Trending Now in Cataract Surgery

Disclosures:
Glaukos (honoraria)

Trending Now in Cataract Surgery

Cataract Surgery Evolution Time-line

First cataract extraction; Dr. Daviel

1748

The first lens implant; Dr. Ridley

1949

Phacoemulsification first performed; Dr. Kelman

1967

First foldable silicone IOL was used; Dr. Mazzocco

1985

Foldable lens

2008

Sutureless

No Shield

The Evolution of Cataract Surgery

1987

Retro-bulbar

12 mm incision

Can opener

Capsulotomy

Phacoemulsification

FMMA lens

Multiple sutures

Subconj. injection/drops

Shield

1987

1991

2011

Topical

1.8 mm incision

Capsulorrhexis

Phacoemulsification

Foldable lens

Sutureless

Drops only

No Shield

2015

Topical

<1.0 mm (Laser)

Capsulorrhexis (Laser)

Laseremulsification

Rollable/Adjustable lens

Sutureless

Drug Delivery

No Shield

Laser LRI

Growing Population for Cataract Surgery

The average age of US cataract patients is declining

Average age of US cataract patient is declining

An Evolving Definition of Cataract

- In 2011, almost 800,000 surgeries will be performed on patients 55-64 years old
- New surgical approaches available to improve UCVA for many patients
- Established LASIK market validates that patients will pay for surgically improved vision

Refractive Outcomes (ReLACS)  
A. Pre- and intraoperative tools
B. RelACS- Laser CEX
C. Lens technology

Refractive Outcomes (ReLACS)  
A. Pre- and intraoperative tools
B. BIometry-Lenstar and IOL master
C. Topography
D. Special Calcs
E. Intraoperative Aberrometry

#TrendingNow


Refractive Outcomes (ReLACS)
A. Pre- and intraoperative tools
B. Biometry-Lenstar and IOL master
C. Topography
D. Special Calcs
E. Intraoperative Aberrometry

#Lenstar

#Nidek

#SpecialCalcs= WHY?

Assumption#1: D = (N_{air} - N_{refr}) / r

"Single plane, n = 1.3375"
Observation of many pts
"Fudged" n for single plane
Constant front/back ratio (Changed in refractive surgery)

D = N_{air} - N_{refr} / f_{true}

\[ R_{front} = \frac{R_{air} - R_{refr}}{f_{true}} \]

D = N_{air} - N_{refr} / f_{true}

Notes: All after refractive surgery
# Intraoperative Aberrometry (ORA)

ORA System – Optiwave Refractive Analysis

- Aphakic Refraction
- Toric Implants
- Surgically Induced Astigmatism
- Posterior K Astigmatism

## Literature


## Mean Absolute Error

<table>
<thead>
<tr>
<th>Condition</th>
<th>Mean Absolute Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aphakic</td>
<td>0.5</td>
</tr>
<tr>
<td>Toric</td>
<td>0.3</td>
</tr>
<tr>
<td>Haigis L</td>
<td>0.06</td>
</tr>
<tr>
<td>Shammas</td>
<td>0.4</td>
</tr>
</tbody>
</table>

## ORA Screenshots

### Toric Implants

- Before Rotation: +1.75 x 3.50 x 92, VA = 20/70
- After Rotation: Plano, VA = 20/20

## Surgically Induced Astigmatism

Frequency Distribution (°)

<table>
<thead>
<tr>
<th>St. Dev?</th>
<th>0.00</th>
<th>1.50</th>
<th>3.00</th>
<th>4.50</th>
<th>6.00</th>
</tr>
</thead>
</table>
Why to Trust Aberrometry with Posterior Astigmatism

- Posterior K Astigmatism
  Its better to measure than estimate
  ~20% of patients don’t have ATR on the posterior cornea


When to Trust Aberrometry

Posterior K Astigmatism

Femtosecond Precise Capsulotomy

Photodisruption or Fragmentation

- Perfect centration
- Precision diameter: < ± 0.25 mm
- No radial tears
- Easy and complete removal of capsule
- No adverse events


The reduction in ultrasound/Phaco energy used during Laser Refractive Cataract Surgery may result in less inflammatory response and preservation of endothelial cells. CCT was significantly lower (p<.05) compared to the control group at 1 day PO.

