Innovations in Contact Lenses

Disclosures:
- Alcon
- Bausch + Lomb
- SpecialEyes
- Valley Contax
- Vistakon

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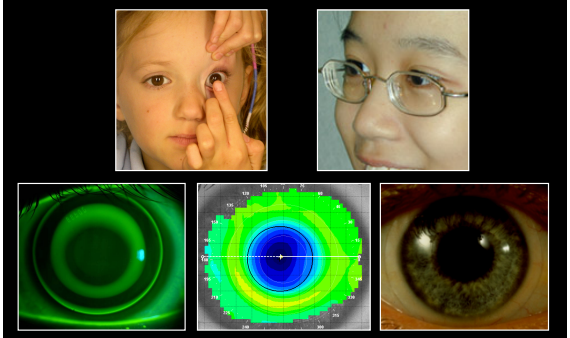
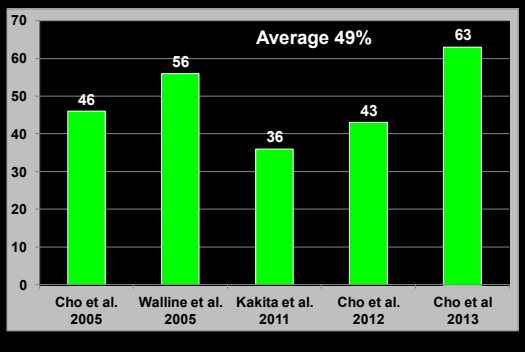
Pacific University Oregon

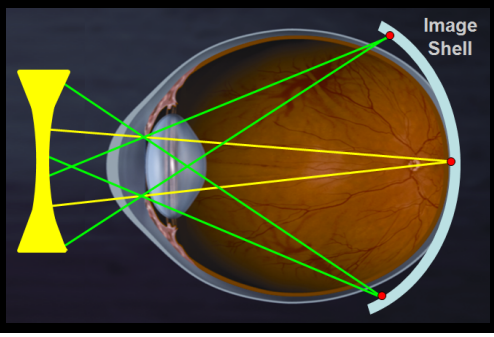
The Optics of Myopia Control



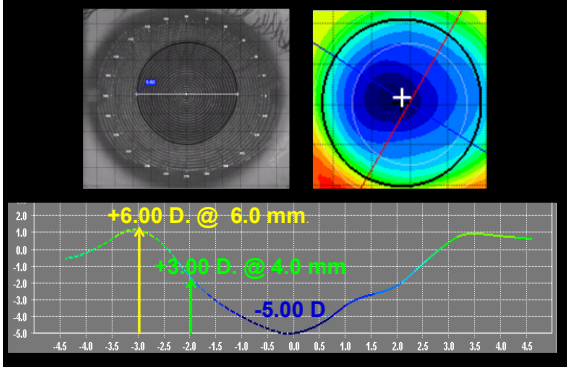
Myopia Control Studies with Ortho-K



Spectacle Lenses and Peripheral Refractive Error

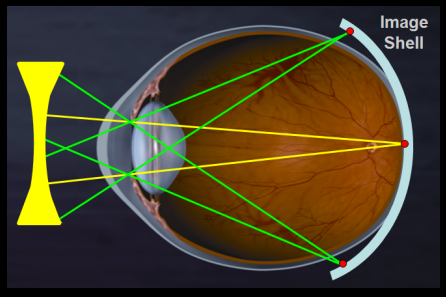


The Optics of Myopia Control



How Hyperopic is the Peripheral Retina at 30 Degrees ???

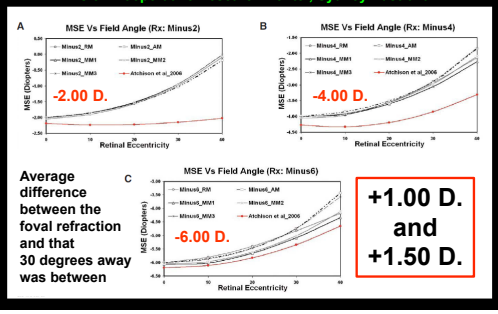
+1.00 D., +2.00 D., +3.00 D. or +4.00 D.



Do Peripheral Refraction and Aberration Profiles Vary with the Type of Myopia?

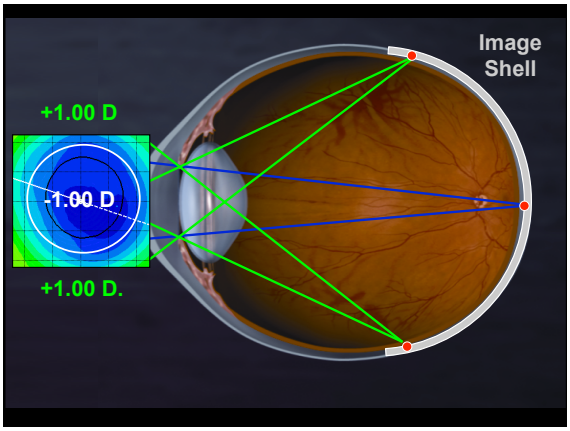
The Journal of Optometry 2009

Ravi Bakaraju, Klaus Ehrmann, Eric Papas, Arthur Ho
Vision Cooperative Research Center, Sydney Australia



Average difference between the foval refraction and that 30 degrees away was between

+1.00 D. and +1.50 D.

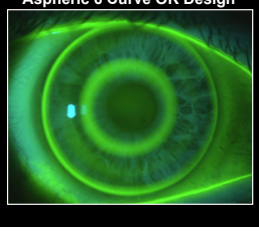


Chow 5 Year OK Axial Length Study

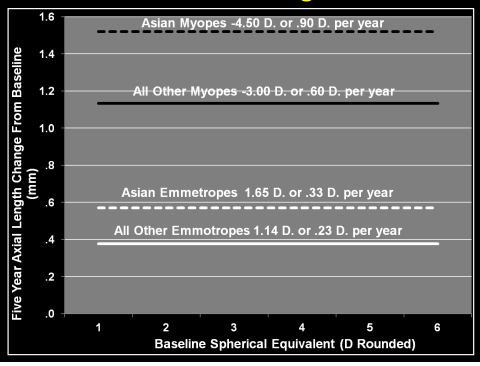
- Traditional 5 Curve OK Lens Design N = 165
- Aspheric 6 Curve OK Lens Design N = 129
- Historical Control CLEERE Study 2007

Traditional 5 Curve Design

Aspheric 6 Curve OK Design

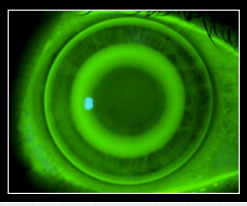


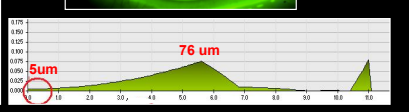
Five Year, CLEERE Study, Axial Length Data Refractive Errors Age 9 to 14



