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Traumatic Aniridia and Aphakia Management with Iris Reconstruction Lens Using Gore-Tex Sutures, an Ab-Externo Approach

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Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

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Conflict of interest: None declared

Patient: Male, 55-year-old
Final Diagnosis: Aphakia
Symptoms: Decreased visual acuity • photophobia
Medication: —
Clinical Procedure: Lens implantation • vitrectomy
Specialty: Ophthalmology

Objective: Management of emergency care

Background: A safer and more delicate approach is required for the management of a post-traumatic aphakia and subtotal aniridia.

Case Report: A 55-year-old man was referred to our clinic with symptoms of decreased vision (hand motion) and photophobia in his right eye. This patient had previously undergone pars plana vitrectomy (PPV) for the management of blunt ocular trauma in the same eye. He was being treated with topical antihypertensives, due to silicone oil-induced glaucoma. On presentation, the best corrected visual acuity (BCVA) in his right eye was 20/40 and the intraocular pressure (IOP) in the same eye was 20 mmHg. Slit lamp examination of his right eye showed aphakia, aniridia, and some silicone oil droplets (fish eggs) following silicone oil extraction. His corneal endothelium and thickness were within normal limits. Dilated fundoscopic examination of the right eye revealed that the retina was attached with no signs of proliferative vitreoretinopathy (PVR). An artificial iris intraocular lens (IOL) was implanted, along with 4-point scleral fixation in conjunction with Gore-Tex sutures. After 6 months, the BCVA in his right eye was 20/40 and he had no symptoms of photophobia. The IOP in that eye was 15 mmHg while on treatment with dorzolamide-timolol eye drops. No suture-related or other serious complications were observed. The patient expressed satisfaction with the functional and cosmetic results.

Conclusions: Modern vitrectomy combined with an artificial iris IOL and scleral fixation with Gore-Tex sutures in eyes lacking an iris and lens can provide long-term anatomic and functional restoration. Intraoperative IOP fluctuations and extra corneal damage can be avoided by lens preparation with the sutures using a small incision ab-externo approach.

MeSH Keywords: Aniridia • Aphakia • Lenses, Intraocular • Polytetrafluoroethylene • Vitrectomy

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Background

Blunt ocular trauma can result in serious complications, such as vitreous hemorrhage, retinal detachment, lens subluxation, and iris defects [1]. After primary intervention with pars plana vitrectomy (PPV), it is important to address the functional problems associated with aphakia and iris defects, such as photophobia, glare sensitivity, contrast sensitivity and decreased visual acuity [1,2]. The restoration or replacement of these structures is not always straightforward. Problems may be directly related to the trauma, such as sulcus absence or thin sclera, or to secondary pathology, such as glaucoma development or keratopathy [1,3,4]. The use of silicone oil as a tamponade agent in eyes with retinal detachment can also cause silicone oil-induced glaucoma [5]. Although various devices and techniques are available for the management of aphakia [6–8] and aniridia [9], some of these are not always effective over the long-term [10,11]. This report describes a safe and viable approach for the management of post-traumatic aniridia and aphakia.

Case Report

A 55-year-old man with a history of severe blunt ocular trauma in his right eye was referred to our clinic with symptoms of blurred vision and photophobia. This patient had undergone 20G PPV with a silicone oil tamponade for repair of traumatic retinal detachment at another hospital, followed 3 months later by silicone oil extraction at the same hospital. His right eye had a best corrected visual acuity (BCVA) of 20/40 and an intraocular pressure (IOP) of 20 mmHg with topical medications, whereas his left eye had a BCVA of 20/25 and an IOP of 15 mmHg. Slit lamp examination of the right eye revealed aphakia, subtotal iris absence and silicone oil droplet accumulation (fish eggs). Corneal thickness was 590 µm and the corneal endothelium was in good condition. Fundoscopy showed that his retina was attached with no signs of proliferative vitreoretinopathy (PVR).

Implantation of the Ophtec (Ophtec USA, Inc., Boca Raton, FL) 311 artificial iris lens was regarded as the optimal treatment. IOL Master showed that the right eye of this patient had an axial length of 23.8 mm, a white-to-white distance of 11.4 mm, and an average K-value was 40.13/43.66 D. The required dioptric power for the lens was determined to be +22.0 D. The scotopic and photopic pupil diameters of the left eye were also measured. Based on the iris color of his left eye and the patient's preference, a black lens body, equivalent to the artificial iris area, was chosen. Based on all measurements, the size of the lens body was determined to be 9 mm and the size of the optic (equal to pupil size) was determined to be 3 mm.

