

ASTIGMATIC CHANGES IN SUTURELESS SMALL INCISION CATARACT SURGERY

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ABSTRACT

Introduction

Cataract is the main cause of bilateral blindness in Nepal. Surgery is the accepted treatment option for cataract with Small incision Cataract Surgery (SICS) and Phacoemulsification being the common procedures being performed with comparable results. Corneal astigmatism has been a by-product of cataract surgery since the first limbal incision was made with improved techniques. Self-sealing scleral pocket incisions are stable and provides early healing, faster visual restoration and more importantly superior astigmatism control. A variety of scleral incisions are being used in manual SICS, with the aim of keeping the post-operative astigmatism to a minimum. Despite having many techniques of scleral incision, there have been only few studies which compares surgical induced astigmatism (SIA) between them

Objective

To determine surgical induced astigmatism following frown, chevron and straight incision forms in suture-less small incision cataract surgery(SICS).

Methodology

A prospective study was done on a total of 120 patients aged 40years and above with senile cataract. The patients were randomly divided into three groups where each group received specific incision- Straight, Frown and Chevron. SICS with intraocular lens (IOL) implantation was performed. The patients were compared on 2 weeks and 6 weeks post operatively for uncorrected visual acuity (UCVA), best corrected visual acuity (BCVA) and keratometric reading. Surgical induced astigmatism (SIA) was calculated using the SIA calculator version 2.0. The study was analysed using SPSS version 20.0.

Results

At 6 weeks UCVA of 6/18-6/6 was attained by 63.41%, 78.94% and 84.61% of patients in group straight, frown and chevron. However about 97% of patients attained BCVA of 6/18-6/6 in all three groups. Mean SIA was least in Chevron group (0.30 D ± 0.16) and was most in the straight group (1.22 D ± 0.36) which was statistically significant.

Conclusion

Chevron incision induces the least astigmatism compared to frown and straight incision.

KEYWORDS

Incision, astigmatism, surgical induced astigmatism



INTRODUCTION

Thirty nine million blind people! This was the estimated figure by World Health Organization (WHO) Global data on visual impairment 2010. The estimated number of people visually impaired (as per ICD 10) in the world is 285 million, 39 million blind and 246 million having low vision, cataract being the second most cause.¹ The prevalence of blindness (presenting VA < 3/60 in the better eye) in Nepal as per recent survey was 2.5%. The prevalence of low vision in people aged 50+ is 1.3 % for Nepal and an estimated 35,800 people aged 50+ are affected. Cataract is the main cause of bilateral blindness in Nepal with a weighted average of 62.2%.²

Surgery is the accepted treatment option for cataract with Small incision Cataract Surgery (SICS) and Phacoemulsification being the common procedures being performed with comparable results.³⁻⁸ Tough phacoemulsification surgery is carried out in most the developed part of the world, the low cost of SICS has made it affordable for the developing nation like Nepal where “cannot afford” is one of the important factor for depriving people from attending health care facilities.² Corneal astigmatism has been a by-product of cataract surgery since the first limbal incision was made with improved techniques. It was 1980 when Karlz developed scleral incision which induced less astigmatic change. Self-sealing scleral pocket incisions are stable and provides early healing, faster visual restoration and more importantly superior astigmatism control. A variety of scleral incisions are being used in manual SICS, with the aim of keeping the post-operative astigmatism to a minimum. Numerous types of scleral incisions have been mentioned, each having their own pros and cons.⁹⁻¹² Despite having many techniques of scleral incision, there have been only few studies which compares surgical induced astigmatism (SIA) between them. Thus, this study was focused on comparing SIA between three well-known incisions–Straight, Frown and Chevron.

