Visual outcome and complications after posterior iris-claw aphakic intraocular lens implantation

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PURPOSE: To evaluate the indications, visual outcomes, and complication rate after implantation of a posterior chamber iris-claw aphakic intraocular lens (IOL).

SETTING: Department of Ophthalmology, University Medicine Charité Berlin, Berlin, Germany.

DESIGN: Retrospective case series.

METHODS: Eyes without adequate capsule support had posterior chamber iris-claw aphakic IOL implantation (Verisyse/Artisan) between 2005 and 2010.

RESULTS: The study comprised 137 eyes (126 patients). The mean follow-up was 5 months (range 1 to 48 months). The IOLs were inserted during primary lens surgery in 10 eyes (7.3%), during an IOL exchange procedure for dislocated posterior chamber IOLs in 95 eyes (69.4%), and as a secondary procedure in 32 aphakic eyes (23.3%). The final mean corrected distance visual acuity (CDVA) (0.38 ± 0.31 [SD] logMAR) was significantly better than preoperatively (0.65 ± 0.58 logMAR) ($P < .05$). In 128 eyes (93.4%), postoperative refractive errors were within ±2.00 diopters (D) of emmetropia. Complications included slight temporary pupil ovalization in 34 eyes (24.8%), cystoid macular edema in 12 eyes (8.7%), hyphema in 3 eyes (2.1%), early postoperative hypotony in 7 eyes (5.1%) and elevated intraocular pressure in 6 eyes (4.3%), chronic uveitis in 1 eye (0.7%), toxic anterior segment syndrome in 1 eye (0.7%), and endophthalmitis in 1 eye (0.7%). Iris-claw IOL disenclavation occurred in 12 eyes (8.7%); all IOLs could be easily repositioned.

CONCLUSION: The retropupillary iris-claw IOL provided good visual outcomes with a favorable complication rate and can be used for a wide range of indications in eyes without adequate capsule support.

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In the absence of adequate capsule support, the surgical correction of an aphakic eye, phakic dislocation, or dislocation of an intraocular lens (IOL) remains challenging. In these cases, an angle- or iris-supported anterior chamber intraocular lens (AC IOL),[1] a transsclerally sutured posterior chamber IOL (PC IOL),[2–4] a fibrin glue–assisted sutureless PC IOL,[5] or an iris-fixated PC IOL[6–8] can be implanted.

Iris-fixated and open- or closed-loop AC IOLs are associated with complications including corneal endothelial cell loss leading to pseudophakic bullous keratopathy, secondary glaucoma, formation of peripheral anterior synechiae, cystoid macular edema (CME), chronic inflammation, and hyphema.[1,9–12] Sutured iris- or scleral-fixated PC IOLs also have disadvantages, such as a difficult suture technique, longer surgical time, hypotony, possible intraoperative bleeding, and damage to the ciliary body.[2–4,8,13,14]

Artisan/Verisyse aphakia IOLs (Ophtec BV; Advanced Medical Optics, Inc.), the latest version of iris-fixated PC IOLs, with haptics fixated to the iris with clips on both sides of the optic, have a significantly different design than previous generations of PC IOLs. The haptics have fine slits to capture, through enclavation, a fold of midperipheral iris stroma, where the iris is virtually immobile, less vascularized, and less reactive.[6,15] This study describes our experience with retropupillary implantation of Artisan/Verisyse aphakia iris-claw IOLs.

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PATIENTS AND METHODS

All cases of Artisan PC IOL (Verisyse VRS54) implantation over a 5-year period (December 2005 to 2010) at Charité University Hospital Berlin were identified from the operating theater logbook and reviewed. All patients were operated on by 1 of 2 experienced surgeons (E.B., P.R.) using the same surgical protocol in all cases.

The etiology of aphakia or IOL dislocation was identified in each case. Preoperative and postoperative evaluations included corrected distance visual acuity (CDVA), spherical equivalent (SE), Goldmann applanation tonometry, slitlamp examination, fundus examination, number of antiglaucoma eyedrops, and surgical complications. The IOL power was calculated using the SRK/T formula[16] and an A constant of 116.9. Visual acuity was converted to logMAR values for statistical analysis,[17] which was performed using the Student *t* test.

