Advances in Cataract Surgery

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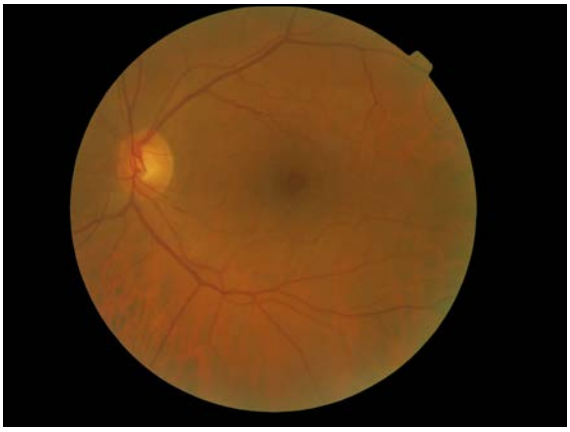
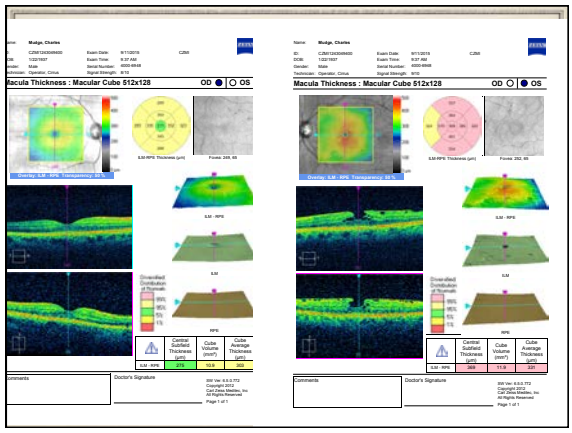
Advances in cataract surgery

- iTeam solicitation.
- The Great Masqueraders
- Advances in Cataract surgery
- What is a FemtoSecond Laser? Why use it in cataract surgery?
- MEC approach to elective enhancements in cataract surgery.

The Masquerades

- 72 y/o male BSCVA 20/30-
- SLE: 1-2+ NS Trace peripheral cortical change

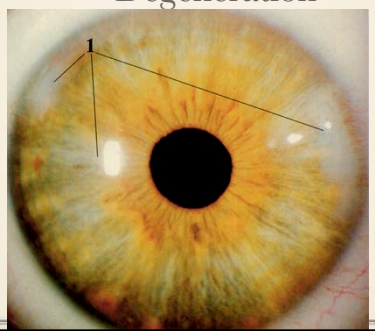




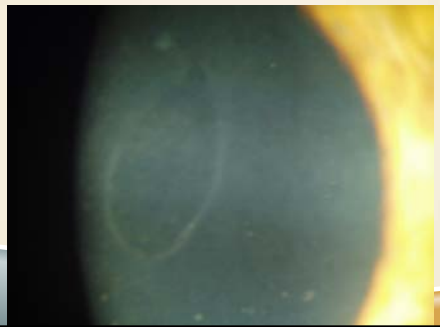
Pre-operative Evaluation: Eye considerations

- Map Dot Fingerprint / Salzmann's
  - Superficial Keratectomy first or combined
  - Consider using K's from other eye

Salzmann's Nodular Degeneration



Pre-operative Evaluation: Map Dot Fingerprint Dystrophy

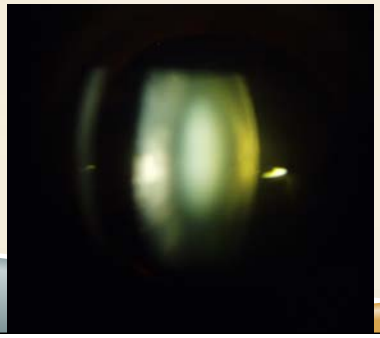


Map Dot Fingerprint Dystrophy

"Fetal Nuclear Sclerosis"

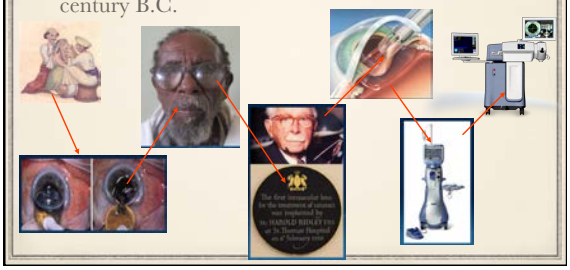
- Center of the lens is sclerosed / harder / more optically dense
- Anatomical "fetal" NOT congenital
- Monocular Diplopia and significant myopia
- Best seen with retinascope or direct ophthalmoscope
- Tends to be in younger patients: 30's & 40's

Fetal Nuclear Sclerosis:



History of Cataract Surgery

- Cataract surgery is one of the oldest surgical procedures performed dating back to the 5th century B.C.



