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Stacked implantation of two prosthetic iris devices for patients with iris defects: A modified surgical technique

David Ethan Rabinovitch [a], Ralf Buhrmann [b], Devesh K. Varma [c,d,*]

[a] Sackler School of Medicine, Tel Aviv University, 35 Klatzkin Street, Tel Aviv, Israel
[b] University of Ottawa Eye Institute, 501 Smyth Rd, Ottawa, Canada
[c] Prism Eye Institute, 2201, Bristol Cir, Toronto, Canada
[d] University of Toronto, 27 King's College Cir, Toronto, Canada

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ABSTRACT

Purpose: Iris pigment deficiency in patients with oculocutaneous albinism (OCA) often causes debilitating photophobia, which is routinely managed by sequential intracapsular insertion of two aniridia rings. A common concern of this technique is the risk of segment interdigitation, which can lead to intraoperative complications.
Observations: In this report, we describe a modified technique through which both rings were stacked together and inserted simultaneously in a 62-year-old male patient with oculocutaneous albinism and a mild cataract. The patient underwent bilateral phacoemulsification followed by implantation of two Morcher 50E aniridia rings simultaneously, prior to IOL implantation behind the implants within the capsular bag. Post-operatively, the patient's photophobia improved dramatically, and there were no post-operative complications.
Conclusions and Importance: Simultaneous insertion of two stacked aniridia rings prior to IOL implantation was a safe and successful alternative surgical method for the management of photophobia in patients with oculocutaneous albinism and cataracts.

1. Introduction

Congenital and acquired abnormalities of the iris can be classified by lack of iris tissue or functional deficits of the iris diaphragm. Absent iris tissue can be caused by congenital diseases including aniridia, coloboma, or anterior segment dysgenesis, or can be the result of penetrating ocular trauma. Impaired function of the iris diaphragm is commonly seen in conditions such as oculocutaneous albinism (OCA), iridocorneal-endothelial (ICE) syndrome, traumatic mydriasis, and herpetic iris atrophy.[1]

OCA is a group of inherited disorder characterized by the reduction or complete absence of melanin biosynthesis, leading to varying degrees of iris and retinal pigment epithelium (RPE) hypopigmentation. The iris' principal role is to act as a diaphragm, limiting the quantity of light that enters the eye. Apart from controlling light entry, the iris diaphragm enhances focus depth and reduces aberrations associated with the lens's edge.[1] Therefore, dysfunction due to hypopigmentation can significantly alter quality of vision and commonly causes excruciating photophobia and glare.[2,3] Other common ocular findings observed in OCA include nystagmus, foveal hypoplasia, and impairment of color vision. Cataract surgery with intraocular lens (IOL) implantation may also potentially worsen photophobia in these patients by increasing light aberration at the IOL margin.[4]

In recent years, the implantation of prosthetic iris devices (PID) has become a popular option in the visual rehabilitation and management of photophobia in OCA patients, and encouraging results have been reported.[1,4–6] The first reported implantation of a prosthetic iris device (PID) was an anterior chamber lens by Peter Choyce in 1956.[1] In 1994, Sundmacher et al.[7,8] and Reinhard et al.[9] implanted a single-piece black diaphragm intraocular lens (IOL) (Morcher GMBH, Stuttgart, Germany) to correct congenital and traumatic aniridia. Depending on the extent of iris defect and presence or absence of capsular support, implants can be placed within the capsular bag, ciliary sulcus, or in the posterior chamber secured by scleral sutures. Currently, PID's are categorized into 3 groups: endocapsular capsular tension ring (CTR)–based PID (aniridia rings), iris-lens diaphragm, and customized artificial iris. A surgeon's choice of PID is primarily based on device availability, extent of iris defect, phakic status, location of implantation, zonular support and presence of an intact capsular bag.[10,11]

Morcher (Morcher GMBH, Stuttgart, Germany) has developed

* Corresponding author. Prism Eye Institute, 2201 Bristol Cir Suite 100, Oakville, ON, L6H 0J8, Canada.
E-mail address: devesh.varma@prismeye.ca (D.K. Varma).

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multiple models of PID that vary in shapes and sizes.[12] The Morcher (Morcher GMBH, Stuttgart, Germany) Type 50E prosthetic aniridia ring consists of a black capsular tension ring (CTR) backbone and eight occluder panels. It has an outer diameter of 10.6 mm, an inner diameter of 3.5 mm, and a single ring can be implanted through a 3.5mm incision. Two rings are required to create a closed iris diaphragm.[4] In the traditional technique, the first ring is implanted into the capsular bag. After this, the second ring is placed in the bag anterior to the first. Additionally, the custom flexible artificial iris prosthesis can be introduced through a small incision and placed within the capsular bag by temporary deformation of the flexible device.[13] Sequential insertion of the two rings requires surgical expertise to ensure that segments of the second ring do not prematurely interlock with those of the first ring during insertion. Such interlocking can be difficult to manage, requiring additional maneuvers in the capsular bag and anterior chamber, which can lead to inadvertent capsule trauma, zonular loss, corneal endothelial injury or device breakage.