A hybrid 25G/27G vitrectomy with the Alcon Constellation system was considered optimal for this patient. Figure 1A presents the eye at the beginning of the operation. The first step of the procedure was oil droplet removal. Because the retina was attached, with no indications of PVR development or any findings indicating a need for prophylactic laser treatment, the surgeons proceeded with lens management. For the lens fixation, Gore-Tex CV-8 sutures were chosen. Two 25G sclerotomies were made nasally and temporally, each exactly 2 mm posterior to the limbus. Accuracy was maximized with a radial keratoplasty marker. The sutures were inserted via sclerotomy into the temporal and nasal quadrants. Using the 'handshake' technique [12], each suture was externalized via the adjacent sclerotomy (Figure 1B). This resulted in the formation of 4 internal loops, 2 nasal and 2 temporal, with the suture ends external to the 4 sclerotomies (Figure 1C). From a limbal incision at 12 o'clock, 2 loops, 1 from each side, were externalized (Figure 1D). To avoid the risk of acute hypotony and extra corneal damage, the lens haptics with the suture loops was prepared ab externo. The loops were tied to the haptics (apex hole) with cow hitch knots (Figure 1E). After tying the sutures onto the lens haptics was completed, the corneal wound was enlarged to approximately 9 mm, and the lens was carefully inserted (Figure 1F). The corneal wound was sutured with 10.0 Prolene. The sutures were pulled from the sclerotomies, achieving lens centration. The adjacent pairs of suture ends, 2 from the temporal and 2 from the nasal side, were tied together and the knots were pushed inside the eye (Figure 1G) from the sclerotomy. Spare suture loops, which had not been tied to the lens, were removed. Finally, the conjunctiva were placed over the exposed sutures and sutured with 8.0 Vicryl (Figure 1H).

Six months after the operation, the patient's eye had a BCVA of 20/40 and an IOP of 20 mmHg, which was controlled with dorzolamide-timolol combination drops. Corneal thickness was 610 µm and endothelial cell density was 1680 cells/mm^2. Lens centration was ideal, and there was no lens tilt. The retina remained attached, with no evidence of cystoid macular edema. No suture-related reactions were observed, and the patient has not reported symptoms of glare and photophobia. The patient also expressed satisfaction with both the functional and cosmetic results (Figure 1I).

Discussion

Aphakia and aniridia can be managed with relatively less invasive methods, such as contact lens use or corneal tattooing [13,14]. The present patient, however, could not tolerate contact lens use and desired a more permanent solution. Patients who underwent IOL scleral fixation [15,16] and customized silicone iris prosthesis (Dr Schmidt Intraocularlinsen GmbH,

