ORIGINAL ARTICLE

# Evaluation of the Ophthalmological Effectiveness and Safety of the Secondary IOL Implantation (Yamane Technique) with Sutureless Scleral Fixation

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## ABSTRACT

**Purpose:** To evaluate the operative safety and efficacy of the cases in which Yamane technique was applied.

**Materials and Methods:** We retrospectively analyzed operation safety and efficacy of 20 patients who underwent eye patch technique as the study group and 24 eyes as the control group with scleral fixation secondary IOL implantation with sutures were analyzed retrospectively.

**Results:** The best corrected visual acuity (BCVA) was 0.66±0.3D in the study group and 0.36±0.2D in the control group ($p<0.00$). In the cylindrical refractive error study group; It was measured as -1.20±2.29D and -2.90±2.82D ($p<0.63$) in the control group. During the operation, vitreous hemorrhage (VIH) occurred in two cases in both groups and iris sphincter rupture occurred in one case in the control group. In the long-term postoperatively, retinal detachment developed in one patient in the study group, retinal detachment in two patients in the other group, Irvine Gass syndrome in two patients, and IOL subluxation in two patients.

**Conclusion:** The Yamane technique applied to cases with zonule or capsule weakness showed significant visual improvement and success in minimizing perioperative and postoperative complications compared to other scleral-fixed secondary IOL implantation cases. Adding minor changes to existing surgical techniques has had serious implications for the ease and effectiveness of the surgical technique for surgeons.


**Keywords:** Secondary IOL with Scleral Fixation, Yamane, Zonal Weakness

## INTRODUCTION

The posterior capsule perforation is the most common and important complication of phacoemulsification (PHACO) surgery.[1] Despite current advances in surgical techniques, it may be non-feasible to implant intraocular lens (IOL) into posterior chamber due to lens posterior capsule support and insufficient zonule support resulting from traumatic cataract, phacodonesis and diseases that may lead lens subluxation.[2, 3] In such patients, iris-claw IOL, anterior chamber IOL (ACIOL) and posterior chamber IOL with scleral suture can be performed. Although each technique has pros and cons, there is an ongoing debate about indication, lens type, surgical technique and incidence of complications in these IOLs.[4]

Complications such as suture erosion/rupture or exposed suture knot may develop at postoperative period in secondary IOL implantation with sutured scleral fixation.[5,6] The ACIOL and iris-claw IOL are other preferred secondary IOL implantation techniques. However, they are less commonly preferred due to complications such as angle closure, posterior synechia, glaucoma or corneal decompensation.[7] In particular, different secondary IOL implantation techniques have been developed in order to reduce surgical time and complications.

Secondary IOL implantation with sutureless scleral fixation (Yamane technique) was first employed by Shin Yamane.[8] The lack of suture-related complications, no corneal contact to implantation of IOL into posterior chamber and lack of synechia are advantages of Yamane technique. In this technique, IOL haptics are inserted into scleral tunnel and tips of haptics are bended using cautery or fixed beneath flap using tissue adhesive.[9]

In this study, it was aimed to investigate IOL safety, visual outcomes and postoperative complications in patients who

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underwent intracapsular cataract extraction, extracapsular cataract extraction, phacoemulsification with insufficient capsular support and zonule support due to traumatic cataract surgery and secondary IOL implantation with sutureless scleral fixation in the same or next session.

## MATERIALS AND METHODS

### Study population

This retrospective study included patients presented to ophthalmology outpatient clinic of Trakya University, Medicine School. The study was approved by Ethics Committee on Scientific Research of Trakya University, Medicine School. The study was conducted in accordance to tenets of Helsinki Declaration and Good Clinical Practice guideline. The study included 20 eyes of 20 patients underwent secondary IOL implantation with Yamane technique and 24 eyes of 24 patients underwent secondary IOL implantation with sutured scleral fixation, all of which had preoperative zonule failure, posterior capsule failure, complicated phacoemulsification surgery or traumatic cataract. In the study, age, gender, diagnosis, IOL position, corneal incision size, spherical and cylindrical refractive values, additional surgery and postoperative complications were analyzed.

### Preoperative assessment

Before surgery, all patients underwent a comprehensive ophthalmological examination including visual acuity (VA) and best-corrected visual acuity (BCVA) measurement by Snellen charts, slit-lamp examination, intraocular pressure (IOP) measurement by Goldmann applanation tonometry, fundus examination, keratometry and anterior segment images. Axial length was measured using IOL MASTER 700 biometry and IOL power was calculated at aphakic mode using SRK-2 formula.

