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ORIGINAL ARTICLE

The assessment of refractive outcome in patients who underwent pars plana vitrectomy and intraocular lens implantation in the same session due to lens or lens fragments drop

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Abstract

Purpose: The objective is to reveal the results of patients who underwent pars plana vitrectomy (PPV) in the same session due to lens nucleus drop during cataract extraction and to compare the refractive results according to uncomplicated phacoemulsification (phaco) surgery.

Methods: The study included 26 eyes of 26 patients who underwent PPV due to lens or lens fragments drop. Preoperative and postoperative best-corrected visual acuity (BCVA), intraocular pressure, spherical equivalent, and the intraocular lens (IOL) implantation methods applied were recorded. Refractive results were compared with the spherical equivalent of 24 eyes of 19 patients who underwent uncomplicated phaco surgery.

Results: Three-piece IOL was implanted in the ciliary sulcus in 20 (77%) patients, and IOL was implanted in one (4%) patient with sutureless scleral fixation using the Yamane technique. In 5 (19%) cases, the surgeries were terminated as aphakic. Preoperative BCVA was 1.3±0.5 logMAR, and postoperative BCVA was 0.29±0.4 logMAR (P<0.001 for both subgroups). Preoperative spherical equivalent was −4±2 D, and it was −0.8±1.4 D after the operation (P<0.001). In patients with PPV and IOL implantation, the postoperative spherical equivalent was −0.8±1.4 D, and it was measured as −0.7±0.6 D in the phaco-only group (P=0.37).

Conclusion: It is possible to achieve optimal results in uncomplicated phaco surgery using IOL measurements calculated with appropriate biometric formulas and advanced optical biometry devices in patients who have undergone PPV due to lens nucleus drop. IOL implantation can be easily planned in the same session for patients undergoing PPV.

Keywords: Intraocular lens implantation; nucleus drop; pars plana vitrectomy; spherical equivalent.

Phacoemulsification is currently the most widely used surgical technique for cataract extraction. However, the loss of lens fragments into the vitreous cavity is one of the most serious complications of phacoemulsification. This complication can lead to vision-threatening consequences such as high intraocular pressure (IOP), corneal edema, uveitis,

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and retinal detachment. Posterior displacement of the lens fragment varies according to the experience of the surgeon performing the phacoemulsification, but the incidence is between 0.3% and 1.1%.[1-6]

Treatment of lens fragments dislocated into the vitreous is performed by pars plana vitrectomy (PPV). In cases with capsular support, a secondary intraocular lens (IOL) can be implanted in the sulcus. In patients without capsular support, sutured or sutureless scleral fixation IOL, anterior chamber IOL, and iris-claw IOL should be inserted.[7-9]

The timing of vitrectomy remains a matter of debate. The accepted best time for vitrectomy is in the same session as cataract surgery to avoid the lens-induced inflammation cycle. A delay in vitrectomy of more than 3 weeks may result in an increased incidence of chronic glaucoma.[2,10]

Posterior capsule rupture and PPV may result in a higher degree of IOL motion and less predictable effective and centralized IOL positioning.[11] There is little information about this topic in the literature. In this study, the results were evaluated of cases in which the lens fragments displaced into the vitreous cavity during phacoemulsification were treated immediately with 23 Gauge PPV, and a secondary IOL was applied in the same session. These results were compared to those of uncomplicated cataract surgery cases performed by the same surgeon.

Materials and Methods

This retrospective, single-center study included 50 eyes of 45 patients. Information was obtained by reviewing the medical records in the database of the clinic between 2017 and 2021 in the eye clinic of a tertiary-level university hospital. The study was approved by the Clinical Research Ethics Committee and all procedures complied with the principles of the Declaration of Helsinki.

The cases were divided into two groups. The PPV-IOL implantation group consisted of patients who underwent 23-gauge PPV and IOL implantation in the same session during phacoemulsification surgery due to lens fragments dropped to the vitreous. The phaco-only group consisted of cases that were performed uneventfully and only phacoemulsification cases were selected to be used as the control group. Uncomplicated phacoemulsification cases performed by the same surgeon were numbered and then selected using an online randomization module (www.randomizer.org) to form the control group.

In this study, cases with 23-gauge PPV and IOL placed in the same session due to nucleus drop for the PPV-IOL implantation group and followed up for at least 6 months after surgery were included. Patients were excluded from the PPV-IOL implantation group if the corneal incision had been widened for the removal of the lens particles. In both groups, patients with high myopia (including axial length > 26.00 mm or - 6.00D refractive error), postoperative retinal detachment, or corneal insufficiency were excluded from the study.

The records of all the patients were reviewed, including a complete ophthalmic evaluation, including best-corrected visual acuity (BCVA) evaluation, slit lamp biomicroscopic examination, and indirect fundus ophthalmoscopy, and IOP measurement using Goldmann applanation tonometry. Refraction status was measured using an automatic refractor (Topcon KR-800A Auto Refractor Keratometer; Topcon Medical, Tokyo, Japan). The IOL power was calculated using a laser-assisted optical biometer (IOL Master 500; Carl Zeiss Meditec, Jena, Germany). IOL power was calculated using the Sanders-Retzlaff-Kraff/Theoretical (SRK-T) formula. The optimal refractive outcome was determined as within ±1D of the cases.[12]

PPV and IOL placement in the PPV-IOL implantation group, and all operations in the phaco-only group were performed by the same surgeon (YÖ).

