

The Effect of Pharmacological Dilation on Calculation of Targeted and Ideal IOL Power Using Multivariable Formulas

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Abstract

Background/Aims To examine the effect of pharmacologic dilation on biometric parameters measured by the Lenstar LS 900, and whether these changes affect the power of the calculated intraocular lens (IOL) using multivariable formulas in an undilated versus pharmacologically dilated state. **Methods** Prospective study of 98 phakic eyes from 53 patients. Axial length (AL), central corneal thickness (CCT), anterior chamber depth (ACD), lens thickness (LT), and keratometry (K) readings were measured. The first set of measurements was taken prior to dilation. After dilation (pupil diameter ≥ 6.0 mm), a second set of measurements was taken. The Barrett, Olsen, Hill-RBF, Haigis, SRK/T, and Holladay I formulas were used to calculate IOL power before and after dilation. Two calculation methods were used: Method A used a commonly available IOL targeted to achieve the lowest myopic spheroequivalent residual refraction (LMP); Method B calculated ideal IOL power for emmetropia (IPE).

Results Statistically significant increases were seen in CCT ($p < 0.01$), ACD ($p < 0.01$), and AL ($p < 0.01$) whereas a statistically significant decrease was seen in LT ($p < 0.01$) post dilation. Using Method A, the percentage of eyes which would have received an IOL with 0.5 D or 1.0 D of higher power, if post-dilation measurements were used, were 25.5%, 30.6%, 20.4% and 23.5% for Barrett, Olsen, Hill-RBF and Haigis, respectively. Using Method B, only Haigis and Olsen had a statistically significant increase in ideal IOL power.

Conclusions Pharmacologic dilation can be associated with an increase in non-custom IOL dioptric power when using multivariable formulas, which may lead to a myopic surprise.

Background

Modern cataract surgery has become a combined restorative and refractive surgical procedure with increased patient expectations of visual function, which include minimizing the need for spectacles postoperatively. Cataract surgeons are increasingly motivated to satisfy these expectations by optimizing the accuracy of intraocular lens (IOL) calculations to improve post-operative refractive outcomes. Selection of IOL power relies on accurate preoperative biometry measurements. Third generation IOL calculation formulas, such as Holladay I and SRK/T, rely primarily on axial length (AL) and keratometry (K) values to predict the effective lens position (ELP). It is known that there are some limitations to these older formulas, such as a decrease in IOL calculation accuracy with ALs at the lower and higher ends of the spectrum, along with decreased accuracy in the setting of low and high average keratometry values.^{1,2}

As a result, multivariable formulas were developed to more accurately determine IOL power by taking into account other biometric variables, such as anterior chamber depth (ACD), central corneal thickness (CCT) and lens thickness (LT), to better estimate the post-surgical ELP.^{3,4} ACD is defined as the axial distance from the cornea to the epithelium of the lens. However, some studies have demonstrated that ACD increases after pharmacological dilation, raising the question of whether dilation may influence the

calculated IOL power when using these formulas.⁵⁻⁸ Specifically, the Haigis formula, which utilizes ACD values in its calculation, has been previously shown to have statistically significant differences in computed IOL power pre- and post-dilation.^{7,8}

In recent years, several multivariable formulas have become increasingly popular with cataract surgeons, including the Barrett Universal II, Olsen and Hill-RBF formulas.⁹ While each of these formulas incorporate unique variables and weigh them differently, ACD is nonetheless an important variable in estimating ELP.^{10-12,A} Given the inclusion of ACD in each of these multivariable formulas, we sought to determine if pupil dilation has an effect on calculated IOL power based on whether biometry measurements are taken in an undilated state as compared to a post-dilated state.

Methods

This study was approved by the Institutional Review Board at the University of Chicago (IRB17-0197) and followed the tenets of the Declaration of Helsinki. A written consent was obtained from each subject. The inclusion criteria for this study were the following: (1) Age 18 years or older and (2) Presence of lens opacity. The exclusion criteria were: (1) Axial length unable to be reliably measured by optical biometry; (2) Anatomically narrow angle (with risk of angle closure upon dilation); (3) Allergy to tropicamide or phenylephrine; (4) Recent soft or rigid gas permeable contact lens wear; (5) History of refractive surgery; (6) Inability to perform biometry testing; (7) pupil diameter greater than 6 mm prior to dilation.

