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Original Research

A comparison of astigmatic results and incisional integrity in phacoemulsification surgery with temporal clear corneal incision and superior scleral incision

[1]MD Harun Rashid, [2]Natasha Gupta

[1]Assistant Professor, Department of Ophthalomogy, Narayan Medical College and Hospital Sasaram, Bihar, India
[2]Assistant Professor, Department of Anaesthesiology, Narayan Medical College and Hospital Sasaram, Bihar, India

ABSTRACT:
Aim: A comparison of the astigmatic results and the integrity of the incisions made during phacoemulsification surgery using a temporal clear corneal incision and a superior scleral incision is the goal of this research. **Methods:** This was a prospective research that was carried out at the Ophthalmology Department. This research comprised a total of 120 different patients. The preoperative assessment included of a complete examination of the anterior segment using a slit lamp examination, as well as an examination of the posterior segment using 90D. Visual acuity, intraocular pressure, and sac syringing were also performed. Keratometry was performed both before and after surgery using automated keratometry. Axial length was measured using a contact 'A' scan unit, and the power of the intraocular lens (IOL) was determined using the SRK II formula. **Results:** Comparison of surgically induced astigmatism (SIA) between two groups, and it demonstrates that there is a statistically significant difference between both groups on every postoperative day. On all postoperative days and comparing the two groups, we saw a substantial difference in the kind of astigmatism that patients had. According to the findings of our research, the SIA in temporal clear corneal on the first post-operative day was 1.14± 0.60, 1.18± 0.50, 0.99± 0.42, 0.93± 0.44, and 0.92 ±0.46. These values were found to be significantly different from each other. For patients in the superior scleral group, the SIA on post-operative days 1, 7, 45, 90, and 180 was respectively 0.93±0.49, 0.93±0.40, 0.81±0.33, 0.78±0.30, and 0.79±0.30. **Conclusion:** The study came to the conclusion that there is a statistically significant post operative shift to WTR astigmatism in temporal clear corneal incision as opposed to ATR astigmatism in superior scleral incision. Because most elderly patients have preoperative ATR astigmatism, it is best to plan temporal incision because of this.
Keywords: Astigmatic, incisional integrity, phacoemulsification surgery, corneal incision

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Corresponding author: MD Harun Rashid, Assistant Professor, Department of Ophthalomogy, Narayan Medical College and Hospital Sasaram, Bihar, India

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INTRODUCTION

Opacity of the human crystalline lens capsule or its material is the definition of the condition known as cataract. That is the most common reason people have trouble seeing across the globe. SICS and Phacoemulsification with IOL, two common types of modern cataract surgery, are widely regarded as the safest, most effective, and most commonly carried out procedures. In compared to phacoemulsification, manual SICS is less costly and needs less infrastructure. As a result, it is the method of choice in low-income settings such as developing nations. [1] The goals of contemporary cataract surgery are to achieve the highest possible visual acuity, with as little postoperative astigmatism as feasible, and to do it as quickly as possible. Donder (1984) was the first person to note that post-cataract surgery often resulted in astigmatism. After a successful cataract operation, the presence of postoperative astigmatism is the one and only barrier that prevents patients from achieving high uncorrected visual acuity. After successful cataract surgery, some patients have post-operative

astigmatism, which may result in reduced visual acuity, glare, monocular diplopia, asthenopia, and distortion of the picture. It is regarded to be the gold standard of contemporary cataract surgery to achieve good postoperative vision, ideally without the need for glasses. [2]

On the other hand, a greater amount of astigmatism was produced by the superior, superonasal, and nasal incisions.[2] While doing phacoemulsification, the incision that is put on the steep corneal axis may, depending on the position of the axis, correct a tiny degree of astigmatism. This was shown to be the case in the Recent review.[3] A higher portion of the patient's astigmatism was rectified by the peripheral corneal relaxing incision. The use of toric intraocular lenses for the treatment of astigmatism of more than one diopter has been shown to be both safe and effective.[4]

We are aware that the incision made in the temporal clear corneal is both effective and bloodless, but the incision made in the superior scleral is both less effective and bloody. Using keratometry, the purpose of this research is to determine, after three months, whether or whether the temporal clear corneal incision will result in a higher rate of SIA than the superior scleral incision. There have been several research on surgically induced corneal astigmatism that used vector analysis of the complex Holladay-Cravy-Koch formula.[5] The Holladay-Cravy-Koch formula for particular SIA was not employed in this investigation since its main emphasis was on a comparison of the mean keratometric reading preop and postop in clear temporal vs superior scleral incisions. This formula takes into account the precise location of the incision. In addition, for homogeneity purposes, the statistical research of ANOVA has to pass the F-test; the procedure of pre-op and post-op assessment should be the same.