To explain the surgical technique; in the PPV-IOL implantation group, surgery was performed using a standard 3-port, 23-gauge PPV. 23-gauge trocar cannulas were placed 3.5 mm posterior to the limbus and a core vitrectomy was performed. The cutting speed was 5000 cuts/min and the vacuum was set at 350 mm Hg. The posterior hyaloid was separated from the retina by staining the vitreous with triamcinolone acetonide. After confirming that there were no vitreous fibrils to be aspirated by the endo phacofragmatome tip, 2 or 3 mL of liquid perfluorocarbon was injected to remove the luxated nuclear material from the macular region. Phacofragmentation was performed to remove the core material. Perfluorodecalin fluid was aspirated. After checking the peripheral retina, the IOL was placed in the sulcus if there was support for the capsular sulcus, otherwise the 3-piece IOL was fixed to the sclera at a distance of 2 mm from the limbus with the sutureless scleral fixation technique. The sclerotomies were closed with 7-0 polyglactin (Vicryl, Ethicon, Johnson and Johnson, USA). If the corneal transparency did not allow viewing, the case was terminated as aphakic. The operations were completed with subconjunctival antibiotic and steroid injections.

In the phaco-only group, after sterile conditions were provided, surgery was performed with a 2-stage temporal 2.8

mm incision on the transparent cornea. IOL placement was accomplished using a cartridge insertion system without incision magnification. Monofocal hydrophilic IOL (Acriva, VSY, Istanbul, Türkiye) was implanted in the capsular bag in all patients in the phaco-only group.

Statistical analysis was performed using SPSS (IBM SPSS Statistics for Windows, Version 22.0. Published 2014. IBM Corp., Armonk, NY, USA). Descriptive analyses are expressed using proportions, or mean ± standard deviation (SD) values. Conformity of the variables to normal distribution was investigated using visual (histogram and probability plots) and analytical methods (Shapiro–Wilk test). The preoperative and postoperative BCVA and IOP values of the patients were compared using the Wilcoxon Signed-Rank test. The spherical equivalents obtained in the groups after the surgeries were compared with the Mann–Whitney U test. The level of statistical significance was accepted as $P < 0.05$.

Results

The evaluation was made of the records of uncomplicated phacoemulsification and IOL implantation surgery in 24 eyes of 19 patients and phacoemulsification and PPV surgery in 26 eyes of 26 patients. Three-piece IOL was placed in the ciliary sulcus in 20 (77%) patients, and sutureless scleral fixation using the Yamane technique in one (4%). Five (19%) cases were aphakic. Nucleus drop occurred in 25 eyes due to posterior capsule tear at the stage of phacoemulsification. This occurred at the beginning of surgery in one eye due to zonule weakness. The demographic and ophthalmological findings of the patients are presented in Table 1. BCVA was determined to be mean 1.3 ± 0.5 logMAR preoperatively and 0.29 ± 0.4 logMAR postoperatively ($P < 0.001$ for both subgroups). Preoperative IOP was 14.8±3 mmHg, and postoperative IOP was 14.9 ± 6 mmHg ($P = 0.95$). In the patients who underwent PPV sulcus IOL, spherical equivalent was −4 ± 2 D preoperatively and −0.8 ± 1.4 D postoperatively ($P < 0.001$). In the phaco-IOL-only group, spherical equivalent was −2.5 ± 1.5 D preoperatively, and −0.7 ± 0.6 D after the operation ($P < 0.001$). The postoperative spherical equivalent was −0.8 ± 1.4 D in the patients who underwent PPV sulcus IOL, and -0.7 ± 0.6 D in the phaco-IOL only group ($P = 0.37$). The preoperative and postoperative characteristics of the PPV and IOL implantation groups are shown in Table 2.

Table 1. Demographic and ophthalmological findings of the patients

	PPV-IOL implantation	Phaco-only	P*
Age	70.9±6.6	69.3±4.2	0.3
Sex (E/K)	14/12	9/10	0.4
IOL placement	20 sulcus iol implantation 1 scleral fixation 5 aphakic	24 in bag	
Preoperative spherical equivalent	−4±2	−2.5±1.5	0.55
Postoperative spherical equivalent	−0.8±1.4	−0.7±0.6	0.37

PPV: Pars plana vitrectomy; IOL: Intraocular lens.

Table 2. Preoperative and postoperative characteristics of PPV and IOL implantation group

	Preoperative	Postoperative	P*
BCVA (logMAR)	1.3±0.5	0.29±0.4	<0.001*
IOP (mmHg)	14.8±3	14.9±6	0.95
Spherical equivalent (D)	−4±2	−0.8±1.4	<0.001*

IOL: Intraocular lens; BCVA: Best-corrected visual acuity; PPV: Pars plana vitrectomy; IOP: Intraocular pressure.