Traditional 4-5 Curve Design

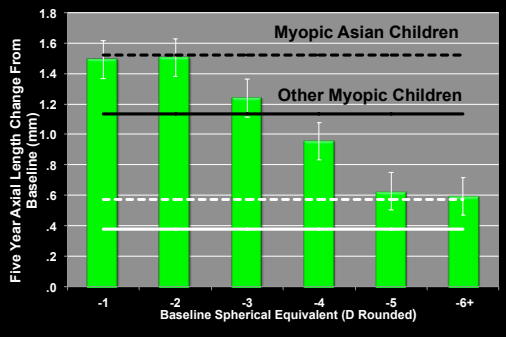
Lens Rx	Right
Flat Base	9.10
Steep Base	
Base Ecc.	
Flat Power	2.00
Steep Power	
Front Ecc	
Add Power	
Diameter	11.0
1st Curve	6.60
1st Width	0.60
1st a Curve	
1st a Width	
1st b Curve	
1st b Width	
2nd Curve	7.96
2nd Width	1.10
3rd Curve	8.15
3rd Width	0.70
4th Curve	10.49
4th Width	0.30
Base OZ	5.6





Chow Study 5 Year Axial Length Data

Traditional 5 Curve OK Lens Design N = 165



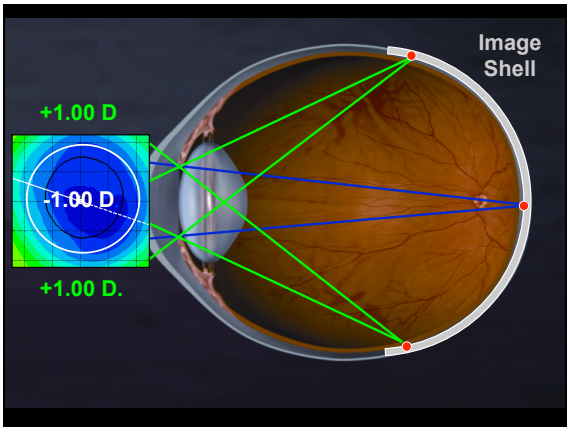
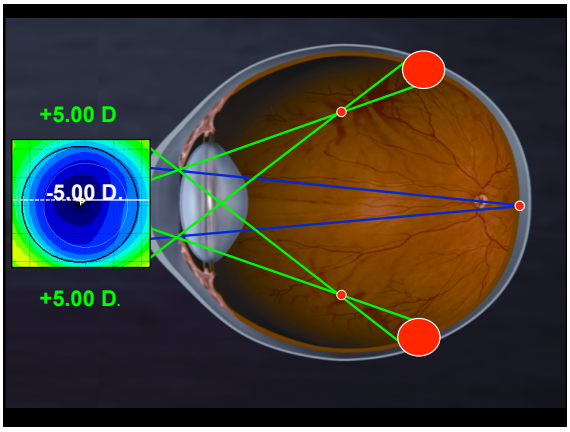
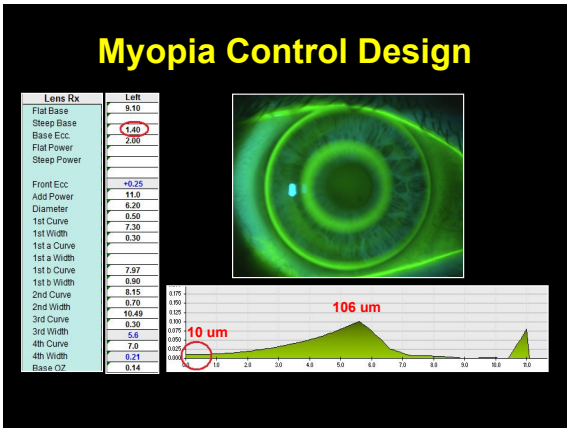
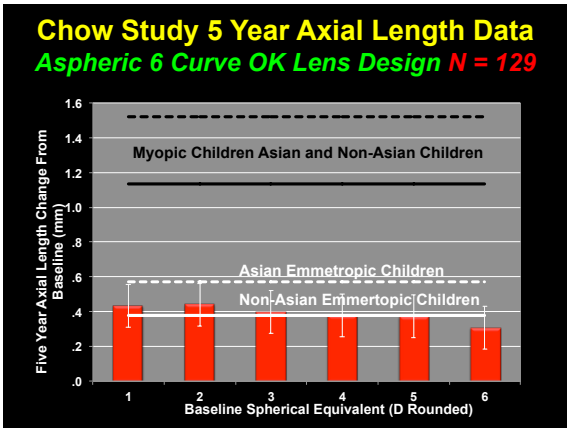
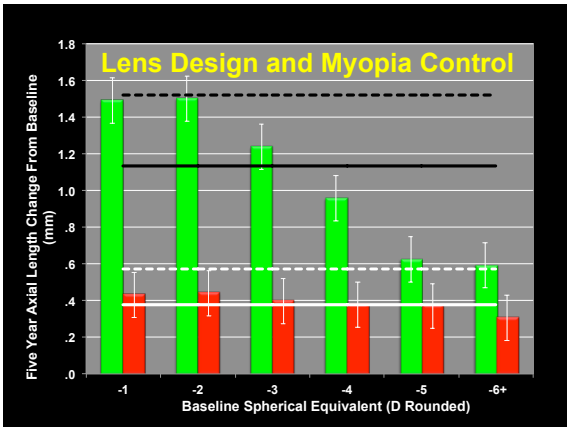


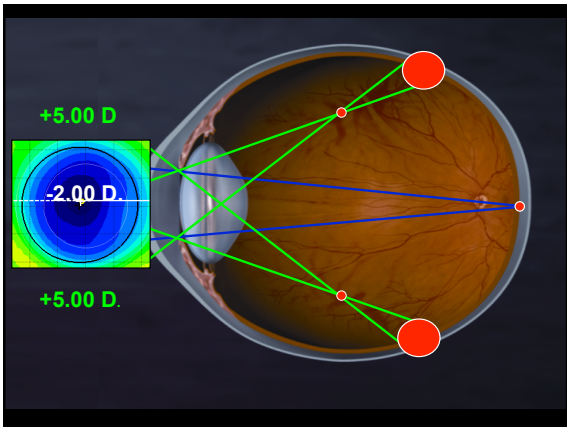
Image
Shell
+1.00 D
-1.00 D
+1.00 D.


+5.00 D
-5.00 D.
+5.00 D.


