Hexavision XO
Summary of Benefits

- Improved image quality and contrast sensitivity, especially in low light conditions.
- Lower refractive index of hydrophilic material may lead to fewer internal reflections.
- Unlike first generation aspheric IOLs, consistent results may be expected even in cases of clinically occurring lens decentration or tilt, as shown by wavefront analysis...

Wavefront Analysis: also called “wavefront error” is the analysis of the deviation of real wavefront from ideal spherical wavefront.

Results in the table below show Hexavision XO lenses have lower Total RMS and HOA RMS compared to first generation aspheric lenses for off-centered conditions. In addition, XO lenses have comparable or lower RMS measurements than spherical lenses for these same conditions...

Decentration and Tilt

An IOL placed in the posterior chamber of the eye of pseudophakic subjects will generally manifest some tilt and decentration. Decentration means range from about 0.3 to 0.7 mm, while tilt means range from 3 to 7 degrees, with lower numbers reported by more recent studies. Secondly, even an IOL perfectly centered in the capsular bag may be significantly centered with respect to the visual axis. This is because structurally, the human eye is not optically symmetrical, i.e. the optical axis of the eye doesn’t generally coincide with its visual axis.

P/N Hexa2034A

Unlike a camera, the eye is a decentered optical system with non-rotationally symmetric components (Fig 1). The principle elements of the eye’s optical system are the cornea, pupil, and the crystalline lens. Each is decentered and tilted with respect to other components rendering an optical system that is typically dominated by coma at all the times.

The cornea, pupil, and crystalline lens are decentered and tilted with respect to each other rendering the eye is decentered optical system that is different between individuals and eyes within the same individual. The line is centered with respect to the cornea represented here as being spherical.

The optics of all Hexavision XO™ lenses are designed to compensate for aberrations of the eye to achieve exceptional optical performance - even in cases of clinically occurring IOL misalignment.

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2. Kozaki J. et al Tilt and decentration of the implanted posterior chamber intraocular lens. J. Cataract Refr Surg. 1990; 17:592-599 (Average tilt of 7.5 degrees and decentration of 0.68 mm)
3. Auran JD et al. In vivo Measurements of Posterior Chamber Intraocular Lens Decentration and Tilt. Arch Ophth. 1990;108:75-79 (Average tilt 6.7 deg and decentration 0.7 mm)

RMS (“root mean square”) is a measure of wavefront error. It is the square root of the average of the squares of all the wavefront errors over the full aperture of the optical system. Total RMS and Higher Order Aberrations RMS (HOA RMS) are each defined by the integration of the Zernike coefficients, representing total and high order wavefront errors respectively.

Total RMS varies with Post-Op refraction but HOA RMS does not. Since Higher Order Aberrations can't be corrected by spectacles, they impact vision even at best corrected conditions. Therefore, HOA RMS is a more relevant measure of aspheric lens performance...

IOL Position in Eye Model

<table>
<thead>
<tr>
<th>Spherical IOL (µm)</th>
<th>First Generation Aspheric IOL* (µm)</th>
<th>Hexavision XO (µm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centered</td>
<td>Total RMS: 0.63</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>HOA RMS: 0.27</td>
<td>0.00</td>
</tr>
<tr>
<td>Decentered 0.5 mm</td>
<td>Total RMS: 0.63</td>
<td>0.24</td>
</tr>
<tr>
<td></td>
<td>HOA RMS: 0.20</td>
<td>0.13</td>
</tr>
<tr>
<td>Decentered 1.0 mm</td>
<td>Total RMS: 0.63</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>HOA RMS: 0.28</td>
<td>0.41</td>
</tr>
<tr>
<td>7 Degree y-tilt and 0.5 mm y-decentration</td>
<td>Total RMS: 0.61</td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td>HOA RMS: 0.25</td>
<td>0.17</td>
</tr>
</tbody>
</table>

* First generation aspheric IOL* is designed to be correct for spherical aberrations only at the centered position.
Hexavision XO Series
Aspheric Hydrophilic Lenses
(available with Heparin Surface Modification)

One type of 1ST GENERATION aspheric IOL is designed with a prolate aspheric surface to compensate for corneal aberrations when the lens is centered. Because the optics of these lenses are optimized for a centered position, they can perform poorly if they become decentered or tilted - often to the point of performing worse than a spherical lens under the same degree of decenteration.

Unfortunately, clinically occurring lens decenteration and tilt are common occurrences. Even the typical human eye itself is not optically symmetrical. Hexavision recognizes this, and has designed its XO optics to represent the NEXT GENERATION of aspheric lenses. XO optic design takes into account a broad range of aberrations arising with lens misalignment. Its aspheric surface is non-prolate which physically distinguishes its shape from 1st generation aspherics. Consequently, Hexavision's XO lens enables better image quality under a variety of real world conditions.

Total Residual Spherical Aberration

Leaves the eye. Despite excellent visual results on eye model,

Regardless of lens spherical aberration, the optics of 1st generation aspheric IOLs are optimized for the centered position. Because of this same performance poorly if they become decentered or tilted - often to the point of performing worse than a spherical lens under the same conditions. And unfortunately, very few IOLs are perfectly centered in the eye.

Hexavision recognizes this and designed its XO lens with more than just perfect conditions in mind. Its optic design takes into account a broad range of aberrations arising with lens misalignment. XO was also optimized for the range of corneal asphericity to offer benefits for patients of different corneal shapes. Consequently, Hexavision's XO lens enables better image quality under real world conditions.

MTF (Modulation Transfer Function) analysis shows the significantly improved image quality of a Hexavision XO aspheric hydrophilic lens to a typical aspheric lens, under various degrees of decenteration and tilt. In addition, the MTF of XO is comparable to or better than that of a spherical optic in cases of significant lens decentration and tilt.

Hexavision's XO lens enables better image quality under real world conditions.

The Next Generation in Aspheric IOLs