

## Re-inventing the straight incision with a single central suture in manual small-incision cataract surgery to minimize surgically induced astigmatism

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**Purpose:** To calculate the surgically induced astigmatism (SIA) in MSICS through a superiorly placed straight scleral incision closed with a single, central, perpendicular 10-0 polyamide suture and to document any suture-related complaints and complications. **Methods:** A retrospective, hospital-based study was carried out in 50 cases of uncomplicated senile cataract (>50 year) with nuclear sclerosis  $\geq$  grade 4, "with the rule" astigmatism who underwent MSICS through a superior, straight incision with a single, central, perpendicular 10-0 nylon suture. Patients with "against the rule" astigmatism, keratoconus, pre-existing corneal opacity, astigmatism  $>2D$ , distorted or oblique mires, and previous ocular surgeries and unwilling to participate were excluded. **Results:** The mean age of the patients was  $64.81 \pm 2.824$  years, with a male: female ratio of 1.38:1. The mean SIA at day 7, week 6, and 12 weeks was  $0.539 \pm 0.118$ ,  $0.529 \pm 0.134$ , and  $0.524 \pm 0.129$ , respectively. Only 6 patients (12%) complained of foreign body sensation. No patient developed any suture-related complications. **Conclusion:** SIA is significantly reduced in straight incision by applying a single, central, and perpendicular 10-0 polyamide suture, as compared to a straight incision without a suture.

**Key words:** Best corrected visual acuity, manual small-incision cataract surgery, straight incision, surgically induced astigmatism, uncorrected visual acuity

Cataract is still the primary cause of curable blindness all over the world.<sup>[1]</sup> Over the years, cataract surgery had undergone immense changes from couching to intra-capsular cataract extraction (ICCE) to conventional extra-capsular cataract extraction (ECCE) to small-incision cataract surgery (SICS) to phaco-emulsification to micro-incision cataract surgery (MICS) to femto-laser cataract surgery (FLCS). Phaco-emulsification is a variant of extra-capsular cataract extraction surgery and was considered the best treatment modality for cataract surgery.<sup>[2]</sup> With the advent of phaco-emulsification, cataract surgery has become a day care surgery, but because of economic reasons and long learning curves, it is limited to big cities and institutions.<sup>[3]</sup>

In third-world countries such as India with limited resources and health care facilities, manual small-incision cataract surgery (MSICS) is a ray of hope for handling the huge burden of curable blindness related to cataract.<sup>[4]</sup> MSICS has become comparable to phaco-emulsification. In addition, it has a shorter learning curve and is more economical and suitable for high-volume surgeries.<sup>[5]</sup> MSICS can be performed in high-volume setups because it is a fast technique. The cost of instruments and disposable blades with a short learning curve are added advantages of MSICS over phaco-emulsification.<sup>[6]</sup> It is also better suited for advanced and mature cataract, usually seen in developing countries because of the lack of awareness and late presentation.<sup>[7]</sup>

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In MSICS, different types of scleral incisions such as the straight, frown, and inverted V/Chevron are being used, with the aim of keeping surgically induced astigmatism to a minimum, leading to better post-operative uncorrected visual acuity (UCVA), which is the need of the hour. All scleral pocket incisions have the advantage of intra- and post-operative stability, which include early healing, faster visual restoration, and superior astigmatism control.<sup>[8]</sup>

In the published literature, the best site for the incision was analyzed and studies have compared the surgically induced astigmatism (SIA) in different types of scleral incisions. Chevron incision was reported to induce the minimum SIA, followed by the frown and straight incision in many studies.<sup>[9-13]</sup> For the ophthalmologists who start learning and performing MSICS, the easiest and most widely used incision is the straight incision. The chevron and frown incisions are comparatively difficult to master as because of their configuration, visco-expression of the nucleus is relatively difficult, leading to more chances of corneal endothelial damage and bag entanglement while trying nucleus delivery via irrigating wire vectis.<sup>[14]</sup> All these disadvantages are well taken care of by straight incision, but because of more SIA due to the sliding of the tunnel lips secondary to least stability, the straight incision is less popular as we are in the era of cataract surgery becoming a refractive surgery.<sup>[15]</sup>

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**Table 1: Classification of visual acuity**