Surgical Technique

Under local (peribulbar) or general anesthesia, a 6.0 mm sclerocorneal tunnel incision was made at 12 o'clock and 2 paracenteses were created at the 2 o'clock and 10 o'clock positions. A cohesive ophthalmic viscosurgical device (OVD) was placed in the anterior chamber through the paracentesis. After the dislocated IOL was removed if necessary, the iris-claw IOL was inserted through the scleral tunnel. Then, the PC IOL was rotated with a hook into a horizontal position from 3 o'clock to 9 o'clock and centered behind the pupil using the Purkinje images. After IOL insertion, acetylcholine chloride 1% (Miochol) was injected behind the pupillary plane. Enclavation of the iris into the IOL claw was performed using an enclavation needle. Peripheral slit iridectomy was not performed. All the OVD was removed, and the incision was closed with interrupted 10-0 nylon sutures. Then, the conjunctiva was sutured with interrupted 7-0 polyglactin (Vicryl) sutures. Ofloxacin and dexamethasone drops were prescribed after surgery and slowly tapered over 4 weeks. Anterior or complete vitrectomy was performed in most cases except those with a history of vitrectomy.

RESULTS

The study comprised 137 eyes of 126 patients. The mean age of the 52 women and 74 men was 66.3 years ± 20.6 (SD) (range 8 to 94 years). The mean follow-up was 5 ± 8.1 months (range 1 to 48 months).

Tables 1 to 3 show the indications for iris-claw IOL implantation. The IOLs were inserted during primary IOL surgery in 10 eyes (7.3%), during an IOL exchange procedure for dislocated IOLs in 95 eyes (69.4%), and as a secondary procedure in 32 aphakic eyes (23.3%).

Table 1. Indications for primary lens surgery.

Indication	Eyes, n (%)
Marfan syndrome/ectopia lentis	6 (60)
Pseudoexfoliation syndrome	3 (30)
Complicated phaco for senile cataract	1 (10)

In all eyes, the mean postoperative CDVA (0.38 ± 0.31 logMAR) was statistically significantly better at the last follow-up than 1 day preoperatively (0.65 ± 0.58 logMAR) ($P < .05$). The final logMAR CDVA was better than preoperatively in 80 eyes (58.4%), was unchanged in 53 eyes (38.7%), and was worse in 4 eyes (2.9%). Fifty-seven eyes (41.6%) gained more than 2 lines of CDVA after surgery. On average, all subgroups had a significant improvement in postoperative CDVA over the preoperative CDVA ($P < .05$) (Table 4).

The mean postoperative SE at the last follow-up was 0.00 ± 1.21 diopters (D) (range −2.25 to +4.50 D); it ranged from −6.00 to +16.00 D preoperatively. At the last follow-up, the postoperative SE was within ±2.00 D of emmetropia in 128 eyes (93.4%) and within ±1.00 D of emmetropia in 104 eyes (75.9%).

The mean intraocular pressure (IOP) at the last follow-up (14.2 ± 3.3 mm Hg) was statistically significantly lower than 1 day preoperatively (17.4 ± 6.8 mm Hg) ($P < .05$). The mean number of antiglaucoma eyedrops required did not change significantly from preoperatively to postoperatively (1.49 ± 0.88 and 1.47 ± 0.87, respectively).

All eyes achieved the desired anatomic results. Table 5 shows the complications. The most common complications were slight, temporary pupil

Table 2. Indications for IOL exchange/secondary procedure.

Indications for IOL exchange	Eyes, n (%)
Pseudoexfoliation syndrome	48 (50.5)
Previous PPV	11 (11.6)
Penetrating eye injury/trauma	9 (9.5)
Myopia magna	4 (4.2)
Uveitis	4 (4.2)
Zonular dehiscence/insufficiency	4 (4.2)
Congenital cataract extraction	2 (2.1)
Dislocated AC IOL	2 (2.1)
Previous acute angle-closure glaucoma	1 (1.1)
IOL dislocation with unknown cause	10 (10.5)

AC = anterior chamber; IOL = intraocular lens; PPV = pars plana vitrectomy

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Table 3. Indications for secondary procedure for aphakia.

