

# Risk factors for posterior synechiae of the iris after 23-gauge phacovitrectomy

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## Abstract

• **AIM:** To identify risk factors for the development of posterior synechiae of the iris (PSI) after 23-gauge phacovitrectomy.

• **METHODS:** A retrospective chart review was performed in consecutive Asian patients treated with 23-gauge phacovitrectomy with a 3-piece intraocular lens (IOL) or a single-piece 4 haptics IOL.

• **RESULTS:** A total of 263 eyes from 242 patients were included in the study. Postoperative PSI was identified in 16 (6.1%) eyes. In multivariate analysis, C3F8 gas tamponade, oil tamponade, and long operation time were significantly associated with PSI formation. There was no difference in the incidence of PSI between the groups using two different types of IOL ( $P=0.779$ ).

• **CONCLUSION:** C3F8 gas or oil tamponade and long operation time increased the incidence of PSI after 23-gauge phacovitrectomy. The single-piece 4 haptics IOL, in lieu of a 3-piece IOL, may be inserted into the capsular bag with a comparable incidence of PSI.

• **KEYWORDS:** complication; intraocular lens; phacoemulsification; vitrectomy

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## INTRODUCTION

Phacoemulsification during pars plana vitrectomy (PPV) is a commonly accepted surgical procedure for patients with vitreoretinal problems and cataracts; however, one of the complications of this procedure is formation of posterior synechiae of the iris (PSI), which may lead to a decrease in visual quality, difficulties in peripheral retinal examination due to the impairment of pupillary movement, and rarely secondary angle-closure glaucoma<sup>[1]</sup>. In our previous study on eyes treated with conventional 20-gauge PPV and phacoemulsification, preoperative PSI, C3F8 gas tamponade, postoperative anterior chamber fibrin deposition, and a single-piece intraocular lens (IOL) were shown to increase the incidence of postoperative PSI<sup>[2]</sup>. PSI developed in 18.9% of eyes in the 3-piece IOL group and 34.0% of eyes in the single-piece IOL group ( $P=0.041$ )<sup>[2]</sup>. Recently, the operation environment has changed radically with the development of new surgical instruments. Transconjunctival sutureless 23-gauge PPV has replaced conventional 20-gauge PPV for most vitrectomy cases. It has been reported that the 23-gauge system provides reduced surgical operation time and postoperative inflammation compared to the 20-gauge system<sup>[3-7]</sup>. Therefore, the aspect of postoperative PSI formation would have been different when using 23-gauge system. In addition, the 3-piece IOL is somewhat difficult to use when it is inserted into the bag. Because of its ease of insertion and its stability in the capsular bag, a single-piece 4 haptics IOL has gained popularity when cataract surgery is combined with PPV<sup>[8-10]</sup>.

The primary purpose of this study was to evaluate risk factors for PSI in combined transconjunctival sutureless 23-gauge PPV and clear cornea phacoemulsification with an in-the-bag IOL insertion (23-gauge phacovitrectomy). In addition, we compared the incidence of postoperative PSI between the groups with two different types of IOL (3-piece IOL vs single-piece 4 haptics IOL).

## SUBJECTS AND METHODS

Approval was obtained from the Korea University Ansan Hospital Institutional Review Board, Ansan, Korea. All

research and data collection followed the tenets of the Declaration of Helsinki. The procedures were fully explained to each patient, and each provided written informed consent.

### Subjects

**Case selection and data collection** We retrospectively reviewed the medical records of consecutive patients treated with phacovitrectomy by one surgeon (Kim SW) at the Korea University Ansan Hospital, Ansan, Korea, between September 2008 and August 2012. Exclusion criteria included a follow-up period of less than 3mo, intraoperative capsular radial tears, posterior capsular injury, zonular dehiscence leading to IOL decentering, and surgery for ocular trauma (*e.g.* corneal or scleral laceration, traumatic retinal detachment, traumatic cataract, or traumatic lens dislocation). Preoperative data, including age, gender, a history of diabetes or uveitis, presence of diabetic retinopathy (DR), presence of retinal new vessels, presence of preoperative PSI, presence of neovascularization of the iris (NVI), anterior chamber depth (ACD), axial length (AL), and major indications for vitrectomy were collected. Intraoperative data, including IOL type, number of endolaser photocoagulation, type of tamponade, and the total operation time of phacovitrectomy (min), and postoperative data, including history of postoperative anterior chamber fibrin formation, were also obtained.

