Visual Acuity in Patients Having Cataract Surgery by Different Techniques

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Background: *Question of different techniques of cataract surgery would offer different post-operative visual acuity (VA) has been asked.*
Objectives: *To compare the pre-and post-operative VA of cataract patients operated by different techniques as Extracapsular Cataract Extraction(ECCE), Phacoemulsification(PE), and Manual Phaco Fragmentation (MPF) and compare in different age groups.*
Method: *The post-operative visual acuity of cataract patients was collected from 72 hospitals in Bangkok and rural part of Thailand. Techniques of cataract surgery were recorded. The cases with pre-operative and intra-operative complication and cases operated without intraocular lens (IOLs) implantation were ruled out.*
Results: *VA of cataract patients post-operation was statistically significant better than pre-operation at p–value (less than 0.05) and the result persisted for every age group. Cataract patients operated by PE had better post-operative VA than patients operated by ECCE and MPF, even if MPF had the best post-operative VA. This is because the total cases were less than the other procedure.*
Conclusion: *Due to the nature of retrospective study, the cause of poor post-operative VA was due to astigmatism. The pre-operative astigmatism was not recorded thus preventing a complete analysis.*

Keywords: *Cataract, Extracapsular Cataract Extraction, Phacoemulsification, Manual Phaco Fragmentation, Intraocular lens, LogMar Visual Acuity, Decimal Visual Acuity*

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Cataract accounts for 50% of blindness globally and remain the leading cause of visual impairment in all regions of the world. This is expected to rise due to an aging population and an increase in life expectancy[1]. According to the National Survey of Blindness in Thailand conducted in 1984, 1987 and 1994[2] including the First National Survey of Visual Impairment in Thailand in 2006[3], cataract is a major cause of blindness. Its prevalence was less when compared with previous studies. However, it still presented high number of cataract backlog[4]. Despite improvements in surgical outcome, Ministry of Public Health (MOPH) and National Health Security Office (NHSO) conducted regular services and launched the intervention program continuously with complete coverage and good quality of care as international standard[5-8]. Although cataracts are not preventable, their surgical treatment is one of the most cost-effective interventions in healthcare. For cataract extraction, conventional extracapsular cataract extraction (ECCE) with midlimbal chord length of 8-12 mm and nucleus expression was replaced by phacoemulsification (PE), which cost more resources and training. It is accepted

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that PE gives a better outcome than ECCE with sutures[9]. Lately small incision cataract surgery without using ultrasound technique was introduced and accepted as Manual Phaco Fragmentation (MPF). Therefore, it has been questioned whether the different techniques of lens extraction would affect the post-operative visual acuity (VA).

The International Health Policy Program (IHPP) is responsible for providing health economic information to policy makers in MOPH and NHSO to allocate limited resources most cost effectively.

Objective

IHPP worked with the Committee of Eye Health Promotion of MOPH to conduct a study to determine pre-operative and post-operative VA of cataract patients operated in governmental hospitals in Thailand. The study demonstrated the post-operative VA result from different techniques of cataract surgery (ECCE, PE and MPF) in every age group.

