

Surgical outcomes and complications of sutureless needle-guided intrascleral intraocular lens fixation combined with vitrectomy

Komal Shelke, Ekta Rishi, Pukhraj Rishi

Purpose: To analyze the surgical outcomes and complications of sutureless needle-guided intrascleral intraocular lens (IOL) implantation (Yamane technique) combined with pars plana vitrectomy. **Methods:** Retrospective study of 47 eyes of 46 patients that underwent scleral fixation of IOL by the Yamane technique combined with 3-port pars plana vitrectomy. Demographic data, primary indications for surgery, history of trauma, best corrected visual acuity (BCVA), intraocular pressure (IOP), duration of follow-up, and complications were analyzed. **Results:** Mean preoperative BCVA was 0.79 logMAR, which improved to 0.39 logMAR at mean 4.21 months (SD: 4.87 D) follow-up. Mean spherical equivalent pre and postoperative was +7.64 D (SD: 7.74 D) and -0.47 D (SD: 2.26 D), respectively. Early postoperative complications included hypotony with cyclodialysis cleft ($n = 1$; 2%), mild vitreous hemorrhage ($n = 2$; 4%), raised IOP ($n = 2$; 4%), and transient corneal edema ($n = 2$; 4%). Late complications included iris optic capture ($n = 1$; 2%), retinal detachment ($n = 1$; 2%), cystoid macular edema (CME; $n = 2$; 4%), IOL decentration ($n = 1$; 2%), and decentration and tilting of IOL ($n = 1$; 2%). Management of complications included laser treatment to cyclodialysis cleft, observation for vitreous hemorrhage, topical and oral IOP lowering agents for raised IOP. CME was managed with topical non-steroidal anti-inflammatory drugs. One eye was subjected IOL refixation. The mean number of surgeries per eye was 1.04. **Conclusion:** Combining needle-guided intrascleral IOL implantation with vitrectomy allows management of other posterior segment complications in the same sitting while obviating the need for the second surgery. It provides satisfactory outcomes that are comparable to published studies. However, a longer follow-up will allow a better understanding of the potential advantages of this approach.

Key words: Aphakia, cataract, complications, eye, intraocular lens, scleral-fixated IOL, surgery, trauma, vitrectomy

Lack of capsular support necessitates the need for a scleral-fixated intraocular lens (SFIOL) in visual rehabilitation of aphakic eyes. Current surgical methods for aphakia correction include anterior chamber IOL (ACIOL), iris claw IOL, and sutured and sutureless techniques of SFIOL. Various studies have described the advantages and disadvantages of each technique. Yamane technique of SFIOL is a novel, relatively safe and easy method of sutureless SFIOL.^[1] However, this technique was described as a secondary surgical intervention in rehabilitation of aphakic eyes. To the best of our knowledge, only one study has shown intermediate results of the modified Yamane technique of SFIOL.^[2] We aim to analyze the surgical outcomes and complications of sutureless needle-guided intrascleral intraocular lens (IOL) implantation (modified Yamane technique) combined with 3-port pars plana vitrectomy as a single-stage procedure.

Methods

This was a retrospective, non-comparative case series. Approval was obtained from the Institutional review

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board (776-2019-P). This study adhered to the tenets of the Declaration of Helsinki. All patients signed the informed consent form. Electronic medical records (EMRs) were screened for patients who presented between January 2018 to December 2018 using keywords 'Secondary IOL' and 'Scleral-Fixated IOL'. Patients who had a minimum 6-week follow-up were included in this study. Demographic data, primary indications for surgery, history of trauma, associated systemic syndromes, associated posterior segment disorders, best corrected visual acuity (BCVA), intraocular pressure (IOP), duration of follow-up, and intraoperative and postoperative complications were analyzed. Postoperative data collected at 6 weeks and at the final visit included refraction, BCVA, IOL position, and presence of any complications. Main outcome measures included BCVA, final refractive error, and intra and postoperative complications. Early postoperative complications were defined as complications within 4 weeks and as late as more than 4 weeks. Ethical committee clearance was obtained (Number 776-2019-P June 2019).