**Definition of posterior synechiae of the iris** PSI was detected by slit-lamp biomicroscopy. A PSI was defined as being present when it was recognized over 30 degrees of the pupillary margin after pupillary dilation with tropicamide and 0.5% phenylephrine hydrochloride (Mydrin® -P, Santen Pharmaceutical Co., Ltd, Osaka, Japan) at two or more examinations conducted during the initial three postoperative months<sup>[11]</sup>. Transient synechiae or those released by pupillary dilation were excluded.

### Methods

All operations were conducted under local anesthesia. In all cases, 23-gauge trocars and cannulas, an Associate DORC posterior vitrectomy system (DORC, Inc., Zuidland, Netherlands), a Stellaris phacoemulsification system (Bausch and Lomb, Rochester, NY, USA), and a binocular indirect ophthalmomicroscope system (Oculus, Wetzlar, Germany) were used. All eyes underwent implantation of a 3-piece hydrophobic acrylic IOL (Tecnis™ Acrylic IOL ZA9003; Abbott Medical Optics, Inc. Santa Ana, CA, USA) or a single-piece hydrophilic 4 haptics IOL (Akreos MI60; Bausch & Lomb, Rochester, NY, USA). In more recent cases, single-piece 4 haptics IOLs were used.

At first, transconjunctival cannulas were inserted in a two-step procedure through the pars plana in the inferotemporal, superonasal, and superotemporal quadrants. The cannulas were temporarily closed with plugs, and the

infusion was closed while the temporal corneal phacoemulsification was performed. A 2.75-mm temporal clear corneal incision was made regardless of IOL type. After a 5.0 to 5.5 mm-sized continuous curvilinear capsulorhexis was created using a bent 27-gauge needle and capsulorhexis forceps, hydrodissection and hydrodelineation of the lens were performed. The lens was removed using a phaco-handpiece. After the IOL was inserted into the capsular bag, the corneal incision was secured using a single 10-0 nylon suture and transconjunctival sutureless 23-gauge PPV was then performed. Triamcinolone acetonide was injected intraoperatively in all cases after core and peripheral vitrectomy to visualize the remaining peripheral vitreous and vitreoschisis or epiretinal membrane (ERM) at the posterior pole. Then, triamcinolone acetonide in the vitreous cavity was removed as much as possible. Complete removal of the fibrovascular tissue was attempted in every case in which fibrovascular proliferation was noted in eyes with proliferative DR or retinal detachment. The ERM or internal limiting membrane was peeled in eyes with macular pucker, macular holes, or macular edema. Endolaser photocoagulation using an argon laser was added when necessary. Bleeding during vitrectomy was controlled by diathermy or by increasing the infusion pressure. If oil or gas tamponade was required, an endotamponade was performed at the end of the surgery with 14% C3F8 gas or 1300 CS silicone oil. Subconjunctival injection of steroids or antibiotics was not performed at the end of the surgery.

**Early postoperative management** All patients were discharged from the hospital one or two days after surgery. Patients with gas tamponade were instructed to keep in the face-down position for one month; however, this duration was customized according to the patient's general and ocular condition. The routine postoperative regimen included instillation of a 1% prednisolone acetate ophthalmic solution and moxifloxacin ophthalmic solution every two hours during the day. Dexamethasone ointment was applied before sleeping. From postoperative 10d, patients were treated with 1% prednisolone acetate ophthalmic solution four times a day until inflammatory cells disappeared from the anterior chamber.

