Vision, Emory Eye Center, Atlanta, Georgia, USA*
[c] *Baylor College of Medicine, Cullen Eye Institute, Houston, Texas, USA*
[d] *ELZA Institute, Zurich, Switzerland*
[e] *Laboratory for Ocular Cell Biology, University of Geneva, Geneva, Switzerland*
[f] *Department of Ophthalmology, Keck School of Medicine, University of Southern California, Los Angeles, California, USA*
[g] *Center for Applied Biotechnology and Molecular Medicine (CABMM), University of Zurich, Zurich, Switzerland*

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keratoconus
ectasia
infectious keratitis
cross-linking plus
accelerated cross-linking

ABSTRACT

Since its inception in the late 1990s, corneal cross-linking has grown from an interesting concept to a primary treatment for corneal ectatic disease worldwide. Using a combination of ultraviolet-A light and a chromophore (vitamin B2, riboflavin), the cornea can be stiffened, usually with a single application, and progressive thinning diseases such as keratoconus arrested. Despite being in clinical use for many years, some of the underlying processes, such as the role of oxygen and the optimal treatment times, are still being worked out. More than a treatment technique, corneal cross-links represent a physiological principle of connective tissue, which may explain the enormous versatility of the method. We highlight the history of corneal cross-linking, the scientific underpinnings of current techniques, evolving clinical treatment parameters, and the use of cross-linking in combination with refractive surgery and for the treatment of infectious keratitis.

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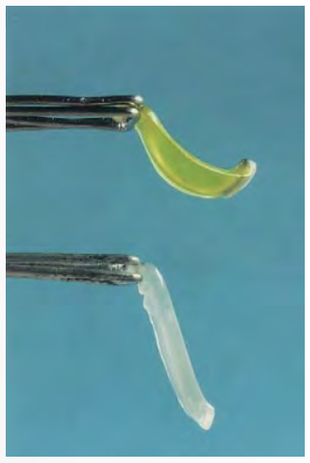
OVERVIEW

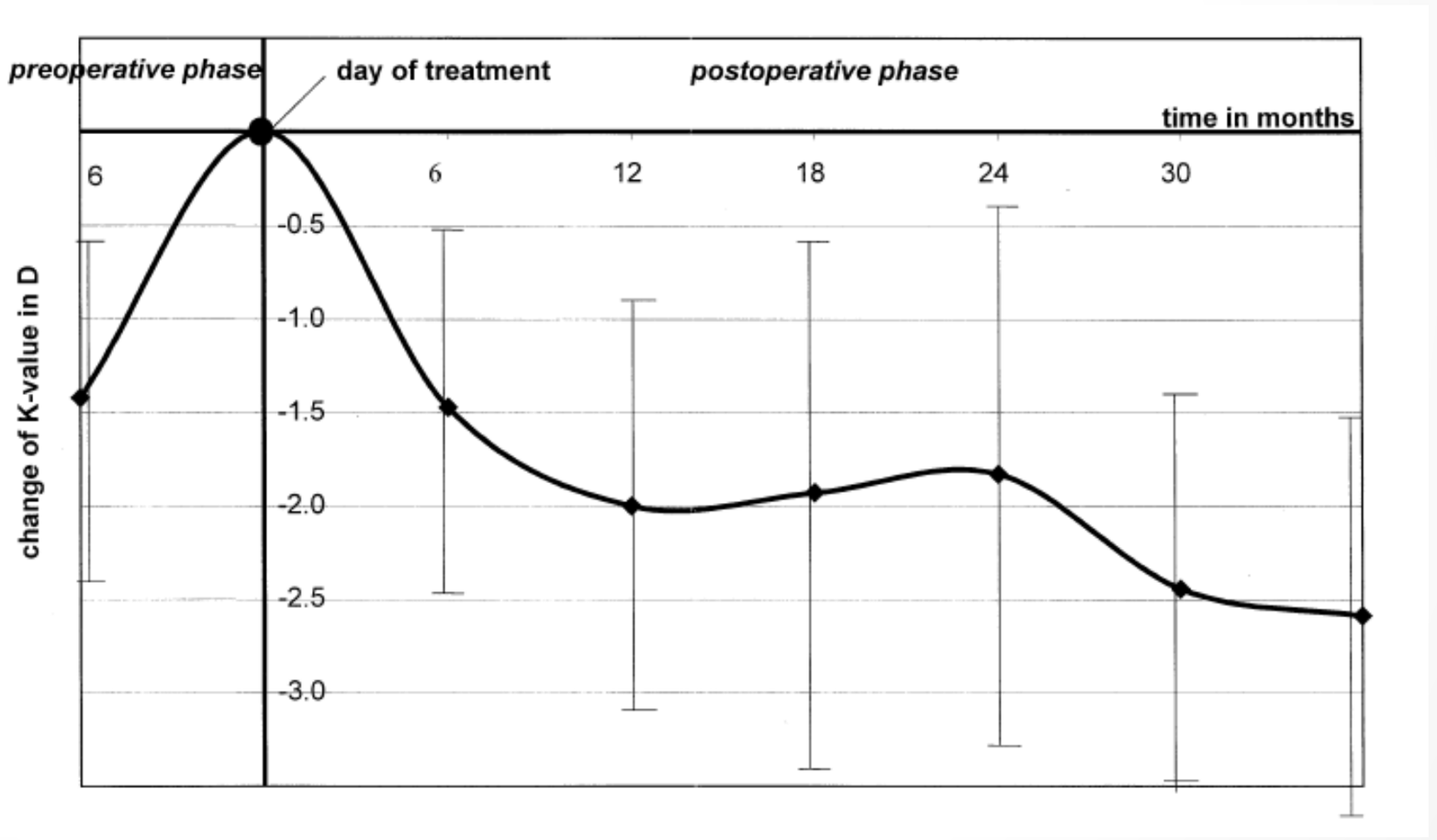
- CXL Basic principles
- CXL Primary Indications
    - Ectatic corneal disorders
- CXL Secondary Indications
    - Infectious Keratitis
    - Refractive interventions: CXL Plus
- CXL: Complications & Controversies

Crosslinking for keratoconus (KC)

- Non-enzymatic collagen stiffening with riboflavin and UVA light

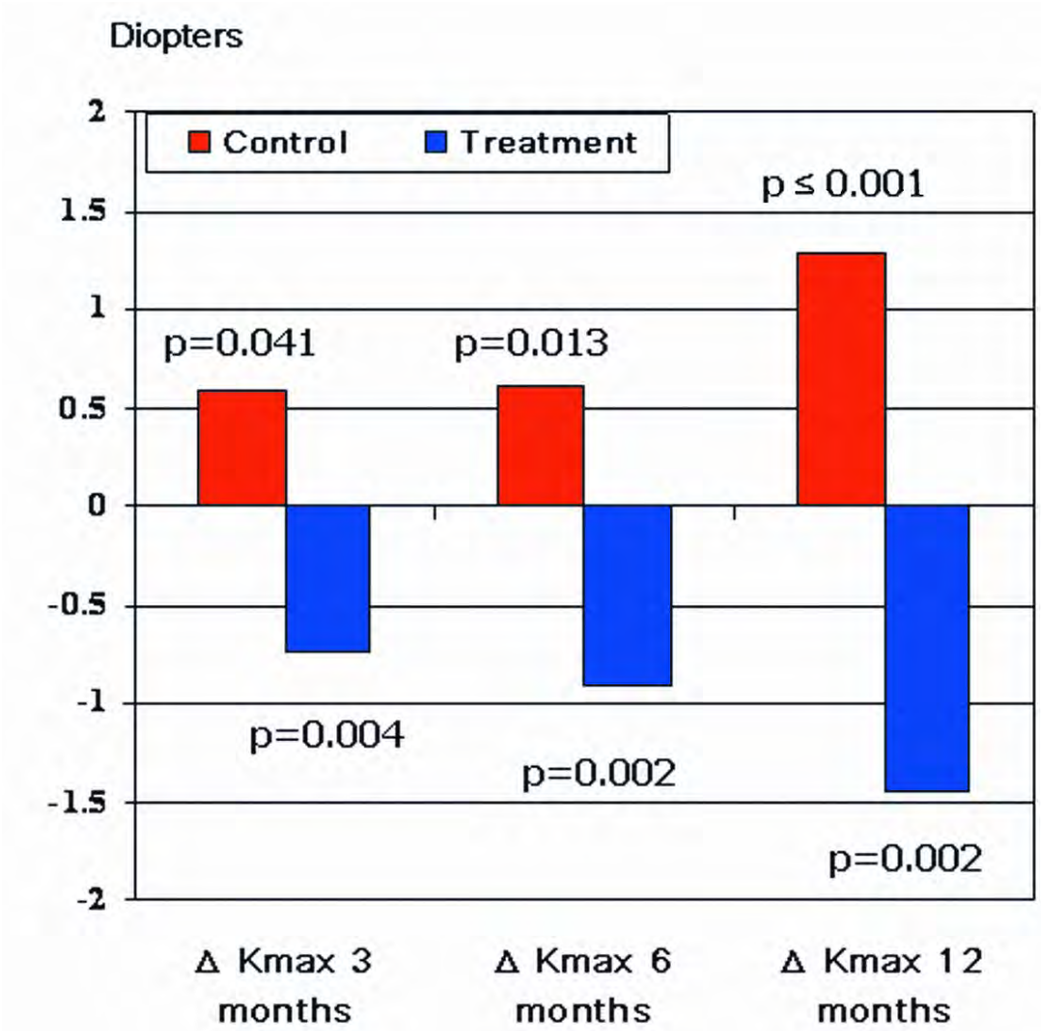


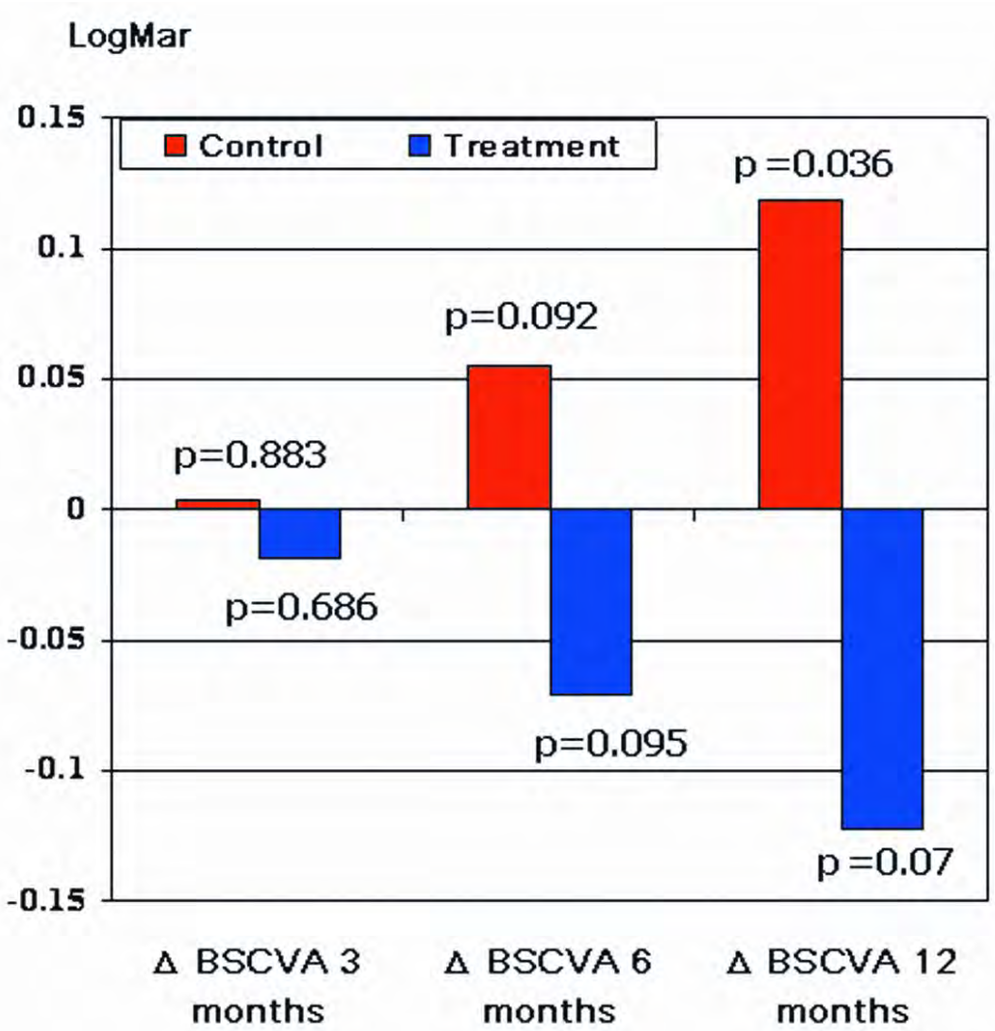




Wollensak, Spoerl, Seiler Am J Ophthalmol 2003

CX: CLINICAL RESULTS





Wittig-Silva JRS 2008

Goals for CXL in Ectasias

- Stabilize ectatic process
- Reduce corneal steepening
- Improve CTL fitting
- Provide alternatives for visual rehabilitation
  - Intracorneal ring segments
  - PRK

Avoid corneal transplantation!

US Phase III CXL Trials

- Two prospective, randomized clinical trials
  - Progressive Keratoconus
  - Corneal Ectasia post-LASIK

- Outcome measures
  - K_{max} (measured on Pentacam)
  - BSCVA, UCVA

- 1-year follow-up

- Data collection completed, submission to FDA 01/12

FDA decision March 2014 April 2016 ?

Avedro Receives FDA Approval for Photrexa® Viscous, Photrexa® and the KXL® System for Corneal Cross-Linking

Photrexa Viscous (riboflavin 5'-phosphate in 20% dextran ophthalmic solution) 0.146%, Photrexa (riboflavin 5'-phosphate ophthalmic solution) 0.146%, and the KXL system are the first and only FDA-approved therapeutic treatment for progressive keratoconus

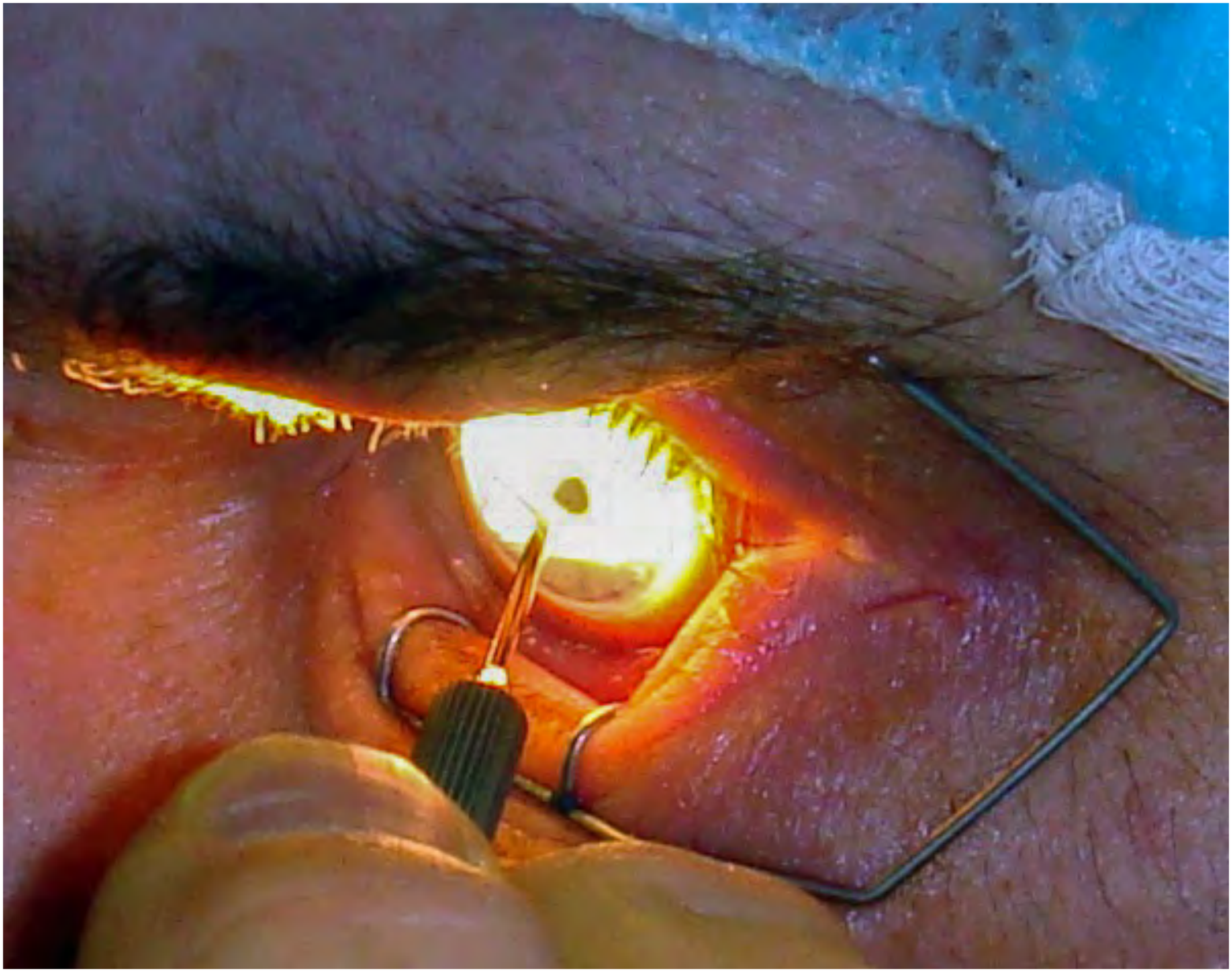
Waltham, Massachusetts, USA, Apr 18, 2016



CXL:
STEP BY STEP

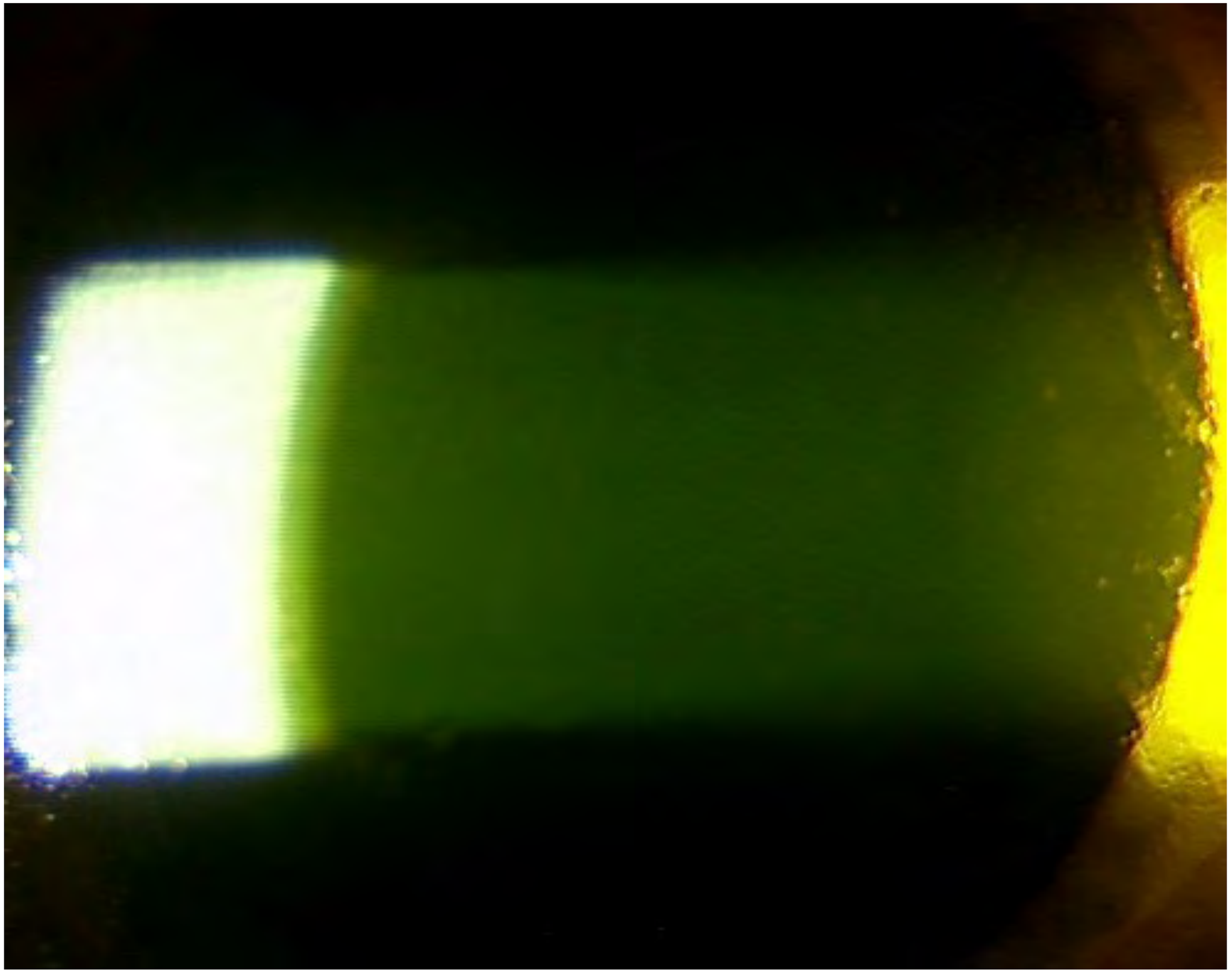
Procedure: Standard Dresden Technique

- 9 mm epithelial removal
- Riboflavin 0.1% drops x 30 min
- Riboflavin 0.1% drops x 30 min with 30 minutes 365 nm UVA (3mW/cm^2)
- UV-X , Peschke Meditrade, Zurich



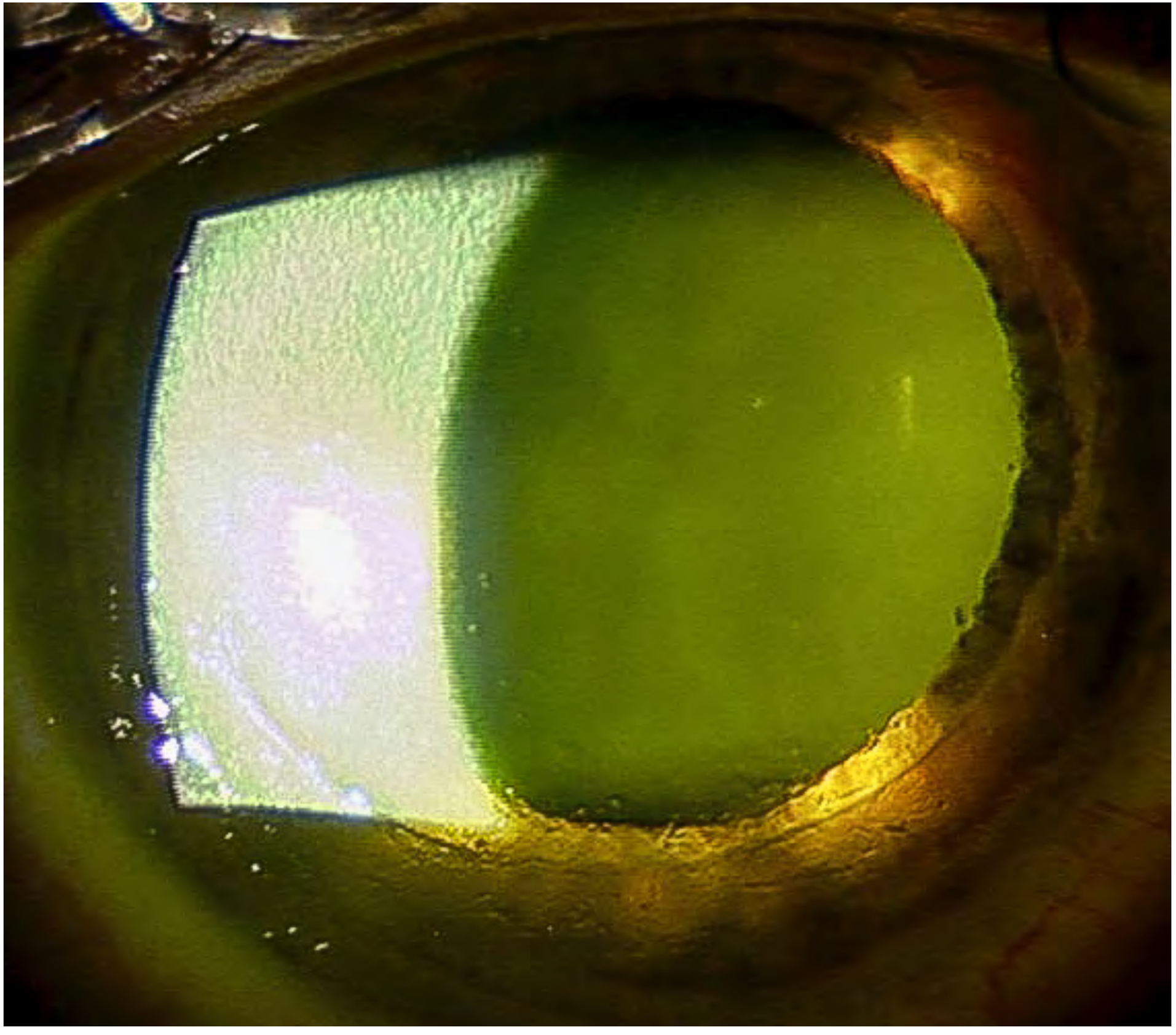

filled within clean-room- conditions
appears under nitrogen (free of oxygen) a
C for 15 minutes. (A 121° C - 15 min
sealed with a PP-dropping applicator unc
-deionised.
drops, each 3.0 mL, packed within a
sterilized
- no reuse
sterilisation: Store dark.
DR.EIEC.KPLATZ 8
FAX +49 431 56 98 66

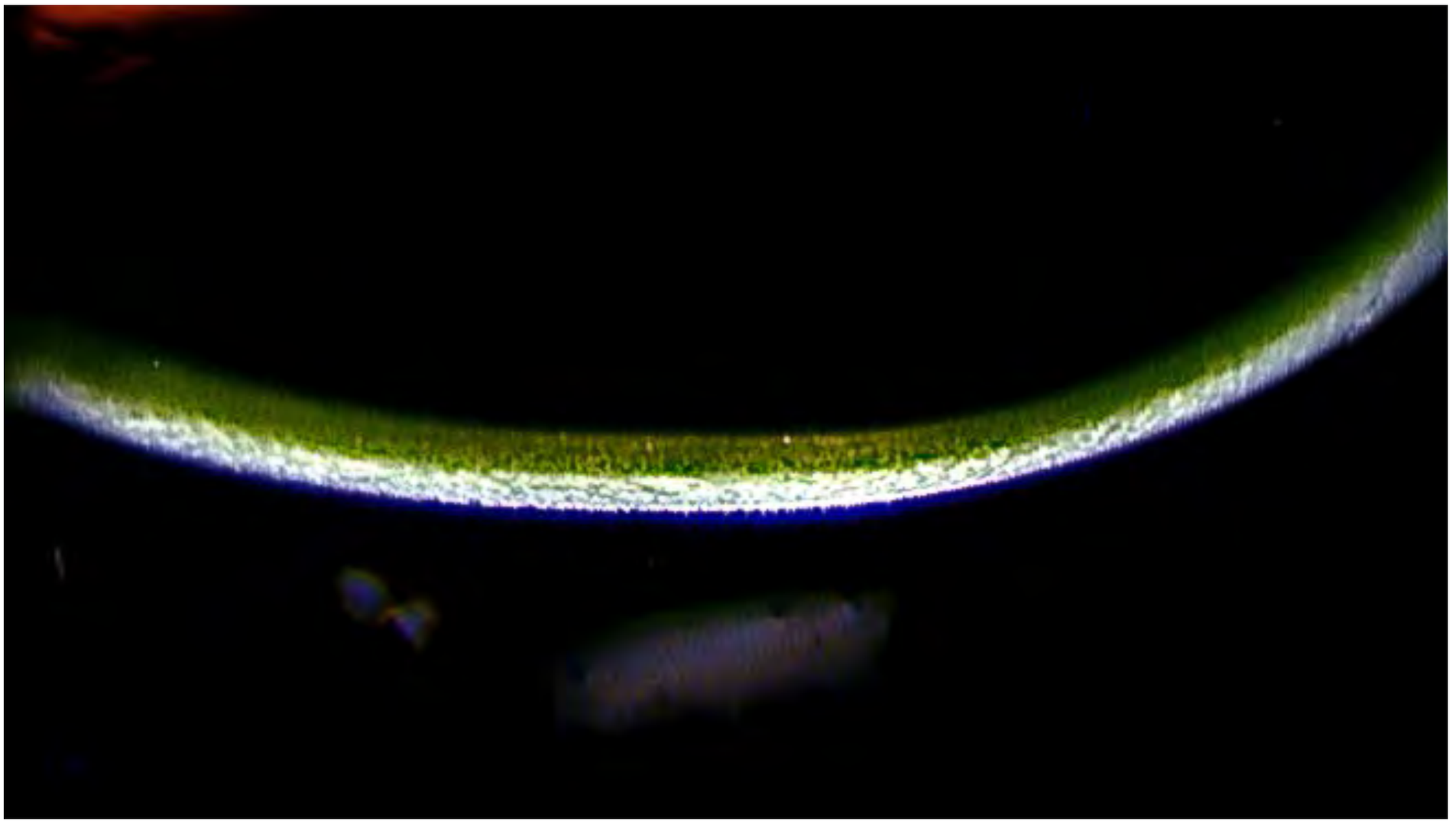


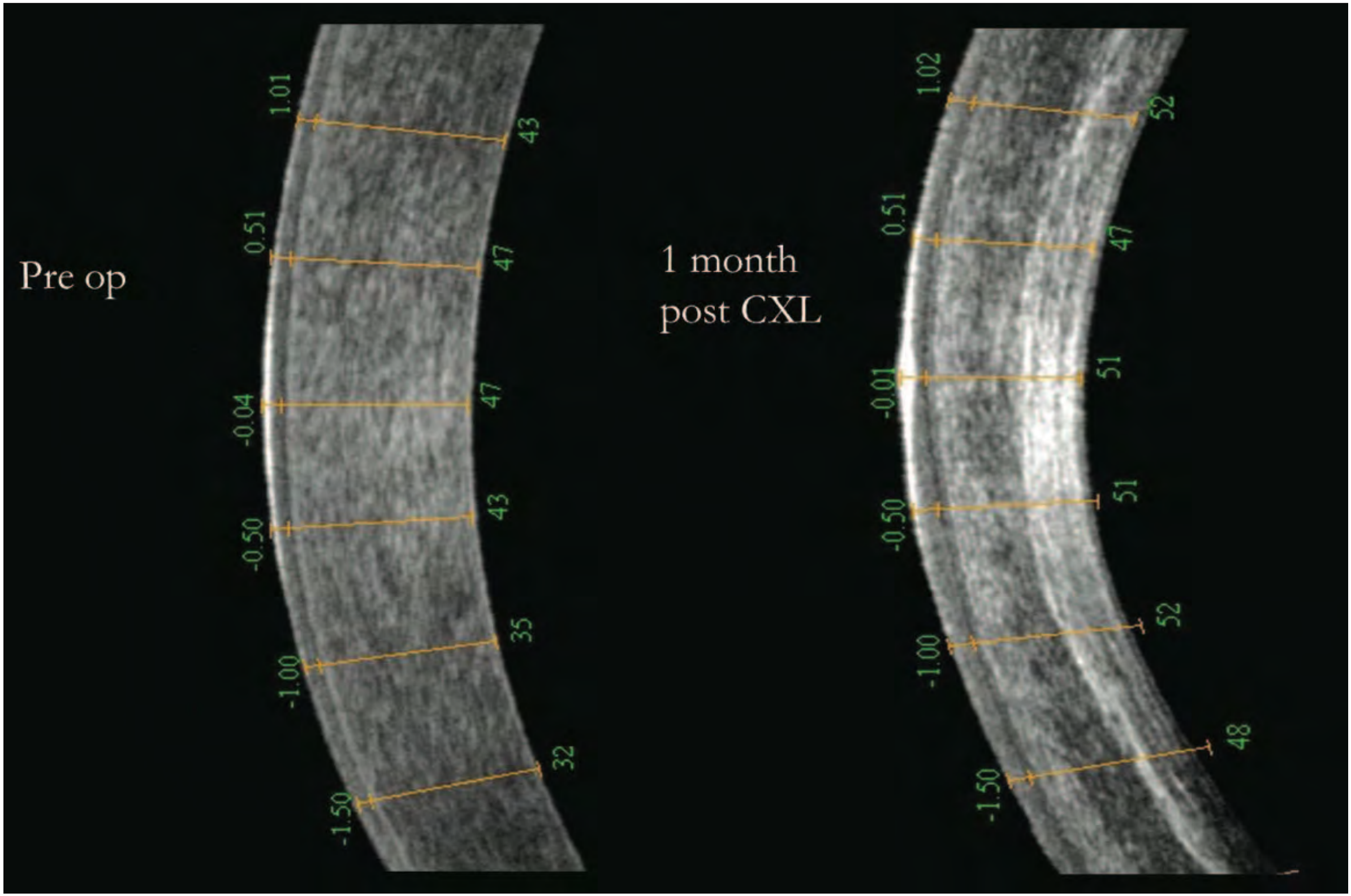





Beam
Aperture
UV-X™

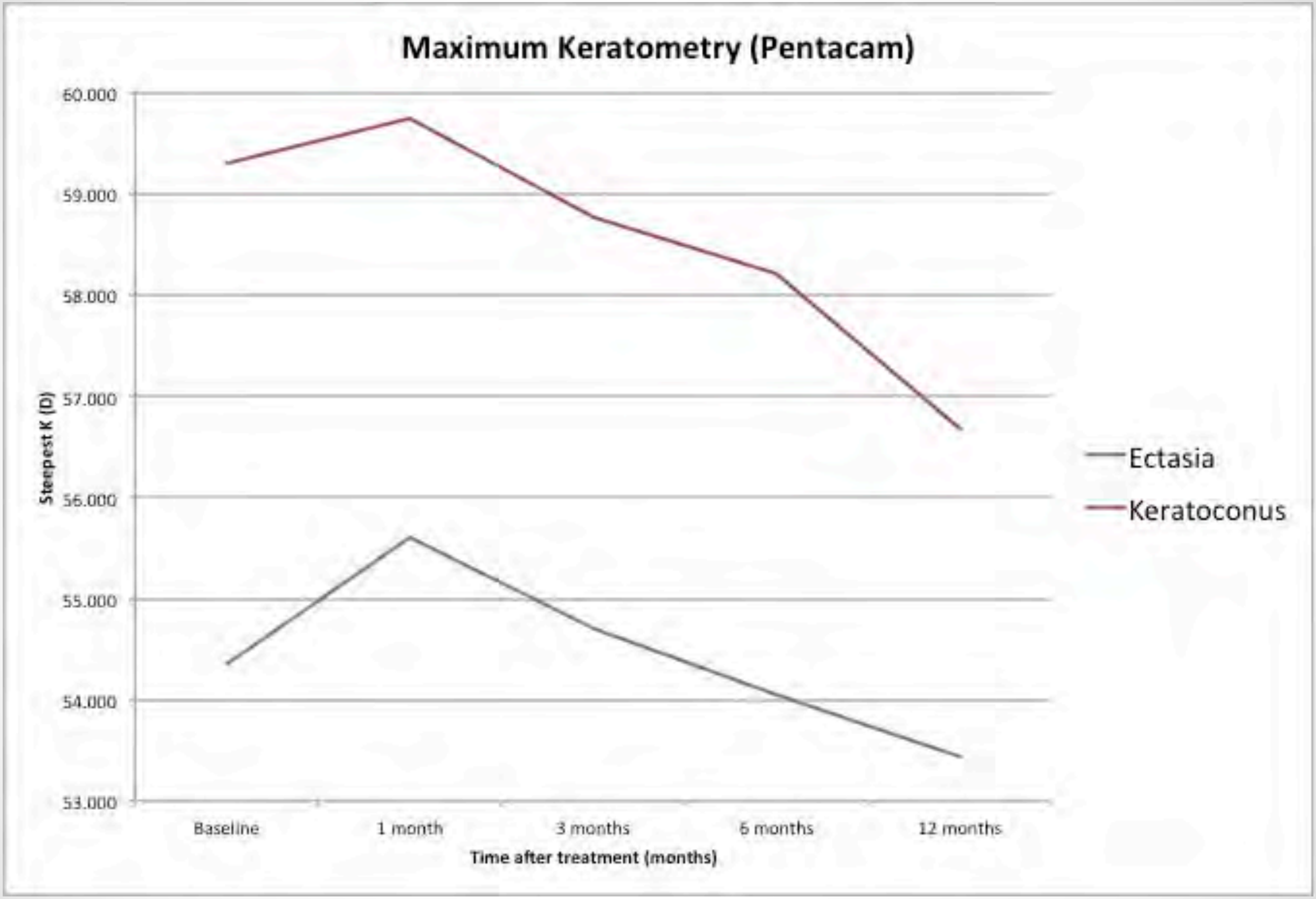




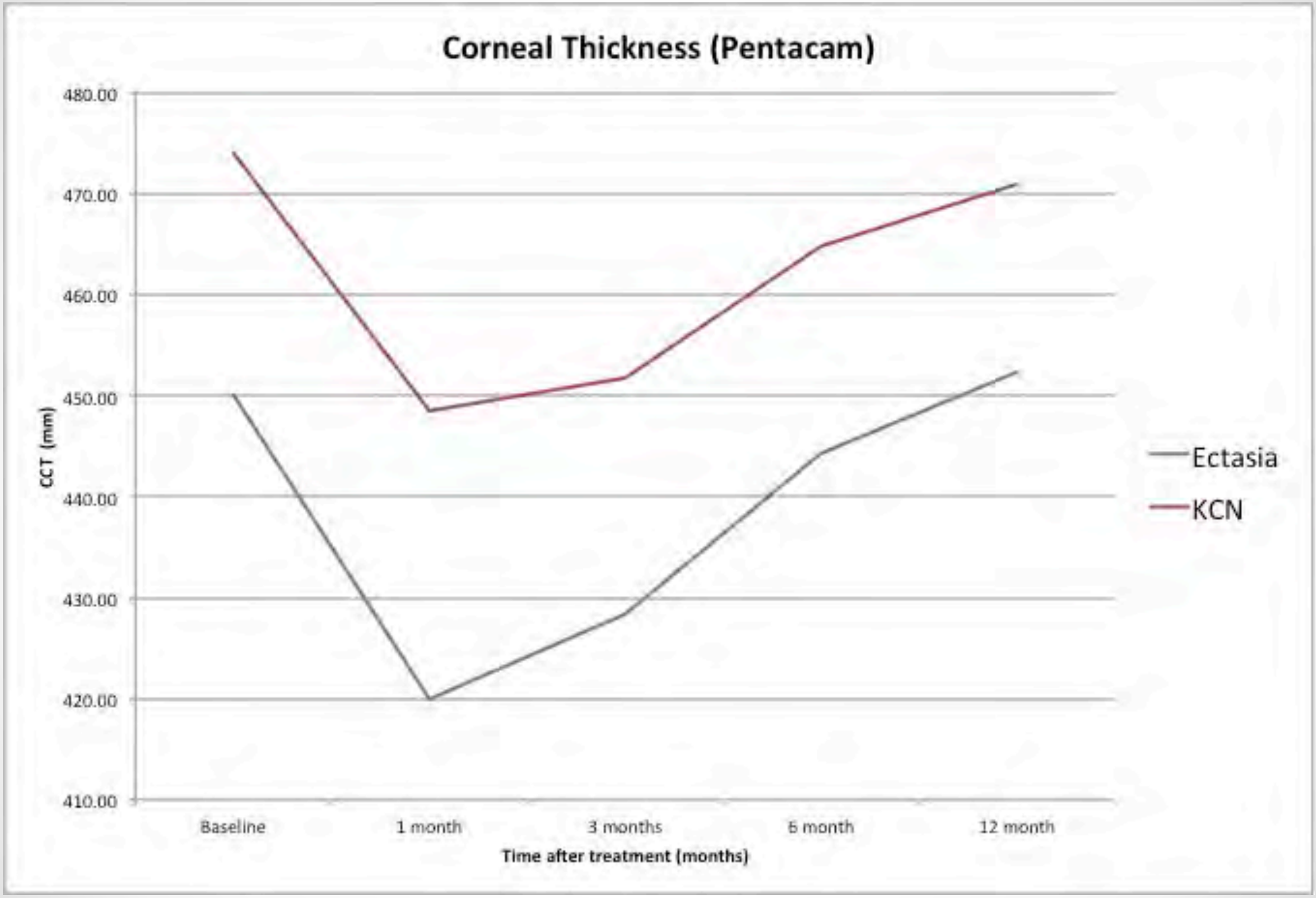

Pre op
1.01
43
0.51
47
-0.04
47
-0.50
43
-1.00
35
-1.50
32
1 month
post CXL
1.02
52
0.51
47
-0.01
51
-0.50
51
-1.00
52
-1.50
48



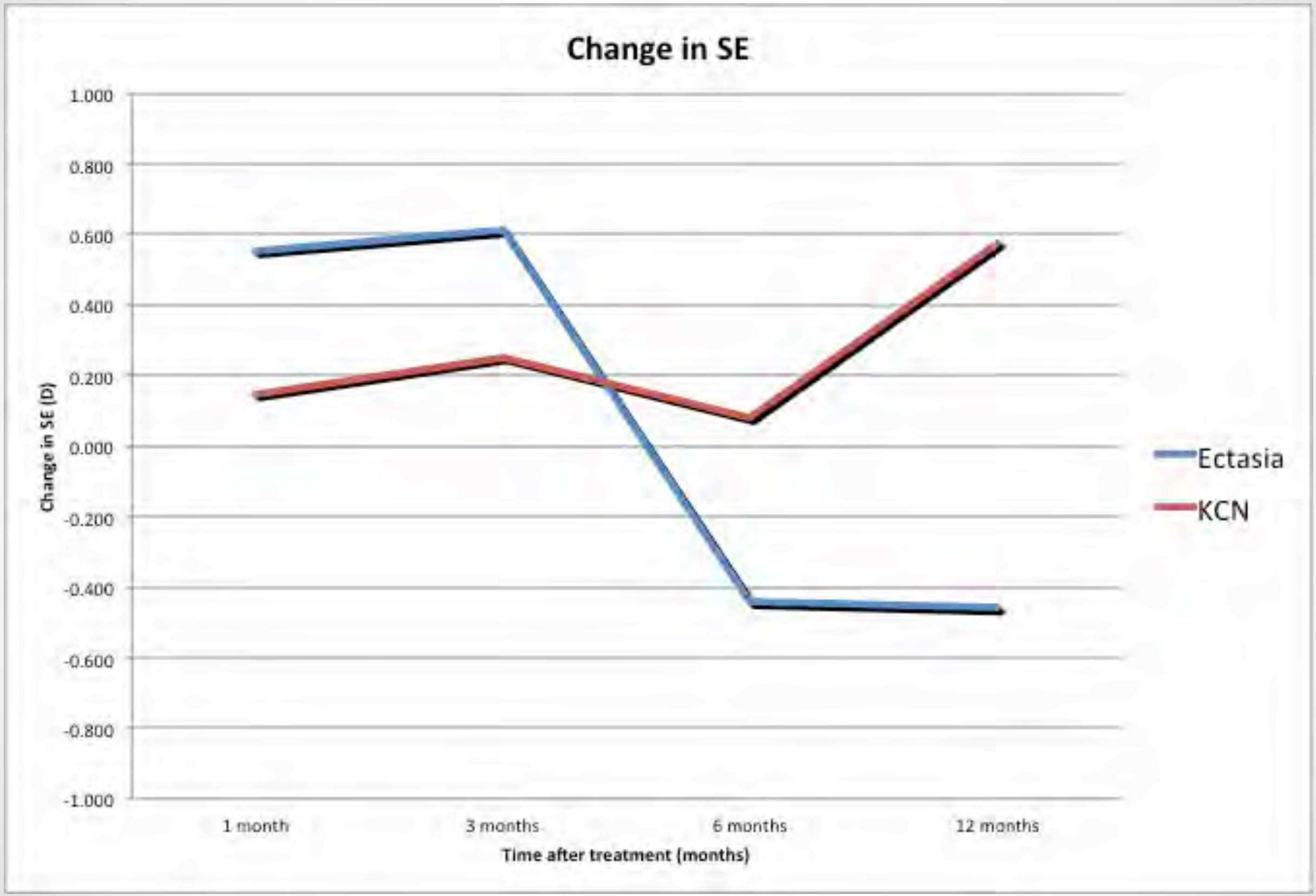
CXL FOR CORNEAL ECTASIAS



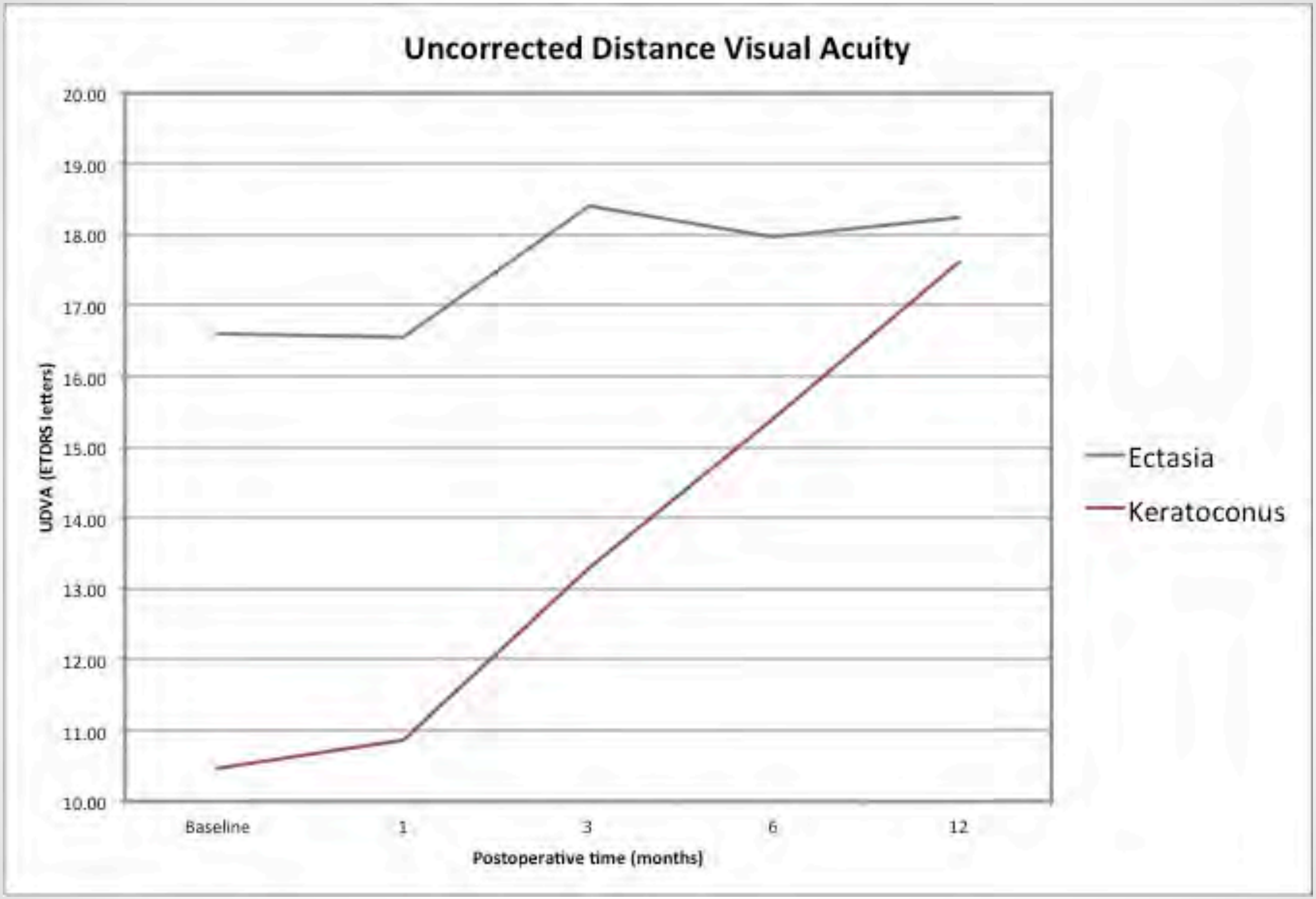
- Emory University data (unpublished)



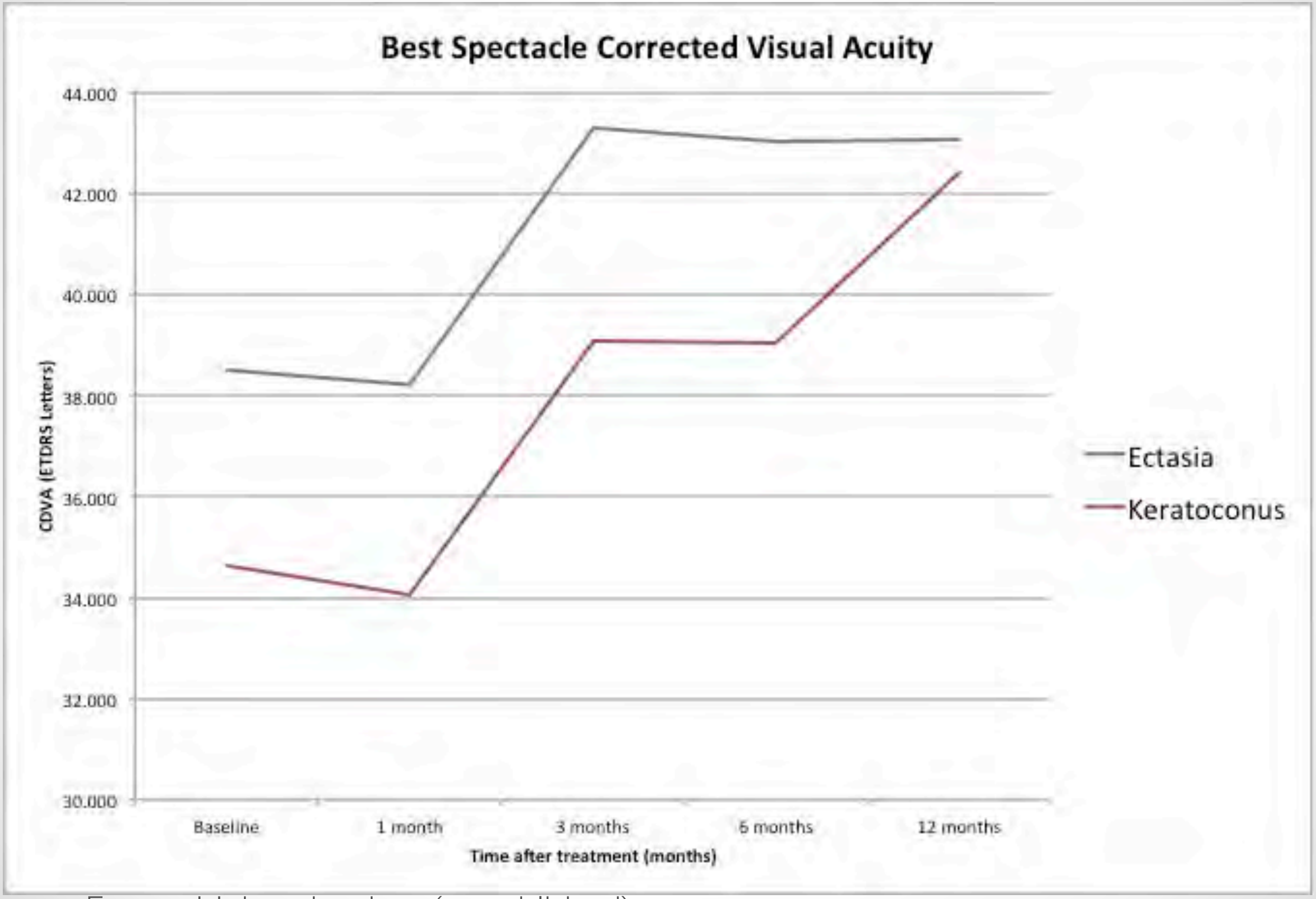
- Emory University data (unpublished)



- Emory University data (unpublished)

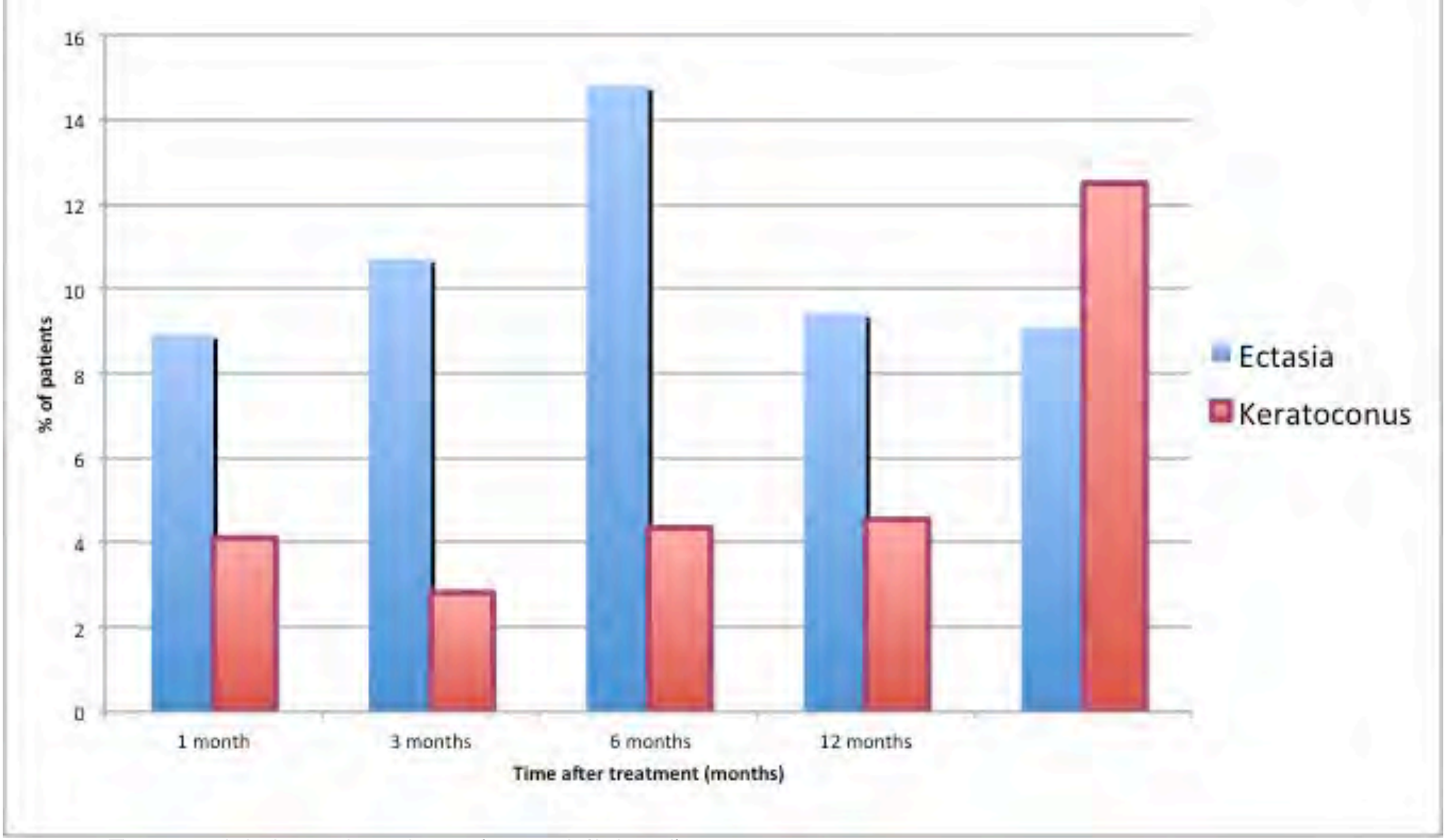


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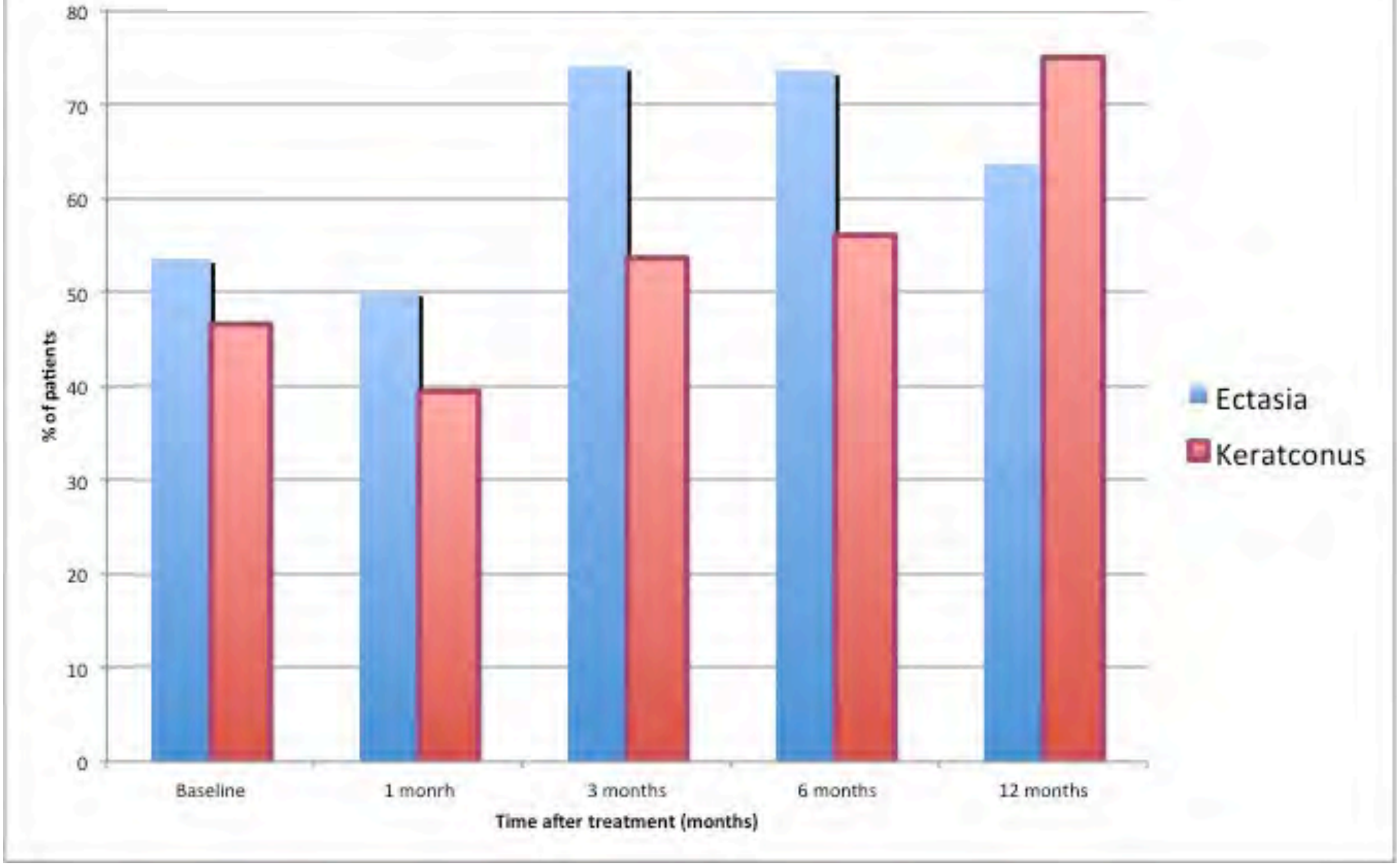
- Emory University data (unpublished)

Eyes Achieving UDVA 20/40 or Better



Emory University data (unpublished)

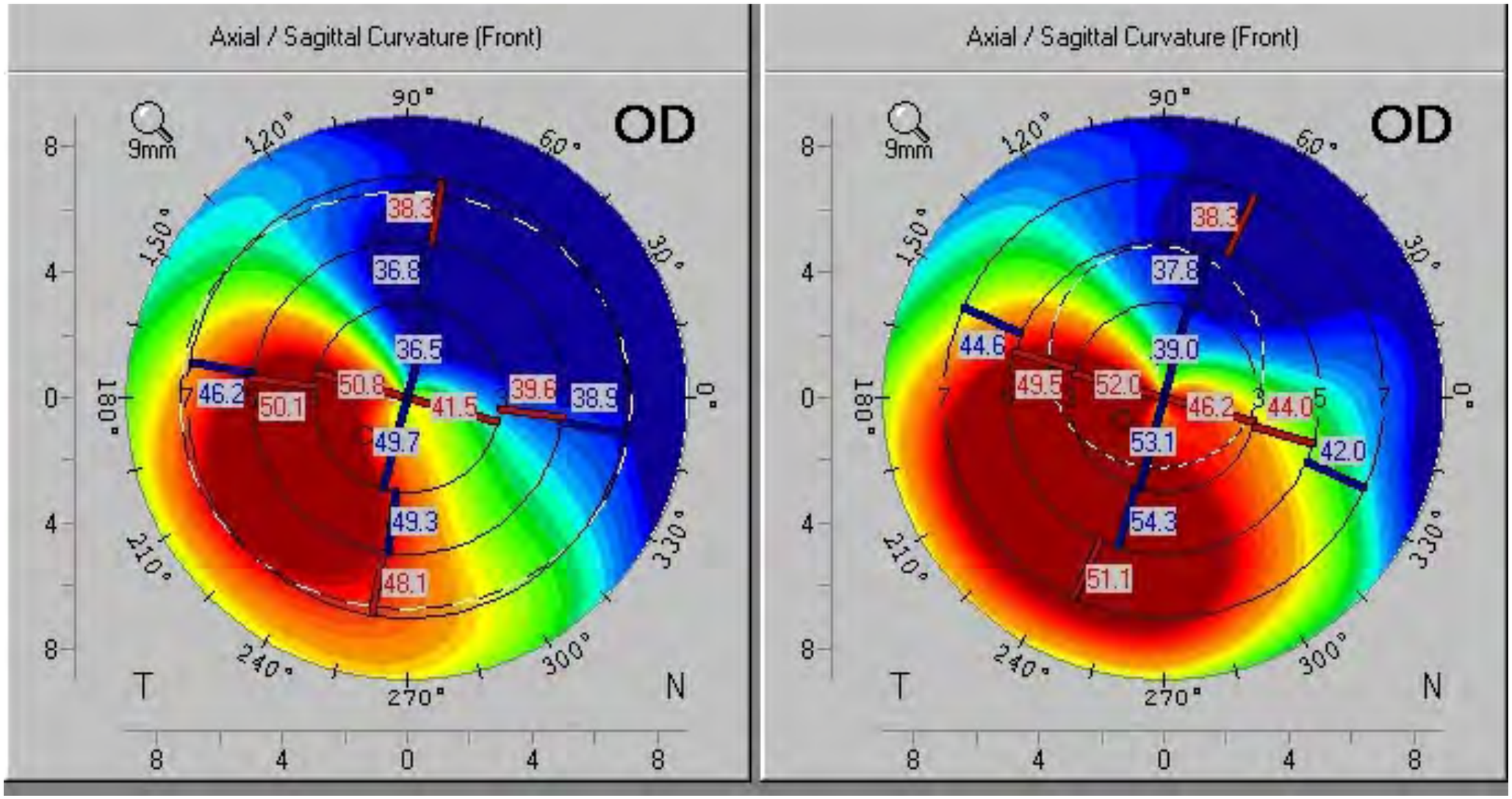
Eyes Achieving BSCVA 20/40 or Better



Emory University data (unpublished)

MEASURING CXL CHANGES: CHALLENGES

Difference Maps



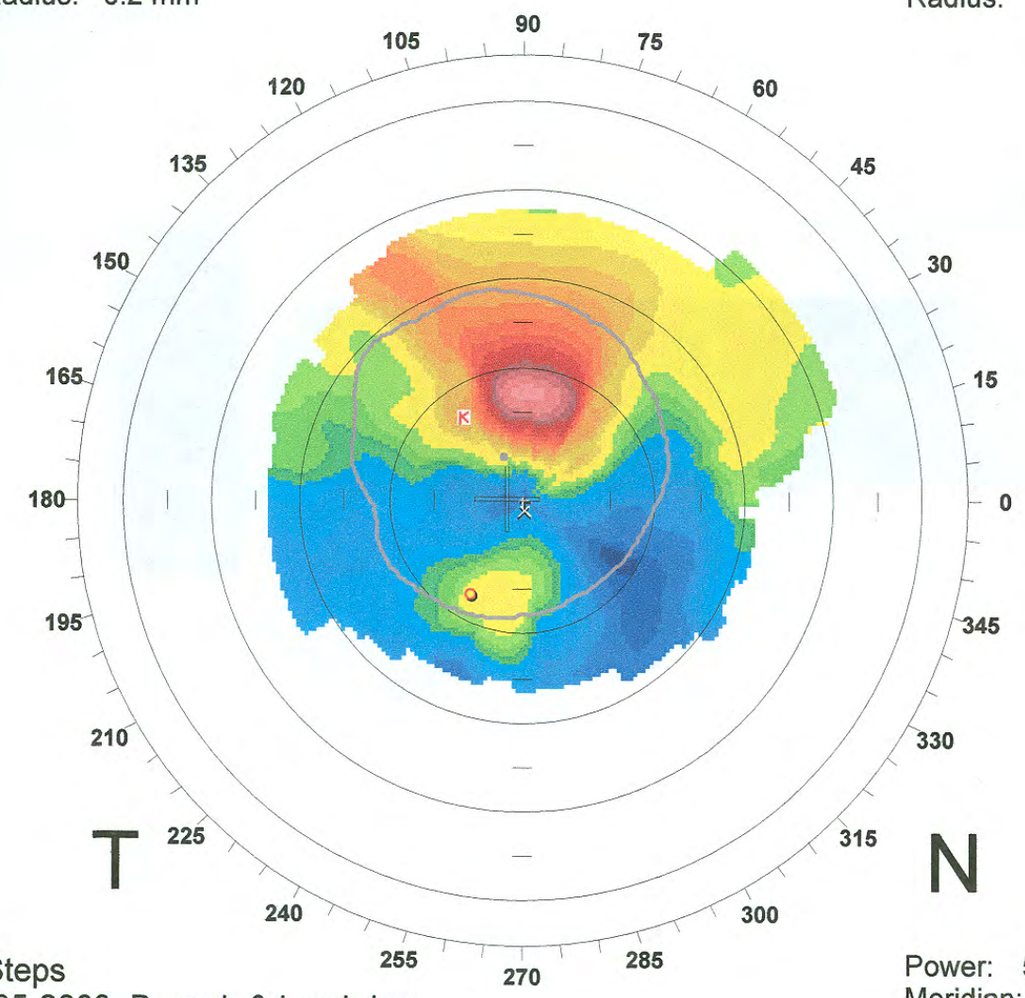
ORBSCAN

Difference - Kera Axial

8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
-5.00
-6.00
-7.00
-8.00

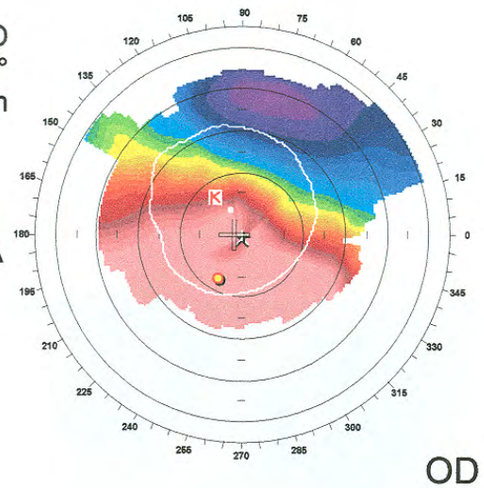
Cyl Pow: -2.70 D
Meridian: 173 °
Radius: 0.2 mm

A-B



Power: 50.93 D
Meridian: 173 °
Radius: 0.2 mm

A

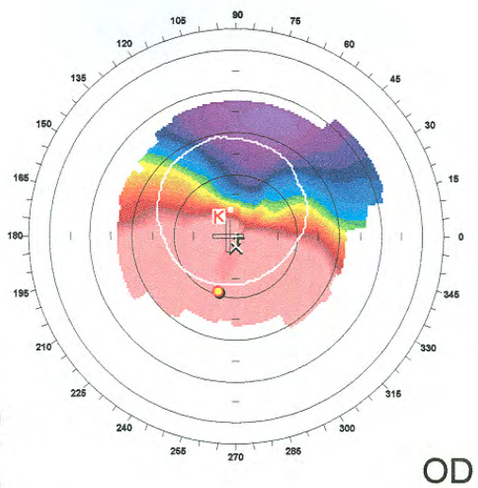


OD

Axial Power
12/17/2008 1:14:13 PM

Axial Power
12/5/2007 1:06:20 PM

B



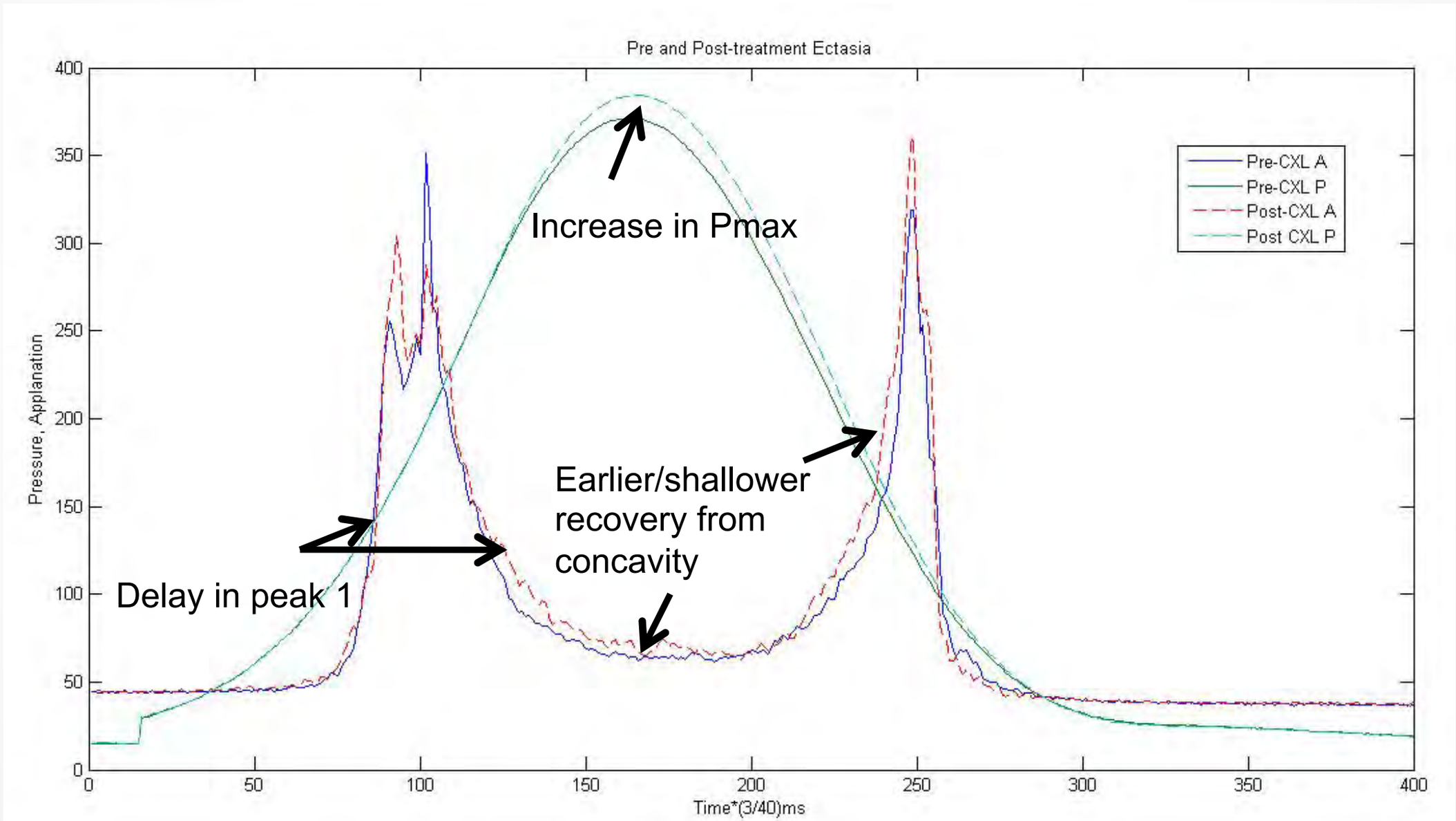
Power: 53.63 D
Meridian: 173 °
Radius: 0.2 mm

OD

0.5 D Color Steps
Copyright 1995-2003, Bausch & Lomb Inc.

v3.12

ORA changes with crosslinking in post-LASIK ectasia



Hallahan KM, Rocha KM, Roy AS, Randleman JB, Stulting RD, Dupps WJ. Effects of corneal crosslinking on ocular response analyzer waveform-derived variables in keratoconus and post-refractive surgery ectasia. *Eye Contact Lens* 2014 Nov;40:339-44

WHAT CONSTITUTES SUCCESS IN CXL?

