

Comparison of Mean Surgically Induced Astigmatism in Manual Small Incision Cataract Surgery Using Frown Vs Chevron Incision



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ABSTRACT

Purpose: To compare the mean surgically induced Astigmatism(SIA) in Manual Small Incision Cataract Surgery (MSICS) using frown (inverted U) versus inverted V (chevron) incision.

Study Design: Quasi experimental study.

Place and Duration of Study: Hayatabad Medical Complex from 27th July 2018 to 27th January 2019.

Methods: This study included 148 patients who were distributed into the Frown group (F) and Chevron group (C) by convenient sampling. Each group had 74 patients through block operative randomization. To eliminate bias, all the surgeries were performed by one surgeon having more than 5 years' experience of MSICS. Pre-operative and Post operative keratometric readings were taken. SIA calculator was utilized, and data was analyzed through SPSS 26. Means and standard deviation for continuous variables like age and surgically induced astigmatism were calculated.

Results: In Group F, mean surgically induced astigmatism was $1.14 \pm 0.65D$ and in Group C it was $0.87 \pm 0.55D$. The independent T test revealed that the mean SIA was significantly lower in the Chevron group compared to the Frown group. The post operative visual acuities showed that the proportion of patients with postoperative 6/6 vision in the Chevron group was more as compared to group F.

Conclusion: Chevron (inverted V) incision induces less postoperative mean surgically induced astigmatism than Frown (inverted U) incision in Manual Small Incision Cataract Surgery. These findings may have implications for cataract surgery techniques and may help in reducing postoperative astigmatism.

Key Words: Chevron, Astigmatism, Frown, Manual Small Incision Cataract Surgery.

How to Cite this Article: Basit A, Zaman M, Khan BD, Abdullah M, Rehman SA. Comparison of Mean Surgically Induced Astigmatism in Manual Small Incision Cataract Surgery Using Frown Vs Chevron Incision. 2024;40(4):358-363. **Doi:10.36351/pjo.v40i4.1814**

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*Received: February 02, 2024
Accepted: September 29, 2024*

INTRODUCTION

Cataracts remain to be a leading cause of blindness worldwide, with age being the most significant risk factor.¹ Pakistan's most detailed eye survey in 2007

discovered that over 570 million people are visually impaired due to cataract; this number would have surely exponentially increased by now.² WHO in its report suggested that cataract cause almost half of all global blindness and International Agency for the Prevention of blindness estimated the worldwide burden to be 65.2 million in their report on world vision.^{3,4} The goal of modern cataract and lens implantation surgery is to obtain the most desirable visual outcome using the best procedures logistically with economic feasibility.

Different techniques of cataract surgeries are

available, including conventional extracapsular cataract extraction, manual small incision cataract surgery, phacoemulsification, and Femtosecond laser-assisted cataract surgery (FLACS). Superiority of one technique over the other is subjective to the type of cataract, surgeon skill, economic feasibility, and personal preference. Manual small incision cataract surgery (MSICS) however appears to be a promising technique for tackling the cataract burden in developing countries due to its low cost.⁵

Visual outcomes after cataract surgery are significantly affected by preexisting astigmatism and the surgically induced astigmatism. A variety of scleral incisions are used in manual SICS to keep postoperative astigmatism to a minimum.⁶ The commonly used incision types in MSICS are straight and frown incisions. Inverted V (Chevron) incision has also been advocated for less postoperative surgically induced astigmatism.⁷

The rationale of the study is to compare the results of post-operative surgically induced astigmatism between frown incision and inverted V (chevron) incision MSICS, amplify or contradict the preexisting data regarding their efficacy, and employ the better technique with less surgically induced astigmatism in the population. This will help in better post-operative unaided visual rehabilitation and improved quality of life for the patients.

METHODS

Our team carried out this research at Hayatabad Medical Complex from 27th July 2018 to 27th January 2019 over a period of 6 months after approval from the ethical committee board. The study was planned to be a randomized control trial with cases being randomly and equally distributed into the two groups. Cases coming through the OPD underwent a thorough Ocular exam and systemic examination before signing an informed consent for this study. A sample size of 148 with 74 in each group was selected with Confidence level of 95%, Margin of Error (M) 10% and Population proportion (P) of 50% according to the formula: $S = Z^2 \times P \times (1-P) / M^2$.

Our inclusion criteria were; any patient between 45-80 years having an operable cataract. Nuclear Opalescence and Nuclear color grade of 4.5 or less according to LOCS III classification system was operated to keep the incision length uniform. Patients with prior ocular surgery (Trabeculectomy, PRK,

LASIK, Pterygium etc.), zonular dehiscence or lens subluxation, scleral thinning, corneal dystrophies and degenerations and advanced diabetic or glaucomatous disease were excluded. These findings were examined through slit lamp microscopy and fundus examination with 78D lens. Patients who had against the rule astigmatism of greater than 2.0 D on keratometry and/or retinoscopy were also excluded.