Grade	Visual acuity
0	<1/60 to PL+ve
1	<3/60 to 1/60
2	<6/60 to 3/60
3	<6/18 to 6/60
4	6/6 to 6/18

Keeping all the available information and literature in mind and to take care of SIA in straight incision, we have re-invented the conventional straight incision into a straight incision with a single, central, perpendicular, and equidistant 10-0 polyamide suture to prevent the sliding of lips, which leads to a significant reduction in the SIA. This retrospective and observational study was performed to calculate the surgically induced astigmatism in MSICS in the superiorly placed straight incision, most used among beginners. All the surgeries were performed by a single surgeon. The data were used to compare SIA reported in published studies, with other types of incision in MSICS such as straight, chevron, and frown incisions.

### Aim and objectives

The objectives are to calculate the SIA in MSICS performed by a single surgeon through a superiorly placed, straight scleral incision closed with a single, central, perpendicular 10-0 polyamide suture and to document any suture related complaints and complications.

### Methods

A retrospective, observational hospital-based study was carried out over a period of 3 months. Fifty patients of uncomplicated senile cataract over 50 years of age with nuclear sclerosis of grade 4 or more and "with the rule" astigmatism were included. An informed, written consent was taken from every study participant. Patients with "against the rule" astigmatism, keratoconus, pre-existing corneal opacity, astigmatism >2 D on keratometry, distorted or oblique mires, previous corneal surgeries, previous glaucoma surgeries, concurrent ocular disease and those who were not willing to participate in the study were excluded from the study.

The standard pre-operative protocol had been followed, including visual acuity assessment with Snellen chart, lacrimal sac syringing, non-contact tonometry (NCT), slit lamp examination (SLE) for anterior segment evaluation, and nuclear sclerosis grading and indirect ophthalmoscopy (IDO) for posterior segment evaluation. Manual keratometry (Bausch and Lomb) had been performed before the surgery by the same person to avoid any inter-observer variation. Intra-ocular lens (IOL) power was calculated using SRK II formula using A scan.

### Surgical procedure

All the patients were operated on by the same surgeon. On the day of surgery, the pupil was dilated with 0.8% tropicamide and 5% phenylephrine drops. Ketorolac 0.4% eye drops were instilled four times to prevent intra-operative miosis. The surgery was performed under peri-bulbar block. After applying superior rectus bridal suture, fornix-based conjunctival flap was made from 10 to 2 o' clock hours, followed by wet field cautery. In every case, 2 mm away from superior limbus, a 7 mm

straight incision was given after measuring with the callipers. A self-sealing sclero-corneal tunnel was made using a sterile disposable 2.8 mm crescent blade, extending into the clear cornea for 1 mm. A side port was made using a micro-vitreo-retinal blade (MVR blade) at 9 o' clock, through which continuous curvilinear capsulorrhexis (CCC) was performed using a 26 G cystotome under viscoelastic cover. A 2.8 mm sterile disposable keratome was used to enter the anterior chamber through the tunnel incision. The internal wound was now enlarged to around 8–10 mm length approximately by crescent to ensure that it was sufficient enough to accommodate a larger nucleus as well. Hydro-dissection was performed; the nucleus was prolapsed into the anterior chamber, and visco-expression of the nucleus was performed, followed by cortical wash using a irrigation-aspiration canula. A single-piece PMMA IOL was implanted in the capsular bag and dialled. To prevent sliding of lips of the self-sealing wound and reduce surgically induced astigmatism, a single, straight, central, perpendicular 10-0 polyamide suture was placed to approximate the lips of the tunnel and rotated toward the scleral side to prevent foreign body sensation and suture-related complications.

Patients were examined on day 1, on day 7, at 6 weeks, and at 12 weeks post-operatively. In the post-operative period, topical prednisolone acetate (1%) eye drops were instilled six times a day, moxifloxacin eye drops (0.5%) were instilled four times daily, and bromfenac (0.09%) eye drops were given three times a day post-operatively. Topical prednisolone drops were tapered over a period of 6 weeks. Uncorrected visual acuity (UCVA), best corrected visual acuity (BCVA), and slit lamp findings were recorded at each visit. Keratometry was performed on day 7, 6 weeks, and 12 weeks post-operatively because SIA would have stabilized by that time and by the same person to prevent any inter-observer variation.<sup>[16]</sup>

Data were collected and analyzed statistically using SPSS Statistics 26.0 software. For counting data, frequencies and percentages were used. SIA was calculated in every case using SIA Calculator version 2.1, a free software program by Dr Saurabh Sawhney and Dr Ashima Aggarwal.<sup>[17]</sup> The mean and standard deviation of SIA were calculated and were compared with previously published data on SIA in sutureless straight, chevron, and frown incision in MSICS, and the *P* value was considered significant if <0.05.