**Statistical Analysis** Statistical analysis was performed using SPSS version 20.0 (SPSS Inc., Chicago, IL, USA). All statistics were two-tailed, and *P*-values less than 0.05 were considered significant. The Kolmogorov-Smirnov test was used to verify the normality of the distribution of continuous variables. For comparison between groups, the Chi-square analysis or Fisher's exact test was used for categorical variables and the *t*-test or Mann-Whitney *U* test was used for continuous variables. To identify risk factors for postoperative PSI, multivariate logistic regression analysis

was conducted. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated.

## RESULTS

During the study period, 322 eyes underwent phacovitrectomy using the 23-gauge TSV system. Of these, 59 eyes were excluded because of early loss to follow-up (28 eyes), capsular or zonular problems (25 eyes), and ocular trauma (6 eyes). Finally, a total of 263 eyes from 242 Asian patients were included in the study. There were no cases in which iris retractor was used or radial iris spincter incision was performed to stretch the small pupil. The mean age of included patients was  $61.3 \pm 13.07$ y. The two major indications for surgery were ERM and vitreous hemorrhage associated with DR, followed by rhegmatogenous retinal detachment (RRD) and retinal traction associated with DR (Table 1).

After phacovitrectomy, PSI developed in 16 (6.1%) of total 263 eyes. There were no significant differences between the groups with and without postoperative PSI in mean age, gender, history of diabetes, laterality of the eye, mean AL, mean ACD, presence of DR, presence of retinal new vessels, presence of preoperative PSI, presence of NVI, IOL type, history of endolaser photocoagulation, or history of postoperative anterior chamber fibrin formation (Table 2). However, number of endolaser photocoagulation, history of gas or oil tamponade, and operation time were significantly different between the two groups ( $P=0.035$ ,  $P<0.001$ , and  $P<0.001$  respectively). Six (2.3%) of total 263 eyes had a history of uveitis and all of these eyes underwent vitrectomy due to vitreous opacity. Postoperative PSI did not develop in any of these eyes with a history of uveitis.

In a subgroup analysis of the eyes that underwent gas or oil tamponade ( $n=89$ ), postoperative PSI developed in 15 (16.9%) cases. Only operation time was significantly different between the groups with and without postoperative PSI ( $P=0.018$ , Table 3). In a subgroup analysis of the eyes whose underlying surgical indication was retinal traction associated with DR or RRD ( $n=46$ ), postoperative PSI developed in 11 (23.9%) cases and all cases underwent gas or oil tamponade (Table 4). Mean ACD was shallower in the group with postoperative PSI ( $P=0.020$ ).

Table 5 shows a comparison of characteristics between the groups with two different types of IOL. Eyes with DR or retinal new vessels were more common in the group using 4 haptics IOL ( $P=0.014$  and  $P=0.002$  respectively).

Multivariate logistic regression analysis was performed using several variables including age, gender, presence of DR, presence of retinal new vessels, AL, ACD, IOL type, number of endolaser photocoagulation, tamponade type, and operation time. C3F8 gas tamponade, oil tamponade, and long operation time were significantly associated with

**Table 1 Surgical indications and formation of postoperative posterior synechiae of the iris**

Indication	Postoperative posterior synechiae	
	No ( $n=247$ )	Yes ( $n=16$ ) (%) <sup>1</sup>
Epiretinal membrane	102	3 (2.9)
VH associated with DR	61	1 (1.6)
Rhegmatogenous retinal detachment	20	8 (28.6)
Retinal traction associated with DR	15	3 (16.7)
Refractory diabetic macular edema	14	1 (6.7)
VH associated with RVO	13	0 (0)
Macular hole	10	0 (0)
Vitreous opacity associated with uveitis	6	0 (0)
VH associated with other diseases	4	0 (0)
Retinal traction associated with RVO	2	0 (0)

VH: Vitreous hemorrhage; DR: Diabetic retinopathy; RVO: Retinal vein occlusion. <sup>1</sup>Incidence of postoperative posterior synechiae of the iris in total cases of stated indication.

postoperative PSI formation (Table 6). The OR of C3F8 gas tamponade for predicting postoperative PSI formation was 29.7 (95%CI=3.28 to 269.07), the OR of oil tamponade was 27.0 (95%CI=1.28 to 567.61), and the OR of operating time (min) was 1.02 (95%CI=1.00 to 1.04).

