LASIK following previous eye surgery

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Review of the scientific literature

• Published reports on lasik after other surgical procedures are limited
• Lasik is still in its infancy and large series of patients who have undergone other surgical procedures are lacking
• As more surgeons perform lasik, more data will be reported on eyes that have had other surgical procedures prior to lasik
Lasik after Penetrating Keratoplasty

Eventhough the success rates of PKP are high certain conditions still limit quality of vision. These include:

- High ammetropia
- High astigmatism/Irregular astigmatism
- Anisometropia
- Spectacle intolerance
- CL intolerance
Lasik after PKP
Review of the Literature

• 10 published reports
• Number of eyes reported ranged from 4 to 26
• Mean time interval between PKP and Lasik ranged from 12 mos to 23 years
• 90/119 eyes reported had keratoconus as the diagnosis prior to PKP
• Mean age 38.6 years (19-80 years)
Lasik after PKP
Review of the Literature

• Mean time interval between final suture removal and Lasik – only one published study reports this information:
  Donnenfeld et al: 35.3 months

Minimum time interval between final suture removal and Lasik ranged from 3-10 months
Lasik after PKP

- Microkeratomes used: 5 studies report using the ACS; 1 study Moria LSK and 1 study did not state which keratome was used.
- Spacer plates used: both 160 micron and 180 micron plates were used.
Lasik after PKP
Review of the Literature

• Lasers used:

  Nidek: 1
  VISX 20/20: 2
  Summit Apex Plus: 1
  Meditec: 1
  Technolas 116: 1

One study did not state model excimer used
Lasik After PKP
Published Results

110 eyes reported in 8 publications

- Range of Follow Up Periods: 6-12 months
- Mean Myopic Preop. Sph. Eq.: -8.47D
- Range of myopia treated was –2.25D to –15.25 D
- Mean Preop Cyl. in Myopic eyes: - 4.97D
- Range of Preop Cyl.treated : -2D to –15D
Lasik After PKP
Published Results

• Mean Post Op Sph. Eq.: est –0.67D
• Range of Post op Sph. Eq.: +1.25-5D
• Mean Post op Cyl.: -2.08D
• Range of Post op Cyl.: -0.25 to –7D
Lasik After PKP
Reduction in Myopia

- Lima (Can J. Ophth 2001) 91% reduction (23)
- Donnenfeld (Ophth 1999) 85.6% (23)
- Forseto (JCRS 1999) 85.3% (22)
- Webber (BJO 1999) 74.8% (18)
- Kwitko (JCRS 2001) 90% (9)
- Arenas (JRS 1997) 78% (4)
- Lam (JCRS 1998) 64.8% (2)
- Parisi (JCRS 1997) 100% (1)
Lasik After PKP
Reduction in Astigmatism

- Lima (Can J. Ophth 2001) 60% reduction (23)
- Donnenfeld (Ophth 1999) 45.6% (23)
- Forseto (JCRS 1999) 58.3% (22)
- Webber (BJO 1999) 65.8% (18)
- Kwitko (JCRS 2001) 47.4% (9)
- Lam (JCRS 1998) 66.3% (2)
- Parisi (JCRS 1997) 40% (1)

Reduction was in absolute # as vector analysis was not performed in all studies
Gain of $\geq=1$ lines BCVA following Lasik After PKP

- Lima (Can J. Ophth 2001) 8 eyes (35%)
- Donnenfeld (Ophth 1999) 12 eyes (52%)
- Forseto (JCRS 1999) 9 eyes (41%)
- Webber (BJO 1999) 15 eyes (58%)
- Kwitko (JCRS 2001) 4 (44%)
- Lam (JCRS 1998) Not reported
- Parisi (JCRS 1997) 0 (0%)
Loss of $\geq 1$ lines BCVA following Lasik After PKP

- Lima (Can J. Ophth 2001) 2 eyes (9%)
- Donnenfeld (Ophth 1999) 2 eyes (9%)
- Forseto (JCRS 1999) 2 eyes (9%)
- Webber (BJO 1999) 3 eyes (12%)
- Kwitko (JCRS 2001) 5 (36%)
- Lam (JCRS 1998) Not reported
- Parisi (JCRS 1997) 0 (0%)
Post op UCVA $\geq 20/40$