We report a modified implantation technique for the Morcher (Morcher GMBH, Stuttgart, Germany) 50E aniridia rings, through which both rings are stacked and inserted together, then spread to create the opaque ring following insertion. We believe that this method can reduce the intraoperative challenges of this procedure and reduce the risk of iatrogenic trauma. To our knowledge, there have been no reported cases in the literature using this stacked insertion of two aniridia rings.

2. Case report and surgical technique

This study adhered to the tenets of the Declaration of Helsinki. A 62-year-old male patient with a history of oculocuteneous albinism presented with progressively worsening photophobia, a mild cataract, foveal hypoplasia and nystagmus. The patient's photophobia was debilitating and caused him to require the use of sunglasses indoors. Preoperative uncorrected distance visual acuity (UDVA) was 20/400 in each eye. The patient underwent bilateral phacoemulsification followed by implantation of two Morcher (Morcher GMBH, Stuttgart, Germany) 50E aniridia rings using a stacked technique (Video 1) (Illustration shown in Fig. 2). The surgery was performed under retrobulbar block due to the patient's nystagmus.

After cataract removal by phacoemulsification, the capsular bag is filled with a dispersive viscoelastic to maintain space and the temporal cataract incision is enlarged to 4mm to accommodate the two stacked Morcher (Morcher GMBH, Stuttgart, Germany) 50E aniridia rings. Trypan blue can be used to help visualize the capsular bag and ensure proper intracapsular implantation.

The two Morcher (Morcher GMBH, Stuttgart, Germany) 50E aniridia rings are placed on the surgical field in a stacked fashion and aligned. The stacked pair is grasped with fine non-toothed forceps and while maintaining their alignment, the pair is introduced carefully through the enlarged incision segment-by-segment. The rings are rotated clockwise, and the leading segments are guided into the capsular bag using a Sinskey hook (Fig. 1A). After all segments are within the eye, the Sinsky hook is used again to direct the trailing edge of the rings into the capsular bag (Fig. 1B). The Sinskey hook is then used to separate and rotate the upper ring to create a continuous opaque aniridia ring (Fig. 1C and D). Additional dispersive viscoelastic is introduced to create space between the aniridia rings and the posterior capsule. The intraocular lens (IOL) is then inserted through the central 3.5mm aperture and centered in the capsular bag posterior to the aniridia rings (Fig. 1E and F) The aniridia rings are adjusted to ensure centration and alignment. A miotic agent is used to constrict the pupil and viscoelastic is removed from the anterior chamber using manual irrigation/aspiration with a Simcoe canula as opposed to automated irrigation-aspiration which risks misaligning the anirida rings and decentering the IOL. Sutures can be used as needed to close the enlarged temporal wound.

Post-operatively the patient's UDVA was 20/160 and 20/120 in the right and left eyes, respectively. Vision was limited by the patients underlying foveal hypoplasia, however, marked improvements were seen in his photophobia and his ability to function in various lighting conditions improved dramatically.

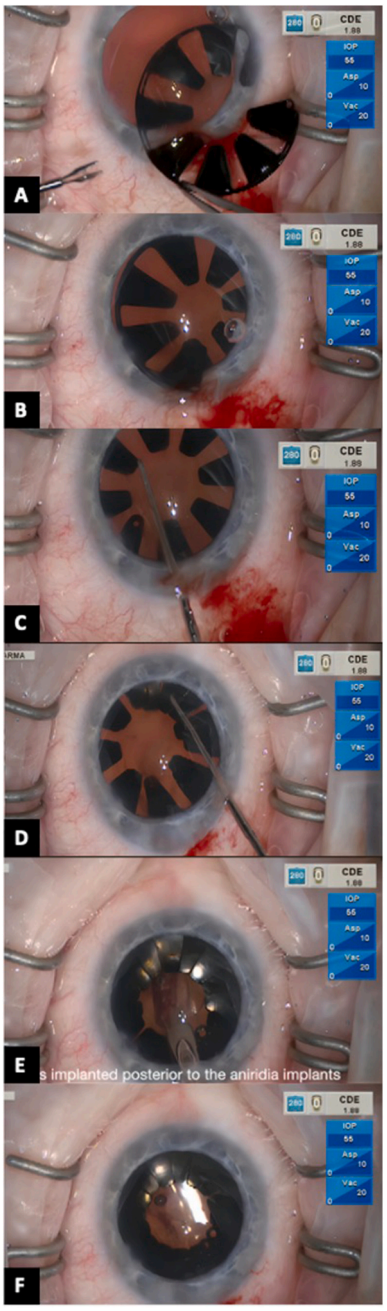

Fig. 1. Intraoperative photographs showing (A) insertion of stacked aniridia rings and manipulation of leading segments, (B) ring insertion prior to manipulation and rotation of trailing segments, (C) complete insertion of stacked rings into capsular bag, (D) rotation of top ring over bottom ring, (E) IOL implantation posterior to aniridia implants and (F) photograph taken at conclusion of the case.