## DISCUSSION

PSI are formed from fibrous metaplasia of the inflamed iris tissue caused by early postoperative iritis [12,13]. In the present study, the incidence of PSI was 6.1%. In our previous study, the incidence of PSI was 23.5%, and other studies reported a frequency of PSI formation after phacovitrectomy between 7% and 30%[2,11,14-18]. It is difficult to compare the incidence of PSI in the present study with the results of other studies because of the different study design, subject characteristics, and surgical techniques. Patient demographic characteristics could be an important explanation for the low incidence of postoperative PSI in this study. The most relevant surgical indications in this study were ERM and DR-associated vitreous hemorrhage, which comprised 63.5% of all cases. Generally, these indications are not considered challenging from a surgical point of view, resulting in less surgical trauma and inflammation within a relatively short operation time. No tamponade with a lack of major surgical complications is the usual surgical scenario in these cases. In addition, the use of the 23-gauge system, which provides reduced surgical operation time and less postoperative inflammation compared to the 20-gauge system, may have affected the relatively low incidence in this study[3-5].

Another reason for the low incidence of PSI may be the type of IOL used in the present study. Previously, we inserted a 3-piece hydrophobic acrylic IOL (Acrysof MA60BM; Alcon labs, Fort Worth, TX, USA) or a single-piece hydrophobic acrylic IOL (Acrysof SA60AT; Alcon labs, Fort Worth, TX, USA). PSI developed in 18.9% of eyes in the 3-piece IOL

**Posterior iris synechiae after 23G phacovitrectomy**

**Table 2 Comparison of characteristics between the groups with and without postoperative posterior synechiae of the iris**

Variable	Postoperative posterior synechiae		P
	No (n=247)	Yes (n=16) (%) <sup>1</sup>	
Age (a)	61.6±12.9	56.8±15.1	0.258
Gender (n)			0.731
M	128	9 (6.6)	
F	119	7 (5.6)	
History of diabetes (n)			0.491
No	118	9 (7.1)	
Yes	129	7 (5.1)	
Laterality (n)			0.063
OD	126	12 (8.7)	
OS	121	4 (3.2)	
Axial length (mm)	23.5±1.3	23.8±1.1	0.050
Anterior chamber depth (mm)	2.91±0.55	2.72±0.99	0.709
Diabetic retinopathy (n)			0.481
No	132	10 (7.0)	
Yes	115	6 (5.0)	
Retinal new vessels (n)			0.876
No	134	9 (6.3)	
Yes	113	7 (5.8)	
Preoperative posterior synechiae (n)			<sup>2</sup> 0.117
No	239	14 (5.5)	
Yes	8	2 (20.0)	
Preoperative NVI (n)			<sup>2</sup> 0.223
No	244	15 (5.8)	
Yes	3	1 (25)	
IOL type (n)			0.779
3-piece	130	9 (6.5)	
4 haptics	117	7 (5.6)	
Intraoperative endolaser photocoagulation (n)			<sup>2</sup> 0.768
No	63	3 (4.5)	
Yes	184	13 (6.6)	
Number of endolaser photocoagulation (n)	457±465	688±471	0.035
Gas or oil tamponade (n)			<0.001
No	173	1 (0.6)	
Yes	74	15 (16.9)	
Operation time (min)	70.9±32.5	113.1±45.4	<0.001
Postoperative AC fibrin formation (n)			<sup>2</sup> 0.201
No	224	13 (5.5)	
Yes	23	3 (11.5)	

NVI: Neovascularization of the iris; IOL: Intraocular lens; AC: Anterior chamber. <sup>1</sup>Incidence of postoperative posterior synechiae of the iris in total cases of the stated indication. The Chi-square analysis or <sup>2</sup>Fisher's exact test was used for categorical variables and the Mann-Whitney U test was used for continuous variables for comparison between the two groups.

group and 34.0% of eyes in the single-piece IOL group in that study <sup>[2]</sup>. A single-piece IOL was a risk factor for PSI formation. In eyes with gas or oil tamponade, the incidence of PSI was 32.6% (15/46) in the 3-piece IOL group and 52.9% (9/17) in the single-piece IOL group<sup>[2]</sup>. In the present study, we used a single-piece 4 haptics IOL or a 3-piece IOL.

