Iris-fixated phakic IOLs have been safely implanted in patients with myopia since 1986.1 The original biconcave iris-claw lens, developed in conjunction with Jan G.F. Worst, MD, of Holland, was updated in 1991 to feature a convex-concave shape. In 1998, the name of the lens changed to the Artisan (Ophtec BV, Groningen, Netherlands; Figure 1). In the following years, hyperopia- and astigmatism-correcting models became available. In 2003, a foldable model of the myopic Artisan, the Artiflex phakic IOL (Ophtec BV; Figure 2), was released in Europe. This lens may offer an advantage over the Artisan because it can be inserted through a smaller incision, with a decrease in surgically induced astigmatism and faster visual recovery.2

Iris-fixated phakic IOLs have provided stable and predictable visual results.3-7 Summarizing the long-term safety, loss of more than 2 lines of BCVA was detected in only 0% to 2.6% of eyes.3-7 Vision-threatening complications are rare with the modern Artisan and Artiflex lenses. Overall, the risk of complications is greater in phakic hyperopes than in phakic myopes, due to the shallower nature of the anterior chamber and smaller angle space. Postimplantation complications of iris-fixated phakic IOLs include pupil ovalization, IOL decentration, low-grade postoperative uveitis, endothelial cell loss, pupillary-block glaucoma, cataract, and retinal detachment; however, all are rare.3,8-10

To minimize these complications, an accurate and extensive preoperative examination of the patient is of utmost importance. The following sections review some important safety information with regard to implanting iris-fixated phakic IOLs.

**PUPIL SIZE**

The pupil plays an important role in lens centration, which is necessary for optimal optical lens function. The Artiflex has an optic diameter of 6 mm, whereas the Artisan is available with an optic diameter of either 6 mm (for IOL powers up to -15.50 D) or 5 mm (for IOL powers from -16.00 to -24.00 D). If the pupil size in mesopic lighting conditions exceeds the optical zone diameter of the phakic IOL, glare and higher-order aberrations could be markedly increased, resulting in decreased visual performance and patient satisfaction. This highlights the
importance of performing preoperative pupil measurements in different lighting conditions.

Postoperatively, pupil size is reduced under scotopic conditions or medical mydriasis. Dick et al.8 showed a mean postoperative scotopic pupil diameter decrease of 1.1 mm in myopic eyes, suggesting that the iris-fixated phakic IOL mechanically restricts pupil size changes under low-light conditions and could reduce the incidence of postoperative photic phenomena. Therefore, we believe that patients can still be eligible for phakic IOL implantation with a scotopic pupil size 1 mm larger than the optic of the lens.

ENDOTHELIAL CELL LOSS

The long-term effect of iris-fixated phakic IOLs on the corneal endothelium remains a point of discussion. The endothelial cell density (ECD) is known to decrease over time, with a physiological rate of 0.6% per year after the age of 18 years.11 Several short-term and a few recent long-term studies have evaluated corneal ECD loss after Artisan phakic IOL implantation, showing an average ECD loss of 0.7% to 11.7% over 3 years.3,10,12 An anterior chamber depth (ACD; measured from the epithelium) of at least 3 mm is suggested as an adequate safety measurement for implantation of the Artisan.3,10 Other safety criteria that have been suggested to maintain a safe distance to the endothelium include a 1.5 mm distance from the edge of the phakic IOL to the endothelium13 and 2 mm from the center of the phakic IOL to the endothelium,14 both of which can be measured using anterior segment imaging (Figure 3).

In a recent study at our institution,15 we found that a shorter distance from the edge of the phakic IOL to the endothelium was associated with higher ECD loss. For example, for an edge distance of 1.37 mm, a linear mixed-model analysis predicted an ECD loss of 0.98% per year. However, an edge distance of 1.15 mm resulted in a yearly ECD loss of 1.8%, and an edge distance of 1.59 mm resulted in a yearly loss of only 0.15%. Because the natural lens enlarges with age, the edge distance will decrease over time. To ensure a lifelong safe distance from the phakic IOL to the corneal endothelium, the distance between the edge of the lens and the endothelium should be monitored yearly using anterior segment imaging.

LENS RISE AND DECENTRATION

Two recent studies suggest that pigment dispersion on the phakic IOL and subsequent inflammatory reactions after iris-fixated phakic IOL implantation may be caused by abnormal pressure on the iris.16,17 In this situation, the iris is sandwiched between the crystalline lens and the phakic IOL. To minimize chafing of iris tissue (ie, between the phakic IOL and the natural lens) and cataract formation, there should be enough space between the posterior surface of the phakic IOL and the anterior surface of the natural lens. An important preoperative distance concerning these complications is the lens rise, which is the distance from the anterior surface of the crystalline lens to the horizontal line between the two angle recesses (Figure 4). Baikoff et al.17 suggest that the preoperative lens rise should be less than 600 µm to avoid pigment dispersion. This distance can be easily measured using an anterior segment imaging device.

Lens decentration, which may develop spontaneously, is often due to an inadequate amount of iris tissue enclavation. However, decentration can also occur after blunt trauma, which may result in loosening of the hap-
Figure 5. (A) Short- and (B) long-term follow up. The patient presented with shifting of one haptic on long-term follow-up.

CONCLUSION

Iris-fixated phakic IOLs safely and effectively correct myopia, hyperopia, and astigmatism when strict inclusion criteria for implantation are applied. In addition to yearly ECD counts, it is important to perform anterior segment imaging to evaluate the distance from the phakic IOL to the endothelium and crystalline lens to make sure these lenses will be safe in the long term.

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