The same investigator (NCS), under supervision of an attending cataract surgeon (KMR), performed all measurements on patients using the same optical biometry device based on optical low coherence reflectometry (OLCR) (Lenstar LS 900 (Haag-Streit Diagnostics, Switzerland)). Each subject included in the study received the first set of IOL measurements prior to pharmacological dilation. After the initial measurements, one drop each of 1% tropicamide and 2.5% phenylephrine was administered for dilation. After 30 minutes, pupil diameter was measured at the slit lamp to verify full dilation (≥ 6 mm). If full dilation was not achieved, an additional set of dilating drops was given; the second set of measurements were taken once full dilation was achieved.

The axial length (AL), central corneal thickness (CCT), anterior chamber depth (ACD), lens thickness (LT), and keratometry (K) readings, including flat K (Kf), steep K (Ks), and mean K (Km), were measured five times on each eye per standard Lenstar protocol. All biometry measurements were consistent with the validation criteria as described previously by Hill.^B

The standard deviations for the five measurements were recorded for AL and K values. If any standard deviation exceeded the acceptable limit, this indicated possible unreliability, and all measurements were repeated. All measurements were also taken in the same room, under the same lighting conditions, and using the same device.

A predicted refractive error for the IOL power to be implanted was calculated for the Barrett Universal II, Olsen, Hill-RBF and Haigis formulas using the software integrated in the OLCR device's Eyesuite IOL package for a Tecnis 1 ZCB00 IOL (Johnson and Johnson Vision, Jacksonville, Florida) using the parameters obtained before and after dilation. Stock IOLs are available in 0.5 D increment powers.

Therefore, we employed two separate prediction methods for each eye. Method A calculated IOL power available from stock increments which would yield the lowest myopic spherically equivalent residual refraction (LMP) for a targeted refraction of -0.25 D, simulating the current scenario in our clinical practice. Method B calculated the ideal IOL power for emmetropia (IPE). Both methods have been previously described in the literature.⁷ Pre- and post-dilation IOL powers were compared for each eye. Similar calculations were performed for the SRK/T and Holladay I formulas as control groups. The Barrett Universal II and Hill-RBF formulas were used with the recommended constants in their online software, when available. The User Group for Laser Interference Biometry IOL constants for the OLCR device were used when calculating the Haigis, SRK/T and Holladay I formulas.^C

Statistical Analysis

The study used Stata version 14.1 for data analysis. P-values of <0.05 were accepted as statistically significant. A minimum sample size of 88 eyes was calculated in order to find a mean change of 0.15 mm in ACD between measurements with $\alpha = 0.05$ and $\beta = 0.20$, assuming a standard deviation of 0.25 mm in each group. ACD change was used as a proxy for IOL power in this sample size calculation (i.e. a significant detectable change in ACD was predicted to cause a significant change in IOL power).

For the biometric data, Shapiro-Wilk tests showed distributions not significantly different from normal ($p>0.05$) for AL, CCT, ACD, and LT measurements pre- and post-dilation. Paired t-tests were used to compare these measurements. Shapiro-Wilk tests showed distribution significantly different from normal ($p<0.05$) for Kf, Ks, and Km. Wilcoxon signed-rank tests were used to compare these measurements.

For the IOL power calculations, Shapiro-Wilk tests showed distribution not significantly different from normal ($p>0.05$) for all six formulas except Barrett and Olsen post-dilation values ($p = 0.039$ and $p = 0.033$, respectively). Paired t-tests were used to compare each formula's IOL power calculations pre- and post-dilation and Wilcoxon signed-rank tests were used to confirm results.

With the eye as the unit of analysis and to account for the correlation between two eyes from the same patient and between two measurements of the same eye over time, a mixed model of the following form was fit: $Y_{ijt} = \alpha + u_i + b_1 t + b_2 \text{eye}_j + b_3 t * \text{eye}_j + e_{ijt}$, where Y_{ijt} is the measurement in the j th eye of the i th patient at time t and u_i is the random effect and e_{ijt} is the error term. These models were fit using SAS Proc MIXED using the UN@UN correlation structure.

Results

A total of 98 eyes from 53 subjects (19 male, 34 female) were measured. 48 right eyes and 50 left eyes were analyzed. The mean age was 65.25 years. The remaining demographic data of the subjects are shown in Table 1.

