

Original Research Article

Factors affecting post-operative astigmatism in superior and temporal approaches in Manual Small Incision Cataract Surgery

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	International Archives of Integrated Medicine, Vol. 5, Issue 3, March, 2018. Copy right © 2018, IAIM, All Rights Reserved. Available online at http://iaimjournal.com/ ISSN: 2394-0026 (P) ISSN: 2394-0034 (O)
	Received on: 18-02-2018 Accepted on: 26-02-2018
	Source of support: Nil Conflict of interest: None declared.
How to cite this article: Giridhar Bellamkonda, Sri Kavya. Factors affecting post-operative astigmatism in superior and temporal approaches in Manual Small Incision Cataract Surgery. IAIM, 2018; 5(3): 44-54.	

Abstract

Background: Cataract surgery and intraocular lens implantation restores near normal visual acuity in otherwise healthy eyes, safe surgery, postoperative emmetropia and early resuming of normal activities are three major considerations of present day cataract surgery.

Aim: To evaluate and compare surgically induced altered refractive status following superior versus temporal incision in small incision cataract surgery.

Materials and methods: 100 cases of cataract surgery were selected for study of post-operative refractive status in superior versus temporal incision in cataract surgery. A complete ocular examination including anterior and posterior segment examination and general physical examination was performed in all cases.

Results: Majority (75%) of patients of the present study who underwent cataract extraction belonged to age group of above 50 years with maximum preponderance in the age group of between 61-70 years. The minimum amount of astigmatism one week after surgery in Group – 2 was 0.5D and the maximum amount was 6.0D. The average amount of astigmatism one week after surgery in Group – 2 was 2.75D. The minimum amount of astigmatism 6 weeks after surgery in Group – I was 0.25D and maximum amount was 4.0D. The minimum amount of astigmatism 6 weeks after surgery in Group –

2 was 0.25D and maximum amount was 2.0D. The complications were seen in early postoperative period more in superior incision group than in temporal group. Astigmatism was cleared in temporal group when compared to superior incision group. After 6 weeks of postoperative follow-up, visual acuity of every patient was recorded after giving proper pseudophasic correction. Temporal Incision had 92% 6/6 -6/9 and 6/12-6/18 visual acuity.

Conclusions: Amount of astigmatism was less in temporal incision SICS than superior incision SICS. The postoperative refractive status, is also good in temporal incision SICS than superior incision SICS.

Key words

Small Incision Cataract Surgery, Temporal incision, Superior incision.

Introduction

Any opacity in the lens or its capsule whether developmental or acquired is called cataract. The only cure for most cataracts is removal. The lens is of special significance to ophthalmologist because it is the structure that is responsible for most of the treatable blindness in the world today. There are more than 18 million blind people due to cataract in the world. India has perhaps the highest blind population. It is the most common cause of curable blindness according to WHO survey (1986-1989) [1].

Cataract surgery and intraocular lens implantation restores near normal visual acuity in otherwise healthy eyes, safe surgery, postoperative emmetropia and early resuming of normal activities are three major considerations of present day cataract surgery. Tremendous changes are taking place in wound construction in cataract surgery mainly to minimize the amount of astigmatism and to improve the post-operative refractive status in patient without compromising on wound stability [2].

A driving force in the evolution of cataract extraction is the attempt to arrive at the safest technique with least possible postoperative astigmatism, early rehabilitation and preferably minimal intraoperative expenses. Manual small incision cataract surgery is promising to fulfil all the above criteria. One obstacle to the achievement of good uncorrected visual acuity after cataract surgery is surgically induced astigmatism. Incision length, shape, location,

relationship to the limbus and cross sectional profile, all contribute to wound healing and the final amount of postoperative astigmatism [3, 4]. The sphere component of the refraction after cataract surgery can be controlled by a careful biometry and IOL power calculation. But cylinder component of refraction (astigmatism) can be controlled only by modifications of length, site, shape and closure of the incision. The purpose of this study was to compare the refractive status in postoperative patients, which is mainly dependent on the type of incision that is superior incision or temporal incision in small incision cataract surgery, which will be helpful to reduce the amount of astigmatism which is the major problem after surgery. Though there are various types of cataract surgeries and many more advances, like phacoemulsification, phacolit etc., but in countries like in India where people are not affordable, it is better to do small incision sutureless cataract surgery. Therefore comparative study of types of limbal incisions and postoperative refractive status in small incision sutureless cataract surgery is preferred here.

