

49<sup>th</sup>

ECLSO

European Contact Lens and  
Ocular Surface Congress

EUROPEAN CONGRESS  
ON MYOPIA CONTROL

2 - 3  
September  
2022

Novotel Tour Eiffel

Paris - France



EUROPEAN CONTACT  
LENS SOCIETY OF  
OPHTHALMOLOGISTS

Speaker's name : Muriel Schornack

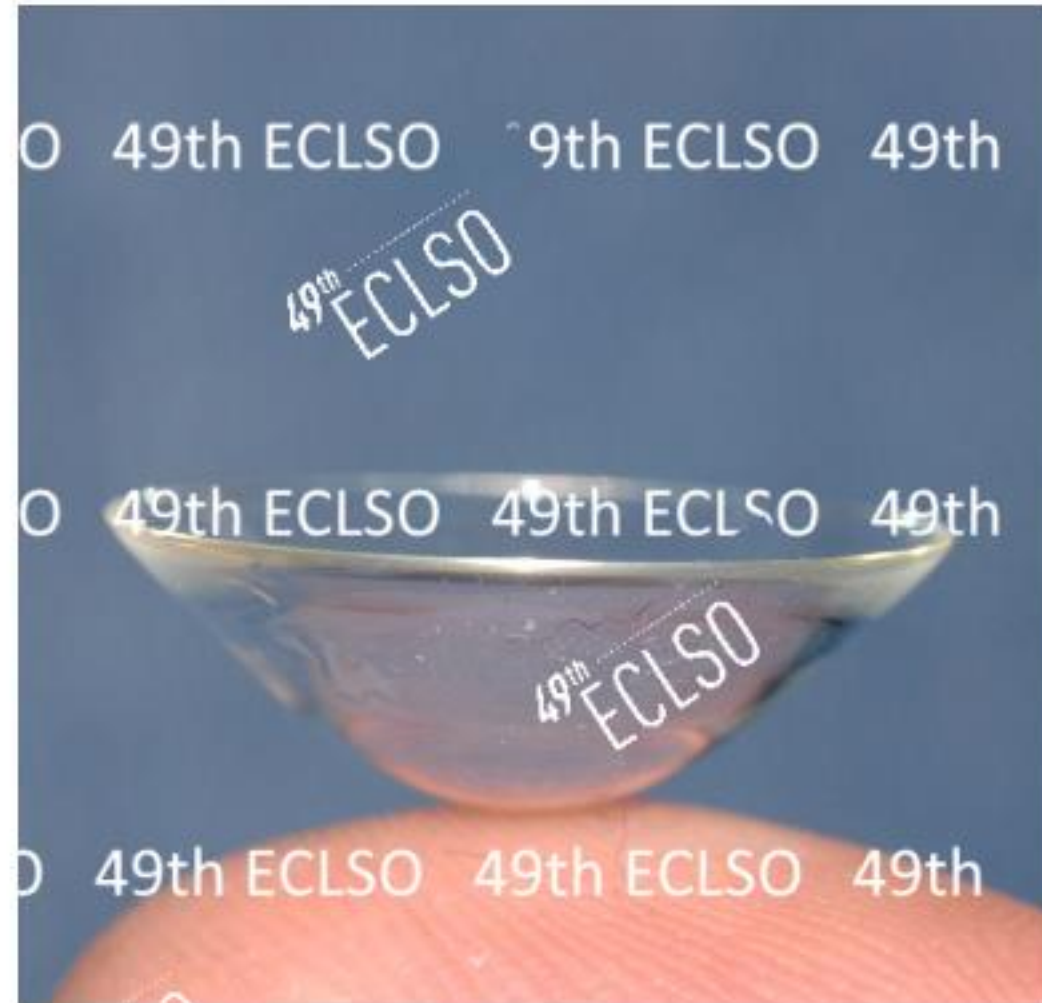
I do not have any potential conflict of interest



# SCLERAL LENSES: THE GOLD STANDARD FOR IRREGULAR CORNEAS

Muriel Schornack, OD

September 2, 2022



## COURSE OBJECTIVES

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- Review published literature on the utilization of scleral lenses in the management of corneal irregularity

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- Describe potential advantages of scleral lenses compared to corneal rigid lenses for this indication
- Present representative cases for the use of scleral lenses

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ARE SCLERAL LENSES NEW?

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## EUGENE KALT 1861-1941

- 1888: published a paper describing the use of blown glass shells to attempt to improve visual acuity in patients with keratoconus



## **INTRODUCTION OF GAS PERMEABLE SCLERAL LENSES**

Ezekiel, D. Gas permeable haptic lenses. *Journal of the British Contact Lens Association* 6(4): 1983.



- Subsequent publications:
  - Pullum
  - Visser
  - Schein
  - Rosenthal



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## 25 YEARS LATER

- Commercial availability
- Educational resources
- Research interest



# Scleral Lenses: A Literature Review

Muriel M. Schornack, O.D.

(Eye & Contact Lens 2015;41: 3-11)

- Review of 184 publications on scleral lenses (through May 2014)

**TABLE 2.** Summary of Indications and Visual Results From Retrospective Reviews of  $\geq 50$  Patients Published Since 2005

Author (Year)	No. Patients (Eye)	Indication (Percentage)	Prelens Visual Acuity (Vision)	Visual Acuity with Lens (Year)	Eyes Attaining 20/40
Pullum et al. <sup>98</sup>	1,003 (1,560)	CE: 78.6; OSD: 11.3; REF: 4.9; Other: 5.2	NR	NR	66%
Rosenthal and Croteau <sup>72</sup>	538 (875)	CE: 57.3; OSD: 42.7	NR	NR	NR
Visser et al. <sup>97,98</sup>	178 (284)	CE: 82.5; OSD: 8.8; Other: 8.5	0.7	0.2 <sup>a</sup>	NR
Severinsky et al. <sup>99</sup>	97 (140)	CE: 94; OSD: 4; REF: 2	20/70	20/32 <sup>a</sup>	93%
Baran et al. <sup>80</sup>	59 (118)	CE: 100	0.56 ± 0.44 logMAR	0.09 ± 0.15 <sup>a</sup> logMAR	93.1%
Pecego et al. <sup>62</sup>	63 (107)	CE: 89.7; OSD: 10.3	20/30 or better in 23% of eyes with spectacles; 20/30 or better in 41% of eyes with contact lenses	20/30 or better in 73% of eyes with scleral lenses	NR
Dimit et al. <sup>85</sup>	51	CE: 45; OSD: 49; Other: 6	CE: 0.41; OSD: 0.51 logMAR	CE: 0.16; OSD: 0.21 logMAR	NR
Lee et al. <sup>77</sup>	58 (90)	CE: 100	0.79 ± 0.48 logMAR	0.15 ± 0.33 <sup>a</sup> logMAR	NR
Ortenberg et al. <sup>100</sup>	97 (155)	CE: 100	0.49 ± 0.35 logMAR	0.21 ± 0.21 <sup>a</sup> logMAR	NR
Visser et al. <sup>101</sup>	144 (213)	CE: 83.5; OSD: 14.6; Other: 1.9	NR	0.8 or better in 62.9% of eyes	NR
Arumugan et al. <sup>91</sup>	63 (85)	CE: 80; OSD: 29	0.51 ± 0.42 logMAR	0.23 ± 0.30 <sup>a</sup> logMAR	NR
Schornack et al. <sup>83</sup>	115 (188)	OSD: 100	0.32 ± 0.37 logMAR	0.12 ± 0.19 <sup>a</sup> logMAR	NR

<sup>a</sup>Indicates statistically significant improvement in visual acuity.

