Research Article

Comparison of surgically induced astigmatism (SIA) and postoperative astigmatism with superior, superotemporal and temporal incisions in phacoemulsification surgery

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Abstract

Introduction: Cataract is defined as any opacity of lens or capsule which is either developmental or acquired. Cataract surgery is the commonest procedure performed in ophthalmology. Astigmatism prevention and control is one of the biggest challenges for a surgeon after cataract surgery. Since postoperative astigmatism is the major determinant of visual outcome, a comparative study is essential to ascertain the difference in induced astigmatism, if any between different sites of incision in Phacoemulsification keeping the size of incision same. **Aims and Objectives:** To compare postoperative astigmatism and surgically induced astigmatism (SIA) with superior, superotemporal and temporal incisions in phacoemulsification surgery. **Materials and Method:** This prospective study comprised of 150 patients of cataract operated by using phacoemulsification using superior, superotemporal and temporal incisions. All the patients were divided in three groups containing 50 patients each depending upon the type of incision used. The outcome measures were post operative and surgically induced astigmatism (SIA) post operatively. **Results:** The pre-operative astigmatism in all three groups was measured it was in the range of 0 to 1.5D with no statistical significant difference. Majority of the patients were having post operative astigmatism between 0.75 to 1.25D. i.e. 44% in group A, 60% in group B and 58% in group C. Surgically induced astigmatism less than 0.75D in group A was seen in 78% patients whereas in group B was 92% and in group C was 90%. According to the Tukey's multiple comparison test, post operative and surgically induced astigmatism was statically significant in group A and C. Whereas the difference in group A and B and group B and C was not significant. **Conclusion:** temporal and superotemporal incision leads to significantly less amount of mean post-operative astigmatism as well as Surgically Induced Astigmatism (SIA) as compared to superior incision.

Keywords: surgically induced astigmatism, superior, superotemporal and temporal incisions.

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INTRODUCTION

Cataract literally means waterfall[1]. It is defined as any opacity of lens or capsule which is either developmental or acquired[2]. Cataract surgery is the commonest procedure performed in ophthalmology[3]. The surgical procedure for cataract removal has come a long way from Sushruta's 'couching' method. It has gone through Intracapsular Cataract Extraction (ICCE), Conventional Extracapsular Cataract Extraction (ECCE), Small Incision Cataract Surgery (SICS), Phacoemulsification surgery to the most recent femtosecond cataract surgery[4]. Patients' expectations from cataract surgery have increased manifold in the past few decades and they expect spectacle independence. Cataract surgery has become a

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refractive surgery today as patients demand better and earlier visual rehabilitation[3].The advances are thus aimed at finding a surgical method which is capable of providing accurate and predictable results in terms of final visual outcome, minimizing the complications, reducing the spectacle dependency and providing maximum comfort for the patient. In 1967, Charles Kelman introduced his revolutionary invention in the field of cataract surgery, 'Phacoemulsification'[5]. It offers many benefits to both surgeon and patient. Its principle advantage is the small incision size, which allows the surgeon greater control over intraocular structures during surgery. There is less tissue injury, less postoperative pain and inflammation; less magnitude of surgically induced astigmatism. The advantages associated with the smaller incision have made phacoemulsification the ideal technique for cataract surgery and the preferred one where the resources are available. Advances in incision construction have improved the refractive results of cataract surgery by minimizing surgically induced astigmatism [6]. Keeping in mind the necessity to have an operating method that minimizes astigmatism, the length and architecture of the incision, site of incision, types of suture and suture materials have all been modified over the years. Astigmatism prevention and control is one of the biggest challenges for a surgeon after cataract surgery. Since postoperative astigmatism is the major determinant of visual outcome, a comparative study is essential to ascertain the difference in induced astigmatism, if any between different sites of incision in Phacoemulsification keeping the size of incision same. Thus in the same view, present study was conducted to compare the surgically induced astigmatism and visual outcome between superior, superotemporal and temporal incisions in Phacoemulsification surgery.

AIMS AND OBJECTIVES

To compare postoperative astigmatism and surgically induced astigmatism (SIA) with superior, superotemporal and temporal incisions in phacoemulsification surgery.

MATERIALS AND METHOD

The present prospective study was conducted on patients reporting in the Department of Ophthalmology, Government Medical College, Aurangabad. The study was conducted from September 2011- November 2013.

A total of 150 patients with varying degree of cataract fitting with the following inclusion and exclusion criteria were selected for the study.

Inclusion Criteria

- Immature senile cataract
- Willingness to give an informed written consent.

