



**“SURGICALLY INDUCED ASTIGMATISM  
AFTER PHACOEMULSIFICATION USING 2.2mm  
INCISION”**

**SUBMITTED IN FULL FILMENT FOR THE DEGREE OF BACHELOR OF  
OPTOMETRY**

**SUBMITTED BY**

**HIBA BELAL**

**ENROLLMENT NO- AJU/180458**

**BATCH 2018-2022**

**DEPARTMENT OF OPTOMETRY  
SCHOOL OF HEALTH AND ALLIED SCIENCE  
ARKA JAIN UNIVERSITY**



## **DECLARATION**

I hereby declare that the contents in this dissertation title is '**Surgically induced astigmatism in phacoemulsification using 2.2mm incision**' submitted by Hiba Belal for the award of the degree of bachelor of optometry to Arka Jain University is a bonafied work carried out by me. I further affirm that its entirely my effort and not has been copied. The dissertation has been conducted with the purpose of submission of fulfillment of the certificate for internship in clinical Optometry in Jamshedpur Eye Hospital, Jamshedpur, Jharkhand.

The above-mentioned information is authentic to the best of my understanding. I declare that the work reported in this thesis has not been submitted and will not be submitted either in full or in part for award of any other degree in this institute or other institute.

Name- Hiba Belal

Enrollment no.- AJU/180458

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Date- *18/05/22*



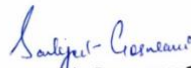
## CERTIFICATE

This is to certify that the thesis entitled “**SURGICALLY INDUCED ASTIGMATISM AFTER PHACOEMULSIFICATION USING 2.2mm INCISION**” submitted by Hiba Belal, for the award of the degree of Bachelor of Optometry, is a record of bonafide work carried out by the student under my supervision, at Jamshedpur Eye Hospital as per the academic code of the University.

The contents of this report have not been submitted and will not be submitted either in part or in full, for the award of any other degree in this institute or any other Institute or University. The thesis fulfils the requirements and regulations of the University and in my opinion meets the necessary standards for submission.

Place: JAMSHEDPUR

Date: 18/05/22

  
Signature of the Programme Coordinator  
Program Co-ordinator  
Department of Optometry  
School of Health & Allied Science  
ARKA JAIN University, Jharkhand

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## **ABSTRACT**

**PURPOSE-**To evaluate surgically induced astigmatism in different incision location after phacoemulsification using 2.2mm incision.

**METHODOLOGY-** 114 patients who visited to Jamshedpur Eye Hospital were enrolled from September 2021 to march 2022. Visual acuity, refraction, keratometry were done before and after phacoemulsification. Outcome measures includes induced astigmatic changes.

**RESULT-** Induced astigmatic changes caused by different incision location showed differences, induced astigmatism is smaller in temporal incision as compared to nasal and superior.

**CONCLUSION-** The average surgically induced astigmatism from the study was 0.39D and temporal incision is preferred over nasal and superior incision while doing phacoemulsification. Temporal incision induces average SIA of 0.354D while nasal and superior incision induce 0.40D.

**KEYWORDS-** Phacoemulsification, cataract, temporal, incision, surgically induce astigmatism (SIA).





- iv. Etiology
- v. Location of opacity

**Astigmatism** is a type of refractive error wherein the refraction varies in different meridian of the eye. Consequently, the light rays of light entering the eye cannot converge to a point focus but form focal lines. Broadly, there are two types of astigmatism.

### **Regular and Irregular astigmatism**

There is various classification of astigmatism that are defined on the basis of clinical factor and other characteristics. Apart from that, this type of refractive error can be grouped into regular and irregular based on ocular components and their orientation

The perpendicularity of the principal meridian of cornea determines whether the astigmatism is regular or irregular. considering the center of pupil as pole, imaginary lenes are drawn around the eyeball that is intersected at the pole sat both anterior and posterior positions, which are called the meridians of the eye. The flattest and steepest meridians of the eye are termed principal meridians.