The Ks, Kf and Km measurements did not have a statistically significant change after dilation ($p = 0.10$, $p = 0.84$, $p = 0.25$, respectively) as shown in Table 2. Statistically significant increases were seen in AL ($.0069 \pm .0316$, $p = 0.03$), CCT (1.676 ± 3.616 , $p < 0.001$) and ACD (0.0640 ± 0.417 , $p < 0.001$), and a statistically significant decrease was seen in LT (-0.0397 ± 0.1136 , $p < 0.001$).

By method A, the stock IOL with the lowest myopic spheroequivalent residual refraction (LMP) for a targeted refraction of -0.25 D was calculated. The IOL power calculated by Barrett Universal II, Olsen, Hill-RBF, and Haigis all showed statistically significant increases by calculating a higher powered IOL based on post-dilation measurements as compared to pre-dilation measurements ($p < 0.001$) as shown in Table 3a. The IOL power calculated by the Holladay I and SRK/T formulas did not show any statistically significant differences ($p = 0.26$ and $0 = 0.81$, respectively). Our findings suggest that, using Method A, patients in our cohort with post-dilation measurements would have received an IOL with 0.5D or 1.0D higher power in 25.5%, 30.6%, 20.4% and 23.5% of cases for the Barrett Universal II, Olsen, Hill-RBF, and Haigis formulas, respectively (Table 4). In contrast, by the same method, patients would have received an IOL with 0.5D or 1.0D lower power in only 1.0%, 2.0%, 3.1%, and 2.0% of cases for the Barrett Universal II, Olsen, Hill-RBF, and Haigis formulas, respectively.

By method B, the ideal IOL power for emmetropia (IPE) calculated by Olsen ($p = 0.002$) and Haigis ($p = 0.04$) were higher based on post-dilation measurements as compared to pre-dilation measurements (Table 3b). However, Barrett Universal II, Hill-RBF, Holladay I, and SRK/T did not show any statistically significant differences ($p = 0.16$, 0.35 , 0.82 , and 0.89 , respectively).

Figure 1 shows an example of two patients, one who demonstrated changes in IOL power and one who showed no changes when using pre-dilation versus post-dilation measurements using Method A.

Discussion

The purpose of our study was to examine the effects of pharmacologic pupil dilation on biometric parameters measured by OLCR biometry, and whether these changes affect the power of the calculated IOL. Specifically, we sought to examine the effect of these changes on IOL power calculated using multivariable formulas (Barrett Universal II, Olsen, Hill-RBF and Haigis) when compared to third-generation formulas such as SRK/T and Holladay I using both lowest myopic residual spheroequivalent residual refraction (LMP) and ideal power for emmetropia (IPE) methods (Method A and Method B, respectively).

We saw no significant changes in keratometry values pre-dilation versus post-dilation, which is consistent with previous biometry studies.^{5-8,13} The significant increase in ACD post-dilation that we observed is also consistent with previous biometric studies, although the increase in our study is smaller than ACD

increases reported in other studies.⁵⁻⁸ Nevertheless, this increase in ACD was still large enough to cause statistically significant increases in the IOL power for formulas that included ACD as a variable.

As mentioned previously, multivariable formulas also rely on other variables, such as LT, to calculate IOL power.³ To our knowledge, our study is the first to find a statistically significant decrease in LT after the administration of tropicamide and phenylephrine. Read et al.¹⁶ reported significant LT changes after accommodation, but other studies have failed to find changes in LT after administration of tropicamide 1%.^{5,17} It is also possible that the changes in LT after pharmacological dilation affected the calculated IOL power in our study.

Two studies reported increases in corneal thickness from administration of tropicamide drops.^{14,15} Our finding of a statistically significant increase in CCT is consistent with these findings. We also observed a small but statistically significant increase in axial length post dilation; this may be partially explained by the increase in CCT. Notably, while an increase in axial length may theoretically lead to a lower IOL power calculation, the magnitude of AL change observed in our study was not large enough to have any significant impact on IOL power calculations.

