Limitations of Phaco Cataract Surgery

Visual Outcomes
- Distance correction predictability
  50% that of LASIK
- Astigmatism Correction
- Effective Power of IOL

Safety
- Complications 10x LASIK
- Ultrasound associated with
  - corneal burn,
  - corneal edema, endothelial cell loss

<table>
<thead>
<tr>
<th>Common</th>
<th>Incidence</th>
<th>Vision Threatening</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior Capsular Opacification</td>
<td>10-30%</td>
<td>Retinal Detachment</td>
<td>0.6-1.7%</td>
</tr>
<tr>
<td>Cystoid Macular Edema (transient)</td>
<td>2-10%</td>
<td>Cystoid Macular Edema (persistent)</td>
<td>1-2%</td>
</tr>
<tr>
<td>Vitreous Loss</td>
<td>1-5%</td>
<td>IOL Malposition</td>
<td>0.3%</td>
</tr>
<tr>
<td>Corneal Endothelial Cell Loss</td>
<td>4-10%</td>
<td>Need for Corneal Transplant</td>
<td>0.3%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Endophthalmitis</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

Incidence of Capsular Tears in Phaco

Marques FF, Marques DM, Osher RH, Osher JM.  
Fate of anterior capsule tears during cataract surgery.  
*J Cataract Refract Surg* 2006;32:1638-42  
- 2,646 eyes  
- Anterior tear of capsulorhexis in 0.8%  
  - 40% of tears extended into the posterior capsule,  
  - 20% required vitrectomy

Unal M, Yücel I, Sarici A, Artunay O, Devranoğlu K, Akar Y, Altin M.  
Phacoemulsification with topical anesthesia: Resident experience.  
- Anterior tear of capsulorhexis in 5.3%  
- Irregular anterior capsulorhexis in 9.3%  
- Posterior capsule tears with vitreous loss in 6.6%

Goals of Laser Refractive Cataract Surgery

- Improve every step of cataract surgery
  - Incision
  - Capsulorhexis
  - Nucleus fragmentation

<table>
<thead>
<tr>
<th>Key Step</th>
<th>Current Surgery</th>
<th>Refractive Impact</th>
<th>Safety Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corneal Incision</td>
<td>Underutilized Not Optimized</td>
<td>Astigmatism</td>
<td>Infection</td>
</tr>
<tr>
<td>Capsulorhexis</td>
<td>Variable Sized, Not Centered</td>
<td>Variable IOL Position &amp; Effective Lens Power</td>
<td>Capsular Tears, Posterior Capsule Opacification</td>
</tr>
<tr>
<td>Lens Fragmentation</td>
<td>Excessive Ultrasound Power</td>
<td>Delayed visual recovery</td>
<td>Loss of endothelial cells, Capsule Rupture</td>
</tr>
</tbody>
</table>
Purpose

To evaluate the use of a novel femtosecond laser in cataract surgery for
- liquefaction of the lens,
- capsulorhexis,
- corneal incisions

Image-Guided Surgery

- Integrated OCT projects images of cornea, lens, iris and capsule onto video microscope
- Surgeon selects incisions, lens treatment; confirms patterns on OCT images
- Procedure time < 1 minute: lens liquefaction, capsulotomy, corneal incisions
Methodology

Procedures performed by Michael Knorz at Semmelweis University, Budapest, Hungary

Thanks to my host, Zoltan Nagy

Results: Capsulorhexis was perfectly centered and highly reproducible in all cases

Only 10% of manual rhexis achieved diameter accuracy of +/- 0.25mm
Results: More Efficient/Safer Lens Removal

46% reduction in Phaco Power

- FS laser was highly effective in liquefying lenses up to 2+ density – often only I/A (no phaco required).
- Harder lenses of up to 4+ were efficiently fragmented for removal with reduced phaco power.

28% Decrease in Endothelial Cell Loss In Laser Group Compared to Phaco Group.

Results: Reduced Variability in Effective Lens Position
Conclusions

- Femtosecond laser application in liquefaction, capsulorhexis and corneal incisions was safe and effective
- All-laser cataract surgery will increase safety and efficiency of cataract removal
- Laser capsulorhexis was perfectly centered and highly reproducible in all cases
- IOLs with femtosecond laser created capsulotomy showed reduced variability in Effective Lens Position (ELPo)

Thank you!