European Journal of Ophthalmology / Vol. 17 no. 4, 2007 / pp. 660-665

SHORT COMMUNICATION

Visual function after implantation of aniridia intraocular lens for traumatic aniridia in vitrectomized eye

S. MOGHIMI, M. RIAZI ESFAHANI, M. MAGHSOUDIPOUR

Farabi Eye Research Center, Department of Ophthalmology, Tehran Univ. of Medical Sciences, Tehran - Iran

PURPOSE. *To evaluate the efficacy and safety of aniridia posterior chamber intraocular lens (PCIOL) in traumatic aniridia and aphakia in vitrectomized eyes.*

METHODS. *Four aphakic patients with traumatic aniridia and previous pars plana vitrectomy (PPV) due to posterior segment trauma enrolled in the study, and had secondary implantation of an aniridia PCIOL. Two patients were men and two women with mean age of 39.25 years. Complete ophthalmic examinations, including preoperative and postoperative visual acuity in dark and light, glare disability, visual function (using VF-9 questions modified from VF-14), stereopsis, and contrast sensitivity in 3, 6, 12, and 18 cycle per degree frequencies, were done for all patients. Postoperative intraocular pressure (IOP), IOL centration, and intraocular inflammation were monitored. Mean follow-up was 12.25 months (range 7 to 15 months).*

RESULTS. *Visual acuity improved in all four patients, especially in the light. Glare was subjectively reduced in all of them. Stereopsis was measurable in three of them postoperatively. Contrast sensitivity improved in all patients, especially in brightness and lower frequencies. All four eyes had improved VF-9. All eyes achieved the desired anatomic results. Two cases developed elevated IOP early after surgery. In one eye, IOP elevation was transient and controlled with antiglaucoma medication, but the other eye, which had secondary glaucoma from previous trauma, required cyclophotocoagulation for the IOP to be controlled. No patient developed chronic uveitis or redetachment.*

CONCLUSIONS. *The aniridia PCIOL can overcome aphakia, reduce glare, and increase visual function, contrast sensitivity, and stereopsis in vitrectomized eyes with traumatic aniridia. Although this kind of IOL appears safe, some disadvantages are secondary glaucoma and reduced visibility of peripheral fundus, and caution should be used in its implantation until more patients with longer follow-up are studied. (Eur J Ophthalmol 2007; 17: 660-5)*

KEY WORDS. *Traumatic aniridia, Aniridia intraocular lens, Black diaphragm intraocular lens, Contrast sensitivity, Glare*

Accepted: February 26, 2007

INTRODUCTION

An intact iris diaphragm decreases spherical aberrations arising from the crystalline lens and increases depth of focus, and thus is essential to accurate, satisfactory visual function. Various techniques to overcome the impairment in visual function arising from aniridia have been described, including eyelid surgery, iridoplasty, colored contact lens, and corneal tattooing (1, 2).

The development of the black iris diaphragm intraocular lens (IOL) brings hope to aniridic patients who are aphakic or require cataract extraction. Some ophthalmologists reported good clinical outcome with implantation of black iris diaphragm IOL in congenital aniridia (2-5), traumatic

1120-6721/660-06$15.00/0

aniridia (3-6), and in combination with penetrating keratoplasty (7). But insertion of these IOLs in eyes without vitreous creates challenges, especially when a large incision is required (8), and the literature on this situation is small (8).

We report four patients with traumatic aniridia and aphakia who had secondary black diaphragm IOL implantation several months after vitrectomy and document visual function changes after surgery.

PATIENTS AND METHODS

Four patients were included in the study between November 2001 and September 2003 and complete ophthalmic examinations were done for all of them. The examinations included Snellen visual acuity, stereopsis with Randot chart, indirect ophthalmoscopy, tonometry, and gonioscopy. Contrast sensitivity was measured in 3, 6, 12, and 18 cycle per degree frequencies with BVAT-2 instrument. Also, visual acuity and contrast sensitivity were measured in brightness with bright light of an indirect ophthalmoscope 30 cm in front of patients. Glare disability was assessed by questioning patients directly and subjective appraisal of improvement in bright light (Tab. I).

To assess visual function, we used Visual Function-9 (VF-9) questions modified from VF-14 questions. VF-9 contains 9 questions about visual degree of difficulty that is experienced by patients in performing vision-related daily activities (Tab. II). Patients' scores on 9 items (1 to 5) were summed and converted to total score from 5 to 45, in which 45 represents no difficulty in performing any of the activities surveyed.

