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Case Report

A Case of Foldable Artificial Iris Implantation for Treatment of Postcataract Surgery Aniridia

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Keywords
Aniridia · Intraoperative floppy iris syndrome · Artificial iris · Endothelial damage

Abstract
We report an approach for managing acquired aniridia induced by intraoperative floppy iris syndrome (IFIS) during cataract surgery. An 81-year-old man with right blurred vision and photophobia symptoms was treated for extensive iris defects due to cataract surgery aniridia. The retained iris for the patient was observed at the 5–10 o'clock position, with the intraocular lens (IOL) inside the capsular bag. Although the aniridia symptoms were successfully addressed by the implantation of a foldable artificial iris (Iris Prosthesis: Ophtec [formerly Reper], Groningen, the Netherlands), the procedure subsequently caused endothelial damage. In summary, while the utilization of the foldable artificial iris can improve aniridia symptoms, further advances in the insertion technique are required.

Introduction

Aniridia, which includes extensive iris defects, is broadly divided into congenital and acquired cases. Acquired aniridia patients notice various visual dysfunctions such as photophobia, glare, ghost images, decreased contrast sensitivity, near vision disorder, and dysphotopsia [1]. Although iris contact lenses have been prescribed in the past for the treatment of these types of cases, they have not been recently recommended. This is because acquired aniridia is often accompanied by corneal lacerations, making the use of contact lenses difficult due to the irregular corneal shapes. Furthermore, as clinically the visual

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function in these types of patients was not expected to improve due to the severe hyperopia and anisometropia, most of these cases were normally only subject to routine follow-ups. In contrast, artificial iris and iris-IOL complexes have become important treatment options in recent years in Europe, the USA, and Japan for acquired or congenital aniridia cases with aphakia [1–7]. The advantages of using an artificial iris can be expected to include the improvement of various visual dysfunctions that were previously mentioned above.

Intraoperative floppy iris syndrome (IFIS) associated with the use of alpha-1 adrenergic antagonists was first described in 2005 [8, 9]. Characteristics of IFIS include poor preoperative pupil dilation and intraoperative iris billowing, iris prolapse, and progressive pupillary miosis.

At the present time, when using pupil expansion devices with ophthalmic viscosurgical devices, the surgical outcomes for most of the IFIS cases usually result in no severe complications. However, there have been a few cases with severe iris trauma, such as extensive iris defect. We report on the transplantation of the Iris Prosthesis (Ophtec [formally Reper], Groningen, the Netherlands) in an iatrogenic iris defect case associated with a cataract surgery. The CARE checklist has been completed by the authors for this case report, attached as supplementary material.

Case Presentation

An 81-year-old man with right blurred vision and photophobia symptoms was referred to our facility from a private eye clinic in September 2020 for the management of postcataract surgery aniridia. Six months before the referral, the patient underwent right phacoemulsification and, during this surgery, developed severe IFIS. Due to this surgery, the patient developed iris prolapse and an extensive iris defect. After the cataract surgery, the patient became aware of blurred vision and photophobia, and after being seen at his eye clinic, it was recommended that he start using an iris contact lens. As subsequently there was no observed improvement in his symptoms, he was referred to our clinic.

Best-corrected visual acuity (BCVA) was 20/20, intraocular pressure (IOP) was 10 mm Hg, and the endothelial cell counts were 976 cells/mm^2 in the patient's right eye. Slit-lamp examination of the right eye showed a clear cornea, with the retained iris observed at the 5–10 o'clock position, with the intraocular lens (IOL) inside the capsular bag (Fig. 1). Fundal examination was normal.

In January 2022, surgical reconstruction was performed using the Iris Prosthesis Model C0 (Ophtec). The C0 is the scleral fixation type, no diopter (no optic) model.

The conjunctiva of the right eye was opened from the 11:00 to 1:30 position. A 3.5-mm-wide three-sided sclerocorneal tunnel incision was made at the 12:00 position. The corneal side ports were created at the 10:00 and 2:00 positions. Subsequently, the ophthalmic viscosurgical device was injected from the corneal side port at the 10:00 position. The artificial iris (Iris Prosthesis C0) was folded three times, placed into the cartridge, and then inserted through the tunnel using the UNFOLDER® Emerald Delivery System (Johnson and Johnson Vision, Irvine, CA). The colored side of the artificial iris was positioned inward during the unfolding process. The artificial iris was placed into the ciliary sulcus, which was located between the retained iris and the IOL-capsule complex. In the final step, the sclerocorneal incision and the conjunctiva were then sutured.

The day after the surgery, BCVA was 20/1,000 and the IOP was 20 mm Hg. During the visual examination of the area, corneal edema with moderate Descemet's folds was noted (Fig. 2). The artificial iris was well centered. Topical antibiotics, corticosteroids, NSAIDS, and ripasudil hydrochloride hydrate eye drops for the treatment of glaucoma (Glanatec Ophthalmic Solution 0.4%, Kowa Co., Ltd., Tokyo, Japan) were used.

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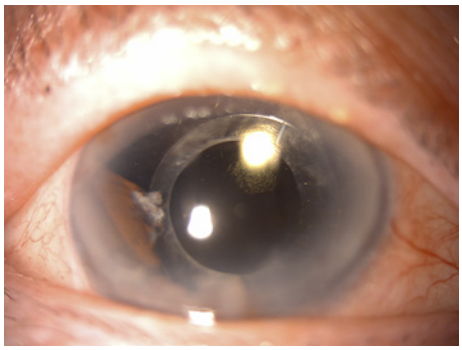

Fig. 1. Anterior segment of right eye, preoperative.