### Surgical technique

All surgical procedures were performed by a single surgeon. In Yamane technique, a cannula with valve was inserted at inferior temporal quadrant using a 25 G trocar. After stabilization of infusion cannula, bottle height was set as 30 mmHg. Anterior vitrectomy was performed in all patients with vitreous in anterior chamber. The limbus was marked at 3 and 9 o'clock positions at two points using 180° marker pen. These marks were used as guide for sclerotomy. Again, a conjunctival marking was made 2 mm beneath limbus (2 mm vertical) from 3 and 9 o'clock positions. For MA60AC (Alcon) IOL implantation, a transparent corneal incision was made at 12 o'clock position using 2.8 blade. NA-hyaluronate was given to anterior chamber and IOL was inserted into posterior chamber. Trans-scleral-conjunctival tunnel was achieved using 27 G injector while IOL haptics were moved through sclerotomy by using a forceps. Tips of haptics were bended using electrocautery and fixed to sclera; then, they were sutured to conjunctiva using 8.0 vicryl sutures. Corneal wound site was closed using stromal hydration.

In secondary IOL implantation with sutured scleral fixation, a cannula with valve was inserted at inferior temporal quadrant using a 25 G trocar. After stabilization of infusion cannula, bottle height was set as 30 mmHg. After conjunctival dissection from at 3 and 9 o'clock positions, a 1/3 thickness scleral flap (3x3 mm in size) with the base at limbus was removed. A transparent corneal incision was made at 12 o'clock position using 2.8 blade and anterior chamber was created using NA-hyaluronate. Polymethacrylate posterior chamber (PMMA) IOL Alcon, CZ70BD model- optical diameter 7.0 mm, haptic diameter 12.5 mm) in 23 eyes and MA60AC IOL in 1 eye was implanted and fixed to sclera with 10/0 polypropylene sutures. Scleral and conjunctival flap were sutured using 8.0 vicryl sutures.

### Postoperative follow-up

After surgery, topical dexamethasone (16x1) was given for one week, which then tapered gradually (8x1 for one week; 6x1 for one week; 4x1 for one week; 2x1 for one week). In addition, topical moxifloxacin (4x1) was given for 2 weeks. The control visits were scheduled on day 1, at week 1 and on months 1, 3 and 6. In control visits, a comprehensive examination including BCVA by Snellen chart, IOP measurement by Goldman applanation tonometry, anterior and posterior segment examination and anterior segment imaging. Postoperative complications were recorded.

### Statistical analysis

All statistical analyses were performed using SPSS (Statistical Package for Social Sciences) for Windows version 10.0. Variables are presented as descriptive statistics (mean, standard deviation, median, frequency, percent). Quantitative variables were compared using Mann Whitney U test and Wilcoxon test. Qualitative variables are compared using Chi-square test, Continuity Correction Yates test and Fisher Exact test. A $p$ value$<0.05$ was considered as statistically significant.

## RESULTS

### Demographic characteristics

The study group included 20 eyes of 20 patients while the

control group included 24 eyes of 24 patients. There were 15 men (75%) and 5 women (25%) in the study group while there were 15 men (62.5%) and 9 women (37.5%) in the control group. Mean age was 68.8 years in the study group and 73.5 years in the control group (p<0.36).

The patients were classified into 5 group according to preoperative diagnoses (Table 1).

It was needed to enlarge transparent corneal incision made by 2.8 blade in 6 patients from the study group and 9 patients from the control group. The size of corneal incision did not lead significant refractive difference when compared to patients without corneal incision (p<0.80).

At long-term follow-up, complications developed in 2 patients from the study group and 6 patients from the control group (Table 2).

Significant difference was detected between preoperative and postoperative vision in all patients (P<0.01).

Table 3 summarizes mean BCVA of the study and control groups at baseline and during follow-up.

Mean cylindrical refraction value was measured as -1.20±2 D in the study group and -2.90±2 D in the control group (p=0.63). Mean spherical refraction value was measured as 1.15±1 D in the study group and 0.69±2 D in the control group (p<0.29).

## DISCUSSION

In this study, we discussed operation safety and visual improvement in cases underwent Yamane technique. Currently, IOL implantation into posterior chamber is used as most suitable refractive correction following modern cataract surgery.[10, 11] However, it is sometimes impossible to implant IOL into bag due to capsule or zonule failure.[12] Zonular support is insufficient for IOL implantation in lens surgery in traumatic cataract, hereditary causes such as Marfan syndrome, Weil Marchesani syndrome and homocystinuria as well as some cases with pseudoexfoliation syndrome.[13, 14] The cases with insufficient capsular support allowed ophthalmologist to develop extra-bag methods. These methods include ciliary sulcus IOL, ACIOL, iris-claw IOL and secondary IOL with scleral fixation.[15, 16]

In the light of current data, the primary goal of technical and technological advances is to minimize spherical and cylindrical refraction value after surgery[17, 18]. In our study, postoperative visual acuity was found to be higher in cases underwent surgery with Yamane technique when compared to controls. The postoperative astigmatism values were

