A New Technique for Treating Posttraumatic Aniridia With Aphakia

First Results of Haptic Fixation of a Foldable Intraocular Lens on a Foldable and Custom-Tailored Iris Prosthesis

Martin S. Spitzer, MD; Efdal Yoeruek, MD; Martin A. Leitritz, MD; Peter Szurman, MD; Karl U. Bartz-Schmidt, MD

We describe a new surgical technique for treating traumatic aniridia with aphakia and its results in a small consecutive case series. We attached a 3-piece acrylic intraocular lens through the haptics to a customized silicone iris prosthesis. The combined implant was inserted through a 5-mm incision and fixated with a transscleral suture in the ciliary sulcus using a knotless technique (Z suture). In all patients, the combined implant stayed firmly fixed within the sulcus and showed a stable and centered position without any tilt or torque during follow-up. Thus, managing posttraumatic aniridia with aphakia by means of haptic fixation of a foldable intraocular lens on a custom-tailored iris prosthesis is a promising approach for visual rehabilitation and cosmetic improvement.


METHODS

PATIENTS

We included 4 patients with traumatic aphakia and aniridia. All patients underwent primary wound closure as soon as possible, with addi-
tional secondary procedures (eg, pars plana vitrectomy for internal reconstruction) a few days later if needed. The patient characteristics are given in Table 1.

Patient 1 required pars plana vitrectomy with silicone oil filling. The patient subsequently developed secondary glaucoma that required silicone oil removal.

**SURGICAL TECHNIQUE**

Iris prostheses custom tailored to the color of the patients’ fellow iris were obtained (Dr Schmidt Intraocularlinsen GmbH). On 2 pair of opposite sides, 2 small stab incisions using a 0.9-mm microsurgical blade were created about 1 mm apart and passing through the back of the customized iris prosthesis (2 incisions at the 0° position and 2 at the 180° position). B, The haptics of a 3-piece IOL are docked inside the tip of a 28-gauge hollow needle and pulled through the small previously created tunnel in the iris prosthesis. C, Because of the high elasticity and stability of the iris prosthesis, the haptics are tightly attached to the back of the artificial iris. D, The haptics are slightly bent by using a needle holder to decrease the maximum diameter of the combined implant. Intraoperative video frames of this technique are found in the eFigure.

The conjunctiva was opened circumferentially at the limbus, and an infusion cannula was positioned in the pars plana in the temporal inferior quadrant. Remaining anterior vitreous was removed by vitrectomy when necessary. A superior corneoscleral tunnel approximately 5 mm in length was created. For correct suture placement (each 90° apart), we used a radial marker for keratoplasty. Corresponding marks were made on the iris prosthesis. Two scleral needles with a double-armed 10-0 polypropylene suture (Prolene; Ethicon, Inc) were passed obliquely through the sclera approximately 1.2 mm posterior to the limbus from the outside inward in an ab externo technique and docked inside the tip of a 28-gauge hollow needle that had been passed through the ciliary sulcus on the opposite side as described previously.10,10 Using a push-pull hook, the 2 sutures were pulled out through the superior tunnel (Figure 2). The sutures were cut, and we ensured throughout the next steps that the resulting 4 free ends were attached to the corresponding quadrant of the iris prosthesis. The free suture ends were pulled through the iris prosthesis along a loop that was created with an additional polypropylene suture. Thereafter, the sutures could be firmly tied to the iris prosthesis–IOL implant. The implant then was partially folded using IOL implantation forceps and introduced through the tunnel incision (Figure 3).

The prosthesis was centered and fixated to the sclera using a Z-suture technique with 5 passes for external fixation of a trans scleral polypropylene suture as reported previously.10 Finally, the sutures were simply cut at the level of the sclera and left without any knot (Figure 4).

