Advances in Cataract Surgery 2014

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Disclosures

• Douglas K. Devries
  — Consultant or Speakers Bureau for
  • Allergan
  • AMO
  • Odyssey Medical
  • Essilor
  • B & L
  • TearLab
  • Nicox
  • Akorn

Premium IOL’s

• Technology in Cataract Surgery
• Advances in IOL’s
  — Multi-Focal
  — Accommodating IOL’s
  — Toric IOL’s
• Technical Variations of Surgery

Refractive Cataract Surgery

• Technological Generation
• Expectation is Plano Sphere
• Distance and Near Desired

Laser Assisted Cataract Surgery

• Traditional Cataract Surgery
  — Capsulotomy size directly related to Effective Lens Position
  — Corneal incisions are manually executed and imprecise
  — High level of phaco power can be associated with post-op complications

Cataract Complications

• PCO 10-30%
• CME transient 2-10%
• Vitreous loss 1-5%
• Corneal endothelial cell loss 4-10%
• Retinal detachment 0.6-1.7%
• CME persistent 1-2%
• IOL Malposition 0.3%
• Need for Corneal Transplant 0.3%
• Endophthalmitis 0.1%
Femtosecond Laser Technology

- LenSx:
- LensAR:
- Optimedica:
- Technolas:
- Nidek:

Femtosecond Cataract Surgery Capabilities

- Keratome Incision
- Paracentesis *
- Limbal Relaxing Incisions
- Anterior Capsulotomy
- Anterior Capsule Polishing *
- Nuclear Sectioning
- Posterior Capsulotomy *
- Vitreolysis *
  *Future application

Femtosecond Cataract Surgery: FDA Approved

- LenSx: Capsulotomy, Incision, Fragmentation
- LensAR: Fragmentation, Capsulotomy
- Victus: B & L Technolas: Capsulotomy, Incisions, Fragmentation and Lasik Flap
- Optimedica pending
- Nidek pending

Where and When to Use

• Pros and Cons of Femoseond Technology
  • Premium IOL
    • Toric
    • Multifocal
    • Monofocal IOL
  • Costs associated with technology
  •
LenSx Femtosecond Laser

LenSx Laser Assisted Cataract Video

Intraoperative Wavefront aberrometry

- Standard and premium IOL calculations
  - Monofocal
    - 25Diopter steps
  - Multifocal
  - Accommodating
  - Toric
Current Surgery Tools Unable to Support Future Expectations

- Historical IOL power formulas have modest success, ~50% within 0.5 diopter (D)
- >40% of patients dissatisfied: need glasses or request secondary enhancement surgery
- Surgeons bear cost of post-surgery enhancement procedures, which can reduce procedure profit by up to 50%
- Patients paying out-of-pocket for premium lenses expect spectacle-free, LASIK-like results

Surgeons need refractive measurement when it matters most – intra-operatively

“True” Aphakic Refractive Cylinder vs Corneal

- After Phaco Incision has been Made
- Measurement Combines Anterior and Posterior Contributions into a Single Value
- Measures line of sight not Apex
- REFRACTIVE Cylinder not Keratometric Cylinder
- Makes No Assumptions About Index Changes like the Keratometric Index Does – We Just Measure It!

Aphakic Reading

Pseudophakic Verification

Pseudophakic Case Complete
LRI Application

- Most effective in Pseudophakic
- Least effective in phakic
- Titrate LRI to target

ORA Post LASIK Challenge

<table>
<thead>
<tr>
<th></th>
<th>Patient 1</th>
<th>Patient 2</th>
<th>Patient 3</th>
<th>Patient 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORA System's ICX Power Calculated</td>
<td>23.0 D</td>
<td>22.5 D</td>
<td>21.5 D</td>
<td>18.5 D</td>
</tr>
<tr>
<td>Patient's Post-Op Refraction</td>
<td>+0.25 D</td>
<td>-0.12 D</td>
<td>-0.25 D</td>
<td>-0.25 D</td>
</tr>
<tr>
<td>Surgeon 1 ICX Recommendation</td>
<td>+0.45 D</td>
<td>+0.10 D</td>
<td>+0.25 D</td>
<td>+0.10 D</td>
</tr>
<tr>
<td>Refractive Error</td>
<td>+0.45 D</td>
<td>+1.00 D</td>
<td>+0.25 D</td>
<td>-0.55 D</td>
</tr>
<tr>
<td>Surgeon 2 ICX Recommendation</td>
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Standard Cases Absolute Prediction Error