Myopia Control Design
Lens Rx
Flat Base
Steep Base
Base Ecc
Flat Power
Steep Power
Front Ecc
Add Power
Diameter
1st Curve
1st Width
1st a Curve
1st a Width
1st b Curve
1st b Width
2nd Curve
2nd Width
3rd Curve
3rd Width
4th Curve
4th Width
Base OZ
Left
106 um
10 um

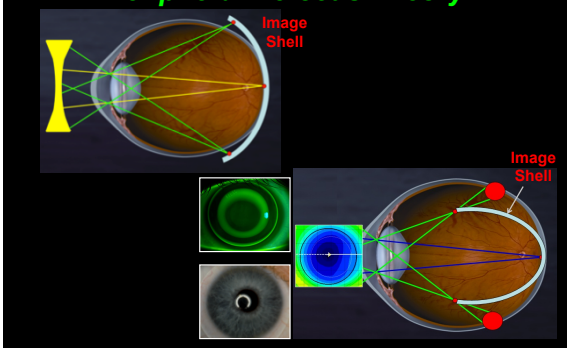

Chow Study 5 Year Axial Length Data
Aspheric 6 Curve OK Lens Design N = 129
Myopic Children Asian and Non-Asian Children
Asian Emmetropic Children
Non-Asian Emmertopic Children
Five Year Axial Length Change From Baseline (mm)
Baseline Spherical Equivalent (D Rounded)


Lens Design and Myopia Control
Five Year Axial Length Change From Baseline (mm)
Baseline Spherical Equivalent (D Rounded)

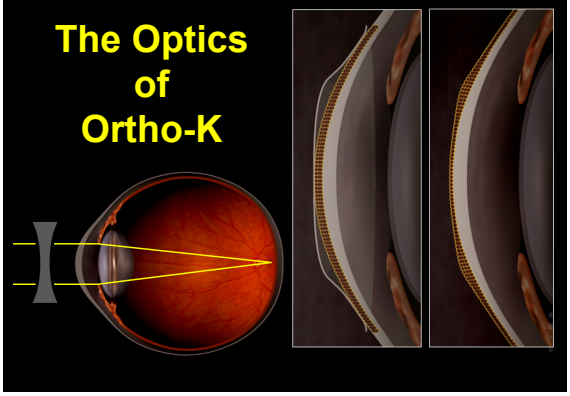

+5.00 D
-2.00 D.
+5.00 D.

Today!!!

Peripheral Defocus Theory

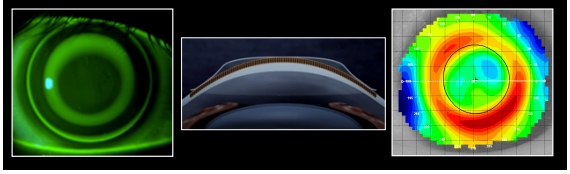


The Optics of Ortho-K

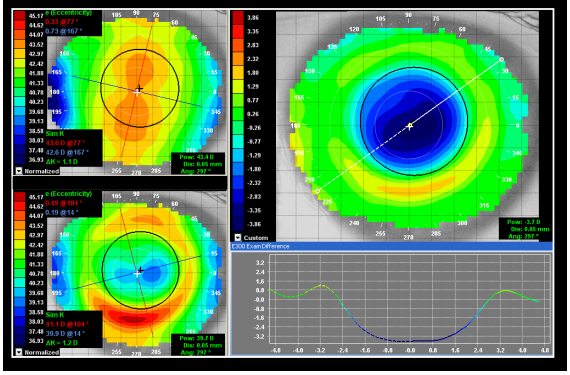


Contemporary Innovations in OK

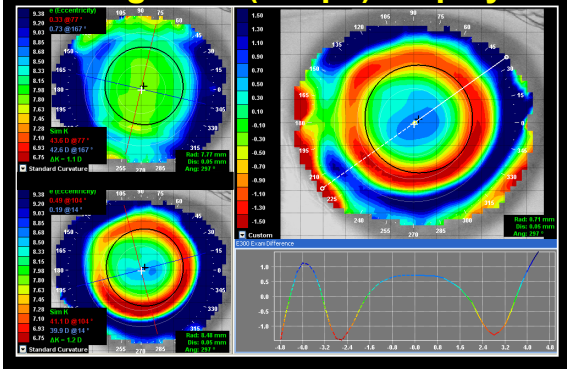
- Reverse geometry lens designs.
- Stable, high Dk lens materials.
- Overnight reshaping modality.
- Improved fitting techniques.
- Instruments for detailed topographic analysis.
- Greater understanding as to how OK works.



