

ORIGINAL ARTICLE

Analyses of Surgically Induced Astigmatism (SIA) after Temporal Phacoemulsification through a Clear Corneal Incision

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Abstract

The aim of the study was to analyze surgically induced astigmatism (SIA) after temporal phacoemulsification with posterior chamber intraocular lens implantation through a clear corneal incision. This prospective study included 50 eyes subjected to temporal phacoemulsification with implantation of a foldable posterior chamber intraocular lens through a clear corneal incision. The astigmatism was measured by Bausch and Lomb Keratometer in addition to other necessary investigations both pre- and post- operatively. SIA was calculated using SIA calculator version 2.1. Age wise cataract patients were in all age groups of 41-50 years (7/14%), 51-60 years (15/30%), 61-70 years (21/42%) and 71-80 years (7/14%). Mean age of cataract patients was 60.6 ± 8.92 years. Gender wise males were 21 (42%) and females 29 (58%). Preoperative astigmatism under study groups ranged from 0.0.

Keywords

Cataract, Phacoemulsification, Surgically Induced Astigmatism

Introduction

Cataract is the leading treatable cause of blindness by means of surgery. Surgery is usually associated with procedure related astigmatism called SIA. The aims of modern cataract surgery are smaller incision size; rapid visual rehabilitation and minimum SIA(1). Phacoemulsification fulfils all these aims and therefore has evolved as the preferred surgical procedure for cataract extraction followed by insertion of a foldable intraocular lens through small incision, best possible uncorrected visual acuity, and minimal SIA (2).

Among various cataract surgery procedures, several workers have documented less SIA in temporal incision as compared to other types of incisions.(3-8) In present study the patients treated for cataract following temporal phacoemulsification have been evaluated in terms of SIA, visual outcome, postoperative complications and patient's satisfaction.

Materials & Methods

Fifty patients in the age group of 41 to 80 years diagnosed for cataract were enrolled in the study. Same

number of eyes was subjected to temporal approach phacoemulsification and posterior chamber intraocular lens implantation (PCIOL). Ethical approval was obtained from the institutional ethics committee and informed consent was obtained from all patients.

After placing a wire speculum, povidone iodine (betadine) was used to clean the eye. Two side ports were created with MVR blade at 6 o' clock and 12 o'clock positions. Viscoelastic was injected into anterior chamber and continuous curvilinear capsulorrhesis was performed with bent-tipped 26 gauge needle. Thereafter, 2.8 mm clear corneal incision in the temporal quadrant was given with the help of 2.8 mm kerotome.

Then hydro-dissection and hydro-delineation were performed. A phaco probe was passed through the incision to emulsify the nucleus. The surrounding cortex was removed with the help of irrigation aspiration cannula. The capsular bag was

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filled with viscoelastic solution. A foldable acrylic lens fitted in an injector system was implanted in capsular bag. Viscoelastic material was removed using irrigation aspiration probe. Anterior chamber was formed and temporal incision and side ports were hydrated with balanced salt solution.

Postoperative steroid antibiotic ointment was applied and pad and bandage was done. Patients were followed postoperatively on day-1, week-1, -4 and -6 for visual acuity, slit lamp examination, keratometry, and refraction. During follow up complications if any were recorded and treated accordingly.

Both pre- and post-operative keratometric horizontal (K1) and keratometric vertical (K2) were measured by Bausch and Lomb Keratometer. Astigmatic magnitude was quantified in dioptres (D) and axis direction was depicted in degrees. Results were analyzed using SIA Calculator Version 2.1.(9)

Patients included in the study were randomly chosen and known principles of inference were applied. The data generated was tabulated and subjected to statistic analysis. (10)

Results

Age wise distribution of patients: Study patients were in the age group of 41 to 80 years. Age wise these

