ORIGINAL ARTICLE

Comparison of Post-surgical Astigmatism Induced by Phacoemulsification through 2.75mm Incision on Steep Axis versus Scleral Tunnel Incision

ABDUL MAJEED MALIK, MUHAMMAD FAROOQ HYDER, TARIQ SHAKOOR, A*BDUL RAFE, OMAR ZAFAR, ALI RAUF*

ABSTRACT

Purpose: To compare post-surgical astigmatism induced by phacoemulsification through 2.75mm clear corneal incision at steep axis versus superior scleral tunnel incision.
Type of study: Quasi-experimental
Sampling technique: Non-Randomized consecutive sampling.
Materials and methods: This quasi-experimental study was performed on 180 eyes of 180 patients of cataract reporting at Eye Department, CMH, Lahore from Oct 2011 to July 2012 who had pre-existing corneal astigmatism. They were randomly assigned to two groups: Group A, 2.75mm clear corneal incision at steep axis group, and Group B, the superior scleral tunnel incision group. SPSS 17
Results: Induced refractive change caused by corneal incision at steep axis showed an overall improvement in pre-operative astigmatism with minimum level of significance while post-surgical astigmatism induced by scleral tunnel incision was found out to be minimal with a good visual rehabilitation.
Conclusion: Corneal incision at steep axis is an effective technique to reduce pre-operative astigmatism while scleral tunnel technique is suitable in cases where minimal change in pre-operative astigmatism is targeted.
Keywords: Astigmatism, steep axis, SI, phacoemulsification, with the rule astigmatism

INTRODUCTION

In Pakistan cataract contributes to 66.7% of the total blindness[1].Cataract surgery is the leading intraocular surgery being performed these days[2].Surgically induced astigmatism is a major concern of the ophthalmologists as it affects the final visual outcome of phacoemulsification. Measurements of the diopteric power of the central corneal zone, in terms of vertical (K1) and horizontal (K2) readings has to be applied in biometric formulas to calculate the IOL power. Pre-operative and post-operative comparison of K-readings can be used to calculate the astigmatism induced by surgery. Various modulations have been undertaken to reduce postoperative astigmatism[3]. Incision length and location are some variable modulations. While corneal incisional tunnel length can also be a factor in reducing postoperative astigmatism. In sutured surgery, suture removal is also a factor that is an indispensable consideration when attempting to reduce astigmatism[4].

We compared the effect of 2.75mm corneal incision at steep axis versus scleral tunnel on post-operative astigmatism.

Department of Ophthalmology, CMHl, Lahore
Correspondence to Dr. Muhammad Farooq Hyder, Assistant Professor Email: hyder_farooq@yahoo.com

MATERIALS AND METHODS

This was a retrospective randomized case study that was conducted in CMH Lahore and included 180 patients. The preoperative keratometry was done and astigmatism was recorded for all the sample patients. They were then randomly assigned to Group A or B for either the phacoemulsification through clear corneal incision at steep axis or phacoemulsification through superior scleral tunnel incision with intraocular lens implant (one surgeon).

Inclusion criteria: Male and female patients with more than 35 years age before which cataract is not age-related cataract only as other types of cataracts may cause corneal distortion in patients undergoing phacoemulsification.

Exclusion criteria: Eye diseases affecting the health of cornea as they distort the curvature and induce astigmatism. These include corneal injuries including chemical burns, corneal opacities, dry eyes, pterygium and lid conditions like entropion, trichiasis, and upper lid tumors etc.

1. Patients having congenital and acquired corneal anomalies e.g., microcornea, keratoconus, Mooren ulcer, peripheral corneal degenerations etc.
2. Patients having previous history of any ocular surgery or trauma as the cornea is already distorted.
3. Glaucoma patients who have thinner corneas prone to astigmatic changes.

Approval was taken from the ethical committee and attached at the end. Administrative permission will be taken from concerned authorities. A detailed history and a thorough clinical examination was carried out on the patients presenting to CMH Lahore, including visual acuity, slit lamp examination and fundoscopy and diagnosis confirmed by the researchers. "RK-F1 automatted kerato-refractometer" (ARK) was employed to take keratometric (K) readings for astigmatic measurement before and after cataract surgery. Change in astigmatism 4 weeks after operation was recorded. Informed written consent was taken and surgical procedure as well as the research details was communicated to the patient. Baseline investigations were carried out. Patients were divided into two groups randomly based on the table of random numbers.

Group A: Phcoemulsification through clear corneal incision at steep axis.

