

Clinical outcome of rescuing dislocated Akreos intraocular lens with closed continuous-loop suture

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Abstract

• **AIM:** To report on the clinical outcomes of rescuing dislocated Akreos intraocular lenses (IOLs) with a closed continuous-loop suture technique (CCS).

• **METHODS:** A retrospective review of patients who underwent CCS for rescuing dislocated IOL between June 2017 and March 2023. The clinical primary outcomes were best-corrected visual acuity (BCVA), intraocular pressure (IOP), IOL positioning, and complications, assessed both preoperatively and for at least 3mo postoperatively.

• **RESULTS:** Nine patients (9 eyes) were reviewed with an average age of 48.67y (range, 18-67y), and a follow-up period averaging 11.67mo (ranging from 3 to 36mo). Post-surgery, the IOLs were well-centered and stable. The preoperative BCVA was 1.03±0.79 logMAR, improving to 0.5±0.48 logMAR at the last follow-up ($P<0.05$). Preoperative IOP of 20±6.84 mm Hg and postoperative IOP 16.11±5.65 mm Hg ($P=0.182$). The mean corneal endothelial cell density decreased from 2177±587 to 2080±581 cells/mm² in five patients ($P=0.71$) and the endothelial cell loss rate is 4.56%.

• **CONCLUSION:** CCS is an effective, safe, and minimally

invasive method for rescuing and stabilizing dislocated Akreos IOLs.

• **KEYWORDS:** intraocular lens dislocation; intraocular lens; scleral fixation

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INTRODUCTION

Intraocular lens (IOL) dislocation is one of the most common complications of phacoemulsification with IOL implantation, with an occurrence rate ranging from 0.4% to 0.8%^[1-2]. Factors contributing to IOL dislocation include insufficient capsular or zonular support and trauma. Dislocated IOLs can lead to significant ocular complications, including disruption of the anterior chamber and damage to the corneal endothelium, and retinal detachment^[3-5]. Creation of a large corneal wound in an anterior approach to explant and replace an IOL also risks postoperative hypotony, astigmatism and delays post-operative recovery^[6]. In recent years, there has been an increasing shift towards using IOL repositioning techniques to manage dislocated IOLs. IOL repositioning allows for correction of lens dislocation with minimal additional trauma to the eye, often resulting in quicker recovery times and improved visual outcomes compared to replacement strategies^[7-8].

The Akreos IOL, made by Bausch and Lomb, a hydrophilic acrylic posterior chamber IOL, is an example of a four-haptic IOL with perforated haptics. This design is particularly suited for 4-point scleral fixation, allowing for sutures to be threaded through the IOL eyelet^[9]. We introduced a less invasive surgical technique utilizing a closed continuous-loop and transscleral suture for four-point fixation of the Akreos IOL^[10]. This method is particularly effective for rescuing dislocated lenses by avoiding IOL removal and reimplantation, greatly reducing surgical complexity and trauma to the patient.

In this paper, we detail the surgical techniques and assess clinical outcomes of a closed continuous-loop suture technique (CCS) for repositioning and securing the Akreos IOL.

PARTICIPANTS AND METHODS

Ethical Approval Institutional review board approval was obtained from Eye Hospital of Shandong First Medical University (Shandong Eye Hospital), Jinan, Shandong Province, China (No.R20241201), for this retrospective case series. The study adhered to the principles of the Declaration of Helsinki. All participants receiving this technique provided written informed consent for possible benefits and risks.

A retrospective observational study was performed by reviewing the medical records of 9 eyes from 9 patients with dislocated IOLs who underwent minimally invasive closed continuous-loop transscleral suture fixation for IOL salvage between June 2017 and March 2023. Inclusion criteria included eyes with subluxated or dislocated Akreos Adapt IOLs. Exclusion criteria were as follows: 1) dislocation of Akreos IOLs complicated by haptic fractures; 2) ocular or systemic comorbidities potentially affecting surgical outcomes (e.g., retinal detachment, advanced glaucoma with significant optic nerve damage); 3) patients with severe systemic disorders unable to comply with surgical procedures and postoperative follow-up. All the patients underwent comprehensive preoperative and postoperative ophthalmic assessments, with collection of relevant data including age, sex, best-corrected visual acuity (BCVA), intraocular pressure (IOP) and intraoperative/postoperative complications.

