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Surgically induced astigmatism in frown versus chevron incision in MSICS

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Abstract

Cataract surgery remains the foremost cause of reversible blindness globally. Phacoemulsification requires expensive equipment, instruments and higher cost of disposables, along with a longer training curve. Manual small incision cataract surgery (MSICS) has evolved to provide excellent postoperative results, with minimal cost. In developing countries like India, patients present with white/advanced cataract, for which MSICS has proven to provide the best results. MSCIS can be used in any type of cataract, with any type of foldable/rigid intraocular lens implantation. Minimising surgically induced astigmatism is of paramount importance as the patient achieves good uncorrected vision postoperatively, which is the need of the hour. The Chevron incision in MSICS has been reported to provide the best results. We undertook the present study in 100 eyes with white cataract/nuclear sclerosis of grade 4-6 to analyse and compare MSCIS through the Frown incision and Chevron incision. The mean surgically induced astigmatism incision was more in the Frown group (0.82D±0.62) than in the Chevron group (0.55D±0.42), which was statistically significant. (*p* 0.017). In the Frown versus Chevron group, the best uncorrected visual acuity was 6/12 or better in 62% and 82% respectively. Thus, the Chevron incision was superior to the Frown incision for MSICS, while both yielded good postoperative results. MSICS is the most affordable and effective surgery of choice, especially for white/ hard cataracts.

Keywords: MSICS, SIA, IOL, UCVA, BCVA

Introduction

Cataract is the leading cause of reversible blindness in the world [1]. Surgery for cataract has evolved over the years to the current options of phacoemulsification and manual small incision cataract surgery. The aim of the surgery is visual rehabilitation, with minimal surgically induced astigmatism. In developing countries like India, the cost-effectiveness of the surgery plays a vital role. MSICS is the most affordable procedure, which has been tested over the last few decades and yields excellent results. Lower cost of instrumentation and equipment in manual SICS is an added advantage [2]. This technique is less expensive in terms of capital equipment investment, equipment maintenance, and disposable costs per case. Phacoemulsification in hard cataracts, typical of populations in developing nations make phacoemulsification significantly more difficult and time consuming [3]. It also remains an expensive procedure because of high-cost instrumentation and may not be affordable in developing countries like India, where MSICS proves to be a safe and good alternative, especially for mature/white cataracts [4-6].

Phacoemulsification machines are expensive to purchase and maintain, and they add relatively high costs of surgical consumables. High-end foldable/ multifocal IOLs are cost-prohibitive for poor populations. The extensive surgical training that is required for phacoemulsification is unrealistic in health care systems with severe shortages of ophthalmologists. Finally, the hard cataracts that are typical of populations in developing nations make phacoemulsification significantly more difficult, time consuming, and prone to complication, making SICS the treatment of choice [4].

Material and Methods

This prospective study was carried out on 100 patients over 50 years of age with senile cataract, which was white or with Grade 4-6 nuclear sclerosis, in accordance with the Declaration of Helsinki. Informed consent was taken from all the patients.

Exclusion criteria

- Patients with any other ocular disease
- Keratometric astigmatism of more than 2 D
- Patient unwilling to participate in the study

A detailed clinical examination was carried out including visual acuity, lacrimal sac examination, applanation tonometry, slit lamp examination and fundoscopy, wherever possible (as some patients had Grade 6 nuclear sclerosis). Manual Keratometry was performed before surgery in all and at regular intervals after surgery, till 12 weeks after the surgery. Intraocular lens (IOL) power was calculated using SRK II formula with the Sonomed A scan. Patients were randomly divided into groups F and V and were given Frown and Inverted V 'Chevron' incision, respectively.

Surgical procedure

On the day of surgery, pupil was dilated with 0.8% tropicamide and 5% phenylephrine drops.

Flurbiprofen 0.03% eye drops were instilled twice to maintain intra-operative mydriasis. The surgery was performed under peribulbar anaesthesia. All the surgeries were performed by one surgeon. After making fornix based conjunctival flap, in group F a 7-8 mm Frown incision was made with 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 5 mm from superior limbus. The distance between two ends of the limbs was 7-8 mm. A sterile disposable, 2.8 mm crescent blade was used to create a self-sealing scleral corneal tunnel, extending into the clear cornea for 1.5-2 mm. A 2.8 mm keratome was used to enter the anterior chamber through the tunnel incision. Continuous curvilinear capsulorrhexis was done after staining the anterior capsule with trypan blue, using a 26 G cystitome through the main tunnel under viscoelastic cover.

The internal wound was enlarged to 8-10 mm length approximately which is required to accommodate a hard and large nucleus. Hydrodissection was performed. The prolapsed nucleus was engaged in the scleral tunnel and was delivered out using an irrigating wire vectis. A single piece IOL was implanted in the capsular bag and dialled. The self-sealing corneoscleral tunnel was not sutured. Prednisolone acetate 1% eye drops were instilled 8 times a day & Moxifloxacin eye drops 0.5% were instilled four times daily postoperatively and tapered over 6 weeks.

Patients were examined on day 1, day 7, 4 weeks, 6 weeks and 12 weeks postoperatively. Uncorrected visual acuity (UCVA), best corrected visual acuity (BCVA) and slit lamp findings were recorded at each visit. Keratometry was done.

Results

This study was done on 100 patients divided equally in 2 groups, in Group F the surgery was done through a Frown incision and in Group V the surgery was done using a Chevron incision. 43 (43%) were males and 57 (57%) were females. Mean age of patients was 62.3 ± 6.65 y (50-75y). Maximum patients (61%) had against the rule astigmatism preoperatively. For the purpose of statistical analysis visual acuity has been quantified using the following gradation scale (Table 1).