Several studies have found no change in IOL power related to pupil dilation when using the SRK/T formula.⁵⁻⁷ The SRK/T formula is based on a linear regression method that uses a theoretical, thin-lens eye model relying primarily on AL and K values.¹⁸ Although we had a statistically significant increase in AL, the magnitude of this change was not large enough to cause a significant change in IOL power chosen. We noted similar results when performing calculations using both the SRK/T and the Holladay I formula. Though it may not be optimal clinical practice, the presence or absence of pharmacological dilation at the time of biometry will likely not significantly affect the calculated IOL power when using these third-generation formulas.

The Haigis formula was the first of the multivariable formulas to incorporate ACD, and used ACD measurements as a proxy for effective lens position (ELP). Rodriguez-Raton et al.⁷ compared pre-dilation and post-dilation biometry results in 107 eyes and observed a significant increase (0.098, $p = 0.01$) in IOL power when using this formula. The authors attributed this result to the increase in ACD seen in the study; because dilation is associated with a shift of the ELP posteriorly, the formula may estimate for an IOL with greater dioptric power in order to reach the target refraction. Khambhiphant et al.⁸ similarly found a statistically significant increase in IOL power in 373 eyes calculated by the Haigis formula after pharmacological dilation.

While we decided to analyze the potential impact of pre- versus post-dilation measurements on actual IOL powers (Method A), as well as on theoretical custom IOL dioptric power (Method B), we believe that Method A is more relevant for cataract surgeons as it simulates clinical practice as compared to Method B, which has primarily theoretical implications. In the United States, the majority of lens manufacturers make IOLs in increments of 0.5D.

To the best of our knowledge, this is the first study to investigate and report a difference in IOL power using two different calculation methods when performed in an undilated versus post-dilated state using the Barrett, Olsen, and Hill-RBF formulas. Our data also confirm the findings reported previously regarding IOL calculations performed in an undilated versus post-dilated state when using third-generation formulas and the Haigis formula. Our results suggest that in some patients, post-dilation biometry measurements may lead to a higher selected IOL power (when using non-custom IOLs), increasing the risk of myopic surprise. Based on these findings, our recommendation is that cataract surgeons should consider obtaining IOL measurements in an undilated state, particularly if using non-custom IOLs.

We presume that our results have relevance for clinic workflow. Detection of a visually significant cataract by clinicians after dilation may sometimes lead to patients undergoing post dilation biometry measurements. As a result of our findings, we have instituted a protocol at our institution to ensure biometry measurements are done in an undilated state to optimize refractive accuracy (Figure 2). In some cases, this may require patients to make an additional visit, though we have instructed ancillary staff and trainees to obtain biometry measurements in all phakic patients with symptoms consistent with visually significant cataract prior to patient dilation and examination by the attending surgeon. We offer that these measures may be of interest to cataract surgeons to consider for their own respective pre-operative clinical testing protocols.

One limitation of our study is that we did not include the Holladay 2 formula, which also incorporates ACD and LT into its calculations. Further studies would be needed to determine whether a similar change in predicted IOL power would occur with this formula. Furthermore, post-surgical validation of mean absolute error (MAEs), median absolute errors (MedAEs), and percentage of eyes within ± 0.25 , ± 0.50 and ± 1.00 D of predicted refraction would be required for our findings in order to demonstrate whether or not the predicted myopic refractive error(s) would occur post-operatively. Based on our preoperative findings, we could not justify using any post-dilation biometry measurements for IOL implantation and therefore cannot comment on the post-surgical MAE and MedAE at this time. Future studies may wish to incorporate a study design to appropriately assess post-operative refractive results based on pre-dilation and post-dilation biometry measurements.

Our study also did not have the required number of eyes to stratify patients based on axial length values (AL), such as short (AL < 22.0mm), average (AL 22.0–24.5mm) and long (AL > 24.5 mm) AL values. Similarly, our study did not have the required number of eyes to stratify patients based on keratometry values. Future studies on this topic may be able to address these limitations.

As the current multivariable formulas are increasing in popularity, and given the increased demands for accuracy with IOL calculations, especially when considering advanced technology lenses, surgeons should give increased consideration to pre-operative biometric testing in order to optimize their surgical results. Our data suggest that post-dilation biometry measurements may favor a higher power IOL in a significant portion of cases, increasing the likelihood of a myopic surprise and a potential increase in

MAEs and MedAEs. Therefore, we recommend that cataract surgery patients receive biometry testing in an undilated state, especially if multivariable IOL calculation formulas are being used.

