


Original Research Article

# A study of the effect of wound modulation on postoperative astigmatism following manual small incision suture less scleral tunnel cataract surgery

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## Abstract

**Introduction:** Globally cataract is the major cause for blindness. About 75% of cases preventable causes of blindness in developing countries are attributed to cataract. As per available literature so many studies are available to study how to control the surgically induced astigmatism in variety of cataract surgeries. In the current study we aimed to focus on the effect of factors like wound modulation, and also role of superior or temporal scleral tunnel incisions on the post-operative astigmatism.

**Objective:** To study the effect of wound modulation on postoperative astigmatism following manual small incision suture less scleral tunnel cataract surgery by either superior or temporal incision.

**Materials and methods:** The study was a hospital based quasi experimental study, conducted in the department of ophthalmology at NRI Medical College and General Hospital, Chinakakani, Andhra Pradesh state from August 2014 to August 2015. A total of 100 randomly selected subjects undergoing cataract surgery by suture less non phaco small incision sclera tunnel technique were included.

**Results:** 36% of the patients included in this study for superior small incision sutureless non phaco cataract surgery pre operatively had with the rule astigmatism and 42% had against the rule astigmatism and no astigmatism is seen in 22% of cases. Pre operatively 34% of the patients included

in this study for temporal small incision suture less non phaco cataract surgery had with the rule astigmatism and 48% had against the rule astigmatism and no astigmatism is seen in 18% of cases. In cases subjected to superior small incision suture less non-phaco cataract surgery showed against the rule astigmatism and in 72% and with the rule in 20% and no astigmatism in 4% of cases. In cases subjected to temporal small incision suture less cataract surgery had surgically induced astigmatism of with the rule in 84% and only 8% had against the rule and no astigmatism was found in 8% of cases. At six weeks 86% of cases subjected to superior small incision suture less non –phaco cataract surgery had surgically induced astigmatism of against the rule type and in 12% with the rule type and 2% had no astigmatism. In cases subjected to temporal small incision suture less non-phaco cataract surgery there was surgically induced astigmatism of with the rule type in 86% of cases ad 8% of against the rule type and 6% had no astigmatism. In cases subjected to temporal suture less non – phaco small incision cataract surgery induced astigmatism by 3 weeks was 0.69D in with the rule type and 0.31D in against the rule type and the average total was about 0.66D. By 6 weeks the mean surgically induced astigmatism in superior SICS was 0.71D in with the rule type and 1.51D in against the rule type and an average of 1.01D in total. In cases subjected to temporal SICS it was 0.69D in with the rule type and 0.33D in against the rule type and a total of 0.66 D by 6 weeks.

**Conclusion:** Temporal small incision cataract surgeries shows less induced astigmatism whereas superior small incision cataract surgeries higher SIAS values.

## Key words

Wound modulation, Astigmatism, Scleral tunnel cataract surgery, Temporal incision.

## Introduction

Globally cataract is the major cause for blindness. Now a day's one of the common problem facing by developing countries is cataract. In 75% of cases, it may be the reason for blindness. The blindness because of cataract is manageable by surgery [1, 2]. Cataract surgery is the best way to restore vision, it gives almost normal vision [2]. Cataract surgery is most common refractive surgical procedure performed in older adults. Using of advanced technology during surgery leads its improvement, like smaller incisions with better out comes [2, 3].

Cataract surgery using advanced technologies is almost reaching the needs of patients like better post-operative vision like normal humans, avoiding of usage spectacles, less post-operative astigmatism [2]. Many studies in the past have documented that both Phacoemulsification and SICS are good techniques in case of safety and also their effectiveness. Among these two techniques, even though Phacoemulsification is dominant in better post-operative vision with less astigmatism, Small incision cataract surgery is

more preferable because of low cost and also suggestable to less resourced settings [4-6]. The main reason for high astigmatism in Manual SICS is because of large size and site of incisions [5, 7].

Few studies in the past also have documented on postoperative astigmatism induced in manual SICS done with a superior, superotemporal and temporal scleral tunnel incision have been compared [5, 7]. Supero temporal and temporal scleral tunnel incisions are better than superior approach in all aspects like good post-operative vision with less surgically induced astigmatism (SIA) and faster recovery due to lack of suture tension [2, 5-10].