Discussion

The preference for phacoemulsification in the treatment of cataracts has increased significantly in recent years, with the advantages of not requiring stitches, short patient rehabilitation, and small incisions. However, the steep learning curve and the need for technological devices can be counted among the factors that make this surgery challenging. Dislocation of the crystalline lens to the vitreous in phacoemulsification surgery is also more common than in extracapsular cataract extraction, and this causes serious problems. Low vision, chronic glaucoma, macular edema, panuveitis, and rarely endophthalmitis and retinal detachment can be seen in the patient due to an intravitreal dislocated crystalline lens. In 10-37% of these patients, the final BCVA may be <0.1.[10,13-15] In some studies, it has been reported that the risk of chronic glaucoma increases in surgeries delayed for more than 3 weeks.[13,14] Although the development of posterior vitreous detachment during the expected period appears to be a factor facilitating the surgery, the operation should be planned without delay, and if possible, in the same session as the phacoemulsification surgery.

Various biometric measuring devices are currently available to determine the axial length, such as ultrasound sensors (contact and immersion), IOL Master (Carl Zeiss Meditec AG [CZM], Jena, Germany), OA-2000 (Tomey, Nagoya, Japan), and Lenstar LS900 (Haag Streit, Switzerland). Studies have shown that IOL Master with swept-source optical coherence tomography (SS-OCT) and partial coherence inter-

ferometry (PCI)-based biometrics is more accurate and has become the "gold standard" in biometrics.[16] In the current study, the PCI-based IOL Master 500 device was used and optimal refractive results were obtained. Hyperopic refraction after phacoemulsification surgery is known to be a very serious problem, but as the current study patients were aged >45 years, the target refraction was set close to −1 diopter due to presbyopia.

It is controversial whether IOL implantation should be performed in the same session or different sessions in these cases. The generally accepted view is that IOL implantation performed in the same session as cataract surgery does not negatively affect the final BCVA.[15,17,18] However, some studies have reported pseudophakic case results of better final BCVA than aphakic case results.[17,18] Previous series have reported between 44.4% and 69.7% of patients with a final BCVA of 0.5 or better. In the current series, an average final BCVA of 0.29 LogMAR (0.5 Snellen Equivalent) was obtained in all patients by performing IOL implantation in the same session. In this respect, the findings are consistent with the literature.[13,17,19]

Retained lens material after cataract surgery has been shown to have a significant effect on visual acuity. With the development of both phacoemulsification and PPV techniques and advances in technology, the approach to these cases is now easier. Especially in these cases, the lens materials remaining in the vitreous may enter the anterior chamber and cause corneal edema, which then makes surgery extremely difficult. Target visual acuity in nucleus drop surgery is also related to the timing of the surgery. Merani et al.[20] showed an association between the development of retinal detachment and the time between cataract surgery and PPV surgery (more than 30 days). Ho et al.[21] reported that PPV surgery performed within 7 days reduced the risk of secondary glaucoma. Bessant et al.[22] showed that 64.7% of the patients who were operated on within 1 week achieved visual acuity better than 6/12, and that visual acuity better than 6/12 was obtained in 41% of the patients who were operated on after 1 week. Al-Khaier et al.[23] reported that delayed PPV for more than 4 weeks was associated with poor visual acuity. In contrast, Margherio et al.[17] reported no difference between early (<7 days) and late (more than 8 days) PPV in terms of increased intraocular pressure, corneal edema, choroidal effusion, cystoid macular edema, and visual acuity. Briefly, performing PPV as early as possible due to nucleus drop will contribute to the improvement of final visual acuity and the prevention of associated secondary complications that may develop.

In cases of lens drop, if there is a vitreoretinal surgeon in the center where the surgery is performed, simultaneous vitrectomy and lens implantation provide a great convenience in the management of the case. If performed in different sessions, complications such as corneal edema, increased intraocular pressure, and uveitis complicate the management of the case. However, this requires waiting for suitable conditions in terms of surgery. The results of the current study showed that optimal refraction results can be obtained with the calculation made with appropriate biometric formulas. It is not known how performing PPV in the same session without the development of capsular fibrosis may affect lens stabilization and IOL centralization, and thus the refractive result. In this series, the refractive results of patients who underwent uncomplicated cataract surgery and combined phaco+PPV performed by the same surgeon were statistically similar, and this can be considered a factor showing the advantage of performing the surgery in the same session.

Optimal refractive results were also obtained in the patient group. The refractive results of the PPV-IOL implantation group and the phaco-only group were statistically similar.

The main limitation of this study can be said to be the limited number of patients.

Conclusion

The results of this study demonstrate that it is possible to achieve optimal results in uncomplicated phaco surgery with the use of IOL measurements calculated with appropriate biometric formulas and advanced optical biometry devices in non-delayed PPV surgery of patients who underwent PPV due to lens nucleus drop. IOL implantation can be easily planned in the same session for patients undergoing PPV.

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