### Results

This study was performed on 50 patients of uncomplicated senile cataract with nuclear sclerosis grade 4 or more who completed a 12-week follow up. The mean age of the patients was 64.81 ± 2.824 years, which ranged from 51 to 92 years. The majority of patients belonged to the age group of 70–79 years (38%), followed by 60–69 years (26%). There was a slight preponderance of males 58% (29/50); there were females 42% (21/50) with an M:F ratio of 1.38:1.

For the purpose of statistical analysis, visual acuity was quantified using the following [Table 1].

A total of 22 out of 50 cases (44%) had their best corrected presenting visual acuity in the range of < 6/60 to 3/60 (Grade 2), that is, advanced senile cataract.

The mean pre-operative vertical keratometry ( $K_v$ ) and horizontal keratometry ( $K_H$ ) were 44.96 ± 0.647 and 44.71 ± 0.459,

respectively. The mean pre-operative astigmatism was  $0.58 \pm 0.33$  D on keratometry. For statistical analysis, pre-operative astigmatism was divided into four groups (<0.5D, 0.51–1D, 1.1–1.5D, and 1.51–2D), and the majority of patients (46%) had pre-operative astigmatism between 0.51 and 1.0D on keratometry.

SIA was calculated by SIA Calculator version 2.1, a free software program. Out of 50 operated uncomplicated senile cataract cases, 34 had SIA, whereas 16 patients had surgically corrected astigmatism on the 12<sup>th</sup> week post-operative visit. The mean SIA at day 7, week 6, and 12 weeks was  $0.539 \pm 0.118$ ,  $0.529 \pm 0.134$ , and  $0.524 \pm 0.129$ , respectively [Tables 2 and 3]. Out of 50 cases, 12% of patients had zero SIA and none of the patients had >2D astigmatism.

A total of 46 patients (92%) attained BCVA of at least 6/18 or better at 12 weeks post-operatively [Table 4]. Only four patients had BCVA <6/18, which was attributed to macular edema in two patients, severe dry ARMD in one patient, and thick fibrinous membrane over the IOL in one patient.

All the patients were followed up regularly over a period of 12 weeks to document any suture-related complication. Out of 50 patients, only six patients (12%) complained of foreign body sensation, whereas no patients developed any suture-related complications such as suture granuloma.

## Discussion

In this study, the mean age of the patients was  $64.81 \pm 2.824$  years, ranging from 51 to 92 years, with a slight preponderance of males with an M: F ratio of 1.38:1, which was comparable to the study conducted by Guzek *et al.*<sup>[18]</sup> and Oshika T *et al.*<sup>[19]</sup> Male predominance of patients undergoing cataract surgery could be probably secondary to the higher education level among males in India. The perceived requirement for activities such as reading and driving is more among males in India.

The mean pre-operative vertical keratometry ( $K_v$ ) and horizontal keratometry ( $K_H$ ) was  $44.96 \pm 0.647$  and  $44.71 \pm 0.459$ ,

respectively, in this study. The mean pre-operative astigmatism was  $0.58 \pm 0.33$  D on keratometry. For statistical analysis, pre-operative astigmatism was divided into four groups and the majority of patients (46%) had pre-operative astigmatism between 0.51 and 1.0D on keratometry. These results were in accordance with studies conducted by Bartov E *et al.*<sup>[20]</sup> and Akura J *et al.*<sup>[21]</sup>