Axial Display with Power Profile

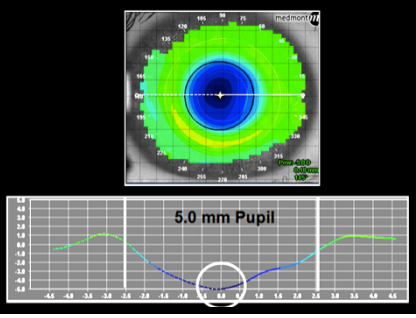


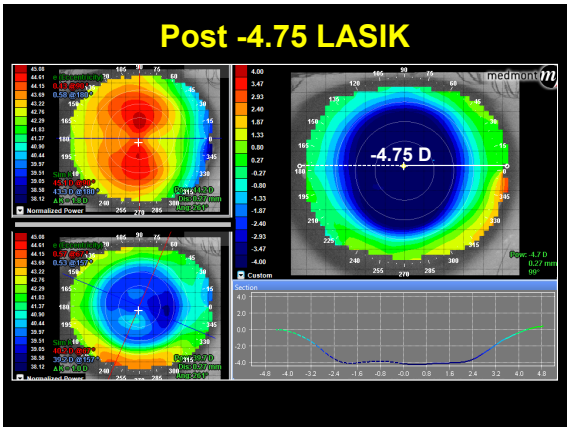
Tangential (Shape) Display

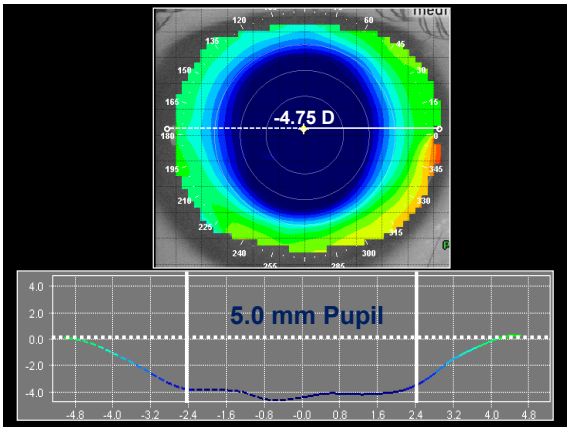


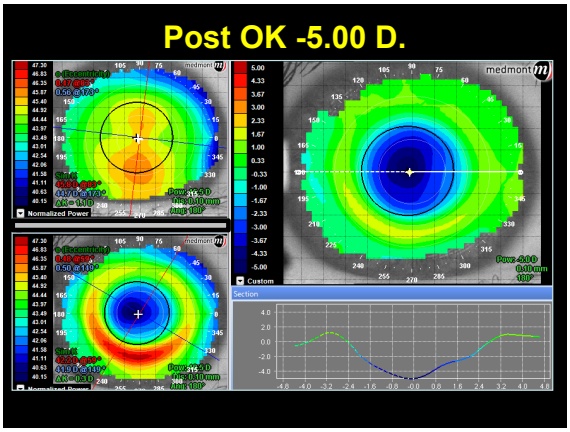
Rule #1, the Optics of OK

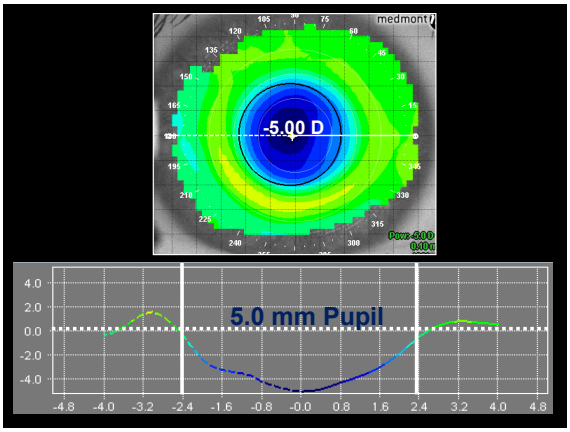
The foval treatment zone in OK is approximately 1.5 to 2.5 mm in diameter.

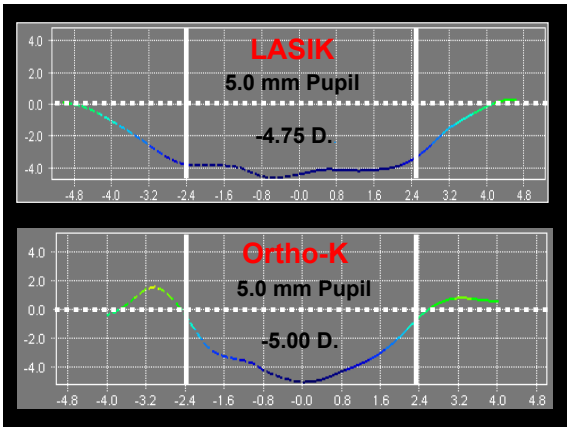












Rule #2, the Optics of OK

The amount of peripheral plus power at *5.0 mm,* is equal to the central minus power corrected.

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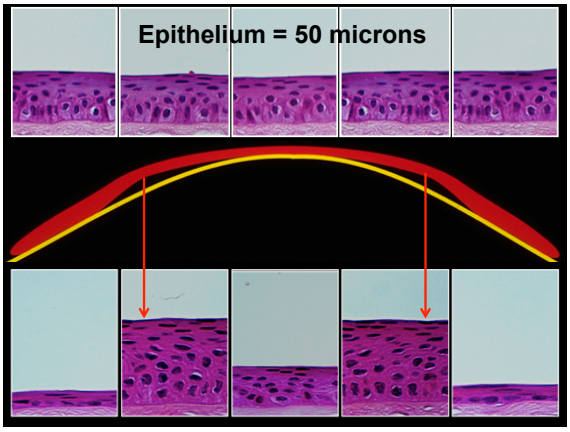
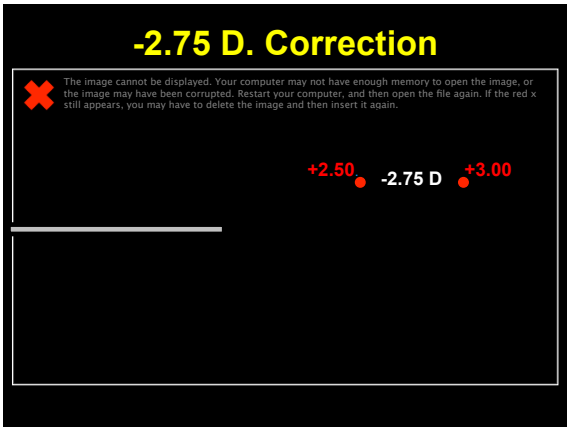
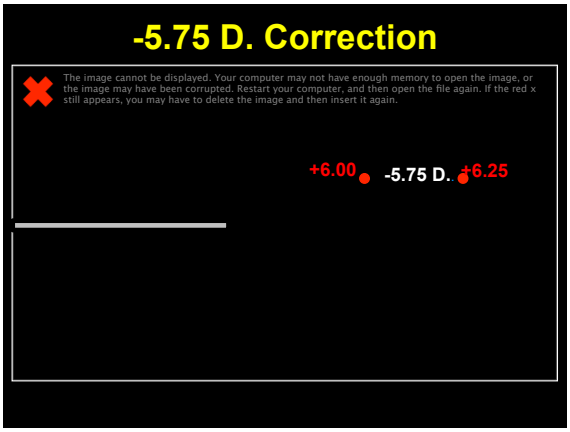

Epithelium = 50 microns


-2.75 D. Correction
The image cannot be displayed. Your computer may not have enough memory to open the image, or the image may have been corrupted. Restart your computer, and then open the file again. If the red x still appears, you may have to delete the image and then insert it again.
+2.50
-2.75 D
+3.00


-5.75 D. Correction
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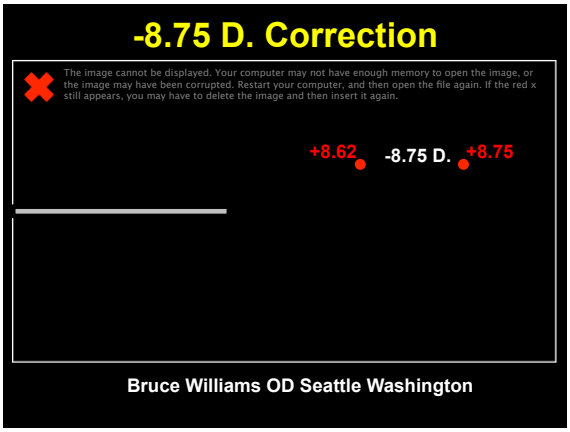
+6.00
-5.75 D.
+6.25