Ten days after the procedure, improvement was noted in the corneal edema with moderate Descemet's folds observed. BCVA was 20/30 and IOP was 13 mm Hg. There was also improvement in the photophobia.

Two months later, BCVA was 20/30 and the IOP was 10 mm Hg. The endothelial cell counts were immeasurable when using a specular microscope (CEM-530 PARACENTRAL®, Nidek, Aichi, Japan) (Fig. 3).

Three months later, BCVA was 20/25 and the IOP was 9 mm Hg. As compared to the preoperative findings, there was improvement noted for the blurred vision and photophobia symptoms.

Discussion

The Iris Prosthesis (Ophtec) is an artificial iris that, unlike those used in the past, is foldable and can be inserted into the eye using an injector. There are two types of the Iris Prosthesis, one using intracapsular, and the other extracapsular (ciliary sulcus), fixation. Since the material used in the prosthesis is hydrophobic acrylic, this makes it possible to insert it through a 3.5 mm incision. Moreover, there are 300 different iris tones that are available when using this prosthesis. Previous usages reported for the Iris Prosthesis include a combination of trabeculectomy and Iris Prosthesis for traumatic glaucoma [10], a combination of corneal transplantation and Iris Prosthesis [11], the use of the Iris Prosthesis with the flange technique performed during a traumatic noniris and nonlens procedure [12], sewn Iris Prosthesis in cases with lens deviation, iris, and nystagmus [13], and the use of the Iris Prosthesis in traumatic aniridia cases that occur after radial keratotomy [14]. In our present case, IFIS developed during cataract surgery, which led to an extensive iris defect, although the capsular bag containing the IOL was still present. In addition, it was not possible to reopen the capsular bag and fix the artificial iris within the capsule, as more than 6 months had passed from the initial cataract surgery. Therefore, it was decided to use the Iris Prosthesis, extracapsular fixation type, which has three haptics along with a positioning hole. During the surgical procedure, the Iris Prosthesis was loaded into a cartridge and, with the use of the UNFOLDER® Emerald Delivery System (Johnson and Johnson Vision, Irvine, CA), was then easily inserted and released into the eye similar to that for a normal IOL. However, it should be noted that there have been several reports of glaucoma complications associated with the artificial iris due to pigmentation, recurrent bleeding, and chronic inflammation [15]. Recently, data from long-term patient follow-ups have documented the presence of residual iris contraction syndrome (RITS) in which the residual iris is atrophied due to friction between the artificial iris and the residual iris [15]. RITS increases the risk when the artificial iris is fixed to the ciliary groove without being sewn to the sclera [15]. In our present case, RITS

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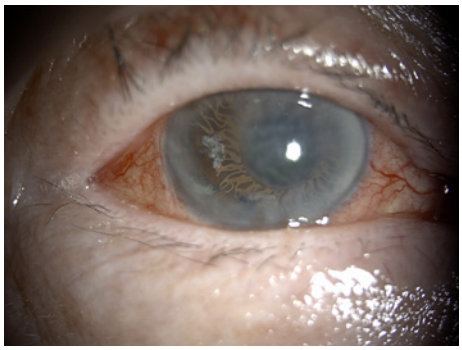

Fig. 2. The day after surgery, corneal edema with moderate Descemet's folds.

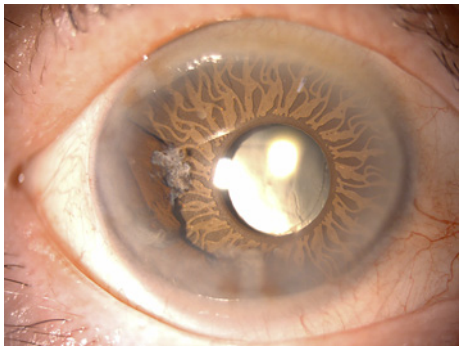

Fig. 3. Two months after surgery, Descemet's folds were improved.

could be a potential concern in the future, as the retained iris was observed at the 5–10 o'clock position. In addition, one of the complications seen in our current case was damage to the corneal endothelium. The presence of this damage was supported by the fact that preoperatively, the endothelial cell counts were lower than 1000. Moreover, there is a possibility that the Iris Prosthesis could have been in contact with the endothelium when it was released. The overall sizes of the Iris Prosthesis were 13.5 mm (for Model C) and 10.5 mm (for Model F). The depth between the endothelium and the IOL complex was about 3 mm, with the size of the Iris Prosthesis when folded three times at least 3.3 mm (1/3 optic size). Since the edges of the optics and haptics are oriented toward the endothelium at release, there was a risk of these contacting the endothelium. A possible solution for this is to put the artificial iris inside out in the cartridge and then insert the edge of the cartridge bevel up instead of the usual bevel down. Although this technique helped to improve the blurred vision and photophobia symptoms in the current case, a long-term follow-up of the patient will be required.

Conclusion

This case report provides two main observations to the field of ophthalmic surgery. First, the foldable artificial iris may be a potential approach that can be used for managing acquired aniridia. Second, although the foldable artificial iris can help provide good visual function and cosmetic results, further improvements to the insertion technique are still required.

Statement of Ethics

The present case report was conducted in accordance with the principles laid out in the Declaration of Helsinki. This study protocol was reviewed and approved by Nippon Medical

School Musashikosugi Hospital Ethics Committee (approval No. 668-4-42). We obtained written informed consent from participant for the publication of details of their medical conditions and accompanying images.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

Norihiro Watanabe: acquisition and analysis of data for the work, and drafting of and revision of the work. Shinichiro Kobayakawa: conception, design, and acquisition of the work, interpretation of data for the work, and revision of work. All authors: final approval of the version to be published.

Data Availability Statement

All data generated or analyzed during this study are included in this article. Further enquiries can be directed to the corresponding author.

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