MATERIAL AND METHODS

This was a prospective research that was carried out at the Ophthalmology Department. This research comprised a total of 120 different patients. Patients with any corneal disease that might interfere with visual evaluation and impair wound healing and astigmatism were excluded from the research. This included corneal opacity and degeneration. Patients with all types of senile cataracts were included in the study. The preoperative assessment included of a complete examination of the anterior segment using a slit lamp examination, as well as an examination of the posterior segment using 90D. Visual acuity, intraocular pressure, and sac syringing were also performed. Keratometry was performed both before and after surgery using automated keratometry. Axial length was measured using a contact 'A' scan unit, and the power of the intraocular lens (IOL) was determined using the SRK II formula.

The cases were arbitrarily split up into two distinct groups. Both groups had phacoemulsification, however one group (Group A) had an incision made in the temporal clear corneal while the other group (Group B) had an incision made in the superior scleral. Both incisions were 5.5 millimeters in size. In every instance, the surgery was performed with the patient under peribulbar block or topical anesthesia. Every patient was given a topical eye drop containing 0.3% ciprofloxacin every six hours starting one day before surgery, and betadine drops were inserted three times for asepsis beginning one hour before operation. In order to induce preoperative sufficient mydriasis, eyedrops containing tropicamide (0.5%), phenylephrine (5%), homoatropine (2%), and flurbiprofen (0.03%) were administered every 15 minutes, beginning one hour before surgery.

Patients in Group A had phacoemulsification performed, during which a temporal clear corneal incision measuring 5.5 millimeters in length was created using a 15 No blade. Afterwards, a self-sealing tri-planar corneal tunnel measuring 1.75 millimeters in length was produced using a crescent knife. The anterior chamber was entered by a keratome that was 2.8 millimeters in diameter. A single entrance via the side port was accomplished. The stop and chop method was used in order to emulsify the nucleus. In every instance, the tunnel was lengthened using a keratome measuring 5.5 millimeters, and a stiff PMMA lens with an optic size of 5.25 millimeters and the necessary power was inserted into the bag. The primary incision as well as the side port were hydrated with stromal fluid.

Patients in Group B had phacoemulsification performed, during which a superior scleral tunnel was created 1.5 millimeters posterior to the corneal vascular arcade. Using a blade with a number 15 and measuring 5.5 mm in length, a straight incision was made through a portion of the thickness of the sclera. The tube was stretched anywhere from 0.75 to 1 mm farther into the clear cornea. Length of tube being 2.25-2.5 mm. Around ten o'clock and two o'clock in the afternoon, two separate side port entry were made. Using a keratome with a diameter of 2.8 millimeters, an entrance was made into the anterior chamber from the anterior limit of the sclera-corneal tunnel. The stop and chop method was used in order to emulsify the nucleus. By using a keratome with a blunt tip, the internal aperture of the tunnel was widened. In each of the instances, a PMMA IOL with a 5.25mm optic and the necessary power was implanted in the bag. Stromal hydration was responsible for closing up the side port opening.

The postoperative evaluation was carried out on the first postoperative day, the first week, the fourth month, and the sixth month. Patients who had just had surgery were examined for their visual acuity, corneal clarity, anterior chamber depth, PCIOL insertion in bag, and keratometry was performed. Incisional integrity was evaluated using a slit light, and SIA was computed with software specifically designed for that purpose.

RESULTS

The patients in Group A had a mean age of 64.36±7.89 years, whereas the patients in Group B had a mean age of 67.89±7.96 years. There was not a statistically significant difference in age between the two groups. As a result, the participants in the research were evenly distributed among age groups. Group A consisted of 35 men and 25 females, while Group B included 33 males and 27 females. Both Groups were similar to one another.