Out of 50 operated uncomplicated senile cataract cases, 34 had SIA, whereas 16 patients had surgically corrected astigmatism on the 12<sup>th</sup> week post-operative visit. The mean SIA at day 7, week 6, and 12 weeks was  $0.539 \pm 0.118$ ,  $0.529 \pm 0.134$ , and  $0.524 \pm 0.129$ , respectively. Out of 50 cases, 12% of patients had zero SIA and none of the patients had >2D astigmatism at 12 weeks post-operatively. In the available literature, there is no published study on SIA in MSICS through a straight incision with a single, straight, perpendicular, equidistant 10-0 polyamide suture. In a previous study, the mean SIA incision was more in the frown group ( $0.82D \pm 0.62$ ) than in the Chevron group ( $0.55 D \pm 0.42$ ), which was statistically significant ( $p = 0.017$ ).<sup>[22]</sup> In another study conducted on comparison of mean SIA in straight, frown, and chevron incision, the mean SIA was found to be  $1.08 \pm 0.67$  D,  $0.96 \pm 0.71$  D, and  $0.88 \pm 0.61$  D, respectively, at 4 weeks post-operatively.<sup>[23]</sup> Similar results were also observed by Bartov E.<sup>[20]</sup> and Akura J.<sup>[21]</sup> On comparing the previously published data on SIA in different incisions in MSICS, the calculated SIA in straight incision with a single suture is significantly low, which may be secondary to more stability of the tunnel because of avoiding of slipping of the tunnel lips.

In the present study, 46 patients (92%) attained BCVA of at least 6/18 or better at 12 weeks post-operatively. Only four patients had BCVA <6/18, which was attributed to macular edema in two patients, severe dry ARMD in one patient, and a thick fibrinous membrane over the IOL in one patient. Henning A *et al.*<sup>[24]</sup> reported in their study that the BCVA in sutureless manual extra-capsular surgery was 6/18 or better in 96.2% of patients at 6 weeks post-operative, which was

**Table 2: Mean surgically induced astigmatism post-operatively (n=34)**

Astigmatism (D)	Day 7 n (No. of patients)	Week 6 n (No. of patients)	Week 12 n (No. of patients)
Nil	6	7	8
< 0.5 D	8	8	9
0.51 D to 1 D	12	10	11
1.1 D to 1.5 D	6	7	5
1.51 D to 2D	2	2	1
>2D	Nil	Nil	Nil
	Mean±SD=0.539±0.118	Mean±SD=0.529±0.134	Mean±SD=0.524±0.129

**Table 3: Mean surgically corrected astigmatism post-operatively (n=16)**

Surgically corrected astigmatism (D)	Day 7 n (No. of patients)	Week 6 n (No. of patients)	Week 12 n (No. of patients)
< 0.5 D	11	10	10
0.51 D to 1 D	5	6	6
1.1 D to 1.5 D	Nil	Nil	Nil
1.51 D to 2D	Nil	Nil	Nil
>2D	Nil	Nil	Nil
	Mean±SD=0.41±0.23	Mean±SD=0.39±0.18	Mean±SD=0.39±0.18

**Table 4: Comparison of UCVA and BCVA at 12 week post-operatively**

Grades of VA	UCVA	BCVA
0 (<1/60 to PL+ve)	Nil	Nil
1 (<3/60 to 1/60)	Nil	Nil
2 (<6/60 to 3/60)	Nil	Nil
3 (<6/18 to 6/60)	16	4
4 (6/6 to 6/18)	34	46

comparable to our study. Similar results were observed by Oshika T *et al.*<sup>[19]</sup> in their study, where they reported that 94.8% of patients with superior scleral incision and 94.8% patients with temporal scleral incision had a BCVA of more than 6/12.

All the patients were followed up regularly over a period of 12 weeks to document any suture-related complication. Out of 50 patients, six patients (12%) complained of foreign body sensation, whereas no patients developed any suture-related complication such as suture granuloma.

## Conclusion

To the best of our knowledge, this is the first study which determined the SIA in a straight incision with a single, straight, and perpendicular suture in MSICS. We conclude that SIA is significantly low in the straight incision with a single suture as compared to the sutureless straight incision and frown incision in MSICS. Ophthalmologists with less experience use the easy-to-master straight incision, as compared to the frown/chevron and other incisions which are reported to cause less SIA. The straight incision with a single suture is an option for young ophthalmologists as it has a shorter learning curve, though it should be used only till the surgeon switches to the frown/chevron or other incisions, as the sutureless tunnel has several advantages. Limitations of this study include a small sample size and lack of long-term follow-up.

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## Conflicts of interest

There are no conflicts of interest.