- Stabilized Kmax?
- Change in acuity?
- Change in refraction?
- Change in quality of vision?

HOW ARE THESE CHANGES BEST MEASURED?

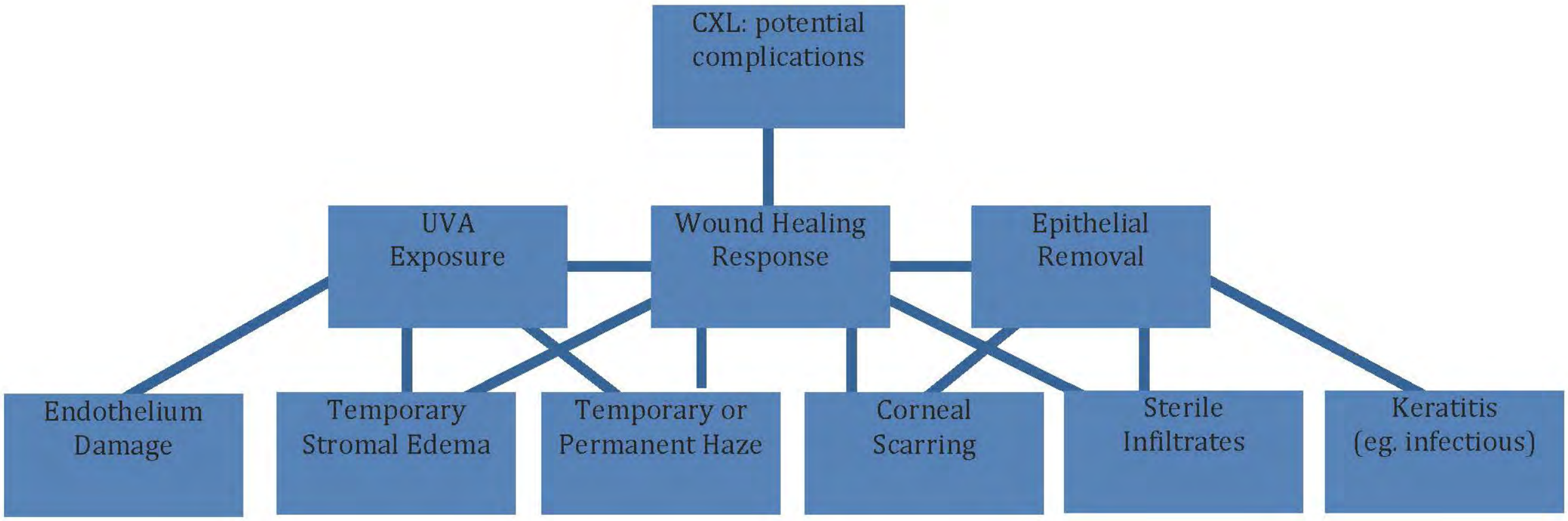
- Topography?
- Tomography?
- Higher order aberration profiles?
- Anatomic changes?
- Clinical (acuity/refraction)?

13

Corneal Collagen Cross-Linking Complications and Their Management

J. Bradley Randleman, MD and Karolinne Maia Rocha, MD, PhD

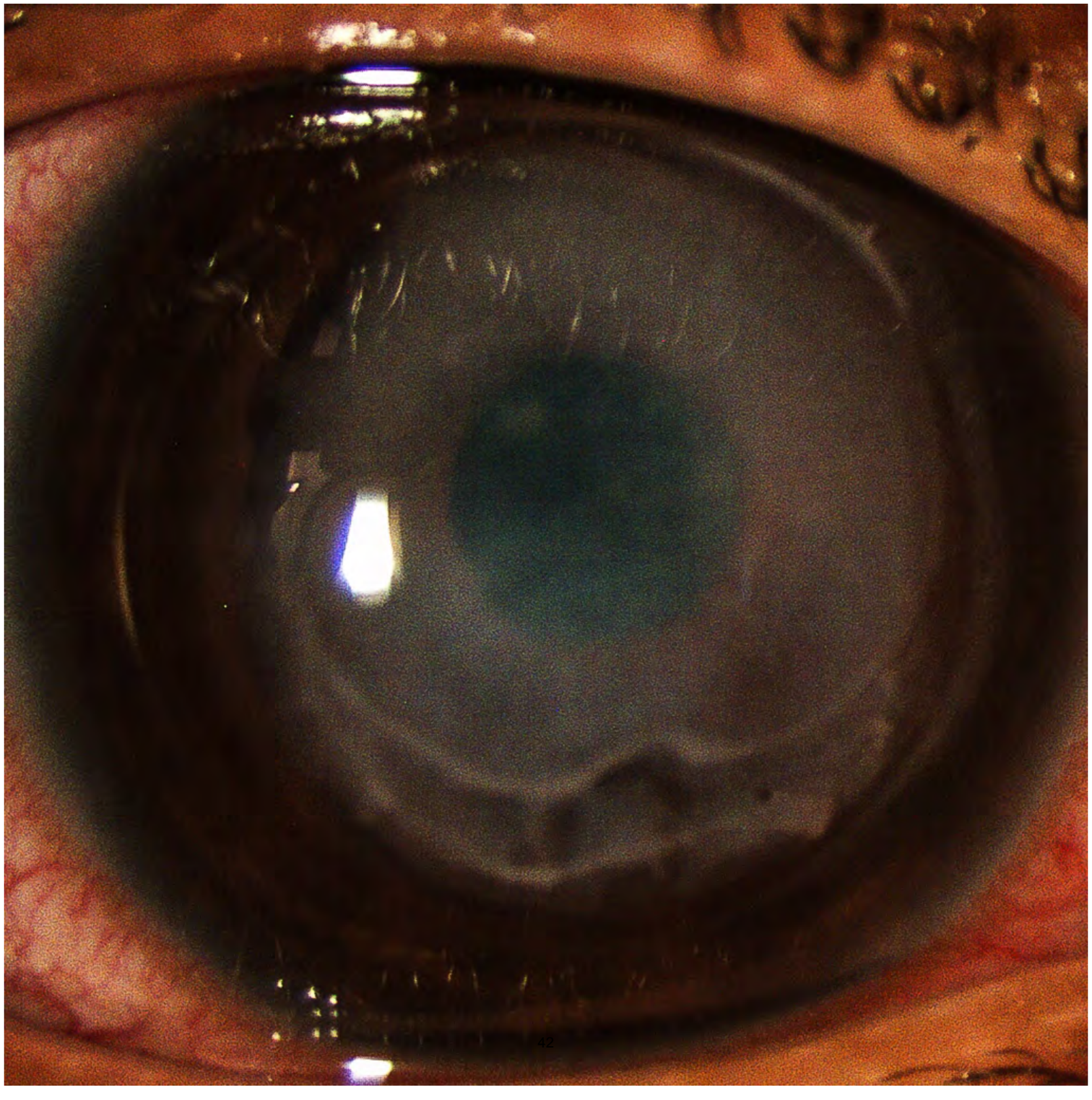
COMPLICATIONS



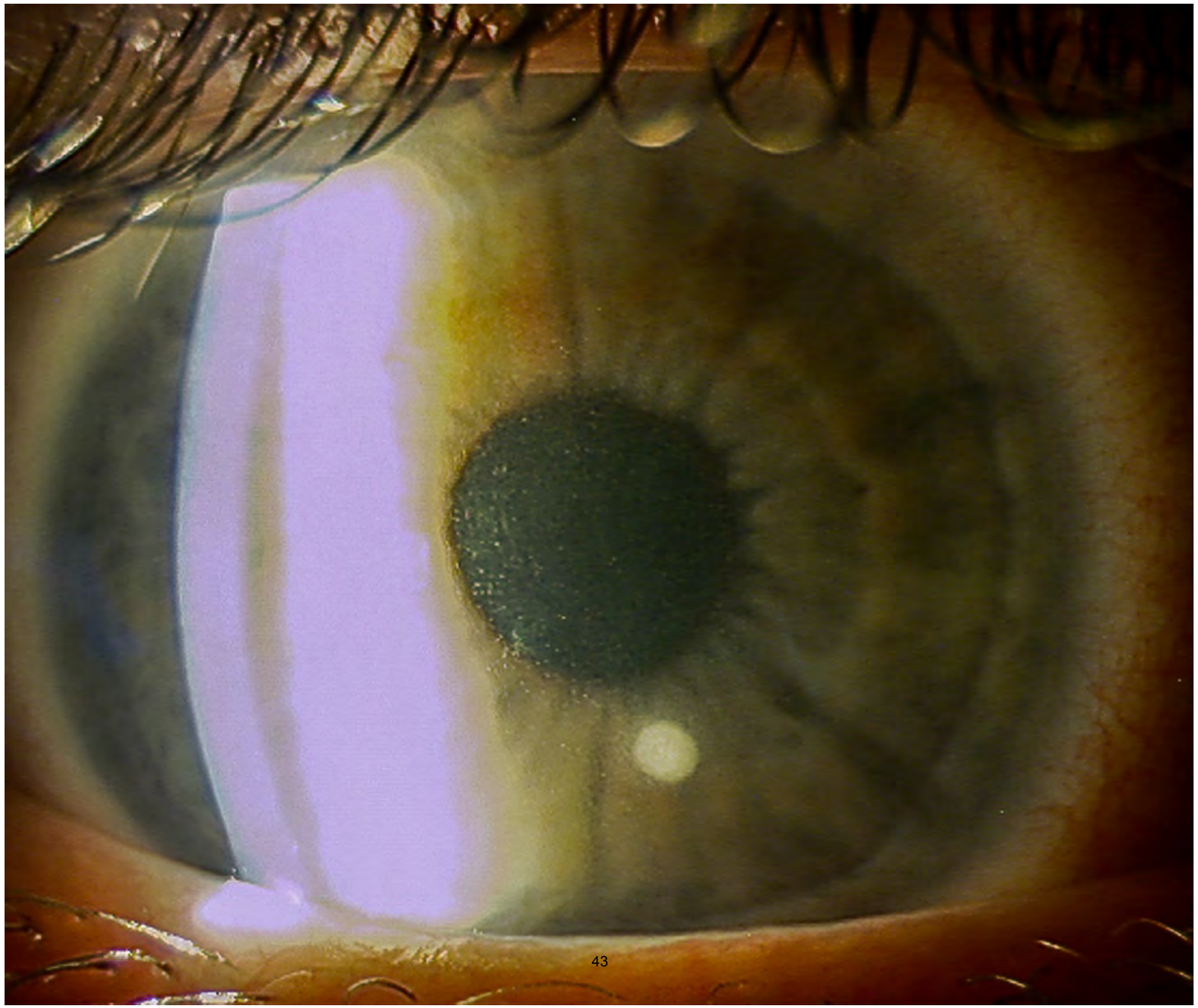
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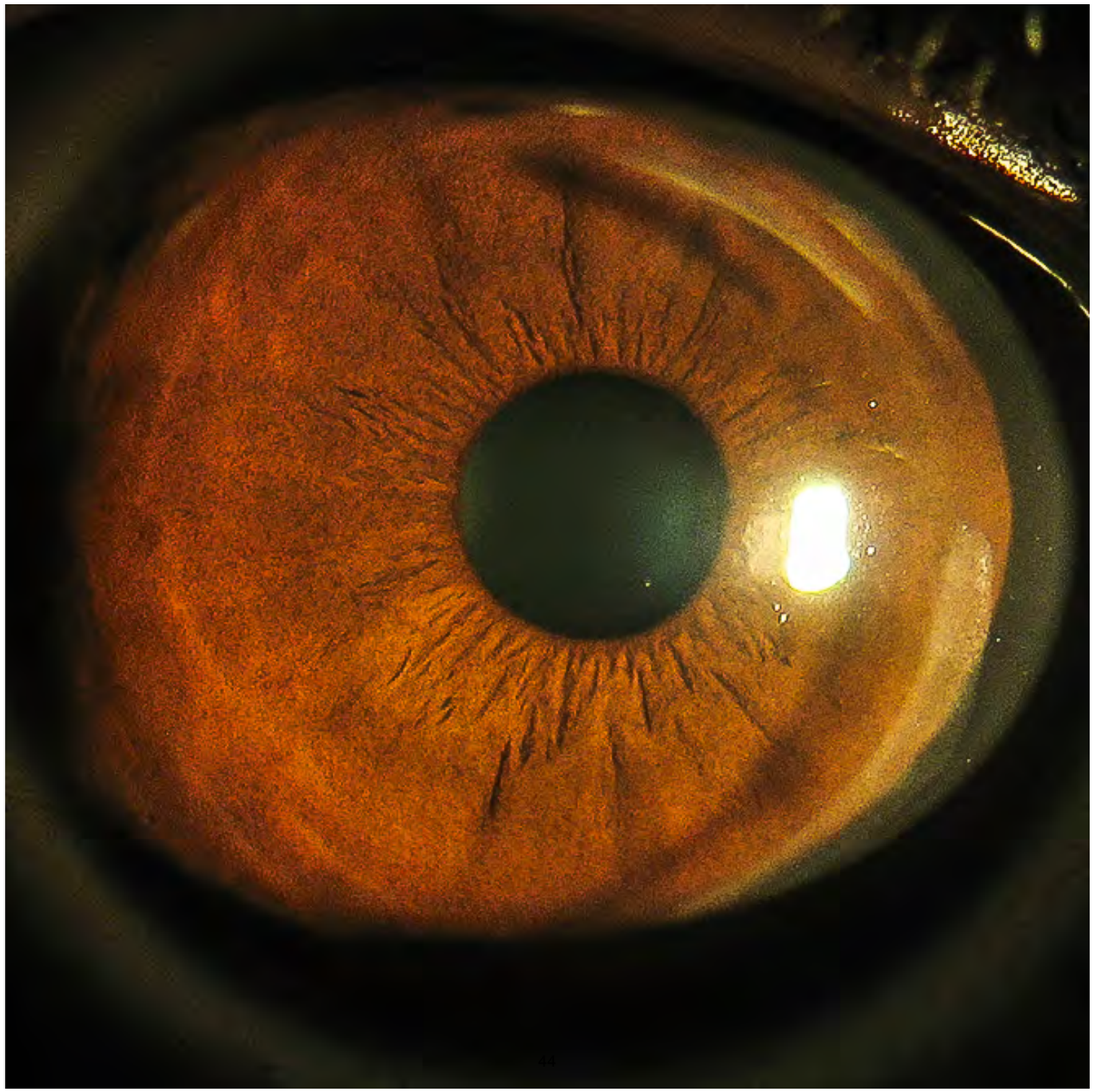
CORNEAL MELT



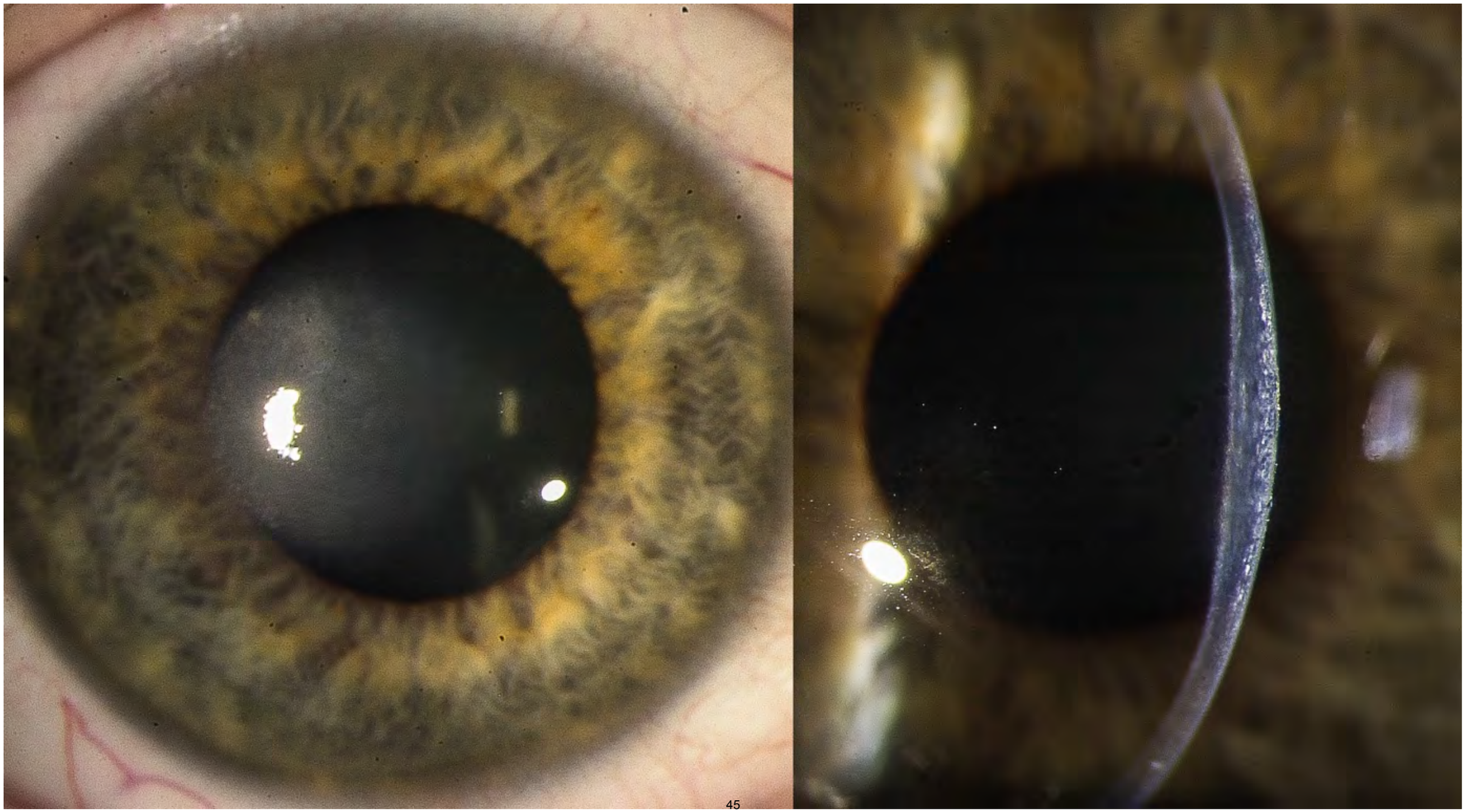
PERIPHERAL INFILTRATES



PERIPHERAL INFILTRATES



ENDOTHELIAL DAMAGE



UVA Corneal Absorption in Presence of Riboflavin

3.00 mW/cm²

1.49 mW/cm²

0.74 mW/cm²

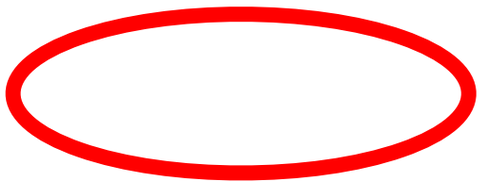
0.36 mW/cm²

0.18 mW/cm²

0.09 mW/cm²

0.06 mW/cm²

Damage Threshold



ADD MODIFICATIONS FOR THIN CORNEAS

- hypo-osmotic solutions
- contact-lens assisted CXL

Contact Lens-Assisted Collagen Cross-Linking (CACXL): A New Technique for Cross-Linking Thin Corneas

Soosan Jacob MS, FRCS, DNB; Dhivya Ashok Kumar, MD; Amar Agarwal, MS, FRCS, FRCOpth; Sushanth Basu, DO; Pratheek Sinha, BOptom; Ashvin Agarwal, MS

[*J Refract Surg.* 2014;30(6):366-372.]

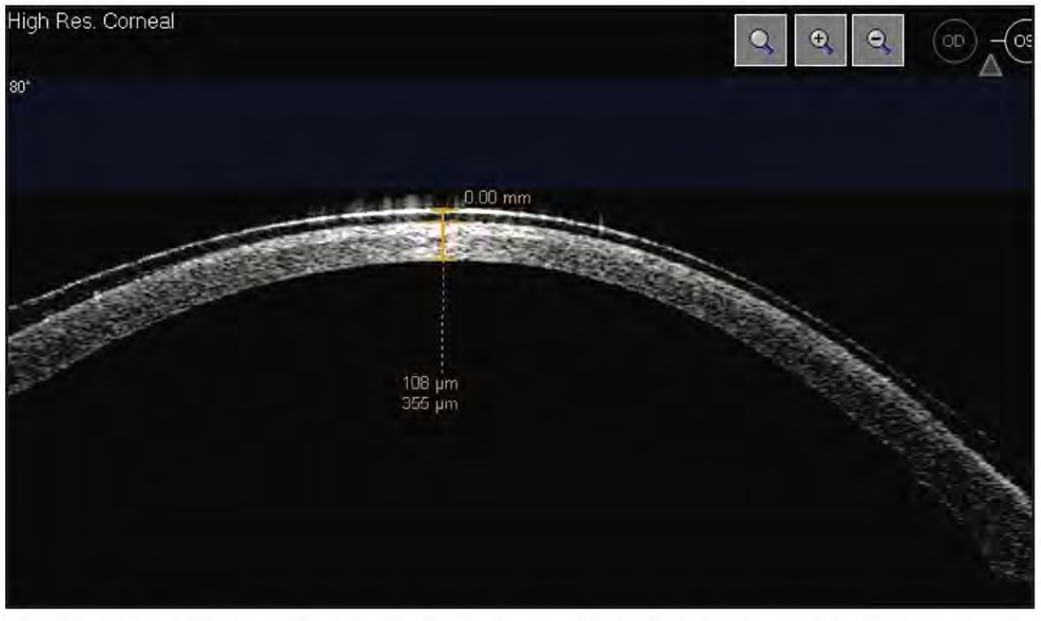


Figure 2. Intraoperative anterior segment optical coherence tomography image showing the soft contact lens on the cornea. Note: The contact lens and riboflavin film contributed the additional 108 μm of treatment zone.

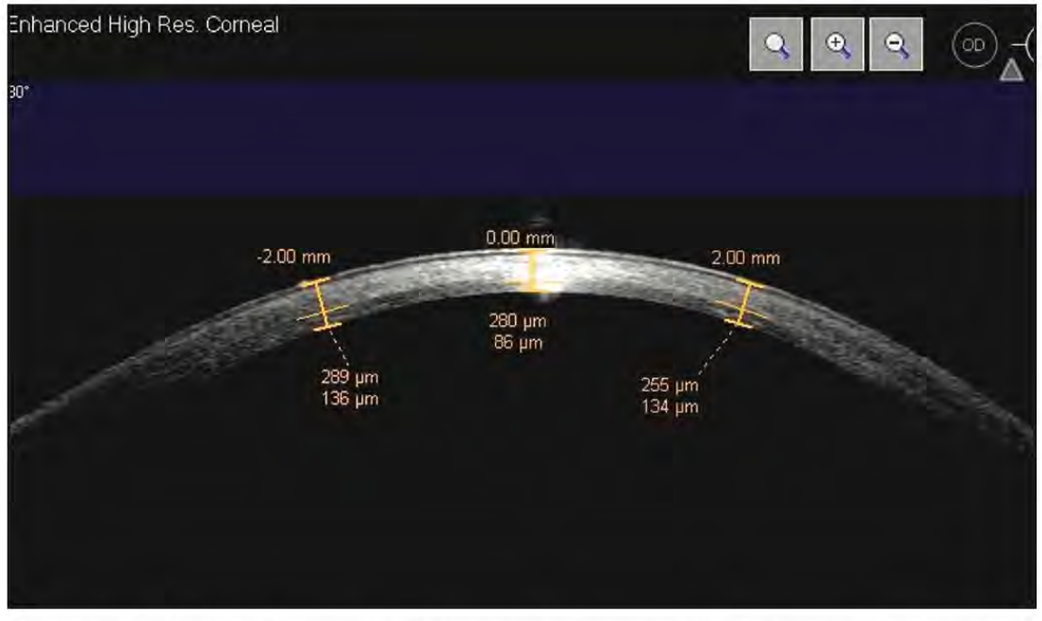


Figure 3. The postoperative stromal demarcation line seen at 1 month after contact lens-assisted corneal cross-linking as seen with anterior segment optical coherence tomography.

ORIGINAL ARTICLE

Contact Lens-Assisted Collagen Cross-Linking (CACXL): A New Technique for Cross-Linking Thin Corneas

Soosan Jacob MS, FRCS, DNB; Dhivya Ashok Kumar, MD; Amar Agarwal, MS, FRCS, FRCOpth; Sushanth Basu, DO; Pratheek Sinha, BOptom; Ashvin Agarwal, MS

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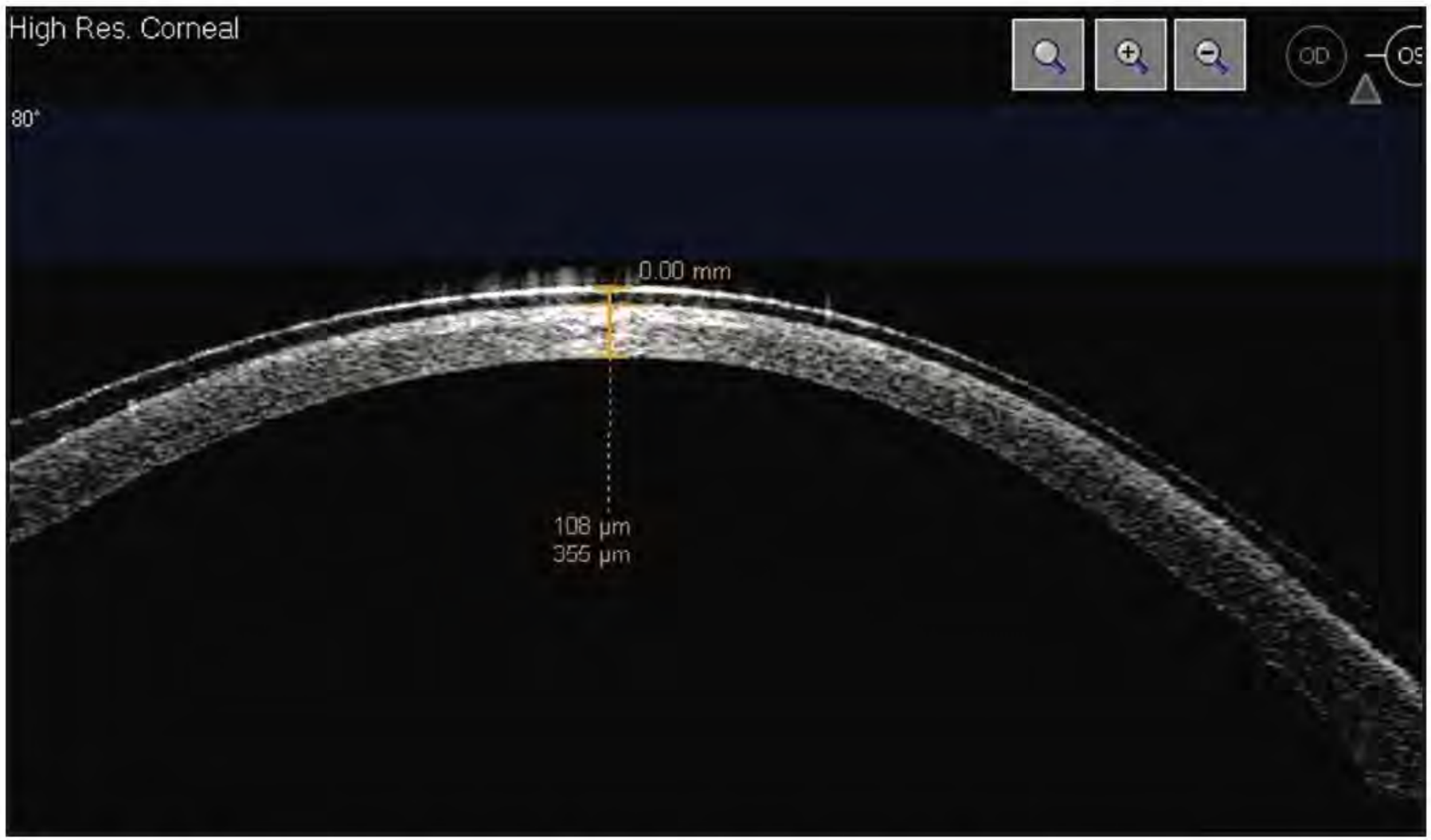


Figure 2. Intraoperative anterior segment optical coherence tomography image showing the soft contact lens on the cornea. Note: The contact lens and riboflavin film contributed the additional 108 μm of treatment zone.

ORIGINAL ARTICLE

In Vivo Confocal Microscopy After Contact Lens-Assisted Corneal Collagen Cross-linking for Thin Keratoconic Corneas

Cosimo Mazzotta, MD, PhD; Soosan Jacob, MS, FRCS, DNB; Amar Agarwal, MS, FRCS, FRCOphth; Dhivya Ashok Kumar, MD

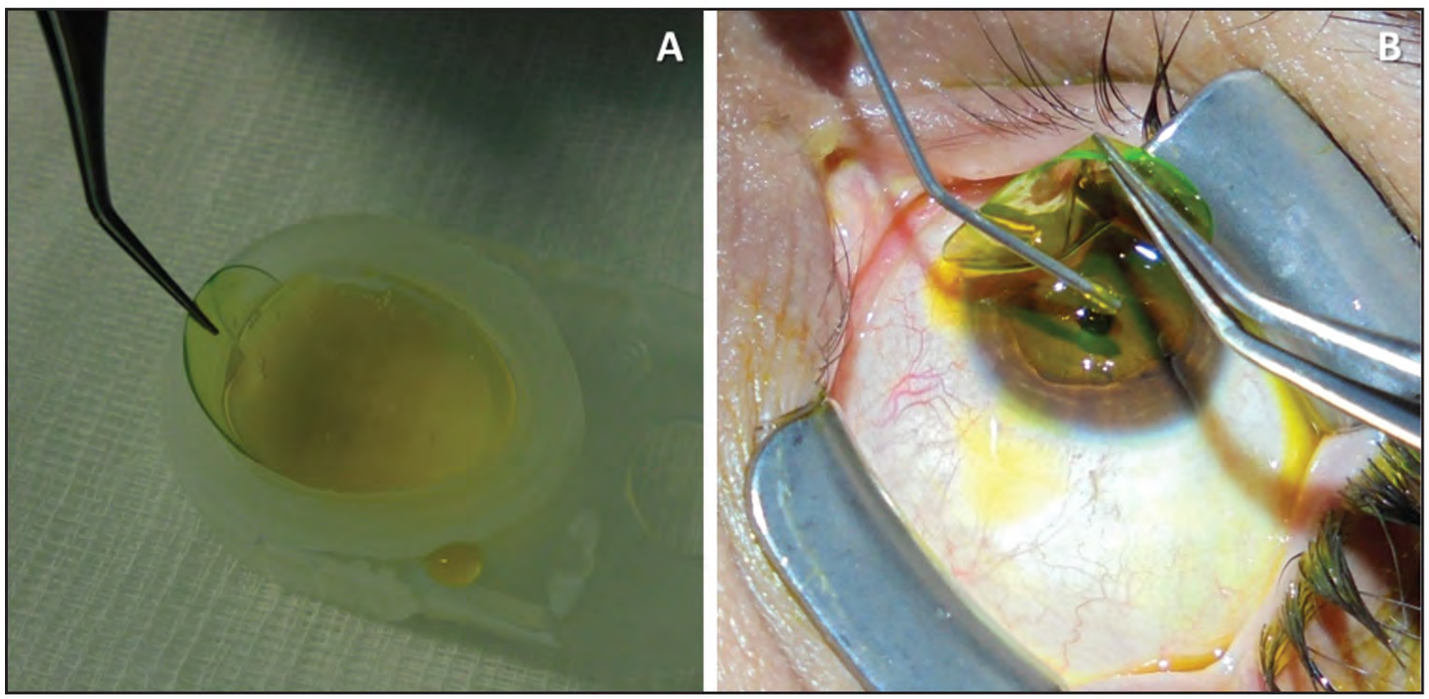


Figure 1. (A) Contact lens immersed in riboflavin 0.1% during contact lens-assisted corneal collagen cross-linking. (B) Riboflavin 0.1% solution application under and above the contact lens during contact lens-assisted corneal collagen cross-linking treatment.

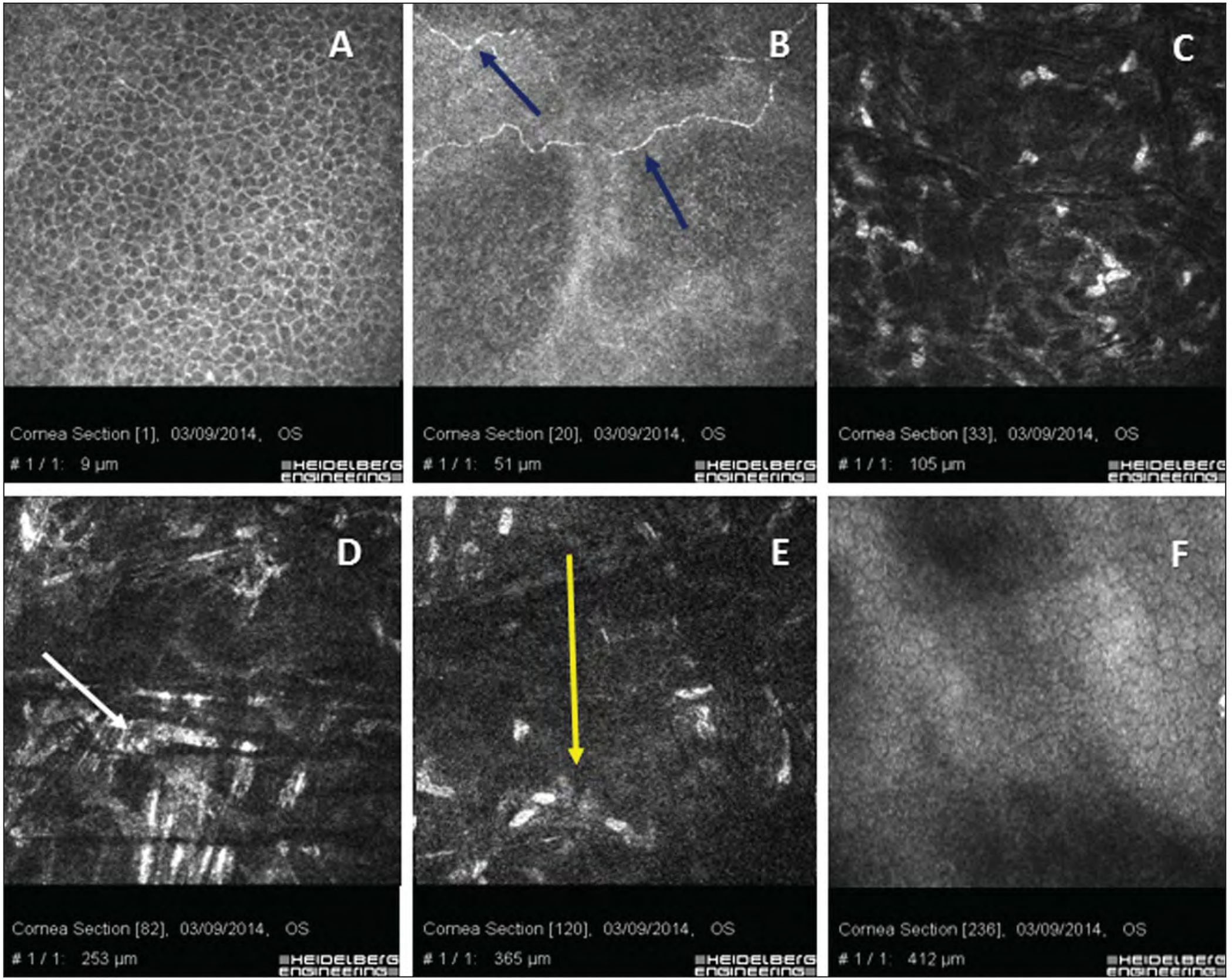
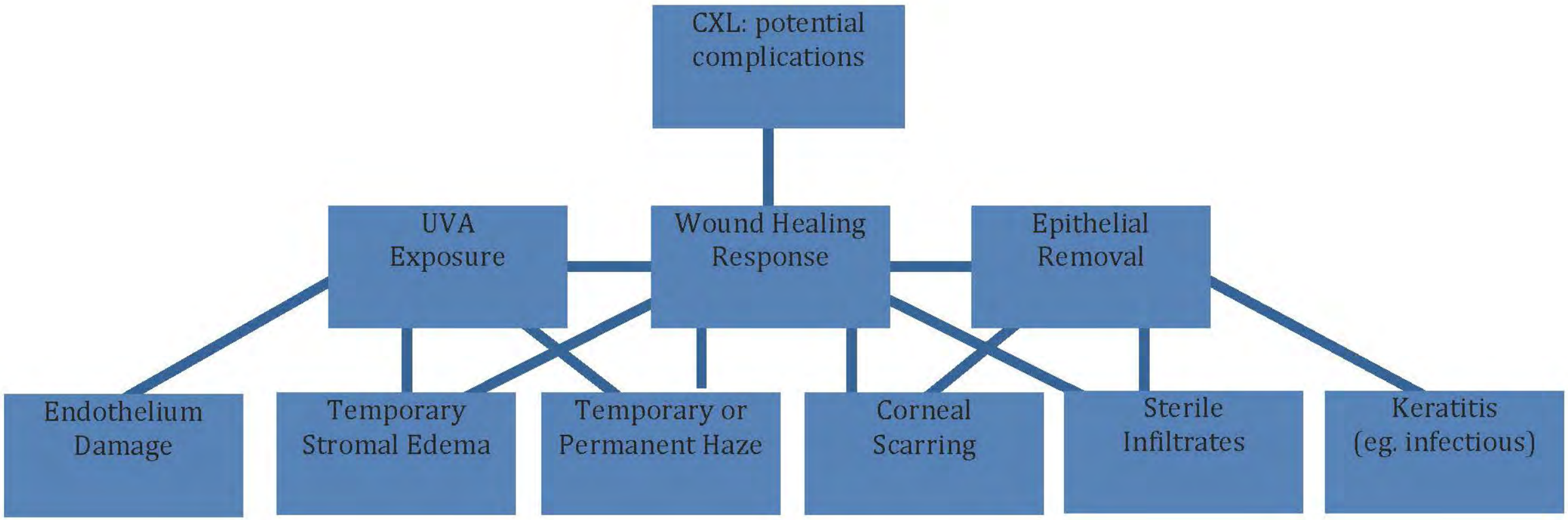


Figure 3. In vivo confocal microscopy analysis performed 3 months after treatment. Scan A shows regular basal epithelium mosaic and cell borders. Scan B shows corneal reinnervation with the presence of subepithelial plexus fibers (blue arrows). Scan C shows initial keratocyte nuclei repopulation of the anterior stroma at 100 μm with progressive edema reduction. Scan D shows edema reduction of the deep stroma followed by gradual keratocyte repopulation and hyperreflective microbands of high molecular weight collagen (white arrow). Scan E showis demarcation line with the presence of activated repopulating keratocytes. Scan F shows regular endothelium mosaic.

COMPLICATIONS



Failed Remodeling



TREATMENT PROTOCOLS

CXL PROTOCOLS

- Epi-Off
  - Standard (30 min x 3mW/cm2)
  - Accelerated
    - 10 min x 5mW/cm2
    - 5 min x 18 mW/cm2
    - 3-4 min x 30mW/cm2
- Epi-on
  - "regular"
  - iontophoresis

Bunsen-Roscoe
Law of Reciprocity

New UV devices





New Beam Profiles


UV-X™
Beam Aperture


UV-X™
Beam Aperture


UV-ILLUMINATION
OPTIMIZED BEAM PROFILE
CROSS-LINKED VOLUME
DEMARCATION LINE
SAFETY MARGIN


UV-ILLUMINATION
STANDARD BEAM PROFILE
CROSS-LINKED VOLUME
DEMARCATION LINE
SAFETY MARGIN



CXL:
ADVANCING INDICATIONS

EDITORIAL

Corneal Collagen Cross-linking: New and Expanding Applications

J. Bradley Randleman, MD



Optimizing treatment protocols

Pediatric ectatic disorders

Infectious keratitis

NEW TECHNOOLOGY

Safety Profile of High-Fluence Corneal Collagen Cross-Linking for Progressive Keratoconus: Preliminary Results From a Prospective Cohort Study

Zisis Gatzioufas, MD, PhD; Olivier Richoz, MD; Eliane Brugnoli; Farhad Hafezi, MD, PhD

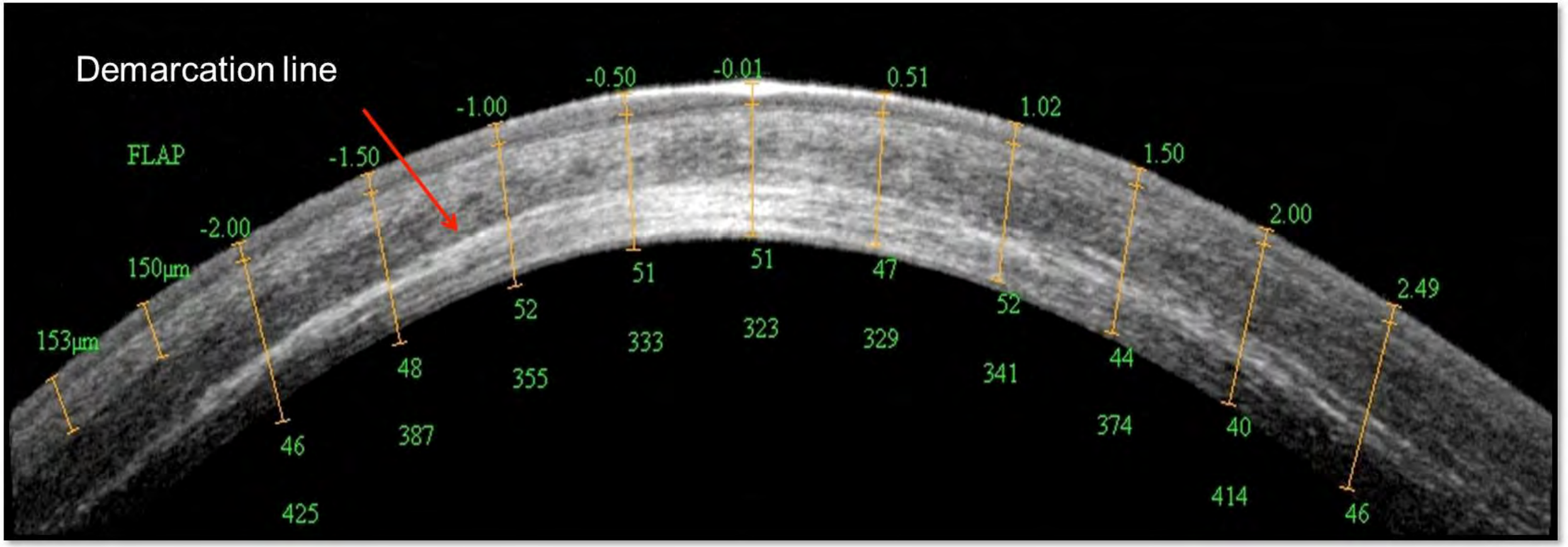
Safe!

Effective?



FAILED REMODELING

EPI-OFF CXL


Demarcation line
FLAP
-2.00
-1.50
-1.00
-0.50
-0.01
0.51
1.02
1.50
2.00
2.49
150µm
153µm
46
48
52
51
51
47
52
44
40
46
425
387
355
333
323
329
341
374
414

ORIGINAL ARTICLE

In Vivo Imaging of Riboflavin Penetration During Collagen Cross-linking With Hand-held Spectral Domain Optical Coherence Tomography

Chintan Malhotra, MS; Rohit Shetty, DNB, FRCS (Glasgow); Rajesh S. Kumar, MS; Himabindu Veluri, MS; Harsha Nagaraj, MS; K. Bhujang Shetty, MS

ORIGINAL ARTICLE

Corneal Confocal Microscopy Following Conventional, Transepithelial, and Accelerated Corneal Collagen Cross-linking Procedures for Keratoconus

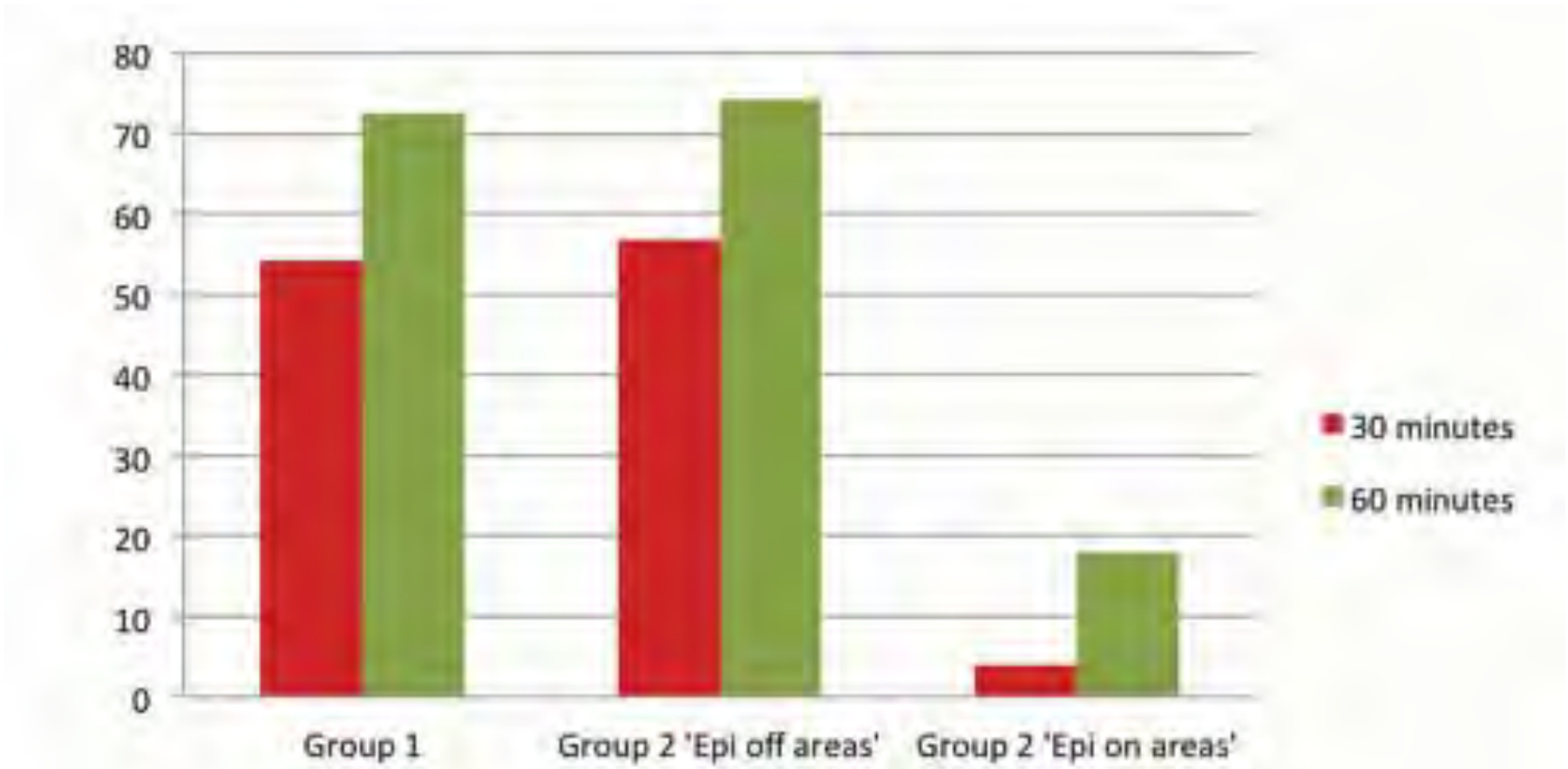
David Touboul, MD; Nathan Efron, PhD, DSc; David Smadja, MD; Caroline Garra; Delphine Praud; Florence Malet, MD; Joseph Colin, MD

Epithelium MUST be removed for efficacy

ORIGINAL ARTICLE

In Vivo Imaging of Riboflavin Penetration During Collagen Cross-linking With Hand-held Spectral Domain Optical Coherence Tomography

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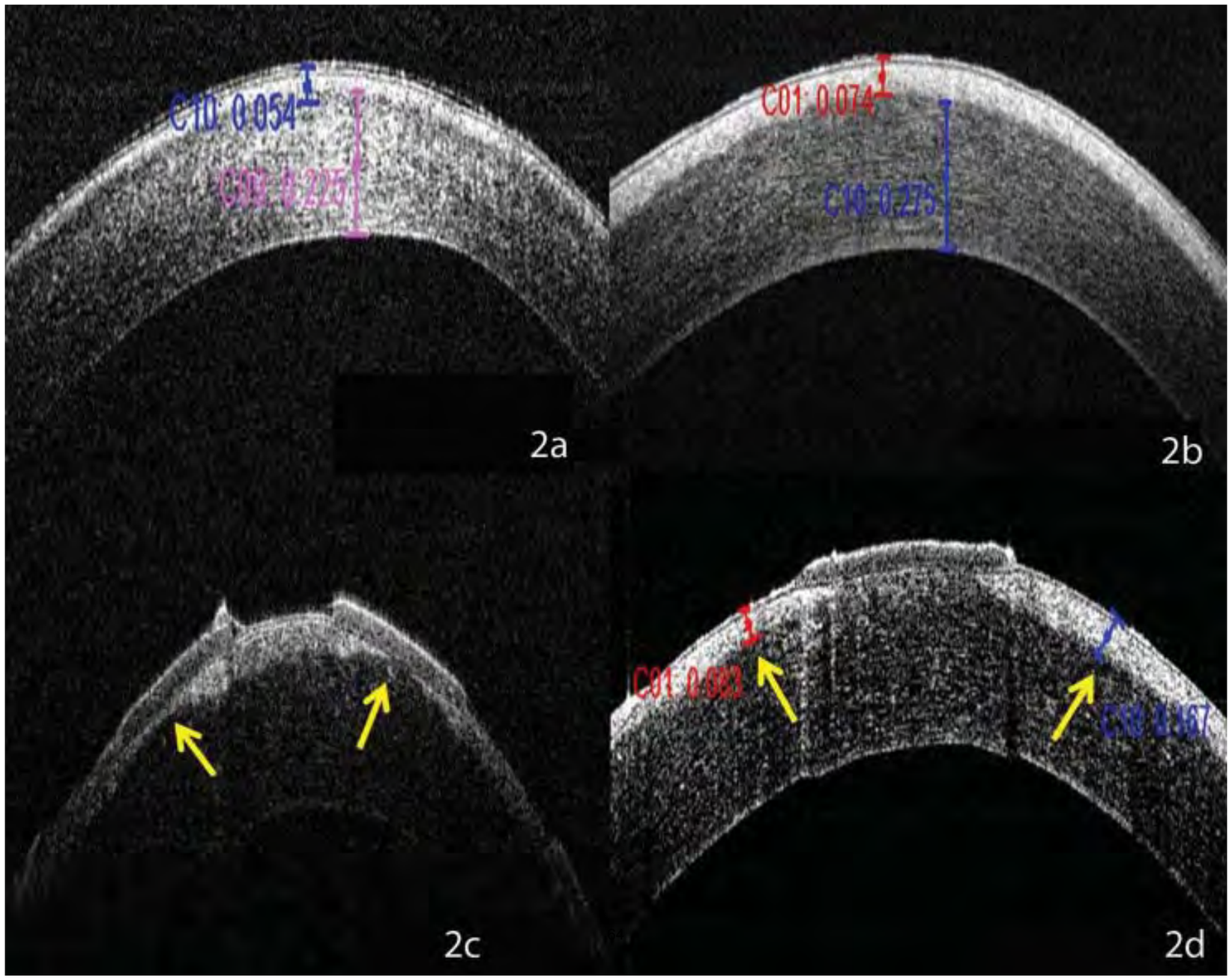


Group 1: Epithelium removed completely
Group 2: Epithelium removed in grid pattern

ORIGINAL ARTICLE

In Vivo Imaging of Riboflavin Penetration During Collagen Cross-linking With Hand-held Spectral Domain Optical Coherence Tomography

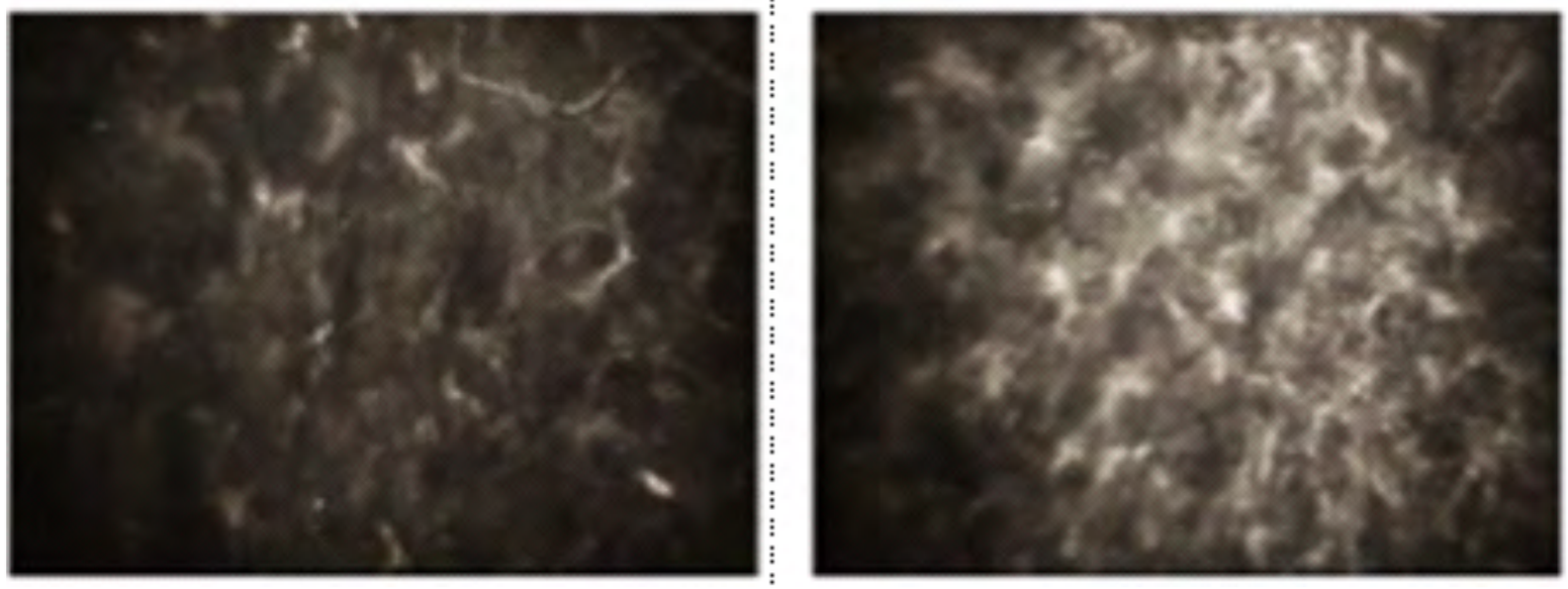
Chintan Malhotra, MS; Rohit Shetty, DNB, FRCS (Glasgow); Rajesh S. Kumar, MS; Himabindu Veluri, MS; Harsha Nagaraj, MS; K. Bhujang Shetty, MS



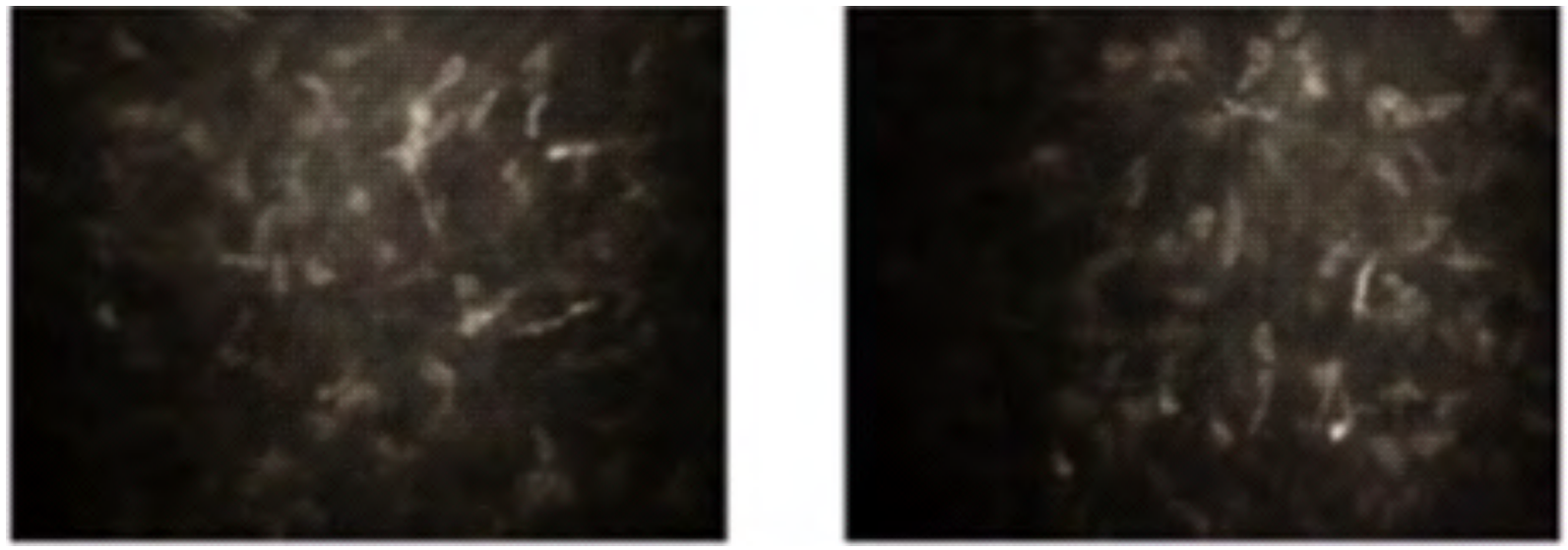
EPITHELIUM ON OR OFF?

