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Original Research Article

A Prospective Comparative Assessment of Astigmatic Outcomes and Incisional Integrity in Temporal Clear Corneal Incision and Superior Scleral Incision Phacoemulsification Surgery

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Abstract

Aim: Comparative study of astigmatic outcomes and incisional integrity in temporal clear corneal incision and superior scleral incision phacoemulsification surgery.

Methods: This prospective comparative study conducted in the Department of Ophthalmology, Nalanda Medical College and Hospital Patna, Bihar, India for 1 year. 100 patients were included in this study. Preoperative evaluation was done including visual acuity, intraocular pressure, sac syringing, thorough examination of anterior segment by slit lamp examination, posterior segment examination by 90D. Keratometry was done preoperatively and post operatively using automated keratometry, Axial length measured with a contact 'A' scan unit and the IOL power was calculated using SRK II formula.

Results: Mean age of patients in category A was 65.45± 5.89 years and that in category B was 66.85 ± 6.36 years. There was no statistically significant difference between two categories regarding age. Hence, the study was age matched Category A had 31 males and 19 females and in category B were 29 males and 21 females. In our study, SIA in temporal clear corneal on 1st, 8th, 40th, 90th, 180th post-operative day were as follows 1.13 (0.61), 1.17 (0.51), 0.98 (±0.43), 0.92 (±0.45) and 0.91 (±0.47). There was a mild increase in the SIA from 1st to 8th post-operative day that decreased significantly by 40th post-operative day. There was mild further decrease in SIA by 3rd month which was not statistically significant and remained same by 6th month. In superior scleral category, SIA was 0.92 (±0.50), 0.92 (±0.41), 0.80 (±0.34), 0.77 (± 0.31) and 0.78 (±0.31) on post op day 1, 8, 40, 90 and 180. The change from 1st to 40th day was significant and there was mild decrease in SIA on postoperative day 90 and 180 but was not significant as compared to postoperative day 40.

Conclusion: The study concludes that there is statistically significant post operative shift to WTR astigmatism in temporal clear corneal incision as opposed to ATR astigmatism in superior sclera incision; hence it is better to plan temporal incision as mostly elderly patients have preoperative ATR astigmatism.

Keywords: astigmatism, temporal incision, phacoemulsification surgery

Introduction

The cataract is defined as opacity of the human crystalline lens capsule or its substance. It is the leading cause of visual disability in the world. Modern cataract surgeries like SICS and Phacoemulsification with IOL are considered safest, successful and frequently performed surgery. Manual SICS is inexpensive, and requires minimal infrastructure in comparison to phacoemulsification, therefore it is a preferred option in low cost settings such as developing countries. [1] 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. Postoperative astigmatism has remained the only obstacle to the achievement of good uncorrected visual acuity after successful cataract surgery. Post-operative astigmatism may lead to decreased visual acuity, glare, monocular diplopia, asthenopia and distortion of image after a good cataract surgery. Good Postoperative vision preferably without spectacles is considered as the bench mark of modern cataract surgery. [2]

Conversely, the superior, superonasal, and nasal incision induced more astigmatism. [2] The review of Amesbury showed that in phacoemulsification, the incision placed on the steep corneal axis can correct small amount of astigmatism depending upon the location of the axis. [3] The peripheral corneal relaxing incision corrected greater amount of astigmatism. The toric intraocular lenses are also safe and effective for treating more than 1 diopter of astigmatism. [4] Many studies on surgical induced cornea astigmatism using vector analysis of complicated Holladay-Cravy-Koch formula. [5]

We know that the temporal clear corneal incision is efficient and bloodless whereas the superior scleral incision is less efficient and bloody. This study aims to find out that the temporal clear corneal incision will not create more SIA than superior scleral incision in three months using keratometry.

Material and methods

This prospective study conducted in the Department of Ophthalmology, Nalanda medical College and Hospital Patna, Bihar, India for 1 year. 100 patients were included in this study. All senile cataracts were included in the study and patients with any corneal pathology that might interfere with visual assessment and affect wound healing and astigmatism like corneal opacity or degeneration were excluded.

Methodology

Preoperative evaluation was done including visual acuity, intraocular pressure, sac syringing, thorough examination of anterior segment by slit lamp examination, posterior segment examination by 90D. Keratometry was done preoperatively and post operatively using automated keratometry, axial length measured with a contact ‘A’ scan unit and the IOL power was calculated using SRK II formula.