In all patients, the combined implant stayed firmly fixed within the

<table>
<thead>
<tr>
<th>Patient No./Sex/Age, y</th>
<th>Type of Trauma</th>
<th>VA at Presentation</th>
<th>Ocular Procedures for Trauma Repair</th>
<th>Time From Trauma to Iris Prosthesis–IOL Implantation, mo</th>
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<tbody>
<tr>
<td>1/M/72</td>
<td>Globe rupture with loss of iris, lens, and vitreous; vitreous hemorrhage</td>
<td>Light perception</td>
<td>Wound closure and PPV with silicone oil for retinal detachment; silicone oil removal 2 mo later</td>
<td>4</td>
</tr>
<tr>
<td>2/M/39</td>
<td>Severe corneal laceration with lens and iris loss</td>
<td>Hand movements</td>
<td>Wound closure; lens removal and anterior vitrectomy 4 d later</td>
<td>6.5</td>
</tr>
<tr>
<td>3/M/78</td>
<td>Globe rupture with loss of iris and IOL</td>
<td>Light perception</td>
<td>Wound closure (patient developed postoperative chronic CME)</td>
<td>11</td>
</tr>
<tr>
<td>4/M/56</td>
<td>Penetrating injury with corneal laceration, partial iris loss, and loss of lens, vitreous, and choroid</td>
<td>Hand movements</td>
<td>Wound closure; PPV 3 d later (pronounced corneal scar)</td>
<td>10</td>
</tr>
</tbody>
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Abbreviations: CME, cystoid macular edema; IOL, intraocular lens; PPV, pars plana vitrectomy; VA, visual acuity.
sulcus and showed a stable and centered position without any tilt or torque during follow-up. Patient 2 underwent uncomplicated perforating keratoplasty for corneal scarring due to the initial trauma. Patient 3 had persistent chronic cystoid macular edema that responded to nonsteroidal anti-inflammatory eye drops and parabulbar corticosteroids but did not resolve completely. The same patient had glau-

Figure 2. Suturing technique for placement of the iris prosthesis. A, Two scleral needles with a double-armed 10-0 polypropylene suture are passed obliquely through the sclera approximately 1.2 mm posterior to the limbus from the outside inward in an ab externo technique. B and C, The sutures are docked inside the tip of a 28-gauge hollow needle, which has been passed through the ciliary sulcus on the opposite side. D, Using a push-pull hook, the 2 sutures are pulled out through the superior tunnel.

Figure 3. Securing the ends of the sutures. A, The sutures are cut. B, The resulting 4 free ends are attached to the corresponding quadrant of the iris prosthesis. C and D, The free suture ends are pulled through the iris prosthesis along a loop that has been created with an additional polypropylene suture. E, Thereafter, the sutures can be firmly tied to the combined iris prosthesis-intraocular lens implant. F, The implant is partially folded and introduced through the tunnel incision.
coma before the injury; however, intraocular pressure was well controlled with topical glaucoma drugs (Table 2). Patient 1 was admitted with suspected postoperative endophthalmitis a few days after surgery. Diagnostic vitrectomy was performed and intravitreal antibiotics were given. Symptoms improved rapidly thereafter. No microorganisms could be grown from the vitreal samples taken during diagnostic vitrectomy. The final outcome was excellent in this patient, with an uncorrected visual acuity of 20/25. The corneal endothelium was not compromised in any of the patients. At the final examination, visual acuity had increased in all patients (range, 20/800 to 20/25). No patient complained of photophobia or glare, and the cosmetic appearance was much improved. The IOL haptics (fixed to the iris prosthesis) and the scleral sutures were barely visible (Figure 5). No evidence of suture erosion, suture loosening, scleral atrophy, or chronic inflammation was observed.

**COMMENT**

Haptic fixation of a foldable IOL on a foldable and custom-tailored iris prosthesis for treating posttraumatic aniridia with aphakia offers a number of advantages. First, the fixation of the IOL to the iris prosthesis is very firm owing to the high elastic stability of the silicone material of the prosthesis, and the tucking of the haptics can be performed quickly and easily. Second, the implantation requires only a small incision of about 4 mm because the combined implant remains foldable. Furthermore, the iris prosthesis is custom tailored to match the iris color of the patient’s fellow iris exactly. The tucked haptics were barely visible on the anterior surface of the iris prosthesis and could only be seen during slitlamp examination or by obtaining a higher-magnification photograph (Figure 5). Moreover, the 4-point Z-suture fixation technique offers the advantages of a knotless approach. By avoiding suture knots, the risk for scleral atrophy and suture erosion may be lowered. Late suture erosion with knot exposure is a well-known problem in transscleral suturing. Hence, burying the suture knots under a scleral flap or in a scleral groove is generally recommended. However, a 73% long-term rate of suture erosion even through scleral flaps has been reported in one study, suggesting that this approach delays but does not prevent this complication. In addition, after complex trauma with scleral injuries and thinning, the creation of scleral flaps may be difficult or even impossible. In contrast, the Z-suture technique reliably secures the external suture in the sclera without any knot and thereby obviates the need for scleral flaps or grooves.

