

# MARRIAGE MADE IN HEAVEN?

Topography and GP Design

**Michael Wyss**

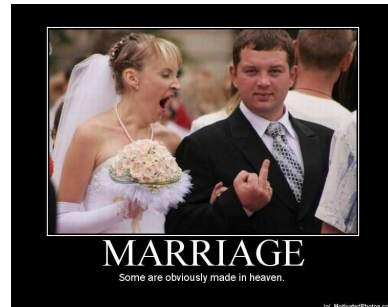
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[http://www.kontaktlinsenstudio.ch/medien/medien\\_Frameset.htm](http://www.kontaktlinsenstudio.ch/medien/medien_Frameset.htm)

## Marriage made in Heaven?



## Technique

- Placido Rings monitored with a video camera
  - Projection of concentric rings to the cornea
  - Distorsion of rings will be mathematically evaluated
  - Reflexion on the cornea are the basis for calculation
  - No measurements in the very center of the cornea, due to the position of the video camera (interpolated data)

## Technique Medmont

- 9,600 measurement points and 102,000 analyze points
  - Coverage extends from a minimum ring diameter of 0.25mm to beyond 10mm
  - Accuracy < 0.1 Diopters



## Technique Oculus

- 22'000 measuring points
  - Nose and forehead make shadows and reduce the amount of measure points
  - Only about the central 8mm diameter are really measured
  - Accuracy +/-0.1D

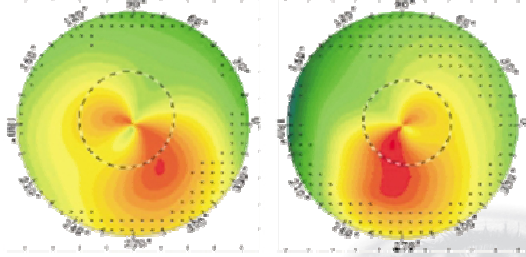


## Diagnostic Software (Mapping)

- The software provides in general 3 different corneal maping possibilities (axial / tangential / elevation)
- Depending on the goal, each mapping offers very specific advantages
  - The next slides shows always the same Px

## Diagnostic Software (Mapping)

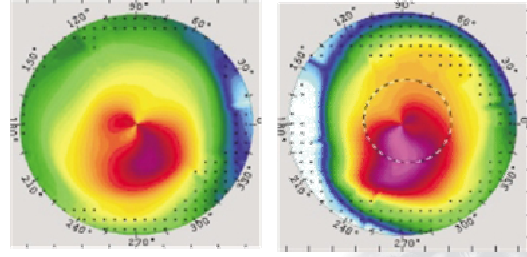
Axial presentation



*freedom to see*

## Diagnostic Software (Mapping)

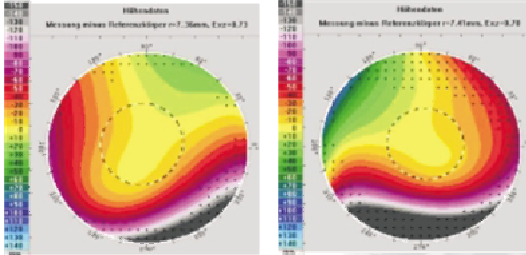
Tangential presentation



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## Diagnostic Software (Mapping)

Elevation Data



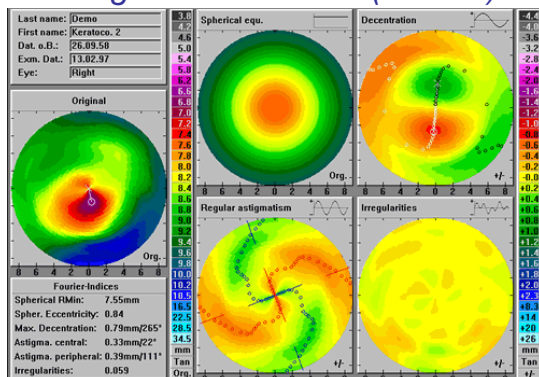
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## Diagnostic Software (Fourier)

- Fourier Analysis
  - Mathematical separation of the topographic map into individual components
  - Optical aberration (spherical component, decentration or decentration with spherical component, regular astigmatism, irregularities or irregularities with spherical component)

