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Determining the Type of Astigmatism in Phacoemulsification Surgery with 2.8 mm Supero-Temporal Clear Corneal Incision

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ABSTRACT

Cataract till today remains the most common yet treatable cause of blindness accounting for more than 50% of blindness and visual impairment in the developing world. The goals for cataract surgery today regardless of type are rapid patient mobilization and comfort, early visual rehabilitation, minimal induced astigmatism and risk benefit ratio shift in patients favor counter balancing the surgeon's ego and faith in one particular technique only. The study was conducted on patients from opd of KMCRI Medical College and Hospital Bharuch for 18 months. The sample size taken for this study was 50 patients, who underwent phacoemulsification surgery of 2.8 mm supero temporal clear corneal incision. Informed consent was obtained from each participants before including in the study. The data collection was done using a proforma. Pre-operatively 12% patients were noted to have no astigmatism, whereas post-operatively after 6 months, 48% patients were noted to have no astigmatism. Preoperatively maximum number of patients (86.0%) had WTR astigmatism whereas postoperatively (52.0%) of patients had WTR astigmatism at 6 months. p-value showed significance ($p < 0.0001$). Pre-operatively maximum patients (66.0%) were in the range of 0.25D-0.50D, whereas post-operatively at 1, 3 and 6 months, maximum patients (54.0%) difference in keratometric dioptric power was $< 0.25D$. In supero temporal clear corneal incision of 2.8 mm there was decrease in both horizontal and vertical meridians postoperatively after 6 months. WTR astigmatism was found in higher number of cases, 6 months postoperatively.

INTRODUCTION

Cataract till today remains the most common yet treatable cause of blindness accounting for more than 50% of blindness and visual impairment in the developing world. It affects approximately 20 million people worldwide and figure is expected to reach 50 million by year 2020^[1]. In India, 2001-7.75 million people were affected and figure will reach to 8.25 million by year 2020^[2]. Cataract surgery, currently, among the most performed planned surgical procedures worldwide, positively impacting over patient's quality of life^[3]. The goals for cataract surgery today regardless of type are rapid patient mobilization and comfort, early visual rehabilitation, minimal induced astigmatism and risk benefit ratio shift in patients favor counter balancing the surgeon's ego and faith in one particular technique only. The cataract surgery paradigm today comprises mainly of the premium and elegant phacoemulsification technique and its poor yet comparable cousin manual small incision cataract surgery (MSICS), the more traditional intra capsular cataract extraction (ICCE) and extra capsular cataract extraction (ECCE) well on their way out except in certain situations. Small incision cataract surgery doesn't require suturing of wound and has low risk of intraoperative and post-operative complications and results in rapid visual rehabilitations^[4,5]. Phacoemulsification results in better postoperative visual acuity^[6]. Therefore, it is almost universally preferred nowadays^[7]. Astigmatism is a visually disabling refractive error affecting the general population, especially those with cataracts^[8]. With increased patient's expectations, the trend is not only to remove the cataract but also to address the problem of pre-existing astigmatism. Spectacle or contact lenses can be used to correct astigmatism. Spectacle results in various optical aberration and contact lens wear has a number of side effects^[9]. Correction of pre-existing astigmatism simultaneously with cataract surgery is attempted nowadays. A clear corneal incision given during phacoemulsification surgery at steep meridian of cornea reduces pre-existing astigmatism^[10,11].

At present time, cataract surgeries by phacoemulsification through clear corneal incision have become the principal method for cataract surgery because of its bloodless and fast approach. The postop SIA (surgical induced astigmatism) has always been a concern to most of surgeons. It has always been assumed that scleral incision would minimize the postop astigmatism. Therefore, the above study was undertaken to determine type of astigmatism in phacoemulsification surgery with 2.8 mm supero-temporal clear corneal incision.

MATERIALS AND METHODS

Study place: The study was carried out at department of ophthalmology, KMCRI Medical College and Hospital Bharuch from march 2022.

Study design: Prospective clinical study.

Inclusion criteria: All patients willing for phacoemulsifications surgery for cataract extraction age 30 years and above, willing for follow up and to be part of this study.

