Intraocular Tamponade use in Pars Plana Vitrectomy Combined with Sutureless Intrascleral Lens Implantation

Utku limon[1], Betul Ilkay Akcay[2]

ABSTRACT

Purpose: To evaluate the effect of intraocular tamponade use on anatomic and functional results and complications in pars plana vitrectomy (PPV) performed simultaneously with sutureless intrascleral lens implantation.

Methods: Patients were divided into two groups according to the type of tamponade used in surgery. Group-1 included patients who underwent 23G PPV with simultaneous 27G needle-assisted sutureless three-piece intrascleral lens implantation and intraocular silicone tamponade. Group-2 included patients who underwent 23G PPV with simultaneous 27G needle-assisted sutureless three-piece intrascleral lens implantation and intraocular C3F8 tamponade. Best corrected visual acuities (BCVA), centralization and stabilization of the intraocular lens, and complications were compared between the two groups.

Results: 15 eyes of 15 patients were included in Group-1, and 14 eyes of 14 patients in Group-2. Preoperative BCVA of Group-1 was 1.82 logMAR, and significantly increased to 0.71 logMAR at the 6th month (p = 0.022). Preoperative BCVA of Group-2 was 1.92 logMAR, and significantly increased to 0.67 logMAR at the 6th month (p = 0.029). There was no significant difference between the visual acuities of both groups at 6 months (p = 0.09). At sixth month, intraocular lens in both groups was centralized and stabilized in biomicroscopic examination and cycloplegic refraction. The most common early complication was increased intraocular pressure, and developed in 4 (26.6%) patients in Group-1 and 3 (21.4%) patients in Group-2.

Conclusion: 23G PPV with silicone or C3F8 tamponade can be performed simultaneously with 27G needle-assisted sutureless intrascleral lens implantation.

Keywords: intrascleral fixation, intraocular tamponade, suturless intraocular lens, vitrectomy, dislocation, aphakia.

INTRODUCTION

In the absence of capsule support, IOL can be implanted to eye with various techniques as anterior chamber implantation , iris fixation , sutured scleral fixation or sutureless scleral fixation techniques.[1]

Anterior chamber IOL implantation technique is simple and the operating time is short but the most important disadvantages of this technique is large corneal or scleral incision and bullous keratopathy.[2]

Iris fixation techniques of the IOL are iris suture of the 3-piece IOL and iris claw IOL. The most important advantage of IOL suturing to the iris is posibility of fixating the already dislocated three-piece IOL to the iris.[3] Another advantage of iris IOL suturing is that the 3-piece IOL can be folded through the small incision. However, iris-claw IOLs need large incision. The most important disadvantages of IOL fixation to the iris are iridodialysis, iris bleeding, pupil ovalization and requirement of an intact iris diaphragm.[4]

The most important disadvantages of suturing the haptics to the sclera are suture rupture, suture exposure and risk of endophthalmitis. These complications can be reduced by suture node rotation or by embedding the suture node in the scleral flap, scleral pocket or scleral incision.[5] However, complications may develop while creating the scleral flap and the duration of surgery will be longer.[6]

1- Uz. Dr., Sağlık Bilimleri Üniversitesi Ümraniye Eğitim ve Araştırma Hastanesi, göz, istanbul, Türkiye

2- Doç. Dr., Sağlık Bilimleri Üniversitesi Ümraniye Eğitim ve Araştırma Hastanesi, göz, istanbul, Türkiye

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Correspondence Adress:
Utku Limon
Sağlık Bilimleri Üniversitesi Ümraniye Eğitim ve Araştırma Hastanesi, Göz, istanbul, Türkiye

Phone: +90 506 848 7190
E-mail: utku_limon@hotmail.com

In sutureless intrascleral techniques, fixation of the haptics can be done transconjunctivally with the help of MVR blades, trocar cannulas or needles.[7] The most important disadvantage of needle assited technique is; difficulty in grasping of the trailing haptic, after the externalization of leading haptic. The most important disadvantages of trocar assited technique is to damage the IOL haptic while holding with forceps and hypotonia.[8] The most important advantages of sutureless scleral fixation techniques were the absence of suture-related complications.[9]

In aphakic eyes, as a result of passing intraocular tamponades into the anterior camber; band keratopathy, bullous keratopathy and elevated intaocular pressure (IOP) may ocur.[10] These complications can be prevented by placing IOL as a barrier between the anterior and posterior segments. In many studies to date, sutureless intrascleral IOL implantation has been combined with PPV.[11-12] This approach can reduce the number of surgeries and the passage of tamponades to anterior segment. However, the effect of tamponade use on sutureless intrascleral IOL stabilization has not been adequately studied.

