



Comparison of surgically induced astigmatism in straight versus inverted V shaped 'Chevron' incision in manual small incision cataract surgery

KEYWORDS

manual small incision cataract surgery; incisions; surgically induced astigmatism

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ABSTRACT

Background: This study was undertaken to compare two types of incisions- straight and inverted V 'Chevron' incisions in manual small incision cataract surgery (MSICS) with regards to surgically induced astigmatism.

Methods: A prospective comparative study involving 100 eyes of 100 patients who underwent MSICS at Justice K S Hegde Charitable Hospital, Deralakatte was carried out from July 2012 to July 2014. All patients were subjected to a detailed ocular examination. Out of the 100 patients who underwent MSICS, 50 were randomized into Straight incision group and 50 into Inverted V shaped 'Chevron' incision group respectively.

Results: No statistically significant difference noted in post-operative uncorrected and best corrected visual acuity. However, only 22% (n=11) of the patients who underwent MSICS with inverted chevron incision had SIA > 1.5 D, as compared to 48% (n=24) in the straight incision group, which was statistically significant.

Conclusions: Inverted V shaped 'chevron' incision results in lesser post-operative astigmatism.

Introduction:

Cataract has been found to be the leading cause of blindness worldwide¹ Senile cataract alone is estimated to be responsible for 33% of visual impairment and 51% of blindness worldwide.²

The prevalence of cataract depends on multiple factors such as genetic, environmental and geographic factors and the access to cataract surgery. The surgical backlog of cataract in any population can be reduced only when the number of cataract surgeries being performed is equal to, if not more than the incidence of cataract.

There are a variety of surgical techniques that can be used for cataract extraction. Two such techniques- manual small incision cataract surgery (MSICS) and phacoemulsification are widely practiced in our country. While the western world switched over from extracapsular cataract extraction to phacoemulsification, this wasn't possible in developing countries where cost is a major factor. Hence, MSICS was developed as a safe, simple and cost effective method of cataract extraction.³ Over the past decade, manual small incision cataract surgery (MSICS) has become an established alternative to phacoemulsification. MSICS which has almost half the cost of phacoemulsification with easier learning curves is more suited for developing countries with a backlog of cataract patients.³ It is evolving from being a procedure that restores vision loss due to the lenticular opacity, into a procedure that aims for postoperative emmetropia.⁴

Wound construction plays a major role in the outcome of MSICS. As the section goes, so goes the operation' this dictum initially framed when the Von Graefe section was in vogue, still holds true to this day.

A variety of scleral incisions are being used in MSICS with the aim of minimizing post-surgical astigmatism. ⁴Self-sealing cataract incisions were described by Kratz et al⁵ in 1980 and later by Girard in 1984.⁶ Kratz was of the view that scleral tunnel is an astigmatic neutral way of entering the anterior chamber. The external configuration may either be straight or curved. Paul Koch described

the "Incisional Funnel" indicating the astigmatic neutral zone. Thrasher et al. in 1984, showed that a 9.0- mm posterior incision induces less astigmatism than a 6.0-mm limbal incision. Michael Mc Farland developed the sutureless incision in 1990. Around the same time, Pallin and Singer described the Chevron shaped and frown incisions respectively. Randieri et al⁷ in 2008 showed that inverted V shaped 'Chevron' incision was associated with lower surgically induced astigmatism which they attributed to its triangular configuration, which renders it geometrically more stable, thereby causing minimal sliding of the tips of the incision.

Previous studies have analyzed the relationship between the site of incision and the resulting surgically induced astigmatism (SIA).^{8,9,10,11,12}

There are only few studies which have compared SIA between various types of scleral incisions.^{7,13,14} In our study, we have performed a comparative analysis of SIA associated with 2 types of incisions in manual SICS- Straight and Inverted V 'Chevron' incisions.

Aim:

The purpose of this study was to compare surgically induced astigmatism (SIA) in Straight and Inverted V shape (Chevron) incisions in manual small incision cataract surgery (MSICS).

Materials and methods:

It was a prospective cross sectional study. 100 eyes of 100 patients with uncomplicated senile cataract undergoing MSICS were included in the study. The study was performed over a period of two years ranging from July 2012 to July 2014. The study was conducted in accordance with the tenets of the Declaration of Helsinki. Informed consent was taken from all the patients included in the study. Patients who had pre-existing astigmatism of ≥ 2 DC, subluxated cataract, cataracts other than age related & combined surgeries were excluded.

All patients were subjected to a detailed ocular examination

including visual acuity testing (Snellen chart), slit lamp examination, funduscopy, lacrimal sac syringing and applanation tonometry. Manual keratometry was performed prior to surgery and 4 weeks after surgery. Axial length was measured using ultrasound A-scan and intraocular lens power was calculated using SRK II formula. Out of the 100 patients who underwent MSICS, 50 were randomized into group A (Straight incision) and 50 into group B (Inverted V shaped 'Chevron' incision) respectively.

