

Refractive Cataract Surgery: What You Need to Know Now

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Excellence in Optometric Education

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Cataract Surgery in The Future

- Only guarantees in life are death & taxes....
 - Add Presbyopia & Cataracts
- Boomers fight aging and create an enormous unmet need
- “Holy Grail” is a presbyopic solution
- Options now include glasses, monovision CL, multifocal CL, monovision IOLs, multifocal IOLs, Accommodating IOLs, other surgeries and lifestyle treatments
- Bottom line: No perfect solution yet
- Challenge is to develop rewarding opportunities providing continuous vision

Cataract Surgery in The Future

- Growth in cataract cases is expected to increase to 38.5million by 2050
- Women comprise majority of cases today
- Caucasians comprise majority of cataracts but Hispanics will take lead by the 2040's as the amount of Caucasians decreases by this time

Cataract Surgery in The Future

- Clear corneal incisions are becoming more standard
 - Femto can create any variety of wound construction
- Faster healing, self sealing in majority
 - Imperative to prevent leaks as infection risk increases
 - Suture necessary in wounds of questionable integrity
- Sutures may create issues
 - Create astigmatism
 - Potential for Infection
 - Longer OR time
 - FBS

Resure Sealant / Ocular Therapeutix, Bedford

- Polyethylene glycol (PEG) and trilysine
- Buffering salts, 89% water, reconstituted in minutes
- Paint sealant onto wounds, without FBS
- Tinted with FD&C Blue no 1 to assist in placement
- Color dissipates quickly
- Glue sloughs off with blinking
- Best use is when surgery time is longer or more instruments are used, stretching incision
 - Tamlostin, dense cataracts, RA, DM

New Drug Delivery Devices for Cataract Pts

- OTX-DP / Ocular Therapeutix (Bedford Mass)
 - Tear duct implant to dispense automatically dexamethasone
 - One month duration
- Tri-Mox, Tri-Mox-Vanc / Imprimis Pharm (SanDiego)
 - Delivers a compounded mix of drugs trans-zonularly remains in the eye for a week
 - “drop-less” cataract surgery
 - Pharmaceuticals that do not mix are solubilized and micronized into uniform suspension optimized for isotonicity and pH for ophthalmic use

Cataract Implants of The Future

- Biconvex optic of 9mm, injectable copolymer
- Accommodative
- 1 piece design
- Wavefront adjustable
- Power customizable
- Photochromic
- Surface modified or drug impregnated
- Implantable through a 1mm incision

5 C's For Optimal Cataract Outcomes

- Cylinder plan - PRK, LASIK, LRIs, on axis incisions
- Corneal surface – address dry eye
- Capsule clear
- Cystoid macular edema – avoid it
- Centering implants
- All of the above become more important with premium channel IOLs

Reasons for Unhappy Patients After Cataract Surgery

- Residual refractive error
- Dry Eye
- Improper expectations
- Personality (+/-)

Immediately Sequential Bilateral Cataract Surgery (ISBCS)

- Paradigm changing as surgery gets safer
- 2/3rds schedule fellow eye surgery at 1-2 weeks post op
- Reasons to Consider – transportation issues, infirmity, terminal illness, anxiety, finances to patients & tax payer funded Medicare system
- Reasons for Concerns – bilateral endophthalmitis, bilateral TASS, monetary concern with reimbursement, refractive outcomes

Phenylephrine 1% & Ketorolac 0.3% Injection (Omeros Corp)

- Single use 4 ml
- Add to irrigation solution prior to intraocular use
- FDA indication:
 - maintain pupil size intraoperatively,
 - prevent intraoperative miosis,
 - reduces post operative pain for 10-12 hours
- Cautions – increases blood pressure in some, sensitivity to NSAIDs, asthma
- Available as OMIDRIA

Cataract Surgery “with a Laser”

FLACS

- Femtosecond laser assisted cataract surgery is here
- Fast accurate capsulorhexis
- Programmed primary incision
- Lens fragmentation/softening of nucleus
- Limbal relaxing incisions for astigmatism
- Benefits – accuracy, bladeless, all skill levels perform better surgery
- Problems – slower operation, multi step process, not covered, difficulty in up-charging Medicare patients
- “Million dollar mousetrap” ?