Declarations

Ethics approval and consent to participate: This study was approved by the Institutional Review Board at the University of Chicago (IRB17–0197) and followed the tenets of the Declaration of Helsinki. Written informed consent was acquired from all patients included in the study.

Consent for publication: Not applicable

Availability of data and materials: Because the dataset includes identifying patient information, the data is currently stored on our medical campus in a locked cabinet but can be made available in an anonymous form upon request.

Competing interests: The authors declare that they have no competing interests.

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Authors' Contributions:

NS made substantial contributions to the conception, design, acquisition of data, analysis of data, and writing of the manuscript. AF made substantial contributions to the analysis of data and writing of the manuscript. MZ made substantial contributions to the acquisition of data and writing of the manuscript. KR made substantial contributions to the conception, design, acquisition of data, analysis of data, and writing of the manuscript. All authors read and approved the final manuscript.

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Tables

Table 1

Age, years	
N	53
Mean	65.25
SD	13.68
Min	28
Max	87
Sex, n (%)	
Male	19 (35.8)
Female	34 (64.2)
Eye side, n	
Right	48
Left	50

Demographic data for studied patient population

Table 2

Parameter	Mean ± SD		Mean Difference ± SD	95% CI for Mean Difference	P-value
	Pre-dilation	Post-dilation			
AL (mm)	24.17 ± 1.31	24.18 ± 1.31	0.0069 ± .0316	.00066, .01307	0.03
CCT (µm)	538.13 ± 39.75	539.81 ± 40.02	1.676 ± 3.616	0.966, 2.387	<0.001
ACD (mm)	3.18 ± 0.360	3.24 ± 0.370	0.0640 ± .0417	0.0558, 0.0722	<0.001
LT (mm)	4.44 ± 0.49	4.40 ± 0.51	-0.0397 ± 0.1136	-0.0620, -0.0174	<0.001
Kf (D)	43.15 ± 1.62	43.16 ± 1.62	0.0155 ± 0.1783	-0.0195, 0.051	0.84*
Ks (D)	44.08 ± 1.66	44.06 ± 1.65	-0.0242 ± 0.2878	-0.0808, 0.0323	0.10*
Km (D)	43.61 ± 1.60	43.60 ± 1.59	-0.00765 ± 0.17435	-0.0419, 0.0266	0.25*

*P-value calculated by Wilcoxon signed-rank test

Pre-dilation and post-dilation optical low coherence biometry measurement values.

Table 3A

IOL Power Formula	Mean \pm SD		Mean Difference	95% CI for Mean Difference	P-value
	Pre-dilation	Post-dilation			
Barrett Universal II	19.68 \pm 3.63	19.80 \pm 3.64	0.123 \pm 0.238	0.076, 0.169	<0.001**
Olsen	19.65 \pm 3.62	19.79 \pm 3.61	0.142 \pm 0.257	0.092, 0.193	<0.001**
Hill-RBF	19.77 \pm 3.65	19.86 \pm 3.64	0.088 \pm 0.238	0.042, 0.135	<0.001**
Haigis	19.88 \pm 3.71	19.99 \pm 3.70	0.108 \pm 0.250	0.059, 0.157	<0.001**
Holladay I	19.80 \pm 3.78	19.81 \pm 3.77	0.010 \pm 0.244	-0.038, 0.058	0.26
SRK/T	19.78 \pm 3.65	19.77 \pm 3.63	-0.010 \pm 0.233	-0.056, 0.036	0.81

**P-value confirmed with Wilcoxon signed-rank test

Predicted IOL power for studied formulas based on pre-dilation and post-dilation measurements for method A (lowest myopic spheroequivalent residual refraction, LMP).

Table 3B

IOL Power Formula	Mean \pm SD		Mean Difference	95% CI for Mean Difference	P-value
	Pre-dilation	Post-dilation			
Barrett Universal II	19.40 \pm 3.58	19.43 \pm 3.57	0.030 \pm 0.215	-0.013, 0.073	0.16
Olsen	19.39 \pm 3.54	19.47 \pm 3.53	0.076 \pm 0.233	0.030, 0.123	0.002
Hill-RBF	19.49 \pm 3.58	19.52 \pm 3.58	0.021 \pm 0.216	-0.022, 0.064	0.35
Haigis	19.56 \pm 3.63	19.61 \pm 3.66	0.055 \pm 0.259	0.003, 0.107	0.04
Holladay I	19.57 \pm 3.74	19.57 \pm 3.74	0.005 \pm 0.213	-0.038, 0.047	0.82
SRK/T	19.44 \pm 3.57	19.45 \pm 3.57	0.002 \pm 0.189	-0.035, 0.040	0.89

Actual IOL power for studied formulas based on pre-dilation and post-dilation measurements for method B (ideal power for emmetropia, IPE).