-8.75 D. Correction
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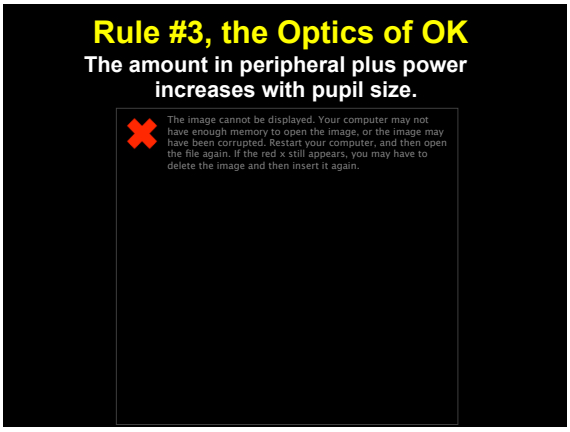
+8.62
-8.75 D.
+8.75
Bruce Williams OD Seattle Washington


Rule #3, the Optics of OK
The amount in peripheral plus power increases with pupil size.
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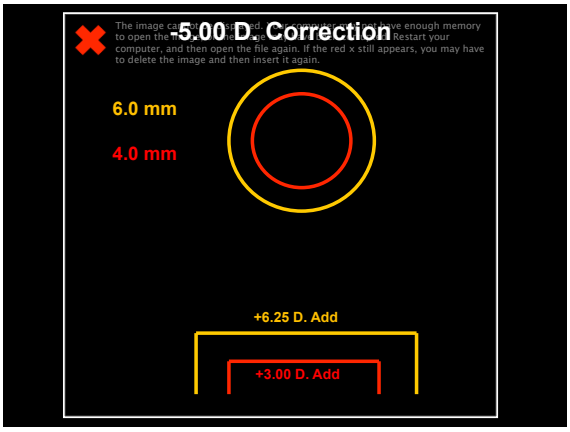
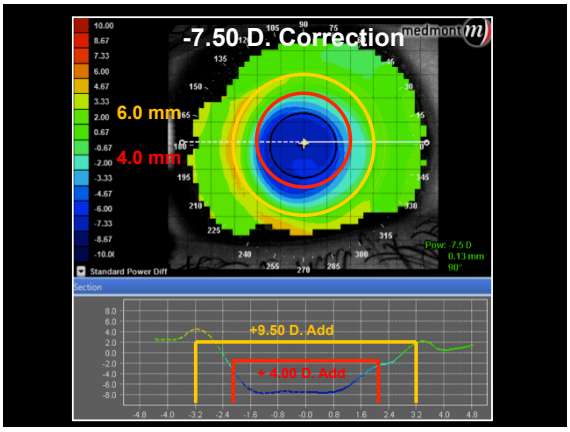
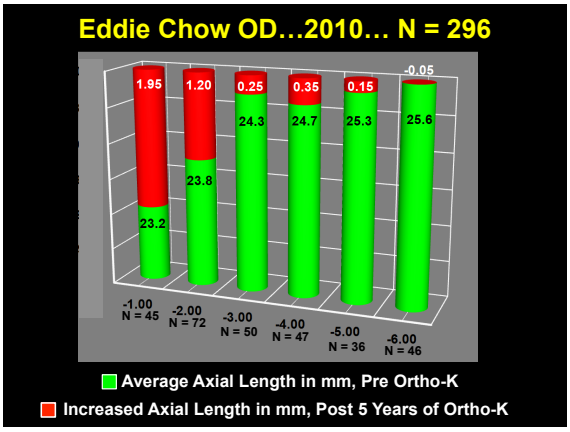
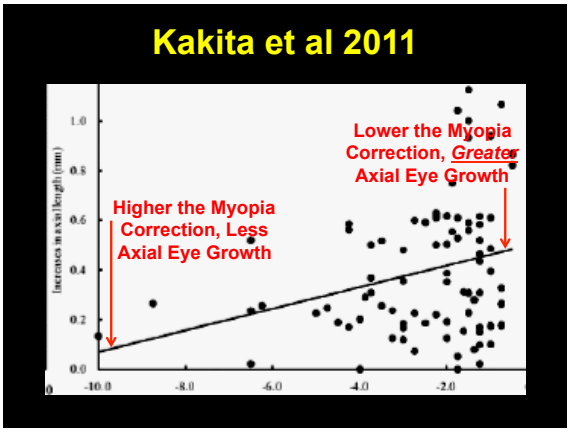
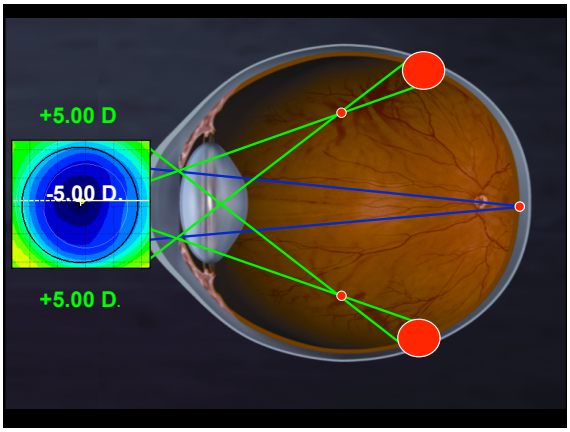
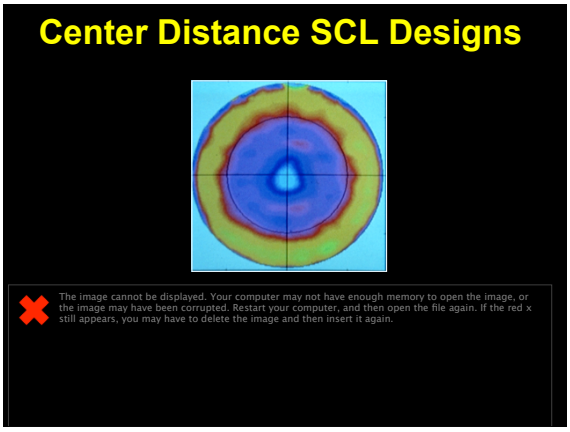

-5.00 D. Correction
The image cannot be displayed. Your computer may not have enough memory to open the image, or the image may have been corrupted. Restart your computer, and then open the file again. If the red x still appears, you may have to delete the image and then insert it again.
6.0 mm
4.0 mm
+6.25 D. Add
+3.00 D. Add


-7.50 D. Correction
6.0 mm
4.0 mm
+9.50 D. Add
+4.00 D. Add


Eddie Chow OD…2010… N = 296
1.95
1.20
0.25
0.35
0.15
-0.05
23.2
23.8
24.3
24.7
25.3
25.6
-1.00 N = 45
-2.00 N = 72
-3.00 N = 50
-4.00 N = 47
-5.00 N = 36
-6.00 N = 46
Average Axial Length in mm, Pre Ortho-K
Increased Axial Length in mm, Post 5 Years of Ortho-K


Kakita et al 2011
Lower the Myopia Correction, Greater Axial Eye Growth
Higher the Myopia Correction, Less Axial Eye Growth


+5.00 D
-5.00 D.
+5.00 D.