Cataract Surgery “with a Laser”

FLACS

- Femtosecond laser may be cataract surgery of the future
- Eliminates the need for phacoemulsification in some
 - Improvements will make softening the lens easier
- Phacoemulsification will die off and a pure fluidics procedure will replace it
- Economics of the model is the difficult part currently
 - CMS will not pay any extra for FLACS
 - CMS will not allow patients to be “upcharged” for cataract surgery
 - Will allow upcharge for anything peripheral to cataract surgery like astigmatic keratectomy
- Technology always wins

Cataract Surgery “with a Laser”

FLACS

- Adding cost to patients is an issue
- While Femto laser can address astigmatism, so can toric IOLs for less cost
- Slows down procedure by 5-10 minutes
- Click fees may need to be replaced by lease programs
- Better technology should be more efficient and cost less
- Surgeons using ORA / Alcon or Calisto / Zeiss claim results as good with standard techniques
- Other emerging technologies like the Mynosys /Freemont CA have developed a disposable nano-pulsed handpiece to automate circular capsulotomy

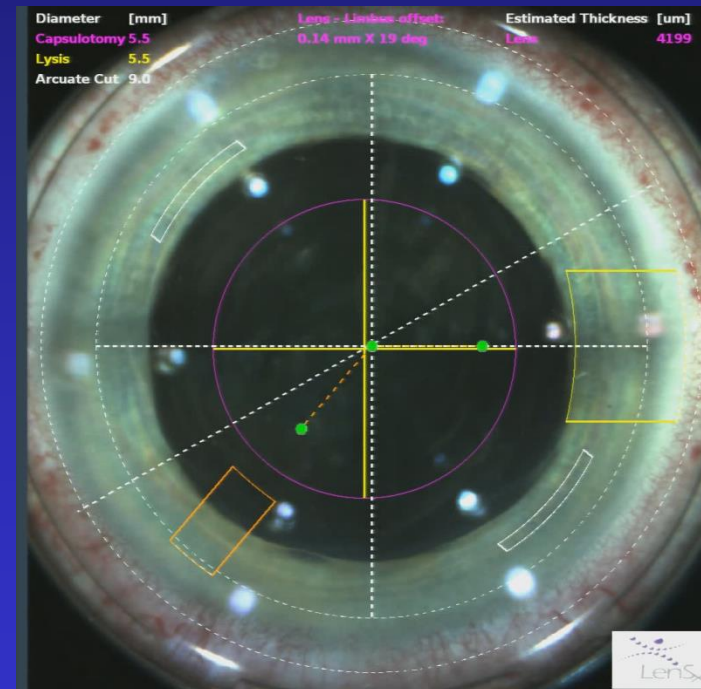
Femto-Laser Assisted Cataract Surgery

- LenSx (Alcon) with Verion Image Guided
- LensAR (LensAR, Inc) - allow customized fragmentation
- Catalys (OptiMedica/Abbott)
- iFS (Abbott Medical Optics)
- Victus (B&L) – with swept source OCT
- FemtoLDV Z8 (Zeimer) – universal use for all refractive and cataract procedures without repositioning
 - 1000 times less energy/pulse & 1000 faster
- Systems include videomicroscopy, real-time integrated OCT, deliver ultrashort near infrared wavelength pulses
- Costs - \$300,000 - \$500,000 plus maintenance

LenSx[®] Laser Arcuate Incisions

Image-guided surgical planning with 3D visualization

- Real time corneal thickness
- Computer programmed incisions
 - % depth
 - incision length and position
 - 3D visualization of incision placement
- Predictable incision width, tunnel length
- Titratable incisions
 - adjustable during surgical procedure
 - adjustable post-op at slit lamp



New Era in Cataract Surgery

- Optimization – continuous improvement of a technique or technology
- More accurate incision, capsulotomy, and astigmatic correction, better placement of IOL, more accurate vision outcomes
- Reduced energy, less wound leak, less endothelium trauma, less capsule tear, fully exploit potential of multifocal IOLs
- If less dependence on glasses is the goal, femto is best
- Keep new technology in proper perspective
 - Traditional is very effective and successful

New Monofocal IOLs for Cataract Surgery

■ enVista IOL – B&L

- No glistenings
- Hardened surface resistant to scratching
- Aspheric and aberration free optic
- Uniformity of optic allows better vision if slight decentration and less distortions and dysphotopsia
- Excellent premium channel choice but monofocal

New Monofocal IOLs for Cataract Surgery

■ CrystaLens AO – B&L

- Accomodating IOL – excellent distance and intermediate
 - May need light near Rx vs overcorrect non-dominant eye (-0.50D)
- Monofocal optic – visual side effects are far less than MFIOLs
- Can be used in a broader range of patients
 - Ideal patients are low to moderate hyperopes
- Aspheric and aberration free optic
- Uniformity of optic allows better vision if slight decentration and less distortions and dysphotopsia
- Excellent premium channel choice
- No aberrations like coma or contrast sensitivity loss as with MFIOLs
- Good choice for post refractive LASIK/PRK/RK

