Correcting Post-RK Hyperopia with High Frequency, Low Energy FEMTO1

Background
Hyperopic shift after radial keratotomy (RK) is not uncommon and its treatment at a corneal level is still controversial. Photorefractive keratectomy can stimulate haze in the presence of previous incisions and laser in situ keratomileusis (LASIK) with a mechanical microkeratome can be affected by reduced safety, predictability and complications such as epithelial ingrowth, diffuse lamellar keratitis (DLK), and incision openings. In general, the use of femtosecond-assisted LASIK on eyes previously treated by RK has not been viewed positively. However, these reports employed earlier femtosecond laser platforms; low-energy dissection with the FEMTO LDV platforms is reported to reduce tissue inflammation and DLK and achieves consistent flaps with limited complications in hyperopic corrections. The present study assessed the safety, efficacy, predictability and complications of LASIK with a low-energy femtosecond laser in the treatment of post-RK hyperopia.

Methods
This prospective consecutive non-comparative case series included 18 eyes from 10 patients having femtosecond LASIK for consecutive hyperopia after RK. Pre-operative assessment consisted of uncorrected distance visual acuity (UDVA), corrected distance visual acuity (CDVA), autorefractometry, manifest and cycloplegic refraction, undilated and dilated slitlamp evaluation, Placido corneal topography and Scheimpflug camera tomography, computer-assisted scotopic pupillography, tonometry and dilated fundoscopy. The corneal flap was created using the FEMTO LDV Z2 femtosecond laser. Flaps were programmed to a nominal thickness of 130 mm with a superior hinge and a 30-degree side-cut angle. The nominal flap diameter was 9.5 mm in eyes with a white-to-white (WTW) diameter more than 12.0 mm and 9.0 mm in eyes with a WTW diameter 12.0 mm or less. For the refractive treatment, an excimer laser was used in tissue-saving mode, with rotational eye tracking and a 6.0 mm optical zone. Full methods can be found in the original published manuscript1.

Results
- **Predictability:** At 9 months post-op, 13 eyes (72%) had less than 0.50 D of defocus equivalent and 16 eyes (89%) were less than 1.0 D. No retreatments were performed. Refractive astigmatism at 9 months post-op was 0.28±0.44 D (range 0.0 to 1.5 D).
- **Safety:** The safety index (postoperative DVA / preoperative CDVA) was 1.11.
- **Efficacy:** The mean UDVA was 0.11±0.10 log-MAR (range 0.0 to 0.3 logMAR). The efficacy index (postoperative UDVA/preoperative CDVA) was 0.97.

### Mean refractive outcomes in 18 eyes after femtosecond laser-assisted LASIK for post-radial keratotomy hyperopia.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Preoperative</th>
<th>9 Months postoperative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spherical equivalent (D)</td>
<td>+2.59 ± 0.53</td>
<td>-0.02 ± 0.51*</td>
</tr>
<tr>
<td>Defocus equivalent (D)</td>
<td>3.13 ± 0.71</td>
<td>0.51 ± 0.47*</td>
</tr>
<tr>
<td>Corrected distance visual acuity (D)</td>
<td>0.09 ± 0.06</td>
<td>0.04 ± 0.06*</td>
</tr>
<tr>
<td>Primary spherical aberration (µm)</td>
<td>-1.63 ± 0.5</td>
<td>-1.24 ± 0.41*</td>
</tr>
<tr>
<td>Primary coma (µm)</td>
<td>0.55 ± 0.66</td>
<td>0.41 ± 0.52</td>
</tr>
</tbody>
</table>

* P < 0.05

- **Stability:** The mean SE at 2 months post-op was -0.38±0.75 D; at 9 months post-op, it was -0.02±0.51 D; the change was not statistically significant (95% CI for the difference between means for paired data).
- **Flap Thickness:** The mean central flap thickness at 9 months post-op was 131.9±11.7 mm.
- **Complications:** No opaque bubble layers, undersized or decentered flaps, DLK, infection or flap dislocations were observed. In all cases, flap dissection was easily achieved with no tissue bridges. A small (<2 mm) peripheral opening of 1 or more radial incisions was noted in 11 eyes (61%) with a major opening in 3 eyes (17%), never extending more than 3 mm.
Conclusions
This work demonstrates that LASIK using the low-energy, high pulse frequency FEMTO LDV is a viable alternative to address post-RK hyperopia. No major complications occurred during flap creation in the postoperative period and a predictable refractive result was achieved. In conclusion, LASIK with a modern low-energy femtosecond laser was a safe and effective approach to treat post-RK hyperopia, causing no relevant tissue inflammation.

References: