Dealing With The Refractive Surprise

Richard S. Hoffman, MD
Clinical Associate Professor of Ophthalmology
Casey Eye Institute
Oregon Health and Science University
No Financial Interest
Why The Surprise?

- Correct patient / Correct lens
- Long or short eye
- Proper IOL formula – Holladay 2
- Data inserted correctly
- Previous refractive surgery
Is It Easily Reversible?

• Lens properly inserted
  – Crystalens upside-down yields myopic shift

• Capsular block
  – Reversed easily with YAG

• Lens exchange
  – Can’t guarantee second lens will be right unless you know why the first lens was wrong
  – ? For small errors
  – How long since original surgery?
Best Treatment for Enhancement

*Piggyback versus Corneal Refractive Surgery*

- **Piggyback**
  - Straightforward
  - Somewhat accurate
  - Relatively expensive compared to LASIK

- **Corneal Refractive Surgery**
  - Straightforward
  - Generally accepted as benign procedure
  - Treats astigmatism at the same time
  - Much less expensive than piggyback
Piggyback IOL Calculations
Piggyback IOL Calculations

Easily calculated utilizing the Holladay IOL Consultant (R Formula)
# HicSoapPro - Iol Calc Report

**Patient:**
- **Surgeon:** HOFFMAN, RICHARD S. (04/16/2008)
- **ID:** PB
- **Date of Birth:** 04/16/2008
- **Sex:** Female
- **Pre-Op. Data**
- **OD**
  - **Refractive:** 23.55 D with +3.50 D +2.75 X 70
  - **Axial Len:** 23.55 ILM
  - **Vertex:** 40.00
  - **BCVA:** 20/20
  - **UCVA:** ????
  - **K1:** 41.26 @ 169
  - **K2:** 46.11 @ 79
  - **Average K:** 43.69
  - **Adjusted K:** 43.69

- **OS**
  - **Refractive:** Axial Len:
  - **Axial Len:**
  - **Vertex:** Adj. AL:
  - **BCVA:** Hor Wt-W:
  - **UCVA:** Phakic ACD:
  - **K1:** Phakic Lens Th.:
  - **K2:** Target Ref.:
  - **Average K:** Tgt Add:
  - **Adjusted K:**

**Additional Data**
- **Eye Status:** Pseudophakic
- **New PC Lens:** In situ
- **Secondary Piggy-Back IOL**
- **Preop Pathology:** No
- **Prev. Rk:** No
- **Keratoconus:** No
- **Scleral Buckle:** No
- **Silicone in Vitreous Cavity:** No

## Holladay R

<table>
<thead>
<tr>
<th>Lens #1</th>
<th>Lens #2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Procedure:</strong> Std Phaco</td>
<td><strong>Procedure:</strong> Std Phaco</td>
</tr>
<tr>
<td><strong>MFG ACD:</strong> 5.55</td>
<td><strong>MFG ACD:</strong> 5.55</td>
</tr>
</tbody>
</table>

### IOL

<table>
<thead>
<tr>
<th>IOL</th>
<th>Pred. Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.50</td>
<td>2.82</td>
</tr>
<tr>
<td>4.00</td>
<td>2.52</td>
</tr>
<tr>
<td>7.92</td>
<td>0.00</td>
</tr>
<tr>
<td>Lens Power NA</td>
<td>8.00</td>
</tr>
<tr>
<td>Lens Power NA</td>
<td>9.00</td>
</tr>
</tbody>
</table>

- **Lens #3 AMO CLRFLXC**
- **Procedure:** Std Phaco
- **SRG Entered ACD:** 5.12

### IOL Consultant Notes

The probability of this IOL is < 0.1%
# HicSoapPro - Iol Calc Report

**Patient:**

**ID:**

**Date of Birth:** 17-Apr-1956  
**Sex:** Male

### Pre-Op Data

**Surgeon:** HOFFMAN, RICHARD S.  
**Date:** 07/02/2007

<table>
<thead>
<tr>
<th>OD</th>
<th>OS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refraction: -10.00 +0.75 X 150</td>
<td>Refraction: -15.00 +0.00 X 0</td>
</tr>
<tr>
<td>Vertex: 12.00</td>
<td>Vertex: 12.00</td>
</tr>
<tr>
<td>BCVA: 20/30</td>
<td>BCVA: 20/50</td>
</tr>
<tr>
<td>UCVA: ????</td>
<td>UCVA: ????</td>
</tr>
<tr>
<td>K1: 44.00 @ 22</td>
<td>K1: 43.72 @ 170</td>
</tr>
<tr>
<td>K2: 44.88 @ 117</td>
<td>K2: 44.56 @ 80</td>
</tr>
<tr>
<td>Average K: 44.44</td>
<td>Average K: 44.15</td>
</tr>
<tr>
<td>Adjusted K: 44.44</td>
<td>Adjusted K: 44.15</td>
</tr>
</tbody>
</table>