New Monofocal IOLs for Cataract Surgery

■ TRULIGN toric IOL – B&L

- Accomodating IOL – excellent distance and intermediate
 - May need light near Rx vs overcorrect non-dominant eye (-0.50D)
- Monofocal optic – visual side effects are far less than MFIOLs
- Can be used in a broader range of patients; 1.25D, 2D, 2.75D
 - Ideal patients are low to moderate hyperopes
- Aspheric and aberration free optic
- Uniformity of optic allows better vision if slight decentration and less distortions and dysphotopsia
- Excellent premium channel choice
- No aberrations like coma or contrast sensitivity loss as with MFIOLs
- Good choice for post refractive LASIK/PRK/RK

Today's Options For Better or Worse

■ Standard Monovision

- Great quality of vision at expense of binocularity, fusion and tolerance (30% cannot tolerate)

■ Multifocal IOLs

- Asphericity & spherical aberrations increase depth of focus at expense of contrast sensitivity and quality of vision
- Intermediate vision not good enough for spectacle independence
- Glare and halos

■ Inlays

- Dryness related to LASIK flap
- Noticeable at close range

Astigmatic Options in Cataract Surgery

- What amount of astigmatism has impact on vision quality?
 - ASCRS Survey 2014
 - 30% OMDs responded 10degrees or less is not significant
 - Each degree of rotation lose 3%
 - 5% of toric IOLs in US are 90degrees off axis
 - Confusion between flat & steep axis
 - Poor markings preoperatively, parallax etc
 - 37% don't mark before surgery
 - 15 degree cyclorotation results in 50% reduction in astigmatic correction
 - 5-10 degree cyclorotation is COMMON when patients move from standing/sitting to supine (must mark upright!)

Astigmatic Options in Cataract Surgery

- On Axis Incisions – average 0.50D flattening
- Limbal relaxing incisions (LRIs)
 - up to 1D
 - Induces Dry eye, issues in ABMD
 - Will die off with intrastromal femto ablations
 - No dry eye, no wound gape, more predictable, up to 0.75Dp
- Laser vision correction
- Toric IOLs - Most effective way to enter “refractive cataract surgery”
 - Best for >1.25D

Astigmatic Options in Cataract Surgery

- What amount of astigmatism has impact on vision quality?
 - ASCRS Survey 2014
 - 33% OMDs answer $>.075D$ of cylinder has no effect on vision
 - Studies show $<0.50D$ of cylinder equal extremely satisfied patient outcomes
 - Only 15% of cataract surgery patients are treated for astigmatism during cataract surgery
- Pearl – must have plan for managing astigmatism if placing premium IOLs or patient satisfaction drops

Astigmatic Options in Cataract Surgery

■ Technis Toric IOL

- Highest negative spherical aberration
- Lowest chromatic aberration
- No glistenings
- No photopsias

Do Patients Like Presbyopia Correcting IOLs?

“....with presbyopia IOLs, specifically Multifocal IOLs, patients are by far the happiest patients & the most unhappy patients I have in the practice”

Eric Donnenfeld, MD

Do Patients Like Presbyopia Correcting IOLs?

- ASCRS Survey 2014
- Patient Satisfaction graded on scale from 1-10
 - Quality of Near Vision 7.2
 - Quality of Intermediate Vision 6.2
 - Quality of Distance Vision 8.3

Cataract Surgery Options for Presbyopia

- Monovision IOLs – 18% in US
- Accommodating IOLs
 - Good quality distance vision (monofocal optic)
 - Less glare / halo
 - Less reading function
 - No loss of contrast sensitivity
- Accommodating IOLs with defocus
 - Intentionally set non-dominant eye for -0.50 to -0.75D

Cataract Surgery Options for Presbyopia

■ Multifocal IOLs

- Truly a “bifocal” with distance and near correction
- Intermediate not in focus
- Require good lighting
- More affected by ocular surface disease
- Glare & halo at night

■ Mix & Match Techniques

- Restor in on eye and Rezoom in the other
- CrystaLens in dominant eye and multifocal IOL in non-dominant eye

Technis MF IOLs / Abbott Medical, IL

- Quality of vision advantage over other earlier MF IOLs
- Better in multiple lighting conditions
- Lower incidence of glare and halos
- Reduced chromatic aberration
- Wavefront designed aspheric surface corrects for spherical aberration to zero
- Material not associated with glistenings
- Includes a UV blocker and glare reducing design
- 98% function at distance and intermediate without glasses, 97% would implant it again

