Section: Ophthalmology

Original Research Article

# POSTOPERATIVE CORNEAL ASTIGMATISM FOLLOWING CATARACT PHACOEMULSIFICATION USING 3.2 MM CLEAR CORNEAL SUPERTEMPORAL INCISION: REPORT FROM A TERTIARY CARE HOSPITAL IN BIHAR

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*Received* : 17/03/2023
*Received in revised form* : 15/04/2023
*Accepted* : 26/04/2023

*Keywords:*
*Postoperative corneal astigmatism, cataract phacoemulsification, corneal supertemporal incision.*

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DOI: 10.47009/jamp.2023.5.3.133

Source of Support: Nil,
Conflict of Interest: None declared

*Int J Acad Med Pharm*
2023; 5 (3); 637-640

## Abstract

**Background:** Cataract poses both a significant socioeconomic burden and a public health concern as it is the leading cause of blindness worldwide and a major cause of visual disability throughout the African continent. The current treatment for cataract is surgery and while phacoemulsification remains the more advanced and technically superior method of cataract surgery, manual small incision cataract surgery (MSICS) is the most popular surgical management option for cataracts in developing countries. **Materials and Methods:** A retrospective study was performed under the Department of Ophthalmology of Darbhanga Medical College and Hospital, Darbhanga, Bihar. The study was conducted on 162 eyes of 148 patients who were operated upon for cataract with intraocular lens implantation in the year May 2022 to April 2023. The follow up period was 6 months. The study was approved by the Institutional ethics Committee. Informed consent was obtained from each patient before enrollment. The patients underwent cataract surgery by phacoemulsification through 3.2 mm superotemporal clear corneal incision (approx. 0.5mm central to the limbus). They were divided into two groups depending upon, "With the Rule" (Group A) or "Against the Rule" (Group B). **Result:** Group A comprised of 68 eyes with mean astigmatism before surgery was 0.79 D and median astigmatism was 0.76 while group B had 94 eyes with a mean and median astigmatism of 0.81 D and 0.78 D, respectively. The mean and median increase in astigmatism post operatively in the two groups was calculated. **Conclusion:** Superotemporal, 3.2 mm clear corneal incision is quite stable and does not significantly increase post operative astigmatism when followed up over a long (several months to years) period of time. This size and site of the incision have also proved to be superior to smaller or larger and superior or sclera incisions respectively.

## INTRODUCTION

Cataract poses both a significant socioeconomic burden and a public health concern as it is the leading cause of blindness worldwide,[1] and a major cause of visual disability throughout the African continent.[2] The current treatment for cataract is surgery,[3] and while phacoemulsification remains the more advanced and technically superior method of cataract surgery, manual small incision cataract surgery (MSICS) is the most popular surgical management option for cataracts in developing countries.[4-6] This is mainly because of the low cost, short surgical time, reduced dependence on technology, and equivalent visual outcome to phacoemulsification.[4-6] The location, size, and shape of incisions used in MSICS influence postoperative surgically induced astigmatism (SIA).[7-9] Temporal approach has been reported to result in smaller SIA than superior approach.[7] Small incisions (6 mm) induced the smallest SIA when compared with medium (6.5 mm) and large (7 mm) incisions.[8] The chevron shaped incision has also been reported to give minimal SIA when compared with straight and frown incisions.[9] Corneal or keratometric SIA is the vector difference between the preoperative corneal or keratometric astigmatism and the postoperative astigmatism.[10]

A medium sized (3.2 mm) superotemporal clear corneal incision has the advantage of its size and


