

Early Post-Operative Effect of Phacoemulsification on Anterior Chamber Depth and Intraocular Pressure in Patients with Cataract

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ABSTRACT

Purpose: To determine the Anterior Chamber depth and Intraocular pressure change following uncomplicated phacoemulsification.

Study Design: Quasi experimental study.

Place and Duration of Study: Layyton Rehmatullah Benevolent Trust Free Eye and Cancer Hospital, Lahore from 16/12/2017 to 15/06/2018.

Methods: One hundred and thirty nine patients who came to Layyton Rehmatullah Benevolent Trust Free Eye for phacoemulsification and IOL implantation were included in the study. Anterior Chamber depth was measured with IOL Master and intraocular pressure was determined using Goldmann Applanation Tonometer one day before and one month after surgery. Data was recorded on a self-designed proforma. Comparison between pre- and post-operative data with respect to change was analyzed by chi-square test. P-value ≤ 0.05 was considered significant.

Results: The mean intra-ocular pressure dropped from 14.36 ± 4.19 mmHg to 12.14 ± 4.26 mmHg 1 month after surgery with a mean drop of 2.21 ± 0.65 mmHg while the mean anterior chamber depth increased from 2.31 ± 0.08 mm to 3.59 ± 0.37 mm with a mean increase of 1.29 ± 0.36 mm. There was no statistically significant difference in the mean change of intra-ocular pressure and anterior chamber depth across various subgroups based on patient's age, gender and duration of cataract.

Conclusion: Phacoemulsification and IOL implantation not only improves the visual acuity by removing the cataract but also deepens the anterior chamber and decreases intra-ocular pressure, which can have a beneficial effect in glaucoma patients.

Key Words: Phacoemulsification, Cataract, Intraocular pressure, Lens, Anterior chamber depth.

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INTRODUCTION

Aqueous humor is secreted by the ciliary epithelium,

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and enters the posterior chamber. It then flows around the lens through the pupil into the anterior chamber.¹ Aqueous leaves the eye by passive bulk flow mainly via two pathways at the anterior chamber angle. Anterior chamber angle widening following cataract extraction was significantly correlated with anterior chamber biometric factors like anterior chamber depth.² Literature shows that cataract surgery significantly deepens the anterior chamber and widens its angle. The more shallow the preoperative anterior

chamber, the greater is the postoperative change in the of the chamber.³

Preoperative lens vault appears to be a significant factor in angle widening and intraocular pressure reduction after phacoemulsification.² The reduction in intraocular pressure is the result of increased anterior chamber depth (ACD) and widening of iridocorneal angle following cataract surgery.⁴ Changes in Anterior chamber depth following uncomplicated cataract extraction via phacoemulsification is associated with decrease in Intraocular pressure.

This study was carried out to see the change in anterior chamber depth and intra ocular pressure after phacoemulsification in non-glaucomatous patients.

METHODS

Study was conducted in LRBT Lahore from December 2017 to June 2018. Study design was quasi-experimental and non-probability consecutive sampling technique was used. After approval from ethical committee, a total of 139 patients, between 20 and 60 years of age and of either gender were admitted to undergo phacoemulsification for cataract extraction. Detailed history and examination including best corrected visual acuity, dilated fundus examination, gonioscopy, IOP measurement and AC depth measurements were carried out before surgery and then 1 month after surgery. Patients with nuclear cataracts NS ++/+++, intraocular pressure of 20 mmHg or less and axial length of 21.0 to < 25.0 mm were included in the study. Patients with known glaucoma, any complication during cataract surgery like posterior capsular rupture and vitreous loss, previous surgery and co-morbid conditions were excluded. Phacoemulsification was done using horizontal chopping method and posterior chamber intra-ocular lens was implanted under local anesthesia. All patients were evaluated by the same experienced consultant using IOL master and Goldmann Applanation Tonometry. Data was recorded on a self-designed proforma. Comparison between pre and post-operative data with respect to change was analyzed by chi-square test. P-value ≤ 0.05 was considered significant. All the collected data was entered and analyzed through SPSS version 22.0. Numerical variables i-e age, pre-operative, post-operative anterior chamber depth and intraocular pressure were presented as mean \pm SD. Categorical variables i-e gender was presented as frequency and percentage. Data was

stratified for age, gender and duration of cataract to address effect modifiers. Post stratification t-test was applied taking p value ≤ 0.05 as significant.