**Results - Laser Fragmentation**

**Effective Lens Position with Premium Lens**

Three Month Variability in Effective Lens Position (ELPo)

<table>
<thead>
<tr>
<th>LensX (n=31)</th>
<th>Manual (n=30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.72</td>
<td>0.8</td>
</tr>
<tr>
<td>0.74</td>
<td>0.82</td>
</tr>
<tr>
<td>0.76</td>
<td>0.84</td>
</tr>
<tr>
<td>0.78</td>
<td></td>
</tr>
</tbody>
</table>

**Goals**

- Minimize other pathology
- Patient goal/desire
- Psychology of ReLACS

**Refractive Outcomes (ReLACS)**

A. Pre- and intraoperative tools
B. ReLACS- Laser CEX

C. Lens technology
   - AK'S/LRI's w/wo Femto
   - Toric IOLs
   - MFDIOLs
   - Calhoun LAL
   - Symphony

**Refractive Outcomes (ReLACS)**

A. Pre- and intraoperative tools
B. ReLACS- Laser CEX

C. Lens technology
   - AK'S/LRI's w/wo Femto

Up to 95% of eyes have some measurable astigmatism.
Astigmatic Keratotomy vs. Limbal Relaxing Incision

**AK**
- Central = bigger effect
- 1:1

**LRI**
- Peripheral = less effect
- Hyperopic Shift

Femtosecond Laser AK’s

**Manual AKs/LRIs**
- Correct 2D Astigmatism
- Based on Pre or Intra or Post op Measurement
- Variability in Depth and Arc Length
- Higher risk of perforation

**Femto AKs**
- Correct 2D Astigmatism
- Based on Pre or Intra Measurement
- Precise Depth, Axis and Arc Length
- Intrastromal Option (Then open>> effect)
- Nomogram

Toric IOLs

http://eyewiki.aao.org/Toric_IOLs

Toric IOL Misalignment

<table>
<thead>
<tr>
<th>Misalignment</th>
<th>% Loss</th>
<th>T3 (1.03D)</th>
<th>T9 (4.11D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0deg</td>
<td>0%</td>
<td>0D</td>
<td>0D</td>
</tr>
<tr>
<td>5deg</td>
<td>17.5%</td>
<td>0.18D</td>
<td>0.71D</td>
</tr>
<tr>
<td>10deg</td>
<td>35%</td>
<td>0.36D</td>
<td>1.41D</td>
</tr>
<tr>
<td>15deg</td>
<td>50%</td>
<td>0.51D</td>
<td>2.05</td>
</tr>
<tr>
<td>30deg</td>
<td>100%</td>
<td>1.03D</td>
<td>4.11D</td>
</tr>
</tbody>
</table>

Toric Misalignment of T9

0°  5°  10°  15°

Causes of Residual Astigmatism

- **Wrong Location**
  - Poor Measurements
  - Poor Calculations
  - Surprising SIA
  - Posterior Ks
  - IOL Rotated
  - Poor IOL Placement

- **Wrong Lens**
  - Poor Measurements
  - Poor Calculations
  - Surprising SIA
  - Posterior Ks

- **Wrong Eye**
  - Ocular Surface Disease
  - AMD
  - Irregular Astigmatism

Treat Disease
Multifocal Implants

- Advantage: Focus light rays and distance, near, and intermediate simultaneously
- Diffraction: Bending of light around corners, MFIOL uses concentric circles to bend to multiple foci.
- Disadvantage: Night time glare and halos (simultaneous vision)
- Advances in optics to minimize night time vision problems...