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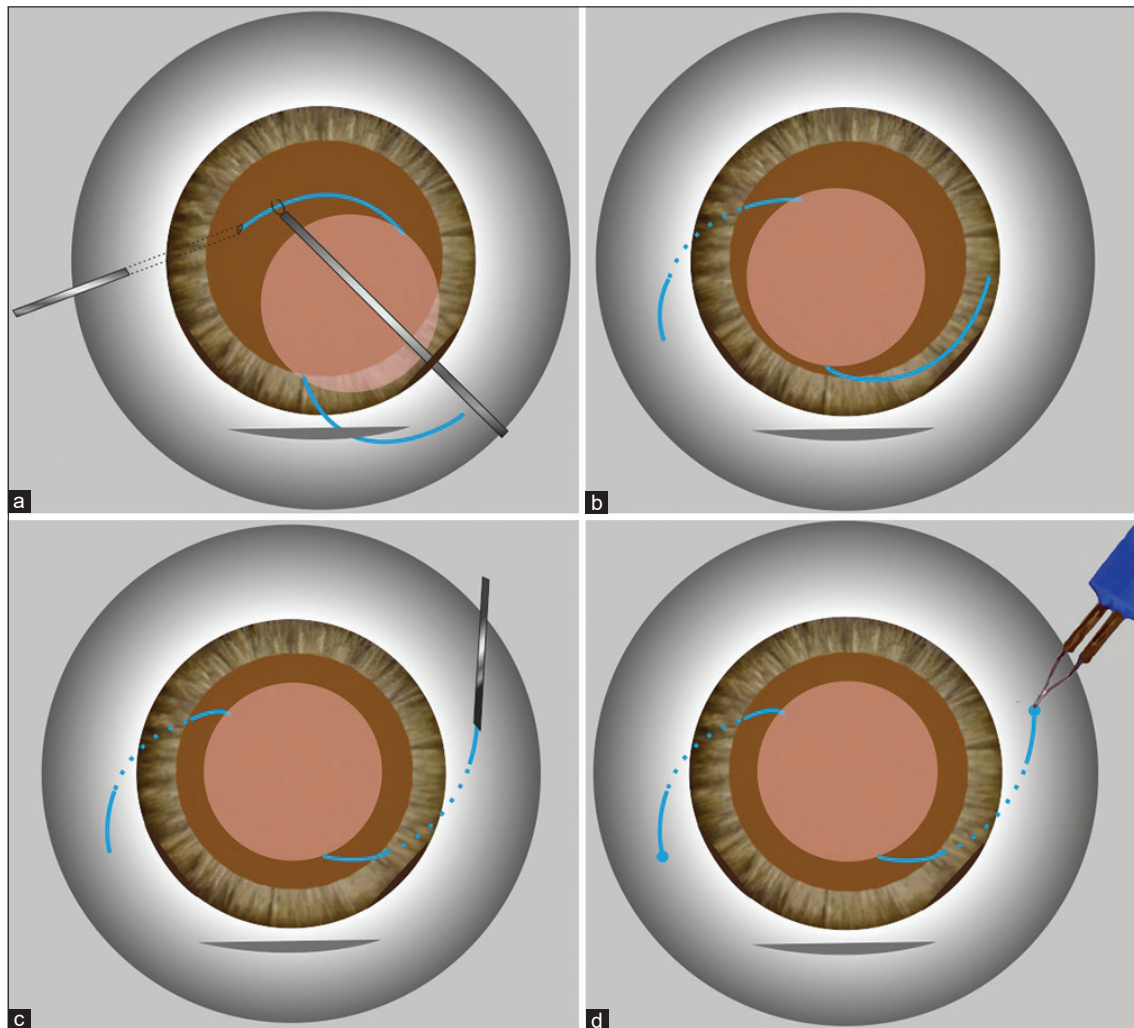


