



Artisan versus ICL in the same Patient: A Slight Aberration makes a big Difference

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Abstract

We report the case of a 30-year-old woman implanted with an iris-fixated lens (Artisan, OPHTEC) in the right eye (RE) and with an implantable contact lens (ICL) (V4, STAAR) the left eye (LE) for the correction of high myopia.

The patient complained of halos and distortion on the RE 4 years after the Artisan implantation. There was a slight superior decentration of the phakic IOL. Uncorrected VA was 20/25 and there was a significant decrease of endothelial cell density. The reported symptoms may be due to the observed slight increase in higher-order aberration and contrast sensitivity (CS).

Three months after implanting a posterior chamber intraocular lens (ICL) in the LE, the uncorrected VA was 20/25. The decrease in the endothelial cell density was not statistically significant. The CS was within normal limits and the higher-order aberration was lower than 0.5 μ m.

Keywords

Iris-fixated lens, Implantable contact lens, Phakic IOL, High order aberrations, Contrast sensitivity

Introduction

After keratorefractive surgeries for high myopic refractive errors, there may be various complications including halos, glare, and contrast sensitivity loss due to higher-order aberration induced by the keratorefractive surgery. Over-flattening of the central cornea can cause higher order aberration. IOLs can correct high refractive errors with minimal changes in the shape of the cornea [1]. The implantation of phakic IOLs has been demonstrated to be an effective, safe, predictable and stable procedure to correct higher refractive errors [2,3]. However, they are not exempt from a high rate of serious, short and long term complications [4]. Are the same benefits obtained with different phakic IOLs?

Several types of phakic IOLs are available, such as anterior chamber iris-fixated PMMA lens, phakic IOLs (Artisan (OPHTEC))

and posterior chamber phakic IOLs (Visian Implantable Collamer Lens, ICL; V4, STAAR Surgical, Nidau, Switzerland).

In this case report, we compare two types of phakic IOLs, Artisan versus ICL, for correcting high myopia in the same patient, and we describe the difference in quality of vision.

Case Report

A 30-year-old woman presented asking for refractive surgery. She worked in a fashion store and although she was using contact lenses and referred stability in the refractive correction, she wanted to remove her glasses permanently. The uncorrected distance visual acuity (UDVA) in both eyes was finger counting at 2 meters. Her manifest refraction was -10.5 -0.75 \times 170 RE and -9.25 -0.75 \times 170 LE, with left eye dominance (hole-in-the-card test). Corrected distance visual acuity (CDVA) was 20/25 RE, and 20/25 LE. Contrast sensitivity (CS) (CSV100 test) for the 4 frequencies examined (A: 3cycles/degree (cpd), B: 6cpd, C: 12cpd, D: 18cpd) were 6, 5, 6 and 6cpd, respectively. Keratometry was 46.75 \times 46.00D RE and 46.75 \times 46.75D LE. Biomicroscopy of the anterior pole of both eyes showed no significant finding. Intraocular pressure measured with the non-contact tonometer (Topcon CT-80) was 19mmHg RE and 18mmHg LE. Posterior segment examination in both eyes was unremarkable. The rest of the ocular examination was normal. Topography (Orbscan II, Bausch & Lomb, Rochester, New York, USA) showed a normal pattern in both eyes.

The patient was given a follow-up appointment for additional tests, but did not attend.

The patient returned to the clinic 4 years later, in September 2011, with an Artisan IOL already implanted in her right eye, inquiring about the possibility of correcting the myopia in her LE. She complained of halos and bad quality of vision in her RE. The uncorrected distance visual acuity (UDVA) was 20/32 RE and measured finger counting at 2 meters LE. Her manifest refraction was -0.75RE and -9.25 -0.75D \times 170LE. Corrected distance visual acuity (CDVA) was 20/20RE, and 20/25LE. Keratometry was 46.75 \times 46.50D RE and 46.5 \times 46.75D LE.