Methods

Retrospective study of cataract patients

Table 1. Cataract cases from 72 hospitals distributed in Bangkok and rural areas

Hospital		Number	Hospital		Number
1	Amnaj Charoen	31	37	Payao	67
2	Ang Thong	41	38	Petchaboon	240
3	Ban Mee, Lopburi	34	39	Prachaub Kirikhan	35
4	Betong, Yala	8	40	Prachomklao Petchaburi	66
5	Burirum	165	41	Prae	110
6	Chachaengsao	63	42	Prapoklao, Chantaburi	153
7	Chaiyapum	44	43	Priest, Bangkok	85
8	Chaopayayommarat,Supanburi	49	44	Putachinnarat, Pisanulok	69
9	Chonburi	109	45	Rajburi	158
10	Christain Manorom, Chainat	31	46	Ranong	27
11	Chulalongkorn, Bangkok	161	47	Sakonnakorn	69
12	Chumporn	102	48	Samutprakarn	27
13	Damnoensaduak Rajburi	31	49	Sapasitprasong, Ubolrajthani	60
14	Dearmbarng, Supunburi	101	50	Saraburi	187
15	Intaburi, Singburi	62	51	Satoon	27
16	Kampangphetch	128	52	Singburi	43
17	Khon Kaen	107	53	Somdadprachaotaksin, Tak	57
18	Lamphun	54	54	Samutsongkram	15
19	Lerdsin, Bangkok	45	55	Somdetprasungkarat17, Ayudhaya	31
20	Lampang	326	56	Songkla	61
21	Mae Sod, Tak	41	57	Srinakarin, Kon Kaen	58
22	Maharat Chiang Mai	109	58	Srisaket	104
23	Maharat Nakonratchasima	342	59	Srisangworn, Sukhothai	40
24	Mahasarakarm	169	60	Srisungvarn, Maehongsorn	26
25	Makarak, Kanchanaburi	23	61	Suhaigoluk, Yala	45
26	Mukdaharn	24	62	Sukhothai	61
27	Nakorn Sawan	144	63	Suratthanee	83
28	Nakornnayok	101	64	Surin	44
29	Nakornpanom	85	65	Takuapa Pang Nga	23
30	Nan	34	66	Trad	15
31	Nong Khai	99	67	Udonthanee	183
32	Nongbualampoo	61	68	Uthaithanee	82
33	Paholphonpayuhasena, Kanchanaburi	94	69	Uttaradit	48
34	Pattalung	75	70	Varachira, Phuket	66
35	Pathumthanee	86	71	Yala	54
36	Pattani	49	72	Yasothon	72
			Total		5,819

Table 2. Age and sex distribution of operated cataract patients(n = 5,819*)

Age range (years)	Male			Female			Total**	Percent
	ECCE	PE	MPF	ECCE	PE	MPF		
Less than 40	20	41	4	15	17	3	100	1.73
40-49	47	89	4	33	66	1	240	4.15
50-59	127	268	6	156	315	4	876	15.13
60-69	233	526	18	348	864	29	2,018	34.86
70 and over	355	663	34	523	940	40	2,555	44.14
Total*	782	1,587	66	1,075	2,202	77	5,789	100.00

*11 male patients were missing data on age
*18 female patients were missing data on age
** 1 patient was missing data on sex

Table 3. Mean pre-operative and pos-operative visual acuity (VA) in LogMar

LogMarVA	Total	Mean in LogMar and Snellen	Std. Deviation	Minimum	Maximum
Pre-operation	5,819	1.6248(20/849)	.86274	.00	3.99
Post-operation	5,819	0.5208(20/67)	.48200	.00	4.00

Table 4. Tests of Normality

LogMar VA	Kolmogorov-Smirnov (a)		
	Statistic	df	Sig.
Pre-operation	0.171	5819	.000
Post-operation	0.213	5819	.000

a Lilliefors Significance Correction

operated in May 2006 were done in 67 provincial/ regional hospitals of MOPH (Amnaj Charoen, Ang Thong, Ban Mee Lopburi, Betong Yala, Bureerum, Chachaengsao, Chaiyapum, Chaopayayommarat, Chonbury, Christain manorom Chainat, Chumpon-ketudomsuk, Damnoensaduak, Rajburi, Dearm-barngnangbuad Supun, Intaburi of Singburi, Kampangphetch, Khon Kaen, Lamphun, Lumpang, Mae Sod, Maharat Nakonratchasima, Mahasarakarm, Makarak Kanchanaburi, Mukdaharn, Nakorn Sawan, Nakornnayok, Nakornpanom, Nan, Nong Khai, Nongbualampoo, Paholpolpayuhasana, Patalung, Pathumthanee, Pattanee, Payao, Petchaboon, Prachaub Kirikhan, Prachomklao Petchabury, Prae, Prapoklao Chantaburi, Putachinnarat Pisanulok, Rajburi, Ranong, Sakonnakorn, Samutprakarn, Sapasitprasong, Saraburi, Singbury,Somdadprachaotaksin, Somdetpraputta lerdlard, Somdetprasungkarat aung 17, Songkla, Srisaket, Srisangworn Sukhothai, Srisungvarn, Suhai goluk, Sukhothai, Suratthanee, Surin, Takuapa Pangnga, Trad, Udontnanee, Uthaithanee, Uttaradit, Varachira Phuket, and Yala, Yasothon). Two MOPH hospitals from Bangkok (Priest and Lerdsin) and three university hospitals (Chulalongkorn, Srinakarin, and Maharat Chiang Mai) sent the data. Therefore, 72 hospitals were in the study. The reason to choose the operated cataract cases in May was because the Cataract Intervention Program of NHSO (Kaew Ta Duang Jai project) finished in April and Cataract Intervention Program for Commemoration for the King's 60th year of Assession to the Throne did not start until July 2006. These two program limited pre-operative VA to blinding cataract level (10/200) and exempted some poor VA that could not live independently (20/200). The exclusion criteria was applied to cataract patients with co-morbidity as hypertension, diabetes, cardiovascular diseases, and major eye diseases of glaucoma, diabetic retinopathy, age-related macular degeneration, corneal diseases, and scar including after cataract that cause subnormal VA. Cataract cases with complication during operation as rupture posterior capsule or