All patients underwent pre-operative keratometry using an automated Keratometer. The patients were divided into one of the two groups through block randomization in such a way that the first ten would be allotted into one group and the subsequent ten patients would be allotted to the other group.

Group F: Patients undergoing MSICS with Frown incision.

Group C: Patients undergoing MSICS with Chevron incision.

To eliminate bias, all the surgeries were performed by one surgeon having more than 5 years' experience of MSICS. Preoperative Mydriasis was achieved with tropicamide 1% or phenylephrine 10%. All the surgeries were performed using 5ml peribulbar anesthesia with 1ml bupivacaine 0.5% and 4ml Lignocaine 2% with adrenaline. Patients in each group were given a partial scleral thickness frown or chevron incision with 15G blade following peritomy. Sclero-corneal tunnel was made with 2.8mm crescent knife extending 1mm into clear cornea. Curvilinear capsulorhexis was done with a needle capsulotome inserted through tunnel after staining with Sopic Blue. Hydro-dissection and delineation followed by hydro delivery of nucleus was done. Aspheric foldable IOL (6.00mm optic and 12.5mm length) was inserted under viscoelastic cover. Conjunctiva was approximated with minimal cauterization. Intracameral antibiotics and sub conjunctival 1cc injection of Decadron was given.

Post operative keratometric readings (K1 and K2/A1 and A2) were collected at 4 weeks and mean SIA was calculated using the online software by Warren-Hill MD. It calculates SIA by vector analysis.⁸ Data Analysis was done through IBM SPSS version 26.

RESULTS

Mean age for Frown Incision Group (Group F) was 60 ± 12.77 years; out of this 38% (n=28) were in 45-60

years range and 62% (n=46) were in 61-80 years range. For Chevron Incision Group (Group C) the mean age was 60 ±13.12 years where in 47% (n=35) patients were in range 45-60 while 53% (n=39) patients were in 61-80 years. Gender distribution in group F was 61% (n=45) female and 39% (n=29) male while in Group C, 59% (n=44) were females and 41% (n=30) were males. Table 1 for details.

Table 1: Age and gender distribution in the two groups with mean and standard deviation.

Age	Group F n=Number(%)	Group C n=Number (%)
45-60 years	28(38%)	35(47%)
61-80 years	46(62%)	39(53%)
Male	45(61%0	44(59%0
Female	29(39%)	30(41%0
Mean and SD	60±12.77 years	59 ±13.12 years
Total	74(100%)	74(100%)

Pre-operative corneal astigmatism was calculated with simple deduction of K1 and K2. Mean Preoperative astigmatism for Group F was 1.318 ± 0.67 whereas in Group C was 1.07 ± 0.76. Post-operative astigmatism for Group F was 1.3247 ± 0.93 while in Group C was 1.0027 ± 0.676. These results show that both types of incisions are viable options as they both resulted in an effective decrease in post operative astigmatism. However, the degree in reduction was greater in Group C than Group F.

Table 2: Pre & Post-Operative Corneal Astigmatism.

	Pre-Operative(Mean±SD)	Post-Operative(Mean±SD)
Group F (n=74)	1.13 ± 0.67	1.33± 0.93
Group C (n=74)	1.07 ± 0.76	1.00± 0.68
T test	0.6068	0.0172

Surgically induced astigmatism (SIA) was calculated by SIA calculator for both groups. Group F had a SIA of 1.14 ± 0.65 whereas in Group C mean SIA was 0.87 ± 0.55 hence Group C showing visibly less induced astigmatism. Data was stratified according to age and gender as in table 3.

“The proportion of patients with 6/6 vision after surgery was higher in the Chevron group. However, the other groups showed similar rates.”

Table 3: SIA with Age and Gender Stratification.

SIA	SIAin Group F (n=74)	SIAin Group C (n=74)	P value
Mean and SD Total	1.14 ± 0.65	0.87± 0.55	0.008
Age 45-60	1.12 ± 0.54	0.95 ± 0.47	0.18
Age 61-80	1.15 ± 0.72	0.798 ± 0.62	0.02
Male (n=89)	1.16±0.60 (n=45)	0.85±0.43 (n=44)	0.01
Female (n=59)	1.125±0.69 (n=29)	0.88±0.63 (n=30)	0.16

Table 4: Post-Operative Visual Acuity.

