The Influence of Soft Contact Lens Materials on the Central, Para-Central and Peripheral Corneal Endothelium

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The influence of soft contact lens materials on the central, para-central and peripheral corneal endothelium

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ABSTRACT

PURPOSE: To examine the influence of a variety of soft contact lens (SCL) materials on the corneal endothelium, prior to and following two weeks cessation of SCL wear.

METHODS: Corneal endothelial cells were examined using a CEM-530 specular microscope (Nidek, Japan). Full-time SCL wearers (n = 31 eyes) were compared to a non-contact lens (NCL) control group (n = 28 eyes) of a similar age (SCL: 20.62 ± 1.69 years, NCL: 21.1 ± 2.45 years, p = 0.58). Parameters were assessed for endothelial cell density (ECO; cells/mm²), mean cell area (MCA, μm²), coefficient of variation (COV) and hexagonality (%).

RESULTS: Prior to SCL cessation, two-way ANOVA testing showed significant differences between silicone hydrogel (SiH) SCLs for the COV at 10°, with generation 2 (SiH) wearers showing increased COV (27.67 ± 3.78) compared to generation 3 SiH (G3SiH) wearers (24.50 ± 3.73, p = 0.01). COV at the superior periphery was significantly less in the NCL group (25.63 ± 2.76) compared to the hydrogel group (29.82 ± 6.22, p = 0.03). The MCA in the inferior periphery was also significantly higher in the NCL group (346.92 ± 36.75) compared to the hydrogel group (314.92 ± 16.57, p = 0.03).

Concluding: SCL wear has an effect on para-central and peripheral corneal endothelial measurements in SCL wearers compared to NCL wearers with significant differences seen between NCL and hydrogel SCL wearers. Following two weeks SCL cessation, there were no significant differences in the stability of all endothelial measurements, regardless of which SCL material was worn.

METHODS

Inclusion criteria
- Myopic prescriptions with low astigmatism (< -2.00 DC). No systemic or ocular disease
- SCL group: Full-time SCL wear (≥ 5 days per week for at least one year).
- NCL group: no history of CL wear in the year prior to enrolment.

Data collection
- Visits: baseline (SCL group: immediately following SCL removal), following SCL cessation on day 1, 2, 7 & 14. NCL control subjects were asked to attend the clinic at the same time intervals.
- Appointments were scheduled at the same time of day (2.5 hours) to limit the possible influence of diurnal variation.
- Endothelial specular microscopy: 7 areas of the endothelium were analysed centrally, para-centrally (0.6mm from centre) at 0°, 90°, 180°, 270° and the superior and inferior periphery (3.7mm from centre) (Figure 1 and 2).

Statistical analysis
- SPSS 22 was used for statistical analysis. Normally for continuous data were assessed using the Shapiro-Wilk method. Two-way ANOVA parametric testing was used for comparisons of groups. P < 0.05 was considered statistically significant.

RESULTS

Figure 2: Corneal points captured by the CEM-530 specular microscope

Figure 3: Endothelial cell density analysed for the SCL material groups at baseline

Figure 4: Coefficient of variation of endothelial cell size analysed for the SCL material groups at baseline

Figure 5: Endothelial cell hexagonality analysed for the SCL material groups at baseline

Figure 6: Mean endothelial cell area analysed for the SCL material groups at baseline

Table 1: Endothelial parameters for the SCL material and NCL groups at baseline

Table: 1

<table>
<thead>
<tr>
<th>Group</th>
<th>NCL (n = 26)</th>
<th>G2SiH (n = 18)</th>
<th>G3SiH (n = 6)</th>
<th>Hydrogel (n = 18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COV (± SD)</td>
<td>37.7 ± 2.05</td>
<td>37.8 ± 2.07</td>
<td>24.50 ± 0.79</td>
<td>27.75 ± 0.79</td>
</tr>
<tr>
<td>MCA (μm²)</td>
<td>21.73 ± 2.36</td>
<td>21.99 ± 2.43</td>
<td>29.73 ± 1.84</td>
<td>34.76 ± 2.49</td>
</tr>
<tr>
<td>ECO (%)</td>
<td>29.92 ± 5.60</td>
<td>29.82 ± 5.53</td>
<td>28.79 ± 1.84</td>
<td>34.76 ± 2.49</td>
</tr>
<tr>
<td>COV (%)</td>
<td>2.79 ± 0.05</td>
<td>2.79 ± 0.05</td>
<td>2.79 ± 0.05</td>
<td>2.79 ± 0.05</td>
</tr>
</tbody>
</table>

Significant results of two-way ANOVA analysis are displayed in shaded cells (p < 0.05).

CONCLUSIONS

- The various SCL materials examined do not have a significant effect on the central endothelial parameters compared to the NCL control group. However, SCL wear had a significant effect on peripheral corneal endothelial measurements in SCL wearers compared to NCL wearers, with the largest significant differences seen between NCL and hydrogel SCL groups.

- Results of this study are in agreement with those of Amarn et al. (2003) who found increased peripheral ECD in SCL wearers compared to NCL wearers. Amarn et al. proposed this was due to a redistribution of endothelial cells towards the periphery in SCL wear. However, we found a significantly reduced ECD in SCL wearers compared to NCL wearers. This reduced ECD would also account for the higher density of cells in the periphery.

- Following two weeks SCL cessation, there was no significant differences in the stability of all endothelial measurements, regardless of which SCL material was worn prior to SCL cessation.

References:
4. Lloyd-McKernan, A., O’Conner V. & Sime Marron, 2014. 6-weeks SCL cessation wear was associated with changes in the endothelium. Contact Lens and Anterior Eye, 37:1, 31-37.

Acknowledgements: Grantees funded by: National Cystic Fibrosis, Murphy and Patricia O’Connor for their help with data collection. No human information please contact aishia.mckernan@dit.ie