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## Diagnostic Software (Fourier)

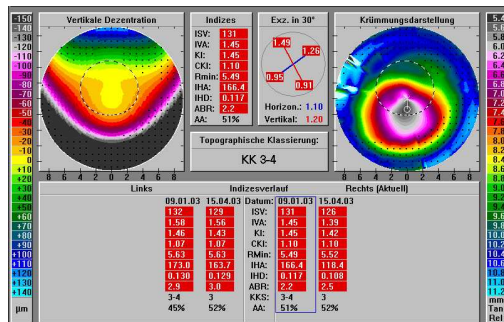


## Diagnostic Software (Indices)

- Automatic identification giving cornea indices and topographical classification of cornea (e.g. stage 2 keratoconus, abnormal cornea, etc)
  - New state of the art in communication with ophthalmologists

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## Diagnostic Software (Indices)



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## Diagnostic Software (Indices)

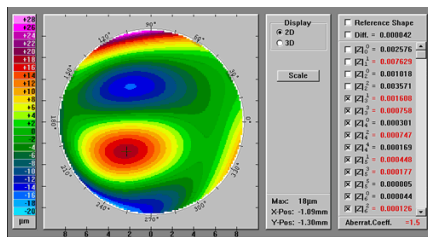
Please note:

- This assessment by the software is entirely based on topography and is not to be regarded as a basis for a clinical diagnosis!!

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## Diagnostic Software (Zernike)

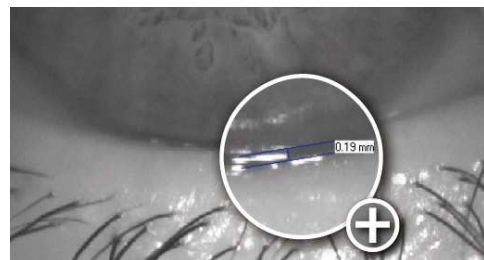
- Higher Order Aberrations can be visualized and analyzed by Software
  - Aberration Index above 1.50 are suspects



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## Diagnostic Software (Dry Eye)

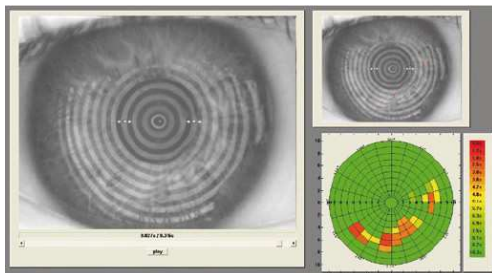
- New: Tear Meniscus Tool (TF Scan)



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## Diagnostic Software (Dry Eye)

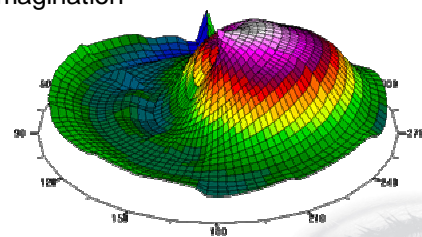
- New: BUT (Break Up Time)



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## 3D Images

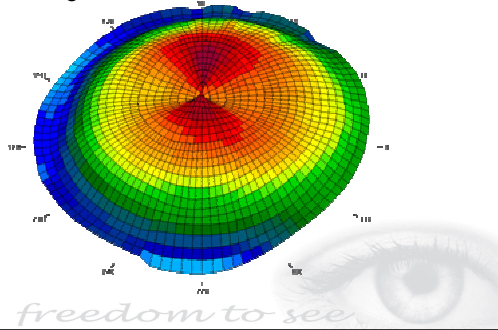
- Gives you and your patient an imagination



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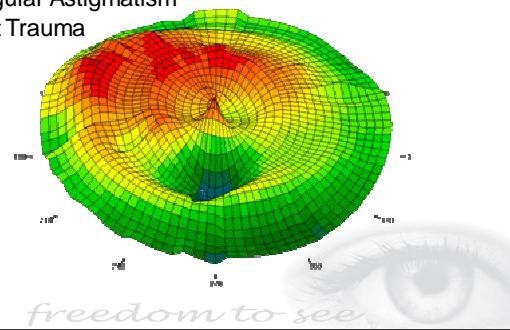
### 3D Images