Materials and methods

The present study was undertaken from 2015 – 2016, cases taken from Regional Eye Hospital, Warangal. Cases were divided into two groups irrespective of age and sex.

Group 1 Superior Incision Group: 50 patients with superior incision in small incision cataract surgery with PCIOL.

Group 2 Temporal Incision Group: 50 patients with temporal incision in small incision cataract surgery with PCIOL implantation (**Photo – 1 to 3**).

Inclusion criteria: All age groups and both sexes were being included.

Exclusion criteria: Cases with gross pre-operative astigmatism of >2D, corneal ectasia. (Keratoconus), raised IOP or previous history, previous history of ocular surgery, any other ocular pathology or infection, uncontrolled diabetes and hypertension.

Photo – 1: Temporal incision in SICS.



Photo – 2: Sclerocorneal tunnel – SICS (Temporal incision).



Photo – 3: Injecting Viscoelastic Substance into Anterior Chamber – SICS.



Methods

- Visual acuity reading.
- Anterior segment evaluation with slit lamp biomicroscopy.
- Posterior segment evaluation.
- Intraocular lens power calculation.
- Systemic evaluation including blood pressure and routine investigations.

Any focus of infection was noted and treated prior to surgery.

Preoperative preparation: Topical broad spectrum antibiotic ciprofloxacin eye drops were instilled every two hourly one day prior to operation. Tablet Acetazolamide 500mg was given 2 to 3 hours before operation.

Mydriatics: People were dilated with instillation of phenylephrine hydrochloride 5% and tropicamide 0.8% 3 to 4 times at 10 minutes interval. Flurbiprofen eye drops were also used.

Anesthesia

All the patients were operated under local anaesthesia. Retrobulbar or peribulbar block with 2% lignocaine with adrenaline 1:2,00,000 with hyaluronidase (1500IU) and Bupivacaine (0.5%) was given using 1.5", 24 gauge dull tipped needle. Gentle pressure was applied over the eye and movement was observed in any direction. Hypotony was achieved by applying intermittent digital pressure and external ocular pressure with

pinky ball for 10 minutes after retrobulbar injection.

Group – 1 cases

Incision – Superior Incision: A half thickness 6.5 mm, scleral groove was placed 2 mm posterior to limbus, perpendicular to the sclera with 11 or 15 number blade. Length the groove was measured by Vernier calipers. The length of the incision was fixed at 6.5 mm because the rigid PMMA intraocular lens used for implantation had optic diameter of 6.5 mm. The groove was dissected forward using crescent blade, with the tunnel being perpendicular to the initial incision. Under direct visualization, into clear cornea. The anterior chamber was entered through a beveled wound created with the help of a keratome. Methyl cellulose was injected into the anterior chamber.

Anterior capsulotomy: Anterior capsulotomy was done.

Hydrodissection: Hydrodissection was performed by irrigating ringer lactate between lens capsule and the lens cortex.

Hydrodelineation: Hydrodelineation was performed by injection of fluid between nucleus and epinucleus. The epinucleus part was aspirated by two-way aspiration cannula attached to 10 CC syringe. The size of the nucleus was thus very much reduced. The nucleus was floated to come into anterior chamber.

Expression of the Nucleus

The nucleus was expressed out by any of the following techniques:

- Hydro-extraction by irrigating vectis.
- Phacosandwich technique.
- Phacofracture technique.

Irrigation / Aspiration of Cortical Matter:

Irrigation / aspiration was done by two way irrigation / aspiration cannula.

Intraocular Lens Implantation (IOL): IOL implantation was done.

Closure of Incision Line: Fornix based conjunctival flap was replaced in each group. A

subconjunctival injection of 20mg of gentamycin and 2mg of dexamethasone was given to each patient. Superior bridle sutures were removed. Pad and bandage done and patient were shifted to ward.