Evolving Techniques in Cataract Surgery

- White cataract
- Small pupil / Floppy Iris
- Loose zonules / capsular dehiscence
- Intraoperative Pharmacology

White Cataract

- Risk:
  - Can't see with liquefied cortex cloud
  - Hydrated lens under pressure: tends to split capsule peripherally
- Treatment:
  - Stain with Trypan Blue
  - Aspirate some of the liquified cortex to depressurize lens

Small Pupils / Floppy Iris

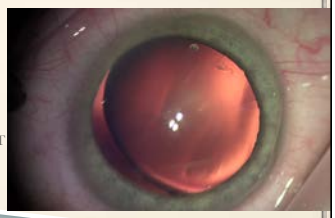
- Risk:
  - Can't see what your doing
  - Intraoperative Floppy Iris Syndrome (IFIS)
- Treatment:
  - Pharmacological: Epi-Shugarcaine
  - Malyugin rings or Iris hooks

Loose Zonules

- Risk:
  - Working on a floppy lens
  - Risk of vitreous prolapse during or after the case
  - Dehiscence of bag during or after the case
- Treatment:
  - Capsular tension rings with or without sutures
  - Ring segments with sutures

Case 12: Marfan's that won't go Away

- 56 y/o subluxed lenses
  - H/O lasik elsewhere
  - Systemic w/u neg
- BSCVA 20/60 OD
  - 20/50 OS
- Discussed risks and benefits AT LENGTH encouraged second opinions
- What now?



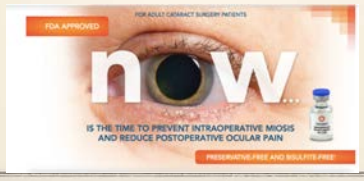
Cionni Capsular Tension Rings and Ahmed Ring Segment

Intraoperative Pharmacology

- Anesthesia:
  - Topical 2% lidocaine jelly
  - Intracameral
    - Shugarcaine: 4% preservative Lidocaine in BSS
    - Epi-Shugarcaine: Addition of Epinephrine for mydriasis or pupil stabilization for Flomax patient

Intraoperative Pharmacology

- Intraoperative Dilation: Omidria
  - Phenylephrine and ketorolac added to irrigating solution.



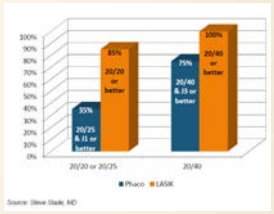
Intraoperative Pharmacology

- Post-operative antibiotic:
  - Intracameral: **Vancomycin**, Cefuroxime or Moxifloxicin
  - Intravitreal:
    - TriMoxi: Triamcinilone and Moxifloxicin
    - TriMoxiVanc: add Vancomycin
- Kenalog staining of vitreous for visualization.

TriMoxi post-zonular injection

Cataract Surgery is becoming more refractive

- More patients are wanting refractive surgery outcomes from cataract surgery
- Standard Cataract surgery is good, BUT does not have the same refractive results that LASIK provides



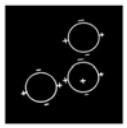
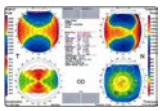
Why is Cataract Surgery less predictable when compared to LASIK?

- Lens implant formula depends on 4 key variables:
  1. Corneal Power (K readings)
     - 1 D error in K readings = 0.9 D refractive error
  2. Axial Length (A Scan)
     - 1mm error = 2.35 D refractive error
  3. Anterior Chamber Constant (A Constant)
  4. Effective Lens Position (ELP)

The Progression of K Readings

Keratometer | Orbscan II | IOL Master




The Progression of A Scan Technology



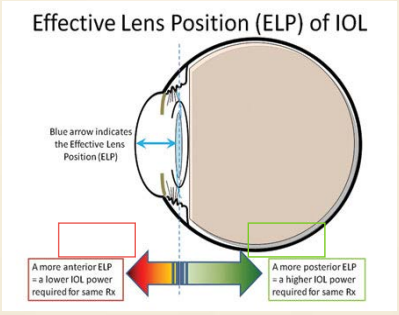
Applanation → Immersion → IOL Master (Optical)

