Original Article

Sutureless glueless intrascleral fixation of posterior chamber intraocular lens: Boon for aphakic

Nagendra Shekhawat, Karishma Goyal

Purpose: To report results of intrascleral fixation of 3-piece IOL without the help of suture and glue. **Methods:** Study included intrascleral fixation of haptic in 50 eyes by T-fixation technique. Preoperative and postoperative visual acuity, slit lamp and fundus examination, applanation tonometry, keratometry, biometry, optical coherence tomography, Scheimpflug imaging were done for extensive evaluation. Qualitative and quantitative data were summarized in the form of proportion and mean and standard deviation, respectively. The significance of difference was measured by Chi-square test or unpaired *t*-test or ANOVA whichever is appropriate. $P < 0.05$ was considered as statistically significant. **Results:** There was one case in which haptic broke during handshake maneuver and another IOL was required. Postoperative complications included corneal edema (4%), increased intraocular pressure (6%), cystoid macular edema (2%), decentration (4%), and dislocation (2%), which were all managed to the level of good visual recovery. There was no significant change in corneal astigmatism. There was significant change found in best-corrected visual acuity and uncorrected visual acuity after surgery. **Conclusion:** This modified technique seems to be a good alternative in IOL implantation in eyes with deficient capsules in view of the decrease in the learning time and surgical time and risk for complications.

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Planned intracapsular cataract extraction,[1] or extracapsular method of cataract extraction complicated by large posterior capsular break[2] or lensectomies; these all results in aphakia. Visual rehabilitation in such patients is quite challenging not only due to the visual outcome but also due to the related complications in the postoperative period. Usual modalities accomplished in the past are the spectacles, contact lens or implantation of anterior chamber intraocular lens (ACIOL), iris-fixated IOL, or scleral-fixated IOL (SFIOL).[3] Spectacles and contact lens have limited use due to their complication profile.[4,5] Then came the concept of IOL implantation.[6]

The endocapsular placement is the most preferred anatomical site for IOL placement. Thus, placement of the IOL in the posterior rather than the anterior chamber reduces the risk of damage to anterior chamber angle structures and corneal endothelium.[7] We evaluated a new technique of intrascleral fixation of three-piece IOL without the use of suture (risk of suture-induced inflammation, suture degradation, and delayed IOL subluxation or dislocation due to broken suture) and glue (expensive or risk of prion infections).[8]

Methods

The ethical committee of the hospital approved the study. It was hospital-based descriptive type of observational study which included 50 eyes of fifty patients. All aphakic patients above 12 years who were ready to give consent were included in the study. Exclusion criteria included patients with corneal opacity, retinal disorder, optic atrophy, bleeding disorder, pregnancy, and those who were unwilling to give consent. Preoperative and postoperative visual acuity, slit lamp and fundus examination, applanation tonometry, keratometry, biometry Carl Zeiss Meditec IOL Master, and optical coherence tomography (OCT) (Topcon 3D OCT 2000) were done for extensive evaluation of anterior and posterior segment.

Statistical analysis was done with the help of IBM SPSS 19.0 software. Qualitative data were summarized in the form of proportion. Quantitative data were summarized in the form of mean and standard deviation (SD). The significance of difference in proportion was measured by Chi-square test. The significance of difference in mean was measured by unpaired *t*-test or ANOVA whichever is appropriate. $P < 0.05$ was considered as statistically significant.

Surgical technique

Under peribulbar anesthesia, 5.0 mm conjunctival peritomy was done at the 2 o'clock and 8 o'clock positions. Then, 2 T-shaped incisions (1.5–2 mm long) were made 1.5–2.0 mm from the limbus and depth was half of scleral thickness, exactly 180° apart diagonally. An infusion cannula or anterior chamber maintainer was inserted. To prevent interference with the creation of the T-shaped incision, infusion cannula should be positioned at 4 o'clock. Anterior vitrectomy (deep core) was performed, if necessary. Sclerotomy was done parallel to the iris at the

