Refractive Outcome after Cataract Surgery in Acute Primary Angle Closure and Primary Angle Closure Patients

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Objective: *To assess refractive outcome and compare the accuracy of SRK-II and SRK/T formula in acute primary angle closure and primary angle closure patients with normal open angle patients undergoing cataract surgery.*

Material and Method: *This retrospective study included 517 eyes divided in 3 groups; 19 eyes in acute primary angle closure group, 184 eyes in primary angle closure group and 368 eyes in normal open angle group, undergoing cataract surgery by using single-piece IOL implantation. The SRK-II and SRK/T formula were used to calculate IOL power in all groups. The accuracy of each formula was analyzed by comparing the mean difference between the predicted post-operative spherical equivalent in each formula and post-operative spherical equivalent (ME). Anterior segment biometry including axial length and anterior chamber depth were compared for searching the related factor of inaccuracy of IOL power calculations.*

Results: *In acute primary angle closure group, the mean best-corrected visual acuity in logarithm of the minimum angle of resolution was worst, the number of anti-glaucoma drugs was most using, the intraocular pressure was highest, the axial length was shortest, the anterior chamber depth was most shallow, the pre-operative refractive error was worst and more hyperopic result than other groups. SRK/T formula show lesser mean error than using the SRK-II formula in all groups. All mean error in both formulas show hyperopic shift than predicted. The primary angle closure patients were statically significant difference more hyperopic shift than the normal open primary closure (p = 0.002275). The acute primary angle closure patients was statically significant less hyperopic shift than primary angle closure patients (p = 0.004408) but not statically significant different with normal open angle patients (p = 0.320347). The pre-operative axial length and anterior chamber depth are not related to inaccuracy of IOL power calculations.*

Conclusion: *IOL power prediction is more accurate when use SRK/T formula. All groups of patients have to choose the IOL power producing the myopic predicted post-operative refractive error. The primary angle closure patients have to choose the power that the predicted post-operative refractive error more myopic than acute primary angle closure and normal open angle patients. The pre-operative axial length and anterior chamber depth are not related to inaccuracy of IOL power calculations.*

Keywords: *Refractive outcome, Cataract surgery, Acute primary angle closure, Primary angle closure*

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The World Health Organization has identified glaucoma is the second leading cause of blindness in the world behind cataract but leading cause of irreversible blindness[1]. Primary angle closure glaucoma is serious destructive disease, estimated in almost half of blindness from glaucoma[2]. The prevalence of primary angle closure glaucoma is highest in Inuit and high in Asian populations. In the Asian, higher prevalence in South-Central and East Asia[3].

The main pathology of primary angle closure glaucoma is caused by abnormal anatomy of anterior segment of the eyes. Most important factor is combinations of lens factors e.g. increased lens thickness with advance age, anterior lens move forward[4]. The other related-factors are small corneal diameter, and short axial length that produce shallow anterior chambers and narrow anterior chamber angle[5]. The long term angle closure may produce peripheral anterior synechiae formation, leading to increased and uncontrolled intraocular pressure[6].

The first treatment of choice to reduce intraocular pressure in primary angle closure glaucoma

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is laser peripheral iridotomy alone or combined with iridoplasty which more reduce peripheral anterior synechiae in synechial/primary/angle-closure/ glaucoma[7]. In some case of acute/on chronic/angle/ closure/glaucoma which prolonged attack or very high intraocular pressure fails to treat with peripheral iridotomy[8]. Previous study found that another choice of treatment in primary angle closure glaucoma is phacoemulsification with intraocular lens implantation and/goniosynechialysis/which can widen the anterior chamber angle and deepen chamber that produce decline and long-term control intraocular pressure[9].

Accuracy of intraocular lens power was decrease in primary angle closure when compared with normal open angle[10]. Previous studies, intraocular lens power can be calculated by several formulas which most surgeons have applied third-generation formulas but limitation of this formulas are the predicting intraocular lens position that determine by axial length and central corneal power[11]. Some studies found that the lowering intraocular pressure induces a shorten in axial length which produce inaccuracy of intraocular lens power[12]. Another cause of inaccuracy may be the intracapsular volume of primary angle closure group is higher than normal open angle. The larger capsular bag may produce more tile or decenter of intracapsular lens which may cause more hyperopic shift in postoperative refraction than intended. But some study found that in primary angle closure glaucoma and acute primary angle closure showed more myopic results than intend[13].

