The Promise of No Glasses or Contact Lenses!

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Requirements

- Centration
- Accurate Biometry – Optical (IOL Master or LenStar)
- Accurate K’s- Repeatable
- 4th Generation Formula (WTW)
- Personalized Lens Constant
- Eliminate Corneal Astigmatism

Multifocal IOL
Optimal Location

- Cannot place on Pupil Center & Visual Axis (near P1) where axial ray is perpendicular to foveola.
- Optimal location is different for each patient and **somewhere between Pupil Center & P1.**

Financial Disclosure

- I have the following financial interests or relationships to disclose:
  - Abbott Medical Optics: C;
  - AcuFocus, Inc.: C,O;
  - Alcon Laboratories, Inc.: C;
  - ArcScan: C,O;
  - Carl Zeiss Inc: C;
  - Elenza: C,O;
  - Oculus, Inc.: C;
  - Visiometrics: C,O;
  - Wavetec: C

www.docholladay.com

Handouts
Horizontal Angle & Alpha & Kappa

Good centration, optimal optical performance?
Decentration: halos
Poor vision for far and near
Courtesy Paolo Vinciguerra M.D.

Diffraction Rings are perfectly concentric with patient’s pupil

Incident light
Diffractive structures
Focal point 2
Focal point 1
Lens

Intensity of diffraction pattern
Graphic
Pictorial

Intensity of diffraction pattern
Graphic
Pictorial

Jack T. Holladay MD MSEE FACS
Regression plot between the photic phenomenon of haloes (x axis) and the kappa angle (y axis).

\( R^2 = 0.26, \ P = 0.029 \)

N = 37
Zero = 25
Non zero = 12

Regression plot between the photic phenomenon of glare (x axis) and the kappa angle (y axis).

\( R^2 = 0.26, \ P = 0.033 \)

N = 37
Zero = 30
Non zero = 7

Horizontal Angle & Alpha & Kappa

\[ \alpha < \kappa < \text{Best Centration of IOL} \]

If > 0.70 mm then concern!


IOL MASTER 500 – ZEISS
Version ≥ 7.1

Anterior chamber depth values

<table>
<thead>
<tr>
<th>Value</th>
<th>2.5 mm</th>
<th>2.4 mm</th>
<th>2.3 mm</th>
<th>2.2 mm</th>
<th>2.1 mm</th>
<th>2.0 mm</th>
<th>1.9 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCD:</td>
<td>3.24 mm</td>
<td>3.24 mm</td>
<td>3.24 mm</td>
<td>3.24 mm</td>
<td>3.24 mm</td>
<td>3.24 mm</td>
<td>3.24 mm</td>
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</tbody>
</table>

White-to-white values

<table>
<thead>
<tr>
<th>Value</th>
<th>10.3 mm</th>
<th>9.6 mm</th>
<th>9.0 mm</th>
<th>8.4 mm</th>
<th>7.8 mm</th>
<th>7.2 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCD:</td>
<td>2.6 mm</td>
<td>2.6 mm</td>
<td>2.6 mm</td>
<td>2.6 mm</td>
<td>2.6 mm</td>
<td>2.6 mm</td>
</tr>
</tbody>
</table>

Reference image capture

No image | No image

IOL MASTER 700 – ZEISS
Version ≥ 1.1

Central corneal thickness

<table>
<thead>
<tr>
<th>Value</th>
<th>533 μm (SD: 4 μm)</th>
<th>533 μm</th>
<th>533 μm</th>
<th>533 μm</th>
<th>533 μm</th>
<th>533 μm</th>
<th>533 μm</th>
</tr>
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<td>533 μm</td>
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</tbody>
</table>

White-to-white values

<table>
<thead>
<tr>
<th>Value</th>
<th>12.2 mm</th>
<th>12.4 mm</th>
<th>12.4 mm</th>
<th>12.4 mm</th>
<th>12.4 mm</th>
<th>12.4 mm</th>
<th>12.4 mm</th>
</tr>
</thead>
</table>