Post-operative treatment

- Tablet Ciprofloxacin – 500mg twice a day for 5 days.
- Tablet Ibuprofen – 400mg 3 times a day for 5 days.
- Steroid and antibiotic mixture eye drops were given for 1 month.
- Diclofenac eye drops were given for two weeks.

Post-operative care

- The bandage was opened on the next day.
- Dark glasses were worn by all patients.
- Eye shields were used at night for few days to avoid injury during sleep.
- Eye was cleaned with Lukewarm boiled water using cotton swab for few days.
- Patient was advised to avoid hair bath for few days and any kind of exertional activity.

Discharge: Patients were discharged on 3rd day. At the time of discharge, thorough slit lamp examination was done to see the state of cornea, iris, anterior chamber, pupil and IOL etc.

Follow-up: The patients were recalled for post-operative follow-up. Detailed examination, including slit lamp biomicroscopic and ophthalmoscopy, was performed at 1, 2, 4 and 6 weeks.

Keratometry: Keratometric evaluation was done one week and six weeks post-operatively. At 6 weeks retinoscopy was done and prescriptions for spectacles were given to the patients.

Group – 2 cases: In Group 2 Cases temporal incision is given and rest is same as Group 1 Cases.

Results

100 cases of cataract surgery were selected for study of post-operative refractive status in superior versus temporal incision in cataract

surgery. A complete ocular examination including anterior and posterior segment examination and general physical examination was performed in all cases. One eye was taken as one case.

There were divided into 2 groups of 50 cases each group:

Group – 1 Superior Incision Group: 50 patients with superior incision SICS with PCIOL.

Group – 2: 50 patients with temporal incision SICS with PCIOL.

Majority (75%) of patients of the present study who underwent cataract extraction belong to age group of above 50 years with maximum preponderance in the age group of between 61-70 years (**Table – 1**). There was no significant difference between both groups (**Table – 2**).

Table – 1: Age and Sex Distribution.

Age (Years)	Superior Incision Group				Temporal Incision Group			
	Male	Female	Total	Percentage	Male	Female	Total	Percentage
<40	–	–	–	0.0	–	–	–	0
41-50	3	2	5	10.0	5	2	7	14.0
51-60	4	11	15	30.0	13	10	23	46.0
61-70	10	8	18	36.0	6	13	19	38.0
>70	5	7	12	24.0	1	0	1	2.0
Total	22	28	50	100.0	25	25	50	100.0

Table – 2: Eye operated.

Eye Operated	Superior Incision Group					
	Male	Percentage	Female	Percentage	Total	Percentage
Right	18	36%	11	22%	29	58%
Left	6	12%	15	30%	21	42%
Total	24	48%	26	52%	50	100%
Temporal Incision Group						
Right	5	10%	18	36%	23	46%
Left	15	30%	12	24%	27	54%
Total	20	40%	30	60%	50	100%

Number of cases with preoperative astigmatism of 1D or less than 1D was 34 in Superior Incision Group and 34 in Temporal Incision Group. Mean value of preoperative astigmatism in Group 1 was 0.85D and minimum value of preoperative astigmatism was 0.00, and Maximum value of preoperative astigmatism was 2.0D. Mean value of preoperative astigmatism in Temporal Incision Group (Group 2) was 0.87D. Minimum value of preoperative astigmatism was 0.00. Maximum value of preoperative astigmatism was 2.0D (**Table – 3**).

Keratometry: After one week, the type and amount of astigmatism induced as a result of surgery was recorded and studied. The relationship of type of postoperative astigmatism

after one week of surgery and the relationship of amount of postoperative astigmatism after one week of surgery to the number of cases in Group – 1 and Group – 2.

The minimum amount of astigmatism one week after surgery in Group – 1 was 3.5D and the maximum amount was 9.5D. The average amount of astigmatism one week after surgery in Group – 1 was 6.0D. The minimum amount of astigmatism one week after surgery in Group – 2 was 0.5D and the maximum amount was 6.0D. The average amount of astigmatism one week after surgery in Group – 2 was 2.75D.

The minimum amount of astigmatism 6 weeks after surgery in Group – 1 was 0.25D and

maximum amount was 4.0D. The minimum amount of astigmatism 6 weeks after surgery in Group – 2 was 0.25D and maximum amount was 2.0D. The complications were seen in early post-operative period more in superior incision group than in temporal group (Table – 4).