Exclusion Criteria

- Preoperative astigmatism > 1.5 D, Oblique astigmatism
- Diabetic or Hypertensive Retinopathy
- Nuclear Cataract Grade IV and above, Developmental cataract, Traumatic cataract, Cataract with glaucoma or Complicated cataract
- Preoperative decompensated cornea, previous ocular surgeries or trauma or Pseudo exfoliation syndrome.

All the selected patients were randomly distributed in three groups containing 50 patients each.

Group A: 50 patients undergoing phacoemulsification surgery with superior- posterior limbal incision by stop and chop method.

Group B: 50 patients undergoing phacoemulsification surgery with supero-temporal posterior limbal incision by stop and chop method.

Group C: 50 patients undergoing phacoemulsification surgery with temporal- posterior limbal incision by stop and chop method.

Written informed consent was obtained from each patient. All eyes underwent a complete ophthalmological examination preoperatively and postoperatively at 1 month and 3 month, including a manifest refraction using a refractometer and snellen projector chart. Astigmatism was measured from the keratometry readings. Data on gender, age, UCVA, manifest refraction, and automatic keratometry (ARK 510A, NIDEK) were collected. All patients were given antibiotic steroid eyedrops for a period of one month in tapering doses starting with a frequency of 6 times per day. Systemic antibiotic, NSAIDS and antacid were given to the patients if needed. A detailed post-operative evaluation of the patients was done on 1st, 15th, 40th day. Postoperative astigmatism was calculated from keratometric readings on day 40. The surgically induced astigmatism was calculated using 'The SIA Calculator version 2.1[7], a free software programme approved by All India Ophthalmological Society (AIOS). Amplitude of preoperative and postoperative astigmatism was calculated from the difference in keratometric value in the steeper and flatter meridian, using plus cylinder notation. Astigmatism was considered a vector with a magnitude equal to this value, directed towards the steeper meridian. The amplitude of SIA was calculated for each eye from preoperative and postoperative amplitudes using the SIA calculator software.

RESULTS

Table 1: Comparison of Pre-Operative Astigmatism

Astigmatism	Group A		Group B		Group C	
	superior- posterior limbal incision		supero-temporal posterior limbal incision		temporal- posterior limbal	
	No. of cases	Percentage (%)	No. of cases	Percentage (%)	No. of cases	Percentage (%)
0	6	12	2	4	4	8
0.25	6	12	6	12	6	12
0.5	10	20	8	16	11	22
0.75	5	10	12	24	10	20
1	11	22	9	18	6	12
1.25	3	6	7	14	5	10
1.5	9	18	6	12	8	16
Total	**50**	**100**	**50**	**100**	**50**	**100**

Chi square test, (P value= 0.6993)

When the pre-operative astigmatism in all three groups was measured it was in the range of 0 to 1.5D. It was observed that the mean preoperative astigmatism in Group A was 0.77±0.49D, in Group B was 0.83± 0.42D and in Group C was 0.76±0.46. There was no statistically significant difference (p=0.69, p>0.05) using Chi square test.

Table 2: Comparison of post-operative astigmatism in Group A, B and C on Day 40

Range of Astigmatism (Diopters)	Group A		Group B		Group C	
	superior- posterior limbal incision		supero-temporal posterior limbal incision		temporal- posterior limbal	
	No. of cases	Percentage (%)	No. of cases	Percentage (%)	No. of cases	Percentage (%)
0-0.5	9	18	13	26	18	36
0.75-1.25	22	44	30	60	29	58
1.5-2	18	36	6	12	3	6
2.25-2.75	1	2	1	2	0	0
Total	**50**	**100**	**50**	**100**	**50**	**100**

It was observed that in all the three groups, majority of the patients were having post operative astigmatism between 0.75 to 1.25D. i.e 44% in group A, 60% in group B and 58% in group C. The mean post-operative astigmatism on day 40 was 1.15±0.577D in Group A whereas in Group B it was 0.96±0.523 and in Group C it was 0.78±0.364.