Regular Astigmatism



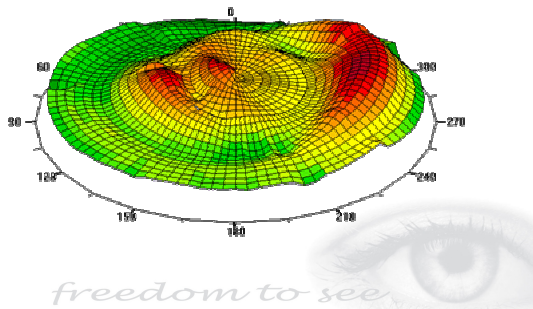
### 3D Images

Irregular Astigmatism  
post Trauma



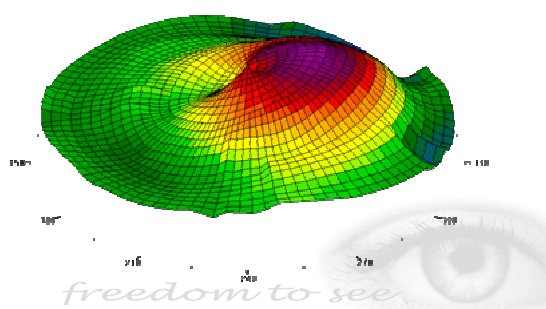
### 3D Images

Pseudo Keratoconus (high riding contact lens)



