Original Research Article

# Effect of clear corneal incision on postoperative astigmatism after phacoemulsification surgery

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## Abstract

**Background:** Phacoemulsification with foldable I.O.L implantation is the global bench mark for treatment of cataract with excellent postoperative results. Manual SICS is inexpensive, and requires minimal infrastructure in comparison to phacoemulsification, therefore it is a preferred option in low cost settings such as developing countries. **Aim and Objectives:** To study the effects of clear corneal incision on postoperative astigmatism after phacoemulsification surgery **Material and Methods:** It's a prospective study done on a total of 22 patients who underwent manual suture less SICS with superotemporal incision, between august 2015 to august 2016 for a period of 1 year at tertiary health care centre. The course of post-operative astigmatic changes were determined by keratometry performed with a standard calibrated Bausch and Lomb keratometer. **Results:** No any patient who underwent superotemporal incision showed high SIA (Surgically Induced Astigmatism) above 2.5 dioptre (D) at any given time, whereas on the contrary, less than 1 D of SIA was seen in 86.36 % patients. The incidence of post-operative against the rule (ATR) astigmatism increased from27.27 % to 40.90% i.e., by 13.63%. While, the incidence of post-operative with the rule (WTR) astigmatism decreased in superotemporal incision group and its decreased by 13.64 %. **Summary and Conclusions:** The decay of astigmatism from 3rd to 6th week in superotemporal incision is negligible implying early wound stabilization and therefore early spectacle correction (by 3rd week after surgery) in superotemporal incision type. Decreased astigmatism leads to better visual function and increased patient satisfaction.

**Key Words:** Astigmatism, Phacoemulsification.

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## INTRODUCTION

The cataract is defined as opacity of the human crystalline lens capsule or its substance. It is the leading cause of visual disability in the world. Modern cataract surgeries like SICS and Phacoemulsification with IOL are considered safest, successful and frequently performed surgery. Manual SICS is inexpensive, and requires minimal infrastructure in comparison to phacoemulsification, therefore it is a preferred option in low cost settings such as developing countries.[1]The aims of modern cataract surgery are minimal postoperative astigmatism, rapid visual rehabilitation, and the best possible visual acuity. Donder (1984) first noticed that astigmatism often occurred after cataract surgery. Postoperative astigmatism has remained the only obstacle to the achievement of good uncorrected visual acuity after successful cataract surgery. Post-operative astigmatism may lead to decreased visual acuity, glare, monocular diplopia, asthenopia and distortion of image after a good cataract surgery. Good Postoperative vision preferably without spectacles is considered as the bench mark of modern cataract surgery.[2] Clear corneal incisions have several potential advantages over corneoscleral incisions: they avoid conjunctival scarring, a result beneficial for glaucoma patients who may eventually need a filtering procedure; they have a lower risk for conjunctival hemorrhage and hyphema; early postoperative alteration of the blood– aqueous barrier is reduced; the shorter

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tunnel allows better visualization during surgery and hence a faster procedure that is more suitable for using topical anaesthesia; and the incision can be performed temporally, allowing easy access to the eye, especially in patients with deep-set globes.[3,4]Phacoemulsification is increasingly applied in the management of cataract because of earlier refractive stabilization, reduced astigmatism, and milder postoperative inflammation. Although such a large corneal incision is no longer a matter with phacoemulsification, in this method denervation of the corneal nerve which has greatest density in temporal site may again leads to decreased corneal sensation and subsequent dry eye.[5]

