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Reper artificial iris model C as an alternative treatment of traumatic aniridia and aphakia: a case series

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Case Report

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Abstract

Purpose:

To describe the surgical approach and outcomes of Reper artificial iris prosthesis Model C implantation in four cases of traumatic aniridia and aphakia managed in our cornea department.

Methods:

Retrospective chart review of four patients who underwent artificial iris implantation under general anesthesia, utilizing a three-point scleral fixation technique with Hoffman pockets. In cases requiring concurrent corneal transplantation, surgery was performed with an open-sky technique and corneal graft suturing followed iris implantation.

Results:

All procedures were completed without intraoperative or immediate postoperative complications. Patients experienced significant improvement in visual acuity, photosensitivity, glare and reported high cosmetic satisfaction. One patient with pre-existing glaucoma experienced increased intraocular pressure (IOP) one year postoperatively and one patient experienced a graft rejection 30 months after surgery.

Conclusion:

The Reper artificial iris prosthesis Model C could be a safe and effective treatment for patients with traumatic aniridia and aphakia.

Introduction

Traumatic aniridia typically presents as a unilateral condition resulting from ocular trauma or due to surgical complications. Common symptoms in patients with aniridia include blurred vision, debilitating photophobia, glare sensitivity and decreased visual quality and contrast sensitivity. In traumatic aniridia, angle recession or pigment dispersion can increase the risk of glaucoma.

Multiple surgical treatments have been developed to address aniridia and aphakia, including artificial iris implants. The Reper Artificial Iris Model C, utilized in this study, is a foldable iris prosthesis composed of a biconvex hydrophobic acrylic copolymer with a haptic thickness of 0.2 mm, optic thickness of 0.46-0.75mm (depending on its refractive power), lens diameter of 3.5 mm and total diameter of 13.5 mm. This model entails a 3 point haptic fixation in the sulcus, in contrast to the Model F which utilizes

capsular bag fixation. Additionally, the Reper Artificial Iris Model C is available with no optical correction (Model C0) or with an integrated optical correction up to + 40D (Model C1)

In this study, we present a detailed clinical evaluation of the Reper Artificial Iris Model C in managing four cases of traumatic aniridia and aphakia, discuss the surgical methodology and report patient outcomes.

METHODS

Study Design and Patient Selection

This retrospective case series was conducted at the Cornea Unit of the Jules Gonin Eye Hospital in Lausanne, Switzerland. It includes patients treated between October 2021 and September 2024. Four patients presenting unilateral traumatic aniridia and aphakia who underwent implantation of the Reper Artificial Iris Model C prosthesis were selected. Inclusion criteria were unilateral traumatic aniridia, aphakia or IOL subluxation and associated visual impairment.

Preoperative Assessment

All patients underwent a comprehensive ophthalmological examination including best-corrected visual acuity (BCVA) on a Snellen chart and expressed in decimal units, intraocular pressure (IOP), slit-lamp biomicroscopy and fundus examination or ocular ultrasound in cases of limited visualization. Detailed systemic and ocular histories were documented.

Surgical Technique

All procedures were performed under general anesthesia by the same surgeon (KH). Surgical protocol involved creating three equidistant 3 x 3mm Hoffman scleral pockets for haptic fixation in the ciliary sulcus. The foldable Reper Artificial Iris Model C prosthesis was secured with 10-0 nylon sutures in an ab-externo manner, taking care to maintain centration. In cases requiring simultaneous penetrating keratoplasty, surgery was conducted using an open-sky technique. The artificial iris prosthesis was implanted first, followed by corneal graft placement and fixation with 16 10-0 nylon interrupted sutures. In these cases, a Flieringa ring was used to maintain the volume of the globe. One case did not require penetrating keratoplasty and an anterior chamber maintainer was used to avoid hypotony and to stabilize the anterior chamber in the vitrectomized eye. The optical power of the implant was determined based on individual refractive requirements. Implant’s colour and texture were selected based on the iris colour of the fellow eye.

Postoperative Care and Follow-up

Postoperatively, patients received topical antibiotics, corticosteroids and artificial tears according to clinical response. Follow-up assessments were undertaken at postoperative day one, week one, month one, three, six and periodically thereafter. Each visit included visual acuity, intraocular pressure, anterior segment and graft evaluation.

Outcome Measures

Primary outcomes measures included postoperative BCVA (decimal), IOP, resolution of photophobia and glare symptoms, patient-reported cosmetic satisfaction and implant stability. Secondary outcomes monitored were postoperative complications, including intraocular inflammation, graft rejection and slit-lamp examination.

Data Collection and Analysis

Data were collected retrospectively from electronic medical records and patient follow-up interviews. Descriptive statistical analysis included demographic data and clinical characteristics, visual outcomes, complications and patient satisfaction data.

RESULTS

Primary Outcomes:

Preoperatively, all patients experienced significant visual impairment, debilitating photophobia and glare, along with substantial cosmetic dissatisfaction. Postoperatively, there were marked improvements in visual acuity with BCVA ranging from 0.5 to 1.25. Patients universally reported significant reduction or resolution of photophobia and glare, and all expressed a high level of cosmetic satisfaction.

Secondary Outcomes:

No intraoperative or immediate postoperative complications were encountered. In our case series, one patient experienced transient corneal graft rejection which resolved effectively with medical intervention. Another patient encountered transient elevation of IOP which was successfully managed with medication. One patient developed significant graft edema at 30 months postoperatively, necessitating a subsequent posterior lamellar keratoplasty. Another patient required cyclophotocoagulation due to persistently elevated IOP despite maximal medical management. All iris prostheses remained stable throughout the follow-up period.

Discussion

Artificial iris implants were first introduced by Choyce in 1964. Since then, various materials such as PMMA, silicone and acrylic have been employed with different clinical outcomes. [1] Previous studies indicated silicone implants may have higher incidences of fibrin reactions and lens deposits in comparison to acrylic and PMMA implants. However, acrylic lenses may offer reduced contrast sensitivity at specific wavelengths compared to silicone or PMMA implants.