3. Discussion

Despite Morcher (Morcher GMBH, Stuttgart, Germany) discontinuing all marketing activities for their aniridia implants as of the end of 2020, Morcher (Morcher GMBH, Stuttgart, Germany) 50E aniridia implants were an effective treatment option for eyes with cataracts, iris defects, and sufficient capsular support. These implants were available

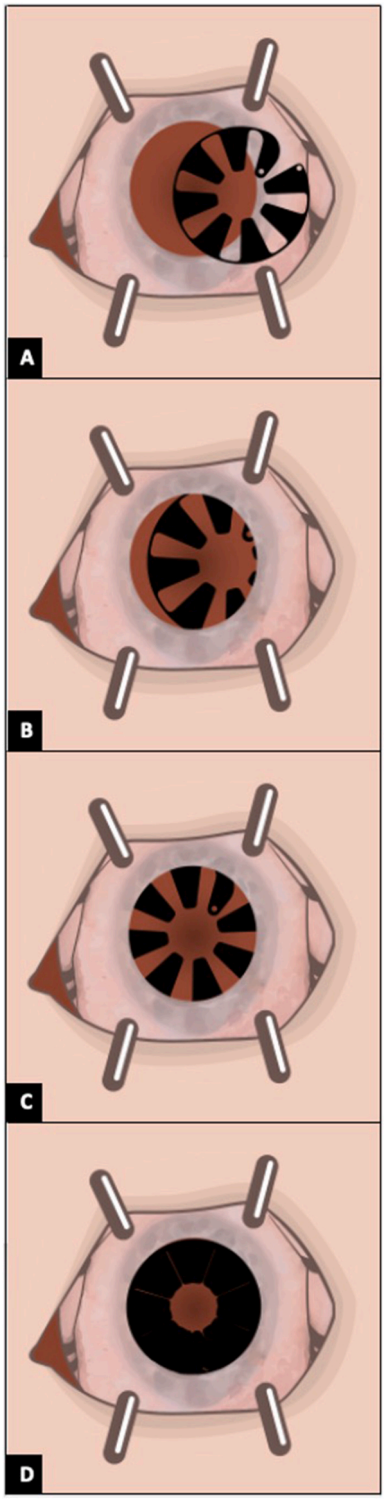

Fig. 2. Graphic illustration of surgical technique showing (A) stacking and alignment of aniridia rings on the surgical field, (B) simultaneous insertion of stacked rings prior to manipulation of segments, (C) complete insertion of stacked rings into capsular bag, and (D) continuous opaque ring following rotation of upper ring.

in a range of sizes to accommodate various effective pupil diameters.[10,11]However, the standard implantation technique of sequentially placing the aniridia rings is often challenging as the segments can easily interdigitate resulting in difficulty rotating the segments and potential zonule or capsular trauma. Capsule tears can propagate quickly due to the expansile nature of the CTR base, requiring subsequent explanation of the device(s). Marked bending of the devices can result in fracture and is best avoided.[5] Lin et al. found that in 4 out of 5 (80%) aniridia ring implantations, the surgeons noted significant difficulty with ring rotation intraoperatively, and in one case this led to zonular dehiscence and IOL dislocation.[14] Implantation and precise alignment can therefore be technically demanding for surgeons.[10]

Our technique of implanting both rings simultaneously eliminates the risk of segment interdigitation and minimizes the risks of segment misalignment, zonular dehiscence and capsule trauma. The reduced manipulation also reduces the risk of iatrogenic implant fracture and the potential for endothelial trauma. Our approach does require a 4mm incision as opposed to a 3.5mm incision to accommodate the thickness of two stacked implants causing greater surgically induced astigmatism and potentially requiring suture closure.

To our knowledge, this is the first report of a simultaneous insertion of two stacked Morcher (Morcher GMBH, Stuttgart, Germany) 50E aniridia rings. This technique can serve as a safer alternative to sequential aniridia ring implantation by reducing the risk of unwanted interdigitation and the ensuring intraoperative complications that can occur when managing this. We believe this modest technique modification can offer surgeons and patients meaningful benefit.

Value statement

What was known.

- Sequential insertion of two aniridia rings is a widely used method of implantation.
- There is a potential risk of ring interdigitation, which requires manipulation that can potentially lead to intraoperative complications.

What this paper adds

- An alternative technique where two aniridia rings are stacked and inserted simultaneously to avoid the risk of interdigitation and therefore reduce complications.

Patient consent statement

Informed consent was obtained in writing from the patient after a complete explanation of the nature and possible consequences of the procedure.

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This study received no financial support.

Authorship

All authors attest that they meet the current ICMJE criteria for Authorship.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.ajoc.2023.101921.

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