Figure 1: (a) An angled sclerotomy made with a 30 gauge needle, 2 mm away from the limbus and the needle tip visualized within the pupillary plane. A 3 piece IOL inserted into the anterior chamber and guiding the haptic into the needle lumen. (b) Leading haptic is seen externalized through the sclera. (c) Similar procedure performed at 180 degrees from the first sclerotomy site, the lagging haptic externalized, and (d) The end of the haptic made bulbous with ophthalmic heat cautery

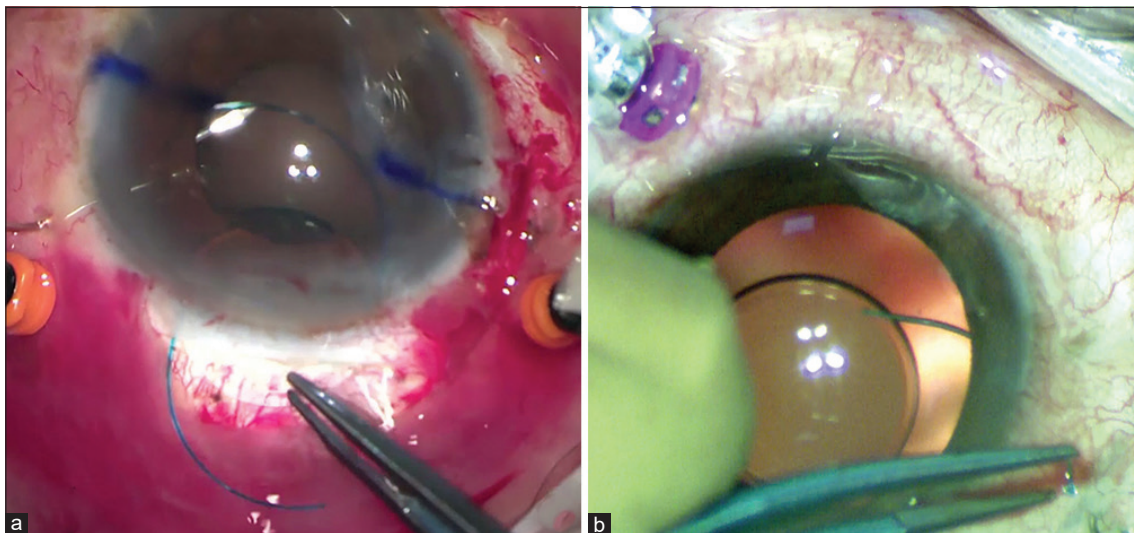


Figure 2: (a) Image showing a leading haptic being engaged into a 30 gauge needle. (b) Image showing end of the haptic made bulbous with ophthalmic heat cautery

Surgical technique: Complete vitrectomy was performed by the 23 gauge or 25 gauge pars plana technique under retrobulbar anesthesia in all patients. Lensectomy using a vitreous cutter was performed in cases of subluxated/dislocated crystalline lens and phacodonesis. A 6 mm sclerocorneal tunnel was made in eyes with dislocated IOL, SFIOL, ACIOL for IOL explantation and was sutured with 10–0 monofilament nylon sutures at the end of the procedure. For eyes with simple aphakia, a 3.2 mm sclerocorneal incision was made. We used the modified Yamane's technique of sutureless SFIOL fixation, as described by Kelkar *et al.*^[2] An angled sclerotomy was made with a 30 gauge needle (TSK ultra- thin wall needle; Tochigi Seiko, Tochigi, Japan) 2 mm away from the limbus and the needle tip visualized within the pupillary plane. A 3-piece IOL Sensar AR40e (Abbott Medical Optics, Santa Ana, CA, USA) was inserted into the anterior chamber, with the trailing haptic kept outside to prevent the IOL from dislocating into the vitreous cavity. The leading haptic was guided into the needle lumen, the needle was withdrawn and haptic was secured with holding forceps. Heat convection from the ophthalmic cautery was used to make the haptic end of the IOL bulbous. A similar procedure was performed 180 degrees from the first sclerotomy site, the lagging haptic was externalized and the end of the haptic was similarly made bulbous [Figs. 1 and 2]. Both the haptics were held simultaneously and bimanually rotated in a steering-wheel fashion and pushed back into the sclerotomy tunnels [Video Clip 1].

