

# Corneal astigmatism after small incision cataract surgery with PCIOL - A comparative study between superior, supero temporal and temporal incision

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## Abstract

**Background:** The goal of present day cataract surgery is to provide clear unaided vision soon after surgery and one of the main impeding factor is postoperative astigmatism. The incision used and its closure can have a profound effect on the astigmatism and therefore, the refractive state postoperatively. **Aim and Objectives:** To compare the post operative corneal astigmatism in patients undergoing small incision cataract surgery(SICS) with posterior chamber intraocular lens(PCIOL) with different types of incision namely – superior, supero temporal and temporal incision. **Materials and Methods:** In a prospective interventional study in 130 patients who underwent SICS with PCIOL between March 2019 and December 2019 after randomly dividing them into superior, superotemporal and temporal incision each 50, 50 and 30 in number respectively. Their surgical induced astigmatism(SIA) was assessed from the keratometry reading taken preoperatively and the 6<sup>th</sup> postoperative week by scalar analysis. Best corrected visual acuity(BCVA) was assessed at post-op 4<sup>th</sup> and 6<sup>th</sup> week. Statistical analysis was done using SPSS Software version 16. **Results:** The mean net astigmatism was within 0.9 Diopter(D) in all three groups and was very minimal in temporal (0.38D) when compared to superior(0.88D) and superotemporal(0.57D) and was found to be statistically significant. It has been noted that Against the rule(ATR) astigmatism was common in superior group postoperatively and With the rule(WTR) astigmatism was common in superotemporal and temporal group. So preoperative WTR astigmatism of about -0.75 D may be benefited by superior incision and preoperative ATR astigmatism around 0.5 D superotemporal and temporal incision. **Conclusion:** The postoperative astigmatism also depends on preoperative astigmatism. Patients with pre-operative WTR astigmatism are benefited from superior incision cataract surgery and preoperative ATR astigmatism may benefit from supero temporal and temporal incision.

**Keywords:** ATR, BCVA SICS, superior superotemporal temporal incisions, Surgically induced astigmatism, WTR

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## INTRODUCTION

Blindness due to cataract is an enormous problem in India in terms of human morbidity, social and economic burden. In south Asia region, cataract contributes 51% of blindness.<sup>1</sup> The goal of present day cataract surgery is to provide clear unaided vision soon after surgery. With the popularity of intraocular lens (IOL) implantation surgery and availability of accurate intraocular lens power calculation methods, the chief impediment to early visual rehabilitation is postoperative astigmatism. The alterations in corneal curvature in the early postoperative period are primarily attributable to the surgical procedure. The

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incision and its closure can have a profound effect on the astigmatism and therefore, the refractive state postoperatively. There were certain characteristics of self sealing incision with respect to length and configuration that imparted not only self-sealability but also astigmatism neutrality to this incision<sup>2</sup>. The scleral pocket incision dampens the astigmatic swing in the early and late post operative periods. A swing of only 1.5D has been reported with SICS.<sup>3</sup> Reduction in astigmatism helps in obtaining a more rapid visual rehabilitation, greater patient satisfaction and better optical results free from cylinder distortion and asthenopic symptoms. In SICS, the site of scleral incision whether superior, superotemporal, temporal incision has some definite influence in the final visual outcome<sup>4,5</sup>. This forms the basis of this study.

### AIMS AND OBJECTIVE

To compare the post operative corneal astigmatism in patients undergoing SICS with PCIOL with different types of incision namely – superior, supero temporal and temporal incision.

### MATERIALS AND METHODS

A prospective interventional study was carried out in 130 patients who underwent SICS with superior, superotemporal and temporal incision at Chengalpattu medical college hospital, Ophthalmology department during the period from March 2019 to December 2019 and based on random sampling were divided into 50, 50, and 30 in number respectively. Ethical clearance was obtained from the institutional ethical committee. Patients admitted for cataract surgery between the age group of 30-75 years were only considered for the study after getting informed consent. Any previous history of wearing spectacles was

