

New two-point scleral-fixation technique for foldable intraocular lenses with four hollow haptics

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Abstract

• **The study was to report a new two-point scleral-fixation technique for foldable intraocular lenses with four haptics. Lenses were slid into the anterior chamber from a 2.8 mm corneal incision and fixed under two sclera flaps at two opposite points. The postoperative best-corrected visual acuities (BCVAs) of all patients were significantly better than their preoperative BCVA. The results demonstrate that two-point, scleral fixations of foldable, intraocular lenses might be practicable and effective.**

• **KEYWORDS:** cataract; intraocular lens; aphakia; scleral fixation

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INTRODUCTION

More and more patients in China received cataract surgery in recent years. For various reasons, without sufficient capsular support aphakia might appear in some of these patients. Additional studies have demonstrated a technique for fixing intraocular lens (IOL) in aphakic patients with insufficient capsular support [1-2]. However, implantation of traditional polymethyl-methacrylate IOL requires a larger incision which can cause iatrogenic astigmatism, intraoperative hypotony, and detachment of the choroid. That said, with the further development of ocular science and technology, a greater range of foldable IOL types have become available; indeed, recent studies have reported the success of techniques that use small-incision injector implantations of foldable IOLs [3-4].

The presented technique entails the placement of an acrylic, posterior-chamber IOL. The one-piece lens used has four haptics and is inserted through a small incision, using a

sutured, two-point fixation. The four-haptic IOL not only obviates large incisions, it also reduces the chance of displacement.

SUBJECTS AND METHODS

Patient Assessments Single eyes of 16 patients (mean age: 37.9y; range: 9-72y; 12 males and 4 females) comprised the sample for this study. The eyes included in this study evinced a complete lack of or, at the very least, inadequate posterior capsular support. Patients with serious corneal scars, glaucoma, proliferative diabetic retinopathies, or age-related macular degeneration were excluded. All patients were recruited from the Department of Ophthalmology, the Second Affiliated Hospital of Anhui Medical University in Hefei, Anhui Province, China, from February, 2011 to February, 2012. All patients provided informed consent. The study was approved by the local institutional-ethics committee of the Second Affiliated Hospital of Anhui Medical University. All procedures followed the tenets of the Declaration of Helsinki.

Materials A complete preoperative assessment including slit-lamp, fundus, visual acuity, best-corrected visual acuity (BCVA), spherical equivalents (SE), and corneal endothelial cell count (ECC) evaluations, which were performed on all patients. A logMAR visual chart was used to test visual acuity. The IOL's power was calculated using IOL Master (Carl Zeiss Meditec AG, YZB/GEM 4270-2008). A one-piece, acrylic-posterior chamber lens (Bausch & Lomb; Akreos Adapt; 5.5 mm optics; 11.0 mm, 10.7 mm, or 10.5 mm haptic diameter) was implanted into the eye using the accompanying injector system. Statistical analysis was performed using SPSS software (version 13.0; SPSS, Inc., Armonk, NY, USA). A $P < 0.05$ was considered statistically significant.

Surgical Technique Figure 1 was showing the operation pattern, while Figure 2 was a photo of the operation itself. After retro-bulbar anesthesia was administered, two triangular, limbus-based sclera flaps approximately half the thickness of the sclera were created in each eye at the 4 and 10 o'clock locations. Forceps were used to gently grasp the outer edges of the sclera flaps at their 10 o'clock locations. A 2.8 mm side-port blade was then used to make a full-thickness, self-sealing incision under each sclera flap, and the resulting anterior chambers were entered. A 10-0, double-armed polypropylene suture [AUM-5&SC-5; 0.2 METRIC; 30 cm (10-0); Alcon, Dallas-Ft. Worth, TX, USA] was used, one end of which suture was a curved needle and the other end of which was a straight needle. Then, the

straight needle was inserted at the 10 o'clock location through the bed of each sclera flap, 1-1.5 mm posterior to the limbus, and threaded into a 27-gauge needle, which had been inserted into the anterior chamber from the same location on the opposite side (Figures 1A-1B, 2A-2B). The sutures were cut after they had been pulled out through the corneal incisions using a hook (Figures 1C, 2C). The two ends of each suture were settled for fixing each IOL's haptics. In each operation, an IOL (Akreos, Basuch&Lomb) was placed into its accompanying injector with the aid of its viscoelasticity. A lenticular hook was used to keep one haptic (the first haptic) outside each eye (Figures 1D, 2D). Each suture at the 4 o'clock location was tied, leaving the annular haptic outside the eye; then, each haptic was slid back into the anterior chamber (Figures 1E-1F, 2E-2F). Next, each anterior-chamber lens was carefully rotated clockwise 180° with a hook (Figures 1G-1H, 2G-2H). The opposite haptic (the second haptic), which was 180° discrete from the first haptic, was hooked from each corneal incision and was then tied with each suture at the 10 o'clock location (Figures 1I-1J, 2I-2J). Afterward, the second haptic was slid back into each anterior chamber. Finally, the tightness of each suture at the 4 and 10 o'clock locations was adjusted, to ensure each IOL remained at the center of the eye (Figures 1K, 2K).

