**Glaucoma**

**Lens Position Parameters as Predictors of Intraocular Pressure Reduction After Cataract Surgery in Glaucomatous Versus Nonglaucomatous Eyes**

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Submitted: February 18, 2016
Accepted: April 4, 2016
Citation: Coh P, Moghimi S, Chen RI, et al. Lens position parameters as predictors of intraocular pressure reduction after cataract surgery in glaucomatous versus nonglaucomatous eyes. Invest Ophthalmol Vis Sci. 2016;57:2593–2599. DOI:10.1167/iovs.16-19384

**PURPOSE.** To evaluate the relationship between lens position parameters and intraocular pressure (IOP) reduction after cataract surgery in patients with primary open-angle glaucoma (POAG) and in nonglaucomatous patients.

**METHODS.** The main outcomes of this prospective study were percent and absolute IOP change, which were calculated using the preoperative IOP and the IOP 4 months after cataract surgery in POAG and nonglaucomatous eyes. Lens position (LP), defined as anterior chamber depth (ACD) + one-half lens thickness (LT), was assessed preoperatively using parameters from optical biometry. Preoperative IOP, axial length (AL), ACD, LT, relative lens position (RLP), and the ratio of preoperative IOP to ACD (PD ratio) were also evaluated as potential predictors of IOP change.

**RESULTS.** Four months postoperatively, the average IOP reduction was 2.80 ± 3.83 mm Hg (15.79%) from the preoperative mean of 14.73 ± 2.89 mm Hg for nonglaucomatous eyes. The average IOP reduction was 2.66 ± 2.07 mm Hg (16.98%) from the preoperative mean of 14.86 ± 2.97 mm Hg for POAG eyes. Preoperative IOP, sex, AL, ACD, PD ratio, and LP predicted IOP change in nonglaucomatous eyes. Preoperative IOP and PD ratio predicted IOP change in POAG eyes.

**CONCLUSIONS.** Intraocular pressure reduction after phacoemulsification cataract surgery in nonglaucomatous eyes is significantly greater in more anteriorly positioned lenses. Though it did not reach statistical significance in patients with glaucoma, the association of LP with IOP reduction is in the same direction as in nonglaucomatous patients where smaller LP appears to predict greater IOP reduction. Lens position is a simple, easily calculable, accurate, and widely available parameter, which clinicians can potentially utilize in managing glaucoma.

Keywords: lens position, intraocular pressure, pressure reduction, predictors, biometry

**Glaucoma** is the second leading cause of blindness worldwide. It is also the leading cause of global irreversible blindness. Clinical care of glaucoma involves managing a healthy level of intraocular pressure (IOP) through use of medications or surgery. Numerous studies have found that cataract surgery is effective at lowering IOP for the majority of patients. The exact mechanism of this is still not fully understood.

Several predictors have been identified with lowering pressure. Preoperative IOP has been found to be a significant predictor of IOP reduction after cataract surgery. In fact, patients with higher levels of preoperative IOP obtain greater averages of postoperative IOP reduction. Another predictor is the shallowness of the anterior chamber depth (ACD). Pressure-to-depth ratio (PD ratio) was also identified as a novel index for predicting the degree of IOP reduction based on the ratio of the preoperative IOP and ACD. Furthermore, our previous studies have also identified angle opening distance (AOD) and preoperative lens vault (LV) to be associated with IOP reduction in nonglaucomatous eyes.

In our previous study of nonglaucomatous eyes, lens position (LP) was found to be an effective predictor of IOP reduction. Lens position is defined as the sum of ACD and one-half lens thickness (LT). Relative lens position (RLP) is defined as LP divided by axial length (AL). The roles of LP and RLP in predicting eye pressure reduction have not been fully explored in subjects with primary open-angle glaucoma (POAG). To our knowledge, there have been no prospective studies showing an association between LP, RLP, and IOP reduction in POAG patients. The aim of this study was to determine if LP, RLP, and IOP are related in POAG patients and to compare these findings with those from normal control patients.
METHODS

Institutional review board approval for this prospective study was obtained from the University of California–San Francisco (UCSF) Committee on Human Research (CHR). The study followed the tenets of the Declaration of Helsinki. Patients were enrolled from the glaucoma service at UCSF from September 16, 2011 to November 30, 2015. Written informed consent was obtained prior to participation.