Operative procedure:

On the morning of the surgery patients were advised to take two tablets of acetazolamide 250 mg half hour prior to being shifted to the operating room. Pupil was dilated with a combination of 0.8% tropicamide and 5% phenylephrine drops. Ketorolac 0.4% was instilled to aid in maintenance of mydriasis. All surgeries were performed by the same surgeon under peribulbar anaesthesia.

A fornix based conjunctival flap was raised. In group A, this was followed by a 6mm straight incision made 2mm posterior to the superior limbus. In group B, an inverted V shaped 'Chevron' incision was made such that the apex of the V was 1.5 mm from the superior limbus and the ends of the 2 limbs being 4mm from the superior limbus. The distance between the two ends of the limbs was 5mm. A self-sealing sclerocorneal tunnel was fashioned using a 2.8mm sterile disposable crescent knife. The anterior chamber was entered through the tunnel using a 3.2 mm keratome. Continuous curvilinear capsulorhexis was made using a 26G cystitome through the main wound. Anterior chamber was maintained by injecting viscoelastic agent. The inner wound was extended to 8-10 mm to facilitate nucleus delivery even in case of larger nucleus. Incisions were not enlarged in any of the cases. Hydrodissection and hydrodelineation were performed. Nucleus was delivered using sandwich technique. A single piece rigid PMMA posterior chamber IOL was implanted in the capsular bag and dialed into position. After ruling out any wound leak, self-sealing scleral wound was left sutureless.

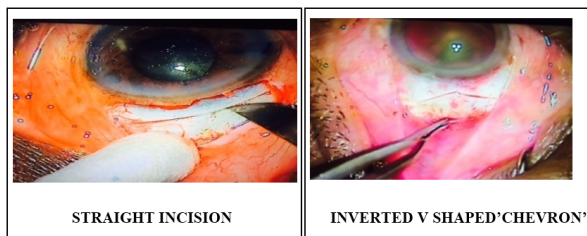


Figure 1: Straight and inverted V shaped 'Chevron' incisions

Postoperatively patients were examined on day 1, day 7 and week 4. A combination of gatifloxacin and dexamethasone eye drops was started on post-op day 1 and tapered over the next 4 weeks. When required, mydriatic and anti-glaucoma medications were also advised. At each visit, uncorrected visual acuity (UCVA), best corrected visual acuity (BCVA) and slit lamp examination findings were documented. At 4th week postoperatively, manual keratometry was repeated. Statistical analysis was performed using SPSS version 17.0. Surgically induced astigmatism was analyzed using the SIA calculator version 2.1, a free software.

Results:

This study included 100 eyes of 100 patients, randomised into two groups of 50 each – Group A and B- undergoing manual SICS surgery using straight and inverted V shaped 'Chevron' incision respectively. The number of males and females was almost equal with 48 males (48%) and 52 females (52%) respectively. The mean age of patients included in the study was 54.73±6.29 years. Pre-operatively, majority of patients had against the rule astigmatism (57%).

Uncorrected visual acuity (UCVA) at 4 weeks post-op:

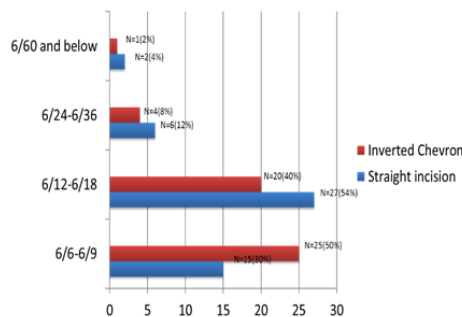


Figure 2: UCVA at 4th post-operative week

From the first post-operative day to the 4th week visit, a progressive increase in UCVA was noted in both groups, but this increase was more in the group that underwent inverted V shaped 'Chevron' incision. However, the difference in UCVA between the two groups was not statistically significant (p > 0.05)

BCVA at 4 weeks post-op:

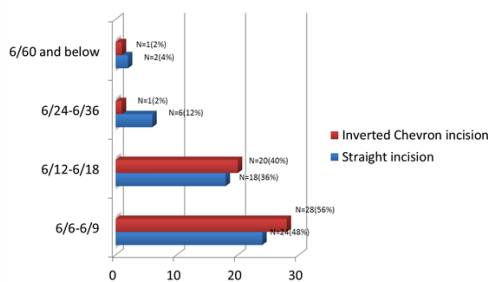


Figure 3: BCVA at 4th post-operative week

An increase in BCVA was noted in both groups. No significant difference was observed between the two groups.

Surgically induced astigmatism:

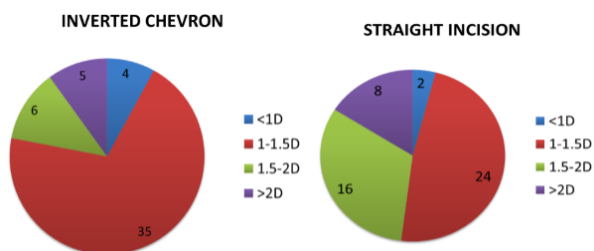


Figure 4: Mean SIA in inverted V 'Chevron' and straight incision group.