The curved needle attached to each 10-0 polypropylene suture and exiting from the sclera bed was used to secure the superior haptic with a knot after the IOL's position was checked. Each knot was trimmed and buried under the sclera flap, which was closed with a 10-0 monofilament suture (Figures 1, 2).

RESULTS

The patients were examined postoperatively 3d, 1wk, 1, 6, 24mo after their respective operations. These follow-up examinations consisted of BCVA, SE, slit-lamp, keratometry, ECC, and fundus evaluations, as well as the use of an ultrasound biological microscope. All eyes maintained or improved their BCVAs postoperatively; preoperatively, the patients' mean BCVAs were 0.98 ±0.37, whereas, after 24mo, their results for the same had improved to a mean of 0.52±0.07 (P=0.005, paired sample t-test). The mean preoperative SE was 1.45±1.00, and the mean postoperative SE was 1.42±1.00, thus evidencing no significant improvement to SE between the pre- and postoperative states (P=0.388, paired sample t-test). The mean preoperative ECC was 2726±713, and the mean postoperative ECC was 2700±708 (three months after surgery), thus evidencing no significant improvement to ECC between the pre- and postoperative states as well (P=0.114, paired sample t-test). No IOL displacement, suture exposure, pigment dispersion, endophthalmitis, or retinal detachment occurred. The most common complication was cystoid macular edema, which occurred in two eyes (12.5%) and from which the subject patients recovered within 6mo. Intraoperative hypotony and vitreous hemorrhage each occurred in one eye (6.25%), and

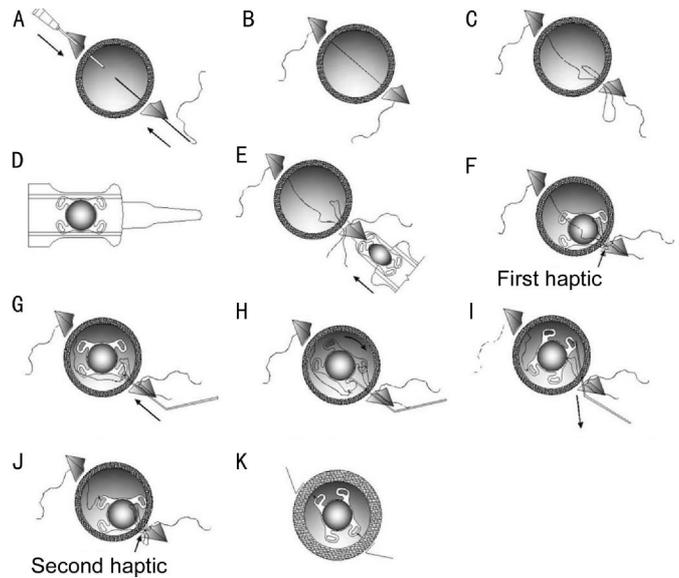


Figure 1 Photo showing the operation pattern.

both subject patients recovered without further treatment for these conditions within 1mo of surgery.

DISCUSSION

When the IOL cannot be implanted into the eye because of insufficient capsular support, scleral fixation might be considered as one of the most practicable alternative treatments. Most reports suggest that a foldable-acrylic IOL with two haptics is the most suitable for scleral fixation because it can be inserted through a small corneal incision with or without the use of an injector [3]. Fass and Herman [4] have reported their use of a foldable-acrylic IOL in eyes without sufficient capsule support. According to their report, limbus-based scleral tunnels and dual paracenteses were created in the sulcus. Then the IOLs were fixed to the sclerals through said tunnels for four points. Thus, although the Akreos IOL has been in use for many years ago, the IOLs used in the present study were rotated clockwise for both scleral and two-point intra-scleral fixation.

Because smaller incisions have highly advantageous to vision improvement, surgeons typically prefer to let them as small as possible. Indeed, traditional large-incision techniques often cause intraoperative hypotony, postoperative hypotony, and subsequent vitreous hemorrhaging. The technique presented herein therefore incorporated the use of a sutureless, 2.8 mm incision and a one piece-lens injection. A closed, anterior-chamber system utilizing the 2.8 mm incision maintained constant intraocular pressure. This surgical technique could reduce complications associated with intraoperative hypotony, especially in eyes with little to no vitreous support [4]; moreover, it could promote better visual rehabilitation of the postoperative eye, while the use of a sutureless, 2.8 mm incision can reduce the likelihood of postoperative astigmatism.