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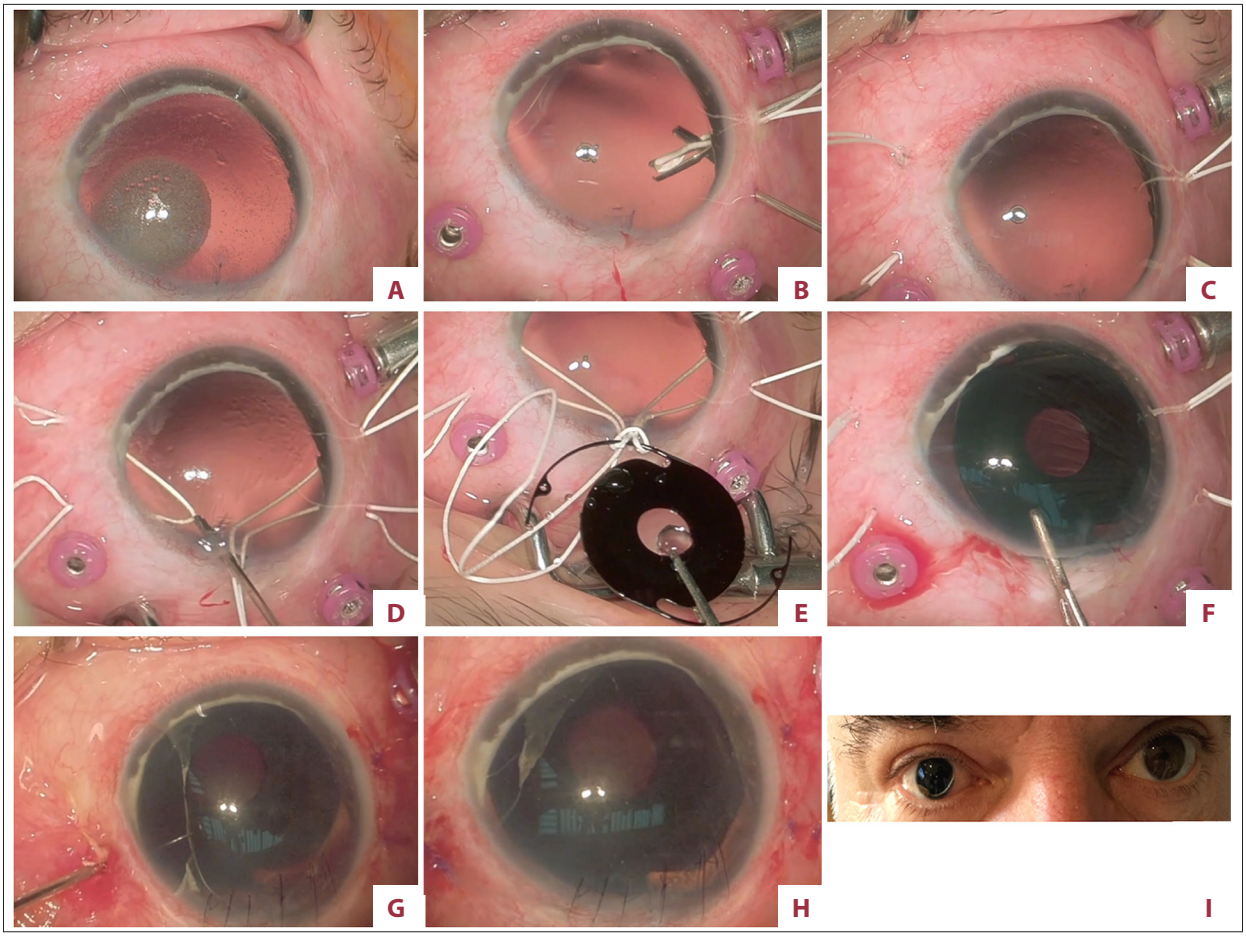

Figure 1. Procedure steps and final result. (**A**) Beginning of the procedure, with the eye showing aphakia, subtotal aniridia, and silicone oil droplets. (**B**) Suture insertion from one temporal sclerotomy and externalization from the adjacent one, using the handshake technique. (**C**) The same step from the nasal side. (**D**) Externalization of 2 suture loops from a small limbal incision at 12 o'clock. (**E**) Ab externo preparation of the lens, with a cow hitch knot centered at the haptic holes. (**F**) Lens insertion from the enlarged limbal incision. (**G**) Rotation and pushing of the knot inside the eye. (**H**) End of the procedure. (**I**) Final result 6 months after the operation.

distributed by HumanOptics AG) have been described [17]. In this patient, a complete solution with a single implant was preferred. The Ophtec 311 iris reconstruction lens is a lens made of a single piece of clear and colored ultraviolet light – absorbing polymethyl methacrylate. The opaque (colored) part of the lens is available in brown, blue, and green and has a biconvex configuration. The available refractive power ranges from +10.0 D to +30.0 D in 0.5 D increments, although lenses without refractive power (plano) are also available. Each lens has 2 haptics in a C-loop configuration, with a small hole located at the apex of each haptic [18].

Several methods have been described for scleral or iris fixation of IOLs [16], but these methods have drawbacks, such as suture erosion or melting [19,20]. This has led to the use of different techniques, such as scleral pockets with the lens haptics [21], or stronger sutures made of materials such as Gore-Tex (W.L. Gore & Associates, Elkton, MD, USA) [22], especially in younger patients. Gore-Tex sutures are non-absorbable, polytetrafluoroethylene monofilaments with greater tensile strength for suturing lenses than the more commonly used Prolene sutures (polypropylene; Ethicon, Somerville, NJ, USA). Gore-Tex sutures are used for heart valve and vascular procedures [23,24], but ophthalmologists use it off-label in oculoplastics and for IOL scleral fixation [22,25,26]. Because our patient was relatively young, the use of Gore-Tex sutures seemed reasonable.

In most trauma cases, the integrity of the eyeball is compromised. Even after successful suturing of the ruptured structures, the anatomy of the eyeball is not always fully restored. Asymmetry may be due to scar tissue formation and scleral thinning. In our patient, the size of the rupture was approximately 5 mm, extending in an oblique direction posterior to the limbus. The conjunctiva was shrunken, the sclera was

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thinned, and the eyeball symmetry was not optimal, resulting in considerations about the possibility of lens centration or tilting. The 4-point fixation technique provides better stabilization and better centration [27–29], whereas the cow hitch knot [30,31], which was applied to the lens haptics, provides sufficient stretch, avoiding unwanted slippage of the sutures on the haptics. Embedding the knots inside the eye is essential to minimize the risk of suture exposure through the conjunctiva, thus preventing potential endophthalmitis.