Tecnis Multifocal

Anterior aspheric wavefronts, less spherical aberration

Step heights decrease peripherally

Clinical Outcomes Following Implantation of Diffractive Multifocal Intraocular Lenses With Varying Add Powers

More than 90% of Tecnis Multifocal +2.75D patients report no difficulty with night vision.

LONG-TERM SUSTAINABILITY

- High patient satisfaction
- PERCENT OF PATIENTS WHO WOULD ELECT TO HAVE THE SAME IOL AGAIN

Enhanced Functionality

- DEGREE OF DIFFICULTY WITH NIGHT VISION
- DEGREE OF DIFFICULTY WITH HALOS/FLARES

WARNINGS:

Contrast sensitivity is reduced with a multifocal lens compared to a monofocal lens. Therefore, patients with multifocal lenses should exercise caution when driving at night or in poor visibility conditions. See Important Safety Information continued on page 38-39.
AcrySof IQ ReSTOR

ReSTOR intraocular lens implantation in cataract surgery: Quality of vision
Patrick J. E. Chan, MBBS(Ophth.), Joe H. Chan, MBBS(Ophth.), Rajesh K. Aggarwal, MBBS(Ophth.), John K. K. W. Leung, MBBS(Ophth.)

PURPOSE: To compare the visual outcome and subjective visual symptoms in patients who had implantation of the AcrySof ReSTOR multifocal intracocular lens (IOL) (Alcon Laboratories) with those in patients who received the AcrySof Stabilized monofocal IOL (Alcon Laboratories) in cataract surgery.

RESULTS: There was no significant difference in the mean uncorrected and best corrected distance visual acuities between the groups. An uncorrected distance visual acuity of 20/30 or better was achieved in 83.7% in the multifocal group and 82.5% in the monofocal group and 82/200 or better in 52.9% and 49.9%, respectively (P = .38). Uncorrected near visual acuities was 20/30 or better in 74.6% of eyes in the multifocal group and 78.3% in the monofocal group. Reading glasses were required by 29.3% in the multifocal group and by 27.3% in the monofocal group. Satisfaction was scored.

CONCLUSIONS: The AcrySof ReSTOR IOL provided predictably good uncorrected distance and uncorrected near acuities. Spectacle independence was significantly higher with this multifocal IOL, which outweighed the psychic symptoms it caused.

#Nidek OPD Scan

Two New/Coming IOL Options

AMO Symphony EDOF

- 96% of patients were UCVA 20/25 or > at intermediate
- 92% of patients were UCVA 20/40 or > at near

AMO Symphony EDOF
**Calhoun LAL—What’s Special?**

- regular silicone polymers
- mobile, silicone subunits, called **macromers**
- photosensitive

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**Adding Power to the LAL**

- **Iris**
- Increased power
- **“Lock-in”**
- => change in radii of curvature => change in power

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**The LAL – FDA Clinical Trials**

- **Accuracy**
- No patient seeing less than 20/20 uncorrected

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**Choose the Right Foot**

- ...and attached patient

**Choose the Right Shoe**

- Put it on correctly

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**Polish It**
Relax with ReLACS

#TrendingNow

**Refractive Outcomes (ReLACS)**
- Pre- and intraoperative tools
- ReLACs- Laser CEX
- Lens technology

**Easing Pain Points**
- IV Free CEX
- Less Drops/Dropless CEX

Challenges/Pain Points in Cataract Surgery

<table>
<thead>
<tr>
<th>Patients</th>
<th>Surgeons &amp; Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Drops</td>
<td>• Paperwork</td>
</tr>
<tr>
<td>• IVs</td>
<td>• Drops</td>
</tr>
<tr>
<td>• Outcomes</td>
<td>• IVs</td>
</tr>
<tr>
<td>• Recovery time</td>
<td>• Costs</td>
</tr>
<tr>
<td>• Others</td>
<td>• Turnover</td>
</tr>
</tbody>
</table>

**IV Free™ Conscious Sedation Compounded Formulation***

- MKO Melt™
  - 3mg of Midazolam
  - 25mg of Ketamine HCl
  - 2mg Ondansetron
  - Compounded Lemon Flavor Sublingual Melt for Administration

- Single-use prescription
- *Compounded by a pharmacist pursuant to an individual patient. May be customized.

