

The effect of phacoemulsification on the intraocular pressure, anterior chamber and pupildiameter in patients with pseudoexfoliation syndrome

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ABSTRACT

Aims: To evaluate the effect of phacoemulsification on the intraocular pressure, anterior chamber and pupil diameter in patients with pseudoexfoliation syndrome.

Methods: 66 eyes of thirty-three patients who had pseudoexfoliation (PEX) and underwent phacoemulsification enrolled in this retrospective study. The eyes divided two groups as a study group that with pseudoexfoliation syndrome (PES) or PEX glaucoma and the other eyes as a control group without PES or PEX glaucoma. The follow-up examinations were preoperatively and postoperatively on the first day, fourth day, first month, and three months. It is important to note that PES often affects the other eye as well. Studies using electromicroscopic, histochemical, and immunohistochemical methods have detected exfoliation material in the other eye, meaning it cannot be considered completely healthy. Best-corrected visual acuity (BCVA), intraocular pressure (IOP), anterior chamber depth (ACD) and pupil diameter (PD) were evaluated at each visit, and glaucoma medications were noted.

Results: There was no statistically significant difference when compared preoperative and postoperative IOP values on the first day between two groups ($p>0.05$). The mean IOP postoperatively at 4th, 30th day and 3rd months, reduced according to preoperative values in the study group ($p<0.05$). Mean anterior chamber depth and pupil diameter were increased significantly at the final visit ($p<0.001$).

Conclusion: Cataract surgery has a beneficial effect on patients with PEX including IOP, ACD and PD.

Keywords: PEX, IOP, ACD, PD

INTRODUCTION

Pseudoexfoliation syndrome (PES) is an age-related condition characterized by the accumulation of fibrogranular extracellular flake-shaped material with a gray appearance in the anterior segment of the eye and visceral organs.^{1,2} Previous studies have shown the etiological association between cataract and PES.³ The shallower anterior chamber and grade of cataract are higher in patients with PES.^{4,5} PES is the most common cause of secondary open-angle glaucoma due to fibro-granular material deposition in the outflow pathway of the trabecular meshwork. The level of intraocular pressure (IOP) is the most important indicator to decide on treatment in glaucoma patients. Cataract surgery in patients with pseudoexfoliation (PEX) glaucoma has a positive effect in lowering IOP.⁶ Also, Anterior chamber depth (ACD) and pupil diameter (PD) are smaller that complicate the cataract surgery in patients with PEX. PEX material can be removed from the eye with cataract surgery. Therefore PD, ACD may

change after cataract surgery in patients with PEX. In this study, we evaluated IOP and anterior segment parameters include PD, ACD of glaucomatous and non- glaucomatous patients with PEX after phacoemulsification and intraocular lens implantation.

METHODS

The study was carried out with the permission of the Kırıkkale University Faculty of Medicine Ethics Committee (Date: 05.06.2024, Decision No: 2024.05.02). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Sixty-six eyes of thirty-three patients with routine cataract surgeries and no postoperative complications that were operated at Kırıkkale University Faculty of Medicine were included in this retrospective study. All patient files were



reviewed retrospectively. Only the patients who underwent bilateral cataract surgery had PES, or PEX glaucoma in one eye and the other eye normal were included.