## MATERIAL AND METHODS

The present prospective study was done on patients who underwent manual suture less SICS (small incision cataract surgery) with a total of 22 patients with superotemporal incision, between august 2015 to august 2016 for a period of 1 year at tertiary health care centre were studied. All patients with senile cataract were included in the present study. Patients with corneal degenerations, dystrophies, traumatic cataract and patients with pre-operative oblique astigmatism were excluded from the study. The majority of the patients who underwent surgery were in the age group of 50 to 60 years. A thorough pre-operative evaluation of the cases including pre-operative keratometry, slit lamp examination and A-scan were done. All surgeries in the study were done by phacosurgeons of ophthalmology department. In the superotemporal sclera incision type, an incision of 6.5 mm was fashioned 3mm behind the limbus extending from 9 O' Clock to 11 O' Clock meridians. A backward cut of l-1.5mm, radial to the limbus was made from each edge of the incision. A scleral tunnel was fashioned with a crescent blade. The incision extended approximately 1mm into the cornea. The dissertation was carried out towards the limbus on both sides to create a funnel shaped "pocket". Anterior chamber was entered with the keratotome and then formed with vicomet. Anterior capsulotomy was performed with a bent 26-gauge needle. Hydro dissection was done. The incision was then extended and the nucleus was delivered out by sandwich method. Cortical aspiration was done using Simcoe cannula. Posterior chamber intra ocular lens (PCIOL) was inserted in all cases. The anterior chamber was then reformed with balanced salt solution. On the immediate post-operative day, keratometry readings were taken in all patients. Post-operatively topical steroids and antibiotics second hourly were given. Generally the drops were tapered down to four times daily until a month after surgery. Tropic amide eye drops was prescribed for the first 2 weeks following surgery to all patients. Periodic examinations (Keratometry and slit lamp examination) were performed at 1st week, 3rd week and 6th week post-operatively. For the simplification of analysis, all the astigmatic changes (pre-operative and post-operative) were studied only in the vertical or horizontal axis (only at 90° and or at 180°). Oblique astigmatism was not studied. The course of post-operative astigmatic changes were determined by keratometry performed with a standard calibrated Bausch and Lomb keratometer. Appropriate statistical methods were used for the data analysis.

## RESULTS AND OBSERVATIONS

From the present study, the follow up of the cases showed that there was no any patient who underwent super temporal incision showed high SIA above 2.5 dioptre (D) at any given time, whereas on the contrary, less than 1 D of SIA was seen in 86.36 % patients in this super temporal group (Table-1).

**Table 1:** Follow up of the astigmatism pattern in patients undergoing superotemporal incision

| Astigmatism in diopter | Supero-temporal incision | |
|---|---|---|
| | Frequency | Percentage |
| </= 0.5 | 10 | 45.46 |
| 0.6-1 | 09 | 40.90 |
| 1.1-1.5 | 02 | 09.09 |
| 1.6-2 | 01 | 04.55 |
| 2.1-2.5 | 00 | 00 |
| >/=2.5 | 00 | 00 |
| **Total** | **22** | **100.00** |

In the present study, the incidence of post-operative against the rule (ATR) astigmatism increased from27.27 % to 40.90 % i.e., by 13.63 % in the super temporal incision type. The incidence of post-operative with the rule (WTR) astigmatism decreased in super temporal incision group and its decreased by 13.64 %. However the decay in ATR astigmatism in super temporal group was from 0.868+/- 0.43 D to 1.04 +/- 2.67 D (a change of 0.172 D) (Table- 2) implying that superotemporal incision is a better approach for patients with pre-operative astigmatism.

**Table 2:** Decay of mean astigmatism in supero-temporal incision

| Period | Number | WTR (Mean and SD) | Number | ATR (Mean and SD) |
|---|---|---|---|---|
| Pre-operative | 11 | 0.53+/-0.28 | 10 | 0.868+/-0.43 |
| 1st week | 12 | 1.03+/-0.59 | 06 | 0.807+/-0.74 |
| 3rd week | 09 | 0.513+/-0.25 | 08 | 0.647+/-0.41 |
| 6th week | 09 | 0.569+/-0.35 | 09 | 1.04+/-2.67 |

**Table 3:** Percentage of astigmatism

| Post-operative | Supero-temporal incision | |
|---|---|---|
| | ATR (%) | WTR (%) |
| 1st week | 06 (27.27) | 12 (54.54) |
| 3rd week | 08 (36.36) | 09 (40.90) |
| 6th week | 09 (40.90) | 09 (40.90) |