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T-shaped incision with a 23-gauge angled microvitreoretinal knife, and a scleral tunnel (3–3.5 mm long) was made parallel to the limbus at the branching point of the T-shaped incision. 2.8 mm keratome was used to make a corneal incision at 10 o'clock through which IOL, with overall diameter 13 mm and optic diameter 6 mm (Abott Sensar AR40e [three-piece Foldable IOL]), was implanted with an injector; the trailing haptic was left outside the incision. The tip of the haptic was then grasped with 24/25-gauge IOL haptic gripping forceps, pulled through the sclerotomy, and externalized on the left side. Then the trailing haptic was inserted into the anterior chamber and the haptic tip was grasped with a 24/25-gauge forceps, pulled through the second sclerotomy and externalized on the right side. The haptic insertion into the anterior chamber may be difficult depending on the material or shape of the haptics, which can cause the IOL to rotate clockwise and the leading haptic to slip back into the eye. To prevent such risks, the IOL optic was pushed to the back of the iris and moved to the 2 o'clock position with a push-and-pull hook inserted through the side port at the 1 o'clock position. The tip of the haptic was subsequently inserted into the limbus–parallel scleral tunnel. A single 8-0 vicryl suture is used to fixate the haptic to the scleral bed to prevent it from shifting immediately after surgery [Figs. 1 and 2].

Scheimpflug imaging (OCULUS PENTACAM) was done to evaluate proper centration of IOL. Follow-up was done on 1st, 7th, 28th postoperative day, at 3 month, and 6 month.

Results

The study population consisted of fifty patients (24 female and 26 male). Mean age was 60.2 years (SD 11.4 year). The minimum age was 25 years while the maximum age of the patient was 80 years. Out of 50, 24 were aphakic due to complicated cataract surgery and two were aphakic after intracapsular cataract extraction. These cases underwent deep core anterior vitrectomy through 23-gauge pars plana route with scleral fixation in the same sitting. During anterior vitrectomy, infusion continued through anterior chamber maintainer and a single pars plana incision 3.5 mm behind the limbus was made. This allowed the flow to move in one direction from anterior to posterior making removal of vitreous more efficient. The rest of the cases included dropped IOL (4), nucleus drop (5), subluxated cataractous lens (4), traumatic posterior dislocated crystalline lens (3), cortical matter in vitreous (1), operated limboscleral tear with subluxated cataractous lens (1), subluxated IOL (1), subluxated traumatic cataract with intraocular foreign body (IOFB) (2), traumatic cataract with IOFB (1), traumatic posterior dislocated IOL (1), and traumatic subluxated IOL with inferior retinal dialysis (1). In these cases, 23-gauge primary pars plana vitrectomy with 360° endolaser was done. Silicon oil was injected in required cases. Then, after 4 weeks, SFIOL was implanted. In silicon-filled eye, SFIOL was implanted after silicon oil removal.

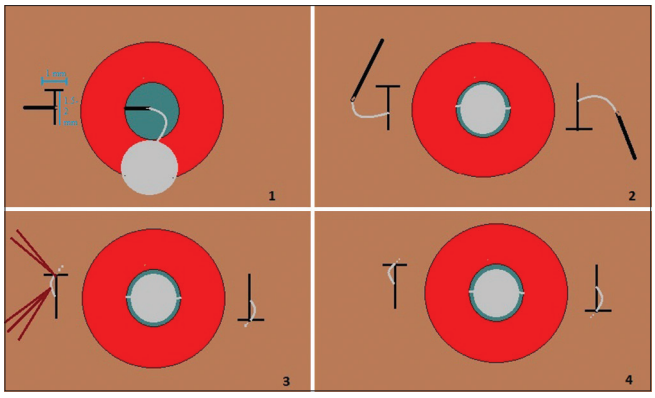


Figure 1: (1) T-shaped incision and sclerotomy made 2 mm from limbus and scleral tunnel formed at branching point. (2) Haptics of intraocular lens exteriorized. (3) Haptic tucked and fixed in scleral tunnel. (4) Proper centration after fixation of both the haptics