The study’s inclusion criteria for the POAG group included age ≥ 18 years; visually significant cataracts; uncomplicated cataract surgeries without adjunctive procedures (e.g., pupil stretching, use of iris hooks or Malyugin rings); and patients in whom POAG had been determined. Glaucoma in POAG patients had been determined if there was use of glaucoma medications plus one of the following scenarios: (1) visual field loss consistent with glaucoma and cup-to-disc ratio ≥ 0.7 or (2) cup-to-disc ratio ≥ 0.9 if the patient was unable to perform visual field examination in the affected eye.

The exclusion criteria for the POAG group consisted of (1) intraoperative or postoperative complications related to the cataract surgery (e.g., posterior capsule rupture, vitreous loss); (2) history of trabeculectomy or other intraocular glaucoma surgeries; (3) occludable angles with a Shaffer classification grade of 0 or 1 in at least two quadrants; (4) peripheral anterior synechiae (PAS); (5) uveitis, severe retinal diseases, or congenital abnormalities; (6) history of ocular trauma; (7) history of intraocular surgery; and (8) pseudoxefoiliation or pigment dispersion. Eyes with history of laser peripheral iridotomy (LPI) or selective laser trabeculoplasty (SLT) were not excluded. Both eyes of a patient were included in the study if they met the criteria.

Inclusion criteria for nonglaucomatous (“control”) patients included age ≥ 18 years; visually significant cataracts; and uncomplicated cataract surgeries without adjunctive procedures. The exclusion criteria included major intraoperative or postoperative complications resulting from cataract surgery; glaucomatous optic neuropathy shown by optic disc cupping or glaucomatous visual field loss; preoperative IOP over 25 mm Hg; the use of glaucoma medications; occludable angles; PAS; uveitis, severe retinal diseases, or congenital abnormalities; history of ocular trauma; history of intraocular surgery; and pseudoxefoiliation or pigment dispersion.

The preoperative evaluation, which occurred 1 to 3 weeks before surgery, included complete slit-lamp and fundus examination, ocular biometry measurements, visual acuity testing, gonioscopy, and IOP determination. Intraocular pressure was measured using Goldmann applanation tonometry by the same observer (SCL) in a masked fashion. Two values were obtained, and the mean value was used for analysis. A third value was obtained, and the median value was chosen if the two values differed by more than two points. Gonioscopy was performed using a Zeiss-style 4-mirror gonioscope (Model G-4; Volk Optical, Mentor, OH, USA) by the same glaucoma specialist (SCL). Angles were graded in all four quadrants (superior, nasal, temporal, and inferior) based on the Shaffer method. Ocular biometry was obtained with the LENSTAR LS 900 (Haag-Streit, Inc., Koeniz, Switzerland) to measure AL, ACD, LT, and central corneal thickness (CCT).

Surgical Technique

All operations were performed by the same surgeon (SCL). Conventional surgical procedures were used in all subjects under topical or sub-Tenons anesthesia. Phacoemulsification was performed via a 2.8-mm temporal clear corneal incision, with in-the-bag one-piece acrylic intraocular lens implantation (models AcrySof SA60AT or AcrySof IQ SN60WF; Alcon Laboratories, Inc., Fort Worth, TX, USA).

Patients were prescribed topical antibiotics, 0.5% ketorolac tromethamine, and topical 1% prednisolone acetate and tapered over 1 month. Postoperative follow-up visits were performed at 1 day, 10 days, 1 month, and 4 months after surgery. During each visit, visual acuity testing, IOP measurement, and complete slit-lamp examination were performed. Best-corrected visual acuity and dilated fundus examination were also conducted at selected visits.

