Silicone hydrogel keratoconus lens fitting in corneal ectatic diseases

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Disclosure Statement of Financial Interests

I have no conflict of interest to disclose
Aim

• To evaluate the results of silicone hydrogel Toris-K / HydroCone® (SwissLens) contact lens fitting in eyes with various ectatic diseases of the cornea
# Hydrocone Toris K

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter</td>
<td>12.00 =&gt; 17.00 mm</td>
</tr>
<tr>
<td>Base curve</td>
<td>7.20 =&gt; 10.80 mm</td>
</tr>
<tr>
<td>Sph</td>
<td>-40.00 =&gt; +40.00 D</td>
</tr>
<tr>
<td>Cyl</td>
<td>-0.25 =&gt; -8.00 D</td>
</tr>
<tr>
<td>Axes</td>
<td>0° =&gt; 180°</td>
</tr>
<tr>
<td>Flattening</td>
<td>K12 + strong K34 ++ very strong</td>
</tr>
<tr>
<td>Central thickness</td>
<td>K12 = 0.42mm, K34 = 0.52 mm</td>
</tr>
<tr>
<td>Central optical zone</td>
<td>5.00 =&gt; 7.50 mm</td>
</tr>
<tr>
<td>Material</td>
<td>Definitive 74 / Igel 77</td>
</tr>
</tbody>
</table>
# Toris K material properties

<table>
<thead>
<tr>
<th></th>
<th>Definitive 74 (silicone 74)</th>
<th>Igel 77</th>
</tr>
</thead>
<tbody>
<tr>
<td>DK Fatt ISO 9913-1</td>
<td>60 / 44</td>
<td>39 / 29</td>
</tr>
<tr>
<td>Material</td>
<td>Silicone hydrogel</td>
<td>Hydrogel</td>
</tr>
<tr>
<td>Classification</td>
<td>Filcon V3</td>
<td>Filcon II3</td>
</tr>
<tr>
<td>Water content</td>
<td>74%</td>
<td>77%</td>
</tr>
<tr>
<td>Refractive index</td>
<td>1.37</td>
<td>1.37</td>
</tr>
<tr>
<td>UV</td>
<td>✓ (blue)</td>
<td>✓</td>
</tr>
</tbody>
</table>
**Toris-K12**

- **Diameter**: 14.00
- **Base Curve**: 7.80 / 8.00 / 8.20 / 8.40
- **Sphere**: plano
- **Cylinder**: -0.01 dpt
- **Axis**: 0°
- **Center thickness**: 0.45 mm
- **Zoc**: 6.00 mm
- **Material**: Definitive 74 III (SiH) blue UV

**Toris-K34**

- **Diameter**: 13.70  13.20  13.30
- **Base Curve**: 7.60 / 7.80 / 8.00  7.20  7.40
- **Sphere**: plano
- **Cylinder**: -0.01 dpt
- **Axis**: 0°
- **Center thickness**: 0.52 mm
- **Central optical zone**: 6.00 mm
- **Material**: Definitive 74 III (SiH) blue UV
Toris K geometry

- Toric anterior surface
- Spherical posterior optical zone with aspherical flattening
- Dynamic stabilization with nasal and temporal bumps
- Optimized central thickness
Materials & Methods

- Full ophthalmological examination
- Corneal topography – K readings
  - Gallilei corneal topographer
- Swisslens Toris-K (HydroCone) lens fit
# Amsler-Krumeich classification

<table>
<thead>
<tr>
<th>Grade 1</th>
<th>Grade 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myopia and/or astigmatism $&lt; 5$ D</td>
<td>Myopia and/or astigmatism $5 - 8$ D</td>
</tr>
<tr>
<td>Keratometry $\leq 48$ D</td>
<td>Keratometry $\leq 53$ D</td>
</tr>
<tr>
<td>Vogt striae</td>
<td>No corneal opacity</td>
</tr>
<tr>
<td>No corneal opacity</td>
<td>Pachymetry $\geq 400$ µm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade 3</th>
<th>Grade 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myopia and/or astigmatism $8 - 10$ D</td>
<td>Refraction cannot be determined</td>
</tr>
<tr>
<td>Keratometry $&gt; 53$ D</td>
<td>Keratometry $&gt; 55$ D</td>
</tr>
<tr>
<td>No corneal opacity</td>
<td>Central scar</td>
</tr>
<tr>
<td>Pachymetry $200 - 400$ µm</td>
<td>Pachymetry $&lt; 200$ µm</td>
</tr>
</tbody>
</table>
## Grade of keratoconus