The purpose of this study is to evaluate the effectiveness of 27-gauge needle assisted sutureless intrascleral IOL fixation simultaneous combined with PPV with silicon or C3F8 tamponade in eyes with insufficient capsule support.

MATERIALS AND METHODS

The protocol of the present study conformed to the Declaration of Helsinki. After discussion with the patient; regarding the risks, benefits and alternatives to the treatment written informed consent was obtained from each patient. The study protocol approval number was 7496 (19/03/2020).

Study Design

In this single-centered and retrospective surgical case series study patients were divided into two groups. In Group-1; we included the patients undergoing 27-gauge needle assisted sutureless intrascleral IOL implantation with 23-gauge PPV with silicon tamponade and in Group-2 we included the patients undergoing 27-gauge needle assited sutureless intrascleral IOL implantation with 23-gauge PPV with C3F8 tamponade. The Best-Corrected Visual Acuity (BCVA), postoperative centralization and stabilization of IOLs and complications were evaluated between two groups. The same surgeon (UL) performed all surgeries under general anesthesia.

Indications for PPV in Group-1 were rhegmatogenous retinal detachment with inferior retinal tears under 3-9 o'clock meridian, traumatic vitreous hemorrhage with inferior retinal tears, completely dislocated IOL with inferior retinal tear, crystalline lens luxation after cataract surgery or trauma with inferior retinal tears and iatrogenic inferior retinal tears during surgery. Indications for PPV in Group-2 were rhegmatogenous retinal detachment with superior retinal tears above 3-9 o'clock meridian, traumatic vitreous hemorrhage with superior retinal tears, completely dislocated IOL with superior retinal tear, crystalline lens luxation after cataract surgery or trauma with superior retinal tears and iatrogenic superior tears during surgery.

Exclusion criteria for both groups were scleral thinning, adequate capsular support for IOL implantation and eyes without vitreoretinal disease requiring surgery.

All patients undergone a complete ophthalmological examination. At initial visit and at each subsequent follow-up visits BCVA using Snellen charts, slitlamp and dilated