As per available literature so many studies are available to study how to control the surgically induced astigmatism in variety of cataract surgeries, but only few are available on non-stitch technique or suture less cataract surgery and its effect on SIA [11-14]. In the current study we aimed to focus on the effect of factors like wound modulation, and also role of superior

or temporal scleral tunnel incisions on the postoperative astigmatism.

## **Aim**

To study the effect of wound modulation on postoperative astigmatism following manual small incision suture less scleral tunnel cataract surgery by either superior or temporal incision.

## **Materials and methods**

### **Study design and study site:**

The study was a hospital based quasi experimental study, conducted in the department of ophthalmology at NRI Medical College and Hospital, Chinakakani, from August 2014 to August 2015.

### **Study population**

People undergoing cataract surgery by suture less non phaco small incision sclera tunnel technique during the study period were the study participants.

### **Sample size and sampling method**

A total of 100 study participants were randomly allocated into two intervention groups, after checking for compliance with inclusion and exclusion criteria.

### **Inclusion and exclusion criteria**

The inclusion criteria for the study were, the patients undergoing cataract surgery by manual - SICS with PCIOL implantation done either superior or temporal section.

People with below conditions were excluded from the study.

- Any corneal diseases which would change/ alter its normal curvature resulting in irregular astigmatism like corneal opacities, keratoconus, peripheral corneal thinning.
- Traumatic cataract with corneal injury
- Corneal dystrophies and degeneration
- Large pterygium encroaching on to the cornea which could alter corneal curvature
- Pseudoexfoliation, lens induced glaucoma, subluxated lens

- Any post-operative complications like striate keratopathy, vitreous loss, wound leak and shallow anterior chamber.

## **Study procedure**

### **Pre-operative work up**

Patients were admitted one day prior to the surgery. After taking a detailed history, careful anterior segment examination was done by slit lamp and then visual acuity was checked with Snellens chart unaided and with pinhole and then any improvement of vision was tried by refraction with auto refractometer. After this patient was subjected to dilatation with tropicamide and phenylephrine eye drops and a detailed fundus examination was carried out with 90D lens in possible cases and if necessary indirect ophthalmoscopy was performed in certain cases.

Routine pre-operative investigations were performed like keratometry by Baush and Lomb keratometer and axial length was calculated by A-scan. After that intra ocular pressure was tested and lacrimal patency was checked by syringing. An informed consent was taken and in the eye to be operated lashes was cut and preoperative medication like antibiotic eye drops, diamox and valium was given. On the next day, the eye to be operated was dilated with tropicamide and phenylephrine eye drops and flurbiprofen eye drops were used for maintenance of dilatation. All the cases were done under local anesthesia with peribulbar technique. After cleaning and draping lid speculum was put. After giving conjunctival incision a fornix based flap was raised in superior scleral section and in temporal section, conjunctiva was cut and separated from the limbus. Cautery was not used to avoid the influence on postoperative astigmatism.

### **Operative procedure**

A straight incision of about 6.5mm was given about 2 mm away from the limbus either superiorly (or) temporally and tunnelling was done with a crescent blade into the clear cornea for 1-1.5 mm. A side port entry of 1.5 mm was

created 3 clock hours way from the main incision. Methylene blue dye was injected into the anterior chamber after injecting air. Now cystitome was prepared with a 26G needle. The dye was washed out and viscoelastic was injected into the anterior chamber and continuous curvilinear capsulorhexis was done of approximately 6 mm diameter. By hydrodissection cortex was separated from the capsule. After this the nucleus was brought into the anterior chamber with the help of cystitome. Viscoelastic was injected in front and behind the lens. Nucleus was expressed out with the help of a vectis and a dialor. A clean cortical wash was given with a symcoe's cannula and viscoelastic was injected into anterior and posterior chambers and a posterior chamber intraocular lens was placed in the bag. Entire viscoelastic was aspirated and chamber was reformed with RL and any wound leak was tested. A sub – conjunctival injection of Gentamycin and Dexamethasone was given and the lid speculum was taken out and lids were closed with a forceps and pad and bandage was applied.

