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A study on effect of clear corneal incision in phacoemulsification surgery on postoperative astigmatism (A study of 25 cases)

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Abstract

Purpose: To determine the astigmatism outcomes after cataract surgery performed using clear corneal incisions.
Setting: Department of Ophthalmology, Guru Gobindsingh Government Hospital, Jamnagar.
Methods: This prospective study includes 25 patients undergoing phacoemulsification with implantation of foldable acrylic intraocular lens through a corneal tunnel incision between 2016-2017. Clear corneal incision was made in all the patients. Astigmatism was measured by keratometry readings before surgery and 5rd, 15th, and 45th days postoperatively.
Results: The results of our study are as follows- most of the patients of our study were between the age group of 41-70 years. Females (56%) outnumbered males (44%) in our study. Majority of the patients (56%) had preoperative astigmatism of 0.50D. Majority of the patients (48%) undergoing phacoemulsification through clear corneal incision had astigmatism of 0.6-1.5D on day 5 postoperatively. On day 15 postoperatively 36% of the operated patients had astigmatism between 0.6-1.0 D which further increased to 44% on day 45 postoperatively. The mean astigmatism was 2.31D, 1.99D and 1.55D on 5,15 and 45 postoperative day. Mean postoperative astigmatism regressed from 5th to 45th postoperative days by 0.75D. Majority (80%) of patients had BCVA of 6/9-6/12. The incidence of against the rule astigmatism was more (56%) in patients undergoing phacoemulsification in which clear corneal incision was made.
Conclusions - Cataract surgery using superotemporal clear corneal incision induced significantly less surgically induced astigmatism in the early postoperative period.

Keywords: astigmatism, cataract surgery, phacoemulsification, best correctable visual acuity, clear corneal incision

1. Introduction

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. Since the turn of the century it has been observed that astigmatism after cataract surgery is generally of against the rule variety [15]. Eight to ten days after operation, it is usually of higher order, tehn gradually decrease during the next six months to somewhat smaller value. In recent years, several studies have investigated the induced astigmatism after various types of small-incisions cataract wounds (scleral, clear corneal, posterior limbal tunnel) and various locations including superior, superonasal, superotemporal, and temporal [1, 13, 16]. 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 tunnel allows better visualization during surgery and hence a faster procedure that is more suitable for using topical anesthesia; and the incision can be performed temporally, allowing easy access to the eye, especially in patients with deep-set globes[3,14]. Temporal incisions have been shown to induce similar or less astigmatism than incisions at other locations. In this prospective study, we studied postoperative astigmatism in phacoemulsification through clear corneal incision in 25 cases.

2. Aims of the study

The chief aims and objectives of this study were:

1. To determine pre-operative astigmatism type and magnitude.
2. To determine postoperative astigmatism type and magnitude after phacoemulsification through clear corneal incision.
3. To determine residual astigmatism after one and half months.
4. To determine regression in postoperative astigmatism.

3. Methods

The study deals with astigmatism after cataract surgery by phacoemulsification technique in 25 patients through clear corneal incision and with implantation of foldable acrylic intraocular lens. All patients were operated in ophthalmology department of shri Guru Gobindsingh Government hospital, Jamnagar during the period of 2016-2017. All surgeries in the study were done by phacosurgeons of ophthalmology department.

Age group of 38 to 74 years were a part of our study with maximum number of patients in the age group of 61-70 years. Exclusion criteria were preoperative diagnosis of an inflammatory ocular condition, surface irregularity or unreliable keratometric readings, and having a history of previous ocular surgery or disease affecting corneal refraction. Patients with systemic connective tissue disease and those taking systemic steroids or immunosuppressive drugs were

also excluded. Written informed consent was obtained from each patient. All eyes had complete ophthalmological examination preoperatively and postoperatively at 5rd, 15th, and 45th days, including manifest refraction using a autorefractometer and Snellen's chart. Astigmatism was measured by keratometry readings. Data on sex, age, UCVA, BCVA, manifest refraction, and manual keratometry were collected. The surgical technique was as follows. All operations were performed using posterior chamber phacoemulsification through a clear corneal incision under peribulbar anesthesia. The surgeon sat in the superior position. The clear corneal incision was performed with a 3.2-mm disposable keratome blade. In all cases, the incisions were centered at approximately 120 degrees.AC maintainer was used in all the surgeries. After injection of viscoelastic material, capsulorhexis was performed. Phacoemulsification and cortex removal were completed. An acrylic foldable intraocular lens was then inserted. The ophthalmic viscoelastic material was removed with a coaxial irrigation and aspiration system. All incisions were left unsutered and the wound edges were hydrated.