### **Regular astigmatism**

Irregular corneal or lens curvature of the eye causes regular astigmatism. In this condition the principal meridians are always 90 degrees apart from each other and, in this case, there will be a consecutive variation in the refractive power from one meridian to another. Each meridian in the regular astigmatic eye has a uniform curvature at every point across the entrance of pupil. This is the most common type of astigmatism in which the symptoms included are blurry vision, headache and light sensitivity to name a few. With this type of astigmatism eye is curved more in one meridian. Regular astigmatism distorts vision, making objects from near to far blurry or stretched. It is possible to have astigmatism along with other refractive errors such as myopia and hyperopia.

There are several options available to effectively correct their vision including contact lens, glasses and laser vision correction.

### **Irregular Astigmatism**

In irregular astigmatisms, the principal meridians are separated by any angle other than 90°, i.e., they are not perpendicular to each other. In this type, the curvature at each meridian is not uniform but changes from one point to another across the entrance of the pupil.

A small amount of irregular astigmatism is seen in every eye when the entire cornea is assessed; however, this is medically irrelevant. Irregular astigmatism, which is clinically relevant, is very uncommon compared with the regular form. It is seen in patients with an irregular corneal surface that occurs either due to natural causes or are causes that are surgically induced.

Different corneal pathologies related to elevated lesions, like Salzmann's nodular degeneration or keratoconus, are the natural causes of irregular astigmatism. These causes lead to primary irregular astigmatism and secondary irregular astigmatism

Astigmatism that is surgically induced can be caused due to removal of the pterygium, extraction of cataract, lamellar as well as penetrating keratoplasty, radial and astigmatic keratectomy, myopic keratomileusis, and laser in situ keratomileusis (LASIK).

Corneal trauma and infections are other important causes of irregular astigmatism.



**No  
Astigmatism**



**Regular  
Astigmatism**



**Irregular  
Astigmatism**

Excellent evaluation of corneal curvature is needed for the best result of uncorrected visual acuity after cataract surgery. Phacoemulsification technique can be used to minimize surgically induced astigmatism.

## REVIEW OF LITREATURE

Year / place of publication	Author/s	Title	Methodology	Result
1. March 2009, investigative ophthalmology and visual science	Jaime tejedor and jose A parez-rodriguez	Astigmatic changes induced by 2.8mm clear corneal incision for cataract surgery	a descriptive study on patients with cataract to rule out SIA according to incision location	This study shows induce refractive changes cause by different incision location.
2. July 2021, nigerian journal of ophthalmology	Angela S D Amita, laura A, Angelo dohino, Andrew adiguna, Halim	Surgically induce astigmatism after phacoemulsification with clear corneal incision using superior approach.	A retrospective study, shows SIA using medical records of patients	The average SIA from the study was 0.34.
3. February 13, 2004, J. Cataract refract. Surg.	Irina S, Edward yu,susan vitale, sandi cassard, Dimitri T azar	Astigmatic outcome of horizontal temporal versus nasal clear corneal incision cataract surgery.	this retrospective study includes 178 eyes to rule out type of astigmatism after surgery.	The mean preoperative astigmatism of 161 eyes shows 54.5% eyes have ATR and 25.5% shows

				WTR astigmatism
4. 13 October, 2017, clinical ophthalmology	Nikose SA S, Saha D, Laddha P M, Patil M	Surgically induce astigmatism after phacoemulsification by temporal clear corneal and superior clear corneal approach: a comparison	This study is a hospital based prospective study with 261 patients divided into two groups. Group A and group B who went to superior and temporal incision respectively.	The mean post operative astigmatism SIA in group A is 0.98 and group B is 1.65. this study concludes temporal is better than superior incision.

## **METHODOLOGY**

This study is conducted at Jamshedpur Eye Hospital, Jamshedpur to determine surgically induce astigmatism after phacoemulsification. This study was conducted for a period of 7 months from September 2021 to march 2022. A total 114 subjects were included in the study with the age older than 50. out of 114 patients 58 were female and 56 were male.