Table 1. Characteristics of population

Age groups (Years)	Age wise No of cases/ %age	Gender wise	
		Male / Female (No. of cases)	Male / Female (%age)
41 - 50	04 / 08	02 / 02	04 / 04
51 – 60	21 / 42	09 / 12	18 / 24
61 – 70	22 / 44	08 / 14	16/ 28
71 – 80	03 / 06	02 / 01	04 / 02
Total	50 / 100	21 / 29	42/ 58 = =50 100
Mean	60.6		
S.D	8.92		
Test statistic value	t= 1.37	$\chi^2 = 1.111$	
Table value	t_{0.05,49} =1.684	$\chi^2_{0.05,1} = 3.85$	

patients in different groups were 7 (14%) each in 41-50 years and 71 - 80 years group. Whereas, in middle two groups 51 - 60 years and 61 - 70 years the patients were 15 (30%) and 21 (42%) respectively. The mean age was 60.6 ± 8.92 years (*Table 1*). Calculated t value (1.37) was less than table value t_{0.05,49} (1.684).

Gender wise distribution: With regard to gender wise cataract patients females (29/59%) were comparatively higher than males (21/42%, *Table 1*). The calculated test value <2 (1.111) was less than tabulated value.

Preoperative astigmatism: Its range was 0.0 - 2.5 D and mean value 0.825 ± 0.657 D. In 38 (76%) patients preoperative astigmatism was 1.0 D and less and rest of the patients 12 (24%) had above 1.0 D. The computed test value t (1.041) was less than tabulated value (1.671, *Table 2*).

Surgically induced astigmatism: SIA range was 0.0 - 2.0 D, 0.0 -1.5 D, 0.0 -1.0 D and 0.0- 0.75 D and mean SIA was 0.905 ± 0.353 , $0.72 V \pm 0.472$, 0.565 ± 0.233 and 0.17 ± 0.212 D on day-1, week-1, week-4 and week-6 respectively.

On day- 1, 42 (84%) patients exhibited SIA 1.0 D. In subsequent observation intervals, up to 1 D SIA was found in 45 (90%) patients, 50 (100%) patients on week-4. On last interval observation of week-6, SIA values shifted steeply to much lower degree 0.0 D in 27 (54%) patients, 0.25 D in 14 (28%) patients, 0.5 D in 07 (14%) patients and 0.75 D in 2 (4%) patients.

The test statistic t-value on day- 1 interval was higher than table value whereas on other three intervals these values were less than the table value t_{0.05,49} (1.671).

Visual acuity: The preoperative visual acuity PL+PR+ in 3 (6%) patients, FCCF to 5/60 in 14 (28%) patients and 6/60 to 6/18 in 33 (66%) patients. As regard postoperative visual acuity, uncorrected visual acuity was 6/36 to 6/18 in 8 (16%) patients and 6/12 to 6/6 in 42 (84%) patients. The best corrected visual acuity 6/12 to 6/6 was found in 44 (88%) patients and 6 (12%) patients 6/36 to 6/18 (*Table 3*).

Discussion

In our study, the mean age of patients was 60.6 ± 8.92 years. Various workers in their studies under

Table 2. Preoperative & Surgically Induced-Astigmatism (SIA) Evaluated in Fifty Patients Under Study

Astigmatism Diopter (D)	Preoperative No of cases/ %age	Surgically Induced Astigmatism (SIA) No of cases / %age			
		Day- 1	Week- 1	Week- 4	Week- 6
0.00	09 / 18	00 / 00	00 / 00	01 / 02	27 / 54
0.25	07 / 14	01 / 02	01 / 02	09 / 18	14 / 28
0.50	05 / 10	10 / 20	17 / 34	21 / 42	07 / 14
0.75	03 / 06	11 / 22	16 / 32	14 / 28	02 / 04
1.00	15 / 30	20 / 40	11 / 22	05 / 10	00 / 00
1.25	02 / 04	03 / 06	03 / 06	00 / 00	00 / 00
1.50	03 / 06	04 / 08	02 / 04	00 / 00	00 / 00
1.75	01 / 02	00 / 00	00 / 00	00 / 00	00 / 00
2.0	02 / 04	01 / 02	00 / 00	00 / 00	00 / 00
2.25	02 / 04	00 / 00	00 / 00	00 / 00	00 / 00
2.50	01 / 02	00 / 00	00 / 00	00 / 00	00 / 00
Mean	0.825	0.905	0.72	0.565	0.17
S.D	0.657	0.353	0.472	0.233	0.212
Test statistic t value	1.041	3.139	0.139	0.557	0.411
Table value $t_{0.05,49}$			1.671		

