FROM THE EDITOR

Phakic intraocular lenses: Lessons learned

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Toast to the lessons not yet learned and to the trials that will teach them.

—Brooke Fraser

Uncorrected refractive errors—defined as visual acuity of less than 0.3 logarithm of the minimum angle of resolution (logMAR) with an improvement of at least 0.2 logMAR (equivalent to 2 lines) following refraction—is one of the leading causes of global vision impairment.1 Moderate-to-severe vision impairment caused by uncorrected refractive errors is expected to rise by about 10%, to 128 million, and blindness attributable to uncorrected refractive errors is expected to increase by about 8%, to 8.0 million, by 2020.2 Clinically significant refractive errors, or ametropia, affect half of the general population in the United States3 and myopia contributes to the greatest burden of refractive errors among healthy adults in Europe.4

Surgical interventions for the correction of ametropia involve either corneal reshaping procedures with laser refractive surgery or intraocular surgical procedures, which include refractive lens exchange and phakic intraocular lens (pIOLs). The first pIOLs were placed in the anterior chamber as early as 1953 by Strampelli.5 These lenses were plagued with endothelial cell loss (ECL), pupil distortion. Due to the significant complications experienced with these lenses nearly 30 years passed before new lens designs began to emerge. In 1977, Jan Worst introduced the iris-fixated iris-claw lens, which was a biconcave design made from poly(methyl methacrylate) (PMMA). This lens avoided many of the glaucoma and endothelial complications.6

Although several models of angle-supported pIOLs have been tried in the past, long-term studies have shown poor safety with significant corneal endothelial cell loss (ECL), leading to recalls of these lenses from the market.7 The most recent recall was the withdrawal of the AcrySof Cachet (Alcon Laboratories, Inc.) angle-supported pIOL in September 2014.8 At the time of writing this editorial, the only U.S. Food and Drug Administration (FDA)- and Conformité Européenne-approved phakic anterior chamber pIOL is the iris-claw (iris enclaved) IOL (Artisan/Verisyse, Ophtec BV/Johnson & Johnson Vision). The Artiflex is the foldable version of the Artisan and is available in Europe. The U.S. equivalent of the Artiflex is the Veriflex, which is currently in trials. Although the iris-claw IOLs have long clinical track records, a recent 10-year follow-up study showed significant linear chronic ECL after implantation with iris-fixated pIOLs.9 Three different multivariate linear mixed models were fitted to the dataset on 127 eyes that had completed 10 years of follow-up. These models showed that lower preoperative age (P < 0.001) and smaller preoperative anterior chamber depth (P < 0.001) were the most important risk factors for ECL.10

Posterior chamber pIOLs came into existence in 1986 and were first developed by Svyatoslav Fyodorov.10 They originally had a collar-button configuration with the optic in the anterior chamber and the haptics behind the iris. The design inspired the Visian implantable collamer lens (ICL) (STAAR Surgical) that is made of a trademarked material known as collamer, which is a copolymer of hydroxyethyl methacrylate and porcine collagen.11 The PRL Phakic Refractive Lens (CIBA Vision) was a nonfixated, 1-piece, hydrophobic silicone elastomer designed to float above the crystalline lens surface, with the haptics resting on the zonules12; it was discontinued due to a tendency to create zonular dehiscence and subluxation into the vitreous cavity.12

The ICL is currently the only posterior chamber pIOL approved for use in the U.S. The earlier version of the ICL required a prophylactic laser or surgical iridotomy to prevent intraocular pressure spikes. However, the new design (Visian V4c), which is CE-marked but not FDA-approved, incorporates the KS-AquaPORT (STAAR Surgical), which is a hole of 360 microns in the center of the ICL optic, to optimize the flow of fluid within the eye. The KS-AquaPORT is named after Kimiya Shimizu, who helped pioneer the technology. The CentraFLOW technology eliminates the need for a laser peripheral iridotomy or an intraoperative surgical iridectomy. Recently, a new posterior chamber pIOL, the implantable phakic contact lens (IPCL, Care Group), has been marketed outside the U.S.13 Although previous studies reported good visual acuities and contrast sensitivities with the CentraFLOW ICL,14,15 there have been other reports of dysphotopsias,16,17 In this issue, Choi et al. (page 1555) report on the 10-year outcomes after implantation of the Visian ICL. This study shows the long-term effectiveness and stability of visual outcomes and safety after ICL implantation in patients with high myopia. The authors demonstrate that vault height tended to decrease over time after ICL implantation,
and the risk of lens opacity was related to low vault height. In addition, higher preoperative age and higher preoperative myopia were risk factors for the development of lens opacity. Also in this issue Martinez-Plaza et al. (page 1591) report on the effect of exact CentraFLOW location of the ICL in respect to the pupil center and visual axis (based on angle kappas) on the quality of vision, as well as on the quality of life. They calculated the real displacement of the CentraFLOW hole location with respect to the pupil center or visual axis, and demonstrated that upward decentration of the CentraFLOW hole is associated with worsening of perceived quality of life, and a longer radius (magnitude of CH decentration) can be related to higher glare discomfort.

These long-term data and multivariate risk factor analyses on both anterior and posterior chamber pIOLs provide surgeons with robust scientific information in selecting the right procedure and analysing the risk-benefit ratio of each procedure, and should form part of the detailed consent process prior to surgical intervention. It reminds me of primum non nocere, that is,”first, to do no harm.”

REFERENCES


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