**Table 3 Subgroup analysis in the eyes that underwent gas or oil tamponade**

Variable	Postoperative posterior synechiae		P
	No (n=74)	Yes (n=15) (%) <sup>1</sup>	
Age (a)	60.1±13.5	56.7±15.6	0.493
Gender (n)			0.523
M	46	8 (14.8)	
F	28	7 (20.0)	
History of diabetes (n)			0.423
No	36	9 (20.0)	
Yes	38	6 (13.6)	
Laterality (n)			0.169
OD	40	11 (21.6)	
OS	34	4 (10.5)	
Axial length (mm)	23.4±1.0	23.8±1.1	0.118
Anterior chamber depth (mm)	2.92±0.53	2.62±0.94	0.313
Diabetic retinopathy (n)			0.369
No	40	10 (20.0)	
Yes	34	5 (12.8)	
Retinal new vessels (n)			0.673
No	40	9 (18.4)	
Yes	34	6 (15.0)	
Preoperative posterior synechiae (n)			<sup>2</sup> 0.336
No	69	13 (15.9)	
Yes	5	2 (28.6)	
Preoperative NVI (n)			<sup>2</sup> 0.999
No	73	15 (17.0)	
Yes	1	0 (0)	
IOL type (n)			0.321
3-piece	34	9 (20.9)	
4 haptics	40	6 (13.0)	
Intraoperative endolaser photocoagulation (n)			<sup>2</sup> 0.698
No	11	3 (21.4)	
Yes	63	12 (16.0)	
Number of endolaser photocoagulation (n)	674±594	712±477	0.591
Tamponade type (n)			<sup>2</sup> 0.999
C3F8 gas	65	13 (16.7)	
Silicone oil	9	2 (18.2)	
Operation time (min)	86.8±39.6	114.1±46.8	0.018
Postoperative AC fibrin formation (n)			<sup>2</sup> 0.999
No	62	12 (16.2)	
Yes	12	3 (20.0)	

NVI: Neovascularization of the iris; IOL: Intraocular lens; AC: Anterior chamber. <sup>1</sup>Incidence of postoperative posterior synechiae of the iris in total cases of the stated indication. The Chi-square analysis or <sup>2</sup>Fisher's exact test was used for categorical variables and the Mann-Whitney U test was used for continuous variables for comparison between the two groups.

The single-piece 4 haptics IOL seemed to be comparable to the 3-piece IOL in terms of postoperative PSI formation. PSI developed in 5.6% of eyes in the single-piece 4 haptics IOL group and 6.5% of eyes in the 3-piece IOL group. Even in the subgroup analysis of eyes with gas or oil tamponade, there was no difference in PSI formation between the single-piece

**Table 4 Subgroup analysis in the eyes whose underlying surgical indication was retinal traction associated with diabetic retinopathy or rhegmatogenous retinal detachment**