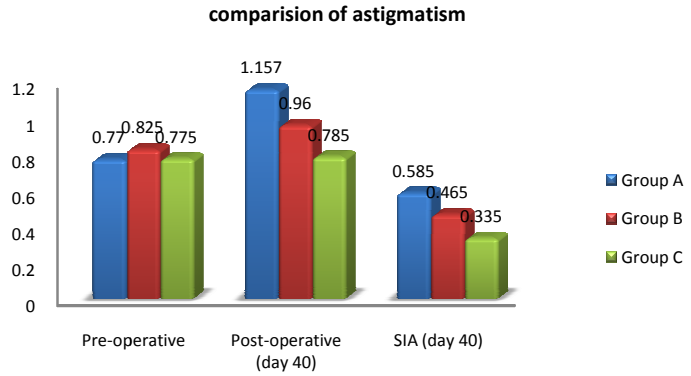
Table: 3: Comparison of surgically induced astigmatism (SIA) between Group A, B and C on Day 40

Range of Astigmatism (Diopters)	Group A		Group B		Group C	
	superior- posterior limbal incision		supero-temporal posterior limbal incision		temporal- posterior limbal	
	No. of cases	Percentage (%)	No. of cases	Percentage (%)	No. of cases	Percentage (%)
0	8	16	7	14	11	22
0.25	10	20	11	22	16	32
0.5	10	20	20	40	18	36
0.75	11	22	8	16	5	10
1	4	8	3	6	0	0
1.25	5	10	0	0	0	0
1.5	1	2	1	2	0	0
1.75	1	2	0	0	0	0
Total	**50**	**100**	**50**	**100**	**50**	**100**

It was observed that in majority of the patients surgically induced astigmatism was less than 0.75D. In group A 78% patients were having SIA less than 0.75D whereas the percentage in group B was 92% and in group C was 90%. The mean Surgically Induced Astigmatism (SIA) in Group A was 0.585±0.4363D, in Group B was 0.465±0.3073D and in Group C was 0.335±0.2348D.

Table 4: Result of statistics for Astigmatism in all groups

Astigmatism	Group A supero-temporal posterior limbal incision		Group B temporal- posterior limbal		Group C superior- posterior limbal incision		P value
	Mean	SD	Mean	SD	Mean	SD	
Pre-operative	0.77	0.4945	0.825	0.4173	0.775	0.4636	0.8036
Post-operative (day 40)	1.1570	0.5722	0.96	0.5233	0.7850	0.3643	0.0011
SIA (day 40)	0.5850	0.4363	0.4650	0.3073	0.3350	0.2348	0.0014



According to the Tukey's multiple comparison test between three groups, there was statistically significant difference in the post-operative astigmatism at day 40 between Group A and C (mean difference= 0.3719, 95% confidence interval) but there was no statistically significant difference in the post-operative astigmatism at day 40 between Group A and B (mean difference= 0.1969, 95% confidence interval) and Group B and C (mean difference= 0.1750, 95% confidence interval). Also, it was found that there was statistically significant difference in the surgically induced astigmatism (SIA) between Group A and C (mean difference= 0.25, 95% confidence interval) but there was no statistically significant difference in the SIA at day 40 between Group A and B (mean difference= 0.12, 95% confidence interval) and Group B and C (mean difference= 0.13, 95% confidence interval).

DISCUSSION

In all the three groups the pre-operative astigmatism ranged from 0-1.5D. The mean post-operative astigmatism on day 40 was 1.15±0.577D in Group A whereas in Group B it was 0.96±0.523 and in Group C it was 0.78±0.364. There was no statistically significant difference (p=0.69, p>0.05) using Chi square test. Thus we could say that all the three groups are comparable. On the 40th day post-operative astigmatism was in the range of 0-2.75D in Group A and B while it was 0-2D in Group C. The mean post-operative astigmatism was 1.15±0.577D in Group A whereas in Group B it was 0.96±0.523 and in Group C it was 0.78±0.364. The one way ANOVA analysis with Tukey's multiple comparison test was used to compare the difference in the three group. It was observed that there was statistically significant difference in the post-operative astigmatism at day 40 between Group A and C but there was no statistically significant difference in the Group A and B and Group B and C. In our study the Surgically Induced Astigmatism (SIA) on the 40th post-operative day ranged from 0-1.75D in Group A, 0-1.5D in Group B and 0-0.75 in Group C. The mean Surgically Induced Astigmatism (SIA) in Group A was 0.585±0.4363D, in Group B was 0.465±0.3073D and in Group C was 0.335±0.2348D. In a study conducted by Mohammad Pakravan *et al*, [8] who compared the astigmatic outcomes of phacoemulsification cataract surgery using temporal versus nasal clear corneal incisions. They observed Surgically Induced Astigmatism of 0.26±0.46D six months after surgery for temporal incision which was comparable to 0.335 D seen in our study. Similar results for temporal incision phacoemulsification (0.47 D) were seen after six months by Kohnen and associates[9] which was also comparable to the results of our study. The one way ANOVA analysis with Tukey's multiple comparison tests was used to compare the difference in SIA in the three groups. It was found that there was statistically significant difference in the surgically induced astigmatism (SIA) between Group A and C. In group A and B and Group B and C, there was no statistically significant difference in the SIA at day 40. Marek R *et al*[10] compared post-operative and surgically induced astigmatism between temporal and superior clear corneal incisions. The mean values of post-operative vector measured 6 months following the operation were 0.54±0.35D in the temporal group and 0.96±0.43D in the