METHODOLOGY

It was a hospital based observational study conducted in Lumbini Eye Institute and Research Centre from January 2017 to July 2018 which included 120 eyes of 120 patients. Ethical clearance was taken from the review board and the informed written consent was taken from the patients. Convenience sampling technique was used and Patients were divided into three groups: Straight (S) n=41, Frown (F) n=39, Chevron (C) n=40, using lottery system. Patients aged more than 40 with senile cataract were included in the study whereas patients with nuclear sclerosis > IV (as per LOCS III classification), IOP > 22mm of Hg (measured by Air Puff non-contact Tonometer), High myopia, eyes with previous ocular surgery, subluxated lens, anterior/posterior segment pathology and all those who didn't want to participate in the study and lost follow up were excluded. Cataract grading was done as per Lens Opacities Classification System III (LOCS III). Preoperative keratometry reading (K reading) was taken using auto keratometer (Zeiss IOL master). All the surgeries were performed by single experienced surgeon. After

making fornix based conjunctival flap, in group S a 6 mm Straight incision was made 2 mm away from superior limbus, in group F a 6 mm Frown incision was made, the centre of the frown being 1.5 mm and periphery 4 mm from the superior limbus. In group V an inverted V incision was made with apex of incision being 1.5 mm from superior limbus and ends of 2 limbs being 4 mm from superior limbus. Castroviejo caliper was used for the measurements. The distance between two ends of the limbs was 6 mm. Visual acuity (VA) was measured in 1st Post-operative day. Keratometry reading, Uncorrected Visual Acuity (UCVA) and best Corrected Visual Acuity (BCVA) was measured at 2 weeks and 6 weeks. SPSS 20.0 was used for data entry and analysis. P value <0.05 was considered statistically significant.

RESULTS

Table 1: Mean age of patients in different groups

Group	Mean	Std. Deviation
Straight	59.90	11.79
Frown	57.85	9.53
Chevron	56.00	9.20
Total	57.93	10.30

Table 2: Distribution of patients according to sex

Group	Sex		Total
	Male	Female	
Straight	26	15	41
Frown	19	20	39
Chevron	20	20	40
Total	65	55	120

Table 3: Preoperative BCVA among different groups

	<1/60-PL	<3/60-1/60	<6/60-3/60	<6/18-6/60	6/18-6/6
Straight	1	21	7	10	2
Frown	1	13	14	11	0
Chevron	1	18	11	9	1
Total	3	52	32	30	3