Statistical Analysis

We characterized the study population by calculating mean and standard deviation for continuous data and summary percentages for categorical data for the control and POAG groups. We compared any potential differences between the groups using the Student’s t-test for continuous variables and the χ² test for categorical variables.

Within each group, we used linear mixed effects regression to assess the relationship of preoperative IOP, age, sex, and other ocular parameters with percent and absolute IOP change, in both univariate analysis and multivariate analysis adjusting for the effects of preoperative IOP age, and sex. The use of mixed models adjusts for the use of both eyes in some subjects.

Multivariate linear mixed effects regression was also used to assess any interaction of glaucoma diagnosis with the associations between ocular parameters (AL, ACD, LT, LP, RLP, PD ratio) and IOP change (i.e., whether the difference in correlation coefficients significantly varied between the control and POAG groups). These mixed models adjusted for preoperative IOP, age, sex, and glaucoma diagnosis. In all models assessing PD ratio and IOP change, preoperative IOP was not included because it is part of the calculation of PD ratio.

P values less than 0.05 were considered to be significant. All statistical analyses were conducted using R statistical software, version 3.1 for Macintosh (R Foundation for Statistical Computing, Vienna, Austria).

Based on the standard deviation of the IOP change, which was 2.42 mm Hg in the study by Hsu et al., we cite this study as a rough guide to statistical power. We note that a sample size of 64 eyes in each of the two groups would provide approximately 80% power to detect an effect size of 1.21 mm Hg, that is, half the standard deviation observed.

RESULTS

The study sample included 97 eyes of 73 nonglaucomatous patients and 76 eyes of 57 POAG patients. The mean age of the control and POAG groups was 62% female compared to 61% of the POAG group. For the control group, the mean IOP was 14.73 ± 2.89 mm Hg at the preoperative visit and 11.93 ± 2.07 mm Hg at 4 months postoperatively, representing a 2.80 ± 3.83 mm Hg (15.79%) reduction. For the POAG group, the mean IOP was 14.86 ± 3.83 mm Hg at the preoperative visit and 12.19 ± 2.41 mm Hg at 4 months postoperatively, representing a 2.65 mm Hg (15.79%) reduction (Table 1).

Preoperative IOP, sex, AL, ACD, LT, and PD ratio were significant predictors of both percent and absolute IOP change for the control group. Age, LT, and RLP were not associated with IOP reduction. In the POAG group, preoperative IOP and PD ratio were significant predictors of both percent and absolute IOP change. Age, sex, AL, ACD, LT, LP, and RLP were
not associated with IOP reduction ($P > 0.05$) in the POAG group. Tables 2 and 3 show the regression coefficients, standard errors, and $P$ values describing the associations of predictors with percent and absolute IOP change in the control and POAG groups. The Figure shows the association between LP and percent IOP change for the control and POAG groups.

The correlation coefficients describing the association of AL, ACD, LP, and PD ratio with IOP change after phacoemulsification were different between the POAG and control groups. The Figure shows the association between predictors with percent and absolute IOP change in the control and POAG groups. The Table shows the regression coefficients, standard errors, and $P$ values of these relationships.

## DISCUSSION

Our prospective study shows that after phacoemulsification cataract surgery with intraocular lens implantation, IOP decreased by 2.80 mm Hg (15.79%) in nonglaucomatous eyes and 2.66 mm Hg (16.98%) in eyes with controlled POAG. Preoperative IOP was a significant predictor of IOP reduction in both groups. Lens position was associated with IOP reduction in nonglaucomatous eyes but not POAG eyes. Though it did not reach statistical significance, the association of LP with IOP reduction is in the same direction as in nonglaucomatous patients, where smaller LP appears to predict greater IOP reduction.

