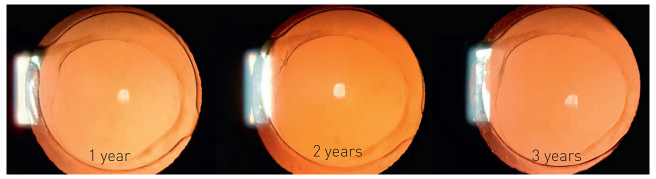
RESEARCH AND DEVELOPMENT IN IOL TECHNOLOGY FOR THE OPTIMISATION OF VISUAL QUALITY

At a special HOYA Symposium held at the Guildhall in London (ESCRS September 2014), a panel of eminent ophthalmologists delivered a series of lectures describing how an improved understanding of human vision and the molecular behaviour of IOL materials and biomolecular behaviour of the human eye is offering cataract patients the prospect of better visual performance and greater satisfaction.

NEW IOL MATERIAL REDUCES LENS AND POSTERIOR CAPSULE OPACIFICATION

The new **HOYA Vivinex™ iSert®** IOL is composed of a new hydrophobic material which appears to be much less prone to glistenings and whitenings, and has a surface modified to resist PCO, moreover, the iSert® preloaded injector system makes the implantation of the lens a very simple procedure, said Prof. Hiroyuki Matsushima, Dokkyo Medical University, Tochigi, Japan.

Glistenings and whitenings are two related phenomena which tend to occur in hydrophobic acrylic IOLs over time. Glistenings are relatively large bright spots, or "voids", around 10 microns in diameter, occurring throughout the entire IOL optic. Whitenings are much smaller voids generally around 100 nm in diameter that are close to the optic's surface. The voids consist of phase-separated water aggregates. Although they cause little trouble at first, they continually increase over the years and can eventually can make the lens significantly and noticeably less transparent.



However, in a clinical study, the amount of light scattering at a follow-up of three years in eyes with the Vivinex lens, both on the surface and in the centre of the optic, was only around half that of eyes with the Tecnis ZA9003 IOL (AMO), and only a fourth that of eyes with the Acrysof SA60AT IOL (Alcon) at a follow-up of only one year.

In addition, designers of the Vivinex lens have used a new process for rendering the surface of a hydrophobic lens more adhesive to the lens epithelial cells and therefore more resistant to PCO. In a clinical study involving 29 eyes of 29 patients, those who underwent implantation of the Vivinex lens had only half as much PCO as those who underwent implantation of an earlier hydrophobic acrylic IOL without the surface modification.

"With stable material, low PCO using surface modification technology and an easy-to use preloaded injector system the 'Vivinex™ iSert®' should be available soon" he concluded.

HOYA Vivinex™ iSert® has a stable material, low PCO using surface modification technology and is an easy to use preloaded injector system

Hiroyuki Matsushima, MD, PhD

TORIC TIPS

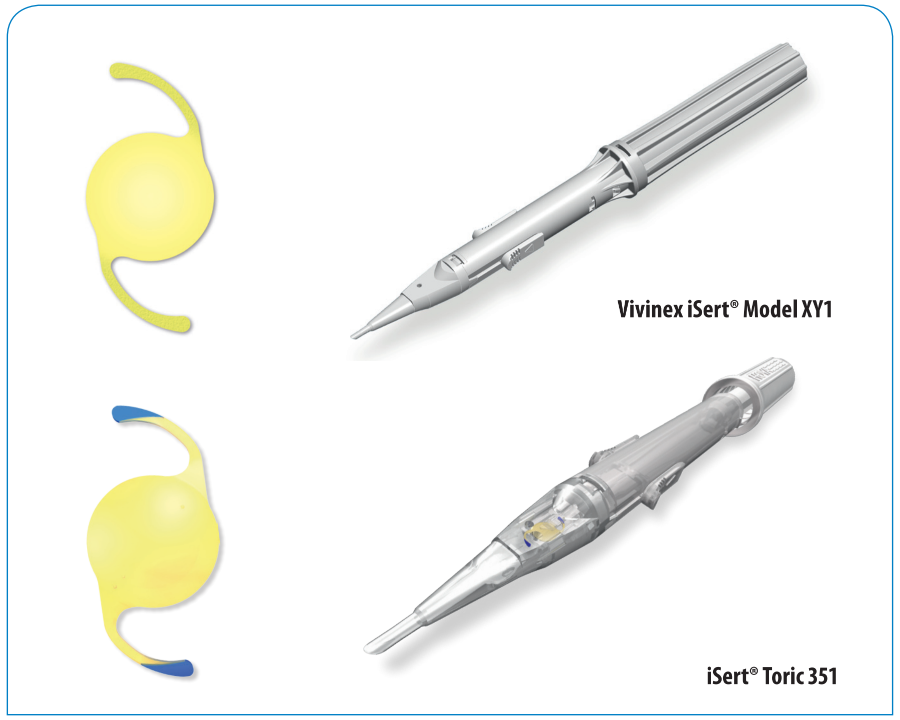
Prof. Navid Ardjomand, University Eye Hospital, Graz, Austria, shared some tips on achieving good results with toric IOLs as well as his preliminary results with the HOYA iSert® Toric 351 IOL which is designed to correct up to 4.0 D of corneal astigmatism.

