Applications of the OCULUS Pentacam® for cataract and refractive surgery and general screening
Pentacam®, the comprehensive analyzer

Scheimpflug Image + Iris image & Keratometry overlay
+ 3D Anterior Chamber Analyzer
+ Pachymetry Map, absolute & relative
+ Topography Maps (ant. & post.)
+ Elevation Maps (ant. & post.)
+ 3D Cataract Analyzer & PNS
+ 3D pIOL simulation & aging prediction
+ Belin/Ambrosio Enhanced Ectasia III
+ Holladay Report & EKR Detail Report
+ Tomography & Corneal Optical Density
+ Cataract Pre-Op Display & Corneal Wavefront
+ Index Report & Help Topic
+ Corneal Ring Display
+ various compare displays

100 Scheimpflug images within one scan in less than 2 seconds

Scheimpflug Example

Schematic course of a scan
Facts about the imaging and calculation process

- Center of the cornea is finely measured during the rotating scan
- Eye motion during imaging process is detected with the pupil camera
- Detected eye motion is corrected during the calculation process
- 3D model of the anterior segment is calculated via ray-tracing
  - The optical distortions are individually corrected

Overview of all captured Scheimpflug images

Help topic
General & Glaucoma screening

Quality specifications, QS

- parameter
- value
- borders
- classification
- explanation
- reasons

QS should be checked after every examination!

General & Glaucoma screening

Kammervolumen

Glaucoma Screening

Automatic Calculation of:
- Anterior chamber depth (ACD): internal/external
- Anterior chamber angle (ACA): in every Scheimpflug image
- Chamber volume (ACV)

anterior chamber "normal" ? eye

anterior chamber narrow angle glaucoma

36,4°

38,2°

20,1°

19,6°

20,2°

19,9°

15.5°

15.5°

12.0 mm

12.0 mm
Glaucoma clinical example

post-pre Iridectomy

Benefit

- Scheimpflug image overview to detect abnormalities during calculation -> time saving
- Indices report
- Objective and automatic calculation of ACD, ACV, ACA in up to 100 locations
- ACV turns out to be best predictor for narrow angle Glaucoma and post-op iridotomy and is not provided by anterior chamber OCT’s
- Comparison of scheimpflug imaging and spectral domain anterior segment optical coherence tomography for detection of narrow anterior chamber angles; Grewal DS, Grewal GS, Jain R and SPS Grewal; Eye (2011), 1-8 & 2011 Macmillan Publishers Limited All rights reserved 0950-222X/11

Corneal Refractive Surgery

- screening for ectasia
- Corneal rings/Intacs
What about this case?

Belin/Ambrosio Display III

Now with a database for hyperopic and myopic patients

Tomographic Normal values for Corneal Elevation and pachymetry in a Hyperopic Population
Joan Kim et al
Clinical & Experimental Ophthalmology, 2011, 2:2

Includes a new parameter ARTmax = Tp/PPI(max)
Tp = thinnest pachymetry
PPI(max) = pachymetry progression index

Novel pachymetric Parameters based on Corneal Tomography for diagnosing Keratoconus
Renato Ambrosio et al
Journal of Refractive Surgery, posted online July 29, 2011
What about these cases?

Keratoconus?

What about these cases?

no keratoconus

keratoconus

Belin/Ambrosio Display III, benefit

- quick visual inspection, comprehensive but intuitive
- quick decision – for myopic and hyperopic patients
- for pre/post surgery Keratoconus/Ectasia detection
- combination of 5 singl, definite parameters into one final overall index
- minimizes the “false negatives” and “false positives”
- helpful for further diagnosis
Cataract pre-op screening (includes the general screening)
Patients selection for Premium IOL

Cataract Pre-Op display

- It was developed in co-operation with Prof. Naoyuki Maeda
- Its main clinical use is the pre-op assessment of corneal optical properties for premium IOL selection using a four steps criteria:
  - evaluation of corneal irregularities
  - corneal shape assessment
  - evaluations of corneal spherical aberrations
  - evaluations of the corneal astigmatism
- An article was published in „The Highlights of Ophthalmology“
  "Assessment of Corneal Optical Quality for Premium IOLs with Pentacam®"

1st Step: Total HOA < 0.3µm, therefore suitable for multifocal IOLs

2nd Step: regular corneal topography, may be suitable for toric IOL

3rd Step: Total Z40 (spherical aberration) = 0.105µm, therefore aberration free IOL

4th Step: Comparison of corneal astigmatism – all are equal, therefore suitable for toric IOL or LRI
Repeatability of corneal astigmatism

Can be found on the website [www.pentacam.com](http://www.pentacam.com)

<table>
<thead>
<tr>
<th>ΔK IOL Master 500</th>
<th>ΔK Pentacam HR cm K</th>
</tr>
</thead>
<tbody>
<tr>
<td>COR</td>
<td>relative COR</td>
</tr>
<tr>
<td>0.51 D</td>
<td>58.06 %</td>
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</table>

Toric IOLs
Repeatability of corneal astigmatism

- Scheimpflug imaging derived values showed best repeatability
- Manual keratometry performed worst
- In range evaluated, no influence of value of astigmatism on COR
- Scheimpflug Tomography offers more data combined with more reliable measurements

Total corneal astigmatism, important for toric IOL’s?

Anterior surface only? Is the posterior surface really important?

The study: Accuracy of Corneal Astigmatism Estimation by Neglecting the Posterior Corneal Surface Measurement showed:

10% of eyes with more than 1 D of astigmatism (candidates to toric IOL) had a difference in magnitude >0.5 D or a difference in angle >10° between anterior and total astigmatism. So considering the posterior surface is useful for these eyes.

Conclusion, the posterior surface should be considered in terms of angle and amount of the astigmatism.
Total Corneal Refractive Power

The Pentacam® calculates the Total Corneal Refractive Power of the cornea, considering:
- anterior and posterior corneal shape
- corneal thickness
- Snell's law of refraction

Benefit

- Pentacam provides most accurate and repeatable astigmatic measurements
- 4 steps to find the best Premium IOL
- Solution for toric IOL’s, incl. posterior corneal surface in terms of:
  - Detection
  - Selection and providing of the best IOL calculation method
  - Print-out for the OR

IOL power calculation with Pentacam®
Import of the axial length of the human eye

The Pentacam® software allows the import of the axial length from optical biometers.

Currently the axial length from the:

- AL-Scan from NIDEK
- Lenstar form Haag Streit
- OA-1000 from Tomey

is supported by the Pentacam® software.

Phaco Optics and OKULIX are supporting this feature already.

Summary: Pentacam for the Cataract surgery

1. pre-op screening using the Indices Display, corneal optical densitometry and Scheimpflug image (PNS) and Belin/Ambrosio Enhanced Ectasia
2. Premium IOL selection using the Cataract pre-op display
3. If necessary use the power distribution display for details
4. IOL power calculation using the:
   - ASCRS or the manufacturers online calculators
   - ray tracing calculators (Phaco Optics, OKULIX), BESt II, Shammas post hyperopic LASIK, EKR’s and Holladay II
5. Keratometry and Topography overlay in the iris image as a print-out for the operating theatre

Imaging
Pentacam Example: PMD

Pentacam example, cornea

Descemet’s Stripping with Endothelial Keratoplasty

With courtesy from Prof. Michael Belin

Pentacam® example, cornea

DLKP (deep lamellar keratoplasty)

With courtesy from Dr. T. Neuhann
Post-op control

Thank you for your attention

Please visit us under www.pentacam.com
Please visit us under www.oculus.de
Please visit us under www.oculus.tv

Hands On Portion ....