Currently, several artificial iris implants dominate the commercial market including Morcher PMMA implants, CustomFlex silicone prosthesis and Reper hydrophobic acrylic prosthesis.

Morcher GmbH (Germany) offers various black iris diaphragm implants made from PMMA, which do not incorporate an attached intraocular lens. First mentioned by Sundmacher et al. in 1994, these implants were further assessed for safety and efficacy by Mavrikakis et al. in 2005 in patients with partial or complete iris defects. [2] [3] Despite demonstrating effectiveness and safety, these implants require a substantial surgical incision (10 mm), exhibit brittleness and require separate posterior chamber lens implantation. In 2018 Miller et al. evaluated these implants in 31 eyes with extensive iris deficiencies and aphakia. [4] The study reported complications such as cystoid macular edema, corneal graft dehiscence, uveitis and ocular hypertension.

The CustomFlex Artificial Iris produced by HumanOptics (Germany) is a popular, foldable silicone prosthesis allowing implantation through a small incision (2.75 mm). Primarily suited for pseudophakic eyes, it requires the separate implantation of an intraocular lens in aphakic cases. As this implant does not have an integrated optical correction, a separate IOL (such as FIL-SSF Carlevale) needs to be sutured to the artificial iris. Studies by Doroodgar et al. (2017) and Bonnet et al. (2021) reported significant improvements in visual acuity, cosmetic satisfaction and quality of life post-implantation. [5] [6] Nevertheless, increased complication rates such as iritis, elevated intraocular pressure and secondary graft failures were noted when combined procedures (including penetrating keratoplasty) were performed. Mayer et al. (2022) retrospectively evaluated seven patients who transitioned from Morcher implants to CustomFlex implants with sutured intraocular lenses, highlighting substantial glare reduction and aesthetic improvements without significant changes in visual acuity or endothelial cell counts. [7]

Pozdeyeva et al. (2005) introduced an innovative foldable iris-lens diaphragm combining PMMA optics and silicone haptics, which demonstrated good stability and self-centration without requiring sutures. [8] This model influenced the design of the Reper prosthesis evaluated in our series.

Reper manufactures a foldable artificial iris prosthesis crafted from hydrophobic acrylic material, originally designed by Dr. Pozdeyeva. This foldable prosthesis offers the advantage of an optional integrated IOL and is CE approved. Alternative sutureless fixation techniques such as the FIL-SSF Carlevale lens and the double-needle flanged intrascleral fixation (Yamane) technique have been increasingly adopted in complex aphakic or aniridic eyes, offering the advantage of improved long-term stability and reduced risk of late suture degradation. [6] Cystoid macular edema is also a complication that may be encountered and therefore postoperative OCT imaging is a valuable tool in postoperative consultations. In our case series, no cystoid macular edema was detected on OCT during follow-up. Angle trauma, pigment dispersion or the rubbing of the implant against the iris root remanence can cause IOP elevation, therefore requiring regular IOP measures. Recent evaluations by Jacob-Girbig et al. (2021) and Frisina et al. (2021) have demonstrated promising outcomes, including enhanced visual acuity, significant reduction in photosensitivity, excellent cosmetic results and minimal complications. [9] [10] Moreover, Gius et al. (2023) have indicated this prosthesis provides superior glare reduction and cosmetic satisfaction relative to other implants. [11]

Limitations

This study has several limitations. First, its retrospective design and small sample size restrict the generalizability of our findings. Second, the absence of a control group or comparison technique prevents direct evaluation of the relative advantages of the Reper Artificial Iris Model C over other available surgical options. Future larger, prospective comparative studies are needed to confirm the long-term safety and efficacy suggested by our results.

CONCLUSION

The Reper Artificial Iris type C prosthesis may represent an efficient and safe alternative solution in managing patients with aniridia and aphakia. It demonstrates certain advantages in comparison to other market options and can be effectively combined with a full thickness corneal transplantation. However, further large-scale, prospective studies are warranted to confirm these promising outcomes.

Case Report

Case report 1

A 67-year-old patient presented to the emergency department after sustaining a right-sided facial injury following a ground level fall.

The past ocular history of the patient was significant for keratoconus treated with bilateral penetrating keratoplasty 20 years ago and of cataract surgery on the right eye a few weeks prior to the insult.

On clinical examination, the patient presented a deformed right globe, a right corneal graft with 270 degrees of dehiscence (from 12 to 9'o clock), hyphema, aphakia and an expulsed iris. The patient's visual acuity was limited to hand movement and the IOP was 0 mmHg.

An urgent anterior vitrectomy, an anterior chamber lavage and a corneal resuturing of the ruptured corneal graft was performed. The patient was hospitalized for 2 days after the intervention and received topical and systemic antibiotic treatment. During the following year, persistent inflammation and increase in corneal graft pachymetry was observed. In addition, the patient complained of disturbing glare and photophobia.

Fifteen months after the insult and 5 months after absence of uveitis an informed consent was obtained for a combined surgical intervention to address his underlying corneal graft failure, aniridia and aphakia. Reper's artificial iris model C1 which included a mounted + 18.5D intraocular lens was fixated to the sclera without any complications.

Six months after the surgery the patient's visual acuity was 0.32 without correction and 0.50 with a scleral contact lens while nine months post-op his uncorrected visual acuity further improved to 0.4 with an IOP of 17 mmHg. The iris-IOL complex was well centered and stable. (Fig. 1,2,3,4)

30 months after surgery, the patient presented with a significant corneal edema due to endothelial decompensation requiring a posterior lamellar corneal graft (DSAEK).

Case report 2

A 53-year-old patient presented to the emergency room after receiving a foreign body in his left eye while using a tractor machine for agricultural activities. The patient presented ocular pain, red eye and diminished visual acuity in the affected eye.