## TABLE 1. Demographic and Clinical Characteristics of the Sample Population

| Variable                  | Normal Group | POAG Group | $P$ Value |
|---------------------------|--------------|------------|-----------|
| No. of patients, eyes     | 73, 97       | 57, 76     |           |
| Age, y, mean ± SD         | 76.05 ± 8.90 | 77.62 ± 7.41 | 0.207     |
| Sex, F/M                  | 61/36        | 46/30      | 0.751     |
| Pre-op IOP, mean ± SD     | 14.73 ± 2.89 | 14.86 ± 2.97 | 0.779     |
| AL, mean ± SD             | 23.68 ± 1.30 | 24.37 ± 1.43 | 0.001     |
| CCT, mean ± SD            | 547.02 ± 38.06 | 529.84 ± 30.52 | 0.002     |
| ACD, mean ± SD            | 2.96 ± 0.46  | 3.05 ± 0.34 | 0.176     |
| LT, mean ± SD             | 4.71 ± 0.47  | 4.68 ± 0.38 | 0.679     |
| PD ratio, mean ± SD       | 5.11 ± 1.36  | 4.94 ± 1.18 | 0.396     |
| LP, mean ± SD             | 5.52 ± 0.31  | 5.39 ± 0.27 | 0.119     |
| RLP, mean ± SD            | 0.22 ± 0.01  | 0.22 ± 0.01 | 0.092     |
| Post-op IOP at 4 m, mean ± SD | 11.93 ± 2.65 | 12.19 ± 2.41 | 0.510     |
| Absolute IOP change, mean ± SD | −2.80 ± 3.83 | −2.66 ± 2.07 | 0.787     |
| % IOP change, mean ± SD   | −15.79 ± 25.03 | −16.98 ± 12.44 | 0.706     |

## TABLE 2. Association of Various Predictors of IOP Change Among Nonglaucomatous and Glaucomatous Subjects (Using % IOP Change as the Dependent Variable)

|      | Univariate | Multivariate | Univariate | Multivariate | Univariate | Multivariate |
|------|------------|--------------|------------|--------------|------------|--------------|
|      | $B$ (SE)   | $P$ Value    | $B$ (SE)   | $P$ Value    | $B$ (SE)   | $P$ Value    |
| Pre-op IOP | −5.72 (0.69) | <0.001       | −1.78 (0.46) | <0.001       |           |              |
| Age   | −0.17 (0.32) | 0.600        | −0.21 (0.21) | 0.529        | 1.85 (3.16) | 0.561        |
| Sex   | 16.18 (5.44) | 0.004        | 1.85 (3.16) | 0.561        | 0.87 (1.07) | 0.414        |
| ACD   | 24.23 (5.50) | <0.001       | 9.13 (1.22) | <0.001       | 8.47 (5.38) | 0.121        |
| LT    | −9.92 (5.54) | 0.080        | 18.78 (4.41) | <0.001       | 3.22 (4.47) | 0.248        |
| LP    | 39.52 (7.91) | <0.001       | −6.95 (4.31) | 0.111        | 31.79 (119.92) | 0.792 |
| RLP   | 81.82 (244.91) | 0.759       | −107.185 (173.87) | <0.001       | 7.39 (7.41) | 0.664        |
| PD ratio | −12.97 (1.42) | <0.001       | −12.52 (1.45) | <0.001       | −4.54 (1.16) | <0.001       |

Univariate mixed models correct for the use of both eyes in some subjects. For all parameters except PD ratio, multivariate mixed models adjust for the effects of preoperative IOP, age, sex, and the use of both eyes in some subjects. Multivariate mixed models for PD ratio adjust for the effects of age, sex, and the use of both eyes in some subjects. $B$, regression coefficient.
tous eyes, without significant difference between the groups. Similarly to these studies, we included controlled glaucoma patients and found no significant difference in IOP reduction between nonglaucomatous and glaucomatous patients.

In these aforementioned studies, use of glaucoma medications was often changed as a result of cataract surgery. For example, Shingleton et al. observed that glaucoma patients showed a statistically significant reduction in the number of glaucoma medications postoperatively. In other studies, the number of medications is not specified. Unique to our study is the consistent use of the same type and number of medications preoperatively and postoperatively. The use of the same medications was a deliberate effort to elucidate the amount of IOP change due to surgery alone.

