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Implantation of iris devices in congenital and traumatic aniridias: Surgery solutions and complications

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PURPOSE. To show surgical solutions in patients with traumatic and congenital aniridia, to evaluate the clinical improvement of these patients when iris prosthesis are implanted, and to examine safety and complications of these implants in a long-term follow-up.
METHODS. Eight patients were included in this retrospective noncomparative case series. Nine eyes had an artificial iris implantation for traumatic or congenital aniridia. Three eyes received a black diaphragm intraocular lens (IOL) in capsular bag after phacoemulsification. An aniridia prosthesis, sulcus sutured, in front of a previous IOL was implanted in two eyes. A black diaphragm IOL, sulcus sutured, in two eyes; two iris diaphragm rings, in front of the previous IOL, in one eye; and a sector iris prosthesis in front of an IOL in the last eye were implanted. Mean follow-up was 22.5 months (range 16 to 44 months).
RESULTS. All patients had improved visual acuity (VA) and visual comfort after surgery. The glare disability was subjectively better in all cases. Two patients developed new ocular hypertension after surgery; one of them was controlled by medical treatment and the other needed cyclodiode. Two of the patients with glaucoma preoperatively also needed cyclodiode procedure and one of them an Ahmed valve.
CONCLUSIONS. Several kinds of artificial iris implants are available. In all our patients with aniridia, iris artificial prostheses improved VA and diminished visual discomfort. Glaucoma is the most important complication after artificial iris implant. It is possible to implant the iris prosthesis in the capsular bag, but this requires a large capsulorrhexis and presents a surgical challenge. (Eur J Ophthalmol 2005; 15: 451-7)

KEY WORDS. Aniridia prosthesis, Black diaphragm intraocular lens, Iris devices

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INTRODUCTION

The iris diaphragm is essential to secure satisfactory visual function. It diminishes the chromatic and spherical aberrations of the lens and increases the depth of focus, improving visual acuity (VA) (1). Patients with partial or complete aniridia, congenital or traumatic, have incapacitating photophobia and glare and consequently their visual function is impaired. In addition, many factors contribute to a poor VA in these patients (2-4). Congenital aniridia is usually accompanied by congenital glaucoma or cataract, optic nerve or macula hypoplasia, nystagmus, and corneal defects. Traumatic aniridia is often associated with corneal scars, secondary glaucoma, and vitreous prolapse in anterior chamber, cystoid macular edema, or retinal detachment.

Treatments to improve VA in aniridia have included eyelid surgery, tinted contact lenses, and tattooing of the cornea, but the results are not satisfactory. Sev-

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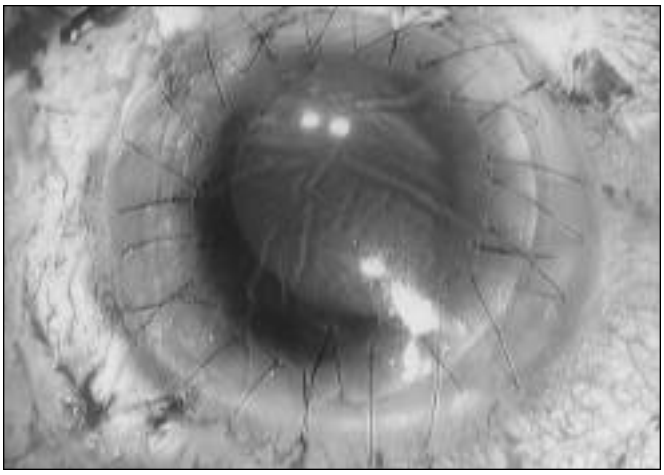

Fig. 1 - Patient 7. Traumatic aniridia. Corneal decompensation. Intraocular lens (IOL) explantation, new IOL black diaphragm iris implant sulcus sutured + corneal graft. End of surgery.