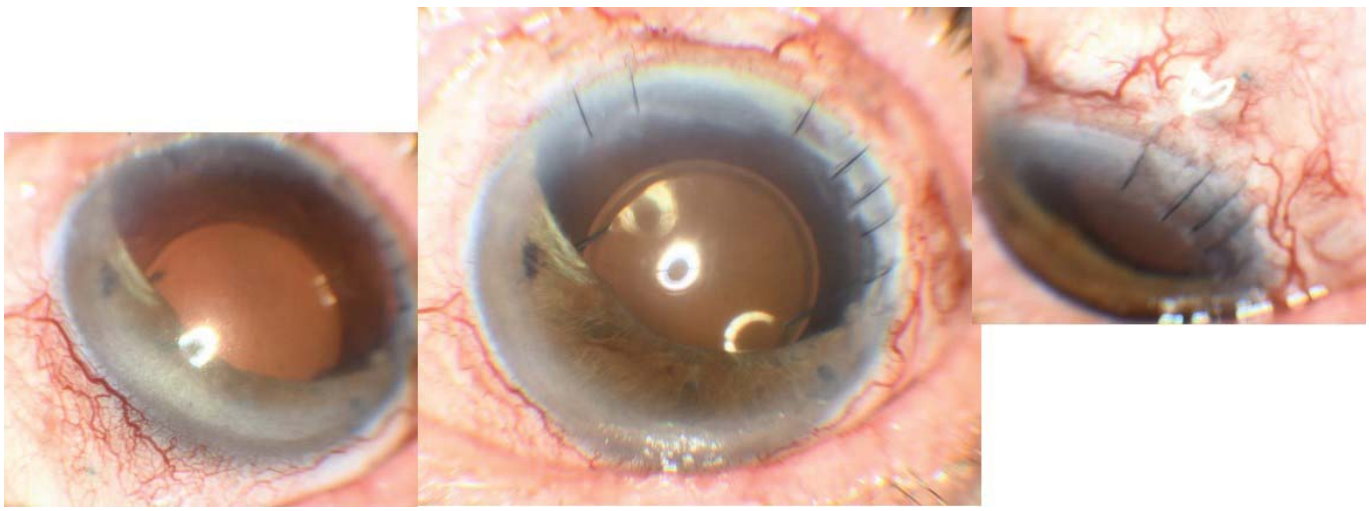

Figure 1: *6th month postoperative slit-lamp photographs of a patient in Group-1.*

