

One Year, Prospective Comparison of Astigmatism Induced by a Straight and Frown Incision in Manual SICS (MSICS) in Patients with Immature Pre-senile and Senile Cataract

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Received: 07-11-2021 / Revised: 21-11-2021 / Accepted: 16-12-2021

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Conflict of interest: Nil

Abstract

Aim: To compare the astigmatism induced by a straight and frown incision in manual SICS (MSICS) in patients with Immature Pre-senile and Senile Cataract.

Material & Method: This was a one-year, prospective study, comprised of 200 patients (100 patients in each group). Group A: MSICS (Frown Incision) Group B: MSICS (Straight Incision) with the patients undergoing manual SICS at the Department of Ophthalmology, Patna Medical College & Hospital, Patna, Bihar, India.

Results: The patients were divided into 2 groups, that is Group A (Patients who underwent MSICS with frown incision) and Group B (Patients who underwent MSICS with straight incision). In Group A, on Day 1, 50 % of the patients had 6/24 – 6/18 visual acuity, on Day 7, 71% had 6/12 – 6/6 visual acuity, on Day 70, 74% had 6/12 – 6/6 visual acuity and on Day 90, 94% had 6/12 – 6/6 visual acuity. In Group B, on Day 1, 12 % of the patients had 6/12 – 6/6 visual acuity, on Day 7, 48% had 6/12 – 6/6 visual acuity, on Day 45, 69% had 6/12 – 6/6 visual acuity and on Day 90, 88% had 6/12 – 6/6 visual acuity.

Conclusion: In conclusion, frown incision is evidently better than straight incision in minimizing surgically induced astigmatism.

Keywords: Surgically Induced Astigmatism, Manual Small Incision Cataract Surgery, Straight Incision, Frown Incision

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Introduction

With the advent of phacoemulsification, cataract surgery has been reduced to a day care surgery. But due to economic reasons, phacoemulsification is limited to big cities & institutions only. Non-phaco or manual small incision cataract surgery (SICS) by virtue of its self-sealing suture-less incision appears as a ray of hope for

tackling the cataract burden in developing countries [1-4].

Cataract has been documented to be the most significant cause of bilateral blindness in India where vision <20/200 in the better eye on presentation is defined as blindness. In India, cataract has been reported to be responsible for 50 to 80% of the bilateral blindness in the country.[5]

The “Cataract incision” is the most common refractive procedure performed today. From submillimeter cataract surgery days of Sushruta (couching) in the 600 BC to the present-day submillimeter cataract surgery, we have probably come a full circle.[6]

Astigmatism induces distortion of image. The retinal image is distorted because of a differential magnification in the two principal meridians. There is 0.3% image distortion per diopter of astigmatism.[7]

Manual SICS is a self-sealing cataract surgery due to the sclera-corneal tunnel construction. Lower cost of instrumentation and disposables in manual SICS is an added advantage. [8, 9]It is also better suited for advanced and mature cataracts seen in developing countries.[10]

Hence, we aim to compare the astigmatism induced by a straight and frown incision in manual SICS (MSICS) in patients with Immature Pre-senile and Senile Cataract.

Material & Method:

This was a one year, prospective study, comprised of 200patients (100patients in each group). Group A: MSICS (Frown Incision) Group B: MSICS (Straight Incision) with the patients undergoing manual SICS at the Department of Ophthalmology, Patna Medical College & Hospital, Patna, Bihar, India.

Inclusion Criteria:

- Patients of the age group between 40-70 years
- Patients of uncomplicated immature senile cataract with cortical cataracts and grade 3 or less nuclear sclerosis
- Patients who have completed all the post-operative visits with the necessary investigations during the 3 months follow up period.

Exclusion Criteria:

- Patients with previous history of ocular trauma.