Exclusion criteria were a history of refractive surgery, patients with phacodonesis or zonular weakness, history of glaucoma surgery or laser trabeculoplasty. PES was diagnosed under biomicroscopic examination. PEX materials were visualized on the anterior lens surface, iris, iridocorneal angle or pupillary border. Patients with PEX glaucoma diagnosed by visual field defects and/or glaucomatous optic nerve changes. All surgeries were performed with phacoemulsification, and intraocular lens implantation with hydroimplantation technique under topical anesthesia by the same surgeon (OT) and the quick-chop phacoemulsification technique was performed. In both groups, two side-ports and a main temporal incision were performed in all eyes. Following injection of viscoelastic 2% hydroxypropyl methylcellulose (Eyevisc, Biotech, India) in both group continuous curvilinear capsulorhexis, hydrodissection, phacoemulsification of the nucleus and cortex aspiration were performed. In group 1, no viscoelastic was injected in the eye. Then the irrigation cannula introduced into the anterior chamber through left side port with irrigation on. After the tip of the cartridge was put into the main port in the direction of the capsular bag, IOL (Eyecryl plus, Biotech, India) was gradually injected. The aspiration cannula was inserted through the other side port, and the optic and haptic were placed into the capsular bag through pressing lightly on by bimanual cannula. Finally, all corneal incisions were hydrated. Posterior capsule rupture or zonular dialysis did not occur in any eyes. The eyes divided two groups as a study group that with PES or PEX glaucoma and the other eyes as a control group without PES or PEX glaucoma. The follow-up examinations were preoperatively and postoperatively on the first day, fourth day, first month, and three months. Best-corrected visual acuity (BCVA), IOP, ACD, and PD were evaluated at each visit, and glaucoma medications were noted. It is important to note that PES often affects the other eye as well. Studies using electromicroscopic, histochemical, and immunohistochemical methods have detected exfoliation material in the other eye, meaning it cannot be considered completely healthy.⁷

BCVA was measured by Snellen chart. IOP was measured with Goldmann applanation tonometry. ACD and PD were measured with optical biometer (Al-Scan, Nidek, Japan) The data for the patients analyzed using SPSS (version 20.0 IBM). Q-q plots were examined, histogram and Shapiro-Wilk's test were used to assess the data normality. For categorical variables, the chi-square test and numerical variables, a parametric paired sample test was used. A p value less than 0.05 was considered significant

RESULTS

There were 18 (%54.4) women and 15 (%45.6) men with a mean age 69.80 ± 6.72 years in the study. In the study group, 20 eyes had PEX and 13 eyes had PEX glaucoma that used at least an antiglaucomatous drug. The mean preoperative IOP was 17.82 ± 3.14 in group 1 and 15.61 ± 2.79 in group 2. There was no statistically significant difference when compared preoperative and postoperative IOP values on the first day between two groups ($p > 0.05$). The mean IOP postoperatively at 4th, 30th day and 3rd months were 16.00 ± 3.13 , 15.97 ± 2.73

and 15.48 ± 2.53 respectively. The mean postoperative IOP except first postoperative day significantly reduced according to preoperative values in the study group ($p < 0.05$). The mean IOP values of the two groups are shown in Table 1. Mean anterior chamber depth was 3.11 ± 0.41 before the cataract surgery. After phacoemulsification and IOL implantation, the ACD increased significantly to 4.08 ± 0.48 ($p < 0.001$, Table 2). Mean PD before and after the surgery were 4.08 ± 0.52 and 4.87 ± 0.67 . Mean pupil diameter was increased significantly at the final visit ($p < 0.001$, Table 2). Glaucoma medication recruitment was reduced in patients with PEX glaucoma. Five patients had passed to monotherapy from the fixed combination.

Table 1. Intraocular pressure in the groups before and after phacoemulsification

	Preop	Postop	Postop 4. day	Postop	Postop	p value
Group 1	17.82 ± 3.14	17.18 ± 2.86	16.00 ± 3.13	15.97 ± 2.73	15.48 ± 2.53	0.165a
						0.013b
						0.006c
						0.001d
Group 2	15.61 ± 2.79	16.39 ± 3.30	15.18 ± 3.52	15.03 ± 2.55	14.52 ± 2.98	0.281a
						0.582b
						0.426c
						0.114d

a: Comparison preop-postop 1. day, b: preop-postop 4. day, c: preop-postop 30. day, d: preop-postop 3. month

Table 2. The changes of ACD and PD of patients with pseudoexfoliation

	Preop	Postop 3. month	p value
ACD	3.11 ± 0.41	4.08 ± 0.48	< 0.001
PD	4.08 ± 0.52	4.87 ± 0.67	< 0.001

ACD: Anterior chamber depth; PD: Pupil diameter

DISCUSSION

This study presented that cataract surgery reduces IOP values in the long term. Also, the rate of antiglaucoma treatment or the number of antiglaucoma agents was reduced after the surgery.