Center Distance SCL Designs
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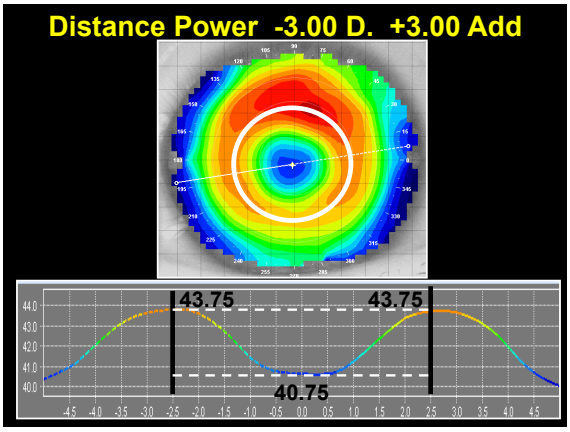
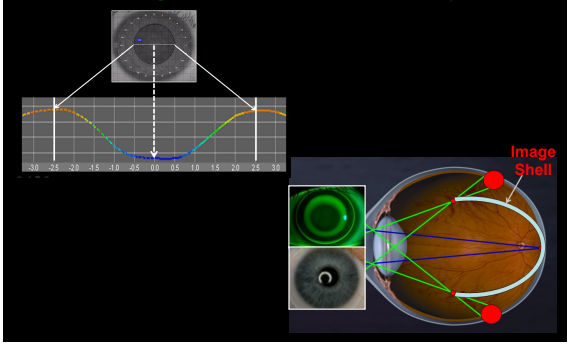

Distance Power -3.00 D. +3.00 Add
43.75
43.75
40.75

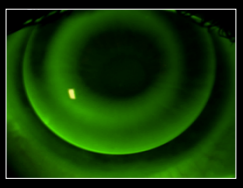
Today!!!

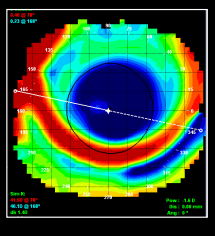
Peripheral Defocus Theory



Persistent High Riding Lenses

- Increasing Lens Diameter ?
- Change lens design/brand ?
- Other ?





Scleral Lens Designs for Orthokeratology

Lens Rx	Right	Left
Flat Base	9.05	8.80
Steep Base		
Base Ecc.		
Flat Power	2.00	2.00

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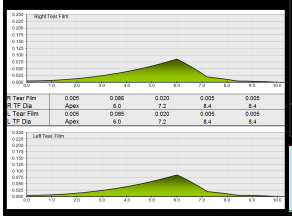
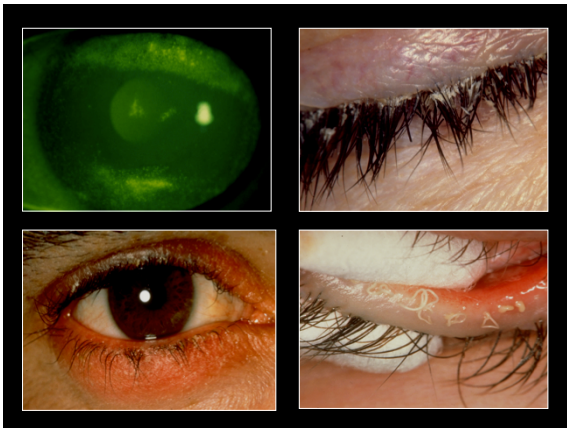


R Tear Film	0.005	0.086	0.020	0.005	0.005
R TF Dia	Apex	6.0	7.2	8.4	8.4
L Tear Film	0.005	0.089	0.020	0.009	0.005
L TF Dia	Apex	6.0	7.2	8.4	8.4

The image cannot be displayed. Your computer may not have enough memory

15.00 15.00
0.30 0.30

Base OZ	6.0	6.0
Front OZ	7.0	7.0
C Thick	0.22	0.22
E Thick	0.14	0.14



Alterations in Meibomian Glands

- Aging causes pouting and narrowing orifices gland deactivations, and gland dropouts.
- Contact lenses ???
- Lid margin diseases i.e.meibomian gland dysfunction (MGD) and chronic blepharitis

Pacific Meibomian Gland Study

Satomi Torii & Pacific Univ. CL Dept.

We examined meibomian gland images of 200 eyes from 100 volunteer subjects

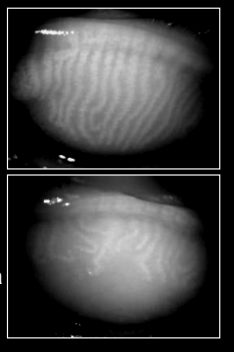
- 68 females
- 32 males
- Mean age 24.6± 4.3 years for females
- Mean age 26.1± 4.5 years for males.

All participants were asked to complete the Texas Eye Institute Dry Eye Questionnaire to obtain participants' dry eye status.

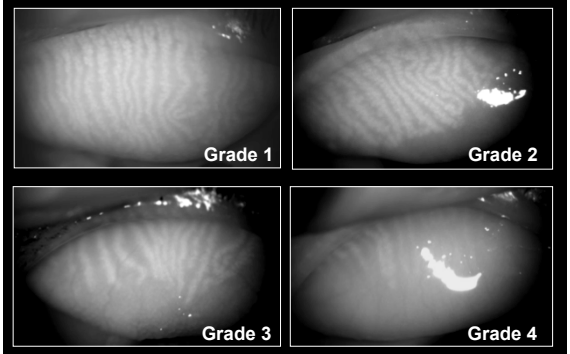
Meibography Photography System

Photo slit lamp equipped with;

1. Infrared video camera (Gappy, Allied Vision Technology, Stadtroda, Germany).
2. Infrared transmitting filter (IR-83, Hoya, Tokyo, Japan)
3. All images were captured from the central portion at a 10× slit lamp magnification.

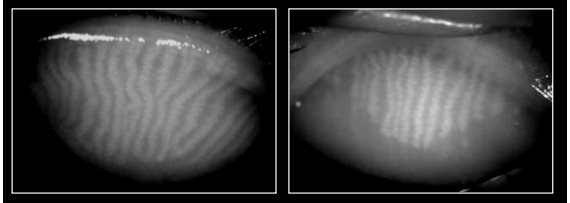


Grading Meibography Images



Results, DE Questionnaire

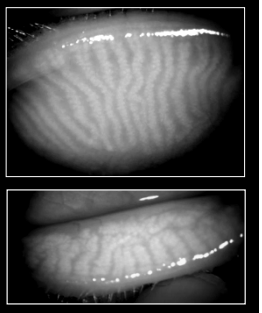
The mean Dry Eye score was 27.5±17.4 (Dry Eye 32 or greater) There was no correlation between Dry Eye questionnaire and meibo-scores



Grade 1 Grade 3

CL Wear and Meibomian Glands

- 73 subjects (51 females and 22 males) were currently wearing SCL's.
- The mean length 9.8±5.8 years.
- There was no significant difference between the MG in the CL vs non-CL wearing groups.