On clinical examination, the cornea presented with few linear abrasions without an ulcer or infiltrate. A temporal subconjunctival hemorrhage was visible. A hyphema with 2 + cells comprised of a mixture of inflammatory, pigment, blood cells and some vitreous was visible in the anterior chamber. A temporal iridodialysis along with iris schisis, iridodonesis and traumatic mydriasis not reactive to light was noted. The crystalline lens appeared clear but the fundus was hard to visualize. The ultrasound examination did not show any particularity. Uncorrected visual acuity in the affected eye was reduced to light perception. Intraocular pressure was 30 mmHg.

After an intensive topical therapy, the pressure dropped to 21 mm Hg and the patient was followed daily.

Three days afterwards the patient presented with a crystalline lens subluxation posteriorly and nasally along with new onset subcapsular cataract. An intervention that included a cataract extraction and a vitrectomy with endolaser application and retinopexy was performed. However, the patient was left aphakic as there was not enough iris tissue left to fixate an iris implant.

After the first intervention the patient complained of low vision, significant photophobia and poor cosmesis. Therefore a second intervention to correct the aniridia and aphakia with Reper's artificial iris-IOL + 22.5D implant was undertaken without any intraoperative complications.

Five months after the procedure visual acuity was 0.1 without correction, BCVA was 1.25 and the measured IOP was 22 mmHg. The patient was very happy as he did not experience any symptoms and was pleased with the cosmetic outcome of the procedure.

Six months later, the patient presented with an IOP of 45 mmHg that was successfully managed with medical treatment. After three days the IOP was 12 mmHg and BCVA was 1.0. The patient continued with good IOP control under medical treatment.

Case report 3

A 34-year-old male presented at the emergency department of our hospital after sustaining a facial injury caused by a moving drone. It was reported that the propeller of the drone came in contact with the patient's right eye and sliced it in half [FIGURE 5]. Upon examination, a penetrating horizontal corneoscleral wound with an expulsion of crystalline lens was detected. The patient underwent immediate surgery under general anaesthesia in which the corneoscleral wound was sutured. The

remaining lens material was aspirated and the patient was left aphakic. The post-operative visual acuity was limited to hand movement with an IOP of 25 mmHg.

One month after the injury, a decision for an exploratory vitrectomy was taken. During the surgery, a suprachoroidal haemorrhage drainage was performed along with a retinal detachment repair. In addition an inferotemporal chorioretinal rupture caused by retinitis sclopetaria was observed and it was treated with retinectomy and 360° endolaser retinopexy. Silicone oil was then used to tamponade the retina. (TS)

Three months later, the silicone oil was removed and further anterior segment reconstructive surgery was planned to address the aniridia and aphakia. As the patient presented with a significant iris defect along with corneal scarring, a combined open-sky procedure was performed that included a full thickness corneal transplantation and the sulcus fixation of a Reper's prosthesis with a + 30.0D mounted intraocular lens. The combined surgery was performed 6 months after the initial trauma. (Figs. 6,7)

During the postoperative period, no complications were observed. The patient was very pleased with the aesthetic outcome. Visual acuity with scleral lens 6 months after the procedure was 1.0 with an IOP of 14 mmHg, the intraocular lens-artificial iris implant was stable with no signs of intraocular inflammation or graft rejection.

Figures 5,6,7,8

Case report 4

A 19-year-old male patient was referred to our cornea unit for management of a subluxated IOL. His medical history included penetrating ocular trauma at age 3, for which he underwent a surgery consisting of a scleral-fixated posterior chamber IOL implantation and corneal suturing. At age 11, after a subluxation of the implant he underwent a second surgery for implant fixation.

Upon presentation (8 years after the last surgery), the IOL was noted to be subluxated posteriorly and a corneal decompensation with central scarring was noted. The patient's case was initially managed by our glaucoma specialists given an elevated IOP despite maximal medical treatment.

Six years after, the clinical exam revealed a central corneal scar, corneal decompensation with bullous keratopathy and a posteriorly subluxated IOL. Visual acuity was limited to counting fingers.

A combined operation to address the corneal decompensation and symptomatic aniridia was planned. Implantation of a glaucoma tube was deemed inappropriate by the glaucoma specialists at this point. The surgery consisted of a full-thickness corneal graft, nasal synechiolysis, IOL extraction and Reper's artificial iris model C1 implantation with a 14.0D lens.

Postoperatively, BCVA improved from finger-counting to 0.5 with significant improvement in cosmesis and glare. Despite maximal medical therapy, IOP remained elevated between 30–40 mmHg. Subsequently cyclophotocoagulation was performed resulting in effective IOP control.

Declarations

Conflict of Interest Statement:

The authors declare that there are no conflicts of interest regarding the publication of this article.

Ethics approval:

This retrospective case series was conducted in accordance with the tenets of the Declaration of Helsinki. The study was performed in accordance with institutional guidelines and applicable regulations. Due to the retrospective nature of the study and the use of anonymized clinical data, formal ethics committee approval was waived by the institutional review board of the Jules Gonin Eye Hospital.

Consent for Publication:

Written informed consent for publication of clinical details and accompanying images was obtained from all patients included in this study which is available upon request on the corresponding author.

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Author Contribution

VB and SRN collected the clinical data, performed the literature review, and drafted the manuscript. KH conceived the study, performed all surgical procedures, supervised the project, and critically revised the manuscript. AG, YS, and TS contributed to data interpretation and provided critical feedback on the manuscript. All authors read and approved the final manuscript.

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References

1. Choyce P. Intraocular lenses and implants. London (UK): H.K. Lewis and Company; 1964.
2. Sundmacher R, Reinhard T, Althaus C. Black diaphragm intraocular lens for correction of aniridia. J Cataract Refract Surg. 1994;20(6):560–5.

