
Artisan lens implantation to correct aphakia after vitrectomy for retained nuclear lens fragments

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Purpose: To report the results of pars plana vitrectomy (PPV) for retained lens fragments with implantation of an Artisan® intraocular lens (IOL) (Ophtec) to correct aphakia.

Setting: University-based referral center.

Methods: In this retrospective case-controlled study, patients who had had a PPV to remove dislocated lens fragments and implantation of an Artisan IOL for pseudophakic correction during initial cataract surgery or PPV were reviewed.

Results: Thirteen patients were identified. The preoperative visual acuity was better than 20/200 in 5 patients and the intraocular pressure (IOP) was higher than 21 mm Hg in 8 patients; 3 patients had normal corneas. In 4 patients, an Artisan IOL was implanted during cataract surgery. Postoperative complications included recurrent erosion (1 eye), premacular fibrosis (2 eyes), and a retinal tear (1 eye). Elevation of the IOP occurred in 2 patients and was controllable with medication. Pupillary block developed in 1 patient and persistent cystoid macular edema in another. All but 2 patients gained more than 2 lines of visual acuity postoperatively, and all corneas remained clear during the follow-up (mean 28.9 months; range 2.5 to 69.0 months).

Conclusions: After the removal of dislocated lens fragments with a PPV, Artisan IOL implantation in aphakic patients without capsule support led to few complications and good visual acuity. Placement of an Artisan IOL requires fewer manipulations than transscleral suture fixation of a posterior chamber IOL.

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Posterior dislocation of the nucleus is a major intraoperative complication of ultrasonic phacoemulsification. Its reported incidence is between 0.4% and 4.0% and is inversely related to surgeon experience.¹ After the removal of dropped lens fragments by a pars

plana vitrectomy (PPV), options to surgically correct aphakia include implanting an angle-supported anterior chamber intraocular lens (AC IOL), a transsclerally sutured posterior chamber (PC) IOL, or an iris-fixated AC IOL.^{2–4} Transscleral fixation of a PC IOL is technically challenging, requires more surgical time, and is associated with a higher incidence of intraoperative complications^{2–4} (eg, lens tilting, decentration, erosion of the buried transscleral sutures, scleral flap necrosis, and epithelial ingrowth^{4,5}). Prolonged surgical time and intraocular manipulation may increase the risk for cystoid macular edema (CME).⁴ Anterior chamber IOLs are also associated with short- and long-term complications, some of which are a direct consequence of the presence of haptics in the AC angle.^{6–11}

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The Artisan® IOL (Ophtec) has a substantially different lens design¹² than previous generations of iris-fixated IOLs, which were also associated with complications. Artisan lenses are anchored to the midperiphery of the iris. Except at the fixation points, they are slightly raised above the iris plane, which prevents them from interfering with the normal physiology of the iris or angle structures. They are easy to place and are associated with a good visual outcome and a low incidence of intraoperative and postoperative complications.^{2,13} We present the preoperative and postoperative results of patients who presented with a dropped nucleus and who had PPV and placement of an Artisan IOL to correct aphakia. Several patients had corneal decompensation or glaucoma at the time of surgery.

Patients and Methods

Data Source

The charts of patients with posteriorly dislocated lens fragments seen in the eye clinic of the Academic Medical Center between October 1, 1996, and April 1, 2000, were reviewed. Selection criteria included (1) a dropped nucleus during previous cataract surgery, (2) a PPV performed to remove the dropped nucleus, and (3) Artisan IOL implantation before or after PPV. The following data were collected: age, sex, ocular history (eg, ocular trauma), interval between cataract surgery and PPV, preoperative parameters (visual acuity, intraocular pressure [IOP], status of the cornea), surgical parameters (fragment size, postoperative complications), peak and final postoperative IOP, presence or absence of CME, final postoperative visual acuity, and length of follow-up.

Surgical Technique

A standard 3-port PPV and a complete vitrectomy were performed up to but not including the vitreous base. All vitreous surrounding the nucleus fragments was carefully removed. A fragmatome was used to aspirate pieces of nucleus to the anterior one-third of the vitreous cavity, where the fragment was sonicated while the tip was directed away from the posterior pole and held in midvitreous. If the nuclear fragment was particularly hard, a lighted tissue manipulator (Alcon) facilitated fragmentation and helped impale the fragment on the polyester (Dacron®) tubing. After the nucleus pieces were removed, the eye was examined by indirect ophthalmoscopy. Abnormalities were treated with cryotherapy.