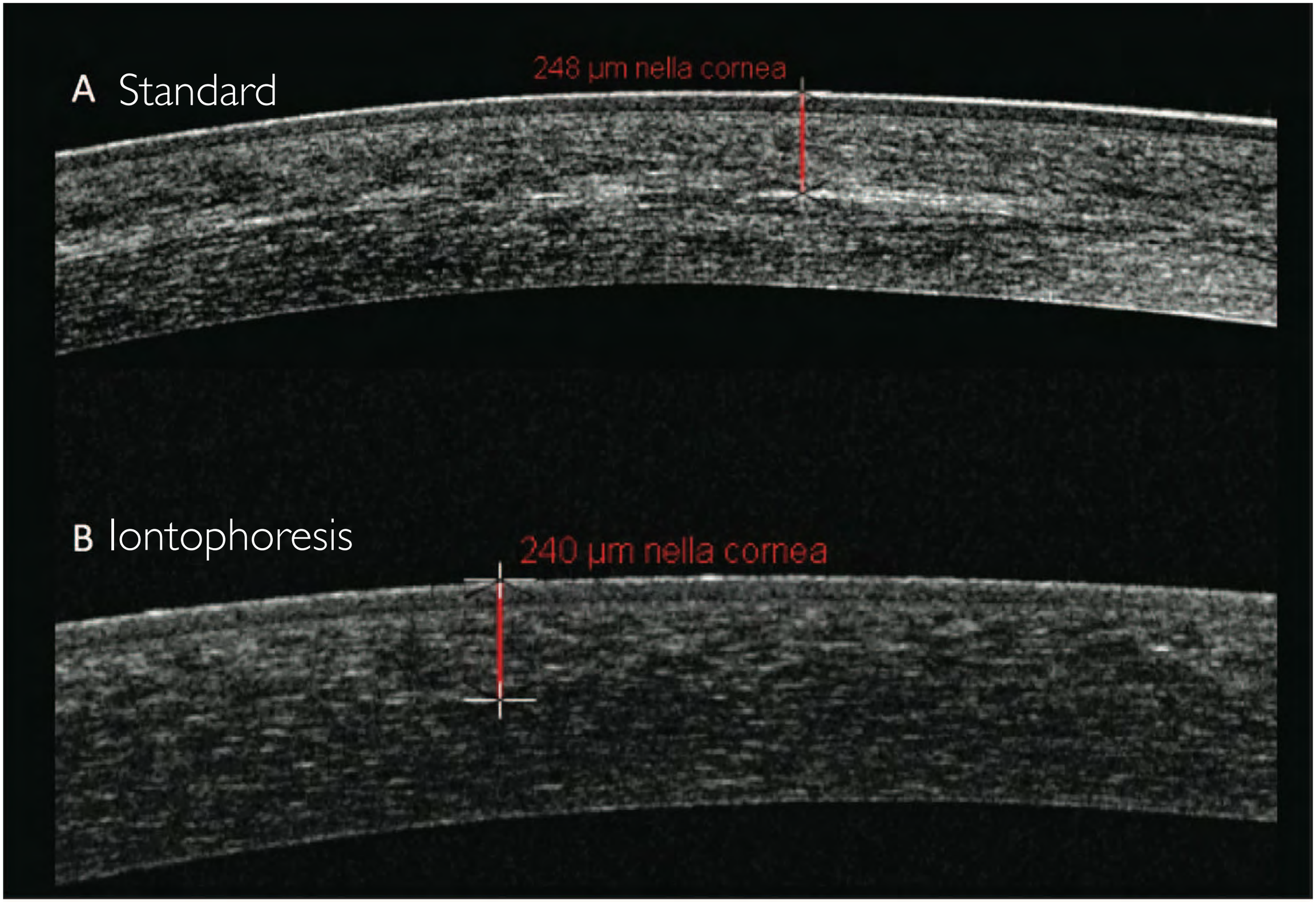
- **Epithelium must be removed for efficacy**

Epi Off



Epi On

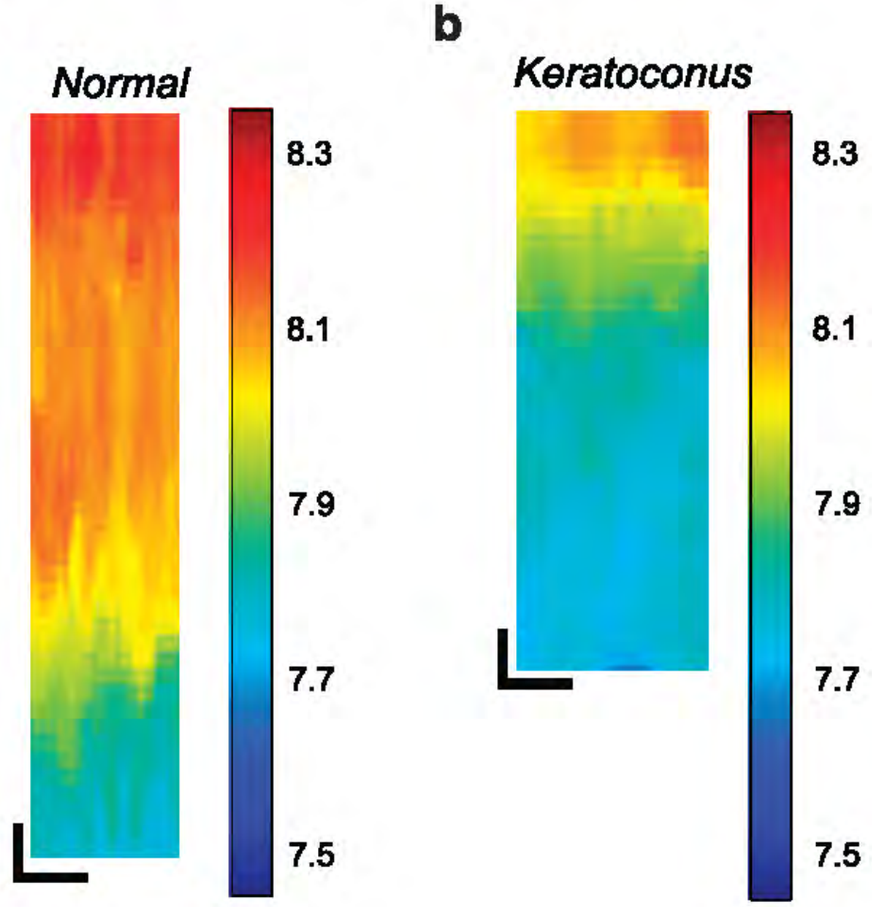



A Standard
248 µm nella cornea
B Iontophoresis
240 µm nella cornea

Biomechanical Characterization of Keratoconus Corneas Ex Vivo With Brillouin Microscopy

Giuliano Scarcelli,[1,2] Sebastien Besner,[1,2] Roberto Pineda,[3] and Seok Hyun Yun[1,2,4]

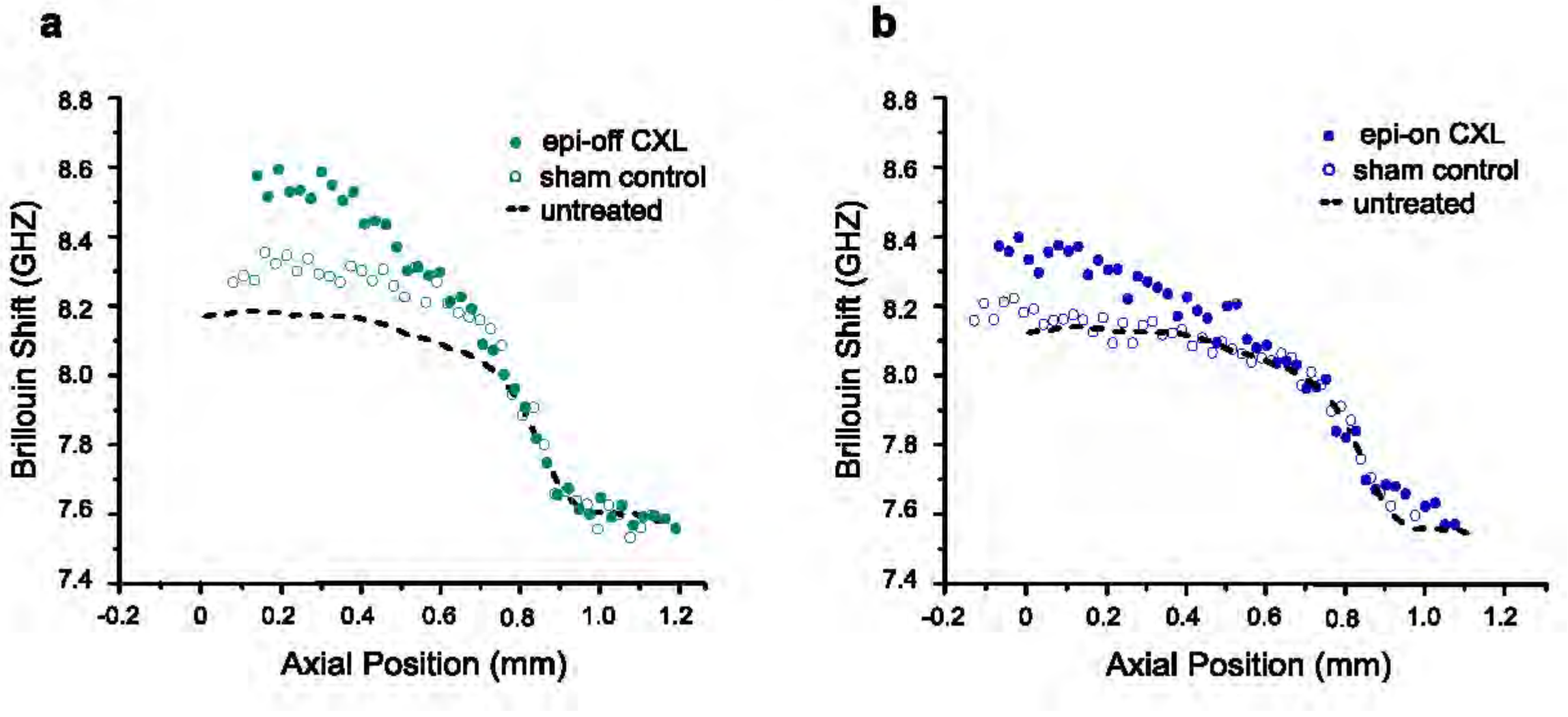
[1]Wellman Center for Photomedicine, Massachusetts General Hospital, Cambridge, Massachusetts, United States
[2]Department of Dermatology, Harvard Medical School, Boston, Massachusetts, United States
[3]Department of Ophthalmology, Massachusetts Eye and Ear Infirmary, Boston, Massachusetts, United States
[4]Harvard-MIT Health Sciences and Technology, Cambridge, Massachusetts, United States



Brillouin Microscopy of Collagen Crosslinking: Noncontact Depth-Dependent Analysis of Corneal Elastic Modulus

Giuliano Scarcelli,[1,2] *Sabine Kling,*[3] *Elena Quijano,*[1] *Roberto Pineda,*[4] *Susana Marcos,*[3] *and Seok Hyun Yun*[1,2,5]

(*Invest Ophthalmol Vis Sci.* 2013;54:1418–1425)



The Efficacy of Corneal Cross-Linking Shows a Sudden Decrease with Very High Intensity UV Light and Short Treatment Time

Jeremy Wernli,[1] *Silvia Schumacher,*[1] *Eberhard Spoerl,*[2] *and Michael Mrochen*[1]

(*Invest Ophthalmol Vis Sci.* 2013;54:1176–1180)

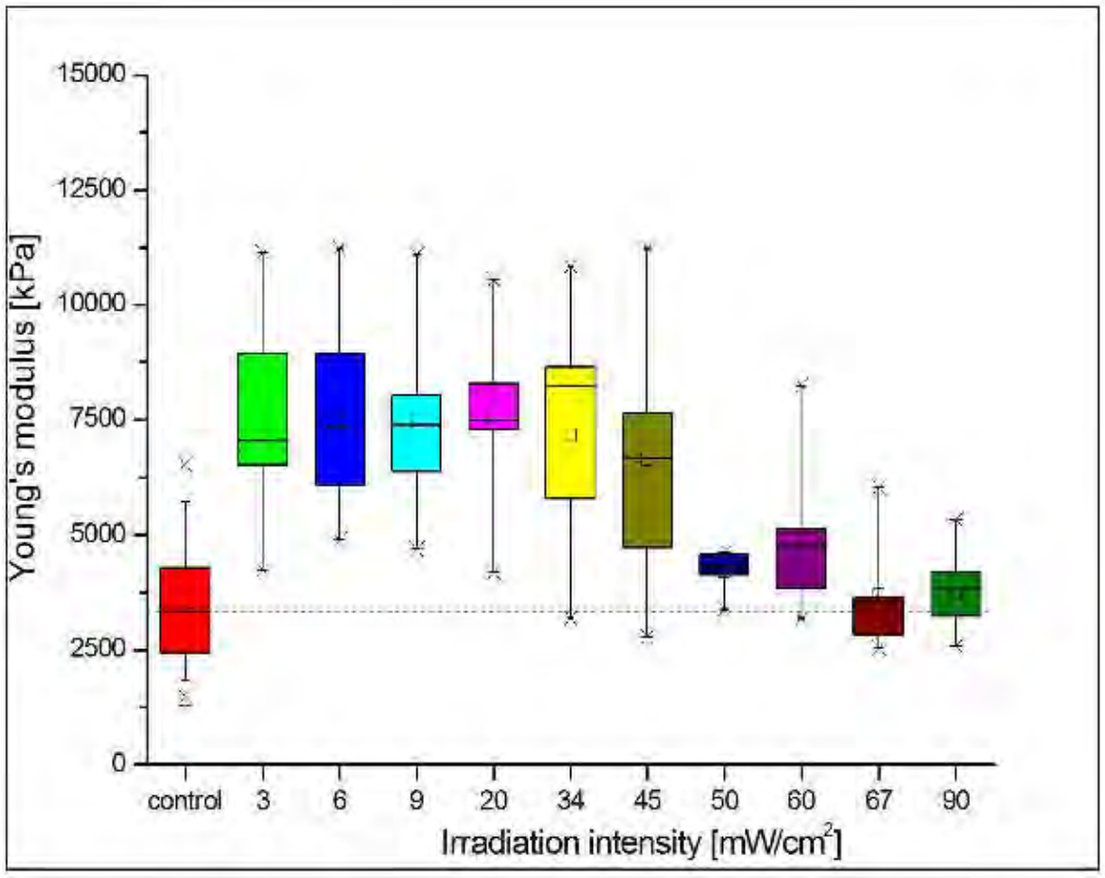


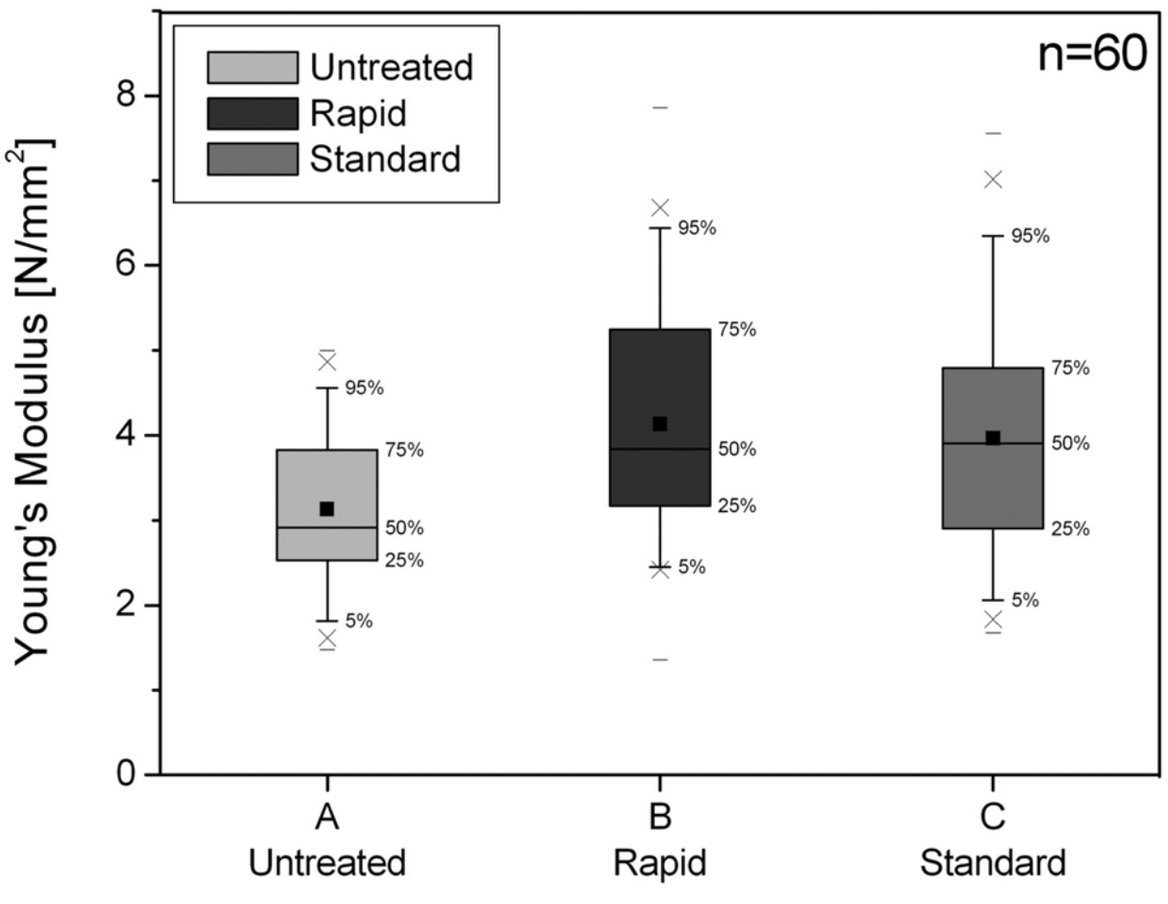
FIGURE 3. Young's moduli at 10% strain for the control and different treatment groups. Box plot whiskers indicate the fifth and the 95th percentiles, *crosses* (x) indicate the first and the 99th percentiles and *dashes* (-) indicate the minimum and maximum values within the groups.

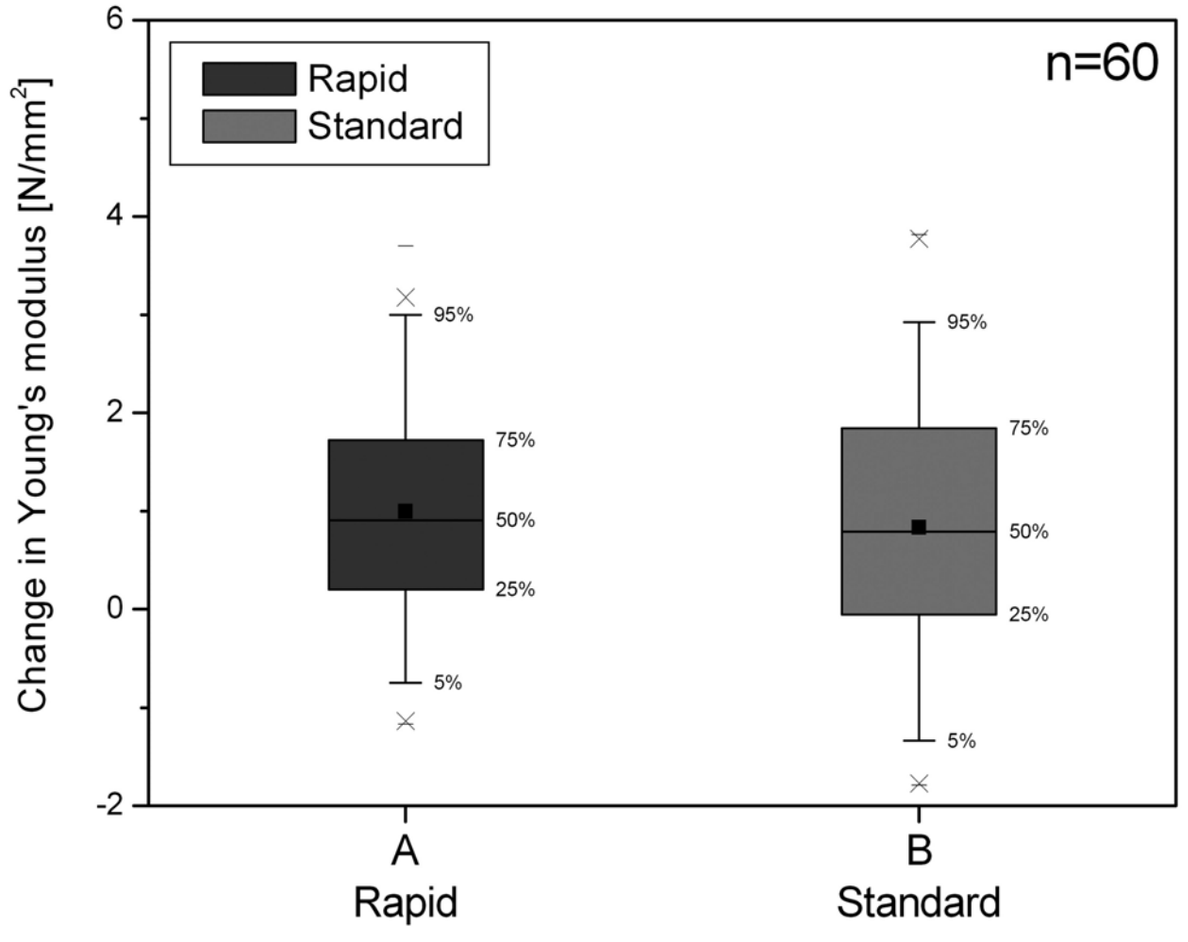
Cornea

Equivalence of Biomechanical Changes Induced by Rapid and Standard Corneal Cross-linking, Using Riboflavin and Ultraviolet Radiation

Silvia Schumacher, Lydia Oeftiger, and Michael Mrochen

(*Invest Ophthalmol Vis Sci.* 2011;52: 9048-9052)





Corneal Biomechanical Properties at Different Corneal Cross-Linking (CXL) Irradiances

Arthur Hammer,[1] Olivier Richoz,[1] Samuel Arba Mosquera,[2] David Tabibian,[1] Florence Hoogewoud,[1] and Farhad Hafezi[1,3]

[1]Department of Ophthalmology, Geneva University Hospitals, Geneva, Switzerland
[2]SCHWIND eye-tech-solutions, Kleinostheim, Germany
[3]Doheny Eye Institute, Keck School of Medicine, University of Southern California, Los Angeles, California, United States

Invest Ophthalmol Vis Sci. 2014;55:2881–2884.

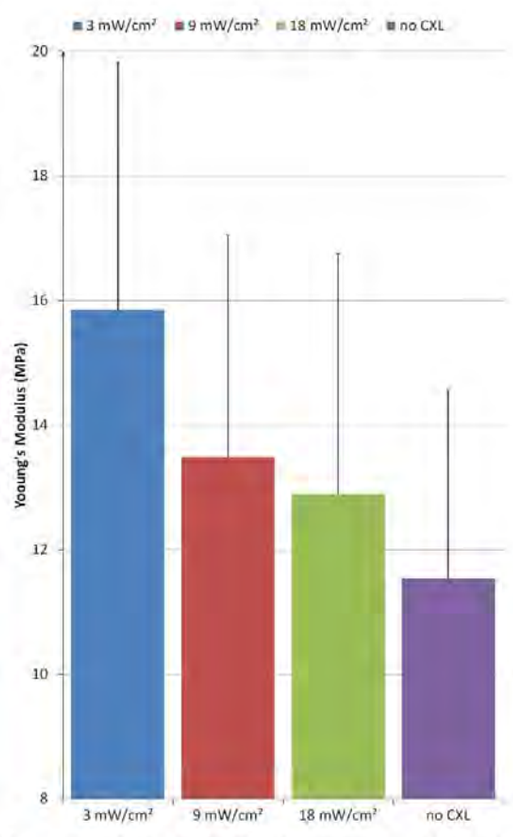
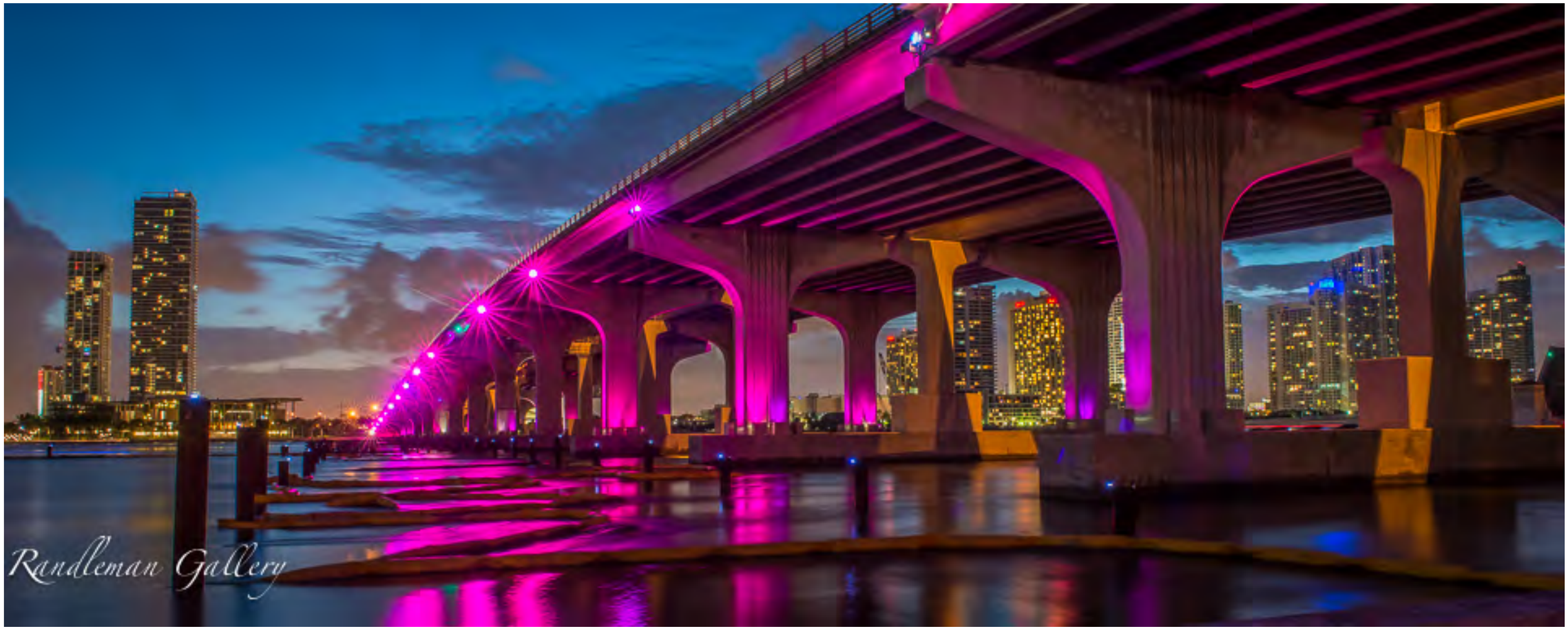


FIGURE. Young's Modulus by 10% of strain at different UV-A light irradiances. 3 mW/cm² of irradiance (*blue*), 9 mW/cm² of irradiance (*red*), and 18 mW/cm² of irradiance (*green*), control group (*purple*).

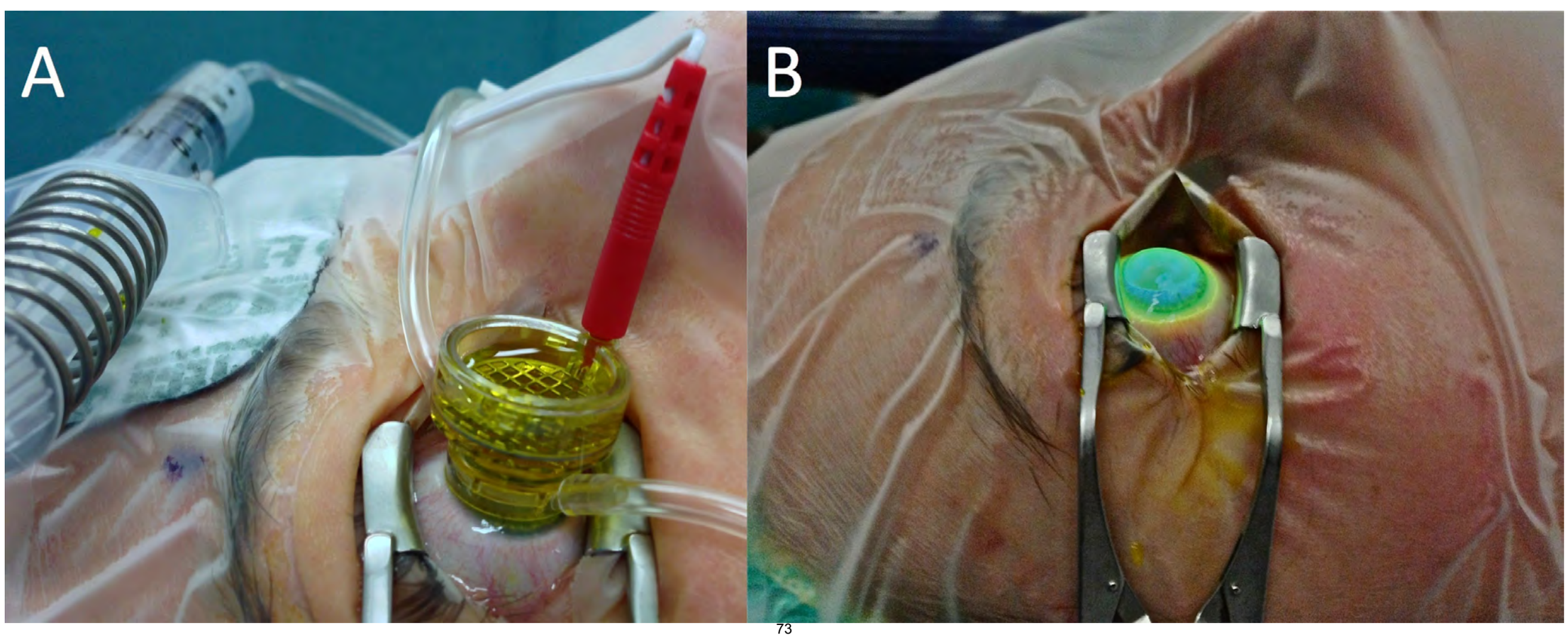


CXL CLINICAL EFFICACY

Transepithelial Iontophoresis Corneal Collagen Cross-linking for Progressive Keratoconus: Initial Clinical Outcomes

Paolo Vinciguerra, MD; J. Bradley Randleman, MD; Vito Romano, MD; Emanuela F. Legrottaglie, MD; Pietro Rosetta, MD; Fabrizio I. Camesasca, MD; Raffaele Piscopo, MD; Claudio Azzolini, MD; Riccardo Vinciguerra, MD

[*J Refract Surg.* 2014;30(11):746-753.]



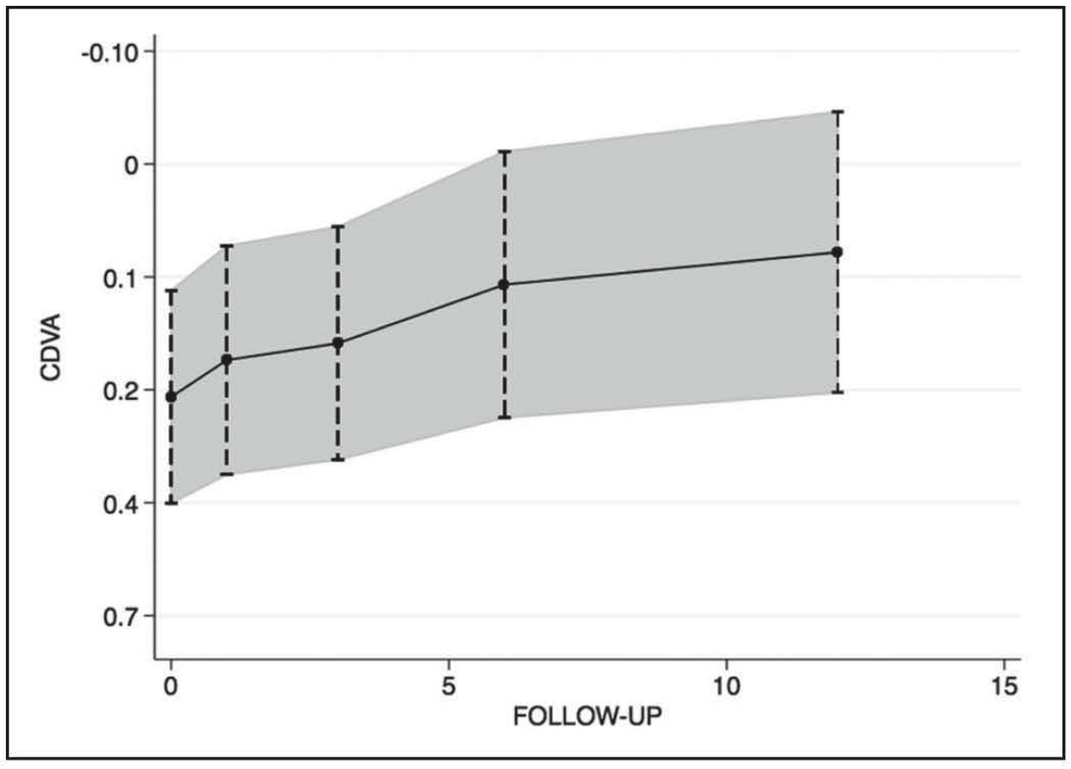
SURGICAL TECHNIQUE

Transepithelial Iontophoresis Corneal Collagen Cross-linking for Progressive Keratoconus: Initial Clinical Outcomes

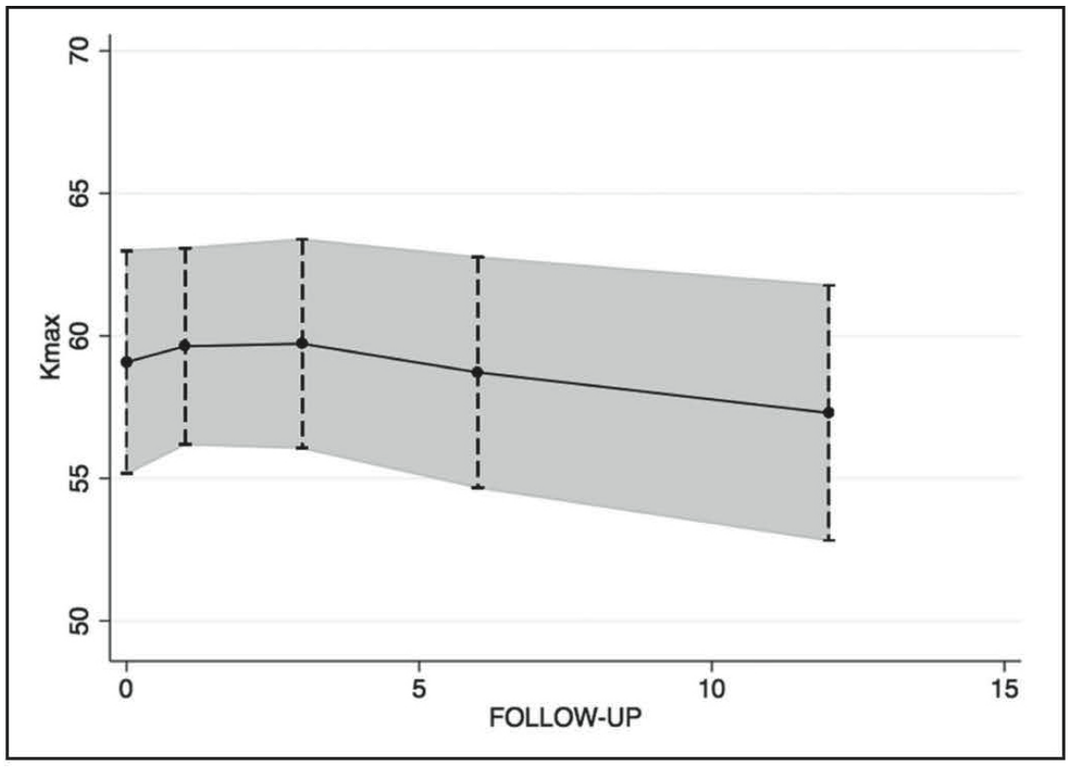
Paolo Vinciguerra, MD; J. Bradley Randleman, MD; Vito Romano, MD; Emanuela F. Legrottaglie, MD; Pietro Rosetta, MD; Fabrizio I. Camesasca, MD; Raffaele Piscopo, MD; Claudio Azzolini, MD; Riccardo Vinciguerra, MD

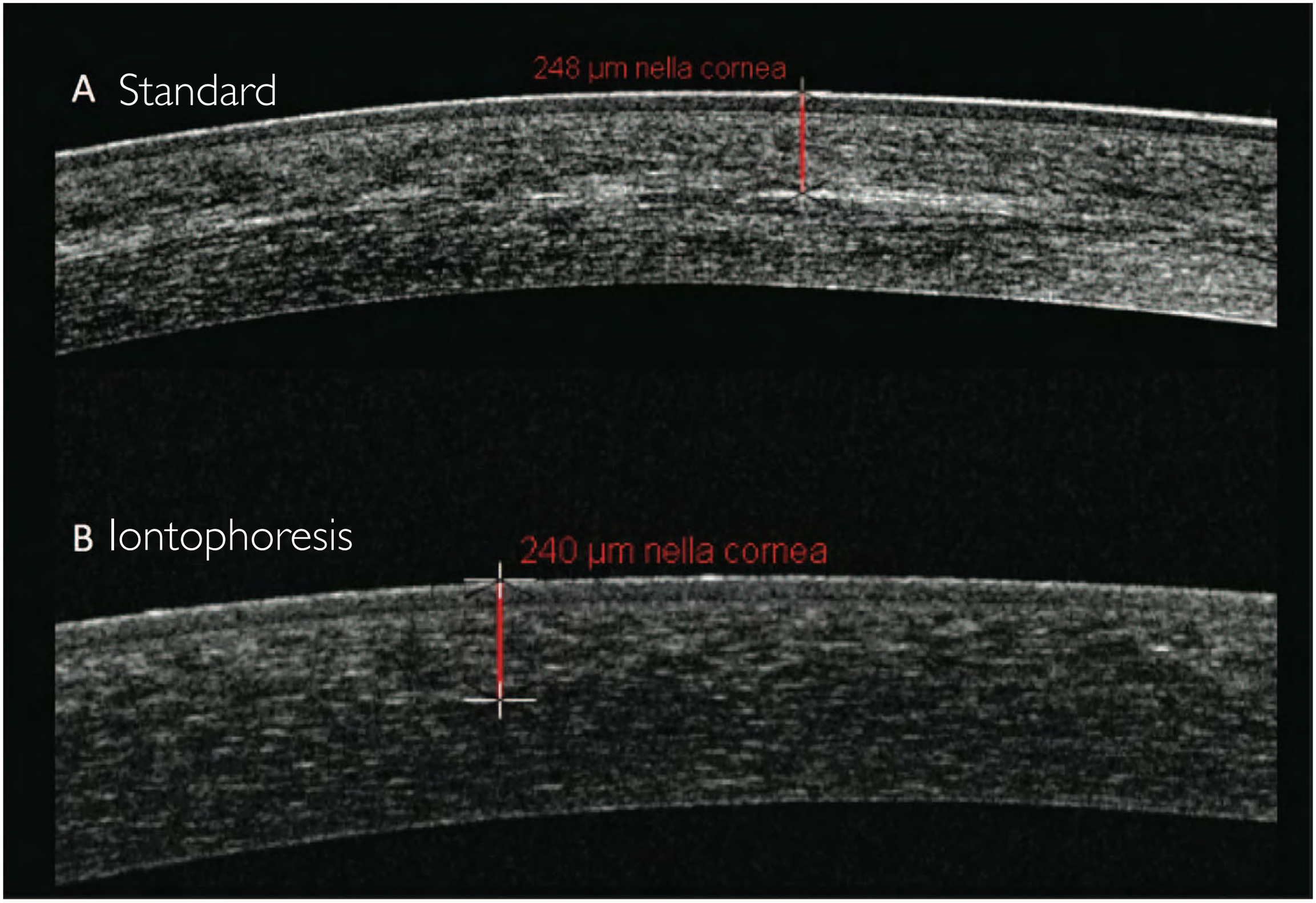
[*J Refract Surg.* 2014;30(11):746-753.]

CDVA



KMax




A Standard
248 µm nella cornea
B Iontophoresis
240 µm nella cornea

ARTICLE

Transepithelial versus epithelium-off crosslinking in adults with progressive keratoconus

Eren Çerman, MD, FEBOphth, Ebru Toker, MD, Deniz Ozarslan Ozcan, MD

J Cataract Refract Surg 2015; 41:1416–1425

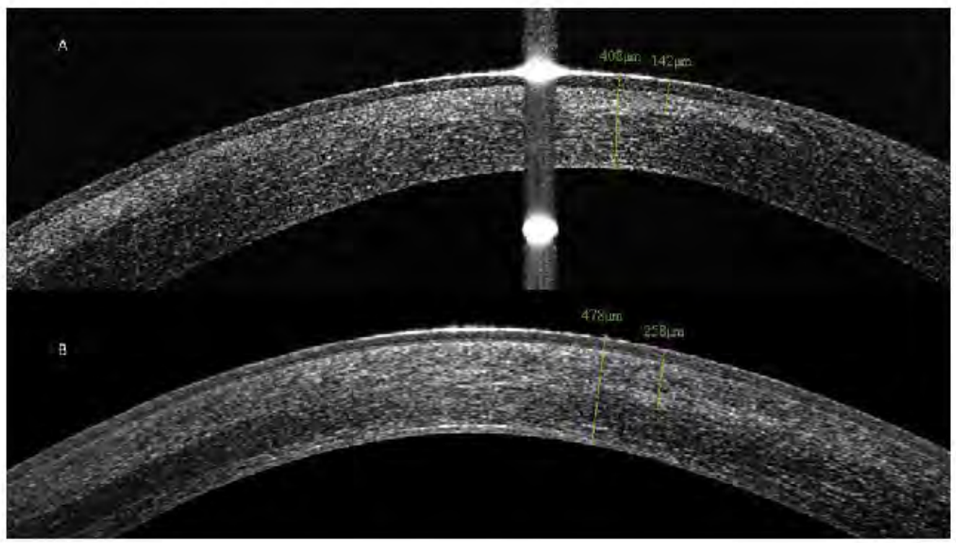


Figure 5. Stromal demarcation line after transepithelial CXL (*A*) and epithelium-off CXL (*B*).

Transepithelial versus epithelium-off crosslinking in adults with progressive keratoconus

Eren Çerman, MD, FEBOphth, Ebru Toker, MD, Deniz Ozarslan Ozcan, MD

J Cataract Refract Surg 2015; 41:1416–1425

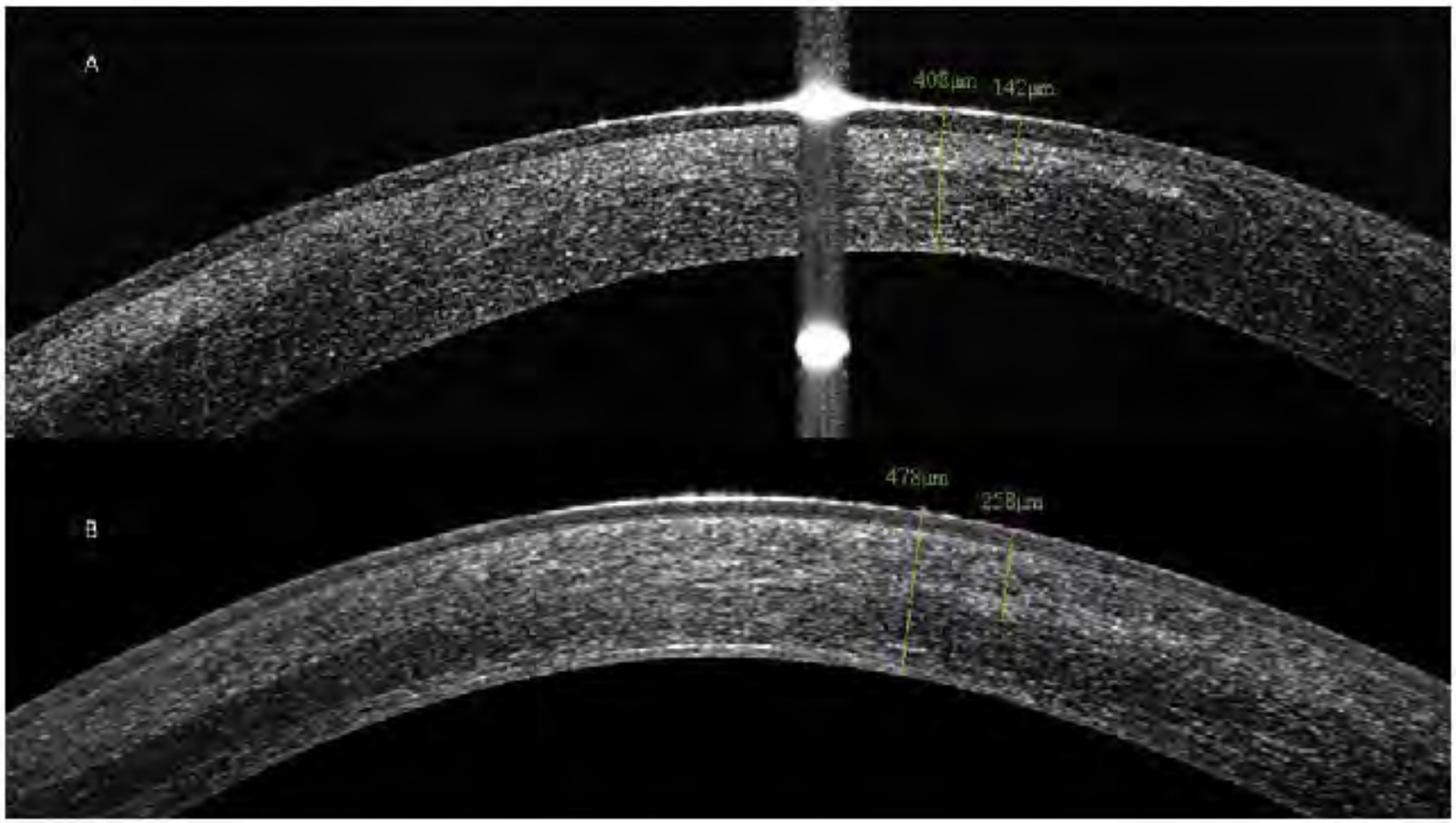


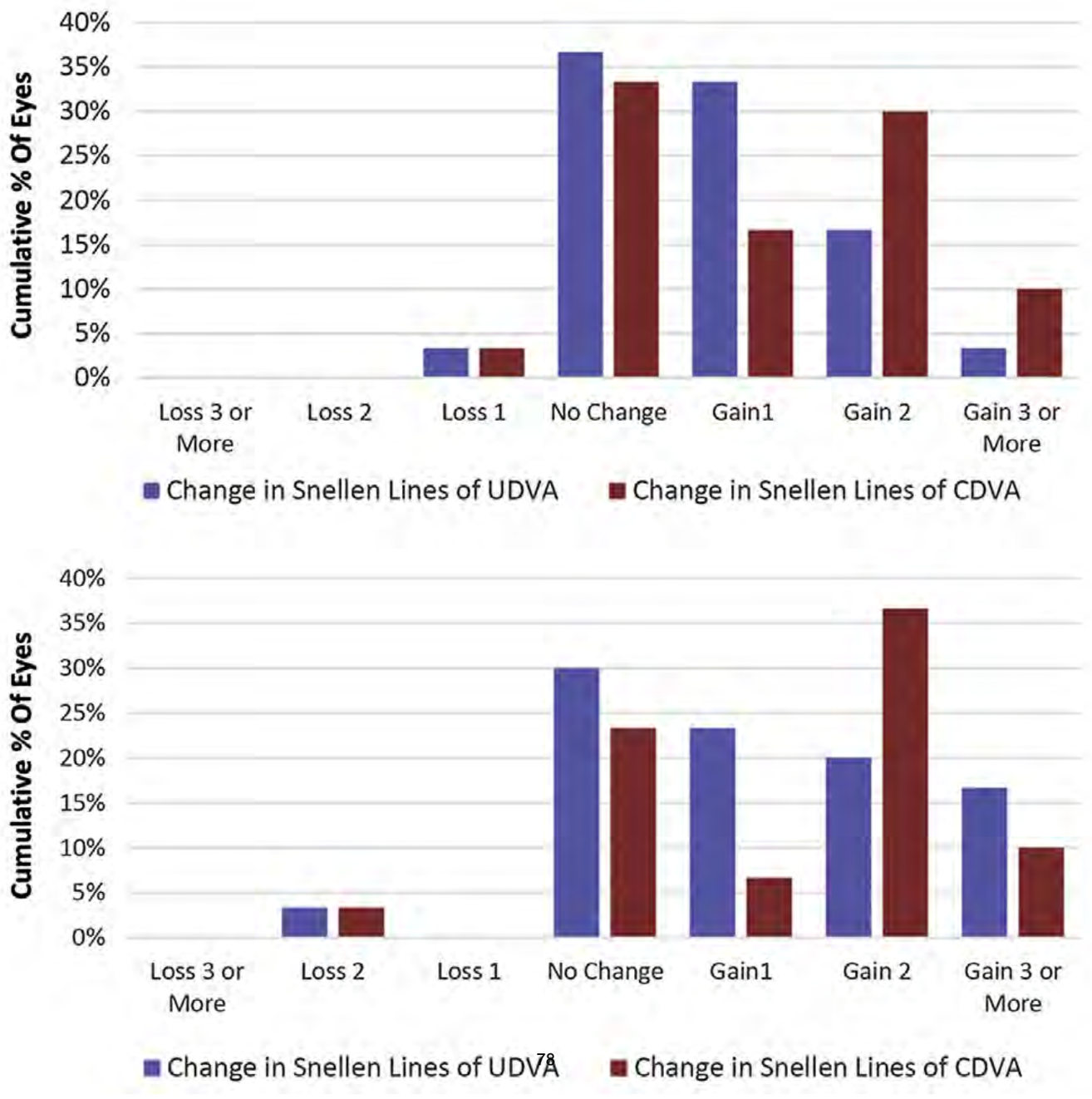
Figure 5. Stromal demarcation line after transepithelial CXL (*A*) and epithelium-off CXL (*B*).

ARTICLE

Transepithelial versus epithelium-off crosslinking in adults with progressive keratoconus

Eren Çerman, MD, FEBOphth, Ebru Toker, MD, Deniz Ozarslan Ozcan, MD

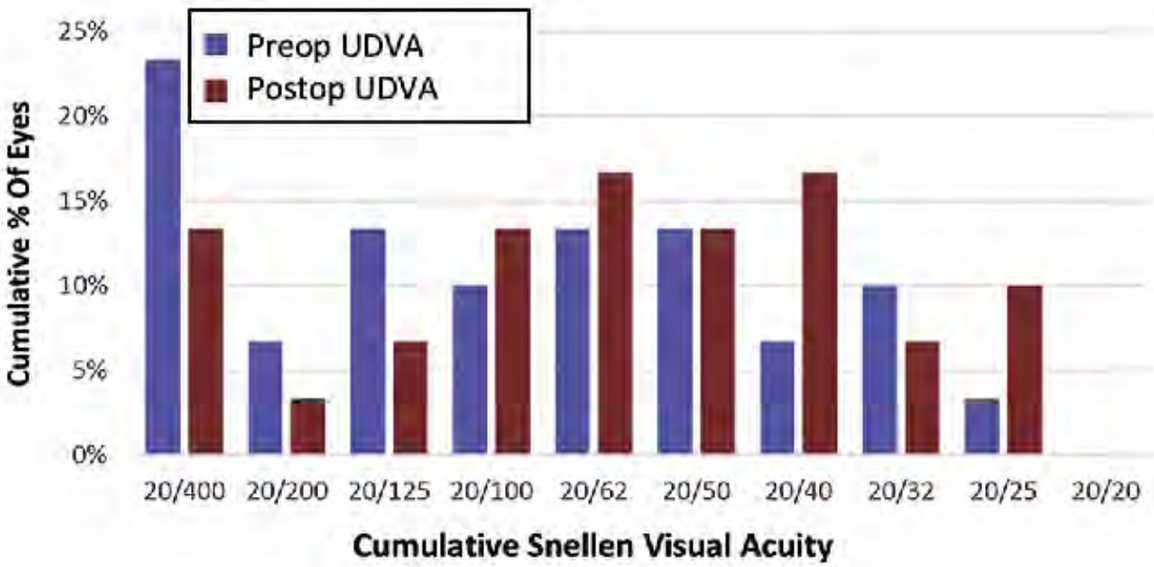
J Cataract Refract Surg 2015; 41:1416–1425



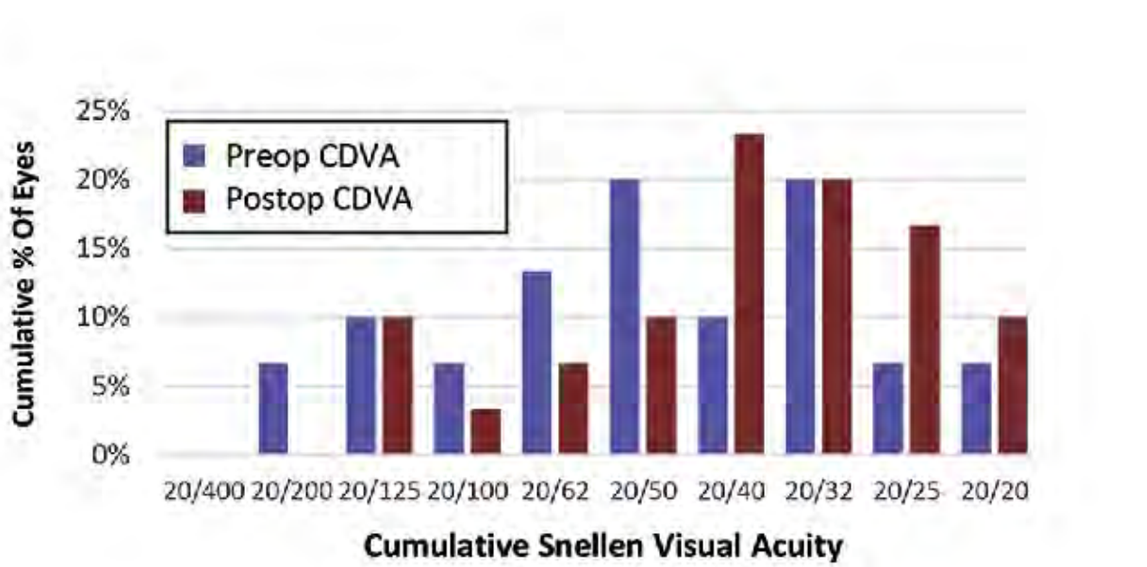
Transepithelial versus epithelium-off crosslinking in adults with progressive keratoconus

Eren Çerman, MD, FEBOphth, Ebru Toker, MD, Deniz Ozarslan Ozcan, MD

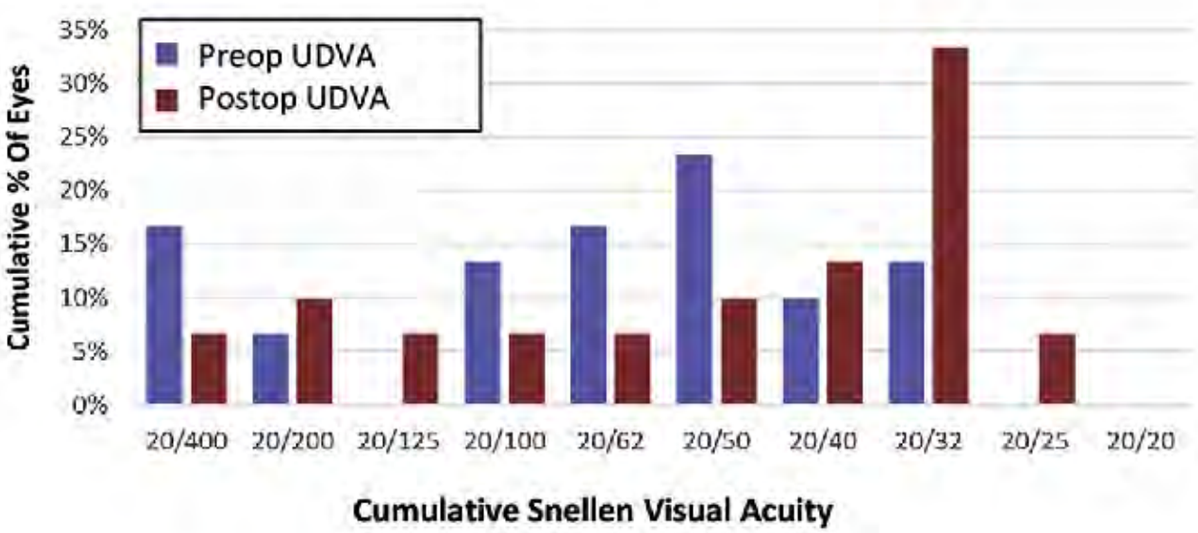
J Cataract Refract Surg 2015; 41:1416–1425



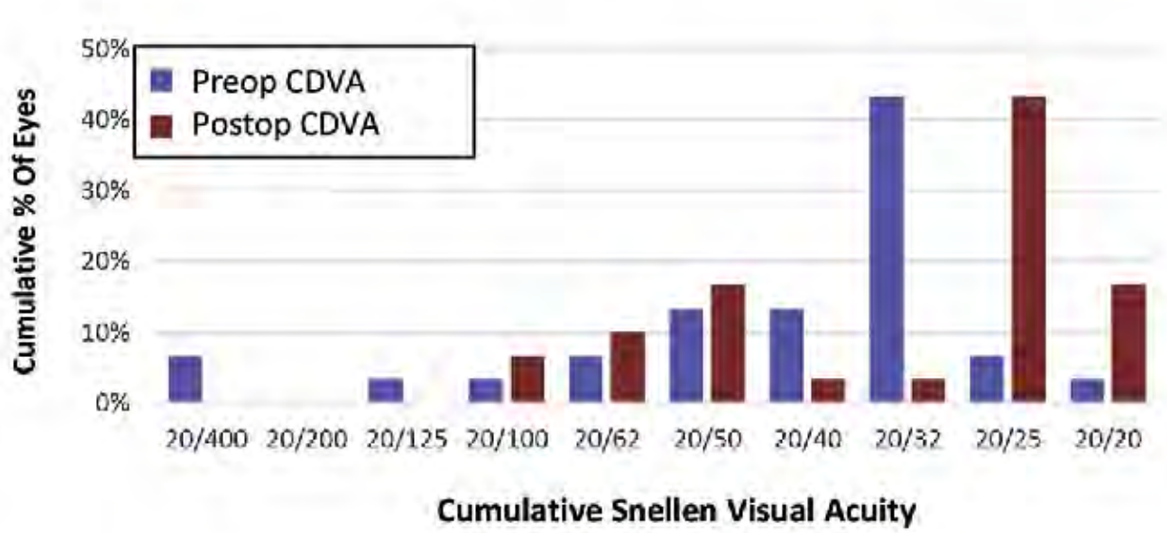
A



B



C



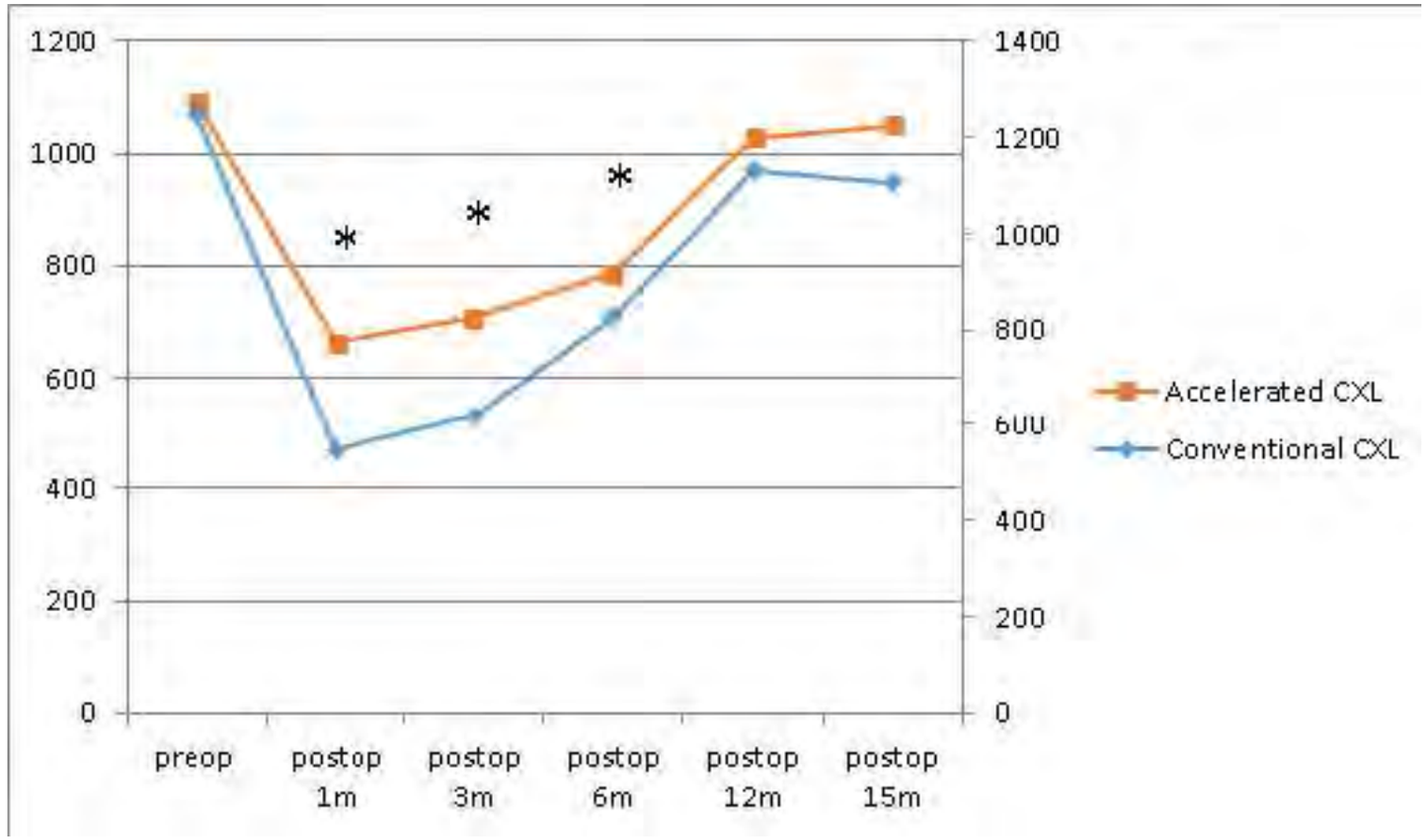
D

ORIGINAL ARTICLE

Evaluation of Corneal Changes After Conventional Versus Accelerated Corneal Cross-linking: A Randomized Controlled Trial

Mahmoud Jabbarvand; Hesam Hashemian; Mehdi Khodaparast; Kambiz Ameli

Equal:
CDVA
K
safety



JRS 2014 (in press)

Anterior keratocyte density



CXL FOR CORNEAL INFECTIONS

PACK-CXL: Defining CXL for Infectious Keratitis

Farhad Hafezi, MD, PhD; J. Bradley Randleman, MD





PACK-CXL

P hoto

A ctivated

C hromophore for

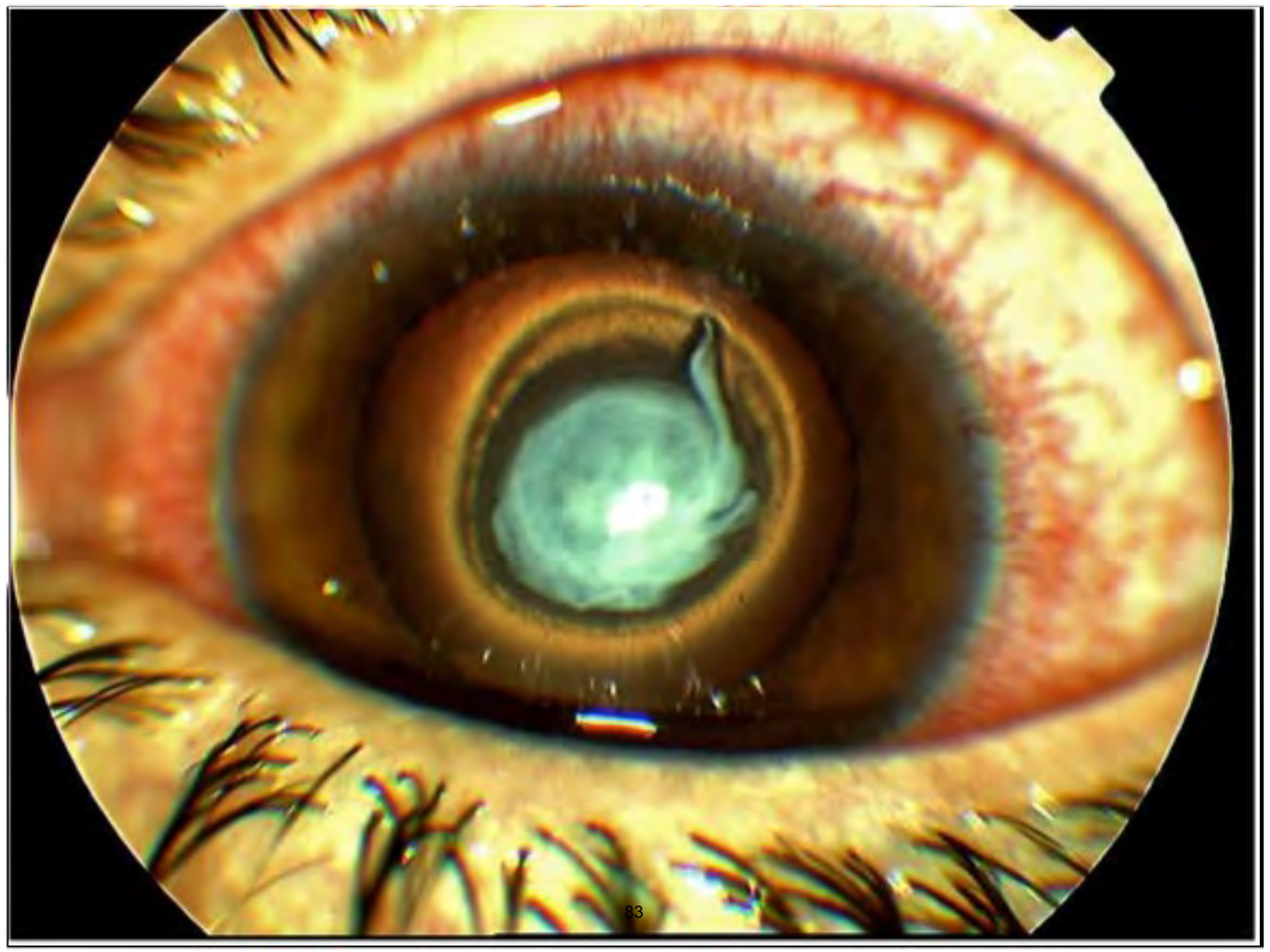
K eratitis

PACK-CXL: Defining CXL for Infectious Keratitis





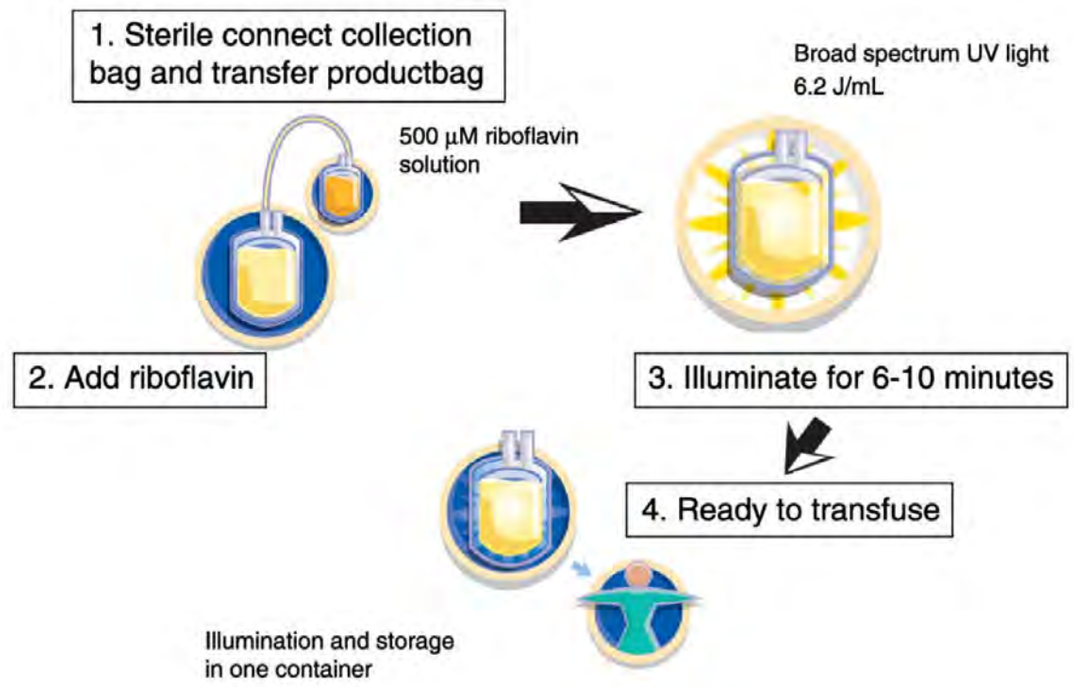
Farhad Hafezi, MD, PhD; J. Bradley Randleman, MD