superior group. Differences between two groups showed statistical significance ($p < .05$) which was comparable to our study. The mean values of SIA in temporal and superior groups were 0.63±0.28 and 1.00±0.54 respectively and were statistically significant ($p < 0.05$) which is also comparable to our study. *Shahzad Iftikhar et al*[11] *(2006) studied* effect of superior versus temporal limbal incision on surgically induced astigmatism (SIA) in phacoemulsification with 5.5 mm rigid intraocular lens (IOL). They observed that superior group had 1.41D of SIA and patients of temporal group had mean SIA of 1.03D. The difference was statistically significant with p value of 0.002 which was in concordance with our study. Simşek S *et al*[12] compared the effect of superior and temporal clear corneal incisions on astigmatism after sutureless, small incision phacoemulsification in 40 eyes of 20 patients. Mean astigmatism was 1.60±0.37D in the superior incision group and 0.83±0.19D in the temporal incision group. Induced astigmatism calculated by vector analysis was 1.44±0.31 D and 0.62±0.28 D respectively. The temporal incision group had significantly lower astigmatism at all follow-ups ($P = 0.000$) and the results were comparable to results of our study. Thus from the finding of the present study and the discussion we could state that temporal incision leads to significantly less amount of mean post-operative astigmatism as well as Surgically Induced Astigmatism (SIA) than Superior incision. It can be done in deep seated and small eyes also but it is difficult to master this incision and has a longer learning curve. The Superotemporal incision was comparable to temporal incision in terms of surgically induced astigmatism. It is easy to master this incision.

CONCLUSION

Temporal and superotemporal incision leads to significantly less amount of mean post-operative astigmatism as well as Surgically Induced Astigmatism (SIA) as compared to superior incision.

REFERENCES

1. Stedman's Concise Medical Dictionary illuatrated, 2nd edition. Philadelphia. Wiliams and Wilkins. 1994
2. Revised by Sihota R, Tandon R. Parson's Diseases of the Eye, 19th edition. New Delhi. Butterworth-Heinemann. An Imprint of Elsevier; 2003
3. Gogate P.Comparison of various techniques for cataract surgery, their efficacy, safety, and cost.Oman J Ophthalmol 2010; 3:105-6.
4. Albert Jakobeics : principle and practice of Ophthalmology ; Vol 2 ;2nd edition WB Saunders company:1500-1550
5. Jaffe NS, Jaffe MS, Jaffe GF. Cataract surgery and its complications. Sixth edition. St. Louis, Missouri: Mosby-Year Book; 1997.
6. Kershner RM. Refractive cataract surgery. Curr Opin Ophthalmol. 1998 Feb; 9 (1):46-54.
7. http://www.insighteyeclinic.in/SIA_calculator.php 'The SIA Calculator version 2.1', a free software programme approved by All India Ophthalmological Society (AIOS).
8. Pakravan M, Nikkhah H, Yazdani S, Shahabi C, Sedigh-Rahimabadi M. Astigmatic Outcomes of Temporal versus Nasal Clear Corneal Phacoemulsification. J OphthalmicVis Res. 2009 Apr; 4(2):79-83.
9. Kohnen S, Neuber R, Kohnen T. Effect of temporal and nasal unsutured limbal tunnel incisions on induced astigmatism after phacoemulsification. J Cataract Refract Surg. 2002; 28:821–825.
10. Marek R, Kluś A, Pawlik R. Comparison of surgically induced astigmatism oftemporal versus superior clear corneal incisions. Klin Oczna.2006; 108(10-12):392-6.
11. Iftikhar S, Bashir R, Naeem BA, Abrar R, Jaffri RH and Sarmad A. Comparison of surgically induced astigmatism in phacoemulsification with 5.5 mm superior vs. temporal incision. Al-Shifa Journal of Ophthalmology 2007; 3(1): 9-14.
12. Simşek S, Yaşar T, Demirok A, Cinal A, Yilmaz OF. Effect of superior and temporal clear corneal incisions on astigmatism after sutureless phacoemulsification. J Cataract Refract Surg. 1998 Apr; 24(4):515-8.

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