The endothelial cell density, determined with a non-contact specular microscope (SP-8800; Konan, Nishinomiya, Japan), was

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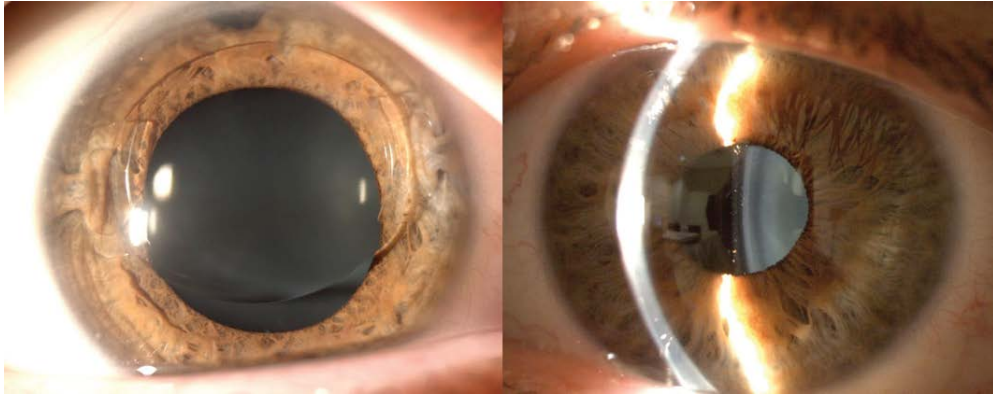


Figure 1: Iris-fixated lens (Artisan, OPHTEC) in the right eye and Implantable contact lens (ICL) (V4, STAAR) the left eye.

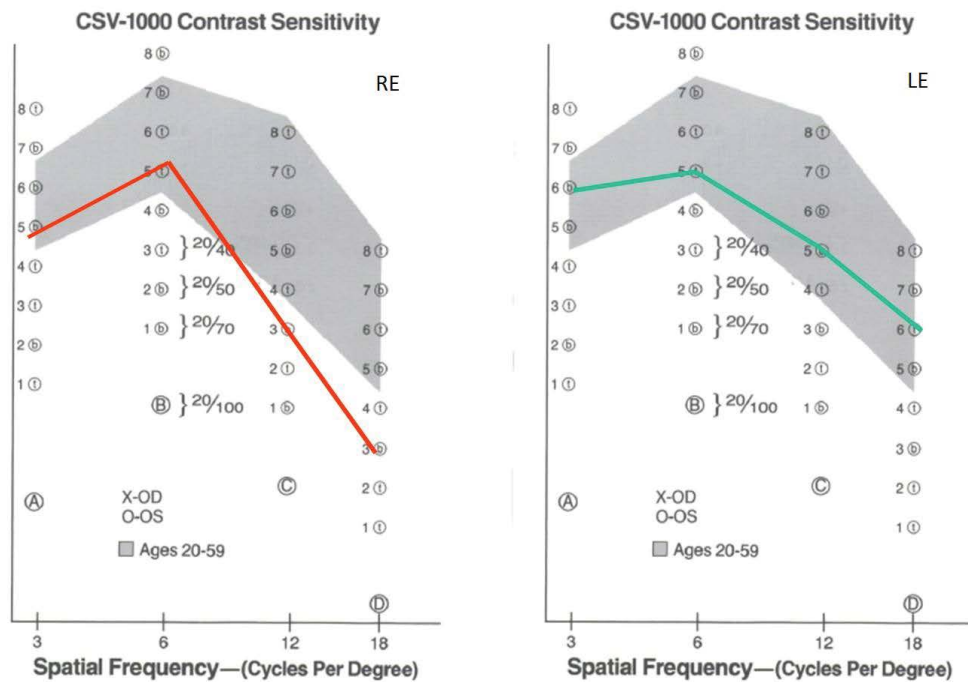


Figure 2: Contrast sensitivity of both eyes, three months after surgery.

2,037cells/mm² RE and 2,401cells/mm² LE. The axial length was 25.11mm LE, ultrasound Pachymetry (DGH Technologies, Exton, Pennsylvania, USA) was 539 micron and anterior chamber depth (ACD) measured from the corneal endothelium with a scanning-slit topographer (Orbscan Ilz: Bauch &Lomb, Rochester, NY) was 3.51mm LE. Pupillometry (mesopic conditions) was 3.6mm RE and 3.9LE. Clinical examination revealed that the Artisan IOL was in a stable position with the haptics in the horizontal axis, with no inflammatory reaction in the anterior chamber and clear lens. There was no contact between the Artisan IOL and the crystalline lens, nor did the anterior surface of the iris appear to rub against the posterior surface of the IOL optic. Dilation showed a slight superior decentration of the IOL (Figure 1a). Other ophthalmic examinations were unremarkable.