After obtaining detailed informed consent, we performed transscleral fixation of an aniridia IOL. All surgery was performed by one surgeon. Under general anesthesia, conjunctival peritomy was created along the superior limbus from 10 to 2 o'clock. A 10.0 mm wide superior limbal incision was made, and then scleral flaps were prepared at 2 and 8 o'clock for covering suture for IOL fixation. In preparation for IOL implantation, viscoelastic material was injected into the anterior chamber and transscleral IOL fixation 1.5 mm posterior to the limbus was performed by a 10-0 polypropylene double-arm suture. The superior incision and the scleral flaps were closed with 10-0 nylon sutures and residual viscoelastic material was carefully removed. A scleral ring was used during surgery to prevent the globe from collapsing. Three eyes (Cases 1, 2, and 4) received an aniridia polymethylmethacrylate (PMMA) IOL (Model 311, OPHTEC, Netherlands) with an overall length of 13.75 mm, optic diameter of 9.0 mm, and pupil diameter of 5.0 mm. The other eye (Case 3) received a black diaphragm PMMA IOL (67G, Morcher, Germany) with an overall length of 12.5 mm, optic diameter of 10.0 mm, and pupil diameter of 4.0 mm.

Postoperatively, topical betamethasone was given six times daily for 2 weeks and then tapered in 1 month. Patients were seen on days 1, 3, and 7, and 1, 3, 6, 8, 12, and 15 months after surgery. The same examinations as described before were done during follow-up. Patients were questioned about glare, photophobia, and satisfaction with the surgical results (Tab. I).

RESULTS

Mean follow-up was 12.25 months (range 7 to 15 months). Table I and Figure 1 show patient data and results after IOL implantation. Figure 2 shows preoperative and postoperative slit lamp photographs of Patient 2.

Visual acuity

The preoperative refraction ranged from +8 to +12 diopters (D). Three cases had improved best-corrected visual acuity (BCVA). Visual acuity improvement was dramatic (at least 5 lines of Snellen chart) in two cases (1, 2). Postoperatively, two cases were moderately myopic (Case 2: –2D, Case 3: –3D). Therefore, uncorrected visual acuity (UCVA) in these two patients was not considerably improved. Brightness visual acuity improvement was more dramatic than visual acuity.

Visual functions

No patients had stereopsis before surgery (>300 sec arc). Postoperatively, stereopsis could be measured in three of them (Cases 1, 2, 4). Contrast sensitivity improved in all patients, especially in 1, 2, and 4, in brightness and lower frequencies. Preoperative contrast sensitivity in Case 2 was undetectable, but it could be measured after surgery and was acceptable (Fig. 1). VF-9 improved in all patients (score range 8 to 21). In Case 2, this improvement was dramatic (21 score).

TABLE I - PREOPERATIVE AND POSTOPERATIVE FINDINGS *(Continued)*

Age, yr	Sex	Original diagnoses/ previous surgery	Implant	Preoperative				Postoperative			
				UCVA		BCVA		UCVA		BCVA	
				Dark	Light	Dark	Light	Dark	Light	Dark	Light
38	F	RG, traumatic cataract, vitreous opacity, IOFB/PPV, PPL, GFE, FB removal, silicone	OPHTHEC Model 311	20/400	20/1000	20/400	20/1000	20/70	20/70	20/70	20/70
42	M	RG, traumatic cataract, vitreous opacity, RD/PPV, PPL, GFE, EL, silicone	OPHTHEC Model 311	20/800	20/800	20/50	20/70	20/30	20/30	20/30	20/30
46	M	RG, traumatic cataract, vitreous opacity, RD, IOFB/PPV, PPL, GFE, FB removal, EL, silicone, SB	Morcher Type 67G	20/1000	20/1000	20/70	20/100	20/400	20/400	20/70	20/70
31	F	RG, traumatic cataract, vitreous opacity/PPV, PPL	OPHTHEC Model 311	20/400	20/800	20/160	20/400	20/200	20/200	20/50	20/60

All patients had improvement in glare disability and photophobia. Two of them (Cases 1, 2) no longer had photophobia. On postoperative questioning, three patients (Cases 1, 2, and 4) reported marked satisfaction with postoperative results. Satisfaction in the other patient was moderate.

IOL centration

All eyes achieved the desired anatomic results. IOL centration was excellent in three cases and reasonable in the other case, with slightly nasal decentration.