Exclusion criteria: Patients who had any pre-existing corneal pathologies, having >1 Diopter pre-existing astigmatism, any intra-operative complications that required corneal sutures or extensions of corneal incisions beyond 2.8 mm, any ocular surgeries done in the past, any ocular trauma in the past and unwilling to give consent for participation.

Sample size: Fifty patients selected from OPD of ophthalmology KMCRI Medical College and Hospital Bharuch.

Data analysis: The data was coded, analyzed and compiled on Microsoft Excel spread sheet.

Ethical considerations: All the necessary ethical permissions were taken from the ethical committee of the institution. Informed consent was obtained from each participants before including in the study.

Patient examination was done in details. Pre-op keratometry was done. Phacoemulsification was done through 2.8 mm supero-temporal clear-corneal incision with intraocular foldable lens. Visual acuity was recorded with the help of internally illuminated standard Snellen's chart. Bio microscopy and Direct ophthalmoscopy was done to find out the type of cataract and to rule out other ocular pathologies. Intraocular pressure was taken on Applanation Tonometer. Retinoscopy was performed in a dark room. Keratometry was performed for every eye, readings were taken with Auto refractometer and were taken in two principal meridians; pre-operatively recorded. A scan for calculating axial length of eye and IOL power was done. Keratometry evaluation was carried out post operatively in 1 week, 1, 3 and 6 months. The findings were recorded and data evaluated to come up with final results. Pre-operative investigations are done to rule out any systemic illness.

RESULTS

Out of these 50 patients, maximum patients (48.0%) were between the age group of 61-70 years, 36% were in the age group of 51-60 years, 8% were in

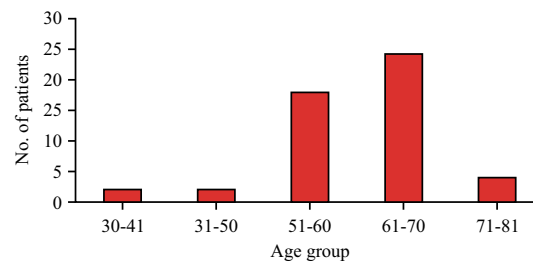


Fig. 1: Distribution of patients according to age-group

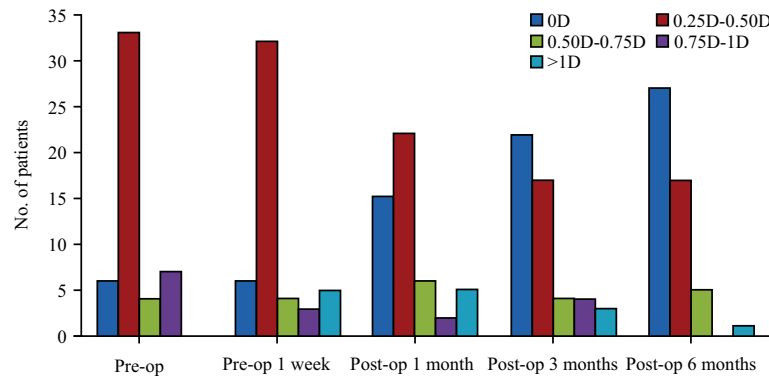


Fig. 2: Distribution of patients according to difference in keratometric dioptric power pre-operative and post-operative

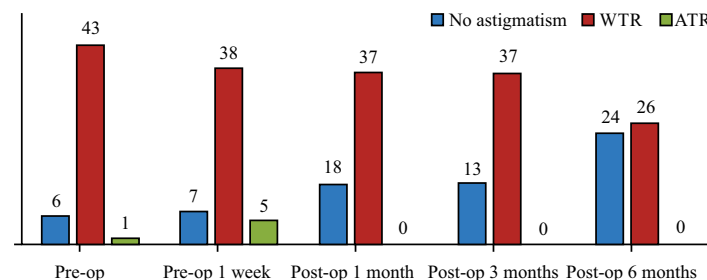


Fig. 3: Distribution of patients according to type of astigmatism

the age group of 71-80 years, followed by 4% patients each in the age group of 31-40 years and 41-50 years (Fig. 1).