Table 3. Pre- and Post- Operative Visual Acuity Among Study Patients

Preoperative visual acuity	Number of cases	%age	Post-operative visual acuity	Uncorrected		Best corrected	
				No. of cases	%age	No. of cases	%age
PL+PR+	3	06	6/60 or less	00	00	0	0
FCCF to 5/60	14	28	6/36 – 6/18	08	16	6	12
6/60 to 6/18	33	66	6/12 – 6/6	42	84	44	88
Total	50	100	Total	50	100	50	100
Chi square (χ^2) Test value	9.20		Chi square (χ^2) Test value	18.67		22.77	
Table value $\chi^2_{0.01,2}$	9.21		Table value $\chi^2_{0.01,2}$	9.21			

different age range have reported the mean age of cataract patients 69.2 ± 7.8 years in the range 50 to 87 years (Reddy *et al*) (11), and 61.5 ± 8.99 years in the range of 45 to 82 years (Gokhlee & Sawhney).(12)

With regard to gender distribution, in our study males were 21 (42%) and females 29 (58%). These results closely corroborated to the reporting by Gokhale *et al* (12) (57.14 males and 42.86 females), Roman *et al* (13) (57.78% males and 42.22% females) Madhu and Raj (14) (56% males and 44% females) and Mukherji *et al* (15) (57.14 males and 42.86 females).

Preoperative corneal astigmatism can cause blurred or impaired unaided vision and postoperatively can reduce

final visual outcome after cataract surgery.(14-16) Correcting it at the time of cataract surgery can give spectacle independence for distant or near vision. (17) A smaller number of studies have attempted to ascertain the prevalence of preoperative cataract astigmatism.(17,18)

In our study, preoperative astigmatism range was 0.0 to 2.5 D and the mean value 0.825 ± 0.657 D. Comparing this study, greater values of preoperative astigmatism have been reported by Ferrer-Blasco *et al* (17) (0.90 ± 0.93), Khan *et al* (18) (1.03 ± 0.728) and David and Patric--2017 (1.09 ± 0.83 D).(19)

Postoperatively SIA range was 0.0 - 2.0 D on day-1, 0.0 - 1.5 D on week- 1, 0.0 - 1.0 D on week-4 and 0.0 - 0.75 D on week-6. With the increase in study intervals the number of patients also shifted to lower degree of SIA. On final interval of study the week-6, SIA 0.0 D was observed in 27 (54%) patients, 0.25 D in 14 (28%) patients, 0.50 D in 7 (14%) patients and 0.75 D in 2 (4%) patients. Final mean value was 0.17 ± 0.212 D.

On 40th postoperatively, range of SIA found in present study (0.0 - 0.75 D) corroborated to the findings of Gade and Khaire (8). However, SIA mean in our study (0.17 ± 0.212 D) was less than the reported value of 0.335 ± 0.234 D by Gade and Khaire.(8)

Pakravan *et al* (20), on six months after temporal phacoemulsification have reported mean SIA 0.26 ± 0.46 D and this value is close to present study. Ghokle and Sawhney (12), on 12 week postoperatively have reported SIA 0.37 D in temporal phacoemulsification. As regards visual acuity, preoperative 6/60 to 6/18 was in 33 (66%) and postoperatively uncorrected in 42 (84%) patients and best corrected in 44 (88%) patients. Statistical calculated value was almost at par with table value in case of preoperative visual acuity and much higher in case of postoperative visual acuity.

Conclusion

Investigations in present study provide the assessment that average age of cataract patients was 60 years, female patients were more than males, preoperative astigmatism was up to 1 D in 78 % patients and SIA considerably reduced on week-6 interval and best corrected visual acuity got improved.