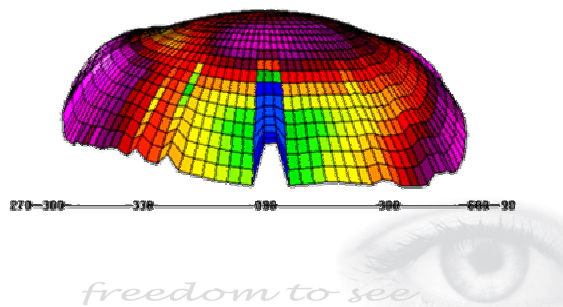
### 3D Images

Keratoconus



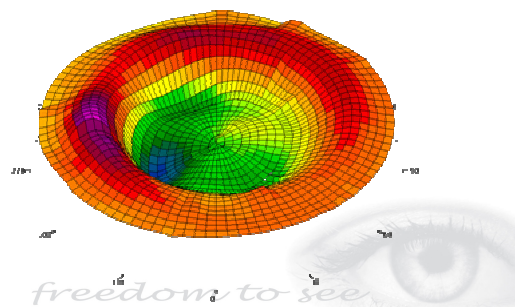
### 3D Images

Keratoplasty



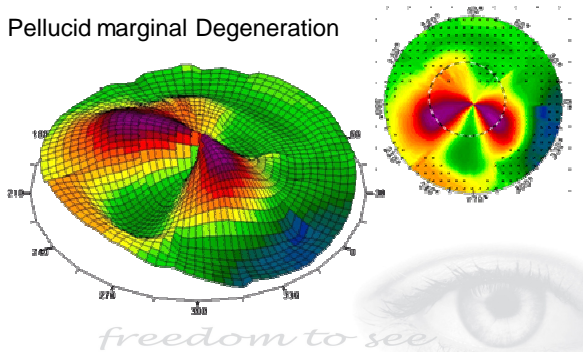
### 3D Images

LASIK / Orthokerathology



## 3D Images

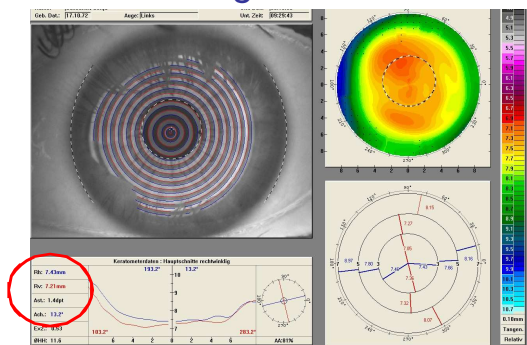
Pellucid marginal Degeneration



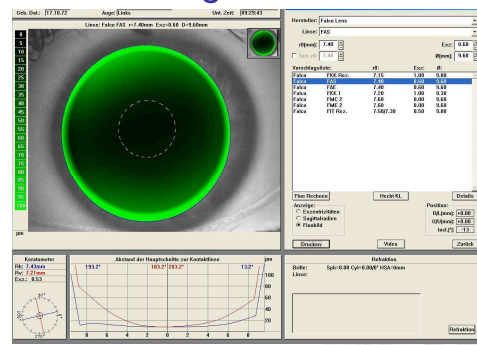
## Fitting Software

- The software automatically suggests a CL from the integrated database and calculates a fluorescein pattern
- Geometry and overall diameter can be manipulated individually on computer, without having every single lens tested on the eye
- Data need to be confirmed by having one defined contact lens interpreted on the eye

## Fitting Software

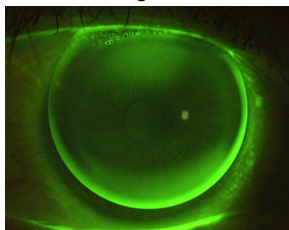


## Fitting Software



## Fitting Software

- “Real Life” peripheral Astigmatism
  - The lens rocks around flat meridian
  - High or Low Riding lens as a consequence



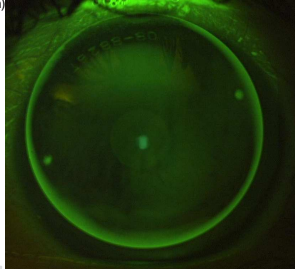
## Fitting Software

Tabelle der Sagittalkurven in den Hauptachsen							Tabelle der Eccentritäten in den Hauptachsen						
Zonen	18°	15°	12°	9°	6°	3°	Zonen	18°	15°	12°	9°	6°	3°
Station Nas	7.44	7.39	7.43	7.48	7.53	7.58	Exc. Nas	7.44	7.39	7.43	7.48	7.53	7.58
Station Temp	7.43	7.40	7.43	7.47	7.51	7.55	Exc. Temp	7.43	7.40	7.43	7.47	7.51	7.55
Station Inf	7.31	7.30	7.30	7.30	7.31	7.32	Exc. Inf	7.31	7.30	7.30	7.30	7.31	7.32
Station Sup	7.32	7.33	7.33	7.32	7.31	7.30	Exc. Sup	7.32	7.33	7.33	7.32	7.31	7.30
Mittelpunkt	7.32	7.30	7.31	7.34	7.37	7.40	Mittelpunkt	7.32	7.30	7.31	7.34	7.37	7.40

Final Parameter: 7.35 -3.0 9.80 06/00

## Fitting Software

- Peripheral Toric lens Design
  - Optical Zone has a spheric Design (without inducing vertical astigmatism)



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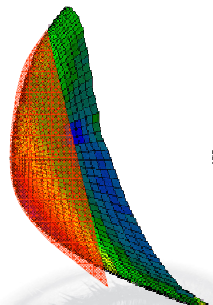
## Specialties



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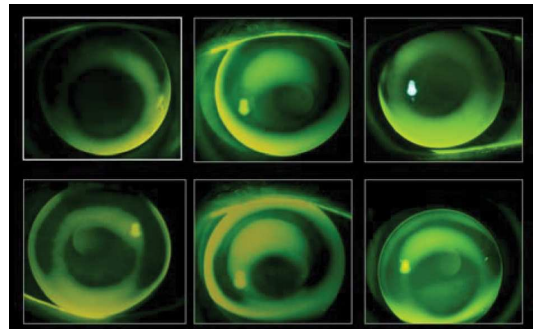
## Keratoconus

- Rotation symmetric Design on a asymmetric Cornea



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## Keratoconus



Picture courtesy of Pat Caroline

*freedom to see*

## Keratoconus (Scarring)

- CLEK Study 1994 - 2002 (1'209 Px)
  - 32% of flat fitted Px by eight years vs. 14% steep fitted
- Korb et al, 1982 (7 Px)
  - 57% flat vs. 0% steep after 12 month
- Maguen et al, 1983
  - 25% flat by 3 years had "significant staining"

