CASE REPORT

Transscleral fixation of a toric intraocular lens by a slipable suture technique

In keratoplasty, astigmatic correction is crucial for achieving a favourable visual outcome. Several procedures have been introduced for astigmatic correction, including astigmatic keratotomy,[1] wedge resection,[2] and excimer laser refractive surgery.[3] Each of these procedures have limitations, including unpredictable refractive outcomes, technical difficulty, expenses, and potential complications.[4]

The toric intraocular lens (TIOL) provides a surgical option for postkeratoplasty astigmatism. The development of a foldable TIOL that can be inserted through a small incision reduces the unpredictability of surgically induced astigmatism in sequential surgery after keratoplasty.[4–6] After combined cataract extraction and keratoplasty, the incompleteness of the can-opener capsulotomy or anteroposterior capsular adhesion precludes insertion of an IOL in the bag. Two cases of transscleral fixation of a TIOL for postkeratoplasty astigmatism have been reported,[7,8] but in one, a supplementary sulcus TIOL was used,[7] and no solution for misalignment was suggested in the other.[8] Here, we describe a case that was successfully managed with a novel suture technique, which enabled readjustment of the haptic suture after scleral fixation, to resolve this complex surgical situation.

A 66-year-old male presented with visual disturbance that had lasted several decades. He had experienced recurrent idiopathic keratitis. Visual acuity (by logMAR) was counting fingers OD and 1.2 OS. On slit-lamp examination, thick corneal opacities were observed bilaterally. The crystalline lenses showed significant opacities. A penetrating keratoplasty was performed with cataract extraction in the left eye. IOL implantation was not performed at that time because it is common practice to leave patients aphakic after keratoplasty and to perform a secondary IOL insertion to match the IOL power to the new keratometry values. Corneal sutures were removed after 1 year. Preoperative evaluation of the IOL implantation revealed a +3.00-diopter (D) sphere, +5.00-D cylinder, and a best corrected visual acuity of 0.2. The keratometric readings obtained via a manual keratometer (Ophthalmometer, OM-4; Topcon, Tokyo, Japan) were K1 = 48.50 D and K2 = 42.00 D, and the steep axis was 180°. Keratometric values of 49.50 and 42.37 D were obtained from a topographer (CT200; Dicon, San Diego, Calif.), and the steep axis was 2°. The axial curvature map showed a symmetric bowtie topography pattern of the left eye. Axial length was 25.57 mm, as determined by A-scan biometry (AXIS II PR Post Refractive Ultrasound; Quantel Medical, Toronto, Ont.). We calculated target power using the SRK-T formula as −0.25 D. An Acrysof IQ toric (Acrysof Toric Natural; Alcon Laboratories Inc, Fort Worth, Tex.) T9 +12.5-D IOL was selected for the secondary TIOL implantation. However, on slit-lamp examination, thick fibrous anteroposterior capsular adhesions were observed. Consequently, the patient could not undergo TIOL implantation in the bag. Instead, a transscleral IOL fixation was performed using a modified method.

Before surgery, the structure of the TIOL was evaluated. The toric marks on the optic and the expected tying point of the haptic were identified by imaging software (LAS EZ 2.0; Leica Microsystems, Wetzlar, Germany). The angle between 2 imaginary axes, 1 formed by connecting the toric marks and the other by connecting the planned tying point, was calculated using ImageJ (National Institutes of Health, Bethesda, Md.). The nearer the tie to the proximal portion of the haptic, the greater the tension and torque on the suture. Therefore, we decided to place the tie at 2.0 mm from the end of the haptic, which would generate an angle of 40.7° from the toric axis (Fig. 1). Theoretically, two 3.0-mm-spaced polypropylene sutures could be tied on the haptic, enabling adjustment of the toric axis by 25.6° after tying.