The reasons behind why or how IOP is reduced after cataract extraction are not yet fully understood. However, theories have been proposed. Hypothetically, cataract surgery results in deepening of the ACD and widening of the anterior chamber angle (ACA). It would be expected that access of aqueous to the filtering portion of the trabecular meshwork would be improved due to widening of the drainage angle, representing one mechanism for IOP lowering. Changes in angle configuration after cataract surgery have been studied using either Scheimpflug or ultrasound biomicroscopic images.

### TABLE 3. Association of Various Predictors of IOP Change Among Nonglaucomatous and Glaucomatous Subjects (Using Absolute IOP Change as the Dependent Variable)

| Predictor | No Glaucoma Univariate | Glaucoma Univariate | No Glaucoma Multivariate | Glaucoma Multivariate |
|-----------|------------------------|---------------------|--------------------------|-----------------------|
|           | $B$ (SE) | $P$ Value | $B$ (SE) | $P$ Value | $B$ (SE) | $P$ Value | $B$ (SE) | $P$ Value |
| Pre-op IOP | $-0.94$ (0.10) | $< 0.001$ | $-0.44$ (0.07) | $< 0.001$ |
| Age       | $-0.02$ (0.05) | 0.639 | $-0.04$ (0.03) | 0.270 |
| Sex       | $2.47$ (0.84) | 0.004 | $0.57$ (0.52) | 0.280 |
| AL        | $1.52$ (0.30) | $< 0.001$ | $1.32$ (0.15) | $< 0.001$ |
| ACD       | $3.38$ (0.86) | $< 0.001$ | $2.51$ (0.61) | $< 0.001$ |
| LT        | $-1.43$ (0.85) | 0.10 | $-1.08$ (0.60) | 0.07 |
| LP        | $5.43$ (1.25) | $< 0.001$ | $5.71$ (0.88) | $< 0.001$ |
| RLP       | $4.78$ (37.25) | 0.898 | $-29.01$ (23.48) | 0.220 |
| PD ratio  | $-2.13$ (0.20) | $< 0.001$ | $-2.08$ (0.20) | $< 0.001$ |

Univariate mixed models correct for the use of both eyes in some subjects. For all parameters except PD ratio, multivariate mixed models adjust for the effects of preoperative IOP, age, sex, and the use of both eyes in some subjects. Multivariate mixed models for PD ratio adjust for the effects of age, sex, and the use of both eyes in some subjects. $B$, regression coefficient.

### FIGURE. Relationship between LP and % IOP change in nonglaucomatous and glaucomatous subjects. LP is positively correlated with percent IOP change among the control group. There is a statistically significant difference between the correlation coefficients of the control and POMG groups.
IOP as a result, was demonstrated by Wang et al. Mathalone pathway, which facilitates aqueous outflow and reduction in trabecular meshwork and the lumen of Schlemm’s canal. and increase in aqueous outflow by expansion of the Issa et al. also demonstrated that IOP reduction is positively ship with postoperative IOP reduction in normal eyes, while Morigh et al. did not find a significant relationship between AL and IOP reduction in nonglaucomatous eyes.

The role of LT as a predictor of IOP reduction remains unclear. Some studies did not find any significant relationship, while other studies show a significant relationship between LT and IOP reduction. Yang et al. reported that LT was an effective predictor of IOP drop among non-glaucomatous patients in both univariate and multivariate analysis (P < 0.05). In the present study, LT was not significantly associated with IOP lowering in either control or POAG eyes.

In our previous study, we found that LP was a clinically accessible parameter with considerable predictive value for postoperative IOP change in nonglaucomatous patients with open angles. In the present study, we also found that LP is a significant predictor of IOP reduction in nonglaucomatous eyes. In the POAG group, there is a trend toward the same finding; however, a statistically significant relationship was not found. Relative lens position was not found to be a significant predictor of IOP reduction in both normal and POAG eyes. Future studies with a larger POAG sample and perhaps longer follow-up are needed to further evaluate these relationships.