To delineate the four scleral fixation sites, trypan blue was utilized at locations 3.5 mm superior and inferior to the horizontal corneal meridian, 2 mm posterior to the limbus. Under peribulbar anesthesia, all patients first underwent 25-gauge pars plana vitrectomy with the Constellation Vision System (Alcon Laboratories, Inc, Duluth, GA, USA) prior to IOL fixation. Two 1-mm corneal clear incisions (CCI) were made at the corneal limbus of 11 and 3 o'clock using a keratome. Subsequently, the anterior chamber was tamponaded with an ophthalmic viscoelastic agent (OVD). The dislocated IOL was manipulated with intraocular forceps and repositioned into the anterior chamber (Figure 1A). To expose the underlying sclera, a radial conjunctival incision measuring approximately 2 mm in length was performed at the inferotemporal fixation site.

A 29-gauge insulin needle was threaded through an eyelet on the right IOL haptic. An additional 29-gauge insulin needle was then passed through the corresponding eyelet on the left IOL haptic, with the suture was externalized from the globe under the needle's guidance (Figure 1B). Using a needle holder, the needle was subconjunctivally maneuvered from the superotemporal to inferotemporal scleral fixation sites (Figure 1C). This maneuver was repeated to thread the fixation suture intraocularly and through the remaining two IOL haptic eyelets *via* the superior scleral fixation sites (Figure 1D, 1E).

The surgical approach was performed in accordance with the technique previously delineated by Zhang *et al*^[10]. Finally, the tails of the 9-0 polypropylene suture were securely embedded within the scleral tissue (Figure 1F)^[11].

RESULTS

This study included 9 patients (7 males and 2 females) with a mean age of 48.67±17.26y. Transscleral four-point fixation was successfully performed in all cases for dislocated Akreos IOLs, with a mean follow-up duration of 11.67mo (range from 3 to 36mo). The mean preoperative BCVA was 1.03±0.79 logMAR, which was significantly improved to 0.50±0.48 logMAR postoperatively ($P<0.05$). At the final follow-up, no significant change was observed in IOP, the mean preoperative IOP was 20.00±6.84 mm Hg, and the mean postoperative IOP was 16.11±5.65 mm Hg ($P=0.182$). All IOLs remained stable and well-centered throughout the follow-up period (Figure 2). Postoperative corneal endothelial cell density was evaluated in 5 patients. In these patients, the mean endothelial cell density decreased from 2177±587 cells/mm² preoperatively to 2080±581 cells/mm² postoperatively, with a mean cell loss rate of 4.56% and no statistical significance ($P=0.71$). The other 4 patients did not receive postoperative endothelial cell density measurement. Of these 4 patients, 1 patient with a history of corneal transplantation presented with preoperative corneal epithelial defects and edema; postoperatively, the corneal epithelium was intact and corneal edema was alleviated. The remaining 3 patients maintained clear corneas without signs of corneal decompensation. No intraoperative or postoperative complications such as vitreous hemorrhage, hypotony, retinal detachment or infection, occurred in any patient.

DISCUSSION

This study reports the initial comprehensive description of a CCS strategy for four-point fixation in the repositioning of dislocated Akreos IOL. The introduced technique shows excellent safety and efficacy, with advantages including limited conjunctival dissection, less manipulation of scleral and corneal structures, and no intraoperative or postoperative complications observed during the whole observation period.