**Table 1:** *Preoperative diagnoses*

| | | Groups | | Total |
|---|---|---|---|---|
| | | Study | Control | |
| Diagnosis | IOL dislocation | 8 | 5 | 13 |
| | Nucleus drop | 5 | 4 | 9 |
| | Aphakia, Posterior capsule perforation | 2 | 7 | 9 |
| | Traumatic cataract, Lens Subluxation | 2 | 6 | 8 |
| | IOL drop | 3 | 2 | 5 |
| **Total** | | **20** | **24** | **44** |

**IOL:** Intraocular lens

**Table 2:** *Postoperative complications in the study and control groups*

| | | Groups | | Total |
|---|---|---|---|---|
| | | Study | Control | |
| Postoperative complication | None | 18 | 18 | 36 |
| | Rhegmatogenous detachment | 1 | 2 | 3 |
| | Irvine Gass syndrome | 1 | 2 | 3 |
| | IOL subluxation | 0 | 2 | 2 |
| **Total** | | **20** | **24** | **44** |

**IOL:** Intraocular lens

**Table 3:** *Preoperative and postoperative visual acuities*

| | Groups | N | Mean (D**) | Std. D (D) | P* |
|---|---|---|---|---|---|
| Preoperative BCVA | Study | 20 | 15,12 | 17,71 | 0.31 |
| | Control | 24 | 22,71 | 23,01 | |
| BCVA on postoperative week 1 | Study | 20 | 17,12 | 18,63 | 0.89 |
| | Control | 24 | 19,46 | 16,70 | |
| BCVA on postoperative month 1 | Study | 20 | 29,41 | 20,17 | 0.59 |
| | Control | 24 | 32,17 | 20,71 | |
| BCVA on postoperative month 3 | Study | 20 | 49,94 | 29,91 | 0.12 |
| | Control | 24 | 28,79 | 19,13 | |
| BCVA on postoperative month 6*** | Study | 20 | 66,35 | 30,58 | 0.00* |
| | Kontrol | 24 | 36,54 | 20,62 | |

*P<0.05: statistical significance
**D: Diopter
***BCVA: Best-corrected visual acuity (by Snellen chart)

markedly lower. This may be due to lack of corneal suture, tissue adhesive or scleral incision.[19, 20]

There may be more deviation in secondary IOL implantation with scleral fixation when compared to intracapsular IOL implantation. The deviation generally tends to be towards hypermetropia. This may be due to fact that secondary IOL with scleral fixation may be localized more posterior when compared to intracapsular IOL.[21-23] In this study, IOL power was calculated according to emmetropia using IOL MASTER 700. The target refractive values were oriented to hypermetropia in the study and control groups. While calculating IOL power with biometry measurements, determination of diopter according to slightly negative value may ensure emmetropia.

In our study, VIH developed in 2 patients from study and control groups The VIH might have developed due to contact to uveal tissue with 27 G injector. In a study by Dick et al., it was shown that the risk for VIH was increased due to contact of sclera with its sutures to uveal tissue. Authors reported VIH incidence as 4.4-10%.[24] In our study, VIH incidence was found as 9%.

In the Yamane group, no IOL dislocation or IOL drop was observed. However, mild subluxation of IOL towards inferior was observed in 2 patients from the control group. However, no additional surgery was considered due to good visual acuity in these cases. Kumar et al. found that IOL was decentralized in 5.6% of cases after secondary IOL implantation with fibrin adhesive-supported scleral fixation.[25]

No significant difference was detected in preoperative and postoperative IOP values (as measured by Goldmann applanation tonometry) between the study and control groups. Yavuzer K et al. low postoperative IOP.[20] Presumably, this may be due to the lack of contact between IOL and iris, pupillary block or positioning not closing or narrowing iridocorneal angle. However, there are studies reporting IOP elevation in 20% to 21% after secondary IOL implantation with scleral fixation.[26]

In our study, rhegmatogenous retinal detachment (RDD) was developed in the patients underwent Yamane technique while in 2 patients at long-term in the control group. These patients had vitreous prolapse and anterior vitrectomy in anterior chamber due to previous phacoemulsification surgery. The vitreous loss leads stretching of retinal barrier and retinal traction, increasing risk for retinal detachment. In previous studies, complications such as hyphema, vitreous hemorrhage and retinal detachment were reported after secondary IOL implantation with scleral fixation. [8, 9, 27]

In the study on 35 eyes by Yamane et al., it was reported that iris entrapment, ocular hypertension and Irvine Gas syndrome were developed with Yamane technique.[8, 28, 29] In our study, Irvine Gass syndrome was developed in one patient in the study group and in two patients in the control group. No glaucoma, hyphema or endophthalmitis was developed during the study.

In conclusion, surgical IOL and artificial fixation with several techniques have gained popularity in cases with zonular or capsular failure. The target technique showed that Yamane technique is safe with no or minimal perioperative and postoperative complications and marked visual improvement. The development of novel techniques should aim to improve safety and efficacy in complex

cases. Further studies with larger sample size and longer follow-up will demonstrate structural and functional outcomes more accurately.

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