

Research Article

Open Access

# Comparing Surgical-Induced Astigmatism through Change of Incision Site in Manual Small Incision Cataract Surgery (SICS)

Ahmad Abdelmegid Radwan

Lecturer of Ophthalmology, Ain Shams University, Egypt

## Abstract

**Purpose:** To compare the astigmatism induced by a superior versus temporal incision in manual small incision cataract surgery (SICS) in eyes with preoperative "with the rule" corneal astigmatism (WTR).

**Methods:** A prospective comparative study was carried on 35 eyes of 24 patients. All of them had senile cataract and were selected from "Ain Shams university hospitals" ophthalmology outpatient clinic. The patients were subdivided into 2 groups according to site of incision. *Group A:* 18 eyes (of 13 patients) underwent SICS through superior approach with implantation of PMMA IOL. *Group B:* 17 eyes (of 11 patients) underwent SICS through temporal approach with implantation of PMMA IOL. The SIA was then calculated for each eye (at day 45 postoperative) and compared.

**Results:** Mean surgical-induced astigmatism (SIA) was found to be significantly lower in the temporal group compared to that in the superior group ( $P < 0.01$ ). The superior incision induced 2.1 D of "against the rule astigmatism (ATR)". While the temporal incision induced 0.7 D of WTR astigmatism.

**Conclusion:** The high SIA induced by superior incision may prove useful when aimed at reducing high levels of preoperative corneal WTR astigmatism (around 2 D). On the other hand, temporal incision is recommended in patients with low levels of preoperative WTR astigmatism. The exact cut-off value is to be studied.

## Introduction

Cataract surgery has become one of the most common and successful procedures in ophthalmology. In addition to improving visual acuity (VA), one of the goals of modern cataract surgery is to reduce pre-existing astigmatism (PEA), a factor that may reduce VA and affect the quality of vision [1].

Various strategies currently available to the cataract surgeon can safely and effectively reduce corneal astigmatism during lens-based surgery. These techniques require careful preoperative surgical planning particularly as regards incision design and site. Employing advanced enhancement techniques (such as corneal relaxing incisions) and/or toric intraocular lens (IOL) technology may also help surgeons to achieve postoperative emmetropia [2].

As regards the choice of incision location, previous studies reported that superior incision induces greater corneal astigmatic change (against-the-rule astigmatism) (ATR), than temporal incision (which induces with-the-rule astigmatism) (WTR) [3-5]. In addition, with-the-rule astigmatism is preferred as it frequently allows better uncorrected visual acuity [6]. Others recommend choosing the location of corneal incision based on preexisting astigmatism by placing the incision on the steeper corneal meridian (on-axis incision) to reduce significant preoperative astigmatism [7].

While phacoemulsification remains the more advanced and technically superior method of cataract surgery, it is not always appropriate either from a cost perspective or the density of the cataracts involved [8]. Small incision manual extracapsular techniques (SICS) - the first choice alternative to phacoemulsification- retains most of the advantages of "phaco" giving visual results equivalent to phacoemulsification at lower cost. However, the larger incision used induces greater astigmatism than phacoemulsification [9].

In view of the previous findings, the study aimed to compare between the surgically induced astigmatism (SIA) in manual SICS by superior (on-axis) incision and temporal incision; to determine the possibility of reduction of preoperative "with the rule astigmatism" (WTR) in patients undergoing SICS.

## Patients and Methods

This prospective comparative study included 35 eyes of 24 patients. All of them had senile cataract and were selected from "Ain Shams University Hospitals" ophthalmology outpatient clinic.

The patients were randomly subdivided into 2 groups according to site of incision (Table 1):

**Group A:** 18 eyes (of 13 patients) underwent SICS through superior approach with implantation of PMMA IOL (Figure 1a).

**Group B:** 17 eyes (of 11 patients) underwent SICS through temporal approach with implantation of PMMA IOL (Figure 1b).

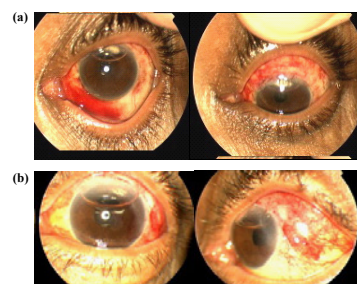


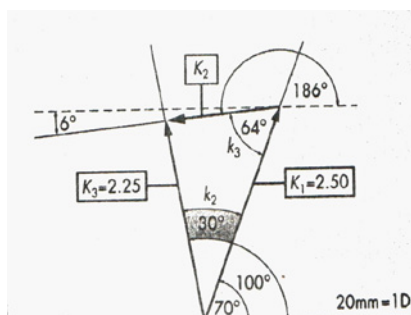
Figure 1: a; SICS (superior approach); b; SICS (temporal approach).