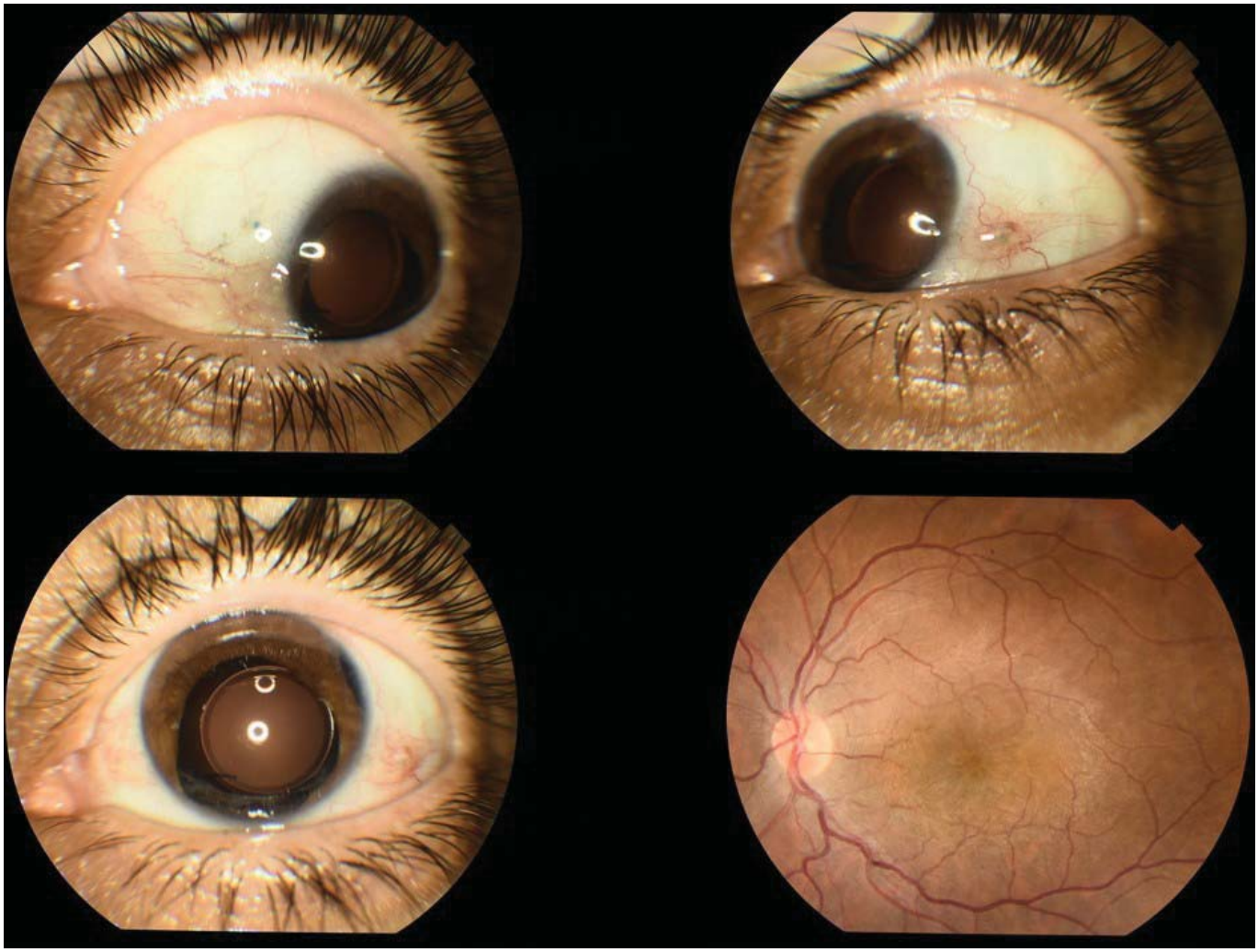

Figure 2: *6th month postoperative slit-lamp and fundus photographs of a patient in Group-2 with ERM and macular edema.*

fundus examination, IOP measurement, cycloplegic refraction, postoperative centralization and stabilization of IOLs and complications were eveluated.

We recorded the data from the initial visit and at each subsequent postoperative follow-up visits (1st, 2nd, 3rd and 6th months) and compared the results preoperatively and at 6th months postoperatively between both groups.

Surgical Procedure

27-Gauge needle assisted sutureless intrascleral fixation of three piece foldable IOL simultaneous combined with vitrectomy with silicon or C3F8 tamponade

We started surgery with 23-gauge PPV (Constellation, Alcon Laboratories) and retinal surgery. Three-piece IOL implantation (Sensar AR40e; Johnson&Johnson Surgical Vision, Santa Ana, USA) was performed before fluid-air exchange. Fluid-air exchange, laser treatment and suitable tamponade placement was done after 3-piece IOL implantation.

The 27-gauge needle entry points were marked 180 degrees apart at a distance of 1.5-2 mm perpendicular to limbus at 2 and 7 o'clock. Then two tunnel entry points were marked in the opposite direction; 2 mm parallel to the limbus at 2 and 7 o'clock from first marked point. Three-piece IOL implantation into the anterior chamber was performed after creating a 2.8 mm corneal incision. Than 27-gauge needle was entered transconjunctivally with 10-15° angles from these marked points to posterior chamber. During IOL implantation the leading haptic of the IOL was inserted in the lumen of the 27-gauge needle. Later the trailing haptic outside the eye was grasped with 23-gauge forceps and placed into the anterior chamber through the main incision. The trailing IOL haptic inserted into the lumen of the 27-gauge needle with 23-gauge forceps and than both haptics were externalized from the sclera. Remaining haptics outside the sclera were flanged with diathermy and pushed under the conjunctiva. All sclerotomies were sutured at the end of the surgery. Exit areas of the haptics were not sutured. At the end of the surgery we controlled

all sclerotomies and exit areas of the haptics for wound leakage (Video-1).

The pupilla was constricted with carbachol (Miostat, Alcon) before fluid air exchange to prevent tamponade passage into the anterior chamber. Viscoelastic (Viscoat, 0.75 mL Alcon Ophthalmic Viscosurgical Device) was left in the anterior chamber of all patients who has intravitreal silicone or C3F8 tamponade. In eyes with luxated 3-piece IOL, the lens was removed with PPV and taken into the anterior chamber, than the haptics were placed in the sclera as described above.

Silicon tamponade removal was performed between 3 and 6 months in patients in Group-1.

Statistical Methods

The decimal BCVA was converted to logMAR for statistical analysis. The changes in preoperative and postoperative results were evaluated by paired Student's t-test. Kruskal-Wallis test was used for comparison two groups. SPSS software 20.0 for Windows (SPSS Inc., Chicago, IL, USA.) was used for analysis and a *p*-value <0.05 was considered statistically significant.

RESULTS

There were 15 eyes of 15 patients in Group-1 and there were 14 eyes of 14 patients in Group-2. The mean follow-up time was 6.2 months (6.0-7.3 months) in Group-1 and 6.3 months (6.0-6.5 months) in Group-2. In Group-1, there were 11 male and 3 female patients with a mean age of 57.4±18.4 (42-70) years. In Group-2, there were 4 female and 10 male patients with a mean age of 55.5±16.7 (44-85) years. Pars plana vitrectomy indications and intraocular tamponades were given in table 1.