In the present study, AL was associated with postoperative IOP change in control eyes but not POAG eyes. Hsu et al. and Bilak et al. found similar results for nonglaucomatous eyes, while Morigi et al. did not find a significant relationship between AL and IOP reduction in nonglaucomatous eyes.

### Table 4. Comparison of Predictors of IOP Change in Relationship to Glaucoma Diagnosis (Using % IOP Change as the Dependent Variable; the Correlation Coefficients Describing the Relationships Between AL, ACD, LP, and PD Ratio With Percent IOP Change Differ Significantly Between the Control and POAG Groups)

| Interaction With Glaucoma Diagnosis | B (SE) | P Value |
|-------------------------------------|--------|---------|
| AL                                  | -10.16 (1.75) | <0.001 |
| ACD                                 | -17.63 (6.78) | 0.010 |
| LT                                  | 6.54 (6.47) | 0.329 |
| LP                                  | -29.38 (8.68) | 0.001 |
| RLP                                 | 101.65 (232.21) | 0.662 |
| PD ratio                            | 8.12 (1.91) | <0.001 |

For all parameters except PD ratio, multivariate mixed models adjust for the effects of preoperative IOP, age, glaucoma diagnosis and the use of both eyes in some subjects. Multivariate mixed models for PD ratio adjust for the effects of age, sex, and the use of both eyes in some subjects. B, regression coefficient.

Hayashi et al. demonstrated by Scheimpflug imaging that the width and depth of the ACA of angle-closure and open-angle glaucoma increase significantly after cataract extraction and IOL implantation.

In addition, there are other proposed contributory factors that may account for IOP lowering, such as ultrasound activation of cytokines, endogenous prostaglandin F2 release, and increase in aqueous outflow by expansion of the trabecular meshwork and the lumen of Schlemm’s canal. Phacoemulsification ultrasound activation of the interleukin 1α/nuclear factor-κB/endothelial leukocyte adhesion molecule 1 pathway, which facilitates aqueous outflow and reduction in IOP as a result, was demonstrated by Wang et al. Mathalone et al. suggested that endogenous prostaglandin F2 released postoperatively may enhance uveoscleral outflow. Shrinking of the lens capsule postoperatively can result in increased posterior traction on the scleral spur, expanding the trabecular meshwork and the lumen of Schlemm’s canal.

Preoperative IOP as a predictor of postoperative IOP reduction has been well documented, and such is the case in the present study in both nonglaucomatous and glaucomatous eyes. This was also true in our recent study with nonglaucomatous eyes, and in other studies involving nonglaucomatous eyes, as well as eyes with POAG, while other studies show a significant relationship between LT and IOP reduction. Yang et al. reported that LT was an effective predictor of IOP drop among non-glaucomatous patients in both univariate and multivariate analysis (P < 0.05). In the present study, LT was not significantly associated with IOP lowering in either control or POAG eyes.

In our previous study, we found that LP was a clinically accessible parameter with considerable predictive value for postoperative IOP change in nonglaucomatous patients with open angles. In the present study, we also found that LP is a significant predictor of IOP reduction in nonglaucomatous eyes. In the POAG group, there is a trend toward the same finding; however, a statistically significant relationship was not found. Relative lens position was not found to be a significant predictor of IOP reduction in both normal and POAG eyes. Future studies with a larger POAG sample and perhaps longer follow-up are needed to further evaluate these relationships.

The parameters LP and RLP were originally introduced to address the effect of the lens on the anterior chamber. However, there are conflicting reports regarding the clinical relevance of LP and RLP in part because LT and ACD, which are the two constituents of these parameters, are interdependent.

Lens position may still serve as a useful predictor of IOP reduction and may be potentially utilized as part of glaucoma management because of its several advantages. Lens position appears to show great predictive value regarding IOP reduction. Lens position is a convenient and simple parameter to calculate and obtain since ocular biometry measurements are required before any cataract surgery for IOL power calculation. In contrast, other predictors such as AOD, ACA, and LV require anterior segment optical coherence tomography (AS-OCT) scanning, which may not be available at all facilities. Lastly, ACD and LT, which are used to compute LP, are reliable and accurate parameters. The diurnal fluctuation in IOP has been well described, making the preoperative IOP and PD ratio more variable.