Variable	Postoperative posterior synechiae		P
	No (n=35)	Yes (n=11) (%) <sup>1</sup>	
Age (a)	51.3±15.3	58.6±15.9	0.122
Gender (n)			<sup>2</sup> 0.494
M	21	5 (19.2)	
F	14	6 (30.0)	
History of diabetes (n)			0.478
No	18	7 (28.0)	
Yes	17	4 (19.0)	
Laterality (n)			<sup>2</sup> 0.732
OD	19	7 (26.9)	
OS	16	4 (20.0)	
Axial length (mm)	23.3±1.4	23.8±1.3	0.252
Anterior chamber depth (mm)	3.05±0.43	2.40±1.00	0.020
Diabetic retinopathy (n)			<sup>2</sup> 0.486
No	20	8 (28.6)	
Yes	15	3 (16.7)	
Retinal new vessels (n)			<sup>2</sup> 0.732
No	19	7 (26.9)	
Yes	16	4 (20.0)	
Preoperative posterior synechiae (n)			<sup>2</sup> 0.999
No	31	10 (24.4)	
Yes	4	1 (20.0)	
Preoperative NVI (n)			
No	35	11 (23.9)	
Yes	0	0 (0)	
IOL type (n)			<sup>2</sup> 0.169
3-piece	13	7 (35.0)	
4 haptics	22	4 (15.4)	
Intraoperative endolaser photocoagulation (n)			<sup>2</sup> 0.999
No	4	1 (20.0)	
Yes	31	10 (24.4)	
Number of endolaser photocoagulation (n)	862±633	845±439	0.877
Gas or oil tamponade (n)			<sup>2</sup> 0.169
No	8	0 (0)	
Yes	27	11 (28.9)	
Operation time (min)	107.1±43.5	121.1±46.2	0.309
Postoperative AC fibrin formation (n)			<sup>2</sup> 0.999
No	29	9 (23.7)	
Yes	6	2 (25.0)	

NVI: Neovascularization of the iris; IOL: Intraocular lens; AC: Anterior chamber. <sup>1</sup>Incidence of postoperative posterior synechiae of the iris in total cases of the stated indication. The Chi-square analysis or <sup>2</sup>Fisher's exact test was used for categorical variables and the Mann-Whitney U test was used for continuous variables for comparison between the two groups.

4 haptics IOL group and the 3-piece IOL group [13.0% (6/46) vs 20.9% (9/43), P=0.321].

These comparable results of single-piece 4 haptics IOL with the 3-piece IOL in PSI formation may be due to its

**Table 5 Comparison of characteristics between the groups with 3-piece intraocular lenses (IOLs) and single-piece 4 haptics IOLs**

Variable	IOL type		P
	3-piece (n=139)	4 haptics (n=124)	
Age (a)	62.4±12.2	60.1±13.9	0.150
Gender (n)			0.167
M	78	59	
F	61	65	
History of diabetes (n)			0.181
No	72	54	
Yes	67	70	
Laterality (n)			0.792
OD	74	64	
OS	65	60	
Axial length (mm)	23.6±1.3	23.3±1.3	0.072
Anterior chamber depth (mm)	2.83±0.66	2.97±0.49	0.081
Diabetic retinopathy (n)			0.014
No	85	57	
Yes	54 (38.8%)	67 (54.0%)	
Retinal new vessels (n)			0.002
No	88	55	
Yes	51 (36.7%)	69 (55.6%)	
Preoperative posterior synechiae (n)			<sup>2</sup> 0.524
No	135	118	
Yes	4	6	
Preoperative NVI (n)			<sup>2</sup> 0.346
No	138	121	
Yes	1	3	
Intraoperative endolaser photocoagulation (n)			0.750
No	36	30	
Yes	103	94	
Number of endolaser photocoagulation (n)	465±453	479±486	0.807
Gas or oil tamponade (n)			0.292
No	96	78	
Yes	43	46	
Operation time (min)	75.8±35.8	70.8±33.6	0.256
Postoperative AC fibrin formation (n)			0.257
No	128	109	
Yes	11	15	

IOL: Intraocular lens; NVI: Neovascularization of the iris; AC: Anterior chamber. The Chi-square analysis or <sup>2</sup>Fisher's exact test was used for categorical variables and the t-test was used for continuous variables for comparison between the two groups.

