The effect of phacoemulsification surgery on intraocular pressure and anterior segment anatomy of the patients with cataract and ocular hypertension

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We evaluated the effect of phacoemulsification surgery on intraocular pressure (IOP), anterior chamber depth (ACD), iridocorneal angle (ICA), and central corneal thickness (CCT) of the patients with cataract and ocular hypertension. The decrease in IO*P* values of the 1st week, 1st month, 3rd month, 6th month, and 1st year was statistically significant, but that of the 2nd year was not significant. The increase in ACD and ICA values of the 1st week, 1st month, 3rd month, 6th month, and 1st year was statistically significant, but that of the 2nd year was not significant. The increase in CCT values of 1st week and 1st month was statistically significant, but those of 3rd month, 6th month, 1st year, and 2nd year were not significant. In conclusion, phacoemulsification surgery decreases IOP and increases ACD and ICA in the short-term. However, in the long-term it does not cause any significant changes.

Key words: Cataract, intraocular pressure, ocular hypertension, phacoemulsification

Modern cataract surgery results in a reduction in intraocular pressure (IOP) in eyes with or without glaucoma, and/or ocular hypertension (OHT).[1,2] As a result of extraction of the natural lens and implantation of the ıntraocular lens (IOL) which is thinner than natural lens, the depth and volume of anterior chamber increases, the angle between cornea and iris widens and the iris moves backward.[3] At the same time, endogenous prostaglandin F2 secretion, an inflammatory mediator, increases due to surgical trauma, causing an increase in uveoscleral outflow of aqueous humor. Cataract surgery leads to fibrosis and contraction of the posterior capsule causing traction on the ciliary body, thus reduction in secretion of aqueous humor and increase in outflow.[4] In addition, postoperative corneal edema increases corneal thickness leading to erroneously higher measurements of IOP. Hence, the real IOP level may be lower than the observed value. All these causes may be influential on the reduction of IOP after cataract extraction. The aim of this study is to evaluate the changes in IOP, anterior chamber depth (ACD), iridocorneal angle (ICA), and central corneal thickness (CCT) in patients with cataract and OHT after phacoemulsification and IOL implantation surgery.

Access this article online

Quick Response Code:

Website: www.ijo.in

DOI: 10.4103/0301-4738.171020

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Manuscript received: 29.01.15; Revision accepted: 31.10.15

Materials and Methods

The study protocol was approved by the Local Ethics Committee. An informed consent was obtained from the patients for the cataract surgery. The study was carried out according to the tenets of the Declaration of Helsinki.

One hundred and twelve eyes of 112 patients with cataract and OHT (60 males, 52 females) who were operated between January 2010 and November 2011 were evaluated retrospectively. Their mean age was 61.32 ± 11.12 (standard deviation [SD]) (45–88) years. Full ophthalmological examinations including uncorrected visual acuity, best corrected visual acuity (BCVA), IOP measurements, ACD, ICA, and CCT measurements, slit-lamp biomicroscopy, and fundus examination, were performed preoperatively and postoperatively. IOP measurements were made with Goldmann Applanation Tonometer (Haag-Streit, Switzerland), ACD with IOL Master optical biometer (Zeiss, Germany), ICA with Goldmann 3-mirror lens (Haag-Streit, Switzerland) and CCT was measured with Ultrasonic Pachymeter (Meda, USA).

The IOP levels of the patients were higher than normal, but they had no visual field defects and neither used any antiglaucomatous medications, that's why classified as OHT. The cases with primary open angle glaucoma, acute or chronic primary angle closure glaucoma (ACG), pseudoexfoliation (PEX) syndrome, pigmentary dispersion syndrome, history of ocular surgery, and intraoperative and/or postoperative complications were excluded.

Statistical analyses were performed by using SPSS version 22 program. Data were compared by using paired *t*-test. $P < 0.05$ was accepted as significant.

Cite this article as: Cetinkaya S, Dadaci Z, Yener HI, Acir NO, Cetinkaya YF, Saglam F. The effect of phacoemulsification surgery on intraocular pressure and anterior segment anatomy of the patients with cataract and ocular hypertension. Indian J Ophthalmol 2015;63:743-5.

Results

Preoperative mean BCVA of the patients was 0.54 ± 0.23 (SD) (0.3–1.00), postoperatively it was 0.03 ± 0.04 (SD) (0.00–0.10) according to the logarithm of the minimum angle of resolution scores. This increase in vision was statistically significant ($P = 0.00$).