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## Keratoconus

- Quadrant-specific Design
  - The idea is to fit the lens in every quadrant as good as possible to the origin cornea curvature
  - The lens has inferior a black colored engraved point which must be inserted in 270°
  - The lens then will be click-in the cornea curvature

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# Keratoconus

③

②

①

1.1

0.9

0.9

0.0

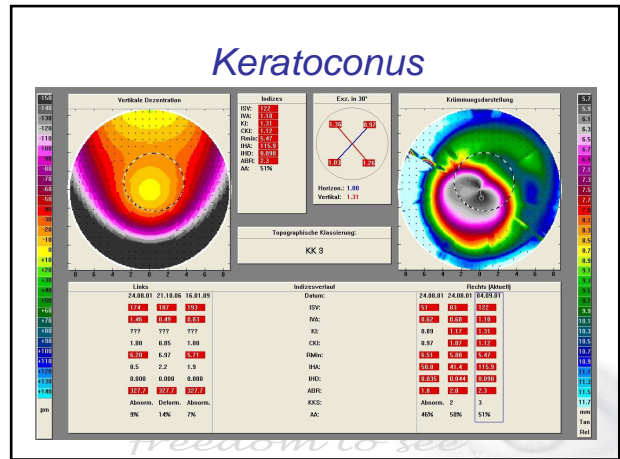
FKQ -4.50 dpt / Ø 11.20 mm  
r0 7.20 mm  
nE 09 / 09 / 11 / 00

11

09

00

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The screenshot displays the KeratoPlus software interface, which is used for contact lens fitting. The interface is divided into several sections:

- Patient Information:** Name, Geb. Dat., Aug., and Zeit fields are present.
- Contact Lens Parameters:** Linse: Falco FAS Rez. r=7.30mm, Exz=0.80 D=9.80mm.
- Refractometer Reading:** A large green circular image shows the contact lens being measured. A red circle highlights the center of the lens. The reading shows: Rht: 7.56mm, Rz: 2.25mm, Exz: 0.97.
- Refractometer Graph:** A line graph showing the refractive index (n) across the lens diameter (mm). The graph has two curves: a blue curve for the front surface and a red curve for the back surface. The y-axis ranges from 0 to 100, and the x-axis ranges from 0 to 10.
- Software Settings:** A 'Kontaktlinsenpassung' (Contact Lens Fitting) window is open, showing 'Hersteller: Falco Lens' and 'Lins: FAS Rezept'. The 'r0(mm)' field is set to 7.30, and the 'Exz.' field is set to 0.80. The 'Vorschlagsliste' (Suggestion List) shows: Br/Lomb Quantum 7.65 0.6, Falco FAS Rez. 7.50 0.0, Falco FFK Rez. 7.40 1.0.
- Buttons:** 'Rechnen' (Calculate), 'Hecht Kl' (Hecht Key), 'Details', 'Drucken' (Print), and 'Zurück' (Back) are visible.

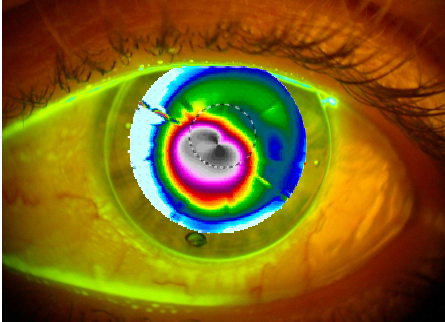
The bottom of the image features the text 'freedom to see' in a stylized font.

Hecht KL: KASINDV-TORH  $r=7.356,45\text{mm}$   $D=9.00\text{mm}$

0  
5  
10  
15  
20  
25  
30  
35  
40  
45  
50  
55  
60  
65  
70  
75  
80  
85  
90  
95  
100