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<tr>
<th></th>
<th>ORA</th>
<th>Pre-op Biometry</th>
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<tr>
<td></td>
<td>Mean 0.31 ± 0.27</td>
<td>Mean 0.42 ± 0.34</td>
</tr>
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</table>

50% 80% 94% 98% 39% 68% 85% 94% 0% 20% 40% 60% 80% 100%

≤ 0.25 ≤ 0.5 ≤ 0.75 ≤ 1

Standard Toric Cases Absolute Prediction Error

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<td>Mean 0.29 ± 0.23</td>
<td>Mean 0.45 ± 0.39</td>
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</table>

50% 86% 94% 98% 37% 69% 83% 90% 0% 20% 40% 60% 80% 100%

≤ 0.25 ≤ 0.5 ≤ 0.75 ≤ 1

Pre-op Kerometric Astigmatism
N=255, Mean Cyl 1.93 ± 1.05

Post-op Refractive Cylinder
N=255, Mean Cyl 0.45 ± 0.49

Standard Toric Cases Cylinder Reduction

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47% 71% 86% 93% 62% 88% 0% 20% 40% 60% 80% 100%

≤ 0.25 ≤ 0.5 ≤ 0.75 ≤ 1

Standard Toric Cases Post Op Cylinder Distribution

<table>
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Post Myopic LASIK Absolute Prediction Error

- 90%
- 60%
- 40%
- 20%
- 0%

N=83, Mean 0.27 ± 0.22

Post Hyperopic LASIK Absolute Prediction Error

- 69%
- 46%
- 23%
- 10%
- 0%

N=31, Mean 0.39 ± 0.41

On-Demand Measurement Impacts
93% of Surgeon’s IOL Decision-Making

WaveTec Calculation vs. Final IOL Power Choice

- Surgeon Pre-op Calc Chosen: 40%
- WaveTec Confirms Surgeon Choice: 53%
- WaveTec Better Than Surgeon Choice: 27%

Pre and Post Op Cylinder (Astigmatism Identified)

- Without ORA: n = 37
- With ORA: n = 30

ORA

- Increases Accuracy of Post-Surgical Outcomes
  - Improved Premium IOL Outcomes
- Higher Level of Technology
- Increased Cost to Patients
- Increased Time in O.R.

Opportunities

- 78 Million Americans (baby boomers) will begin enrolling in Medicare Beginning in 2011
- Technology Adopters
- Care is Provided in Your Practice
- Our Role to Educate and Guide
**Aging Population**

- Average annual increase in 60 year old or older population is 3.4%

**2014 Cataract Market**

- US cataract procedures are estimated to grow 3% annually between 2009 and 2014

**Year Growth Projection for 60+ Population**

**Prevalence of Cataract by Age**

**2009 US Market Analysis**

- PC-IOLs are expected to be:
  - 7% of total IOLs implanted
  - 15.5% of total IOL revenue

**IOL Market Share by Revenue**

**Why isn’t this percentage greater?**

**Prevalence of Astigmatism**

- 1.5 D to 3.5 D = 20%

**Corneal Topography**

A corneal topography map is the most accurate way of determining and recording the corneal topography.
Effect of 1.5 D Cylinder on UCVA

Limbal Relaxing Incisions
- Similar to Astigmatic Keratotomy
- 600 microns deep
- Up to 6mm in length
- Can be paired for larger amounts of Cyl
- Up to 3.00 Diopters of Cyl
**Limbal Relaxing Incisions**