References

1. Rainer G, Menapace R, Vaas C, *et al*. Corneal Shape Changes after Temporal and Superolateral 3.0 mm Clear Corneal Incisions. *J Cataract Refract Surg* 1999; 25: 1121-26.
2. Jackson TL. *Moorfields Manual of Ophthalmology*. Mosby Elsevier, 2008; Philadelphia, pp.6.
3. Simsek S, Yasar T, Demirok A, Cinal A, Yilmaj OF. Effect of superior and temporal clear corneal incisions on astigmatism after suture less phacoemulsification. *J Cataract Refract Surg* 1998; 24(4):5515-18.
4. Rana AY, Yonca AA, Sezin A, Sirel G, Caglar O. Effect on astigmatism of the location of clear corneal incision in phacoemulsification of cataract. *J Refract Surg* 2007; 23:515-18.
5. Malik VK, Kumar S, Kamboj R, Jain C, Jain K, Kumar S. Comparison of astigmatism following manual small incision cataract surgery: superior versus temporal approach. *Nepal J Ophthalmol* 2012; 4(7):54-58.
6. Viney KV, Sudhendra AN, Vishal K, Beena DV. A study on surgical induced astigmatism following small incision cataract surgery. *Indian J Fundamental and Applied Life Sciences* 2012;2(3):147-52.
7. Rashid MA, Hossain KA, Islam AKMR, Uddin Z. Comparative study of postoperative astigmatism following small incision cataract surgery-SICS in superior, superotemporal and temporal incision. *Medicine Today* 2013;25(2):72-74.
8. Gade SP, Khaire BS. Comparison of surgically induced astigmatism with superior, superotemporal and temporal incisions in phacoemulsification surgery. *International J Recent Trends in Science & Technology* Oct 2014;12(3):517-21.
9. Sawhney S and Aggarwal A. SIA Calculator Version 2.1. A free software program approved by All India Ophthalmological Society (AIOS). *Saurabhsawhney@rediffmail.com*.
10. Prasad S. Elements of Biostatistics. First Edition Rastogi Publications; *Reprint ISBN* 2003; 81: 613-2.
11. Reddy B, Raj A and Singh VP. Site of incision and corneal astigmatism in conventional SICS versus phacoemulsification. *Ann Ophthalmol* 2007; 39 :209-16.
12. Gokhle NS and Sawhney S. Reduction in astigmatism in manual small incision cataract surgery through change of incision site. *Indian J Ophthalmol* 2005; 53 (3):201-03.
13. Roman SJ, Auclin FX, Chong Sit DA, Ullern N. Surgically induced astigmatism with superior and temporal incision in cases of with-the- rule preoperative astigmatism. *J Cataract Refract Surg* 1998; 24 (12):1636-41.
14. Madhu M and Raj VK. A study on postoperative corneal astigmatism in superior and temporal sections of sclera pocket small incision cataract surgery. *AIOC* 2006; Proceedings: 328-31.
15. Mukherji S, Kamath PA, Parihar JKS, Bandyopadhyay S. Temporal SICS: Practical advantages and great results at low cost- our experience. *AIOC*, 2007; *Proceedings*: 127-30.
16. Nichamin LD. Astigmatism control. *Ophthalmol Clin North Am* 2006; 19(4):485-93.
17. Ferrer-Blasco T, Montes-Mico R, Peixoto -de-Matos SC, Gonzalez-Meizome JM and Cervino A. Prevalence of corneal astigmatism before cataract surgery. *J Cataract Refract Surg* 2009; 35(1):70-75.
18. Khan MI, Muhtaseb M. Prevalence of corneal astigmatism in patients having routine cataract surgery at a teaching hospital in the United Kingdom. *J Cataract Refract Surg* 2011;37(10):1751-55.
19. David SC and Patrick H. Prevalence of corneal astigmatism in an NHS cataract surgery practice in Northern Ireland. *Ulster Med J* 2017;86(1):25-27.
20. Pakravan M, Nikkhah H, Yazdani S, *et al*. Astigmatic outcome of temporal versus nasal clear corneal phacoemulsification. *J Ophthalmic Vis Res* 2009;4(2): 79-83.