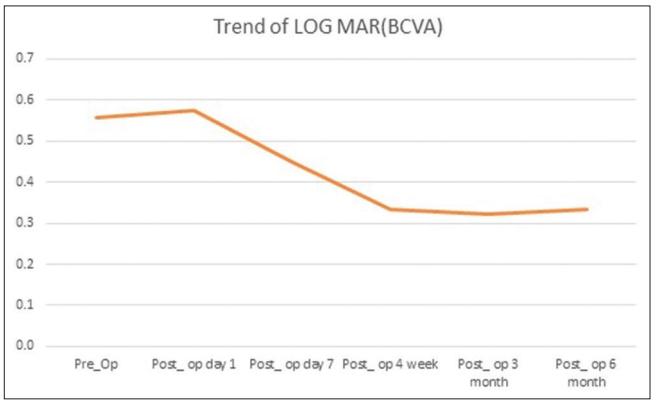
Change in uncorrected visual acuity in LOGMAR from preoperative (1.8 ± 0.6) value to every follow-up postoperatively (0.8 ± 0.3; 0.6 ± 0.3; 0.5 ± 0.2; 0.5 ± 0.2: 0.5 ± 0.3 respectively) was highly significant ($P = 0.0000$).

Changes in best-corrected visual acuity in LOGMAR from preoperative (0.6 ± 0.2) to day 1 follow-up (0.6 ± 0.3) were not significant ($P = 0.6842$), but on next follow-up (0.5 ± 0.4), change was significant ($P = 0.0183$), and later, on every follow-up (0.3 ± 0.2; 0.3 ± 0.2; 0.3 ± 0.2), change was highly significant ($P = 0.0000$) [Graph 1].

Corneal topography (K1 and K2) and astigmatism was measured using Scheimpflug imaging preoperatively (K1 = 43.2 ± 2; K2 = 44.6 ± 2; astigmatism = 2 ± 1.8) and on final follow-up at 6 months (K1 = 43.3 ± 1.8; K2 = 44.5 ± 1.9; astigmatism = 1.8 ± 1.6). Changes in keratometry (K1, K2) and astigmatism was found insignificant ($P = 0.6324$, 0.4556 and 0.0510 respectively), showing that scleral tunnel made in this technique does not affect corneal astigmatism.

Complications were noted on each follow-up.

On day 1, there were 2 (4%) cases of corneal edema due to surgical manipulations which got resolved in the next follow-up; on day 7, there were 3 (6%) cases of raised intraocular pressure (IOP) which were managed medically and 1 (2%) case of decentration. That time, tunnel was not fibrosed. Exposed haptic was grasped and pulled to ensure proper centration of IOL and then tucked into the same tunnel and an absorbable suture was applied to ensure the fixation till the tunnel get fibrosed. At 3 months, there was 1 (2%) case of cystoid macular edema (CME) which was managed medically and 1 (2%) case of decentration. Tunnel integrity was lost in this time. Hence, a new tunnel was made at the same site in a little deeper plane and then fixate the haptic.