Comparison of preoperative and postoperative astigmatism on all post-op follow ups between two groups is shown in Table 1.

Table 1: Comparison of Astigmatism at pre op, post op day

	Group A	Group B	
Astigmatism	**Mean+SD**	**Mean+SD**	**P value**
Pre-operative	0.62±0.48	0.84±0.56	0.005
Post op day 1	0.93±0.59	1.46±0.77	0.001
Post op day 7	0.90±0.54	1.40±0.74	0.001
Post op day 45	0.82±0.57	1.31±0.76	0.001
Post op day 90	0.78±0.54	1.27±0.69	0.001
Post op day 180	0.76±0.56	1.27±0.69	0.001

This comparison is statistically significant, and it also demonstrates that the comparison between the two groups is meaningful. Additionally, a comparison of preoperative astigmatism with post-operative astigmatism on day 1, day 7, day 45, day 90, and day 180 in Group A and B revealed statistically significant differences on all post-op days.

Table 2 presents a comparison of surgically induced astigmatism (SIA) between two groups, and it demonstrates that there is a statistically significant difference between both groups on every postoperative day. On all postoperative days and comparing the two groups, we saw a substantial difference in the kind of astigmatism that patients had. It reveals a significant shift in astigmatism in Group A (WTR) with a P value of less than 0.001 (P<0.001), and it reveals a significant shift in astigmatism in Group B (ATR) with a P value of less than 0.001 (P<0.001). According to the findings of our research, the SIA in temporal clear corneal on the first post-operative day was 1.14± 0.60, 1.18± 0.50, 0.99± 0.42, 0.93± 0.44, and 0.92 ±0.46. These values were found to be significantly different from each other. From the first to the seventh post-operative day, there was a little rise in the SIA, but by the 45th post-operative day, this increase had greatly diminished. After the third month, there was a little additional reduction in SIA; however, this decline was not statistically significant, and by the sixth month, it had not changed at all.

For patients in the superior scleral group, the SIA on post-operative days 1, 7, 45, 90, and 180 was respectively 0.93±0.49, 0.93±0.40, 0.81±0.33, 0.78±0.30, and 0.79±0.30. The difference between the first day after surgery and the 45th day after surgery was statistically significant. There was a little reduction in SIA on postoperative day 90 and 180, but the difference was not statistically significant when compared to postoperative day 45.

Table 2: Comparison of SIA at post op day 1, day 7, day 45, day 90 and day 180 in study Group in diopter(D)

	Group A	Group B	
Type of SI A	**Mean+SD**	**Mean+SD**	**P Value**
Post op day 1	1.14±0.60	0.93±0.49	0.001
Post op day 7	1.18±0.50	0.93±0.40	0.001
Post op day 45	0.99±0.42	0.81±0.33	0.001
Post op day 90	0.93±0.44	0.78±0.30	0.001
Post op day 180	0.92±0.46	0.79±0.30	0.001

In both Group, incision integrity was good and non-leaking on all postoperative days. Stromal hydration and self-sealing nature of incision maintained incision integrity postoperatively and there was no incidence of wound leak or endophthalmitis noticed.

DISCUSSION

In comparison to the superior scleral incision, the clear temporal corneal incision did reveal statistically significant alterations of greater keratometric astigmatism one month following phacoemulsification. Yet, after three months there was no improvement that could be considered statistically significant. It is conceivable that a little incision in the cornea might take up to three months before the patient experiences steady refractive error. In addition, the effort to treat astigmatism by a temporal cornea technique, such as wound incision or limbal relaxation incision (LRI), may have the least amount of success after three months have passed. The research conducted by Holladay found that the period of time between 60 and 365 days postoperatively had the lowest incidence of surgically induced refractive change (SIRC). [5]

Several studies have shown that temporal clean corneal incisions of 2.8, 3.2, and 4mm may successfully reduce levels of astigmatism in the eye.[6,7-10] Yet, there is a very limited amount of published research that provides commentary on the incision integrity and wound stability of a suture-free 5.5mm clear corneal incision. According to the findings of this research, the incision integrity and SIA of patients who had phacoemulsification surgery with 5.5 mm self-sealing clear corneal incisions were equivalent to those of patients who underwent surgery with smaller incisions. The incision location and the length of the incision are the two primary parameters that influence the SIA. In the research, two groups with the same incision size (5.5 mm) are compared with one another at two distinct sites: one group has a temporal clear corneal incision, while the other group receives a superior scleral incision.