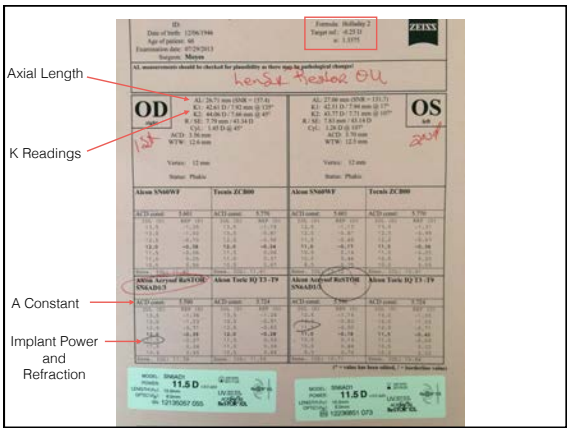
A Constant

- Provided by the manufacturer: Measured in a lab /optical bench before commercially available
- Lens Implant Dependent
- Surgeon Dependent: Can calculate surgeon specific A constant for particular lenses

Effective Lens Position

0.5 mm difference in position changes refraction by 1.0 diopter





What areas in Standard Cataract surgery can we try to improve on?

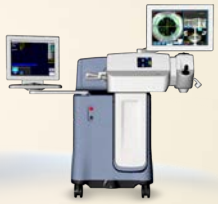
- **Astigmatism treatment**
  - Standard cataract surgery does not address astigmatism.
  - Corneal astigmatism of 1.00 D or more will limit best uncorrected visual acuity
- **Capsulorhexis**
  - manual capsulorhexis are not perfect
    - will induce lens tilt, decentration that will effect refractive outcome

What areas in Standard Cataract surgery can we try to improve on?

- **Effective Lens Position (ELP)**
  - cataract lens implant formulations attempt to estimate where the lens will rest
  - if the lens implant moves 0.5mm (forward or back) while healing the spectacle plane result will be off by 1.0 D from intended
  - a perfect capsulorhexis has been shown to produce a more consistent ELP thus allowing more predictable results
- **Cataract surgery with the LenSx laser improves these 3 concerns resulting in a better refractive outcome**

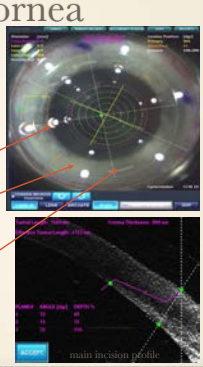
LenSx Laser System

- The LenSx laser system is a complete anterior segment cataract workstation
- Treats:
  - cornea
  - capsule
  - lens
- Used at MEC for premium cataract surgery and refractive lensectomy packages



LenSx: Cornea

- Real time OCT images cornea
- Overlay allows custom placement of:
  - main incision
  - side port
  - astigmatic keratectomies
    - reduces astigmatism by 50%
    - have corrected 3.0 D of cylinder



LenSx: Capsule

- Produces complete, reproducible capsulotomies with pristine edges
- Customize capsulorhexis size
- Identify anterior lens capsule with real time OCT

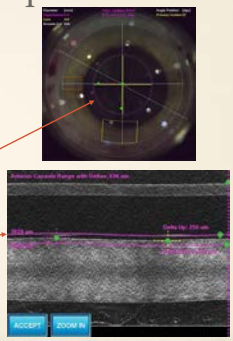
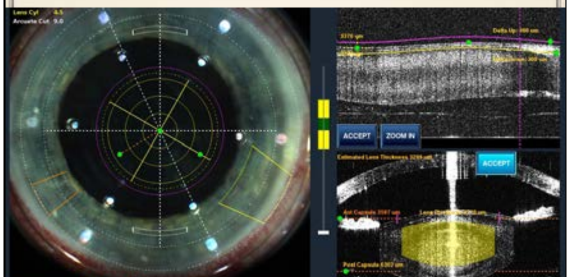


Image-Guided Refractive Cataract Surgery



Limitations of Traditional Phaco Cataract Surgery

Key Step	Current Surgery	Impact	Safety Impact
Corneal Incision	Not Optimized	Induced Cylinder	Infection
Capsulorhexis	Variable Sized, Not Centered	Variable IOL Position & Effective Lens Power	Capsular Tears, Posterior Capsule Opacification
Lens Fragmentation	Excessive Ultrasound Power	Delayed Visual Recovery	Loss of Endothelial Cells, Capsule Rupture