- Patients with complicated cataract, congenital cataract.
- Patients having immature cataract associated with other ocular diseases.
- Patients with intra-operative and post-operative complications.
- Patients with pre-op irregular astigmatism.
- Patients with associated glaucoma, corneal scarring or degeneration, uveitis, previous intra-ocular surgeries.
- Patient with against the rule astigmatism
- Patient with grade 4 Nuclear sclerosis

Methodology

Pre-operative evaluation included Name, Age, Sex, Visual acuity, Anterior Segment examination, IOP using Schiotz indentation tonometer, Fundus examination using 90 D lens with slit lamp biomicroscopy. Corneal astigmatism was measured by keratometer (Bausch & Lomb): KH(Horizontal), KV(Vertical) and axis. Eyes were randomly (simple randomization) assigned to either of the two groups.

Surgically Induced Astigmatism (SIA) was calculated using a computer program (software) called ‘SIA Calculator 1.0’ for a given set of pre- and post-operative keratometric data. This Surgically Induced Astigmatism Calculator (SIA Calculator) has been designed to calculate, by means of vector analysis, the amount of surgically induced astigmatism created during the cataract surgical procedure.

Statistical Analysis

The data was analysed using SPSS Statistics software (version 20). Statistical tests like t test and repeated measures ANOVA test were used for data analysis. P-value of <0.05 was considered to be statistically significant.

Results:

The patients were divided into 2 groups, that is Group A (Patients who underwent MSICS with frown incision) and Group B (Patients who underwent MSICS with straight incision). Mean age of patients was 60.51 ± 8.02 years in group A and 57.92 ± 7.21 Years in group B. (Table 1)

In group A 52% of patients were male and 48% were female with male: female ratio of 0.80:1. In group B 50% were male and 50% were female with male: female ratio of 1:1. (Table 2)

In group A, majority of the patients (40%) were in the range of $<3/60$ followed by 35% in range of $6/60$ to $3/60$. In group B, majority (55%) had preoperative visual acuity in the range of $<3/60$, followed by 32% in the range of more than $6/60$. (Table 3)

In Group A, on Day1, 50 % of the patients had $6/24 - 6/18$ visual acuity, on Day 7, 71% had $6/12 - 6/6$ visual acuity, on Day 70, 74% had $6/12 - 6/6$ visual acuity and

on Day 90, 94% had $6/12 - 6/6$ visual acuity. In Group B, on Day 1, 12 % of the patients had $6/12 - 6/6$ visual acuity, on Day 7, 48% had $6/12 - 6/6$ visual acuity, on Day 45, 69% had $6/12 - 6/6$ visual acuity and on Day 90, 88% had $6/12 - 6/6$ visual acuity. (Table 4)

In Group A, majority of the patients (49%) had SIA in the range of 0.75D– 1.0 D, 25% were in the range of 1.25 – 1.5 D, and 21% were in the ranges of 0.00 – 0.5 D.

In Group B, majority of the patients (26%) had SIA in the range of 1.25– 1.5 D, 23% were in the range of 0.75 – 1.0 D, 20 % were in the range of 0.00 – 0.5D. (Table 5)

The mean post-operative SIA was $.94 \pm .62$ Diopter and $2.81 \pm .88$ Diopter in group A and group B respectively on day 1 ($p < 0.05$) which changed to $.80 \pm .48$ Diopter and $1.42 \pm .90$ Diopter in group A and group B respectively after day 90 ($p < 0.05$). (Table 6)

Table No 1: Age distribution

Age (Years)	Group A	Group B
45 – 50	7	11
51 – 60	32	68
61 – 70	61	21
Total	100	100

Table 2: Gender distribution

Gender	Group A	Group B
Male	52	50
Female	48	50
Total	100	100

Table 3: Preoperative visual acuity

Visual acuity	Group A	Group B
$>6/60$	25	32
$6/60$ to $3/60$	35	13
$<3/60$	40	55
Total	100	100

Table 4: Distribution of subjects according to post-operative visual acuity (VA) findings in Group 1 and 2 on various follow up visits.