3. Mavrikakis I, Mavrikakis E, Syam P, Bell J, Casey JH, Casswell AG. Surgical management of iris defects with prosthetic iris devices. Eye (Lond). 2005;19(2):205–9. 10.1038/sj.eye.6701448.
4. Miller KM, Kuo A, Olson MD, Masket S. Safety and efficacy of black iris diaphragm intraocular lens implantation in eyes with large iris defects: report 4. J Cataract Refract Surg. 2018;44(6):686–700. 10.1016/j.jcrs.2018.03.033.
5. Doroodgar F, Jabbarvand M, Niazi F, Niazi S, Sanginabadi A. Implantation of artificial iris, a CustomFlex iris prosthesis, in a trauma patient with an Artisan lens: a case report and review. Med (Baltim). 2017;96(45):e8405. 10.1097/MD.0000000000008405.
6. Bonnet C, Vazirnia P, Deng SX, Aldave AJ, Miller KM. Sutured custom foldable silicone artificial iris implantation combined with intraocular lens implantation and penetrating keratoplasty: safety and efficacy outcomes. Cornea. 2021;40(10):1236–47. 10.1097/ICO.0000000000002564.
7. Mayer C, Scharf D, Khoramnia R. Austausch von Aniridie-IOL gegen individuelle Iris-IOL-Implantate. Ophthalmologe. 2022;119(2):181–9. 10.1007/s00347-021-01447-9.
8. Pozdeyeva NA, Pashtayev NP, Lukin VP, Batkov YN. Artificial iris-lens diaphragm in reconstructive surgery for aniridia and aphakia. J Cataract Refract Surg. 2005;31(9):1750–9. 10.1016/j.jcrs.2005.02.037.
9. Jakob-Girbig J, Salewsky S, Meller D. Use of the Reper artificial iris Model C1 in patients with aniridia/aphakia. Klin Monbl Augenheilkd. 2021;238(7):803–7. 10.1055/a-1475-1049.
10. Frisina R, De Biasi CS, Tozzi L, Gius I, Londei D, Gambato C, et al. Reper intraocular lens with artificial iris: implantation techniques and outcomes. Eur J Ophthalmol. 2021;31(3):1469–74. 10.1177/11206721211005693.
11. Gius I, Tozzi L, De Biasi CS, Pizzolon T, Parolini B, Frisina R. Artificial iris: state of the art. J Cataract Refract Surg. 2023;49(4):430–7. 10.1097/j.jcrs.0000000000001147.

Figures

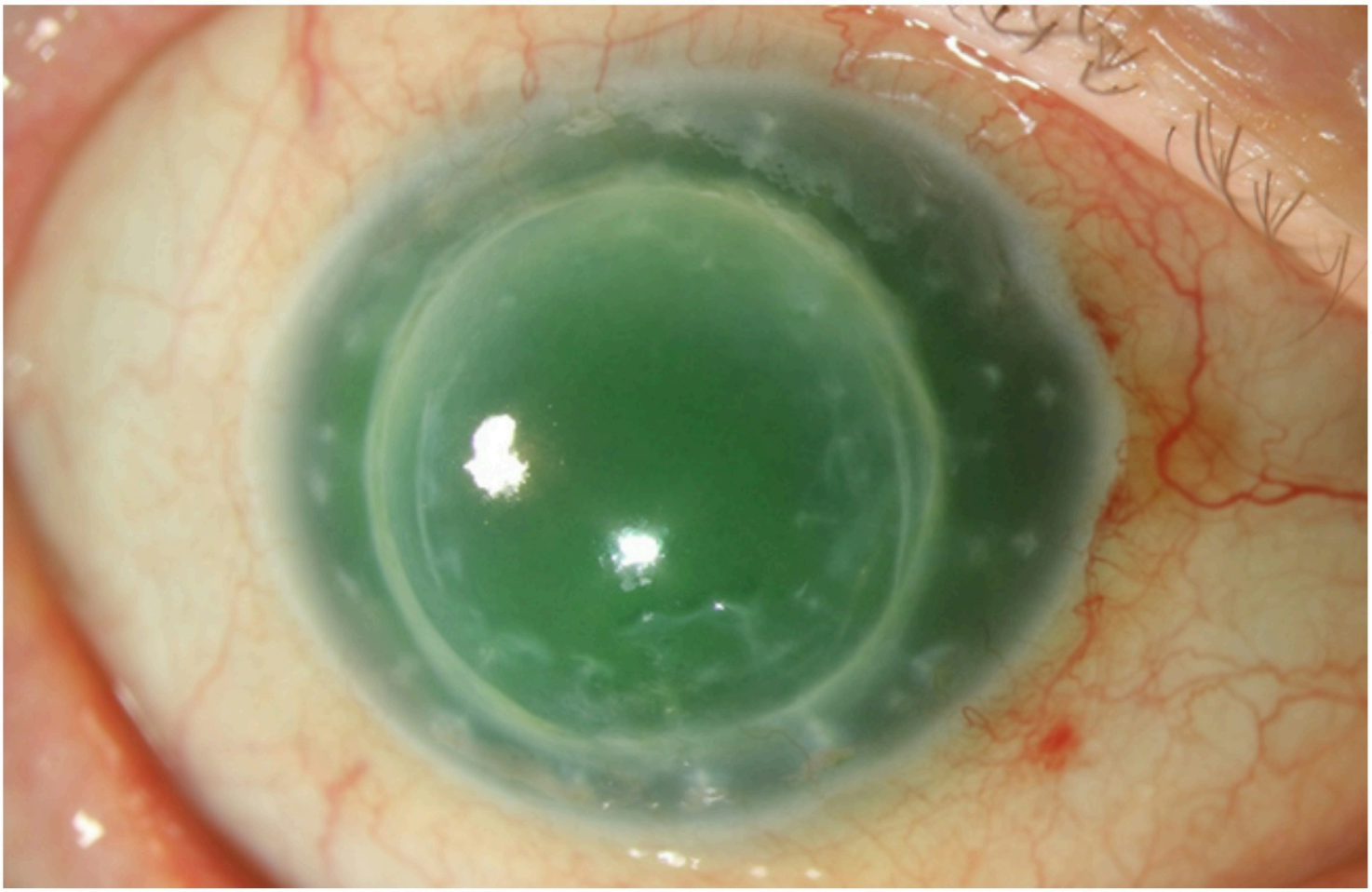


Figure 1

Preoperative photo showing corneal decompensation, aniridia and aphakia. (Case 1)