**\*Corresponding author:** Ahmad Abdelmegid Radwan, Lecturer of Ophthalmology, Ain Shams University, Egypt, E-mail: [drahmedradwan1971@yahoo.com](mailto:drahmedradwan1971@yahoo.com)

Received March 28, 2011; Accepted May 18, 2011; Published May 20, 2011

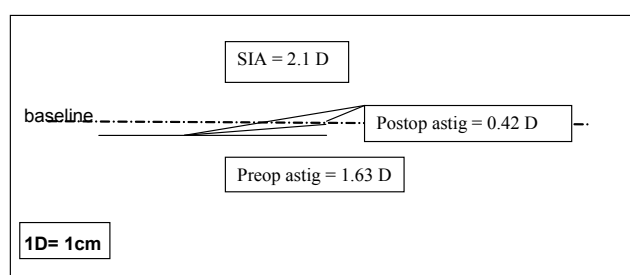
**Citation:** Radwan AA (2011) Comparing Surgical-Induced Astigmatism through Change of Incision Site in Manual Small Incision Cataract Surgery (SICS). J Clinic Experiment Ophthalmol 2:161. doi:10.4172/2155-9570.1000161

**Copyright:** © 2011 Radwan AA. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.



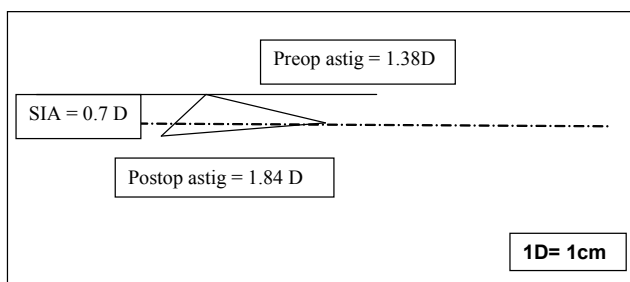
K1 (preoperative astigmatism) = 2.50D @ 35  
K3 (postoperative astigmatism) = 2.25D @ 50  
K2 (surgically induced astigmatism) = 1.25D @ 93

**Figure 2:** An example of vector analysis of astigmatism<sup>(10)</sup>.



SIA: surgical induced astigmatism  
Preop astig: preoperative astigmatism  
Postop astig: postoperative astigmatism

**Figure 3a:** SIA in group A (superior incision) using vector analysis.



SIA: surgical induced astigmatism  
Preop astig: preoperative astigmatism  
Postop astig: postoperative astigmatism

**Figure 3b:** SIA in group B (temporal incision) using vector analysis.

- The inclusion criteria were Significant senile cataract.
- Keratometric WTR astigmatism.

#### The exclusion criteria were

- Complicated cataract, and pseudo exfoliation.
- Pre-existing pathology other than cataract causing diminution of vision such as corneal opacities, macular disorders and optic nerve diseases.
- Any patient who had undergone previous ocular surgery (trabeculectomy, refractive or retinal detachment surgery).

Preoperatively, a full ophthalmic examination was done including uncorrected visual acuity (UCVA), best-corrected visual acuity (BCVA), keratometry and 'A-scan' biometry. Keratometry was

performed using Javal Shiotz keratometer (to determine preoperative corneal astigmatism). All patients also signed an informed consent.

The patients were scheduled for Manual SICS at the department of Ophthalmology Ain-Shams University Hospitals. All surgeries were done under peribulbar anesthesia. The incision architecture was similar in the 2 groups. A 6 mm scleral straight incision, 1.5 mm from the limbus was made with a number 15 Bard Parker blade. A funnel shaped sclerocorneal pocket incision was created with a crescent knife. One side-port was made 90 degrees apart of the scleral tunnel with a 15 degree angulation knife. With a 3.2 keratome, the anterior chamber was entered 1.5 mm into the clear cornea and the internal incision was enlarged sideways to 8 mm. A single piece PMMA IOL of 6mm optic size and 12.5 mm total size was implanted into the capsular bag. No sutures were given.

