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A STUDY ON COMPARISON OF KERATOMETRIC CHANGES BETWEEN PRE-INCISION AND SINGLE-STEPPED CLEAR CORNEAL INCISION IN PHACOEMULSIFICATION SURGERY

Ophthalmology

Dr. Sourav Kumar Das Department Of Ophthalmology, Nilratan Sircar Medical College & Hospital, Kolkata, West Bengal.

Dr. Aritro Nandi* Department Of Ophthalmology, Nilratan Sircar Medical College & Hospital, Kolkata, West Bengal. *Corresponding Author

Dr. Rupam Datta Department Of Ophthalmology, Nilratan Sircar Medical College & Hospital, Kolkata, West Bengal.

Dr. Debarshi Jana Young Scientist, IPGMER And SSKM Hospital, Kolkata.

ABSTRACT

Phacoemulsification surgery is the most widely used technique for cataract surgery nowadays. It can be done by either pre-incision or by clear corneal incisions. Clear corneal incisions are becoming more popular option for cataract surgery and IOL (intraocular lens) implantation. The availability of foldable IOL that can be inserted through small incisions has created a trend for clear corneal incisions. To compare post-operative kera to metric changes after phacoemulsification surgery between pre-incision or tunnel-based incision and single stepped clear corneal incisions. Fifty patients undergoing phacoemulsification surgery in the Dept. Of Ophthalmology, Nilratan Sircar Medical College & Hospital, Kolkata, West Bengal. Both pre-incision and clear-corneal incision in phacoemulsification surgery results in surgically induced astigmatism post-operatively, but there was no significant difference in post-operative induced astigmatism in between both techniques.

KEYWORDS

Keratometric Changes, Single-stepped, Corneal Incision, Phacoemulsification Surgery

INTRODUCTION

Phacoemulsification surgery is the most widely used technique for cataract surgery nowadays. It can be done by either pre-incision or by clear corneal incisions. Clear corneal incisions are becoming more popular option for cataract surgery and IOL (intraocular lens) implantation. The availability of foldable IOL that can be inserted through small incisions has created a trend for clear corneal incisions. Clinical outcomes of cataract surgery are influenced by many factors e.g blade used for incisions, the phacoemulsification apparatus and IOL used which together constitute a surgical system.

Cataract literally means "waterfall". The surgical procedure for cataract removal has come a long way from SUSHRUTA's "Couching" method. There are many surgical procedures for cataract surgery e.g ICCE(intra-capsular cataract extraction), ECCE (extracapsular cataract extraction), SICS(small incision cataract surgery),phacoemulsification surgery and most recent femtosecond cataract surgery .Advances are aimed at finding a surgical method which is capable of providing better visual outcome, minimizing the complication and reducing the spectacle dependency. In 1967, CHARLES KELMAN introduced his revolutionary invention, phacoemulsification. It offers many benefits including small incision size, less tissue injury, less post-operative pain and inflammation and less surgically induced astigmatism. The incisions can be given by two methods- pre-incision and single stepped clear corneal incision. Advances in incision construction have improved the refractive results of cataract surgery by minimizing post-operative astigmatism. Astigmatism prevention and control is one of the biggest challenges for a surgeon after cataract surgery. Several studies have investigated the induced astigmatism after various types of small incisions and various locations including superior, temporal, supero-temporal, supero-nasal. On the other hand proper wound site is very important for reducing post-operative astigmatism. There are several options for this e.g phacoemulsification incision located on the steep corneal axis corrects small amount of astigmatism. Peripheral corneal relaxing incisions and toric IOL implantation used for more astigmatism correction.

To compare post-operative kera to metric changes after phacoemulsification surgery between pre-incision or tunnel-based incision and single stepped clear corneal incisions.

MATERIALS AND METHODS

1. Study area: Dept. Of Ophthalmology, N.R.S MEDICAL COLLEGE & HOSPITAL.

2. Study period: 1ST April, 2016 to 31st March, 2017.

3. Study population: Patients undergoing phacoemulsification surgery in the Dept. Of Ophthalmology.

4. Sample size: 50 cases.

5. Sample design:

a) Inclusion criteria: They are in the age group of 45 to 80 years.

b) Exclusion criteria: complicated cataract and eyes with evidence of corneal disease, glaucoma, squint or fundus pathologies.

a. Study design: It is a hospital based observational and prospective study.

b. Parameters to be studied:

1. Records of the patient (name, age, registration no, date of admission)
2. Complete ocular examination: It included visual acuity (aided and unaided), anterior-segment examination with slit-lamp, dilated fundoscopy, intraocular pressure measurement and, keratometry, A-scan biometry.
3. Patients are assessed post-peratively: 1st post-operative day, 1 week, 2weeks and 4 weeks.
4. Final recovery is assessed at 4weeks after surgery.