![Figure 4. Fixation of the combined implant. The implant is sutured to the sclera at 4 points with a polypropylene suture using a Z-suture technique in a zigzag-shaped pattern with 5 suture passes. The sutures are then cut at the level of the sclera and left without any knot.](image)

![Figure 5. Clinical photographs of patient 1. A, Before iris prosthesis–fixed intraocular lens (IOL) implantation, near-complete iris loss and aphakia is observed. Visual acuity at this time was 20/63 (with +11 diopters [D]), and the patient complained of debilitating glare and photophobia. B, Appearance at the last follow-up visit. The patient’s visual acuity was 20/25 (with −0.5 D sphere), and glare and photophobia were absent. The IOL haptics are barely visible on the anterior surface of the iris prosthesis.](image)

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>VA and Refraction Before Iris Prosthesis–IOL Implantation</th>
<th>Postoperative VA and Refraction at Last Follow-up</th>
<th>Length of Follow-up After Implantation, mo</th>
<th>Additional Procedures After Implantation</th>
<th>Ocular Comorbidities and Persisting Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20/60 (with +11 sphere)</td>
<td>20/25 (with −0.5 sphere)</td>
<td>48</td>
<td>Diagnostic PPV and intravitreal antibiotics for endophthalmitis; ptosis repair</td>
<td>Mild/dry AMD</td>
</tr>
<tr>
<td>2</td>
<td>20/600 (with +9 sphere)</td>
<td>20/50 (with +0.5 sphere, −3.0 cylinder, 70°)</td>
<td>24</td>
<td>Penetrating keratoplasty for corneal scarring</td>
<td>Irregular astigmatism (pending fitting of rigid CL)</td>
</tr>
<tr>
<td>3</td>
<td>20/50 (with +10.25 sphere, 3.0 cylinder, 65°)</td>
<td>20/40 (with +1.25 sphere, −2.0 cylinder, 81°)</td>
<td>15</td>
<td>Parabulbar corticosteroids therapy</td>
<td>Persisting CME; glaucoma</td>
</tr>
<tr>
<td>4</td>
<td>20/800 (with +14 sphere)</td>
<td>20/800 (plano)</td>
<td>4</td>
<td>Scheduled for penetrating keratoplasty</td>
<td>Pronounced central corneal scarring</td>
</tr>
</tbody>
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Abbreviations: AMD, age-related macular degeneration; CL, contact lens; CME, cystoid macular edema; IOL, intraocular lens; PPV, pars plana vitrectomy; VA, visual acuity.
One possible disadvantage of this technique is that the surgeon must meticulously keep track of the original and course of the various sutures. However, if confusion concerning the suture ends is feared, the fixation of the transscleral sutures to the iris prosthesis could be easily modified by first passing only 1 of the 2 scleral double-armed 10-0 polypropylene sutures obliquely through the sclera. Then, after pulling the suture through the tunnel incision, the cut ends of the sutures are attached to the corresponding position at the iris prosthesis. The same procedure is then performed at corresponding sites with the second double-armed 10-0 polypropylene suture. Thus, the surgeon has to deal with only 2 free suture ends at a time. We used 4-point instead of 3-point transscleral fixation in view of reports in the literature about hydrolysis of 10-0 polypropylene sutures. This should be especially advantageous in posttraumatic eyes in which the sclera, the angle, and the cornea might be compromised because of long-term sequelae of the injury.

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Correspondence: Martin S. Spitzer, MD, Department of Ophthalmology, University Eye Hospital Tubingen, Centre of Ophthalmology, Eberhard-Karls University Tubingen, Schleichstrasse 12, 72076 Tubingen, Germany (martin.spitzer@med .uni-tuebingen.de).

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Thus, the technique can be used for both types of the iris prosthesis. The mesh-containing device, in our experience, is mandatory only when partial iris defects are approached. Partial iris defects often require suturing through the prosthesis and fixation to the iris after the implant has been introduced into the anterior chamber. Under these circumstances, the mesh facilitates suturing. However, in the technique described herein, all stitches through the iris prosthesis are made while the prosthesis is still outside the globe, which is possible without a problem using either version of the device.23

Our technique with fixation of the free suture ends to the iris prosthesis by using temporarily placed suture loops avoids extensive intraocular manipulation with the long solid needles used for the 10-0 polypropylene sutures. This should be especially advantageous in posttraumatic eyes in which the sclera, the angle, and the cornea might be compromised because of long-term sequelae of the injury.

REFERENCES