CE, corneal ectasia; OSD, ocular surface disease; REF, refractive error; NR, not reported.



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## SCOPE STUDIES

- Survey-based research on scleral lens prescription and management practices



## SCOPE 2015

- Purpose: To describe international scleral lens prescription and management practices
- Design: Cross-sectional survey of scleral lens practitioners
  - Distributed to members of contact lens-related organizations
  - Links to survey placed in e-newsletters which featured topics of interest in the contact lens community



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## SURVEY QUESTIONS

- Demographic information from all respondents
  - Country of practice
  - Practice modality
  - Year of first lens fit
- Individuals who had fit  $\geq 5$  patients with scleral lenses were asked:
  - Estimated total number of lens fits
  - Indications for scleral lens wear
  - Placement of scleral lenses within a therapeutic regimen

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## RESULTS

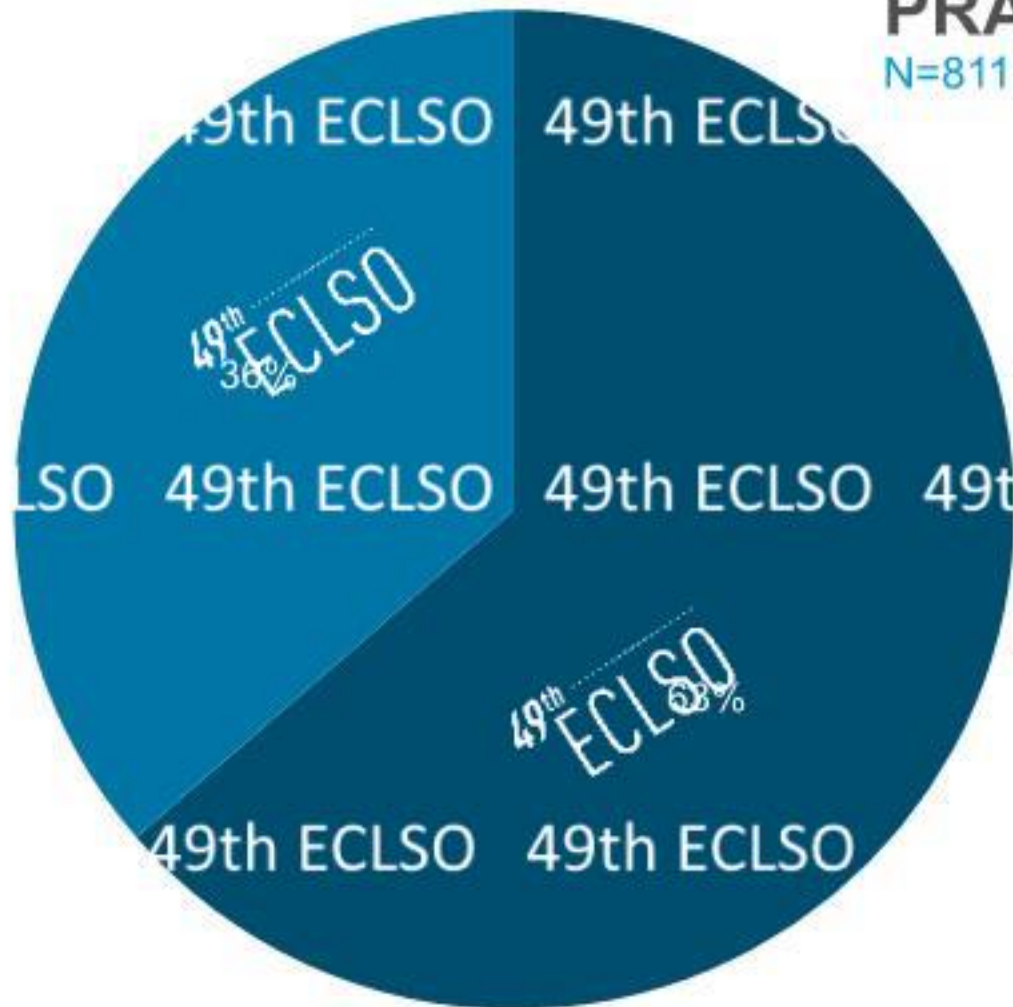
- 989 respondents
- 723 respondents who had fit 5 or more patients
- Represented an estimated 84,375 lens fits

- United States: 72%
- Canada: 4%
- India: 3%
- Fewer than 20 respondents from each of 47 other countries represented