## References

- Zawar SV, Gogate P. Safety and efficacy of temporal manual small incision cataract surgery in India. *Eur J Ophthalmol* 2011;21:748-53.
- Tabin G, Chen M, Espandar L. Cataract surgery for the developing world. *Curr Opin Ophthalmol* 2008;19:55-9.
- Ruit S, Tabin G, Chang D, Bajracharya L, Kline DC, Riehheimer W, *et al.* A prospective randomized clinical trial of phacoemulsification manual sutureless small-incision extracapsular cataract surgery in Nepal. *Am J Ophthalmol* 2007;143:32-8.
- Khanna R, Pujari S, Sangwan V. Cataract surgery in developing countries. *Curr Opin Ophthalmol* 2011;22:10-4.
- Singh K, Misbah A, Saluja P, Singh AK. Review of manual small-incision cataract surgery. *Indian J Ophthalmol* 2017;65:1281-8.
- Pershing S, Kumar A. Phacoemulsification versus extracapsular cataract extraction: Where do we stand? *Curr Opin Ophthalmol* 2011;22:37-42.
- Gogate P, Deshpande M, Nirmalan PK. Why do phacoemulsification? Manual small-incision cataract surgery is almost as effective, but less expensive. *Ophthalmology* 2007;114:965-8.
- Haldipurkar SS, Shikari HT, Gokhale V. Wound construction in manual small incision cataract surgery. *Indian J Ophthalmol* 2009;57:9-13.
- Gokhale NS, Sawhney S. Reduction in astigmatism in manual small incision cataract surgery through change of incision site. *Indian J Ophthalmol* 2005;53:201-3.
- Reddy B, Raj A, Singh VP. Site of incision and corneal astigmatism in conventional SICS versus phacoemulsification. *Ann Ophthalmol (Skokie)* 2007;39:209-16.
- Ale JB. Surgically induced astigmatism of small incision cataract surgery. *Nepal J Ophthalmol* 2012;4:343-6.
- Guan C, Xiao T. Astigmatism following small incision cataract extraction through superotemporal incision. *Eye Sci* 2012;27:94-7.
- Mallik 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;4:54-8.
- Rohatgi J, Gupta VP, Sangma D. A prospective randomized comparative study of manual SICS using 6 mm frown versus 5 mm modified Chevron Incision. *AIOS Proceedings*; 2008.
- Yadav RD, Bajracharya K, Shrestha N, Joshi K, Gupta AK. Astigmatic changes in sutureless small incision cataract surgery. *Birat J Health Sci* 2021;6:1280-4.
- Eslami Y, Mirmohammadsadeghi A. Comparison of surgically induced astigmatism between horizontal and X pattern sutures in scleral tunnel incisions for manual SICS. *Indian J Ophthalmol* 2015;63:606-10.
- Basak SK, Basak S, Chowdhury AR. SIA-Soft: A new software to calculate surgically induced astigmatism in comparison with manual mathematics by vector method. *Indian J Ophthalmol* 2008;56:170.
- Guzek JP, Ching A. Small incision manual extracapsular cataract surgery in Ghana, West Africa. *J Cataract Refract Surg* 2003;29:57-64.
- Oshika T, Sugita G, Tanabe T, Tomidokoro A, Amano S. Regular and irregular astigmatism after superior versus temporal scleral incision cataract surgery. *Ophthalmology* 2000;107:2049-53.
- Bartov E, Isakov I, Rock T. Nucleus fragmentation in a scleral pocket for small incision extracapsular cataract extraction. *J Cataract Refract Surg* 1998;24:160-5.
- Akura J, Kanada S, Hiera S, Matsuura K. Controlling astigmatism in cataract surgery requiring relatively large self-sealing incision. *J Cataract Refract Surg* 2000;26:1650-9.
- Rathi M, Soni D, Verma R, Sachdeva S, Phogat J. Surgically induced astigmatism in frown vs chevron incision in SICS. *Int J Ophthalmol* 2020;2:95-7.
- Jauhari N, Chopra D, Chaurasia RK, Agarwal A. Comparison of surgically induced astigmatism in various incisions in MSICS. *Int J Ophthalmol* 2014;7:1001-4.
- Henning A, Kumar J, Yorston D, Foster A. Sutureless cataract surgery with nucleus extraction: Outcome of a prospective study in Nepal. *Br J Ophthalmol* 2003;87:266-70.