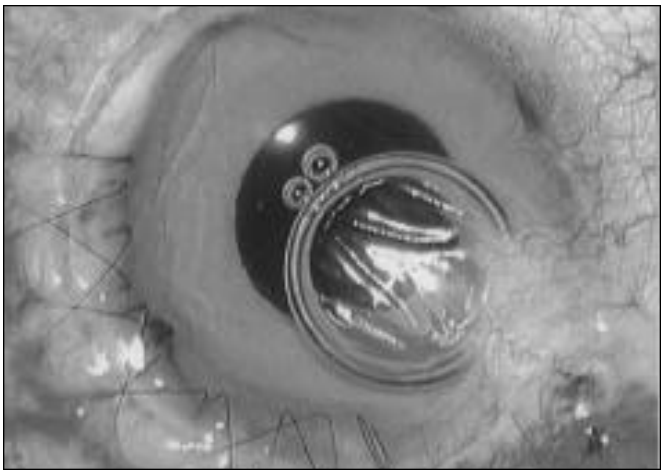

Fig. 2 - Patient 6. OPHTEC prosthesis custom-made, matching the color of the fellow eye. End of surgery.

eral kinds of intraocular lenses (IOLs) or prostheses, with an opaque peripheral segment to simulate the iris diaphragm, have been developed and the designs and the surgery technique modified (5, 6).

The aim of this article is to describe our experience with several kinds of implants in different aniridia situations, clinical improvement, management during surgery, and long-term complications.

We normally use two different kinds of Morcher lenses (67G and 67F): the sector prosthesis (Morcher 96F) and the rings (50D). We also implant OPHTEC IOLs and prostheses, whose use, to our knowledge, has not been reported.

PATIENTS AND METHODS

Eight patients (nine eyes), three with congenital aniridia (one bilateral case) and five with traumatic aniridia, had an implantation of a black diaphragm posterior chamber IOL or prosthesis for correction of aniridia, associated with cataract, aphakia, or pseudophakia. All operations were performed by the same surgeon between 1998 and 2002. There was one woman (a bilateral case). Their mean age at the time of surgery was 22 years for congenital aniridia cases (range 21 to 23 years) and 45.6 years for traumatic aniridia cases (range 35 to 50 years). All patients signed an informed consent form before surgery.

Full examination was done preoperatively, and was repeated at intervals of 1 day, 1 week, 1 month, and every 3 months after surgery. The examination included best-corrected VA (BCVA), except in patients with mental disorder, biomicroscopy, applanation tonometry, fundus exploration, and subjective assessment of visual discomfort because of glare and photophobia. B-scan ultrasound was performed previous to surgery, if it seemed necessary, to evaluate retina and vitreous. In patients with intraocular hypertension, surgery was performed only if IOP was medically controlled before the operation.

All patients had an extensive iris defect, and reported glare and photophobia: one was aphakic, three pseudophakic, and five had a cataract; one patient (bilateral case) had congenital glaucoma and another secondary glaucoma controlled by medical therapy. Basic preoperative data are shown in Table I.

Surgery was performed using peribulbar anesthesia (lidocaine 2% and bupivacaine hydrochloride 0.5%, 1:1 mixture), except in patients with mental disorders who needed general anesthesia or those who requested general anesthesia. Surgical details are summarized in Table II. In patients with cataract a phacoemulsification was performed. Patient 2 also had congenital glaucoma and a subscleral sclerectomy with 5-fluouracil was added to the surgery. Patient 7 had corneal decompensation after his first surgery, and IOL explantation, a new IOL black diaphragm iris implant, sulcus sutured, and a corneal graft was performed (Fig. 1).