A phakic intraocular lens of -10D (STAAR) and 12.1mm of diameter, with a 5.8mm of optic zone, was implanted in the posterior chamber of the left eye. ICLs was made of a flexible material proprietary hydrophilic porcine collagen (<0.1%) hydroxyethyl methacrylate (HEMA) termed Collamer. The surgery was performed under topical anesthesia, intraoperative iridotomy with vitreotome, as per the usual technique and without complications. The patient followed the postoperative protocol of antibiotic and steroid eye drops plus visits at 24 hours, one week, and one month.

The patient was followed up periodically. Three months after surgery, the manifest refraction for the left eye was +0.25-0.50 ×

180 with UCVA of 20/25 and BCVA of 20/20. Keratometry was 46.5 × 46.75D LE. Endothelial cell density was 2389cells/mm². Biomicroscopy examination showed a centered ICL, vault 1 (Figure 1b), with a wide anterior chamber, permeable iridotomy and clear lens. Intraocular pressure was 13 mmHg. The patient reported good quality of vision in her LE, but symptoms of difficulty in night driving and halos in her RE. CS showed a clear decrease on the high frequencies (Figure 2) in accordance with the patient's symptoms. The high order aberration data (HOAs), obtained with a Hartmann-Shack aberrometer (Zywave, Bausch & Lomb, Rochester, New York, USA) (Figure 3), was 0.56µm RE and 0.46µm LE (Figure 3). The spherical aberration was -0.13µm RE and -0.08µm LE. The difference was significant (P<0.05).

Discussion

The visual performance of ICL IOL was better than the Artisan IOL for our patient, although both phakic IOLs showed equal and comparable safety, predictability, and efficacy in a study of 68 highly myopic eyes published in 2011 [5]. However, the authors did not measure CS and aberrations.

Different degrees of glare associated with this IOL have been reported in the literature. Maloney et al. [6] reported mild to moderate glare in 18 eyes (13.8%) and severe glare in 1 eye (0.8%) of 130 eyes implanted with an Artisan iris-supported phakic IOL. In 3

