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LASER REFRACTIVE CATARACT SURGERY

Michael C. Knorz
Medical Faculty Mannheim, University of Heidelberg
Mannheim, Germany

History of Cataract Surgery

- **Sushruta performed couching 800 BC**
 - Sushruta Samhita (सुश्रुतसंहिता)
- **Jaques Daviel invented ECCE 1747**
- **Sir Harold Ridley implanted first posterior chamber IOL 1950**
- **Charles Kelman introduced phacoemulsification in 1967**

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Charles Kelman, 1967




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Limitations of Phaco Surgery

- **Visual Outcomes**
 - Distance correction predictability 50% that of LASIK
 - Astigmatism Correction
 - Final IOL Position
- **Safety**
 - Complications 10x LASIK
 - Ultrasound associated with:
 - corneal burn
 - corneal edema
 - endothelial cell loss^{1,2)}



¹Pereira et al. JCRS 2006 Oct;32(10):1661-6 ²Park et al. Ophthalmic Surg Lasers Imaging. 2010 Mar-Apr;41(2):236-41

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Phaco 1967 - What is next ?

- **Laser Refractive Cataract Surgery using a femtosecond laser !**
 - 2008: first surgery performed in Budapest by Zoltan Nagy using **Alcon LenSx** laser
 - 2009: **Alcon LenSx** first laser to receive FDA approval for cataract surgery
 - 2010: first surgery in the US performed by Stephen Slade using **Alcon LenSx** laser

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OVERVIEW OF LASER SYSTEMS

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Laser Systems

- Alcon LenSx (CA, USA)
- OptiMedica CATALYS (CA, USA)
- LensAR (FL, USA)
- Technolas VICTUS (Munich, GER)
- Others

Alcon LenSx



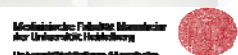
- Femtosecond laser
- OCT
- 510K approvals
- CE marked
 - Capsulorhexis
 - Liquefaction
 - Corneal incisions (AK !)








OptiMedica CATALYS

- Liquid Optics Interface
- OCT
- Femtosecond laser
- Not approved in US
- CE-marked for
 - Capsulorhexis
 - Lens fragmentation




LensAR Laser

- Initially designed to soften lens to correct presbyopia
- Picosecond laser
- Scheimpflug camera, not real-time
- 510K approval for
 - Capsulotomy
 - Lens fragmentation

Technolas VICTUS

- Femtosecond laser
- Only combined platform
 - Flaps
 - Corneal transplants
 - AK
 - INTRACOR
 - Not approved:
 - Capsulorhexis and liquefaction

Other Systems

- AMO IntraLase iFS
 - Combined system
 - Astigmatic cuts
 - Incisions
 - Capsulorhexis?
 - Fragmentation?



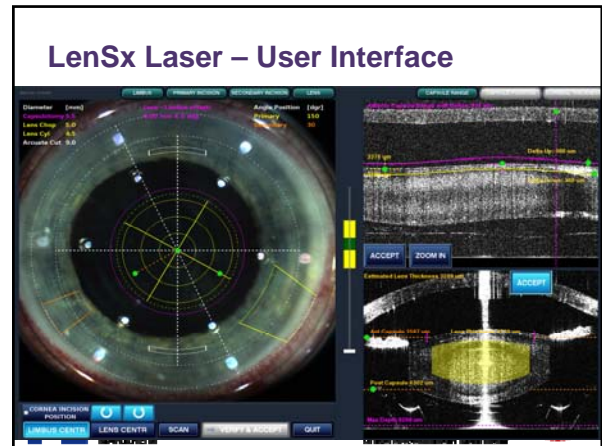


My Personal Experience

- Alcon LenSx laser
- Surgery performed in Budapest, Hungary
- Alcon LenSx laser in Mannheim since 7-2011





LenSx Laser – User Interface





Why Laser Refractive Cataract Surgery ?