- Visual acuity is taken by logMAR chart.
- Anterior and posterior segment were evaluated with the help of slit lamp and indirect ophthalmoscope.

Preoperative evaluation includes uncorrected and corrected visual acuity, intraocular pressure, slit lamp Biomicroscope, indirect ophthalmoscope, biometry. In postoperative examination visual acuity, intraocular pressure, slit lamp examination were repeated. Outcome measure were induced astigmatic change.

### Inclusive criteria

- Age older than 50 years
- No known systemic disease
- Only patient with nuclear sclerosis of grade 1 to grade 3 and posterior subcapsular opacification is selected.
- Uncorrected or best corrected visual acuity must be 6/60 or better.

### Exclusive criteria

- Systemic illness and weakness
- Any ocular pathology except cataract
- Any Posterior polar cataract and grade 4 to grade 5 nuclear sclerosis

Two surgeons performed all the surgery with 2.2mm incision. Phacoemulsification is performed under local anesthesia

## RESULT

114 Patients were included in which 24 patients were rejected (refused/ lost during follow up) nasal incision are used in 30 patients, temporal incision in 30 patients and superior incision in 30 patients out of 90 patients who were selected. Nasal incision induced average corneal refractive change of 0.41 whereas temporal incision caused an average corneal refractive change of 0.35D and superior incision induced corneal refractive change of 0.41D. the average surgically induced astigmatism from this study is 0.39D irrespective of location of incision.

TABLE 1 :Average of Astigmatic Change Pre Cataract Surgery

Incision Type	Average Astigmatic Change
Superior	0.34
Temporal	0.33
Nasal	0.37

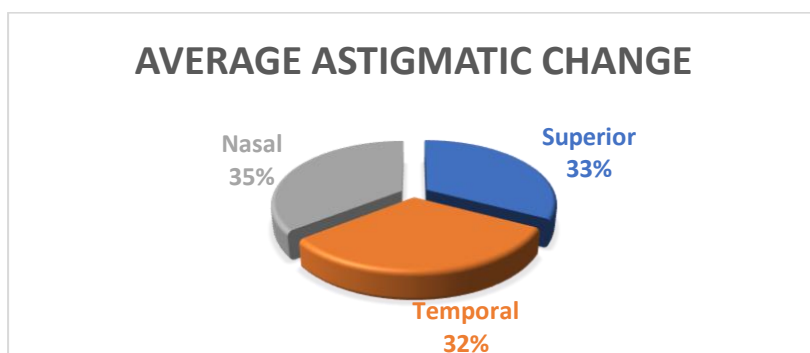
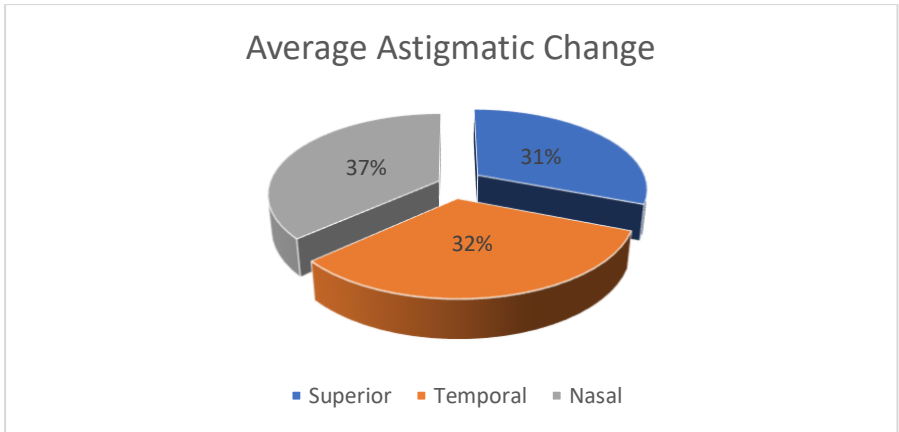