Preoperative mean IOP value was 24.67 ± 2.14 (SD) (21–29) mmHg, the decrease in IOP values of the 1st week, 1st month, 3rd month, 6th month, and 1st year was statistically significant but that of the 2nd year was not significant. Preoperative mean ACD value was 2.98 ± 0.33 (SD) (2.4–3.6) mm. The increase in ACD values of the 1st week, 1st month, 3rd month, 6th month, and 1st year was statistically significant, but that of the 2nd year was not significant. Preoperative mean ICA value was Grade 2.85 ± 0.75 (2–4) according to Shaffer classification. The increase in ICA values of the 1st week, 1st month, 3rd month, 6th month, and 1st year was statistically significant, but that of the 2nd year was not significant. Preoperative mean CCT value was 550.89 ± 20.07 (SD) (520–595) µm. The increase in CCT values of 1st week and 1st month was statistically significant, but those of 3rd month, 6th month, 1st year and 2nd year were not significant. Postoperatively, visual field tests were performed every 6 months from a 1st postoperative month on. No visual field defect was detected in any patient.

In Table 1 preoperative and postoperative BCVA, IOP, ACD, ICA, and CCT values are summarized. In Fig. 1, postoperative IOP changes, in Fig. 2, postoperative ACD changes, in Fig. 3, postoperative ICA changes, and in Fig. 4, postoperative CCT changes are illustrated.

Table 1: Pre- and post-operative BCVA, IOP, ACD, ICA and CCT values

	Preoperative	Postoperative 1st week	Postoperative 1st month	Postoperative 3rd month	Postoperative 6th month	Postoprative 1st year	Postoprative 2nd year
BCVA (logMAR)	0.54±0.23 (SD) (0.3-1.00)			0.03±0.04 (SD) (0.00-0.10) P=0.00			
IOP	24.67±2.14 (SD) (21-29) mmHg	21.60±1.93 (SD) (18-25) mmHg P=0.00	21.07±1.67 (SD) (19-25) mmHg P=0.00	21.32±1.88 (SD) (18-25) mmHg P=0.00	21.00±1.76 (SD) (18-24) mmHg P=0.00	23.71±1.11 (SD) (21-25) mmHg P=0.03	24.42±1.85 (SD) (21-28) mmHg P=0.07
ACD	2.98±0.33 (SD) (2.4-3.6) mm	3.27±0.34 (SD) (2.8-4) mm P=0.00	3.28±0.34 (SD) (2.9-4.1) mm P=0.00	3.26±0.29 (SD) (3-3.9) mm P=0.00	3.05±0.29 (SD) (2.5-3.6) mm P=0.01	3.02±0.32 (SD) (2.5-3.6) mm P=0.03	3.01±0.30 (SD) (2.5-3.6) mm P=0.07
ICA	2.85±0.75 (SD) (Grade 2-4)	3.46±0.50 (SD) (Grade 3-4) P=0.00	3.6±0.49 (SD) (Grade 3-4) P=0.00	3.71±0.46 (SD) (Grade 3-4) P=0.00	3.28±0.65 (SD) (Grade 2-4) P=0.001	3.28±0.76 (SD) (Grade 2-4) P=0.04	2.89±0.73 (SD) (Grade 2-4) P=0.56
CCT	550.89±20.07 (SD) (520-595) µm	629.35±20.98 (SD) (600-670) µm P=0.00	574.85±12.45 (SD) (557-599) µm P=0.00	550.64±18.76 (SD) (520-595) µm P=0.10	551.64±19.86 (SD) (520-596) µm P=0.28	550.82±19.88 (SD) (520-592) µm P=0.84	551.03±20.37 (SD) (518-592) µm P=0.87

Data are presented as mean±SD, *P* value indicates the significance between preoperative and postoperative values according to paired *t*-test. BCVA: Best corrected visual acuity, IOP: intraocular pressure, ACD: Anterior chamber depth, ICA: Iridocorneal angle, CCT: Central corneal thickness, SD: Standard deviation, logMAR: Logarithm of the minimum angle of resolution

Discussion

It is known that the cataract extraction causes IOP reduction, but the mechanism is not known completely.[2] After cataract surgery, IOP reduction is more prominent in patients with acute or chronic ACG. The more shallow anterior chamber is preoperative, the more deepening will occur postoperatively, and ICA widens more and as a result of these, mean IOP reduction occurs more.[5] Nonaka *et al*.[6] showed that in patients with primary ACG, cataract surgery resulted in the dissolution of lens volume and pupillary block and also attenuation of the anterior positioning of the ciliary process, which contributed to the postoperative widening of the angle. Huang *et al*.[7] reported that postoperative reduction in IOP was proportional to the increase in angle after cataract surgery and postoperative IOP reduction was greater in eyes with a narrower angle.

