Comparison of a hydrophilic and a hydrophobic apodized diffractive multifocal IOL.

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Financial Disclosure: Dr. Lapid is a speaker for Alcon, Hanita Lenses, MSD, Oculentis, and a clinical investigator for Alcon. Mr. van der Linden and Dr. van der Meulen have no financial interest in the subject of the poster.
Introduction

• Multifocal IOLs (MFIOL) effectively treat ametropia and presbyopia

• Satisfaction with MFIOLs depends on patient motivation to be free of spectacles, and also on the design of the IOL optic.

• Most optics use a refractive or diffractive pattern to separate the light into 2 foci – 1 for far and 1 for near. This causes a blur circle of the focus that is not clear, but also other visual side effects.

• In apodized diffractive MFIOLs the ring pattern on the optic is a source of halos and visual side effects. Changes in this design could lead to a decrease in visual side effects.
The diffractive rings on the optic allow for separation of different foci, and apodization, which is the different height and distance of each ring, allows for a more clear separation of different foci, and the precise design of these apodized diffractive rings influences the balance between:

1. Distance versus near dominance of a MFIOL
2. Induction of halos by the ring pattern
3. Depth of focus of the near focus
The Hydrophilic MFIOl

Seelens MF (Hanita Lenses, Israel)
Hydrophilic material
Optic 6 mm, haptic 13 mm
Aspheric, biconvex, posteriorly angulated haptics 5°
11 apodized diffractive rings
360° posterior square edge of optic
reading addition: +3.0 D
The Hydrophobic MFIOL

SN6AD1 ("Restor +3") (Alcon, USA)
Hydrophobic Acrysof material
Optic 6 mm, haptic 13 mm
Aspheric, biconvex, not angulated
9 apodized diffractive rings
square edge of optic and haptics
reading addition: +3.0 D
Purpose
To compare outcomes between a new design apodized diffractive hydrophilic multifocal IOL (Seelens MF; study group), and a well-known apodized diffractive hydrophobic multifocal IOL (SN6AD1; control group).

Methods
• comparative case series
• refractive and visual outcomes at distance and near,
• patient satisfaction with a validated questionnaire,
• dysphotopsia and straylight measurement scores
• at 3 months post-operatively.
Results: Uncorrected and Corrected Distance Visual Acuity

Figure 1:
Mean uncorrected distance visual acuity (UCDA) up to 6 months from surgery. At all time points measured postoperatively the study group and the control group performed equally in terms of uncorrected distance visual acuity and was not statistically significantly different. @ 3 months: Seelens MF logMAR 0.02 ± 0.07 vs SN6AD1 0.04 ± 0.09.

Figure 2:
The comparison of the postoperative corrected distance acuity up to 6 months is shown. The difference between the groups is small but statistically significant in favour of the study group (the Seelens MF) -0.04 ± 0.05 vs control group (SN6AD1) -0.1 ± 0.04 ( <0.019).
Results in terms of near visual acuity:

Figure 3: UNVA at 40 cm, at different time points in the follow up period. The study group and the control group perform equally well: logMAR Seelens MF 0.09 ± 0.12 versus SN6AD1 0.08 ± 0.08. There were no clinical or statistically significant differences between the groups.

Figure 4: The difference in near acuity, without correction, and at different distances is shown in the graph. There is no clinical of statistical difference for the 30 and 40 cm distance between the study and control group. However, there is a clinical and statistically significant better reading at 50 (p<0.03) and 60 cm (p<0.007) for the study group (SeelensMF).
## Demographic data study vs control group