Conventional therapeutic approaches for the management of dislocated IOLs encompass two primary strategies: retention of the preexisting IOL or replacement with a new lens. IOL exchange is generally associated with more extensive tissue trauma and carries the potential for irreversible compromise to corneal structural integrity. Thus, salvage of the dislocated IOL represents the preferable intervention in anatomically suitable cases, as it constitutes a minimally invasive alternative to IOL explantation and subsequent replacement^[12-13]. Aligning with this minimally invasive therapeutic paradigm, Genç and Esen^[14] described a knotless scleral suture technique for IOL

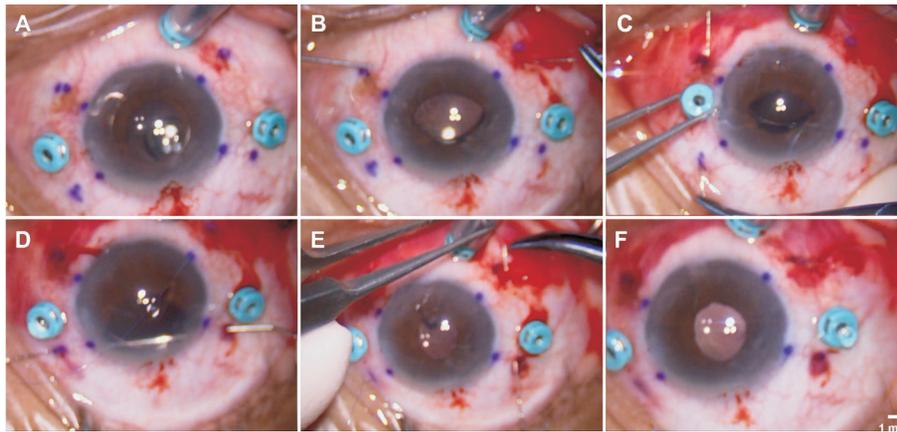


Figure 1 Key steps of rescuing dislocated Akreos IOL with closed continuous-loop suture A: Trypan blue was utilized to delineate the scleral suture fixation sites 2 mm posterior to the limbus. The dislocated IOL was then grasped with intraocular forceps and repositioned into the anterior chamber. B: One needle was passed through an eyelet on the right haptic of the IOL. An 29-gauge insulin needle was inserted through the corresponding eyelet on the left haptic, and the needle was then externalized from the globe under guidance of the 29-gauge needle. C: Using a needle holder, the needle was subconjunctivally externalized from the superotemporal scleral fixation site to the inferotemporal scleral fixation site. D, E: The same surgical maneuvers were repeated to pass the fixation suture into the eye and through the remaining IOL haptic eyelets *via* the two superior scleral fixation sites. F: The tails of the 9-0 polypropylene suture were securely embedded within the scleral tissue. IOL: Intraocular lens.