Secondary glaucoma

Two cases (Patients 2 and 3) developed elevated intraocular pressure (IOP) early after surgery. Case 3 had secondary glaucoma from trauma before implantation but IOP was adequately controlled by topical medication and prior cyclophotocoagulation. He required an increase in antiglaucoma medication in the postoperative period. To control IOP accurately, he had an additional cyclophotocoagulation on day 30. In Case 2, IOP elevation was transient and controlled adequately with antiglaucoma medication.

Other complications

Postoperative inflammation resolved in all four patients within 2 weeks with topical corticosteroid. None of the eyes in our study developed retinal detachment, macular edema, vitreous hemorrhage, or hyphema.

DISCUSSION

Various techniques, including eyelid surgery, iridoplasty, colored contact lenses, and corneal tattooing, have been described to overcome impairment in visual function arising from aniridia. But they have some disadvantages. Eyelid surgery causes a cosmetic deformity and ptosis.

TABLE I - *(Continued)* - PREOPERATIVE AND POSTOPERATIVE FINDINGS

Visual function (score)		Glare disability		Stereopsis (sec arc)		IOP elevation			IOL position	Satisfaction	Follow-up mo
Pre op	Post op	Pre op	Post op	Pre op	Post op	Pre op	Post op	Treatment			
35	43	++	_	_	300	_	_	_	Centered	+++	13
19	40	+++	_	_	120	_	Temporal elevation	Medication	Centered	+++	15
25	33	+++	+	_	_	NL with medication	Yes	Medication, CPC	Centered	+	14
30	42	+++	+	_	200	_	_	_	Small nasal decentration	++	7

UCVA = Uncorrected visual acuity; BCVA = Best-corrected visual acuity; RG = Ruptured globe; IOFB = Intraocular foreign body; PPV = Pars plana vitrectomy; PPL = Pars plana lensectomy; GFE = Gas–fluid exchange; EL = Endolaser; SB = Scleral buckling; RD = Retinal detachment; Glare disability: none = –; Mild = +; Moderate = ++; Severe = +++; Satisfaction: None = –; Low = +; Moderate = ++ ; high = +++; IOP = Intraocular pressure; IOL = Intraocular lens; CPC = Cyclophotocoagulation

TABLE II - VF-9 QUESTIONS MODIFIED FROM VF-14

Reading small print	Cooking (women), driving (men)
Doing fine handwork	Seeing steps, stairs, curbs
Reading newspapers or books	Reading large-print material
Writing checks, completing forms	Recognizing people at close distance
Watching television	

Extent of difficulty: None: 1; Little: 2; Moderate amount: 3; Great deal: 4; Unable to do: 5

Iris defect may be too large for suturing to repair the defect. Colored contact lenses may not be tolerated. Tattooing makes a permanent opacity in a region of the cornea and the results are unpredictable (1, 2).

In traumatic aniridia, with the history of pars plana vitrectomy, anterior segment is usually disrupted and it is frequently associated with aphakia or cataract. Iris diaphragm IOL implantation presents an opportunity to overcome these problems simultaneously. Insertion of this IOL in eye without vitreous due to previous vitrectomy creates challenges (8).

The first prosthetic iris implantation was performed by Peter Choyce in 1956 (9). Other surgeons report considerable improvement in visual acuity with implantation of