**Table 4:** Gross decay of astigmatism in supero-temporal incisions

| Period | Supero-temporal incision | |
|---|---|---|
| | Number | Mean and SD |
| Pre-operative | 22 | 0.653+/-0.382 |
| 1st week | 21 | 0.833+/-0.695 |
| 3rd week | 20 | 0.532+/-0359 |
| 6th week | 20 | 0.487+/-0.358 |

In the superotemporal type of incision pattern, there was a constant decline in the gross astigmatism from 1st to 6th post-operative week. The mean SIA at 1st week after surgery following super temporal incision was 0.833 D that declined to 0.532 D at the end of 3rd week and to 0.487 D at 6th week. Thus, the decline in astigmatism was 0.301D between 1st and 3rd week and 0.045 D between 3rd and 6th week. The change in SIA between 3rd and 6th postoperative group in superotemporal incision type was statistically insignificant ($p > 0.05$) and early spectacle correction can be done with good results.

## DISCUSSION

Corneal astigmatism after phacoemulsification surgery depends on the type, location, and configuration of cataract incision and presence or absence of wound suture. Phacoemulsification with foldable I.O.L implantation is the global bench mark for treatment of cataract with excellent postoperative results. However, it is not always feasible in developing countries like India due to high cost of phacoemulsification machine, and infrastructure. Manual SICS is a good alternative, but there is a concern that visual results may not be comparable to Phacoemulsification. In a study by Sharma N *et al*.[6] found that, the magnitude of SIA was similar in manual SICS and Phacoemulsification when temporal incisions were used during cataract surgery. Also, mean post-operative astigmatism in group undergoing temporal manual SICS was1.08 (±0.55) D and in other group undergoing temporal clear corneal Phacoemulsification was 0.78 (±0.52) D after 1 month of surgery. Incisional astigmatism may be caused by various factors such as incision size, the optical center of the cornea, and surgical approach. [7] Many studies have demonstrated that a temporally located clear corneal incision induces the least astigmatism. Locating the incision superotemporally comforts surgical manipulations. Decreased astigmatism leads to better visual function and increased patient satisfaction.[8] In a study conducted by (Ken and Fuminoroi, 1994)[9] corneal topography was used to assess the surgically induced corneal shape alterations and at end of one month, the mean SIA in superotemporal incision was 0.94±0.66 which was similar to our study. From a study by Nikhil andSaurabh2005, its clear that, a negligable change (0.045D) occurred in astigmatism from 3rd to 6th week in superotemporal incision. Thus, prescription of spectacles can be done as early as 3rd week following superotemporal incision. This study is similar to study where they found superotemporal incision led to early stabilization of astigmatism and early visual recovery. (Nikhil and Saurabh, 2005).[10] Most of the studies conducted in the west, John *et al*.[11], Altan Yaycioglu *et al*.[12], have tried superotemporal approach mainly for phacoemulsification surgery and found that it causes less SIA thus proving the superiority of this incision in clear cornea phacoemulsification surgery.

## CONCLUSION AND SUMMARY

In a developing country like India where manual SICS is still practiced extensively, a simple change in the site of incision can have many advantages. The decay of astigmatism from 3rd to 6th week in superotemporal incision is negligible implying early wound stabilization and therefore early spectacle correction (by 3rd week after surgery) in superotemporal incision type. Clear corneal incision was found to be of advantageous for both the surgeon and the patient on the following grounds,

1. No damage to the conjunctiva, therefore minimal corneal scarring.
2. Astigmatically more stable and predictable refractive outcome
3. Incision site can be planned depending upon the axis of astigmatism, thereby reducing the astigmatism
4. postoperatively.
5. Less time consuming.
6. Early patient rehabilitation.
7. Better patient comfort.
8. Does not hinder future ocular surgeries.
9. Self-sealing.
10. No suture related complications.

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