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ORIGINAL RESEARCH

Evaluation of ultrasonic biomicroscopy results in anterior eye segment before and after cataract surgery

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Background: The aim of this study was to assess the value of ultrasonic biomicroscopy in reporting decreases in intraocular pressure resulting from changes in anterior chamber depth and angle after phacoemulsification and intracapsular lens implantation in patients with cataract.
Methods: This prospective interventional case series included 50 eyes of 50 consecutive subjects operated at the same center. Patients with eye disease affecting visual acuity, a history of eye surgery, corneal surface irregularities, a pupil diameter $<$ 5 mm after preoperative dilation, aged younger than 35 years, posterior capsule perforation, iris dialysis during surgery, intensive postoperative corneal edema, and inability to attend adequate follow-up were excluded. Intraocular pressure, anterior chamber depth and angle, and corneal thickness were measured before and one month after surgery.
Results: The mean preoperative intraocular pressure was 14 mmHg and postoperatively was 11 mmHg. Mean anterior chamber depth preoperatively was 2.8 mm and increased to 3.7 mm postoperatively. The mean anterior chamber angle was measured as 27° preoperatively and as 42° postoperatively.
Conclusion: After phacoemulsification and intracapsular lens implantation, ultrasonic biomicroscopy showed that the iris diaphragm had shifted backwards, widening the angle of the anterior chamber and decreasing intraocular pressure.
Keywords: anterior chamber depth, anterior chamber angle, ultrasonic biomicroscopy

Introduction

The purpose of cataract surgery is to obtain good visual acuity by extracting the opaque lens. Optimal vision can be achieved with current surgical techniques. In recent years, the technology used in cataract surgery has improved, with continuous innovations such that smaller surgical incisions are possible, resulting in better visual and refractive outcomes. In addition, intraoperative and postoperative complications have decreased.[1] Smaller incisions have avoided a number of potential problems, including postoperative intraocular inflammation, wound complications, and surgery-related astigmatism, and have shortened the durations of surgery and postoperative rehabilitation. Phacoemulsification has been used routinely for cataract surgery in millions of people throughout the world for many years, and has had a significant socioeconomic impact in terms of postoperative rehabilitation.[2]

Parallel developments have occurred in surgical techniques and in diagnostic technology, including the advent of pachymetry and ultrasonic biomicroscopy. A pachymeter is used to measure corneal thickness, and the newer generation devices can also provide more accurate intraocular pressure values than those measured by

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applanation tonometry. Ultrasonic biomicroscopy is an examination method that allows ultrasonic examination of the anterior segment and provides both visual and numerical parameters. In this prospective interventional case series, we evaluated the ability of ultrasonic biomicroscopy to confirm decreased intraocular pressure as a result of anatomical changes in the anterior segment after phacoemulsification.

Materials and methods

This prospective interventional case series included 50 eyes from 50 consecutive subjects diagnosed with senile cataract from May 2008 to April 2009. All the patients gave their informed consent for the surgical procedure. The ethics committee of Adana Numune Training and Research Hospital deemed that approval was not required for this study. The tenets of the Declaration of Helsinki were followed.

All patients underwent detailed ophthalmologic examinations preoperatively and one month following surgery, including best-corrected visual acuity with Snellen charts, biomicroscopy, funduscopy, and intraocular pressure measurements using a pachymeter and Goldmann tonometer. Corrected intraocular pressure were measured by a blinded observer using a PacScan™ 300P pachymeter (Sonomed Inc, Lake Success, NY), and the mean of three separate measurements was recorded.

The anterior chamber depth and iridocorneal angle were measured using a high-definition ultrasonic biomicroscope (Optikon 2000, Rome, Italy). In normal eyes, anterior segment structures including the angle, iris, ciliary body, zonular fibers, and posterior chamber can be visualized with ultrasonic biomicroscopy. The locations of the corneoscleral junction and scleral spur must be identified, and these landmarks are the reference points for angle measurement.[3]

All measurements were done under topical anesthesia and complied with the following protocol:

- Patient in the supine position
- Without use of lid speculum
- An eye cup filled with water was used as the acoustic path
- Use of a 35 MHz probe
- Use of antibiotic eye drops after the procedure.

All the patients underwent phacoemulsification and intracapsular lens implantation at the Department of Ophthalmology, Adana Numune Training and Research Hospital. Capsulorhexis was performed and an intracapsular hydrophilic acrylic intraocular lens was implanted in all cases. All operations were performed by the same surgeon. The intraocular lenses selected were foldable, hydrophilic, acrylic, and monobloc units. The optical diameter was 6 mm, the haptic diameter was 12.5 mm, and the A constant was 118.0. Intraocular pressure, anterior chamber depth and angle, and corneal thickness were measured before and one month after surgery. The Statistical Package for the Social Sciences (SPSS Inc, Chicago, IL) was used for statistical analysis of the data.