Dr. Ardjomand noted that when performing keratometry it is important to remember that the measurements of the different devices are not interchangeable, although comparison of their measurements can be very useful, particularly in eyes with K readings higher than 46.0 D.

He added that the toricity of the IOL must be calculated based not only on the corneal cylinder but also on the anterior chamber depth. For example, in a long, myopic eye with a corneal astigmatism of 2.0 D, the cylinder of the IOL should be 2.2 D, whereas in a short, hyperopic eye it should be 2.6 D.

He noted that the iTrace aberrometer (Tracey) is specifically adapted for marking the eye's astigmatic axis, and provides an overlay for guiding the orientations of the lens during surgery. Dispersive OVDs are contraindicated because they increase the risk of rotation of the lens. When performing the phaco incision, the steep axis is generally a safe option when possible.

Dr. Ardjomand now has one month of follow-up with the iSert® Toric 351 IOL in a series of 22 eyes. It shows that the between the first postoperative day and first postoperative month the IOL rotated by a mean of only three degrees. In addition, mean decimal visual acuity was 0.67 uncorrected 0.9 with correction.



THE BENEFITS OF POSITIVE SPHERICAL ABERRATION

Dr. Damien Gatinel, Rothschild Foundation, Paris, France, reviewed the optical science behind spherical aberration and its potential to enhance depth of focus.

He noted that a refractive surface with positive spherical aberration has an oblate shape, meaning that the amount of curvature increases from the centre outwards. As a result, the peripheral rays come into focus increasingly in front of the focus of the central rays. With negative spherical aberration the situation is the reverse, and a prolate shape causes peripheral rays to come into focus increasingly behind the focus of the central rays.

Although spherical aberration reduces the sharpness of an image, it also increases the depth of field. In a human eye, positive spherical aberration creates a myopic defocus and negative spherical aberration creates a hyperopic defocus. Spherical aberration can be modulated with laser ablations of the cornea, but due to corneal healing effects and other problems they cannot currently match the precision of IOL technology.

"With IOLs made with specific levels of spherical aberration properties you can do a much better job and provide better outcomes for your patients and that is the principle behind the EDF (Enhanced Depth of Focus)", Dr. Gatinel added.

IMPROVING THE CLINICAL VISUAL OUTCOME IN MONOVISION

In IOL technology the two main approaches to achieve spectacle independence are multifocality and monovision. The controlled positive aspheric lens provides a third approach, monovision enhanced through an increased depth of field, said Prof. Oliver Findl, Hanusch Hospital, Vienna Austria and Moorfields Eye Hospital, London UK.

He noted that although multifocal IOLs tend to provide better spectacle independence than conventional monovision, a disproportionate number of patients with the lenses have them explanted. The most frequent sources of dissatisfaction with multifocal lenses include dysphotopsias and loss of contrast, both of which are inherent to the split-focus design of the lenses.

Like multifocal lenses, monovision entails some compromises, and a disparity of more than 2.0 D between the dominant and fellow eye can severely reduce stereopsis. However, good distance and intermediate vision appears to be satisfactory for most patients and can be achieved with what has become known as mini- or moderate monovision. In this approach, the target refraction is emmetropia in the dominant eye and only 1.0 D to 1.25 D of myopia in the fellow eye.

Taking that idea one step further Prof Findl and Dr. Gatinel have recently completed recruitment for prospective randomised controlled study involving 40 patients. It will compare a new micro-monovision approach using a new positive aspheric lens with standard monofocality using the HOYA iSert® 251 lens. In the group receiving the positive aspheric lenses, the dominant eye will be targeted for emmetropia and the fellow eye for -0.5 D of myopia.

"We expect to have the three-month follow-up results of the trial by beginning of 2015", Prof. Findl added.

by Colin Kerr

Prof. Hiroyuki Matsushima, MD, PhD
Dokkyo Medical University, Tochigi, Japan

Prof. Navid Ardjomand, MD
University Eye Hospital, Graz, Austria

Dr. Damien Gatinel MD
Fondation Ophtalmologique A. de Rothschild, Paris, France

Prof. Oliver Findl MD PhD
Hanusch Hospital, Vienna Austria and Moorfields Eye Hospital, London UK