- Lima (Can J. Ophth 2001) 78%
- Donnenfeld (Ophth 1999) 36%*
- Forseto (JCRS 1999) 54.5%
- Webber (BJO 1999) 28%
- Kwitko (JCRS 2001) 33%
- Lam (JCRS 1998) 50%
- Parisi (JCRS 1997) Not reported
PKP Lasik After Hyperopia

- Range of Follow Up Periods: 6-12 months
- Mean Hyperopic Preop. Sph. Eq.: +4.74D
- Range of Hyperopia treated was +1.50D to +7.13 D
- Mean Preop Cyl. in Hyperopic eyes: -4.16D
- Range of Preop Cyl. treated: -1.5D to -6D
Lasik After PKP -- Hyperopia

- Mean Post Op Sph. Eq.: -0.73
- Range of Post op Sph. Eq.: -2.25 to +0.75
- Mean Post op Cyl.: -1.81D
- Range of Post op Cyl.: -0.5 to -5.50D
Lasik After PKP
Reduction in Hyperopia

• Lima (Can J. Ophth 2001) 77% (4)
• Kwitko (JCRS 2001) 79% (5)
Lasik After PKP
Reduction in Astigmatism

- Lima (Can J. Ophth 2001) 88% (4)
- Kwitko (JCRS 2001) 79% (5)
Regression and Retreatments

- Not reported in all studies: Kwitko reported retreatment rate of 42.9% because of cyl undercorrection
- Stabilization of the postop refraction appears to occur at one month (Lima, Forseto, Donnenfeld) with no significant change at 6 months
- Tendency for eyes to remain undercorrected
Lasik After PKP Complications

- Increased astigmatism postop: 5 cases
- Epithelial Ingrowth\textsuperscript{1,2}
- Hemorrhage into the flap: 1 case
- Microkeratome Jam on suture: 1 case
- Buttonhole: 1 case
- Flap dislocation day: 1 case 1 day postop
- Decentered ablation: 1 case
- RD: 1 case pseudophakic 2 years post lasik
Complications that were not seen

- Wound dehiscence at the graft host junction 0% incidence
- Striae
- Unstable refractions postoperatively
- Graft rejections
- Significant endothelial cell loss
- Overcorrection
Recommendations For Performing Lasik After PKP

• Perform in those pts who have significant anisometropia and/or astigmatism who are spectacle and/or CL intolerant
• Present realistic expectations to pts-you are attempting to reduce their ametropia to get them into spectacles
• Perform no sooner than 6 months after all sutures have been removed but the longer you wait the better
• Wait for refractive and topographic stability
Recommendations For Performing Lasik After PKP

- Center flap over the pupil
- Avoid the microkeratome incision at the graft-host junction—begin 1mm outside or inside the graft host junction
- Experience counts—the longer you keep suction on the eye the greater the chance of wound dehiscence
- Use steroids for a longer period of time (Sen JCRS 2002) at least two weeks
Further Data Required

- Position of Hinge and its effect on outcome
- Effect of creating the flap on refractive change
- Flap thickness
- Effect of newer generation lasers with smaller spot sizes and tracking capabilities
- Wavefront technology and topographically linked lasik should improve results
## LASIK After Cataract Surgery

<table>
<thead>
<tr>
<th>Author</th>
<th>Laser Used</th>
<th>Microkeratome Used</th>
<th>Mean Interval between Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ayala et. al.</td>
<td>NIDEK EC-5000</td>
<td>ACS</td>
<td>10 mos. (3 – 72 mos)</td>
</tr>
<tr>
<td>JRS 2001</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# LASIK After Cataract Surgery