## PRACTICE MODALITY

N=811



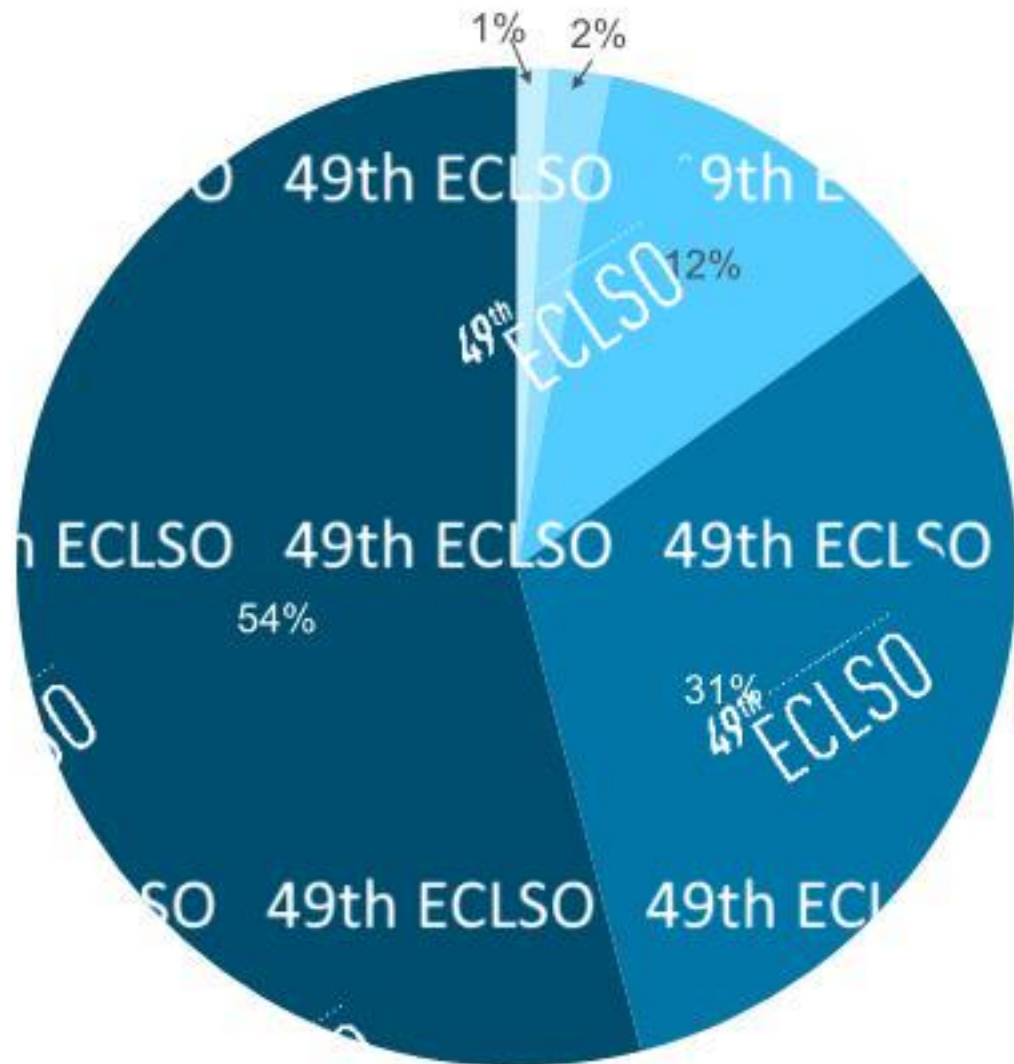
- Non-Academic
  - >Private practice
  - >Group practice
  - >Retail

- Academic
  - >Hospital
  - >Teaching Institution
  - >Research

# YEAR OF FIRST SCLERAL LENS FIT

N=634

- Prior to 1983
- 1983-1989
- 1990-1999
- 2000-2009
- 2009 or later







## TOTAL NUMBER OF SCLERAL LENS FITS

N=678

- <10
- 11-50
- 51-99
- >200



Mean number of lens fits/respondent:  
125

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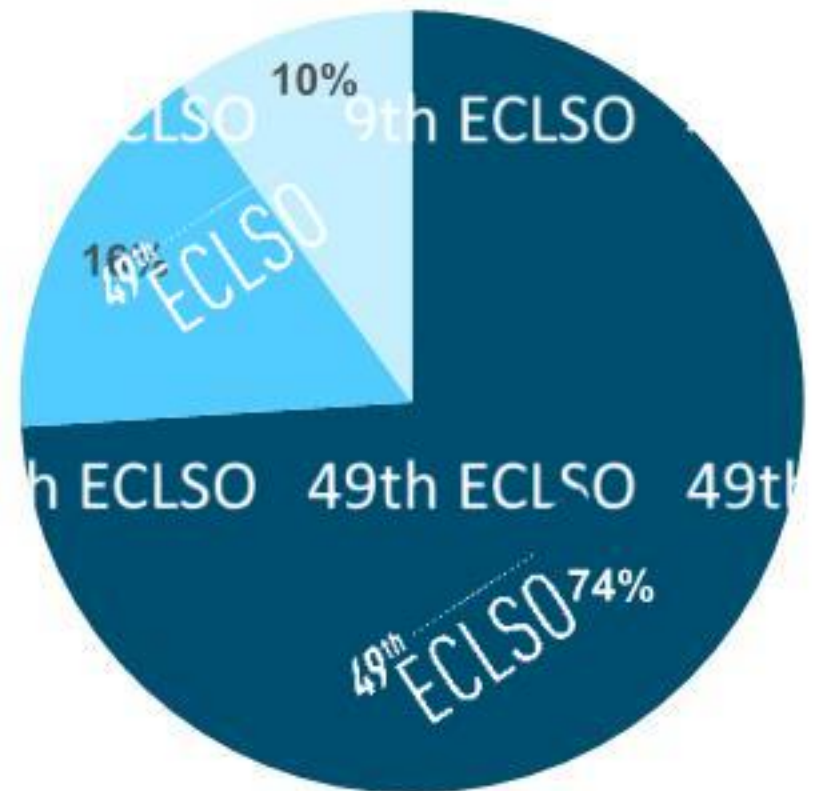
## INDICATIONS FOR SCLERAL LENS WEAR

N=672

### Specific conditions:

- Keratoconus (97%)
- Pellucid marginal degeneration (72%)
- Post-refractive surgery (70%)
- Post-keratoplasty (68%)
- Post-traumatic irregularity (47%)

- Corneal Irregularity
- Ocular Surface Disease



## Corneal Irregularity, n=629

- First place ranking:
  - Corneal rigid lenses: 277
  - Scleral lenses: 217
- Mean rank:
  - Corneal rigid lenses: 2.0
  - Scleral lenses: 2.3
- Top 3 options:
  - Corneal rigid lenses: 90%
  - Scleral lenses: 81%

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**PLACEMENT**  
ECLSO  
**OF SCLERAL**  
**LENS**  
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**THERAPY**  
49th ECLSO  
LSO 49th ECLSO 49th

# LENS-RELATED

## ISSUES AND COMPLICATIONS

84,375 lens fits

- Lens care and handling issues 0.55%
- Corneal edema 0.45%
- Neovascularization 0.28%
- Giant papillary conjunctivitis 0.16%
- Microbial keratitis 0.08%

A large, stylized graphic of a circular lens or contact lens is positioned on the left side of the slide. The lens is white with a blue border that has a textured, brush-stroke-like appearance. The word "SCOPE" is written across the lens in a blue, sans-serif font, with the letter "O" being a solid blue circle. Below the lens, the text "Scleral Lenses in Current Ophthalmic Practice Evaluation" is written in a smaller, blue, sans-serif font.

