

Surgically Induced Astigmatism in Manual Small-Incision Cataract Surgery: A Comparative Study between Straight, Frown and Inverted V Shape (Chevron) Incision

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Abstract

Background: In majority of developing countries, the cause of total blindness by cataract is 50-90% among the people aged above 50 years. Surgical removal of the opacified lens is considered to be the most effective and definitive treatment of cataract. Due to the cataract backlog and higher surgical volume in developing countries like in India manual small incision cataract surgery in comparison to phacoemulsification proves to be a viable cost-effective alternative.

Aim: To determine the Surgically induced astigmatism in manual small-incision cataract surgery between Frown, Straight and Inverted V shape (Chevron) incisions.

Methods: A hospital based prospective interventional study was carried out on 75 cataract patients between age group of 45 to 70 years were randomly split into 3 groups (25 each) based on Inverted V 'Chevron', Frown and Straight incision. For comparing different categorical data among three types incision Fisher Exact test was applied. SPSS version 20 was used.

Results: Surgically induced astigmatism is nil in 32% of cases in Inverted V type incision, 12% in Frown type incision, 4% in straight type incision, more than 2 is 0 in inverted V incision, 4% in Frown incision, 4% in Straight line type of incision.

Conclusion: Chevron incision has lesser surgically induced astigmatism compared to frown and straight type of incisions with statistical significance ($P < 0.01$). Additionally on comparison between straight and frown type there was no statistically significant difference (p value 0.732).

Keywords: Post operative astigmatism, Manual SICS, frown incision, Inverted V incision, Straight line incision.

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Introduction

In majority of developing countries, the cause of total blindness by cataract is 50-90% among the people aged above 50 years. [1] Surgical removal of the opacified lens is considered to be the most effective and definitive treatment of cataract. [2] Due to the cataract backlog and higher surgical volume in developing countries like in India manual small incision cataract surgery in comparison to phacoemulsification proves to be a viable cost-effective alternative. [3] In addition manual SICS is known to be significantly faster compared to phacoemulsification and also both the final CDVA outcomes and complication rates are equal between them. [4]

Surgically induced astigmatism is majorly dependent on multiple preoperative factors like corneal pathologies, astigmatism and keratometry. Surgically induced astigmatism is also influenced by intraoperative factors like the site and size of incision, sutures, any intraoperative complications. [5] Many studies have compared the surgically induced astigmatism based on the site of incision and came to a conclusion that manual SICS with temporal approach offers a significantly lesser surgically induced astigmatism and better stabilization of the refraction than that of superior approach. [6] There are various types of scleral incisions that are practiced in manual small incision cataract surgery namely Straight incision, Chevron or inverted V-shaped incision, Frown incision. [7] Some studies have compared surgically induced astigmatism after manual SICS between the two types of incision. [8] Here in our study we are offering comparison of surgically induced astigmatism between 3 different incisions namely Straight, Inverted V 'Chevron' and Frown Incisions

Materials and Methods

This hospital based prospective interventional study was carried out on 75 patients under the Department of Ophthalmology in Melmaruvathur adhiparasakthi institute of medical sciences and research, kancheepuram, tamilnadu. The study was started after obtaining the ethical clearance from institutional ethical committee. Also written and informed consents were obtained from all of the study participants enrolled in this study. This 75 patients were included between the age group of 45 to 70 years with a diagnosis of presenile and senile cataract. Patients with secondary cataracts due to trauma, hypermature cataracts, pseudoexfoliation syndrome, uveitis, keratometric astigmatism >1 D, poor dilating pupils, posterior synechiae, corneal pathologies or corneal scarring and any other concurrent eye disease and patients who are unwilling to participate in the study were not included in the study.

A detailed history was obtained regarding any systemic illness and drug allergies. After which a standard clinical examination was made including unaided visual acuity was checked for far as well as near vision and along with pinhole the best corrected visual acuity was also documented using Snellen chart. And other examinations were carried out like lacrimal sac syringing, intraocular pressure measurement by applanation tonometry. A thorough slit-lamp examination was performed for anterior segment and fundus examination wherever possible which was further confirmed by direct and indirect ophthalmoscopic examination. Cataractous lens was graded based on Lens Opacities Classification System III. Keratometry was done once before surgery and 4 weeks after surgery. SRK II formula was used for the Intraocular lens power calculation. All the 75 patients were randomly split into 3 groups based on Inverted V 'Chevron', Frown and

Straight incision namely A, B and C respectively.

All the surgeries were performed by single surgeon with the same standard manual small incision cataract surgery surgical procedure with only difference being the type of incision. In group A, an Inverted V shaped incision made whose apex is 1.5 mm away from superior limbus and the ends of the 2 limbs of incision being around 4 mm from the superior limbus. Also the distance measured between the two ends of the limbs was around 5 mm. On the patients belonged to group B, Frown incision was made about 6 mm with the periphery being 4 mm away from the superior limbus and the centre is just 1.5 mm away from superior limbus. Group C included patients with Straight incision of 6mm size which are 2 mm from superior limbus.

Postoperatively, all the operated patients were started on moxifloxacin + dexamethasone eye drops eight times during the 1st week and then gradually tapered. Patients were asked to follow-up after surgery on the following postoperative days 7, 15, 30, and 45. During each visit corrected and uncorrected visual

acuity, detailed slitlamp examination and keratometry readings were taken during the last visit and surgically induced astigmatism is calculated

Statistical tool : Mean and Standard deviation is used for continuous data whereas percentage and proportion is used for categorical data. For comparing different categorical data among three types incision Fisher Exact test was applied. SPSS version 20 was used and p value <0.01 was considered significant.