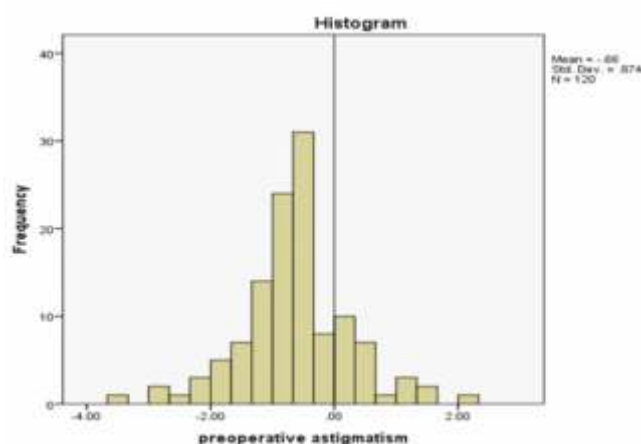


Figure 1: Histogram showing preoperative astigmatism

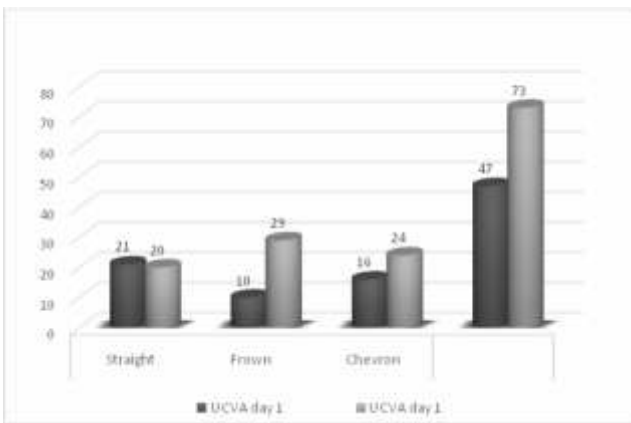


Figure 2: UCVA at first post-operative day

Table 4: UCVA 6 weeks postoperatively

Group	UCVA week 6				BCVA week 6			
	<6/18-6/60		6/6-6/18		<6/18-6/60		6/6-6/18	
	n	Percent	n	Percent	n	percent	N	Percent
Straight	15	36.59	26	63.41	1	2.4	40	97.6
Frown	8	20.51	31	79.49	1	2.56	38	97.44
Chevron	6	15	34	85	1	2.5	39	97.5
Total	29	24.17	91	75.83	3	2.5	117	97.5

Table 5: Surgical Induced Astigmatism at week 2 and week

Group		SIA at 2 week	SIA at 6 week
Straight	Mean	1.05 D	1.22D
	Std. Deviation	.35D	.35D
Frown	Mean	.42D	.50D
	Std. Deviation	.20D	.20D
Chevron	Mean	.27D	.30D
	Std. Deviation	.16D	.15D
Total	Mean	.56D	.68D
	Std. Deviation	.42D	.47D
P value		<0.001	<0.001

Table 6: Preoperative and postoperative astigmatism among three groups

Group		preoperative astigmatism	postop astigmatism 6 weeks	Change in astigmatism
Straight	Mean	-.66 D	-1.66 D	-1.00 D
Frown	Mean	-0.74 D	-1.06 D	-0.32 D
Chevron	Mean	-.57 D	-.66 D	-0.09 D
K-W test	P value	.506	<.001	

DISCUSSION

Since SICS has become a common practice for the treatment of cataract, this study was done to evaluate different aspect of the surgery among three common type of incisions- straight, frown and chevron. This was a hospital based prospective study which had 120 participants. All three group had almost equal number of patients and similar demographic characteristics. The mean age of the patients in the study was 57.93 years (SD ± 10.3 years) which was similar to the study by Venkatesh et al.⁶ which had mean age

of 56.6 years in SICS group and to the study by George et al⁸ where mean age was 58.75 years in SICS. However it was different from the study by Gogate et al.,¹³ Ruit et al.,³ Ambardekar¹³ and Ghosh et al.¹⁴, in these studies mean age was 62.7 years, 63.8 years, 60.7 years and 62 years respectively. In this study most of the patients presented with visual acuity of less than 6/60. Patients with mature cataract were excluded from this study and only cataract with nuclear sclerosis grade IV or less were included, this could be a cause for lesser mean age of the patients. Out of 120 patients 52 (43.3%) had BCVA of <3/60-1/60 preoperatively. 32 (26.7%) patients had BCVA <6/60-3/60. Overall 72% of the patients presented with BCVA less than 6/60 preoperatively. This was in consistence with the results of the study by Ruit et al.³ where average preoperative visual acuity was 20/300 in phacoemulsification group and 20/353 in SICS group. However study by Desai P, Reidya A, Minassian DC¹⁵ performed in the United kingdom showed that 84% of patients waiting for cataract surgery had VA better than 6/60 (31% better than 6/12). This difference in the preoperative visual acuity may be due to the late presentation of cataract in our setup which may be due to poverty, illiteracy and lack of information about the curative nature of the disease. At the end of six weeks, 75.83% of the patients had good vision (6/6-6/18) whereas 24.17% had borderline vision (<6/18-6/60) and no-one had poor vision (<6/60) without any refractive aid. SIA is one of the important aspect of the cataract surgery. It is generally accepted that the incision causes a flattening effect along the orientation in which it is applied. These curvature changes result in significant alterations to the magnitude and orientation of the principal meridians post-surgically¹⁶⁻¹⁸ which was similar to the finding of this study that showed flattening of the vertical meridian at 2 weeks and at 6 weeks. In this study mean SIA at 2 weeks and 6 weeks was comparable to the results obtained by by Huang FC, Tseng S H.¹⁹ Similarly, SIA in scleral frown group at 1 month period was 0.75 D as compared to 1.12 D of clear corneal incision group. This is even comparable with the SIA in phacoemulsification as reported by Yoon JH, Kim K-H, Lee JY, Nam DH.²⁰ which was 0.81 D for the temporal incisions and 0.92 D for nasal incisions at 1 month. The flattening produced by the incision along the vertical meridian was gradually increasing with the time, this finding was in consistent with the finding by Nielsen P²¹ which changed from +0.01 D at the first postoperative day to -0.25 D at 6 weeks. Jonathan H. et al²² in their study suggested this trend in progression of ATR astigmatism continued up to 36 months postoperatively but our study was limited to six weeks duration which suggests that complete wound stability was not achieved during the follow up period. Mean SIA in straight incision group in this study was 1.05 D (SD ± .35 D) at 2 weeks which was 1.22 D (SD ± .35D) at 6 weeks which was similar to results obtained by Jauhari N, Chopra D, Chaurasia RK, and Agarwal A²³ (-1.08 ± 0.67 D at 6 weeks). However, Jha KN and Vats DP²⁴ had lower degree of astigmatism at six weeks using straight incision which was ± 0.75 D. Mean SIA in frown