**SCOPE**  
Scleral Lenses in Current  
Ophthalmic Practice Evaluation

**SCOPE 2020**



## SCOPE 2020

- Purpose: To evaluate changes in international scleral lens prescription and management practices over the course of 5 years
- Design: Cross-sectional survey of scleral lens practitioners
  - Distributed to members of contact lens-related organizations
  - Links to survey placed in e-newsletters which featured topics of interest in the contact lens community
- Financial support was provided by Contamac



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## SURVEY QUESTIONS

- Survey was similar to original SCOPE survey, but was updated to reflect new lens designs/technology
- Demographic information
  - Country of practice
  - Type of practice
  - Year of first fit
- Individuals who had fit  $\geq 5$  patients with scleral lenses were asked:
  - Estimated total number of lens fits
  - Indications for scleral lens wear
  - Placement of scleral lenses within a therapeutic regimen

## RESULTS (2015)

- 922 respondents (989)
- 858 (723) respondents who had fit 5 or more lenses
- Represented an estimated **213,465** lens fits (84,375)



- United States: 63% (72%)
- Canada: 4% (4%)
- Italy: 4% (India 3%)
- Fewer than 20 respondents from each of 58 (47) other countries represented

## PRACTICE MODALITY

2015: N=811; 2020: N=765



### Non-Academic

- >Private prac
- >Group pract
- >Retail

### Academic

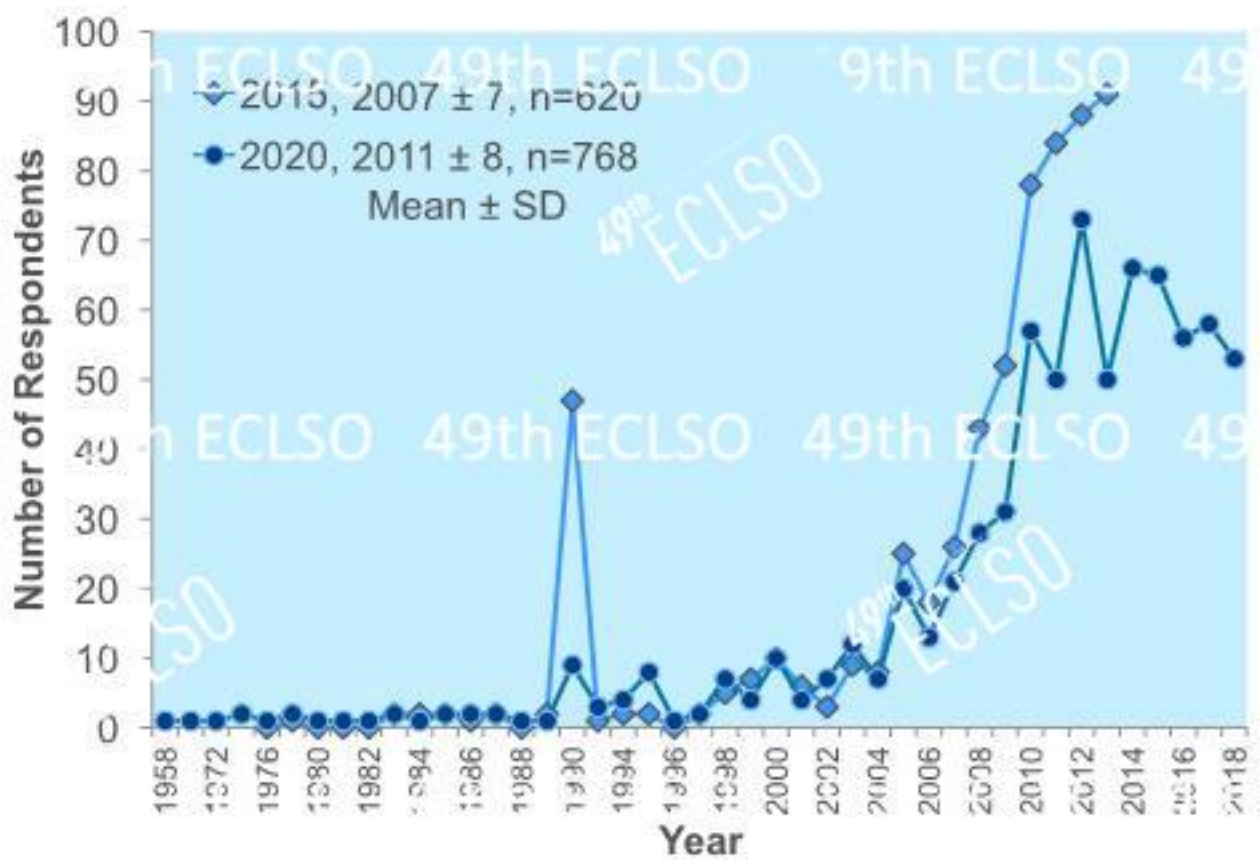
- >Hospital
- >Teaching Institution
- >Research