elicited and checked up. All types of cataract between the age group 30-75 years, Patients with no other cause for defective vision other than cataract and Patients with no history of previous ocular surgery in the operating eye are included in this study. Patients with preexisting corneal disease excluded. After routine pre-op workup including Preoperative keratometry with Bausch and Lomb Keratometer, A scan biometry and IOL power calculation using SRK II formula , SICS was done using 5.5-6mm long sclerocorneal tunnel (frown) with a self sealing corneal valve was fashioned at 12o' clock position 1.5-2mm posterior to the limbus for the superior type of SICS. Forsupero temporal the incision was made which was centered at 11'o clock position the right eye and 1'o clock position at left eye. The temporal incision was made at 9'o clock position in the right eye and 3'o clock position in the left eye. Post operatively patients received topical antibiotic steroid drops in a tapered dose for 6 weeks. BCVA and keratometry reading were taken at 4<sup>th</sup> week and 6<sup>th</sup> week post operatively. Patients were reassessed at 3 months. Surgically induced astigmatism (SIA) was calculated by scalar analysis<sup>6,7</sup> method. In this method, SIA was calculated by subtracting the preoperative keratometric cylinder from that measured at each postoperative examination. Steep meridians between 46° and 134° were considered as with-the-rule and those with steep meridians less than 46° and greater than 134°, against-the-rule. Preoperative or postoperative WTR cylinders were called positive; preoperative or postoperative ATR cylinders were called negative. For example, an eye with 1D of preoperative WTR cylinder that results in 1D of postoperative ATR cylinder has been altered by a net 2D astigmatic shift towards against-the-rule. Statistical analysis was done by SPSS Software version 16.

### RESULTS

In this 130 cataract patients in the age group of 31-72 were studied. Out of these 96 patients were in the age group of 50-69 years (73.77%) and only 11 patients(8.46%) were more than 70 years. Out of the 130 cases, 65 were male patients and 65 were female patients. Table 1 and 2 depict the preoperative types and range of astigmatism in diopters.

**Table 1:** Types of Pre Operative Astigmatism

TYPES OF ASTIGMATISM	SUPERIOR INCISION	SUPERO TEMPORAL INCISION	TEMPORAL INCISION	TOTAL(%)
WTR	15	16	9	40(30.76%)
ATR	25	27	18	70(53.86%)
NEUTRAL	10	7	3	20(15.38%)
<b>TOTAL</b>	<b>50</b>	<b>50</b>	<b>30</b>	<b>130</b>

**Table 2:** Range of Astigmatism In Diopters – Pre Operatively

RANGE OF ASTIGMATISM IN DIOPTERS	SUPERIOR INCISION	SUPERO TEMPORAL INCISION	TEMPORAL INCISION	TOTAL
≤ 0.25-NIL	10	14	3	27 (20.7%)
0.26-0.5	10	5	6	21 (16.1%)
0.6-0.75	7	7	2	16 (12.3%)
0.76-1	12	10	9	31 (23.8%)
1.1-1.5	6	9	3	18 (13.8%)
1.6-2.0	2	2	4	8 (6.2%)
>2	3	3	3	9 (7.1%)
<b>TOTAL</b>	<b>50</b>	<b>50</b>	<b>30</b>	<b>130</b>

The mean net SIA (Table 3) postoperatively was within 0.9 D in all three groups but it was very minimal in temporal group(0.38±0.22D) when compared to superior(0.88±0.57D) and supero temporal group(0.57±0.58D) with a significant P value of <0.05. When analyzing the net astigmatism keratometry reading taken preoperatively and at postoperative 6th week only were considered.

**Table 3:** Amount of Surgically induced Astigmatism

ASTIGMATISM IN DIOPTERS	SUPERIOR INCISION (50)	SUPERO TEMPORAL INCISION (50)	TEMPORAL INCISION (30)
≤ 0.25-NIL	13(26%)	20(40%)	20(66%)
0.26-0.5	9(18%)	14(28%)	9(30%)
0.6-0.75	5(10%)	4(8%)	0
0.76-1	12(24%)	2(4%)	1(3.3%)
1.1-1.5	7(14%)	6(12%)	0
1.6-2.0	4(8%)	4(8%)	0
>2	0	0	0
MEAN(SD)	0.88(± 0.57)	0.57(± 0.58)	0.38(± 0.22)

The stabilization of SIA occurs at 4 weeks itself in superotemporal and temporal group than the superior group which was stabilized only at 6 weeks(Table 4).