Similar techniques have been described for fixing IOLs with Gore-Tex sutures [27]. However, the implant was larger in our patient, requiring a larger incision and more delicate manipulations inside the eye. Thus intraoperative IOP fluctuations (acute hypotony) and extra corneal damage had to be considered. The technique used in the present patient combines the advantages of previously described techniques but utilizes an ab-externo approach. Sutures were first introduced inside the eye as loops, for easier grasping with the forceps, and subsequently externalized from the adjacent sclerotomy. Both internal loops were externalized from a small limbal incision, allowing the sutures to be tied to the haptics outside the eye (closed system) and enlarge the incision prior to lens insertion. This technique is safer, with less risk of acute hypotony. Manipulations are more delicate and less harmful.

The possible disadvantages of this technique may be related to the embedded knots, which may result in scleral thinning, as described for similar techniques entailing scleral flap creation [19,32]. Inserting the suture as a loop results in 4 externalized suture ends, which can later confuse the surgeon, as the loops related to the lens may be unclear. The 2 spare sutures, 1 from each side, should be removed prior to lens preparation. Another disadvantage is associated with the properties of the lens, as type 311 lenses can only be implanted through relatively large incisions (approximately 9 mm), which may potentially induce astigmatism [18]. These problems can be overcome by using a Carlevale scleral fixated IOL (Soleko) [33], which is foldable, along with an artificial iris [34]. However, there may be disadvantages when using 2 different implants, as the integrity and symmetry of the eyeball may be compromised.

Conclusions

In conclusion, we have described a safer and more delicate technique for the management of patients with complicated eye trauma cases accompanied by aniridia and aphakia, with very favorable anatomically functional and cosmetic results. The Ophtec Lens 311 may be an effective alternative in the management of such cases.

Conflicts of interest

None.

References:

1. Viestenz A, Kuchle M. [Retrospective analysis of 417 cases of contusion and rupture of the globe with frequent avoidable causes of trauma: the Erlangen Ocular Contusion-Registry (EOCR) 1985–1995]. Klin Monbl Augenheilkd, 2001; 218(10): 662–69 [in German]
2. Miller KM, Nicoli CM, Olson MD et al: Outcomes of implantation of modified capsule tension rings with multiple black occluder paddles for eyes with congenital and acquired iris defects: Report 3. J Cataract Refract Surg, 2016; 42(6): 870–78
3. Bojikian KD, Stein AL, Slabaugh MA, Chen PP: Incidence and risk factors for traumatic intraocular pressure elevation and traumatic glaucoma after open-globe injury. Eye (Lond), 2015; 29(12): 1579–84
4. Tanzer DJ, Smith RE: Black iris-diaphragm intraocular lens for aniridia and aphakia. J Cataract Refract Surg, 1999; 25(11): 1548–51
5. Ichhpujani P, Jindal A, Katz LJ: Silicone oil induced glaucoma: A review. Graefes Arch Clin Exp Ophthalmol, 2009; 247(12): 1585–93
6. De Novelli FJ, Garrido Neto TL, de Sena Rabelo G et al: Net technique for intraocular lens support in aphakia without capsular support. Int J Retina Vitreous, 2017; 3: 32
7. Gabor SG, Pavlidis MM: Sutureless intrascleral posterior chamber intraocular lens fixation. J Cataract Refract Surg, 2007; 33(11): 1851–54
8. Bloom SM, Wyszynski RE, Brucker AJ: Scleral fixation suture for dislocated posterior chamber intraocular lens. Ophthalmic Surg, 1990; 21(12): 851–54
9. Weissbart SB, Ayres BD: Management of aniridia and iris defects: An update on iris prosthesis options. Curr Opin Ophthalmol, 2016; 27(3): 244–49
10. Mayer CS, Laubichler AE, Khoramnia R et al: Challenges and complication management in novel artificial iris implantation. J Ophthalmol, 2018; 2018: 3262068
11. Davies EC, Pineda R 2nd: Complications of scleral-fixated intraocular lenses. Semin Ophthalmol, 2018; 33(1): 23–28
12. Agarwal A, Jacob S, Kumar DA et al: Handshake technique for glued intrascleral haptic fixation of a posterior chamber intraocular lens. J Cataract Refract Surg, 2013; 39(3): 317–22
13. Alio JL, Sirerol B, Walewska-Szafran A, Miranda M: Corneal tattooing (keratopigmentation) with new mineral micronised pigments to restore cosmetic appearance in severely impaired eyes. Br J Ophthalmol, 2010; 94(2): 245–49
14. Kim JH, Lee D, Hahn TW, Choi SK: New surgical strategy for corneal tattooing using a femtosecond laser. Cornea, 2009; 28(1): 80–84
15. Stem MS, Todorich B, Woodward MA et al: Scleral-fixated intraocular lenses: Past and present. J Vitreoretin Dis, 2017; 1(2): 144–52
16. Lewis JS: Ab externo sulcus fixation. Ophthalmic Surg, 1991; 22(11): 692–95
17. Spitzer MS, Yoeruek E, Leitritz MA et al: 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. Arch Ophthalmol, 2012; 130(6): 771–75
18. Price MO, Price FW Jr., Chang DF et al: Ophtec iris reconstruction lens United States clinical trial phase I. Ophthalmology, 2004; 111(10): 1847–52
19. Szurman P, Petermeier K, Aisenbrey S et al: Z-suture: A new knotless technique for transscleral suture fixation of intraocular implants. Br J Ophthalmol, 2010; 94(2): 167–69
20. Solomon K, Gussler JR, Gussler C, Van Meter WS: Incidence and management of complications of transsclerally sutured posterior chamber lenses. J Cataract Refract Surg, 1993; 19(4): 488–93