<table>
<thead>
<tr>
<th>Classification of stages of Keratoconus using Videokeratometry</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level</strong></td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td><strong>Pre-stage (early signs)</strong></td>
</tr>
<tr>
<td><strong>Level 1</strong></td>
</tr>
<tr>
<td><strong>Level 2</strong></td>
</tr>
<tr>
<td><strong>Level 3</strong></td>
</tr>
<tr>
<td><strong>Level 4</strong></td>
</tr>
</tbody>
</table>

**Remarks:**
- **Pre-stage (early signs):** The diagnosis of the pre-stage of Keratoconus is always based on clinical criteria such as a change in power and the axis of the astigmatism, fluctuating refraction values, conspicuous changes in retinoscopy and corneal shadows during observation with the direct ophthalmoscope. Videokeratometry provides supplementary information, but a diagnosis cannot be based solely on the results. Corneal tear film irregularities and fixation problems can yield similar images, without the presence of a true Keratoconus.
- **This classification was adapted from the classical Amsler- and Muckenheim standards.** It is a topography based graduation and not a clinical one.
- **ISV = Index of surface variance**  
  **KI = Keratoconus index**  
  **Rmin = minimum value of the curvature of the cornea**  
  **Eccentricity in 30° refers to the four measuring values nasal, temporal, superior and inferior.**
- **If visual acuity of 20/25 to 20/20 is achieved with a spectacle correction, contact lenses are not necessarily indicated.**
- **Munson-sign:** The cornea bulges forward. The conical shape is easily recognized in profile, particularly by the acute bulge observed at the lower lid when the patient looks down.
Fitting procedure

- Determine keratoconus stage
  - Topography: K > 6.8 mm Grade 1-2
    K < 6.8 mm Grade 3-4
  - Visual acuity: VA > 60% = K12
    VA < 60% = K34

- Determine BC and diameter of the lens
  - Stage 1-2 b.c.: 8.00, dia: 14.00 mm
  - Stage 3-4 b.c.: 7.80, dia: 13.70 mm

- Apply the trial lens and wait for 30 min.

- Determine lens centralization and stabilization (lateral bumps)

- Over-refract (sph & cyl)

- If vision not satisfactory ....
  one flatter / steeper lens or increase the central thickness

-
Evaluation of the Topograph

Central position of the Apex

VA < 0.3

Deep position of the Apex

VA between 0.5 and 0.8

Better indication for soft keratoconus contact lenses

Not a good indication for soft keratoconus contact lenses
Central position of the Apex

Inferior position of the Apex
Patients

- 42 eyes of 27 patients (6 ♀)
- 2010 to 2014
- Mean age 31.67 ± 8.06 years (range: 19 – 49)

- 5 eyes - previously fitted with RGP & had subjective complaints or corneal disturbances
- 2 eyes – hx of corneal CXL
- 1 eye - unsuccessfully fitted with a decentralized soft contact lens
Results

- Mean K readings 48.02 ± 4.93 D (38.25 - 59.48)

- Mean thinnest pachymetry 474.28 ± 62.61 µ
- Mean spherical equivalent -4.93 ± 4.15 D (-1.00 to -16.25)
Results

- **20 eyes ... TorisK-K12 lenses**
  - central thickness 0.45 mm
  - base curve 7.80 / 8.00 / 8.20 / 8.40 mm
  - total diameter 14.00 mm

- **22 eyes ... TorisK-K34 lenses**
  - central thickness 0.52 mm
  - base curve 7.2 mm with total diameter of 13.70 mm, base curve 7.4 mm with total diameter of 13.30 mm or base curve 7.6 / 7.80 / 8.0 mm with total diameter of 13.70 mm
Results

20 eyes K12
Mean B.C. 8,09 ± 0,2 (7,8 – 8,4)

22 eyes K34
Mean B.C. 7,56 ± 0,19 (7,2 – 8,0)
Results

- Mean TorisK SE: $-4.63 \pm 3.85 \, D$ (range -0.75 – -18.00)

- Mean UCVA $0.17 \pm 0.16$ (range: 0.01 – 0.6)

- Mean spectacle BCVA $0.54 \pm 0.26$ (range 0.1 – 1.0)