Both the kind of astigmatism that was surgically created and the type of astigmatism that was compared in both groups for age, sex, and the laterality of the eyes that were operated on were not statistically significant. Neither group had an advantage over the other. When the different types of astigmatism that occurred post-operatively were compared, it was discovered that there was a large shift to WTR astigmatism following temporal clean corneal incision and that there was a considerable change to ATR astigmatism in the superior scleral incision. It was determined that the difference was due to the distractive influence that eyelid blinking had on the superior wound. Both medically generated astigmatism and the astigmatic refractive error are caused by a change in the cornea's natural curvature.

Using the vector approach, Kohnen et al. found that the SIA in 20 eyes with a temporal 5.0mm clean corneal incision was 0.91D (±0.77) and 0.70D (±0.50) SIA after post-op week 1 and post-op 6 month, respectively. These values were found to be statistically significant. There was a consistent drop in SIA up to six months after the operation was performed. Both before and after the surgery, a computerized video kerato graphic study was performed. 10 A research was conducted on a total of fifty eyes by Mahumad Asif and colleagues. Corneal astigmatism in a 5.5 mm temporal clear corneal incision was determined to be 1.737 (±0.344) in the fourth post-operative week, 1.739 (±0.344) in the eighth post-operative week, and 1.732 (±0.344) in the twelfth post-operative week. In contrast to the astigmatism before surgery, which was 2.028 (±0.342), this result was statistically significant.[11] Reddy et al came to the conclusion that there is a large ATR shift in the superior incision by phacoemulsification and manual SICS surgery, and that the temporal incision had a WTR shift. [12] Karad et al. evaluated the SIA that occurred after non-phaco SICS performed at various sites and came to the conclusion that a 5.5mm superior incision causes 1.02±0.52 whereas the temporal location had 0.70±0.49.[13] Nikose AS et al. came to the additional conclusion that at the end of the procedure, the integrity of the CCI is determined not only by the size of the initial incision but also by the degree to which the incision was distorted throughout the later phases of the procedure. Their research also demonstrated the effect that hydrating corneal incisions has on the ingress of extraocular fluid into the anterior chamber. Based on their findings, they came to the conclusion that hydrating the incisions may help to prevent aqueous leakage and also, to some extent, the inflow of fluid from the ocular surface into the anterior chamber. This is because it restricts the ingress of small particles. In order to try to seal the wound, stromal hydration is performed in combination with clear corneal incision.

The incision that is made temporally in the cornea provides an additional benefit because the distance that extends from the visual axis to the cornea's periphery along the horizontal meridian is greater than it is for other incisions. Because of this, flattening at this incision has a substantially less likelihood of being communicated to the visual axis, which results in a significantly smaller SIA. When the incision is placed superiorly, both gravity and the eye blink have a tendency to cause a drag on the incision, which ultimately results in ATR induced astigmatism. It is to the patient's benefit to have WTR astigmatism generated by a temporal incision since the majority of senior cataract patients have pre-operative ATR astigmatism. According to the findings of this research, a superiorly positioned incision is something that should be considered for patients who have a high degree of WTR astigmatism. Nonetheless, in situations with pre-operative ATR astigmatism, the temporally implanted clear corneal tunnel is recommended as the method of choice. So, the kind of preoperative astigmatism has to be taken into consideration before deciding where to make the incision in order to minimize the amount of postoperative astigmatism. Big incisions, up to 5.5 mm clear corneal incisions, have the potential to have self-sealing qualities. As a result, stiff PMMA lenses may be used in patients who cannot afford sutures, which eliminates the need for such procedures.

CONCLUSION

The study came to the conclusion that there is a statistically significant post operative shift to WTR astigmatism in temporal clear corneal incision as opposed to ATR astigmatism in superior scleral incision. Because most elderly patients have preoperative ATR astigmatism, it is best to plan temporal incision because of this.

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