Management of Highly Aberrated Corneas After Keratorefractive Surgery

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Various Topo-guided/Corneal WF-guided ablation pattern could be used in spite of their insufficiency!

Weaknesses of Topo-guided procedures:

- Surgical plan is generally subjective and individual
- Difficult to predict the precise spherical or Cylindrical component that will be corrected/remained
- Potential for a hyperopic shift (excess central ablation)
- Possibility to increase (rather than decrease) the irregularity if the exact corneal elevation is not treated.
- Inadvertent localized ablation of the steepest area as opposed to the most elevated area can compromise vision rather than improve vision by increase the slope of elevation.

WF-guided ablation Profile

- Provides a more constant measure of the Cause / Effect relationship
- This can enables the surgeon to develop an ablation nomogram for irregular customization
WFG Laser Vision Correction using the iDesign System

- High-resolution sensor maximizes capture rates
  - High-resolution Hartmann-Shack wavefront sensor (5 times higher than WaveScan)
  - Fourier reconstruction algorithms using up to 1257 micro-refractions over a 7 mm diameter wavefront
  - Outstanding accuracy, and ability to measure complex wavefronts or highly aberrated eyes for treatment planning
- Increasing resolution provides
  - Ability to capture more patients
  - Improved spot quality, reduces spot cross over effect
  - Detection of HOAs
  - Better reconstruction

High-Definition Hartman-Shack Sensor

WaveScan vs. iDesign system comparison
- Improved spot quality
- Better detection of highly aberrated eyes
  - For example: keratoconus, post incisional refractive procedures, irregular ablation profiles

Objectives

To evaluate the visual, refractive, contrast sensitivity, and aberrometric outcomes in a group of highly aberrated corneas undergoing wavefront-guided LVC surgery using the iDesign high definition aberrometer and the Star S4IR excimer laser platform from Abbott Medical Optics

Subjects & Methods

- 9 eyes of Nine patients with highly irregular cornea (6 females, 3 males) (Age: 20 to 52 ys.)
- Horus Vision Correction Center, Alexandria
- Nov. 2012 to August 2013
- 2 clinical groups:
  - I- Post RK (4 eyes)
  - II- Post LASIK decenteration/irregular ablation (5 eyes)

CONCLUSION: Wavefront-guided LASIK using the VISX CustomVue technology provides an effective and predictable correction of low to moderate myopia in the long term, preserving the patient’s visual acuity and quality.

The Time-Honored WF Ablation!!

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Subjects & Methods

- Full preoperative evaluation for Topography, Tomography, Refraction and Visual performance evaluation
- iDesign-generated ablation profile
- PRK with MMC / LASIK redo by flap lift
- All patients were followed up for more than 6 months
CASE 2. Post RK

- 52 years old women
- Had RK in 1995 (8 radial cuts at 3.5 mm OZ with 2 cuts invading optical zone). Present with a halos, glare and ghosting
  - UCVA 0.1
  - Manifest Refraction +3.00 – 3.25 x 105
  - BCVA 0.2
  - CCC 583 µm
- Untreatable to date due to lack of capture with previous aberrometer

CASE 2. Post RK
Preop Pentacam

Irregularity Indices

CASE 2. Post RK
Preop iDesign MAP

Ablation Profile design over the irregular cornea

CASE 2. Post RK Results:
6 months after CustomVue PRK powered by iDesign

- Ablated tissue thickness 57 µm
- Manifest Refraction +0.50 –1.00 X 45

✔ Very significant improvement in Corneal Irregularity indices and Aberrations
CASE 2. Post RK. Preop vs Postop Corneal Irregularity Indices

<table>
<thead>
<tr>
<th>Pre Op</th>
<th>Post Op</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index (in 6mm zone)</td>
<td>Index (in 6mm zone)</td>
</tr>
<tr>
<td>E1</td>
<td>E2</td>
</tr>
<tr>
<td>0.5</td>
<td>1.0</td>
</tr>
</tbody>
</table>

CASE 2. Post RK. Preop vs Postop iDesign Map

CASE 3. Post LASIK Decentration

- 25 y lady
- Had LASIK in July 2010 for -11.00 ?. Presented with ghosting, poor night vision
- UCVA 0.1
- Manifest Refraction +2.50 -1.00 x 120
- BCVA 0.3
- CCC 468 µm

- Untreatable to date due to lack of capture with previous aberrometer

CASE 3. Post LASIK Decentration Preop Pentacam

CASE 3. Post LASIK Decentration Preop iDesign MAP

CASE 3. Post LASIK Decentration Ablation Profile design over the irregular cornea
CASE 3. Post LASIK Decentration

Preop vs Postop Pentacam

Ablated tissue thickness 41 µm

Manifest Refraction -0.75 -0.5 x180

Results: 4 months after CustomVue LASIK powered by iDesign

CASE 3. Post LASIK Decentration

Preop vs Postop iDesign Map

Mean (SD) Median (Range)
Preoperative Postoperative p-value
LogMAR UDVA 0.98 (0.34) 1.00 (0.40 to 1.30) 0.19 (Wilcoxon)
Spheres (D) -0.78 (1.97) -0.50 (-4.00 to +3.00) 0.81 (Wilcoxon)
Cylinder (D) -2.65 (1.534) -2.50 (-5.50 to -1.00) 0.02 (Wilcoxon)
Spherical equivalent (D) -2.10 (1.85) -0.88 (0.70 to +0.88) 0.05 (Wilcoxon)
LogMAR CDVA 0.62 (0.27) 0.61 (0.10 to 1.00) 0.01 (Wilcoxon)
Efficacy 2.88 (1.50) 2.33 (1.13 to 6.00) ---
Safety --- 3.00 (1.13 to 6.00) ---

Efficacy

Changes in Corrected Distance Visual Acuity after surgery

Results of the total Sample

Preoperative Postoperative
LogMAR UDVA 1.80 (1.80 to 1.80)
Spheres (D) -0.50 (-1.50 to +0.50)
Cylinder (D) -1.80 (-2.50 to -1.50)
Spherical equivalent (D) -0.88 (0.70 to +0.88)
LogMAR CDVA 0.10 (0.10 to 1.00)
Efficacy ---
Safety ---
Conclusions

• The New iDesign System allows us to measure eyes with high aberrations that were not captured with previous aberrometers.

• With iDesign we avoid to treat the patients twice one with Topo Guided LVC to smooth the cornea and another ablation for refractive correction.

• The higher Iris Registration capture rate allows to center the ablation in the right place.

• Wavefront guided ablations are now my preferred choice for normal and highly aberrated eyes.