Postoperatively, topical prednisolone acetate 1% eye drops were administered six times a day in the first week and gradually tapered every week over six weeks. Topical ofloxacin eye drops 0.3% were administered four times a day for the first ten days and then discontinued.

Patients were thoroughly examined postoperatively on days 1, 7, 15 and 45 after surgery. The preoperative and postoperative keratometric readings (at day 45 of follow-up visit), for each eye were used for statistical analysis. Amplitude of astigmatism was calculated from the difference in the keratometric value in the steeper and flatter meridian, using the plus cylinder notation.

The SIA was then calculated for each eye using vector analysis method [10]: astigmatism vectors are drawn using a protractor and a ruler;

A horizontal baseline is drawn, on which a center point is marked. First, the preoperative vector (K1) is depicted, by drawing a line from the center outward, at an angle double the preoperative astigmatism angle, and equal in length to the magnitude of the preoperative astigmatism. For the magnitude, a convenient scale can be chosen (in the present study, the scale used was one dioptre = one centimeter).

Next, the postoperative vector (K3) is drawn, again beginning at the center and going outwards. These two lines are joined. This third line is the resultant vector and represents SIA (K2). The junction of this line and the postoperative vector is marked as the 'head', and its other end as tail. To determine the exact SIA, this line is measured and the reading is converted into dioptric value using the earlier scale. This is the magnitude of SIA.

A horizontal line is drawn through the tail of the resultant vector, and the angle that the resultant makes with it is measured. Halve this angle, and it gives the axis of SIA (Figure 2) [10].

Statistical analysis was performed using Statistical Package for Social Sciences software-Windows Version-17 (SPSS-17).

#### Results

This study included 35 eyes of 24 patients. There were no significant differences in the age, sex, or preoperative astigmatism between the two groups (Table 1).

Applying vector analysis method, the SIA was calculated, (scale used was, one dioptre = one centimeter);

In group A (superior incision), the mean preoperative astigmatism was 1.63 D @ 93; the mean postoperative astigmatism was -0.42 D @ 11. The mean SIA was calculated as -2.1 D @ 5 (Figure 3a).

	Group A (Superior incision)	Group B (Temporal incision)	P value
No. of patients	13	11	
No. of eyes	18 eyes	17 eyes	
Age in years (range) (mean $\pm$ SD)	60-79 68.6 $\pm$ 6.7	56-83 65 $\pm$ 5.4	p>0.05
Sex	8 females 5 males	6 females 5 males	p>0.05
Keratometric astigmatism in diopters (mean $\pm$ SD)	1.63 $\pm$ 1.23	1.38 $\pm$ 1.03	p>0.05

SD: Standard deviation

**Table 1:** Preoperative data of the patients.

	Group A (Superior incision)	Group B (Temporal incision)	P value
Mean preoperative astigmatism (D)	1.63 $\pm$ 1.23	1.38 $\pm$ 1.03	p>0.05
Mean postoperative astigmatism (D)	-0.42 $\pm$ 1.17	1.84 $\pm$ 1.36	P<0.01*
Mean SIA astigmatism (D)	-2.05 $\pm$ 1.19	0.46 $\pm$ 0.43	p<0.01*

\*Statistically significant (P<0.01)

**Table 2:** Pre, post, and surgically induced astigmatism in both groups.

In group B (temporal incision), the mean preoperative astigmatism was 1.38 D @ 84; the mean postoperative astigmatism was 1.84 D@ 92. The mean SIA was calculated as 0.7 D @ 112 (Figure 3b).

On comparing the mean postoperative astigmatism between group A and B, a statistically significant difference was found (p<0.01). The mean SIA was significantly higher in group A (-2.1 D $\pm$ 0.9) of ATR astigmatism than in group B (0.7 D $\pm$ 0.52) of WTR astigmatism (P<0.01) (Table 2).

## Discussion

The term “refractive cataract surgery” has come to represent a reality for our cataract patients. In order to achieve excellent visual results, the effect of astigmatism on postoperative vision must be minimized [1].

Today’s cataract incisions provide better control of surgically induced astigmatism, either by using temporal approach to produce “astigmatically neutral” surgery or by using on-axis incision to induce astigmatism at the steep axis to counteract preexisting astigmatism [11].

