

## Evaluation of Corneal Curvatural Changes After Astigmatism Friendly Phacoemulsification Incisions in Cataract Surgery

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**Abstract:** Background and objectives: A cross sectional study was conducted at New Civil Hospital, Surat to evaluate changes in corneal curvature 1,1½ & 2 years after on axis phacoemulsification surgery incisions. Method: 50 patients having undergone clear corneal phacoemulsification with astigmatism friendly incisions and foldable intraocular lens implantation 1 to 2 years back with detailed preoperative data were seen. They were grouped as 1(Group A) ,1½(Group B) and 2years (Group C) post surgery follow ups. Their postsurgery corneal curvature and refraction was observed at time of study and was compared to same at 40th day after surgery. Results: Mean post op astigmatism in group A (0.50±0.25), Group B (0.51 ± 0.30) and Group C (0.75±0.29) were observed. The mean change in corneal curvature as compared to baseline was not significant statistically in Group A (p=0.6) and Group B (p = 0.6). In Group C the change corneal curvature of 0.22 D was statistically significant by t tests. The mean change in refraction was not significant statistically in all three groups. Conclusion: Against the rule change in corneal curvature, independent of type of incision seen after 2 years of surgery which can be age related. Thus reassessment of refraction is not required frequently in astigmatism friendly incisions. [Foram D NJIRM 2017; 8(3):75-77]

**Key Words:** clear corneal, refraction, against the rule

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**Introduction:** The science of Ophthalmology evolved around the basic urge for unaided vision. However, cataract and refractive errors are the two rampant causes of blindness against which the ophthalmologists are waging war till date. Cataract surgery has begun to make its mark as a refractive surgery in the recent times.<sup>1,2,3</sup> The modern day cataract surgeons operate with the aim of early patient rehabilitation, minimum postoperative discomfort and freedom from glasses. With advances in the fields of instruments, techniques and intraocular lens, the rate of cataract related complications has decreased. However there is one milestone still to be achieved. Research is being carried out widely to decode the changes in cornea after phacoemulsification.

Cornea forms the major portion of the refractive unit of eye. Any distortion in its shape caused due to surgery or otherwise leads to incorrect focusing of rays on retina and thereby astigmatism. The astigmatism can be WTR ( With The Rule - vertical meridian steep) or ATR ( Against The Rule -horizontal meridian steeper). Any ocular surgery including cataract surgery which affects the normal anatomical integrity of cornea will cause astigmatism. In spite of these ceaseless attempts it has been difficult to get rid of the stigma of atigmatia because of age & time related changes in cornea, interpersonal difference in healing process, varying surgical finesse, etc. Due to all these variables prognosticating the long term outcome after

phacoemulsification is not an easy task. Analysis of long term changes in corneal curvatures after surgery and its associated factors will thus aid in unveiling the mystery.

**Methods:** All pseudophakic patients having undergone astigmatism friendly that is, on steep axis clear corneal phacoemulsification cataract surgery at the hands of senior experienced consultants and coming to the outpatient department of our hospital either for routine ophthalmic examination or cataract extraction in fellow eye or for change in refractive status or for any other pathology were screened.

### Inclusion criteria :

- I. Patients having age 18 years and above.
- II. All patients who have undergone clear corneal phacoemulsification.
- III. Incisions placed on steep axis.
- IV. All patients having foldable IOL implanted in the operated eye.
- V. All patients in whom the IOL is centralised.

### Exclusion criteria:

- I. Patients having undergone cataract surgery other than phacoemulsification surgery.
- II. Patients with decentred or tilted PCIOL.
- III. Patients with IOLs other than foldable IOL.
- IV. Patients lacking detailed pre-operative data.
- V. Patients having retinal/corneal pathology.

Approval of study protocol was attained from Human Research Ethics Committee, New Civil Hospital, Surat . 50 patients befitting the above mentioned criteria were included in our study after taking their informed consent. Their particulars like name, age, sex , pre - operative keratometry, time of surgery, type of surgery , type of IOL implanted , keratometry and refraction on 40<sup>th</sup> post operative day were noted from discharge card and OPD papers.

Visual acuity was measured using Snellen’s chart. Slitlamp examination was carried out on Carl Zeiss Meditech AG slitlamp and fundus examination was done using Heinz direct ophthalmoscope to rule out corneal and retinal pathology. Keratometry was performed using Bausch & Laumb manual keratometer. We considered WTR astigmatism having a cylinder with a plus axis between the 60°-90°-120° meridia, and ATR astigmatism as having a plus axis between the 150°-180°-30° meridian.

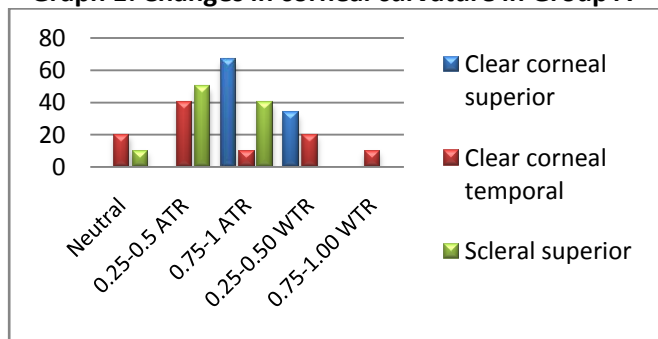
**Patients from different age groups were divided into following groups:**

- I. Time since surgery – Group A: 1 year , Group B: 1 ½ years and Group C: 2 years.
- II. Types of incisions - Corneal superior , corneal temporal and scleral superior
- III. Amount of astigmatism in diopters.