Etiology of Aphakia	Eyes, n (%)
Penetrating eye injury/trauma	12 (37.5)
ICCE	9 (28.1)
Complicated phaco with PXF	7 (21.8)
Congenital cataract extraction	2 (6.3)
ICCE and uveitis	2 (6.3)

ICCE = intracapsular cataract extraction; PXF = pseudoexfoliation syndrome

Table 4. Preoperative and postoperative CDVA by subgroup.

	Mean CDVA (logMAR) ± SD	
Subgroup	Preop	Postop
Primary lens surgery (n = 10)	1.08 ± 0.80	0.49 ± 0.44*
Secondary IOL exchange (n = 95)	0.68 ± 0.59	0.39 ± 0.30*
Aphakia (n = 32)	0.46 ± 0.42	0.30 ± 0.28*

CDVA = corrected distance visual acuity
*$P < .05$, preoperative to postoperative

ovalization in the early postoperative period (<1 week); CME, which developed a mean of 6.7 months after primary surgery; and postoperative dislocation of 1 haptic of an Artisan PC IOL due to disenclavation at a mean of 3.3 months (range 1 to 13 months). The disenclavation was caused by new trauma in 1 case. In the case of deposits on 1 IOL, the IOL was removed 34 months postoperatively due to chronic uveitis.

DISCUSSION

Anterior and scleral-fixated PC IOLs have been the most popular type of IOLs used in implantation in the absence of adequate capsule support,[3] and they avoid the need for aphakic spectacles or contact lenses. However, there is much discussion on the best method for secondary IOL implantation that offers the lowest complication rate and best possible visual rehabilitation over several years.[18,19] Retropupillary fixation of an iris-claw IOL has the advantages of true posterior chamber implantation, which results in a deeper anterior chamber and greater distance to the corneal endothelium and has a lower intraoperative and postoperative risk profile than anterior fixation.[20,21]

This study reviewed the use of retropupillary iris-claw IOLs to treat aphakia in the absence of capsule support for a wide range of indications; the majority of cases were secondary IOL exchange procedures for dislocated PC IOLs due to pseudoexfoliation syndrome. One hundred thirty-three eyes (97.1%) achieved improved (80 eyes, 58.4%) or unchanged (53 eyes, 38.7%) postoperative CDVA. Four eyes (2.9%) lost 2 or more lines of visual acuity. Other studies report an improvement in visual acuity in all patients after implantation of a retropupillary Artisan aphakia IOL.[4,6,21] In our study, the loss of visual acuity in 4 patients could be explained by macular edema in 3 eyes and by toxic anterior segment syndrome with secondary glaucoma in 1 eye.

Eighty-seven eyes (63.5%) achieved a CDVA of 0.3 logMAR or better; 85.3% of eyes without preoperative ocular comorbidity achieved this level. This is comparable to the results in previous studies of PC iris-claw IOLs,[21] anterior-fixated iris-claw IOLs,[22,23] secondary open-loop AC IOLs (60% to 77% of eyes[11,24]), secondary sulcus-sutured PC IOLs (53.8% to 77.8%[3,14]), and secondary iris-sutured PC IOLs (60% to 67%[8,25]).

The most common complication in our study was slight, temporary pupil ovalization (34 eyes, 24.8%) in the early postoperative period (<1 week). Pupil ovalization can occur if the fixation of the haptics is performed asymmetrically or too tightly. At the last follow-up, persistent pupil ovalization was documented in 19 eyes (13.9%). It is unclear whether this was due to a lack of objective photodocumentation of all eyes sequentially after surgery or if pupil ovalization tends to normalize over time. Baykara et al.[21] found persistent pupil ovalization after posterior iris-claw IOL implantation in 12.7% of eyes.

Previous studies[11,18,22] found that secondary AC IOL implantation can result in severe endothelial cell loss and subsequent corneal decompensation. Güell et al.[26] report a 7.78% cell loss within the first year and a 10.9% loss over the first 36 months after anterior-fixated aphakic Artisan IOL implantation, suggesting that most endothelial cell damage occurs intraoperatively. Another study[7] found no significant endothelial cell loss over a 22-month follow-up. Nevertheless, the posterior position of the iris-claw IOL

Table 5. Postoperative complications.