Subtract from Ascan measured Axial Length ~ 0.8 mm

Zaldivar-Holladay JCRS May 2000
Zeiss - IOL Master - 2000

Optimizing intraocular lens power calculations in eyes with axial lengths above 25.0 mm

Li Wang, MD, PhD, Mariko Shiroyama, MD, Yngvason John, MD, PhD, FACS, Douglas D. Koch, MD

Linear Regression to compensate for AVERAGE Index of Refraction in Long Eyes

Requirements
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IOL Power Calculations
- Pentacam can measure FRONT & BACK SURFACE POWER
- Can Calculate:
  - Equivalent K-Reading (EKR)
    - 65% Mean, Peak & Average
  - NET POWER

EKR
- Reports Keratometry value but adjusts for Back Surface Power from Normal (Current IOL Formulas)
- If corneal front surface is 7.5 mm (45 D), but if back surface -0.3 D > normal:
  \[ EKR = 45.0 - 0.3 = 44.7 \text{ D} \]
  Note: Net Power = 43.3 D
IOL Calcs – Abnormal Cornea
(Use 65% MEAN EKR)

- Post Refractive Surgery
- Post PKP
- Keratoconus
- Corneal Scar
- Any Irregular Astigmatism

Use 65% Mean EKR ( @ 4.5, 4 & 3 mm zones)

Normal
- 41 to 44 D
- 3 D Range
- 36 to 41 D
- 5 D Range
- 32 to 45 D
- 13 D Range

POST LASIK

Post LASIK CALC
- $K_{\text{mean}} = 39.8$ D
- Used $39.8$ D => SEQ = $+1.12$ D
  $(+1.00 + 0.25 \times 155 = 20/20)$
- 65% mean = $38.8$ D => $+0.12$ D
- Use 65% mean $K$
Conclusions

- EKR – Use 65% Mean for all IOL Calcs
- Look @ smaller zones than 4.5 mm if pupil very small (< 3.0 mm in dim light)

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Vergence Formula

\[ IOL = \frac{1336}{AL-ELP} - \frac{1336}{1000} - ELP + K(\text{Post } R) \]

\[ \frac{1000}{1000} - V' \]

DPostRx

CONCLUSION: 9 EYES

<table>
<thead>
<tr>
<th>Anterior Segment Size</th>
<th>Megalocornea + axial hyperopia (2%)</th>
<th>Megalocornea (2%)</th>
<th>Large Eye Buphthalmos Megalocornea + axial myopia (8%)</th>
<th>Megalocornea (2%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small</td>
<td>Small eye Nanophthalmia (20%)</td>
<td>Microcornea (2%)</td>
<td>Microcornea + axial anisotropia (10%)</td>
<td></td>
</tr>
<tr>
<td>Short</td>
<td>Normal Axial Length</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Measurements taken for Predictors of ELP

- Axial Length
- Average K (Pre Ref)
- Horizontal WTW
- ACD
- LT
- Pre-op Refraction
- Age
FORMULA PERFORMANCE

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Personalized Lens Constant

- Never use Manufacturer’s Constant except to start
- 20 to 40 cases and continue
- Factors
  - IOL Style
  - Lens placement
  - Post op medications
  - Biometer, keratometer, ...

TORIC IOL Calculations

- Commercial Calculators use a constant ratio (1.46) for the corneal cylinder to the IOL cylinder
- Exact Calculation depends on IOL SEQ Power and ELP … to correct 2D of corneal astigmatism
  - 10 D IOL => 3.5 D Cylinder
  - 22 D IOL => 2.9 D Cylinder
  - 34 D IOL => 2.4 D Cylinder

A 1.1 D difference from 10 D to 34 D!
Toric Optimization

PREOP 6 D Toric IOL

PREOP 6 D Toric IOL -- OD

PREOP 6 D Toric IOL -- OS

!Thank You!