**Genesis of the Meltaway**

- Started using Sublingual Versed 3 years ago
  - Liquid under tongue
  - Fast On/Off
  - Sliding Dosing Scale
  - Patients didn’t Startle
  - Patients loved not getting IVs
  - Staff loved not starting IVs
- Heard surgeons like IV Ketamine
  - Analgesic
  - Anxiolytic
  - Ketamine Star—mesmerized
  - Mild euphoria — daze-free
  - Safe

**Administration**

- 1-2 MKO Melts™ administered under the tongue
  - Dosing determination made by anesthetist/anesthesiologist
    - Based primarily on age, secondarily on weight, and alcohol/benadryl/apap use of patient
  - Takes approximately 2-5 minutes to dissolve
    - Patients have reported feeling effects within 1-2 minutes
  - Lemon flavored – slightly bitter
  - We currently use in 99% of cataract surgeries in our practice
MKO Experience

<table>
<thead>
<tr>
<th>Total Surveyed</th>
<th>Preferred MKO Melt</th>
<th>Preferred IV</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>18</td>
<td>6</td>
<td>75%</td>
</tr>
</tbody>
</table>

Patients surveyed had cataract surgery in one eye with topical anesthesia and the second eye using the sublingual MKO troche for conscious sedation.

Preferred MKO Melt:
1. Patients surveyed preferred the troche because it is non-invasive, and/or do not like IV
2. Patients surveyed preferred the troche because they did not feel as tired post surgery
3. Patients surveyed preferred the troche because it was equal to having of IV
4. Patients surveyed preferred the troche because they felt less pain and painless of IV

Preferred IV:
1. Patients surveyed preferred IV because they indicated they were too tired post operatively
2. Patients surveyed preferred IV because taste of the troche was not pleasant

Bill Wiley, MD – Practice Evaluation*

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*12 performed by Dr. Wiley and 12 performed by Dr. Bafna

#TrendingNow

Refractive Outcomes (ReLACS)

A. Pre- and Intraoperative tools
B. ReLACS- Laser CEX
C. Lens technology

Easing Pain Points

A. IV Free CEX
B. Less Drops/Dropless CEX
C. Intravitreal injections

Ocular Therapeutix- Steroid Punctal Plug Trial

**Purpose:** To evaluate pain and inflammation after cataract surgery in patients who received a dexamethasone punctal plug in place of topical steroids.

**Methods:**
1. multi-centered, randomized (Placebo vs. punctal plug), double masked, phase 3 FDA clinical trial.
2. Dissolvable plug with 0.4mg of dexamethasone.
3. 240 patients, 6 follow-up visits.
4. At any point in the study patients may be prescribed “Rescue” anti-inflammatory medications, mainly steroids.

**Results: from Ocular Therapeutix Stage 2 FDA trial**

1. Absence or no anterior chamber cell at day 14: Plug Group 34.5% vs. 3.4% in the placebo group
2. Absence or no anterior chamber cell at day 30: Plug Group 62.1% in the plug group vs. 13.8% for placebo

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Ocular Therapeutix- Steroid Punctal Plug Trial

- Results: from Ocular Therapeutix Stage 2 FDA trial
  1) Dexamethasone plug retention rate @ day 30: 97%
  2) Percent of patients needing rescue steroid at day 14:
     20% in the plug group vs. 72% in the placebo group.

Introducing TriMoxi and Drop a Day Cataract Surgery (DAD)

**WHAT?**

- Drop a Day "DAD" - is an injection of an antibiotic & steroid combination in the eye at the time of surgery.

