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Über die Problematik: “Wavefront and clinical analysis of an aspherical intraocular lens”

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Our aim was to study the clinical outcome and total Wavefront results of a new acrylic foldable aspheric IOL (TECNIS™ Acrylic IOL ZA9003) and compared it with Sensar AR40e IOL . The Tecnis ZA9003 from AMO is an intraocular lens with a modified anterior prolate surface which gives the IOL a negative spherical aberration of -0.27 um. This lens was conceived to compensate the positive corneal aberration of the human eye and so diminish the unwanted symptomatic that such aberration may cause.
In order to do this, we carried out a prospective randomized clinical trial. We recruited 20 patients (Age 74.1 +/- 10.5 years old). The inclusion criteria were bilateral clinical cataract, BCVA 0.7 or worse cylinder less than 1.5 D. and no additional pathology except the lens opacification. The first operated eye was aleatory selected. The first eye was implanted with a Tecnis ZA9003 and three weeks later, the contralateral eye was implanted with Sensar AR40e. Both IOLs have the same material and design and are only differentiated from the anterior prolate surface. Pre-operative BCVA, spaltlamp examination, IOP and fundus examination in midriasis were examined. Lens power calculation was performed by measuring the Axis length, K1 and K2 values and anterior chamber depth (IOL Master, Zeiss). Uneventful surgery was performed under the same surgical conditions and by the same surgeon. After 2-3 months postoperatively, patients were evaluated for: visual acuity, pupil size measurements under three different illumination conditions (scoptopic, mesopic high and mesopic low, Procyon 2000) keratometry and corneal,

internal and total wavefront analysis (under pupil dilatation at least of 5mm) (OPD Scan II, Nidek).

The parameter analyzed included: (1)root mean square (RMS) of high order aberrations (HOAs), spherical aberration (SA), coma (C), and trefoil (T). (2) zernike coefficient of HOAs, SA, C and T. (3) Wavefront Error (WF) of HOAs, SA, C and T., for pupil diameter of 5,5mm.

The mean value and standard deviation for the data were calculated. A paired t test and the Wilcoxon signed ranks test were used to analyze the difference in the mean values of HOAs, SA, C and T between right and left eye (Tecnis and AR40e IOLs). A statistical significance level was set at p 0.05.

A correlation test was performed between pupil size and ocular aberration and between C-quant results with total spherical aberrations in both groups. All statistical analyses were performed with WinSTAT software for Excel.

Preoperative visual acuity increased in the 2-3 months postoperatively control in both groups and showed no significant difference (Wilcoxon test).

No significant difference was found under any of the illumination conditions (p values: 0.55, 0.27 and 0.17 respectively).

Under normal light conditions, and even under scotopic conditions, most patients were in the 5mm and less category, only a few had a pupil size of 5mm and more. The maximum pupil size under mesopic conditions was 5.8 mm for the AR40e group and 5.7mm for the tecnis group (only nine eyes).

There was no statistical difference between the corneal spherical aberration in both groups (p value 0.24). The main differences were found when comparing the internal and total spherical aberrations (p values 0.008 and 0.0006 respectively). Tecnis showed a tendency towards lower amounts of stray light measured by the C-quant. (Tecnis 1.0 Log, p value: 0.006)

As seen in other clinical trials, the eyes implanted with Tecnis ZA9003 IOL were able to compensate positive aspheric corneal aberrations when compared to the AR40e.

Preoperative pupil size measurements, as well as corneal wavefront analysis, are recommendable prior to implantation of an aspheric IOL.