ISSN (O): 2687-5365; ISSN (P): 2753-6556

site. This size does not allow the wound lips to undergo unnecessary stretching, while injecting the IOL, avoiding increase and change in axis of the preoperative astigmatism.[11] The superotemporal site of the incision in the oblique meridian, in fact, has a positive effect on both types of astigmatisms as the steepest meridians are not usually exactly at 180 or 90 degrees,[12] rather these lie in between and have a relative vertical or relative horizontal position as we have considered in our study. Generally, a clear corneal incision placed super temporally leads to smaller postoperative astigmatism by flattening the horizontal corneal axis. This has an advantage as ATR astigmatism is common in older age group.[13] Another factor, which can influence the expected outcome, is axis in which the IOL haptics are placed. If the IOL haptics are placed at 180°, pre-existing WTR astigmatism can be reduced and vice versa.[14] These days' toric intraocular lenses can reduce preexisting astigmatism quite effectively.[15] Femtosecond laser assisted cataract surgery further promises better incision morphology and stability thereby reducing chances of post operative astigmatism.[16]

## MATERIALS AND METHODS

A retrospective study was performed under the Department of Ophthalmology of Darbhanga Medical College and Hospital, Darbhanga, Bihar. The study was conducted on 162 eyes of 148 patients who were operated upon for cataract with intraocular lens implantation in the year May 2022 to April 2023. The follow up period was 6 months. The study was approved by the Institutional ethics Committee. Informed consent was obtained from each patient before enrollment.

The patients underwent cataract surgery by phacoemulsification through 3.2 mm superotemporal clear corneal incision (approx. 0.5mm central to the limbus). They were divided into two groups depending upon, "With the Rule" (Group A) or "Against the Rule" (Group B). WTR astigmatism (negative cylinder in the horizontal axis) was considered to be the one in the meridian between 60 and 120 degrees and ATR (negative cylinder in the vertical axis) in the meridian between 1 and 30 degrees and 150 and 180 degrees.

Astigmatism other than these was classified as oblique. The patients with oblique or irregular astigmatism were not included in the study. Similarly, the patient who had undergone filtration, refractive or pterygium excision surgery or had corneal scaring and opacities, very high or irregular preoperative astigmatism, were also not included in this study.

Intraocular lens calculations were performed using A-scan ultrasonography (Quantel Medical 11 M Hz) for axial length measurements and keratometry using Topcon KR 8800 digital autokeratorefractometer. After administering peribulbar local anaesthesia with 2% lignocane with 1:200,000 adrenaline, in all the cases a clear corneal superotemporal (10-11 clock) incision (approx 0.50 mm central to the limbus) was made using a 3.2 mm true cut keratome. A continuous curvilinear capsulorhexis was performed with cystitome. Phacoemulsifation was performed using system (Ammerican Optics Inc.) machine with 19 Ga 30-degree tip. All patients implanted with single piece, foldable acrylic IOL with an optical diameter of 6.0 mm (total diameter of 13.0mm), placed in the capsular bag.

All patients were treated postoperatively with a combination of dexamethasone 0.1% and tobramycin 0.3%, three hourly for the first week and then six and eight hourly over the three subsequent weeks. Topical ofloxacin was given 6 hourly for 1 week postoperatively. Follow up for evaluation of astigmatism was performed on Topcon KR 8800 autokerato-refractometer from three months onwards after surgery.

Data was analyzed using Microsoft excel. Results have been depicted in form of text or tables, as appropriate.

## RESULTS

Group A comprised of 68 eyes with mean astigmatism before surgery was 0.79 D and median astigmatism was 0.76 while group B had 94 eyes with a mean and median astigmatism of 0.81 D and 0.78 D, respectively. The mean and median increase in astigmatism post operatively in the two groups was calculated [Table 1-2]. This showed a slight shift toward WTR astigmatism post operatively.

In group A, 23 (33.8%) cases showed an increase in astigmatism while 13 (19.1%) remained unchanged, 14 (20.6%) converted to ATR astigmatism, 8 (11.8%) neutralized and 6 (8.8%) experienced a decrease in WTR astigmatism. In group B, 58 (61.7%) cases showed an increase in astigmatism while 9 (9.6%) remained unchanged, 10 (10.6%) converted to WTR astigmatism, 5 (5.3%) neutralized and 12 (12.8 %%) experienced a decrease in ATR astigmatism.