Technis MF IOLs / Abbott Medical, IL

- Available now in 3 platforms to customize according to patients needs
- Technis MF IOL +2.75D
 - Best for intermediate vision needs, and has 97% satisfaction
- Technis MF IOL +3.25D
 - Best for longer reading distances
- Technis MF IOL + 4.0D
 - Best for those requiring near vision, reading, sewing
- Offers opportunity to mix these for unique customization
- Our plan is +4.0D in non-dominant eye and +2.75D in dominant eye

Emerging Surgery Options for Presbyopia

■ Extended Depth of Focus IOLs

- Redistribute light rays to extend single focus in monofocal IOL to a range of foci
- Create spherical aberration that increases depth of focus
- Extension of multifocality with compensation of chromatic aberration to offset loss of contrast sensitivity
- One focal point spread over 2D+ range
- Can exploit “micromonovision” by being off 0.50D and be within 2D range so still keep 20/20 but read well
- Clinical trials demonstrate 98% patient satisfaction

■ Coming soon TechnisSymphony/AMO, Mplus/Oculentis, MiniWell/SifiMedtech, IC-8IOL/AcuFocus

Technis Symphony / Abbott Medical, IL

- Extended Depth of Focus IOL about 1 year away from FDA approval
- Unilateral or bilateral, with or without astigmatism
- One piece acrylic design same as TechnisMF
- Diffractive echelette but ONE image on retina not 2 like other MFIOLs
- No glare or halo (similar numbers to monofocal IOLs)
- 20/25 @near 46%, @intermediate 91%, @distance 95%
- 20/40 @near 88%, @intermediate 99%, @distance 99%

Trifocal IOLs are Coming Soon

- Trifocal IOLs combine 2 different diffractive profiles to improve vision across all spectrums
- Distance is as good as Multifocal IOLs
- Intermediate vision is significantly BETTER
- Near reading vision is worse than multifocal IOLs
- Perform better than extended depth of focus IOLs, Multifocal IOLs in general performance
- Less higher order aberrations, less loss of defocused light so less glare and less reduced contrast sensitivity
- AcrySof IQ PanOptix (Alcon), FineVision Trifocal(PhysIOL), AT LISA Trifocal (CarlZeissMeditec)

Tomorrow's Best IOLs

■ Calhoun Vision, Inc.

- Next generation “*adjustable*” material, unique, unstable, silicone, foldable
 - Cross-linked silicone polymer matrix - Mechanical and optical properties
 - Macromer - Low molecular weight links to photoreactive group
 - Photoinitiator - Organic molecule dissociates into free radicals, begins polymerization on exposure to special wavelengths, moving macromer down diffusion gradient into radiation area thickening the lens

LAL - IOLs

- 2 weeks post-operative UV protection required
- Adjust refractive error at 2 week post-op
 - Uses 380nm exposure of light at slit lamp system
- Next perform lock-in
 - Pink tint is commonly reported 1-2 days post lock-in
- Not cleared in US but Canada, Europe etc

Accommodating IOLs

- Sapphire AutoFocus IOL (Elenza, Roanoke VA)
 - Electro-optic diffractive IOL - Monofocal IOL with central aspheric modification
 - Far & intermediate vision
 - Smart electro active diffractive liquid crystal
 - Near
 - Microsensors detect physiologic triggers of accommodation, pupil size change and illumination decrease
 - Onboard processors & algorithms to control power sequence by altering index of refraction of the material
 - Lithium ion power cells – weekly charge

Accommodating IOLs

- AkkoLens (AKKOLens International)
 - Sulcus implants
 - 2 lenses moving perpendicular to optical axis with ciliary body movement
 - Move in opposite directions
 - Lenses have variable curvatures to increase accommodative power up to 6D
- Nulens (Nulens LTD, Israel)
 - Sulcus implant
 - Counterintuitive mechanism

Accommodating IOLs

- Fluid-Vision Lens (Power Vision, Belmont CA)
 - Annular 3-D haptics communicate with center optic
 - All filled with silicone oil
 - Oil moves in and out of optic changing its power
 - Optic outer shell is proprietary hydrophobic acrylic
 - Inside is index matched silicone oil so no interface optical issues
 - Minimum of 2-2.5D accommodation, 3-5D average (35yr old)
- Triplet – sandwich of 2 convex lenses and a concave lens in the middle: produces up to 6 D accommodation
 - Different materials and different index of refraction
 - Compression by ciliary body of 1um = 1D accommodation

Implantable Miniature Telescope

- Indicated in advanced AMD
 - 75 years of age, no previous cataract surgery in one eye
 - Adequate Endothelial cell counts and Anterior chamber depth
- FDA & CMS approved
- Wide angle micro-optics in combination with cornea create telephoto system
- Galilean design
- 2.2-2.7X enlargement of retinal image
- 3.6mm diameter, 4.4mm length (size of pea)

Thank you

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