In the name of God

Presbyopia Correction

SUPRACOR multifocal corneal LASIK

Seyed Javad Hashemian MD
Eye Research Center
Rassoul Akram Hospital
Iran University of Medical Sciences
Iranian Eye Clinic
No financial interest
SJ_Hashemian@yahoo.com
www.drhashemian.com
www.ireyeclinic.com
ISOP Paris 2019
PresbyLASIK:
There are currently three different approaches for PresbyLASIK.

- **Central PresbyLASIK**, the central area is shaped hyperpositively for near vision, whereas the midperipheral cornea for far vision.

- **Peripheral PresbyLASIK**, the central area is shaped for far vision and the mid-peripheral corneal area for near vision.

- **Laser blended vision**, is a combination of micro-monovision and increase depth of field,
Comparing the three treatment modalities of PresbyLASIK:

- **Central PresbyLASIK** shows a tendency to provide good near vision but reduced far vision, which translates to a compromised safety.

- **Peripheral PresbyLASIK**, seems to provide good far vision and safety, while providing a relatively poor near vision.

- **Laser blended vision** seems to have no major drawbacks, providing good far and near vision combined with a good safety.
SUPRACOR*

- SUPRACOR* presbyopic algorithm is suitable for the treatment of hyperopic (CE approved) myopic and post-LASIK eyes, providing near addition whilst minimizing undesired aberrations

- SUPRACOR utilizes
  - ZYOPTIX Aspheric for Hyperopia, myopia
  - Corneal K- and Q-Values to optimize the ablation
  - Full X/Y- and rotational Eyetracking
Supracor

- Supracor creates a varifocal cornea wherein there is a 12 µm elevation in the central 3 mm of the cornea to give a near addition of approximately two diopters (D).
- Outside of the near addition is an aberration-optimized transition zone that gives good intermediate and good distance vision.
- The algorithm is available in the Technolas 217P and Teneo 317 excimer lasers (Bausch and Lomb Technolas, Munich, Germany).
- Since Supracor is a LASIK-based algorithm, its main advantage is it can correct refractive error and presbyopia in a single procedure.
- Supracor can be used in one eye or in both eyes depending on each patient’s needs and expectations.
Supracor Basic Principle

Pre-op Cornea

Post-op Cornea

Intermediate & Distance Zone

Near Addition Zone

Central near addition

Near and far in focus

Near and far in focus

SUPRACOR Corneal Profile
**Purpose:**

To assess the visual and refractive outcomes and complications of unilateral SURACOR multifocal corneal Femto-LASIK in non-dominant eye for the correction of hyperopia and presbyopia.

**Methods:**

- This study enrolled 54 eyes of 27 patients who had bilateral femto-LASIK for the correction of hyperopia plus SURACOR multifocal corneal Lasik in non-dominant eye.
- Monocular and binocular uncorrected (UDVA) and corrected distance visual acuity (CDVA), monocular and binocular uncorrected (UNVA) and distance-corrected near visual acuity (DCNVA) at 40 cm, Central corneal power and High order aberrations changes and complications were evaluated over 6 months.
<table>
<thead>
<tr>
<th></th>
<th>SUORACOR Eye</th>
<th>Dominant Eye</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient</strong></td>
<td>(Eye/n)</td>
<td>54/27</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>(Mean±SD)</td>
<td>51.00±3.65</td>
</tr>
<tr>
<td></td>
<td>Range</td>
<td>45 - 60</td>
</tr>
<tr>
<td><strong>Sex (%) Female</strong></td>
<td>Female</td>
<td>17 (63.0%)</td>
</tr>
<tr>
<td><strong>Pre-Operative MSE</strong></td>
<td>(Mean±SD)</td>
<td>+1.54±0.69</td>
</tr>
<tr>
<td></td>
<td>Range</td>
<td>0.00 - +3.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+1.41±0.66</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.00 – 2.75</td>
</tr>
</tbody>
</table>
Ocular Dominance testing

- Ocular dominance was assessed using the “hole test”. The “hole test” involved the patient binocularly aligning a distant object through a hole in a plain A4 sheet of paper.

- The eyes were alternately covered while looking through the hole. The eye with which the object appeared most centered through the hole was deemed to be the dominant eye.
Inclusion Criteria

For hyperopic presbyopic patients
- Up to +3.0D MRSE,
- Up to 2.0D astigmatism
- Mean K-readings at 41.0D to 45.0D
- FSLASIK Flaps of 110µm, diameter = 9mm
- Angle Kappa < 8°
- Patients ≥ 47 years
- Near addition of +1.75 D minimum
- Maximal 0.75D difference between cycloplegic and manifest refraction SE
- Pupil between 3-6mm
- Central corneal thickness of 500 µm
- Both eyes with cc vision ≥ 0.8
Exclusion criteria:

- Presence of ocular surface disease,
- Clinically significant corneal opacity
- Abnormal corneal topography,
- Any signs of binocular vision anomalies at distance or near.

