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Original Research Article

A Comparative Study of Effect of Various Types of Incision in Manual Small Incision Cataract Surgery (SICS) on Surgically Induced Astigmatism (SIA)

Pradhnya P Rangari[1], Pravin Wahane[1], Rajashree Hatware[1]

[1]DR Rajendra Gode Medical College, Mardi Road, Amravati, Maharashtra, India

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Corresponding Author: Dr. Pradhnya P Rangari
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Abstract:

Background: Surgically induced astigmatism is common after SICS which could be reduced by taking proper sclerocorneal incision. It is necessary to study which incision is better in terms of visual outcome and post operative astigmatism. Hence comparison of various shapes of the incision require study to improve the visual outcome with respect to astigmatism.

Methods: A prospective randomized observational study was done on a total of 150 patients aged 40y and above with senile cataract. The patients were randomly divided into three groups (50 each). Each group received a particular type of incision (Straight, Frown or Inverted funnel shaped incisions). Manual SICS with intraocular lens (IOL) implantation was performed. The patients were compared on day 1, 1week, 6 weeks post operatively for slit lamp examination, uncorrected visual acuity (UCVA), best corrected visual acuity (BCVA) and SIA. All calculations were performed using the SIA calculator version 2.1, a free software program (SPSS version 15.0 statistical analysis software).

Results: The study found that 89.5% of patients in Straight incision group, 94.2% in Frown incision group and 95.7% in Inverted V group attained BCVA post-operatively in the range of 6/6 to 6/18. Mean SIA was minimum (-0.88±0.61D×90 degrees) with Inverted V incision which was statistically significant.

Conclusion: Inverted funnel (inverted U shaped) incision in SICS gives minimal SIA. It gave astigmatism comparable to that in phacoemulsification. It can be done in peripheral hospitals without facility of phacoemulsification machine.

Keywords: Manual Small Incision Cataract Surgery, Incisions, Surgically Induced Astigmatism.

Introduction

Cataract is the most common cause of reversible visual loss which can be corrected by surgery. In Indian scenario, most common approach for cataract surgery is small incision cataract surgery (SICS) [1]. Although phacoemulsification has come out to be most effective method in terms of visual recovery and post-operative visual acuity [2]. SICS is still practiced in many part of the country as the main modal of cataract surgery with Intra Ocular Lens(IOL) implantation [3].

SICS when compared to phaco is:

1. Cost effective.
2. Non machine dependent.
3. Maintenance free.

Hence, it is important to study the SICS with various techniques so as to improve the visual outcome in the patients. One of the common post-operative lookout in SICS is the astigmatism that is induced due to the scleral tunnel incision [5].

Types of scleral incision commonly practiced are

1. Straight.
2. Frown.
3. Inverted u-shaped incision [6].

Also, the location of the incision has impact on the wound closure and corneoscleral lip closure and subsequent astigmatism. Temporal, superio-temporal and superior incision are practiced in the cataract surgery [7]. Irrespective of the location of the incision, the shape of the incision is very important factor when we compare the visual outcome post-operatively [8].

Astigmatism is the most common post-operative refractive error to be rectified for the best corrected visual acuity [9]. Hence comparison of various shapes of the incision require study to improve the visual outcome with respect to astigmatism.

Various studies have been done in the past comparing the incision shape like straight, frown and inverted u or funnel shaped incision [10]. Few studies are found regarding 4.5 mm inverted u or funnel shaped incision in SICS found to be effective in reducing the astigmatism [11]. Inverted funnel shaped incision is a 4.5 mm inverted incision with the extension up to 4 mm superiorly on sclera.

In our study, we are going to compare the straight, frown and 4.5mm inverted funnel shaped incision.

Materials and Method

It was a prospective observational study, enrolling 150 patients aged 40 years and above with uncomplicated various grades of senile cataract. The study was done in accordance to the tenets of the Declaration of Helsinki. Patients having astigmatism below 1.0 D were included. The study was approved by the Scientific Research Committee and Institutional Ethics Committee of Vivekananda Polyclinic and Institute of Medical Sciences Lucknow. Informed consent was obtained from all the study patients. Patients with any other ocular disease and keratometric astigmatism of more than 1.0 D were not included in the study. Detailed history was taken from the patient. Thorough ocular examination (anterior &posterior segment) was carried out. Visual acuity was checked with Snellen's visual acuity chart/ Landolt's C chart and pinhole improvement was noted. Keratometry was carried out using the Topcon Auto- kerato refractometer KR-8900. Ascan was done on Echorule Pro Biomedics.

Routine blood investigations were done to rule out HIV, Hepatitis, Diabetes and Hypertension.

Patients were randomly divided into groups A, B and C and were given Straight, Frown and Inverted U shaped 'funnel'4.5mm incision respectively.