UVA and riboflavin = disinfectant

Other uses in medicine



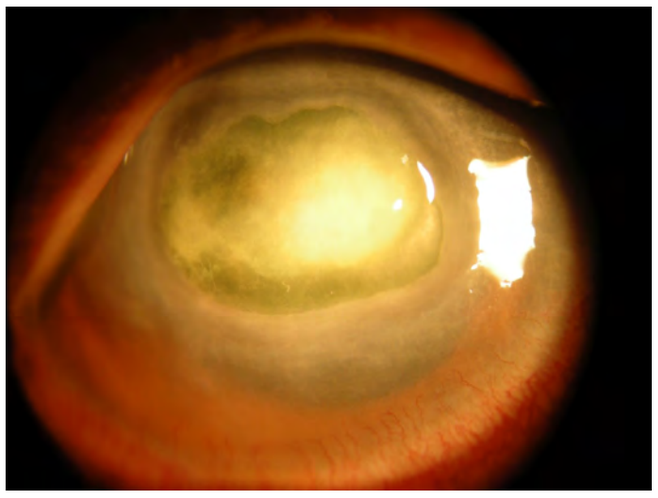


Reddy et al, 2008, Transfusion Med Rev

Infectious keratitis

New





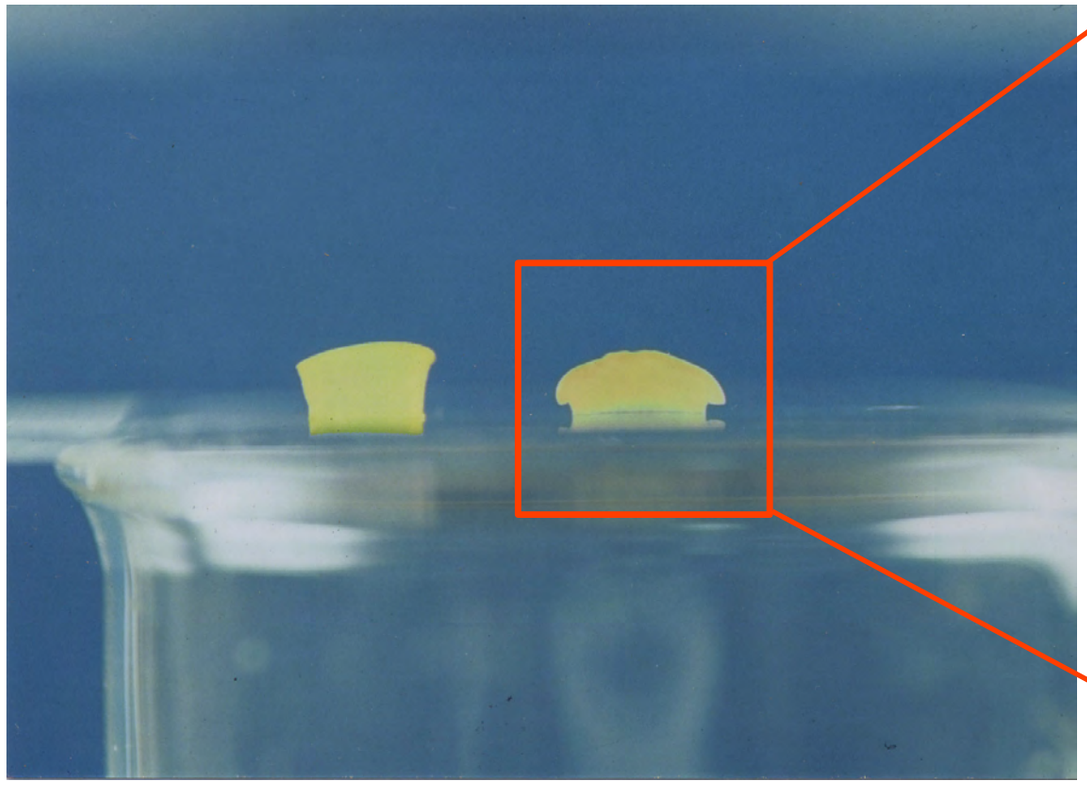
- 3rd leading cause of blindness (WHO)
- > 5 million new cases / year worldwide
- State of the art: Medication

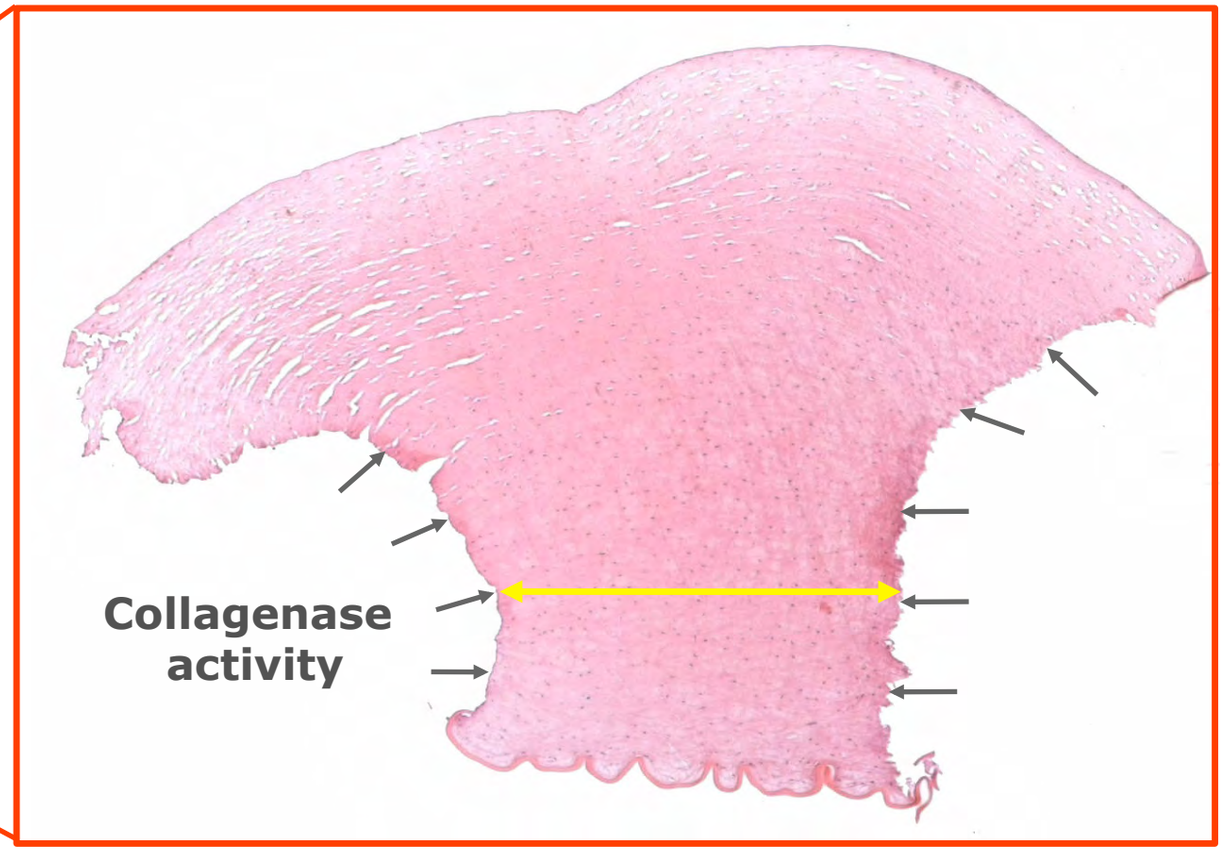
- Problems: diagnostic dilemma, expensive treatment, resistance to antibiotics
- CXL: Proof of concept given in 2008

Iseli et al, 2008, Cornea

PACK = disinfectant

1. Direct action: Irreversible binding to DNA via intercalation
2. Creation of ROS: cytotoxic effect
3. Modification of collagen structure.
   Increased resistance to enzymatic digestion.



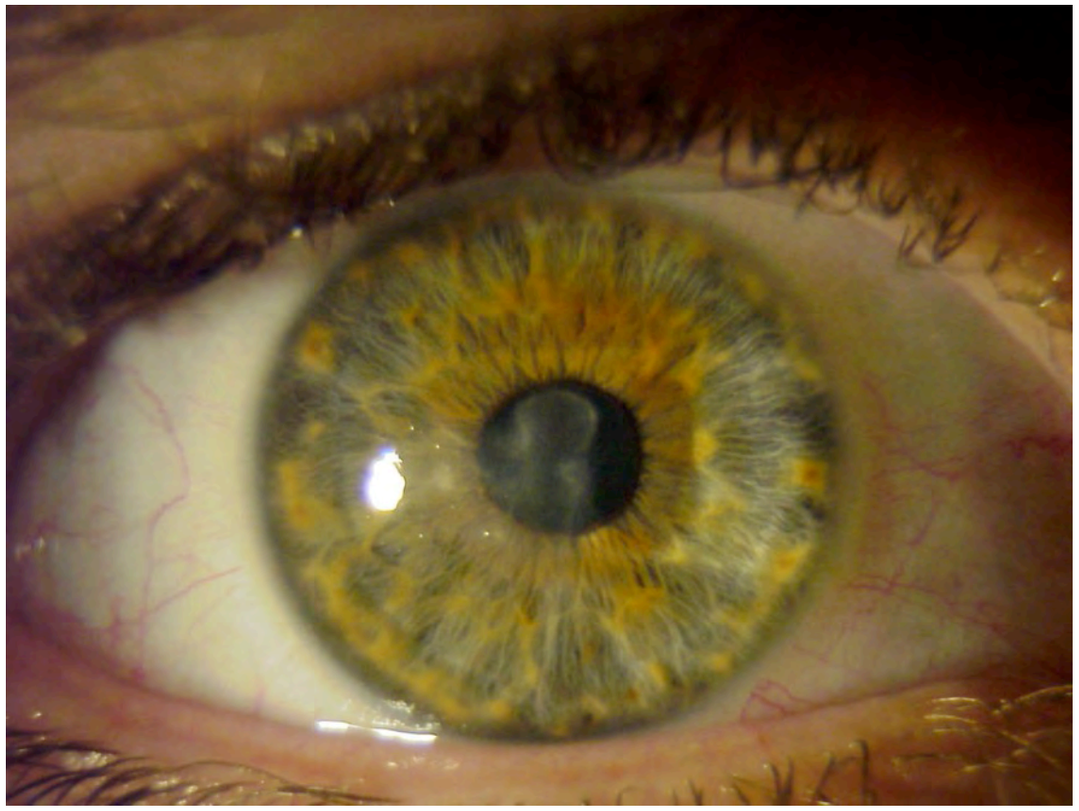


Spoerl et al, Cornea ,2008

2008: Proof of principle



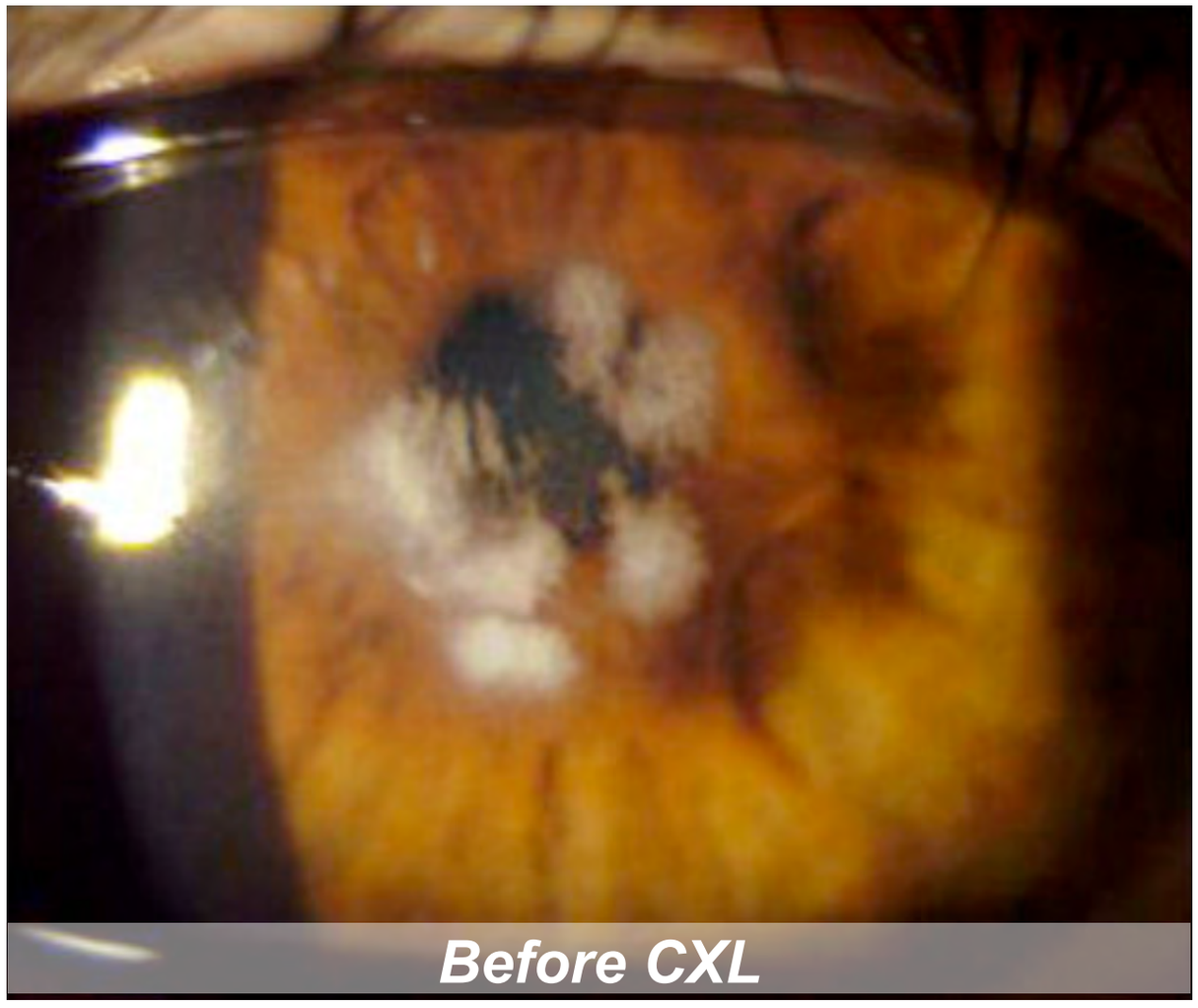
Post-LASIK keratitis



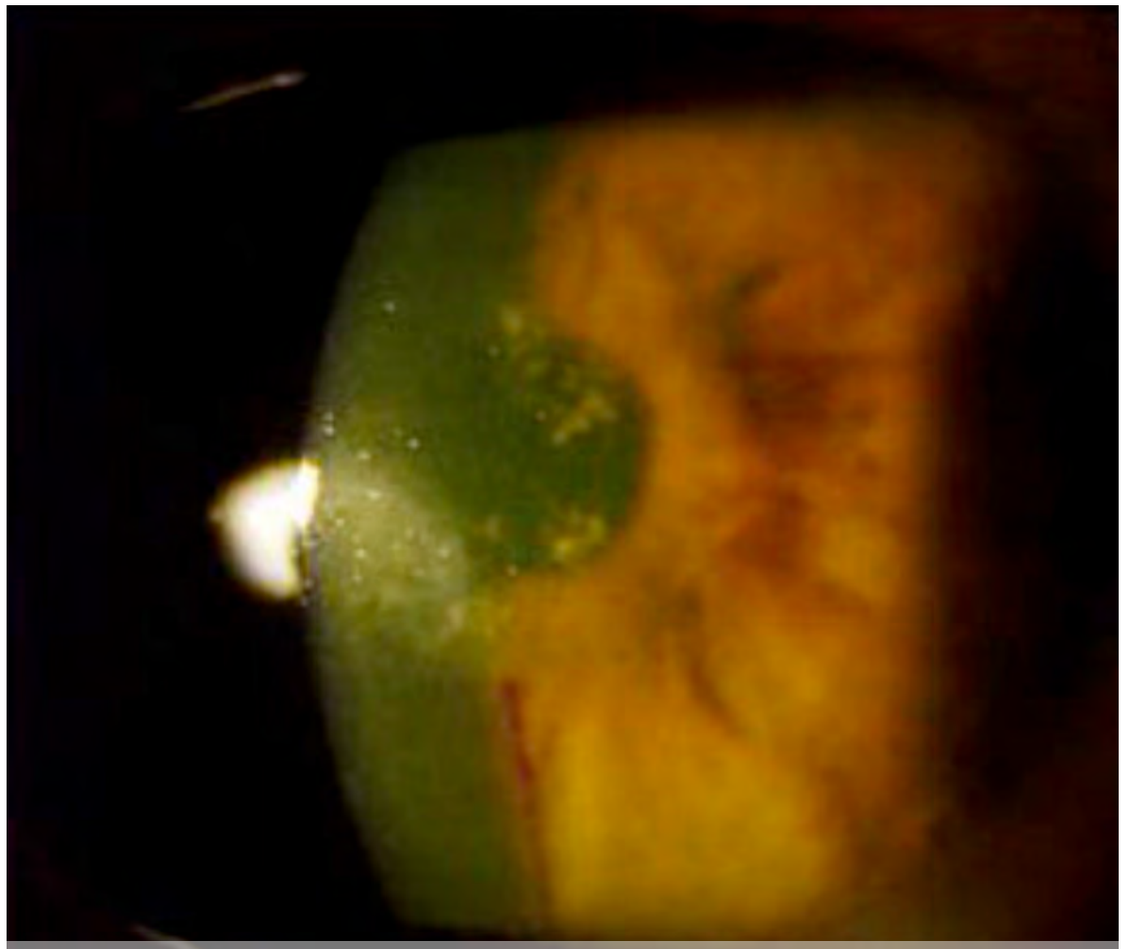
Ten days after CXL

Iseli et al., 2008, Cornea

2008: Proof of principle



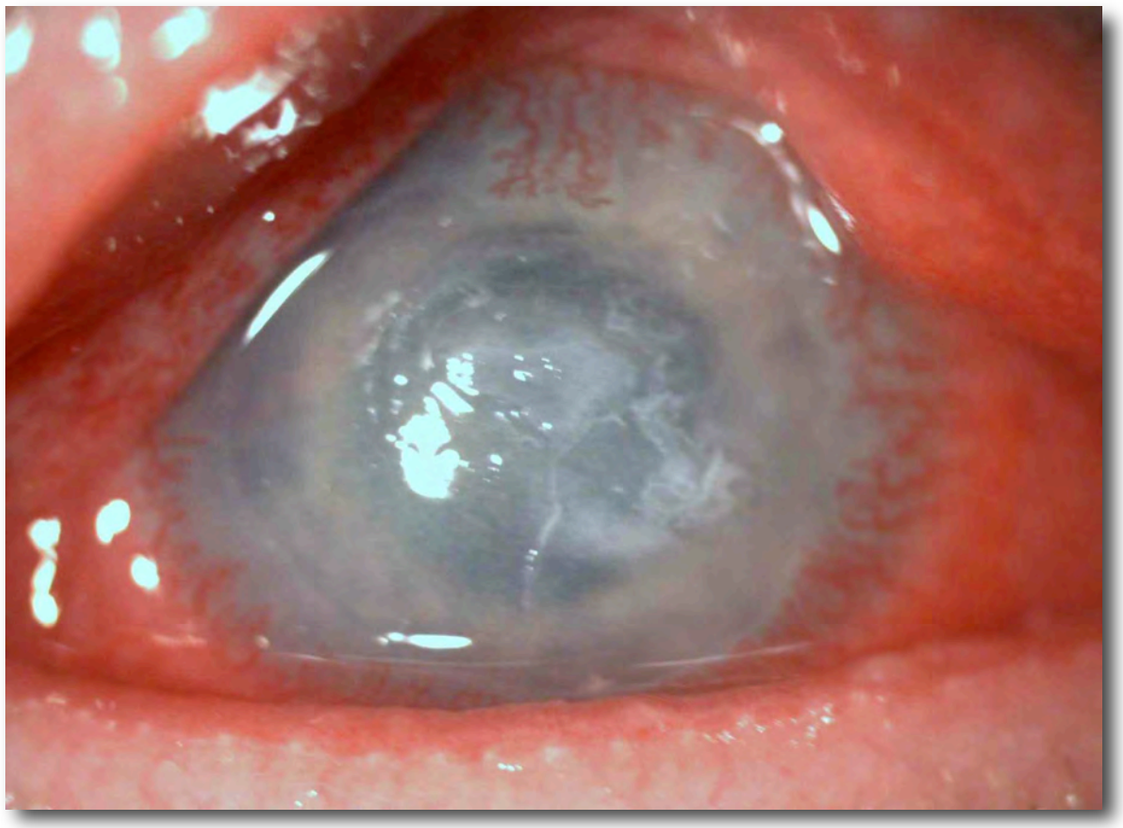
Before CXL



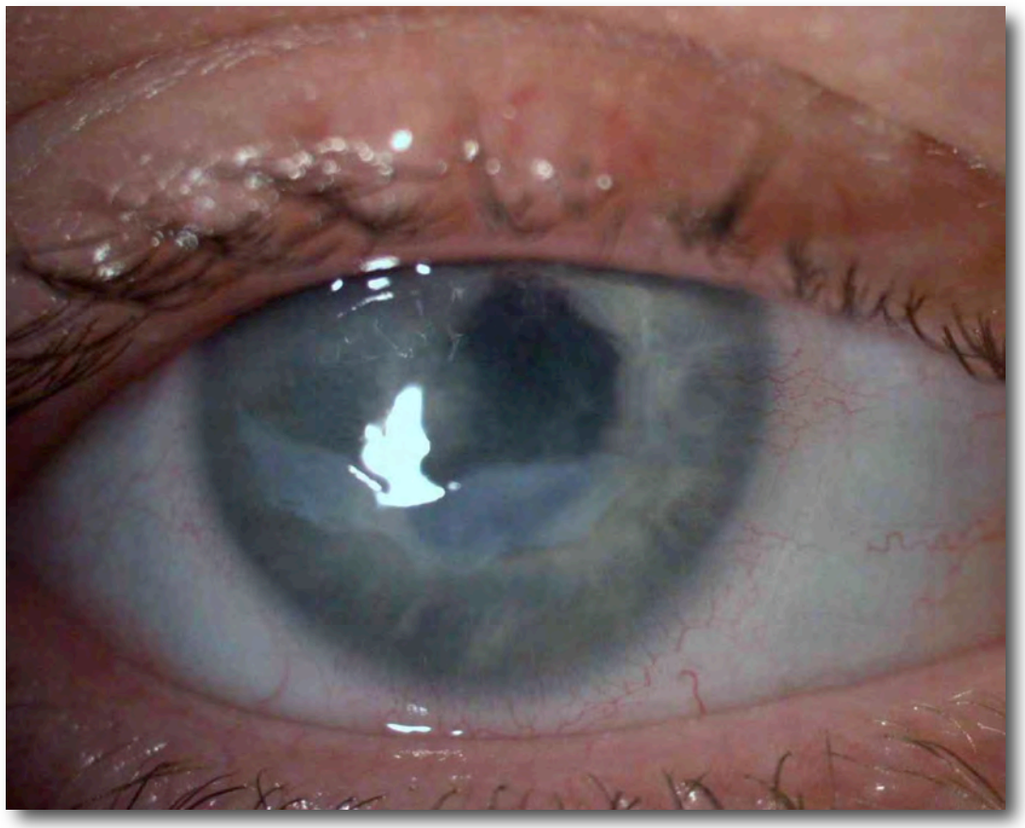
5 days after CXL

Iseli, Hafezi et Seiler, 2008, Cornea

2011: Confirmation by Swedish case series



Before CXL

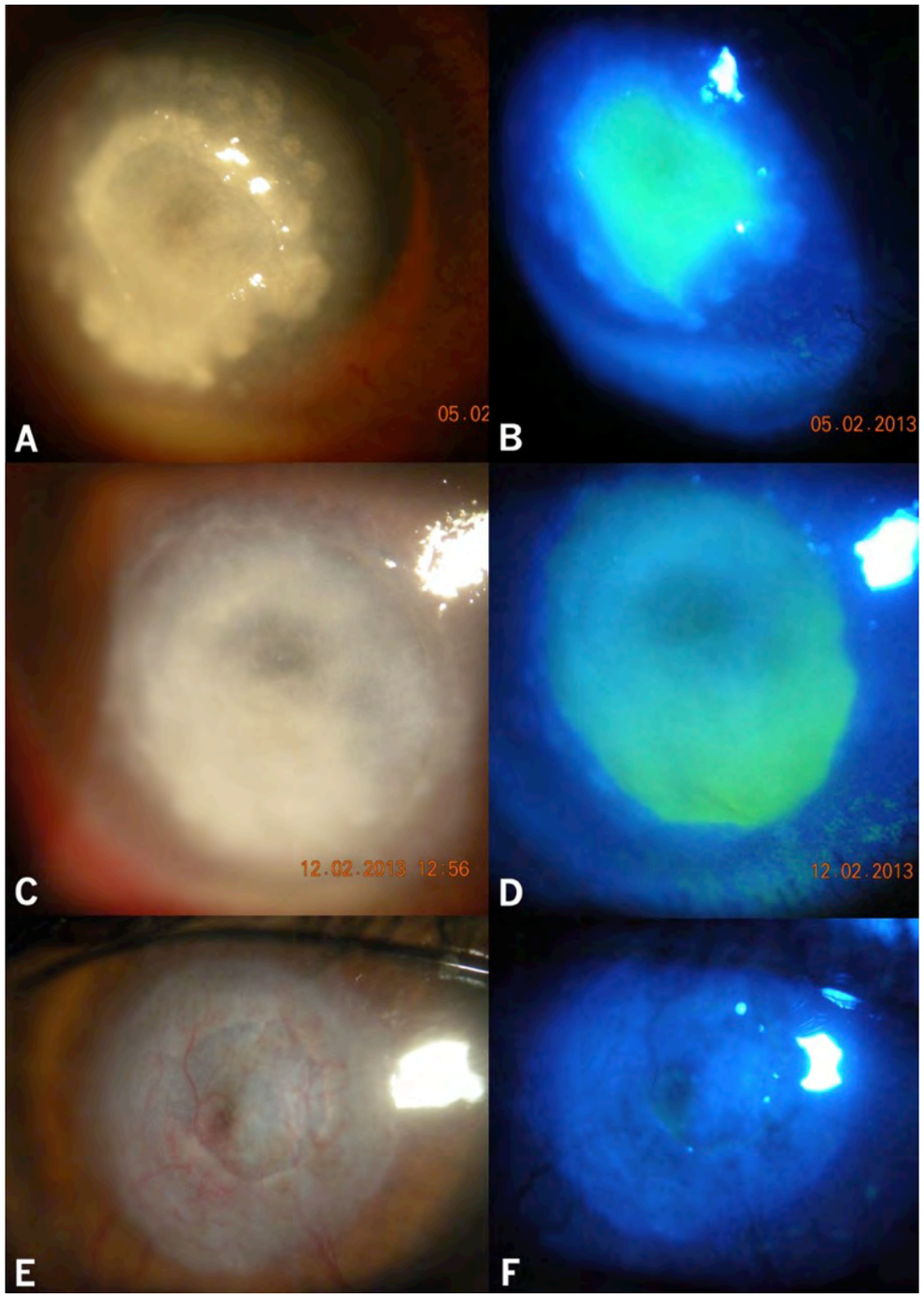


Two weeks after CXL

Mortensen et al., 2011

Geneva-Cairo study 2010-2013

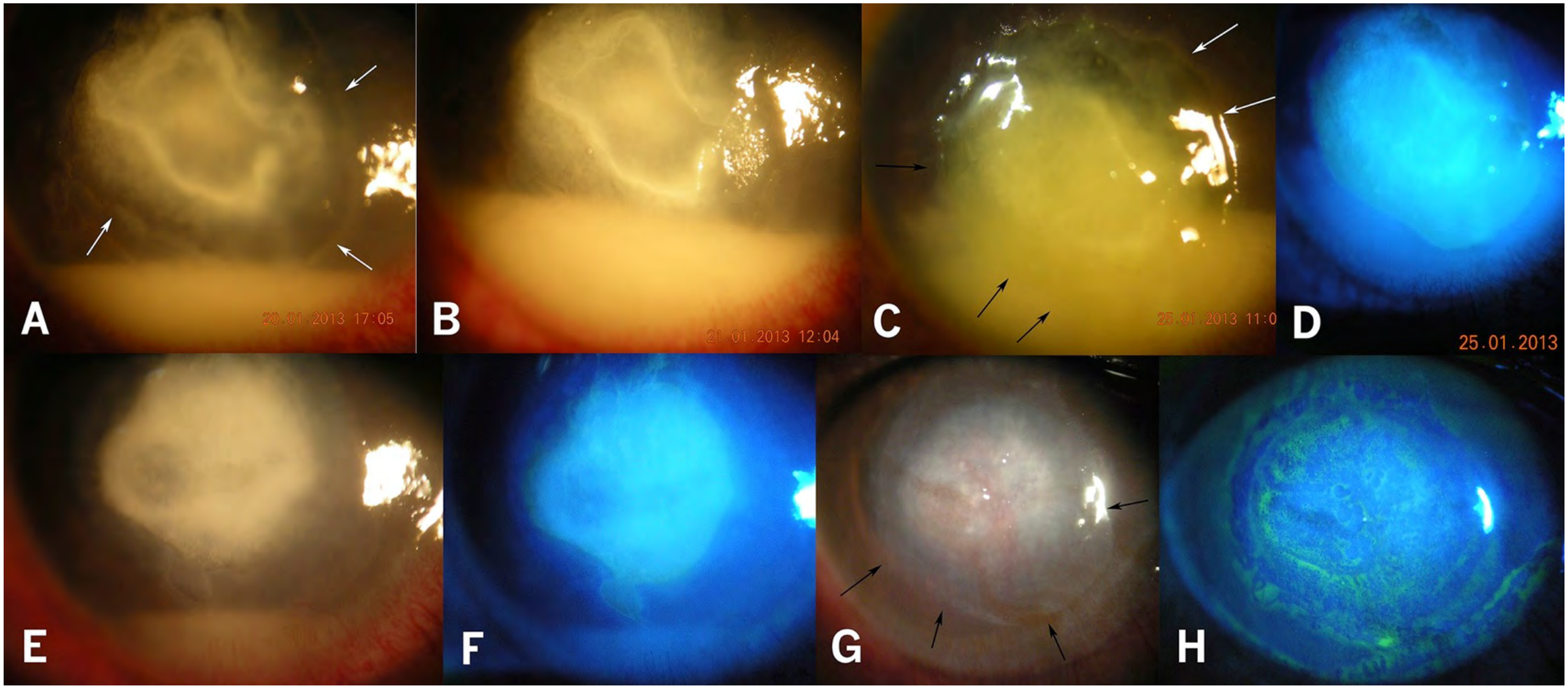
- Prospective randomized cohort study
- 40 patients with therapy-resistant end-stage ulcer
- Bacterial, fungal, mixed
- Medication only: 21 patients
  Medication plus CXL: 19 patients
- Healing time comparable, but complications in
  - Medication only: 23%
  - Medication plus CXL: 0%



Healing within 14 days

Said and Hafezi, Ophthalmology, in press

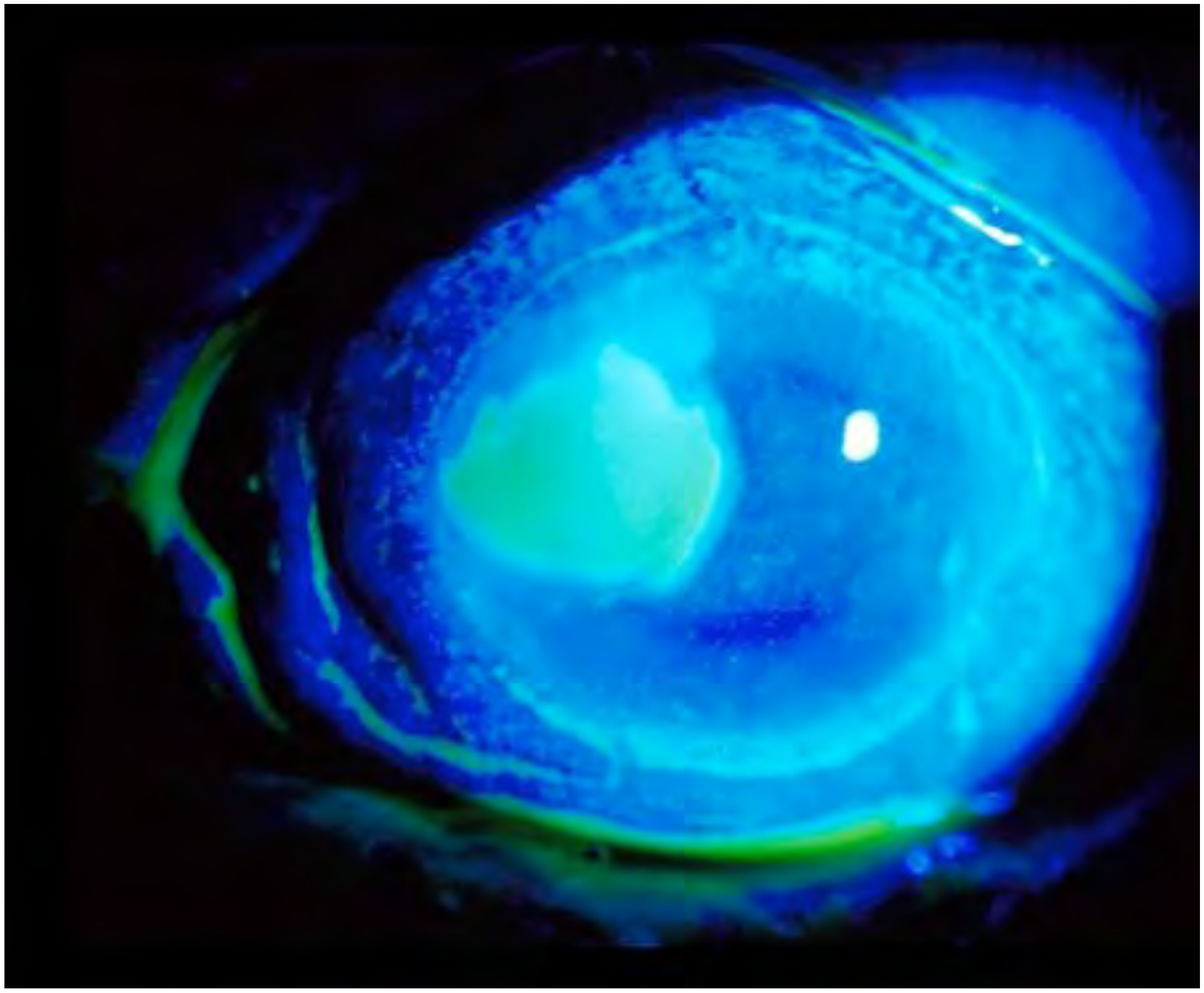
Geneva-Cairo study 2010-2013



Healing within 10 days

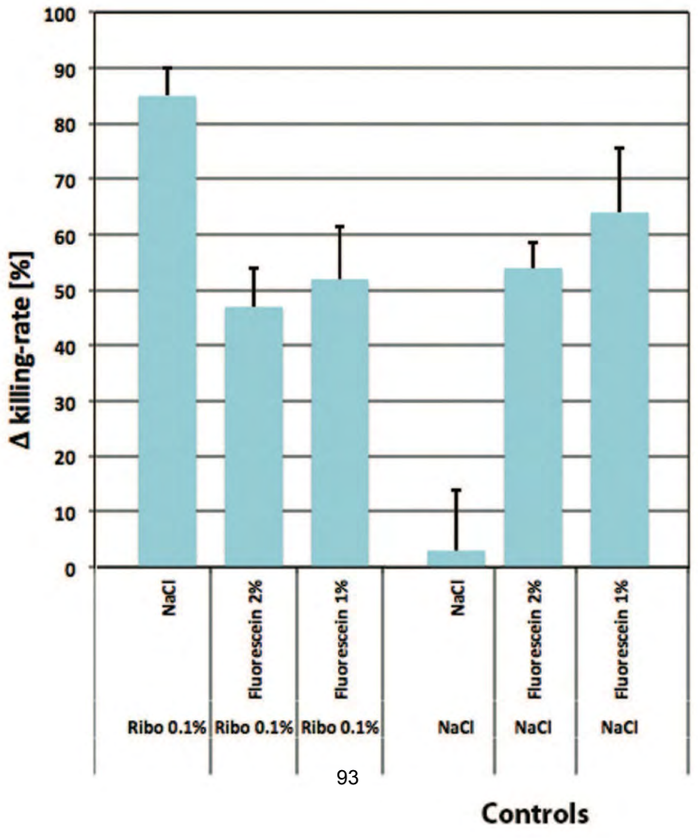
Said and Hafezi, Ophthalmology, in press

Staining of ulcer before CXL



Impact of Fluorescein on the Antimicrobial Efficacy of Photoactivated Riboflavin in Corneal Collagen Cross-linking

Olivier Richoz, MD; Zisis Gatzioufas, MD, PhD; Patrice Francois, PhD; Jacques Schrenzel, MD; Farhad Hafezi, MD, PhD

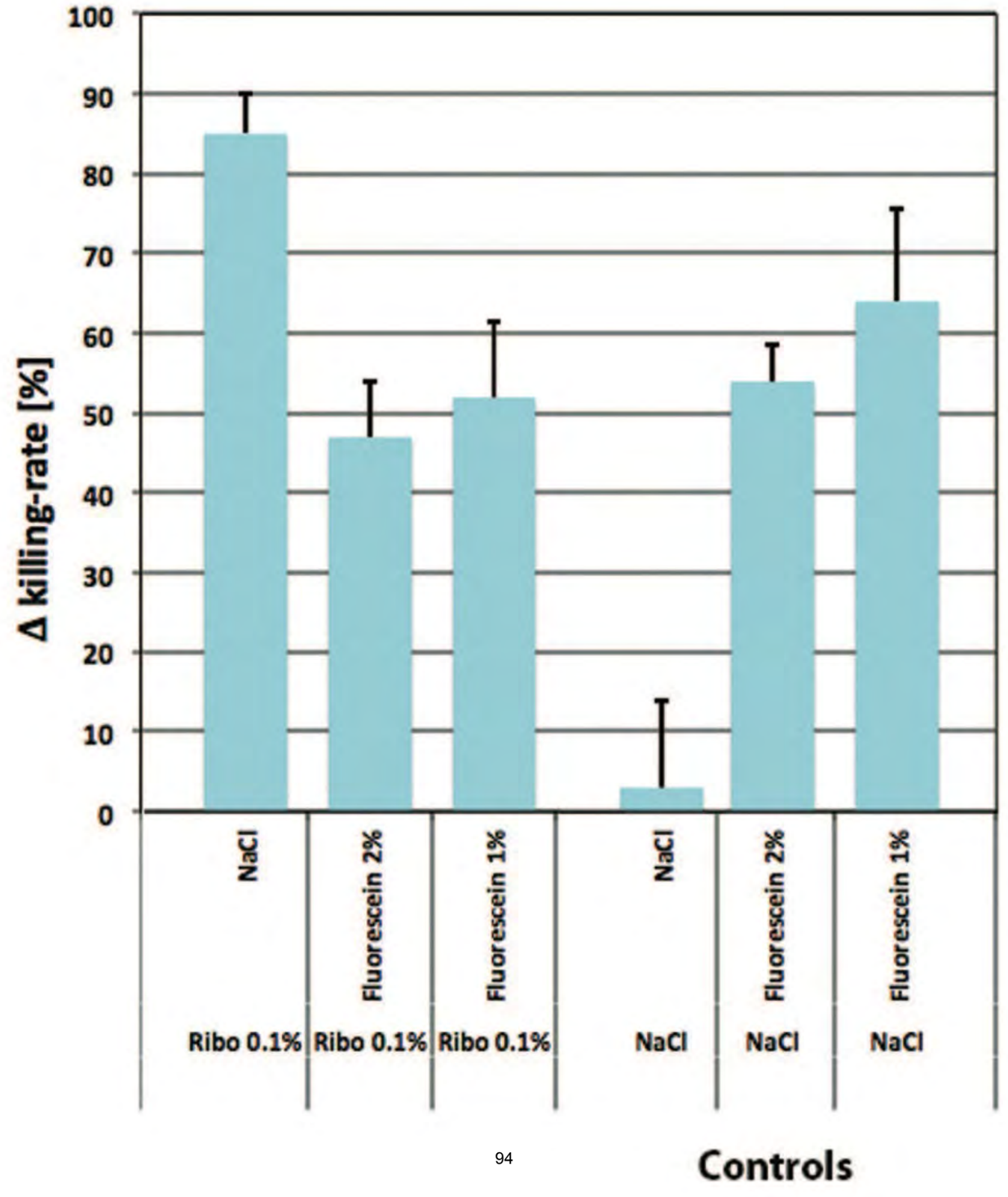


JRS 2013 (December)

TRANSLATIONAL SCIENCE

Impact of Fluorescein on the Antimicrobial Efficacy of Photoactivated Riboflavin in Corneal Collagen Cross-linking

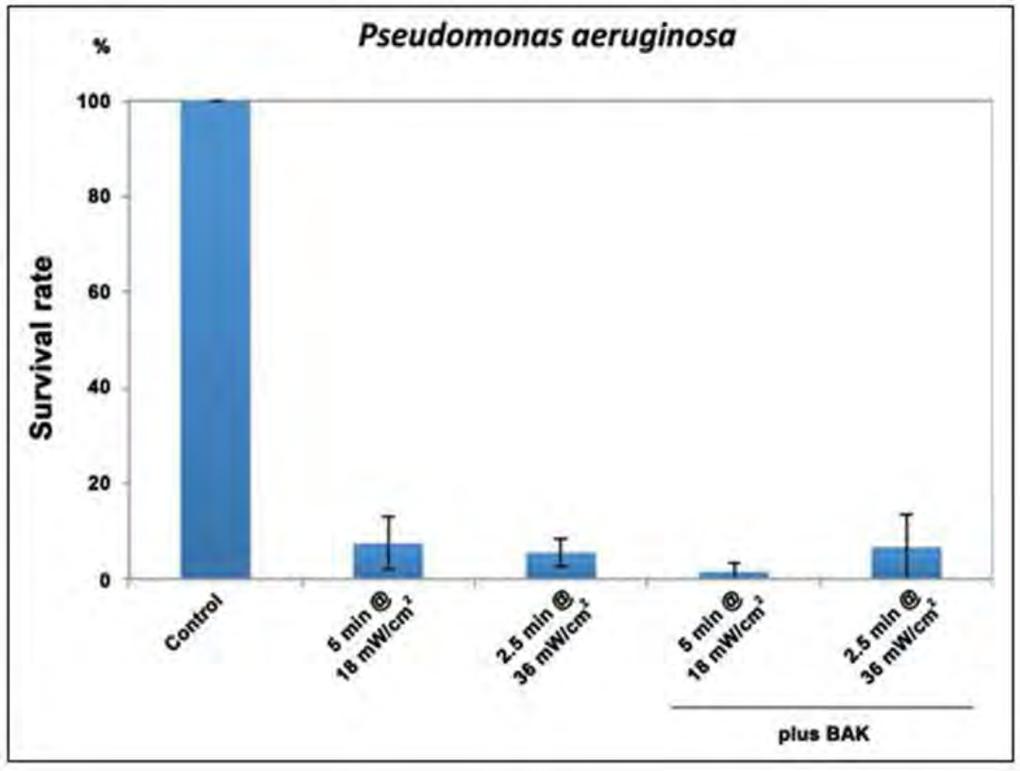
Olivier Richoz, MD; Zisis Gatzioufas, MD, PhD; Patrice Francois, PhD; Jacques Schrenzel, MD; Farhad Hafezi, MD, PhD

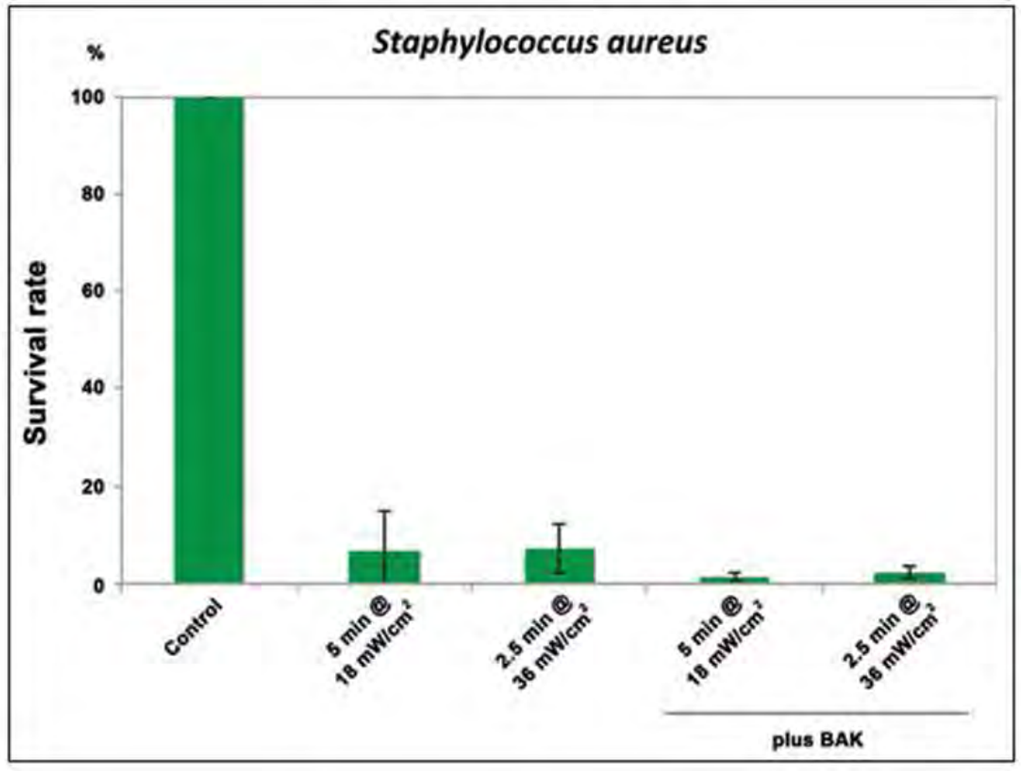


ORIGINAL ARTICLE

Antibacterial Efficacy of Accelerated Photoactivated Chromophore for Keratitis Corneal Cross-linking

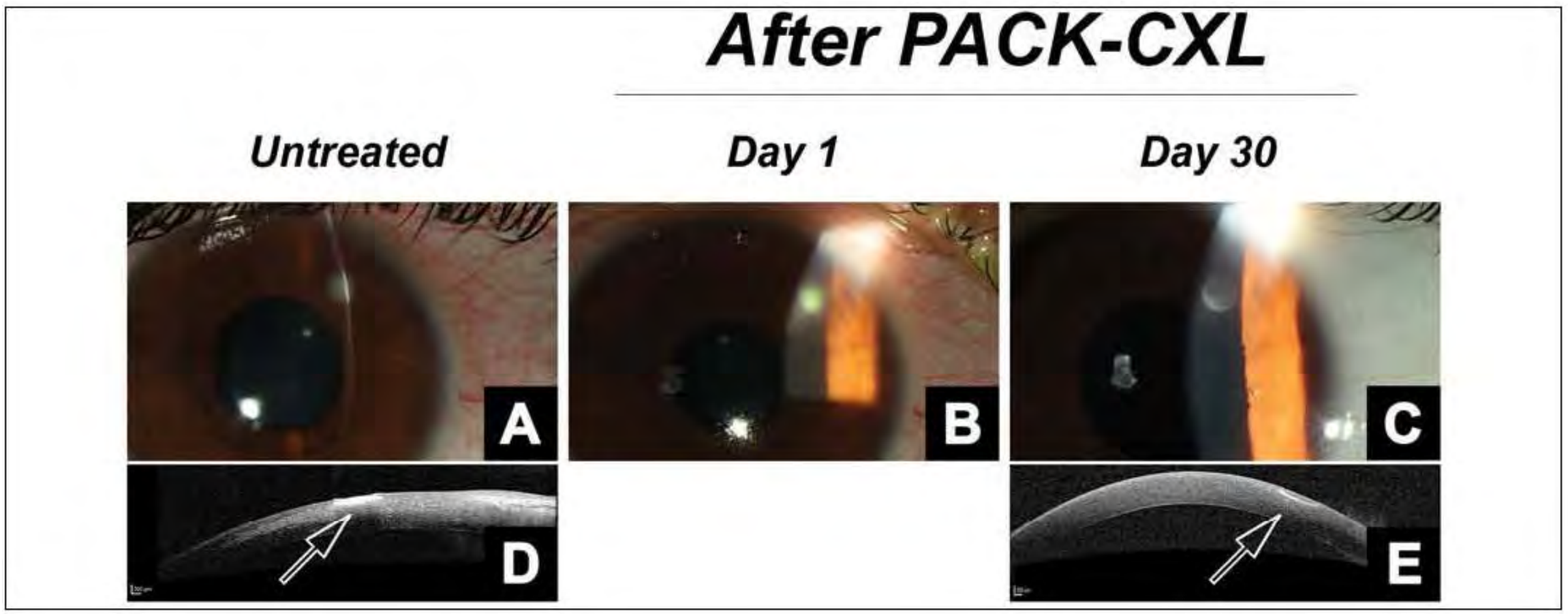
Olivier Richoz, MD; Sabine Kling, PhD; Florence Hoogewoud, MD; Arthur Hammer, MD; David Tabibian, MD; Patrice Francois, PhD; Jacques Schrenzel, MD; Farhad Hafezi, MD, PhD





Accelerated Photoactivated Chromophore for Keratitis–Corneal Collagen Cross-linking as a First-line and Sole Treatment in Early Fungal Keratitis

David Tabibian, MD; Olivier Richoz, MD;
Arnaud Riat, MS; Jacques Schrenzel, MD;
Farhad Hafezi, MD, PhD



New CXL device, also including PACK



Slit lamp

Tonometer



C-Eye© device

C-Eye device



EMAGINE
GROUPADVANCE MEDICAL EQUIPMENT



C-Eye© device, CE mark 2014



CXL COMBINED WITH REFRACTIVE PROCEDURES: CXL PLUS

REVIEW

Corneal Collagen Cross-linking (CXL) Combined With Refractive Procedures for the Treatment of Corneal Ectatic Disorders: CXL Plus

George D. Kymionis, MD, PhD; Michael A. Grentzelos, MD; Dimitra M. Portaliou, MD; Vardhaman P. Kankariya, MD; J. Bradley Randleman, MD

[*J Refract Surg.* 2014;30(8):566-576.]

- + Surface ablation
- + Intracorneal rings segments (ICRS)
- + Phakic IOLs
- + Multiple treatments

16

Corneal Collagen Cross-Linking in Combination With Surface Ablation

George Kymionis, MD, PhD and Georgios A. Kontadakis, MD, MsC

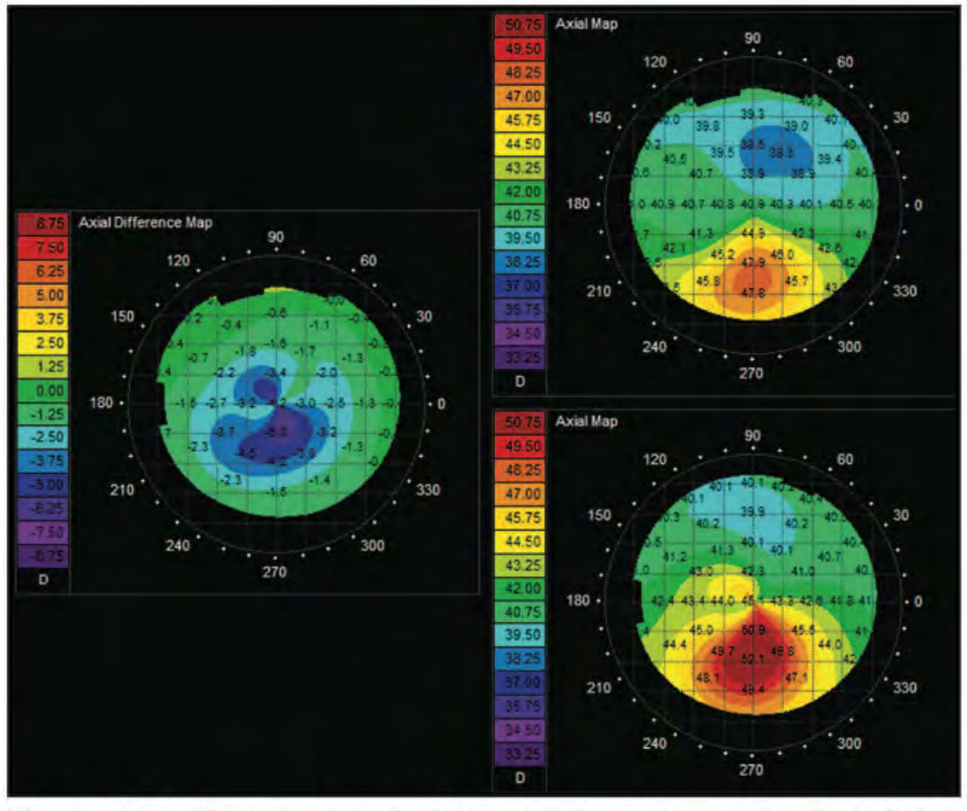


Figure 16-1. Preoperative (bottom right), postoperative (top right), and difference axial maps (left) of a patient with keratoconus showing significant improvement following topography-guided PRK and CXL.

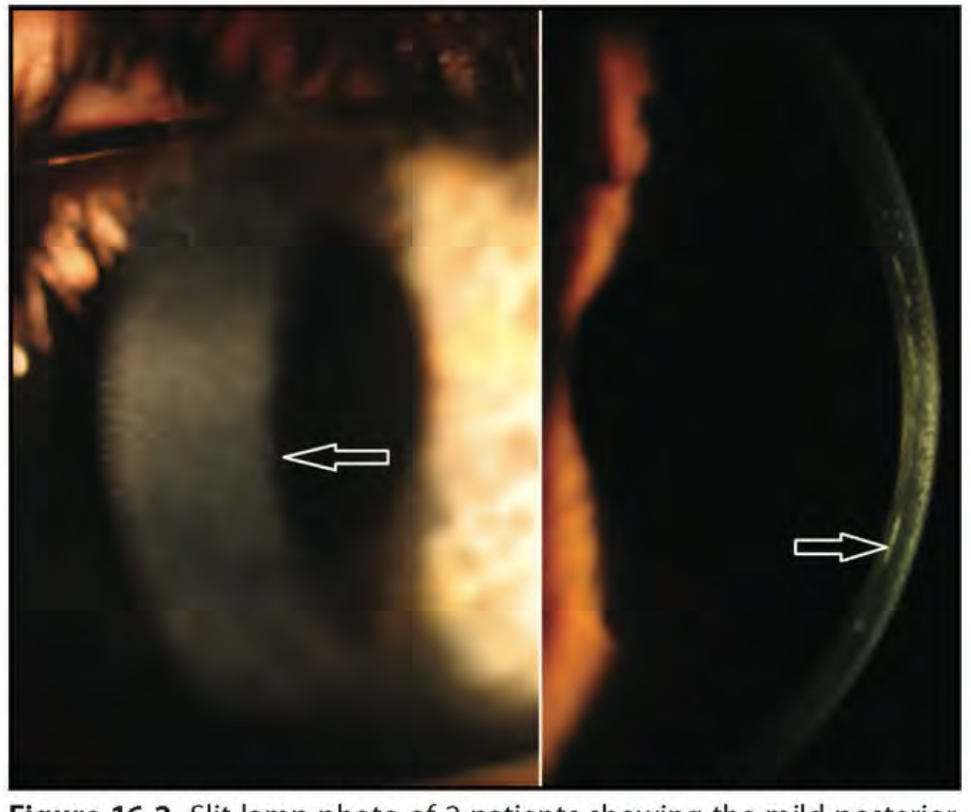


Figure 16-2. Slit-lamp photo of 2 patients showing the mild posterior haze in the deep stroma 3 months after simultaneous topography-guided PRK and CXL. Posterior haze is not visually significant and gradually moves anteriorly and becomes less dense in most of the patients.

