

## Evaluating post-operative astigmatism in 5.2 mm temporal clear corneal incision for cataract surgery

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### Abstract

**Aim:** To evaluate post-operative astigmatism in 5.2 mm temporal clear corneal incision for cataract surgery.

**Materials and Methods:** This is a retrospective data analysis study of 20 cataract surgery cases operated at Department of Ophthalmology, Faculty of Medicine & Health sciences, S.G.T University Gurugram Haryana. All cases were operated using temporal clear corneal phacoemulsification technique, followed by implantation of 5.2 mm rigid PMMA IOL.

**Results:** Post-operative astigmatism was calculated using online SIA calculator (SIA calculator version 2.1). The mean astigmatism at one month duration was calculated. The mean astigmatism at one month duration was 1.02 D at 104 degree.

**Keywords:** 5.2 mm clear corneal incision, Astigmatism, Cataract, Phacoemulsification, Temporal incision

### Introduction

Cataract is the most important cause of preventable blindness in India. Cataract surgery has evolved from merely removal of cataract to modern day refractive procedure. Cataract surgery is one of the safest and successful procedures performed in modern day medical practice. Post-operative astigmatism is the universal outcome of a successful cataract surgery. The imperfection in the curvature of cornea leads to astigmatism. When cornea and lens are equally curved in all directions they focus the light rays sharply on retina. However if cornea or lens is not evenly curved light rays are not properly focused on retina leading to formation of fuzzy or blurred image. This condition of refractive error is known as astigmatism. Corneal astigmatism denotes to irregular curve of cornea whereas when lens curvature is distorted it leads to lenticular astigmatism. Astigmatism induced following cataract surgery is concerned mainly with corneal astigmatism. Lenticular astigmatism is not considered because lens is removed during cataract surgery.

Astigmatism means unequal dioptric power of the two principal meridian of cornea, the principal light refractive part of the eye. Astigmatism is further divided into regular astigmatism and irregular astigmatism. If two principal meridians are perpendicular to each other it is termed as regular astigmatism. Regular astigmatism is further classified into against the rule (ATR) astigmatism in which horizontal meridian has more dioptric power than vertical meridian, on the other hand if dioptric value of vertical meridian is more than horizontal meridian it is called with the rule (WTH) astigmatism.

Humans always desire for perfection in their work and that is perhaps the reason that the emphasis in cataract surgery has shifted from focusing on extractive aspect to the refractive aspect. Modern day cataract surgeon aim to achieve best uncorrected visual-acuity after a successful cataract removal along with IOL

implantation. Astigmatism induced due to cataract surgery incision remains the greatest hurdle in achieving good uncorrected visual acuity in post-operative period. Astigmatism induced after cataract surgery is the outcome of these important factors.<sup>(1)</sup>

1. Pre-existing corneal astigmatism
2. Astigmatism induced by cataract surgery corneal incision

Surgically induced astigmatism is therefore the outcome of all these factors combined. The aim of modern cataract surgeons is to control and decrease these two sources of astigmatism. The final post-operative astigmatism is the outcome of surgeon's phacoemulsification technique, size of incision & location of the cataract incision. To achieve the desired results keratometry readings, computerized corneal topography, A-scan measurement have been used to give the patient freedom from myopia and hyperopia after surgery. The goal is to reduce existing astigmatism (PEA) which is a major factor that would help in reducing visual acuity and affect the vision quality of the patient.

Various modalities have been proposed to control post-operative astigmatism such as steep axis phacoemulsification, decreasing the size of corneal incision, use of sclero - corneal incision, limbal relaxing incision.

The aim of modern day cataract surgeon is to reduce post-operative astigmatism. It is therefore suggested that every cataract surgeon should evaluate his/her own surgically induced astigmatism (SIA), to provide good quality vision to his/her patients. In this study, we would like to evaluate the post-operative astigmatism induced by 5.2 mm temporal clear corneal incision phacoemulsification.

### Materials and Methods

This is a retrospective data analysis of patient's case records. 20 case records were analysed. All cases were

operated by single surgeon using standard 2.8 mm temporal clear corneal incision phacoemulsification. After successful removal of cataract temporal incision was enlarged and 5.25 mm rigid PMMA IOL was implanted after enlarging the main temporal incision.

#### **Inclusion criteria**

1. Cataract patients in age group 30-80

#### **Exclusion criteria**

1. Hazy cornea including corneal degenerations & dystrophy
2. Traumatic & paediatric cataract
3. Patients with retinal & optic nerve disorders

Patients were thoroughly examined before surgery. Pre-operative examination protocol included visual acuity recording, slit-lamp bio- microscopy, tonometry and fundus examination by using direct, indirect ophthalmoscope and 90D lens. Keratometry readings were recorded by using an auto-keratorefractometer (Topcon autokeratorefractometer KR8800). Axis between 60 and 120 degree were taken as vertical axis and between 30 and 150 degree considered as horizontal axis. The IOL power was calculated by contact A-scan biometry using the SRK 2 formula. Routine investigations like random blood sugar, ECG and BP were recorded. Informed consent was taken from the patients. Topical eye drops containing Tropicamide 0.8% with phenylephrine 5%, were used one hour prior to surgery to dilate pupil of the marked eye. Topical antibiotic and non-steroidal anti-inflammatory eye drops were instilled every 15 minutes, one hour before the surgery Peribulbar anaesthesia with 5 cc of a 3:2 mixture of injection Xylocaine 2% and injection bupivacaine 0.5% with 150 I.U. of Hyaluronidase was used to achieve anaesthesia & akinesia in all patients.