Table 5. Compare pre and post -operative VA in LogMar with nonparametric test, Wilcoxon Signed Ranks Test (2 related)

LogMar V A		Total	Mean Rank	Sum of Ranks
Post-operation	Negative Ranks	5,462 (a)	2,833.61	15,477,153.00
Pre-operation	Positive Ranks	137(b)	1,460.20	200,047.00
	Ties	220 (c)		
	Total	5,819		

a LogMar VA post-operative less than LogMar VA pre-operative
b LogMar VA post-operative more than LogMar VA pre-operative
c LogMar VA post-operative equal to LogMar VA pre-operative

Table 6. Test Statistics(b) of pre and post-operative VA in LogMar

	LogMar VA post-operative LogMar VA pre-operative
Z	-63.161(a)
Asymp. Sig. (2-tailed)	.000

a Based on positive ranks.
b Wilcoxon Signed Ranks Test

post-operative complication as IOL decentation and corneal edema were also excluded.

Results

Five thousand eight hundred nineteen cataract cases operated from 72 hospitals, distributed from all over the country as shown in Table 1 were part of this study. Male to female ratio was 1: 1.38 with the age range of 4 to 99 years and a mean age of 66.82 with the standard deviation of $\pm$ 10.64 years. Age group, sex distribution, and techniques used to operate cataract are shown in Table 2 and Fig. 1. To compare pre- and post-operative VA, the LogMar visual acuity system was used. Mean LogMar VA pre-operative was 1.628 (equivalence to VA of 20/849) and mean LogMar VA post-operative was 0.5208 (equivalence to VA of 20/67) (Table 3). By using statistics nonparametric Wilcoxon Signed Ranks Test compared these pair of means, it was proved that post-operative VA was better than pre-operative VA with statistically significant different with p-value of less than 0.05 (Table 4, 5, 6).

In the same data set, concerned with different operative technique (ECCC , PE , MPF) showed difference between means LogMar VA pre- and post-operative (Table 7). The mean LogMar VA post-operative of MPF was 0.2952 (VA = 20/39), PE was 0.4646 (VA = 20/58), and ECCE was 0.6528 (VA = 20/90). This identifies MPF as the better one. Using nonparametric statistics of Kruskal-Wallis Test (Table 8, 9, 10) to compare means outcome of these three operating techniques, the result came out to be statistically significantly different with p-value of less than 0.05 and the setting with least mean LogMar VA post-operation had the best result.

In different age groups (n = 5,799, with 20 missing data of age and sex) mean LogMar VA pre- and post-operative were studied (Table 11, 12, 13). It was proved that the age group of 50-59 years had the best visual outcome post-operatively with a mean LogMar VA post-operative of 0.4539 (VA = 20/57). The mean visual outcome of every age group proved to be statistically significant different with p-value of less than 0.05 between pre- and post-operation.

Pre and post-operative VA of cataract patients operated in May 2006 (Table 14 and Fig. 2) in Snellen system revealed that 59.41% were blinding cataract and 40.59% were for better quality of vision. Post-operative VA were very good for 43% (20/20-20/40) and good for 30.7% (20/50-20/70).