17

Corneal Collagen Cross-Linking in Combination With Intrastromal Corneal Ring Segments

David Touboul, MD and David Smadja, MD

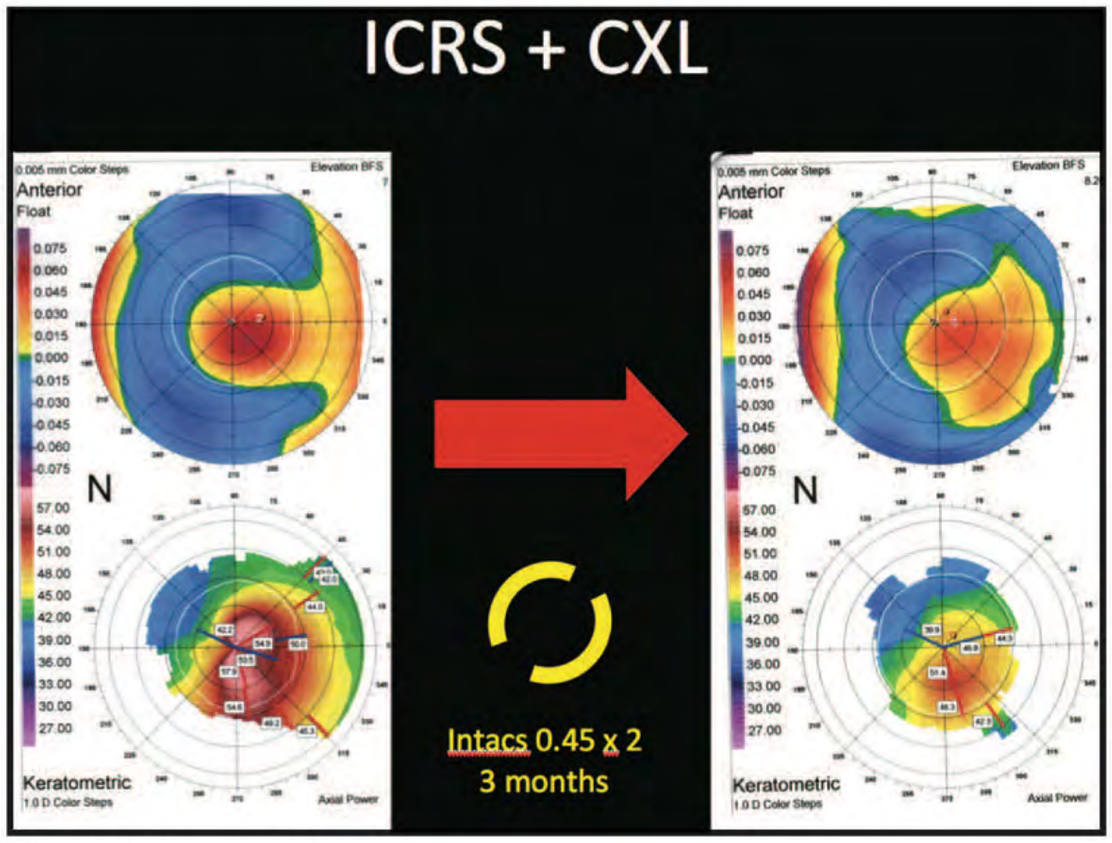


Figure 17-1. caption

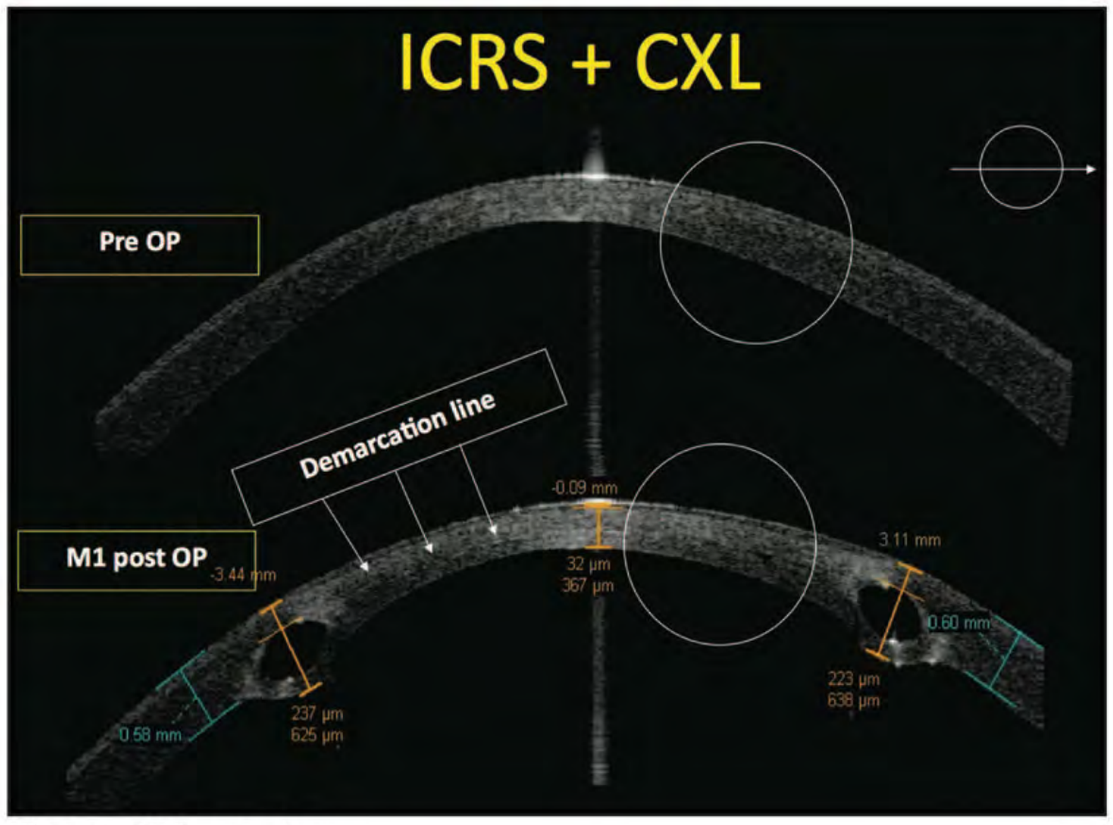
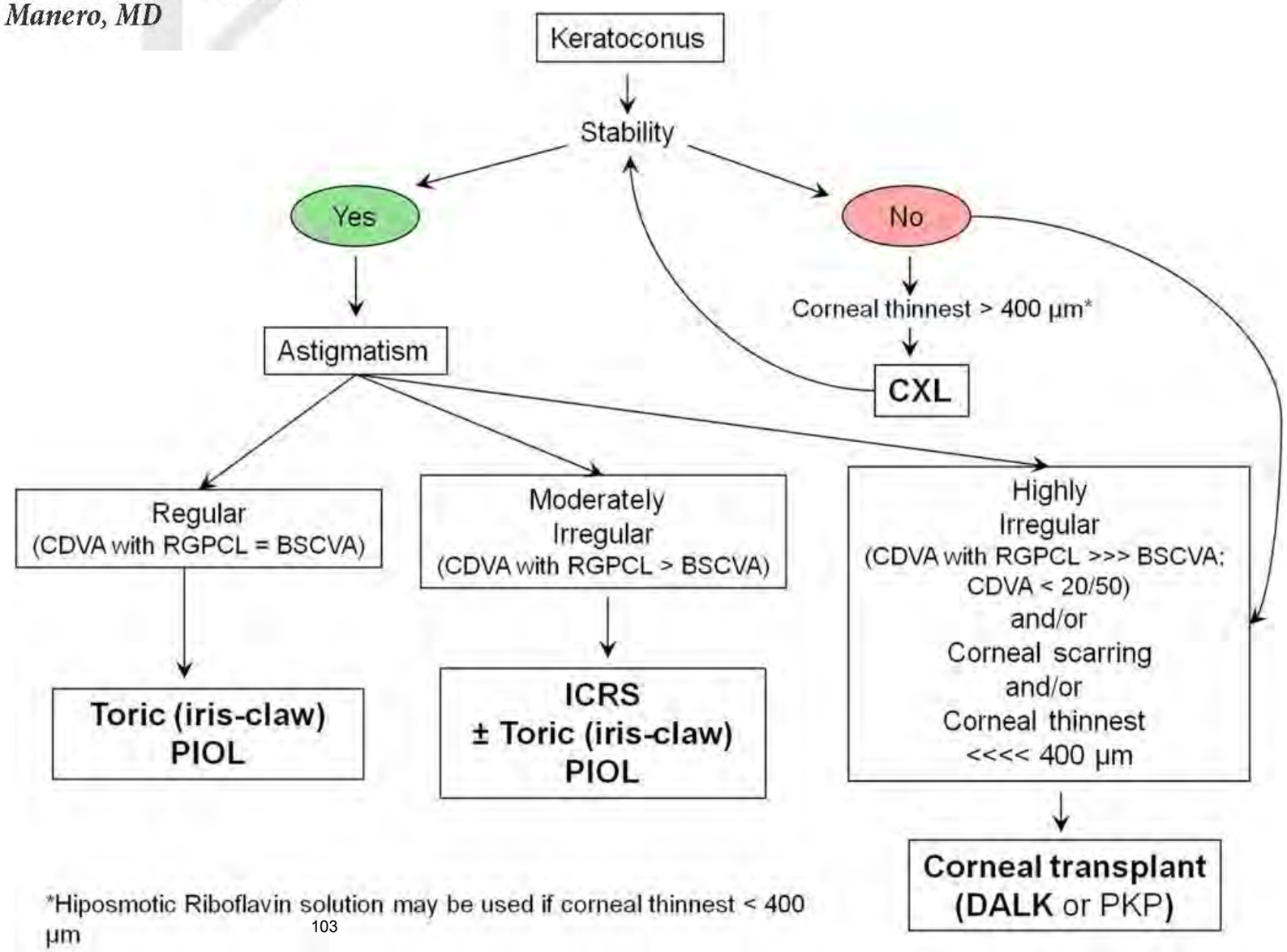


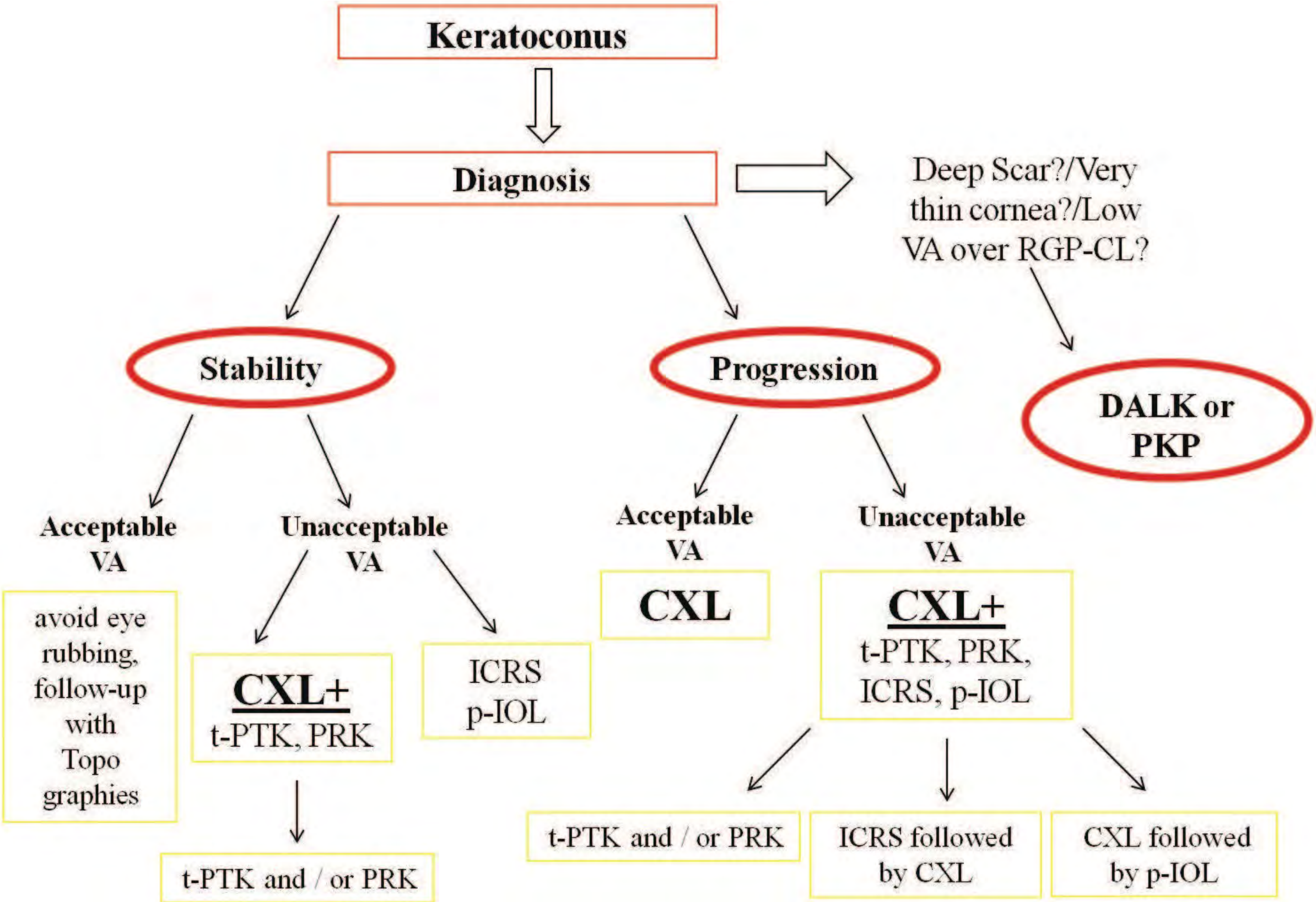
Figure 17-2. caption

18

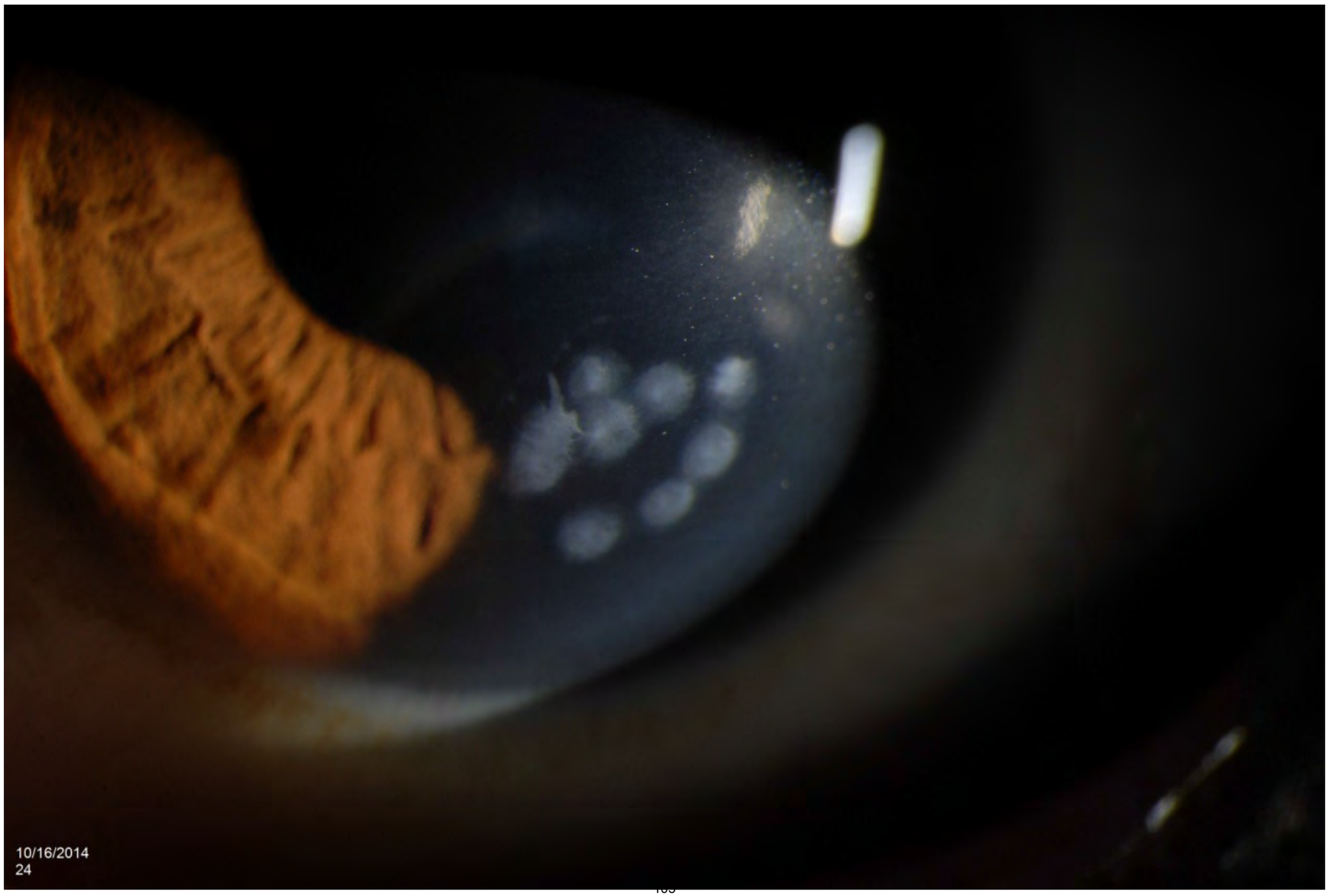
Corneal Collagen Cross-Linking in Combination With Phakic Intraocular Lenses

Jose Güell, MD, PhD; Merce Morral, MD, PhD; Oscar Gris, MD, PhD; Daniel Elies, MD; and Felicidad Manero, MD




Keratoconus
Diagnosis
Deep Scar?/Very thin cornea?/Low VA over RGP-CL?
Stability
Progression
DALK or PKP
Acceptable VA
Unacceptable VA
Acceptable VA
Unacceptable VA
avoid eye rubbing, follow-up with Topo graphies
CXL+ t-PTK, PRK
ICRS p-IOL
CXL
CXL+ t-PTK, PRK, ICRS, p-IOL
t-PTK and / or PRK
t-PTK and / or PRK
ICRS followed by CXL
CXL followed by p-IOL

CXL + CK



CXL + CK





MEASURING THERAPEUTIC SUCCESS

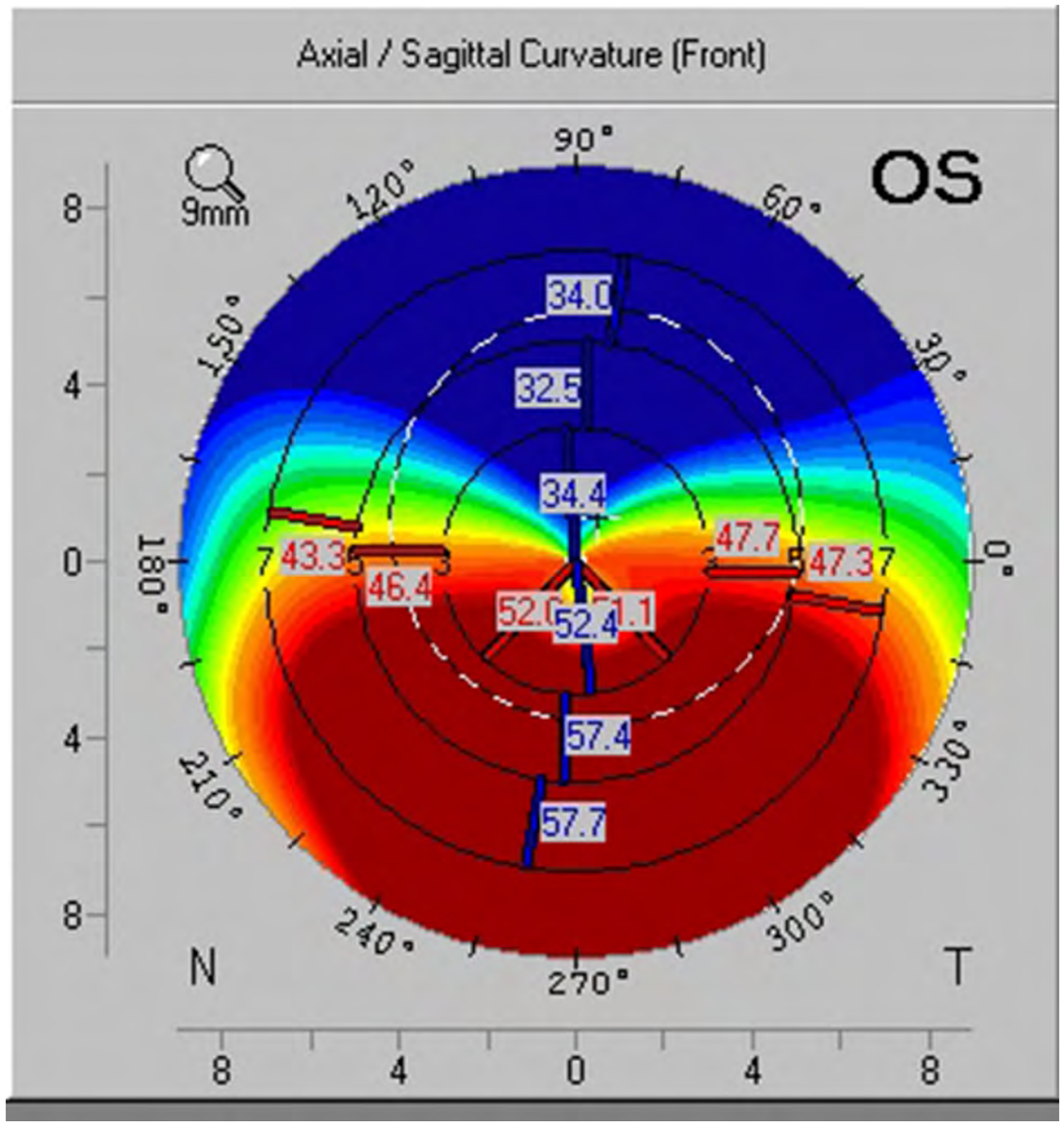
after[107] CXL

MEASURING CXL CHANGES: CHALLENGES

- Variability of measurements in the keratoconic cornea
- Variability of response
- Variability of measurable parameters
- Variability of measurement devices

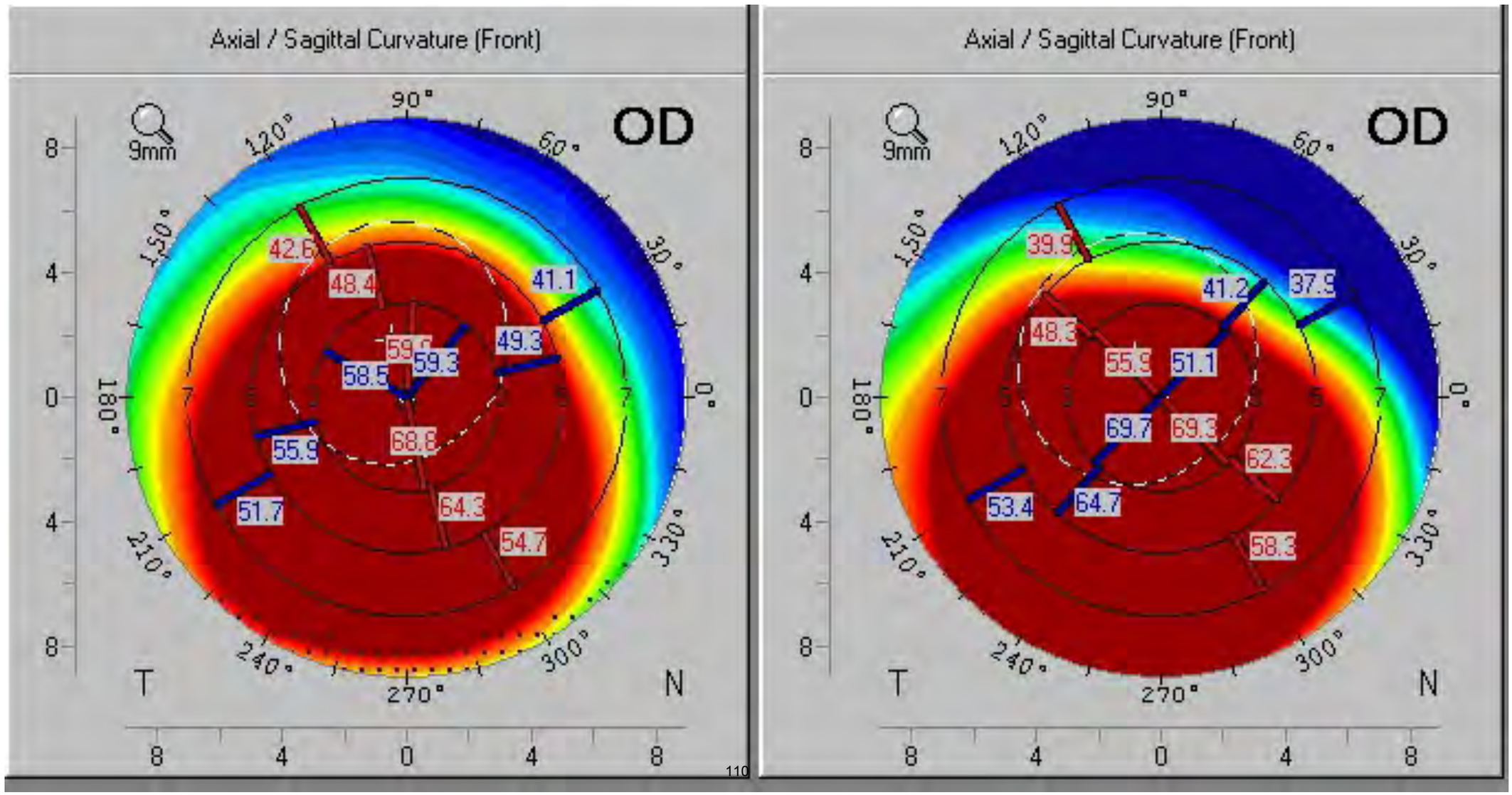
TOPOGRAPHIC CHANGES AFTER CXL

Is this before or after CXL?

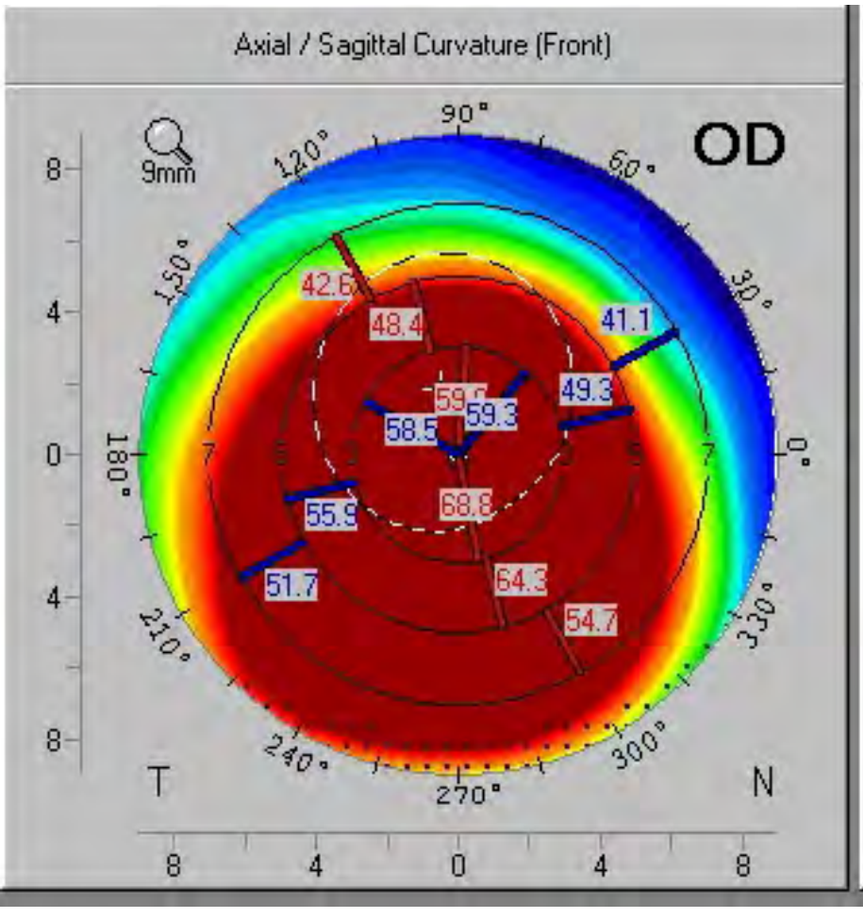


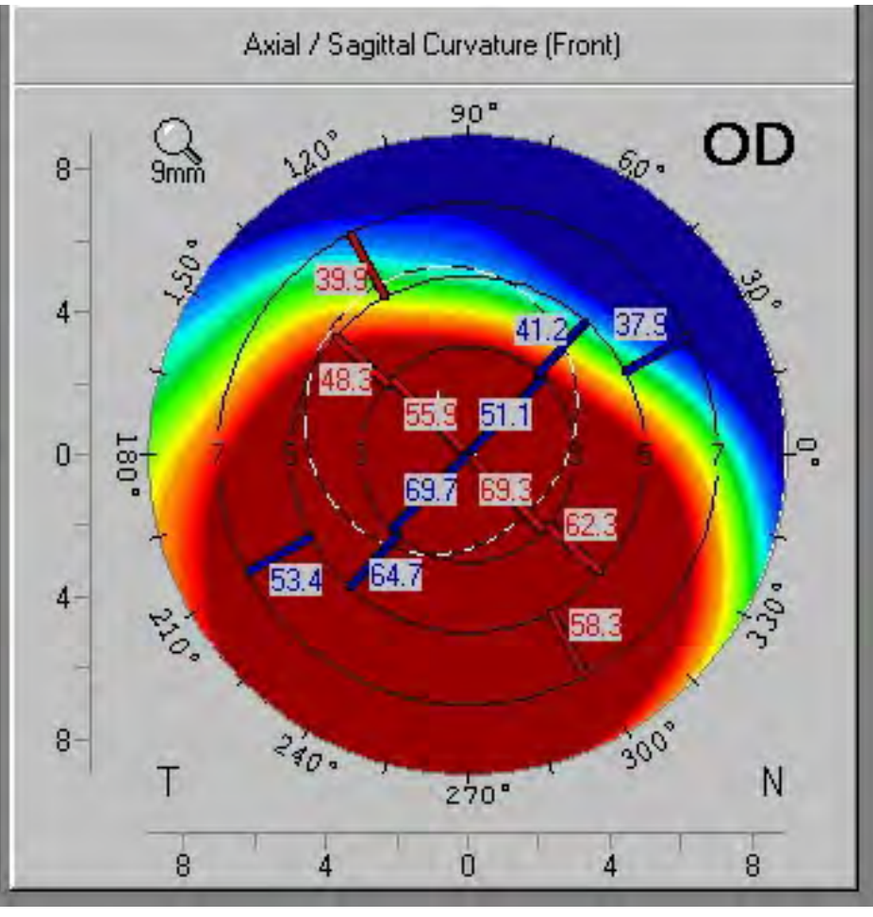
MEASURING CXL CHANGES: CHALLENGES

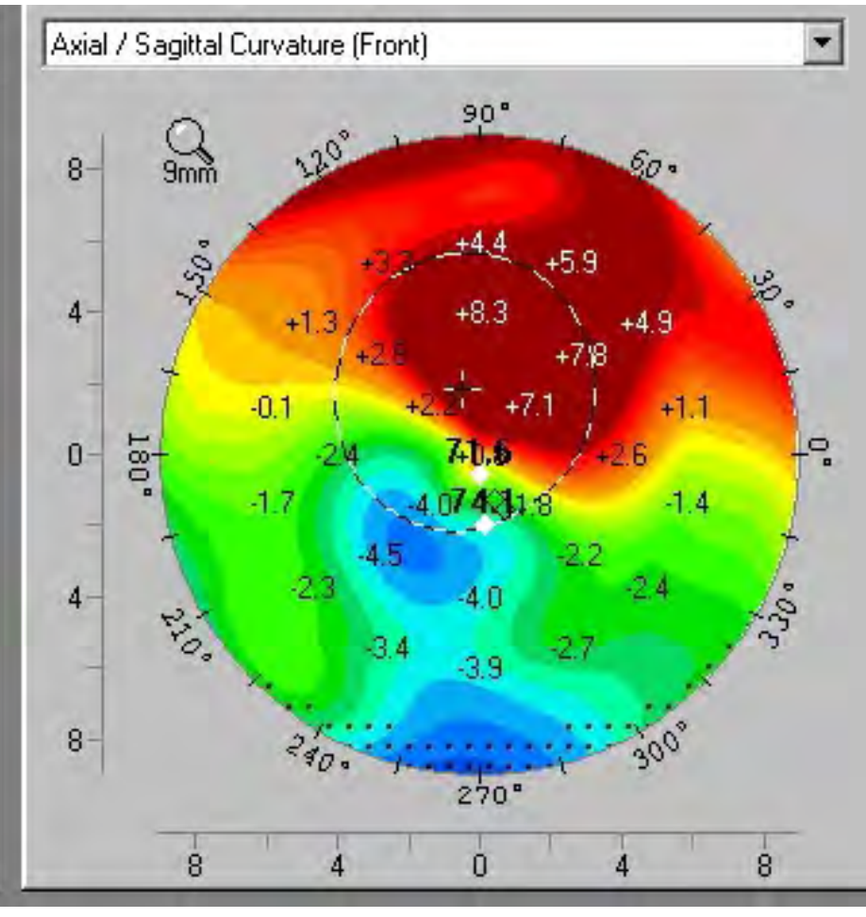
Difference Maps



MEASURING CXL CHANGES: CHALLENGES

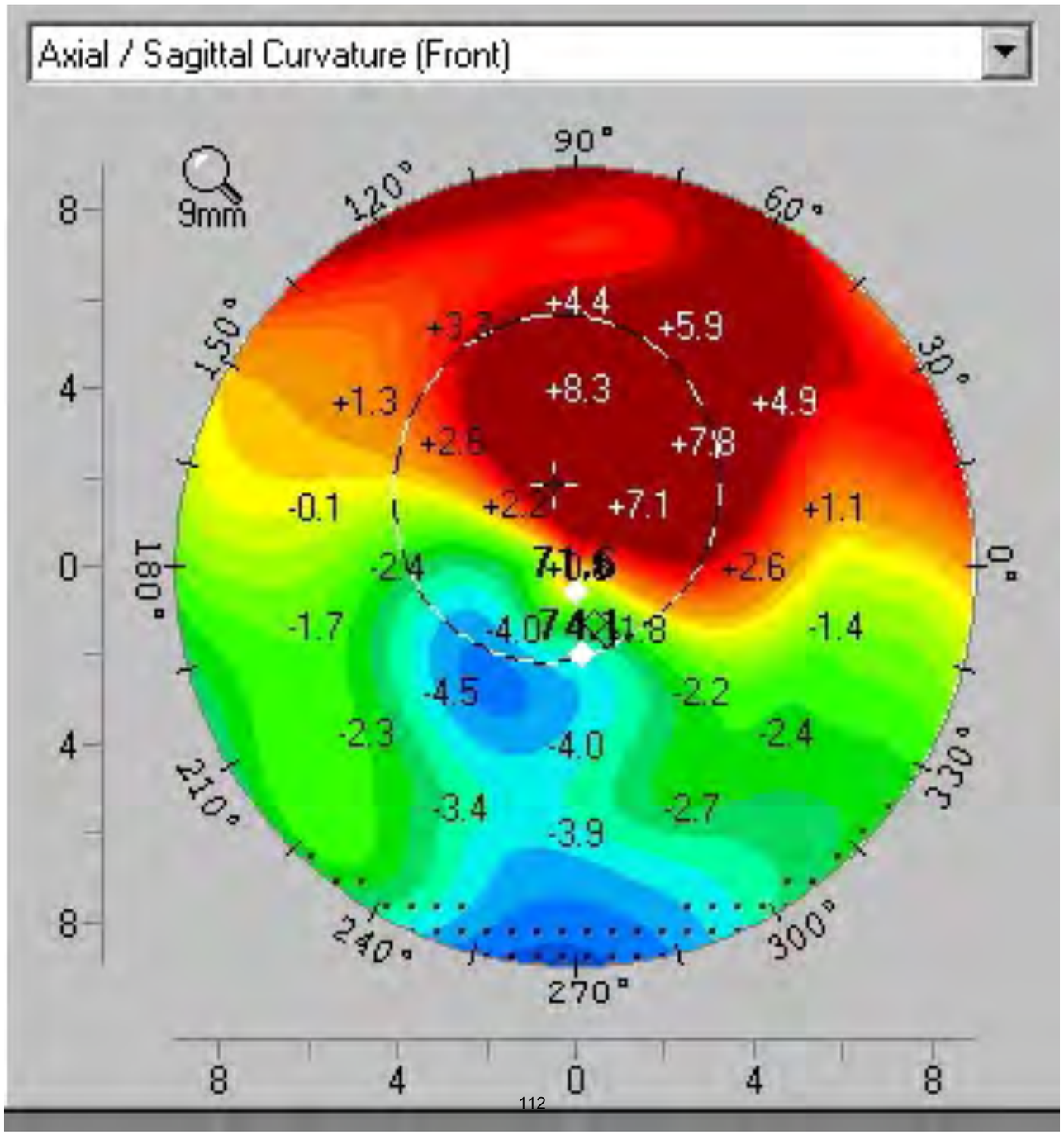






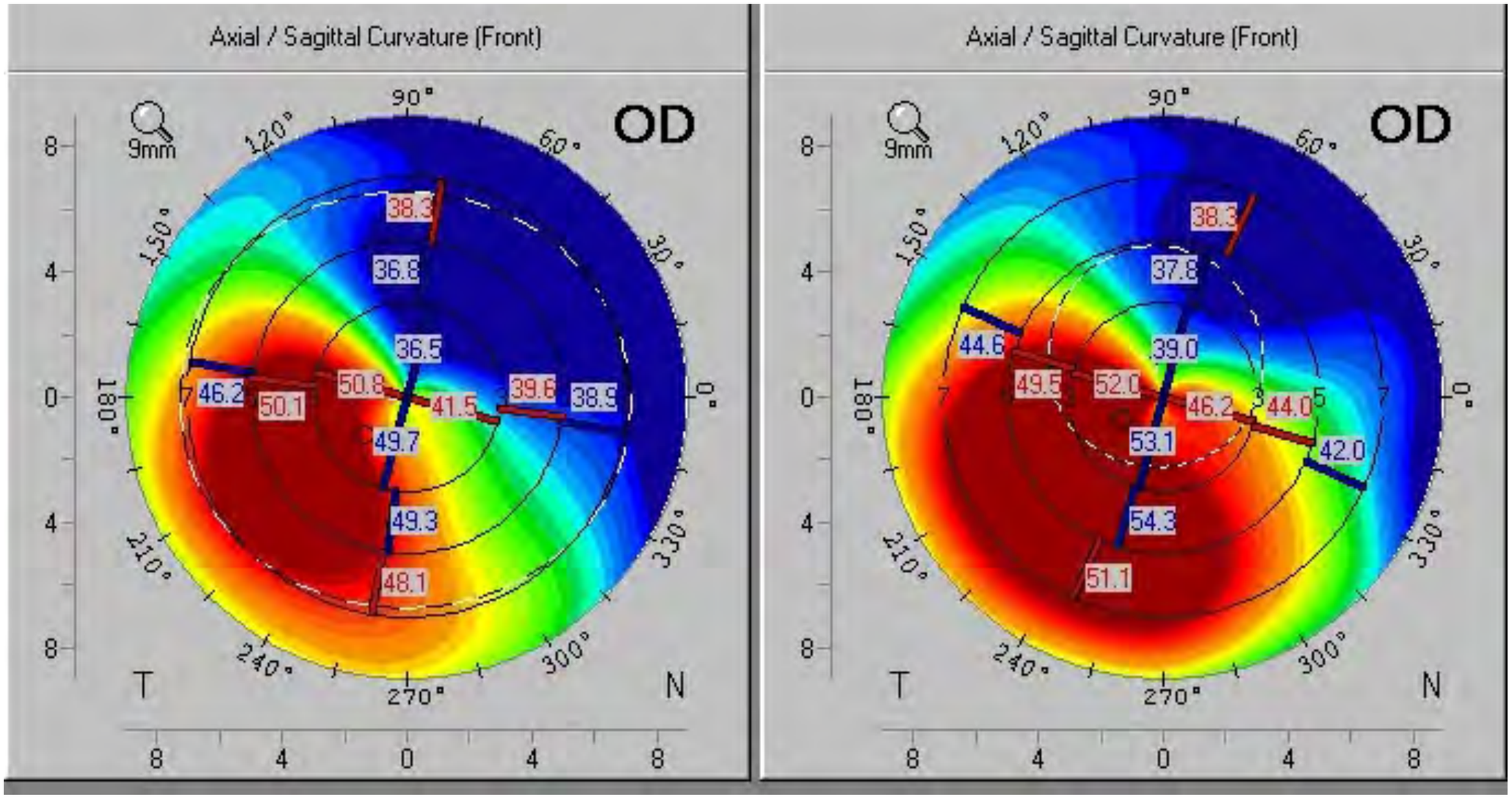
MEASURING CXL CHANGES: CHALLENGES

"Natural" CXL



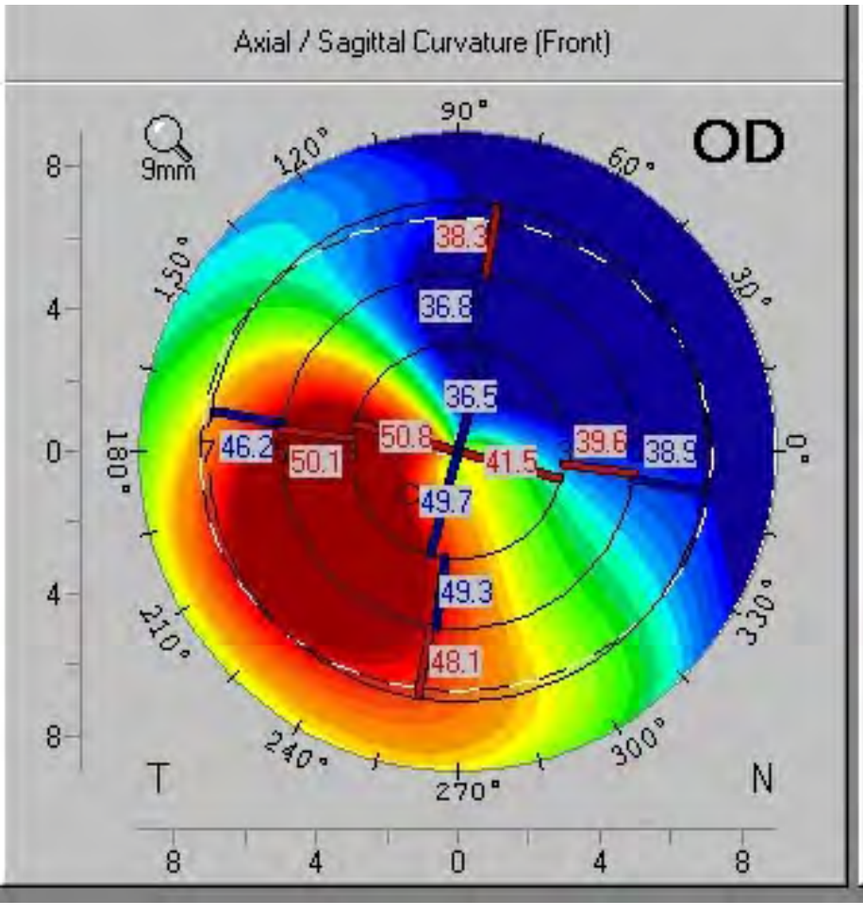
MEASURING CXL CHANGES: CHALLENGES

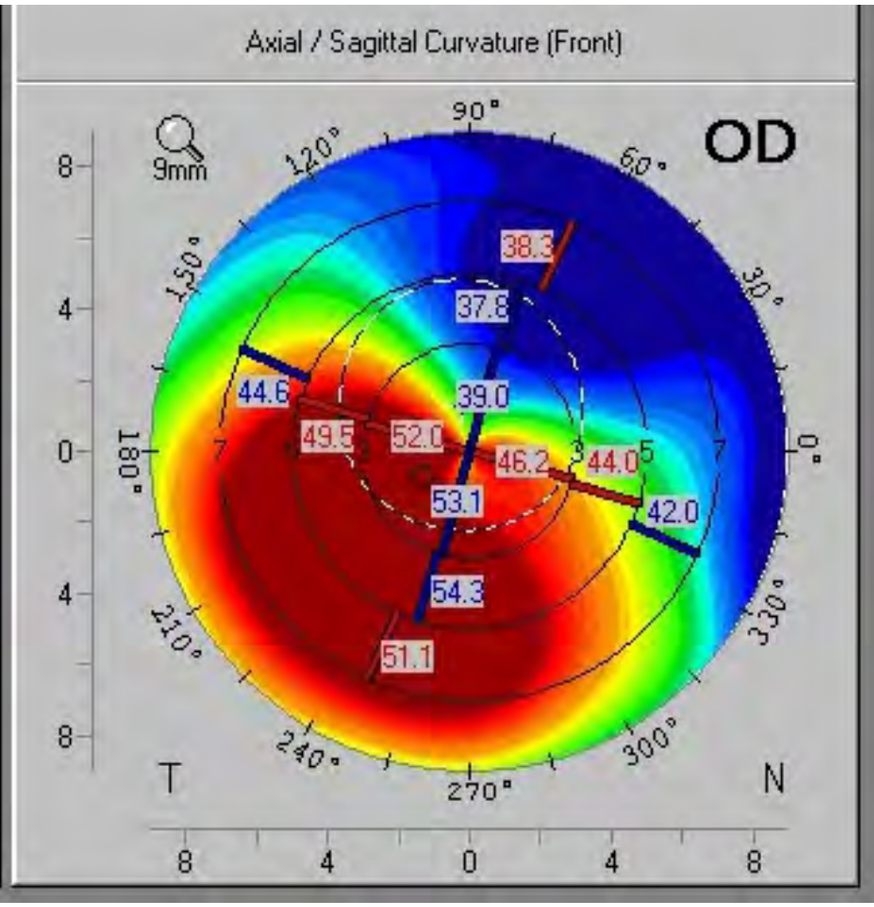
Our Case

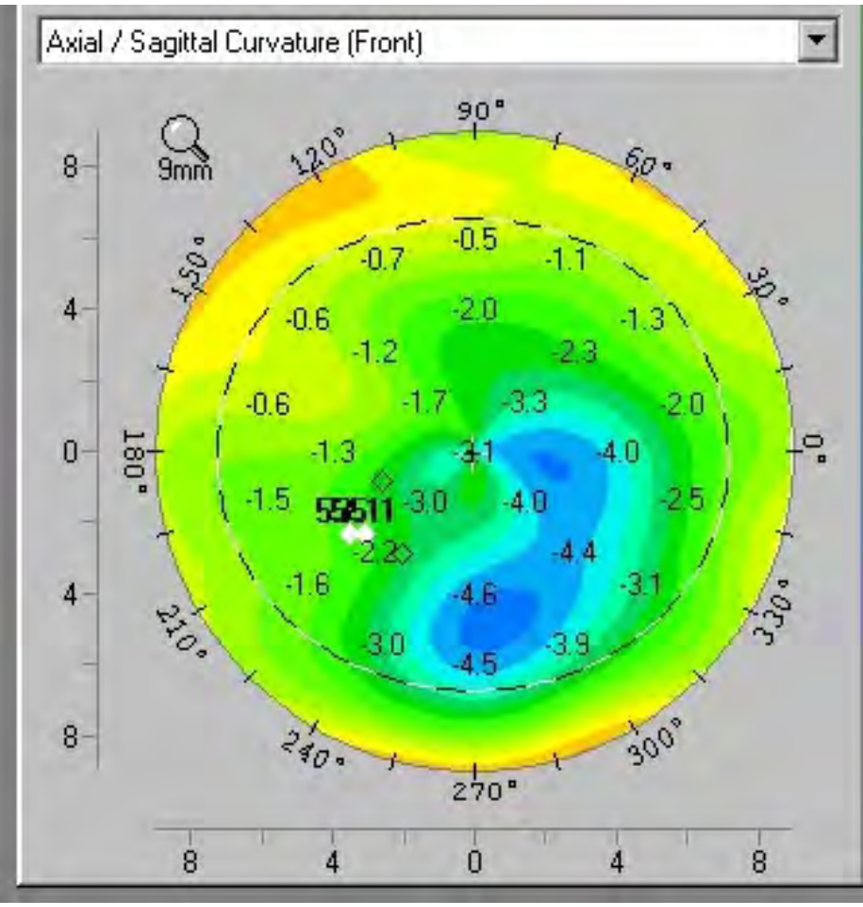


MEASURING CXL CHANGES: CHALLENGES

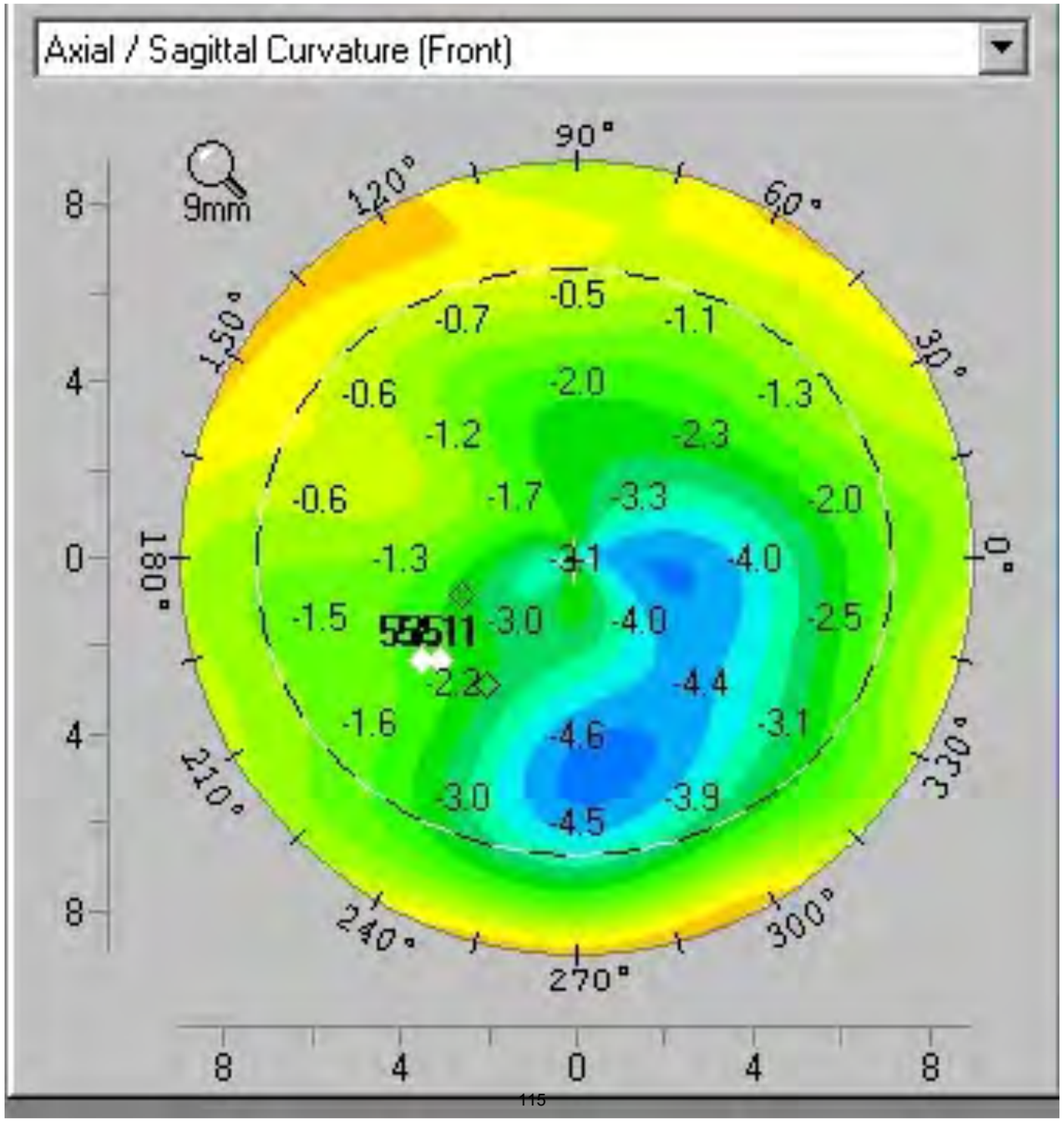
Our Case







MEASURING CXL CHANGES: CHALLENGES

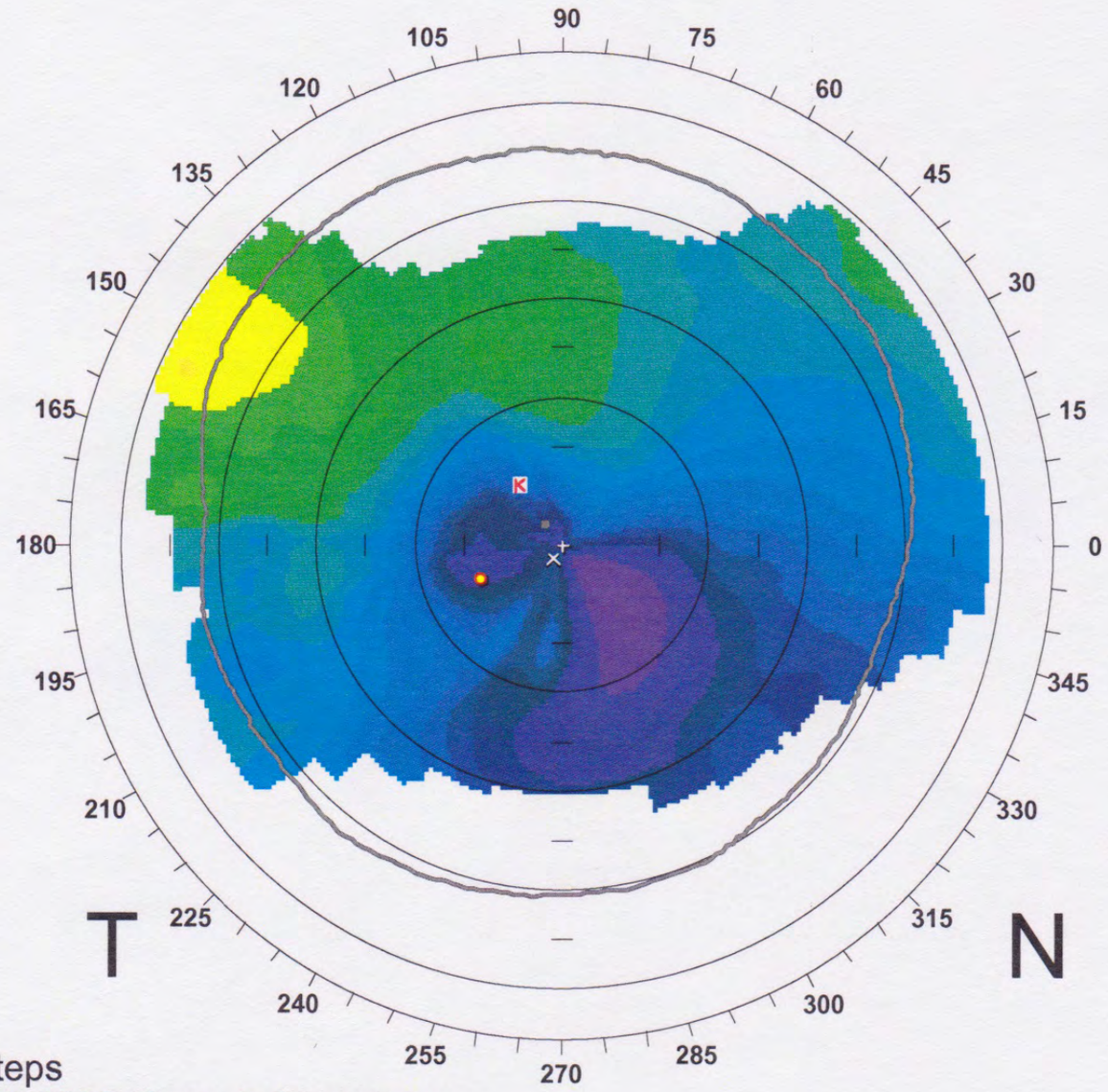


ORBSCAN

Difference - Kera Axial

8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
-5.00
-6.00
-7.00
-8.00

A-B



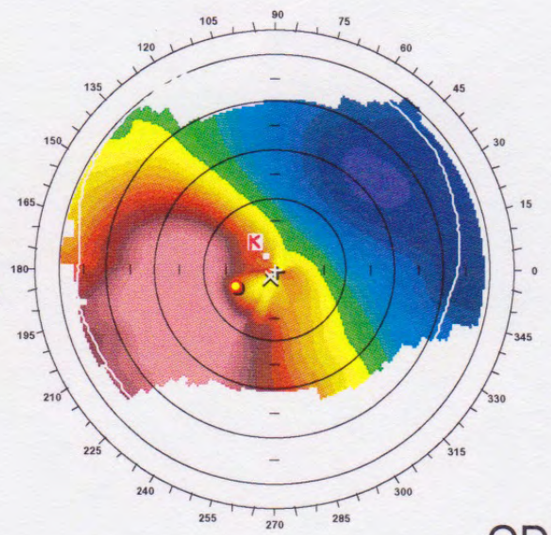
0.5 D Color Steps

Copyright 1995-2003, Bausch & Lomb Inc.

v3.12

Axial Power
Luis Salas, 10/8/2012 5:04:15 PM

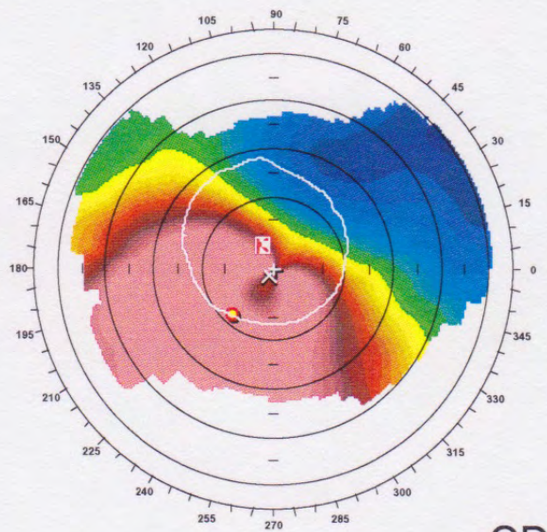
A



OD

Axial Power
Luis Salas, 9/23/2008 3:54:28 PM

B



OD

Variability in CXL Outcomes

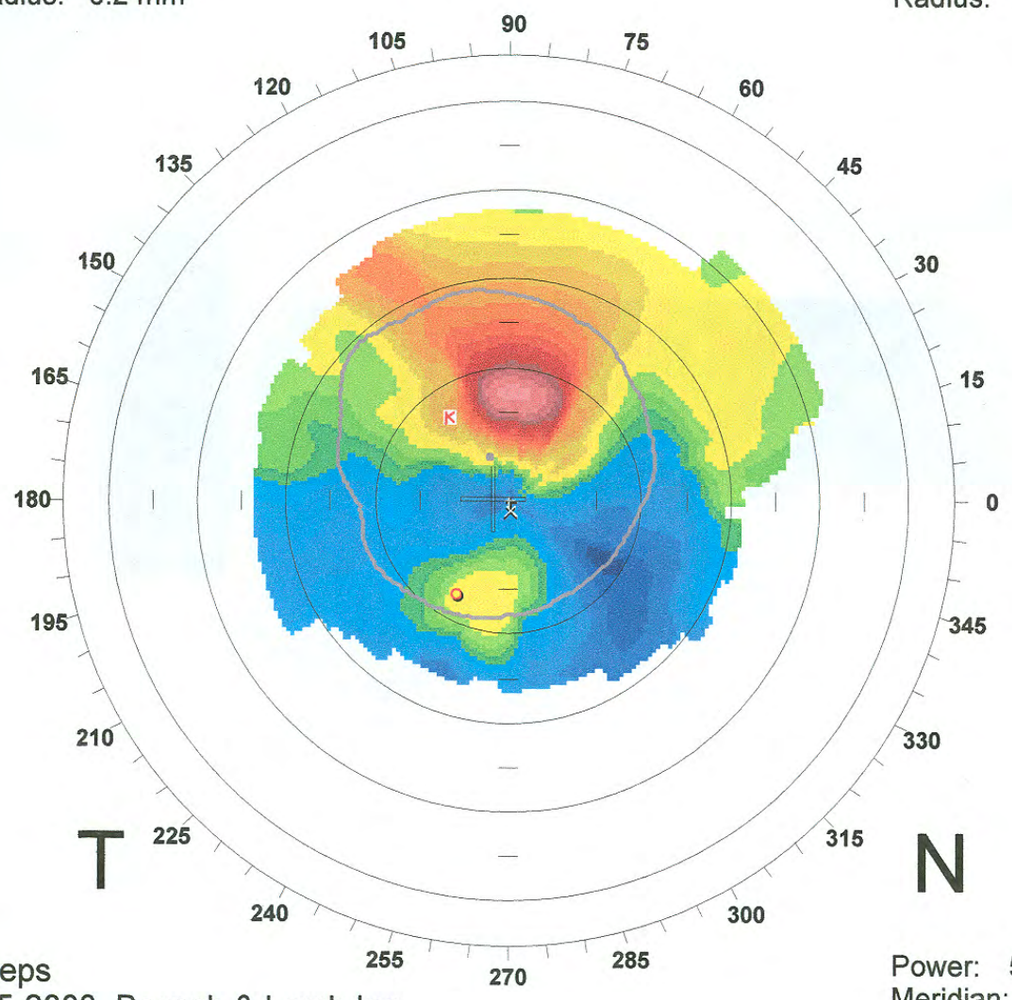
ORBSCAN

Difference - Kera Axial

8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
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-8.00

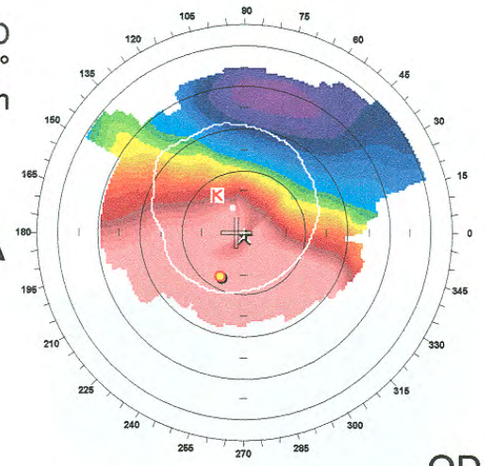
Cyl Pow: -2.70 D
Meridian: 173 °
Radius: 0.2 mm

A-B



Power: 50.93 D
Meridian: 173 °
Radius: 0.2 mm

A

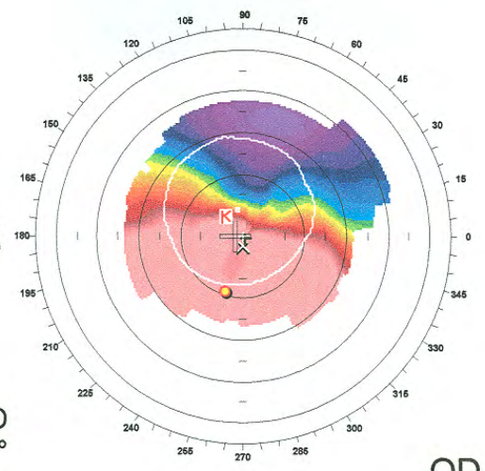


Axial Power
12/17/2008 1:14:13 PM

OD

Axial Power
12/5/2007 1:06:20 PM

B



Power: 53.63 D
Meridian: 173 °
Radius: 0.2 mm

OD

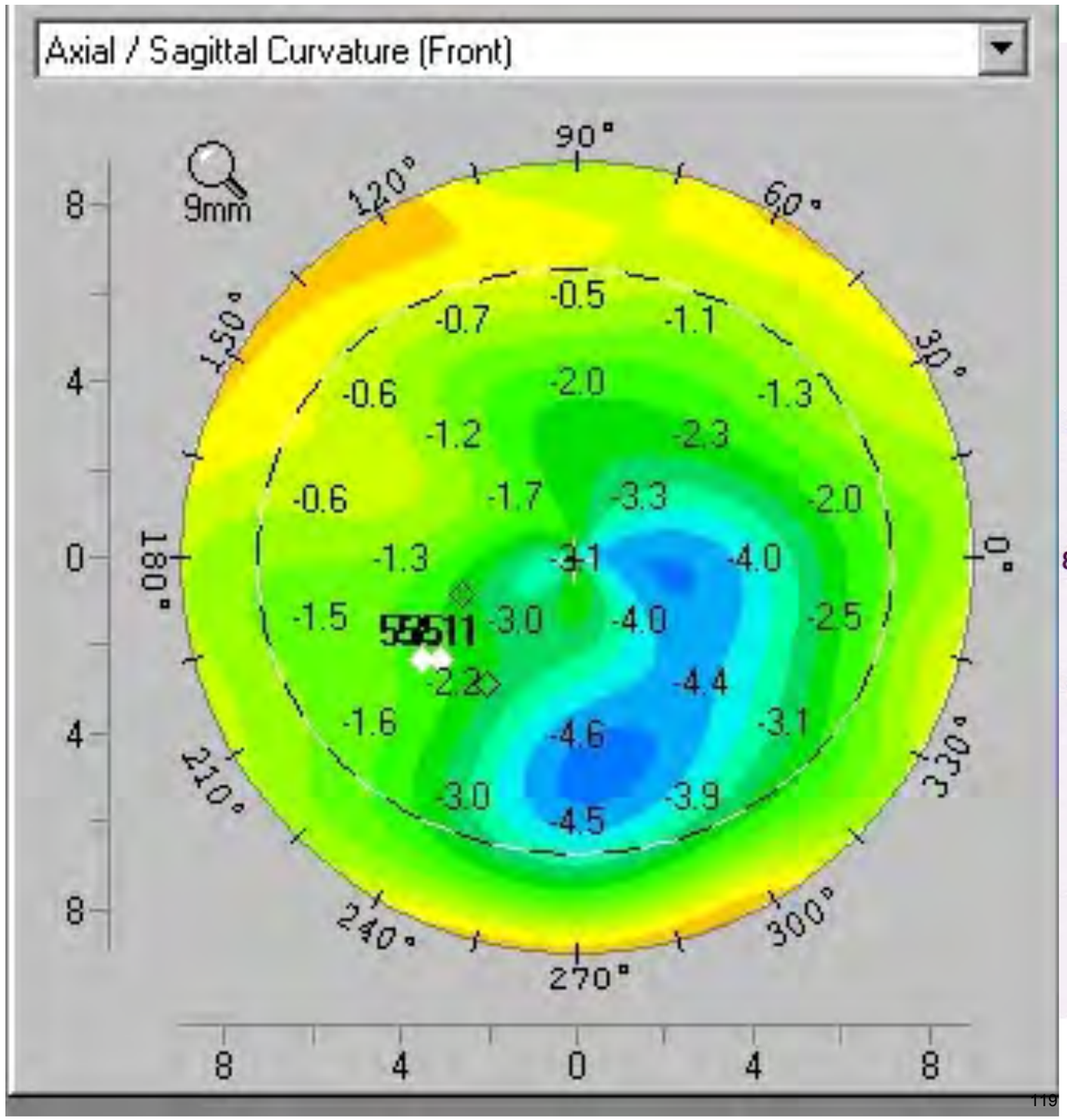
0.5 D Color Steps
Copyright 1995-2003, Bausch & Lomb Inc.

