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Topography-guided treatments with WaveLight ALLEGRETTO WAVE - 3 month results -

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Background

- Corneal topography alone does not provide adequate information to determine the ideal corneal first surface.
- Eye is an optical system of two main elements: cornea and crystalline lens.
Background

- Treatment of the irregular astigmatism has been posing a challenge before the refractive surgeons for a while and several surgical techniques have been used to diminish the irregular astigmatism and thus smoothen the corneal surface:
  - Arcuate cuts
  - The PALM technique: photoablated lenticular modulator
  - Selective Zonal Ablations with Excimer Laser
  - LTK
  - Topography-guided LASIK
- WaveLight Topolyzer LASIK - preliminary study (Jankov M, Mrochen MC, ISRS 2001)
Background

- If the cornea is severely aberrated, using only topography as a guide for a surgery in order to create a more physiologic surface should improve the optical quality of the corneal first surface and therefore improve visual performance in an otherwise normal eye.
Asphericity

- A perfect sphere, due to the Spherical aberration, will form different foci for the paraxial (longer focus) compared to the peripheral rays (shorter focus).
- The normal corneal curvature is aspherical, i.e. steeper at the apex and less steep (flatter) at the periphery.
Corneal Asphericity

- Prolate
- Spherical
- Oblate

- \( r = 3.25 \)
- \( Z_0 = 0.709 \)
- \( Z_2 = 0.728 \)
- \( Z_1 = 0.692 \)
- \( Z_0 = 0.709 \)
- \( Z_2 = 0.728 \)
- \( Q_0 = 0 \)
- \( Q_1 = -0.5 \)
- \( Q_2 = +0.5 \)
- \( R_1 = 7.82 \)
- \( R_0 = 7.80 \)
- \( R_2 = 7.78 \)
Purpose

■ To evaluate the clinical results of topography-guided treatments for the correction of large irregular astigmatism.
Material and method

- 7 eyes of 7 patients
- Age: 42 ± 5 (35 - 50) years
- Pre operatively (mean):
  - UVA: 20/50
  - SEQ: -1.00 D (+0.25 to -3.25 D)
  - Cyl: -1.75 D (up to -4.00 D)
  - BSCVA: 20/30
  - Q: -0.04 ± 0.27 (-0.55 to +0.21)
- Inclusion criteria:
  - Irregular astigmatism
  - large dioptic change (>4 D) within the pupil
Material and method

- The calculation of ablation profiles
  - T-CAT software: Zernike expansion of corneal aberration
  - attempted asphericity of the cornea
- LASIK has been performed by WaveLight ALLEGRETTO WAVE laser
  - 0.95 mm Gaussian Beam
  - 200 Hertz
  - Active Tracker • 6 ms Response Time
Results

- UVA: 20/27
Results

- **BSCVA: 20/23**
Results

- All patients report a significant decrease in halos, shadows, monocular diplopia and other symptoms.

<table>
<thead>
<tr>
<th></th>
<th>Pre op</th>
<th>Post op</th>
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<tbody>
<tr>
<td>SEQ [D]:</td>
<td>-1.00 (+0.25 to -3.25)</td>
<td>-0.57 (-0.25 to -1.75)</td>
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<tr>
<td>Cyl [D]:</td>
<td>-1.75 (up to -4.00)</td>
<td>-0.87 (up to -1.75)</td>
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<tr>
<td>Q-value:</td>
<td>-0.04 ± 0.27 (-0.55 to +0.21)</td>
<td>-0.14 ± 0.13 (-0.33 to +0.02)</td>
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D.T., male, 30 years

- PRK in 1989 (approx Sph: -6.0 D *sic*)
- UVA: 20/25+
  20/25+
- BSCVA: 20/25+ plano
  20/25+ plano
- Paquimetry: 490/488 µm, scotopic pupil size: 6.0 mm
- Halos, glare, driving!

3 months post-op

- UVA 20/30-
- BSCVA 20/20+ Sph: -1.00
- No symptoms!
2.8 mm
Results

5.8 mm

Keratometric data: major meridians perpendicular (d=3mm)

Rh: 37.4D
Rv: 37.9D
Ast.: -0.5D
Axs.: 10.2°
Ecc.: -0.96
Øcor: 12.4

AA: 68%
NS, male, 54 y.o.

- RK in 1985 (approx Sph: -6.0 D sic)
- UVA: 20/60+
  20/50+
- BSCVA: 20/30  Sph: +1.75 Cyl: -2.25 @ 20°
  20/30  Sph: +1.0 Cyl: -1.75 @ 40°
- Paquimetry: 590/588 µm, scotopic pupil size: 6.0/5.5 mm
- Halos, glare, visual fluctuation, driving!

3 months post-op

- UVA 20/30-
- BSCVA 20/20- Sph:+0.50 Cyl: -2.00 @ 25°
- Slitlamp: no cuts open
Wavefront vs. Topography

- Topography Zernikes reflected from the corneal surface
- TOPOGRAPHY $\leftrightarrow$ INDUCED ABERRATIONS!
- Topography for large irregularities $> 4$ D ($<10$?)
  - small OZ (esp. pervious hyperopic treatments)
  - decentered ablations
  - irregular ablations (water, lasering on the hinge, scar/melt)
  - scars (inflammation, PKP, RK)
Conclusions

- Topography may provide valid information for treating highly irregular corneas.
- WaveLight ALLEGRETTO laser is precise enough to perform the photorefractive correction
- WaveLight T-CAT software is safe
- WaveLight T-CAT software is predictable
- Larger clinical study with a longer follow-up is under way
Thank you!