Surgical Procedure

All the surgeries were performed by a single surgeon. Moxifloxacin 0.5% eye drop was used preoperatively for 3 days. On the day of surgery, pupil was dilated with 0.8% tropicamide and 5% phenylephrine drops. The surgery was performed under peribulbar anesthesia. After making fornix based conjunctival flap, in group A, 6 mm Straight incision was made 1.5 mm away from the limbus, in group B, 6 mm Frown incision was made, the center of the frown being 1.0 mm and periphery 3.5 mm from the superior limbus. In group C, an Inverted U/Funnel shaped 4.5mm incision was made with center of incision 2.0 mm from limbus and sides of 2 limbs being 4.5 mm away from each other. The distance of 4.5 mm only between two ends was maintained . A crescent blade was used to create an incision and a self-sealing sclerocorneal tunnel, with the clear corneal entry for 1 mm. . Continuous curvilinear capsulorrhexis was done using a 26 G cystitome through the side port incision after putting cohesive viscoelastic substance. Anterior chamber entry was done with 2.8 mm keratome through the tunnel incision. The internal wound was now extended to 8-10 mm length approximately. Hydro dissection was performed and prolapsed nucleus was delivered out. A single piece PMMA IOL was implanted in the capsular bag and dialed. Wound was hydrated and anterior chamber was maintained. Subtenon injection of gentamycin and dexamethasone was given. Surgery was closed.

Patients were examined on day 1, day 7 and 6 week postoperatively. Post operatively treatment plan:

e/d Predforte 6 times a day x 7 days, then 5 times a day, then 4 times a day x 7 days, then 3 times a day x 7 days, then 2 times and then once a day x 7 days.

e/d Moxifloxacin 4 times a day x 1 month.

Uncorrected visual acuity (UCVA), best corrected visual acuity (BCVA), slit lamp findings, astigmatism correction was recorded at each visit. Data was analyzed statistically using SPSS version 15.0 statistical analysis software. The study was analyzed using the SIA Calculator version 2.1, a free software program.

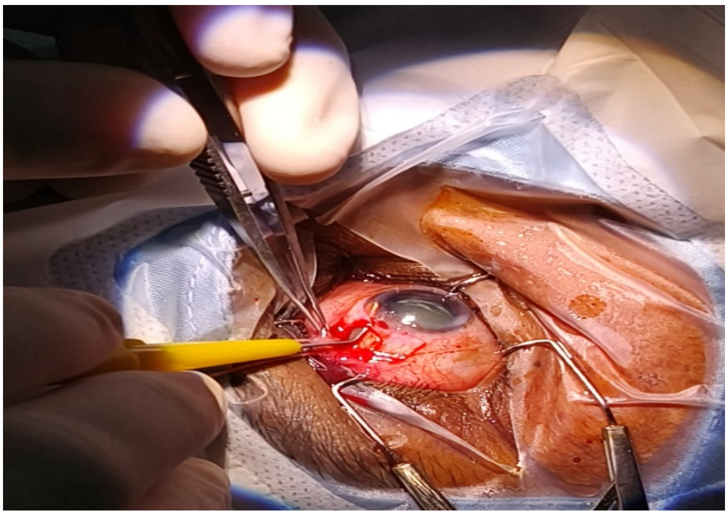

Figure 1: Image depicting a 4.5 mm inverted u or funnel shaped incision in sics

Results

This study was done on 150 patients divided equally in 3 groups, each group receiving a different incision in manual SICS. There were almost equal percentage of males 48.6~~6~~7% (73) and females 51.33% (77). Mean age of patients was 57.89±8.33y (40-75y). Patients (47.3%) had against the rule astigmatism preoperatively and with the rule astigmatism (52.7%). For the purpose of statistical analysis visual acuity has been quantified using the following gradation scale (Table 01).

Table 1: Quantification of preoperative visual acuity.

Grade	Visual Acuity
1	Between 3/60 to PL+
2	Between 6/60 to 6/18
3	More than 6/18

From visit I to visit III, there is an increase in UCVA in all groups, but maximum increase is observed in group 3 which was probably due to better visual acuity preoperatively. The difference among groups at both the time intervals was not statistically significant (P>0.05; Table 02). Few postoperative findings with comparatively less vision were attributed to corneal edema, raised intraocular pressure and anterior chamber reaction.

No major complications like posterior capsular rent or tilted IOL, iris prolapse were noted.

Table 2: Comparison of UCVA among 3 groups at 1st, 2nd, 3rd follow-up (ATLEAST VISUAL 6/18)

	Group A	Group B	Group C
DAY 1	41	44	46
DAY 7	42	44	47
WEEK 6	43	45	47

There is an increase in BCVA in all the incision groups but no significant intergroup difference was observed for any of the follow-up visits (P>0.05; Table 03). No macular edema or posterior capsular opacification was observed.