In the present study, we used a retrospective approach to compare the accuracy of second-(SRK-II) and third-generation formulas (SRK/T) in acute primary angle closure and primary angle closure patients with normal open angle patients undergoing cataract surgery.

Material and Method

Patients

This was a retrospective study included 517 eyes that visited the glaucoma clinic, department of ophthalmology at Thammasat University from July 2012 to July 2015, and underwent cataract extraction with IOL implantation under topical anesthesia by multiple surgeons using the different technique but all surgeons use single-piece IOL. We divided the patients in 3 groups depended on clinical and gonioscopic diagnosis.

The primary angle closure patient group of this study included primary angle closure (PAC) and primary angle closure glaucoma (PACG). The clinical diagnostic criteria for primary angle closure eye are (1) angle closure on gonioscopy (iridotrabecular contact in three or more quadrants) (2) intraocular pressure higher than 21 mmHg and/or presence of primary peripheral synechaie on gonioscopy (3) normal optic disc and visual field. Primary angle closure glaucoma (PACG) eyes have the same gonioscopy findings as in PAC but presence of glaucomatous optic neuropathy and visual field loss.

The acute primary angle closure patient group eyes are the same gonioscopic findings as in PAC but included other sign and symptoms (1) at least two of these symptoms: ocular or periocular pain, nausea and/ or vomiting, headache, a previous history of intermittent blurring of vision with haloes. (2) at least three of the following signs: conjunctival injection, corneal epithelial edema, mid-dilated unreactive pupil, shallow anterior chamber.

The normal open-angle group eyes as a comparative control group were defined by open angle on gonioscopy.

All eyes in acute primary angle closure and primary angle closure groups had previously undergone bilateral Nd: YAG laser peripheral iridotomies before cataract surgery. All patients in all groups did not have the history of (1) ocular trauma (2) ocular surgeries except laser peripheral iridotomy (3) any other ocular disease other than glaucoma (3) underlying disease affecting ocular disease (4) continue ocular medication.

Compliance with ethics

The study protocol was approved by the institutional review board of Thammasat University Hospital.

Data collections

The pre- and post-operative data were collected from patient's records. The pre-operative data collected; age, gender, best-corrected visual acuity (measured with Snellen chart), number of anti-glaucoma medication, intraocular pressure (measured with Goldmann applanation tonometry), keratometer (measured with automated keratometer), refractive error (measured with automated keratometer), axial length and anterior chamber depth were measured by IOL master. The intraocular lens used in the study were single-piece acrylic IOLs. The power of the intraocular lens and predicted postoperative spherical equivatent refractive error were measured and calculated by IOL master based on biometric data. We used SRK/T and

SRK-II formula to calculate intraocular lens power. The best-corrected visual acuity was converted to LogMAR visual acuity. The pre-operative refractive error was calculated to spherical equivalent.

The post-operative data, 6-months after surgery, we collected; best-corrected visual acuity (measured with Snellen chart) and then converted to LogMAR visual acuity, number of anti-glaucoma medication, intraocular pressure (measured with Goldmann applanation tonometry), keratometer (measured with automated keratometer) and post-operative refractive error (measured with automated keratometer) that was calculated to spherical equivalent.

Mean error was the different between predicted post-operative spherical equivatent refractive error and post-operative spherical equivatent refractive error (predicted post-operative spherical equivatent refractive error minus post-operative spherical equivatent refractive error).

All patients underwent phacoemulsification using a 2-mm clear cornea incision with single-piece intraocular lens in lens capsule and sutureless without complication.

Statistics

The sample size was calculated by using the spherical equivalent refractive error of different between predicted post-operative spherical equivatent refractive error and post-operative spherical equivatent refractive error using SRK/T formula of acute primary angle closure group[13], primary angle closure group and normal open angle group in Pearson's Chi-squared test (Fleiss, Levin, and Paik 2003).

We need 19, 184 and 368 eyes for acute primary angle closure, primary angle closure and normal open angle group, respectively.

All statistics were calculated using STATA .The continue data were reported as mean $\pm$ SD. The difference of all pre-, post-operative data and mean error between 3 groups were statistical analyzed by the Kruskal-Wallis test because the data were abnormal distribution. The significance was set at 0.05.