Results

The study comprised 47 eyes of 46 patients undergoing scleral fixation of IOL by the Yamane technique combined with vitreous surgery. The mean postoperative follow-up was 4.21 months (SD: 4.87 months; the range of the follow-up period was 1.43 months–24 months).

Demographics and indications: The mean presenting age was 43.76 ± 16.23 years (range = 9 to 84 years); 34 patients were males (74%) and 12 were females (26%). The most common primary indication for surgery was aphakia; secondary to a complicated cataract surgery ($n = 9$ eyes) and trauma ($n = 8$ eyes) [Table 1]. Other indications included posteriorly dislocated crystalline lens ($n = 9$; posttraumatic = 7, spontaneous dislocation = 2), subluxated cataractous lens ($n = 7$), dislocated IOL ($n = 6$), phacodonesis ($n = 4$), dropped nucleus ($n = 2$), anterior chamber (AC) IOL with decompensated cornea ($n = 1$), and dislocated sutured SFIOL ($n = 1$). Systemic associations for subluxated and dislocated crystalline lens included Marfan's syndrome ($n = 2$) and pseudoexfoliation syndrome (PXF; $n = 1$). SFIOL with PPV was planned due to non-availability or inadequacy of the capsular support on slit lamp examination.

All patients underwent pars plana vitrectomy at the time of SFIOL placement.

Outcomes: Mean preoperative BCVA was 0.79 logMAR, which improved to 0.39 logMAR at mean 4.21 months of follow-up. Mean spherical equivalent pre and postoperatively was +7.64 dioptres (SD 7.74D; median = 10.625) and -0.47 dioptres (SD 2.26 D, median = -0.375), respectively. Mean preoperative and postoperative IOP (at last follow-up) was 16.5 ± 9 mmHg and 14.8 ± 7.9 mmHg at 6-week follow-up.

The mean number of surgeries per eye was 1.04.

Table 1: Indications for intrascleral intraocular lens fixation

Condition	n, (%)
Aphakia	17 (36)
Postsurgical	9 (19)
Posttraumatic	8 (17)
Posteriorly dislocated crystalline lens	9 (19)
Posttraumatic	7 (15)
Spontaneous (Marfans syndrome)	2 (4)
Subluxated cataractous lens	7 (15)
Dislocated IOL	6 (13)
Phacodonesis	4 (9)
Dropped nucleus	2 (4)
ACIOL with decompensated cornea	1 (2)
Dislocated SFIOL	1 (2)

Table 2: Comparison of complication rates

Complication	Yamane <i>et al.</i> (n=100), n %	Kelkar <i>et al.</i> (n=31), n %	Our study (n=47), n %
Transient corneal edema	1 (1)	nil	2 (4)
IOP elevation	2 (2)	12 (39)	2 (4)
Hypotony	2 (2)	nil	1 (2)
Cystoid macular edema	1 (1)	nil	2 (4)
Vitreous hemorrhage	5 (5)	1 (3.2)	2 (4)
IOL decentration	nil	2 (6.4)	1 (2)
IOL decentration with tilting	nil	nil	1 (2)
Iris capture	8 (8)	nil	1 (2)
Retinal detachment	nil	nil	1 (2)

IOP: Intraocular pressure; IOL: Intraocular lens

Complications: None of the eyes had any intraoperative complications.

Early postoperative complications included hypotony with cyclodialysis cleft ($n = 1$; 2%), mild vitreous hemorrhage ($n = 2$; 4%), transiently raised IOP defined as IOP >25 mm Hg ($n = 2$; 4%), and transient corneal edema ($n = 2$; 4%). Late complications included pupillary optic capture ($n = 1$; 2%), retinal detachment ($n = 1$; 2%), cystoid macular edema (CME; $n = 2$; 4%), IOL decentration ($n = 1$; 2%), and IOL decentration with tilting ($n = 1$; 2%). Management of complications included laser for cyclodialysis cleft, observation for vitreous hemorrhage, topical and oral IOP lowering agents for raised IOP, and hypertonic saline drops with topical steroids for corneal edema. CME was managed with topical non-steroidal anti-inflammatory drugs. One eye with IOL decentration and tilting underwent IOL refixation.