Table – 3: Relationship of No. of cases its distribution among cases.

Type of Astigmatism	Superior Incision Group		Temporal Incision Group	
	No. of Cases	Percentage	No. of Cases	Percentage
0.00 – 0.50	28	56%	26	52%
0.75 – 1.00	6	12%	8	16%
1.25 – 1.50	10	20%	10	20%
1.75 – 2.00	6	12%	6	12%
Total:	50	100%	50	100%
Postoperative Astigmatism after One Week Surgery				
No Astigmatism	–	–	–	–
0.25 – 2.00	–	–	20	40%
2.25 – 3.00	–	–	14	28%
3.25 – 4.00	12	24%	10	20%
4.25 – 5.00	6	12%	4	8%
5.25 – 6.00	10	20%	2	4%
6.25 – 7.00	12	24%	–	–
7.25 – 8.00	4	8%	–	–
8.25 – 9.00	4	8%	–	–
>9.00	2	4%	–	–
Total	50	100%	50	100%
Frequency of Value of Cylinder after 6 Weeks of Surgery				
0 – 0.50	10	20%	20	40%
>0.5 – 1.00	22	44%	15	30%
>1.00 – 2.00	10	16%	11	22%
>2.00	8	20%	4	8%
Total	50	100%	50	100%

Table – 4: Early Post-operative Complications.

Complications	Superior Incision Gp		Temporal Incision Group	
	No. of Cases	Percentage	No. of Cases	Percentage
Gaping of incision	–	–	–	–
Striate keratitis	16	32%	4	8%
Flat AC	–	–	–	–
Anterior capsular drugs	–	–	–	–
Raised IOP	2	4%	4	8%
Iridocyclitis	6	12%	3	6%
Hyphaemia	–	–	–	–
Residual cortical matter	–	–	–	–
Irregular pupil	4	8%	3	6%
Endophthalmitis	–	–	–	–
Poor centration of IOL	–	–	–	–
Total	28	56%	14	28%

In this study with 100 patients, Superior Incision Group consisted of 30 patients with immature senile cortical cataract of 15 patients were with mature cataract and 5 patients were with hyper mature cataract. Temporal Incision Group, consisted of 25 patients with immature senile

cortical cataract, 18 patients with mature cataract and 7 patients were with hyper mature cataract (Table – 5). Astigmatism was cleared in temporal group when compared to superior incision group (Table - 6).

Table – 5: Types of cataracts operated.

Type of Cataract	No. of cases		No. of cases	
	Superior Incision Gp	Group 2	Superior Incision Gp	Group 2
Immature cataract	30	25	60	50
Mature cataract	15	18	30	36
Hyper mature cataract	5	7	10	14
Total:	50	50	100	100

Table – 6: Relationship of Type of Astigmatism at Surgery and after 6 week.

Type of Astigmatism at Surgery	Superior Incision Group		Temporal Incision Gp	
	No. of cases	Percentage	No. of cases	Percentage
No astigmatism	–	–	2	4%
Astigmatism with the rule	6	12%	34	68%
Astigmatism against the rule	40	80%	8	16%
Oblique astigmatism	4	8%	6	12%
Total:	50	100%	50	100%
Astigmatism after 6 Weeks				
No astigmatism	–	–	2	4%
Astigmatism with the rule	10	20%	30	60%
Astigmatism against the rule	32	64%	14	28%
Oblique astigmatism	8	16%	4	8%
Total:	50	100%	50	100%

Table – 7: Corrected Visual Acuity.

Preoperative Visual Acuity	Superior Incision Group		Temporal Incision	
	No. of Cases	Percentage	No. of Cases	Percentage
6/60	6	12%	8	16%
C6/60 – CF – 1mt <6/60 – CF – 1mt	16	32%	20	40%
Close to face <CF – 1mt – HM <CF – 1mt – HM+	24	48%	16	32%
Light perception PL+	4	8%	6	12%
Total	50	100%	50	100%
Final Corrected Visual Acuity				
6/6 – 6/9	27	54%	29	58%
6/12 – 6/8	13	26%	17	34%
6/24 – 6/36	5	10%	4	8%
6/60	5	10%	–	–
Total	50	100%	50	100%

After 6 weeks of postoperative follow-up, visual acuity of every patient was recorded after giving proper pseudophasic correction. Temporal Incision has 92% 6/6 -6/9 and 6/12-6/18 visual acuity (Table – 7).