Discussion

Because this study was retrospective, the pre-operative astigmatism and expected post-operative VA (IOLs calculation) were not recorded. Most of the cases with VA less than 20/40 were from post-operative astigmatism and mild myopic setting for the elderly or the priests in rural areas. For ECCE, proper suture tension helps reduce post-operative astigmatism; loose sutures cause astigmatism perpendicular to the axis of the suture and tight sutures cause astigmatism in the axis of the suture[10]. The ECCE technique require a superior incision of up to 2 diopters of with the rule astigmatism was accepted. Although the post-operative astigmatism would usually diminish with

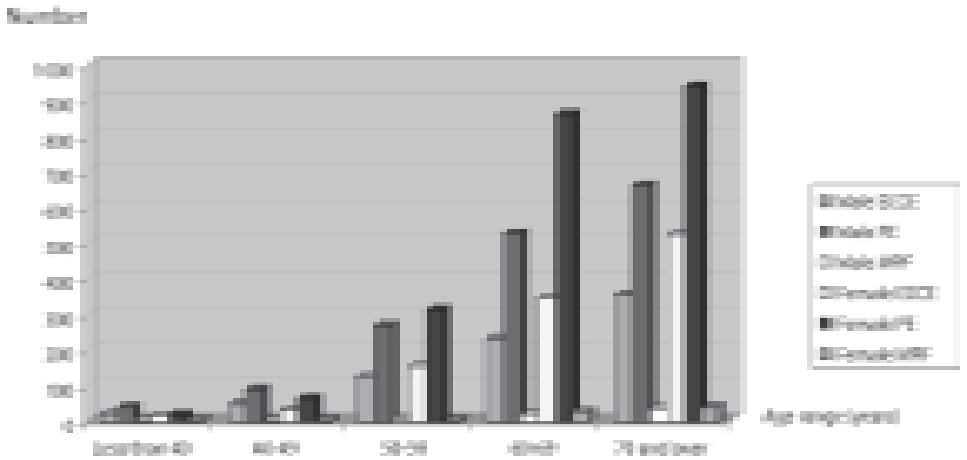

Fig. 1 Age and sex distribution of operated cataract patients by 3 techniques

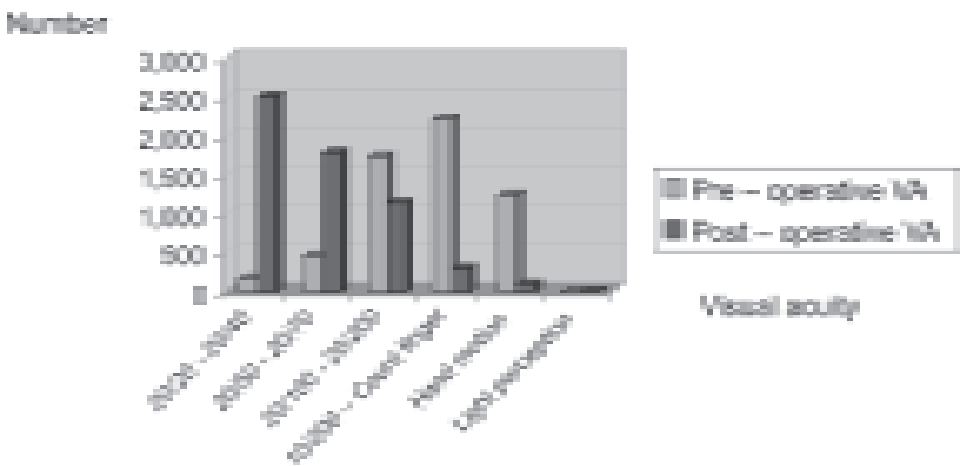

Fig. 2 Pre and post-operative visual acuity of cataract patients

Table 7. Mean pre and post-operative VA in LogMar of cataract patients operated with different techniques

	Operation	Number	Mean LogMar VA	Standard deviation	Median	Variance
Pre-operation	ECCE	1,867	2.1953	0.81270	2.00	0.660
	PE	3,809	1.3547	0.75040	1.00	0.563
	MPF	143	1.3693	0.64307	1.15	0.414
Post-operation	ECCE	1,867	0.6528 (VA = 20/90)	0.53266	0.55	0.284
	PE	3,809	0.4646 (VA = 20/58)	0.44771	0.34	0.200
	MPF	143	0.2952 (VA = 20/39)	0.22378	0.18	0.050

Table 8. Tests of Normality

LogMar VA	Operation	Kolmogorov-Smirnov (a)			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Pre-operation	ECCE	0.285	1867	.000	.825	1867	.000
	PE	0.207	3809	.000	.896	3809	.000
	MPF	0.277	143	.000	.804	143	.000
Post-operation	ECCE	0.209	1867	.000	.743	1867	.000
	PE	0.205	3809	.000	.759	3809	.000
	MPF	0.240	143	.000	.822	143	.000

a Lilliefors Significance Correction

Table 9. Comparison of post-operative VA by LogMar between ECCE , PE and MPF. To prove statistically significant different by Kruskal-Wallis Test (k independent)

