Original Article

Effect of Incision Site on Pre-existing Astigmatism in Phaco-emulsification

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Pak J Ophthalmol 2014, Vol. 30 No. 1

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Purpose: The purpose of the study was to determine the mean change in pre-existing astigmatism, by site of incision in phacoemulsification.

Material and Methods: It was a prospective study, conducted at Ophthalmology Department, Khyber Teaching Hospital Peshawar, from March 1st 2012 to August 31st 2012. All cases were operated by phacoemulsification with intraocular lens implantation keeping 3.2 mm incision perpendicular to steep meridian of cornea. Astigmatism was measured in diopters by keratometry pre-operatively and at 6 weeks post-operatively.

Results: Total number of patients included in the study was 113. The mean pre-operative astigmatism was 1.90 ± 0.49 diopters with a range from 1.20 to 3.25 diopters. The astigmatism decreased in 105 eyes (92.92%), remained unchanged in 4 eyes (3.53%) and increased in 4 eyes (3.53%). The mean reduction in astigmatism at the end of study was 0.54 ± 0.27 diopters. This difference in preoperative and postoperative was statistically significant (P value = 0.0001).

Conclusion: A 3.2 mm Perpendicular incision at the steep meridian of cornea is effective in reducing the pre-existing astigmatism.

Cataract affects approximately 20 million people worldwide and this figure is expected to reach 50 million by the year 2020[1]. In Pakistan cataract accounts for 66.7% of the total blindness[2] and cataract surgery is the most commonly performed ocular surgery[3].

Small incision cataract surgery doesn't require suturing of wound, has low risk of intra operative and postoperative complications and results in rapid visual rehabilitation[4]. Phacoemulsification results in better postoperative visual acuity (VA) than extra capsular cataract extraction (ECCE) at all postoperative intervals[5]. Therefore, phacoemulsification is almost universally preferred nowadays[6].

Spectacles or contact 5 lenses can be used to correct astigmatism. Spectacles wear for correction of astigmatism can cause various optical aberrations. Contact lens wear has a number of side effects such as risk of infection, mechanical and hypoxic keratitis, immune response keratitis and giant papillary conjunctivitis[7].

Correction of preexisting astigmatism simultaneously with cataract surgery is attempted nowadays. Different methods of reducing astigmatism during cataract surgery include keratotomy, toric intraocular lens (IOL) implantation, opposite clear corneal incision (OCCI) and limbal relaxing incisions or corneal relaxing incisions[5].

A clear corneal incision given during phacoemulsification at the steep meridian of cornea reduces preexisting astigmatism[8,9]. Limbal relaxing incisions performed during phacoemulsification are also very safe, stable and effective in reducing pre-existing corneal astigmatism[9].

The objective of the study was to determine the mean change in pre-existing astigmatism, by site of incision in phacoemulsification as altering the incision site may help in reducing pre-existing astigmatism.

MATERIAL AND METHODS

It was a prospective study conducted at Ophthalmology Department, Khyber Teaching Hospital

Peshawar, from March 1st 2012 to August 31st 2012. All patients with age related cataract with pre existing astigmatism of 1D or more were included in the study. Patients having irregular astigmatism and astigmatism due to pterygium, previous history of any surgery in same eye, corneal opacity and those having traumatic or complicated cataract were excluded from the study. Sampling technique was non-probability consecutive sampling.

Approval was taken from the hospital ethical committee before starting the study and written informed consent was taken from the patients. Pre-operatively detailed history was taken and complete systemic and ocular examination was done, including keratometry for the type and degree of astigmatism.

All cases were operated by phacoemulsification with IOL implantation keeping 3.2mm incision at the limbus perpendicular to steep meridian of cornea. After viscoelastic material was injected, a continuous curvilinear capsulorhexis, hydro dissection, phaco-emulsification, aspiration of cortex and capsular bag refilling with viscoelastic solution was performed. A foldable acrylic IOL was implanted in the capsular bag. Viscoelastic material was removed and anterior chamber formed with Ringer's lactate. Wound was tested for water tightness. In all eyes phaco power, viscoelastic gel, irrigation solution (Ringer's lactate) and IOL were kept constant. All surgeries were performed by the same surgeon.

Postoperatively each patient received 0.3% ofloxacin eye drops and 0.1% dexamethasone eye drops 4 times / day. Steroid eye drops were tapered in 4 – 6 weeks. Analgesics were used whenever required.

Post-operatively the patients were followed up after 6 weeks. At follow up visit, keratometry was performed to see the effect of incision site in the form of correction of pre-existing astigmatism. All the relevant data was recorded in a pre-designed proforma. All the collected data was analyzed using SPSS version 10.0.

RESULTS

The number of patients included in our study was 113. Patient's age ranged from 41 to 84 years with a mean of 59.36 ± 10.08 years. 62 patients (54.86 %) were male and 51 (45.13%) were female. All the patients underwent phacoemulsification and IOL implantation through a 3.2 mm wide incision perpendicular to the steep meridian of cornea. Right eye was operated in 59 (52.21%) cases and left eye was operated in 54 (47.78%) cases.

Pre-operative astigmatism in all the patients was measured in diopters (Table 1). The mean pre-operative astigmatism was 1.90 ± 0.49 diopters with a range from 1.20 to 3.25 diopters.

