

Factors Affecting Surgically Induced Astigmatism after Phacoemulsification

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ABSTRACT

Introduction: Astigmatism is known to reduce the visual acuity. Surgically induced astigmatism (SIA) is the most common complication after phacoemulsification and has a potential to hamper post operative vision.

Materials and methods: A retrospective study was conducted from October 2017 to November 2017. Patients were divided into groups 1, 2, 3, 4, 5 and 6 according to their age (in years) < 50, 51-55, 56-60, 61-65, 66-70 and >70 respectively. Patients were also divided according to grades of preoperative astigmatism (in dioptres) in Group P(0-0.50), Group Q(0.75-1.00), Group R(1.25-1.50), Group S(>1.50). Patients were also divided according to preoperative keratometry (in dioptres) in group W (40-42), group X(42.25-44), Group Y (44.25-46) and Group Z(>46). Demographic details were noted and preoperative keratometry was done. A 2.8 mm clear corneal phacoemulsification was done. Postoperative keratometry at 4 weeks was noted. SIA was calculated and statistically analysed.

Result: Out of 52 patients 35 (67.3%) were males. Mean preoperative and postoperative astigmatism (in dioptres) were 0.841 ± 0.65 and 1.603 ± 1.11 respectively ($p < 0.05$). Mean preoperative astigmatism (in dioptres) in groups 1, 2, 3, 4, 5, and 6 were 0.63 ± 1.44 , 0.88 ± 0.14 , 0.93 ± 0.78 , 1 ± 0.74 , 0.57 ± 0.35 , and 0.75 ± 1.09 while mean post-operative astigmatism (in dioptres) were 1.28 ± 0.66 , 1.37 ± 0.07 , 1.76 ± 1.34 , 1.72 ± 0.9 , 1.28 ± 0.75 , and 1.53 ± 1.38 respectively. Mean preoperative astigmatism (in dioptres) in groups P, Q, R and S were 0.27, 0.89, 1.43 and 2.16 while mean post-operative astigmatism (in dioptres) were 0.54, 0.65, 1.28 and 1.95 respectively. Mean preoperative astigmatism (in dioptres) in groups W, X, Y and Z were 0.96, 0.67, 0.84 and 1.11 while mean post-operative astigmatism (in dioptres) were 0.82, 0.67, 0.89 and 1.17 respectively ($p > 0.05$).

Conclusion: Phacoemulsification induces significant SIA. SIA was more in males than females. SIA has no correlation with age. Lower preoperative astigmatism induces greater SIA. Preoperative keratometry has no correlation with SIA.

Keywords: Phacoemulsification, Surgically Induced Astigmatism, Keratometry.

INTRODUCTION

There has been a dramatic rise in patient's expectations of visual outcome after cataract surgery. Since the patients are paying high fee for cataract surgery and expensive intraocular lenses, it is not unreasonable on part of the patients to expect a spectacle free crystal clear vision after cataract surgery. Although spherical errors have been minimised after the introduction of optical biometry,^{1,2} post operative residual astigmatism still remains a common cause of unsatisfactory

visual outcome.^{3,4} Moreover, every cataract surgery induces a variable amount of astigmatism, called surgical induced astigmatism (SIA), depending on the preoperative ocular, intraoperative course, and postoperative complication.^{5,6} SIA has become a limiting factor in the way of achieving spectacle free vision.

SIA is the most common complication as well as the most common cause of decreased quality of vision after phacoemulsification.^{7,8} It is important to identify the factors affecting SIA so that appropriate measures be taken to attain better visual outcome. Hence a study was conducted to identify the factors affecting SIA after phacoemulsification.

MATERIAL AND METHODS

This retrospective study was conducted at Department of ophthalmology, Geetanjali Medical College and Hospital, Udaipur, India.

Inclusion criteria

All patients operated by 2.8 mm clear corneal temporal phacoemulsification by a single surgeon (RM) during October 2017 to November 2017 who turned up for follow-up at 1 month were included in the study.

Exclusion criteria

Patients with corneal pathologies, pre existing surgery, intraoperative and post operative complications were excluded.

Patient examination

Out of 76 patients who were enrolled for the study 52 were found adhering to the selection criteria. Demographic details included was patient's name, age and sex. Patients were divided into groups 1, 2, 3, 4, 5 and 6 according to their age (in years) < 50, 51-55, 56-60, 61-65, 66-70 and >70 respectively. Patients were also divided according to grades of preoperative astigmatism (in dioptres) in Group P(0-0.50), Group Q (0.75-1.00), Group R (1.25-1.50), Group S(>1.50). Patients were also divided according to preoperative keratometry (in dioptres) in group W (40-42), group X (42.25-44), Group

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Y (44.25-46) and Group Z(>46). Preoperative keratometry was done by autokearatometer(Visuref 100, Carl Zeiss, Germany). Postoperative keratometry at 4 weeks was noted

Surgical technique

After peribulbar anaesthesia, temporal clear corneal incision 2.8mm wide and 2 mm long was made. 1.2 mm wide sideports were made at 12o'clock and 6 o'clock positions. Phacoemulsification was done by direct chop followed by bimanual irrigation and aspiration and foldable intraocular lens implantation.