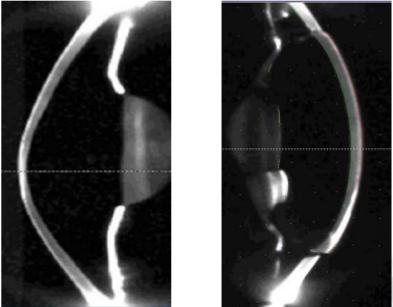
0.6  
1.2  
1.5

# Keratoconus



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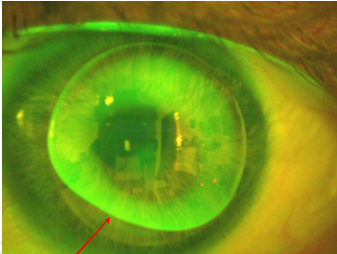
*Penetrating Keratoplasty*



*freedom to see.*

## Penetrating Keratoplasty

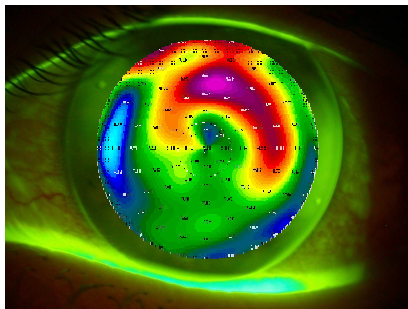
- Example of a common problem
  - fitting a rotation symmetric small lens



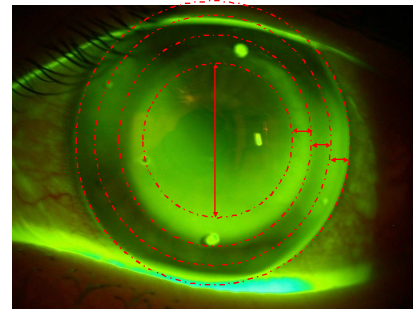
## Penetrating Keratoplasty

- Second try:
  - Bigger Diameter, with reverse geometry
  - Spherical optic, Periphery-toric alignment
- Periphery-toric Design
  - Horizontal Eccentricity 1.0
  - Vertical Eccentricity 0.6
- Astigmatism of 2.4 dpt in the Periphery

## Penetrating Keratoplasty

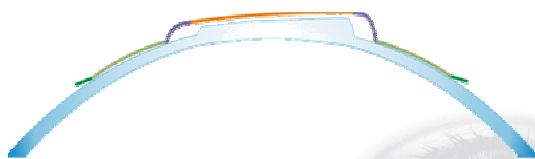


## Penetrating Keratoplasty

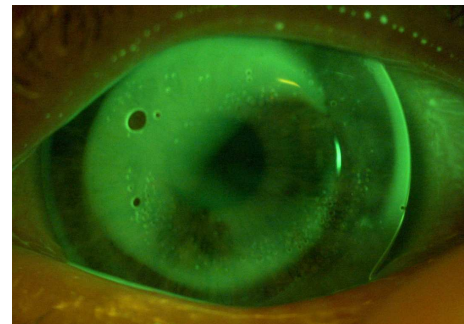


## Penetrating Keratoplasty

- New Geometry possibility for tilted grafts
  - Periphery-toric geometry with tilted reverse geometry



## Penetrating Keratoplasty

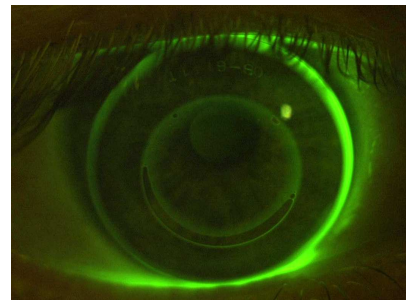


## Penetrating Keratoplasty



*freedom to see*

## Orthokeratology



*freedom to see*

## Orthokeratology

- NaFl becomes visible at a thickness of  $20\mu\text{m}$  (Young 1989)
  - Only way to see, what the lens has done during night in her static state under the closed eye
- Diagnostic of the cause of a problem
  - Difference map shows what actually happens to the origin cornea

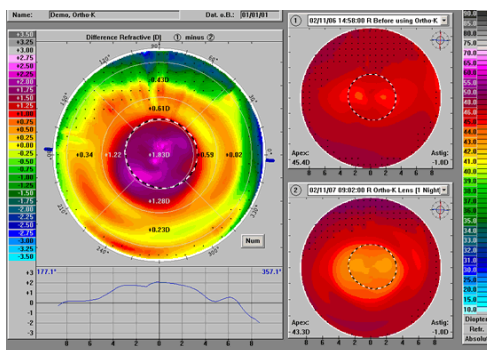
*freedom to see*

## Orthokeratology

- Use axial, tangential an refractive power **difference (subtractive) maps**
  - Axial Power shows the objective Rx changes
  - Tangential Power shows centration of the changes
  - Refractive Power shows objective Rx and Treatment-Zone changes