Meibomian Glands and Birth Control Pills

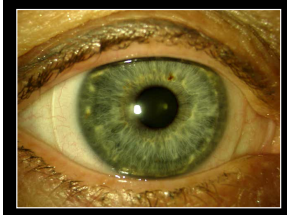
- 29 female participants were currently taking birth control pills.
- 39 female were not.
- The BC group showed greater gland dropout than the non-BC group.
- There was no significant difference in meibo-score between males and non-birth control use females.

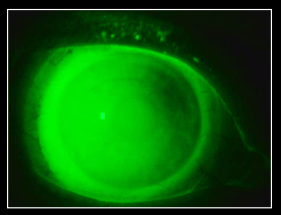
Birth Control Pills

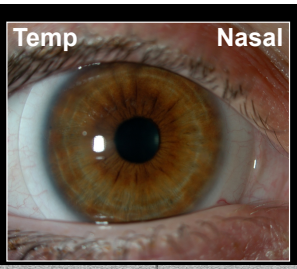
- In 2008, "the pill" is used by an estimated 12 million women in the U.S. and 100 million women worldwide.
- In our pilot study, 29 out of 68 females were on birth control

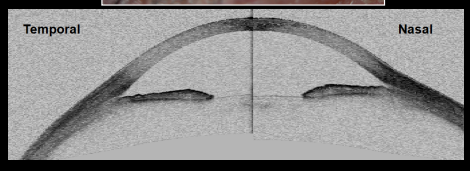
Observation

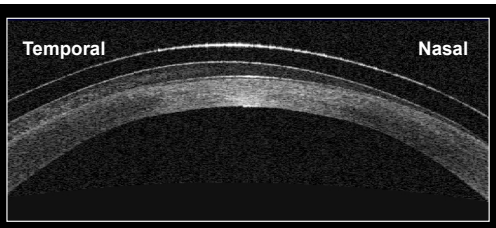
Why do scleral lenses frequently decenter temporally???

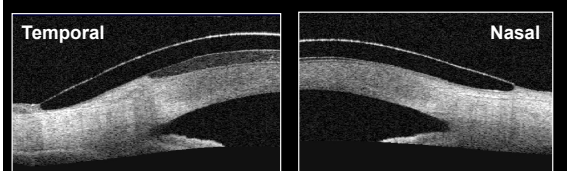




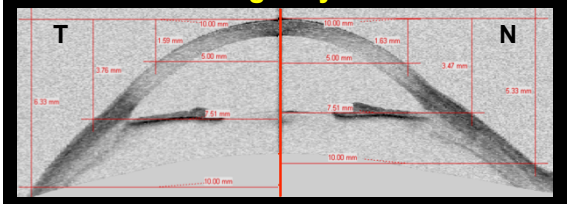








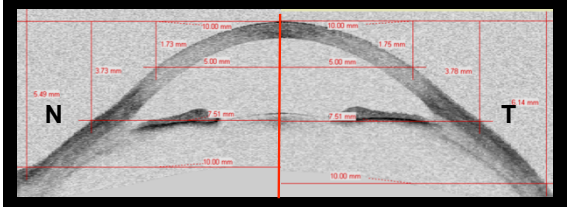
Right Eye



Horizontal 15.0 mm Chord N = 18
Temporal 3 eyes Higher **Nasal 15 Eyes Higher**
RT Average 173 um Higher Nasally

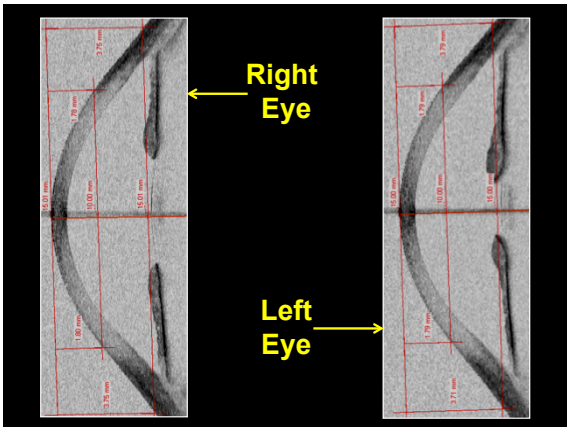
Horizontal 20.0 mm Chord N = 18
Temporal 0 Eyes Higher **Nasal 18 Eyes Higher**
RT Average 838 um Higher Nasally

Left Eye

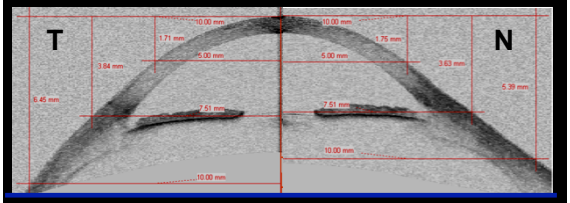


Horizontal 15.0 mm Chord N = 18
Nasal 7 Eyes Higher **Temporal 11 Eyes Higher**
LT Average 2 um Higher Nasally

Horizontal 20.0 mm Chord N = 18
Nasal 18 Eyes Higher **Temporal 18 Eyes Higher**
LT Average 659 um Higher Nasally

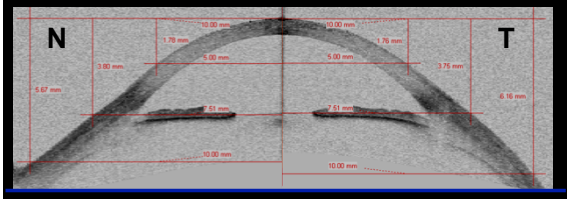


Right Eye



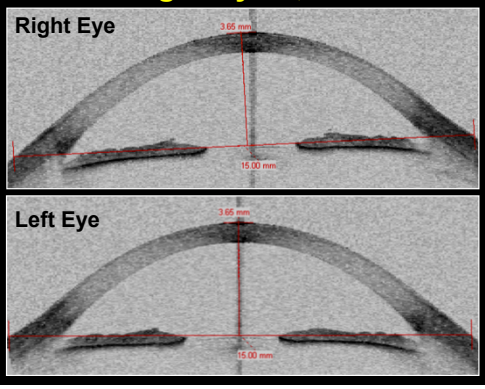
At 15.0 mm nasal higher by 210 um
At 20.0 mm nasal higher by 1,060 um