SIA calculation

Preoperative and postoperative keratometry values were fed into online SIA calculator version 2.1 of Dr Saurabh Sawhney and Dr Aashima Aggarwal and SIA was calculated.⁹

STATISTICAL ANALYSIS

All the data was entered in MS Excel sheet 2016 (version16.0). The data was exported to statistical package for social sciences (SPSS) version 21 and analysed. Paired t test was done to calculate p value. The result was considered significant for p < 0.05.

RESULTS

Out of total 52 patients who fulfilled the selection criteria 35(67.3%) were males. Their age ranged from 43-72 years (mean age 60±3 years). The number of patients in groups 1, 2, 3, 4 and 5 were 4(7.69%), 4(7.69%), 21 (40.38%) and 13 (26%) respectively. The number of patients in groups P, Q, R and S were 22 (42.3%), 16 (30.76%), 8 (15.38%) and 6 (11.53%) respectively. The number of patients in groups W, X, Y and Z were 7(13.46%), 13 (25%), 23 (44.23%) and 9 (17.3%) respectively.

DISCUSSION

SIA is dependent on preoperative factors such as corneal pathologies, keratometry and astigmatism, intraoperative factors such as site¹⁰ of incision, size of incision¹¹, intra-operative complications¹² and sutures taken, and post-operative factors which affect wound healing.

In our study we found that SIA was 0.76±0.69which was statistically significant.[table-1] Such a high SIA could be due to 2.8mm kearotme used for clear corneal incision.We believe that SIA can be reduced by using a smaller size of keratome.¹³

In our study interstingly SIA in males was statitically significant while in females it was not statistically significant

Gender	n	Mean Pre Operative Astigmatism (in dioptres)	Mean SIA (in dioptres)	p Value
Male	35	0.79 ± 0.53	0.85±0.73	<0.05
Female	17	0.96 ± 0.85	0.58±0.60	>0.05
Total	52	0.841± 0.65	0.76±0.69	<0.05

Table-1: Correlation of SIA according to sex

Category	Age group	n	Mean Pre Operative Astigmatism (in dioptres)	MeanSIA (in dioptres)	p Value
1	≤50	4	0.63±1.44	0.65±1.05	> 0.05
2	51 - 55	4	0.88±0.14	0.49±0.10	< 0.05
3	56 - 60	21	0.93±0.78	0.83±1.06	< 0.05
4	61 - 65	13	1±0.74	0.72±0.92	< 0.05
5	66 - 70	7	0.57±0.35	0.71±0.55	< 0.05
6	> 70	3	0.75±1.09	0.78±1.24	> 0.05

Table-2: Correlation of SIA according to age group

Group	n	Mean Pre Operative Astigmatism (in dioptres)	Mean SIA (in dioptres)	p value
P	22	0.27± 0.22	0.27±0.29	<0.05
Q	16	0.89± 0.13	-0.24±0.63	<0.05
R	8	1.43± 0.26	-0.15±0.49	>0.05
S	6	2.16± 0.47	-0.21±0.48	>0.05

Table-3: Correlation of SIA according to grade of preoperative astigmatism

Group	n	Mean Pre Operative Astigmatism (in dioptres)	MeanSIA (in dioptres)	P value
W	6	0.96± 0.57	0.14±1.1	>0.05
X	14	0.67± 0.44	0±1.11	>0.05
Y	22	0.84± 0.80	0.05±0.685	>0.05
Z	10	1.11± 0.70	0.06±0.745	>0.05

Table-4: Correlation of SIA according to preoperative keratometry.

[table-1]. It can be explained by the fact that preoperative astigmatism was higher in females as compared to males (0.96D vs 0.79D). It appears that higher preoperative astigmatism induces higher SIA.

Mean preoperative astigmatism (in dioptres) in groups 1, 2, 3, 4, 5, and 6 were 0.63 ± 1.44 , 0.88 ± 0.14 , 0.93 ± 0.78 , 1 ± 0.74 , 0.57 ± 0.35 , and 0.75 ± 1.09 while mean SIA (in dioptres) were 0.65 ± 1.05 , 0.49 ± 0.10 , 0.83 ± 1.06 , 0.72 ± 0.92 , 0.71 ± 0.55 and 0.78 ± 1.24 respectively (table-2).

It signifies that SIA has correlation with age. Similar result has been found in other studies.¹⁴

Mean SIA (in dioptres) in groups P and Q was statistically significant while in groups R and S was not statistically significant. [table-3] It shows that SIA is higher for lesser preoperative astigmatism (0-1 D) and lesser for higher preoperative astigmatism (>1D). It appears that SIA has inverse relationship with magnitude of preoperative astigmatism.¹⁵

We also noted that SIA in groups W, X, Y and Z was statistically insignificant [table-4]. It signifies that preoperative keratometry doesn't significantly affect SIA.¹⁶ It could be due to high degree of precision and similarity of construction of clear corneal incision irrespective of steepness of cornea.

The limitations of our study are small sample size, short follow-up time, use of auto keratometre for keratometry and use of large size keratome. Therefore we recommend a study with larger sample size, longer follow-up time, use of pentacam for keratometry and use of smaller size keratome.

CONCLUSION

Phacoemulsification induces significant SIA. SIA was more in males than females. Lower preoperative astigmatism induces greater SIA and vice versa. Age and sex were not found to have any correlation with SIA.

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