### Additional Data

<table>
<thead>
<tr>
<th>Eye Status: Phakic</th>
<th>PreOp Pathology: No</th>
</tr>
</thead>
<tbody>
<tr>
<td>New PC Lens: In bag</td>
<td>No</td>
</tr>
</tbody>
</table>

### Lens Calculations

#### Lens #1 AMO NXG1
- **Procedure:** Std Phaco
- **MFG ACD:** 5.20

<table>
<thead>
<tr>
<th>IOL</th>
<th>Pred. Ref.</th>
<th>IOL</th>
<th>Pred. Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.50</td>
<td>0.56</td>
<td>4.68</td>
<td>0.00</td>
</tr>
<tr>
<td>4.00</td>
<td>0.39</td>
<td>6.00</td>
<td>-0.92</td>
</tr>
<tr>
<td>6.50</td>
<td>-1.23</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Lens #2 Staar AQ-5010V
- **Procedure:** Std Phaco
- **MFG ACD:** 5.55

<table>
<thead>
<tr>
<th>IOL</th>
<th>Pred. Ref.</th>
<th>IOL</th>
<th>Pred. Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.50</td>
<td>0.57</td>
<td>3.36</td>
<td>0.00</td>
</tr>
<tr>
<td>3.00</td>
<td>0.29</td>
<td>3.49</td>
<td>0.00</td>
</tr>
</tbody>
</table>

#### Lens #3 AMO AR 40e
- **Procedure:** Std Phaco
- **MFG ACD:** 5.20

<table>
<thead>
<tr>
<th>IOL</th>
<th>Pred. Ref.</th>
<th>IOL</th>
<th>Pred. Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.50</td>
<td>0.59</td>
<td>3.67</td>
<td>0.00</td>
</tr>
<tr>
<td>4.00</td>
<td>0.29</td>
<td>3.50</td>
<td>-0.09</td>
</tr>
<tr>
<td>4.50</td>
<td>-0.01</td>
<td>5.00</td>
<td>-0.98</td>
</tr>
<tr>
<td>5.00</td>
<td>-0.31</td>
<td>4.00</td>
<td>-0.39</td>
</tr>
</tbody>
</table>

#### Lens #4 Alcon MTA4UO
- **Procedure:** Std Phaco
- **MFG ACD:** 3.39

<table>
<thead>
<tr>
<th>IOL</th>
<th>Pred. Ref.</th>
<th>IOL</th>
<th>Pred. Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.50</td>
<td>0.51</td>
<td>3.36</td>
<td>0.00</td>
</tr>
<tr>
<td>3.00</td>
<td>0.21</td>
<td>2.76</td>
<td>0.00</td>
</tr>
<tr>
<td>3.50</td>
<td>-0.09</td>
<td>5.00</td>
<td>-1.68</td>
</tr>
<tr>
<td>4.00</td>
<td>-0.39</td>
<td>5.50</td>
<td>-2.07</td>
</tr>
<tr>
<td></td>
<td>OD</td>
<td>OS</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>-------------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td><strong>Surgeon</strong></td>
<td>HOEFMAN, RICHARD S. 07/05/2007</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Refraction</strong></td>
<td>-1.65 +0.00 X 0</td>
<td>29.09 ILM</td>
<td></td>
</tr>
<tr>
<td><strong>Vertex</strong></td>
<td>12.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BCVA</strong></td>
<td>20/30</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>UCVA</strong></td>
<td>????</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Axial Len</strong></td>
<td>29.09 ILM</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Adj. AL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hor W-t-W</strong></td>
<td>12.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Phakic ACD</strong></td>
<td>4.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>K1</strong></td>
<td>43.72 @170</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>K2</strong></td>
<td>44.58 @80</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Average K</strong></td>
<td>44.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Adjusted K</strong></td>
<td>44.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PreOp Pathology</strong></td>
<td><strong>Pseudophakic in situ</strong></td>
<td><strong>No</strong></td>
<td></td>
</tr>
<tr>
<td><strong>New PC Lens</strong></td>
<td><strong>No</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Keratoconus</strong></td>
<td><strong>No</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Scleral Buckle</strong></td>
<td><strong>No</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Silicone in Vitreous Cavity</strong></td>
<td><strong>No</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Formula</strong></td>
<td>Holladay II</td>
<td>Holladay R</td>
<td></td>
</tr>
<tr>
<td><strong>Lens #1</strong></td>
<td>AMO NXG1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Procedure</strong></td>
<td>Std Phaco</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MFG ACD</strong></td>
<td>5.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>IOL</strong></td>
<td>-3.50</td>
<td>-2.83</td>
<td></td>
</tr>
<tr>
<td><strong>Pred. Ref.</strong></td>
<td>0.37</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td><strong>Lens Power NA</strong></td>
<td>-3.00</td>
<td>-2.50</td>
<td></td>
</tr>
<tr>
<td><strong>IOL</strong></td>
<td>2.83</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td><strong>Pred. Ref.</strong></td>
<td>0.09</td>
<td>-0.19</td>
<td></td>
</tr>
<tr>
<td><strong>Lens Power NA</strong></td>
<td>-2.00</td>
<td>-0.47</td>
<td></td>
</tr>
<tr>
<td><strong>IOL</strong></td>
<td>2.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pred. Ref.</strong></td>
<td>-0.47</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Piggyback IOL Calculations