Results

The patient demographic data are summarized in Table 1. There were 19 eyes in the acute primary angle closure group, 184 eyes in primary angle closure group and 368 eyes in normal open angle group. The mean age $\pm$ standard deviation was 60.1$\pm$6.03 years in the acute primary angle closure group, 67.38$\pm$9.18 years in primary angle closure group and 66.71$\pm$8.77 in normal open angle group. The *p*-values shown in the table are the *p*-values between the three groups. All three groups showed significantly different in age. Eyes in acute primary angle closure group showed significantly younger than primary angle closure group and normal open angle group. There was no significant difference in gender of 3 groups but more female patient than male in all groups.

Table 2 summarizes the preoperative data. The *p*-values between the three groups show 8 of the preoperative data were statistically significant differences; the mean best-corrected visual acuity in logarithm of the minimum angle of resolution, number of anti-glaucoma drug, intraocular pressure, axial length, anterior chamber depth, pre-operative refractive error, predicted postoperative spherical equivalent refractive error using SRK-II formula and the power of intraocular lens. In the acute primary angle closure group, the mean best-corrected visual acuity in logarithm of the minimum angle of resolution was worst, the number of anti-glaucoma drugs was most using, the intraocular pressure was highest, the axial length was shortest, the anterior chamber depth was most shallow, the pre-operative refractive error was worst and more hyperopic result than other groups, the predicted postoperative spherical equivalent refractive error using SRK-II formula was most myopic aim and the power of intraocular lens was highest in 3 groups. There was no statistically significant differences between the three groups in the both of keratometer value and the predicted postoperative spherical equivalent refractive

Table 1. Patient demographics

	APAC	PAC	Open	*p*-value
No.	19	184	368	
Age (years)	60.1$\pm$6.03	67.38$\pm$9.18	66.71$\pm$8.77	0.0005*
Gender	M = 8, F = 11	M = 74, F = 110	M = 154, F = 214	0.9329

APAC = acute primary angle closure; PAC = primary angle closure; Open = normal open angle; M = male; F = female.
**p*<0.05

error using SRK/T formula.

Post-operative data at 6 months after cataract surgery with intraocular lens are shown in Table 3. There was three post-operative data that statically significant difference between 3 groups; number of anti-glaucoma drug, keratometer and mean error in SRK/T formula using. The post-operative number of anti-glaucoma drug shown that in the acute primary angle closure group was more continue administered drug after the surgery than other groups. The mean best-corrected visual acuity in logarithm of the minimum angle of resolution was better in normal open angle, acute primary angle closure group, respectively but worst in primary angle closure group. The intraocular pressure was highest in acute primary angle closure group. All mean post-operative spherical equivalent refractive error were minus indicating myopic result. The post-operative spherical equivalent refractive error was also worst in acute primary angle closure group. All mean error in both formulas show negative value indicating a more hyperopic shift than predicted and the mean error in SRK/T formula using were statically significant difference. In primary angle closure group was highest difference and the acute primary angle closure group

Table 2. Preoperative data

	APAC	PAC	Open	*p*-value
BCVA (logMAR)	57.78±0.34	32.25±0.27	0.48±0.36	0.0001*
No. Drug	3.36±0.76	1.26±8.48	0.47±1.25	0.0001*
IOP (mmHg)	46.10±17.00	17.20±7.32	14.48±4.55	0.0001*
AL (mm)	22.50±0.62	22.86±0.75	23.67±1.31	0.0001*
K1 (D)	44.51±1.00	44.08±1.40	43.88±1.70	0.1863
K2 (D)	45.31±1.02	45.12±1.47	44.99±1.71	0.6011
ACD (mm)	2.34±0.09	2.61±0.42	3.24±0.43	0.0001*
Pref (D)	0.53±1.80	0.17±1.78	-0.75±2.89	0.0011*
PPSE (K/T) (D)	-0.20±0.21	-0.21±0.13	-0.18±0.20	0.2339
PPSE (KII) (D)	-0.33±0.33	-0.23±0.29	-0.15±0.29	0.0001*
No. IOL	22.89±1.80	22.13±1.80	19.96±3.5	0.0001*