incision group in this study was .42 D (SD \pm .20D) at 2 weeks and .50D (SD \pm .20 D) at 6 weeks which was better than 1.28 D that was reported by Gokhale NS and Sawhney S²⁵ but was higher than 0.11 D \pm 0.64 D that was reported by Nielsen J.²⁶ In this study least astigmatism was induced by the chevron incision. Mean SIA in chevron incision group was 0.27 D (SD \pm 0.16 D) at 2 weeks and 0.30 D (SD \pm 0.15 D) at six weeks which was statistically significant when compared to other group at 2 weeks at 6 weeks. Moreover, finding suggested that chevron incision achieved the astigmatic stability much earlier than the other group as net change in mean SIA in 2 weeks and 6 weeks is only 0.03 D in chevron group as compared to 0.17 D in straight group and 0.8 D in frown group. This early astigmatic stability in chevron incision was also reported by Pallin SL¹¹ which was attributable to early postoperative decay in astigmatism.

CONCLUSION

This was conducted to compare SIA between three different type of incisions in SICS: Straight, Frown and Chevron. Mean preoperative astigmatism was -0.65 D which was increased to -1.04 D at 6 weeks indicating flattening of the vertical meridian and progression towards ATR astigmatism. Chevron incision had the least SIA at Week 2 and 6 but all the incision type had good visual outcome at 6 weeks postoperatively.

RECOMMENDATION

The study looked for the surgical induced astigmatism among three different type of incisions that are commonly used in small incision cataract surgery at 2 weeks and 6 weeks. As the follow-up period was only six weeks, a study

with longer follow up period can be performed to study the natural history of the wound in the different incision types and change in SIA in long term. Similarly, complications related to different incision type can also be studied along with feasibility of these incisions among mature and cataract with larger nucleus needs to be considered.

LIMITATIONS OF THE STUDY

Thought this was a hospital based randomized study, calculated sample size could not be obtained due to single surgeon criteria and time limitation. Since patients with any surgical complications were excluded from the study, complications related to incision type could not be studied. Due to short follow up period of only 6 weeks natural history of wound healing and astigmatism decay in different incision type could not be studied in much detail. As only cataract with nuclear sclerosis grade IV or less were included in the study, the feasibility and outcome of the incisions on larger nucleus could not be ascertained.

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CONFLICT OF INTEREST

There is no any conflict of interest.

FINANCIAL DISCLOSURE

None

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