Besides, after cataract surgery, IOP reduction is prominent in eyes with pseudoexfoliative glaucoma. This is due to increase blood-aqueous barrier permeability which is impaired in PEXsyndrome and intraoperative aspiration of the pseudoexfoliative material on anterior lens capsule and trabecular meshwork leading to increased outflow.[4]

The most important parameter affecting postoperative IOP is the preoperative IOP level, meaning the higher preoperative IOP is, the more postoperative reduction is, the lower preoperative IOP is, the less postoperative reduction is.[8]

Mansberger *et al*.[9] reported that cataract surgery decreased IOP in patients with OHT over a long period of time, at least 36 months.

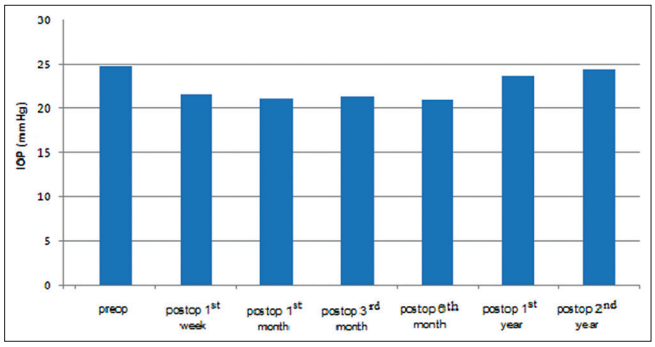

Figure 1: Postoperative intraocular pressure changes

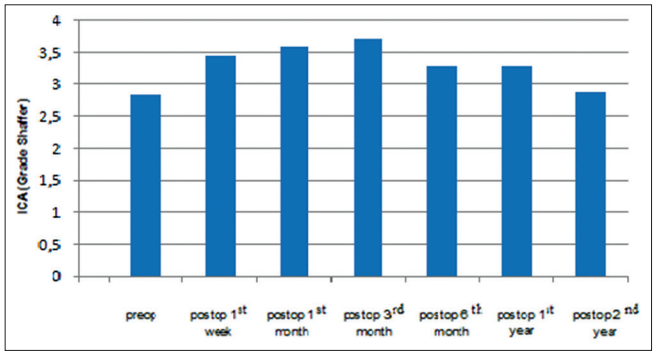

Figure 3: Postoperative iridocorneal angle changes

Chang *et al.*[10] reported that, in ocular hypertensive and glaucoma patients, uncomplicated phacoemulsification had no significant IOP-lowering effect compared with the phakic fellow eye for up to 3 years postoperatively and also there was no difference between the mean number of postoperative IOP-lowering medications used in the surgical and fellow eyes.

In our study, we observed that, in patients with cataract and OHT, after phacoemulsification, reduction in IOP and increase in both ACD and ICA were statistically significant at postoperative 1st week, 1st month, 3rd month, 6th month, and 1st year, but these changes were not significant at the end of 2nd year.

Conclusion

Phacoemulsification surgery decreases IOP and increases ACD and ICA in the short-term, but in the long-term, it does not cause any significant changes.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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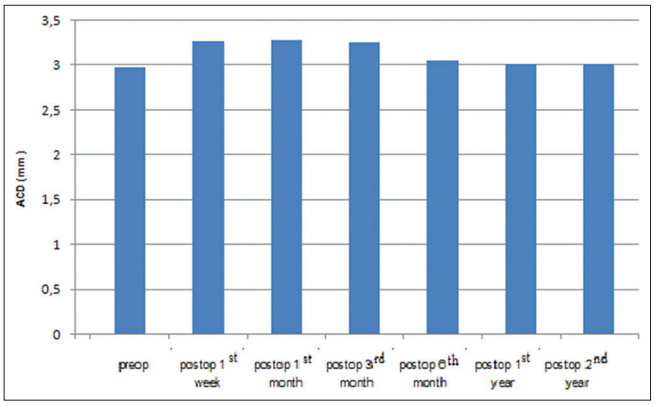

Figure 2: Postoperative anterior chamber depth changes

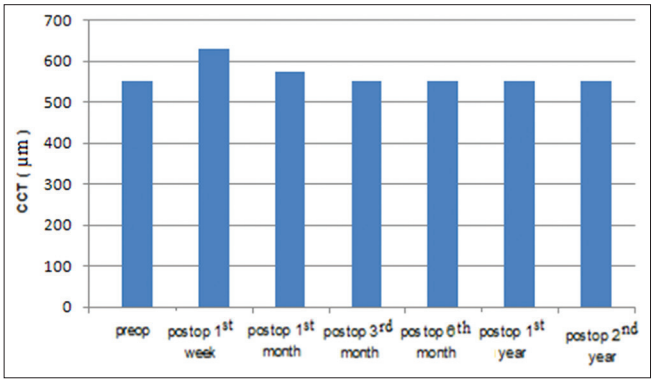

Figure 4: Postoperative central corneal thickness changes

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