APAC = acute primary angle closure; PAC = primary angle closure; Open = normal open angle; BCVA = best-collected visual acuity; logMAR = logarithm of the minimum angle of resolution; No. Drug = number of medication; IOP = intraocular pressure; AL = axial length; K1 = keratometry; K2 = keratometry; ACD = anterior chamber depth; Pref = pre-operative spherical equivalent; PPSE (K/T) = predicted post-operative spherical equivalent when using SRK/T formula; PPSE (KII) = predicted post-operative spherical equivalent when using SRK-II formula; No. IOL = number of intraocular lens power
Value given as means ± standard deviation. * $p<0.05$

Table 3. Postoperative data

	APAC	PAC	Open	*p*-value
BCVA (logMAR)	7.20±0.15	15.73±0.22	0.12±0.16	0.1217
No. Drug	0.57±0.96	0.45±0.82	0.17±0.43	0.0001*
IOP (mmHg)	14.00±5.50	12.79±2.74	12.55±2.44	0.4534
K1 (mm)	44.59±1.03	44.09±1.44	43.81±1.70	0.0441*
K2 (mm)	45.36±1.07	45.12±1.54	44.92±1.82	0.4069
PSE (D)	-0.13±0.68	-0.07±0.70	-0.08±0.73	0.5639
MRE (K/T) (D)	-0.06±0.77	-0.14±0.71	-0.09±0.76	0.0126*
MRE (KII) (D)	-0.19±0.85	-0.16±0.77	-0.08±0.79	0.1663

APAC = acute primary angle closure; PAC = primary angle closure; Open = normal open angle; BCVA = best-collected visual acuity; logMAR = logarithm of the minimum angle of resolution; No. Drug = number of medication; IOP = intraocular pressure; K1 = keratometry; K2 = keratometry; PSE = post-operative spherical equivalent; MRE (K/T) = mean refractive error when using SRK/T formula; MRE (KII) = mean refractive error when using SRKII formula.
Value given as means ± standard deviation. * $p<0.05$

was lowest difference. The mean error in SRK/T formula using were closer to zero than the mean error in SRK-II formula using in acute primary angle closure and primary angle closure group. The mean error in SRK-II formula using was highest in acute primary angle closure group.

Table 4. shows differences in pre-operative and post-operative data after cataract surgery. The *p*-values in this table compare between the two groups in the three pairs; the acute primary angle closure group compare with the normal open angle group, the primary angle closure group compare with the normal open angle group and the acute primary angle closure group compare with the primary angle closure group. All mean difference of best-corrected visual acuity in logarithm of the minimum angle of resolution between before and after surgery were positive indicating the post-operative visual acuity are better than the pre-operative visual acuity and all three pairs comparisons were statistically significant. The acute primary angle closure group shows highest positive value indicating the best improvement of visual acuity after surgery. The mean different number of anti-glaucoma drug was highest in the acute primary angle closure group. All groups were positive value indicating continue administered drug after surgery but the most was in the acute primary angle closure group, the primary angle closure group was the second. The mean different number of anti-glaucoma drug before and after surgery were statistically significant when compare in three pairs. All mean difference of intraocular pressure before and after surgery were positive value indicating post-operative intraocular pressure decrease when compare with pre-operative intraocular pressure. The acute primary angle closure group was highest of mean difference, the second is the primary angle closure group. The difference of keratometer was no statically significant in all three pairs. The difference of mean error in SRK/T formula using between the acute primary angle closure group and the normal open angle group was no statically significant but between the primary angle closure group and the normal open angle group, the acute primary angle closure group and the primary angle closure group were statically significant. The difference of mean error in SRK-II formula using between the acute primary angle closure group and the normal open angle group, the primary angle closure group and the normal open angle group were statically significant but between the acute primary angle closure group and the primary angle closure group was no statically significant.