6. Study Tools:

1 .Torch- I have used torch to see the general status of the eyes e.g pupillary reaction, status of the eyelids, see for squint, redness, any discharge, watering etc.

2 .slit-lamp- I have used slit-lamp to examine the cornea, conjunctiva, the types and grades of cataract, dilated fundoscopy using 78D/90D lens etc.

3. Direct ophthalmoscope- I have used direct ophthalmoscope to examine the fundus, optic-disc, macula.

4. Keratometer- I have used BAUSCH & LOMB KERATOMETER. The working principle of constant object size and variable image size. The following equation gives the relationship between radius of curvature and diopteric power of cornea: D= n-1/r

D = diopteric power of cornea
N =index of refraction of the cornea
R =radius of curvature in metres.

Since the invention of ophthalmometer y Helmholtz, the index of refraction of the cornea has been taken 1.3375 for calibrating the instrument. Therefore, r (in metres) = 1.3375 – 1/D
Or r (in metres) 337.5/D

The range of keratometer is 36 to 52 D (6.5 to 9.38 mm). Its lower limit can be extended upto 30 D (5.6 mm) and upper limit up to 61 D (10.9 mm) by interposing a lens of -1D and +1.25D respectively, in front of objective of telescope.

LIMITATIONS

- The measurements of keratometer are based on a false assumption that the cornea is a symmetrical spherical or spherocylindrical structure with two principle meridian separated from each other y 90 degree, whereas the cornea in reality is aspheric.
- It measures the refractive status of a very small central area of cornea (3 – 4 mm) ignoring the peripheral corneal zones.
- It loses its accuracy when measuring very flat or steep cornea.
- Finally, small corneal irregularities would preclude the use of keratometer due to irregular astigmatism.

RESULT AND ANALYSIS

Our study showed that the mean age of the patients underwent CCI was 58.63 ± 7.2 and those underwent Pre-incision was 57.17 ± 5.23. The p value is 0.425 which is not statistically significant. Out of 50 patients 27 patients were underwent CCI and 23 patients were underwent Pre-incision. In the age group of 41-50, 5(18.52) patients were underwent CCI and 3(13.04) patients were underwent Pre-incision. In the age group of 51-60, 12(44.44) patients were underwent CCI and 15(65.22) patients were underwent Pre-incision. In the age group of 61-70, 10(37.04) patients were underwent CCI and 5(21.74) patients were underwent Pre-incision. The p value is 0.316 which is not statistically significant. Out of 50 patients in our study, 36 patients were female and 14 patients were male patients. Out of those 36 female patients, 19(70.37) patients were underwent CCI and 17(73.91) patients were underwent Pre-incision phacoemulsification surgery. Out of 14 male patients 8(29.63) patients underwent CCI and 6(26.09) patients were underwent Pre-incision. Thus, p value is p= 0.781, that is statistically not significant.The mean IOP of the patients underwent CCI was 14.44 ± 2.68 and those underwent Pre-incision was 15.04 ± 2.55. Thus it comes out with p = 0.424, which is not statistically significant.

We found that in case of CCI, the p values between preoperative Kh and DAY 1 Kh, pre-operative Kh and 1st week Kh, pre-operative Kh and 2nd week Kh, pre-operative Kh and 4th week Kh are respectively 0.498, 0.082, 0.147 and 0.305 which are not statistically significant. Whereas in case of those patients, underwent Pre-incision, the p values between pre-operative Kh and DAY 1 Kh, pre-operative Kh and 1st week Kh are respectively <0.001(p < 0.05) and 0.041(p <0.05), which are statistically significant. Also in case of Pre-incision pre-operative Kh and 2nd week Kh, pre-operative Kh and 4th week Kh are respectively 0.186 and 0.155, which are not statistically significant. In case of patients, underwent CCI, the p values of pre-operative Kv and DAY 1 Kv, pre-operative Kv and 1st week Kv, pre-operative Kv and 2nd week Kv, pre-operative Kv and 4th week Kv are respectively 0.001, <0.001, <0.001 and <0.001 (p<0.05). Thus the p values are statistically significant. Also in case of Pre-incision, the p values of pre-operative Kv and DAY 1 Kv, pre-operative Kv and 1st week Kv, pre-operative Kv and 2nd week Kv, pre-operative Kv and 4th week Kv are respectively <0.001, <0.001, <0.001 and <0.001, which are statistically significant.