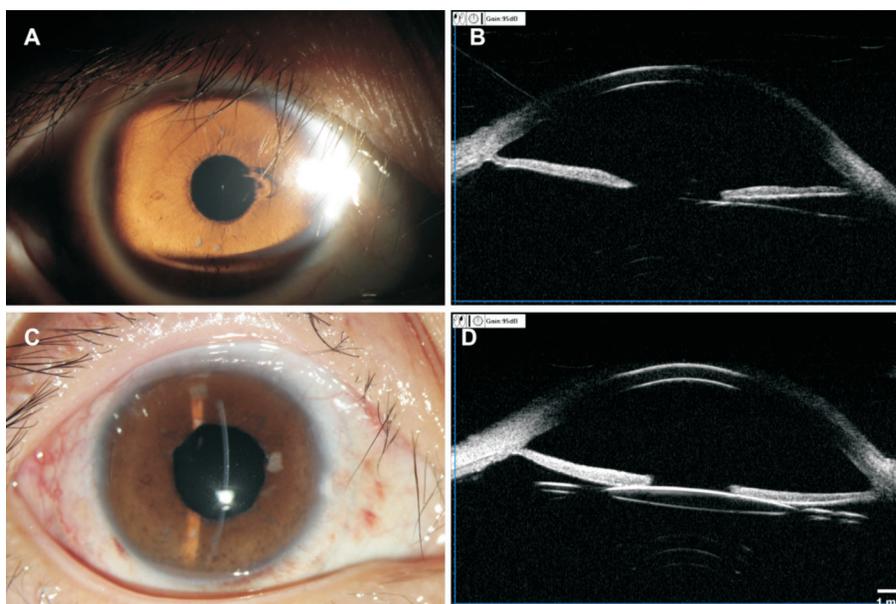


Figure 2 Four-point scleral fixation of the dislocated Akreos IOL using a closed continuous-loop suture in patients A: Preoperative slit-lamp photograph demonstrating a haptic of the dislocated Akreos IOL positioned within the pupillary zone; B: Preoperative ultrasound biomicroscopy (UBM) demonstrated inferior dislocation of the IOL posterior to the iris; C: Postoperative slit-lamp photograph revealing a well-centered posterior chamber IOL; D: Postoperative UBM image demonstrating a well-located IOL. IOL: Intraocular lens.

rescue, and a knot-free suture technique for scleral fixation to rescue dislocated IOL, thereby supporting a minimally invasive approach. The Akreos Adapt IOL is equipped with four closed-loop haptics, rendering it particularly amenable to four-point transscleral fixation. The closed continuous loop suture technique for four-point fixation of IOLs was first introduced by Zhang *et al*^[10]. This technique has subsequently been validated as effective and safe for IOL stabilization in patients with inadequate capsular support, yielding favorable visual outcomes and manageable complication profiles

over prolonged follow-up period^[15]. As such, this method is particularly well-indicated for the salvage of dislocated Akreos IOLs.

The primary benefit of this surgical approach is its minimally invasive design. To begin with, the procedure is safe and technically straightforward. With two 1-mm clear corneal incisions, the dislocated IOL can be safely repositioned into the anterior chamber using intraocular forceps, which streamlines the entire fixation procedure. BCVA significantly improved from 1.03 ± 0.79 logMAR preoperatively to 0.5 ± 0.48 logMAR

at the last follow-up ($P < 0.05$). This suggests that this technique effectively restores optical function and stabilizes the IOL. Such visual improvement can be attributed to stable IOL fixation, limited intraocular trauma, and improved lens centration, all of which promote favorable refractive outcomes. IOP remained well-maintained throughout, with mean values of 20 ± 6.84 mm Hg preoperatively and 16.11 ± 5.65 mm Hg postoperatively ($P = 0.182$). In contrast to some scleral fixation techniques that carry a risk of hypotony due to larger wounds, this minimally invasive strategy helps preserve stable IOP and lowers related complication risks. Endothelial cell density decreased by 4.56% postoperatively, a change that was not statistically significant ($P = 0.71$). For comparison, a systematic review by Wong *et al.*^[16], including 57 studies involving 2624 eyes reported an average endothelial cell loss of 8.95% after various scleral-fixated IOL procedures. The lower endothelial cell loss in this study indicates milder corneal trauma, likely due to smaller incisions and reduced intraocular manipulation. Second, the conjunctival incision is minimal. Unlike approaches that use Gore-Tex sutures for IOL repositioning^[8], the current technique only requires a 2 mm radial conjunctival incision at one fixation site for suture burial. Third, the suture ends are tied to form a friction knot, which is then placed into a scleral tunnel to prevent suture exposure^[11].

Several limitations should be acknowledged in the present study, notably a small sample size, retrospective study design, and relatively limited follow-up duration. Subsequent investigations involving larger study cohorts and prolonged observation periods will be required to more precisely assess long-term visual stability, safety profiles, and complication incidences.

In conclusion, the CCS represents a safe, effective and minimally invasive strategy for the rescue of dislocated Akreos IOLs. Our findings highlight its advantages in visual rehabilitation, IOL stability, and corneal preservation. Further studies are needed to establish its long-term safety and broaden its clinical indications

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