Limitations for Lasik Surgery
Results:

- Mean postoperative spherical equivalent refraction was -0.03 ± 0.52 diopters (D) for dominant eyes and -0.80 ± 0.52 D for non-dominant eyes.
- Mean binocular UDVA was ≥20/25.
- Mean binocular UNVA was ≥Jaeger 2.
- At 6 months, 100% of patients achieved 20/25 and could read Jaeger 2 binocularly.
- Mean non-dominant eye UDVA was ≥20/50 at 6 months.
- The mean central keratometry steepening was 2.51 D.
- There were significantly more negative spherical aberration and vertical coma in the central 6 mm postoperatively (P < .05).
- Ninety-eight percent of these patients did not need any glasses for distance and near vision.
Results:

Cumulative UCDVA in Dominant Eye

100% ≥ 20/25
Results:

Cumulative UCDVA in SupraCor

6.0 months postop; 80% ≥ 20/50
Results:
Cumulative CDVA in Dominant Eye

100% ≥ 20/25
Results:

Cumulative BCDVA in SupraCor

100% ≥ 20/40

Pre-Op  2 Month  6 Month

20/20  20/25  20/30  20/40
Results: Cumulative UCNVA in SupraCor

100% ≥ J2

Graph showing cumulative UCNVA in SupraCor at various time points: Pre-Op, 5 Day, 2 Month, and 6 Month.
Results:

Cumulative CDNVA in SupraCor

80%≥ J3
**Results:**

High order aberrations changes

<table>
<thead>
<tr>
<th>SupraCor</th>
<th>Pre-Op</th>
<th>Post-Op</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zernike RMS- High Order 6mm</td>
<td>0.46±0.08</td>
<td>0.72±0.29</td>
<td>0.004</td>
</tr>
<tr>
<td>Zernike RMS-HO w/o Z400 6mm</td>
<td>0.37±0.08</td>
<td>0.61±0.25</td>
<td>0.002</td>
</tr>
<tr>
<td>Zernike RMS- Total</td>
<td>1.64±0.63</td>
<td>1.10±0.36</td>
<td>0.000</td>
</tr>
<tr>
<td>Vertical coma- Z311</td>
<td>0.045±0.17</td>
<td>0.089±0.40</td>
<td>0.591</td>
</tr>
<tr>
<td>Horizontal coma- Z310</td>
<td>-0.002±0.23</td>
<td>-0.238±0.26</td>
<td>0.013</td>
</tr>
<tr>
<td>4th order spherical aberration- Z400</td>
<td>-0.24±0.11</td>
<td>0.38±0.20</td>
<td>0.000</td>
</tr>
<tr>
<td>Horizontal trefoil- Z330</td>
<td>0.039±0.09</td>
<td>0.105±0.17</td>
<td>0.036</td>
</tr>
</tbody>
</table>
### Results:

High order aberrations changes

<table>
<thead>
<tr>
<th>Dominant Eye</th>
<th>Pre-Op</th>
<th>Post-Op</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zernike RMS- High Order 6mm</td>
<td>0.47±0.13</td>
<td>0.47±0.11</td>
<td>0.884</td>
</tr>
<tr>
<td>Zernike RMS-HO w/o Z400 6mm</td>
<td>0.39±0.11</td>
<td>0.44±0.13</td>
<td>0.296</td>
</tr>
<tr>
<td>Zernike RMS- Total</td>
<td><strong>1.86±0.52</strong></td>
<td><strong>1.00±0.31</strong></td>
<td><strong>0.000</strong></td>
</tr>
<tr>
<td>Vertical coma- Z311</td>
<td>0.003±0.22</td>
<td>0.037±0.26</td>
<td>0.573</td>
</tr>
<tr>
<td>Horizontal coma- Z310</td>
<td>-0.023±0.14</td>
<td>-0.052±0.21</td>
<td>0.236</td>
</tr>
<tr>
<td>4th order spherical aberration- Z400</td>
<td>-0.25±0.11</td>
<td><strong>0.07±0.13</strong></td>
<td><strong>0.000</strong></td>
</tr>
<tr>
<td>Horizontal trefoil- Z330</td>
<td>-0.036±0.11</td>
<td>-0.044±0.18</td>
<td>0.829</td>
</tr>
</tbody>
</table>
Results:

Cylinder

![Graph showing changes in cylinder over time with data points at Pre-Op, 5 Day, 2 Month, and 6 Month. The graph compares SupraCor and Dominant categories.]
Results:

Mean SE

| 2 Month Post-Op SE (Mean±SD) Range | -0.86±0.58 (-2.00 - +0.50) | +0.05±0.37 (-0.50 - +1.00) |
Discussion:

- SUPRACOR is a corneal approach to treat hyperopic presbyopia.
- We induced micro-monovision with the Technolas excimer workstation 317P.
- Ryan and O’Keefe reported 91% of patients had a binocular UDVA of 0.2 logMAR or better and 91% had an uncorrected reading ability of N8 or better at 6 months postoperatively; their re-treatment rate was 22%.
- Co-sar and Sener reported UDVA was 20/20 or better in 22% eyes and UNVA was 20/20 or better in 77.2% at 6 months postoperatively.
- In our study, **100% of patients had a binocular UDVA of 20/25 or better for distance at 6 months postoperatively**
Discussion:

- For near vision, 60.2% of patients had a UNVA of Jaeger 1 or better for near vision at 6 months and 100% of patients had a UNVA of Jaeger 2 or better.

- We had better results with the same algorithm (SUPRACOR Regular), probably because we included micro-monovision to improve the compromise between the distance and near vision.

- As with the many other presbyopia correction procedures, the improvement of near vision involves a compromise, which needs to be discussed and explained to the patient.
Long-term Outcomes of PresbyLASIK:

Two effects may decrease patient satisfaction and spectacle independence in long-term follow up.

First, the natural tendency of the epithelium to shape a smooth, physiologic corneal surface,

Second, the simple fact that presbyopia may increase.
Conclusions:

Supracor procedure in non-dominant eye may improve functional near, intermediate, and distance vision without significant photic phenomena in presbyopic patients with low and moderate hyperopia.
Thank You for Kind Attention