Three port phacoemulsification with implantation of rigid PMMA IOL was completed under peribulbar anaesthesia. Three step temporal 2.8 mm clear corneal incision was made using a keratome. Phacoemulsification of cataract was performed using Zeiss Visalis 100 phacoemulsification system. Rigid P.M.M.A posterior chamber IOL implanted in the bag after enlarging the corneal incision using 5.2 mm keratome. Anterior chamber was reformed using ringer lactate. After subconjunctival antibiotic and steroid injection eye was padded and bandaged.

Oral antibiotic along with analgesic were prescribed for five days. Topical antibiotic and steroid combination eye-drop six times per day was prescribed and the same was tapered over one month period. The patients were examined on the 1<sup>st</sup> post-operative day, subsequently on 7<sup>th</sup> 21<sup>st</sup> 30<sup>th</sup> day of surgery. The uncorrected and best corrected visual acuity were recorded. Topcon autokeratorefractometer was used to measure and record keratometry data.

The surgically induced astigmatism was calculated from the pre and postoperative keratometric values. All the calculations were performed by using SIA calculator

(SIA calculator version 2.1 by Dr Saurabh Sawhney and Dr Ashima Aggarwal).

#### **Discussion**

The aim of modern day cataract surgeons is to control, modify and minimise surgically induced astigmatism. The surgically induced astigmatism can be modified/decreased by decreasing the size of corneal incision, steep axis phacoemulsification, use of sclero - corneal incision during cataract extraction. Phacoemulsification of cataract with implantation of foldable IOL is the gold standard in modern times. Corneal incision used during surgery are less than 3mm which induce minimal or negligible amount of post-operative astigmatism. The biggest disadvantage of phacoemulsification with implantation of foldable IOL is the cost of surgery to the patient and society. Phacoemulsification is definitely more advanced and technically superior but may not be the preferred choice for different possible reasons that include cost or density of cataract. The cost of the surgery can be broadly classified under two heads, first being the one-time expenditure on phacoemulsification unit, second is the recurring cost of foldable IOL. This high cost of phacoemulsification surgery has forced surgeons to look for safe, reliable alternatives which do not compromise on the final visual outcome of the surgery. The important question then emerges as to what could be the possible alternatives that provide best possible results to the patients and the first alternative is small incision manual extracapsular technique Manual small incision cataract surgery and phacoemulsification with implantation of rigid PMMA IOL are surgeries commonly performed in India..

Levy et al studied the astigmatism changes after cataract surgery using 5.1 and 3.5 mm suture less incision. It was discovered as others have also proved that small incision results in less surgically induced astigmatism but after 3 months the astigmatism in two groups was not different.<sup>(2)</sup>

Steinert et al discussed that surgically induced astigmatism was similar for patients undergoing large or small incision surgeries. However for small incision patients refractive stability was long term but for patients with large incision against the rule decay went for a long time.<sup>(3)</sup>

Gokhale et al calculated SIA of 0.37D in temporal manual small incision cataract surgery. Manual small incision cataract surgery is considered to be safe cost effective alternative to phacoemulsification but it requires peri bulbar anaesthesia with its associated though rare complications.<sup>(4)</sup>

Many surgeons prefer clear corneal incision over scleral tunnel incision because it provides an easier access to the eye, better visualization of intra ocular structures and ability to perform the entire procedure without incising vascularized tissue. Kohnen et al. studied the induced astigmatism in 3.5 mm, 4.0 mm, and

5.0 mm temporal clear corneal incision at the interval of 6 months after the surgery. The clear corneal 3.5 mm incision averaged 0.37 D while for 4.0 mm incision it was 0.56 D and for 5.0 mm incision it was 0.70 D.<sup>(5)</sup> This was a significant study demonstrating that the temporal clear corneal tunnel incision results in minimal astigmatism that also varies on the size of the incision. Temporal incision is farthest from visual axis therefore post-operative flattening following cataract extraction has the least effect on corneal curvature at visual axis.

In this study the surgeon has evaluated the post-operative astigmatism of 5.2 mm temporal clear corneal incision. 5.2 mm incision allows surgeon to implant rigid P.M.M.A IOL after phacoemulsification, moreover a nicely constructed 5.2 mm incision is self-sealing, mitigating the need to suture the wound. We have evaluated the post-operative astigmatism induced due to 5.2 mm clear corneal incision. The study of surgically induced astigmatism SIA for a given procedure is important as it helps surgeon to compare, modify his technique to give best possible surgical outcome to his patient. Vikas Mahatame<sup>(6)</sup> et al in a study have concluded that there is no statistically significant difference in the astigmatism after implantation of foldable or non-foldable IOL also Jaya Devendra et al in a study to compare SIA in manual small incision cataract surgery and phacoemulsification with implantation of 5.25 rigid IOL had values of 0.98D & 2.06 D respectively.<sup>(7)</sup> In our study mean post-operative astigmatism due to 5.2 mm temporal clear corneal Incision was 1.02D at 104 degree.

### Conclusion

Phacoemulsification with implantation of foldable IOL is the best treatment available for cataract, however it is an expensive surgery. High cost renders this option out of reach of poor patients, especially in context of developing countries such as India. Manual small incision cataract surgery is a safe and inexpensive option available in the absence of phacoemulsification machine. During this study we did not observe any increased incidence of post-operative complications such as iritis and ocular hypotony. All Incisions were water tight and sutures were not required. It is therefore recommended that if phacoemulsification machine is available then phacoemulsification with implantation of rigid P.M.M.A. IOL can be considered as a safe option with good post-operative results. It can also be used as a tool to modify pre-existing corneal astigmatism.

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