Toric IOL Selection and Positioning Guided by Intraoperative Aberrometry

Kathryn M. Hatch, M.D.
Massachusetts Eye and Ear Infirmary

Toric IOL

- Intraocular lens designed to decrease postoperative astigmatism
- Multiple manufacturers—Alcon, Abbott Medical Optics, Staar, Bausch & Lomb

Intraoperative Aberrometry

- "Real-time" aphakic readings
- Assist with IOL choice
  - Power calculation
  - Toric calculation
- Astigmatism management with Toric IOLs alignment and LRIs

Toric IOL

- Pre-OP Data
  - 1.37D X 21° IOL, Master A
  - 0.00D Target Refraction

- State of the Eye
  - Aphakic
    - Power Calculation
    - LRI
    - LRI Enhancement
  - Pseudophakic
    - After IOL Implant Non-Toric
    - LRI
    - LRI Enhancement
    - After Toric Implant

End Surgery
Intraoperative Aberrometry

• Value?

• To our knowledge, there is no peer-reviewed literature evaluating the use of aberrometry with Toric IOLs
Methods

- Non-randomized retrospective comparative trial
- Private practice setting
- 2 surgeons

Baseline Characteristics of Intraoperative Aberrometry vs Toric Calculator Groups

- **Aberrometry group: 37 cases**
  - Mean pre-op keratometric astigmatism:
    - $1.83 \pm 0.79$ D
    - Range 0.74 D to 3.77 D
  - Mean postop timeframe:
    - 58 days (2 months)
    - Range: 15 to 132 days
  - Lenses implanted:
    - SN6AT3: 18
    - SN6AT4: 4
    - SN6AT5: 5
    - SN6AT6: 2
    - SN6AT7: 1
    - SN6AT8: 2
    - ZCT150: 3
    - ZCT225: 1
    - ZCT300: 1

- **Non-ORA group: 27 cases**
  - Mean pre-op keratometric astigmatism:
    - $1.59 \pm 0.69$ D
    - Range 0.69 D to 4.10 D
  - Mean postop timeframe:
    - 60 days (2 months)
    - Range: 29 to 119 days
  - Lenses implanted:
    - SN6AT3: 18
    - SN6AT4: 2
    - SN6AT5: 6
    - SN6AT7: 1

Preoperative Keratometric Astigmatism Versus Aphakic Aberrometry Measurement (n=37)

- **Aberrometry group (n= 37 eyes)**
  - Cylinder power and axis of placement determined by ORA aphakic refraction
    - Placement refined by pseudophakic refraction

- **Toric calculator ("traditional method") group (n=27 eyes)**
  - Cylinder power and axis of placement determined by standard biometry and toric calculator

- **Primary Outcome Measurement**
  - Post-op refractive cylinder
Preoperative Keratometric Astigmatism Toric Calculator Group (n=27)

Number of Rotations Made After 1st Toric Lens Positioning Pseudophakic Measurement

• No rotations; 68%
  – This number may also be aided by intraop info provided to surgeon via reticle and aphakic refraction/vector analysis
  • ≤ 3 rotations; 92%
  • > 3 rotations; 8%

Altered Decision Making in OR; Aberrometry Group

• Toric IOL power
  – Changed 24% of the time (9/37)

• Spherical IOL power
  – Changed 35% of the time (13/37)
### Post-Operative Residual Refractive Astigmatism (RRA)

<table>
<thead>
<tr>
<th></th>
<th>≤ 0.25 D RRA</th>
<th>≤ 0.50 D RRA</th>
<th>≤ 0.75 D RRA</th>
<th>≤ 1.00 D RRA</th>
</tr>
</thead>
<tbody>
<tr>
<td>% patients Non-Aberrometry group</td>
<td>38%</td>
<td>78%</td>
<td>86%</td>
<td>95%</td>
</tr>
<tr>
<td>Mean</td>
<td>0.68 D</td>
<td>0.46 D</td>
<td>0.89 D</td>
<td>0.34 D</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>+ / - 0.34 D</td>
<td>+ / - 0.42 D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>p-value</td>
<td>0.0153</td>
<td>statistically significant</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Results of Alcon FDA Trial

<table>
<thead>
<tr>
<th></th>
<th>n=244</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-ORA Group</td>
<td>62%</td>
<td>0.55 D</td>
<td>± 0.50 D</td>
</tr>
<tr>
<td>ORA Group</td>
<td>88%</td>
<td>0.46 D</td>
<td>± 0.42 D</td>
</tr>
</tbody>
</table>

### Chance of a patient being in a lower postoperative residual refractive range increases when intraoperative aberrometry is used

p-value: 0.0130

---

### Non Aberrometry Group

Pre-op and Post-op Astigmatism

- **57% reduction in cylinder**

### Aberrometry Group

Pre-op and Post-op Astigmatism

- **75% reduction in cylinder (p-value: 0.0027)**
Review of an Aberrometry Case in which ORA was not followed

• Female, 61 years old
  – IOLMaster k’s: 2.48 @ 177
  – Autorefraction k’s: 1.50 @ 87
  – Other device k’s: 1.12 @ 171
  – Target refraction: plano

• Preop plan to implant 13.5 D SN6AT3
Review of an Aberrometry Case in which ORA was not followed

Limitations

• Cost
• OR time
• Learning Curve
• IOP
• Bubbles
• Lid speculum

Conclusions

• You don’t always “get it right the first time”...
  – Toric power changed in 25%
  – > 1 rotational adjustment in 1/3

• Intraop aberrometry reduces absolute post-operative RRA and improves UCVA

• Aberrometry (in our hands) 2.5 x more likely to achieve ≤0.50 D residual refractive astigmatism

Patient’s manifest refraction at 15 days postop was -2.00 +2.00 x 174