Table 4. Differences in preoperative and postoperative data after cataract surgery

	APAC	Open	*p*-value	PAC	Open	*p*-value	APAC	PAC	*p*-value
VA	5.00±0.35	0.35±0.35	0.00000*	0.16±0.23	0.35±0.35	0.00000*	0.50±0.35	0.16±0.23	0.000007*
No. Drug	3.94±1.35	0.30±1.19	0.00000*	0.80±1.07	0.30±1.19	0.00000*	3.94±1.35	0.80±1.07	0.00000*
IOP (mmHg)	32.05±18.91	2.06±4.72	0.00000*	4.46±7.46	2.06±4.72	0.00000*	32.05±18.91	4.46±7.46	0.000001*
K1 (D)	-0.07±0.42	0.06±0.86	0.74871	-0.008±0.7	0.06±0.86	0.74507	-0.07±0.42	-0.008±0.7	0.94681
K2 (D)	-0.05±0.49	0.06±0.97	0.94681	-0.005±0.82	0.06±0.97	0.94763	-0.05±0.49	-0.005±0.82	0.4069
MRE (K/T) (D)	-0.06±0.77	-0.09±0.76	0.320347	-0.14±0.71	-0.09±0.76	0.002275*	-0.06±0.77	-0.14±0.71	0.004408*
MRE (KII) (D)	-0.19±0.85	-0.08±0.79	0.016629*	-0.16±0.77	-0.08±0.79	0.016631*	-0.19±0.85	-0.16±0.77	0.16232

APAC = acute primary angle closure; PAC = primary angle closure; Open = normal open angle; BCVA = best-collected visual acuity; logMAR = logarithm of the minimum angle of resolution; No. Drug = number of medication; IOP = intraocular pressure; K1 = keratometry; K2 = keratometry; PSE = post-operative spherical equivalent; MRE (K/T) = mean refractive error when using SRK/T formula; MRE (KII) = mean refractive error when using SRKII formula.
Value given as means ± standard deviation. * $p<0.05$

From the result reported in Table 3, the mean post-operative spherical equivalent refractive error of all groups were myopic result. The Fig. 1 shows proportion of myopic and hyperopic results of post-operative spherical equivalent refractive error in each group. All groups show proportion of myopic result more than hyperopic result. In acute primary angle closure group was highest myopic result proportion. There were no statistically significant differences in mean pre-operative axial length and anterior chamber depth between group of myopic and hyperopic result in acute primary angle closure and primary angle closure group but statistically significant differences in mean axial length in normal open angel group that myopic result eyes show a trend to have shorter axial length (Table 5).

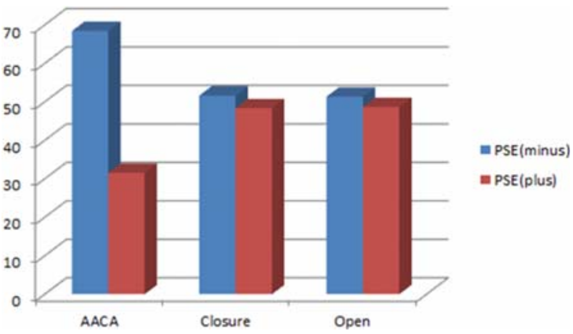

Fig. 1 Proportion of myopic and hyperopic results of post-operative spherical equivalent refractive error in each group.

The mean error in both formulas of all group show more hyperopic shift than predicted. The Fig. 2, 3 shows proportion of hyperopic and myopic shift of mean error when using SRK/T and SRK-II formula in three group. All groups of both formula using show proportion of hyperopic shift more than myopic shift. In SRK/T using formula, there were no statistically

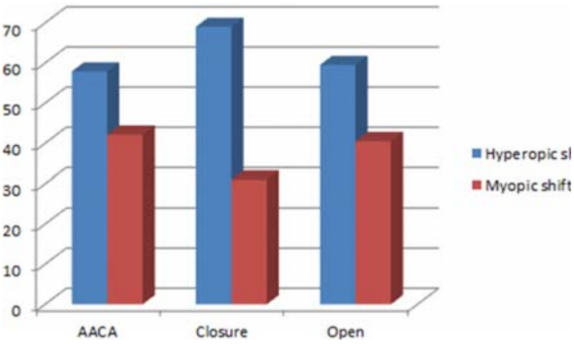

Fig. 2 Proportion of hyperopic and myopic shift of mean error when using SRK/T in each group.

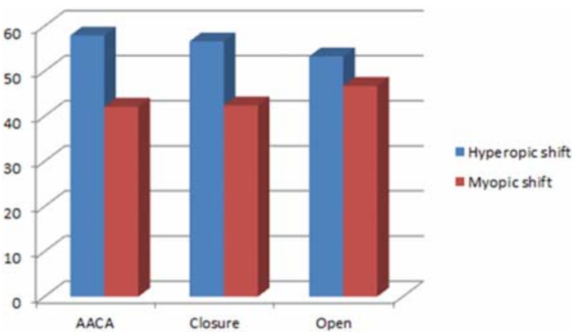

Fig. 3 Proportion of hyperopic and myopic shift of mean error when using SRK-II.