The mean SIA in straight and inverted V 'Chevron' incision was found to be -1.08± 0.67 D and -0.88±/0.61 D respectively at four weeks postoperatively. Majority of the patients in both groups- 70% (n=35) in inverted V shaped 'Chevron' group and 48% (n=24) in straight incision group showed SIA between 1- 1.5D. However, only 22% (n=11) of the patients who underwent MSICS with inverted chevron incision had SIA > 1.5 D, as compared to 48% (n=24) in the straight incision group. 8% (n=4) of patients in inverted chevron group had SIA < 1D versus 4% (n=2) in the straight incision group. Statistical analysis showed that the difference in SIA between the two groups was statistically significant (p < 0.05).

Discussion:

Earlier studies have shown that MSICS is associated with an early visual rehabilitation due to little inflammation and less SIA. Randeri et al⁷ in 2008 showed that 57.14% of patients in the inverted chevron

group had astigmatism of <1 D. In our study, 8% of the eyes in inverted chevron group had postoperative astigmatic error < 1D. Induced astigmatism >1 and < 1.5 D was seen in 70% eyes.

Jha and Vats¹⁵, reported that in MSICS by 6mm straight incision, 85.5% of patients had astigmatism up to 1 D, and 8.7% cases having astigmatism >2 D. However, in our study the straight incision group shows only 4% patients with astigmatism up to 1 D with 48% patients with astigmatism between 1 to 1.5 D.

The mean SIA in Straight and Chevron incision was found to be -1.08±0.67 D and -0.88±0.61 D respectively at four weeks postoperatively in our study. In a study by Jauhari et al¹⁴ 33.3% of the eyes in the inverted V shaped 'Chevron' group did not have any postoperative astigmatic error. Induced astigmatism up to 1 D was seen in major proportion of eyes (47.6%) in inverted V shaped 'Chevron' group. Straight incision group showed only 27.8% patients with astigmatism up to 1 D with 50% patients having astigmatism between 1.25 to 2 D.

Conclusion:

We conclude that inverted V shaped 'chevron' incision results in lesser post operative astigmatism compared to straighter incisions. Although more difficult to perform and difficult to maneuver with a steeper learning curve, once mastered, inverted V 'chevron' incisions can improve patient outcomes following MSICS surgery by reduction in SIA.

Limitations:

Limitations of this study include the small sample size and the relatively short duration of follow up.

References:

1. Pascolini D, Mariotti SP. Global estimates of visual impairment: 2010. *Br J Ophthalmol* 2012;96:614-8.
2. Panday M, George R, Asokan R, Ramesh SV, Velumuri L, Choudhari NS, Boddupalli SD, Sunil GT, Vijaya L. Six-year incidence of visually significant age-related cataract: the Chennai eye disease incidence study. *Clin Experiment Ophthalmol*. 2015 Aug 20.
3. Gogate P, Optom JJ, Asokan R, Deshpande S, Naidoo K. Meta-analysis to compare the safety and efficacy of manual small incision cataract surgery and phacoemulsification. *Middle East Afr J Ophthalmol*. 2015 Jul-Sep;22(3):362-9.
4. Haldipurkar SS, Shikari HT, Gokhale V. Wound construction in manual small incision cataract surgery. *Indian J Ophthalmol*. 2009;57(1):9-13.
5. Kratz RP, Colvard DM, Mazzocco TR, et al. Clinical evaluation of the terry surgical keratometer. *Am Intraocular Implant Soc J* 1980;6:249-51.
6. Girard LJ. Origin of the Scleral tunnel incision. *J Cataract Refract Surg* 1995;21:7.
7. Randeri JK, Desai RJ, Mehta FS, Billore OP, Gupta A, Kukadia G. Incision induced astigmatism-a comparative study of Chevron incision and Frown incision in SICS. *AIOS Proceedings* 2008
8. Gokhale NS, Sawhney S. Reduction in astigmatism in manual small incision cataract surgery through change of incision site. 2005;53(3):201-203
9. Reddy B, Raj A, Singh VP. Site of incision and corneal astigmatism in conventional SICS versus phacoemulsification. 2007;39(3):209-216
10. Ale JB. Surgically induced astigmatism of small incision cataract surgery. 2012;4(2):343
11. Guan CY, Xiao TT. Astigmatism following small incision cataract extraction through superotemporal incision. 2012;27(2):94-97
12. 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. 2012;4(1):54-58
13. 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
14. Jauhari N, Chopra D, Chaurasia RK, Agarwal A. Comparison of surgically induced astigmatism in various incisions in manual small incision cataract surgery. *Int J Ophthalmol* 2014;7(6):1001-1004
15. Jha KN, Vats DP. Manual small incision cataract surgery: experience at a military hospital. *MJAFI* 2006;62(3):212-215