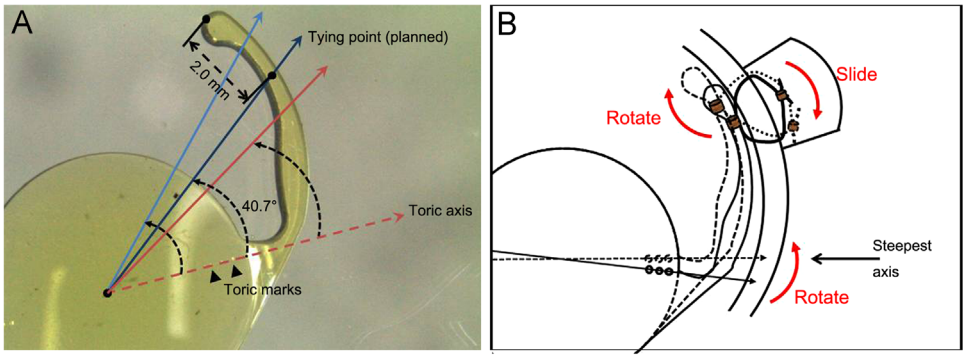

Fig. 1—(A) Microscopic toric intraocular lens (IOL) measurements. The IOL (Acrysof Toric Natural T9; Alcon Laboratories Inc) was evaluated using a stereoscopic microscope (S6D; Leica Microsystems). Both the toric axis and the tying points were calculated via image analysis software (LAS EZ 2.0; Leica Microsystems). The toric axis is the imaginary axis passing through both toric marks in the IOL optic. The planned tying point (dark blue line) was placed 2.0 mm from the haptic end point. The planned tying point was at a 40.7° angle from the toric axis (red dashed line). (B) Theoretical principle rotation of the toric IOL. As the surgeon rotates the knot clockwise, the toric IOL is rotated counterclockwise. Using this manoeuvre, the surgeon can calibrate the toric axis to the steepest meridian.

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Immediately before the operation, the perpendicular axes were marked at the limbus. The steepest meridian (180°) and tying axis (40°) were marked. Two 3.0-mm scleral flaps were made at the 40° meridian. The capsule was removed using a 23G vitrector (Millenium Phaco Vitrectomy A/P CX3173; Bausch & Lomb, Bridgewater, N.J.). Two curved needles with a double-armed 10-0 polypropylene suture (Ethicon, Inc, Somerville, N.J.) were inserted 2.0 mm posterior to the limbus, separated by 3.0 mm, and passed from one scleral flap to the other with a docking technique using the 26-gauge needle. The 2 strands of the sutures were pulled out through the corneal incision with a Kuglen hook and cut between the strands. The new ends of the sutures on the same side were tied at one haptic, at 2.0 mm from the haptic end (as measured by caliper), using conventional square knots. After one haptic had been fixated with the sutures, the IOL was folded using Buratto forceps and was introduced into the anterior chamber via the same aforementioned clear corneal incision. The other haptic was externalized and tied in the same manner. By pulling on both ends of the sutures, the IOL was positioned in the eye and aligned toward the desired axis. Both ends of the sutures were tied to the scleral bed under the scleral flap, and the knots were locked. The suture loop at each haptic was mobilized and rotated with forceps, thus allowing the IOL to rotate as well. After positioning the IOL at the correct meridian, the viscoelastics and prolapsed vitreous fibers were removed. The overall surgical procedure is summarized in Video 1 (available online) and Figure 2.

On postoperative day 1, uncorrected visual acuity was 0.5, and the IOL was well centred. Each toric mark was properly positioned at the planned meridian. The refraction was +2.00-D cylinder error at 180°. By 2 months, the keratometric readings were K1 = 49.00 D and K2 = 42.75 D, the steep axis was 8°, and refraction was +2.25-D cylinder