DISCUSSION

The aim of all surgical procedures is reduced astigmatism and better visual function, but incisional astigmatism is usually inevitable. Incision site, configuration, incision size, surgical approach is important factors for cprneal astigmatism. In our hospital-based observational study conducted among 50 cases (27 CCI and 23 pre-incision phacoemulsification surgeries) between age group of 45 to 80 years to compare post-operative keratometric changes after phacoemulsification surgery between pre-incision or tunnel-based incision and single-stepped clear corneal incisions.

In our study there was no difference in age and sex distribution between two groups.

There was no difference in mean pre-operative Kh value, mean DAY 1 post-operative Kh value, mean 1st week post-operative Kh value, mean 2nd week post-operative Kh value, mean 4th week post-operative Kh value between two groups. Mean DAY 1 post-operative Kh value and mean 1st week post-operative Kh value was significantly lower than pre-operative Kh value (p value<0.001 and 0.041 respectively) in pre-incision group.

There was no difference in mean pre-operative Kv value, mean DAY 1 post-operative Kv value, mean 1st week post-operative Kv value, mean 2nd week post-operative Kv value, mean 4th week post-operative Kv value between two groups. Whereas mean DAY 1 post-operative Kv value, mean 1st week post-operative Kv value, mean 2nd week post-operative Kv value, mean 4th week post-operative Kv value was significantly lower than mean pre-operative Kv value in both the groups (p<0.001).

Gross RH, Miller KM [1] conducted a study on corneal astigmatism after phacoemulsification an IOL implantation through unsutured scleral and corneal tunnel incision and found significantly greater with-the-rule astigmatic change in sclera incision group on the 1st post-operative day. The effect disappeared in the 6th post-operative week. BiliA, ska E, WesoA, ek-Czernik A, Synder A, Omulecki W [2] in their study of surgically induced astigmatism after cataract phacoemulsification, found that surgically induced astigmatism can be minimized with incision in clear cornea and no suture. Mercieca F, Luck J et al. [3] in their study analyzed the early surgically induced corneal astigmatism with a 3.5 mm oblique clear corneal incision for phacoemulsification and flexible silicone implant. The oblique clear corneal incision for phaco is a comfortable and safe incision with a predictable and acceptable degree of SICA that may be better tolerated than that induced by superior incision.

CONCLUSION

Both pre-incision and clear-corneal incision in phacoemulsification surgery results in surgically induced astigmatism post-operatively, but there was no significant difference in post-operative induced astigmatism in between both techniques.

Table: Distribution of mean PRE OP Kh, DAY 1 Kh, WEEK 1 Kh, WEEK 2 Kh, WEEK 4 Kh, IOP, PRE OP Kv, DAY 1 Kv, WEEK 1 Kv, WEEK 2 Kv and WEEK 4 Kv

	CCI	INCISION PRE I	p Value	Significance
	Mean ± Std. Deviation	Mean ± Std. Deviation		
PRE OP Kh	44.31 ± 1.25	44.37 ± 1.19	0.877	Not Significant
DAY 1 Kh	44.26 ± 1.16	44.16 ± 1.14	0.769	Not Significant
WEEK 1 Kh	44.12 ± 1.12	44.04 ± 1.18	0.809	Not Significant
WEEK 2 Kh	44.14 ± 1.19	44.17 ± 1.19	0.918	Not Significant
WEEK 4 Kh	44.19 ± 1.21	44.14 ± 1.25	0.879	Not Significant
IOP	14.44 ± 2.68	15.04 ± 2.55	0.424	Not Significant
PRE OP Kv	43.95 ± 1.51	43.8 ± 1	0.694	Not Significant
DAY 1 Kv	43.69 ± 1.35	43.52 ± 0.96	0.610	Not Significant
WEEK 1 Kv	43.47 ± 1.45	43.15 ± 0.95	0.364	Not Significant
WEEK 2 Kv	43.43 ± 1.46	43.14 ± 1.03	0.437	Not Significant
WEEK 4 Kv	43.33 ± 1.44	43.24 ± 1	0.792	Not Significant

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