4. Results

The results of our study are as follows. From table 1 depicts that most of the patients of our study were between the age group of 41-70 years. Table 2 depicts that females (56%) outnumbered males (44%) in our study. From table 3 it is clear that majority of the patients (56%) had preoperative astigmatism of 0.50D. Table 4 shows that majority of the patients (48%) undergoing phacoemulsification through clear corneal incision had astigmatism of 0.6-1.5D on day 5 postoperatively. Table 5 shows that on day 15 postoperatively 36% of the operated patients had astigmatism between 0.6-1.0 D which further increased to 44% on day 45 postoperatively from table 6.table 7 shows that the mean astigmatism was 2.31D,1.99D and 1.55D on 5,15 and 45 postoperative day.It is clear that mean postoperative astigmatism regressed from 5th to 45th postoperative days by 0.75D.From table 8 it is clear that majority (80%) of patients had BCVA of 6/9-6/12. From table 9 it is clear that the incidence of against the rule astigmatism was more (56%) in patients undergoing phacoemulsification in which clear corneal incision was made.

Table 1: Agewise distribution of patients.

Age (in years)	Percentage
<40	4
41-50	28
51-60	28
61-70	36
>70	4

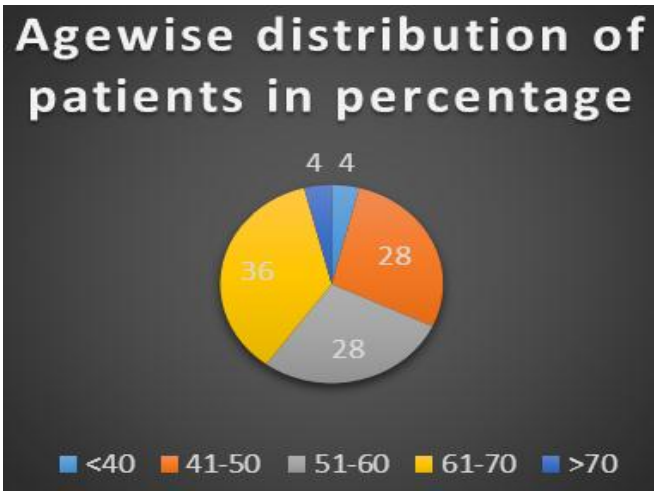

Fig 1

Table 2: Sex distribution of patients

Sex	percentage
male	44%
female	56%

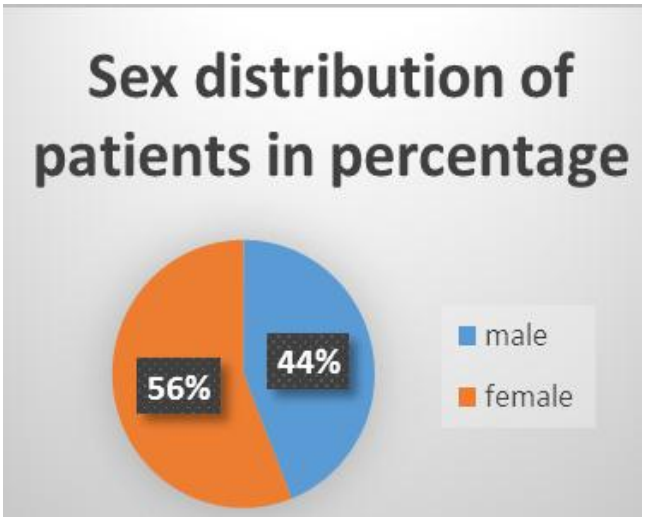

Fig 2

Table 3: Preoperative corneal astigmatism in patients operated for cataract.