On comparing the patients according to difference in keratometric dioptric power, pre-operatively maximum patients (66.0%) were in the range of 0.25D-0.50D, whereas post-operatively at 1, 3 and 6 months, maximum patients (54.0%) difference in keratometric dioptric power was <0.25D, $p < 0.001$ showed significance. Pre-operatively no patient was noted to have difference in keratometric dioptric power of >1 D, whereas post-operatively after 6 months 1 patient was noted with difference in keratometric dioptric power of >1 D (Fig. 2).

In our study pre-operatively pre-operatively 12% patients were noted to have no astigmatism, whereas post-operatively after 6 months, 48% patients were noted to have no astigmatism. Pre-operatively maximum No. of patients (86.0%) had WTR

astigmatism whereas postoperatively (52.0%) of patients had WTR astigmatism at 6 months. p -value showed significance ($p < 0.0001$) 2% patients were noted to have ATR astigmatism, Pre-operatively whereas post-operatively after 6 months, 0 patients were noted to have ATR astigmatism (Fig. 3).

Pre-operatively mean of horizontal keratometry value was 44.24, whereas post-operatively after 6 months, mean of horizontal keratometry value was 43.52 (Table 1).

Mean difference between horizontal keratometry values pre-operatively and post-operatively after 1 week was 0.66 (Table 2).

Mean difference between horizontal keratometry values pre-operatively and post-operatively after 1 months was 0.67.

Mean difference between horizontal keratometry values pre-operatively and post-operatively after 3 months was 0.62.

Table 1: Comparison of pre-operative Vs post-operative mean horizontal Keratometry

	Mean	Standard deviation
Before	44.24	1.04
After 1 week	43.58	1.10
After 1 month	43.56	1.16
After 3 month	43.61	1.11
After 6 month	43.52	1.12

Table 2: Comparison of pre-operative vs post-operative mean difference of horizontal Keratometry

	Mean difference	t-value	p-value
Before vs after 1 week	0.66	9.21	<0.0001
Before vs after 1 month	0.67	10.96	<0.0001
Before vs after 3 month	0.62	9.10	<0.0001
Before vs after 6 months	0.72	10.29	<0.0001

NS: Not significant and S: Significant

Table 3: Comparison of pre-operative vs post-operative mean difference of vertical Keratometry

	Mean difference	t-value	p-value
Before vs after 1 week	0.214	2.62	p = 0.012
Before vs after 1 month	0.255	4.17	p<0.0001
Before vs after 3 month	0.337	4.79	p<0.0001
Before vs after 6 week	0.471	6.32	p<0.0001

NS: Not significant and S: Significant

Table 4: Comparison of visual acuity in pre-operative and post-operative

Log mar equivalent	Pre-operative vision	Post-operative Vision 3 months	Post-operative vision 6 months
0.00	0	09	13
+0.2	0	04	02
+0.3	03	14	22
+0.5	03	14	13
+0.6	09	09	0
+0.8	06	0	0
+1.0	06	0	0
+2.0	23	0	0
+3.0	0	0	0
Total	50	50	50
Chi-square value		10.6	32.6
p-value		p<0.001	p<0.001

Mean difference between horizontal keratometry values pre-operatively and post-operatively after 6 months was 0.72. p-value was significant for all the above groups.

Mean difference between vertical keratometry values pre-operatively and post-operatively after 1 week was 0.214 (Table 3).

Mean difference between vertical keratometry values pre-operatively and post-operatively after 1 months was 0.255.

Mean difference between horizontal keratometry values pre-operatively and post-operatively after 3 months was 0.337.

Mean difference between horizontal keratometry values pre-operatively and post-operatively after 6 months was 0.0.471. p-value was significant for all the above groups.

Pre-operatively maximum number of patients (23 out of 50) visual acuity was +2.0 whereas Post-operatively at 3 months and 6 months maximum No. of patients (22 out of 50) had visual acuity of +0.3, p<0.001 showed significance (Table 4).