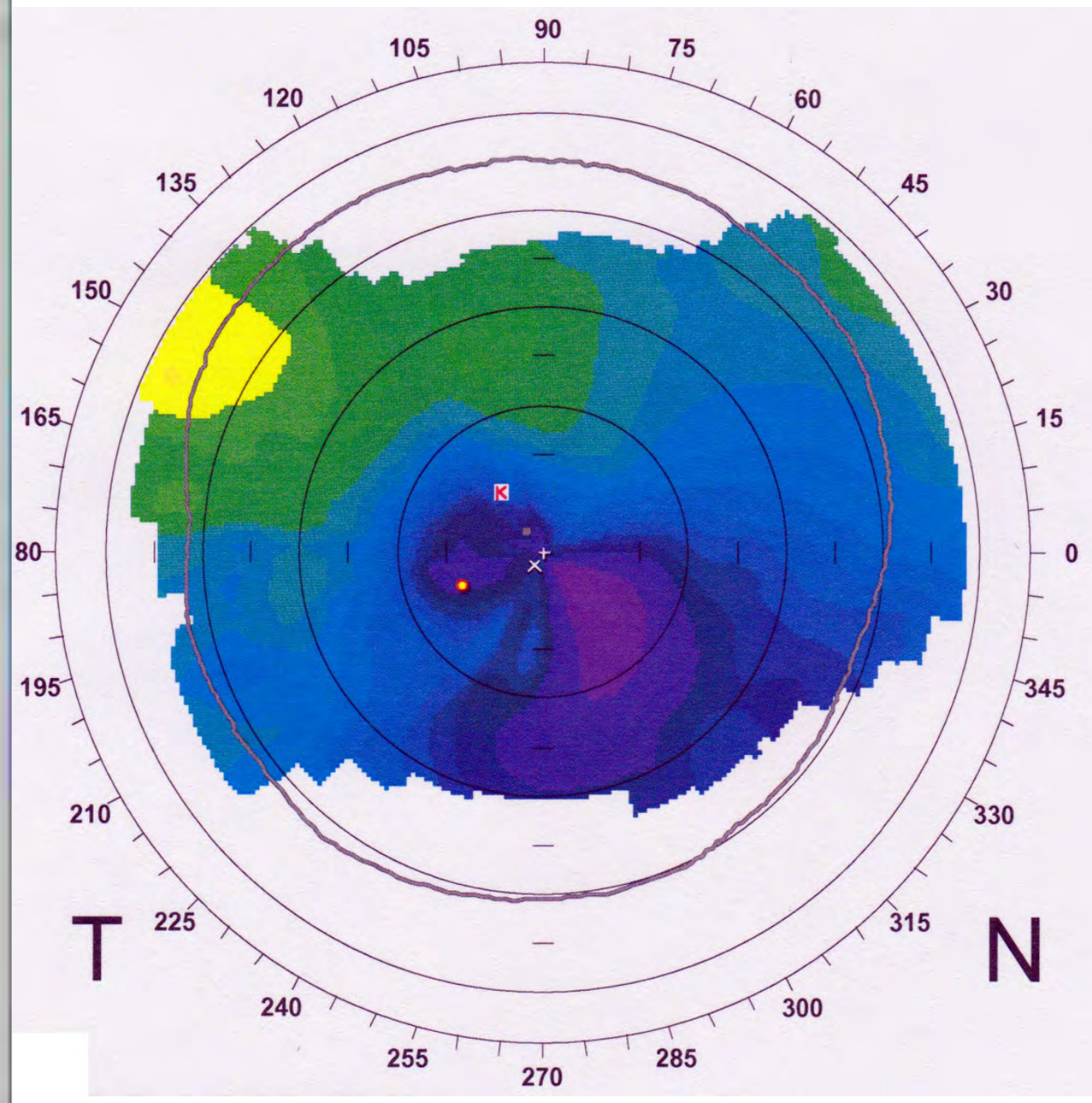
v3.12



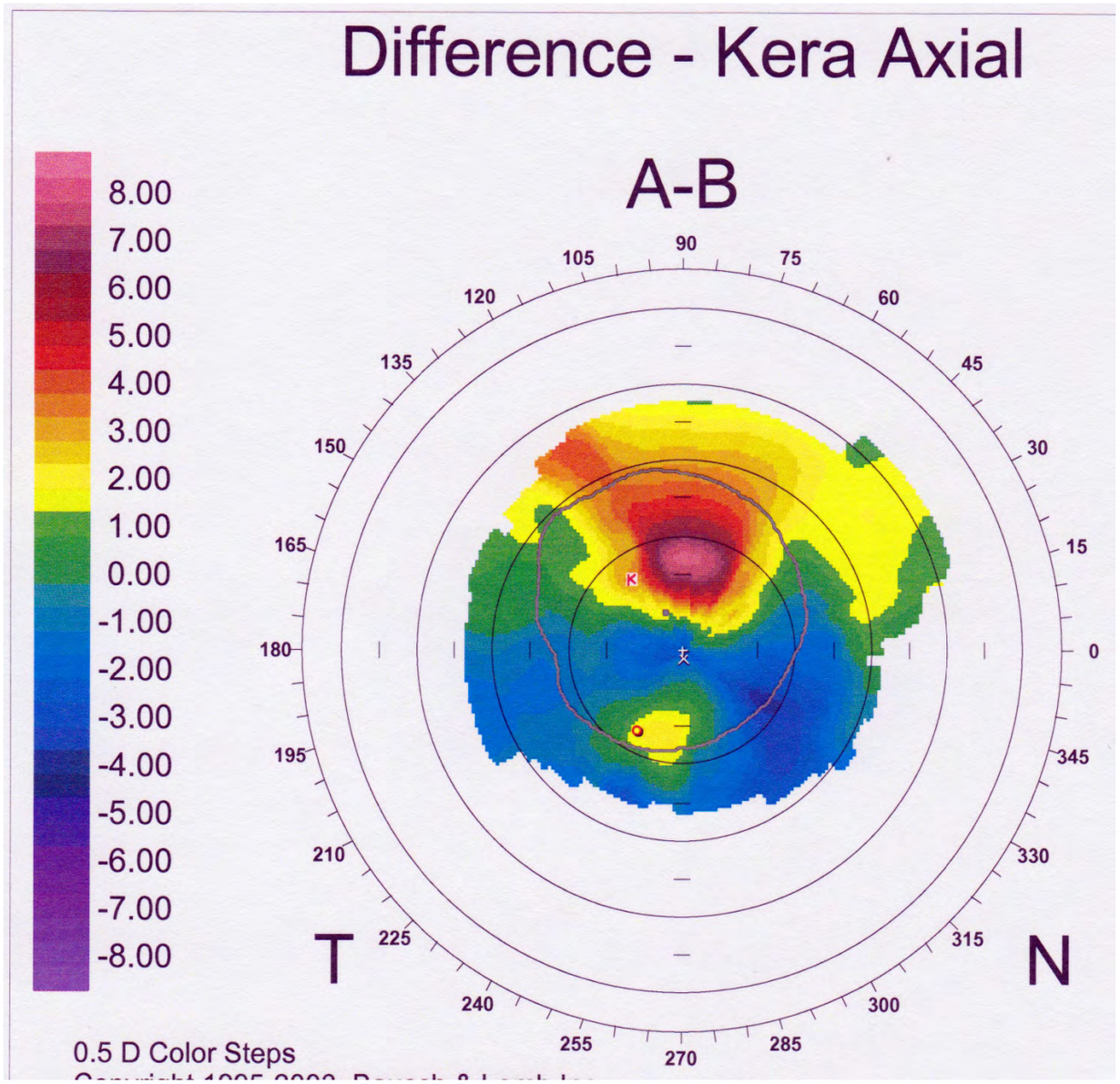
DEVICE COMPARISONS

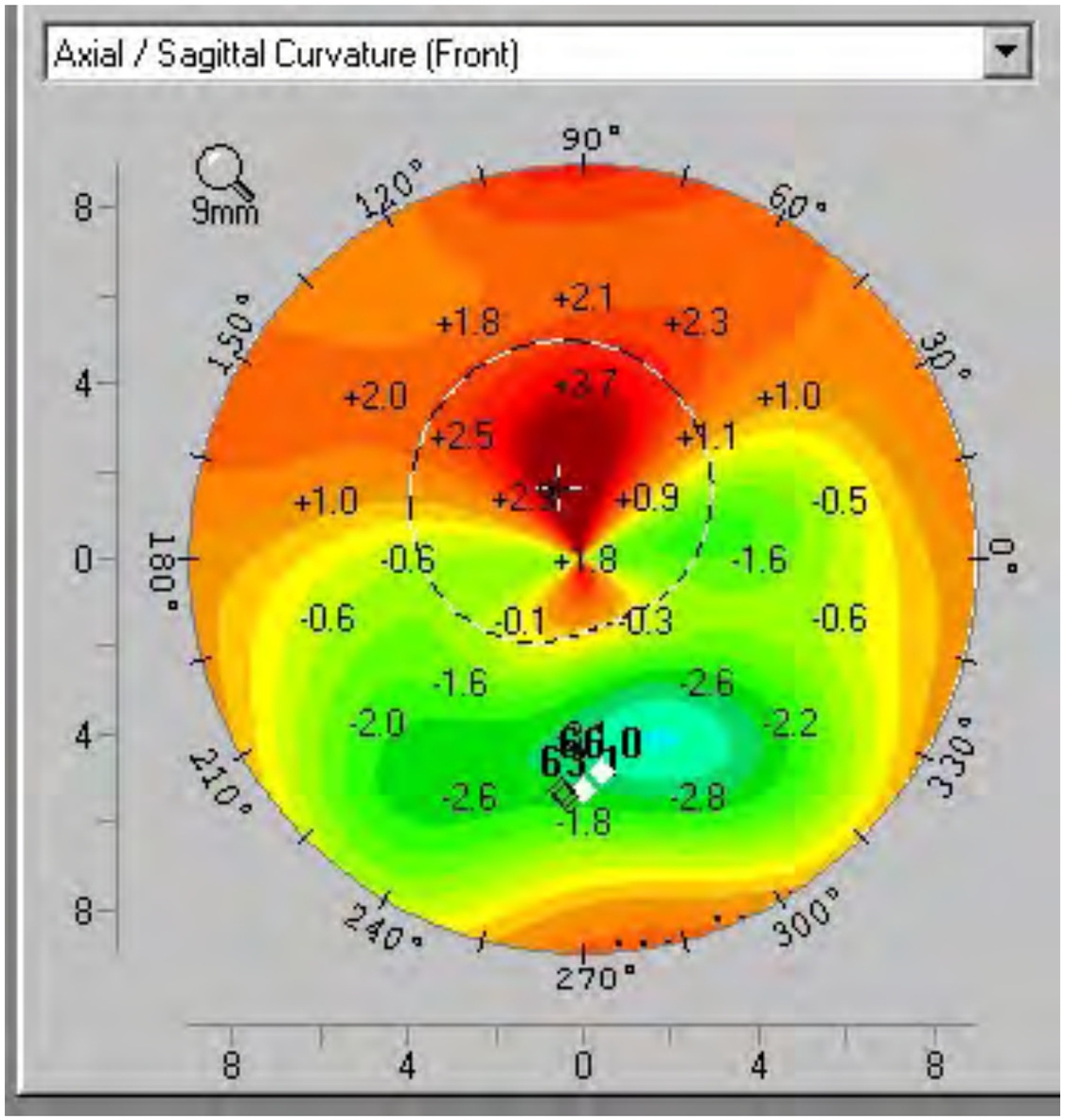
PLACIDO/SCHEIMPFLUG COMPARISON



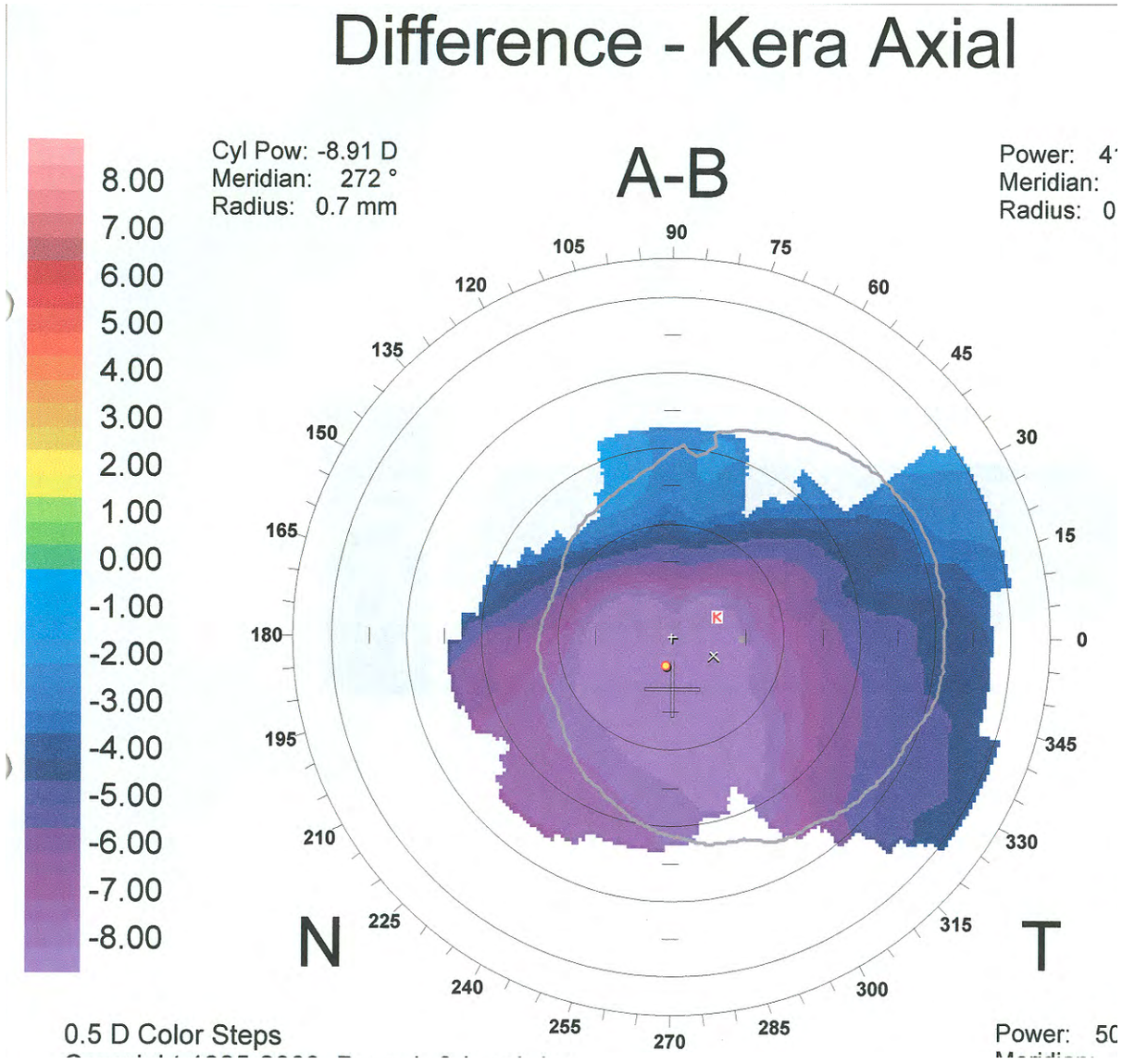


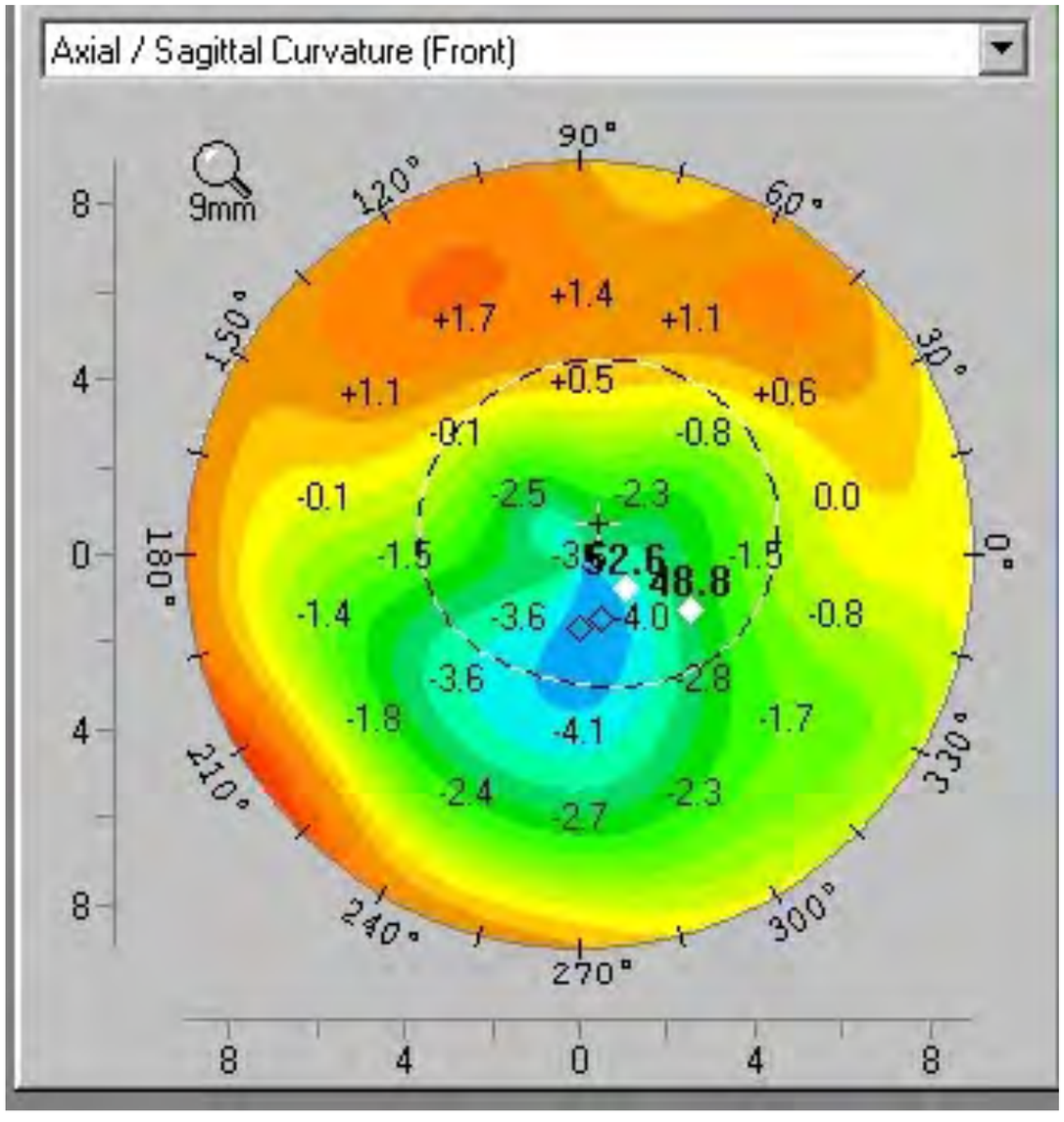
PLACIDO/SCHEIMPFLUG CORRELATIONS



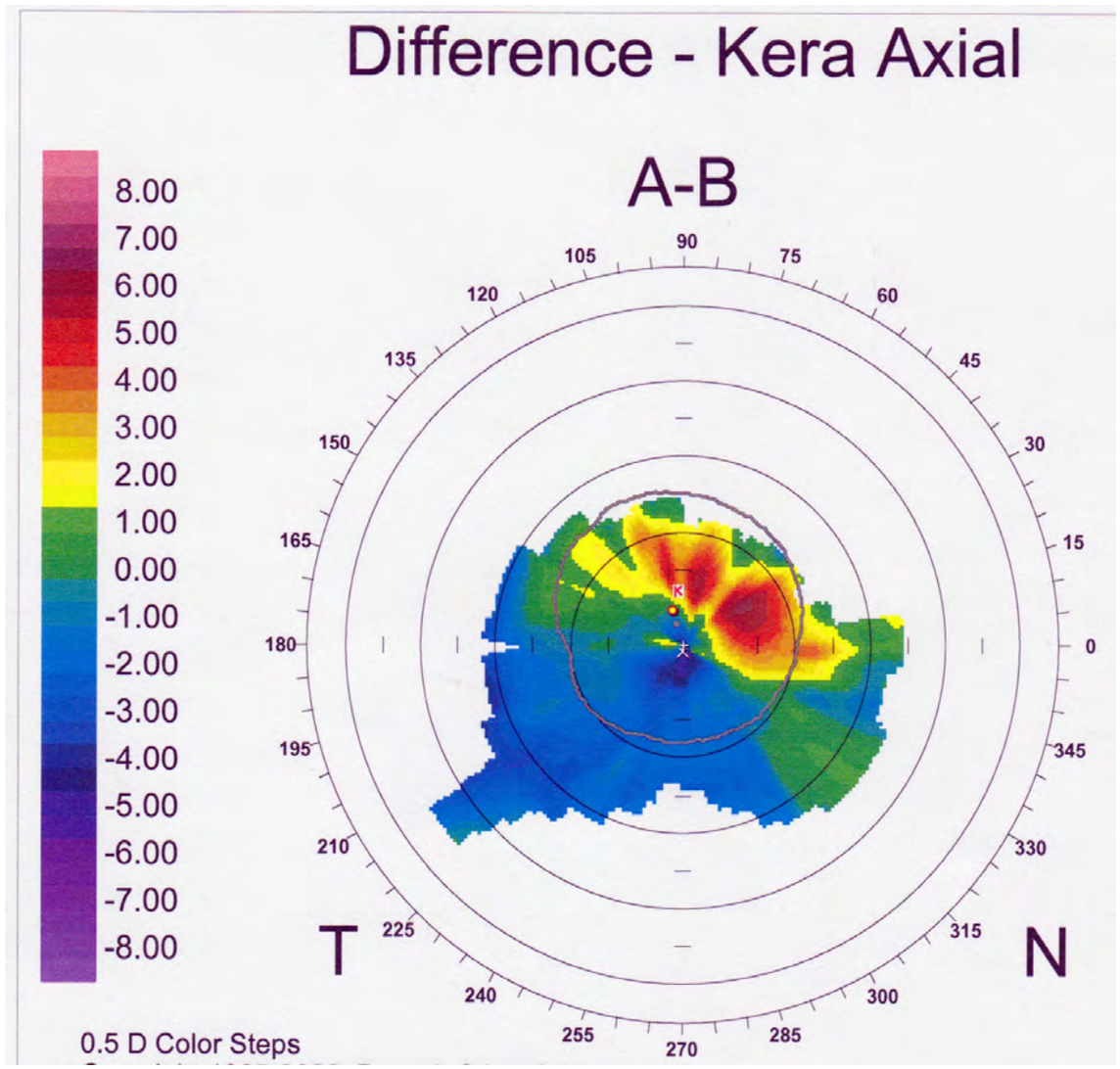


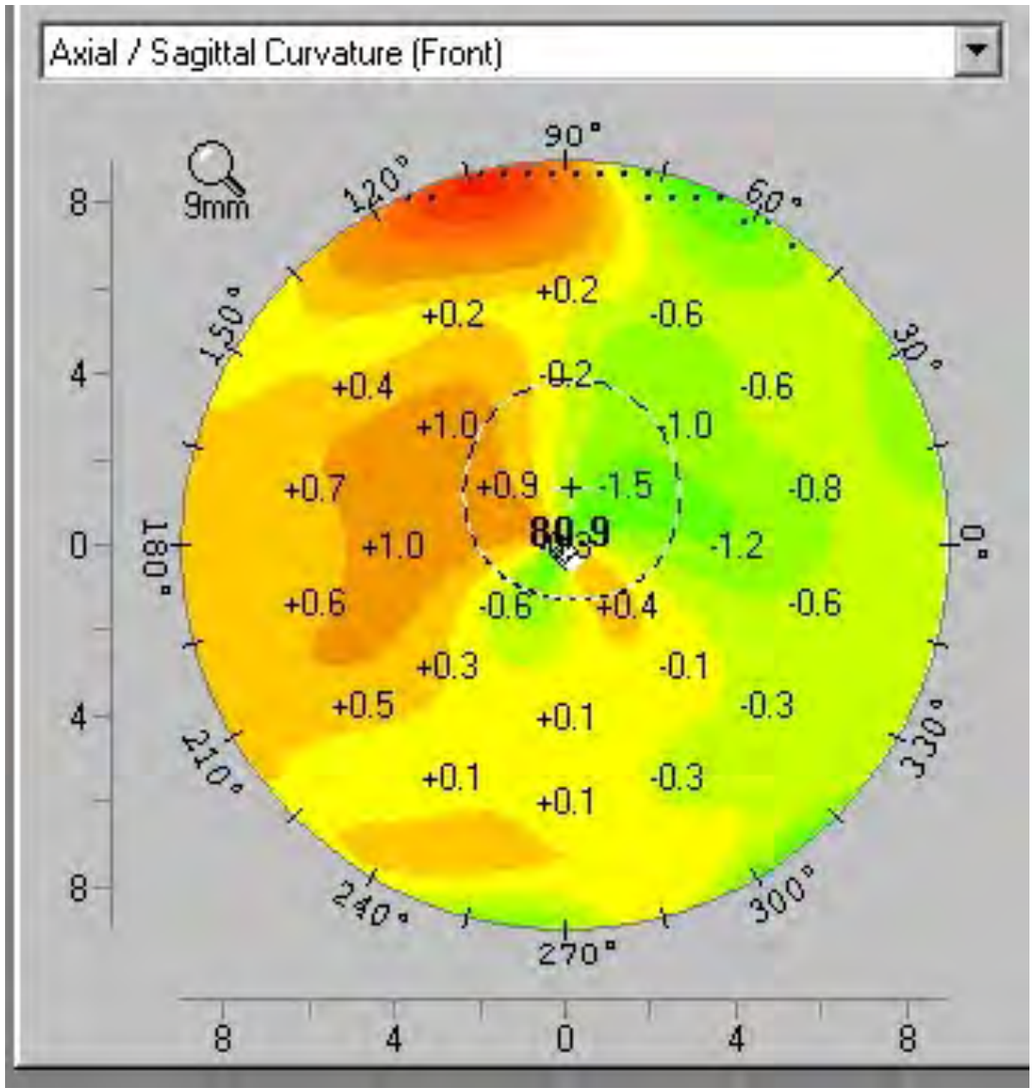
PLACIDO/SCHEIMPFLUG CORRELATIONS

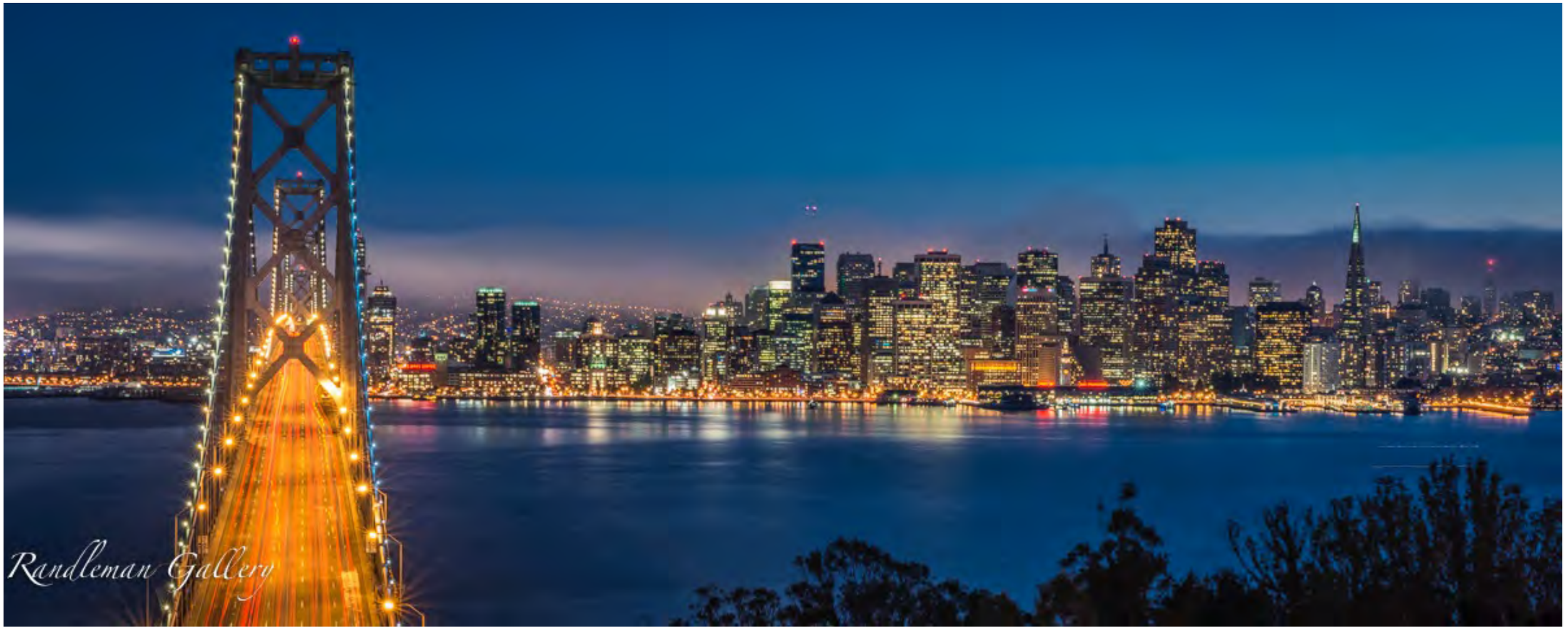




PLACIDO/SCHEIMPFLUG CORRELATIONS







CLINICAL CORRELATIONS

topographic & clinical outcomes

CASE (BP) - ECTASIA

OD	Pre-CXL	Post-CXL
UDVA	<20/200	20/150
CDVA	20/25	20/25
MRx	-9.75 +3.50 x180	-6.25+2.5 x 180

CASE (BP) - ECTASIA

OS	Pre-CXL	Post-CXL
UDVA	20/125	20/125
CDVA	20/50	**20/20**
MRx	-4.50 +3.50 x 005	-5.00 +2.50 x 005

ORBSCAN

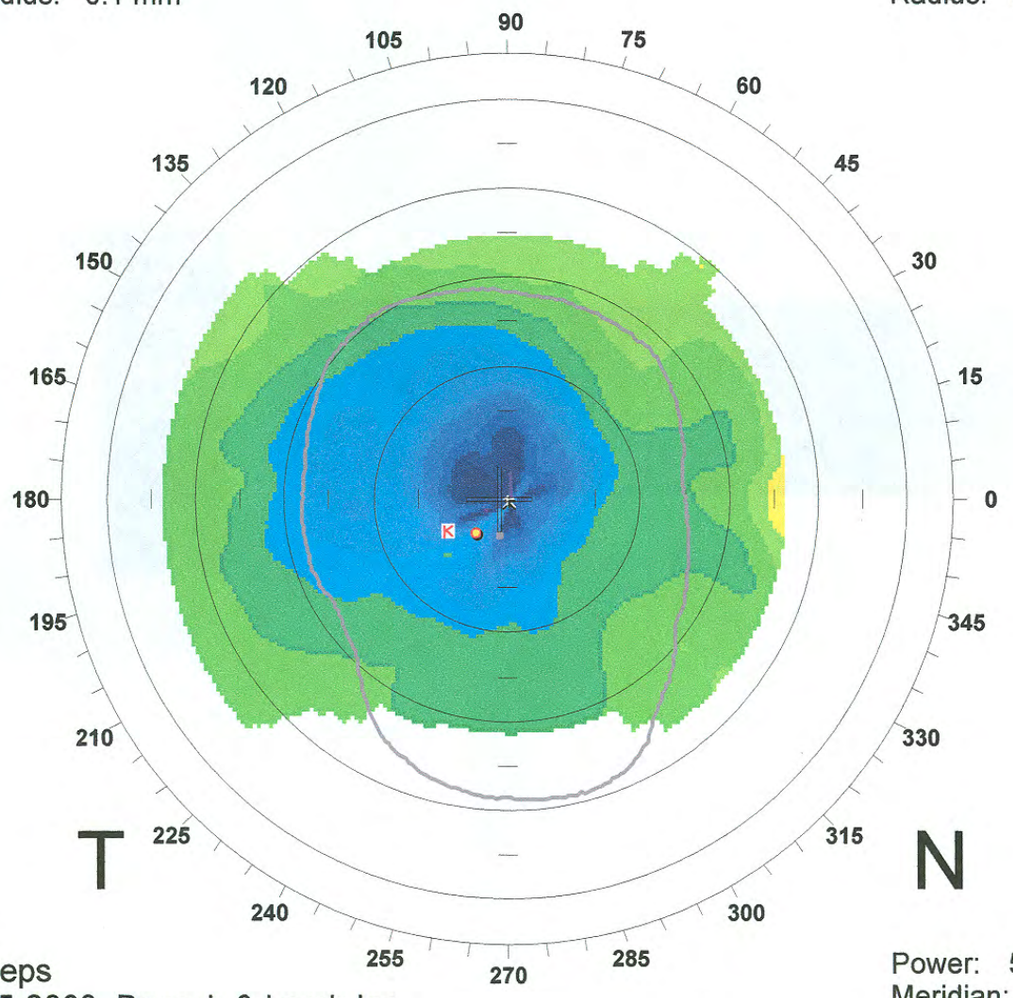
Difference - Kera Axial

Axial Power
1/24/2011 3:36:06 PM

8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
-5.00
-6.00
-7.00
-8.00

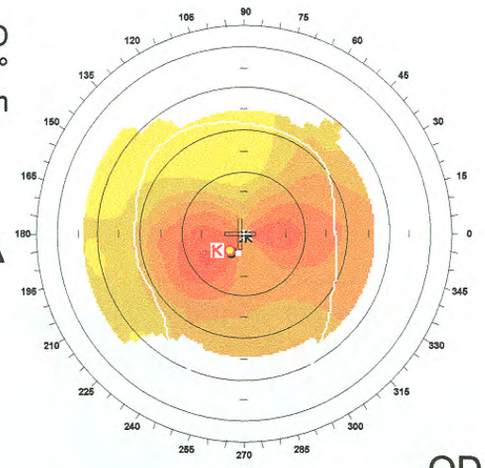
Cyl Pow: -3.90 D
Meridian: 180 °
Radius: 0.1 mm

A-B



Power: 46.46 D
Meridian: 180 °
Radius: 0.1 mm

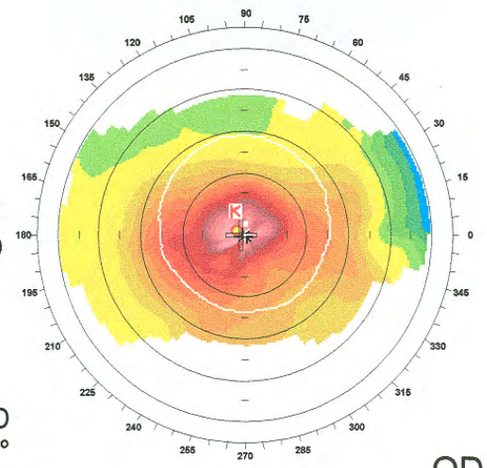
A



OD

Axial Power
6/11/2008 11:59:34 AM

B



Power: 50.36 D
Meridian: 180 °
Radius: 0.1 mm

OD

0.5 D Color Steps

Copyright 1995-2003, Bausch & Lomb Inc.

v3.12

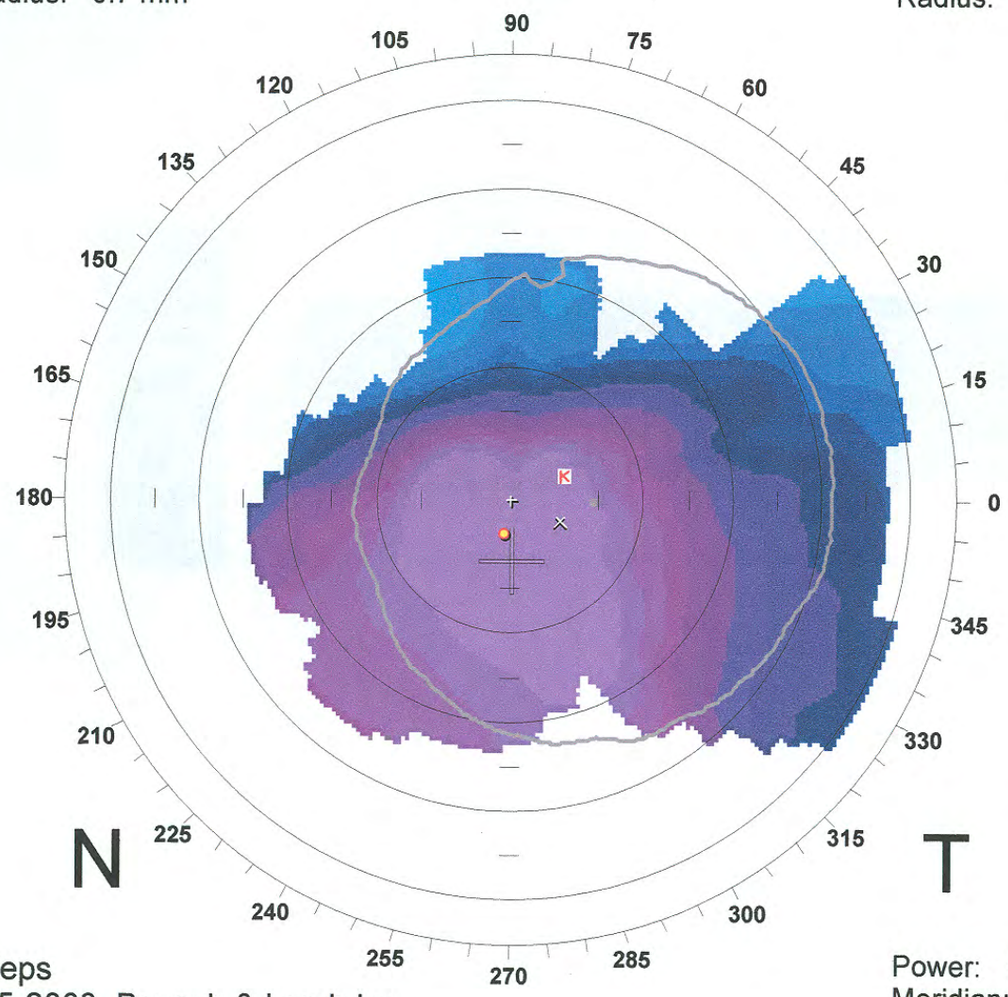
ORBSCAN

Difference - Kera Axial

8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
-5.00
-6.00
-7.00
-8.00

Cyl Pow: -8.91 D
Meridian: 272 °
Radius: 0.7 mm

A-B



0.5 D Color Steps

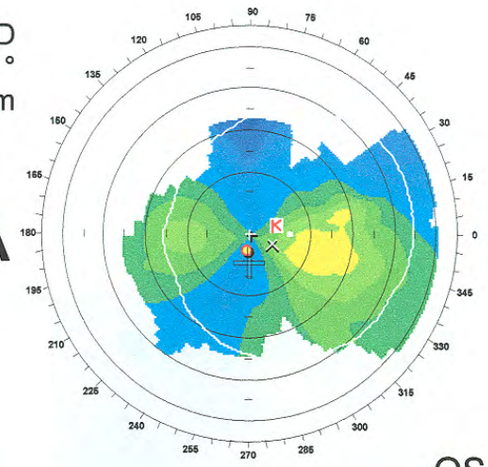
Copyright 1995-2003, Bausch & Lomb Inc.

v3.12

Power: 41.20 D
Meridian: 272 °
Radius: 0.7 mm

Axial Power
1/24/2011 3:36:21 PM

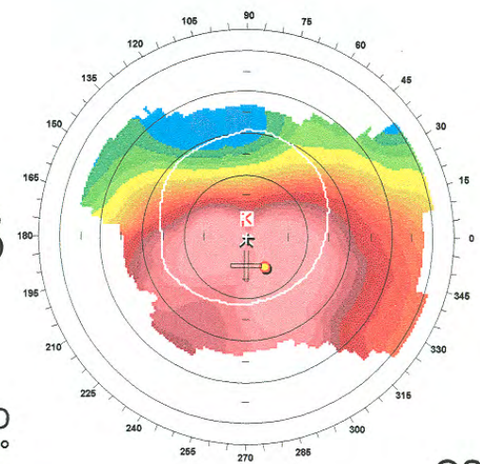
A



OS

Axial Power
8/26/2008 9:25:12 AM

B



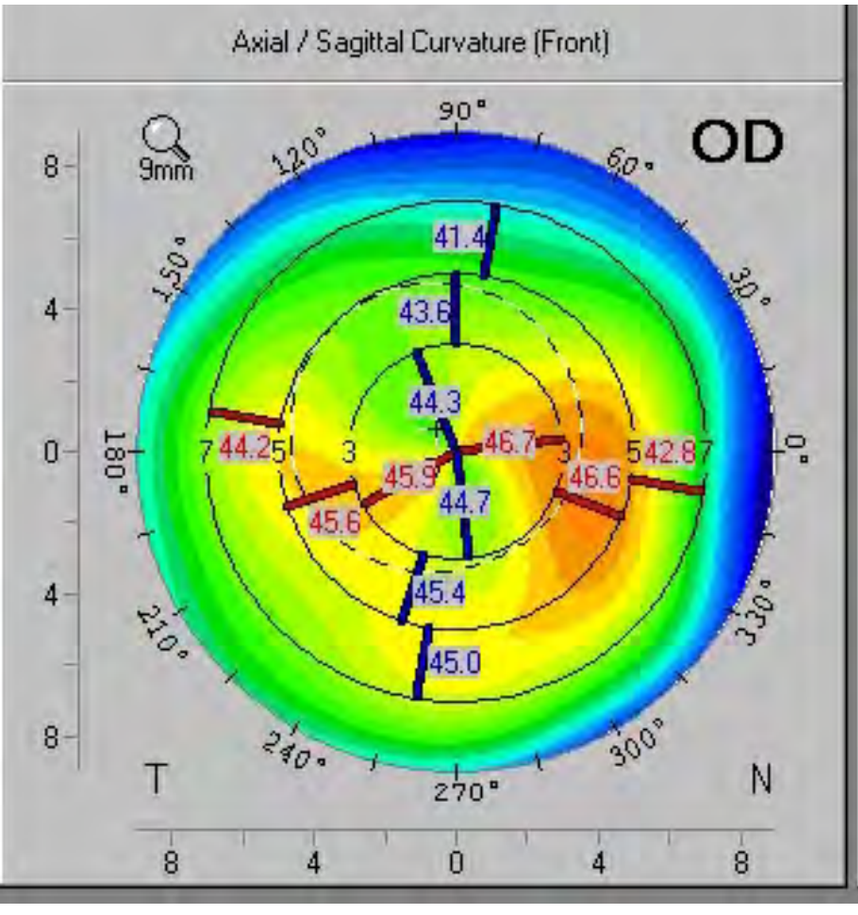
Power: 50.11 D
Meridian: 272 °
Radius: 0.7 mm

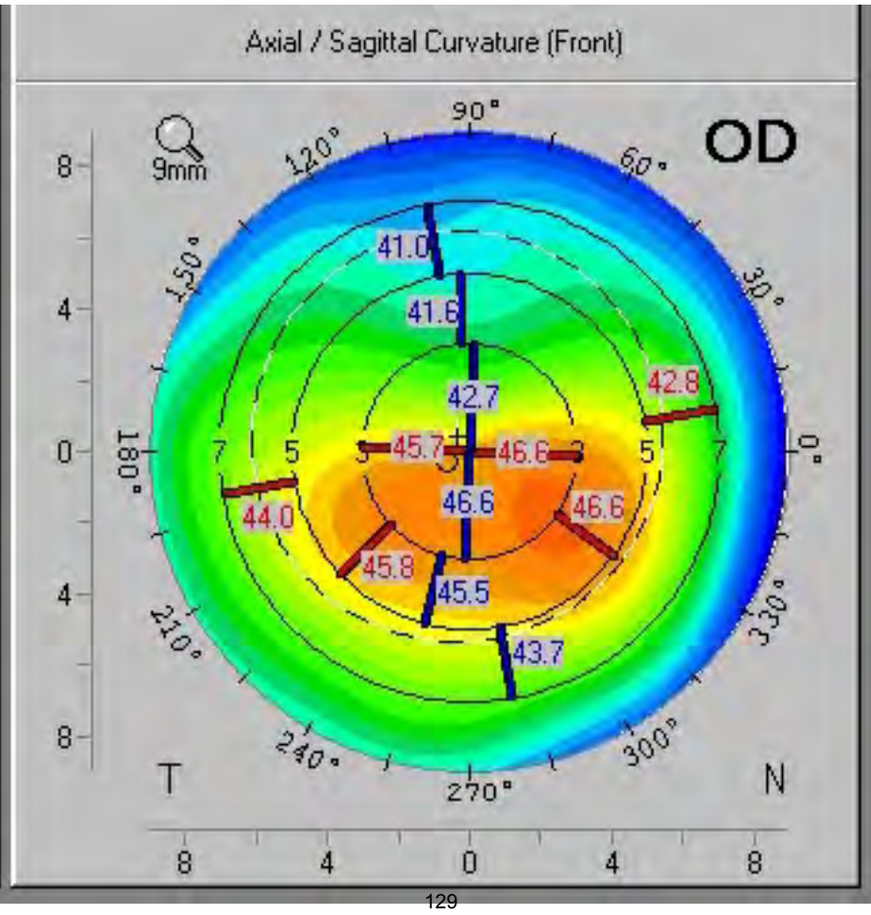
OS

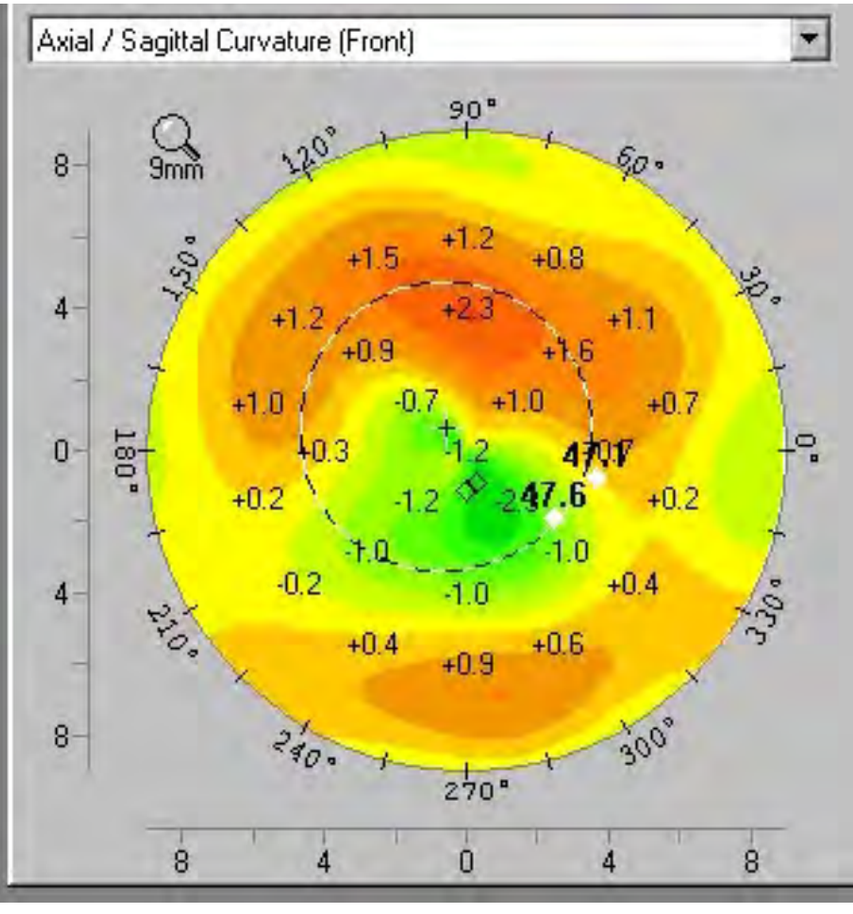
CASE SUMMARY

BP	OD	OS
UDVA	+1 line	Stable
CDVA	stable	**+ 4 lines**
MRx	3 D less	0.3 D less

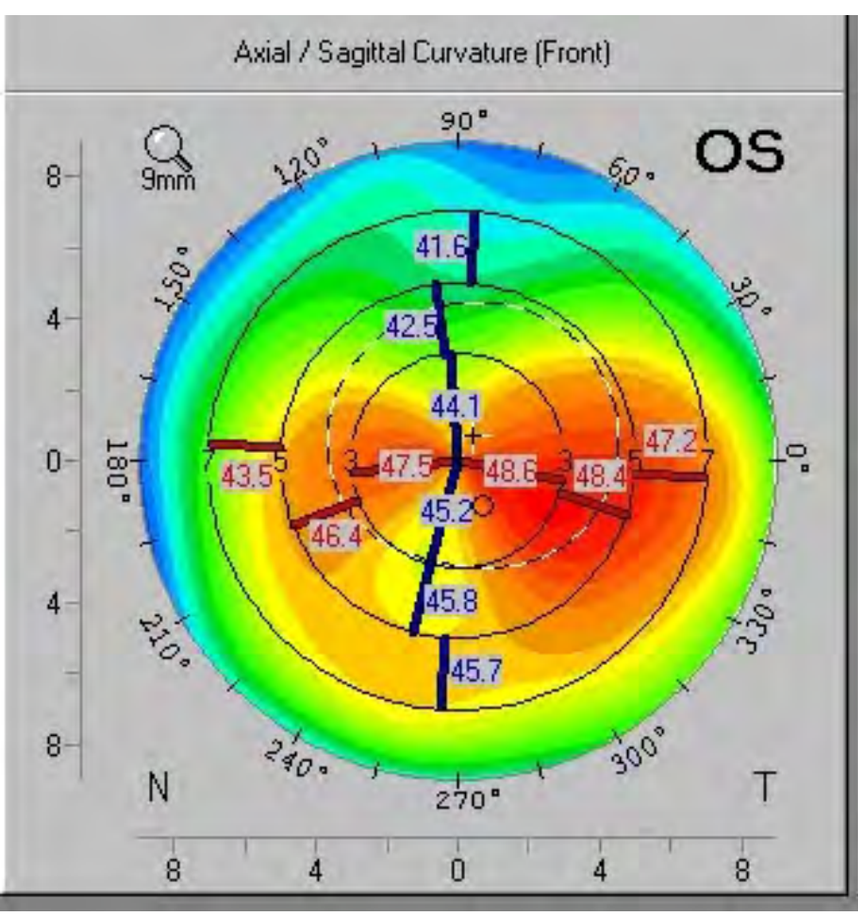
BP	UDVA	CDVA	MRx
OD	+1 line	**stable**	**3 D less**

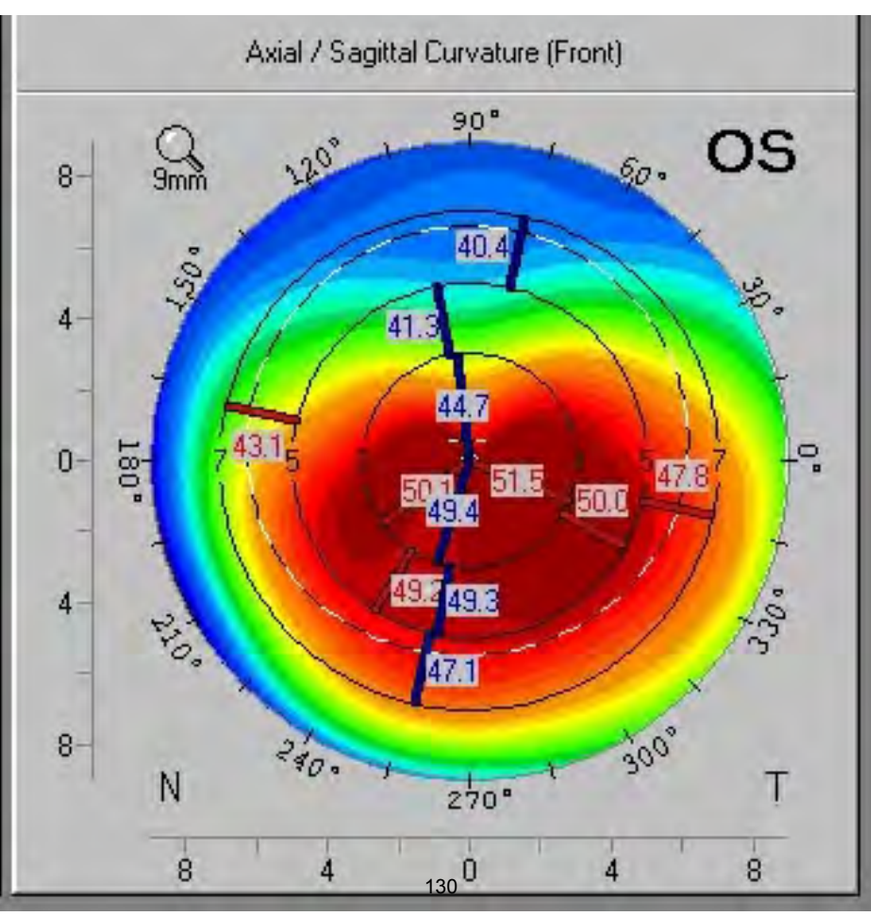


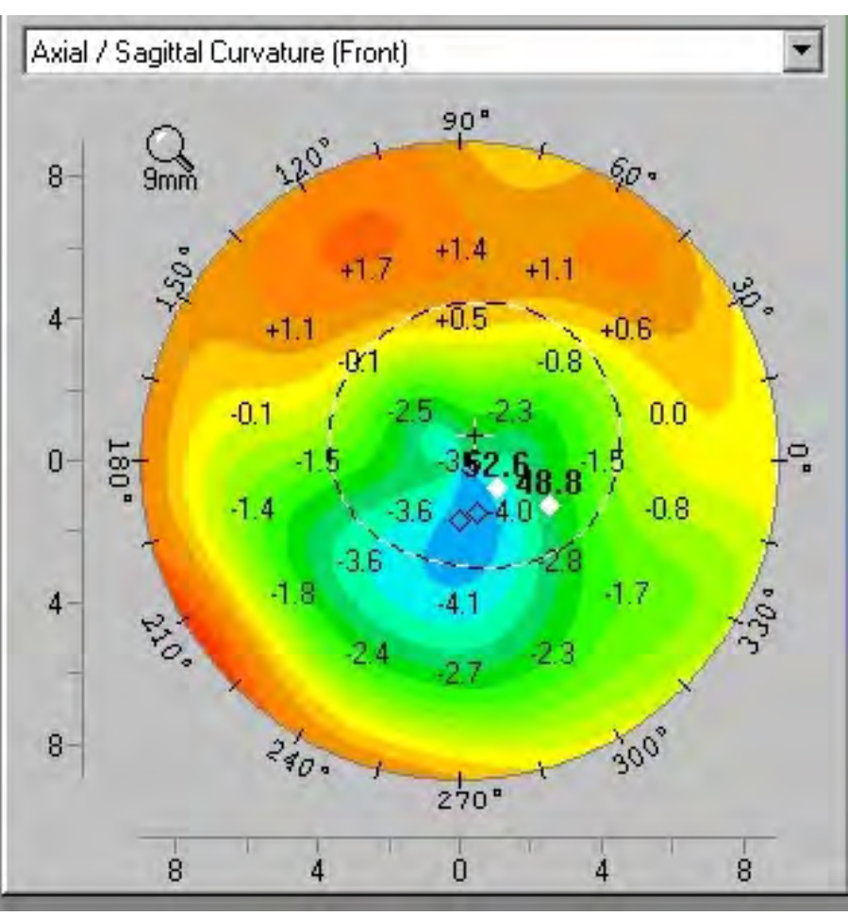


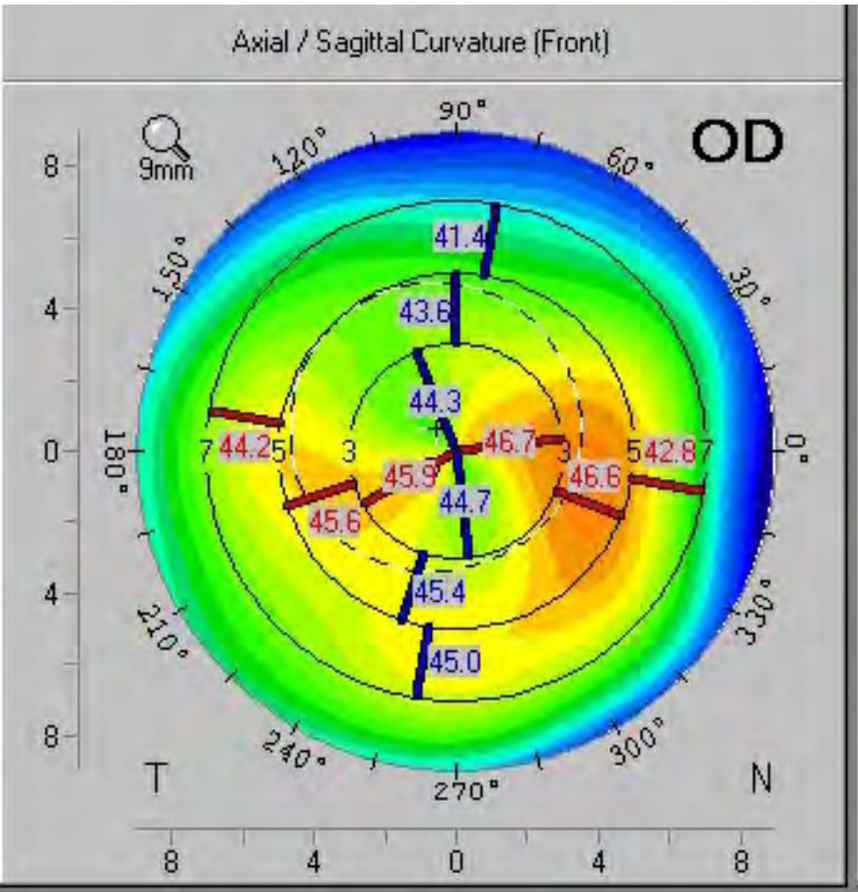


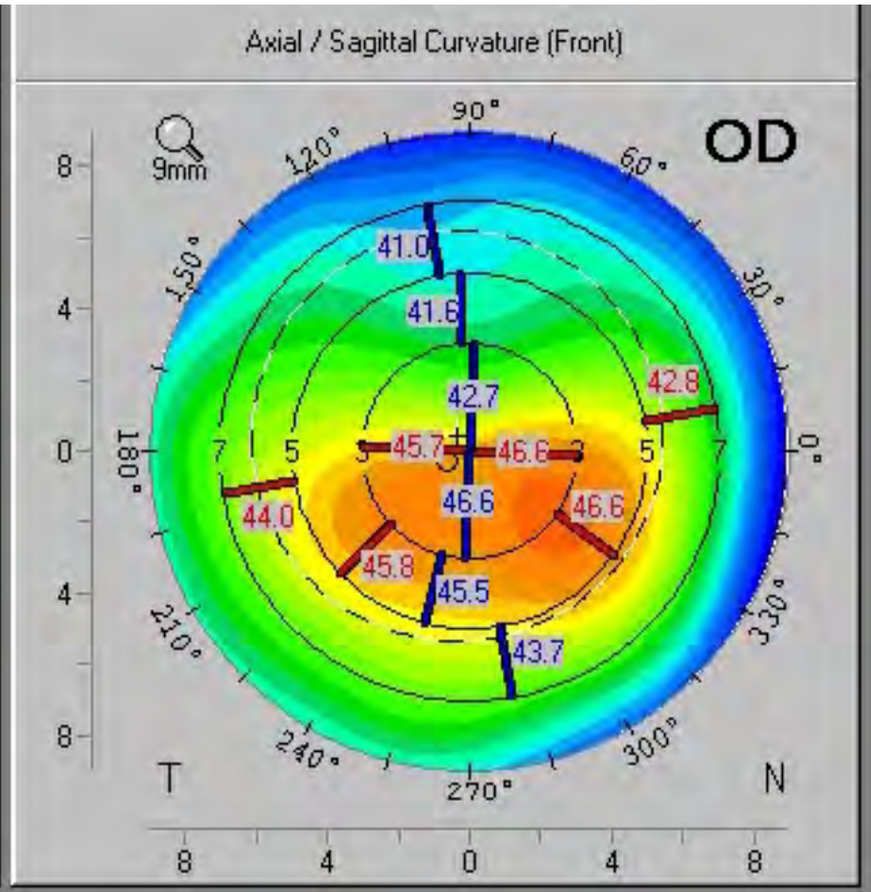
BP	UDVA	CDVA	MRx
OS	Stable	**+ 4 lines**	**0.3 D less**

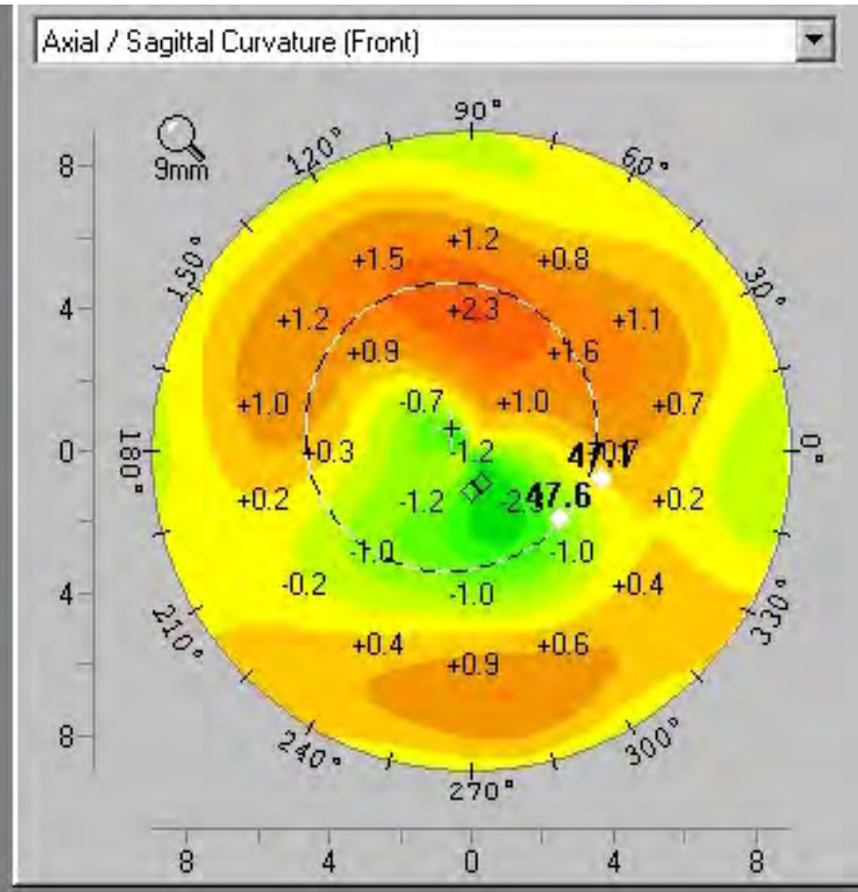


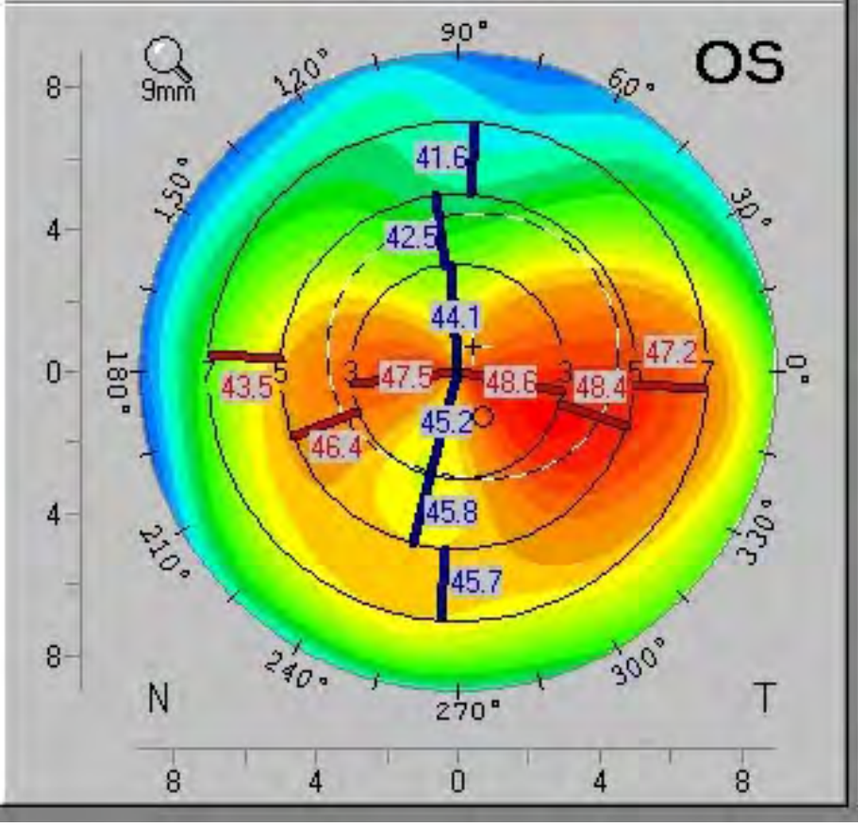


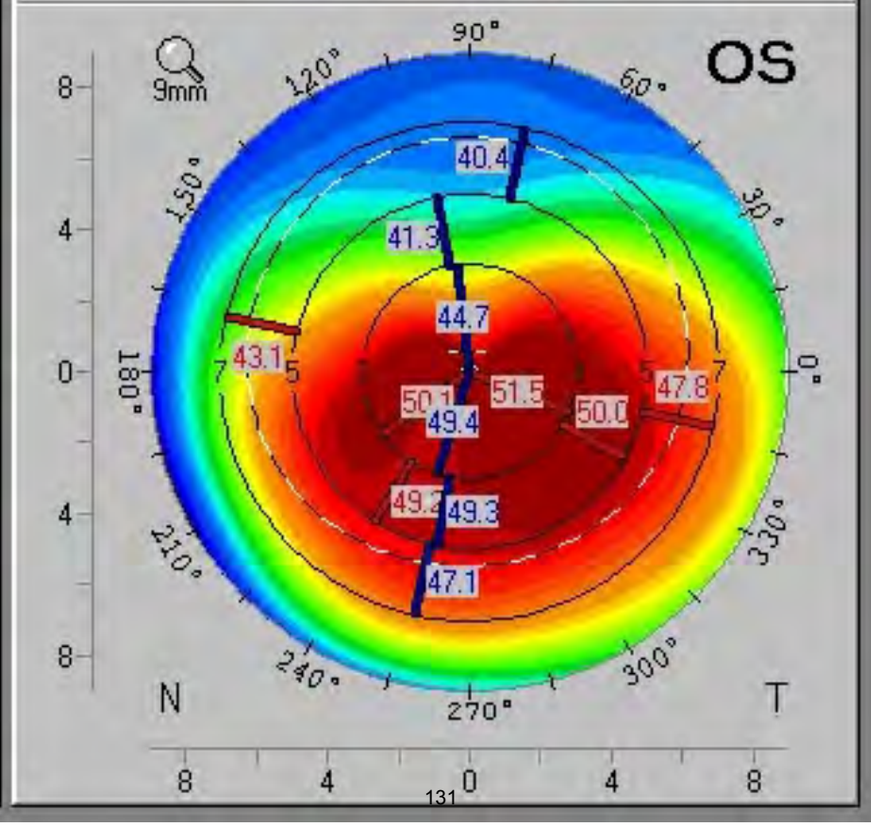


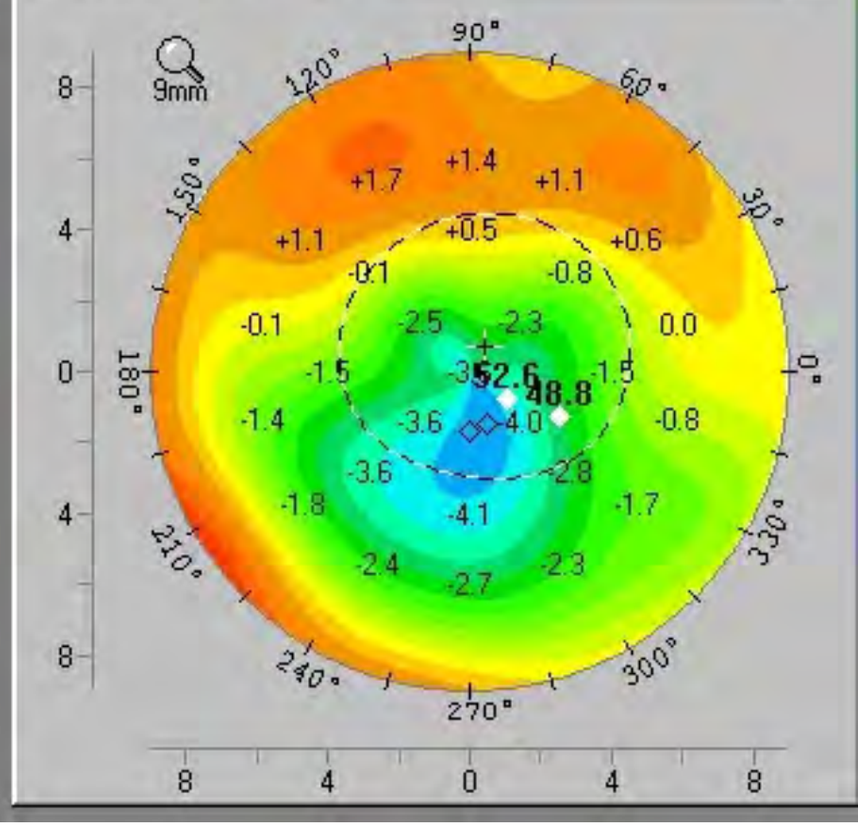

Axial / Sagittal Curvature (Front)
OD
9mm
41.4
43.6
44.3
44.2
46.7
45.9
42.8
46.6
45.6
44.7
45.4
45.0
T
N


Axial / Sagittal Curvature (Front)
OD
9mm
41.0
41.6
42.7
42.8
45.7
46.6
44.0
46.6
46.6
45.8
45.5
43.7
T
N


Axial / Sagittal Curvature (Front)
9mm
+1.2
+1.5
+0.8
+1.2
+2.3
+1.1
+0.9
+1.6
+1.0
-0.7
+1.0
+0.7
+0.3
-1.2
47.1
+0.2
-1.2
47.6
+0.2
-1.0
-1.0
-0.2
-1.0
+0.4
+0.4
+0.9
+0.6


Axial / Sagittal Curvature (Front)
OS
9mm
41.6
42.5
44.1
43.5
47.5
48.6
48.4
47.2
46.4
45.2
45.8
45.7
N
T