### Table 5. Comparison of Predictors of IOP Change in Relationship to Glaucoma Diagnosis (Using Absolute IOP Change as the Dependent Variable; the Correlation Coefficients Describing the Relationships of AL, ACD, LP, and PD Ratio With Absolute IOP Change Differ Significantly Between the Control and POAG Groups)

| Interaction With Glaucoma Diagnosis | B (SE) | P Value |
|-------------------------------------|--------|---------|
| AL                                  | -1.47 (0.24) | <0.001 |
| ACD                                 | -2.19 (0.95) | 0.025 |
| LT                                  | 0.98 (0.90) | 0.281 |
| LP                                  | -3.48 (1.25) | 0.005 |
| RLP                                 | 31.59 (125.04) | 0.329 |
| PD ratio                            | 1.01 (0.27) | <0.001 |

For all parameters except PD ratio, multivariate mixed models adjust for the effects of preoperative IOP, age, glaucoma diagnosis and the use of both eyes in some subjects. Multivariate mixed models for PD ratio adjust for the effects of age, sex, and the use of both eyes in some subjects. B, regression coefficient.
How LP serves as a predictor of IOP reduction is not yet known, but a possible explanation may be that an anteriorly positioned lens may result in “partial pupillary block.” According to the iris–lens canal theory, the posterior chamber–anterior chamber pressure gradient is inversely proportional to the height of the iris–lens canal. When the lens is more anteriorly positioned and the height of the iris–lens canal is decreased, the higher pressure gradient will cause a situation similar to pupillary block. Such a partial blockage may be relieved with lens extraction, which could be a potential mechanism of IOP reduction after cataract surgery for eyes with open-angle configuration.

Our interpretation of why LP is associated with IOP change in the control but not the POAG group is that the use of glaucoma medications may mask the true effect of LP by suppressing IOP. The medications may have a greater effect on IOP compared to LP or angle opening.

Perhaps a more indicative parameter of postoperative IOP reduction is LV, which describes lens protrusion into the anterior chamber. It is defined as the perpendicular distance between the line joining the two scleral spurs and the anterior pole of the lens. In angle-closure glaucoma, Tan et al. showed LV to be an independent risk factor for angle-closure glaucoma, while other studies showed the opposite. Although some studies such as the one performed by Huang et al. have reported LV to be strongly associated with IOP reduction after phacoemulsification in normal eyes, others did not. However, LV is not as easily obtainable compared to LP since not all facilities have access to AS-OCT scanning.

Limitations of this study include the relatively small sample size, particularly of the POAG group. We also acknowledge that the follow-up period was only 4 months. It is possible that the IOP reductions observed after cataract surgery may change and that a longer follow-up period may be desired to ensure more stable IOP measurements after surgery. However, prior studies have found IOP reduction after cataract surgery to be typically stable and long-lasting after 4 months. Finally, patients in the POAG group had pressures that were controlled, which may have altered actual changes in IOP after surgery. Future studies implementing a medication washout period may be desired. On the other hand, one strength of our study was the fact that IOP measurements were consistently obtained during the same time of the day, typically between 1:00 and 5:00 PM.

Our study reports that the absolute and percentage of IOP reduction after phacoemulsification cataract surgery in non-glaucomatous eyes is significantly greater when the lens is more anteriorly positioned. There is a trend toward a similar effect in POAG eyes, but it is not statistically significant. Lens position is a simple, easily calculable, accurate, and widely available parameter that clinicians can potentially utilize when predicting a patient’s IOP response to phacoemulsification cataract surgery as part of glaucoma management.

Acknowledgments

Supported by Core Grant EY002162 from the National Eye Institute, That Man May See, Inc. (SCL), and Research to Prevent Blindness.

Disclosure: P. Coh, None; S. Moghimi, None; R.I. Chen, None; C.-H. Hsu, None; M. Masis Solano, None; T. Porco, None; S.C. Lin, None

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