<table>
<thead>
<tr>
<th>Author</th>
<th>Num. of Eyes</th>
<th>Mean Pre-Op Sph. Eq.</th>
<th>Mean Post-Op Sph. Eq.</th>
<th>Mean Pre-Op Astigmatism</th>
<th>Mean Post-Op Astigmatism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ayala et. al.</td>
<td>22</td>
<td>-2.90 ± 1.8 D</td>
<td>+0.40 ± 0.60</td>
<td>-1.70 ± 1.40D</td>
<td>-1.80 ± 0.90*</td>
</tr>
<tr>
<td>JRS 2001</td>
<td></td>
<td>(-0.80 to -8.50D)</td>
<td>(-0.6 to +1.50D)</td>
<td>(-0.25 to -6.50D)</td>
<td></td>
</tr>
</tbody>
</table>

* Not significant
### LASIK After Cataract Surgery

<table>
<thead>
<tr>
<th>Author</th>
<th>≥ 20/40</th>
<th>≥ 20/20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ayala et. al.</td>
<td>45.4%</td>
<td>0%</td>
</tr>
<tr>
<td>JRS 2001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

BSCVA after LASIK was significantly better before LASIK at 3, 6 and 12 month periods.
## LASIK After Cataract Surgery

<table>
<thead>
<tr>
<th>Author</th>
<th>± 0.5D Emmetropia</th>
<th>± 1.0D Emmetropia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ayala et. al. JRS 2001</td>
<td>50% (11)</td>
<td>81.8% (18)</td>
</tr>
</tbody>
</table>
## LASIK After Thermal Keratoplasty

<table>
<thead>
<tr>
<th>Author</th>
<th>Laser Used</th>
<th>Microkeratome Used</th>
<th>LTK Unit</th>
<th>Interval between Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portellinha et. al. JRS 1999</td>
<td>NIDEK</td>
<td>ACS 160/8.5</td>
<td>Fyodorov</td>
<td>&gt;2 yrs.</td>
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</table>
## LASIK After Thermal Keratoplasty

<table>
<thead>
<tr>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Portellinha et. al. JRS 1999</td>
<td>12</td>
<td>+3.31 (+1 to +6.50)</td>
<td>+0.88D (0 to +1.50D)</td>
<td>-0.48D (0 to –2.0D)</td>
<td>-0.38D (0 to –1.5D)</td>
<td>1 yr.</td>
</tr>
<tr>
<td>Attia et. al. JRS 2000</td>
<td>50</td>
<td>+2.92 (+0.50 to +6.50)</td>
<td>+0.36 (-2.75 to +3.75)</td>
<td></td>
<td></td>
<td>6 mos.</td>
</tr>
</tbody>
</table>
# LASIK After Thermal Keratoplasty

<table>
<thead>
<tr>
<th>Author</th>
<th>≥ 20/40</th>
<th>≥ 20/25</th>
<th>Loss of BCVA</th>
<th>Gain of BCVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portellinha et. al. JRS 1999</td>
<td>91%</td>
<td>66%</td>
<td>25% lost 1 line</td>
<td>8% gained 1 line</td>
</tr>
<tr>
<td>Attia et. al. JRS 2000</td>
<td>72%</td>
<td>46%</td>
<td>14% lost 1 line 16% lost 2 lines</td>
<td>34% gained 1 line</td>
</tr>
</tbody>
</table>
### LASIK After Thermal Keratoplasty

<table>
<thead>
<tr>
<th>Author</th>
<th>± 0.5D</th>
<th>± 1.0D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portellinha et. al.</td>
<td>42%</td>
<td>67%</td>
</tr>
<tr>
<td>JRS 1999</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attia et. al.</td>
<td>42%</td>
<td>60%</td>
</tr>
<tr>
<td>JRS 2000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- No complications including no morphological changes on radial thermal scars.
- At 24 months, undercorrection 33% (+1.25 to +1.50D).
- At 6 months, 26% had regression.
Indications

- Penetrating keratoplasty
- Pseudophakia
- Glaucoma Sx
- Radial / Astigmatic keratotomy
- Retinal Surgery
- PRK/ Lasik
- Bioptics
LASIK Following Radial Keratotomy