Other Preoperative Observations: Intraocular pressure in all eyes preoperatively ranged between 14.6mm of Hg and 20.6mm of Hg. Eyes with IOP exceeding 20.6mm of Hg were excluded from the study.

Slit Lamp Examination: Only eyes with no intra-ocular pathology were selected.

Discussion

Cataract or opacification of lens is extremely common global problem. The surgical of cataractous lens through a wound, which heals with an invisible scar seemed an approach to perfection. With the advent of microsurgical procedures, the modern day ophthalmology is concerned not only with managing the ocular pathology i.e., cataract extraction but, also with improving the postoperative optical function of the human eye. The astigmatic component of refractive error following cataract surgery remains the greatest obstacle to achievement of this goal.

Both safe surgery and postoperative emmetropia are important both for patient and do operating surgeon. As already known, cataract is the most common preventable cause of blindness worldwide, surgery is the important tool to tackle problem. There are many recent advances in cataract surgery.

Cataract surgery includes various types like: ICCE which is intracapsular cataract extraction, where cataractous lens is removed completely with intact capsule. There is more risk of zonular detriscence, usually not advisable in young patients and implantation of intraocular lens is also not possible following surgery.

Later ECLE with posterior chamber intraocular lens implantation, introduced by surgeons, which is extracapsular cataract extraction with posterior chamber intraocular lens implantation. The risk of zonular detriscence is avoided in this surgery and there is every possibility to implant intraocular lens in posterior capsular bag.

ECEE again includes various types like ECCE:

- Conventional ECCE with PCIOL implantation.
- Manual SICS (small incision cataract surgery) with PCIOL implantation.
- Phacoemulsification

Recently “phaconit” also done by surgeons with negligible or no astigmatism.

Age and Sex Incidence: Majority (75%) of patients of the present study who underwent cataract extraction belong to age group of above 50 years with maximum preponderance in the age group of between 61-70 years. Duke Elder reported that cataract occurred in 65% of people in sixth decade and over 95% in above 65 years. This age incidence was consistent with the findings reported by Duke Elder [4].

Males outnumbered females in both Groups 1 and 2 i.e., 111 and 89 respectively. This difference in the incidence of male to female ratio would be a coincident as either of the sex did not have any kind of bearing on the development of cataract.

Placement of incisions: A sclera tunnel superior incision was made in Group – I Superior Incision Group cases and a temporal incision in Group – 2 cases.

Kirby observed and reported that transitional tissue at the limbus healed rapidly [5]. Author noted that with limbal incision the chances of bleeding from deep vessels of sclera are very less. Some prefer purely corneal incision instead of limbal incision with or without conjunctival flap. With pure corneal incision there had been no chance of hyphaema, better access of instruments and unobstructed view of anterior chamber. But other authors stressed that pure corneal incision healed very slowly and Jaffe blamed that with such incisions there would be much induced astigmatism [6].

Jaffe NS., et al. [7] preferred pars plana entrance into the eye for cataract surgery and reported

quicker healing. He recorded that this technique eliminated postoperative astigmatism. Girard [8] introduced the sclera tunnel incision as these induce less astigmatism. Gill and Sanders also started that astigmatism is inversely proportional to the distance the incision is placed from the limbus [9].

Astigmatism

Preoperative Astigmatism: The preoperative value of astigmatism was recorded in each case. 34 cases (12%) had no astigmatism, 49 cases (50%) had astigmatism with the rule and 87 cases (38%) had astigmatism 'against the rule'. Mean value of preoperative astigmatism was 0.87D. The preoperative incidence of physiological astigmatism in our series was 80%, as compared 95% by Duke Elder [4].

Postoperative Astigmatism: Range, Mean and Standard Deviation were calculated for each group.

After 7 Days of Surgery: The mean induced astigmatism was 6.00D in Superior Incision Group and 2.75D in Group – 2. The standard deviation was 1.82 and range was 3.5 – 9.5 in Superior Incision Group. The standard deviation was 1.30 and range was 0.5 – 6.0 in Group – 2.