No Holladay IOL Consultant
Piggyback IOL
Gills Nomogram

• Underpowered Pseudophake (Hyperope)
  1. Short Eye (<21mm): Power = \((1.5 \times SE) + 1\)
  2. Average Eye (22-26mm): Power = \((1.4 \times SE) + 1\)
  3. Long Eye (>27mm): Power = \((1.3 \times SE) + 1\)

• Overpowered Pseudophake (Myope)
  1. Short Eye (<21mm): Power = \((1.5 \times SE) - 1\)
  2. Average Eye (22-26mm): Power = \((1.4 \times SE) - 1\)
  3. Long Eye (>27mm): Power = \((1.3 \times SE) - 1\)
Piggyback IOL
Nichamin Nomogram

Sulcus IOL : AQ5010V

- Minus power = 1:1 (-2D SE = -2D IOL)
- Plus power = 1:1.5 (+2D SE = +3D IOL)
Piggyback IOL
Brown’s Refractive Reasoning

0.50 D IOL power = 0.37 D at the spectacle plane
Piggyback IOL Choices
AMO Sensar

- Acrylic
- 6.0 mm optic
- 13.0 mm overall length
- OptiEdge (rounded front)
  - Pigment dispersion
- -10.0 to +30.0 (half-diopter steps)
Staar AQ 2010 and AQ5010

*Thin Optic Edges*

- Silicone
- 6.3 mm optic  (larger optic = \( \downarrow \) iris capture)
- **AQ2010**
  - 13.5 mm length
  - +5 to +9 D (whole D steps)
  - +9.5 to 30 D (half D steps)
- **AQ5010**
  - 14 mm length
  - -4 to +4 D (whole D steps)
Raynor Sulcoflex

Not FDA Approved

- Designed for sulcus placement
- Hydrophilic acrylic
- Aberration-neutral
- 6.5 mm aspheric optic
- Posterior concave surface avoids physical contact between IOLs
- Undulating haptics with posterior 10° angulation
  - Reduced risk of Pigment Dispersion Syndrome
  - Rotational stability
Raynor Sulcoflex

Sulcoflex® Toric  
Sulcoflex® Multifocal
How Long Do You Wait?

Ideally as long as possible to allow LEC metaplasia and fibrosis to be completed

– Refractive stability usually achieved by 2 weeks but can be longer
Piggyback IOL
Excimer Laser Enhancement
How Long Do You Wait?

**LASIK vs. PRK**

- **PRK** can be done anytime
- **LASIK** – When is the incision stable?
  - Nobody knows for sure
  - Marked elevation in IOP from microkeratome
  - Wait at least 6 weeks and probably 3 months
  - If unacceptable to patient then PRK
PRK or LASIK

- Many of these patients have received LRIs
- Small risk of epithelial ingrowth
- Tend to be older patients – possible dry eye
- For most patients – PRK rather than LASIK
PRK

- 20% Ethanol (1 cc 100% Ethanol + 4 cc BSS)
- 8.0 mm trephine or OZ marker
- 20-30 seconds
- Remove easily with #64 Beaver blade
- BCL
  - Antibiotic
  - Non-steroidal
  - Steroid
Wavefront Treatments

- Usually not reliable through a multifocal IOL
- Do we want to treat multifocal aberrations?
- Just treat the manifest refraction
- Accommodating IOLs OK
Enhancements

• Prepare patient pre-op
  – Give percentages for enhancement
  – Give additional costs – No surprises
  – Undersell don’t oversell
Enhancements
Enhancements
Enhancements

• Prepare patient pre-op
  – Give percentages for enhancement
  – Give additional costs – No surprises
  – Undersell don’t oversell

• Reassure patient post-op
  – Easily enhanced
  – Enhancements are relatively safe
  – Try not to belittle their concerns
  – Go the extra mile for the unhappy patient
  – Discuss risk/benefit when they get obsessive
Obrigado