Group B: Phcoemulsification through superior sclera tunnel incision.

Single consultant surgeon performed the surgeries to avoid the difference of technique among different surgeons. Surgery was performed in following way: Topical/local anaesthesia was applied. Clear corneal incision was given at steep axis in group A, while superior scleral tunnel was made in group B. Cataract was extracted by phaco-emulsification in both the groups. Foldable intraocular lens was implanted. No suture was applied in both the groups and eye was padded. Dressing was removed in the same evening. Eye was thoroughly examined with slit-lamp biomicroscope and topical antibiotics and steroids were instituted. The patients were followed up on the 1st & 7th post-op day and later one month post-operatively and their k-readings recorded and compared with the pre-op ones.

RESULTS

Out of a total of 180 eyes, 90 were males and 90 were females, while 85 eyes were right and the rest were left as shown in Tables 1 and 2.

Table 1: Gender of patients

Gender	Total	%age
Male	90	50
Female	90	50

Table 2: Laterality of eyes

	Total	%age
Right	85	47
Left	95	53

Twenty seven of the patients were in the age group of 50 or less, while the rest were above 50 years of age as depicted in Table 3.

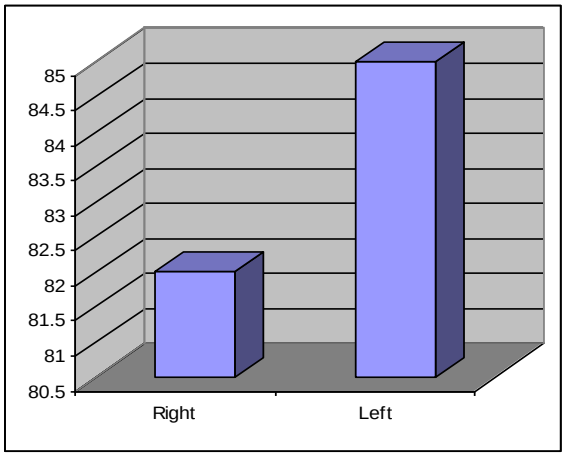
Table 3: Ages of patients

	Total	%age
50 years or less	27	15
More than 50	153	85

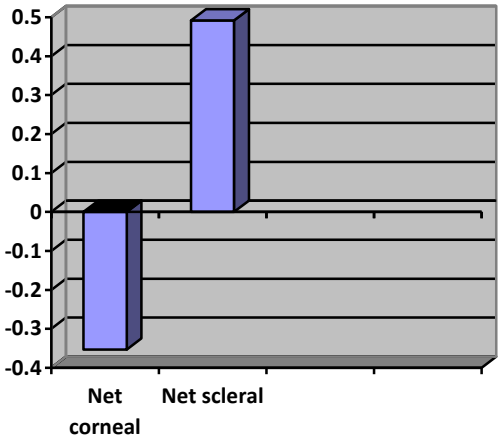
Table 4: Comparison of mean astigmatisms.

	Mean	SD
Net astigmatism with corneal incision at steep axis	-0.353 D	0.597
Net astigmatism with scleral tunnel incision	0.4917 D	0.428

Graph 1: Laterality of eyes



Graph 2: Comparison of post-surgical astigmatism induced by clear corneal incision at steep axis vs scleral tunnel incision



We found that post-surgical astigmatism induced by clear corneal incision, fashioned at steep axis was -0.353±SD 0.597 diopters (D) (Table 4). This implied that steep axis corneal incision constantly and effectively reduced astigmatism by 0.35 D in all cases. On the other hand scleral tunnel technique produced a net post-surgical astigmatism of 0.4917±0.428 D which is statistically significant (Graph 2).

DISCUSSION

It would not be an exaggeration to state that cataract surgery has emerged as a true refractive surgical procedure[5]. To improve uncorrected visual acuity, we have to deal with spherical ametropia as well as with astigmatism. The corneal component of astigmatism depends on many factors, which include the suturing material used, the type and location of the surgical incision, suture placement, and the postoperative use of steroids[6]. We have some options to reduce post-surgical astigmatism during cataract surgery. These options include creating an incision to reduce preexisting astigmatism through manipulation (location, length, and construction)[7]. Self-sealing tunnel incisions do not induce corneal changes caused by sutures. Incisions are not just a port of access to the anterior chamber, but also the most important step during surgery ensuring ocular integrity and corneal stability.