After 6 Weeks of Surgery: The mean induced astigmatism was more than 2.00 D in 20% of cases in Superior Incision Group and more than 2.00D in 8% of cases in Group – 2. The standard deviation was 1.17 and range was 2 – 6 in Superior Incision Group. The standard deviation was 0.70 and range was 0 – 4 in Group – 2.

These observations of the present study in both the groups show that astigmatism in the immediate postoperative period is high and reduces with time. These observations are in agreement with reports of various authors available in literature.

Changes in Type of Astigmatism after 6 Weeks: In the Superior Incision Group Group – I, 64% of patients (32) had astigmatism against the rule, 20% (10) of patients had astigmatism

with the rule and 16% (8) patients had oblique astigmatism. While in Group – 2, 60% (30) patients had astigmatism with the rule, 28% (14) patients had astigmatism against the rule 8% (4) patients had oblique astigmatism and 4% (2) patients had no astigmatism.

Lamba and Sood [10] found that there was an increase of 0.53D of spherical equivalent and a decrease of 1.22D in the cylindrical value of postoperative astigmatism from the first to final follow-up. Nirankari M. S. [11] noted against the rule astigmatism in 70% of cases after sclera flap incision for cataract surgery.

Postoperative Complications

Striate Keratitis: In Group – I striate keratitis was present in 4 (8%) cases. In Group – 2, 16 (32%) cases had striate keratitis. Striate keratitis was more in Temporal Incision Group cases because more manipulation had been done for the removal of nucleus and cortical matter, and insertion of intraocular lens in Group – 2 cases as compared to Group – I cases.

Iridocyclitis: Early postoperative iridocyclitis can be caused because of surgical manipulation and retained lens matter. In the present study 3 cases of postoperative uveitis were seen in Group – I and 6 cases in Group – 2 on second postoperative day. The cells and flare subsided after 5-6 days of treatment with corticosteroid and mydriatic.

The results of the study are almost same as the studies done in recent literature that is the postoperative refractive status is better with temporal incision than superior incision and the amount of astigmatism is also less with temporal incision.

Therefore practically temporal incision in cataract surgery gives good visual outcomes in postoperative period. This study is very much useful as it evaluates the refractive status postoperatively and enlightens the significance of temporal incision in small incision cataract

surgery, when compared to superior incision commonly done by majority of the surgeons.

Surgeons should also kept in mind the minor risk of infection, which is more with temporal incision in small incision cataract surgery, as the site of incision will not be protected by eyelids completely and there is possibility of infection. But this is not the limitation for temporal incision in small incision cataract surgery. As this risk is very less likely to occur if strict aseptic precautions are followed and it is avoidable. But practically, in this study there occurred no risk of infection and all patients had good visual outcome. The outcome or results of this study are much important, not only from surgeons point of view, in decreasing the amount of astigmatism but also from patients point of view.

Merits and Demerits of SICS:

Merits:

SICS – Small incision cataract surgery has universal applicability, with good learning curve and it is not machine dependent, with less surgical complications. The surgery is with lens operating time and is cost effective.

Demerits:

Includes conjunctival congestion persists for 5-7 days at the site of conjunctival flap; Mild tenderness may be present, with risk of postoperative hyphaema and late visual rehabilitation when compared to phaco. The same study is more useful if done in phacoemulsification that is by comparing the amount of postoperative refractive status in superior and temporal incision with posterior chamber interocular implantation. The more recent advances in type of cataract surgery include “PHACONIT”, with negligible astigmatism.

Conclusion

Various techniques were developed for cataract extraction. After doing this study, the amount of astigmatism was less in temporal incision SICS than superior incision SICS. The postoperative

refractive status, is also good in temporal incision SICS than superior incision SICS.

Advantages of temporal incision SICS are as follows:

- Less surgically induced astigmatism
- Easy to manipulate instruments during surgery, in cases with sunken eyes
- Better patient comfort, less foreign body sensation
- Low cost
- Easy learning curve

Hence, temporal incision small incision cataract surgery gives lesser astigmatism and good visual outcome (postoperative refractive status) compared to superior small incision cataract surgery with PCIOL.

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