VA (LogMAR)	Day 1		After 7 days		After 45 days		After 90 days	
	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
6/60 to 6/36	15	48	3	11	0	2	0	0
6/24 to 6/18	50	40	26	41	11	29	6	12
6/12 to 6/6	35	12	71	48	70	69	94	88
Mean±SD	.50±.11	.71±.24	.28±.12	.59±.27	.32±.17	.39±.22	.24±.17	.29±.19
Significance	p=0.00*		p=0.00*		p=0.003*		p=0.050**	

Table 5: Range of surgically induced astigmatism

Range of SIA	Group A (N=100)	Group B (N=100)
0.00 – 0.5 D	21	20
0.75 – 1.0 D	49	23
1.25 – 1.5 D	25	26
1.75 – 2.0 D	2	13
2.25 – 2.5 D	2	8
2.75 – 3.0 D	1	5
3.25 – 3.5 D	0	5

Table 6: Comparison of amount of surgically induced astigmatism (SIA) between two groups at different time interval

Variable	Day 1	After 7 days			After 45 days		After 90 days	
SIA (in Diopter)	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
Mean±SD	.94±.62	2.81±.88	2.16±.71	1.63±.82	.95±.63	1.78±.80	.80±.48	1.42±.90
Significance	p=0.001*	p=0.010*			p=0.005*		p=0.001*	

Table 7: Comparison of KH between two groups at different time interval

Variable	Day 1		After 7 days		After 45 days		After 90 days	
KH	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
Mean±SD	53.22±3.71	53.62±3.77	53.72±3.66	53.79±3.89	53.72±3.39	53.52±3.90	53.56±3.53	53.62±4.04
Significance	p=0.803		p=0.492		p=0.577		p=0.62	

Table 8: Comparison of KV between two groups at different time interval

Variable	Day 1		After 7 days		After 45 days		After 90 days	
KV	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
Mean±SD	50.21±1.83	50.63±3.82	50.72±3.82	50.72±3.63	50.70±3.82	50.74±4.73	50.62±3.73	50.42±4.80
Significance	p=0.020		p=0.027		p=0.010		p=0.016	

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Discussion:

It is reported from previous studies that patients undergoing Manual SICS have an early visual rehabilitation. The quick visual restoration is attributed to little inflammation and less SIA. Patients also have fewer complaints regarding ocular discomfort in terms of pain, foreign body sensation and redness.[12]

Cataract surgery has refined tremendously in recent years mainly to fulfill the expectation of the patients that is early visual rehabilitation and minimal induced astigmatism. Modern day cataract surgery aims not only at the 'Restoration of sight' and 'Reduction of economic blindness' but on an 'Early restoration of optimum visual acuity' and therefore, a reduction in surgically induced astigmatism. It is reported from previous studies that patients undergoing Manual SICS have an early visual rehabilitation.[13, 14]

Olsen et al compared induced regular astigmatism and irregular astigmatism after scleral and corneal tunnel incisions on 100 phacoemulsification patients with less than 1 D of preoperative astigmatism. The SIA was analyzed by vector analysis from keratometric data. They concluded that the clear corneal incision induces significantly more regular as well as irregular astigmatism than the scleral tunnel incisions.[15]

High astigmatism is an important cause of poor uncorrected visual acuity after cataract surgery.[16] The results of this study show that there is minimal astigmatism in MSICS and that SIA can be modified by modification of the incision location.

Another study in 2011 with 6 mm straight temporal sclerocorneal incision has reported mean SIA of 1.35 ± 0.49 D four weeks post-operatively [17]. Gokhale and Sawhney [18] have found mean

astigmatism in manual SICS with superior frown incision to be 1.28 D at 29 degrees.

Deng and Liu studied the impact of ECCE and phacoemulsification with 5 mm tunnel incisions or 7 mm frown-shaped incision on the postoperative visual acuity and corneal refractivity in 243 eyes and concluded that 7 mm frown incision of phacoemulsification was the most effective method to control postoperative astigmatism in cataract surgery.[19,20]

Conclusion:

Small incision size and absence of suture are the most important factors that contribute to less astigmatism and faster stabilization of SICS. The duration for stabilization of postoperative astigmatism in straight incision group is 6 weeks, whereas it is 3 weeks in frown incision.

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