Results

A total of 50 eyes from 50 patients (21 women, 29 men) of mean age 63.48 ± 10.8 (range 46–82) years were included in the study. Twenty-four (48%) patients had nuclear cataract, nine (18%) had nuclear and posterior subcapsular cataract, seven (14%) had corticonuclear cataract, and ten (20%) had posterior subcapsular cataract (Table 1). Twenty-nine patients had right eye involvement and 21 had left eye involvement (Table 2).

Mean preoperative intraocular pressure was 14 mmHg and one month postoperatively was 11 mmHg, indicating a 24% decrease in the month following surgery, which was statistically significant ($P < 0.001$, Table 3).

The mean anterior chamber depth preoperatively was 2.8 mm, which increased to 3.7 mm one month postoperatively, representing an increase of 31% (Figure 1) which was statistically significant ($P < 0.001$, Table 3). The mean preoperative anterior chamber angle was 27°, and increased to 42° one month postoperatively, representing an increase of 47% (Figure 1) which was statistically significant ($P < 0.001$, Table 3).

The mean angle-opening distance 250 μm from the scleral spur (AOD250) was 208 ± 109 μm and the mean angle-opening distance 500 μm from the scleral spur (AOD500) was 347 ± 181 μm. The AOD250 and AOD500 were increased in all four quadrants. The mean preoperative corneal thickness was 534 μm, which increased to 546 μm one month postoperatively, representing an increase of 2%, which was statistically significant ($P < 0.001$, Table 3).

Discussion

Phacoemulsification is now considered the standard of care in cataract surgery. Closed systems are used in phacoemulsification, enabling more controlled surgery.

Table 1 Distribution of cataract type

Cataract type	Patients (n)	Percentage
Nuclear	24	48
Nuclear and posterior subcapsular	9	18
Corticonuclear	7	14
Posterior subcapsular	10	20
Total	50	100

Table 2 Demographic data

	Patients (n)	Percentage
Eye		
Right	29	58
Left	21	42
Gender		
Female	21	42
Male	29	58

In this way, intraocular compartments remain stable during surgery and risks such as expulsive hemorrhage, cystoid macular edema, retinal detachment, posterior vitreous detachment, iris prolapse, and hyphema are minimized. Tissue trauma, edema, and inflammation are also minimal, so that patients can return to their daily physical activities early in the postoperative period.

The anterior chamber depth has been reported to increase on average by 850 μm postoperatively.[4] The reason for this is that the iris diaphragm had shifted backwards from the inner surface of the cornea, widening the angle of the anterior chamber.[5] Six parameters significantly affect postoperative anterior chamber depth, axial length, preoperative anterior chamber depth, keratometric values, lens thickness, refraction, and patient age. The effect of patient age is the weakest.[6]

Anterior chamber depth, sulcus size, and corneal thickness were measured by ultrasonic biomicroscopy. There was no statistically significant difference between anterior chamber depth measurements recorded by normal ultrasound and by ultrasonic biomicroscopy. Limbal measurements alone are insufficient for estimation of sulcus depth, which has a significant and negative correlation with corneal power. When sulcus measurements are done using ultrasonic biomicroscopy, the standard error is 0.4 mm.[7]

Using ultrasonic biomicroscopy, anterior chamber depth values recorded have been reported to be 0.087 mm less than those recorded by the Orbscan® IIz. A mean preoperative anterior chamber depth of 2.82 ± 0.46 measured by the Orbscan device becomes 2.91 ± 0.43 when measured by ultrasonic biomicroscopy. This difference is statistically significant but not clinically significant. Refractive error also affects measurement of anterior chamber depth.[8]

In our study, the mean preoperative angle of the anterior chamber was 29° and increased to 42° in the first month postoperatively, representing an increase of 47%. Anterior chamber angle is known to increase by about 10° postoperatively, which is very important in pigment dispersion syndrome, pigmentary glaucoma, and angle closure glaucoma.[9] Our changes in postoperative anterior chamber depth and angle were statistically significant, and are believed to be due to backwards displacement of the iris diaphragm after lens extraction.

The mean angle-opening distance 250 μm from the scleral spur (AOD250) was 208 ± 109 μm and the mean angle-opening distance 500 μm from the scleral spur (AOD500) was 347 ± 181 μm. The AOD250 and AOD500 were increased in all four quadrants. In some studies, the contact distance between the iris and the intraocular lens has been shown to decrease significantly in the postoperative period, and manifests clinically as a decrease in intraocular pressure.[9] In our study, intraocular pressure decreased by 24% postoperatively, but we did not measure the postoperative distance between the iris and the intraocular lens. The decrease in intraocular pressure was statistically significant.