Discussion

Surgically induced aphakia can be secondary to complicated cataract surgery or following successful removal of subluxated/dislocated crystalline lens or IOL explantation. Optical rehabilitation of these cases is important with secondary IOLs or SFIOL either in the same sitting or as a staged procedure. This can be achieved through different approaches such as ACIOL,^[3] iris-sutured posterior chamber (PC) IOL,^[4] iris claw IOL,^[5,6] and

SFIOL. SFIOL can be performed by sutured^[7,8] and sutureless^[9,10] techniques. All these techniques can be performed with or without complete vitrectomy. Multiple studies have highlighted the advantages of sutureless techniques of SFIOL in comparison to sutured methods.^[11,12] Yamane *et al.* described the sutureless 27-gauge needle-guided intrascleral posterior chamber IOL implantation technique in 2014.^[1] This involved simultaneous exteriorization of both haptics of the IOL. In this procedure, the needle engaged in the leading haptic is allowed to hang in the vitreous cavity while the lagging haptic is manipulated into another needle 180 degrees apart. Taking into consideration the potential complications like inadvertent iris, ciliary body, and retinal damage by the hanging needle, Kelkar *et al.*^[2] modified this surgical technique. They introduced the technique of completely exteriorizing and fixing the leading haptic before manipulating the lagging haptic. We employed this modified Yamane technique along with pars plana vitrectomy in our study. Pars plana vitrectomy reduces potential posterior segment complications by obviating vitreoretinal traction, evacuating inflammatory debris, vitreous hemorrhage and cytokines, and enhancing media clarity. The visual outcomes in our study are comparable to those published in the literature [Table 2].

Although Yamane's technique was originally described as a 'secondary surgery' for aphakic rehabilitation, our combined (PPV+SFIOL) approach addresses several surgical issues in a single sitting, *e.g.*, subluxated/dislocated cataractous lens requiring lensectomy and vitrectomy, dislocated IOL requiring explantation, PPV, and SFIOL implantation in the same sitting hence negating the need, potential complications and costs related to a secondary procedure. Anesthesia-related complications, surgically induced astigmatism due to scarring, risk of postoperative endophthalmitis, IOP fluctuations and risk of retinal breaks, and detachment can be reduced by a single-stage procedure. Apart from management of combined vitreoretinal complications, a complete vitrectomy helps to prevent entwinement of the residual vitreous around the SFIOL that has the potential to induce IOL kinking. A thorough vitrectomy might prevent vitreous turbulence and traction responsible for the formation of macular edema, retinal breaks, and even retinal detachment. The threat of vitreous traction forces on the retina at the time of a future posterior vitreous detachment is also eliminated. Other complications of residual vitreous, like epiretinal membrane formation and CME can be reduced by shaving the vitreous and removing all capsular elements.

However, both complete vitrectomy and anterior vitrectomy have shown similar success in terms of visual rehabilitation. Both procedures have a set of advantages and disadvantages over one another.^[13] Hence in conclusion, the modified Yamane technique of SFIOL fixation can be performed by both anterior and posterior segment surgeons. Early and late postoperative complications in our study are comparable to previously reported studies [Table 2].

The limitations of our study stem from its retrospective nature and relatively short follow-up. A longer follow-up will help evaluate the functional and anatomical outcomes of this technique better.

Conclusion

In conclusion, our study shows that the modified Yamane technique combined with PPV is a relatively safe approach

for surgical management of aphakia. Potential complications related to sutures, fibrin glue, scleral tunnels, and scleral flaps can be avoided with this technique.

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Conflicts of interest

There are no conflicts of interest.

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