Preoperative astigmatism	
Astigmatism in diopters	**Percentage**
0-0.5	56
o.6-1	20
1.1-1.5	8
1.6- 2.0	4
2.1-2.5	8
2.6-3.0	4

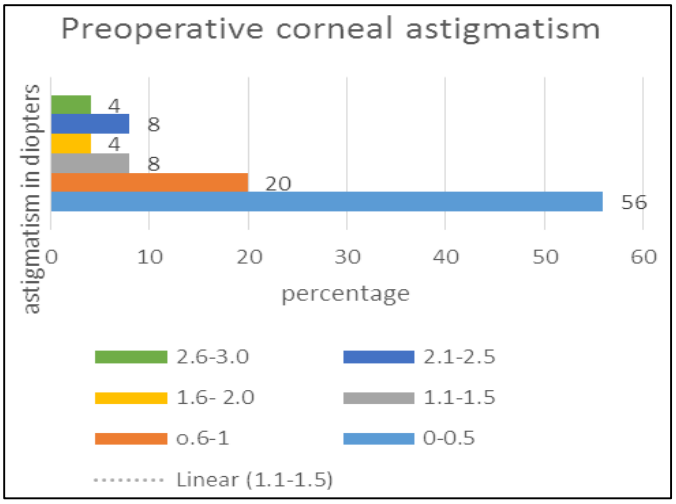

Fig 3

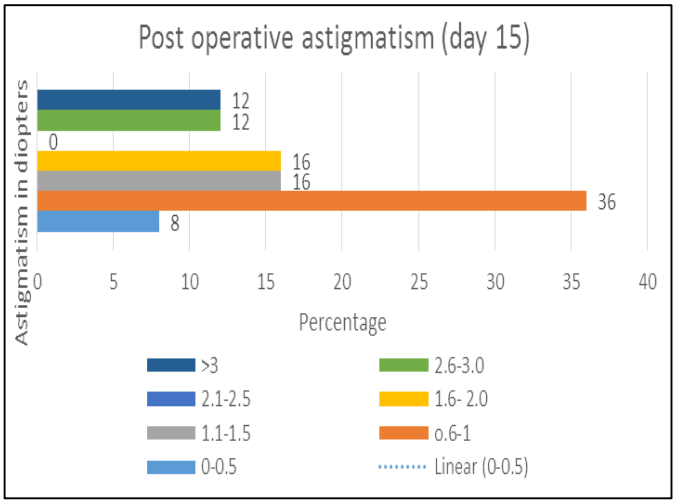

Fig 5

Table 4: Post-operative corneal astigmatism (day 5)

Post-operative astigmatism(day5)	
astigmatism in dioptres	**percentage**
0-0.5	8
o.6-1	28
1.1-1.5	20
1.6- 2.0	4
2.1-2.5	8
2.6-3.0	8
>3	24

Table 6: Post operative corneal astigmatism (day 45)

Postoperative astigmatism (day 45)	
Astigmatism in diopters	**Percentage**
0-0.5	8
o.6-1	44
1.1-1.5	16
1.6- 2.0	12
2.1-2.5	0
2.6-3.0	8
>3	12