The Morcher polymethylmethacrylate (PMMA) single-piece iris diaphragm IOL (Morcher GmbH, Stuttgart,

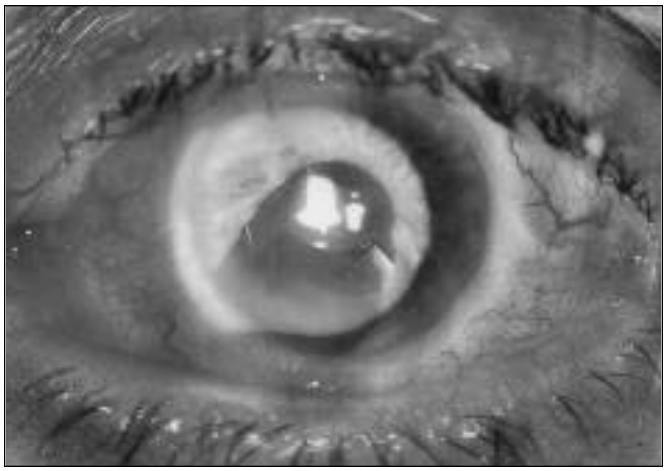

Fig. 3 - Patient 8. A sector endocapsular ar black diaphragm prosthesis (Morcher 96F). A month after surgery.

Fig. 4 - Patient 5. Rotatory corneal graft 1 year after OPHTEC prosthesis sulcus sutured. Three months after surgery.

Germany) styles 67F and 67G have a full iris diaphragm 10.0 mm in diameter surrounding a central optic 5.0 mm in diameter. They differ only in the haptic diameter, 13.5 for 67F and 12.5 for 67G. The endocapsular rings Morcher 50D have an overall diameter of 10 mm. The Morcher 96F sector iris prosthesis has an overall diameter of 12.9 mm. The OPHTEC PMMA IOL (OPHTEC Groningen, Holland) has a full iris diaphragm 10.0 mm in diameter surrounding a central hole 3.0 mm in diameter. The length of the haptics is 13.75 mm. The OPHTEC prosthesis has the same dimensions and both IOLs and prosthesis can be custom-made to match the color of the fellow iris (Fig. 2).

A black diaphragm IOL (Morcher 67G) was implanted, in the capsular bag, in three eyes; a black diaphragm IOL (OPHTEC personalize), sulcus sutured, in one eye; a black diaphragm IOL (Morcher 67F), sulcus sutured, in one eye; a black diaphragm prosthesis, sulcus sutured (OPHTEC personalize), in front of the previous IOL in two eyes; a sector endocapsular black diaphragm prosthesis (Morcher 96F) in one eye (Fig. 3); and two endocapsular rings (Morcher 50D) conforming the iris diaphragm in another one eye. Anterior vitrectomy was needed in only two eyes. All black-diaphragm IOLs and prostheses were inserted through a corneal incision larger than 10 mm, except the rings Morcher 50D and the sector prosthesis Morcher 96F, which were implanted through a regular phacoemulsification incision. When the Morcher 67G IOLs were implanted in the capsular bag, a big capsulorrhexis was needed.

The sulcus transscleral suture was performed using a personal technique. Two conjunctival fornix-based flaps were created, one superotemporal and the other inferonasal. Anchoring sutures were placed under a limbus-based triangular scleral flap, 1.5 mm from limbus. We used 10-0 double-armed polypropylene (Prolene) sutures with a straight needle. The suture needle goes from inside the eye to outside, guided by the sleeve of a 28-gauge hypodermic needle that goes always from outside to inside the eye. Conjunctival and scleral flaps were sutured with 7-0 synthetic reabsorbed suture, burring the Prolene knot under the scleral flap aiming to avoid intraocular infections.

Standard postoperative medication consisted of dexamethasone and tobramycin eyedrops four times a day for the first week and then in progressively decreasing doses for another 3 weeks. The average follow-up was 22.5 months (range 16 to 44 months).

RESULTS

There were no intraoperative complications. Postoperative data are listed in Table III. The black-diaphragm IOL and prosthesis centration was excellent in all cases and no postoperative cystoid macular edema occurred in any case.

BCVA improved in all patients and glare and photophobia diminished subjectively in all cases. In Cases 1 and 3, due to their mental disorders, we could not test their BCVA objectively, but their relatives not-

ed a big improvement in their daily activities.