- Less Stable and Less Predictable than Toric IOL
- Can Be Used In Combination With Toric IOL In Higher Cylinder Amounts

**Non-Covered Services**

- Refraction
- Contact Lens Trial
- Wavefront Testing
- Topography
- Pachymetry
- Routine Care
- Keratoplasty for Enhancement
- IOL Exchange

**Pre-Operative Care**

- Comprehensive Exam
  - Accurate Refraction
  - Manual Ks
  - Careful Cornea Eval
    - Presence of Guttata or other
    - Deficient Tear Syndrome
    - Blepharitis / MGD
  - Careful DFE

**Pre-Operative Care**

- Special Testing
  - BAT
  - K Topography
  - Pachymetry
  - IOL Master / A-Scan
  - IOL Calculations

**Corneal Topography**

**IOL Technology**

- Wavefront
- Accommodating
- Multi-Focal
- Toric
What is 20/20?
• All of the following represent 20/20 vision (Spherical Aberration)

Young Lens

Aging Lens

Spherical IOL’s

Tecnis IOL

Available Aspheric IOL’s
• AMO Tecnic
• Alcon AcrySof
• B & L Aspheric
• LensTec
IOL Master

Candidate for Toric IOL

- Careful Manifest Refraction or Past History of Refraction – Amount and Axis of Cylinder
- Manual Keratometry
- Topography
- Careful Analysis
- Discussion of Method
- Discussion of Expectations

Candidate for Toric IOL?

72 Year Old Male
PC  +.50 – 1.75 X 083
    -.25 – 1.25 X 088
MR  +.25 – 1.50 X 090
    -.50 – 1.25 X 085
Auto K’s  41.87/43.25 @ 178
        41.50/43.00 @169

Candidate for Toric IOL?

67 Year Old Female
PC  -1.25 – 2.50 X 140
    -1.50 – 1.75 X 156
MR  -2.00 – 2.50 X 142
    -2.00 – 2.00 X 158
Auto K’s  45.00/44.00 @ 160
        44.75/44.00@180
Ideal Candidate

- OD PI - 1.75 X 0.05
- k’s 44.75/43.00@006

Prior to Premium IOL

- Rule of Anterior Segment
- Perform Evaluation for Dry Eye Disease
- Treat Dry Eye Disease in Advance

AMO Tecnis Toric
**STAAR Toric IOL**

**B & L Toric Crystalens**

**FDA device description.** “The crystalens is a modified plate haptic lens with hinges across the plates adjacent to the optic.”

**Crystalens Aspheric**

**AcrySof® Toric**

**Plate vs Haptic Rotation**

**Capsule Immediate Post-Op**

**On Axis**
2/10/14

Targeting Zero Residual Cylinder

- Toric IOL is tolerant of axis deviations
- 10° results in cylinder reduction of 2/3
- 20° results in cylinder reduction of 1/3
- Partial reduction with up to 30° misalignment

Oblique to Stria

Pseudophakic Verification
**Toric Rotation**

IOL within 15° of intended meridian?

**YES**  No action necessary

**NO**  Consider reposition if the patient is symptomatic.

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**IOL Repositioning**

- Ideal Time Frame 2 Weeks
- Capsule Fibrosis and Shrinking
- Creates Lock and Key After 3-4 Weeks

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**Options**

- Possible Repositioning
  - if soon enough
- Laser Refractive Surgery
- Limbal Relaxing Incisions
- Spectacle Correction
- Contact Lens

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**Pre-Op Evaluation**

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**Zonular Weakness - PXE**

- Poor pupil dilation
- Dandruff-like flakes
- Phacodonesis – 25% of zonules weak
- Capsular tears
- Vitreous loss
- Post-op inflammation
- Capsular phimosis
- Scandinavians up to 20%

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**Capsular Tension Rings**

- Stabilize lens-zonule complex
- Circumferential expansive force to capsular equator
- Forces equally distributed
- Can be left in place
- Prevents capsular phimosis
**Intraoperative Floppy Iris Syndrome**