Visual Acuity	Group F (% Group)	Group C (% Group)	Total
6/6	8(10.8%)	15(20.2%)	23
6/9	22(22.9%)	23(31.1%)	45
6/12	27(36.4%0	22(22.9%)	49
6/18	12(16.2%)	10(13.5%)	22
6/24	4(5%)	2(2.7%)	6
6/36	0	2(2.7%)	2
6/60	1(1.4%)	0	1
Total	74	74	148

DISCUSSION

Cataract surgery is one of the most cost-effective surgical procedures for improving the quality of life and preventing blindness.⁹ It has remained one of the most common surgical procedures in the past decades and there is no indication that it will lose its top position.¹⁰ Cataract surgery involves removing a cloudy natural lens and replacing it with an intraocular lens for visual function. One of the greater prejudices against this otherwise miraculous procedure is the wide variety of ominous side effects and complications that could result from this surgery. Even though modern cataract surgery is safe in more than 95% of patients, complications like endophthalmitis and posterior capsule rupture can be devastating for both the surgeon and patient alike.¹¹ If all other complications are avoided, surgically induced astigmatism is one complication which can be modulated and controlled but never truly eliminated.¹²

With the advent of new state of the art cataract techniques involving modern age machinery, cataract surgery outcomes are getting better every day.¹³ However, MSICS (Manual small incision cataract surgery) remains the bread and butter of ophthalmologists in the developing world where the limiting factors are costs and technology.¹⁴ MSICS does not rely on machinery and can be done using easily sterilizable instruments.¹⁵ An incision in the

sclera granting entry into the anterior chamber is the general principle on which this surgery is based. The relative post operative success can be assumed to depend on a lot of factors including, incision location, size and shape, pre-existing pathology, role of sutures and configuration of the sclero-corneal tunnel.¹⁶

In our study, we performed a randomized control trial to assess the effectiveness of the Frown and the Chevron incision in terms of SIA. A frown incision is a curved incision with the concave part facing away from the limbus.¹⁷ The incision is made near the limbus and extended into the cornea. The frown-like shape gives it the name “frown incision”. On the other hand, a Chevron incision is an inverted V shape like the logo of the company ChevronTM. This is also made near the limbus and then expanded into the cornea. The Chevron incision is more surgically demanding and has a steeper learning curve.¹⁸ Both incisions are self-sealing and require no sutures.

In Group F, mean SIA was 1.14 ± 0.65 and in Group C, it was $0.87 \pm 0.55D$. These results co-related with study by Manisha Rathi et al. which showed mean SIA in Chevron to be $0.34D \pm 0.22D$, in straight incision it was $0.97D \pm 0.29D$, and in frown incision it was $0.575D \pm 0.25D$.¹⁷ These results were complemented by a study done by Jauhari N et al.¹⁸ The mean SIA in Straight, Frown and Chevron incision was $-1.08 \pm 0.67D$, $-0.96 \pm 0.71D$ and $-0.88 \pm 0.61D$ respectively at four weeks postoperatively. Mean SIA was minimum ($-0.88 \pm 0.61D \times 90$ degrees) with Inverted V incision which was statistically significant. Another study by Patra et al,¹⁹ showed that chevron had the best results with minimum astigmatism and 48% of the patients had astigmatism between 0.5 D and 1D followed by 36% with 0.6-1D with frown incision.

Similar results were observed in another study conducted by Balwir D et al, in which the mean SIA of Chevron incision was 1.17 ± 0.41 and of Frown Incision was $1.40 \pm 0.45D$ respectively.²⁰ Rathi et al, performed study on 100 eyes using similar inclusion criteria in which yet again mean SIA was less in Chevron group ($0.55D \pm 0.42$) compared to ($0.82D \pm 0.42$) in frown group. This study also found a better visual acuity in patients with chevron incision.²¹

Studies comparing MSICS to Phacoemulsification showed less SIA in Phacoemulsification ($0.86 \pm 0.34D$ in comparison to $1.16 \pm 0.28D$).²² However, SICS remains the preferred method in high surgical volume sites with limited access to phacoemulsification

machines and in hypermature and brunescant cataracts. Modern Femtolaser generated clear corneal incisions have also been evaluated for surgically induced astigmatism but no statistically significant difference has been found in comparison to manual clear corneal incision.²³

Limitations of this study is single center study which limits generalizability of the findings. All surgeries were performed by one surgeon with more than 5 years of experience. While this eliminates variability in surgical technique, it also limits the study's applicability to other surgeons with different levels of expertise or experience. The study duration was six months. A longer follow-up period could provide better insights into the long-term effects of the different incision types on surgically induced astigmatism. In future studies, addressing these limitations could strengthen the findings and provide a more comprehensive understanding of the impact of incision type on postoperative outcomes.

CONCLUSION

Manual Small Incision Cataract Surgery will remain one of the most popular methods of cataract surgery especially for developing countries with limited resources and higher disease burden. Moreover, in cases of hypermature and brunescant cataracts which are not suitable for phacoemulsification's. Our research supplemented already available knowledge that a Chevron incision results in lesser surgically induced astigmatism and better unaided visual acuity as compared to Frown incision.

Funding: This study was not funded by any organization.

Patient's Consent: Researchers followed the guidelines set forth in the Declaration of Helsinki.

Conflict of Interest: Authors declared no conflict of interest.

Ethical Approval: The study was approved by the Institutional review board/Ethical review board (HMC-QAD-F-00-1687).

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