Patient 3 developed an early posterior capsular opacification, and due to his mental disorder and lack of collaboration in YAG laser, we performed a pars plana capsulotomy. An autologous rotating corneal graft was realized in Patient 5 (Fig. 4), a year after the iris implant surgery, to correct the corneal scar opacity. Patient 6 had a corneal trophic ulcer and an episcleritis after surgery that was controlled with topical medical treatment.

New postoperative ocular hypertension was present in two patients (Patients 4 and 5), both of them traumatic aniridia cases with a black-diaphragm sulcus sutured OPHTEC prosthesis. In Case 5 the ocular hypertension was transitory and well controlled by topical beta-blockers, but Patient 4 needed three antiglaucoma eyedrops and a cyclodiode treatment.

Patients 2 and 6 had ocular hypertension before surgery. In Patient 2 (congenital aniridia bilateral case) a subscleral sclerectomy was added to the iris black-diaphragm IOL implantation, but the IOP was still uncontrolled and cyclodiode was performed. Patient 6 (traumatic aniridia) needed two cyclodiode treatments and an Ahmed valve implantation to control his IOP.

DISCUSSION

Iris artificial implants improve VA and discomfort in patients with congenital or traumatic aniridia. Congenital aniridia patients obtain less visual improvement due to the concomitant ocular pathology and the amblyopia. Traumatic aniridia patients get better results except if corneal scars or glaucoma are present. We have reported six different prosthetic iris devices in congenital and traumatic aniridia and in all cases VA, quality of vision, and visual discomfort improved.

The iris diaphragm IOL Morcher type 67 has been studied in several articles. These authors have reported implantation of model 67G by suture fixation and mod-

TABLE I - PREOPERATIVE DATA

Patient	Aniridia	Previous surgery	BCVA	Glaucoma treatment	Iris defect, hr	Lens condition
1	Congenital polymalformative syndrome	Fellow eye: amaurosis post childhood surgery	MD	No	12	White cataract
2A	Congenital	No	20/32	Three drops	12	Polar cataract
2B	Congenital	No	20/32	Three drops	12	Polar cataract
3	Congenital Wilms tumor	Fellow eye: phthisis bulbi	MD	No	12	Cataract
4	Traumatic	Corneal wound repair, PPV + PHACO + IOL in bag	20/25	No	10	Pseudophakia
5	Traumatic	Sclero-corneal wound repair, PHACO + IOL in bag	20/25	No	6	Pseudophakia
6	Traumatic	ECCE	20/50	Beta-blockers	12	Aphakia
7	Traumatic	Corneal wound repair, PPV + PHACO + IOL sulcus sutured	CF	No	6	Pseudophakia
8	Traumatic	Corneal wound repair	20/50	No	3-4	Cataract

BCVA = Best-corrected visual acuity; MD = Mental disorder; PPV = Pars plana vitrectomy; PHACO + IOL = Phacoemulsification and intraocular lens; ECCE = Extracapsular cataract extraction; CF = Count fingers

TABLE II - SURGICAL DATA

Patient	Anesthesia	IOL or prosthesis type and surgery	AV	IOL or prosthesis fixation
1	General	PHACO + IOL + 2 rings (Morcher 50D)	No	Capsular bag
2A	Peribulbar	PHACO + subscleral sclerectomy 5-FU + IOL (Morcher 67G)	No	IOL in capsular bag
2B	Peribulbar	PHACO + subscleral sclerectomy 5-FU + IOL (Morcher 67G)	No	IOL in capsular bag
3	General	PHACO + IOL (Morcher 67G)	No	IOL in capsular bag
4	Peribulbar	OPHTEC prosthesis	No	Sulcus sutured
5	Peribulbar	OPHTEC prosthesis	Yes	Sulcus sutured
6	General	PHACO + OPHTEC IOL	Yes	IOL sulcus sutured
7	General	IOL explantation + Morcher IOL 67F implant + 8.5 mm PK	No	IOL sulcus sutured
8	Peribulbar	PHACO + IOL + Morcher 96F sector prosthesis	No	In capsular bag

IOL = Intraocular lens; AV = Anterior vitrectomy; PHACO = Phacoemulsification; 5-FU = 5-fluoruracil; PK = Penetrating keratoplasty