Table 3: Comparison of BCVA among 3 groups on 1st, 2nd, 3rd follow up.

	Group A	Group B	Group C
DAY 1 (6/18 OR BETTER)	40	47	48
DAY 7 (6/18 OR BETTER)	45	47	48
WEEK 6	50	50	50

In the present study, 90% of patients in straight incision group, 94% in frown incision group and 96% in inverted U/Funnel shaped incision group respectively have BCVA of at least 6/18 or better at 1wk postoperatively. All the patients were having 6/6p or more vision at 6 weeks

A significant intergroup difference was observed in mean SIA. 33.3% of patients in group V did not have any induced astigmatism and none had induced astigmatism >2 D. The mean SIA value was greatest in group S and minimum in group V (Table 04).

Table 4: Mean SIA in different incision groups at 4wk postoperatively.

Astigmatism	Group A		Group B		Group C	
	No.	%	No.	%	No.	%
Nil	7	14	4	8	13	26
0-1.0	17	34	33	66	27	54
1.5-2.0	25	50	12	24	10	20
>2.0	1	2	1	2	0	0
Mean ± SD	-1.47±0.4.2 D×85 Degree		-0.95±0.32 D ×91 degrees		-0.46±0.22 D ×90 degrees	

Mean value is calculated for all the cases in which induced astigmatism was observed. z=6.465; P=0.039 (Kruskall Wallis test used; comparison of grades).

Multiple comparisons revealed that both groups A and B had significantly higher mean SIA as compared to group C which was also statistically significant (P<0.05). However, no significant difference was observed between group A and group C (P=0.620; Table 05)

Table 5: Comparison of SIA in three incision groups.

Group	Z	P
Group A (Straight incision)	0.521	0.652
Group B (Frown incision)	1.99	0.022
Group C (Inverted U/Funnel)	2.110	0.033

Discussion

Manual SICS have good visual rehabilitation have been noted in previous studies [13],[14],[12]. The little inflammation and less SIA have led to fast visual rehabilitation. Patients have few complaints pain, foreign body sensation and redness which is very less. 93.3% of patients had BCVA of 6/18 or better at 8wk after SICS with central frown incision was found by Rohatgi et al [15]. 2000 eyes undergoing manual SICS found that 93.4% of eyes achieved a final BCVA better than 6/12 at 6wk postoperatively by Zawar and Gogate [16] in their study.

In our study 26% of the eyes in group C did not have any postoperative astigmatic error. Induced astigmatism up to 1 D was seen in major proportion of eyes (54%) in group C. This finding is well supported by the study of Rajappa et al [11], that 4.5 mm u shaped incision is more stable with respect to the keratometry of the cornea. Contribution for the result of lesser astigmatism was given to the central astigmatically neutral zone incision. Hence the incision was more geometrically stable and the results were phaco comparable.

Pfleger et al. conducted a study, which compared 3.5 and 4.5 mm sutureless self-sealing scleral tunnel. The author concluded that the SIA was less than 0.5 D in the early postoperative period and less than 0.25 D during late postoperative follow-up in both groups. [17]

In the present study, in frown incision group, maximum patients (66%) showed induced astigmatism of less than 1 D. Another study with central frown incision has reported induced astigmatism of less than 1 D in only 28.57% patients, with maximum patients (42.85%) had SIA between 1.25-2 D [18].

The mean SIA in Straight, Frown and 4.5mm inverted funnel shaped incision was found to be -1.47±0.4.2 D, --0.95±0.32 D and --0.46±0.22 D respectively at six weeks postoperatively in our study. Archana S et al in 2011 reported mean SIA of 1.35±0.49 D four weeks post-operatively with 6 mm straight incision [19]. Gokhale and Sawhney [20] have found mean astigmatism in manual SICS with frown incision to be 1.28 D at 29 degrees.

An inter group comparison in our study observed minimal SIA (-0.46±0.22 D ×90 degrees) in the inverted funnel 4.5mm incision group while maximum SIA (-1.47±0.4.2 D×85 Degree) was seen in straight incision group which was statistically significant ($P<0.05$).

To the best of our knowledge this is the first study which compares the SIA with respect of inverted funnel shaped incision in manual SICS. In our study, we conclude that inverted funnel 4.5mm incision gives minimum SIA in manual SICS.

Limitations of this study include the small sample size and lack of long term follow up. The steep learning curve associated with inverted funnel incision has been the major factor for it not been widely used in practice. At the moment, the ease of learning and performing frown incision with relatively low SIA has made it a popular choice among ophthalmic surgeons.

Conclusion

Inverted funnel/ U shaped 4.5mm incision shows less SIA when compared to both Straight and Frown shaped incision, while Frown shaped incision is better than straight incision.

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