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Study Group</th>
<th>Control Group</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes(n)</td>
<td>48</td>
<td>37</td>
<td>-</td>
</tr>
<tr>
<td>Female sex, n (%)</td>
<td>7(28)</td>
<td>9(45)</td>
<td>0.18</td>
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<tr>
<td>Mean age (y) + SD</td>
<td>57.4 ± 2.81</td>
<td>59.6 ± 7.49</td>
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<tr>
<td>Mean CDVA (logMAR) + SD</td>
<td>0.10 ± 0.62</td>
<td>0.09 ± 0.13</td>
<td>0.20</td>
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<tr>
<td>Indication for Surgery</td>
<td></td>
<td></td>
<td>0.16</td>
</tr>
<tr>
<td>Cataract, n(%)</td>
<td>28(58)</td>
<td>27(73)</td>
<td></td>
</tr>
<tr>
<td>RLE, n(%)</td>
<td>20(42)</td>
<td>10(27)</td>
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</table>
## Ocular Parameters: Study vs Control Group

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Study Group</th>
<th>Control Group</th>
<th>P value</th>
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</thead>
<tbody>
<tr>
<td>Sphere (D)</td>
<td>Mean ± SD 1.14 ± 1.59</td>
<td>Mean ± SD 0.31 ± 3.12</td>
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<tr>
<td></td>
<td>Range -3.5D to +5.75D</td>
<td>Range -6.5D to +5.25D</td>
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<tr>
<td>Cylinder (D)</td>
<td>Mean ± SD -0.45 ± 0.38</td>
<td>Mean ± SD -0.67 ± 0.32</td>
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<td></td>
<td>Range 0 to -1.25</td>
<td>Range -0.25 to -1.50</td>
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<tr>
<td>Spherical Equivalent (D)</td>
<td>Mean ± SD 1.19 ± 1.68</td>
<td>Mean ± SD -0.02 ± 3.06</td>
<td>0.035</td>
</tr>
<tr>
<td></td>
<td>Range -3.88 to +5.13</td>
<td>Range -6.88 to +5.00</td>
<td></td>
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<tr>
<td>Axial Length</td>
<td>mm ± SD 23.47 ± 1.56</td>
<td>mm ± SD 23.84 ± 1.78</td>
<td>0.30</td>
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<tr>
<td></td>
<td>Range 22.17 to 25.54</td>
<td>Range 21.01 to 27.45</td>
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</tr>
<tr>
<td>Anterior Chamber Depth</td>
<td>mm ± SD 3.33 ± 0.12</td>
<td>mm ± SD 3.24 ± 0.43</td>
<td>0.34</td>
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<tr>
<td></td>
<td>Range 2.61-3.93</td>
<td>Range 2.70-4.56</td>
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<tr>
<td>Preoperative Pupil Diameter</td>
<td>mm ± SD 3.39 ± 0.21</td>
<td>mm ± SD 3.46 ± 0.85</td>
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<tr>
<td></td>
<td>Range 2. to 4.1</td>
<td>Range 2.3 to 4.6</td>
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Visual quality, Halos, and Patient Satisfaction

- **Straylight** changed (improved) from a mean log S of $1.276 \pm 0.078$ in the Seelens MF group to $1.077 \pm 0.237$ (p<0.0001). In the SN6AD1 group straylight reduced less from $1.243 \pm 0.594$ preoperatively to $1.189 \pm 0.0194$ postoperatively (P<0.25). The mean difference between the study and the control group postoperatively was a -0.12 log S in favour of the study group (p<0.002).

- **Halos** were reported at 3 months in 3 (12%) of patients in the study group and 5 (28%) of patients in the control group. This difference did not reach statistical significance, even though there is a clinical significance.

- **Satisfaction** Overall 24 (96%) in the study group were satisfied with the multifocal IOLs. In the control group 19 (95%) patients were satisfied with the surgery and the effect on vision. Clinically and statistically there is no difference in the satisfaction between the study and the control group.
Conclusion:

• The Seelens MF performs well compared to a well known multifocal apodized IOL, the SN6AD1.
• The lens material and design of the Seelens MF clinically and statistically significantly improves straylight and quality of vision. Clinically the incidence of halos was less in the study group, however this was statistically not significant.
• Near acuity was comparable in both groups, with a clinically and statistically significant advantage for the Seelens MF at the 50-60 cm distances.
• The Benz26 material makes the Seelens MF free of glistenings, but the SN6AD1 is a lens that has been used more often, with excellent results, and excellent possibilities of accurate IOL calculation.