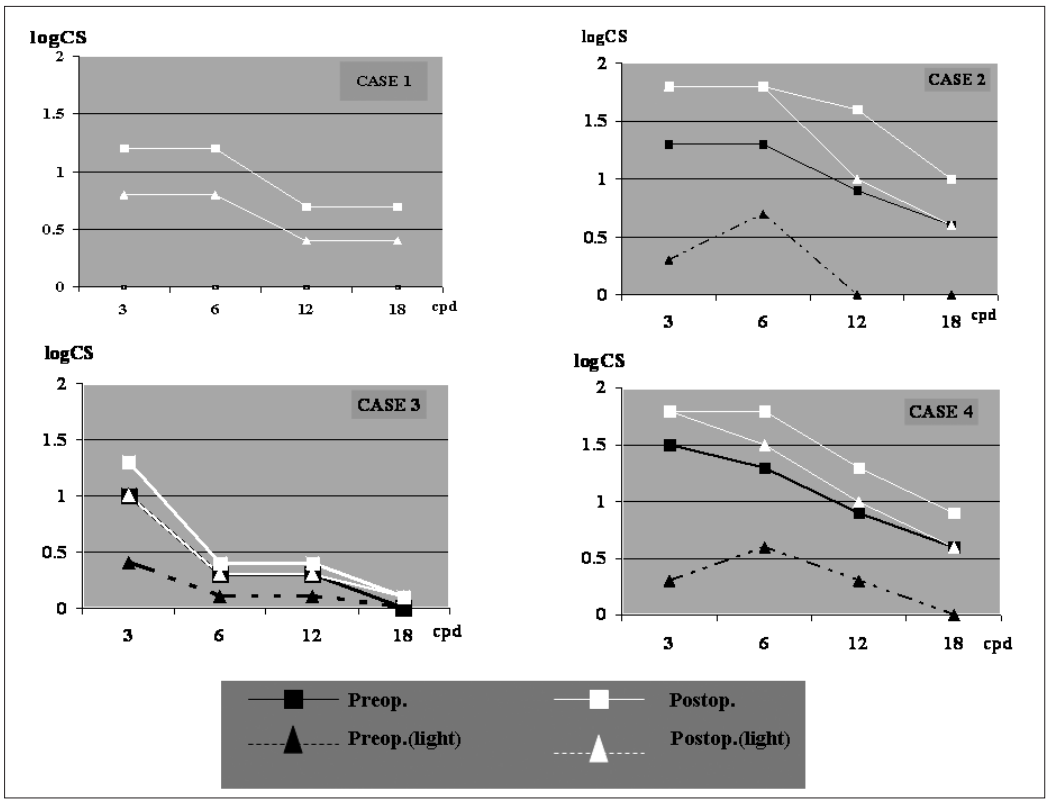

Fig. 1 - *Preoperative and postoperative contrast sensitivity of patients. logCS = logarithm of contrast sensitivity; Preop = preoperative; Postop = postoperative.*

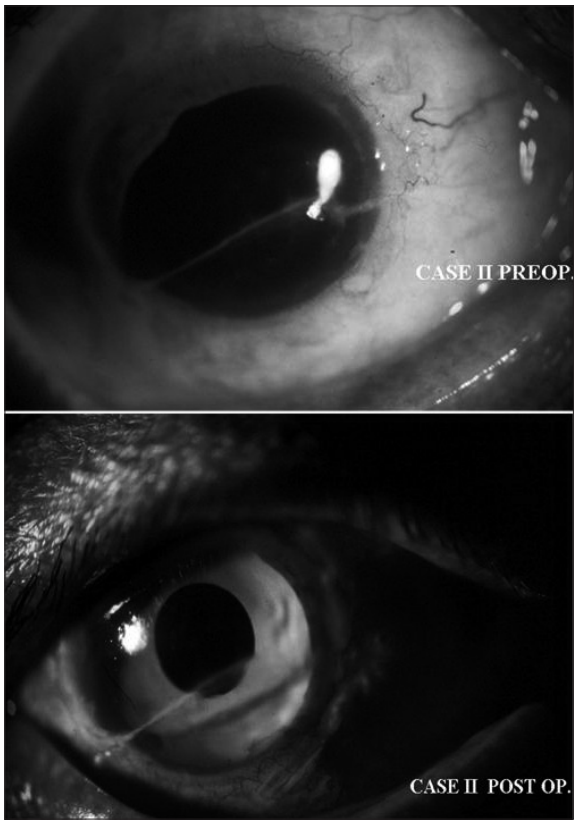

Fig. 2 - *Preoperative and postoperative slit lamp photograph of Case 2.*

black iris diaphragm IOL (1, 2, 4-6, 8-11). Recently, Dong and coauthors (8) described good surgical outcome with implantation of this device in vitrectomized eyes. In our study, three of four patients had dramatic improvement in BCVA. Although UCVA increased in all patients, two of them did not have considerable improvement due to moderate postoperative myopia. We also examined other visual function changes after overcoming aniridia and aphakia. There was considerable improvement in stereopsis in three of them. Contrast sensitivity improved in all patients especially in brightness and lower frequency. VF-9 improved in all patients and they were satisfied with surgical results.

In previous studies, although implantation of this device after cataract extraction improved BCVA and visual function prominently, it had an inconsistent effect on glare disability (2, 4, 9). In Burk et al's study (4), glare was reduced in 96% of patients. They noted that IOL edge, by itself, might cause glare. Thompson et al (9) postulated that the cause of glare and photophobia was multifactorial, and repairing the iris defect alone may not necessarily improve these symptoms. However, glare and photopia was reduced in all our patients.