In conclusion, there are positional changes in anterior segment structures after cataract surgery. Phacoemulsification is now the standard method used for cataract surgery. Anatomical changes are more pronounced after phacoemulsification surgery because it is a closed system and allows more controlled surgery. Quantitative changes in anterior chamber depth and angle was determined by ultrasonic biomicroscopy,

Table 3 Statistical analysis of changes in study parameters following cataract surgery

Patients (n = 50)	Parameters	Minimum	Maximum	Mean	Standard deviation	*t*	*P*
Preoperative	Corrected IOP (mmHg)	10	25	14.04	3.16	8.29	<0.001
	Anterior chamber depth (mm)	1.45	3.75	2.82	0.45	–13.76	<0.001
	Anterior chamber angle (degrees)	14.36	50.71	28.66	7.12	–12.77	<0.001
	Corneal thickness (μm)	445	615	533.80	36.87	–4.72	<0.001
Postoperative first month	Corrected IOP (mmHg)	6	18	10.74	3.18		
	Anterior chamber depth (mm)	2.37	4.30	3.68	0.46		
	Anterior chamber angle (degrees)	31.93	53.09	42.27	4.72		
	Corneal thickness (μm)	460	661	546.10	44.01		

Abbreviation: IOP, intraocular pressure.

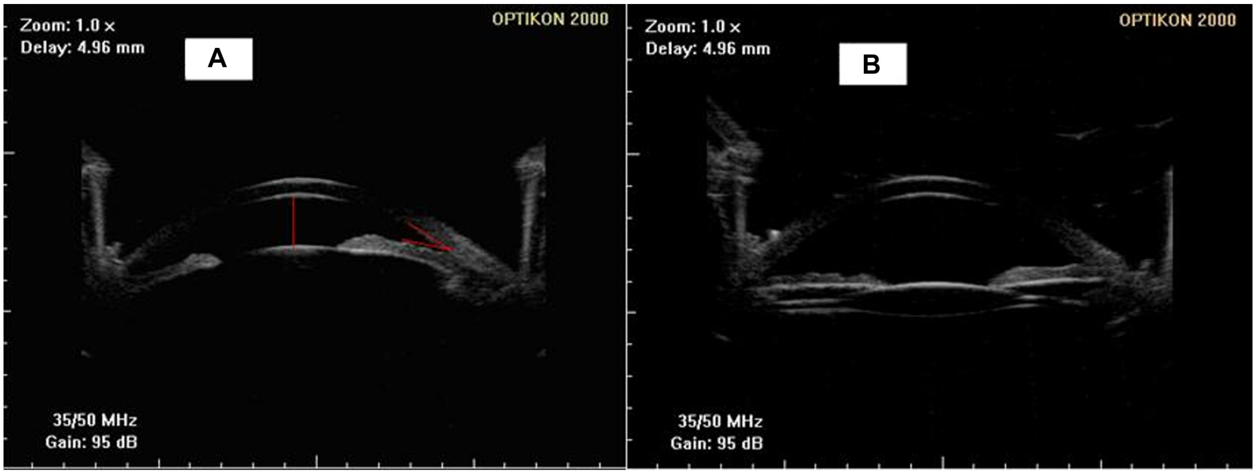

Figure 1 Ultrasonic biomicroscopic images for the same eye before (**A**) and one month after surgery (**B**) showing increased anterior chamber depth and an enlarged iridocorneal angle.

and the corneal thickness factor in assessment of changes in intraocular pressure was eliminated by pachymetry. In our study of noncomplicated phacoemulsification and intracapsular lens implantation, the mean anterior chamber angle increased by approximately 15° and intraocular pressure decreased by an average of 3 mmHg. After phacoemulsification and intracapsular lens implantation, ultrasonic biomicroscopy showed that the iris diaphragm had shifted backwards, widening the angle of the anterior chamber and decreasing intraocular pressure.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Weikert MP. Update on bimanual microincision cataract surgery. *Curr Opin Ophthalmol*. 2006;17:62–67.
2. Alio J, Rodriguez-Prats JL, Galal A, Ramzy M. Outcomes of microincision cataract surgery versus coaxial phacoemulsification. *Ophthalmology*. 2005;112:1997–2003.
3. Pavlin CJ, Harasiewicz K, Foster FS. Ultrasound biomicroscopy of anterior segment structures in normal and glaucomatous eyes. *Am J Ophthalmol*. 1992;113:381–389.
4. Liebmann JM, Ritch R. Ultrasound biomicroscopy of the anterior segment. *J Am Optom Assoc*. 1996;67:469–479.
5. Kurimoto Y, Park M, Sakaue H, Kondo T. Changes in the anterior chamber configuration after small-incision cataract surgery with posterior chamber intraocular lens implantation. *Am J Ophthalmol*. 1997;124:775–780.
6. Olsen T. Prediction of the effective postoperative (intraocular lens) anterior chamber depth. *J Cataract Refract Surg*. 2006;32:419–424.
7. Pop M, Payette Y, Mansour M. Predicting sulcus size using ocular measurements. *J Cataract Refract Surg*. 2001;27:1033–1038.
8. Lee JY, Kim JH, Kim HM, Song JS. Comparison of anterior chamber depth measurement between Orbscan IIz and ultrasound biomicroscopy. *J Refract Surg*. 2007;23:487–491.
9. Pereira FA, Cronemberger S. Ultrasound biomicroscopic study of anterior segment changes after phacoemulsification and foldable intraocular lens implantation. *Ophthalmology*. 2003;110:1799–1806.