Table 5. Proportion of myopic and hyperopic results of post-operative spherical equivalent refractive error in each group and their pre-operative anterior segment biometry

	Myopic PSE	Hyperopic PSE	*p*-value
AACA	13 (68.42%)	6 (31.57%)	
AL (mm)	22.59±0.64	22.31±0.58	0.8608
ACD (mm)	2.34±0.09	2.34±0.10	0.3805
Closure	95 (51.63%)	89 (48.36%)	
AL (mm)	22.89±0.81	22.83±0.69	0.4396
ACD (mm)	2.58±0.47	2.64±0.37	0.8734
Open	189 (51.35%)	179 (48.64%)	
AL (mm)	23.46±1.16	23.88±1.42	0.0027*
ACD (mm)	3.25±0.46	3.22±0.41	0.8014

APAC = acute primary angle closure; PAC = primary angle closure; Open = normal open angle; PSE = post-operative spherical equivalent; AL = axial length; ACD = anterior chamber depth.
Value given as means ± standard deviation. * $p<0.05$

significant differences in mean pre-operative axial length and anterior chamber depth between hyperopic and myopic shift group in acute primary angle closure and primary angle closure group but statistically significant differences in mean axial length in normal open angel group that hyperopic shift eyes show a trend to have longer axial length (Table 6). In SRK-II using formula, there were no statistically significant differences in mean pre-operative axial length and anterior chamber depth between hyperopic and myopic shift group in acute primary angle closure and normal open angle group but statistically significant differences in mean axial length in primary angle closure group that hyperopic shift eyes show a trend to have shorter axial length (Table 7).

Discussion

The present study demonstrates refractive outcome after cataract surgery and the possibility of inaccurate IOL power calculation in acute primary angle closure and primary angle closure patients compare with normal open angle patients through the comparison of IOL formulas, SRK/T and SRK-II, by using only single-piece IOL and excluding complicated cataract surgery cases.

In this study using the SRK/T formula show lesser mean error than using the SRK-II formula in all groups that mean using the SRK/T formula for predicting IOL power producing more accurate refractive error results than the SRK-II formula in acute primary angle closure, primary angle closure and normal open

Table 6. Proportion of hyperopic and myopic shift of mean error when using SRK/T in each group and their pre-operative anterior segment biometry

	Hyperopic shift	Myopic shift	*p*-value
AACA	11 (57.89%)	8 (42.10%)	
AL (mm)	22.46±0.66	22.53±0.61	0.9349
ACD (mm)	2.35±0.07	2.33±0.11	0.4365
Closure	127 (69.02%)	57 (30.97%)	
AL (mm)	22.90±0.76	22.77±0.73	0.2461
ACD (mm)	2.60±0.39	2.61±0.48	0.6035
Open	219 (59.51%)	149 (40.48%)	
AL (mm)	23.84±1.43	23.40±1.07	0.0011*
ACD (mm)	3.22±0.43	3.26±44.68	0.7448

APAC = acute primary angle closure; PAC = primary angle closure; Open = normal open angle; PSE = post-operative spherical equivalent; AL = axial length; ACD = anterior chamber depth.
Value given as means ± standard deviation. * $p<0.05$

Table 7. Proportion of hyperopic and myopic shift of mean error when using SRK-II in each group and their pre-operative anterior segment biometry

	Hyperopic shift	Myopic shift	*p*-value
AACA	11 (57.89%)	8 (42.10%)	
AL (mm)	22.54±0.54	22.44±0.75	0.7412
ACD (mm)	2.36±0.08	2.32±0.11	0.2831
Closure	106 (56.60%)	78 (42.39%)	
AL (mm)	22.79±0.67	22.96±0.85	0.0481*
ACD (mm)	2.63±0.34	2.61±0.43	0.7105
Open	196 (53.26%)	172 (46.73%)	
AL (mm)	23.72±1.39	23.60±1.22	0.401
ACD (mm)	3.21±0.42	3.26±0.45	0.5776

APAC = acute primary angle closure; PAC = primary angle closure; Open = normal open angle; PSE = post-operative spherical equivalent; AL = axial length; ACD = anterior chamber depth.
Value given as means ± standard deviation. * $p<0.05$

angle patients. The eyes with primary angle closure produced statistically significant more inaccurate results than acute primary angle closure and normal open angle patient but the accuracy in acute primary angle closure and normal open angle patients were not statistically significant. In previous studies showed the cause of unstable refractive error results after cataract surgery in angle closure glaucoma was higher intracapsular volume and larger capsular bag than normal that may cause unstable IOL placement, tilting or decentering, and cause unstable refractive error after cataract surgery.