Thompson et al (9) reported moderate IOL decentration in

two of their cases. Accurate centration during surgery in these cases is made more difficult by the lack of central pupil to provide a reference to the optical axis and by distortions caused by corneal scarring (9). Other reasons may be lack of iris and vitreous to support the lens (8). However, in our study all IOLs achieved the desired anatomic results.

Some studies have described persistent postoperative inflammation (2, 3), but others have not (8, 9). In our study, with continuing topical steroid for 1 month, postoperative inflammation was mild and transient.

In all other reports, elevated IOP was the most common postoperative complication, occurring in 8 of 13 cases in the Reinhard et al (5) study and 5 of 15 cases in the Dong et al (8) study. In Sundmacher et al's (3) study on eight eyes with traumatic aniridia, glaucoma was noted in five eyes preoperatively and six postoperatively. It was controlled medically, surgically, or both in five eyes and remained uncontrolled in one. In our study two of four eyes developed increased IOP postoperatively, one of which required increased medication and cyclophotocoagulation for the IOP to be controlled. However, this patient had secondary glaucoma due to previous trauma preoperatively. The other patient developed increased IOP transiently, which was controlled medically.

The most serious complication may be retinal detachment in a traumatized eye. Fortunately, none of our patients developed it during follow-up. Dong et al (8) also did not report retinal detachment in their cases. Although the problem may be reduced visualization of retina especially in traumatic patients with posterior segment injury, vitreoretinal surgeons have noted that the implant does not interfere with adequate visualization for vitreoretinal surgery (2).

In summary, implantation of a black diaphragm IOL is an effective option for managing eyes with traumatic aniridia and aphakia, even in the absence of vitreous, and can improve visual functions and reduce glare disability from iris deficiency. Although secondary glaucoma is one of the most important complications in these patients, postoperative inflammation might not be a serious one. One serious problem may be reduced visualization of retina, especially in traumatic patients with posterior segment injury. Despite these encouraging findings, we would advise caution and careful patient selection until larger studies with longer follow-up are available.

Proprietary interest: None.

Reprint requests to:
Sasan Moghimi, MD
Farabi Eye Research Center
Quazvin Sq.
Tehran, Iran
sasanimii@yahoo.com

REFERENCES

1. Hersh PS, Shingleton BJ, Kenyon KR. Anterior segment trauma. In: Albert DM, Jakobiec FA, eds. Principles and Practice of Ophthalmology. Philadelphia, PA: Saunders; 1994: 3383-403.
2. Sundmacher R, Reinhard T, Althaus C. Black diaphragm intraocular lens in congenital aniridia. Ger J Ophthalmol 1994; 3: 197-201.
3. Sundmacher R, Reinhard T, Althaus C. Black-diaphragm intraocular lens for correction of aniridia. Ophthalmic Surg 1994; 25: 180-5.
4. Burk SE, Da Mata AP, Snyder ME, Cionni RJ, Cohen JS, Osher RH. Prosthetic iris implantation for congenital, traumatic, or functional iris deficiencies. J Cataract Refract Surg 2001; 27: 1732-40.
5. Reinhard T, Engelhardt S, Sundmacher R. Black diaphragm aniridia intraocular lens for congenital aniridia. J Cataract Refract Surg 2000; 26: 375-81.
6. Synder A, Nawrocki J. Implantation of black diaphragm intraocular lens in congenital and traumatic aniridia. Klinika Oczena 2000; 102: 119-24.
7. Tanzer DJ, Smith RE. Black iris-diaphragm intraocular lens for aniridia and aphakia. J Cataract Refract Surg 1999; 25: 1548-51.
8. Dong X, Yu B, Xie L. Black diaphragm intraocular lens implantation in aphakic eyes with traumatic aniridia and previous pars plana vitrectomy. J Cataract Refract Surg 2003; 29: 2168-73.
9. Thompson CG, Fawzy K, Bryce IG, Noble BA. Implantation of a black diaphragm intraocular lens for traumatic aniridia. J Cataract Refract Surg 1999; 25: 808-13.
10. Bao Y, Liang K, Niu G. The black diaphragm intraocular lens implantation. Chin J Ophthalmol 2001; 37: 434-6.
11. Chen YJ, Wu PC. Favorable outcome using black diaphragm intraocular lens for traumatic aniridia with total iridectomy. J Cataract Refract Surg 2003; 29: 2455-7.