A 5.0 mm corneoscleral incision was made at 12 o'clock, after which 1 mL of acetylcholine (5 mg/mL) was injected in the AC to constrict the pupil. An Artisan IOL of appropriate power was implanted in the AC. Using a bent

cystotome-like needle (Ophtec), the iris was hooked laterally and medially between the claw-like footplates. An anterior or posterior approach through the corneoscleral wound or the sclerotomy was used based on surgeon preference. A superior peripheral iridotomy was made, and the wound was closed with interrupted 10-0 nylon sutures.

Results

During the study period, an Artisan IOL was implanted in approximately 60% of patients having a PPV. Thirteen patients meeting the inclusion criteria were identified (Table 1). The mean age at presentation of the 6 men and 7 women was 77.5 years (range 63 to 84 years). The median interval between the dropped nucleus and removal of the lens by PPV was 9 days (range 2 to 50 days). In 4 eyes (30%), an Artisan IOL was implanted at the time of cataract surgery. In 1 eye (7%), a PC IOL implanted during cataract surgery was replaced with an Artisan IOL during PPV. In the remaining 8 eyes (62%), the Artisan IOL was implanted during PPV.

The preoperative visual acuity was better than 20/200 in 5 eyes (38%). At presentation, the IOP was elevated (greater than 21 mm Hg) in 8 eyes (62%). One patient presented with an IOP of 0 mm Hg and a leaking wound. Before the vitreoretinal procedure, the cornea was clear in 3 patients. Ten eyes (77%) showed evidence of Descemet's folds, stromal thickening, frank corneal edema, or bullae.

In all cases, the dropped nucleus was removed using a pars plana approach. Fragmentation of the dropped nucleus occurred during vitrectomy in 7 eyes (54%); in the remaining cases, the fragments were removed using a vitreous cutter (Table 2). In 9 eyes (69%), half or more of the crystalline lens had dropped into the vitreous cavity. In 1 patient, a PC IOL was implanted in the sulcus during the first procedure; as it was incorrectly centered, it was removed during the vitrectomy and replaced with an Artisan IOL. Complications after vitrectomy included recurrent erosion (1 eye; 7%), retinal tear treated by photocoagulation (1 eye; 7%), and premacular fibrosis (2 eyes; 15%). The IOP was elevated in 2 patients (15%). In 1 patient, this occurred within days of the vitrectomy and was the result of postoperative inflammation; the IOP was controlled with medication. The other patient presented with elevated IOP 24 months after the

Table 1. Patient characteristics at presentation.

Patient	Age at Presentation (Y)	Sex	Interval Between Cataract Surgery and PPV (D)	AC IOL Implanted During 1st Eye Surgery	IOP (mm Hg)	Cornea	Visual Acuity
1	71	F	3	N	60	Edema	HM at 1 m
2	84	F	5	N	10	Descemet's folds	20/200
3	84	M	2	N	32	Bullae	CF at 1 m
4	71	F	35	N	20	Edema	LP
5	82	F	5	N	45	Descemet's folds	HM at 1 m
6	74	F	12	N*	4	Clear	20/125
7	81	M	21	N	20	Edema, Descemet's folds	20/60
8	76	M	9	N	28	Descemet's folds	HM at 1 m
9	78	F	9	N	34	Clear	20/40
10	73	M	5	Y	52	Edema	HM at 1 m
11	63	F	6	Y	37	Clear	20/125
12	77	M	23	Y	0	Edema, Descemet's folds	LP
13	82	M	50	Y	22	Descemet's folds	HM at 1 m

CF = counting fingers; HM = hand motions; IOL = intraocular lens; IOP = intraocular pressure; LP = light perception; PPV = pars plana vitrectomy

*IOL exchange

vitrectomy. In this patient, the Artisan IOL caused pupillary block and the peripheral iridectomy was not patent. After a peripheral iridectomy was made with a neodymium:YAG laser, the IOP normalized.

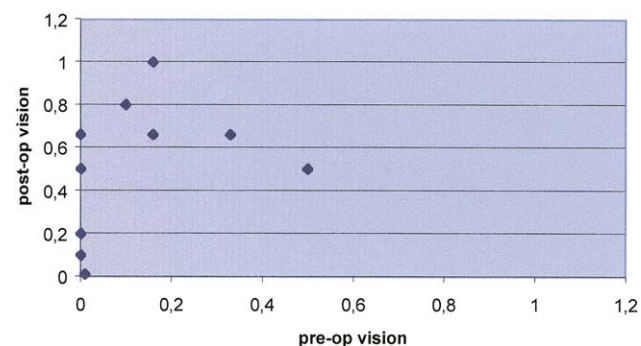
Table 2. Characteristics of the procedures and visual outcomes.