IOL dislocation is one of the most serious complications of transscleral and scleral fixation, which can lead to clinically significant, uncorrectable irregular astigmatism and diminish

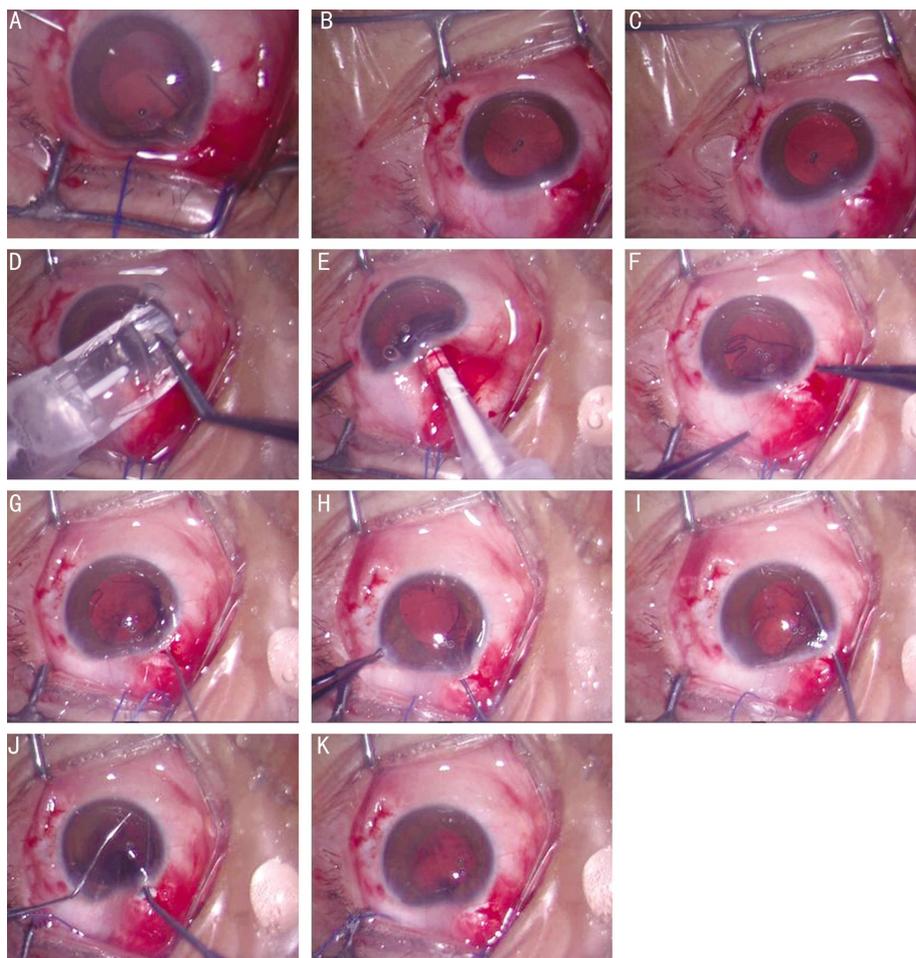


Figure 2 Photo of the operation.

the efficacy of the implant. When a traditional, two-haptic IOL is implanted in the eye without capsular support, the IOL might roll and cause retinal damage. Reducing the occurrence of this complication has become one of the most important of ophthalmological goals. The four-haptics system featuring transscleral scleral fixation, as presented herein, is one promising realization of this goal; it not only ensures the IOL remain fixed at the center of the eye due to haptic short-arm force, but also due to said short-arm force, it provides uniform tension on both symmetrical haptics over a large surface area as well.

Finally, it is worth noting that suture exposure did not occur in any of the 16 cases after 2y. Although many other practitioners have begun using newer kinds of sutures^[5-6], such as the 9-0 suture, and have even gone so far as to use sutureless techniques^[7], the 10-0 suture used in present study proved safe and caused comparatively fewer eye lesions. Thus, long-term follow-ups to the present study should be conducted to determine whether the sutures used degrade.

In conclusion, the presented technique, which introduces injector implantation of transscleral IOLs and is a novel modification of the two-point transscleral-fixation technique that instead uses a four-haptic, foldable IOL, offers a simpler, lower-risk alternative to previously proposed operations, as well as a shorter recovery time and faster restoration of the visual function.

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Conflicts of Interest: Liu HT, None; Jiang ZX, None; Tao LM, None.

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