mechanical properties. The most prominent advantage of the single-piece 4 haptics IOL over the 3-piece IOL was its ease of insertion and the management of the IOL in the capsular bag, probably resulting from its flexibility and thin optic portion. In spite of its flexibility, the four legs of the single-piece 4 haptics IOL allowed it to remain stable in the capsular bag during infusion and aspiration after IOL insertion and during the vitrectomy procedure. Besides its four haptic design, the single-piece 4 haptics IOL has a 10-degree haptic angle and a wide area at the optic haptic

**Table 6** Multivariate logistic regression results for predicting postoperative posterior synechiae formation after 23-gauge phacovitrectomy

Variable	Odds ratio	95%CI	P
Tamponade type			
No tamponade	ref.		
C3F8 gas	29.7	3.28 to 269.07	0.003
Silicone-oil	27.0	1.28 to 567.61	0.034
Operation time (min)	1.02	1.00 to 1.04	0.029
Age (a)	0.97	0.91 to 1.03	0.279
Gender (M)	0.41	0.10 to 1.59	0.195
Presence of diabetic retinopathy	0.47	0.05 to 4.24	0.501
Presence of retinal new vessels	1.86	0.22 to 15.49	0.564
Axial length (mm)	1.19	0.70 to 2.03	0.523
Anterior chamber depth (mm)	0.49	0.19 to 1.23	0.129
IOL type (4 haptics)	0.81	0.20 to 3.21	0.763
Number of endolaser photocoagulation (n)	1.00	0.99 to 1.00	0.543

IOL: Intraocular lens.

junction, which resisted the buoyancy of the expanding gas and helped maintain its optic portion behind the iris plane level [8]. Furthermore, beyond its mechanical properties, the hydrophilic characteristics of the single-piece 4 haptics IOL may be another reason for the low incidence of PSI in the single-piece 4 haptics IOL group. Amon and Menapace [19] demonstrated that hydrophilic surfaces showed cellular reactions in a lower percentage of cases compared with hydrophobic surfaces.

Known risk factors of PSI are preoperative PSI, gas or oil tamponade, single-piece IOL implantation, postoperative anterior chamber fibrin deposition, the existence of proliferative DR, and the amount of photocoagulation [2,11,14,19]. In the present study, C3F8 gas or oil tamponade and long operation time were significantly associated with postoperative PSI formation. Long operation time may be associated with increase of postoperative inflammation and consequently, increase of PSI formation. As already noted by several studies, gas or oil tamponade may increase PSI formation due to the tighter apposition of the IOL to the posterior iris surface [2,11,15,20,21]. In previous our study, uveitis history, preoperative PSI, and postoperative anterior chamber fibrin deposition were significantly higher in the group with postoperative PSI [2]. But these variables were not significant in this study. This may be due to low incidence of postoperative PSI in this study using of the 23-gauge system. In subgroup analysis, preoperative ACD was shallower in the group with postoperative PSI (Table 4). Although preoperative ACD was not significant for predicting postoperative PSI formation in multivariate analysis, the shallower preoperative ACD may be associated with the tighter apposition of the IOL to the posterior iris surface.

There are certain limitations to this study, including its

retrospective design and the heterogeneity of surgical indications for vitrectomy. PSI may be associated with intraoperative unusual findings in the anterior chamber such as prolapsed iris, iris damage, or bleedings. However, retrospective design of this study prevented further analysis. The surgical indications for vitrectomy were so diverse that it was difficult to categorize them into small subgroups. Furthermore, even for the same indication, the severity of disease was different and very hard to present in a single scale. Therefore, we could not directly evaluate the effect of each disease on PSI formation; however, we could assess the severity and the effect of the disease indirectly by considering various surgical factors. In addition, the surgical indications for vitrectomy might have some degree of interaction with tamponade type, which is one of the risk factors for PSI. For example, macular holes or RRD surgery always require an endotamponade, which might increase the incidence of PSI in these diseases.

In conclusion, C3F8 gas or oil tamponade and long operation time during 23-gauge phacovitrectomy increased the possibility of postoperative PSI formation. The single-piece 4 haptics IOL, in lieu of a 3-piece IOL, may be inserted into the capsular bag to achieve a comparable incidence of postoperative PSI.

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