	Operation	Number	Mean Rank
LogMar VA post-operation	ECCE	1867	3506.29
	PE	3809	2654.86
	MPF	143	1920.86
	Total	5819	

Table 10. Test Statistics (a,b)

	LogMar VApost-operative
Chi-Square	378.894
df	2
Asymp. Sig.	.000

a Kruskal Wallis Test
b Grouping Variable: operation

Table 11. Mean LogMar of VA pre-operative and post-operative in different age group (5,799)

Age group	Mean logma VA preop	Meam logma VA postop
less than 40	1.8534	0.5572 (VA = 20/72)
40 to 49	1.6829	0.4699 (VA = 20/59)
50 to 59	1.6760	0.4539 (VA = 20/57)
60 to 69	1.5734	0.4853 (VA = 20/61)
70 and over	1.6379	0.5767 (VA = 20/75)

Table 12. Tests of Normality

LogMar VA	Age group (years)	Kolmogorov-Smirnov (a)			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Pre-operative	less than 40	.230	100	.000	.852	100	.000
	40 to 49	.180	240	.000	.887	240	.000
	50 to 59	.161	885	.000	.897	885	.000
	60 to 69	.174	2018	.000	.896	2018	.000
	70 and over	.175	2556	.000	.884	2556	.000
Post-operative	less than 40	.224	100	.000	.715	100	.000
	40 to 49	.200	240	.000	.753	240	.000
	50 to 59	.201	885	.000	.719	885	.000
	60 to 69	.200	2018	.000	.777	2018	.000
	70 and over	.228	2556	.000	.749	2556	.000

a Lilliefors Significance Correction

Table 13. Comparison of LogMar VA pre and postoperative in different age group for each pair of age groups

LogMar VA/Age group(years)	Number	Mean Rank	Sum of Ranks	Test Statistics(b)	logma VApost - logma VApre
Post-operative	92(a)	46.50	4278.00	Z	
Pre-operative	0(b)	.00	.00	Asymp. Sig. (2-tailed)	
less than 40	8(c)				
Negative Ranks	100				
Positive Ranks					-8.333(a)
					.000
Ties					
Total					
Post-operative		117.96	26422.00	Z	
Pre-operative		23.83	143.00	Asymp. Sig. (2-tailed)	
40 - 49					
Negative Ranks					
Positive Ranks	224(a)				-13.010(a)
	6(b)				.000
Ties	10(c)				
	240				
Total					
Post-operative		435.34	367860.50	Z	-24.879(a)
Pre-operative		240.74	4092.50	Asymp. Sig. (2-tailed)	.000
50 - 59					
Negative Ranks					
Positive Ranks	845(a)				
	17(b)				
Ties	23(c)				
	885				
Total					
Post-operative		984.21	1872942.50	Z	-37.416(a)
Pre-operative		465.30	19542.50	Asymp. Sig. (2-tailed)	.000
60 - 69					
Negative Ranks					
Positive Ranks	1903(a)				
	42(b)				
Ties	73(c)				
	2018				
Total					
Post-operative		1241.13	2953898.00	Z	-41.490(a)
Pre-operative		693.96	48577.00	Asymp. Sig. (2-tailed)	.000
70 and more					
Negative Ranks					
Positive Ranks	2380 (a)				
	70(b)				
Ties	70(b)				
	2556				
Total					

a LogMar VApost-operative less than logma VApre-operative,
b LogMar VApost-operative more than LogMar VApre-operative,
c LogMar VApost-operative equal to LogMar VApre-operative

a Based on positive ranks
b Wilcoxon Signed Ranks Test

Table 14. Number of cases in different level of Snellen's VA appeared in pre and post-operative cases

	Pre-operative VA		Post-operative VA	
Visual Acuity (Snellen)	Number	Percent	Number	Percent
20/20 - 20/40	165	2.83	2,501	42.98
20/50 - 20/70	462	7.94	1,786	30.69
20/100 - 20/200	1,735	29.83	1,141	19.61
10/200 – Count finger	2,217	38.10	296	5.09
Hand motion	1,239	21.29	94	1.62
Light perception	1	.0.00	1	0.00
Total	5,819	100.00	5,819	100.0

time, some still persist up to 6 months and caused less VA when compared to PE and MPF.