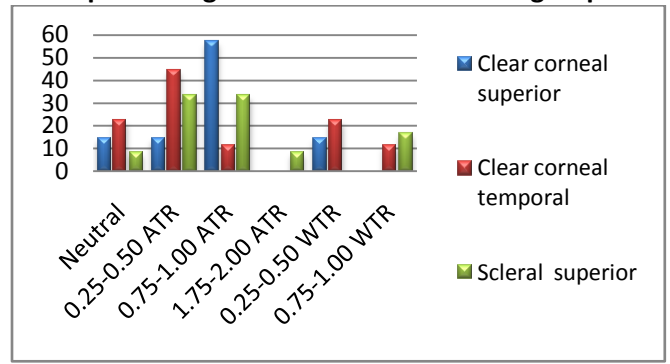
The changes in corneal curvature at 40<sup>th</sup> day after surgery and the then pseudocorrection were considered as baseline. Keratometry and pseudocorrection at 1 year, 1 ½ years and 2 years were then noted in 3 different groups of patients as such a long follow up of the same patient was difficult in our set up. The data thus gathered was analysed using the software ‘ Open Epi ’ and the data was analysed using t tests.

**Result:** Out of 50 patients considered in our study , 31 (62%) were males and 19 (38%) were females.

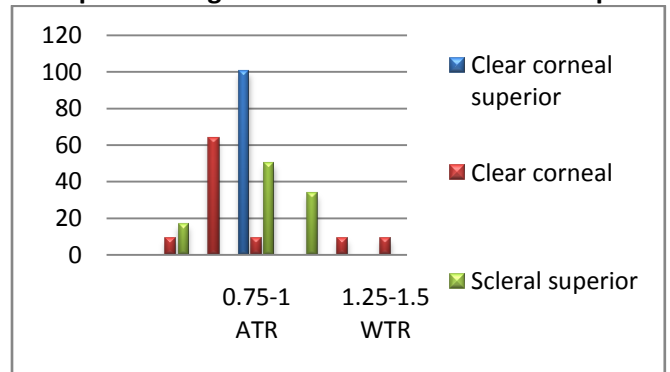
**Graph 1: Changes in corneal curvature in Group A**



**Graph 2.Changes in corneal curvature in group B**



**Graph 3. Changes in corneal curvature in Group C**



13 (26 %) patients were in group A , 16 ( 32%) patients were in group B and 21 ( 42%) patients were in group C. From the above 3 graphs it is evident that ATR astigmatism is more common at 1, 1½ and 2 years after phacosurgery with 3 different incision groups.

**In patients undergoing clear corneal superior surgery:** At 1 & 1 ½ years , there is a shift towards ATR astigmatism but the difference in keratometry ( p = 0.1 & 0.6 respectively ) and refraction (0.2 & 0.5 respectively ) is not statistically significant. At 2 years, the difference in refraction is not statistically significant (p=0.3). However there is statistically significant ( p= 0.01) difference in the keratometry at the end of 2 years. ATR rule shift in astigmatism was observed at the end of 2 years of clear corneal superior surgery.

**In patients undergoing clear corneal temporal surgery:** At 1& 1 ½ years the difference in keratometry ( p = 0.8 & 0.6 respectively) and refraction ( p = 0.8 & 0.8 respectively) is not statistically significant. At 2 years , ATR is more common but there is no significant change in refraction at the end of 2 years. However there is statistically significant difference ( p = 0.04 ) in keratometry at the end of 2 years.

**In patients undergoing scleral superior surgery :** At 1 & 1 ½ years , ATR is more common but the difference in keratometry ( p = 0.4 & 0.4 respectively)and refraction ( p = 0.7 & 0.2 respectively)is not statistically significant At 2 years ATR is more common but the difference in keratometry and refraction is not statistically significant ( p = 0.4 & 0.2) respectively.

**Discussion:** In our study an ATR shift was noted to set in after 1 year of phacosurgery in all 3 incision groups. A statistically significant shift towards against the rule astigmatism was observed after 2 years of phacoemulsification in clear corneal superior and superior scleral incisions. Change in temporal incisions is not significant.<sup>4,5</sup>

Some degree of flattening of corneal meridian occurs at right angle to the direction of incision. Thus superiorly placed incision causes against the rule shift in pre operative astigmatism i.e vertical meridian becomes flatter and temporal incision causes with the rule astigmatism.<sup>6,7</sup> Also, an against the rule change in astigmatism with age was noted.<sup>8,9</sup>

**Conclusion:** On evaluating changes in corneal curvature after phacoemulsification surgery at different time intervals, in patients from different age groups with varying incision types, no statistically significant changes were observed at 1 and 1 ½ years of surgery. But after 2 years of surgery , a mild shift towards ATR astigmatism , independent of incision type was noted. Although statistically significant, subjectively these patients did not have any visual deterioration due to these curvatural changes which can thus be age related. Astigmatism friendly phacoemulsification incisions provide long term refractive stability and thus the reassessment of refraction is not required frequently.

**Recommendation:** The study can be made more reliable by observing a large number of patients from different age groups for a longer duration of time.

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