- Capsulorhexis
- Lens fragmentation / liquefaction
- Corneal incisions
- Astigmatism correction

CAPSULORHEXIS






Ideal Capsulorhexis

- Reproducible size and shape, well centered

Current Manual Capsulorhexis

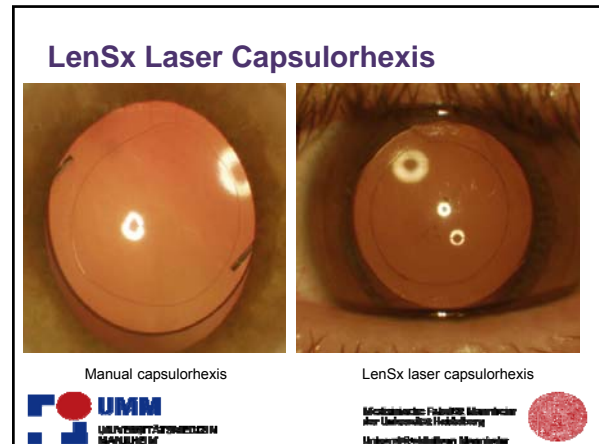
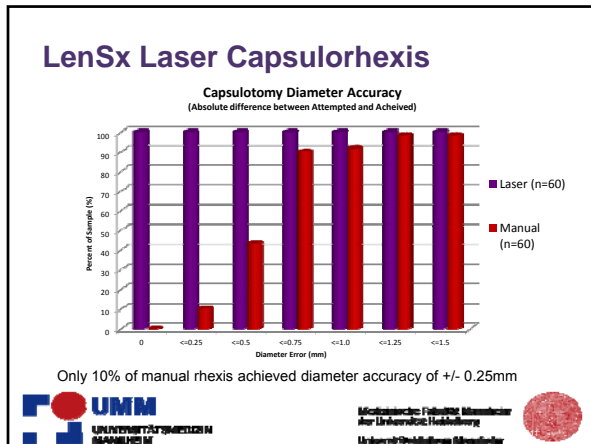
Too large	Too small	Irregular shape	Off center
No capsule-IOL overlap IOL tilt	Phimosis Difficult phaco maneuver	IOL tilt IOL decentration	IOL decentration Edge catches visual axis

Laser Capsulorhexis







How strong is the Laser CCC ?

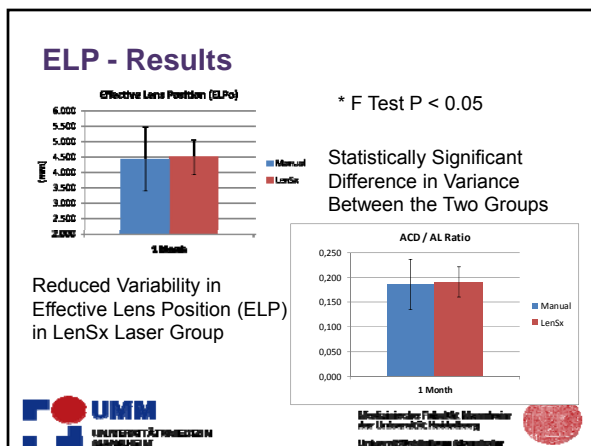
- Nagy Z, Takacs A, Filkorn T, Sarayba M
Initial Clinical Evaluation of an Intraocular Femtosecond Laser in Cataract Surgery
J Refract Surg 2009; 25:1053-1060
 - 8 porcine eyes each group, 5-mm CCC using corneal mark
 - CCC stretched with calipers, ratio calculated
- Laser CCC**
 - Ratio 2.13 +/-0.03 (range, 2.07 – 2.17)
- Manual CCC**
 - Ratio 1.98 +/-0.08 (range, 1.84 – 2.09)

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Capsulorhexis and ELP

- Prospective study**
 - 4.5 mm LenSx laser capsulorhexis
 - 4.5 mm manual capsulorhexis
- ACD and AL measured using LenStar Optical Biometry**


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LENS FRAGMENTATION / LIQUEFACTION


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Liquefy and Chop Pattern



Liquefy

- Used for softer lenses (to Grade 2)
- Number of cylinders customizable



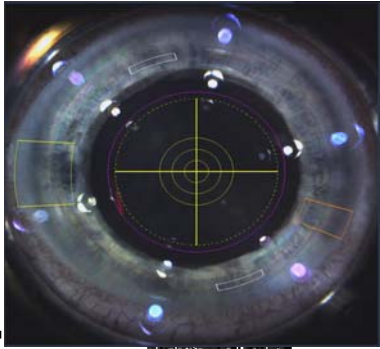
Chop

- Generally used for harder lenses (grade 3, 4+)
- Number of cuts customizable

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Hybrid Technique




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Hybrid Pattern

- Combination of liquefaction and chop patterns
- Efficient for all cataract grades
- Rapid lens removal with minimal phaco required
- Preferred pattern for surgeons going forward



Hybrid Pattern

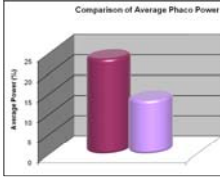
- Used for all Cataract Grades
- # Cuts/Cylinders Customizable