There was a postoperative marked improvement in uncorrected visual acuity (UCVA) in both the incision groups, but no significant intergroup difference was observed for any of the follow-up visits ($p>0.05$; Table 2).

In the present study, 92 (92%) of patients had a BCVA of at least 6/12 or better at 12wk postoperatively. Only 8 (8%) patients had BCVA less than 6/12 which was attributed to retinal disease all in these patients. (Table 3)

A significant difference was observed in mean SIA between both groups. In group V 20% of patients did not have any induced astigmatism and none had induced astigmatism >2 D. In group F 12% patients did not have any induced astigmatism and two had induced astigmatism >2 D. The mean SIA value was more in group F (0.82D ± 0.62) than in group V (0.55D ±0.42) which was statistically significant. (p 0.017; Table 4).

Table 1: Quantification of visual acuity

Grade	Visual acuity
0	Visual acuity <1/60 to PL±
1	Less than 3/60 to 1/60
2	Less than 6/60 to 3/60
3	Less than 6/18 to 6/60
4	6/6 to 6/18

Table 2: Comparison of UCVA between different incision groups at 12-weeks follow-up visits

UCVA	Chevron group	%	Frown group	%
	No.		no.	
6/6-6/12	41	82	31	62
6/12 or less	09	18	19	38

Table 3: Comparison of BCVA between different incision groups at 12-weeks follow-up visits

BCVA	Chevron Group	%	Frown group	%
	No.		no.	
6/6-6/12	47	94	45	90
6/12 or less	3	06	5	10

Table 4: Mean SIA in both incision groups at 12 weeks post operatively

S. No.	Astigmatism (D)	Group frown		Group chevron		*P* value
		No.	%	No.	%	
1	Nil	6	12	10	20	
2	0.25-1	27	54	38	76	
3	1.25-2	15	30	2	04	
4	>2	2	4	0	0	
Mean ± SD		0.82D ± 0.62		0.55D ± 0.42		0.017

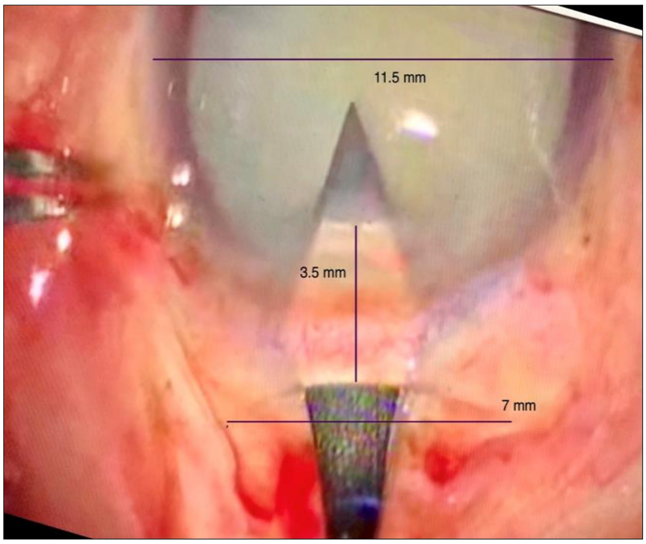

Fig 1: Showing the measurements of an ideal tunnel in one of our cases

Discussion

Ophthalmologists are looking for alternative techniques that would yield outcomes like instrumental phacoemulsification but at lower costs. Manual techniques of extracting cataracts through sutureless small incisions, i.e., manual small incision cataract surgery (MSICS), have been developed to achieve the same benefits as phacoemulsification. This is a technique of cataract surgery that is safe and effective for visual rehabilitation yet economical. Millions of people in developing nations with reversible blindness from mature cataracts still go untreated because of poverty. If services continue to be skewed toward only the wealthiest members of poor countries, then the number of people who will be blind from cataracts will double by the year 2020.

MSICS is accepted as the surgery of choice in advanced/hard cataracts, which are more likely to develop corneal edema due to high phaco energy. In difficult cases like phacolytic glaucoma and cataract with uveitis, studies have shown that that MSICS is safe and effective, with a good outcome. MSICS has also been shown to be less time consuming, less expensive, and less technology dependent than phacoemulsification, making it appropriate for advanced cataracts [7]. It has been recommended to use trypan blue dye staining of the anterior capsule [5, 9].

Phacoemulsification machines are expensive to purchase and maintain, and they add relatively high costs of surgical consumables. Foldable/multifocal IOLs are cost-prohibitive for poor populations. Finally, the hard cataracts that are typical of populations in developing nations make phacoemulsification significantly more difficult, time consuming, and prone to complication [3]. MSICS has evolved to a level that gives a surgical outcome that is equivalent to phacoemulsification, at a much lower cost and no requirement of expensive equipment or recurring cost of disposables.

Surgically induced astigmatism is an important cause of poor uncorrected visual acuity after cataract surgery [4]. Patients expect a better uncorrected visual acuity. Mean SIA in MSICS in straight incision has been studied to be 1.29 ± 0.36 D to 1.37±0.92 D at 3 months while in frown incision, SIA was 0.83±0.53 to 0.95 ± 0.41 D at 3 months ($P<0.05$) [8, 10]. The mean SIA in Straight, Frown and Chevron incision was found to be -1.08±0.67 D, -0.96±0.71 D and -0.88±0.61 D respectively, estimated 4 weeks after the surgery [11].

We decided to undertake this study as the Frown versus Chevron incision for MSCIS. In our study, the mean SIA in the Frown versus Chevron group was 0.82D ± 0.62 and 0.55D ±0.42 respectively which was statistically significant (*p* 0.017). This led to an uncorrected good vision in a large number of cases, which was what is required. Thus the Chevron incision gives the best results in MSCIS with the minimum SIA and a good visual acuity.

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