Effective Lens Position (ELP)

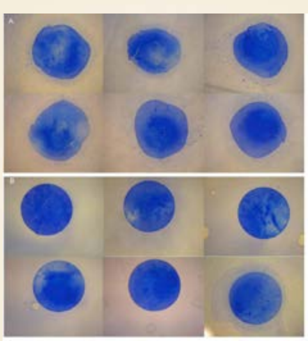
- "The key to highly accurate IOL power calculation is being able to correctly predict ELP for any given patient and IOL"[1]
- ELP is assumed value, from empirical data[2]
- Size of capsulorhexis effects ELP[3]
- Significant source of IOL power error and post surgery refraction[4]

1Haigis W, Lege B, Miller N, Schneider B, Comparison of immersion ultrasound biometry and partial coherence interferometry for IOL calculation according to Haigis, Graefes, Arch Clin Exp Ophthalmol, 2000;238:765-773.2Norrby S, Sources of error in intraocular lens power calculation,*J Cataract Refract Surg, 2008;34:368-376.*3Hill WE, Does the Capsulorrhexis Affect Refractive Outcomes? In Chang D, editor: *Cataract and Refractive Surgery Today*, 2009:78.4Cekic O, Batman C. The relationship between capsulorhexis size and anterior chamber

Intraocular **Lens Tilt and Decentration** Measured By Scheimpflug Camera Following Manual or Femtosecond Laser-created Continuous Circular Capsulotomy (CCC)

- Laser created CCC are accurate, round and reproducible with accurate diameters.
- Laser created CCC provides better circular overlap of the IOL optic by the anterior capsule and can maintain the correct position of the IOL.
- Horizontal and vertical tilt were significantly higher in the manual CCC group
- Lenses implanted after manual CCC showed greater horizontal and total decentration
- Corrected Distance Visual Acuity (CDVA) was significantly improved in the laser CCC group compared to the manual CCC group at 1 month and 1 year

Manual Capsulorhexis



LenSx Capsulorhexis

Figure 5. Excised and stained lens capsule samples from a manual capsulorhexis (A) and a laser capsulotomy (B).

J CATARACT REFRACT SURG - VOL 37, JULY 2011

1196 FEMTOSECOND LASER CAPSULOTOMY

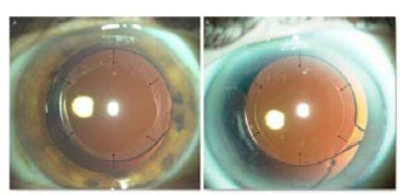
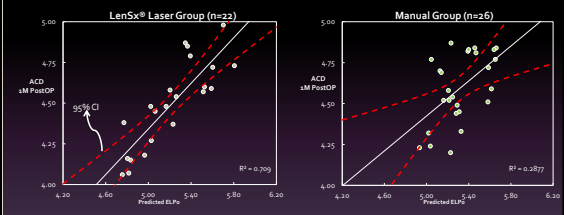


Figure 8. Slitlamp view of the edge of the capsule on the day after surgery for manual capsulorhexis (A) and laser capsulotomy (B).

Manual Capsulorhexis

LenSx Capsulorhexis

Actual ELP vs. Predicted ELP SN60WF

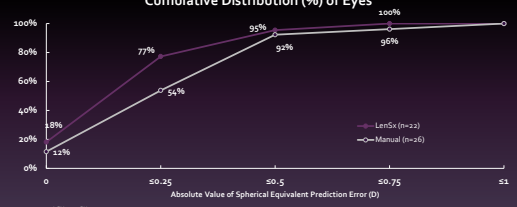


Better ELP Predictability

- **71%** of the variable's variance result for the LenSx® Laser group Vs. only **29%** for the manual group

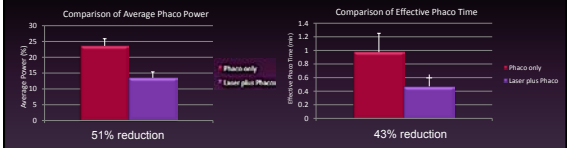
Prediction Error at 1M Post-OP

- *p-value* for ≤0.25D is 0.08 (Fisher's Exact Test)
- *p-value* for both groups is 0.169 (Mann-Whitney U-test)



LenSx® Laser Phacofragmentation

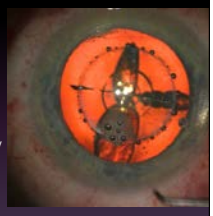
- Cylinder pattern, utilized for the softer lens, enables removal with I & A only, no phaco power
- Chop pattern efficiently fragments the lens for removal with reduced phaco power and time[1]