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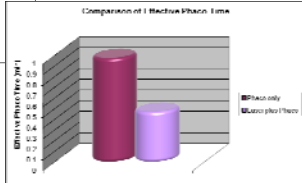
Phaco vs LenSx Laser

Comparison of Average Phaco Power



51% reduction

Comparison of I Radian Phaco Irm

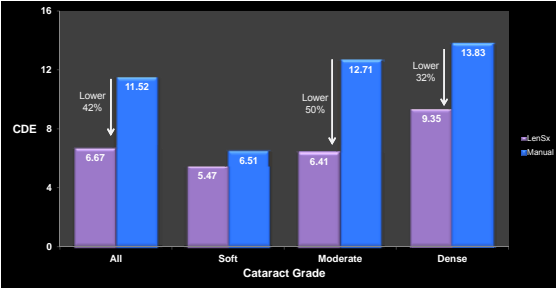


43% reduction

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Cummulative Dissipated Energy (CDE)



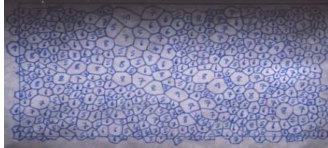
Cataract Grade	Laser (CDE)	Manual (CDE)	Reduction
All	6.67	11.52	Lower 42%
Soft	5.47	6.51	
Moderate	6.41	12.71	Lower 50%
Dense	9.35	13.83	Lower 32%

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Phaco vs LenSx Laser



- 28% decrease in endothelial cell loss in Laser group compared to Phaco group (one month postop)



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CORNEAL INCISIONS

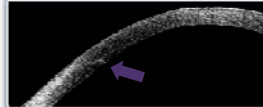

Manual Corneal Incisions

- ❖ Wound architecture limited by hand-held instruments, manual incisions
 - imprecise tunnel length and geometry
- ❖ Frequently require stromal hydration to seal
- ❖ Can result in cascading intraoperative difficulties
 - fluid control, anterior chamber maintenance
- ❖ Recent literature suggests an increased incidence of post-op infection¹
- ❖ Incisions may be unstable at low IOPs²






LenSx Laser Corneal Incisions

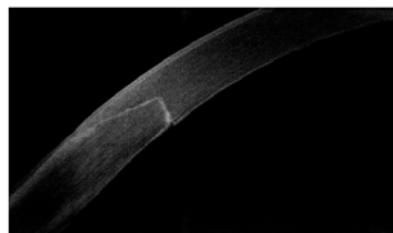
Complete flexibility to customize architecture of all corneal incisions



- 3D visualization
- Predictable Accuracy
- Precise, self-sealing wound design

LenSx Laser Corneal Incision



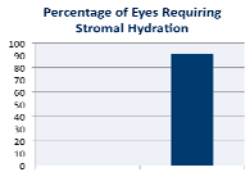
PostOp OCT image of LenSx 2-plane corneal incision


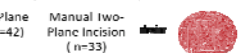
Laser Incisions

- ❖ Laser incisions are more architecturally reproducible and have greater self-sealing properties



Percentage of Eyes Requiring Stromal Hydration



Incision Type	Percentage of Eyes Requiring Stromal Hydration
Laser Iwo-Plane Incision (n=42)	0%
Manual Iwo-Plane Incision (n=33)	~90%


ASTIGMATISM CORRECTION

Manual Arcuate Incision

Traditional, handheld Diamond Knife

- Manually executed by "tracing" corneal marks
- Inconsistent depth control
- Poorly predictable