Graph 1: Change in best-corrected visual acuity with each follow-up

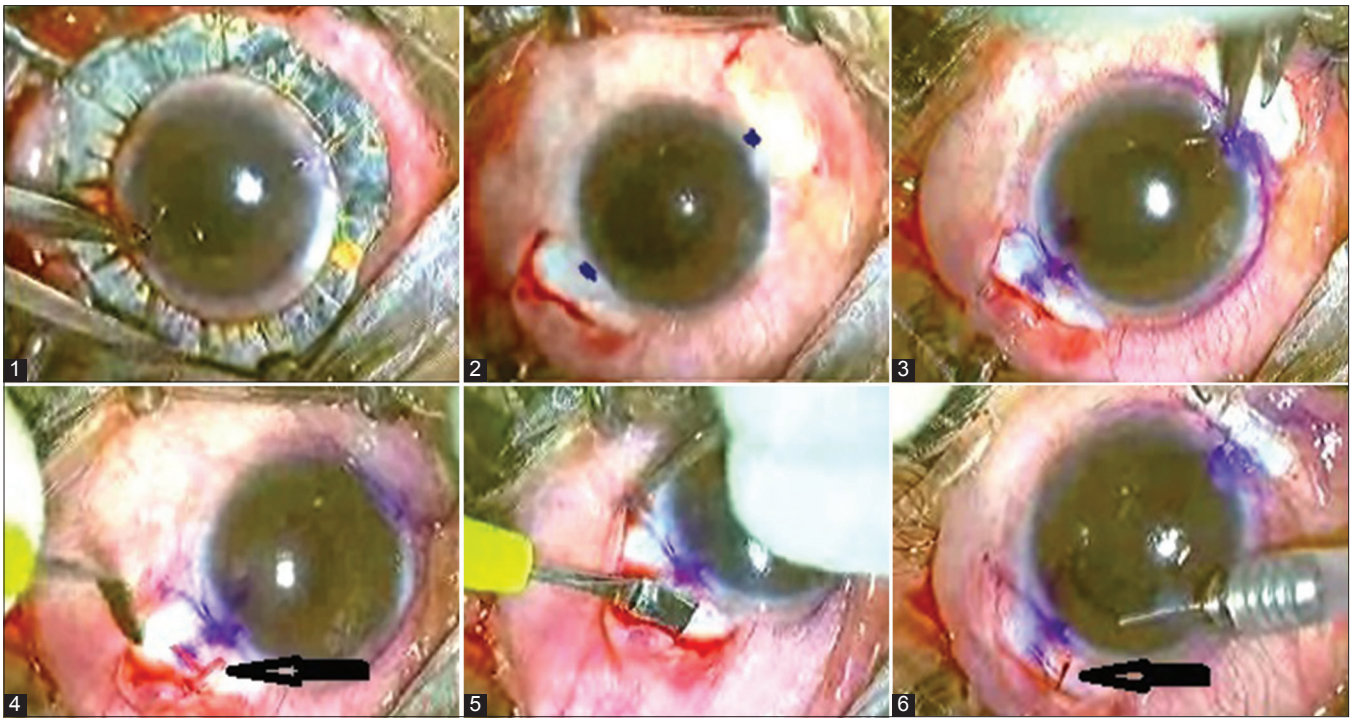


Figure 2: Surgical steps showing marking the incision site (1–3), making T-shaped incision (black arrow) (4), formation of scleral tunnel (5), haptic fixation in tunnel (black arrow) (6)

Mean IOP was 14.6 ± 3.2 mmHg preoperatively while it was 15.00 ± 1.7 mmHg postoperatively at 6 months. Mean IOP change from preoperative period to 6 weeks postoperative period was not statistically significant, $P = 0.4980$. Mean change in IOP from preoperative period to postoperative day 1 (15.9 ± 2) ($P = 0.0110$) and postoperative day 7 (16.3 ± 4.7) ($P = 0.0300$) was found significant as there was some case of raised IOP due to inflammation or pigment release due to maneuvering. These cases were treated medically, and on next follow-up, their IOP came out normal.

At the end, all cases have well-centered IOL with good visual acuity [Figs. 3 and 4].

Discussion

The endocapsular placement of an IOL is undoubtedly anatomically most preferable following successful cataract extraction as implantation of an IOL in the capsular bag provides stable fixation at a position closest to the nodal point of the eye. In eyes with insufficient or no capsular support, IOL implantation and fixation techniques are still controversial. Scleral-sutured IOLs have been popular in the past; however, to avoid the intraoperative and postoperative suture-related problems, Gabor and Pavlidis developed a sutureless technique for sulcus fixation of posterior-chamber IOL (PCIOL) using permanent incarceration of the haptics in a scleral tunnel parallel to the limbus.[9] This method offers the postoperative axial stability of the IOL while avoiding suture-related problems. This method combines the control of a closed-eye system with the postoperative axial stability of the PCIOL. This technique has an advantage in that it can be performed in the presence of significant structural abnormalities of the anterior chamber and that it mitigates many of the adverse outcomes associated with ACIOLs, iris fixated IOLs, and sutured scleral-fixated IOLs.