In Group-1 the mean BCVA was 1.82±0.45 logMAR preoperatively and improved significantly to 0.71±056 logMAR (p=0.022) at the 6th months. In Group-2 the mean BCVA was 1.92±047 logMAR preoperatively and improved significantly to 0.67±0.53 logMAR (p=0.029) at the 6th months. There was no significant difference between the postoperative 6th month BCVA changes between the two groups (p=0.09).

At 6th month IOL was centralized and stabilized in both groups with slit lamp examination and cycloplegic refraction. The mean 6th month spherical equivalent (SE) was -1.27±0.97 diopters (between +0.50 and -1.50 diopters) in Group-1 and -1.21±0.72 diopters (between +0.50 and -1.75 diopters) in Group-2. There was no significant difference between the postoperative 6th month SE between groups (p=0.85).

The most common intraoperative complication was iatrogenic retinal break that developed in 3 (20%) eyes in Group-1 and 3 (21.4%) eyes in Group-2. We treated the iatrogenic retinal breaks with endolaser and intraocular tamponade. Iatrogenic haptic damage occurred in 3 (20%) eyes in Group-1 and in 2 (14.2%) eyes in Group-2. In patients with intraoperative iatrogenic haptic damage

Table 1: *Preoperative lens status and PPV indications.*

Preoperative lens status, PPV indications	Group-1 (n=15), (Silicon tamponade)	Group-2 (n=14), (C3F8 tamponade)
Crystalline lens luxation after trauma, rhegmatogenous retinal detachment with retinal tears, n (%)	2 (13.3)	2 (14.2)
Crystalline lens luxation after trauma, iris defect, rhegmatogenous retinal detachment, n (%)	1 (6.6)	2 (14.2)
Crystalline lens subluxation after trauma, traumatic vitreous hemorrhage with retinal tears, n (%)	2 (13.3)	2 (14.2)
Completely dislocated IOL after trauma, rhegmatogenous retinal detachment, n (%)	2 (13.3)	1 (7.1)
Completely dislocated IOL after trauma, traumatic vitreous hemorrhage with retinal tears, n (%)	2 (13.3)	1 (7.1)
Crystalline lens luxation after cataract surgery, vitreous hemorrhage with retinal tears, n (%)	2 (13.3)	2 (14.2)
Crystalline lens luxation after cataract surgery, iris defect, iatrogenic retinal tears during surgery, n (%)	1(6.6)	2 (14.2)
Completely dislocated IOL, iatrogenic retinal tear during surgery, n (%)	2 (13.3)	1 (7.1)
Aphakia after trauma, vitreous hemorrhage with retinal tears, n (%)	1 (6.6)	1 (7.1)

IOL: Intraocular lens, **PPV**: Pars Plana Vitrectomy.

IOL was removed and a new 3-piece IOL was implanted. Hemorrhage from iris developed in 1 eye in Group-1.

The most common early postoperative complication was IOP elevation that developed in 4 (26.6%) eyes in Group-1 and in 3 (21.4) eyes in Group-2 within 1 week after surgery. Intraocular pressure was decreased with topical medications. Postoperative intravitreal hemorrhage occurred in 3 eyes in both groups and regressed spontaneously in 2 weeks. Transient hypotony (IOP<5 mmHg) occured in 2 (14.2%) eyes in Group-2 and spontaneously recovered without any treatment within 1 week. A small silicone bubble entered to the anterior chamber in 2 (13.3%) eyes in Group-1 but we did not observe corneal decompansation or increase IOP. A gas (C3F8) bubble less than half the level of the cornea entered to the anterior chamber in 2 (14.2%) eyes in Group-2. The gas bubbles in the anterior chamber were withdrawn spontaneously in both patients within 1.5 months. In Group-2 in 2 (14.2%) eyes, C3F8 gas pushed the iris from behind and caused irido-endothelial contact. Iris capture of IOL was developed in 2 (13.3%) eyes in Group-1 and in 3 (21.4%) eyes in Group-2. The iris capture of IOL was recovered with Siklopentolat Hcl (SIKLOPLEJIN % 1 5 m, Abdi İbrahim) in 3 eyes within 1 week.