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21. Yamane S, Sato S, Maruyama-Inoue M, Kadonosono K: Flanged intrascleral intraocular lens fixation with double-needle technique. Ophthalmology, 2017; 124(8): 1136–42
22. Khan MA, Gupta OP, Smith RG et al: Scleral fixation of intraocular lenses using Gore-Tex suture: Clinical outcomes and safety profile. Br J Ophthalmol, 2016; 100(5): 638–43
23. Rim Y, Laing ST, McPherson DD, Kim H: Mitral valve repair using ePTFE sutures for ruptured mitral chordae tendineae: A computational simulation study. Ann Biomed Eng, 2014; 42(1): 139–48
24. Shimamoto T, Komiya T, Sakaguchi G: Half-leaflet suspension with a thin Gore-Tex suture for aortic leaflet prolapse. Ann Thorac Surg, 2011; 91(3): 907–8
25. Chee SP, Chan NS: Suture snare technique for scleral fixation of intraocular lenses and capsular tension devices. Br J Ophthalmol, 2018; 102(10): 1317–19
26. Morax S: Use of GORE-TEX (polytetrafluoroethylene) in the anophthalmic socket. Adv Ophthalmic Plast Reconstr Surg, 1990; 8: 82–87
27. Hadayer A, Puri S, Fassbender Adeniran J et al: Minimally invasive ab interno four-point scleral fixation of intraocular lens. Retina, 2019; 39(Suppl. 1): S21–23
28. Baykara M, Avci R: Prevention of suture knot exposure in posterior chamber intraocular lens implantation by 4-point scleral fixation technique. Ophthalmic Surg Lasers Imaging, 2004; 35(5): 379–82
29. Chakrabarti A, Gandhi RK, Chakrabarti M: Ab externo 4-point scleral fixation of posterior chamber intraocular lenses. J Cataract Refract Surg, 1999; 25(3): 420–26
30. Can E, Kocak N, Yucel OE et al: Ab-interno scleral suture loop fixation with cow-hitch knot in posterior chamber intraocular lens decentration. Indian J Ophthalmol, 2016; 64(2): 124–26
31. Meyer DC, Bachmann E, Ladermann A et al: The best knot and suture configurations for high-strength suture material. An *in vitro* biomechanical study. Orthop Traumatol Surg Res, 2018; 104(8): 1277–82
32. Hu XT, Zhang ZD, Zhou R, Pan QT: Cauterization technique for suture erosion in transscleral fixation of intraocular lenses. Int J Ophthalmol, 2013; 6(6): 892–94
33. Veronese C, Maiolo C, Armstrong GW et al: New surgical approach for sutureless scleral fixation. Eur J Ophthalmol, 2020; 30(3): 612–15
34. Spitzer MSS, Nessmann A, Wagner J et al: Customized humanoptics silicone iris prosthesis in eyes with posttraumatic iris loss: Outcomes and complications. Acta Ophthalmol, 2016; 94(3): 301–6

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