**Preparation:**
1. triamcinolone
2. moxifloxacin

**Where?**

- Pars plana injection into the vitreous cavity.
- Medicine is injected after the IOL placement.
- Patients are still under anesthesia so it is mostly painless.

**What?** The doctor can expect

- View of the injected medication 2 hours after injection.
Benefits of TriMoxi and DAD- #3C’s

- **Compliance**
- **Convenience**
- **Cost**

**Endophthalmitis Rates**

- Archives of Ophthalmology: 1960-2000 the rate of Endophthalmitis was 0.128%.
- This same review showed a large increase in cases from 2000-2003, rate of 0.265%.

**Safety?**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate of Endophthalmitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>A - No antibiotic</td>
<td>0.23%</td>
</tr>
<tr>
<td>B - Intracameral cefuroxime</td>
<td>0.05%</td>
</tr>
<tr>
<td>C - Topical levofloxacin</td>
<td>0.17%</td>
</tr>
<tr>
<td>D - Intracameral &amp; topical</td>
<td>0.03%</td>
</tr>
</tbody>
</table>

**Why? Kaiser Study**

- 22 (2100%) fold decrease in endophthalmitis from 2007-2011.

Take Home Point

1. This study showed a 5-fold decrease in endophthalmitis with intracameral cefuroxime.

Convenience

- 128 drops
- 30 drops
- 98 fewer drops
**Cost**

<table>
<thead>
<tr>
<th>Drops</th>
<th>TriMoxi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vigamox - $161 @ ShopKo</td>
<td>• Tri-Moxi - $25</td>
</tr>
<tr>
<td>Pred - $64 @ Walgreens</td>
<td>• No cost to patient</td>
</tr>
<tr>
<td>Ilevro - $232 @ ShopKo</td>
<td>• Ilevro - $232 @ ShopKo</td>
</tr>
<tr>
<td><strong>Total = $457</strong></td>
<td><strong>Total = $232</strong></td>
</tr>
</tbody>
</table>

\[\text{Cost} = 457 - 232 = 295\]

**Hurdles Moving Forward**

**Hurdles and or Reservations**
1. Off-Label
2. Compounding Pharmacy
3. TASS
4. Steroid Responders.

**Promising Attributes**
1. Better compliance
2. Less patient aggravation/time
3. Less corneal toxicity
4. Sting from drops eliminated
5. Better Safety - AAO preferred guidelines. Antibiotics above suprathreshold levels
6. Cost
   1. Cost to patient - 75.00
   2. Cost to insurance companies

**Concerns with DAD/TriMoxi**
1. Cystoid Macular Edema
2. Steroid response/ IOP spikes
3. HORV
4. Overall experience

**Why? Drop a Day vs. Dropless**

- AAO Systematic Review: Prevention of Inflammation and Macular Edema
  - Steroids vs. Nonsteroidal Anti-inflammatory Eye Drops post CEX.
  - 7 randomized clinical trials were reviewed.

\[25.3\% \text{ vs. } 3.8\%\]

<table>
<thead>
<tr>
<th>Steroids alone</th>
<th>NSAIDs alone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rates of P. O. CME</td>
<td></td>
</tr>
</tbody>
</table>

**Concerns with DAD/TriMoxi**

1. Cystoid Macular Edema
   - This study measured macular thickness in both arms at both 1 week and 1 month post-op
   - No statistically significant difference in macular thickness

Concerns with DAD/TriMoxi

1. Cystoid Macular Edema
2. Steroid response/ IOP spikes
3. HORV


Conclusion?

1. What is the Standard of Care?
   - According to ESCRS 75%
   - 2014 ASCRS Endophthalmitis survey: 47% current or 6 months

2. AAO – 2011, 1.82 million CEX in Medicare population
   - Cost to Medicare in post-op ABX ($75.00) alone was $136 million
   - Thomas Kuhn’s 1962 Text “The Structure of Scientific Revolutions”
   - Rest Easy

THANK YOU

QUESTIONS?