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Year of First Lens Fit

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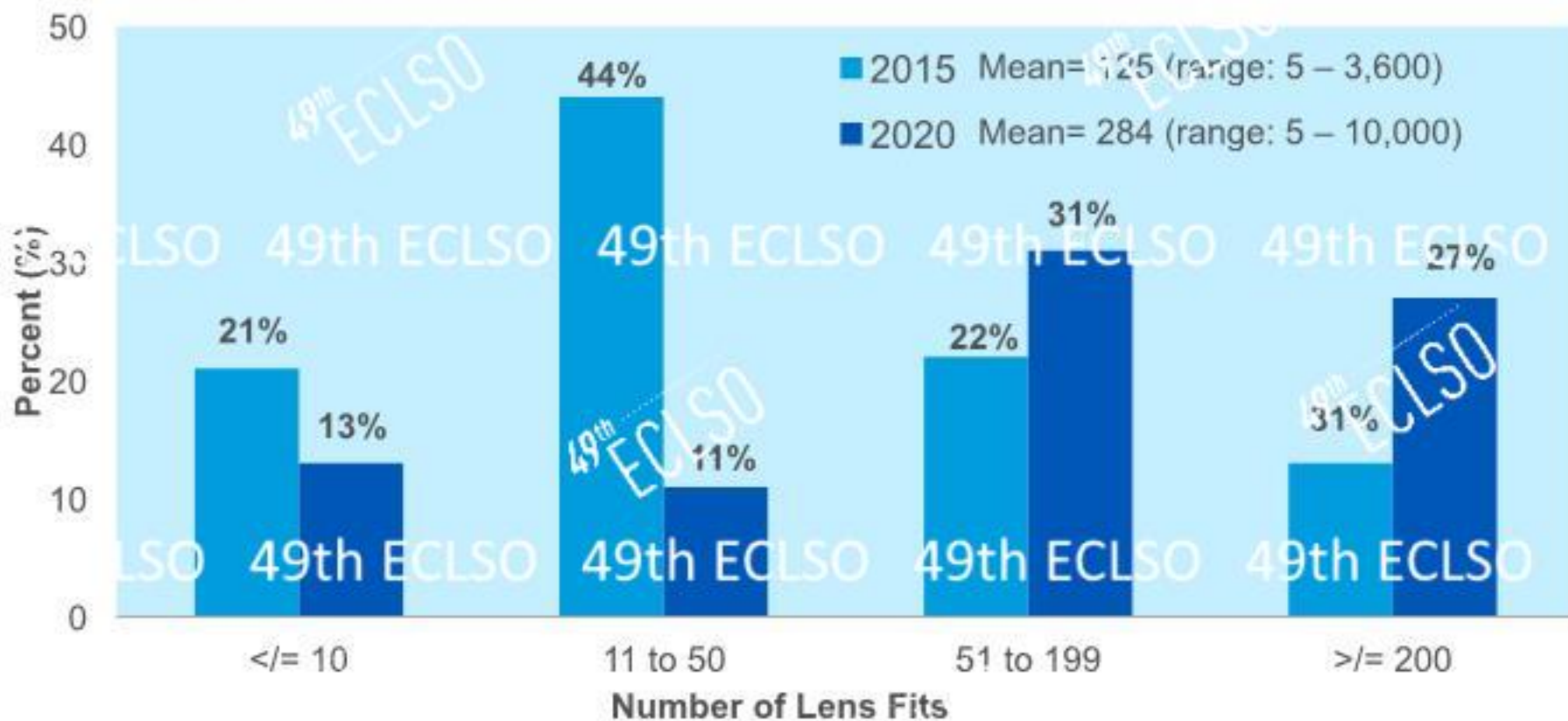
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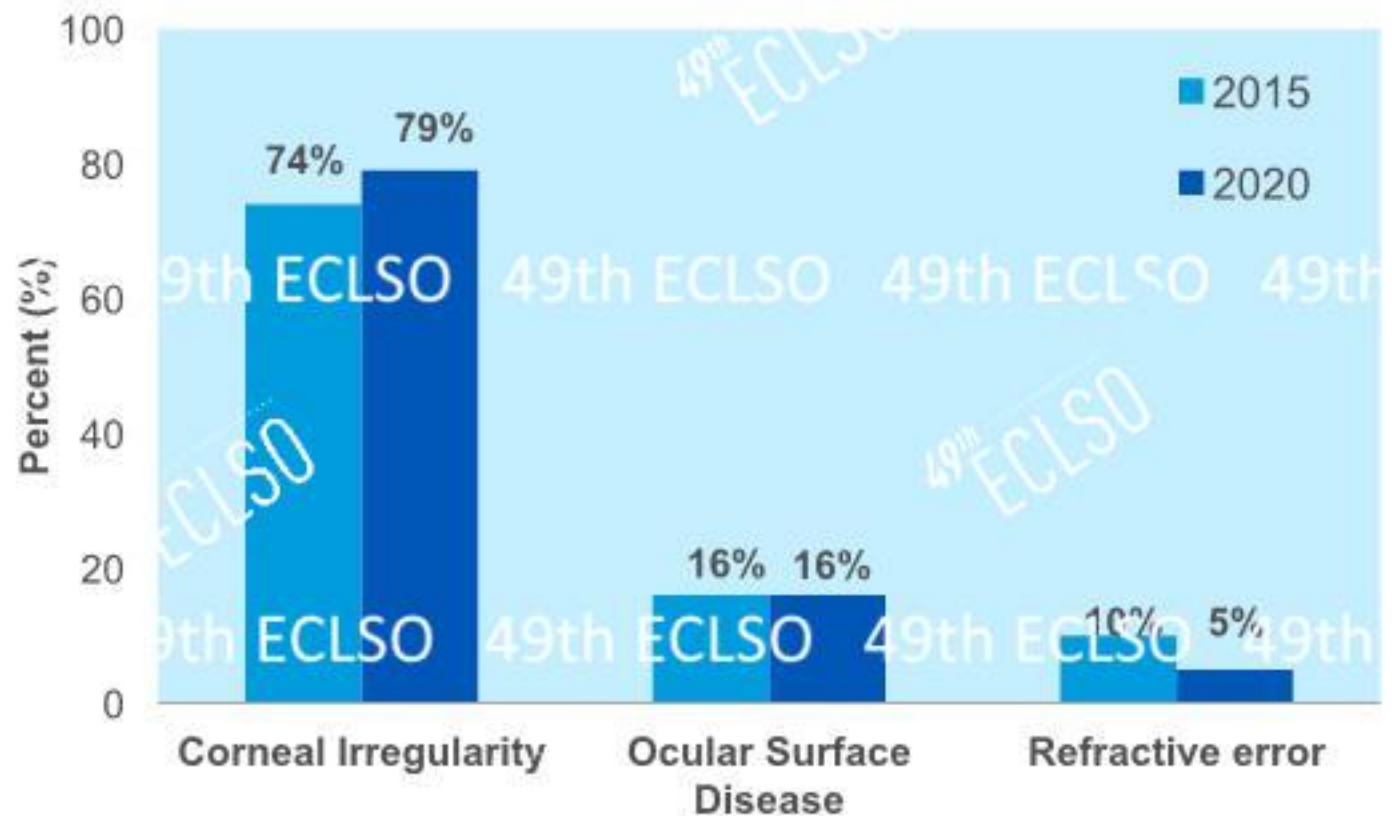
# TOTAL NUMBER OF LENSES FIT

2015: N=678, 2020: N=754



# INDICATIONS FOR SCLERAL LENS WEAR

2015: n=672  
2020: n=717



## THERAPEUTIC PLACEMENT

Higher percentage of participants consider scleral lenses as first-line management for corneal irregularity

- Sclerals lens first choice: 268
- RGP first choice: 132

(n=631)

## CORNEAL IRREGULARITY

1. Scleral lenses
2. Corneal rigid gas permeable lenses
3. Custom hydrogel lenses

Mean ranking:

- Scleral lenses: 2.54
- Corneal rigid lenses: 2.87

Top 3 options:

- Scleral lenses: 466
- Corneal rigid lenses: 401

## Contact Lens Prescribing Trends for Keratoconus at an Academic Medical Center: Increased Utilization of Scleral Lenses for Severe Disease

*Angelica C. Scanzera, OD, MPH, Marc Deeley, O.D., Charlotte Joslin, O.D., Ph.D., Timothy F. McMahon, O.D., and Ellen Shorter, O.D.*

*Eye & Contact Lens 2022;48: 58-62*

- Retrospective review of patients with keratoconus evaluated in the contact lens service in 2010 and 2020.
  - 292 patients in 2010
    - 69% wore corneal rigid lenses
    - No patients wore scleral lenses
  - 217 patients in 2020
    - 60% wore corneal rigid lenses
    - 22% wore scleral lenses
  - Mean K's
    - 53.0 D in scleral lens patients
    - 46.6 D in all other patients