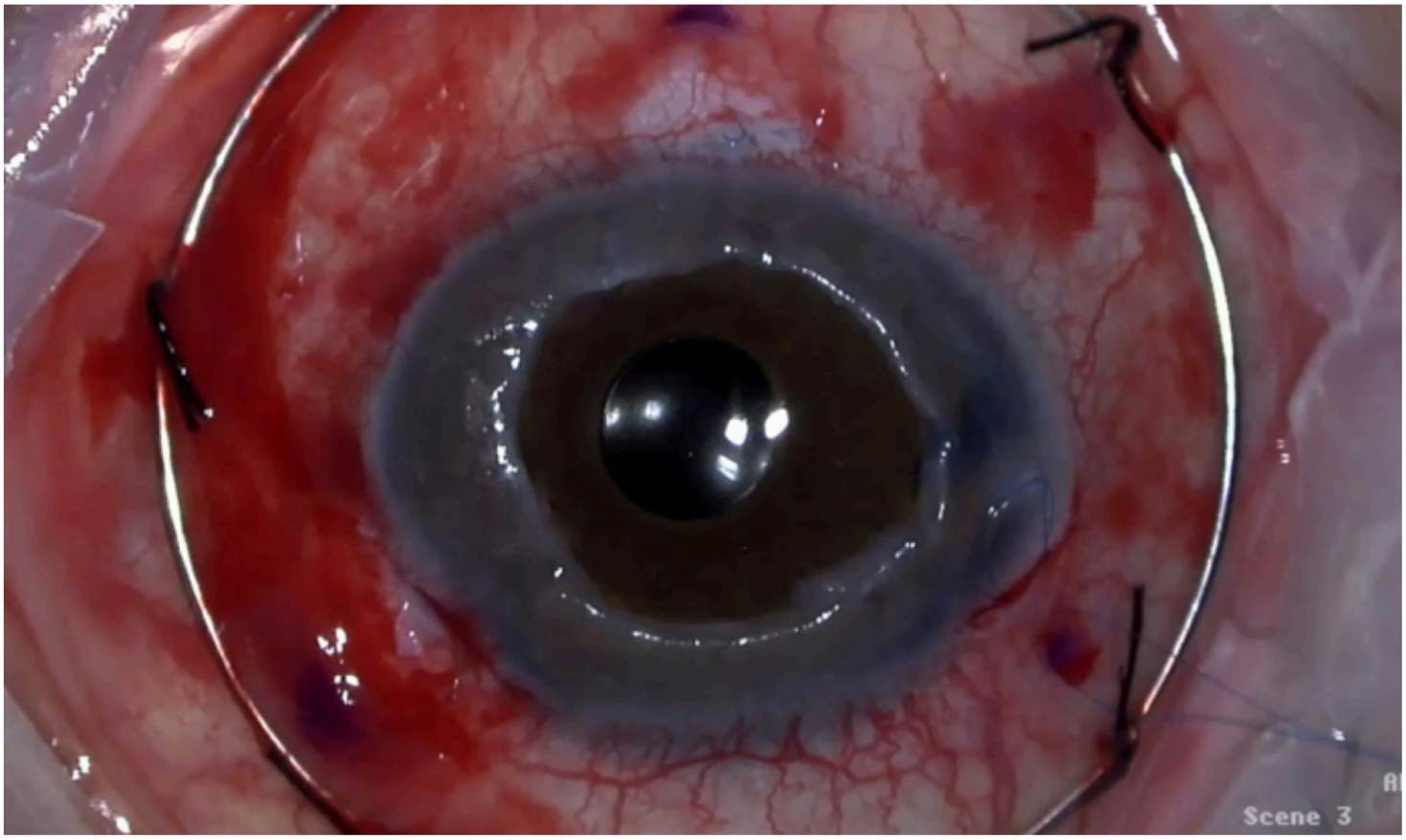


Figure 2

Intraoperative photo, the arrows show the 3 points of scleral fixation, (Case 1)