TABLE III - POSTOPERATIVE DATA

Patient	Follow-up, mo	BCVA preop	BCVA postop	Glaucoma control	Complications and other surgeries
1	22	MD	MD	—	None
2A	23	20/100	20/63	Beta-blockers cyclodiode	None
2B	23	20/100	20/63	Beta-blockers cyclodiode	None
3	22	MD	MD	—	Posterior capsule opacification: PPV + posterior capsulotomy
4	44	20/200	20/25	Three drops cyclodiode	None
5	20	20/200	20/100	Beta-blockers	Rotatory corneal graft
6	17	20/50	20/40	Beta-blockers cyclodiode Ahmed valve	Trophic corneal ulcer episcleritis
7	16	CF	20/63	—	None
8	16	20/50	20/25	—	None

BCVA = Best-corrected visual acuity; MD = Mental disorder; PPV = Pars plana vitrectomy; CF = Count fingers

el 67F in ciliary sulcus location, because of its greater overall diameter (5, 7-10). We prefer Morcher 67F IOL implantation sulcus sutured and we use model 67G to implant in capsular bag to achieve the maximum possible stability. The implantation of this device in the capsular bag is challenging and needs a large capsulorrhexis. To our knowledge, there is only one case reported of an endocapsular implantation of a Morcher 67G aniridia IOL (6). We present three cases of endocapsular 67G IOL implant for congenital aniridia.

To our knowledge, there are no published cases of a posterior chamber OPHTEC IOL or prosthesis implantation for iris deficiencies. We only found a reported case of an anterior chamber OPHTEC IOL implanted for partial traumatic aniridia and aphakia (11). We present three cases of posterior chamber OPHTEC devices, all sulcus sutured, to correct traumatic aniridia, two prosthesis implanted in front of previous acrylic IOL and an iris diaphragm IOL implanted after a phacoemulsification.

The endocapsular devices (Morcher 50D and 96F) were implanted at the time of cataract surgery with the acrylic IOL. Both of them are easy to implant through a small incision. However, as other authors say (10), a gentle surgical technique is essential because the material is brittle and susceptible to fracture and the multiple-fin devices (type 50D) are difficult to align.

As reported by other authors (10), abnormal anterior capsule fragility was noted in the eyes with congenital aniridia, and we used the can-opener capsulorrhexis technique or the diathermia to create the capsulorrhexis.

We used our personal technique for sulcus transscleral suture in four cases with good results. There was no intraoperative ciliary sulcus bleeding and the scleral flaps, hiding the Prolene suture, avoid intraocular infections sometimes described (12).

All the aniridia devices, except the endocapsular rings, are too large, requiring a wide surgical incision and causing a high postoperative induced astigmatism. We used to do a selective ablation of the sutures starting 8 weeks after surgery.

Glaucoma is the most common postoperative complication reported (5, 7-10). In our group of patients there were two new cases of ocular hypertension after surgery, and both of them were traumatic aniridia with a sulcus sutured OPHTEC prosthesis implantation. One of them needed cyclodiode to control the IOP and the other was controlled medically. Patients with ocular hypertension before surgery still needed treatment after aniridia devices implantation. In Patient 2 (bilateral case) a cyclodiode was performed, even with the subscleral sclerectomy surgery associated with the endocapsular black-diaphragm IOL implantation. Patient 6 needed an Ahmed valve to control the IOP. None of the congenital aniridia patients developed new ocular hypertension after surgery. Some authors attribute the secondary glaucoma to irritation of the ciliary body and angle structures due to the IOL or prosthesis location in sulcus, the Prolene sutures, and the post-traumatic disruption of the anterior segment (7, 13).

Artificial iris implantation surgery presents a special challenge for the surgeon, mainly because he or she may combine various techniques such as phacoemulsification, corneal grafting, or glaucoma surgery. It is a safe and effective technique and there is no alternative. Our patients are satisfied, but longer follow-up studies are necessary to assess their clinical performance and possible complications.

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