- Toris K BCVA $0.85 \pm 0.21$ (range: 0.3 – 1.0)

(p<0.05 for both, paired t-test)
Visual results

- In all eyes visual acuity Toris-K fit > UCVA & spectacle BCVA
- The BCVA increased by
  - a mean 2.8±1.7 lines in grade 1-2 KCN
    - range: 0-6 lines, median: 2 lines
  - a mean 3.36±1.79 lines in grade 2-3 KCN
    - range: 0-7 lines, median: 3 lines
- Toris-K visual acuity
  - ≤ 0.5 in only 3 eyes (7.1%) … all grade 3-4
  - ≥ 0.8 in 31 eyes (73.8%)
Subjective results

- Halos & glare (1 patient)
- Better visual quality with previous RGPs (3 patients ... 4 eyes)
- All new CL users satisfied with visual gain
  - Including those after CXL tx
- No reported comfort problems
Previous RGP user, OD

- UCVA cf1m
- BCVA 0.5
- -14.50(-3.50@30)
- K readings 51.79 - 49.13 D

- Toris K34
- B.C. 7.8++
- -14.50(-2.75@15)
- Dia 13.70 mm
- BCVA 0.7
Previous RGP user, OS

- UCVA cf1m
- BCVA 0.4
- -13.25(-2.25@125)
- K readings 53.10 – 51.36 D

- Toris K34
  - B.C. 7.6++
  - -16.25(-3.50@130)
  - Dia 13.70 mm
  - BCVA 0.7
Keratoconus Rehabilitation

- Spectacles
- Contact lenses
- Cross Linking
- ICRS
- RK
- Phakic IOL
- Bioptics
- Phakic IOL
- CK
- ICRS
- LASIK
- ASTIGMATIC RK WEDGE RESECTION
- RE-PKP
- Keratoplasty
CL fitting in KCN

**Aim**
- High $O_2$ transmission
- Good centralization
- Minimal apical touch
- Movability
- Maximum visual acuity

**CL alternatives**
- Soft
- Rigid gas permeable
- Piggy-back
- Hybrid
A New Fitting Approach for Providing Adequate Comfort and Visual Performance in Keratoconus: Soft HydroCone (Toris K) Lenses

Koray Gumus, M.D., FEBOphth. and Nisa Kahraman, M.D.

Objective: To evaluate the comfort and visual performance of soft HydroCone (Toris K) silicone hydrogel lenses in keratoconus patients.

Methods: Fifty eyes of 50 keratoconic patients who were fitted with the Toris K lens were included in the study. All patients were evaluated at baseline and after 2 weeks of lens wear. Uncorrected and best-corrected visual acuities were measured. Corneal topography, ocular aberrations, and point spread function (PSF) were obtained using NIDEK-OPD Scan. Comfort level and visual performance in daytime and nighttime conditions were scored from 0 to 5 after 2 weeks of lens wear.

Results: Best-corrected visual acuity was significantly better with the Toris K lens ($P<0.001$). Mean increase in visual acuity with the lens was 4.5 lines. Mean $K_{1}$, $K_{2}$, and $K_{3}$ values significantly decreased with the lens ($P<0.001$). Both total and higher-order root-mean-square errors were significantly corrected with the Toris K lens ($P<0.001$ and $P=0.038$, respectively). A significant correction of total coma and trefoil aberrations was achieved with the lens. Also, PSF values were significantly increased with the lens ($P<0.001$). Although comfort scores in 46 eyes (92.0%) were classified as good/excellent, only 4 eyes (8.0%) had moderate comfort scores. Visual acuity was classified as good/excellent in 46 eyes (92.0%) in daytime and in 38 eyes (76%) in nighttime conditions.

Conclusions: Soft HydroCone silicone hydrogel keratoconus lenses should be considered as alternative visual correction for keratoconus patients. The soft and full-custom design provides optimal comfort and visual performance for the patients’ daily requirements.

Key Words: Keratoconus—Contact lens—Soft HydroCone contact lens.

(Eye & Contact Lens 2015;0: 1–6)
Conclusion

Silicone hydrogel keratoconus lenses seem to be a good alternative in corneal ectatic disorders as an initial contact lens fit…

Good alternative for visual rehabilitation in early – mid stage disease
Try in case of less-than adequate performance with other soft / RGP lenses
Thank you...