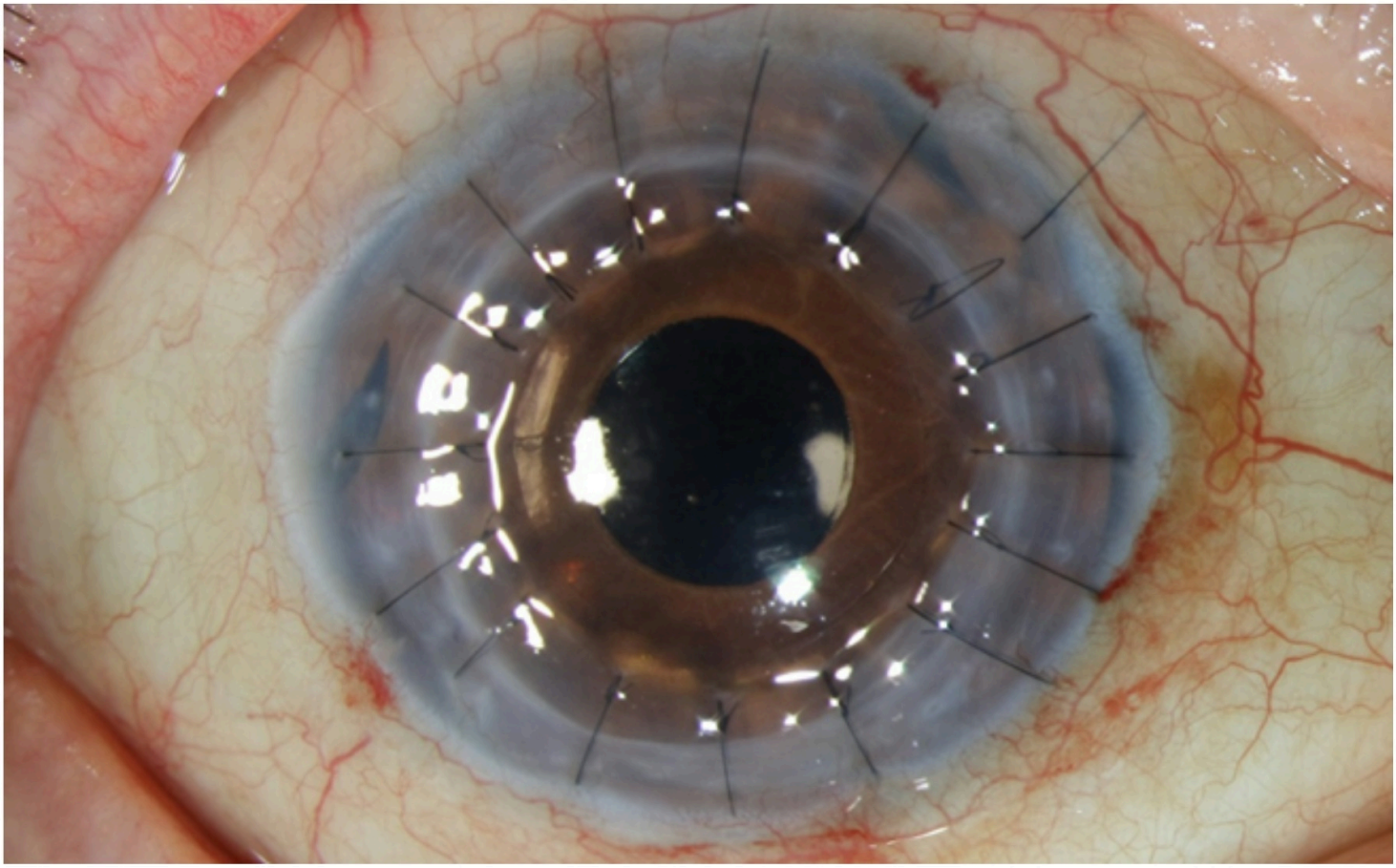


Figure 3

Clinical image of a well-centered iris prosthesis and clear graft 4 months after surgery. (Case 1)

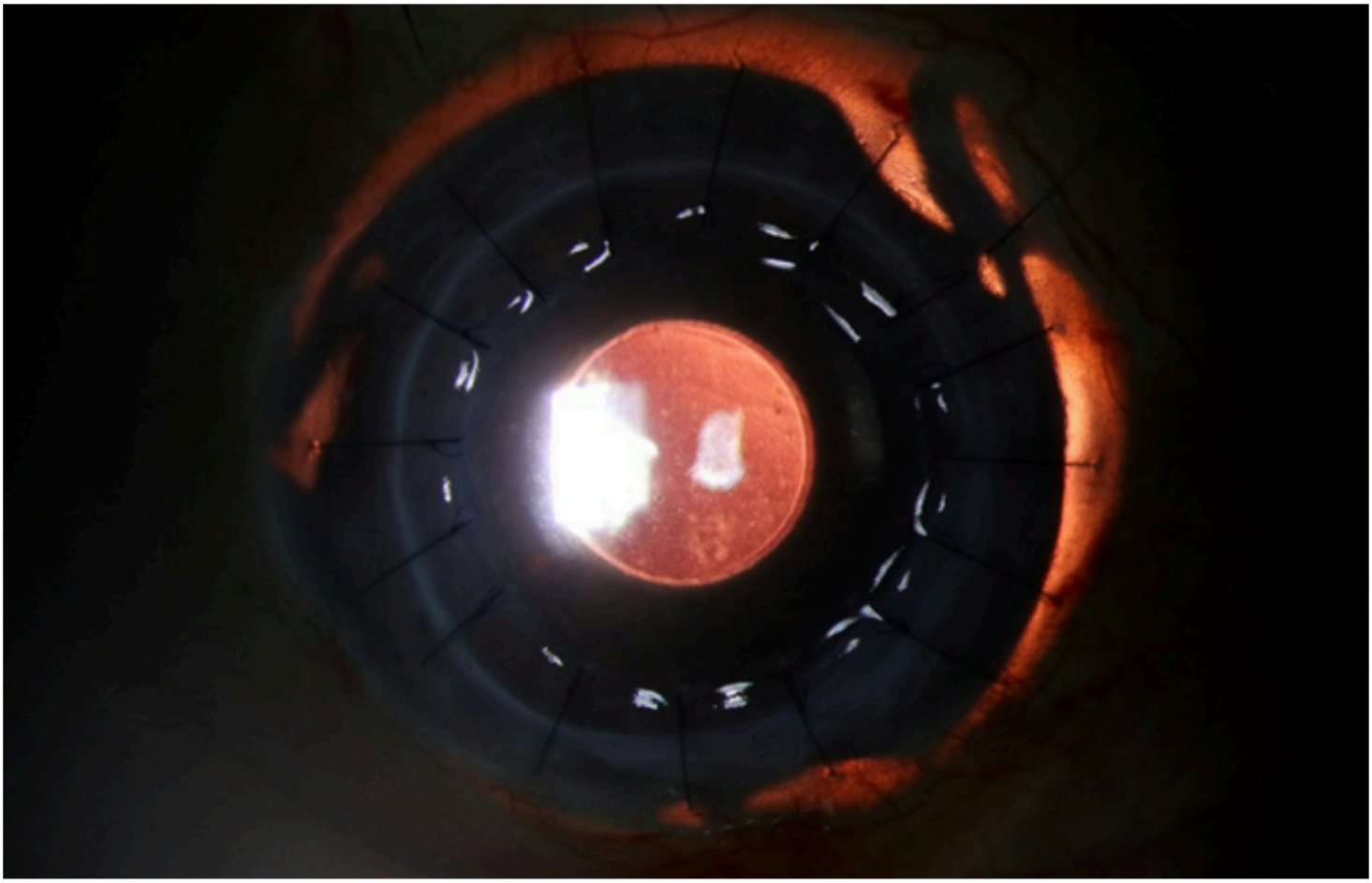


Figure 4

Iris prosthesis shown using retroillumination. (Case 1)