RESULTS

The age of the patients ranged from 40 years to 65 years with a mean of 62.3 ± 4.3 years. There were 68 (48.9%) males and 71 (51.1%) female patients. Duration of cataract was from 1 year to 6 years with a mean of 2.8 ± 1.3 years as shown in Table 8.1.

The mean intra-ocular pressure dropped from 14.36 ± 4.19 mmHg to 12.14 ± 4.26 mmHg 1 month after surgery with a mean drop of 2.21 ± 0.65 mmHg while the mean anterior chamber depth increased from 2.31 ± 0.08 mm to 3.59 ± 0.37 mm with a mean increase of 1.29 ± 0.36 mm. There was no statistically significant difference in the mean change of intra-ocular pressure and anterior chamber depth across various subgroups based on patient's age, gender and duration of cataract.

Table 1: Baseline Characteristics of Study Sample.

Characteristics	Participants (n = 139)
Age (years)	62.3 ± 4.3
• 40-52 years	7 (5.0%)
• 53-60 years	132 (95.0%)
Gender	
• Male	68 (48.9%)
• Female	71 (51.1%)
Duration of Cataract (years)	2.8 ± 1.3
• 1-3 years	106 (76.3%)
• 4-6 years	33 (23.7%)

Table 2: Early Post-Operative Effect of Phacoemulsification on IOP and ACD (n = 139).

Parameter	Pre-operative	Post-Operative	Mean Change
IOP (mmHg)	14.36 ± 4.19	12.14 ± 4.26	2.21 ± 0.65
ACD (mm)	2.31 ± 0.08	3.59 ± 0.37	1.29 ± 0.36

Table 3: Stratification of Mean Change in IOP across Various Subgroups (n = 139).

Characteristics	N	Mean Change in IOP (mmHg)	P-value
Age			
• 40 – 52 years	7	2.23 ± 0.53	0.952
• 53 – 60 years	132	2.21 ± 0.66	
Gender			
• Male	68	2.22 ± 0.62	0.858
• Female	71	2.20 ± 0.68	

Duration of Cataract

• 1 – 3 years	106	2.20 ± 0.64	0.724
• 4 – 6 years	33	2.25 ± 0.69	

Table 4: Stratification of Mean Change in ACD across Various Subgroups (n = 139).

Characteristics	N	Mean Change in ACD (mm)	P-value
Age			
• 40 – 52 years	7	1.31 ± 0.22	0.848
• 53 – 60 years	132	1.29 ± 0.37	
Gender			
• Male	68	1.29 ± 0.38	0.861
• Female	71	1.28 ± 0.34	
Duration of Cataract			
• 1 – 3 years	106	1.29 ± 0.36	0.821
• 4 – 6 years	33	1.28 ± 0.38	

t-test, observed difference was statistically insignificant

DISCUSSION

Crystalline lens is an important refractive medium of eye. Modern cataract surgery (phacoemulsification technique) helps to improve vision by exchanging damaged inelastic lens with intra-ocular lens. Literature shows a positive association between shallower temporal iridotrabecular angle and small anterior chamber depth and larger lens vault.⁵ The lens vault quantifies the portion of the lens located anterior to the anterior chamber angle.⁶ A larger lens vault is independently associated with narrow angles.⁷ Anterior chamber depth correlates highly with anterior chamber angle.⁸ Phacoemulsification surgery has the ability to deeply alter the anterior segment morphology, especially in eyes with shallow anterior chamber (AC) and narrow anterior chamber angle (ACA).

An earlier study showed an increase in anterior chamber depth from 2.76 (0.08) mm preoperatively to 3.95 (0.05) mm post-operatively and a mean change of 1.20 (0.06) mm six months following surgery.⁹ A mean change of Intraocular pressure of 1.55 (0.47) mmHg in open-angle patients six months after surgery was also observed in the same study.⁹ Another study showed an increase in anterior chamber depth following cataract extraction in eyes with glaucoma.¹⁰ Angle widening following phacoemulsification is postulated to be a cause of intraocular pressure reduction.