Axial / Sagittal Curvature (Front)
OS
9mm
40.4
41.3
44.7
43.1
50.1
51.5
50.0
47.8
49.4
49.2
49.3
47.1
N
T


Axial / Sagittal Curvature (Front)
9mm
+1.7
+1.4
+1.1
+1.1
+0.5
+0.6
-0.1
-0.8
-0.1
-2.5
-2.3
0.0
-1.5
-1.5
-1.4
-3.6
-4.0
-0.8
-3.6
-2.8
-1.8
-4.1
-1.7
-2.4
-2.7
-2.3

CASE (ML) - KC

OD	Pre-CXL	Post-CXL
UDVA	20/60	**20/25**
CDVA	20/30	**20/20-**
MRx	-5.00 +2.75 x 125	-1.75 +0.50 x 145

CASE (ML) - KC

OS	Pre-CXL	Post-CXL
UDVA	20/80	20/50
CDVA	20/30	**20/20+**
MRx	-4.00 +2.25 x 050	-4.50 +2.50 x 055

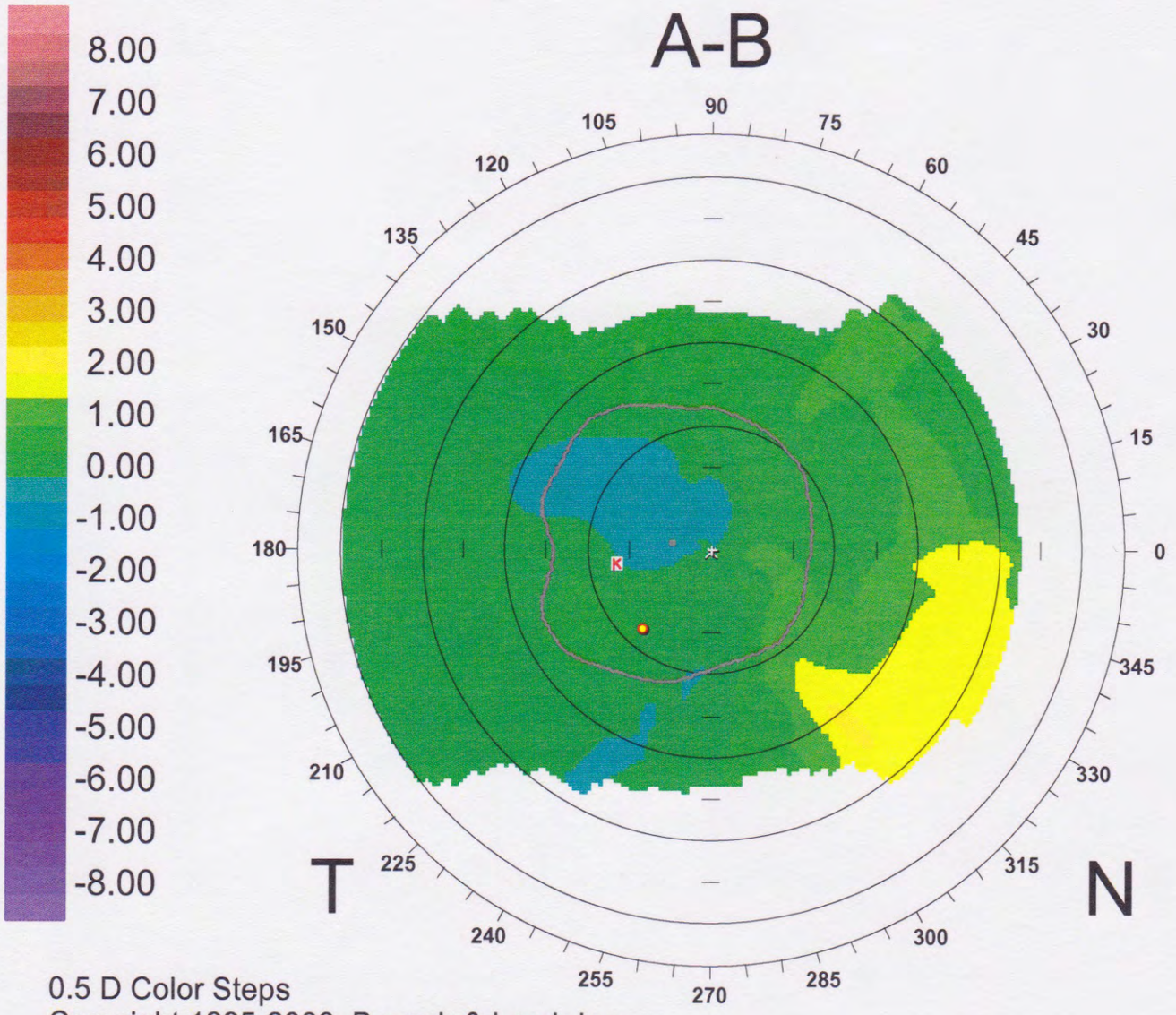
CASE SUMMARY

ML	OD	OS
UDVA	+4 lines	+2 lines
CDVA	**+2 lines (20/20)**	**+2 lines (20/20)**
MRx	2 D less	0.4 D less

ORBSCAN

Difference - Kera Axial

A-B



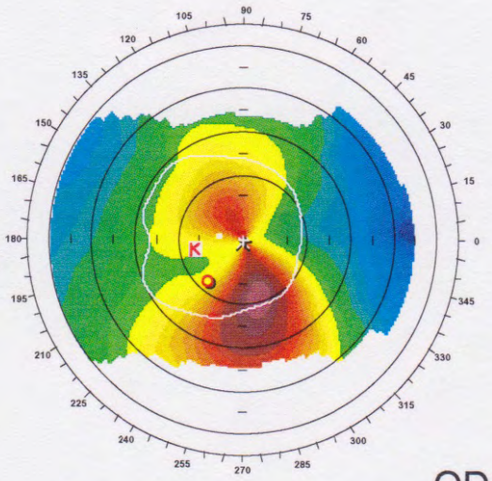
0.5 D Color Steps

Copyright 1995-2003, Bausch & Lomb Inc.

v3.12

Axial Power

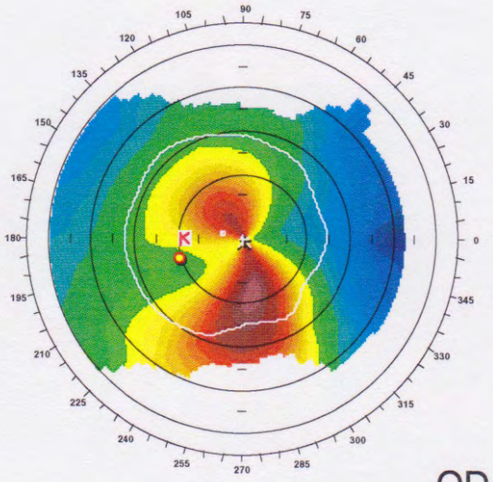
A



OD

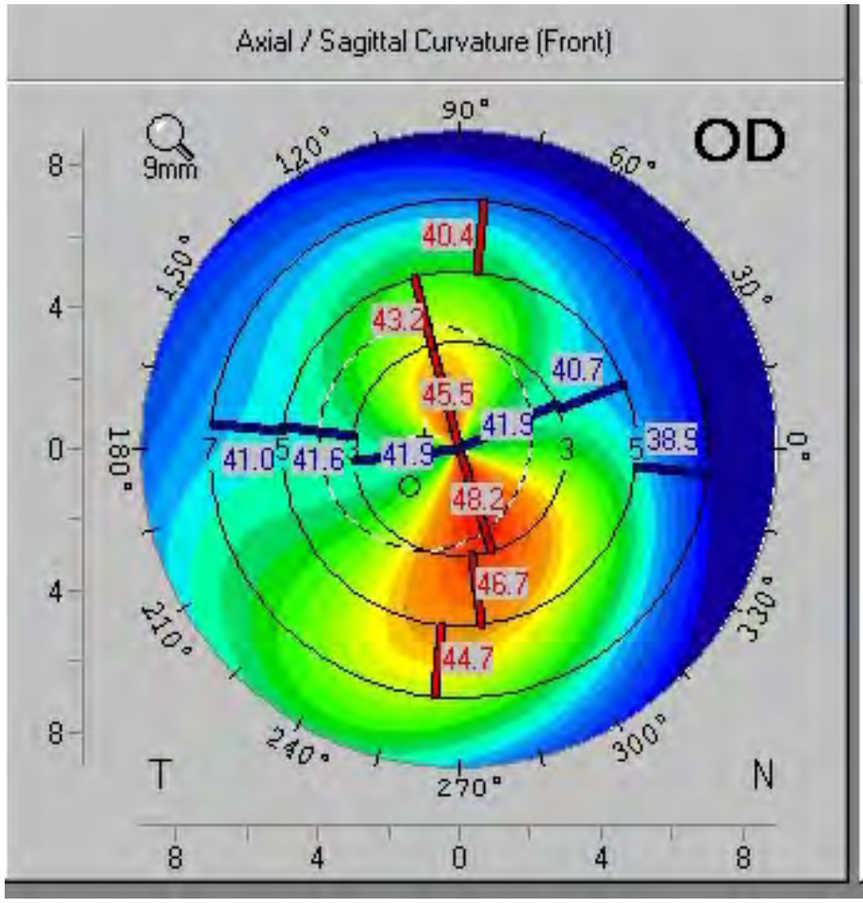
Axial Power

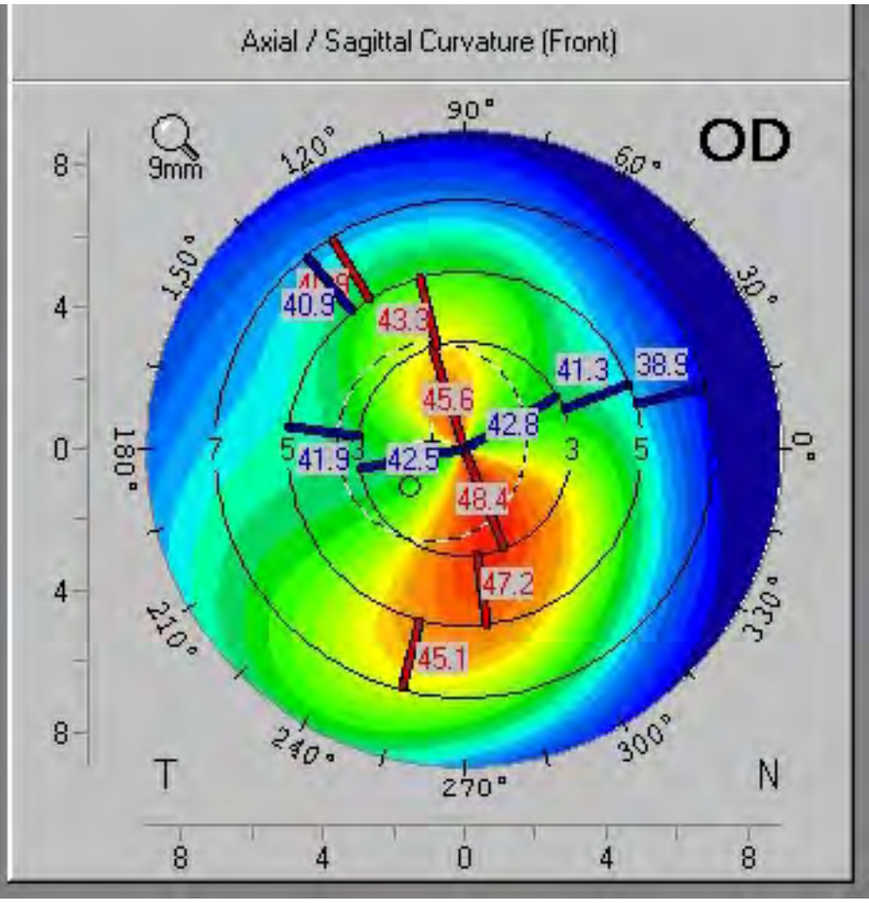
B

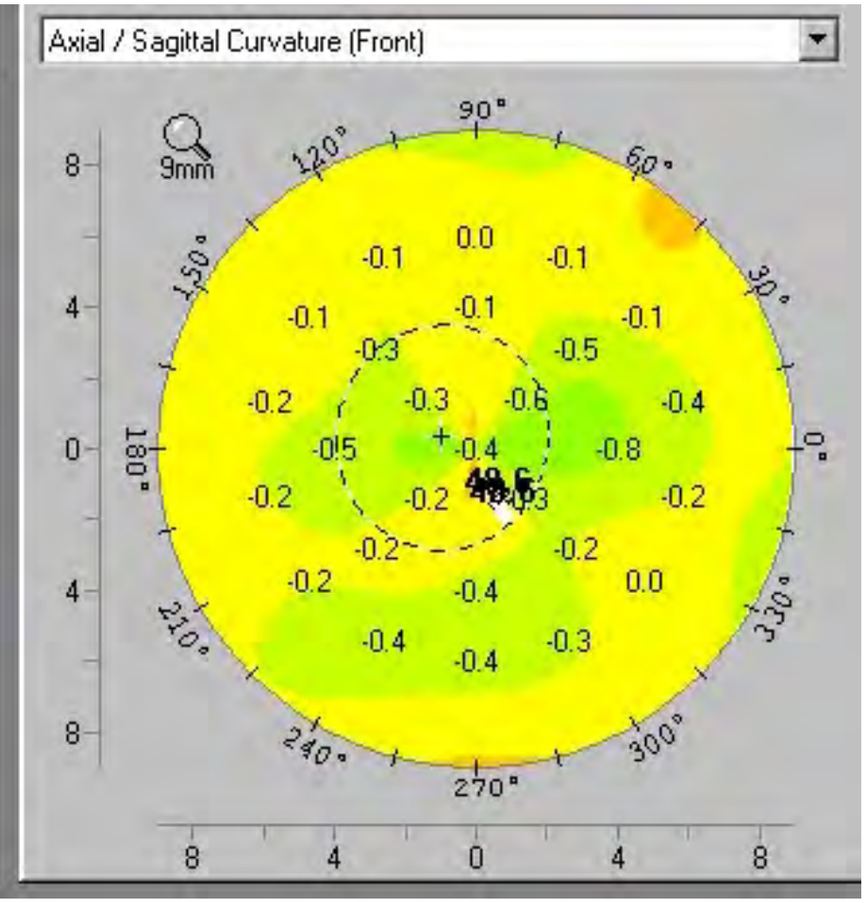


OD

ML	UDVA	CDVA	MRx
OD	+4 lines	**+2 lines (20/20)**	2 D less









CXL CONTROVERSIES

ARTICLE

Combined laser in situ keratomileusis and prophylactic high-fluence corneal collagen crosslinking for high myopia: Two-year safety and efficacy

Anastasios John Kanellopoulos, MD, George Asimellis, PhD

J Cataract Refract Surg 2015; 41:1426–1433

ARTICLE

Superficial corneal crosslinking during laser in situ keratomileusis

Theo G. Seiler, MD, Isaak Fischinger, MD, Tobias Koller, MD,
Viktor Derhartunian, MD, Theo Seiler, MD, PhD

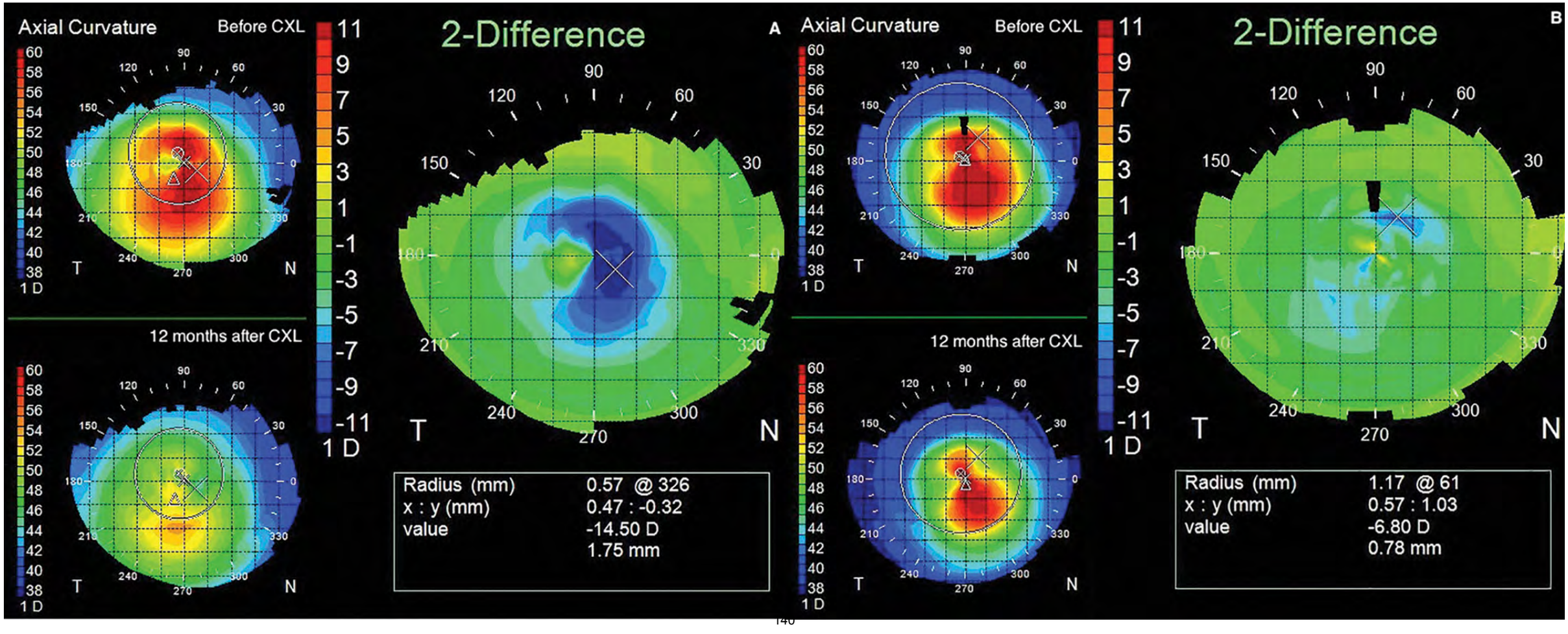
J Cataract Refract Surg 2015; 41:2165–2170

REPORT

Intense Early Flattening After Corneal Collagen Cross-linking

Marcony R. Santhiago, MD, PhD; Natalia T. Giacomin, MD;
Carla S. Medeiros, MD; David Smadja, MD;
Samir J. Bechara, MD, PhD

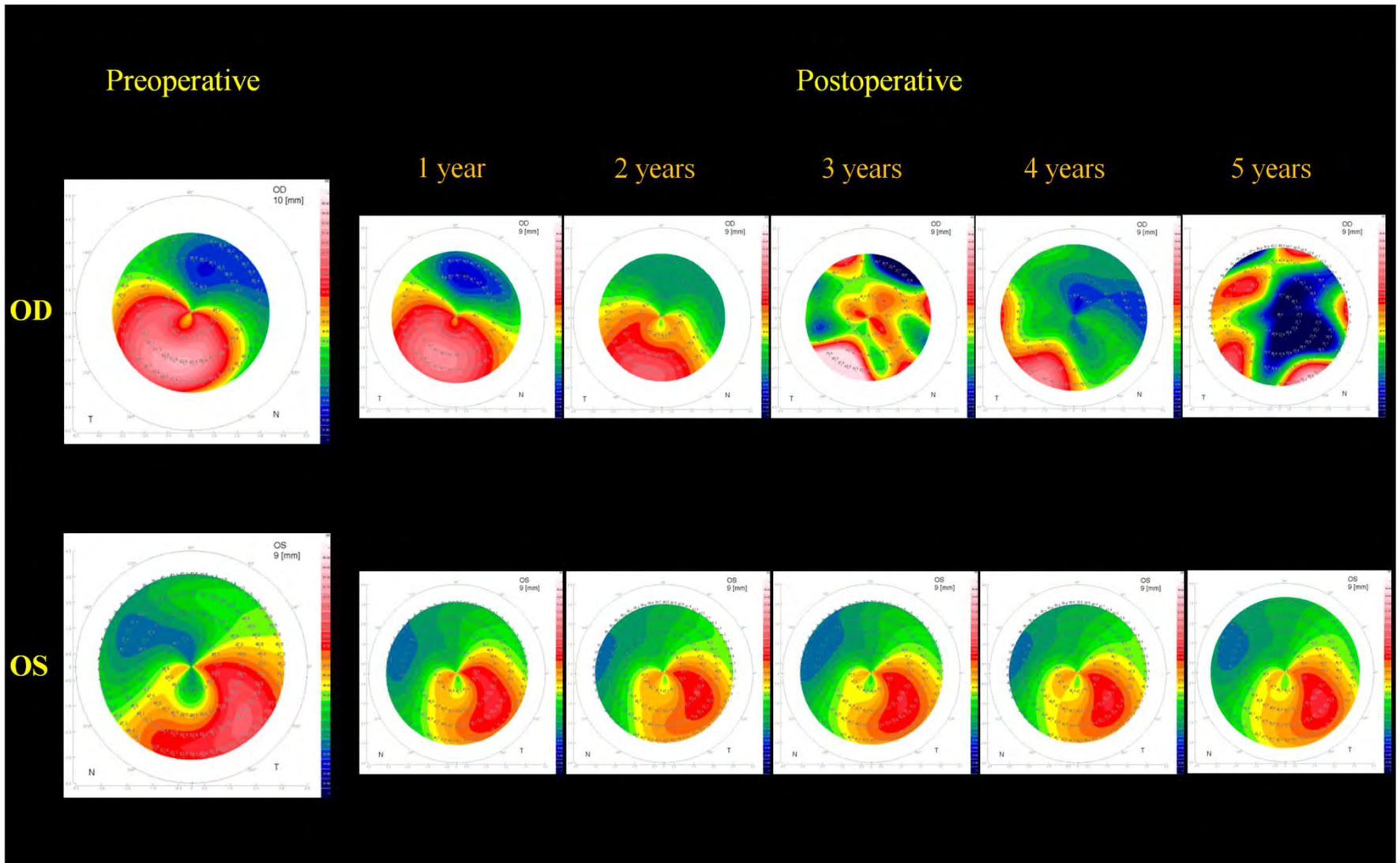
[*J Refract Surg.* 2015;31(6):419-422.]



Excessive Corneal Flattening and Thinning After Corneal Cross-linking: Single-Case Report With 5-Year Follow-up

George D. Kymionis, MD, PhD,† Konstantinos I. Tsoulnaras, MD,* Dimitrios A. Liakopoulos, MD,* Theodoros A. Paraskevopoulos, MD,* Anna I. Kouroupaki, MD,* and Miltiadis K. Tsilimbaris, MD, PhD**

(*Cornea* 2015;34:704–706)





WHAT'S COMING NEXT?

New UV devices





New Beam Profiles


UV-X™
Beam Aperture


UV-X™
Beam Aperture


UV-ILLUMINATION
OPTIMIZED BEAM PROFILE
CROSS-LINKED VOLUME
DEMARCATION LINE
SAFETY MARGIN


UV-ILLUMINATION
STANDARD BEAM PROFILE
CROSS-LINKED VOLUME
DEMARCATION LINE
SAFETY MARGIN

RIBOFLAVIN


MedioCROSS TE
SINGLE USE EYE DROPS
12 - 2013
12XTR0425 Q94


ParaCel
SINGLE USE EYE DROPS
Riboflavin 0.25%, NaCl, BAC, EDTA
Tris, HPMC
06 - 2014


MedioCROSS M
SINGLE USE EYE DROPS
12 - 2013
12XTR0425 Q94

VibeX Xtra
SINGLE USE EYE DROPS 2.0 ML
Riboflavin phosphate 3.25 mg
12 - 2013
12XTR0425 Q94

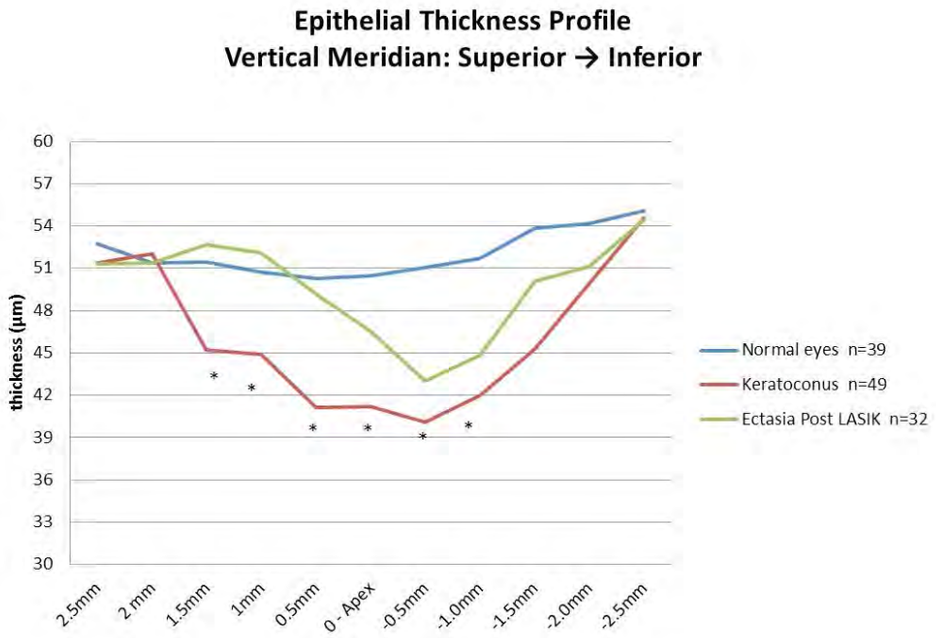

VibeX Rapid
06 - 2013

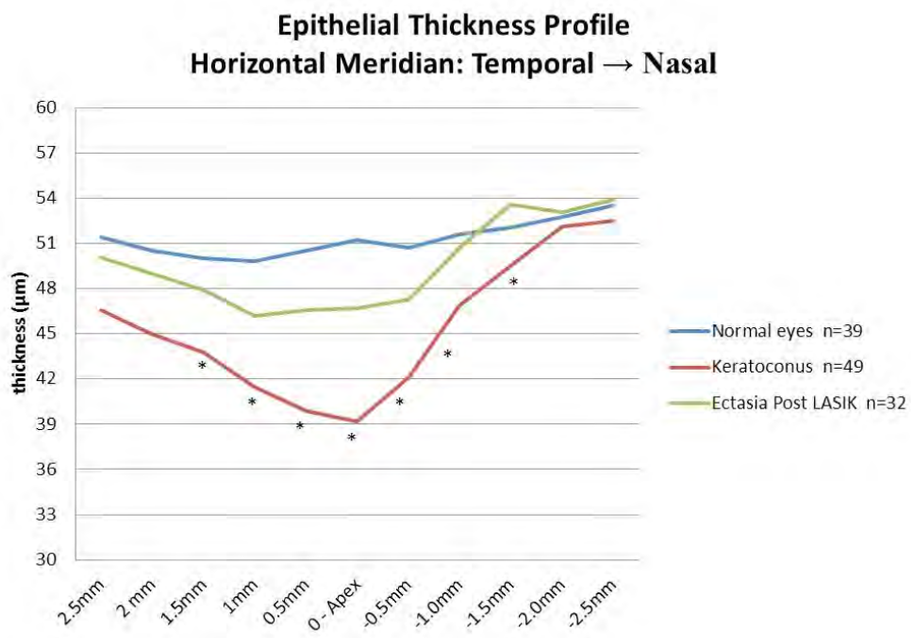
PIXL - CXL FOR REFRACTIVE ERROR…



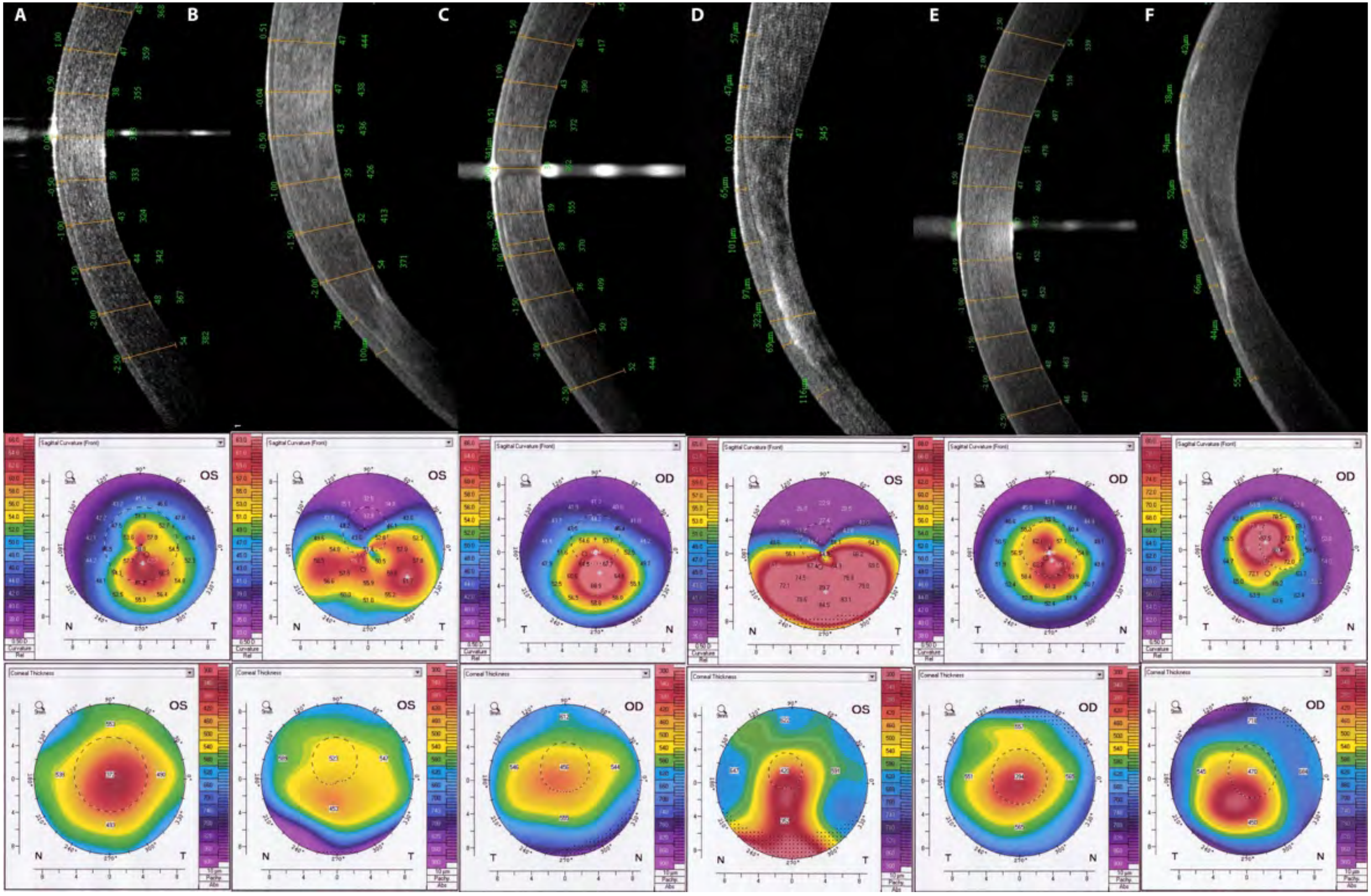
SD-OCT Analysis of Regional Epithelial Thickness Profiles in Keratoconus, Postoperative Corneal Ectasia, and Normal Eyes

Karolinne Maia Rocha, MD, PhD; Claudia E. Perez-Straziota, MD; R. Doyle Stulting, MD, PhD; J. Bradley Randleman, MD





JRS 2013: 173-179

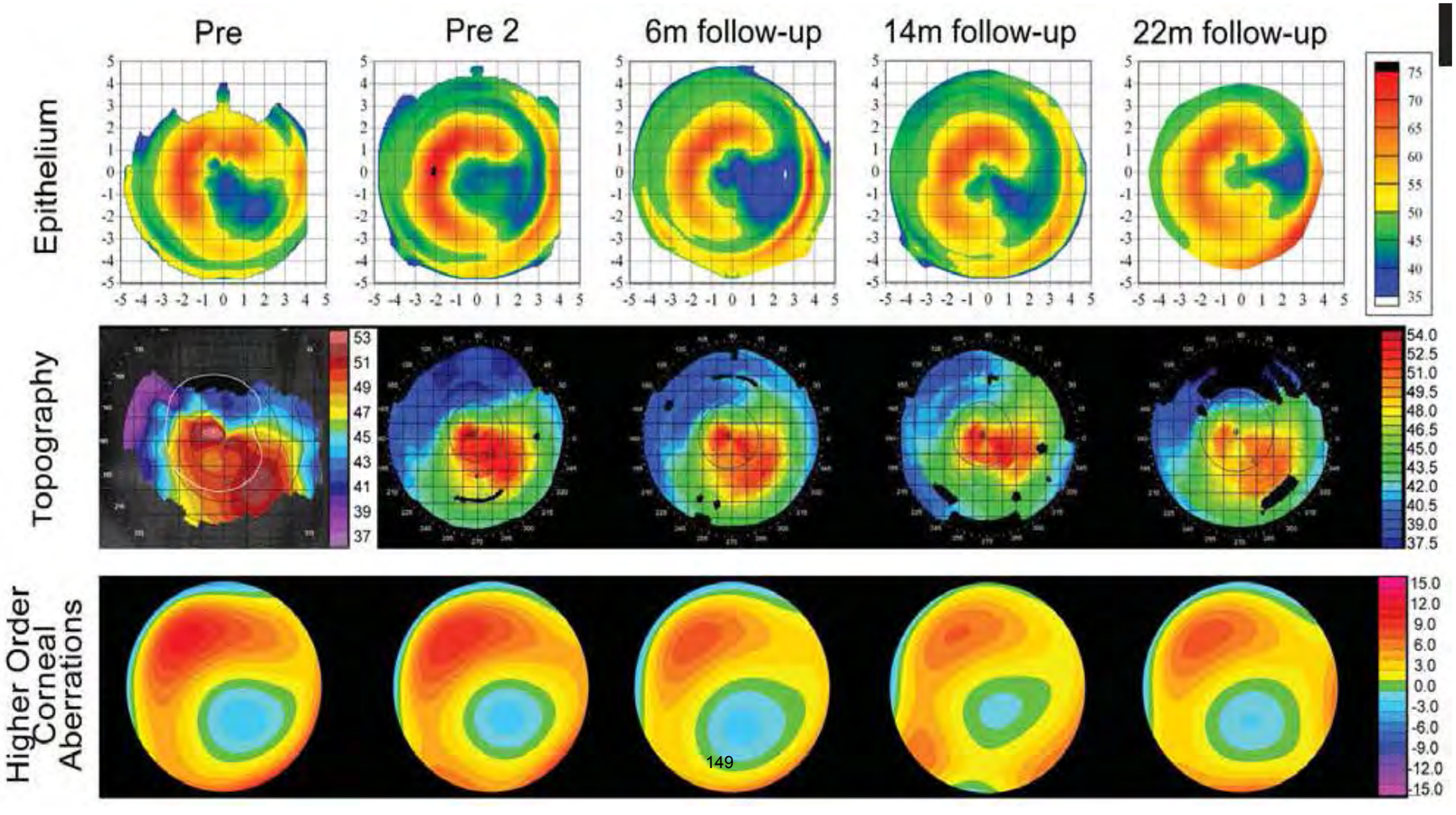


Unpredictable epithelial thickness profiles based on curvature or total thickness maps

NEW TECHNOLOGY

Epithelial Thickness Profile as a Method to Evaluate the Effectiveness of Collagen Cross-linking Treatment After Corneal Ectasia

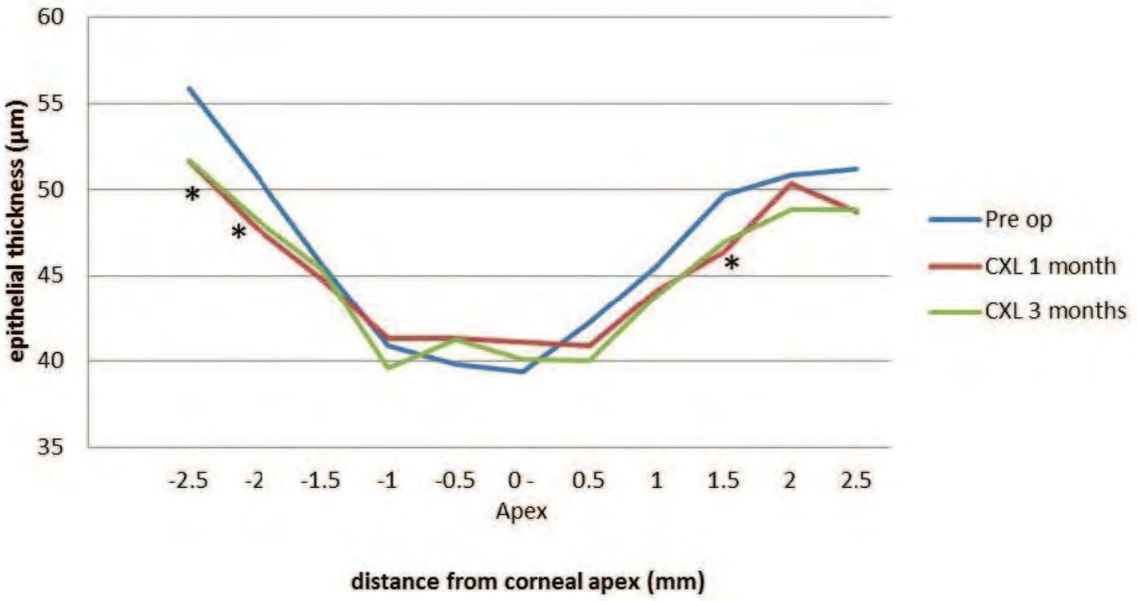
Dan Z. Reinstein, MD, MA(Cantab), FRCSC, FRCOphth; Marine Gobbe, MST(Optom), PhD; Timothy J. Archer, MA(Oxon), DipCompSci(Cantab); Darren Couch, BScOptom

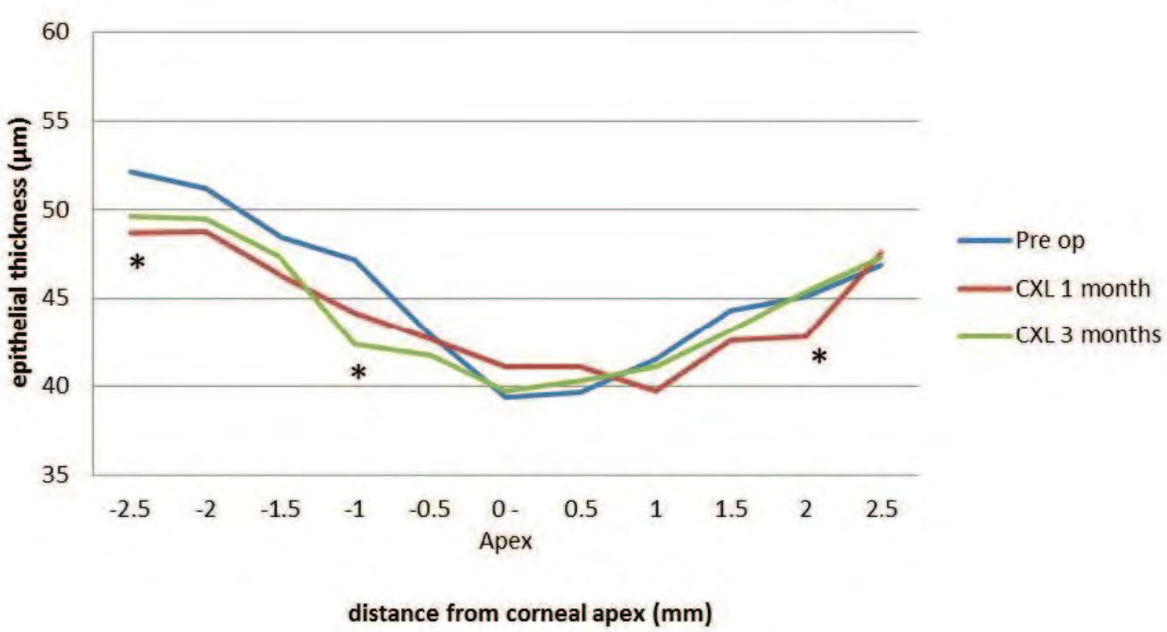


ORIGINAL ARTICLE

Epithelial and Stromal Remodeling After Corneal Collagen Cross-linking Evaluated by Spectral-Domain OCT

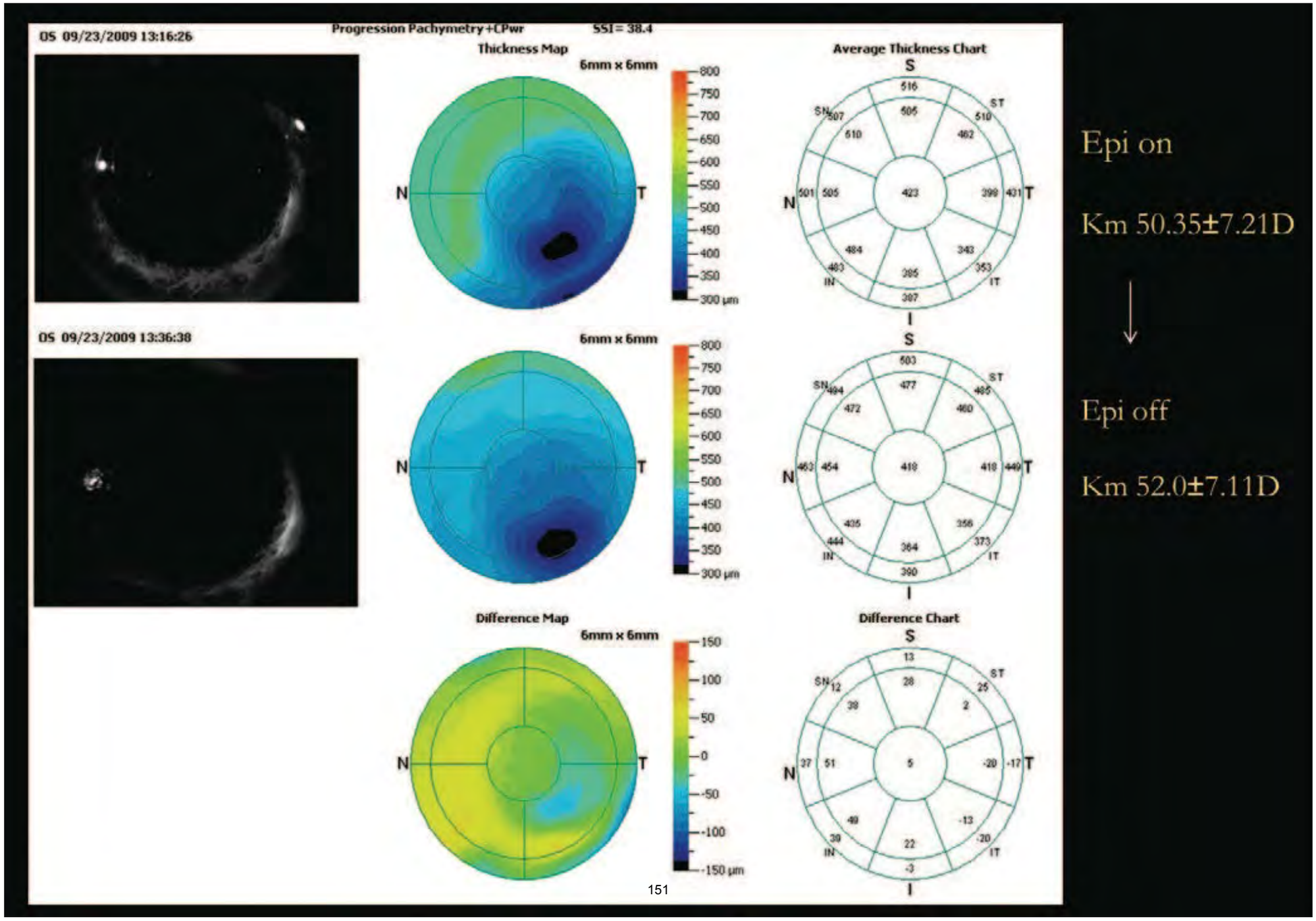
Karoline Maia Rocha, MD, PhD; Claudia E. Perez-Straziota, MD; R. Doyle Stulting, MD, PhD; J. Bradley Randleman, MD



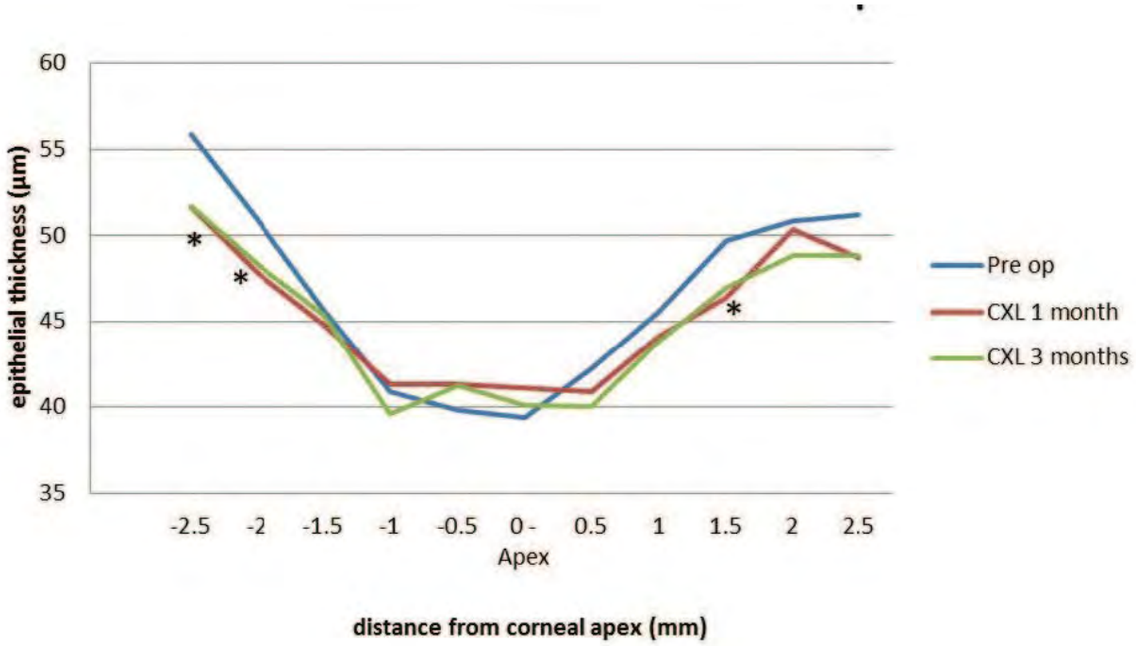


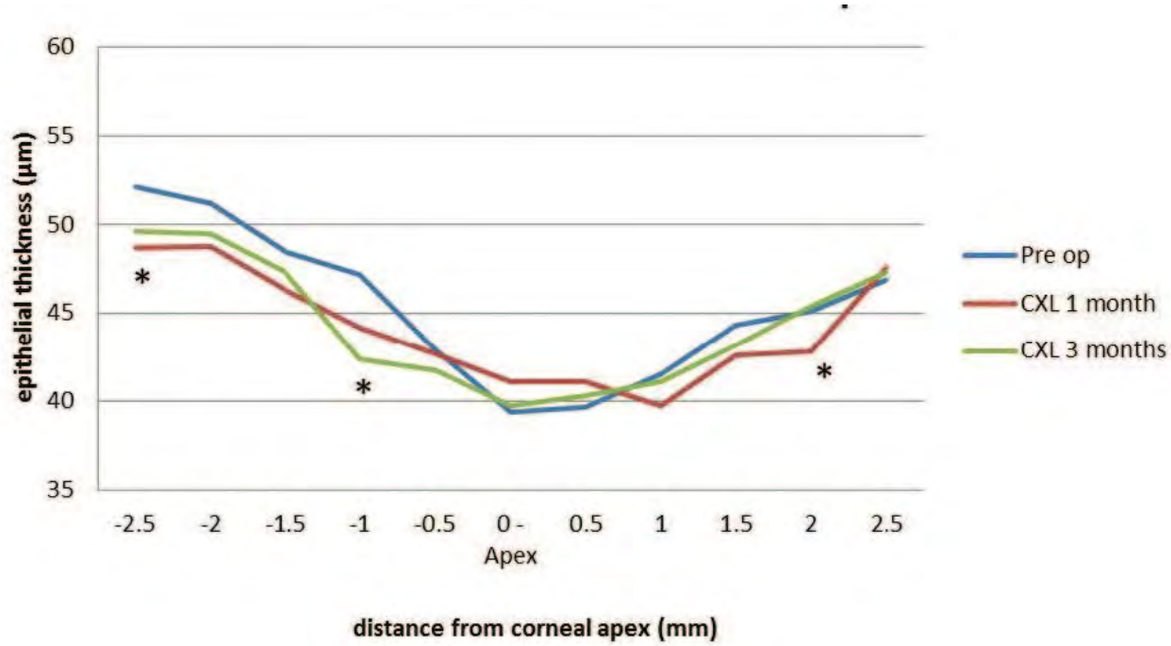
JRS 2014

EPITHELIUM MASKS TRUE CURVATURE

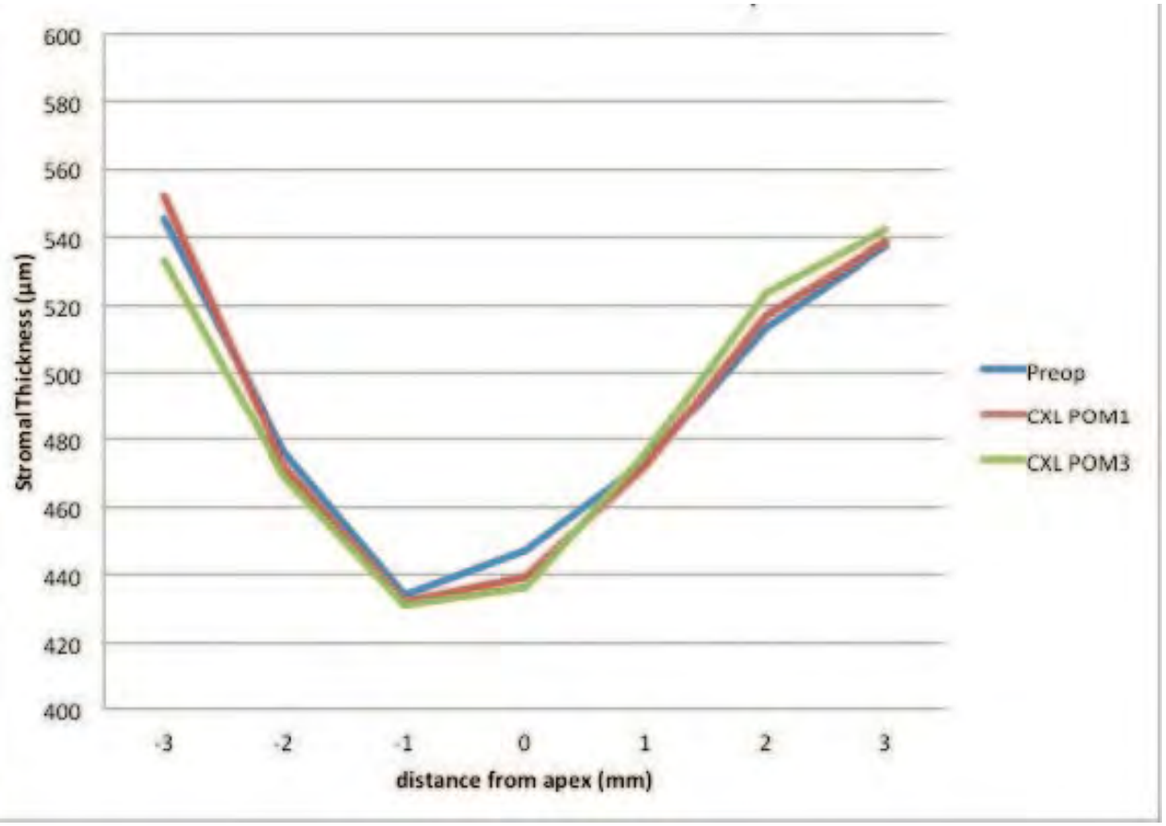


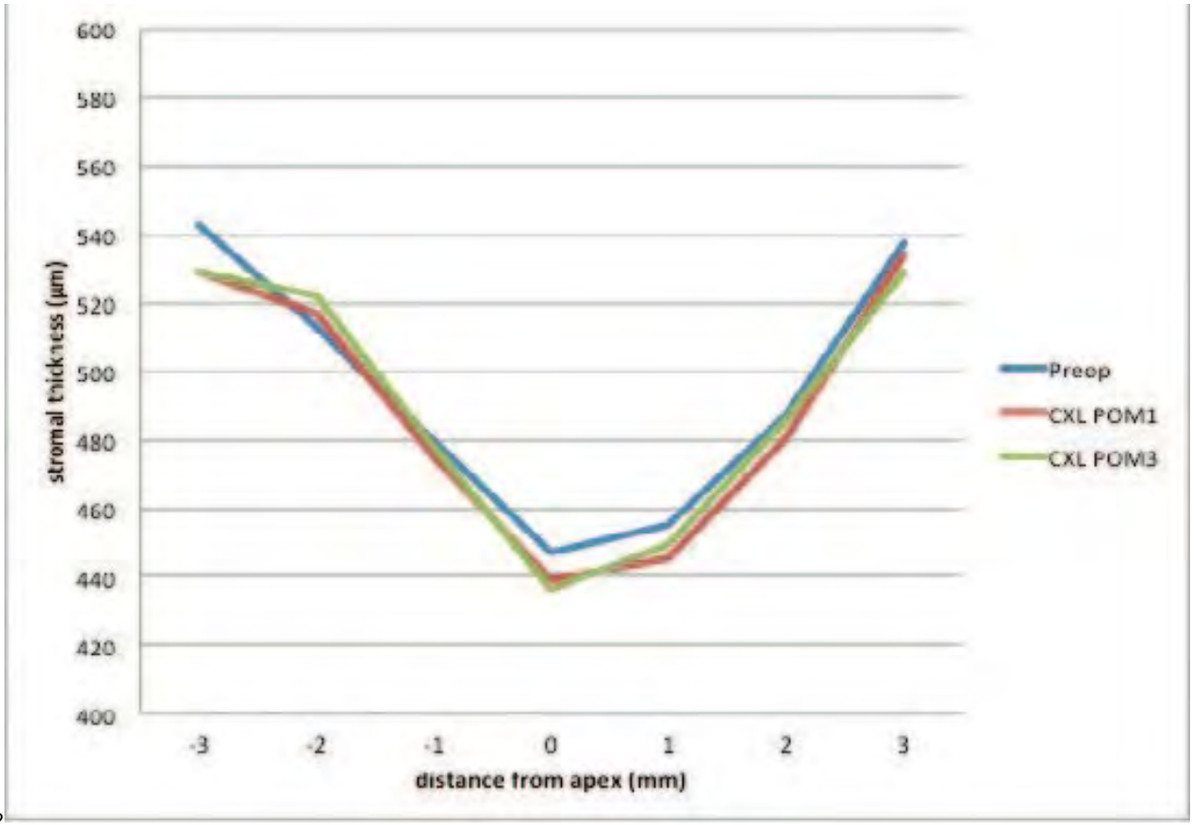
Epithelium





Stroma

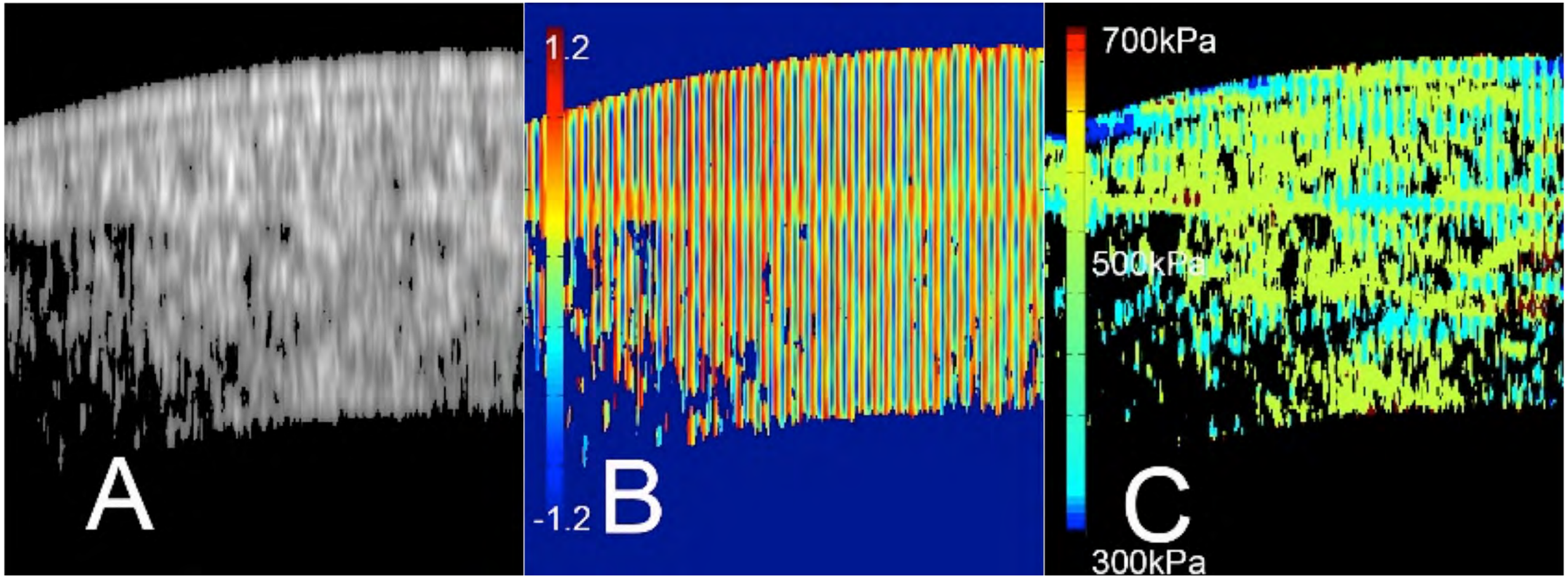




Journal of Biomedical Optics 16(1), 016005 (January 2011)

Method for optical coherence elastography of the cornea

Matthew R. Ford,[a,b] William J. Dupps Jr.,[a,b,c,d] Andrew M. Rollins,[a] Abhijit Sinha Roy,[b] and Zhilin Hu[a]

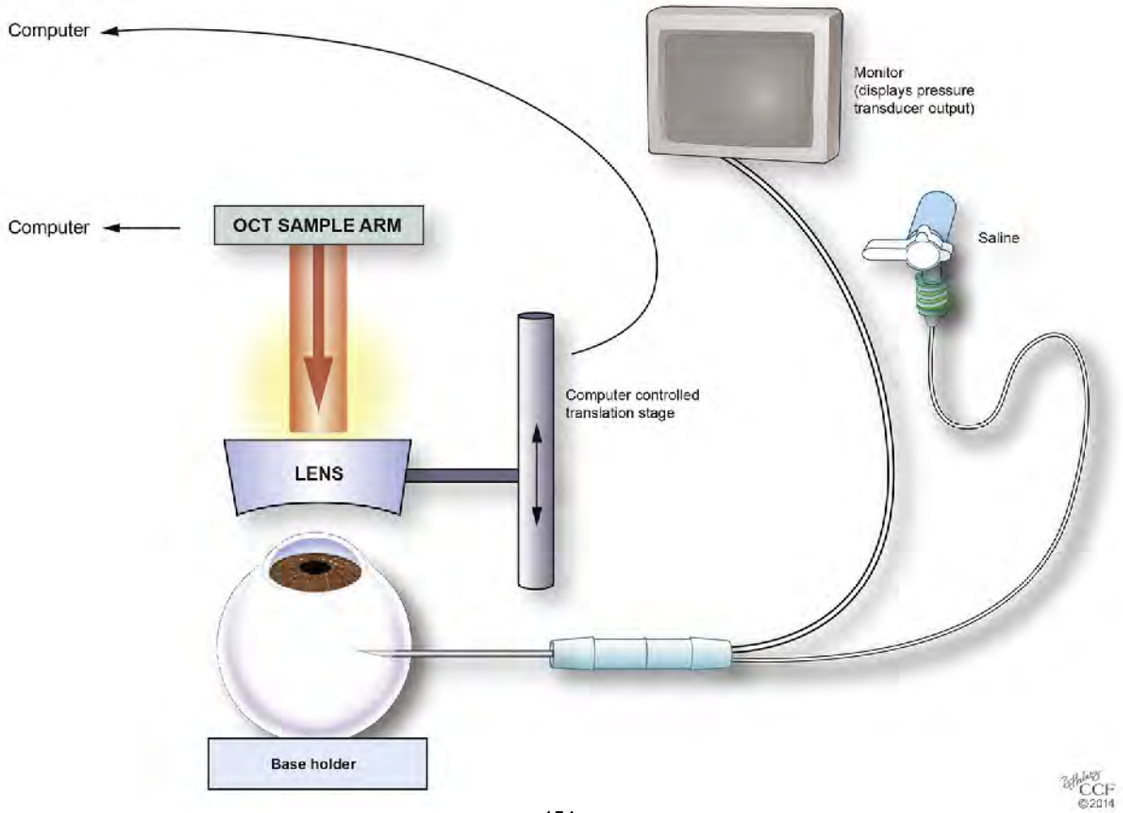


ORIGINAL ARTICLE

Serial biomechanical comparison of edematous, normal, and collagen crosslinked human donor corneas using optical coherence elastography

Matthew R. Ford, BS, Abhijit Sinha Roy, PhD, Andrew M. Rollins, PhD, William J. Dupps Jr, MD, PhD

J Cataract Refract Surg 2014; 40:1041–1047

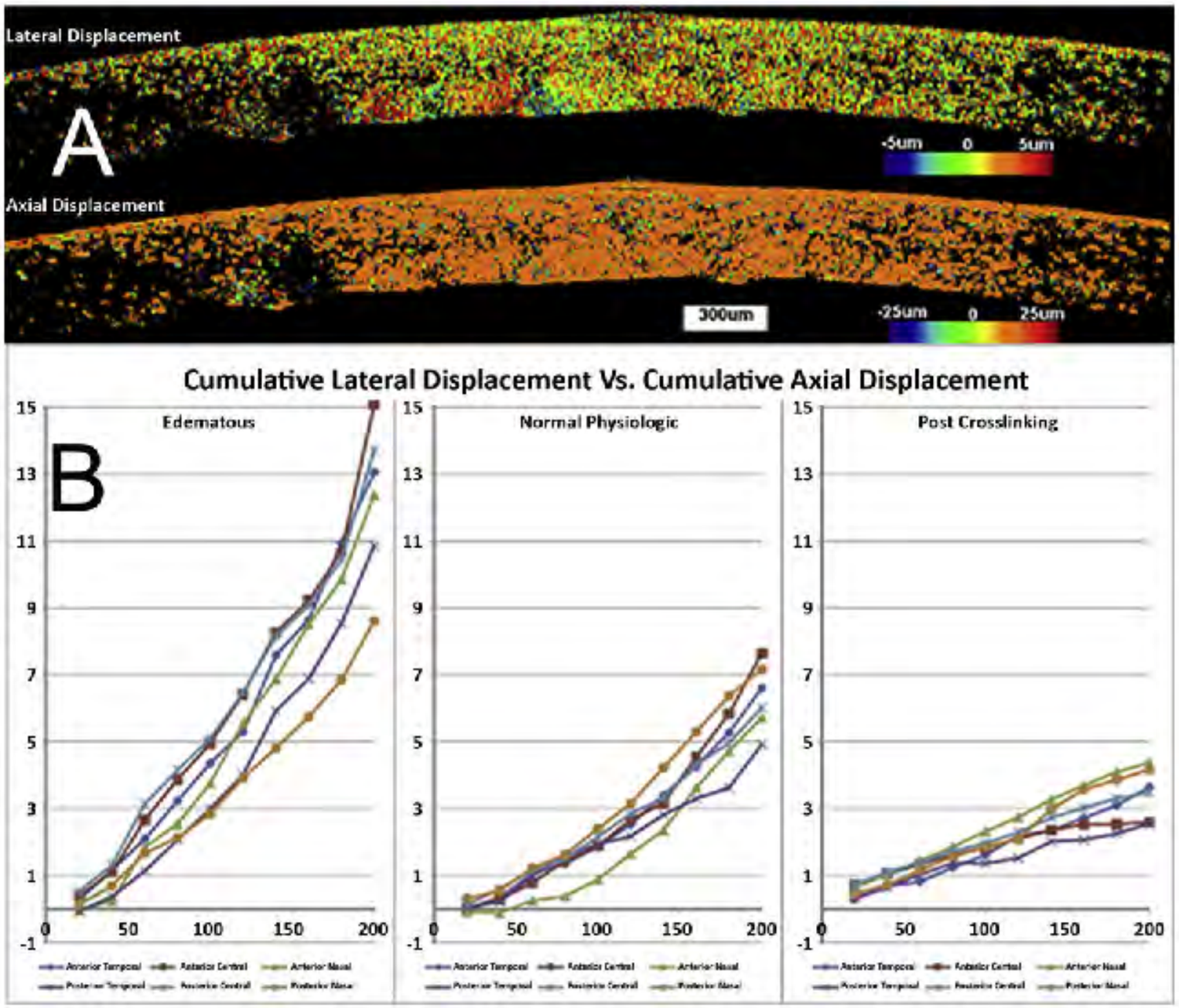


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Serial biomechanical comparison of edematous, normal, and collagen crosslinked human donor corneas using optical coherence elastography

Matthew R. Ford, BS, Abhijit Sinha Roy, PhD, Andrew M. Rollins, PhD, William J. Dupps Jr, MD, PhD

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Meeting Abstract | June 2015

Observation of focal weakening in keratoconic corneas in vivo and ex vivo with Brillouin microscopy

Giuliano Scarcelli; Sebastien Besner; roberto pineda; Seok H Yun

CONCLUSIONS

- CXL well established for adult corneal ectatic disease
- New applications gaining acceptance
  - Pediatric CXL (at time of diagnosis)
  - Infectious keratitis (adjunctive v. primary)
  - CXL Plus - still controversial

CONCLUSIONS

- Complications can arise after CXL
- Requires diligence early postoperative
- Affects screening for CXL
- Affects patient and surgeon acceptance of protocols

CONCLUSIONS

- Variations in clinical protocols occurring faster than research into these protocol variations
- Variability in comparative results depending on the metric followed
- Best metrics to follow still undetermined

International CXL Experts´ Meeting

With the participation of

- Theo Seiler, MD, PhD
- Eberhard Spoerl, PhD
- Farhad Hafezi, MD, PhD
- Paolo Vinciguerra, MD
- J. Bradley Randleman, MD
- François Malecaze, MD, PhD
- George Kymionis, MD, PhD
- A. John Kanellopoulos, MD
- Frederik Raiskup, MD, PhD
- Simon Pot, DVM
- Frank Famose, MD
- William J. Dupps, PhD
- Renato Ambrosio, MD, PhD
- Robert Wisse, MD, PhD
- Keith Meek, PhD
- Sabine Kling, PhD

and more...