- **Special Concerns**
  - Treat epithelial inclusions and wound gapes prior to LASIK (re-suture if ness.)
  - Careful surface marking
  - Carefully handle flap to avoid tearing RK along incisions
  - Thicker flaps
  - Enhancements difficult
  - Higher incidence of DLK?
LASIK following Radial Keratotomy

- PERK Study: 43% of eyes had a 1D hyperopic shift at 10 years
- Following LASIK 91% improvement or no change in BCVA\(^1\)
- Following LASIK no loss of 2 lines in BCVA\(^2\)

\(^1\) Attia. Journal of Cataract and Refractive Surgery, 2001
\(^2\) Lindstrom. Ophthalmology, 2000
LASIK following Radial Keratotomy

- Hyperopic shift/ Visual fluctuation may continue
- Ineffective for irregular astigmatism (except with wavefront-guided and/or topo-guided)
50 y/o male, s/p RK for about –8 in USSR 1990

- UCVA 20/40-, 20/40
- +2.00 -2.50 117  20/25 (8/10)
- +2.75-2.25 070   20/25- (7/10)
- Significant night glare (dec)
Pre-op
Post-op
46 y/o male 10 years s/p RK for \(-3.00 -1.50 x \) and subsequent hyperopic shift
46 y/o male 10 years s/p RK for –3.00 –1.50 x ? and subsequent hyperopic shift

sc: 20/80 diplopia
Rx +4.75 –6.00 x 17 gives 20/25

LASIK with the Moria M2 and the Allegretto-wave

• Post-op 3 months:
• Sc 20/30!
• +1.25 – 1.50 x 40 20/25
LASIK Following Penetrating Keratoplasty

- 39-70% of PK’s are within 3D of emmetropia
- Mean cylinder following PK is 4-5 D
- Following LASIK 100% are within 3 D emmetropia\(^1\)
- 91% of eyes BCVA remained the same or improved\(^1\)
- Contact lens remains standard of care

\(^1\)Donnenfeld. *Ophthalmology*, 1999
LASIK Following Penetrating Keratoplasty

• Special Concerns
  • Avoid graft-host interface
  • Flap adherence 5 minutes
  • Increased postoperative corticosteroids
  • Endothelial dysfunction and flap slippage\(^1\)
  • Keratoconus and progressive ectasia

\(^1\)Donnenfeld. ASCRS, 2001
34 y/o male 2 years s/p Therapeutic PK for a CL-related ulcer

- Good cell counts: top = OD unaffected eye
- Bottom = OS eye with PK
- Rx –4.50 –5.50 x 56 with the Allegretto-wave
- Post-op 3 months:
  - Sc 20/30!
  - +0.25 – 0.50 x 50 20/25
Wavefront

- Regular pattern
- Refraction differs with larger aperture
LASIK Following Cataract Surgery

- No significant concerns with PC/IOL
- Careful with endothelial dysfunction around phaco wound site (flap slippage, poor adhesion)
- ? PRK with AC/IOL
- Future of cataract surgery
LASIK and the Glaucoma Patient

Absolute Contraindications

- Filtering/Valve Surgery
  - End stage disease
- Significant ON damage and/or Visual Field Loss
- Uncontrolled Glaucoma
- More than 2 Medications
LASIK and the Glaucoma Patient

- **Special Concerns**
  - Epithelial Sloughing:  
    - Discontinue topical meds pre-op
    - Oral CAIs
  - Nerve Fiber Layer Analysis (HRT, GDx)
  - Post-operative IOP Measurement
    - Mean Decrease in IOP is 4.3 mm Hg
  - Beware of low IOP and progressive ON damage (interface fluid-Maloney Ophthalmology 2002)

LASIK Following Retinal Detachment

- Pre-LASIK vitreoretinal consultation
- Avoid LASIK in high buckles-risk of poor suction/ irregular flap
- Treatment of asymptomatic holes controversial
- Avoid silicone oil eyes
LASIK after Previous PRK

• Central keratometry/ Orbscan
• Consider Epithelial hyperplasia – (If suspected plan for thicker flap)
  • Increased postoperative steroids
LASIK after Previous LASIK