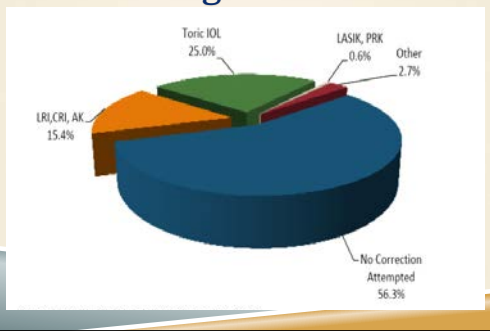
[1]Nagy ZZ, Takacs A, Filkorn T, Sarayba M, Initial Clinical Evaluation of an Intraocular Femtosecond Laser in Cataract Surgery, *Journal of Refractive Surgery*, 2009;25:1053-1060.

LenSx® Laser Lens Treatment

- The lens fragmentation pattern moves with the incision if incision is rotated
- Facilitates cracking with pre-chopper
- Allows easier disassembly following the laser treatment



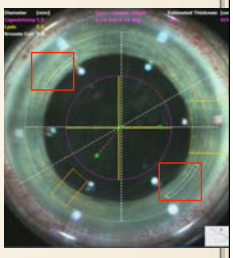
Treatment of Pre-existing Astigmatism



LenSx Arcuate Incisions

Image-guided 3D visualization:

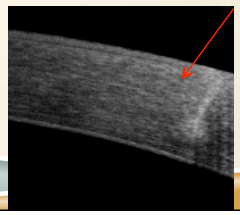
- Real time corneal thickness
- Computer programmed incisions
  - % depth
  - incision length and position
  - 3D visualization of incision placement

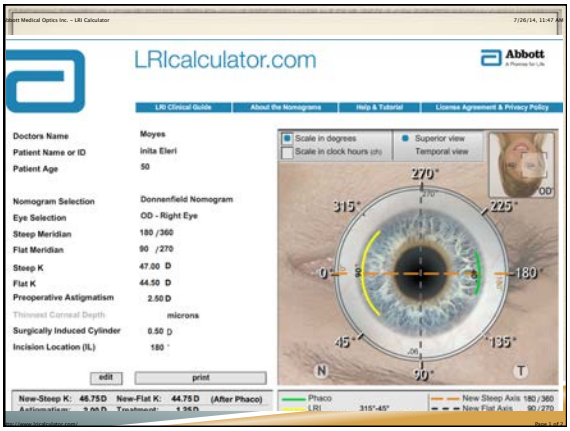


Predictable incision width, tunnel length

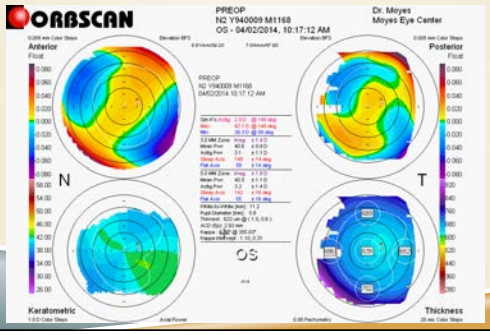
LenSx Arcuate Incisions

→ Square edge
→Uniform depth (no ripples)
→Precise, reproducible:
Arc shape
Arc length
Diameter