Cases were randomly divided into two categories. One category (Category A) underwent phacoemulsification with temporal clear corneal incision of 5.5mm and other category (Category B) underwent phacoemulsification with superior scleral incision of 5.5mm incision size. All cases were operated under peribulbar block or topical anaesthesia. All patients received 6 hourly topical ciprofloxacin 0.3% eye drop one day prior

to surgery and betadine drops were instilled thrice for asepsis 1 hour preoperatively. Preoperative adequate mydriasis was achieved by instillation of Tropicamide 0.5% and phenylephrine 5% eye drop, homoatropine 2% eye drop, flurbiprofen 0.03% eye drop every 15 minutes, starting one hour prior to surgery.

Category A patients underwent phacoemulsification with temporal clear corneal incision of 5.5mm length with 15 No blade, following which a self sealing tri-planar corneal tunnel of 1.75mm length was made using crescent knife. Anterior chamber entry was done using 2.8mm keratome. Single side port entry was made. Nucleus was emulsified using stop and chop technique. Tunnel was extended with 5.5mm keratome and rigid PMMA lens of 5.25mm optic size of appropriate power was implanted in the bag in all cases. Stromal hydration of main incision and side port was done.

Category B patients underwent phacoemulsification with superior scleral tunnel made 1.5 mm posterior to the corneal vascular arcade. A straight incision of 5.5mm length was made with a 15 no. blade through partial thickness of the sclera. The tunnel was extended 0.75-1 mm into clear cornea. Length of tunnel being 2.25-2.5 mm. Two side port entries were made at 9:30 and 2:30' 0 clock. Anterior chamber was entered fr om the anterior limit of sclera-corneal tunnel using a 2.8 mm keratome. Nucleus was emulsified using stop and chop technique. The inner opening of tunnel was extended using blunt-tip keratome. 5.25mm optic, PMMA IOL of appropriate power was implanted in the bag in all cases. Side port opening was sealed by stromal hydration.

Post operative assessment was done on post op day 1, week 1, week 4, month 3 and month 6. Post op patients were assessed for visual acuity, corneal clarity, anterior chamber depth, PCIOL placement in bag and keratometry was done. Incisional integrity was checked on slit lamp, and SIA was calculated using SIA software.

Results

Mean age of patients in category A was 65.45± 5.89 years and that in category B was 66.85 ± 6.36 years. There was no statistical significant difference between two category regarding age. Hence, the study was age matched Category A had 31 males and 19 females and in category B were 29 males and 21 females. Both the category were comparable.

Table 1 shows comparison of preoperative and post operative astigmatism on all post-op follow ups between two categories which is statistically significant and also comparison between two categories is significant. Also, comparison of preoperative astigmatism with post-op day 1, day 8, day 40, day 90, day 180 in category A and B and it showed statistically significant difference on all post-op days.

Table 2 shows comparison of surgically induced astigmatism (SIA) among two category and it shows statistically significant difference in both the category on all postoperative days.

We observed significant change in type of astigmatism on all postoperative days and between the two category. It shows significant With The Rule (WTR) shift in astigmatism in category A ($P<0.001$) and significant Against The Rule (ATR) shift in astigmatism in category B ($P<0.001$). In our study, SIA in temporal clear corneal on 1st, 8th, 40th, 90th, 180th post-operative day were as follows 1.13(0.61), 1.17(0.51), 0.98(±0.43), 0.92((±0.45) and 0.91(±0.47). There was a mild increase in the SIA from 1st to 8th post-operative day that decreased significantly by 40th post-operative day. There was mild further decrease in SIA by 3rd month which was not statistically significant and remained same by 6th month.

In superior scleral category, SIA was 0.92(±0.50), 0.92(±0.41), 0.80(±0.34), 0.77(±0.31) and 0.78(±0.31) on post op day 1, 8, 40, 90 and 180. The change from 1st to 40th day was significant and there was mild decrease in SIA on postoperative day 90 and 180 but was not significant as compared to postoperative day 40.

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

Astigmatism	Category A (n=50)		Category B (n=50)		P value
	Mean	SD	Mean	SD	
Pre-operative	0.61	0.49	0.83	0.57	<0.005
Post op day 1	0.92	0.60	1.45	0.78	<0.0001
Post op day 8	0.89	0.55	1.39	0.75	<0.0001
Post op day 40	0.81	0.58	1.30	0.77	<0.0001
Post op day 90	0.77	0.55	1.26	0.70	<0.0001
Post op day 180	0.75	0.57	1.26	0.70	<0.0001

1, day 8, day 40, day 90 and day 180 in study category op:operative

In both categories, 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.