## Randomised controlled trial of corneal vs. scleral rigid gas permeable contact lenses for keratoconus and other ectatic corneal disorders

Alexander Levitt<sup>a,b,c,d,\*</sup>, Martin Benwell<sup>c</sup>, Bruce J.W. Evans<sup>b,c</sup>

<sup>a</sup> Barnard and Levitt Optometrists, Zausenhof House, 58 Clifton Gardens, London, NW11 7EL, UK

<sup>b</sup> Institute of Optometry, 56-62 Newington Causeway, London, SE1 6DS, UK

<sup>c</sup> London South Bank University, School of Health and Social Care, 103 Borough Rd, London, SE1 0AA, UK

<sup>d</sup> Ophthalmology Department, Central Middlesex Hospital, Acton Ln, Park Royal, London, NW10 7NS, UK

Corr Lens Ant Eye 2020;43(6):543-522

- Prospective randomized crossover study of 34 patients
- Outcomes:
  - VA, contrast sensitivity
  - VFQ-25
  - Subjective perception of vision
  - Subjective perception of comfort
  - Preferred lens at completion of study
- Scleral lens wearers reported higher subjective perception of comfort; no additional significant differences were noted.



## Keratoconus Patient Satisfaction and Care Burden with Corneal Gas-permeable and Scleral Lenses

Ellen Shorter, OD, FAAO,<sup>1\*</sup> Muriel Schornack, OD, FAAO,<sup>2</sup> Jennifer Harthan, OD, FAAO,<sup>3</sup> Amy Nau, OD, FAAO,<sup>4</sup>  
Jennifer Fogt, OD, MS, FAAO,<sup>5</sup> Dingcai Cao, PhD,<sup>1</sup> and Cherie Nau, OD, FAAO<sup>2</sup>

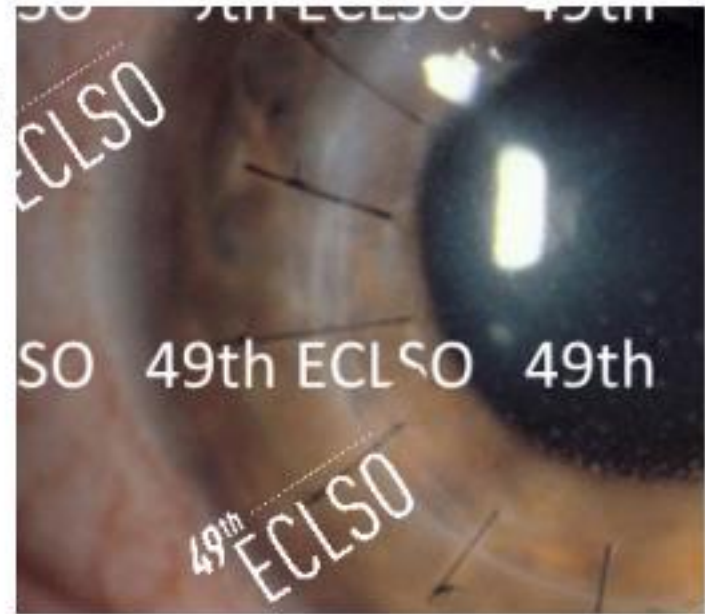
*Optom Vis Sci* 2020;97:790–796

- Online survey of patients with keratoconus
  - 75 patients wore corneal rigid lenses bilaterally
  - 76 patients wore scleral lenses bilaterally
- Scleral lens wearers
  - Higher overall satisfaction with vision and comfort
  - Less problems associated with lens movement or dislocation
- Corneal rigid lens wearers
  - Less issues with lens handling
  - Fewer difficulties with “haloes”
- Both groups reported issues with cloudy or foggy vision and lens discomfort



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## SCLERAL LENSES VS KERATOPLASTY



## Prosthetic Replacement of the Ocular Surface Ecosystem (PROSE) Scleral Device Compared to Keratoplasty for the Treatment of Corneal Ectasia

KAREN S. DELOSS, NADEEM H. FATTEH, AND CHRISTOPHER T. HOOD

Am J Ophthalmol 2014;158:974-982

- Retrospective comparative case series
- Enrolled consecutive patients with corneal ectasia who were evaluated for scleral lens wear (36) or underwent keratoplasty (37) from 2010-2012
- Findings:
  - Eyes undergoing keratoplasty had more severe ectasia
  - Optimal visual acuity was achieved more rapidly with scleral lenses
  - Mean visual acuity was better with scleral lenses
  - More eyes with stage 4 ectasia achieved 20/25 or better acuity with scleral lenses than with keratoplasty

## Impact of scleral contact lens use on rate of corneal transplantation for keratoconus

Jennifer Ling, MD<sup>1</sup>, Shahzad Mian, MD<sup>1</sup>, Joshua D Stein, MD, MSc<sup>1,2,3</sup>, Moshir Rahman, PhD<sup>1</sup>, Joel Poliskey, BSc<sup>4</sup>, Maria A. Woodward, MD, MSc<sup>1,2</sup>

Cornea. 2021 January ; 40(1): 39-42

- Retrospective review of contact lens use/penetrating keratoplasty in patients with corneal ectasia from 2012-2013
- 3.2% of patients underwent keratoplasty during that time period
- Corneal rigid use (33.9%) significantly lowered hazard of undergoing keratoplasty (HR 0.30, 95% CI 0.17-0.52) compared to no contact lens use.
- Scleral lens use (22.7%) significantly lowered the hazard of undergoing keratoplasty (HR 0.19, 95% CI 0.09-0.31) compared to no contact lens use.
- Conclusion: Try contact lenses first!