Results

In this study, 75 patients were included with age distribution range 45 to 70 yrs. with mean age being 58.72 with a SD of 6.681. Among these 50.63 % were females and 49.33% were males. Here, 36 patients underwent surgery in the right eye whereas 34 patients underwent in the left eye. These 75 patients are split up equally in 3 groups.

Pre operative uncorrected visual acuity is considered to be equal on all three types of incisions, majority (36%) has visual acuity <1/60 to PL+ and 36% have < 3/60 to 1/60, none of them have visual acuity <6/6 to 6/18.

Table 1: Comparison of UCVA between different incision groups

Pre OP uncorrected visual acuity (UCVA)							
Grade	VA	Group A		Group B		Group C	
		Number	%	Number	%	Number	%
Grade 0	< 1/60 to PL+	9	36	9	36	9	36
Grade 1	< 3/60 to 1/60	9	36	9	36	9	36
Grade 2	< 6/60 to 3/60	6	24	6	24	6	24
Grade 3	< 6/18 to 6/60	1	4	1	4	1	4
Grade 4	< 6/6 to 6/18	0	0	0	0	0	0

Post operative best corrected visual acuity < 6/6 to 6/18 is 96% in Group A (Inverted V type incision), 92% in Group B (Frown type incision), 88% in Group C (Straight type incision), none of them had visual acuity < 1/60 to PL+ and < 3/60 to 1/60. By applying Fischer Exact test there is no statistically

significant difference in post Post operative best corrected visual acuity among different types of incision (p value 0.893). But on comparing Pre operative uncorrected visual acuity with post operative best corrected visual acuity there is statistically significant difference with a p value of <0.01.

Table 2: Comparison of BCVA between different incision groups

Post OP best corrected visual acuity (BCVA)							
Grade	VA	Group A		Group B		Group C	
		Number	%	Number	%	Number	%
Grade 0	< 1/60 to PL+	0	0	0	0	0	0
Grade 1	< 3/60 to 1/60	0	0	0	0	0	0
Grade 2	< 6/60 to 3/60	0	0	1	4	1	4
Grade 3	< 6/18 to 6/60	1	4	1	4	2	8
Grade 4	< 6/6 to 6/18	24	96	23	92	22	88

Surgically induced astigmatism is nil in 32% cases in Group A (Inverted V type incision), 12% in Group B (Frown type incision), 4% in Group C (Straight type incision), more than 2 is 0 in inverted V incision, 4% in Frown incision, 4% in Straight line type of incision. By applying Fischer Exact test there is a statistically significant difference in SIA

among different types of incision (p value < 0.05). Group A (Inverted V type incision) has less surgically induced astigmatism compared to other type incisions. On comparing Group B (Frown type incision) and Group C (Straight type incision) there is no statistically significant difference (p value 0.732).

Table 3: Comparison of Surgically induced astigmatism between different incision groups

Surgically induced astigmatism							
Grade	Astigmatism	Group A		Group B		Group C	
		Number	%	Number	%	Number	%
1	Nil	8	32	3	12	1	4
2	0 to 1	13	52	8	32	11	44
3	1.25 to 2	4	16	13	52	12	48
4	More than 2	0	0	1	4	1	4

Discussion

One of the main motive of cataract surgery is minimal induced astigmatism and early visual rehabilitation. Manual SICS serves as better alternative to phacoemulsification for the cost effectiveness, time consumption, suitability for cases like hard cataract, phacolytic glaucoma, cataract with uveitis, thus making it ideal for mass camp surgeries in developing countries., And it has less minimally induced astigmatism than conventional ECCE and without sutures. [9]

Astigmatism is one of the well known complication following cataract surgery. Poor uncorrected visual acuity following the

cataract surgery is mainly caused by Surgically induced astigmatism. It is noteworthy to mention that most of the astigmatic stabilization occurred within 4 weeks and after it the amount of variation is very negligible and thus being the perfect time for checking refraction and prescribing spectacle correction. Factors such as incision length, it's architecture and location can greatly influence it. [10] In view of these factors, our study aims to evaluate the Surgically induced astigmatism between 3 different incisions namely Straight, Inverted V 'Chevron' and Frown Incisions in Manual Small incision cataract surgeries.

In our study, Inverted V type incision known as Chevron has lesser surgically induced

astigmatism compared to frown and straight type of incisions. This difference between them was found to be statistically significant with $P < 0.01$. Additionally on comparing the straight and frown type there was no statistically significant difference (p value 0.732). This study yielded similar results when compared to another study done in Lucknow by Nidhi Jauhari et al which stated that 33.3% of patients in Inverted V type incision have not reported any surgically induced astigmatism and also none had an induced astigmatism >2 D. [11] Also in Roshan Dev Yadav's study a total of 120 patients aged above 40 years with senile cataract proved that mean SIA was least in Chevron group and was most in straight incision group which was statistically significant. [12]

On contrary, a study by Shweta Tripathi et al enrolled 60 patients between the age group of 50 to 75 years concluded that frown incision to have a significantly better ($p < 0.001$) mean net astigmatism in comparison with the straight type of incision. [13] Deepshikha Solanki et al evaluated 145 eyes of 137 patients and observed that average surgically induced astigmatism for frown, chevron and straight was 0.68 D, 1.02 D and 1.15D and concluded that frown incision to be the best comparing to all other incision types with regards to the aspect of surgically induced astigmatism. [14]

This hospital-based study has its own limitations like small sample size which cannot be generalised to a very large population. Also this study has a drawback of limited follow-up.

Conclusions

This study has shown that the Chevron incision (Inverted V shaped incision) is best for manual small incision cataract surgery in terms of comparing Surgically induced astigmatism as it has lesser surgically induced astigmatism compared to other type incisions with a statistically significant difference. In addition,

on comparing the straight and frown type there was no statistically significant difference

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