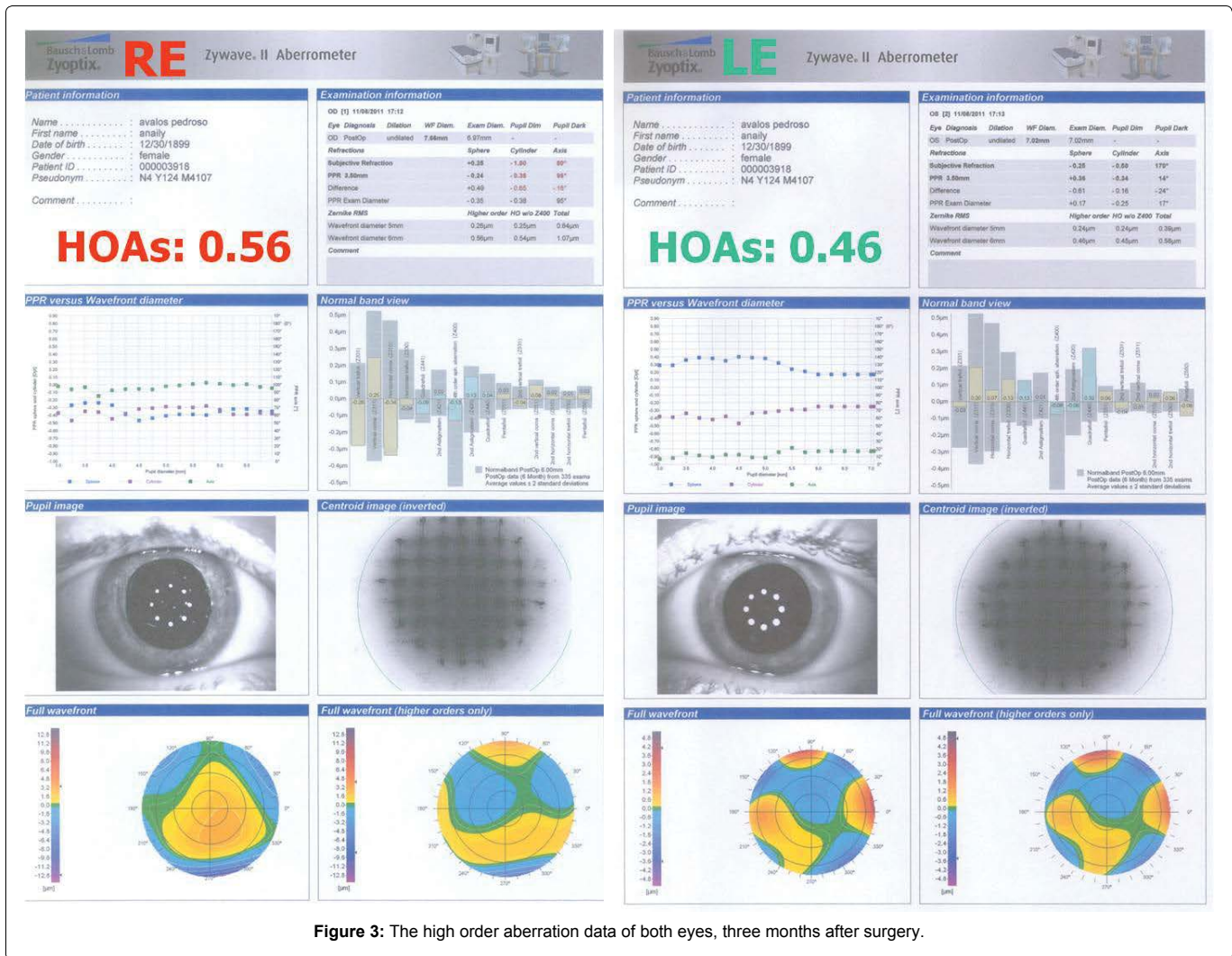


Figure 3: The high order aberration data of both eyes, three months after surgery.

eyes an optic diameter too small relative to the pupil size was found to be the cause of the visual disturbances and an IOL with a 5.0 mm optic was exchanged for an IOL with a 6.0 mm optic, with no glare noticed afterwards [6]. The slight decentration of the IOL in the RE could cause visual disturbance such as diplopia and glare but in our patient a pupil in mesopic conditions of 3.6 mm can hardly explain the symptoms. Furthermore, a small degree of decentration should be more likely found after iris fixation of an Artisan IOL than when an ICL is placed in the posterior chamber of the eye.

Marroccos et al. [7] showed that, with objective measurements, there was an increase in both glare and halos which was more prominent in eyes with an ICL than with Artisan (both 5.0 and 6.0), and that symptoms lead to a decreased visual performance at night time, causing visual disturbances in dim light conditions [7]. These findings were thought to be due to the edge effects of the small diameter of the ICL and the small optic diameter (4.5 to 5.5mm) in relation to the pupil size (5.3 to 7.4mm). This was attributed to the larger optic (6.0mm versus 5.0mm) and the fixation of the IOL to the iris, which causes less pupil dilation. Conversely, in our patient, the ICL had fewer halos and better quality of vision than with the Artisan.

The contrast sensitivity decreased in the Artisan IOL compared to the ICL IOL for our patient. Stulting et al. [8] after analyzing 3-year results of the Artisan PIOL, did not detect a decrease in the contrast sensitivity. However, in this prospective study, patients with a mesopic pupil greater than the PIOL optic were not included; 80% of the PIOLs had a 6.0 mm optic and only 20% had a 5.0 mm optic [8]. In another study the CS decreased in the immediate preoperative exam but returned to baseline three months after surgery under photopic conditions [9]. As in our patient, Artisan PIOLs led to a small increase of HOAs under photopic conditions [8,9]. For different pupil sizes an increase in HOAs, trefoil and spherical aberration

was also found [10]. The authors reported a significant correlation between PIOL decentration and postoperative spherical aberration and coma. Different incision sizes may explain differences in trefoil, whereas the optic design seems to affect spherical aberration.

The spherical aberration was found to be in our patient $-0.13\mu\text{m}$ RE and $-0.08\mu\text{m}$ LE. Artisan phakic IOLs are safe and effective for refractive error correction but with a significant increase in 4th order spherical aberration [11,12] which, according to the authors, could be related to the optic design.

The ICL performed better in terms of endothelial cell density in the short term in our patient, in accordance with Ju et al. [13]. The Artisan phakic IOL provided good refractive outcomes but a higher than normal rate of endothelial cell loss. During a 2-year follow up, Benedetti et al. [14] found a 5.4% endothelial cell loss in 60 patients implanted with the Artisan phakic IOL affected with myopia [14]. Other authors reported rates between 1.8% [8] and 1.45% [11] per year.

Artisan and ICL phakic intraocular lenses are effective for refractive correction, but the Artisan performed worse in terms of contrast sensitivity than the ICL in our patient. HOAs were also significantly higher in the Artisan lens than in the ICL. Centering of the IOL is very important for the result in vision quality.

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