Antibiotic, NSAID and Diamox tablets were given on the day of surgery. On the 1<sup>st</sup> postoperative day after slit lamp examination antibiotic–steroid combination drops were instilled 8 times a day and mydriatics were give 2 times a day and the patients were discharged after giving post operative instructions and were informed about their visits. After 2 weeks, mydriatics were stopped and antibiotic-steroid drops were slowly tapered over 6 weeks.

### **Postoperative follow-up**

Patients were examined periodically on day 1, after 1 week, 3 weeks and at 6 weeks. The examination was done with keratometry and Slit lamp bio microscopy. The course of postoperative astigmatism changes were determined by keratometry and readings were tabulated for corresponding periods in all the 100 cases. Glasses were prescribed after 6 weeks by using an auto refractometer and subjective verification.

### **Statistical analysis**

Various types of astigmatism were considered as primary outcome variables. Suture less scleral tunnel non-phaco cataract surgery done by either superior (or) temporal section and its change over a period of time with wound modulation was the primary explanatory variable. Descriptive analysis of the data was done by using frequency and percentage for categorical variables, mean and standard deviation for quantitative variables. The mean values of the astigmatism were compared among study groups by using the students t-test. P value 0.05 was considered as statistically significant. IBM SPSS version 21 was used for statistical analysis.

### **Results**

A total of 100 participants were included in the final analysis, out of which 50 were subjected to superior section and the remaining 50 were done by temporal section. Out of which 40 were males and remaining 60 were females. Age groups ranged in between 40 to 90 years (**Table - 1**).

36% of the patients included in this study for superior small incision sutureless non phaco cataract surgery pre-operatively had with the rule astigmatism and 42% had against the rule astigmatism and no astigmatism is seen in 22% of cases. Pre operatively 34% of the patients included in this study for temporal small incision suture less non phaco cataract surgery had with the rule astigmatism and 42% had against the rule astigmatism and no astigmatism is seen in 18% of cases.

In cases subjected to superior small incision suture less non-phaco cataract surgery showed against the rule astigmatism and in 76% and with the rule in 20% and no astigmatism in 4% of cases. In cases subjected to temporal small incision suture less cataract surgery had surgically induced astigmatism of with the rule in 84% and only 8% had against the rule and no astigmatism was found in 8% of cases (**Table - 2**).

After 3 weeks 82% of cases subjected to superior small incision sutureless non phaco cataract surgery showed against the rule 14% of cases showed with the rule astigmatism, and 4% had no astigmatism. In cases subjected to temporal suture less non-phaco small incision cataract surgery 84% of cases showed with the rule type of surgically induced astigmatism and 8% of against the rule variety and 8% showed no astigmatism.

**Table - 1:** Description of the study groups (N=120).

| Age group (Years) | Male       | Female      | Total     |
|-------------------|------------|-------------|-----------|
| 40-50             | 8 (20%)    | 6 (10%)     | 14 (14%)  |
| 51-60             | 7 (17.5%)  | 23 (38.33%) | 30 (30 %) |
| 61-70             | 17 (42.5%) | 29 (48.33%) | 46 (46%)  |
| 71-80             | 5 (12.5%)  | 2 (3.33%)   | 7 (7%)    |
| 81-90             | 3 (7.5%)   | 0 (0.0%)    | 3 (3%)    |
| Total             | 40         | 60          | 100       |

**Table - 2:** Prevalence of various types of astigmatism in the study population.

| Type of astigmatism | No. of cases  |                | Chi square value | P-value |
|---------------------|---------------|----------------|------------------|---------|
|                     | Pre-operative | Post-operative |                  |         |
| <b>I. Superior</b>  |               |                |                  |         |
| With the rule       | 18 (36%)      | 10 (20%)       | 13.41            | 0.001   |
| Against the rule    | 21 (42%)      | 38 (76%)       |                  |         |
| No astigmatism      | 11 (22%)      | 2 (4%)         |                  |         |
| <b>II. Temporal</b> |               |                |                  |         |
| With the rule       | 17 (34%)      | 42 (84%)       | 26.8             | <0.001  |
| Against the rule    | 24 (42%)      | 4 (8%)         |                  |         |
| No astigmatism      | 09 (18%)      | 4 (8%)         |                  |         |

At six weeks 86% of cases subjected to superior small incision suture less non –phaco cataract surgery had surgically induced astigmatism of against the rule type and in 12% with the rule type and 2% had no astigmatism. In cases subjected to temporal small incision suture less non-phaco cataract surgery there was surgically induced astigmatism of with the rule type in 86% of cases ad 8% of against the rule type and 6% had no astigmatism (**Table - 3**).