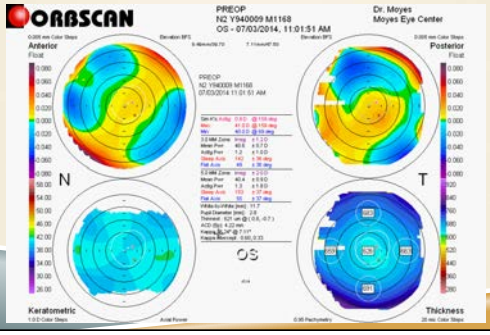




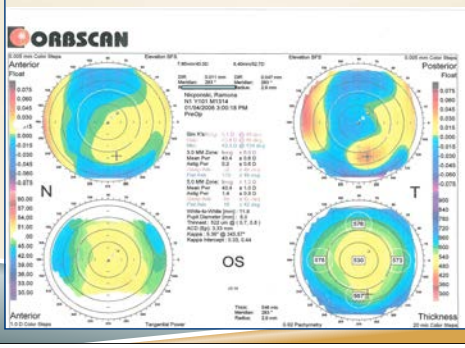
Pre-op +2.25+3.50X154



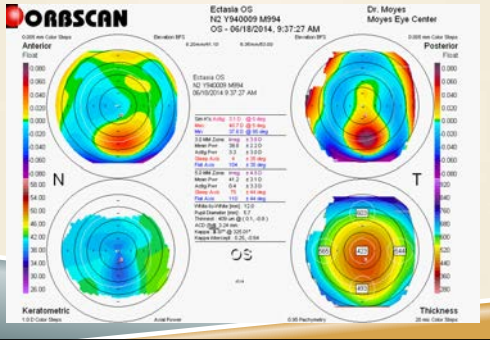
Post-Op -0.75+1.00X164



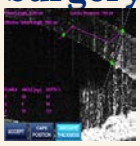
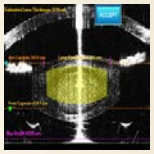
Pre-op Lasik in New York OS -5.00+o.25X10



8 years post op Plano+2.0X180 20/70



Improved Refractive Cataract Surgery

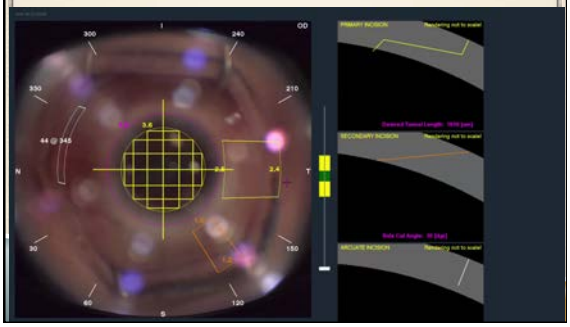
Improved wound architecture and reproducible

Astigmatism treatment with precision keratotomy

Decreased Phaco ultrasound energy

Improved control of ELP via precision capsulorhexis

Lensx surgery: programming and laser treatment



Comparison of IOL Power Calculation and Refractive Outcome After Laser Refractive **Cataract Surgery With a Femtosecond Laser vs. Conventional Phacoemulsification**
J Refract Surg. 2012;28(8):540-544

- Refractive Predictability:
  - 41.6% in laser group were within + or - 0.25D
    - 28.1% in conventional surgery group
  - 98.7% in laser group were within + or - 1.00D
    - 87.7% in conventional surgery group

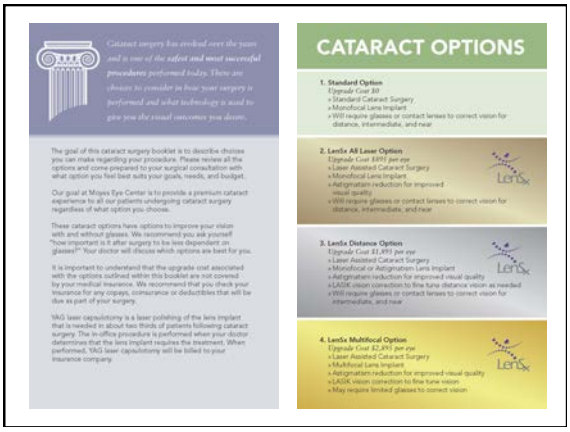
Moyes Eye Center Results

- **LenSx group**:
  - average refractive cylinder preop: 1.15 D (**range: 0.50-4.75**)
  - average refractive cylinder postop: 0.58 D
  - average spherical equivalent preop: 1.80 D
  - average spherical equivalent postop: 0.07 D
  - average postop acuity: 0.07 log mar acuity = **20/20**
- **Standard group**:
  - average refractive cylinder preop: 1.09 D (**range: 0.50-2.25**)
  - average refractive cylinder postop: 0.87 D
  - average spherical equivalent preop: 1.91D
  - average spherical equivalent postop: 0.30 D
  - average postop acuity: 0.2 log mar acuity = **20/32**

Femtosecond laser in cataract surgery.

Journal of Refractive Surgery. 2009;25:1053-1060.

- 43% reduction in phaco time
- 51% reduction in ultrasound energy delivered intraocularly
- Reduced energy = less tissue damage = less corneal damage = better visual outcomes



- There will be halos at night
- +3 add → 2.5 at spec plane
- Best near vision with both eyes done
- Eyes must be otherwise pristine
- 20% Lasik enhancement rate

MOYES EYE CENTER
Joy Through Sight

"We appreciate the opportunity to work with you and serve your patients"

- Moyes Eye Center Team