In group A, 37 (54.4%) eyes showed a clockwise shift in the axis and 9 (13.2%) eyes showed an anti-clockwise shift. In group B 27 (28.7%) eyes showed a clockwise shift in the axis and 54 (57.4%) eyes showed an anti-clockwise shift. The rest did not show any shift.

**Table 1: Postoperative astigmatism noted among the study participants**

| | Postoperative astigmatism status (N) | Mean Postoperative astigmatism (D) | Median Postoperative astigmatism (D) |
|---|---|---|---|
| Group A (N = 68) | 32 (19.8%) | 1.10 | 1.75 |
| Group B (N = 94) | 85 (52.5%) | 1.20 | 1.25 |
| Neutralized | 45 (27.7%) | | |


ISSN (O): 2687-5365; ISSN (P): 2753-6556

**Table 2: Difference for various parameters**

| | Astigmatism (in Diopters) | | | | Difference |
|---|---|---|---|---|---|
| | Preoperative | | Postoperative | | |
| | Mean | Median | Mean | Median | |
| Group A (N = 32) | 0.79 | 0.76 | 1.10 | 1.75 | Mean diff = 0.31 Median diff = 0.99 |
| Group B (N = 85) | 0.81 | 0.78 | 1.25 | 1.25 | Mean diff = 0.44 Median diff = 0.47 |

## DISCUSSION

Placing incisions on the steeper corneal meridian has been recommended during MSICS with the idea that there is flattening of the meridian on which the incision is placed.[17] Hence, with an on-axis incision, there is a reduction in the corneal power of the steeper meridian because of the flattening effect of the incision leading to minimal postoperative corneal astigmatism. For patients with ATR astigmatism who have a flatter vertical corneal meridian, it would be expected that a superior approach MSICS would flatten the already flatter vertical meridian leading to high postoperative corneal astigmatism. With senile cataract being the most common type of cataract in developing countries and since there is an ATR shift in astigmatism with age,[18,19] most cataract patients in developing countries may have preoperative ATR astigmatism. The choice of the location of incision for these groups of patients is therefore very important as that can influence the amount of postoperative corneal astigmatism.

In our study we have found that a superotemporal (10-11 O' clock) 3.2 mm incision hardly causes any astigmatism or induces any significant change in the existing preoperative astigmatism, i.e. less than 0.50 diopters generally, when followed over a longer period of time. This correlates with a similar study carried out by S C Moon et al.[11] However the median value showed a slightly more shift on the WTR side.

Regarding the toric shift, most of the cases in group A showed a clockwise shift while in group A the trend was opposite in most of the cases. This shift is not very significant during refraction and prescription of glasses. Less number of cases in both the groups showed wider shift. This concluded a minor overall change in the keratometric readings although the incision was made through the clear cornea. Our patients showed a slight shift towards higher median WTR astigmatism with the passage of time. Different studies have demonstrated flattening of the cornea along the incisional meridian.[11] This leads to WTR astigmatic changes with a temporal incision,[20,21] comparable with the results of our study. In a similar study where keratometric analysis of corneal astigmatism was done after surgery and a comparison was done between two groups undergoing phacoemulsification through superotemporal corneal incision and superior scleral incision. The former did not increase keratometric corneal astigmatism more than the one by superior scleral incision after three months of operation.[22] The incision length and location have a bearing on the changes in the horizontal and vertical meridians of the cornea after cataract surgery. This study was also affected by these two factors. This fact is also supported by two other similar studies; small temporal incisions induced less change than superior incisions.[11,23]

## CONCLUSION

Superotemporal, 3.2 mm clear corneal incision is quite stable and does not significantly increase post operative astigmatism when followed up over a long (several months to years) period of time. This size and site of the incision have also proved to be superior to smaller or larger and superior or scleral incisions respectively.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556

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ISSN (O): 2687-5365; ISSN (P): 2753-6556