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: 20.8 ± 1.69 years, NCL: 21.4 ± 2.65 years, p = 0.58). Parameters assessed included endothelial cell density (ECD; cell/mm²), mean cell area (MCA; µm²), coefficient of variation (CV) and hexagonality (%) among groups.

RESULTS: Prior to SCL cessation, two-way ANOVA testing showed significant differences between silicone hydrogel (SH) SCL materials for the COV at 1º, with generation 2 SiH (G2SH) wearers showing increased COV (27.67 ± 3.78) compared to generation 3 SH (G3SH) wearers (24.50 ± 3.73, p = 0.01). COV at the superior periphery was significantly higher in the NCL group (25.63 ± 2.76) compared to the hydrogel group (29.92 ± 6.22, p = 0.00). The MCA in the inferior periphery was also significantly higher in the NCL group (346.92 ± 30.75) compared to the hydrogel group (314.92 ± 16.57, p = 0.03).

Following 14 days SCL cessation, no statistically significant differences in stability of endothelial parameters were detected between NCL and SCL material groups (all p-values ≥0.05).

CONCLUSION: Endothelial cell density of SH SCL wearers is lower than that of the control group, with a statistically significant difference found between SH and NCL groups. No significant difference in endothelial cell size was seen between NCL and SH SCL groups.

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:
- 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 h) 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 0º, 90º, 180º, 270º and the superior and inferior periphery (3.7mm from centre) (Figure 1 and 2).

RESULTS

Statistical analysis:
- SPSS 20 was used for statistical analysis. Normality for continuous data was assessed using the Shapiro-Willis method. Two-way ANOVA parametric testing was used for comparisons of groups. P ≤ 0.05 was considered statistically significant.

Figure 1: Corneal endothelial density captured by the CEM-530 specular microscope

Exercise 2: Cell density (cell/mm²)

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

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

Exercise 5: Coefficient of variation of endothelial cell size (µm²)

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

Exercise 6: Endothelial cell area analyised for the SCL material groups at baseline

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

<table>
<thead>
<tr>
<th>NCL (n = 28)</th>
<th>G2SH (n = 8)</th>
<th>G3SH (n = 6)</th>
<th>Hydrogel (n = 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCL (µm²)</td>
<td>100.0 ± 10.0</td>
<td>100.0 ± 10.0</td>
<td>100.0 ± 10.0</td>
</tr>
<tr>
<td>COV at 0º</td>
<td>27.67 ± 3.78</td>
<td>24.50 ± 3.73</td>
<td>27.33 ± 4.87</td>
</tr>
<tr>
<td>COV at 90º</td>
<td>29.33 ± 4.87</td>
<td>27.33 ± 4.87</td>
<td>27.33 ± 4.87</td>
</tr>
<tr>
<td>MCA central</td>
<td>314.92 ± 16.57</td>
<td>346.92 ± 30.75</td>
<td>314.92 ± 16.57</td>
</tr>
<tr>
<td>MCA super</td>
<td>314.92 ± 16.57</td>
<td>346.92 ± 30.75</td>
<td>314.92 ± 16.57</td>
</tr>
<tr>
<td>MCA inferior</td>
<td>314.92 ± 16.57</td>
<td>346.92 ± 30.75</td>
<td>314.92 ± 16.57</td>
</tr>
</tbody>
</table>

Statistically 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. Hydrogel 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 Amani et al. (2009) who found increased peripheral ECD in SCL wearers compared to NCL wearers2. Amani et al. proposed this was due to a rebbedition of endothelial cells towards the periphery in SCL wear. However, we found a significantly reduced MCA in SCL wearers compared to NCL wearers. This reduced MCA 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:

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