Table 2: Comparison of SIA at post op day 1, day 8, day 40, day 90 and day 180 in study category in diopter(D)

Type of SI A	Category A (n=50)		Category B (n=50)		p-value
	Mean	SD	Mean	SD	
Post op day 1	1.13	0.61	0.92	0.50	<0.01
Post op day 8	1.17	0.51	0.92	0.41	<0.0001
Post op day 40	0.98	0.43	0.80	0.34	<0.001
Post op day 90	0.92	0.45	0.77	0.31	<0.005
Post op day 180	0.90	0.47	0.78	0.31	<0.01

op:operative , SIA: surgically induced astigmatism

Discussion

The clear temporal corneal incision did show statistically significant changes of more keratometric astigmatism 1 month after phacoemulsification compared to superior scleral incision. However, there was no statistically significant change after three months. It is possible that a small incision on the cornea may take up to three months to be refractive stable. In addition, the attempt of correcting astigmatism such as wound incision or limbal relaxation incision (LRI) through temporal cornea approach may get minimum effectiveness after three months. According to Holladay's study, the least SIRC (surgical induced refractive change) happened between 60 to 365 days post-op. [5]

There are many studies that document temporal clear corneal incisions of 2.8, 3.2 and 4mm which induce low astigmatism. [6,7-10] But there is very less literature available that comments on the incision integrity and wound stability of suture less 5.5mm clear corneal incision. This study shows that results of self-sealing 5.5mm clear corneal incision are comparable to smaller incision phacoemulsification surgeries in terms of incision integrity and SIA. Incision site and its length are the two major factors affecting the SIA. The study compares two category for same incision size (5.5mm) at two different sites, one for temporal clear corneal incision and other for superior scleral incision.

Surgically induced astigmatism and type of astigmatism was compared in both the category for age, sex and laterality of the eyes operated, neither of them were statistically significant. On comparing the type of astigmatism post-operatively, it was found that there was change to WTR astigmatism after temporal clear corneal incision and to ATR astigmatism in the superior scleral incision which was significant. The difference was attributed to the distractive force of eyelid blinking on superior wound. The change in the corneal curvature is responsible for surgically induced astigmatism and the astigmatic refractive error.

Kohnen et al reported SIA by vector method in 20 eyes with a temporal 5.0 mm clear corneal incision which was 0.91 D (±0.77) and 0.70D (±0.50) SIA after post-op week 1 and post-op 6 month. There was a steady decrease of SIA till six months post-operatively. Computerized video keratographic analysis pre-operatively and post- operatively was used. [10] Mahumad Asif et al performed a study on 50 eyes. Corneal astigmatism in 5.5mm temporal clear corneal incision was calculated on 4th post- operative week was 1.737 (±0.344), on 8th post-operative week was 1.739 (±0.344) and on 12th post-operative week was 1.732 (±0.344). In comparison to the pre-operative astigmatism 2.028(+/-0.342) it was statistically significant. [11] Reddy et al concluded that there is significant ATR shift in superior incision by phacoemulsification and manual SICS surgery and temporal incision had WTR shift. [12] Karad et al compared SIA following non phaco SICS at different site and concluded that 5.5mm superior incision induces 1.02±0.52 while at temporal site had 0.7±0.49. 13Vasavada et al also concluded that at the end of surgery, it is not the initial incision size alone but also the distortion of the incision during subsequent stages of surgery that determine the integrity of the CCI. Their study also demonstrated the impact of hydrating corneal incisions on the ingress of extra ocular fluid into the anterior chamber, concluded 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, because it restricts the ingress of small particles. Hence, Stromal hydration is done in conjunction with clear corneal incision in attempt to close the wound. [13,14]

The temporally placed incision has an added advantage, since the distance from the visual axis to the periphery in the horizontal meridian is longer than for others in the cornea. Therefore, flattening at this incision is less likely to be transmitted to the visual axis resulting in significantly lower SIA. When the incision is located superiorly, both gravity and eye-blink tend to create a drag on the incision and hence ATR induced astigmatism. WTR astigmatism induced by a temporal incision is advantageous, since most elderly cataract patients have pre-operative ATR astigmatism.) According to this study, in patients with a high degree of WTR astigmatism, superiorly placed incision can be considered. But the temporal placed clear corneal tunnel is best preferred for cases of pre-operative ATR astigmatism. Hence type of preoperative astigmatism must be considered before planning the site of incision to reduce postoperative astigmatism. Large incision size of up to 5.5mm clear corneal incision can have self-sealing properties hence use of rigid PMMA lens in non affording patients and dismissing the use of suture.

Conclusion

The study concludes that there is statistically significant post operative shift to WTR astigmatism in temporal clear corneal incision as opposed to ATR astigmatism in superior sclera incision; hence it is better to plan temporal incision

as mostly elderly patients have preoperative ATR astigmatism.

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