Complication	Cases, n (%)
Pupil ovalization	34 (24.8)
Macular edema	12 (8.7)
IOL dislocation	12 (8.7)
Hypotony	7 (5.1)
Elevated IOP	6 (4.3)
Hyphema	3 (2.1)
Endophthalmitis	1 (0.7)
TASS	1 (0.7)
Chronic uveitis	1 (0.7)

IOL = intraocular lens; IOP = intraocular pressure; TASS = toxic anterior segment syndrome

and the greater distance from the endothelium makes this technique safer.[21] Accordingly, we did not observe corneal decompensation in our patients. However, a limitation of our study is that corneal endothelial cell counts (ECCs) were not performed sequentially after surgery.

Secondary glaucoma or pupillary block are more frequently observed with AC IOLs than with PC IOLs due to changes in the iridocorneal angle.[27] Frequent secondary glaucoma development and damage to the ciliary choroidal body after secondary implantation of scleral-sutured IOLs has also been reported.[28] In our study, the mean postoperative IOP (14.2 ± 3.3 mm Hg) was significantly lower than the mean preoperative IOP (17.4 ± 6.8 mm Hg) while the mean number of antiglaucoma eyedrops did not change (preoperative: 1.49 ± 0.88; postoperative: 1.47 ± 0.87). Despite rare intermediate postoperative elevated IOP (6 eyes, 4.3%), no eye had clinically significant pigment dispersion or secondary glaucoma requiring additional postoperative treatment. Therefore, primary open-angle and secondary glaucoma are not contraindications to posterior iris-claw IOL implantation. The Artisan aphakia iris-claw IOL has a significantly different design than previous generations of iris-fixated IOLs, which were also associated with complications.[21] Artisan IOLs are anchored to the midperiphery of the iris. They have a vaulted design. This provides good clearance between the iris and the IOL. Except at the fixation points under the iris, the IOLs are slightly raised below the iris plane, which prevents them from interfering with the normal physiologic features of the iris.[20] Secondary pupillary block glaucoma was not expected; therefore, we did not perform a peripheral iridectomy.

Studies[29,30] have estimated a rate of IOL dislocation due to suture breakage in scleral-fixated PC of between 7.8% and 27.9%; the dislocation rate in our study was 8.7%. Other studies of posterior-fixated iris-claw IOLs[6,31,32] report a similar dislocation rate (0% to 10%). If enclavation fails, it results in dislocation of the iris-claw IOL into the vitreous cavity. Inadequate tissue grasping may cause the iris-claw haptics to become detached, especially over the long term. In our study, 12 eyes had dislocation of 1 haptic of the Artisan PC IOL due to disenclavation at a mean of 3.3 months (range 1 to 13 months) after surgery.

Bading et al.[29] and Vote et al.[30] found a retinal detachment rate of 6.3% to 8.2% and a choroidal hemorrhage rate of 3.2% after the implantation of a transsclerally sutured PC IOL. We have not observed such complications after implantation of retropupillary iris-claw PC IOLs, which is in agreement with findings in other studies.[4,6,21]

In our study, the incidence of postoperative macular edema was 8.7% after 6.7 months. Although this is higher than the 4.1% to 4.8% rate in other studies,[6,32] our CME rate is still lower than the rate after implantation of scleral-fixated PC IOLs (5.8% to 33%[2,33]).

To our knowledge, this is the largest reported series of posterior iris-claw IOL insertion for aphakia for a wide range of primary and secondary indications for implantation. We report visual outcomes and complications that are comparable to or better than those for alternative IOL types. However, limitations of our study are the short follow-up and the lack of corneal ECCs after surgery. Although there is no consensus on the best IOL to implant in the absence of capsule support, we believe that retropupillary iris-claw IOL implantation is an effective and well-evaluated option.

WHAT WAS KNOWN

- Artisan/Verisyse IOLs with anterior iris fixation have given good outcomes and favorable complication rates in eyes to correct aphakia in the absence of capsule support.

WHAT THIS PAPER ADDS

- Artisan/Verisyse IOL implantation with posterior iris fixation achieved good visual outcomes in primary and secondary indications for implantation in a large number of patients. Outcomes and complications compare favorably with those of alternative IOL types.

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