All patients were followed up at 6th week post-operatively and post-operative astigmatism was recorded (Table 2). The mean post-operative astigmatism was 1.36 ± 0.53 diopters with a range from 0.50 to 2.80 diopters.

Table 1: Pre-operative Astigmatism (In Diopters)

Astigmatism (Diopters)	Frequency n (%)
1.01 - 1.25	03 (02.65)
1.26 - 1.50	26 (23)
1.51 - 1.75	31 (27.43)
1.76 - 2.00	15 (13.27)
2.01 - 2.25	13 (11.50)
2.26 - 2.50	10 (08.84)
2.51 - 2.75	08 (07.07)
2.76 - 3.00	05 (04.42)
3.01 - 3.25	02 (01.76)
Total	113 (100)

Mean pre-operative astigmatism = 1.90 ± 0.49 D

Table 2: Pre-operative Astigmatism (In Diopters)

Astigmatism (Diopters)	Frequency n (%)
0.26 - 0.50	02 (1.76)
0.51 - 0.75	07 (06.19)
0.76 - 1.00	24 (21.23)
1.01 - 1.25	30 (26.54)
1.26 - 1.50	17 (15.04)
1.51 - 1.75	08 (07.07)
1.76 - 2.00	09 (07.96)
2.01 - 2.25	06 (05.30)
2.26 - 2.50	07 (06.19)
2.51 - 2.75	02 (01.76)
2.76 - 3.00	01 (00.88)
Total	113 (100)

Mean pre-operative astigmatism = 1.36 ± 0.53 D

Difference between pre-operative and post-operative astigmatism was noted at 6 weeks (Table 3). The change in astigmatism was ranging from -1.25 D to + 0.25 diopters with a mean of -0.54 ± 0.27 diopters. The astigmatism decreased in 105 eyes (92.92%), remained unchanged in 4 eyes (3.53%) and increased in 4 eyes (3.53%). The mean change in astigmatism at the end of my study was 0.54 ± 0.27 diopters. Student t test was applied for significance of change in astigmatism after the surgery. The p value was 0.0001 and this difference was considered to be statistically significant.

Table 3: Change in Astigmatism at 6 weeks after surgery

Change in Astigmatism	Frequency n (%)
-01.25 to -01.01	06 (05.30)
-01.00 to -00.76	12 (10.16)
-00.75 to -00.51	43 (38.05)
-00.50 to -00.26	38 (33.62)
-00.25 to -00.01	06 (05.30)
00	04 (03.53)
+00.01 to +00.25	04 (03.53)
Total	113 (100)

Mean change in astigmatism = -0.54 to 0.27 D
Decrease in astigmatism
+Increase in astigmatism

DISCUSSION

Modern cataract surgery aims at achieving a good refractive outcome postoperatively with minimal post-operative astigmatism[10]. Postoperative astigmatism depends on the site, width and architecture of the incision and suturing technique[11,12]. Even with small incision cataract surgery using foldable IOL the visual outcome may vary greatly due to pre-existing astigmatism.

Placing the incision on the steepest meridian results in decreased refractive power in that meridian and an increased refractive power in the meridian perpendicular to it[13]. In our study this concept was utilized in eyes with pre-operative astigmatism of 1.00 D or more. In this study a 3.2 mm self-sealing incision was given perpendicular to the steep axis of cornea to assess the effect of a site of incision on neutralizing the pre-existing astigmatism.

This study shows that by placing a 3.2 mm incision perpendicular to the steeper axis, it is possible to reduce the amount of astigmatism in eyes with pre-operative astigmatism of 1.00 D or more. Lever and Dahan[14] reported in their study that a 3.5 mm opposite clear corneal incision in the steep meridian was effective in reducing pre-existing corneal astigmatism by a mean value of 2 Diopters.

Corresponding figures have been reported to be 0.5 Diopters by Tadros[15] and 1.5 Diopters by Khokhar.[8] In one study,[16] in patients who underwent conventional small incision cataract surgery (SICS), eyes with superior incisions had 1.92 ± 0.53 D "against the rule" astigmatism and eyes with temporal incisions had 1.57 ± 0.24 D "with the rule" astigmatism at 90 days. In patients who underwent phacoemulsification, 1.08 ± 0.36 D astigmatism was seen with clear corneal incision and 1.23 ± 0.71 D astigmatism was seen with corneo-scleral incision. In the study of George et al[17], mean astigmatism after conventional ECCE, manual SICS and phacoemulsification surgery was 1.77 D, 1.17 D and 0.77 D respectively (P = 0.001).

In our study a 3.2 mm clear corneal incision was given in all cases, in the steep meridian. Post-operative keratometry was done 6 weeks after the surgery, to give time for complete wound healing and stabilization of refraction. The decrease in astigmatism at the follow up was 0.54 ± 0.27 diopters. The difference between pre-operative and post-operative astigmatism was statistically significant (P value = 0.0001). However, placing the corneal incision in the steep meridian alone may not fully correct high astigmatism and this may have to be combined with other procedures[5] or the residual astigmatism may have to be corrected with glasses post-operatively.

CONCLUSION

A 3.2 mm wide incision for phacoemulsification placed perpendicular to steep axis of cornea is effective in reducing the pre-existing corneal astigmatism.

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