The most common late postoperative complication cystoid macular edema developed in 2 (13.3%) eyes in Group-1 and in 3 (21.4%) eyes in Group-2 and resolved with topical medications [Acular 4*1 (ketarolac), Allergan] and subtenon triamcinolone. Postoperative retinal detachment occurred in 2 (13.3%) eyes in Group-1 and treated with PPV and silicon oil injection again. Epiretinal membrane developed in 2 (13.3%) eyes in Group-1. Corneal decompensation occurred in 2 (13.3%) eyes in Group-1 and in 1 (7.1%) eye in Group-2. Herpetic endothelial keratitis was developed in 1 (6.6%) eye in Group-2 and treated with oral and topical medications. None of our patients developed complications such as IOL dislocation, subluxation, decentration, tilt and endophthalmitis in both groups. There was no significant difference between the postoperative 6th month complications (p>0.05). Complications were given in table-2. Postoperative 6th month slit-lamp photographs of a patient in Group-1 and a patient in Group-2 were given in figure-1 and figure-2 (Informed consent was obtained for the patient pictures used in the article).

DISCUSSION

Sutureless inrascleral IOL fixation techniques were

Table 2: *Intraoperative, early and late postoperative complications.*

	Group-1, n (%)	**Group-2** n (%)
Intraoperative complications		
Iatrogenic haptic damage	3 (20)	2 (14.2)
Iatrogenic retinal break	3 (20)	3 (21.4)
Iris hemorrhage	1(6.6)	
Early postoperative complications		
Vitreous hemorrhage	3 (20)	3 (21.4)
Transient hypotony (IOP<5 mmHg)		2 (14.2)
IOP elevation	4 (20.6)	3 (21.4)
Iritis		1 (7.1)
Gas (C3F8) entering to the anterior chamber Irido-endothelial contact		2 (14.2) 2 (14.2)
Silicon entering to the anterior chamber	2 (13.3)	
Iris capture of IOL	2 (13.3)	3 (21.4)
Late postoperative complications		
Pseudophakic bullous keratopathy	2 (13.3)	1 (7.1)
Cystoid macular edema	2 (13.3)	3 (21.4)
Herpetic endothelial keratitis		1 (7.1)
Retinal detachment	2 (13.3)	
Epiretinal membrane Peripheral synechae	2 (13.3) 1 (6.6)	

IOP: Intraocular pressure, **IOL**: Intraocular lens.

described in 2007 by Gabor et al.[13] In this technique after standart PPV they used 24-gauge cannula to perform the sclerotomies. After 3-piece IOL implantation to anterior chamber IOL haptics were externalized with forceps from sclerotomies. In 2014 Yamane et al.[14] used 27-gauge needle guided intrascleral IOL implantation with 25-gauge PPV. However, in these studies, no information was given about which tamponade was used after PPV. In our study we clearly stated which tamponade we used. To the best of our knowledge, our study is in the first study in the literature which examined the effect of tamponade use on sutureless intrascleral IOL implantation combined with PPV.

Yamane et al.[15] used 30-gauge needle for intrascleral IOL implantation. They flanged the external haptic to prevent the slippage. In our study we flanged the external haptics with diathermy and pushed under the conjunctiva to prevent slippage. Although we have used tamponade, IOL dislocation and haptic damage did not develop after surgery in both groups. Flanging the external haptic is very important for lens stabilization.

Bonnel et al.[16] used 30-gauge needle for haptic externalization with 25-gauge PPV. They also give no information about which tamponade was used or not used. In patients who do not have capsule support that needs intraocular tamponade after vitrectomy, simultaneous implantation of intrascleral IOL with PPV with tamponade may prevent the passage of intraocular tamponade to the anterior chamber. In our study, there was no increase in IOP or corneal decompensation in a total of 4 patients in both groups with silicone or C3F8 gas passage to the anterior chamber. However, bullous keratopathy developed in a total of 3 trauma patients in both groups.