Patient	Lens Removal	Follow-up (Mo)	Raised IOP	Final Postop Visual Acuity	CME
1	P	69	N	20/100	U
2	P	56	N	20/25	N
3	L	60	N	CF at 2 m	N
4	L	7	N	20/30	U
5	P	12	N	20/200	U
6	V	31	Y	20/30	N
7	V	28	N	20/30	N
8	P	20	N	20/40	U
9	P	9	N	20/40	N
10	P	30	N	20/100	N
11	V	38	Y	20/20	N
12	V	2.5	N	20/30	N
13	P	14	N	20/100	Y

CF = counting fingers; CME = cystoid macular edema; IOP = intraocular pressure; L = via limbal incision; P = phacofragmentation; U = unknown; V = vitreous cutter

Eight patients (62%) achieved a visual acuity of 20/40 or better (62%), and all but 2 patients gained more than 2 lines of acuity (Figure 1). One patient with age-related macular degeneration had a visual acuity of counting fingers preoperatively and postoperatively. The other patient's visual acuity remained 20/40. Cystoid macular edema was found in 1 patient; although the patient gained more than 2 lines, the last documented visual acuity was 20/100. In 4 patients, the presence of CME was not documented.

The mean follow-up was 28.9 months (median 28.0 months; range 2.5 to 69.0 months). At the end of

**Figure 1.** (van der Meulen) Preoperative versus final visual acuity.

follow-up, all corneas were clear with no signs of stromal thickening.

Discussion

Several management options after the removal of dislocated lens fragments are available. If sufficient capsule support is present or can be obtained with the use of a capsular tension ring, the logical choice is to implant a PC IOL in the sulcus. In the absence of adequate capsule support, a transsclerally sutured PC IOL or an AC IOL can be implanted. Implanting sulcus-fixated IOLs requires technical skill and a longer surgical time.^{2,6} Visual rehabilitation is generally adequate, with patients retaining the same or slightly improved visual acuity postoperatively as preoperatively.^{2,6,14,15} Among the remaining patients, the incidence of persistent CME is as high as 26%¹⁵⁻¹⁸; chronically raised IOP, 7%¹⁷⁻¹⁹; and retinal detachment (RD), 6%.^{14,15,17,20} Surgical manipulation and additional operative time may contribute to these complications.⁴

Placement of an AC IOL is less technically challenging and provides good visual rehabilitation, with 50% of patients achieving a visual acuity of 20/40 or better.^{4,6,10,11} A long-term disadvantage of an AC IOL is its proximity to the corneal endothelium and the risk for corneal decompensation or pseudophakic bullous keratopathy. Most cases of AC IOL-related pseudophakic bullous keratopathy are caused by angle-supported AC IOLs that were incorrectly sized, vaulted too steeply, or designed with an inappropriate amount of flexibility.⁴

Iris-fixated AC IOLs (eg, Artisan IOLs used for the correction of myopia) induce a mean corneal endothelial cell loss of 7.1% in the first year followed by a diminution in the rate of cell loss to a mean physiological rate of 0.7% per year between years 2 and 3.¹³ Although this was not studied in our patients, we used a similar lens design. All eyes with corneal edema fully recovered with no evidence of corneal thickening during a follow-up up to 5.5 years. As with the Artisan IOLs used to correct myopia, IOL rotation, pupil deformation, uveitis, and persistent corneal dystrophy were not observed.¹³

Other reports emphasize the frequent presence of anterior segment inflammation with AC IOLs.^{21,22} Postoperative inflammation in patients with Artisan IOLs has not been significant and is comparable to

inflammation observed in patients with PC IOLs.² Iris-fixated IOLs result in a lower incidence of glaucoma than flexible, open-loop AC IOLs.^{2,11} One study found no difference in the incidence of RD or CME between eyes with AC IOLs and eyes with PC IOLs.² Successful RD repair occurs at the same rate in patients with Artisan IOLs and those with PC IOLs.²³

With an incidence of RD between 3% and 18% after removal of a dropped nucleus, careful examination of the peripheral retina is advisable, particularly in the first 2 to 3 months.²⁴⁻³² The older iris-plane lenses severely limited pupil dilation.³³⁻³⁷ This limitation does not occur with Artisan lenses, allowing good visualization of the peripheral retina.²³

In our series, 62% of patients recovered a visual acuity of 20/40 or better. Eleven of 13 patients gained 2 or more lines of acuity. These results compare favorably with results in other published series in which 53% to 71% of cases had a final visual acuity of 20/40.^{1,25-28,30,31}

Our series demonstrates that the Artisan claw IOL is an alternative to sutured PC IOLs in patients with retained lens fragments. It is now our IOL of choice in patients with no capsule support. Placement of the Artisan IOL requires few manipulations and provides excellent visual rehabilitation. Although long-term visual prognosis should be excellent in these patients, a larger study should be done to confirm this.

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