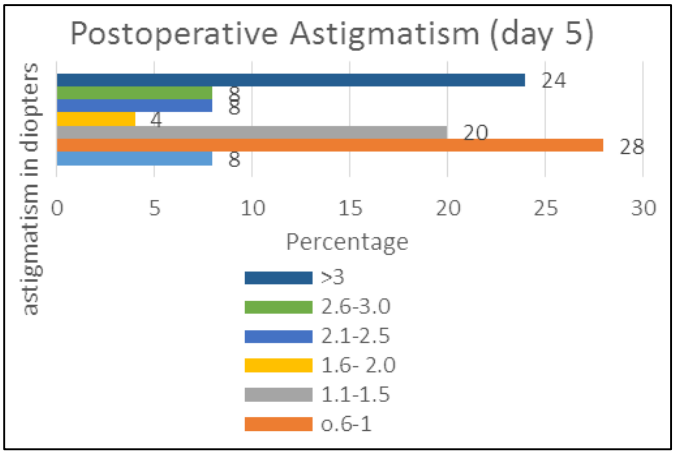

Fig 4

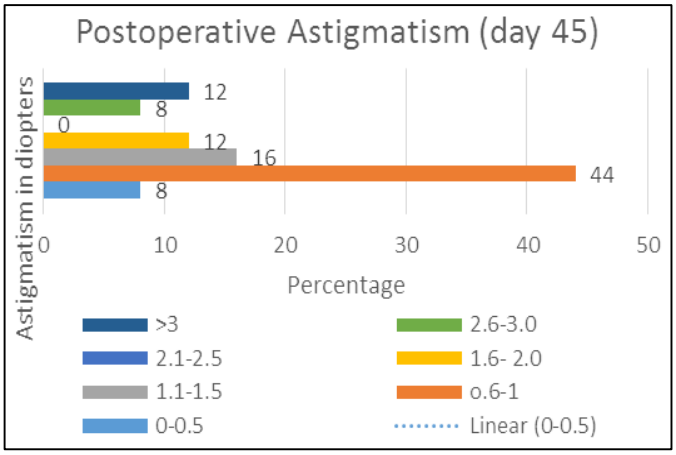

Fig 6

Table 5: Post operative corneal astigmatism (day 15)

Post-operative astigmatism (day 15)	
Astigmatism in diopters	**Percentage**
0-0.5	8
o.6-1	36
1.1-1.5	16
1.6- 2.0	16
2.1-2.5	0
2.6-3.0	12
>3	12

Table 7: Mean postoperative astigmatism in patients operated for clear corneal incision phacoemulsification

Mean postoperative astigmatism	
Postoperative day	**Mean astigmatism in diopters**
on day 5	2.31
on day 15	1.99
on day 45	1.56

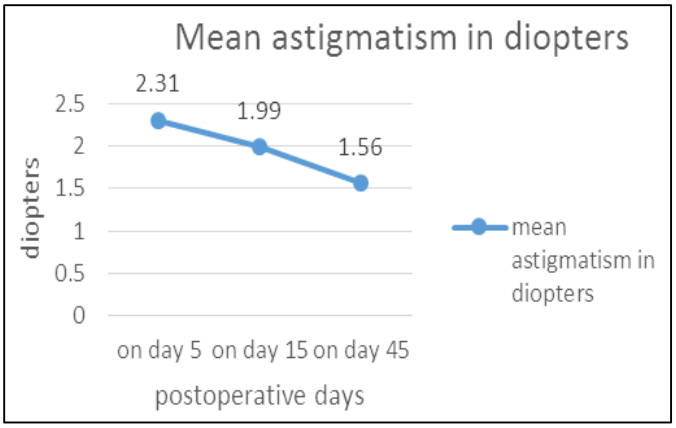

Fig 7

Table 8: Best correctable visual acuity in postoperative patient

Best correctable visual acuity in postoperative patients	
BCVA	**Percentage**
<6/18	12
6/9-6/12	80
6/6	8

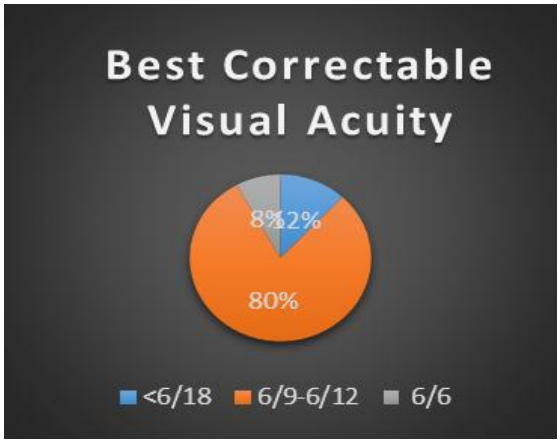

Fig 8

Table 9: Type of induced astigmatism after phacoemulsification with clear corneal incision on 15th postoperative day