# Scleral Lenses Reduce the Need for Corneal Transplants in Severe Keratoconus

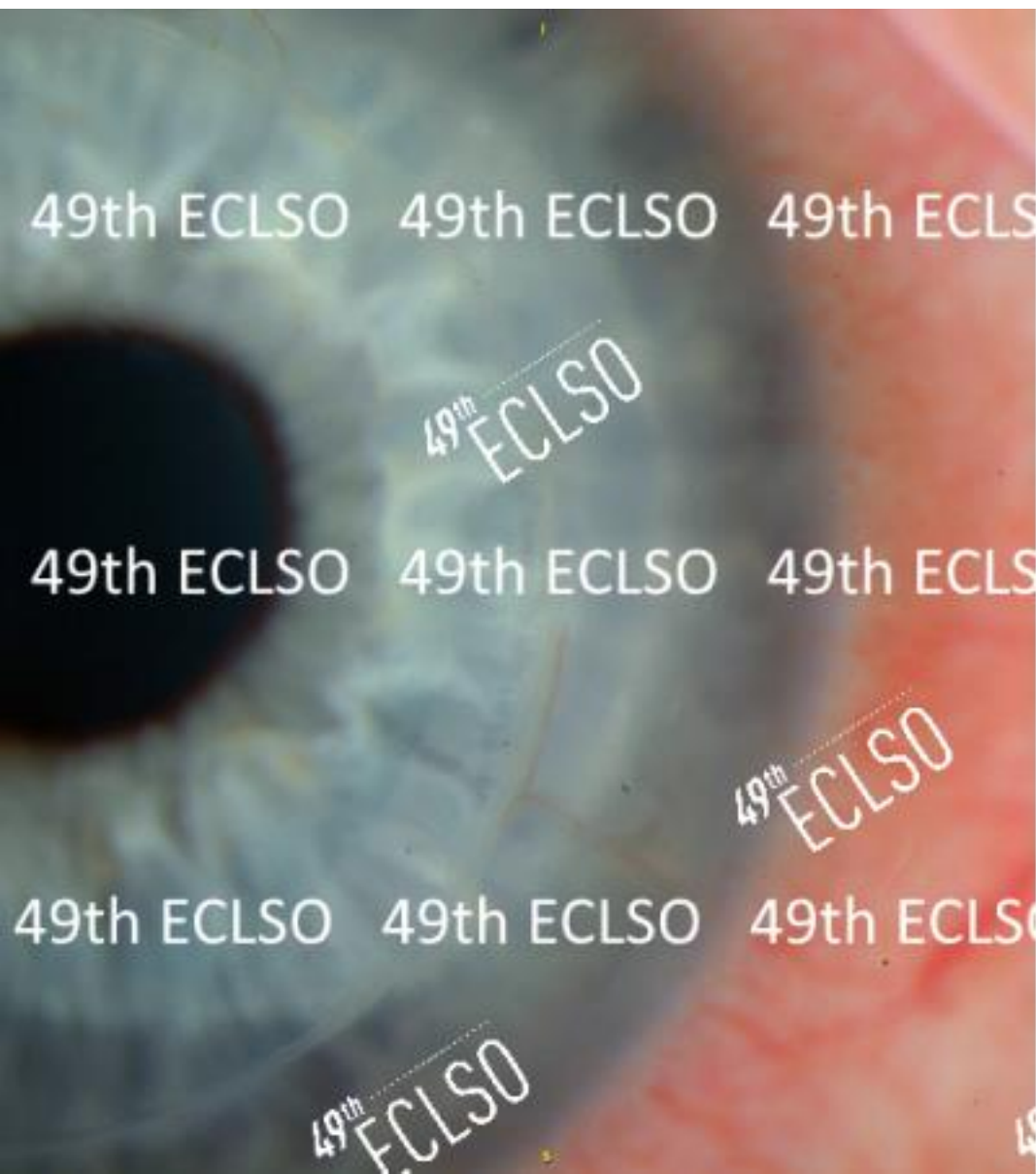


CARINA KOPPEN, ELKE O. KREPS, LIESELOTTE ANTHONISSEN, MAARTEN VAN HOEY,  
SORCHA NI DHUBHGHAILL, AND LOUISE VERMEULEN

Am J Ophthalmol. 2018 January ; 185: 43-47

- Retrospective case series of all patients who presented for evaluation of keratoconus in 2010-2014
  - Total of 75 eyes were evaluated
  - 3 eyes underwent keratoplasty
  - 51 eyes were successfully fit with scleral lenses
  - 40 eyes continued to wear scleral lenses for a mean follow-up of 30 months
- 40 eyes that would have otherwise undergone transplant surgery were successfully treated with long-term scleral lens wear.





WHY TRY SCLERAL LENSES?

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## RESIDUAL REFRACTIVE ERROR

- Farmer
- Underwent penetrating keratoplasty for keratoconus in 2004 due to contact lens intolerance
- Developed corneal neovascularization secondary to hybrid lens wear following keratoplasty
- Refit with scleral lens in 2011

## WHY TRY SCLERAL LENSES?

### OCULAR COMORBIDITIES

- Pastor
- Severe keratoconus along with severe atopic dermatitis
- Fit with scleral lenses in 2008
- Penetrating keratoplasty was necessary in 2020 following hydrops
- Returned to scleral lens wear upon recovery



WHY TRY SCLERAL LENSES?

## “BRIDGE” THERAPY

- Original penetrating keratoplasty in 1987, now needs repeat procedure
- Fellow eye is fit with scleral lens to provide functional vision during recovery