**Table 4:** Best Corrected Visual Acuity(BCVA) at 4<sup>th</sup> Week and 6<sup>th</sup> week

BCVA	SUPERIOR		SUPERO TEMPORAL		TEMPORAL	
	4 <sup>th</sup> Week	6 <sup>th</sup> Week	4 <sup>th</sup> Week	6 <sup>th</sup> Week	4 <sup>th</sup> Week	6 <sup>th</sup> Week
6/6	9(18%)	10(20%)	11(22%)	12(24%)	14(46.6%)	14(46.6%)
6/9	14(28%)	14(28%)	25(50%)	26(52%)	7(23.3%)	7(23%)
6/12	13(26%)	14(28%)	10(20%)	7(14%)	5(16.6%)	5(16%)
6/18	14(28%)	12(24%)	4(8%)	5(10%)	4(13.3%)	4(13.3%)
<b>TOTAL</b>	<b>50</b>	<b>50</b>	<b>50</b>	<b>50</b>	<b>30</b>	<b>30</b>

Postoperative WTR astigmatism was common in superotemporal and temporal group and postoperative ATR in temporal group.(Table 5)

**Table 5:** Comparison of Type of Astigmatism (Pre operative and Post operative)

Type of Astigmatism	Superior Supero Temporal Temporal					
	Pre operative	Post operative	Pre operative	Post operative	Pre operative	Post operative
WTR	15	8	16	30	9	20
ATR	25	38	27	14	18	6
NEUTRAL	10	4	7	6	3	4
<b>TOTAL</b>	<b>50</b>	<b>50</b>	<b>50</b>	<b>50</b>	<b>30</b>	<b>30</b>

## DISCUSSION

The location, shape and size of incision in SICS influence postoperative SIA as reported in many studies <sup>8,9</sup>. This study one of the few comparing the three types of incision and SIA. In this study, 82.4% of the study group falls above 50 yrs of age and preoperative ATR astigmatism was more frequent (53.86%). As the individual ages the astigmatism

tends to go from steeper at vertical meridian to steeper horizontally due to the blinking action of lids tends to flatter the vertical meridian. In this study, it can be observed that 113 patients (86.7%) have mild astigmatism i.e. less than 1.5D and 17 patients (13.3%) have moderate (1.5-2D) to severe astigmatism (more than 2D). It is in the second group of patients the preoperative keratometry

plays a vital role so that appropriate incision can be chosen to reduce the post operative astigmatism.<sup>(10)</sup>The reason being the superior incision might be slightly closer to the corneal apex than a temporal incision and might have a greater effect on central corneal curvature. This and gravity may account for the difference in superior and temporal wounds, but it is also possible that the anatomy of the superior and temporal cornea and limbus differ. Our reported SIA value was similar to that of Thomas et al<sup>11</sup> and half that was reported by Mallik et al<sup>12</sup> and our results are consistent with the idea that superior approach SICS induces higher SIA than a temporal approach SICS. According to our study the stabilization of SIA occurs at 4 weeks itself in superotemporal and temporal group than the superior group which was stabilized only at 6 weeks. The study by Thomas et al<sup>11</sup> is consistent with our study. It has been noted that ATR astigmatism was common in superior group postoperatively and WTR astigmatism was common in supero temporal and temporal group. So preoperatively WTR astigmatism of about -0.75diopter may be benefited by superior incision and preoperative ATR astigmatism around 0.5diopter may be benefited by supero temporal and temporal incision similar to certain studies<sup>4,13,14</sup>. Visual results, degree of postoperative refractive error, stability of refraction, and long-term safety are the main criteria on which any cataract surgical technique should be evaluated. Decreased astigmatism and increased wound stability lead to better visual function and accelerated visual rehabilitation. In addition, they may help reduce the number of postoperative spectacle changes, leading to more patient satisfaction.

## CONCLUSION

There is significant difference in net stigmatism between 5.5-6mm frown superior, supero temporal and temporal incision. Supero temporal being better than superior and temporal the best of the 3 types. The postoperative astigmatism also depends on preoperative astigmatism. Patients with pre-operative WTR astigmatism are benefited from superior incision cataract surgery and preoperative ATR astigmatism may benefit from supero temporal and temporal incision.

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