DISCUSSIONS

In the study conducted above, 50 patients, 48.0% were aged between 61 to 70 years. However, this difference was not statistical significant. A study

conducted by Yongqi He, Siquan ZHU, Ming Chen and Dejiao Li shown age varied between 25-70 years old.

In above study, pre-operatively maximum patients (66.0%) were in the range of 0.25D-0.50D, whereas post-operatively at 1, 3 and 6 months, maximum patients (54.0%) difference in keratometric dioptic power was <0.25D, p<0.001 showed significance. Singh *et al.*^[12] studied both temporal clear corneal versus superior scleral tunnel phacoemulsification incisions and found that after 3 months clear corneal incision showed 1.08±0.36D and scleral incision showed 1.23±0.71 D of astigmatism. Roman *et al.*^[13] showed scleral incision had 0.69D of SIA (p<0.05) and 0.67 D of post-operative astigmatism (p<0.05), Temporal corneal incision had 0.69D SIA (p>0.05) and 0.98 D (p<0.05) post-operative astigmatism.

The mean Horizontal Keratometry in 50 patients, pre-operatively was 44.24±1.04, which reduced to 43.52±1.12 post-operatively at 6 months. p-value showed significance (p = <0.0001) after 1 week, 1, 3 and 6 months. Similarly, in above study mean vertical keratometry in 50 patients, pre-operatively was 44.24±1.04 and changed to 43.77±1.09 post-operatively at 6 months, p-value shows significance (p = 0.012) after 1 week and (p<0.0001) after 1, 3, 6 months. In clear corneal incisions there is a reduction in both vertical and horizontal meridians postoperatively. A study conducted by Sitki Samet Ermis *et al.*^[14] showed that SIA did not differ significantly between the 2 incisions groups (p>0.05), decomposition of vector showed that the horizontal component of SIA after superonasal incision was statistically higher than supero temporal incision throughout the study (p<0.05). Vertical components of SIA and the incision size after IOL implantation with the syringe/cartridge system between the 2 incision group were not significantly different (p>0.05). Olsen *et al.*^[15] showed that the surgically induce astigmatism six months after surgery was 0.72±0.35, respectively (p<0.01) in the temporal clear corneal incision. In their study the temporal clear corneal incision induces significantly more regular as well as irregular astigmatism.

Pre-operatively majority of the patients (86.0%) had WTR astigmatism and (2%). Of them were having ATR astigmatism (12.0%) of them had no astigmatism.

Post-operatively after 1 week majority of the patients (76.0%) came under WTR astigmatism and were ATR astigmatism (10.0%). Rest of them had no astigmatism (14.0%) p-value (0.217) showed no significance. After 1-month majority of the patients 74.0%) came under WTR astigmatism and were ATR astigmatism (00) Rest of them had no astigmatism (26.0%) p-value (0.133) showed no significance. After 3 month's majority of the patients (74.0%) came under WTR astigmatism and were ATR astigmatism (00). Rest

of them had no astigmatism (26.0%) p-value (0.133) showed no significance. After 6 month's majority of the patients (52.0%) came under WTR astigmatism and were ATR astigmatism ((00). Rest of them had no astigmatism (48.0%) p<0.0001 showed significance. A study by Singh *et al.*^[12] studied both temporal clear corneal versus superior scleral tunnel phacoemulsification incisions and found significantly against the rule astigmatism in the both groups after 3 months. Gross *et al.*^[16] studied and found that significantly found greater with the rule change in astigmatism in the scleral incision than in the clear corneal incision on the first postoperative day and disappeared by one month.

Cilino *et al.*^[17] showed phacoemulsification using a temporal clear corneal approach and superior corneo scleral phacoemulsification there was a highly significant between group differences in SIA at each examination (p<001) because of positive (WTR) SIA in temporal clear corneal approach and negative (ATR) SIA in the superior sclera corneal approach. No other significant difference between groups were found. In above study, maximum number of patients pre-operatively presented with UCVA of +2.0 (46%) and postoperatively maximum number of patients presented with BCVA OF +0.3 (44%).

CONCLUSION

In supero temporal clear corneal incision of 2.8 mm there was decrease in both horizontal and vertical meridians postoperatively after 6 months. WTR astigmatism was found in higher number of cases, 6 months post-operatively and amount of astigmatism was <0.25D. Postoperatively maximum number of patients presented with BCVA of +0.3.