Note to editor: Tables 3A and 3B can be combined into a single table as long as it is clear that the contents of 3A apply to method A and the contents of 3B apply to method B.

Table 4

IOL Power Formula	Number of eyes to receive IOL with 0.5 D or 1.0 D of lower power	Number of eyes to receive the same IOL power	Number of eyes to receive IOL with 0.5 D or 1.0 D of higher power
Barrett Universal II	1 (1.0%)	72 (73.5%)	25 (25.5%)
Olsen	2 (2.0%)	66 (67.3%)	30 (30.6%)
Hill-RBF	3 (3.1%)	75 (76.5%)	20 (20.4%)
Haigis	2 (2.0%)	73 (74.5%)	23 (23.5%)
Holladay I	11 (11.2%)	74 (75.5%)	13 (13.3%)
SRK/T	12 (12.2%)	76 (77.6%)	10 (10.2%)

Pre-dilation versus post-dilation predicted IOL values by Method A

Figures

Example Patient 1

Barrett Pre-Dilation

IOL (D)	Refraction (D)
19.50	0.08
20.00	-0.27
20.50	-0.63

Selected IOL: 20.00 D

Olsen Pre-Dilation

IOL (D)	Refraction (D)
19.50	0.18
20.00	-0.18
20.50	-0.54

Selected IOL: 20.00 D

Hill-RBF Pre-Dilation

IOL (D)	Refraction (D)
19.50	0.12
20.00	-0.13
20.50	-0.47

Selected IOL: 20.00 D

Haigis Pre-Dilation

IOL (D)	Refraction (D)
20.00	0.14
20.50	-0.21
21.00	-0.55

Selected IOL: 20.50 D

Holladay Pre-Dilation

IOL (D)	Refraction (D)
19.50	0.18
20.00	-0.15
20.50	-0.49

Selected IOL: 20.00 D

SRK/T Pre-Dilation

IOL (D)	Refraction (D)
19.00	00.15
19.50	-0.19
20.00	-0.54

Selected IOL: 19.50 D

Barrett Post-Dilation

IOL (D)	Refraction (D)
19.50	0.37
20.00	0.02
20.50	-0.33

Selected IOL: 20.50 D

Olsen Post-Dilation

IOL (D)	Refraction (D)
19.50	0.53
20.00	0.18
20.50	-0.19

Selected IOL: 20.50 D

Hill-RBF Post-Dilation

IOL (D)	Refraction (D)
19.50	0.38
20.00	0.04
20.50	-0.30

Selected IOL: 20.50 D

Haigis Post-Dilation

IOL (D)	Refraction (D)
20.00	0.42
20.50	0.08
21.00	-0.27

Selected IOL: 21.00 D

Holladay Post-Dilation

IOL (D)	Refraction (D)
19.50	0.23
20.00	-0.11