**Magnitude of astigmatism:**

Magnitude of astigmatism during the first week in patients subjected to superior small incision sutureless non-phaco cataract surgery was below 0.5D in 54% of cases and in the range of 0.5D to 1.00D in 30% of cases and in 12% of cases it was in the range of 1-2D and in only 4% of cases it was more than 2D. In patients subjected to

temporal small incision cataract surgery 84% of patients had astigmatism below 0.50D and 14% had in the range of 0.5D to 1.00D and in only 2% of cases it was more than 1.00D.

In patients subjected to superior suture less non-phaco small incision cataract surgery magnitude of astigmatism during 3<sup>rd</sup> week was below 0.5D in 28% of cases in 42% of cases it was between 0.6-1.00 and in 20% it was in the range of 1-2D and in 10% it was above 2.00D. In patients subjected to temporal suture less non-phaco small incision cataract surgery magnitude of astigmatism during 3<sup>rd</sup> week was less than 0.5 D in 48% of cases and in 44% of cases it was between 0.5-1.00D and in only 8% of cases it was above 1.00 D.



In patients subjected to superior small incision suture less non-phaco cataract surgery the magnitude of astigmatism by 6 weeks was below 0.50D in 22% and 36% in the range of 0.50D to 1.00D, 34% in the range of 1.00-2.00D and 8% had more than 2.00D. In patients with temporal small incision suture less non-phaco cataract surgery the magnitude of astigmatism was below 0.50D in 56% and in 36% it was between 0.50D to 1.00D and only 8% showed between 1.00 to 1.50D and none showed greater than 1.50D by 6 weeks (**Table - 3**).

**Table - 3:** Pattern and magnitude of astigmatism at different time periods during the post-operative follow up period.

|                                 | Week 1   |          | Week 3   |          | Week 6   |          |
|---------------------------------|----------|----------|----------|----------|----------|----------|
|                                 | Superior | Temporal | Superior | Temporal | Superior | Temporal |
| <b>Pattern</b>                  |          |          |          |          |          |          |
| With the rule                   | 10 (20%) | 42 (84%) | 07 (14%) | 42 (84%) | 06 (12%) | 43 (86%) |
| Against the rule                | 38 (76%) | 04 (8%)  | 41 (82%) | 04 (8%)  | 43 (86%) | 04 (8%)  |
| No astigmatism                  | 02 (4%)  | 04 (8%)  | 02 (4%)  | 04 (8%)  | 01 (2%)  | 03 (6%)  |
| <b>Magnitude of astigmatism</b> |          |          |          |          |          |          |
| 0-0.50                          | 27 (54%) | 42 (84%) | 14 (28%) | 24 (48%) | 11 (22%) | 28 (56%) |
| 0.60-1.00                       | 15 (30%) | 07 (14%) | 21 (42%) | 22 (44%) | 18 (36%) | 18 (36%) |
| 1.10-1.50                       | 05 (10%) | 01 (2%)  | 08 (16%) | 04 (8%)  | 11 (22%) | 04 (8%)  |
| 1.60-2.00                       | 01 (2%)  | Nil      | 02 (4%)  | Nil      | 06 (12%) | Nil      |
| 2.10-2.50                       | 01 (2%)  | Nil      | 04 (8%)  | Nil      | 04 (8%)  | Nil      |
| >2.50                           | 01 (2%)  | Nil      | 01 (2%)  | Nil      | Nil      | Nil      |
| <b>Mean Astigmatism</b>         |          |          |          |          |          |          |
| With the rule                   | 0.70     | 0.48     | 1.08     | 0.69     | 0.71     | 0.69     |
| Against the rule                | 0.76     | 0.31     | 0.98     | 0.31     | 1.51     | 0.33     |
| No astigmatism                  | 0.72     | 0.43     | 0.99     | 0.66     | 1.01     | 0.66     |

### Mean Astigmatism

During first week surgically induced astigmatism was 0.70D of with the rule type and 0.76D of against the rule type and on an average of 0.72D in total in cases subjected to superior sutureless small incision cataract surgery.