REFERENCES

1. Khan, A., M. Alam, M.R. Afridi and I. Ahmad, 2014. Effect of incision site on pre: Existing astigmatism in phaco-emulsification. Pak. J. Ophthalmol., 30: 45-48.
2. Murthy, G., S. Gupta, N. John and P. Vashist, 2008. Current status of cataract blindness and vision 2020: The right to sight initiative in India. Indian J. Ophthalmol., 56: 489-494.
3. Gothwal, V.K., T.A. Wright, E.L. Lamoureux and K. Pesudovs, 2010. Measuring outcomes of cataract surgery using the visual function index-14. J. Cataract. Refrac. Surg., 36: 1181-1188.
4. Jose, K., N. Junior and M.R. Santhiago, 2009. Aspherical IOLs: Clinical evaluation and options. Rev. Bras. Oftalmol., 68: 175-179
5. Alió, J.L., M.C.C. Agdeppa, V.C. Pongo and B.E. Kady, 2010. Microincision cataract surgery with toric intraocular lens implantation for correcting moderate and high astigmatism: Pilot study. J. Cataract. Refrac. Surg., 36: 44-52.
6. Ahmad, A. and J. Ahmad, 2000. Combined phacoemulsification, intraocular lens implantation and trabeculectomy. Pak. J. Ophthalmol., 16: 26-28
7. Yi, D.H. and B.R. Sullivan, 2002. Phacoemulsification with indocyanine green versus manual expression extracapsular cataract extraction for advanced cataract. J. Cataract. Refrac. Surg., 28: 2165-2169
8. Chakrabarti, A., S. Singh and R. Krishnadas, 2000. Phacoemulsification in eyes with white cataract. J. Cataract. Refrac. Surg., 26: 1041-1047.
9. Kanski, J.J., 2007. Kanski's Clinical Ophthalmology: A Systematic Approach. 7th Edn., Butterworth Heinemann Elsevier, ISBN-17: 978-0-7020-7711-1, Pages: 956.
10. Khokhar, S., P. Lohiya, V. Murugiesan and A. Panda, 2006. Corneal astigmatism correction with opposite clear corneal incisions or single clear corneal incision: Comparative analysis. J. Cataract. Refrac. Surg., 32: 1432-1437.
11. Altan-Yaycioglu, R., Y.A. Akova, S. Akca, S. Gur and C. Oktem, 2007. Effect on astigmatism of the location of clear corneal incision in phacoemulsification of cataract. J. Refrac. Surg., 23: 515-518.
12. Singh, V.P., B. Reddy and A. Raj, 2007. Site of incision and corneal astigmatism in conventional SICS versus phacoemulsification. Ann. Ophthalmol. (Skokie), 39: 209-216.
13. Roman, S.J., F.X. Auclin and D.A. Chong-Sit, 1998. Ullern MM. Surgically induced astigmatism with superior and temporal incisions in cases of with-the-rule preoperative astigmatism. J. Cataract. Refract. Surg., 24: 1636-1441.
14. Ermis, S.S., U.U. Inan and F. Oztürk, 2004. Surgically induced astigmatism after superotemporal and superonasal clear corneal incisions in phacoemulsification. J. Cataract. Refract. Surg., 30: 1316-1319.
15. Olsen, T., M. Dam-Johansen, T. Bek and J.Ø. Hjortdal, 1997. Corneal versus scleral tunnel incision in cataract surgery: A randomized study. J. Cataract. Refrac. Surg., 23: 337-341
16. Gross, R.H. and K.M. Miller, 1996. Corneal astigmatism after phacoemulsification and lens implantation through unsutured scleral and corneal tunnel incisions. Am. J. Ophthalmol., 121: 57-64.
17. Cillino, S., D. Morreale, A. Mauceri, C. Ajovalasit, F. Ponte, 1997. Temporal versus superior approach phacoemulsification: short-term postoperative astigmatism. Cataract. Refract. Surg., 23: 267-271.