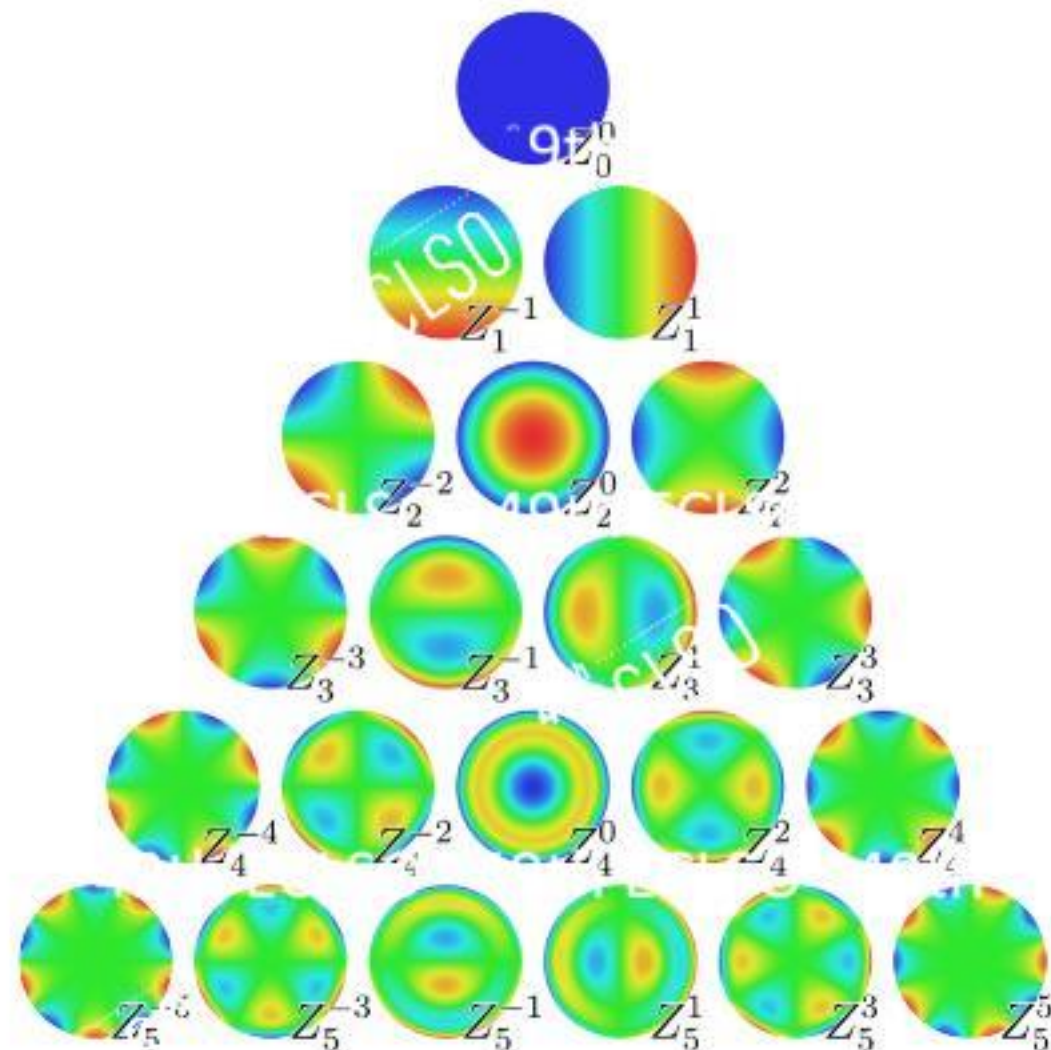


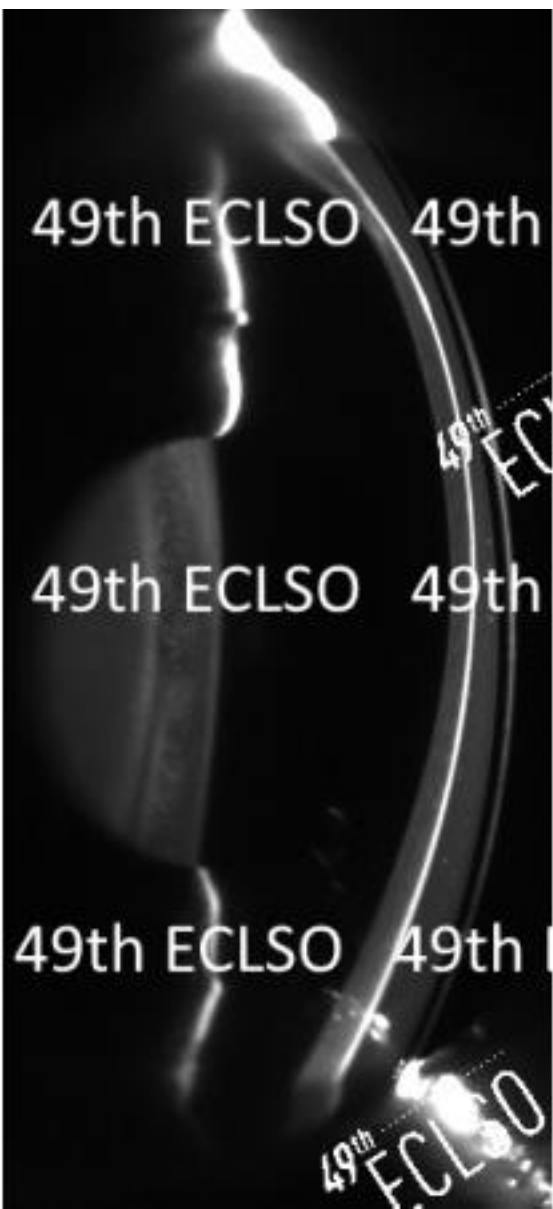


## FUTURE POSSIBILITIES

# CORRECTION OF HIGHER ORDER ABERRATIONS

- Scleral lenses are both rotationally and translationally stable
- Scleral lenses can be lathed very precisely
- Ongoing research is being conducted

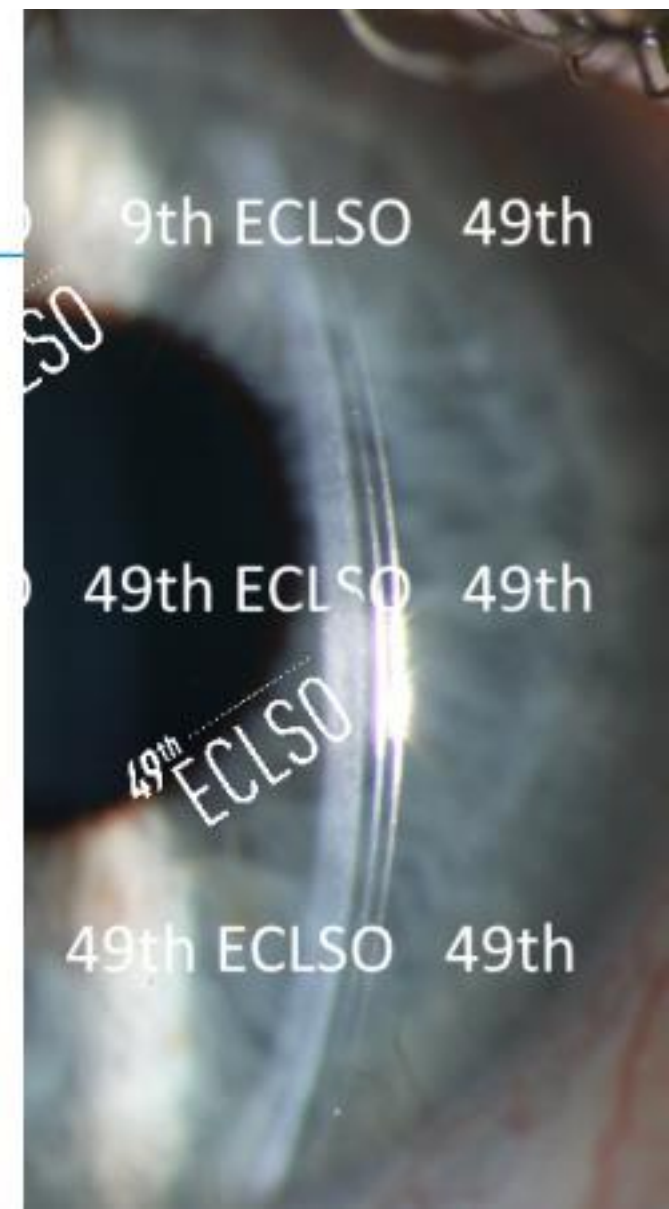




FINAL THOUGHTS

## SCLERAL LENSES:

- Can provide significant improvement in vision in patients with corneal irregularity.
- Can frequently be worn by patients who cannot tolerate corneal rigid lenses.
- May delay or avoid the need for keratoplasty in patients with minimal corneal opacity







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## THANK YOU

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