The PE technique needs learning curve to overcome complication. In this study, all the cases were done by the phaco expert. According to the phaco surgeons, the most common and simplest PE incision site is temporal part. Ozkurt et al[11] stated that the surgically induced astigmatism was lower in the temporal incision group than in the nasal incision group so they preferred superotemporal incision. Most of the phaco-surgeon in Thailand prefers clear corneal temporal incision of 2.7-4.0 mm wide. Using non-foldable IOL, the incision has to be enlarged to 5-5.5 millimeters and one or more stitches have to be applied to close the wound. Post-operative astigmatism may be caused by tight radial sutures, which steepen corneal curvature in the axis of the suture[12]. The original incision size should be wide enough to put a foldable IOL. Therefore, surgeons preferred not to put the suture to close to the temporal incision site. Assuming the temporal wound closure will cause less post-surgically astigmatism, it will have better post-operative VA. Another reason for post surgically astigmatism could be because of rotation of the IOLs after implantation, which was common in 3-piece IOLs but unusual for the intact posterior capsule.

Although the cause of poor post-operative VA from corneal scar were excluded by the exclusion criteria, the corneal burn from PE can happen and cause astigmatism with poor post-operative VA. In the elderly group, the astigmatic pattern is with the rule, with a steep meridian at 90°. If the PE incision site at the temporal part has wound closure by suture, the astigmatism will be less. Therefore, using non-foldable IOLs in PE with wound suture would offer better VA. In the middle age group (40-49, 50-59 years old) their astigmatism were less, therefore, to operate at the temporal part without suture will cause some astigmatism (more flat in 180°). If the stitch is applied, it causes less flat, thus the post-operative VA of foldable and non-foldable IOL were not different.

MPF offered best post-operative VA. This may be due to small incision at upper limbus, which was different from PE. It may also be due to the smaller number of cases compared with other groups.

It was accepted that endophthalmitis is more common in PE than ECCE, especially PE with clear corneal incision without suture[13-15]. After treatment of endophthalmitis, the final VA would be less than the group without endophthalmitis. This would be one cause of poor post-operative VA in PE cases but not in this study.

For further study, it would be interesting to compare the post-operative VA of using different technique for cataract operation, the pre-operative astigmatism and the specific width of wound opening should be recorded. Cataract incision with astigmatic correction should be recorded. Furthermore, recording the type of wound closing will make possible the evaluation of the effect of cataract surgical technique correctly.

Conclusion

VA of cataract patients post-operation was better than pre-operation and the result persisted for every age group. Cataract patients operated by PE had better post-operative VA than patients operated by ECCE. MPF had the best post-operative VA although the total cases were less than other procedure.

Recommendation to health administrators and policy makers

PE is the most common technique used for cataract surgery in Thailand. It improves quality of life of aging population, makes their living independent

and productive. Making the PE cost lower is a mandate for health administrators and policy makers.

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ระดับสายตาของผู้ป่วยต้อกระจกเมื่อผ่าตัดด้วยวิธีต่างกัน

ศุภลักษณ์ รายยวา, วัฒนีย์ เย็นจิตร, ฉวีวรรณ เย็นจิตร, มงคล ทะปัญญา

ภูมิหลัง : *ปัจจุบันการผ่าตัดต้อกระจกนิยมทำโดยเหลือเปลือกเลนส์ไว้เพื่อใส่แก้วตาเทียม การจะนำเลนส์ที่ขุ่นออก วิธีที่ใช้กันมากมี 2 วิธีคือ ผ่าตัดเปิดแผลขนาดประมาณ 10-12 มม. ผ่าตัดเอา nucleus ของเลนส์ออกทั้งอัน แล้วจึงล้าง cortex ที่เหลือออก และเย็บแผลปิดหลังจากใส่แก้วตาเทียม วิธีนี้เรียกว่าวิธี ECCE ซึ่งต่างกับวิธีผ่าตัดแผลเล็กและสลายต้อกระจกด้วยคลื่นเสียงความถี่สูงแล้วดูดเอาเศษเลนส์ออก(PE) หรือวิธีที่ 3 ที่แนะนำในประเทศกำลังพัฒนาคือ เปิดแผลเล็กและใช้เครื่องมือตัดเลนส์เป็นชิ้นเล็กๆ ออกมาโดยไม่ใช้คลื่นเสียงความถี่สูง(MPF) ทั้ง 3 วิธี นี้มีต้นทุนที่ใช้ในการผ่าตัด การฝึกอบรม และการดูแลรักษาเครื่องมือที่แตกต่างกันมาก จึงมีปัญหาสงสัยว่าวิธีผ่าตัดที่แตกต่างกันจะทำให้การมองเห็นหลังผ่าตัดต่างกันหรือไม่*