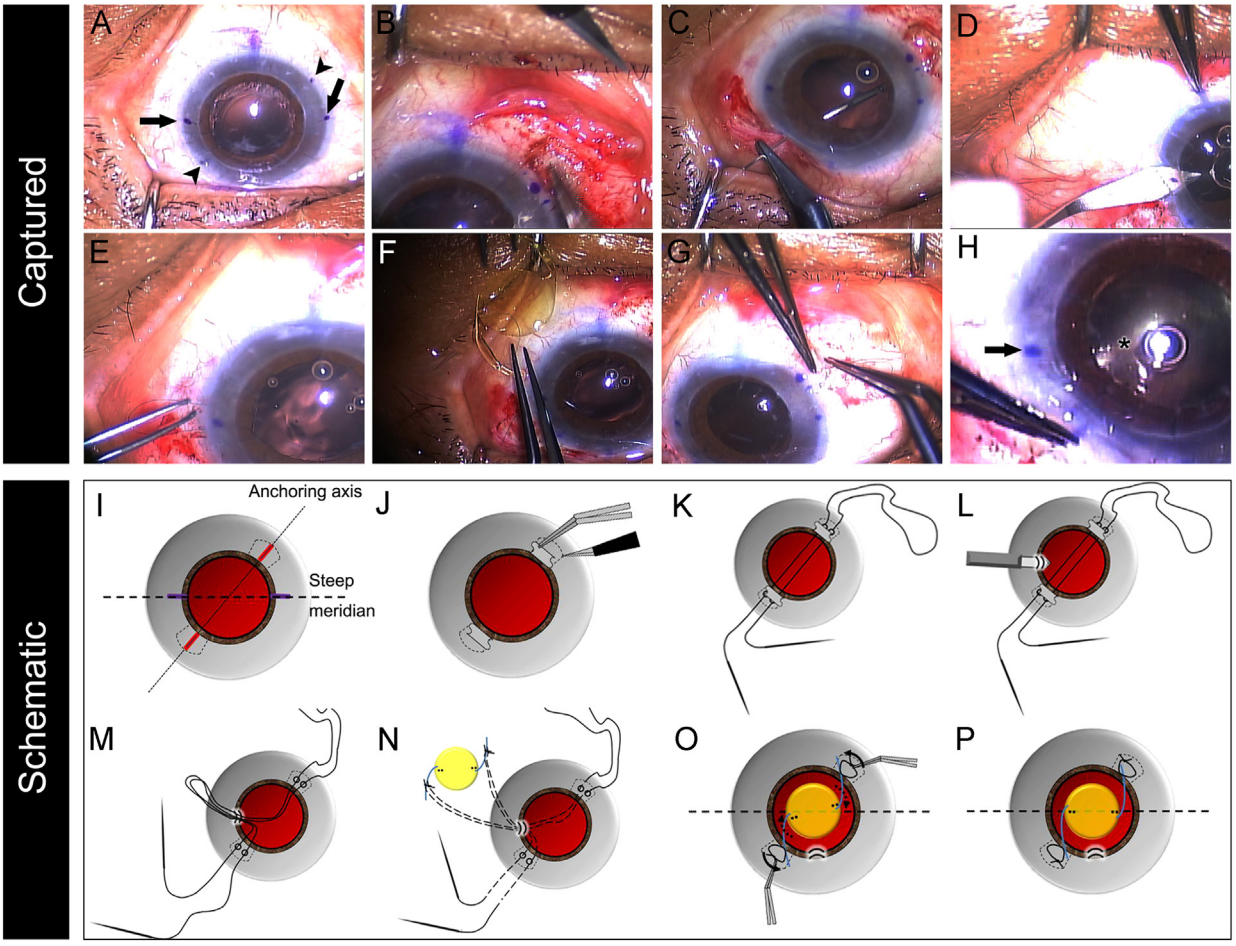

Fig. 2—Intraoperative images (A–H) and corresponding schematic diagrams (I–P) of transscleral intraocular lens (IOL) fixation using a novel sliding knot technique. (A, I) The steepest meridian (arrows) was marked, and the haptic fixation meridian (arrow heads) was determined based on the steepest meridian. (B, J) A partial-thickness scleral flap was created using a microscalpel. (C, K) Each end of the double-armed 10-0 polypropylene suture was passed from the bed of the partial-thickness scleral flap 2.0 mm posterior to the limbus and 3.0 mm apart, using a 26G needle. (D, I) A 2.75-mm-wide clear corneal incision was made using a disposable scalpel. (E, M) The middle portion of the suture was extracted through a clear corneal incision. (F, N) The cut end of each suture was tied to the IOL haptics. (G, O) The outer portion of the suture was tied and rotated using microforceps. (H, P) The toric axis of the IOL was aligned to the steepest meridian.