• Relift flap if possible (unless limited by thin cornea)
• Undercorrect consecutive ametropia

\(^1\)Jacobs. *Journal of cataract and refractive surgery, 2001*
LASIK after Previous LASIK

- New flap should be larger and deeper than the original flap or narrower and thinner (the same MK will cut a thinner consecutive flap on a thinner cornea)
- Posterior flap ablation when residual stromal bed not adequate (not possible with flying-spot excimers)
- Personal preference: minimum cornea thickness > 400nm
- 35 < K’s < 49
BIOOPTICS: Artisan phakic IOL and staged LASIK

A. John Kanellopoulos, MD
Manhattan Eye, Ear and Throat Hospital
ASCRS 1999
Background

- Unable to correct high myopes > 12-14D with LASIK
- Growing interest in phakic IOL’s
- Anterior chamber (haptics, iris fixated)
- Posterior chamber
Methods

- Evaluated 12 patients with myopia > 10 D
- Initial flap formation
- 2-5 days later Artisan implantation
- 6 weeks later LASIK enhancement for RE > 0.50 D
- Follow-up 1D, 1Week, 1 month, 3 Months, 6 Months
Results

- 12 eyes mean RE: -14.55D
- At 6 weeks mean RE: -2.50D
- 10 eyes received enhancement
- Postoperative RE: -0.45
## Results Va

<table>
<thead>
<tr>
<th></th>
<th>BCVA</th>
<th>UCVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preop</td>
<td>20/45</td>
<td>CF</td>
</tr>
<tr>
<td>Postop</td>
<td>20/27</td>
<td>20/42</td>
</tr>
</tbody>
</table>
## Complications

<table>
<thead>
<tr>
<th></th>
<th>IOP spikes</th>
<th>ECC loss</th>
<th>Under Crctn &gt; 0.50</th>
<th>Epi ingrowth</th>
<th>Glare Halos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artisan</td>
<td>0</td>
<td>+2 %!</td>
<td>10</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Enhancement</td>
<td>0</td>
<td>+1.2%!</td>
<td>0</td>
<td>1(Ns)</td>
<td>2</td>
</tr>
</tbody>
</table>
Artisan
Endothelial cell counts
Case report

- 1 patient randomized for one IOL each eye
- Artisan OD: -0.50 –0.50 X 90 UCVA 20/25
- ICL OS: -0.50 UCVA 20/25+
- Outflow facility: unchanged OD (0.285 to 0.286 microL/min/mmHg), reduced from 0.287 to 0.185) 35.5% OS
27y/o F –14.00, -9.00
OD Bioptics 6 months postop
20/20
OS Lasik  8 months postop
20/25
Conclusions

• Good predictable approxim of emmetropia
• Artisan require more surgical skill and elaborative technique
• Away from K, angle, crystalline lens
• Minimal if any ECC loss
My technique

- 1 Drop of Alcaine
- Betadine scrub and drape eyelids
- Aspirating speculum
- Lubricate blade and rotating parts with Alcaine!!!
Placement of the M2
Push down until good suction, then lift
Microkeratome pass
Observe patient anxiety and “squeeze”
My technique

• Fold flap onto itself to minimize Dehydration and exposure (minimal manipulation)

• Even bed hydration – very dry technique (hinge ½ most moist)
ABLATION:
Check parameters! (last chance to avoid error)

Intraoperative moisture eq if needed
Irrigation of flap and careful wipe (remove fluid from interface)
My technique

- Irrigation very important
- “Squeeze” out excessive fluid and Striae with moist Weck-cell
- Suspension-opaque drop (predforte 1%) to delineate gutter width, centration and possible striae
Attempt to compensate for irregular hydration state of the flap during the procedure (excimer, procedure speed)
Is the flap back in place?
1’ observation interval
Flap is evaluated with build-in slit-lamp
Video
Conclusion

• With intelligent pre-operative selection and surgical planning, LASIK can be invaluable in the visual rehabilitation of patients following previous ocular surgery.
Thank You

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