In the present study, the astigmatism induced by a superior (on-axis) incision versus temporal incision in manual SICS in eyes with preoperative “with the rule” corneal astigmatism was compared. It was measured using vector analysis method, which is a simple, powerful, and accurate method. However, it is tedious requiring patience [10]

The SIA was found to be significantly lower in the temporal group compared to that in the superior group. This is in agreement with previous studies [3-5].

The superior incision induced 2.1 D of “against the rule astigmatism”. This was greater than SIA by superior incision in phacoemulsification (1.5 D) as reported by Tejedor and Murube [12]. which is explained by the larger incision size in SICS. Also it was higher than that mentioned by Haldipurkar et al. [13] who reported 1.2 D in SICS. The high SIA in this study may help to neutralise a pre-existing WTR astigmatism of 2 D, and to reduce significant WTR astigmatism of > 2 D using superior incision.

On the other hand, temporal incision induced an average SIA of 0.7 D of WTR astigmatism which is a low value. Hence, it doesn't jeopardize low levels of WTR astigmatism.

In conclusion, the high SIA induced by superior incision may prove useful when aimed at reducing high levels of preoperative corneal WTR astigmatism (around 2 D). On the other hand, temporal incision is recommended in patients with low levels of preoperative WTR astigmatism. The exact cut-off value is to be studied.

## References

- Beltrame G, Salvat M, Chizzolini M, Driussi G (2001) Corneal topographic changes induced by different oblique cataract incisions. J Cataract Refract Surg 27: 720-727.
- Wang M, Swartz T (2007) Managing astigmatism during lens-based surgery. Cataract and Refractive Surgery Today Feb: 19.
- Joo CK, Han HK, Kim JH (1997) Computer-assisted videokeratography to measure changes in astigmatism induced by suture less cataract surgery. J Cataract Refract Surg 23: 555-561.
- Mendivil A (1996) Comparative study of astigmatism through superior and lateral small incisions. Eur J Ophthalmol 6: 389-392.
- Lindstrom R (1994) Cataract surgery and lens implantation. Curr Opin Ophthalmol 5: 1-4.
- Bradbury J A, Hillman J S, Cassells-Brown A (1992) Optimal postoperative refraction for good unaided near and distance vision with monofocal intraocular lenses. Br J Ophthalmol 76: 300-302.
- Nielsen P (1995) Prospective evaluation of surgically induced astigmatism and astigmatic keratotomy effects of various self-sealing small incisions. J Cataract Refract Surg 21: 43-48.
- Sachdeva V, Malik K P S, Bajaj S, Goel R (2006) Prospective study of early postoperative corneal astigmatic changes following nonphaco SICS and clears corneal temporal incision phaco. AIOC proceedings.
- Ravindran R , Aravind H, Mathen Minu (2004) Relevance and clinical significance of SICS (Manual Phaco) in Modern Cataract Surgery. In Clinical Practice in Small Incision Cataract Surgery. Edited by: Garg A, Fry L, Tabin G, Gutierrez-Carmona F, and Pandey S. Taylor and Francis Group. United Kingdom: 238.
- Jaffe NS, Clayman HM (1975) The pathophysiology of corneal astigmatism after cataract extraction. Trans Am Acad Ophthalmol Otolaryngol 79: 615.
- Gills JP, Gayton JL (1998) Reducing pre-existing astigmatism. In Cataract Surgery; The State of the Art. Edited by Gills JP, Fenzl R, and Martin RG. Slack Incorporated. New Jersey: 53
- Tejedor J, Murube J (2005) Choosing the Location of Corneal Incision based on pre-existing astigmatism in phacoemulsification. Am J Ophthalmol 139: 767-776.
- Haldipurkar SS, Shikari HT, Gokhale V (2009) Wound construction in manual small incision cataract surgery. Indian J Ophthalmol 57: 9-13.

## Submit your next manuscript and get advantages of OMICS Group submissions

### Unique features:

- User friendly/feasible website-translation of your paper to 50 world's leading languages
- Audio Version of published paper
- Digital articles to share and explore

### Special features:

- 100 Open Access Journals
- 10,000 editorial team
- 21 days rapid review process
- Quality and quick editorial, review and publication processing
- Indexing at PubMed (partial), Scopus, DOAJ, EBSCO, Index Copernicus and Google Scholar etc
- Sharing Option: Social Networking Enabled
- Authors, Reviewers and Editors rewarded with online Scientific Credits
- Better discount for your subsequent articles

Submit your manuscript at: [www.editorialmanager.com/clinicalgroup](http://www.editorialmanager.com/clinicalgroup)