This study shows more hyperopic results than predicted in both formula in all group same as the previous studies[12]. The most hyperopic shift in ocular lens power displayed in primary angle closure patients. After cataract surgery in angle closure glaucoma, the anterior chamber will deepen and the capsular bag will posterior shift from the previous position result in hyperopic shift in ocular lens power due to IOL position will more posterior plane than intended. The other reason of hyperopic shift is after cataract surgery the intraocular pressure will decrease result in axial length shorten. However, in this study, we found the two statically significant difference that not found statically significant difference in the previous studies[13,14,16] that may because our patients included in this study were more than other previous studies and this study is the first study comparing acute primary angle closure with primary angle closure patients. The first point, the primary angle closure patients were statically significant difference more hyperopic shift than the normal open primary closure that can explain the reasons as above and the second was the acute primary angle closure patients was statically significant less hyperopic shift than primary angle closure patients but not statically significant different with normal open angle patients may because a forward shift of IOL from a loose Zinn's zonule nullifies axial length shortening from decreasing intraocular pressure after cataract[15].

We found that no statically significant difference in the axial length and anterior chamber depth between the hyperopic shifted and myopic shifted eyes in acute primary angle closure and primary angle closure patients. We suggest that the pre-operative axial length and anterior chamber depth are not related to inaccuracy of IOL power calculations. Same as the previous studies reporting they can not determined the accuracy of IOL calculations from pre-operative biometric data in eyes with angle closure glaucoma[12,16].

From the results of this study, we found that cataract surgery can statically significant improve visual acuity in all groups. For acute primary angle closure and primary angle closure patients, the surgery is effective in decreasing IOP and post-operative medication use. We suggest touse SRK/T formula to calculate IOL power in all group. To choose the IOL power in acute primary angle closure patients can choose the same myopic predicted post-operative refractive error as the normal open angle patients but in the primary angle closure patients may have to choose the power that the predicted post-operative refractive error more myopic than acute primary angle closure and normal open angle patients. We can not found the pre-operative factors that related to inaccuracy of IOL power calculation. We believe that the related-factor may be a post-operative IOL position. Because of this study is retrospective study, we can not collect data of a post-operative IOL position that is not a routine collecting data in our clinic. In next study, we plan to collect the patient as prospective study and use the anterior segment OCT to measure a post-operative IOL position for searching relation.

The limitations of this study are the retrospective study design, multiple surgeons that may produce the inaccuracy results.

Conclusion

IOL power prediction is more accurate when use SRK/T formula. All group of patients have to choose the IOL power producing the myopic predicted post-operative refractive error. The primary angle closure patients have to choose the power that the predicted post-operative refractive error more myopic than acute primary angle closure and normal open angle patients. The pre-operative axial length and anterior chamber depth are not related to inaccuracy of IOL power calculations.

What is already known on this topic?

Accuracy of intraocular lens power was decrease in primary angle closure when compared with normal open angle.

What this study adds?

IOL power prediction is more accurate when use SRK/T formula. We have to choose the IOL power producing the myopic predicted post-operative refractive error. The primary angle closure patients have to choose the power that the predicted post-operative refractive error more myopic than acute primary angle closure and normal open angle patients.

Potential conflicts of interest

None.