Type of astigmatism	
Type of astigmatism	**Percentage of Patients**
Against the rule	56
With the rule	44

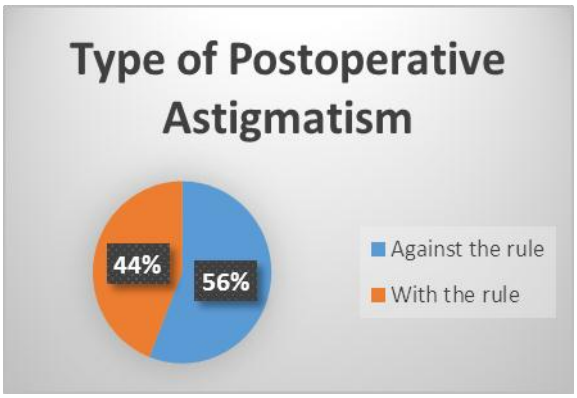

Fig 9

5. Discussion

Corneal astigmatism after phacoemulsification surgery depends on the type, location, and configuration of cataract incision and presence or absence of wound suture [10, 11]. Many studies have demonstrated that a temporally located clear corneal incision induces the least astigmatism [2, 5, 8] Locating the incision superotemporally comforts surgical manipulations [9]. Decreased astigmatism leads to better visual function and increased patient satisfaction.

Incisional astigmatism may also be caused by various other factors such as incision size, the optical center of the cornea, and surgical approach. [7, 9]

Large majority (56%) of patients in this study had preoperative astigmatism in the 0-0.5 D range which is in accordance to the values of duke elder ophthalmology [16].

For comparing our study data with related studies, our study is considered study A. Study B is by renuka *et al* comparing visual rehabilitation following phacoemulsification through clear corneal incision.

Study C is a by zomini *et al* comparing visual rehabilitation following phacoemulsification through clear corneal incision.

Table 10: Comparision of mean post-operative astigmatism on 5th postoperative day.

Mean post-operative astigmatism	Phacoemulsification through clear corneal incision
Study A	+2.31D
Study B	+0.58D
Study C	+0.47D

Table 11: Comparision of mean post operative astigmatism on 15th postoperative day.

Mean post operative astigmatism	Phacoemulsification through clear corneal incision
Study A	+1.99
Study B	+0.13
Study C	+0.47

Table 12: Comparision of mean post-operative astigmatism on 5th postoperative day.

Mean post operative astigmatism	Phacoemulsification through clear corneal incision
Study A	+1.56D
Study B	-0.21D
Study C	+0.45D

Table 13: Comparision of best correctable visual acuity on 45th postoperative day.

BCVA	Study A	Study B	Study C
<6/18	12	0	0
6/9-6/12	80	80	85
6/6	8	20	15

Table 14: Comparision of shift of postoperative astigmatism on 5 to 45th postoperative day.

astigmatism	5th day	15th day	45th day
Study A% of patients with astigmatism			
WTR	58	56	52
ATR	32	44	48
Plano	10	0	0
Study B% of patients with astigmatism			
WTR	70	60	30
ATR	30	40	70
Plano	0	0	0
Study C% of patients with astigmatism			
WTR	60	40	40
ATR	40	60	60
Plano	0	0	0

6. Conclusion

The following conclusions can be drawn from the study.

- Preoperative evaluation of corneal astigmatism by keratometry is mandatory.
- There is against the rule astigmatism pattern following surgery through clear corneal incision.
- There is a reduction in post operative astigmatism from 5th postoperative day to 45th postoperative day.
- Clear corneal incision was found to be of advantage for both the surgeon and the patient on the following grounds-
  - No damage to the conjunctiva, therefore minimal corneal scarring.
  - Astigmatically more stable and predictable refractive outcome
  - Incision site can be planned depending upon the axis of astigmatism, thereby reducing the aastigmatism postoperatively.
  - Less time consuming.
  - Early patient rehabilitation
  - Better patient comfort
  - Does not hinder future ocular surgeries.
  - Self-sealing
  - No suture related complications.

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