December 2-3 2016

Zurich Switzerland

Important Dates

Abstract deadline:	23.09.2016
Early bird registration:	30.09.2016
Regular registration:	31.10.2016

All experience levels welcome!

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Cours demi-journée en français le 02.12.2016 !

www.cxlexpertsmeeting.com



THANK YOU

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J. Bradley Randleman, MD

Professor of Ophthalmology, Director, Cornea, External Disease, and Refractive Surgery Service

J. Bradley Randleman, MD is one of the nation's top corneal researchers and surgeons and an expert on everything from LASIK to the latest FDA approved treatments for corneal cross-linking surgery.



Alena Reznik, MD

Assistant Professor of Clinical Ophthalmology

Dr. Reznik specializes in early detection and treatment of glaucoma and cataracts as well as novel surgical techniques for advanced cases. Her research interests are minimally invasive glaucoma surgery and new approaches to eye emergencies. She is a principal investigator on clinical trials for glaucoma medications and surgical devices.



Damien C. Rodger, MD, PhD

Assistant Professor of Clinical Ophthalmology

Dr. Rodger's clinical interests include diabetic retinopathy, macular degeneration, medical retina, retinal detachment, uveitis and vitreoretinal surgery.He has conducted research on the design, fabrication, and testing of high-density microtechnologies for retinal and spinal cord prostheses, and has been instrumental in the development of other novel bioMEMS.

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Private 2 Hour CME in Beverly Hills

Date: Monday, Februay 13, 2017
Time: 7:00pm
Location:
Maggiano's Little Italy at The Grove
189 The Grove Dr. Suite Z80
Los Angeles, CA 9036
RSVP: Lina Poyzner at
lina.poyzner@med.usc.edu

Program:

Glaucoma (Optic Nerve Cupping), presented by Dr. Reznik — 1 Hour

Retina (OCT Reading and OCT Enigmas), presented by Dr. Rodger — 30 min.

Cornea (Cross Linking), presented by Dr. Randleman — 30 min.

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Beverly Hills, CA 90211
310-601-3366

Pasadena Clinic
USC Roski Eye Institute
625 S. Fair Oaks Avenue, Suite 400
Pasadena, CA 91105
626-796-0293

Arcadia Clinic
USC Roski Eye Institute
65 N. First Avenue, Suite 101
Arcadia, CA 91006
626-446-2122

CURRICULUM VITAE

JAMES BRADLEY RANDLEMAN

NOVEMBER 1, 2016

PERSONAL INFORMATION:

Work

USC Roski Eye Institute
1450 San Pablo Street Suite 4700
Los Angeles, CA, 90033
Phone: 323-442-6425
Fax: 323-442-6412
Work Email: randlema@usc.edu

Home

5550 Wilshire Blvd
Apt 334
Los Angeles, CA, 90036
Citizenship: United States

EDUCATION AND PROFESSIONAL APPOINTMENTS

EDUCATION:

1988-1992	Bachelor of Arts, Biology-Psychology Major*, Columbia College at Columbia University, New York City, New York*
1992-1994	Graduate Studies, Biology/Chemistry, *Sam Houston State University* Huntsville, Texas
1994-1998	Doctor of Medicine, *Texas Tech University School of Medicine* Lubbock, Texas

POST-GRADUATE TRAINING:

1998-1999	Transitional Year Residency (Internship), *Atlanta Medical Center*, Atlanta, Georgia
1999-2002	Residency in Ophthalmology, *Emory University School of Medicine, Department of Ophthalmology*, Atlanta, Georgia
2001-2002	Chief Resident, Ophthalmology, *Emory University School of Medicine, Department of Ophthalmology*, Atlanta, Georgia
2003-2004	Fellow, Cornea, External Disease, & Refractive Surgery Emory University School Of Medicine, Department of Ophthalmology Atlanta, Georgia

Continuing Professional Development Activities:

2007	Junior Faculty Development Course, Emory University, School of Medicine
2009	Leadership Development Program, American Academy of Ophthalmology

HONORS, AWARDS:

1989-1992	Columbia College Achievement Scholarship
1992	Bronze Crown Award for Excellence in Student Leadership, Columbia College
1992	Dean's List, Columbia College
1994	Beta Beta National Honor Society, Sam Houston State University
1996	Endowment Scholarship for Leadership and Academic Excellence, Texas Tech School of Medicine
1997	Junior Alpha Omega Alpha Medical Honor Society, Texas Tech SOM

1998	Merck Pharmaceuticals Quest for Excellence Award, Texas Tech SOM
2001	Outstanding Teaching Resident Award, Emory University
2004	Claes Dohlman Fellow Society (Outstanding Corneal Fellow in Nation)
2006	Best Poster, American Academy of Ophthalmology
2007	Best Paper (Refractive), American Academy of Ophthalmology Annual Meeting
2007	Best Paper of Session, American Society of Cataract and Refractive Surgery
2007	Secretariat Award, American Academy of Ophthalmology
2008	Best Paper of Session, American Society of Cataract and Refractive Surgery
2008	Achievement Award, American Academy of Ophthalmology
2010	Best Paper of Session, American Society of Cataract and Refractive Surgery
2010	Premier Surgeon P250 – selected as inaugural member as leading innovator in the field of premium IOL implant surgery
2010	Binkhorst Young Ophthalmologist Award, American Society of Cataract and Refractive Surgery
2011	Leading Ophthalmologists in America, named by Becker's ASC Review
2011-present	America's Top Doctors (Ophthalmology), Castle Connolly, Ltd.
2011	Kritzinger Memorial Award, International Society of Refractive Surgery
2012	*US News & World Reports* Top Ophthalmologists
2014	Senior Achievement Award, American Academy of Ophthalmology
2015	John H. and Helen S. Hughes Professorship in Ophthalmology, Emory University
2015	Recognition Award (Inaugural Award), International Society of Refractive Surgery
2016	Premier Surgeon 300 – leading innovator in premium refractive surgery, Ocular Surgery News
2016	Jose Ignacio Barraquer Award. Brazilian Society of Cataract and Refractive Surgery
2016	Atlanta's Best Doctors, Atlanta Magazine
2016	International Gold Medal, Indian Intraocular Implant & Refractive Society
2016	Founder's Award, International Society of Refractive Surgery

ACADEMIC APPOINTMENTS (CURRENT):

2016-Present: Professor of Clinical Ophthalmology, Keck School of Medicine of USC, Los Angeles, CA

ACADEMIC APPOINTMENTS (PREVIOUS):

2002-2003 Clinical Instructor & Chief Resident, Department of Ophthalmology,

Emory University, Atlanta, GA

2004-2008 Assistant Professor of Ophthalmology, Emory Eye Center, Emory University, Cornea, External Disease, & Refractive Surgery Section

2008-2012 Associate Professor of Ophthalmology, Emory Eye Center, Emory University, Cornea, External Disease, & Refractive Surgery Section

2012-2016 Professor of Ophthalmology, Emory University School of Medicine, Atlanta, GA

2015-2016 John H. and Helen S. Hughes Professorship in Ophthalmology, Emory University School of Medicine, Atlanta, GA, USA

ADMINISTRATIVE APPOINTMENTS (CURRENT):

2016-present: Director, Cornea & Refractive Surgery Service, USC Roski Eye Institute, Los Angeles, CA

2016-present: Medical Director, Keck Medical Center of USC, Beverly Hills, CA

ADMINISTRATIVE APPOINTMENTS (PREVIOUS):

2002-2004 Assistant Residency Program Director, Department of Ophthalmology, Emory University School of Medicine, Atlanta, GA

2007-2012 Director, Cornea, External Disease, & Refractive Surgery Fellowship, Department of Ophthalmology, Emory University School of Medicine, Atlanta, GA

2010-2012 Interim Director, Cornea, External Disease, & Refractive Surgery Service, Emory Eye Center, Emory University School of Medicine, Atlanta, GA

2012-2016 Director, Cornea, External Disease, & Refractive Surgery Service, Emory Eye Center, Emory University School of Medicine, Atlanta, GA

Licensures / Boards:

Georgia, issued 1999
California, issued 2016

Specialty Boards:

American Board of Ophthalmology 2005 (recertification completed 2015)

TEACHING

DIDACTIC TEACHING:

Institution

1992-1994 Teaching Assistant, Introductory Biology, Sam Houston State University

1995-1997 Teaching Assistant, Gross Anatomy, Texas Tech University School of Medicine

2007-2016 Lecturer, Biology of the Eye Course, Emory University. 2-3 lecture hours/year
Topics: Cataract Surgery, Red eye, and Refractive Surgery

2015 Manuscript Writing. Junior Faculty Development Course, Emory University School of Medicine

Ophthalmology Residency:

2003-2016 Lecturer for the Residency Training Program, Emory University
Department of Ophthalmology
Topics: Blepharitis, *Corneal Surface Issues: Lumps, Bumps, Spots & Dots*, Chemical Injuries, Ectatic Corneal Disease, Penetrating Keratoplasty: Indications & Surgical technique, Penetrating Keratoplasty: Outcomes/complications, Refractive Surgical Screening, Refractive Surgical techniques: LASIK, PRK, & Phakic IOLs, Refractive Surgery Complications, Corneal Topography: Basic & Advanced, Corneal Cross-Linking, Femtosecond-assisted Cataract Surgery, IOL Repositions & Exchanges, IOL Selection
Frequency: 12 hour long lectures per year

CME COURSES DEVELOPED

National/International

Administrative Positions:

2007-2010	Program Committee, American Society of Cataract and Refractive Surgery
2008	Program Planning Committee, ASCRS 2008 Winter Update Meeting
2008	Organizer, Southeastern Cataract, Cornea, and Refractive Surgery Conference
2012-2014	Co-Chair, International Congress of Corneal Cross-Linking
2016	Co-Chair, Corneal Cross-Linking Experts Meeting

Sessions as chair:

2008-2010	Chair, Young Physicians and Residents Symposium: Challenging Video Cases for the Young Surgeon, American Society of Cataract and Refractive Surgery Annual Meeting
2010	Symposium Chair, World Ophthalmology Congress Refractive Surgery Subspecialty Day, Berlin Germany
2010	Symposium Chair, World Ophthalmology Congress, Berlin Germany
2011	Symposium Chair, ISRS/Pan American Society of Ophthalmology Annual Meeting, Buenos Aires, Argentina
2011	Session Chair, ASCRS Cornea Day, San Diego, CA
2012	Co-Chair & Faculty, ISRS/AAO Symposium: Introduction to Refractive Surgery for Residents, AAO Annual Meeting, Chicago, IL
2013	Chair, ISRS Symposium, ESCRS Annual Meeting, Amsterdam, Netherlands
2011-present	Session Chair, The Journal of Refractive Surgery's Hot, Hotter, Hottest Session. ISRS/AAO Refractive Surgery Subspecialty Day, ISRS/AAO Annual Meeting
2016	Planning Committee & Session Chair, Course on Advanced Cornea Surgery (CoACS). Emory University School of Medicine. Atlanta, GA
2016	Symposium Co-Chair, SYM 43 Therapeutic & Refractive Cross-Linking, American Academy of Ophthalmology Annual Meeting, Chicago, IL

Formal Courses Given for CME

2005	Instructor, Clinical Applications of Corneal Confocal Microscopy, American Academy of Ophthalmology Annual Meeting, Chicago, IL
2005	Senior Instructor, Surgical and Nonsurgical Management of Refractive Error, & Irregular Astigmatism, and Ectasia after Corneal Refractive Surgery, American Academy of Ophthalmology Annual Meeting, Chicago, IL
2005	Senior Instructor, Introduction to the Alphacor Keratoprosthesis, American Academy of Ophthalmology Annual Meeting, Chicago, IL
2007	Instructor, Symposium 507: Important Current Issues for Refractive Surgeons, American Academy of Ophthalmology Annual Meeting, New Orleans, LA, 2007
2007-present	Senior Instructor, AAO Course: Advanced Corneal Topographic Analysis, American Academy of Ophthalmology Annual Meeting
2007-present	Senior Instructor AAO Course: Surgical Management of Astigmatism in Cataract and Refractive Surgery, American Academy of Ophthalmology Annual Meeting
2008-2014	Faculty, Identifying Risk Factors for Ectasia: Practical Approach, American Society of Cataract and Refractive Surgery Annual Meeting
2008-2011	Faculty, Corneal Evaluation of the Refractive Surgery Patient, American Society of Cataract and Refractive Surgery Annual Meeting
2008	Instructor, AAO LAB229B-Laser Refractive Surgery for Ophthalmology Residents. American Academy of Ophthalmology Annual Meeting
2008	Instructor, AAO Course 190-LEO Clinical Update Course on Refractive Surgery. American Academy of Ophthalmology Annual Meeting
2009	Instructor, Course 207, Risk Factors, Diagnosis, and Treatment of Refractive Surgical Complications, AAO Annual Meeting, San Francisco, CA
2009	Senior Instructor, Course B135, Refractive Surgery Roundtable: Ectasia, How to Prevent it, AAO Annual Meeting, San Francisco, CA
2010	Senior Instructor, Controversies in Topographic Evaluation Course. American Society of Cataract and Refractive Surgery Annual Meeting, Boston, MA
2010	Senior Instructor, Pushing the Envelope in Refractive Surgery: BCSC 13 Course, American Academy of Ophthalmology Annual Meeting, Chicago, IL
2011-present	Moderator: ISRS/AAO Subspecialty Day Meeting. The Journal of Refractive Surgery's Hot, Hotter, Hottest: Late Breaking News Session
2011	Faculty, ASCRS Symposium: Cataract Surgery and the Compromised Cornea. ASCRS Annual Meeting, San Diego, CA
2012	Faculty, ASCRS Symposium: Controversies in Cataract and Refractive Surgery. ASCRS Annual Meeting, Chicago, IL
2012	Faculty, ASCRS Symposium: Cornea Clinical Committee Highlights. ASCRS Annual Meeting, Chicago, IL
2012	Faculty, ASCRS Course: Interactive Video Dialog on the Complicated Cataract. ASCRS

	Annual Meeting, Chicago, IL
2012	Senior Instructor, ASCRS Course: Phaco Flip: Underutilized Technique that Every Cataract Surgeon Should Know. ASCRS Annual Meeting, Chicago, IL
2013-2014	Faculty, ARVO Course: Predicting, Measuring and Treating Changes in Corneal Biomechanics
2014	Faculty, ASCRS Course: Early Detection and Management of Keratoconus Including Collagen Crosslinking. ASCRS Annual Meeting
2014-present	Faculty, Current State of CXL (Corneal Collagen Cross-Linking): Controversies & Recommendations, ESCRS Annual Meeting
2014-present	Instructor, Course 314 - Danger Zone: Refractive Surgery Nightmares and Worst-Case Scenarios AAO Annual Meeting, Chicago, IL
2015-present	Senior Instructor, ASCRS Course: ASCRS Course: Bring Your Own Topography. ASCRS Annual Meeting, San Diego, CA
2015-present	Senior Instructor, AAO Course: Corneal Cross-linking: Basic and Advanced Indications, American Academy of Ophthalmology Annual Meeting
2015-present	Faculty, AAO Course: Therapeutic Corneal Refractive Surgery, American Academy of Ophthalmology Annual Meeting
2016	Faculty, Toric IOLs Made Simple. European Society of Cataract & refractive Surgery Annual Meeting, Copenhagen Denmark
2016	Instructor Course 689 - Toric IOLs 2016: Choice, Alignment, Results, and Management of Complications, American Academy of Ophthalmology Annual Meeting, Chicago, IL

UNDERGRADUATE, GRADUATE AND MEDICAL STUDENT (OR OTHER) MENTORSHIP:

2005	Foster JB	Medical Student	Intraocular Lens Power Calculations after LASIK
2007	Hu MH	Medical Student	High Order Aberration Changes after Wavefront-Optimized PRK and LASIK
2007	White AJ	Medical Student	Incidence and Risk Factors for Enhancement after Wavefront-Optimized PRK & LASIK
2012	Nunnery, EW	Medical Student	Corneal Biomechanical Evaluation of Refractive Surgical Candidates
2014	Lockwood, J	Medical Student	IOL Calculations for Toric IOLs and post-LASIK

POSTGRADUATE MENTORSHIP:

Cornea Fellowship Training:

1. Andreea Partal, M.D. (2005), University of Tennessee, Memphis, TN
2. Chris Banning, M.D. (2006), Private practice, Kansas City, KS
3. Michael McMann, M.D. (2006), Private practice, Ewa Beach, HI
4. Ajit Nemi, M.D., (2007), Private practice, Atlanta, GA
5. Terrence Doherty, M.D. (2007), Private practice, Nashville, TN
6. Evan S. Loft, M.D. (2008), Private practice, Atlanta, GA

7. Gaston Lacayo, M.D. (2008), Rush University Medical Center, Chicago, IL
8. Olivia A. Lee, M.D. (2009), Private practice, Austin, TX
9. Maria A. Woodward, M.D. (2009), University of Michigan, Ann Arbor, MI
10. Seema Patel, M.D. (2010), Private practice, New Jersey
11. Tyler A. Hall, M.D. (2010), University of Alabama Birmingham, Birmingham, AL
12. Yuri McKee, M.D. (2011), Private practice, Mesa AZ
13. Rupa D. Shah, M.D. (2011), Case Western Reserve University, Cleveland, OH
14. Trent Albright, M.D. (2012), Private practice, Columbus, OH
15. Jennifer G. Bromley, M.D. (2012), Private practice, Savannah, GA
16. Claudia Perez-Straziota, M.D. (2013), USC Roski Eye Institute, Los Angeles, CA
17. Maulik Zaveri, M.D. (2013), Private practice, San Diego, CA
18. Sonia Belliapa, M.D. (2014), Private practice, New Jersey
19. Samir Vira, M.D. (2014), Private Practice, Atlanta, GA
20. John Welling, M.D. (2015), International Corneal fellowship, Salt Lake City UT
21. David Sackel, M.D. (2015), Private practice, Atlanta, GA
22. Ilyse Habermna, M.D. (2016), NYU School of Medicine, NY, NY
23. Anam Qureshi, M.D. (2016), NYU School of Medicine, NY, NY

RESIDENCY PROGRAM:

2000-2003:
Nick Anderson, M.D.; Doug Blackmon, M.D.; Sue Hewitt, M.D.; Saxon Moss, M.D.;
Cathy Reed, M.D.

2001-2004:
Claxton Baer, M.D.; Daniel Chang, M.D.; Eric Gershenbaum, M.D.; Sean Pieramici, M.D.; Jennifer Scruggs, M.D.

2002-2005:
Chris Banning, M.D.; Kevin Barber, M.D.; Chris Bergstrom, M.D.; Hunter Cherwek, M.D.; Keith Shuler, M.D.

2003-2006:
Steve Bailey, M.D.; Blaine Cribbs, M.D.; Wayne Lo, M.D.; Mark Spirn, M.D.;
Leiv Takle, M.D.

2004-2007:
John Davies, M.D.; Evan Loft, M.D.; Kristina Price, M.D.; Adrienne Ruth, M.D.;
Brian Schwent, M.D.

2005-2008:
Emily Graubart, M.D.; Paral Khator, M.D.; Phoebe Lenhart, M.D.; Paul Pruett, M.D.; Jeremy Wolfe, M.D.; Maria Woodward, M.D.

2006-2009:
Michele Crosby, M.D., Valerie Elmalem, M.D., Nelam Gor, M.D., Gene Lee, M.D., Purnima Patel, M.D., Grace Prakalapakorn, M.D.

2007-2010:
Alok Bansal, M.D., Bonnie Germain, M.D., Carolyn Hebson, M.D., David Paine, M.D., John Payne, M.D., Krishna Sanka, M.D.

2008-2011:
Jennifer Bromley, M.D., Vishak John, M.D., Johnstone Kim, M.D., Gene Lee, M.D., Lyndon Lee, M.D., Pryanka Sood, M.D.

2009-2012:
Jeremy Jones, M.D., Cecilia Jung, M.D., Sumitra Khandelwal, M.D., Philip Laird, M.D., Claudia Perez-Straziota, M.D., Johua Robinson, M.D.

2010-2013:
Matthew Emanuel, M.D., Lawson Grumbine, M.D., Neil Palejawala, M.D., David Risner, M.D., Gagan Sawahany, M.D., Paul Walia, M.D.

2011-2014:
Jihan Akthar, M.D., Felicia Fountain, M.D., Vincent Ho, M.D., Luke Peterson, M.D., Jim Sargent, M.D., Chris Stelton, M.D.

2012-2015:
Abdulah Jeroudi, M.D., Jennifer Kim, M.D., Jessica Shantha, M.D., Michael Shumski, M.D., Heather Weissman, M.D., Monica Zhang, M.D.

2013-2016: Andrew Anzeljc, M.D., Daniel Connor, M.D., Caroline Cromelin, M.D., Joshua Levinson, M.D., William Pierce, M.D., Praneetha Thulasi, M.D.

INTERNATIONAL FELLOWS:

2007-2008	Claudia Perez-Straziota, MD, Venezuela
2010-2011	Karolinne Maia Rocha, MD, PhD, Brazil
2014-2015	Sang Woo Kim, M.D., South Korea
2015-2106	Alvaro Broncano Fidalgo, M.D., Spain

SERVICE

DEPARTMENT SERVICE:

1999-2000	Resident Representative, Applicant Interview Committee
2001-2002	GME Representative for Academic Affairs, Emory University Department of Ophthalmology
2001-2009	Residency Education Committee, Emory University Department of Ophthalmology
2002-2011	Resident Application Interview Committee, Emory University Department of Ophthalmology
2004-2005	Chair, Service Committee, Emory University Department of Ophthalmology Academic Retreat
2005-2012	Medical Students Education Committee, Emory University Department of Ophthalmology
2005-2015	Research Advisory Committee, Emory University Department of Ophthalmology
2005-2016	Director of Resident Research, Emory University Department of Ophthalmology
2009-2016	Faculty Development and Mentoring Committee, Emory University Department of Ophthalmology
2010-2016	Executive Committee, Emory University Department of Ophthalmology

MEDICAL SCHOOL SERVICE:

1998	Student Representative, Education Planning Committee Curriculum Subcommittee, Texas Tech School of Medicine, Lubbock, TX
2007-2016	ASC Peer Review Member, Emory University
2016-present	Mentoring and Career Advancement Task Force, Keck School of Medicine of USC
2016-present	Clinical Strategy Design Team, Keck School of Medicine of USC

HOSPITAL OR MEDICAL GROUP SERVICE:

2007	Georgia Society of Ophthalmology Representative, Medicare Carrier Advisory Committee
2007	Chairman, Third Party Payer Committee, Georgia Society of Ophthalmology
2007-2008	Member, Georgia Society of Ophthalmology Council

PROFESSIONAL SERVICE:

2004-2006	Young Physicians and Residents Clinical Committee, American Society of Cataract and Refractive Surgery
2005-2007	Refractive Surgery Management Specialty Information Team Clinical Committee, American Academy of Ophthalmology
2007-2010	COMPASS Panel for Refractive Management/Intervention, American Academy of Ophthalmology
2007-2009	Executive Editor, Management of LASIK and PRK Complications Online Course, American Academy of Ophthalmology
2007-2009	Integrated Eyecare Taskforce, American Society of Cataract and Refractive Surgery
2007-2010	Chairman, Young Physicians and Residents Clinical Committee, American Society of Cataract and Refractive Surgery
2009-2014	Writing Committee, BSCS Section 13: Refractive Surgery, American Academy of Ophthalmology
2010-2011	Advisory Member, Young Physicians and Residents Clinical Committee, American Society of Cataract and Refractive Surgery
2010-2012	Member, Cornea Clinical Committee, American Society of Cataract and Refractive Surgery
2011-present	Member, International Society of Refractive Surgery (ISRS) International Meetings Committee
2011-present	Member (Ex-Oficio), International Society of Refractive Surgery (ISRS) Executive Committee
2011-present	Chair, Editorial Board, Journal of Refractive Surgery

CONSULTANTSHIPS AND ADVISORY BOARDS:

2014-present	Scientific Advisory Board, OptoQuest
2016-present	Medical Advisory Board, EMAgine

PROFESSIONAL SOCIETY MEMBERSHIPS:

1994-2000	American Medical Association
1999-2001	American College of Surgeons
1999-present	International Society of Refractive Surgery
1999-present	American Society of Cataract and Refractive Surgeons
1999-present	American Academy of Ophthalmology
1999-2010	Georgia Society of Ophthalmology
2003-present	Cornea Society (Member with Thesis, 2007-present)
2009-present	Pan American Society of Ophthalmology
2016-Present	Los Angeles County Society of Ophthalmology

RESEARCH AND SCHOLARSHIP

EDITORSHIPS AND EDITORIAL BOARDS:

2007-2010	Alternate Editor, The American Academy of Ophthalmology Ophthalmic News & Education (ONE) Network, Refractive Management & Intervention Section
2008-2011	Associate Editor, Journal of Refractive Surgery
2008-2011	Associate Editor, Journal of Cataract and Refractive Surgery
2011-present	Editor-In-Chief, Journal of Refractive Surgery
2014-present	International Editorial Board Member, Revista Mexicana de Oftalmologia (Mexican Journal of Ophthalmology)
2014-present	Editorial Board Member, EyeNet, American Academy of Ophthalmology

MANUSCRIPT REVIEW:

Year-Year	*Journal*
2002-present	*Cornea*
2003-present	*American Journal of Ophthalmology*
2003-present	*Journal of Cataract and Refractive Surgery*
2003-present	*Ophthalmology*
2005-present	*Eye*
2006-present	*Journal of Refractive Surgery*
2006-present	*Canadian Journal of Ophthalmology*
2006-present	*Archives of Ophthalmology*
2006-present	*Ophthalmic Surgery & Lasers*
2008-present	*British Journal of Ophthalmolog*
2011-present	*European Journal of Ophthalmology*

MAJOR AREAS OF RESEARCH INTEREST

My primary research focus is the measurement and management of corneal biomechanics. This manifests itself clinically in corneal refractive surgery screening protocols and management of keratoconus an related ectatic corneal diseases, especially with corneal cross-linking, and the identification, management, and prevention of complications after refractive surgery. A second clinical focus is maximizing refractive outcomes after cataract and IOL surgery, with particular emphasis on management of astigmatism.

GRANT SUPPORT - CURRENT:

GRANT SUPPORT - PAST:

Investigator status: Principal investigator
Funding source/type: Avedro, Inc.
Title: A Multi-Center, Randomized, Placebo-Controlled Evaluation of the Safety and Efficacy of the KXL System with VibeX (Riboflavin Ophthalmic Solution) for Corneal Collagen Cross-Linking in Eyes with Keratoconus (KXL-001)
Amount: TBD
Year(s): 2013-2016

Investigator status: Principal investigator
Funding source/type: JAEB
Title: Corneal Donor Study
Amount: $17,171 (to date)
Year(s): 8/1/1999 - 7/31/2013

Investigator status: Sub investigator
Funding source/type: VisionCare Ophthalmic Technologies, Ltd., (industry)
Title: Five Year Follow-up of IMT-002 Patients: A Long Term Monitoring Study of IMT-002 Patients
Amount: $28,245 (total for follow-up study)
Year(s): 3/21/2011- 3/21/2015

Investigator status: Secondary Investigator
Funding source/type: Ophtec USA, Inc. (industry)
Title: Clinical Study of OPHTEC Model 311 Iris Reconstruction Lens for the Treatment of Visual Disturbances From Partial or Total Absence of the Human Iris
Amount: $7,000
Year(s): 2007-2016

Investigator status: Principal investigator
Funding source/type: Clinic Research Consultants
Title: Topography Guided LASIK using the Allegretto Wave Eye Q 400 Excimer Laser System the Treatment of Manifest and Cornea based Myopic and Hyperopic Optical Errors
Amount: $ 16,700
Year(s): 1/27/10-12/31/10

Investigator status: Principal co-investigator
Funding source/type: Peschke Meditrade GmbH, Switzerland
Title: Safety and Effectiveness of the UV-X System for Corneal Collagen Cross-Linking in Eyes with Corneal Ectasia after Refractive Surgery (UVX-002)
Year(s): 2007-2010

Investigator status: Principal co-investigator
Funding source/type: R. Doyle Stulting, M.D., Ph.D.
Title: Safety and Effectiveness of the UV-X System for Corneal Collagen Cross-Linking in Eyes with Progressive Keratoconus (UVX-001)

Year(s): 2007-2010

Investigator status: Principal Investigator
Funding source/type: Lux Biosciences, Inc. (industry)
Title: Corneal Allograft Rejection Study LX201-01**:** A Multi-center, Placebo-Controlled, Randomized, Parallel-Group Dose Ranging Study to Assess the Efficacy and Safety of LX201 for Prevention of Corneal Allograft Rejection Episodes and Graft Failure Following Penetrating Keratoplasty with LX201 Implantation in Subjects Who Are at Increased Immunological Risk
Amount: $130,000
Year(s): 2007-2010

Investigator status: Secondary Investigator
Funding source/type: Lux Biosciences, Inc. (industry)
Title: Corneal Allograft Rejection Study LX201-02: A Multi-Center, Dose-Ranging Study to Assess the Efficacy and Safety of LX201 for the Prevention of Corneal Allograft Rejection in Patients Who Have Experienced a Rejection Episode Following Corneal Transplantation
Amount: $120,000
Y*ear(s):* 2007-2010

Investigator status: Principal Investigator
Funding source/type: American Society of Cataract and Refractive Surgery Foundation Grant ($5000), RPB Departmental Research Grant ($3000)
Title: Analysis of Quantitative Corneal Stromal Cohesive Tensile Strength
Amount: $8,000
Year(s): 2007-2009

Investigator status: Principal Investigator,
Funding source/type: Ophtec USA, Inc. (industry)
Title: US Clinical Investigation of the Artisan Myopia Lens for the Correction of High Myopia, USFDA – Industry Sponsored Clinical Trial
Amount: $7,000
Year(s): 2005-2007.

Investigator status: Co-Principal Investigator and Faculty Advisor
Funding source/type: Research to Prevent Blindness, Departmental Research Grant
Title: The effect of microkeratome oscillation rates and head-advance speeds on the quality of human LASIK interface surfaces
Amount: $3,000
Year(s): 2006-2007

Protocols Approved for Human Investigation:

2006-2014	Visual outcomes after wavefront- optimized surface ablation Emory IRB00045849
2007-2010	A Multi-Center, Placebo-Controlled, Randomized, Parallel-Group, Dose-Ranging Study to Assess the Efficacy and Safety of LX201 Implantation for the Prevention of Corneal Allograft Rejection Episodes or Graft Failure in Subjects Who Have Experienced One or More Rejection Episodes Following Penetrating Keratoplasty. Emory IRB00004418
2007-2010	A Multi-center, Placebo-Controlled, Randomized, Parallel-Group Dose Ranging Study to Assess the Efficacy and Safety of LX201 for Prevention of Corneal Allograft Rejection Episodes and Graft Failure Following Penetrating

	Keratoplasty with LX201 Implantation in Subjects Who Are at Increased Immunological Risk Emory IRB00003500
2008-2010	Safety and Effectiveness of the UV-X System for Corneal Collagen Cross-Linking in Eyes with Corneal Ectasia or Progressive Keratoconus Emory IRB00005828
2009-2010	Safety Profiles of Conventional Monofocal Intraocular Lenses (IOLs) and Multifocal IOLs Emory IRB00022314
2010-2014	The Cornea Donor Study Emory IRB00024924
2010-2011	Accuracy of intraocular lens power prediction using the Haigis, Hoffer Q, Holladay 1, Holladay 2, and SRK/T formulas Emory IRB00012667
2013-2016	Management of intraocular complications associated with anterior and posterior scleritis Emory IRB00047692
2013-2016	Advanced Corneal Biomechanical Evaluation in Refractive Surgical Patients Emory IRB00061671
2013-2016	Pediatric Corneal Topography: Imaging for Early Detection of Keratoconus Emory IRB00062526
2014-2016	Intraocular Lenses Power Calculations in Challenging Cases Emory IRB00072092

INVITED LECTURES, SYMPOSIA, KEYNOTE ADDRESSES

2009	Invited Speaker, Vanderbilt Eye Institute Comprehensive Ophthalmology: Pearls XII Course, Nashville TN
2010	Invited Speaker, University of Florida College of Medicine, Refractive Surgery Pearls for Practice Course
2010	Invited Speaker, Egyptian Society of Cataract and Refractive Surgery Annual Meeting
2010	Invited Speaker, Colombian Society of Ophthalmology International Ophthalmology Congress, Bogota Colombia
2010	Invited Speaker, Atlantic Eye Symposium, Halifax Nova Scotia
2011	Invited Speaker, Bascom Palmer Eye Institute Cataract & Refractive Surgery Congress, Miami, FL
2011	Invited Speaker, Canadian Ophthalmology Society (COS) Annual meeting, Vancouver. BC
2012	Invited Speaker, Refractive.online & SICSSO International Congress, Rome, Italy
2012	Invited Speaker, 3rd ISRS /Magrabi Meeting & Saudi Ophthalmological Society, Riyadh KSA

2013 Invited Speaker, Lo Mejor en Cornea, March 21-23, 2013, Mexico City, DF

2013 Invited Speaker, Athens/ISRS Refractive Surgery Course, Athens Greece,

2013 Invited Speaker, University of Sao Paolo 16th Annual Ophthalmology Congress, Sao Paolo, Brazil

2013 Visiting Professor, Wills Eye Hospital, Philadelphia, PA

2014 Keynote Speaker, Bascom Palmer Eye Institute Cataract and Refractive Surgery Congress, Miami FL

2014 Invited Speaker, New Orleans Academy of Ophthalmology, New Orleans LA

2014 Invited Speaker, 20th Annual White Nights International Ophthalmology Congress, St. Petersburg, Russia

2014 Invited Speaker, 20th Annual Cornea & Refractive Surgery International Course, Riviera Nayarit, Mexico

2014 Invited Speaker, Chilean Congress of Ophthalmology, Vina del Mar, Chile

2014 Visiting Professor, SUNY Downstate Ophthalmology Department, Brooklyn, NY

2015 Invited Speaker, Nashville Academy of Ophthalmology Meeting, Nashville, TN

2015 Invited Speaker, Les Entretiens Ophtalmologiques de l'Université de Montréal 2015 (EOUM), Montreal, Quebec

2015 Drouilhet Visiting Professor, UT Houston Department of Ophthalmology, Houston, TX

2015 Keynote Speaker, Congresso Brasileiro Oftamologia, Florianopolis, Brazil

2015 Keynote Speaker, Nebraska Academy of Eye Physicians and Surgeons Fall Scientific Meeting, Omaha, NE

2015 Keynote Speaker, Apectasias Inaugural Meeting on Corneal Ectasia. Mexico City (Coyoacán), DF

2016 Keynote Speaker, SUNY Downstate Medical Center Current Concepts in Ophthalmology, Atlantic City, NJ

2016 Guest of Honor, New England Ophthalmological Society Meeting, Boston MA

2016 Keynote Speaker, Duke Eye Center Controversies in Cornea and Cataract Surgery, Durham, NC

2016 Jose Ignacio Barraquer Lecture. Brazilian Society of Cataract and Refractive Surgery XIV International Congress of Cataract and Refractive Surgery, São Paulo, Brazil

2016 Invited Speaker, USC Roski Eye Institute 41st Anniversary Symposium, Los Angeles CA

2016 Invited Speaker, Annual Conference of Indian Intraocular Implant & Refractive Society, Chennai, India

INVITED GRAND ROUNDS, CME LECTURES

Invitations to National or International Conferences:

2005 Faculty, ASCRS Summer Refractive Congress, American Society of Cataract and Refractive Surgery, Seattle WA

2005 Faculty, Turkish Ophthalmology Society National Meeting, Antalya, Turkey

2005-2011 Faculty, Southeastern Cataract, Cornea, and Refractive Surgery Conference

2007 Faculty, ASCRS Summer Refractive Congress, American Society of Cataract and Refractive Surgery, San Diego CA

2007 Faculty, Cornea Subspecialty Day, American Academy of Ophthalmology Annual Meeting, New Orleans, LA

2008 Faculty, ASCRS 2008 Winter Update Meeting. Riviera Maya, MX

2008 Faculty, Understanding, Preventing, and Treating Post-LASIK Corneal Ectasia, 2008 World Ophthalmology Congress, Hong Kong

2008 Faculty, Cornea Society Symposium, Hot Topics in Cornea and External Disease, American Society of Cataract and Refractive Surgery Annual Meeting, Chicago, IL

2008 Faculty, Management of High Risk Corneal Grafts and Current Trends in Eye Banking, 2008 World Ophthalmology Congress, Hong Kong

2008 Faculty, AAO Refractive Surgery Subspecialty Day

2009 Faculty, ASCRS 2009 Winter Update Meeting, Riviera Maya, Mexico

2009 Faculty, ESCRS Winter Refractive Meeting, Basics Optics Course, Rome Italy

2009 Faculty, Cleveland Clinic Innovations in Ophthalmology Course, Key Largo, FL

2009 Faculty, Cornea Day. Medical/Surgical Corneal Conditions and Controversies in Cataract Surgery ASCRS Annual Meeting, San Francisco CA

2009 Faculty, AAO Refractive Surgery Subspecialty Day, San Francisco CA

2009 Faculty, AAO Annual Meeting, San Francisco, CA

2010 Faculty, AAO Refractive Surgery Subspecialty Day, Chicago, IL

2010 Faculty, AAO Annual Meeting, Chicago, IL

2011 Faculty, 6th International Congress of Collagen Cross-Linking, Milan, Italy

2011 Faculty, ISRS/SOE Corneal Collagen Cross-linking Symposium, European Society of Ophthalmology (SOE) Biennial Meeting, Geneva, Switzerland

2011 Faculty, ASCRS Symposium: Cornea Clinical Committee Highlights Session. ASCRS Annual Meeting, San Diego, CA

2011 Faculty, ISRS Symposium, European Society of Cataract & Refractive Surgery, Vienna Austria

2011 Faculty, Eurokeratoconus Annual Meeting, Bordeaux, France

2011 Faculty, ISRS/AAO Refractive Surgery Subspecialty Day, Orlando, FL

2011 Faculty, AAO Annual Meeting, Orlando, FL

2012 Faculty, Hawaiian Eye Meeting, Maui, HI

2012 Faculty, ASCRS Cornea Day. ASCRS Cornea Day Annual Meeting, Chicago, IL

2012 Faculty, ISRS/AAO Refractive Surgery Subspecialty Day, ISRS/AAO Annual Meeting, Chicago, IL

2012 Faculty, 8th International Congress of Corneal Cross-Linking, Geneva, Switzerland

2013 Faculty, Hawaiian Eye Meeting, Hawaii, HI

2013 Faculty, OSN New York, New York City NY

2013 Faculty, ISRS/AAO Refractive Surgery Subspecialty Day, ISRS/AAO Annual Meeting, New Orleans, LA

2013 Faculty, 9th International Congress of Corneal Cross-Linking, Dublin, Ireland

2014 Faculty, International Society of Refractive Surgery (ISRS) Tokyo Summit

2014 Faculty, World Ophthalmology Congress (WOC), Tokyo Japan

2014 Faculty, ISRS Symposium: Three Big Debates & Controversies in Corneal Refractive Surgery, ESCRS Annual Meeting, London, UK

2015 Faculty, World Cornea Congress VII, San Diego, CA

2015 Faculty, Eucornea Meeting, Barcelona Spain

2015 Faculty, 11th International Congress of Corneal Cross-Linking, Boston, MA

2016 Faculty, WOC Symposium: World Forum of Ophthalmological Journal Editors, World Ophthalmology Congress, Guadalajara, MX

2016 Faculty, WOC Symposium: Pearls & Pitfalls for Selecting and Implanting Refractive IOLs, World Ophthalmology Congress, Guadalajara, MX

2016 Faculty, WOC Symposium: Clinical Decision-making with Cataract Complications, World Ophthalmology Congress, Guadalajara, MX

2016 Faculty, Aspen Corneal Society Annual Meeting, Aspen CO

2016 Faculty, ASCRS Cornea Day. ASCRS Annual Meeting, New Orleans, LA

2016 Faculty, Los Angeles County Optometric Society LACOS Meeting, Los Angeles, CA

2016 Faculty, ISRS/AAO Refractive Surgery Subspecialty Day, ISRS/AAO Annual Meeting, Chicago, IL

2016 Faculty, AAO Annual Meeting, Chicago, IL

Invited Presentations at National or International Conferences:

1. Adenovirus Reactivation after LASIK. Southeastern Cataract, Cornea, and Refractive Surgery Conference, Durham, NC, March 2004
2. Management of Corneal Ectasia after LASIK. Southeastern Cataract, Cornea, and Refractive Surgery Conference, Charleston, SC, March 2005
3. Why I Chose Academic Medicine. Young Physicians and Residents Clinical Committee Job Fair Didactic Session, American Society of Cataract and Refractive Surgery, Washington D.C., April 2005
4. Evidence of Alphacor Biointegration. Alphacor User's Meeting, Washington D.C., April 17, 2005
5. Intacs for Keratoconus. Georgia Society of Ophthalmology Annual Meeting, Sea Island, GA, July 29, 2005.
6. Intacs for Corneal Ectasia after LASIK. ASCRS Summer Refractive Congress, Seattle WA, August 2005
7. IOL Calculations after Refractive Surgery. ASCRS Summer Refractive Congress, Seattle WA, August 2005
8. Corneal Ectasia after LASIK. Turkish Ophthalmology Society National Meeting, Antalya Turkey, September 2005
9. Cataract Surgery in the Era of LASIK. American Academy of Ophthalmology/Turkish Ophthalmology Society Joint Panel, Turkish Ophthalmology Society National Meeting, Antalya Turkey, September 2005
10. Advances in Cataract Surgical Techniques, Materials, and Intraocular Lenses. American Academy of Ophthalmology/Turkish Ophthalmology Society Joint Panel, Turkish Ophthalmology Society National Meeting, Antalya Turkey, September 2005
11. Why I Chose Academic Medicine. Young Physicians and Re Young Physicians and Residents Clinical Committee Job Fair Didactic Session, American Society of Cataract and Refractive Surgery, San Francisco, CA, March 2006
12. Lens Based Refractive Surgery Challenging Cases. Young Physicians and Residents Clinical Committee Symposium, American Society of Cataract and Refractive Surgery, San Francisco, CA, March 2006
13. Bilateral Infectious Keratitis after PRK. Southeastern Cataract, Cornea, and Refractive Surgery Conference, Atlanta, GA, April 2006
14. The Surgical Management of Astigmatism. The Dulaney Foundation CPE Cornea Fellows Program. Dallas, TX, September 2006
15. Endothelial Keratoplasty. The Dulaney Foundation CPE Cornea Fellows Program. Dallas, TX, September 2006
16. Delayed Dislocated LASIK Flap Management. Southeastern Cataract, Cornea, and Refractive Surgery Conference, Miami, FL February 2007
17. Management of the Malfeasant IOL. Southeastern Cataract, Cornea, and Refractive Surgery Conference, Miami, FL February 2007
18. Management of Corneal Ectasia after LASIK. Cornea Day, San Diego, CA, May 2007
19. Management of the Refractive Surgery Patient with Previous Refractive Surgery. American Society of Cataract and Refractive Surgery, San Diego, CA, May 2007
20. Results of LASIK Survey to Residents and Young Physicians. American Society of Cataract and Refractive Surgery, San Diego, CA, May 2007
21. The Risks vs. Benefits of Performing PRK for FFKC. International Congress on Advanced Surface Ablation & SBK. Ft. Lauderdale FL, 2007
22. Quantitative Analysis of Corneal Stromal Cohesive Tensile Strength and its Relevance to Refractive Surgery. International Congress on Advanced Surface Ablation & SBK. Ft. Lauderdale FL, 2007

23. Is This Topography Abnormal? ASCRS Summer Refractive Congress, San Diego CA, August 2007
24. Is this Patient at Risk for Ectasia? ASCRS Summer Refractive Congress, San Diego CA, August 2007
25. Penetrating Keratoplasty and Ectasia Management, Cornea Subspecialty Day, American Academy of Ophthalmology Annual Meeting, New Orleans, LA, 2007
26. Validation of the Ectasia Risk Score System, Refractive Surgery Subspecialty Day, American Academy of Ophthalmology Annual Meeting, New Orleans, LA, 2007
27. Ectasia is not Preventable. Symposium 507: Important Current Issues for Refractive Surgeons, American Academy of Ophthalmology Annual Meeting, New Orleans, LA, 2007
28. Diagnosis and Management of Ectasia after LASIK. Association of Technical Personnel in Ophthalmology (ATPO) Annual Meeting, New Orleans, LA, 2007
29. Challenging Cases In keratorefractive Surgery. ASCRS 2008 Winter Update Meeting, Riviera Maya, Mexico
30. Collagen Cross Linking. ASCRS 2008 Winter Update Meeting, Riviera Maya, Mexico
31. SBK vs. Surface Ablation vs. LASIK. ASCRS 2008 Winter Update Meeting, Riviera Maya, Mexico
32. Screening Strategies for Identifying High Risk Patients. 2008 World Ophthalmology Congress, Hong Kong, July 2008
33. Pediatric Keratoplasty: Indications and Prognosis. 2008 World Ophthalmology Congress, Hong Kong, July 2008
34. Diagnosis and Management of Corneal Ectasia after LASIK. 2008 National Medical Association Scientific Assembly Atlanta, Georgia, July 2008.
35. Phakic Intraocular Lens Implantation in Forme Fruste Keratoconus. Southeastern Cataract, Cornea, and Refractive Surgery Conference, Asheville, NC, September 2008.
36. The Latest on Risk Factors for Ectasia. Refractive Surgery Subspecialty Day, American Academy of Ophthalmology Annual Meeting, Atlanta, GA, 2008
37. Expert Discussant 1: Ectasia: Refractive Surgery Subspecialty Day, American Academy of Ophthalmology Annual Meeting, Atlanta, GA, 2008
38. Keratorefractive Surgery: When PRK & When LASIK? ASCRS 2009 Winter Update Meeting, Riviera Maya, Mexico
39. Evaluating the Cornea with Scheimpflug Imaging. ESCRS 2009 Winter Refractive Meeting, Basics Optics Course, Rome
40. Infectious Keratitis after Refractive Surgery: Current Trends. Cleveland Clinic Innovations in Ophthalmology Course, Key Largo FL
41. Corneal Biomechanics and Implications for Refractive Surgery. Cleveland Clinic Innovations in Ophthalmology Course, Key Largo FL
42. Corneal Topographic Evaluation: Efficacy, Reproducibility, and Inter-observer Agreement. Cleveland Clinic Innovations in Ophthalmology Course, Key Largo FL
43. Refractive Surgical Screening: The Ectasia Risk Scoring System. Cleveland Clinic Innovations in Ophthalmology Course, Key Largo FL
44. Infectious Keratitis after Refractive Surgery: Where are we in 2009? Vanderbilt Eye Institute Comprehensive Ophthalmology: Pearls XII Course, Nashville TN
45. Advanced Topographic Evaluation of the Refractive Surgical Patient. Vanderbilt Eye Institute Comprehensive Ophthalmology: Pearls XII Course, Nashville TN
46. Corneal Ectasia after LASIK: Diagnosis & Management. U. of Florida Refractive Pearls for practice, 2010
47. Infectious Keratitis after Refractive Surgery. U. of Florida Refractive Pearls for practice, 2010

48. LASIK Flap Complications: Recognition & Management. U. of Florida Refractive Pearls for practice, 2010
49. Advanced Topographic Evaluation of the Refractive Surgical Patient. U. of Florida Refractive Pearls for practice, 2010
50. Astigmatism Management in Cataract & Refractive Surgery. Egyptian Society of Cataract & Refractive Surgery Annual Meeting, Cairo Egypt, 2010
51. Refractive Surgical Decision Making: When PRK and When LASIK? Egyptian Society of Cataract & Refractive Surgery Annual Meeting, Cairo Egypt, 2010
52. LASIK Flap Complications: Recognition & Management. Egyptian Society of Cataract & Refractive Surgery Annual Meeting, Cairo Egypt, 2010
53. Advanced Topographic Evaluation of the Refractive Surgical Patient. Egyptian Society of Cataract & Refractive Surgery Annual Meeting, Cairo Egypt, 2010
54. Corneal Ectasia after LASIK: Diagnosis & Management. Egyptian Society of Cataract & Refractive Surgery Annual Meeting, Cairo Egypt, 2010
55. Subjective Topographic Pattern Correlations Between Scanning Slit-Beam Topography and Scheimpflug Images. ASCRS Annual Meeting, Boston, MA, April 2010 (**2010 ASCRS Foundation Binkhorst Young Ophthalmologist Award Paper**)
56. Ectasia. World Ophthalmology Congress Refractive Surgery Subspecialty Day, Berlin, Germany, June 2010
57. Ectasia: Diagnosis & Treatment. World Ophthalmology Congress, Berlin, Germany, June 2010
58. Corneal Ectasia after LASIK: Diagnosis & Management. Colombian Society of Ophthalmology International Ophthalmology Congress, Bogota Colombia, August 2010
59. Advanced Topographic Evaluation for the Refractive Surgical Patient. Colombian Society of Ophthalmology International Ophthalmology Congress, Bogota Colombia, August 2010
60. Management of Malpositioned Intraocular Lenses. Colombian Society of Ophthalmology International Ophthalmology Congress, Bogota Colombia, August 2010
61. Astigmatism Management in Cataract & Refractive Surgery. Colombian Society of Ophthalmology International Ophthalmology Congress, Bogota Colombia, August 2010
62. Surprises and Solutions After Refractive Surgery. Atlantic Eye Symposium, Halifax Nova Scotia, September 2010
63. PRK vs. LASIK: How to Choose. Atlantic Eye Symposium, Halifax Nova Scotia, September 2010
64. Corneal Ectasia: Pathophysiology and Risk Factors. Atlantic Eye Symposium, Halifax Nova Scotia, September 2010
65. Status of Collagen Cross-linking in the United States: Studies vs. Approval Process. AAO Refractive Surgery Subspecialty Day Meeting, Chicago, IL October 2010
66. Flap Thickness in Eyes with Post-LASIK Ectasia. OSN New York 2010. November 2010
67. CXL for Post-LASIK Ectasia. 6th International Congress of Collagen Cross Linking, Milan Italy, January 2011
68. Corneal Ectasia Post-Refractive Surgery: Diagnosis & Treatment. Bascom Palmer Eye Institute Cataract & Refractive Surgery Congress, Miami, FL, February 2011
69. Prevention and Management of LASIK Flap Complications. Bascom Palmer Eye Institute Cataract & Refractive Surgery Congress, Miami, FL, February 2011
70. Topographic Evaluation and Surgical Screening of the Refractive Surgery Patient. Bascom Palmer Eye Institute Cataract & Refractive Surgery Congress, Miami, FL, February 2011
71. Case Studies in Corneal Topography. ASCRS Annual Meeting, San Diego, CA, March 2011

72. Astigmatism Management in the Post-Refractive Surgery Cornea. ASCRS Annual Meeting, San Diego, CA, March 2011
73. Collagen Cross Linking for Ectasia after LASIK. European Society of Ophthalmology (SOE) Biennial Meeting, Geneva Switzerland, June 2011
74. IOL Fixation Options When the Capsule is Compromised. Canadian Ophthalmology Society (COS) Annual meeting, Vancouver. BC, June 2011
75. IOL Cutting Instruments. Canadian Ophthalmology Society (COS) Annual meeting, Vancouver. BC, June 2011
76. Advanced Topographic Analysis for Cataract and refractive Surgeons. Canadian Ophthalmology Society (COS) Annual meeting, Vancouver. BC, June 2011
77. Astigmatism Management after Refractive Surgery. Pan American Society of Ophthalmology Annual Meeting, Buenos Aires, Argentina, July 2011
78. The Verysyse Phakic IOL. Pan American Society of Ophthalmology Annual Meeting, Buenos Aires, Argentina, July 2011
79. Risk Factors for Ectasia: Are thin Cornea at Increased Risk for Post-LASIK Ectasia? ISRS Symposium at the European Society of Cataract & Refractive Surgery, Vienna Austria, September 2011
80. Changes in Ocular Response Analysis (ORA) after Cross Linking for Keratoconus and Ectasia after LASIK. Eurokeratoconus Annual meeting, Bordeaux, France, September 2011
81. Keratoconus & Ectasia: Screening & Procedure Selection. Given during AAO Course #420: Modern Trends in Diagnosis and Management. AAO Annual Meeting, Orlando, FL, October 2011
82. Battle of the Bulge: We Can Predict Ectasia. ISRS/AAO Refractive Surgery Subspecialty Day Meeting, Orlando, FL, October 2011
83. Update on Cross Linking for Keratoconus and Ectasia. OSN New York 2011, November 2011
84. Update on Cross Linking for Keratoconus and Ectasia. Hawaiian Eye 2012, Maui, January 2012
85. Riboflavin Crosslinking for Infectious Keratitis. ASCRS Cornea Day Annual Meeting, Chicago, IL, March 2012
86. The Role of the Ectasia Risk Score System. ASCRS Annual Meeting, Chicago, IL, April 2012
87. Predicting Ectasia Risk. ASCRS Annual Meeting, Chicago, IL, April 2012
88. The Taming of the Tumultuous Toric. ASCRS Annual Meeting, Chicago, IL, April 2012
89. Treatment Algorithm for the Dissatisfied Premium IOL Patient. Refractive.online & SICCSO International Congress, Rome, Italy, June 2012
90. Topographic Evaluation. ISRS/AAO Symposium 53: Introduction to Refractive Surgery for Residents, AAO Annual Meeting, Chicago, IL
91. Surgical Management of Astigmatism. 3rd ISRS /Magrabi Meeting & Saudi Ophthalmological Society, December 1-3, 2012, Riyadh, KSA
92. Managing Patients Dissatisfied with Multifocal IOLs. 3rd ISRS /Magrabi Meeting & Saudi Ophthalmological Society, December 1-3, 2012, Riyadh, KSA
93. IOL selection & Implantation; My 5 Best Tips. 3rd ISRS /Magrabi Meeting & Saudi Ophthalmological Society, December 1-3, 2012, Riyadh, KSA

94. LASIK Interface Disorders: Diagnosis and Management. 3rd ISRS /Magrabi Meeting & Saudi Ophthalmological Society, December 1-3, 2012, Riyadh, KSA

95. Refractive Surgery Screening. 3rd ISRS /Magrabi Meeting & Saudi Ophthalmological Society, December 1-3, 2012, Riyadh, KSA

96. Topography, Tomography & Aberrometry for the Refractive Surgeon. 3rd ISRS /Magrabi Meeting & Saudi Ophthalmological Society, December 1-3, 2012, Riyadh, KSA

97. Finding a Consensus on Reporting CXL Outcomes: Epithelial Mapping. 8th International Congress of Corneal Cross-Linking, December 7-8 2012, Geneva, Switzerland

98. Corneal Topography and the ERSS score, An Update. 8th International Congress of Corneal Cross-Linking, December 7-8 2012, Geneva, Switzerland

99. Collagen Cross-Linking: Current Status. Hawaiian Eye 2013, Hawaii's Big Island, HI, January 2013

100. LASIK Interface Disorders: Etiology and Management. Hawaiian Eye 2013, Hawaii's Big Island, HI, January 2013

101. Utilizing the ERSS for Refractive Surgical Screening. Lo Mejor en Cornea, March 21-23, 2013, Mexico City, DF

102. Choosing the Appropriate IOL after Corneal Refractive Surgery. Lo Mejor en Cornea, March 21-23, 2013, Mexico City, DF

103. Managing Corneal Ectasia after LASIK. Lo Mejor en Cornea, March 21-23, 2013, Mexico City, DF

104. Fundamentals of Corneal Topography & Tomography Evaluation. Lo Mejor en Cornea, March 21-23, 2013, Mexico City, DF

105. Corneal Topography to Detect Biomechanical Changes. Predicting, Measuring and Treating Changes in Corneal Biomechanics Course. ARVO, Seattle, WA, 2013

106. Correlation of corneal imaging in keratoconus suspect diagnosis. Athens/ISRS Refractive Surgery Course, Athens Greece, September 2013

107. Utilizing the ERSS for refractive Surgical Screening. Athens/ISRS Refractive Surgery Course, Athens Greece, September 2013

108. Toric, Multifocal, and Accommodating IOLs. ISRS/AAO Symposium 02: Introduction to Refractive Surgery for Residents, AAO Annual Meeting, New Orleans, LA, November 2013

109. Future Trends in Refractive Surgery. University of Sao Paolo 16th Annual Ophthalmology Congress, Sao Paolo, Brazil, November 2013

110. Utilizing the ERSS for Refractive Surgical Screening. University of Sao Paolo 16th Annual Ophthalmology Congress, Sao Paolo, Brazil, November 2013

111. Keratoconus; What is Progression? 9th International Congress of Corneal Cross-Linking, Dublin, Ireland, December 2013

112. Corneal Topography and the ERSS. 9th International Congress of Corneal Cross-Linking, Dublin, Ireland, December 2013

113. The Ectasia Risk Score System. Wills Eye Hospital, Philadelphia, PA, December 11, 2013

114. Corneal Topography: Wills Eye Hospital, Philadelphia, PA, December 11, 2013

115. Refractive Surgery: Patient Evaluation. Wills Eye Hospital, Philadelphia, PA, December 11, 2013

116. LASIK interface disorders. Bascom Palmer Eye Institute Cataract and Refractive Surgery Congress 2014. Miami, FL, February 21, 2014

117. LASIK vs. PRK - when to choose which procedure. Bascom Palmer Eye Institute Cataract and Refractive Surgery Congress 2014. Miami, FL, February 21, 2014

118. Corneal topography & tomography for refractive and cataract surgeons. Bascom Palmer Eye Institute Cataract and Refractive Surgery Congress 2014. Miami, FL, February 21, 2014

119. Preoperative evaluation for LASIK & PRK. Bascom Palmer Eye Institute Cataract and Refractive Surgery Congress 2014. Miami, FL, February 21, 2014

120. Choosing the appropriate IOL after corneal refractive surgery New Orleans Academy of Ophthalmology, New Orleans LA, March 2014

121. Managing Patients Dissatisfied with Multifocal IOLs. New Orleans Academy of Ophthalmology, New Orleans LA, March 2014

122. Keys to success with New Technology IOLS. New Orleans Academy of Ophthalmology, New Orleans LA, March 2014

123. LASIK Interface Disorders: Etiology and Management. New Orleans Academy of Ophthalmology, New Orleans LA, March 2014

124. The Role of Ectasia Risk Score System. New Orleans Academy of Ophthalmology, New Orleans LA, March 2014

125. Fundamentals of Corneal Topography and Tomography Evaluation. New Orleans Academy of Ophthalmology, New Orleans LA, March 2014

126. Surgical Management of Astigmatism. New Orleans Academy of Ophthalmology, New Orleans LA, March 2014

127. Collagen cross-linking complications and their management. New Orleans Academy of Ophthalmology, New Orleans LA, March 2014

128. Managing Cataract Surgery Complications. New Orleans Academy of Ophthalmology, New Orleans LA, March 2014

129. CXL for Infectious Keratitis (PACK-CXL). ISRS Tokyo Summit, April 1 2014

130. LASIK, Ectasia, and Phakic IOLs. ISRS Tokyo Summit, April 1 2014

131. Advanced Tomography & Topography Evaluation, World Ophthalmology Congress, Tokyo, Japan, April 2014

132. Corneal topography to measure the therapeutic success of CXL. ARVO Annual Meeting Education Course, Orlando, FL, May 3, 2014

133. LASIK interface disorders: Etiology and management. 20th Annual White Nights International Ophthalmology Congress, St. Petersburg, Russia, May 26, 2014

134. Choosing the appropriate IOL after corneal refractive surgery. 20th Annual White Nights International Ophthalmology Congress, St. Petersburg, Russia, May 26, 2014

135. Management of Corneal Ectasias. 20th Annual White Nights International Ophthalmology Congress, St.

Petersburg, Russia, May 27, 2014

136. Managing patients dissatisfied with multifocal IOLs. 20th Annual White Nights International Ophthalmology Congress, St. Petersburg, Russia, May 27, 2014

137. Managing Presbyopia-Correcting IOL Dissatisfaction. 20th Annual Cornea & Refractive Surgery International Course, Riviera Nayarit, Mexico, September 10-12, 2014

138. Ectasia Management. 20th Annual Cornea & Refractive Surgery International Course, Riviera Nayarit, Mexico, September 10-12, 2014

139. LASIK Interface Disorders. 20th Annual Cornea & Refractive Surgery International Course, Riviera Nayarit, Mexico, September 10-12, 2014

140. CXL Treatment Modifications: Fluence, Irradiation Profiles, and The Role of the Epithelium. ESCRS Annual Meeting, September 13-17, 2014, London, UK

141. Topographic and Tomography Evaluation. ISRS/AAO Symposium 02: Introduction to Refractive Surgery for Residents. AAO Annual Meeting. Chicago, IL October 2014

142. Interactive Corneal Refractive Surgery Consultations. ISRS/AAO Annual Meeting. Chicago, IL October 2014

143. Laser Vision Correction Enhancements. ISRS/AAO Annual Meeting. Chicago, IL October 2014

144. Flap & Interface Complications. AAO Annual Meeting. Chicago, IL October 2014

145. Phakic IOL Exchange. ISRS/AAO Annual Meeting. Chicago, IL October 2014 Topography and Tomography evaluation for Cataract and Refractive Surgeons. Chilean Congress of Ophthalmology, Vina del Mar, Chile, November 2014

146. Managing Patient Dissatisfaction after Presbyopia-Correcting IOL Implantation. SUNY Downstate Ophthalmology Department, Brooklyn, NY, November 2014

147. Case Studies in Refractive Surgery. SUNY Downstate Ophthalmology Department, Brooklyn, NY, November 2014

148. The Role of Ectasia Risk Score System in Refractive Surgery Screening. Chilean Congress of Ophthalmology, Vina del Mar, Chile, November 2014

149. CXL for infectious Keratitis. Chilean Congress of Ophthalmology, Vina del Mar, Chile, November 2014

150. Future Trends in Refractive Surgery. Chilean Congress of Ophthalmology, Vina del Mar, Chile, November 2014

151. LASIK Interface Disorders: Etiology and Management. Chilean Congress of Ophthalmology, Vina del Mar, Chile, November 2014

152. CXL: Complications and their management. Chilean Congress of Ophthalmology, Vina del Mar, Chile, November 2014

153. CXL: Indications and Outcomes. Chilean Congress of Ophthalmology, Vina del Mar, Chile, November 2014

154. Corneal Cross-Linking: Current Status. Nashville Academy of Ophthalmology Meeting, Nashville, TN, January 2015

155. IOL Repositioning & Exchange Techniques. Les Entretiens Ophtalmologiques de l'Université de

Montréal 2015 (EOUM), Montreal, Quebec. May 2015

156. Therapeutic Refractive Surgery. Les Entretiens Ophtalmologiques de l'Université de Montréal 2015 (EOUM), Montreal, Quebec. May 2015

157. Advanced Topography and Tomography Evaluation. Les Entretiens Ophtalmologiques de l'Université de Montréal 2015 (EOUM), Montreal, Quebec. May 2015

158. Measuring the Success of Corneal Cross-Linking. Les Entretiens Ophtalmologiques de l'Université de Montréal 2015 (EOUM), Montreal, Quebec. May 2015

159. The Fragility of Knowledge. Drouilhet Visiting Professor Lecture, UT Houston Department of Ophthalmology, Houston, TX, June 2015

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164. Post Refractive Surgery Corneal Ectasia. 6th Annual Eucornea Congress, Barcelona Spain, September 2015

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174. Optimizing IOL Surgery Using Advanced Optics. SUNY Downstate Medical Center Current Concepts in Ophthalmology, Atlantic City, NJ, January 9, 2016

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176. Publishing a Scientific Paper: Tables, Graphs, and Figures. World Ophthalmology Congress, Guadalajara, MX, February 8, 2016

177. Publishing a Scientific Paper: Choosing the Correct Journal. World Ophthalmology Congress, Guadalajara, MX, February 8, 2016

178. LASIK Interface Disorders: Etiology & Management. Aspen Corneal Society Annual Meeting, Aspen CO, February 14, 2016

179. Role of Tomography in Keratoconus Evaluation: Fact & Fancy. Aspen Corneal Society Annual Meeting, Aspen CO, February 14, 2016

180. Collagen Crosslinking: What's Out There and What's Approved Where. Course on Advanced Cornea Surgery (CoACS). Emory University School of Medicine. Atlanta, GA, March 5, 2016

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198. IOL Removal – Do's & Dont's. Annual Conference of Indian Intraocular Implant & Refractive Society, July 2-3, 2016, Chennai, India

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201. New Indications for Corneal Cross-Linking. European Society of Cataract & Refractive Surgery Annual Meeting, September 11, 2016, Copenhagen, Denmark

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