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ค่าสายตาคงเหลือหลังการผ่าตัดต้อกระจกในผู้ป่วยมุมตาแคบฉับพลันและผู้ป่วยมุมตาแคบ

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วัตถุประสงค์: *เนื่องจากต้อหินเป็นสาเหตุที่ทำให้เกิดภาวะตาบอดเป็นอันดับสองรองจากต้องกระจกแต่เป็นภาวะตาบอดที่ไม่สาเหตุแก้ไขได้ ต้อหินมุมปิดเป็นภาวะที่พบได้ประมาณเกือบครึ่งหนึ่งของภาวะตาบอดจากต้อหิน ความชุกของต้อหินมุมปิดพบมาในกลุ่มประชากรเอเชีย สาเหตุของโรคมักเป็นจากลักษณะทางกายภาพของช่องหน้า ลูกตาผิดปกติ สาเหตุที่สำคัญคือเลนส์ตาที่หนาขึ้นตามอายุ ซึ่งในระยะยาวทำให้เกิดการติดของม่านตาบริเวณมุมตาทำให้เกิดภาวะความดันตาขึ้น การรักษานอกจากการทำเลเซอร์เปิดมุมตาแล้ว ยังอาจจำเป็นต้องทำการผ่าตัดต้อกระจกเพื่อรักษาภาวะมุมตาแคบเพื่อลดความดันลูกตา ปัจจุบันการวัดค่าเลนส์เทียมของภาวะมุมตาแคบแบบต่าง ๆ ยังไม่มีข้อสรุปที่ชัดเจนในการเลือกค่าเลนส์เทียม จึงเป็นที่มาของงานวิจัยฉบับนี้*

วัสดุและวิธีการ: *เป็นการศึกษาแบบย้อนหลัง 3 ปี โดยการค้นแฟ้มประวัติคนไข้จำนวน 517 ตา แบ่งออกเป็น 3 กลุ่ม คือ 19 ตา เป็นกลุ่มมุมปิดฉับพลัน 184 ตาเป็นกลุ่มมุมตาปิด 398 ตาเป็นกลุ่มมุมตาเปิด โดยทั้งสามกลุ่มได้รับการผ่าตัด ต้อกระจกแบบให้คลื่นอัลตราซาวน์และใส่เลนส์เทียม ใช้สูตร SRK-II และ SRK-T ในการคำนวณค่ากำลังขยายของเลนส์เทียม ความแม่นยำของแต่ละสูตรถูกวิเคราะห์โดยค่าเฉลี่ยความแตกต่างระหว่างค่าสายตาคาดการณ์และค่าสายคงเหลือจริงหลังการผ่าตัด ค่าสัดส่วนต่าง ๆ ของตาส่วนหน้าถูกวัดเพื่อหาปัจจัยที่เกี่ยวข้องกับความคาดเคลื่อน ในการวัดค่าเลนส์เทียม*

ผลการศึกษา: *ในกลุ่มมุมตาแคบฉับพลัน ค่าการมองเห็นแย่ที่สุดในสามกลุ่ม ต้องใช้ยาลดความดันตาจำนวนมากที่สุด ความดันตาสูงสุด ความยาวลูกตาสั้นที่สุด ช่องหน้าลูกตาแคบสุด หลังผ่าตัดสายตาค่อนไปทางสายตายาวมากที่สุด สูตร SRK/T ในการคำนวณค่ากำลังขยายเลนส์เทียมจะให้ค่าที่แม่นยำมากกว่าใช้สูตร SRK-II แต่ทั้งสองสูตรจะให้ค่าสายตาหลังผ่าตัดค่อนไปทางสายตายาวกว่าที่คาดการณ์ไว้ กลุ่มมุมตาแคบให้ค่าสายตาหลังการผ่าตัด ค่อนไปทางสายตายาวมากกว่ากลุ่มมุมตาเปิดอย่างมีนัยสำคัญ และในกลุ่มมุมตาแคบฉับพลันให้ค่าสายตา หลังการผ่าตัดค่อนไปทางสายตายาวมากกว่ากลุ่มมุมตาแคบอย่างมีนัยสำคัญ ไม่พบความสัมพันธ์ของค่า ความยาวลูกตาและค่าความลึกของช่องหน้าลูกตากับความไม่แม่นยำในการคำนวนค่าเลนส์เทียม*

สรุป: *การคำนวณกำลังขยายของเลนส์เทียมจะแม่นยำกว่าเมื่อใช้สูตร SRK-T ทุกกลุ่มควรเลือกกำลังขยายที่คาดการณ์ไปในแนวทางสายตาสั้น กลุ่มมุมตาแคบ ควรเลือกไปในแนวทางสายตาสั้นมากกว่ากลุ่มมุมตาแคบฉับพลันและกลุ่มมุมตาเปิด*