20.50	-0.44

Selected IOL: 20.00 D

SRK/T Post-Dilation

IOL (D)	Refraction (D)
19.00	0.20
19.50	-0.14
20.00	-0.49

Selected IOL: 19.50 D

Example Patient 2

Barrett Pre-Dilation

IOL (D)	Refraction (D)
21.00	0.19
21.50	-0.15
22.00	-0.51

Selected IOL: 21.50 D

Olsen Pre-Dilation

IOL (D)	Refraction (D)
21.00	0.21
21.50	-0.14
22.00	-0.49

Selected IOL: 21.50 D

Hill-RBF Pre-Dilation

IOL (D)	Refraction (D)
21.50	-0.05
22.00	-0.38
22.50	-0.72

Selected IOL: 22.00 D

Haigis Pre-Dilation

IOL (D)	Refraction (D)
21.50	0.03
22.00	-0.31
22.50	-0.66

Selected IOL: 22.00 D

Holladay Pre-Dilation

IOL (D)	Refraction (D)
21.50	0.01
22.00	-0.32
22.50	-0.66

Selected IOL: 22.00 D

SRK/T Pre-Dilation

IOL (D)	Refraction (D)
21.50	-0.04
22.00	-0.38
22.50	-0.72

Selected IOL: 22.00 D

Barrett Post-Dilation

IOL (D)	Refraction (D)
21.00	0.22
21.50	-0.13
22.00	-0.48

Selected IOL: 21.50 D

Olsen Post-Dilation

IOL (D)	Refraction (D)
21.00	0.25
21.50	-0.10
22.00	-0.45

Selected IOL: 21.50 D

Hill-RBF Post-Dilation

IOL (D)	Refraction (D)
21.50	-0.03
22.00	-0.36
22.50	-0.70

Selected IOL: 22.00 D

Haigis Post-Dilation

IOL (D)	Refraction (D)
21.50	0.01
22.00	-0.32
22.50	-0.66

Selected IOL: 22.00 D

Holladay Post-Dilation

IOL (D)	Refraction (D)
21.50	0.03
22.00	-0.30
22.50	-0.64

Selected IOL: 22.00 D

SRK/T Post-Dilation

IOL (D)	Refraction (D)
21.50	-0.03
22.00	-0.36
22.50	-0.70

Selected IOL: 22.00 D

Example of a patient who saw a 0.50D increase in IOL power post-dilation when calculated using the Barrett, Olsen, Hill-RBF, and Haigis formulas. This patient saw no change in IOL power when calculated using SRK/T Holladay and SRK/T formulas.

Example of a patient who saw no changes in IOL power post-dilation calculations for all six formulas.

A

B

Figure 1

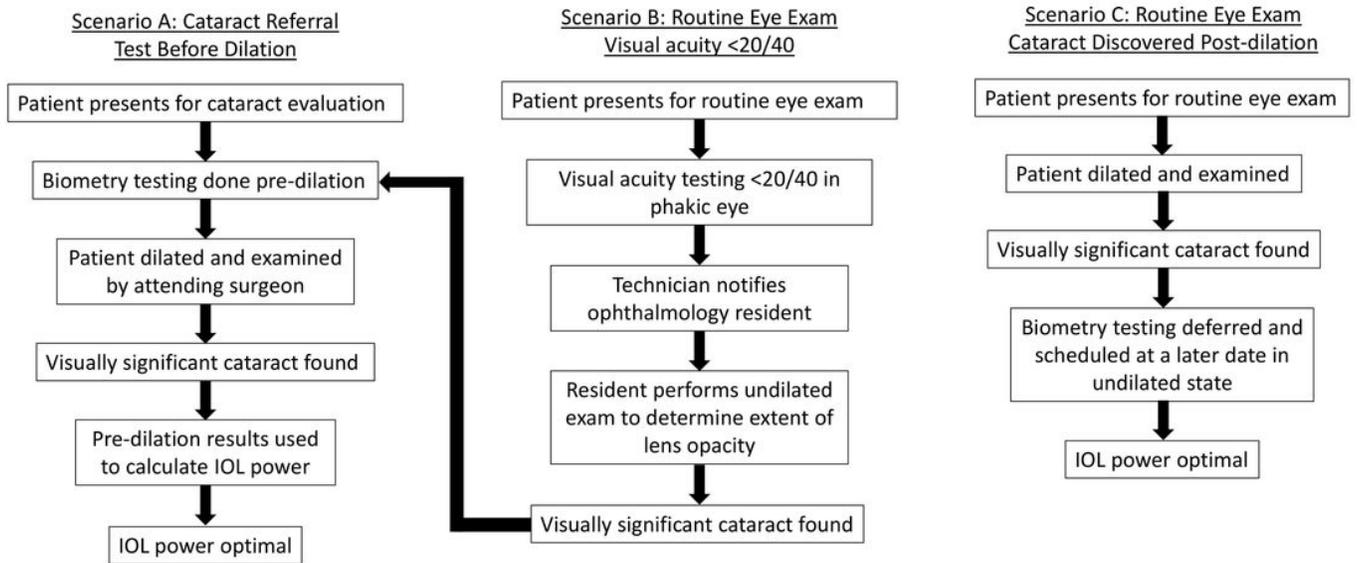


Figure 2