In the present study, the mean age of the patients was 62.3 ± 4.3 years. A similar mean age of 63 ± 6.7

years has been reported by Tahir et al among patients presenting with cataract at Jinnah Post Graduate Medical Centre, Karachi.¹¹ Khan et al¹² has reported similar mean age of 62 ± 10.2 years at Holy Family Hospital, Rawalpindi and Zafar et al¹³ reported it to be 62.4 ± 7.8 years at Shifa International Hospital, Islamabad. A comparable mean age of 63.8 ± 8.9 years has been reported by Bharath et al¹⁴ among Indian patients while in Bangladesh it was reported it to be 66.7 ± 8.1 years.¹⁵

We observed a slight female predominance with 48.9% males and 51.1% female patients. A similar female predominance has been reported in another local study, where Tahir et al.¹¹ reported 53.7% females and 46.3% male patients. Similar frequency of male (48.6%) and female (51.4%) patients has been reported at Liaquat University of Medical and Health Sciences, Hyderabad.¹⁶ Our observation is also in line with Indian studies.¹⁴

In the present study, we observed that the mean intra-ocular pressure dropped from 14.36 ± 4.19 mmHg to 12.14 ± 4.26 mmHg 1 month after surgery with a mean drop of 2.21 ± 0.65 mmHg while the mean anterior chamber depth increased from 2.31 ± 0.08 mm to 3.59 ± 0.37 mm with a mean increase of 1.29 ± 0.36 mm. Our observation is line with another local study where Ahmad et al.¹⁷ reported similar change in mean IOP (17 ± 2 mmHg to 13 ± 2 mmHg) and anterior chamber depth (1.5mm) following cataract surgery in glaucoma patients. Bhallil et al¹⁸ in Morocco reported similar decrease in mean intra-ocular pressure (2.25 mmHg) from 14.18 ± 3.4 to 12.07 ± 2.6 mmHg after phacoemulsification in normal patients. They also reported similar increase in mean anterior chamber depth (1.13 mm) from 2.96 mm to 4.09 mm. In a Chinese study, Liu et al.¹⁹ reported similar decrease in mean IOP (14.86 ± 3.79 mmHg to 12.17 ± 4.22 mmHg) and increase in mean anterior chamber depth (2.38 ± 0.32 mm to 3.04 ± 0.39 mm) following phacoemulsification in normal subjects. Qu et al²⁰ observed comparable decrease in mean IOP (14.3 ± 3.1 mmHg to 12.7 ± 3.3 mmHg) with a comparable increase in mean ACD (2.54 ± 0.41 mm to 3.99 ± 0.33 mm).

Dooley et al²¹ reported decrease in mean IOP (2.5 ± 3.2 mmHg) from 14.8 ± 3.1 to 12.3 ± 2.7 mmHg after phacoemulsification. They also reported similar increase in mean anterior chamber depth (1.08 ± 0.50 mm) from 2.66 ± 0.38 to 3.70 ± 0.75mm among normal Irish subjects with cataract. Takmaz et al.²²

reported similar fall in mean intraocular pressure from 14.6 ± 3.5 to 10.4 ± 2.4 mmHg and increase in mean anterior chamber depth from 2.7 ± 0.4 to 3.5 ± 0.3 mm after uneventful phacoemulsification in Turkish patients with cataract.

The results of the present study are in line with the already published research on the topic and establish that phacoemulsification and IOL implantation not only improves the visual acuity by removing the cataract but also deepens the anterior chamber and decreases intra-ocular pressure, which can be beneficial for glaucoma patients. So in future practice, patients having cataract and glaucoma with uncontrolled intra-ocular pressure by non-surgical means should be offered cataract surgery as it will not only improve their visual acuity but may also help in controlling IOP and avoiding or at least delaying glaucoma surgery.

CONCLUSION

Phacoemulsification and IOL implantation deepens the anterior chamber and decreases intra-ocular pressure, which is sustained over 1 month, this may be beneficial for glaucoma patients irrespective of gender and cataract duration.

Ethical Approval

The study was approved by the Institutional review board/ Ethical review board. (No.2/Admn/Ex-Cer/LRBT-2020)

Conflict of Interest

Authors declared no conflict of interest.

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Author's Designation and Contribution

Mashal Tayyab: Consultant Ophthalmologist: *Concepts, Design, Literature search, Statistical analysis, Manuscript preparation, Manuscript editing, Manuscript review.*

Awaid Abid: Medical Officer: *Data acquisition, Data analysis, Statistical analysis, Manuscript editing.*