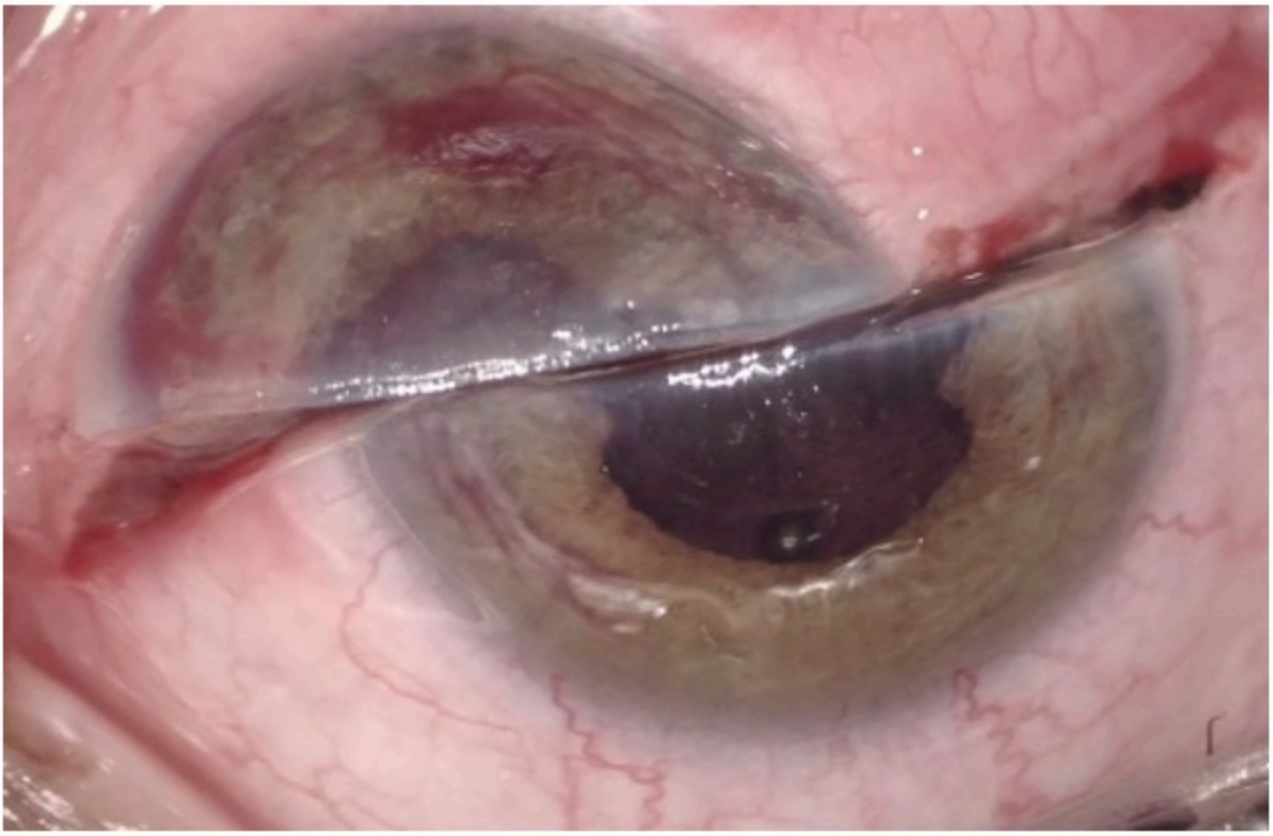


Figure 5

Preoperative photograph of the right eye following drone propeller injury (Case 3). Slit-lamp photograph demonstrating a full-thickness, horizontal, penetrating wound extending across the cornea and sclera.