วัตถุประสงค์ : *คณะทำงานส่งเสริมสุขภาพตาและสำนักพัฒนานโยบายสุขภาพระหว่างประเทศ จึงทำการศึกษาการมองเห็นของผู้ป่วยต้อกระจกหลังผ่าตัดด้วยวิธีเดิม (ECCE),ผ่าตัดแบบแผลเล็กโดยการสลายต้อด้วยการใช้คลื่นเสียงความถี่สูง(PE) และการผ่าตัดแบบแผลเล็กโดยไม่ใช้คลื่นเสียงความถี่สูง (MPF) ในผู้ป่วยที่ผ่าตัดต้อกระจกในโรงพยาบาลของรัฐ*

วัสดุและวิธีการ : *ศึกษาผู้ป่วยต้อกระจกจำนวน 5,819 คน ที่ได้รับการผ่าตัดจากโรงพยาบาลของรัฐ 72 แห่ง วัดสายตาก่อนและหลังผ่าตัด ศึกษาเปรียบเทียบสายตาก่อนผ่าตัดและหลังผ่าตัดทั้งแบบแยกกลุ่มอายุและไม่แยกกลุ่มอายุ และศึกษาเปรียบเทียบสายตาก่อนผ่าตัดและหลังผ่าตัดโดยการผ่าตัดแบบ ECCE, PE, MPF ผู้ป่วยที่มีปัญหาโรคของกระจกตา โรคของจอประสาทตาและน้ำวุ้น รวมทั้งมีภาวะแทรกซ้อนขณะผ่าตัด และหลังผ่าตัดจะถูกตัดออกจากการศึกษา*

ผลการดำเนินการ : *พบว่าสายตาของผู้ป่วยที่รับการผ่าตัดต้อกระจกโดยรวมดีขึ้นกว่าก่อนผ่าตัดอย่างมีนัยสำคัญทางสถิติที่ p-value น้อยกว่า 0.05 ค่าเฉลี่ยสายตา (VA) ก่อนผ่าตัดเท่ากับ 20/849 หลังผ่าตัดเท่ากับ 20/67 และศึกษาโดยแยกกลุ่มอายุก็ได้ผลดีกว่าเดิมเช่นกัน และเมื่อศึกษาโดยแยกชนิดของการผ่าตัดพบว่า ผู้ป่วยที่ทำผ่าตัดโดยการสลายต้อกระจกโดยไม่ใช้คลื่นเสียงความถี่สูงแบบแผลเล็ก (MPF) แม้จะมีจำนวนน้อยมากในการศึกษานี้ แต่มีการมองเห็นดีที่สุด(VA = 20/39) และผ่าตัดโดยการสลายต้อด้วยการใช้คลื่นเสียงความถี่สูง(PE) ได้การมองเห็นอันดับสอง (VA = 20/58) ส่วนการทำผ่าตัดแบบเดิมECCE พบว่าผลการมองเห็นหลังผ่าตัดเป็นอันดับสาม (VA = 20/90) พิสูจน์แล้วว่ามีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติที่ p-value น้อยกว่า 0.05 สาเหตุที่ทำให้การมองเห็นแตกต่างกันเนื่องจากการมีสายตาเอียง*

สรุป : *เนื่องจากเป็นการศึกษาแบบมองย้อนไปด้านหลัง จึงไม่ได้วัดความเอียงของสายตาก่อนผ่าตัดในผู้ป่วยทุกคน ทำให้ไม่สามารถสรุปได้ว่าสายตาเอียงหลังผ่าตัดมีมาตั้งแต่ก่อนผ่าตัดและเกี่ยวข้องกับรูปแบบการผ่าตัดหรือไม่ เพื่อให้ได้ผลการศึกษาที่แน่นอนควรวัดความเอียงของสายตาก่อนผ่าตัดและระดับสายตาที่ต้องการหลังผ่าตัดจึงจะสามารถประเมินผลได้ชัดเจน*