All patients had deeper an anterior chamber when compared with the other eye and before the surgery. The pupil diameter increased after the surgery. PEX is characterized by production and deposition of abnormal fibrillar extracellular material in the ocular adnexa, Iris and Lens Capsule. Due to its manifestation, zonular weakness, Iris atrophy, and the non-dilating pupil may It is important to note that PES often affects the other eye as well. Studies using electromicroscopic, histochemical, and immunohistochemical methods have detected exfoliation material in the other eye, meaning it cannot be considered completely healthy occur in patients. Also, the anterior chamber depth is smaller.^{8,9} Doganay et al.¹⁰ evaluated anterior segment parameters in patients with (PEX) syndrome or (PEX) glaucoma and found that ACD was significantly lower in the PEX glaucoma group that 80 eyes of 57 patients compared with 80 eyes of 45 healthy subjects. In the other study, Güngör SG et al.¹¹ compared ACD in patients with PES who underwent phacoemulsification and found that ACD values increased following the surgery. In our study, ACD values were more extensive in both patients with PES

and PEX glaucoma after cataract surgery than preoperative values. Small pupil size is the most frequent trouble in PES that related to surgical complication.¹² There are many studies reported smaller pupil diameter in PES despite the mydriatic medication.¹³⁻¹⁵ In this study, the authors compared pupil diameter with healthy control, but in our study, we analyzed the difference before and after the surgery, and we found a higher pupil size. We think that this result may be related with the cleaning of the fibrogranular material from the surface of the lens and iris margin which forcing the pupil dilatation. Cataract and glaucoma often coexist in eyes with glaucoma and PES.¹⁶ There some reports are stating that cataract extraction has positive effects on intraocular pressure. Lai et al.¹⁶ evaluated outcomes of 21 patients who had cataract and primary angle closure glaucoma following cataract surgery. They found IOP decreased significantly when compared with intraoperative level. The requirement for the anti-glaucomatous drug was reduced from 1.91 ± 0.77 (range, 1-3) to 0.52 ± 0.87 (range, 0-3) at the last visit.¹⁷ Especially this effect is more pronounced in PES and PEX glaucoma. Lia et al. All compared the effect of phacoemulsification in two types glaucoma that primary open angle and PEX. In this study, the IOP level reduced significantly after the surgery for both kinds. In the other research that comprised 1122 eyes with PES, the author found a long-term reduction in IOP in patients who 2.7% progressed to the need for glaucoma treatment almost three years after phacoemulsification. There is no consensus on why IOP reduce after cataract surgery. The outflow of aqueous humor may simplify because of the trabecular meshwork cleaned especially in patients with PEX.¹⁸

Limitations

In our study, all parameters which we evaluated in this study showed that phacoemulsification or cataract surgery has a beneficial effect in patients with PEX. The other advantage of cataract surgery is that increasing the anterior chamber depth reduces the risk of primary angle closer glaucoma attack. Also, due to the pupil relaxes, pupil size increases and the response to light returns to normal. The limitation of this study was the small sample size.

CONCLUSION

This study showed that the benefit of cataract surgery does not only improve the vision but also reduces IOP, increases ACD and PD in patients with PEX. Furthermore, recruitment of glaucoma medication was reduced following the cataract surgery. It is more accurate to perform cataract surgery before deciding on glaucoma surgery in these patients.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of the Kırıkkale University Faculty of Medicine Ethics Committee (Date: 05.06.2024, Decision No: 2024.05.02).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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