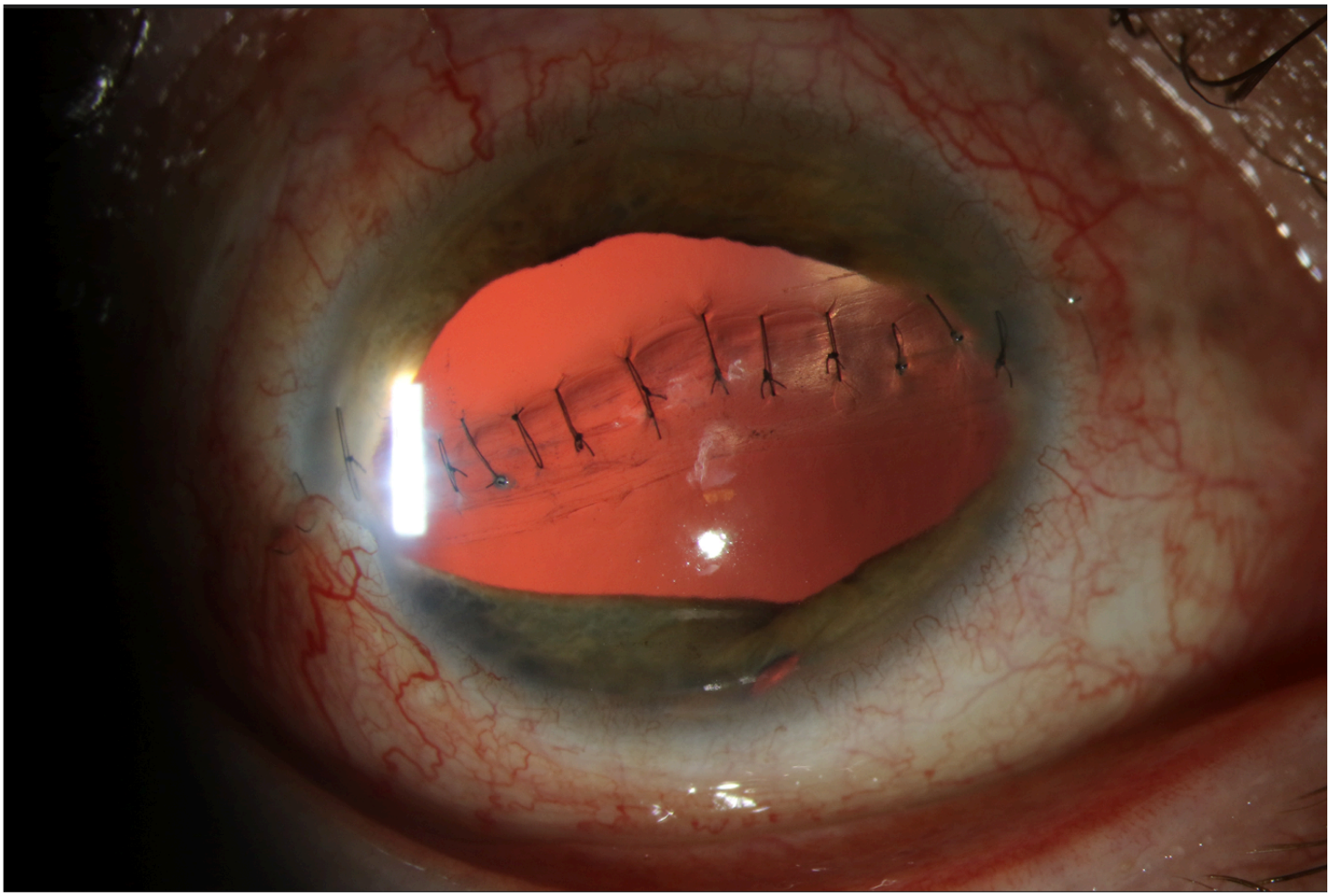


Figure 6

Postoperative photo after initial intervention with primary corneo-scleral wound suturing. (Case 3)

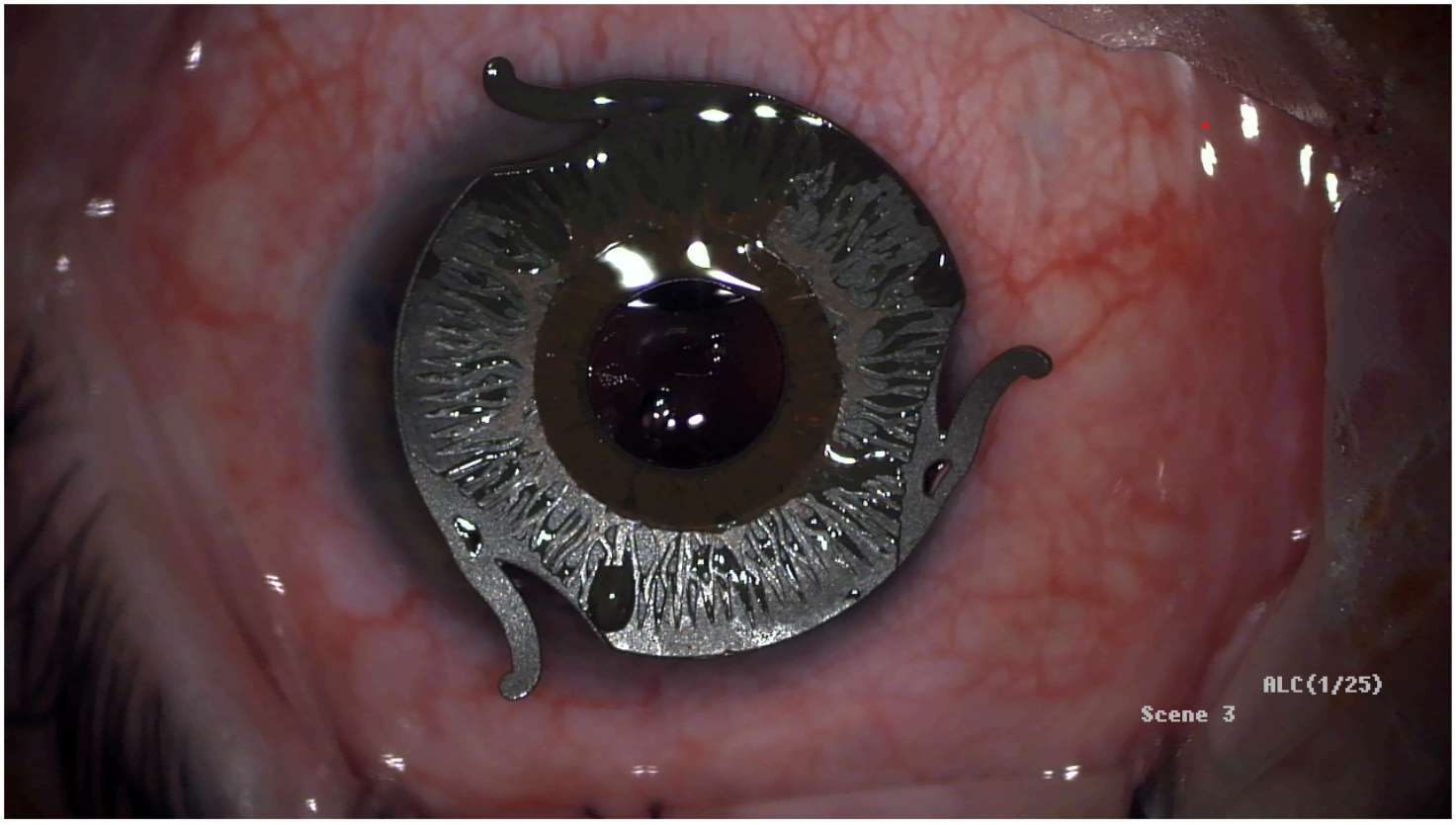


Figure 7

Intraoperative image showing the Reper artificial Iris lens prosthesis



Figure 8

Postoperative facial photo 3 months after artificial iris lens prosthesis implantation. (Case 3)