Removal of the crystalline lens deprives the eye of the stabilizing effect of the lens-zonule barrier. When the eye moves, it acquires kinetic energy from its muscles and attachments, and the energy is dissipated to the internal fluids as it stops. Thus, pseudophacodonesis is the result of oscillations of the fluids in the anterior and posterior segment of the eye. The oscillations, initiated by movement of the eye, resulting in shearing forces on the corneal endothelium which may result in damage. The similar motion of the vitreous causes shearing forces which may damage the retina.[10,11] In addition, positioning the lens closer to the rotational center of the eye, just anterior to the vitreous face, may reduce the centrifugal forces on the lens and stabilize the ocular contents, thereby decreasing the probability of complications such as iritis, CME, and retinal detachment. Another advantage of positioning the lens closer to the nodal point and center of rotation of the eye is the superior optical properties accrued by the lens in this position. In sutured scleral-fixated IOL, there is increased chance of pseudophacodonesis due to the torsional instability of ciliary body-suture-haptic attachment, while in scleral tucking of haptic, there is less chance of torsional instability due to rigid ciliary body-haptic-optic attachment.[12]

In this study, out of 50 cases, there were 2 cases of decentration, 1 case of CME, 3 cases of raised IOP, and 2 cases of corneal edema. All were managed well, and in the end, all patients had well-centered IOL with good visual acuity.

Because of the overall diameter of these IOLs, we did not observe increased forces to the sclera. Scleral tunnels are

Figure 3: Well-centered multipiece intraocular lens as seen on the slit lamp

well known from cataract surgery, and we would not expect scleromalacia to occur except, possibly, in cases of preexisting inflammation (e.g. scleritis, episcleritis, rheumatoid arthritis, and herpes zoster ophthalmicus).[13]

This technique also minimizes intraoperative maneuvers, which could reduce the risk of intraoperative trauma. Using a foldable IOL and (preferably) implanting it using an injector keep the incision small and prevent higher surgically induced astigmatism. Furthermore, the technique can be performed with a standard 3-piece PCIOL without the need for special haptic architecture or haptic preparation or for storage or ordering special IOLs for rare indications.

It has been shown that the overall length (12.5–14.0 mm) of the IOL helps ensure a firm, stable fixation at the posterior chamber behind the iris, where the average diameter in emmetropic eyes is approximately 13.0 mm. In addition, the large optics lowers the risk of clinically significant postoperative decentration.[12] Externalization of the greater part of the haptic along its curvature stabilizes the axial positioning of the IOL and thereby prevents IOL tilt.[14] Sulcus fixation of single-piece IOLs is not popular owing to postoperative complications such as pigment dispersion, iris transillumination defects, dysphotopsia, elevated IOP, intraocular hemorrhage, and CME. This is due to the fact that bulky single-piece haptics are large and thick enough to contact the posterior iris when placed in the sulcus. Furthermore, the haptics are planar rather than angulated and therefore do not vault the optic posteriorly from the iris.[15]

The scleral fixation technique has evolved over time, with one of the greatest changes being the use of foldable IOL. This makes it possible to perform the entire procedure through small self-sealing incisions. This has the intraoperative advantage of having a well-formed globe throughout the surgery. It eliminates iris prolapse during IOL insertion and wound suturing and significantly decreases surgical time. This foldable IOL has postoperative advantages of having fewer complications associated with larger wounds, such as

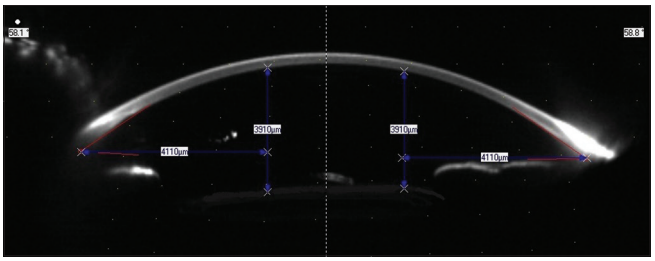


Figure 4: Well-centered intraocular lens on Scheimpflug imaging

postoperative wound leak and shallow anterior chamber, as well as decreases astigmatism.

Conclusion

We believe this method of IOL implantation is appropriate for eyes with deficient or absent posterior capsule and this can be performed easily with the available IOL designs, instruments, and with less surgical time. Based on our current experience and published results, sutureless PCIOL implantation is an effective alternative in the eyes with deficient capsule support.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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