*freedom to see*

## Orthokeratology



*freedom to see*

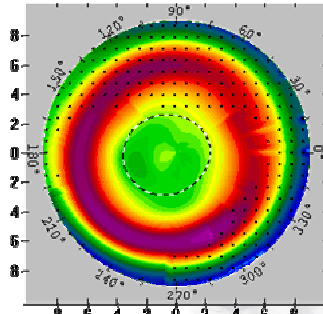
## Orthokeratology

- Bulls-Eye is the **ONLY** valid and acceptable outcome
  - Good high contrast sensitivity
  - Maximum Rx change with time
- Characteristic:
  - A well-centered area of corneal flattening (Treatment Zone)
  - A circle of mid-peripheral corneal steepening
  - Little or no peripheral corneal change

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## Orthokeratology

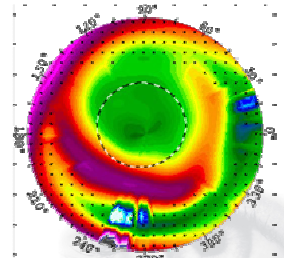
- Bulls Eye



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## Orthokeratology

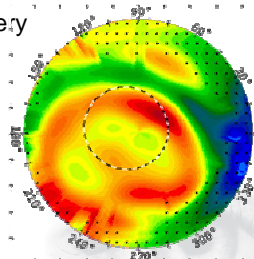
- “Smiley Face” : Highriding Lens during sleeping
  - Too flat in periphery
  - Sagittal depth too low



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## Orthokeratology

- “Frowny Face”: Low riding lens during sleeping
  - Too steep fitted Periphery
  - Sagittal depth too high



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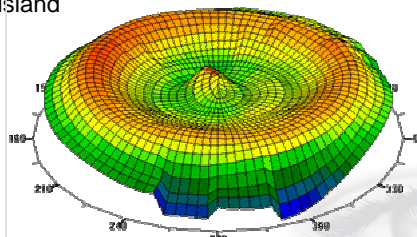
## Orthokeratology

- “Central Island”
  - Developing after 1 week or more, a true central island never resolve over time
  - Early sign: Around Bulls-Eye formation, slight indentation
- Characteristic
  - Steep zone always around the pupil
  - Too steep, right after Reverse Zone
  - Too hard alignment pressure

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## Orthokeratology

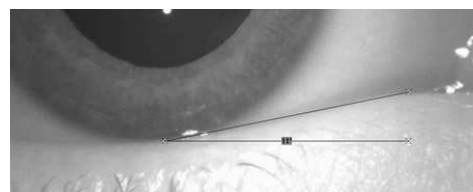
- Warning!!
  - Staining in the very center can mimic a central island



*freedom to see*

## Presbyopia

- Lid-Angle Measurement
  - Usefull in translating GP designs to determin possible rotation of reading segment



*freedom to see*

## Presbyopia

- Near-portion height measurement
  - Essential to determine the dividing line for translating bifocal contact lenses

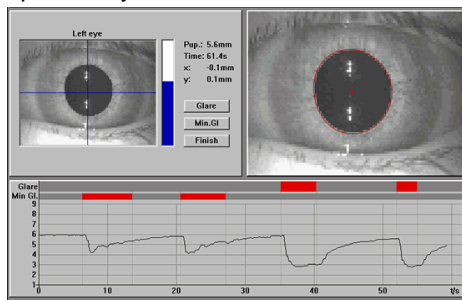


## Presbyopia

- Pupillometry
  - Graphical representation of the results: change of pupil within a span of time; minimum, medium and maximum pupil diameter including standard deviation
  - Essential for simultaneous multifocal contact lens designs
  - Possibility of comparison view for Anisokoria

## Presbyopia

- Pupillometry



# GP

## A GROWING PLEASURE!

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