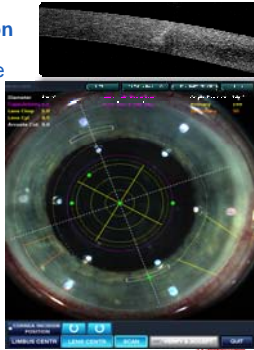


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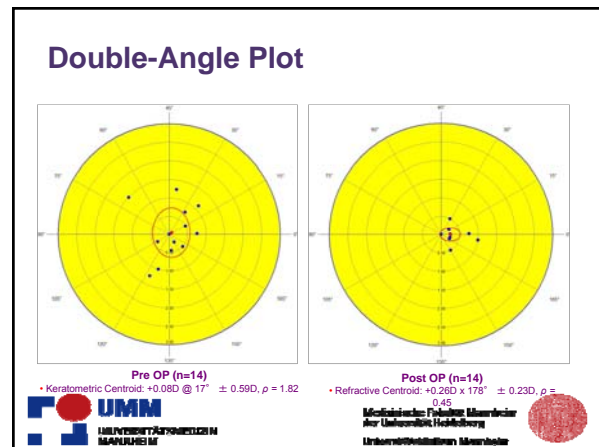
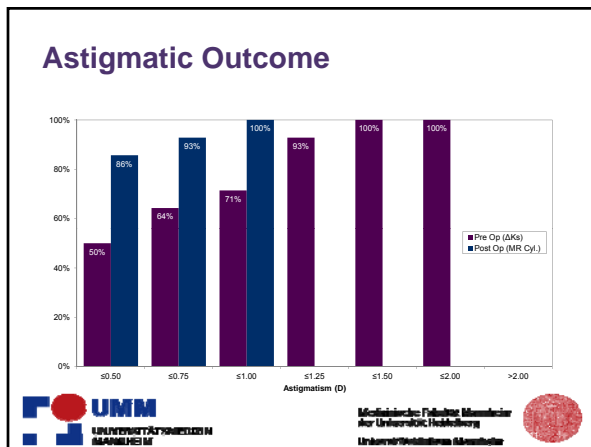
LenSx Laser Arcuate Incisions

Image-guided with 3D visualization

- Fully Customizable and adjustable
- Refractive incisions are no longer an art form. They are a science.
- Place Desired Incisions:
 - EXACT Size
 - EXACT Place
 - EXACT Depth
 - Every Time



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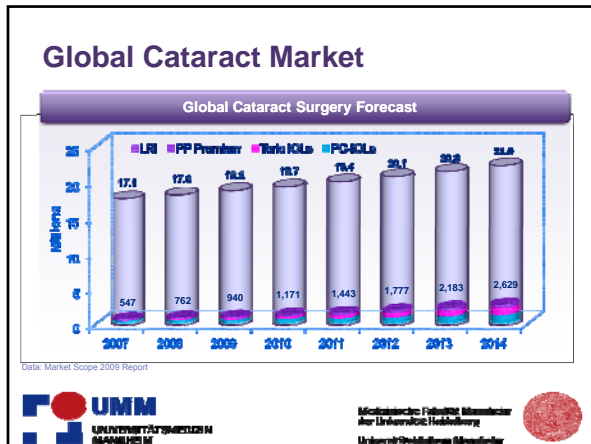
MARKET POTENTIAL

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Issues to Consider

- Can the market support another premium technology ?
- Do we need a laser to improve our clinical performance ?
- Will our patients understand and embrace the technology ?

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Laser Refractive Cataract Surgery

- **A Market Fueled by Baby Boomers**
 - Educated
 - Demanding
 - Financially Secure
 - Embracing Demand-Driven Healthcare
- **The Expectation**
 - A Better Experience
 - A Predictable Procedure
 - A Better Value Proposition

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Surgeon Expectations

Alcon LenSx technology provides the surgeon:

- Known benefits of femtosecond technology
 - Improved accuracy of all incisions
 - Predictability at every step
- True image-guided intraocular surgery
 - Opportunity to create optimal wound architecture
 - Precise capsulotomy
- Expanded revenue stream
 - A strong value proposition
 - A message that easily resonates with patients and staff

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Patient Expectations

Alcon LenSx technology provides the patient:

- Perceived benefits of a laser procedure
 - Computer controlled precision
 - Procedural predictability
- A comprehensive, advanced technology approach to lens replacement surgery
- A truly premium, value-added surgical experience


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LASER - LINSENSTAUSCH
MITTELS FEMTOSEKUNDELASER

(AUSTAUSCH DER AUGENLINSE GEGEN EINE KONTAKTLINSE MITTels ZEWINGUNG DES LASERS)



freeVis

FreeVis LADK Zentrum
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LenSx Lasers, Inc.
CONFIDENTIAL

Welcome to the Future !

Laser Refractive Cataract Surgery

A combination of premium technologies
A premium opportunity for surgeons and patients

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Conclusions

- Laser Refractive Cataract Surgery will increase safety and efficacy of cataract removal
- Laser fragmentation requires less phaco power to complete the nucleus removal
- The reduction in ultrasound energy during *Laser Refractive Cataract Surgery* preserves endothelial cells

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Conclusions

- Outcome predictability will improve as the laser replaces most of the manual, imprecise steps of cataract surgery
- A laser created, perfectly centered capsulotomy improves effective lens position (ELP) and thereby refractive predictability
- Laser-created corneal incisions to correct astigmatism deliver a new level of *refractive cataract surgery*

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THANK YOU !