Czajka et al. [17] made sclerotomies with 23-gauge or 25-gauge trocars for haptic externalization and they used intraocular tamponade at 8 eyes after PPV. In their study IOL dislocation developed in 1 of the eyes using intraocular gas tamponade 3 weeks after surgery. In their study hypotony (IOP<5 mmHg) occurred in 20 eyes on 1 day after surgery. However, hypotony was not observed at the final follow-up visit. They suggested an extra suture around the haptics when a gas tamponade is necessary. We have shown that IOL dislocation was not observed in the eyes using intraocular tamponade. We think that the use of intraocular tamponade does not cause IOL dislocation after intracleral lens implantation. In our study transient hypotony (IOP<5 mmHg) occurred at 2 eyes in Group-1 although sutured sclerotomy. Hypotony was recovered spontaneously after 1 week. Haptic exit areas should be sutured to prevent hypotonia. In Group-2, C3F8 gas was entered to the anterior chamber in 2 eyes and resolved spontaneously within 1.5 months without any complications. In 1 patient in group-2, the silicone bubble in the anterior chamber did not cause complications such as increased intraocular pressure or endothelial decompensation. Silicone was removed at the 4th month after surgery. In two patients, C3F8 gas pushed the iris from behind and caused irido-endothelial contact. This situation was corrected by giving viscoelastic again to the anterior chamber on the first postoperative day and prone position.

Different 3-piece IOLs have been used for intrascleral implantation in different studies. Stem et al.[18] used MA50BM and MA60AC 3-piece acrylic IOL (Alcon). In 2014 Yamane et al.[14] used Tecnis ZA9003 (Abbott Medical Optics, Santa Ana, CA) and in 2017 Yamane et al.[15] used X-70 (Santen, Osaka, Japan, 7mm optic diameter), Tecnis ZA9003 (Abbott Medical Optics, Santa Ana, CA), PN6A (Kowa, Tokyo, Japan) or MA60MA (Alcon) 3-piece IOLs. Iris capture of IOL is the most common complication seen in the study of Yamane et al. However, there is no sufficient information about how many iatrogenic haptic damage occurred in their studies. Czajka et al.[17] used ZA9003, Aspira 3P, MN60AC, AR40E 3-piece IOLs. In early postoperative period 2 IOL dislocation occurred with MA60AC and AR40E IOLs. We used the Sensar AR40e IOL and it is also sufficient for intrascleral fixation. Iatrogenic haptic damage occurred in 3 eyes in Group-1 and in 2 eyes in Group-2. Intraocular tamponades would not cause IOL dislocation, but it should be kept in mind that tamponades may increase other complications as pseudophakic bullous keratopathy.

The cause of herpetic endothelial keratitis that developed at 1 patient in Group-2 may be related to the trauma, surgery and stress experienced by the patient. It regressed with systemic and topical treatments.

The disadvantages of intraocular tamponade use in pars plana vitrectomy combined with sutureless intrascleral lens implantation surgery are the long duration of the surgery, corneal epithelial edema towards the end of the surgery and the need to scrape the corneal epithelium, difficulty in visualization of fundus for the laser treatment after the liquid air exchange, risk of subretinal decalin due to shaking of the decalin during scleral lens implantation, IOP elevation because of viscoelastic material in anterior chamber, in patients who don't disobey the prone positon the risk of passage of silicone or gas into the anterior chamber, risk of irido-endothelial contact, risk of corneal decompensation and secondary angle-closure glaucoma. Due to all these risks, this surgery should be done carefully and patiently.

The major limitations of our study are small sample size, short folllow-up period, not measuring the endothelial cell count, not measuring the IOL tilt with anterior segment OCT.

Long-term studies with a greater number of patients will be required to further validate these comparisons in non-traumatic eyes treated with intraocular tamponade with intrascleral lens implantation.

CONCLUSION

This approach can reduce the number of surgeries and also avoid the passage of tamponades to anterior segment. Both of the intraocular tamponades silicon and C3F8 does not cause IOL dislocation after suturless intrascleral lens implantation. Pars plana vitrectomy with tamponade can be performed simultaneously with 27-gauge needle assisted sutureless intrascleral IOL implantation. However, it should be taken into consideration that many different tolerable complications may develop intraoperatively or postoperatively.

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Conflicting interests

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