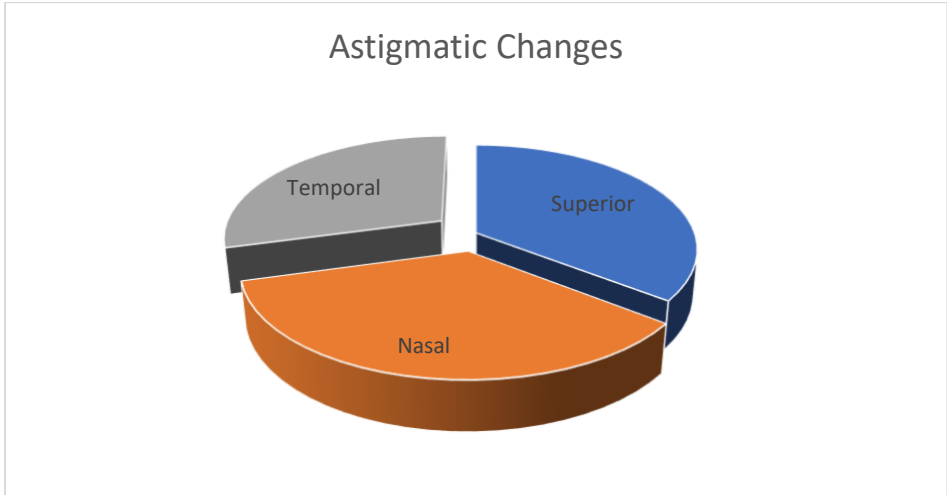
TABLE 2: Average of Astigmatic Change Post Cataract Surgery

Incision Type	Average Astigmatic Change
Superior	0.38
Temporal	0.40
Nasal	0.45



**TABLE 3 : Difference of Astigmatic Change Pre Cataract Surgery and Post Cataract Surgery**

<b>Incision Type</b>	<b>Average Astigmatic Change</b>
Superior	0.41
Temporal	0.35
Nasal	0.41



## **DISCUSSION**

Small 2.2mm incision in phacoemulsification induced on average very small astigmatic change. Getting accurate postoperative refraction will determine the success of cataract surgery <sup>2</sup>. One of the main factors that determine good postoperative refraction is SIA<sup>4</sup>. SIA is influenced by many factors such as type of cataract surgery, incision type, incision site, and suturing technique.

Nowadays, the two most common types of cataract surgery are phacoemulsification and small incision cataract surgery. in general phacoemulsification surgery produced low SIA<sup>5</sup>. In addition to incision techniques, Gokhale has found that temporal approach would result in lower SIA compared to superior approaches. the use of superior approach results in larger SIA due to gravitational force and blinking of eyes at incision point <sup>6</sup>

Different location of incision in different type of astigmatism will also affect SIA <sup>1</sup>. Superior incision will result in an astigmatism shift towards against the rule, while the temporal incision will cause an astigmatism shift towards with the rule <sup>4</sup>. Thus, the other researchers said that superior incision should be performed on astigmatism WTR, whereas temporal incision should be carried out on ATR astigmatism <sup>8</sup>. This is because incision can decrease corneal curvature <sup>7</sup>. The incision is made on the site with more convex curvature, intended to balance the corneal curvature meridian and in turn reduce SIA. Another factor that can reduce SIA is doing incision without suturing. The suturing process can change structures of the wound which may induce SIA <sup>4</sup>.



## **CONCLUSION**

The average SIA after phacoemulsification using 2.2mm corneal incision is 0.39D irrespective of location of incision. average Astigmatic change induced in nasal incision is 0.41D, temporal incision cause 0.35D and superior approach causes 0.41D.

My study demonstrated the effect if SIA. A temporal approach is more accessible than superior and nasal approach a prominent brow and deep-set sunken eyes obstruct the maneuvering of the probe in nasal and superior approach.

SIA in temporal incision is less than superior and nasal approach and gives better visual outcome, optical quality and patient satisfaction.

## **LIMITATION**

- **Less sample sizes**
- Lost follow ups
- Less expertise

## **CONFLICT OF INTEREST**

There is no conflict of interest in this work.

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