The mean surgically induced astigmatism in temporal SICS was 0.48D of with the rule type and 0.31D of against the rule type and an average total of 0.43D by first week. The mean surgically induced astigmatism in superior sutureless non-phaco small incision cataract surgery cases was 1.08D of with the rule type and 0.98D of against the rule type and on the whole it was 0.99D by 3 weeks.

In cases subjected to temporal suture less non – phaco small incision cataract surgery induced astigmatism by 3 weeks was 0.69D in with the rule type and 0.31D in against the rule type and the average total was about 0.66D. By 6 weeks the mean surgically induced astigmatism in superior SICS was 0.71D in with the rule type and 1.51D in against the rule type and an average of 1.01D in total. In cases subjected to temporal SICS it was 0.69D in with the rule type and 0.33D in against the rule type and a total of 0.66 D by 6 weeks (**Table - 3**).

### Discussion

As per available literature so many studies are available to study how to control the surgically induced astigmatism in variety of cataract surgeries, but only few are available on non

strich technique or suture less cataract surgery and its effect on SIA [11-14].

Few studies in the past also have documented on postoperative astigmatism induced in manual SICS done with a superior, superotemporal and temporal scleral tunnel incision have been compared [2, 5, 7]. Supero temporal and temporal scleral tunnel incisions are better than superior approach in all aspects like good post-operative vision with less surgically induced astigmatism (SIA) and faster recovery due to lack of suture tension [2, 5-10]. Current study has focused on to compare the astigmatism post and preoperatively between superior and temporal SICS groups, this study also focused on pattern, magnitude of astigmatism at 1 week, 3 weeks and 6 weeks during post-operative follow up period.

In the current study nearly 36% of the patients of superior small incision suture less non phaco cataract surgery preoperatively had WTR astigmatism, 42% had ATR astigmatism and only 22% had no astigmatism. Post operatively the same group of patients was 76% had moved to ATR astigmatism only 20% of them had WTR astigmatism, 4% had no astigmatism. Temporal small incision suture less non phaco cataract surgery people in post-operative condition, 34% had WTR, 42% had ATR astigmatism and 18% had no astigmatism where as In post operatively 84% belongs to WTR astigmatism, 8% with ATR and only 8% had no astigmatism. Like the current study Barequet I. S., et al. [15], Cillino S., et al. (1997) [16] had shown significant shift towards WTR in temporal approach.

In case of Superior approach at 1 week follow 76% of the study participants were had ATR astigmatism, at 3 weeks 82% and 6 weeks 86% were had ATR, but in case of temporal approach significant shift to WTR astigmatism, 84%, 84% and 86% respectively at three follow ups. Studies of Barequet I. S., et al. [15], Simsek S., et al. [17] also supporting the current study, in superior approach ATR astigmatism was

significantly higher than the temporal incisions at post-operative follow ups.

The magnitude of SIA was also low at post-operative follow ups in temporal approach than the superior approach. At first week in temporal approach only 2% of cases were more than 1D, 8% in other two follow ups, but in case of superior approach 4%, 10% and 8% respectively at 3 follow ups were more than 2D. No cases were found more than 2D in case of temporal approach. The study by Simsek S., et al. [17] also have documented low magnitude of SIA values in temporal approach.

The mean values of astigmatism in superior approach at 3 follow ups were 0.70 D, 0.98D, 1.51 D respectively in against rule type where as in temporal approach, 0.48D, 0.69D, 0.69 D respectively in with the rule type. Superior approaches leads to fluctuating towards against the rule type astigmatism which is significantly higher than the temporal approaches. Few older studies like Lyhne N., et al. [18] and Simsek S., et al. [17] also recorded same observations.

## Conclusion

Temporal small incision cataract surgeries shows less surgically induced astigmatism whereas superior small incision cataract surgeries show higher SIA values.

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