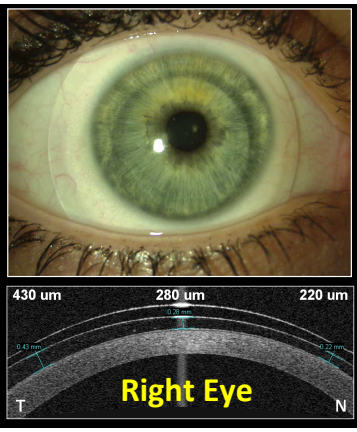
Left Eye

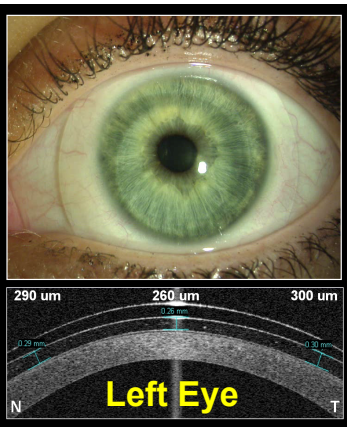


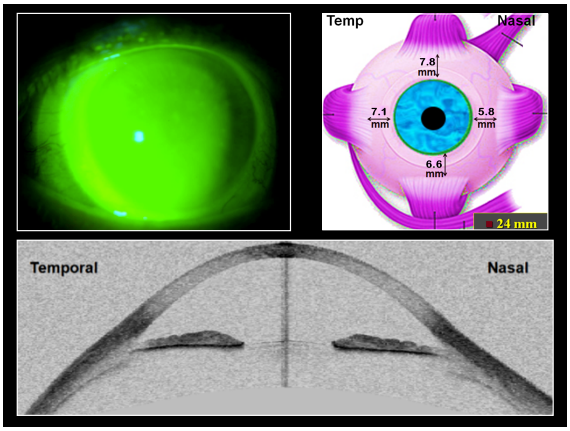
At 15.0 mm temporal higher by 50 um
At 20.0 mm nasal higher by 490 um

SA Right Eye 3,650 um









Other Applications

- Scleral lenses
  - Ortho K
  - Multi-focal
- Soft contact lenses
  - Multi-focal
  - Toric
  - Specialty soft for irregular corneas
  - Higher order aberration correction

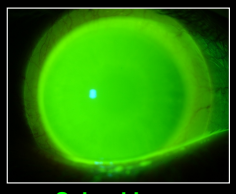
High DK Scleral Materials

• Paragon HDS 100	DK = 100
• B + L, Boston XO	DK = 100
• B + L, Boston XO_2	DK = 141
• Contamac, Optimum Extra	DK = 100
• Contamac, Optimum Extreme	DK = 125
• Lagado, Tyro -97	DK = 97

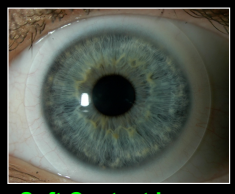
Movement and Tear Exchange Beneath CL's

RGP Lenses…. 20% per blink

Soft Lenses…. <1% per blink



Scleral Lens



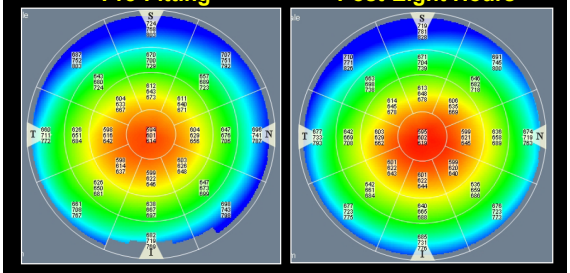
Soft Contact Lens

6 Subjects wore .35 mm (350 micron), 100 DK scleral lenses for 8 hours Habitual DW SCL for 8 hours

Pachemetry was measured before lens wear and after 8 hours with the Zeiss Visante, Anterior Segment OCT System.

MA Right Eye

Pre-Fitting | Post-Eight Hours

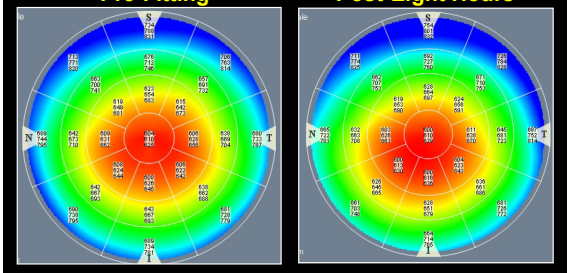


601 um | 602 um

Difference, 1 um Increase

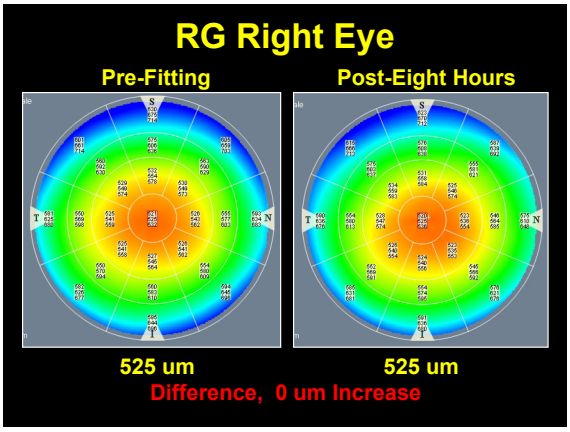
MA Left Eye

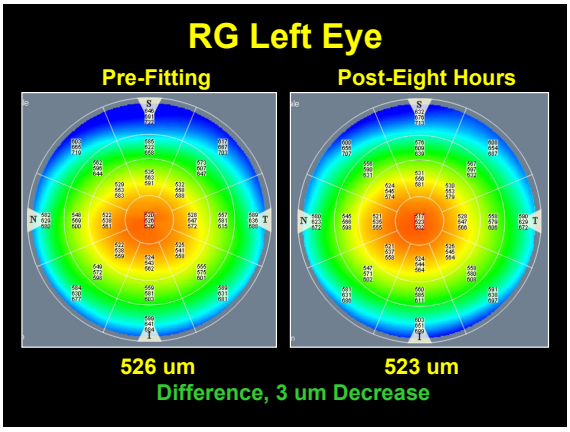
Pre-Fitting | Post-Eight Hours



610 um | 610 um

Difference, 000 um


RG Right Eye
Pre-Fitting
Post-Eight Hours
525 um
525 um
Difference, 0 um Increase


RG Left Eye
Pre-Fitting
Post-Eight Hours
526 um
523 um
Difference, 3 um Decrease