Astigmatism is that condition of refraction wherein a point focus of light cannot be formed upon the retina because of unequal refraction of light in different meridians of cornea. It is measured in diopters (D) employing autorefrectometer or a keratometer[8]. SIA is related to length, location, architecture and closure technique of the incision. Smaller incisions and peripheral incisions at sclera and limbus result in a less surgically induced astigmatism than those that involve cornea[9]. Similarly suturing the incision may result in either steepening or flattening of cornea[4]. Besides reducing astigmatism, smaller incision also gives early recovery, better unaided visual acuity[10].

After manual extra capsular cataract surgery, in many cases post-operative visual acuity is not satisfactory. Surgically induced astigmatism is a major cause for this result. Astigmatism induced by phacoemulsification is lesser than that by extra capsular cataract extraction[11]. To provide even better wound healing and minimum surgically induced astigmatism, Kratz thought of scleral tunnel as an astigmatic neutral way of entering the anterior chamber[12]. Astigmatism after clear corneal incision phacoemulsification is 0.72+0.35D while that induced by scleral tunnel technique is 0.36+O.21 D[13].

While no study comparing the astigmatism induced by the two surgical interventions have been done locally, some international studies claim that the incision through either temporal clear cornea or superior scleral tunnel in phacoemulsification shows no statistic difference in astigmatic change[14]. In order to determine the better technique for future application, astigmatism induced by the two techniques will be compared in this study.

The choice of scleral tunnel has many advantages over corneal incision in that it induces lesser post-operative astigmatism. The wound is well covered and protected under the conjunctival flap, thus avoiding corneal burns and post-operative incision marks on the cornea. Our study corroborated with other studies in that surgically-induced astigmatism (SIA) by scleral tunnel incision was more or less the same. Furthermore, SIA was less as compared to that induced by clear corneal incision, thus scleral tunnel is an effective in patients who already have insignificant astigmatism.

REFERENCES

1. Khan A Q, Qureshi B, Khan M D. Rapid assessment of cataract blindness in age 40 years and above in District Skardu, Baltistan, Northern Areas of Pakistan. Pak J Ophthalmol 2003; 19:84-9
2. Qazi ZA. Corneal endothelium tissue that demands respect [editorial]. Pak J Ophthalmol 2003; 19:1-2.
3. Zheng L, Merriam JC. Astigmatism and visual recovery after “large incision” extracapsular cataract surgery and “small incisions” for phacoemulsification. Trans Am Ophthalmol Soc 1997; 95:387-415.
4. Cho YK, Kim MS. Perioperative Modulating Factors on Astigmatism in Sutured Cataract Surgery. Korean Journal of Ophthalmology 2009;23:240-248.
5. Raviv T, Ebstein RJ. Astigmatism management. *Int Ophthalmol Clin* 2000;40:183-98.
6. Bar-Sela SM, Spierer A. Astigmatism outcomes of scleral tunnel and clear corneal incisions for congenital cataract surgery. *Eye* 2006;20:1044-8.
7. Kim HY. The changes of with-the-rule astigmatism after clear corneal temporal incision cataract surgery. *J Korean Ophthalmol Soc* 2008;49: 433-1.
8. Naz MA. Effect of 3.2 mm superior scleral incision for phacoemulsification on corneal curvatures (Assessed by k-readings).Pak J Ophthalmol 2006, 1(22): 38-41.
9. Junejo SA, Jatoi SM. Chick feed technique versus standard chop technique in micro incision cataract surgery.J Ayub Med Coll Abbottabad 2009;21(1): 43-7.
10. Osher RH, Injev VP. Thermal study of bare tips with various system parameters and incision sizes. J Cataract Refract Surg 2006;32:867-72.
11. George R, Rupauliha P, Sripriya AV, Rajesh PS, Vahan PV,Praveen S.Comparison of endothelial cell loss and surgically induced astigmatism following conventional extracapsular cataract surgery, manual small-incision surgery and phacoemulsification. Ophthalmic Epidemiol. 2005 Oct;12(5):293-7.
12. Haldipurkar SS, Shikari HT, Gokhale V. Wound construction in manual small incision cataract surgery. Indian J Ophthalmol 2009;57:9-13
13. Olsen T, Dam-Johansen M, Bek T Corneal versus scleral tunnel incision in cataract surgery: a randomized study. J Cataract Refract Surg**.** 1997; 23(3): 337-41.
14. He Y, Zhu S, ChenM. Comparison of the Keratometric Corneal Astigmatic Power after Phacoemulsification: Clear Temporal Corneal Incision versus Superior Scleral Tunnel Incision.J Ophthalmol. 2009;210621. Epub 2010 Jan 5.