Selective alpha-1A receptor subtype blocker
- Rapaflo – silodosin

Non-subtype selective alpha receptor blocker
- Hytrin – terazosin
- Cardura – doxazosin
- Uroxatral – alfuzosin

Nutraceutical
- Saw palmetto

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**Flomax - Tamsulosin**

- Selective alpha-1A receptor subtype-blocker
- Treats benign prostatic hypertrophy
- Loss of iris dilator smooth muscle tone-permanent
- Relaxes smooth muscle of bladder neck/prostate
- Treats urinary retention in women

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**IFIS Strategies**

- Pre-op atropine
- Intracameral epinephrine
- Viscomydriasis
- Flexible iris retractors
- Malyugin expansion ring

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**Multi-Focal IOL’s**

- AMO Array (first generation)
- AMO ReZoom
- Alcon ReSTOR
- Alcon Aspheric ReSTOR (yellow)
- Alcon ReSTOR 3.0
- AMO Tecnis Multi-focal
Aspheric ReSTOR® Apodized Diffractive IOL

- Apodized diffractive structure blends into peripheral refractive region
  - Gradually emphasizes energy going to distance vision with larger pupil sizes
  - Nighttime visual disturbances minimized by directing more light to distance when pupils are larger

AcrySof® ReSTOR® Aspheric IOL Design

- The AcrySof® ReSTOR® Aspheric IOL model SN6AD3 is designed with negative spherical aberration.

ReSTOR® Aspheric +3.0 D IOL

Multi-Focal IOLs

Patient Selection

Tecnis Multifocal

- High-quality vision in any light condition
  - Near, far, and intermediate: Excellent vision day or night
  - Proprietary non-apodized optic and proven clear hydrophobic acrylic for best image quality
Crystalens Model AT-45

FDA device description. “The crystalens is a modified plate haptic lens with hinges across the plates adjacent to the optic.”

Newest Crystalens HD

Z-Syndrome / CCS

IOL Power and Accommodation

<table>
<thead>
<tr>
<th>Axial Length (mm)</th>
<th>22</th>
<th>23</th>
<th>24</th>
<th>25</th>
<th>26</th>
<th>27</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOL Power (D)</td>
<td>27</td>
<td>24</td>
<td>20</td>
<td>17</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>Accommodation per 1.0 mm forward IOL movement (D)</td>
<td>1.9</td>
<td>1.6</td>
<td>1.3</td>
<td>1.1</td>
<td>0.9</td>
<td>0.8</td>
</tr>
</tbody>
</table>

How is Accommodation Achieved?

1. Ciliary muscle contraction
2. Ciliary body shifts forward
3. Pressure change in vitreous
4. Displaces posterior capsule
5. Crystalens moves forward

ReZoom IOL

Patient Selection
Pre-operative Considerations

- Patients who no longer desire to wear glasses
- Ocular pathology
  - Dry Eye Disease
    - Dry Eye Evaluation
  - Corneal scarring
    - Injuries
    - Herpetic
    - IK

* Journal of Cataract and Refractive Surgery, Vol. 29, #11 p. 2069-2072
Patient Selection
Pre-operative Considerations

– Ocular pathology
  • Optic nerve disease
  • Ischemic optic neuropathy
  • Optic neuritis
  • Amblyopia

Patient Selection
Pre-operative Considerations

– Astigmatism considerations
  • Pre-op cylinder < 0.75 D ideal
  • Cylinder ≥ 0.75
  • Refractive vs Corneal???
    – Intra-op AK/LRI
    – Post-op excimer Tx

Patient Selection
Pre-operative Considerations

– Patients’ visual demands
– Occupational needs
– Realistic expectations
– Avoid in hypercritical patients

If Refractive???

• A Trial Frame or Spectacle Correction Will Resolve Issues
• If Not Resolved
  – Centration
  – PCO
  – Pathology
    • OCT
    • Ocular Surface Disease/MGD

Possible Options

• Possible Repositioning
  – if soon enough
• Laser Refractive Surgery
• Limbal Relaxing Incisions
• Spectacle Correction
• Contact Lens