Original Article

Surgically Induced Astigmatism Comparison between Forceps and Injector Delivery System for Foldable IOL in Phacoemulsification

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Purpose: To compare surgically induced astigmatism between injector and forceps delivery system for intraocular lens implantation in phacoemulsification.

Methods: This Quasi experimental study was carried out in Ophthalmology Department, Shaikh Zayed Hospital, Lahore. One hundred consecutive cataract patients were operated upon by phacoemulsification with acrylic foldable IOL implantation. Patients were randomly divided into two groups i.e. group I, injector delivery system and group II forceps delivery system for IOL implantation. Preoperative and postoperative keratometric reading of the patients were taken by Javal-Schiotz keratometer. All patients were followed for 8 weeks. Surgically induced astigmatism was calculated by vector method.

Results: The mean preoperative astigmatism K_1 in group I was 0.545 D (±0.538) while in group II was 0.615 D (±0.587). The mean postoperative astigmatism K_3 in group I was 0.86 D (±0.580) and in group II was 0.785 D (±0.670). The mean surgically induced astigmatism in group I was 0.998 D (±0.532) and 1.064 D (±0.757) in group II. The difference in surgically induced astigmatism K_2 in both groups was 0.066 D, not significant (P=0.625).

Conclusion: Both injector and forceps delivery systems of IOL were safe and equally acceptable with insignificant difference in surgically induced astigmatism.

Cataract is the commonest cause of treatable blindness throughout the world and for this reason cataract extraction is the commonest procedure done all around the globe[1]. Aims of modern cataract surgery are minimal postoperative astigmatism, smaller incision size, and rapid visual rehabilitation[2]. Phacoemulsification fulfils these aims and has therefore evolved as the preferred surgical procedure for cataract extraction over the past two decades[3]. It is one of the most innovative and popular techniques[4]. To implant foldable IOLs through small incision in phacomulsification popular methods are injector and forceps delivery systems. Using an injector to insert acrylic IOLs may have an advantage because IOL does not contact the lid or conjunctiva intraoperatively[5]. Less wound manipulation occurs with an injector system and the wound required for implantation is smaller than with other methods[6]. Some studies suggest that insertion of an acrylic lens with a forceps brings bacteria into eye[7].

Surgically induced astigmatism is related to the type, length and location of the incision and closure techniques[8,9]. This study is the comparison of induced astigmatism between forceps and injector delivery systems for foldable IOL implantation in phaco-emulsification.

MATERIAL AND METHODS

This Quasi experimental study was conducted in the Ophthalmology department, Sheikh Zayed Hospital, Lahore from April 2005 to February 2006. 100 patients

were selected for surgery by purposive non-probability sampling with random allocation to the two groups of patients i.e. Group 1 (Injector delivery system for IOL) and Group 2 (Forceps delivery system for IOL).

Inclusion Criteria for patients was age related cataract suitable for phacoemulisification with no associated anterior or posterior segment pathology.

Pre-operative evaluation of the patients included detailed ocular and systemic history with complete ocular examination including visual acuity assessment, extra ocular motility, slit lamp examination and dilated fundus examination. Preoperative kerotometery (with Javal Shiorts keratometer) and axial length was recorded for biometry.

All the patients except one male were operated under local anaesthesia in the form of peri-bulbar injection, using a mixture of 0.50% bupivacaine and 2% xylocain in 1:1. One patient was operated under general anaesthesia.

A standard surgical procedure was followed in all the patients. After applying the lid speculum, continuous curvilinear capsulorehexis was done with a bent-tipped 27 gauge needle. A 2mm side port incision was made with 15° knife slightly below 180° to 3mm main 12 o'clock incision, on temporal side for right eyes and on nasal side for left eyes i.e. 8 o'clock position.

Hydrodissection was performed with 23 gauge cannula attached to 3 ml syringe filled with balanced salt solution (BSS), endocapsular phacoemulsification using single handed phase-flip technique was performed and aspiration of the epinucleus was carried out. Aspiration of the residual cortical matter was done with a manual Simcoe's cannula. The anterior chamber was reformed with the viscoelastic material.

In group I patients foldable C-flex 570C acrylic IOL was implanted with injector, which was provided with IOL. No attempt was made to enlarge the incision. Incision length was measured using a Kohnen (G19136, Gender) caliper. The caliper tips were inserted in the internal openings of the incision and were gently opened until modest tissue resistance was noted. The viscoelastic material was cleared out by irrigation with balanced salt solution and aspirated by manual cannula. All of the incisions were left suture less.

In group II, wound was slightly enlarged with 5.5 mm knife and IOL was implanted using forceps. Wound length was measured with caliper. All of the incisions were left suture less.

Post-operatively patients were examined next morning. Detailed anterior segment examination was carried out with slit lamp. Kerotometery readings were taken by Javal-Schiotz keratometer and noted.

All the patients were prescribed with topical antibiotics and steroids combination (0.3% tobramycin and 0.1% dexamethasone). Topical drops were given one drop x 2 hourly for first week. Then these drops were tapered off gradually and terminated in 4 weeks.

All the patients were examined on 1st, 2nd, 4th and 8th week postoperatively. Uncorrected visual acuity, slit lamp examination for condition of wound, inflammatory signs in anterior chamber and any other complication was noted and K-readings were recorded on each visit.

Data was entered and analyzed by SPSS-10. Catagoric variables like sex and complications were given as frequency and percentage. Numerical variables like age, degree of astigmatism pre and postoperative were given by mean and standard deviation. Keratometric readings were compared by applying student's `t' test with significance P value equal to or less than 0.05.

RESULTS

Table 1 shows age distribution between 2 groups. Age did not differ significantly between the 2 groups. There were 25 (50%) males, 25 (50%) females in group I and 19 males (38%), 31 females (62%) in group II as shown in figure 1. Wound size ranged 3.1-3.5 mm in group I, mean 3.21 and 3.44-4.0 mm in group II, mean 3.72 mm (Table 2). The difference in mean of wound size was 0.516 mm between two groups.

The mean preoperative astigmatism K_1 in group I was 0.545 D @ 135° and mean preoperative astigmatism K_1 in group II was 0.615 D @ 119.10°. The mean post-operative astigmatism K_3 in group I was 0.86 D @ 109.8° and mean post-operative astigmatism K_3 in group II was 0.785 D @ 84.7°. The mean shift in angle in group I was 25.2° and in group II was 34.4°. The mean surgically astigmatism K_2 in group I was 0.998 D @ 94.44° and in group II was 1.06 D @ 78.59° (Tables 3).

Post-operative uncorrected VA after 8 weeks in group I was 6/6 in 5 (10%) and in group II was nil, 6/6p in group I was 1 (2%) and in group II was 5 (10%), 6/9 in group I was 18 (36%) and in group II was 11 (22%), 6/12 in group I was 13 (26%) and in group II

was 14 (28%), 6/18 in group I was 7 (14%) and in group II was 14 (28%), 6/24 in group I was 3 (6%) and in group II was 4 (8%), 6/36 in group I was 2 (4%) and in group II was 2 (4%), CF in group I was 1 (2%) and no patient (0%) was in group II.

The range of surgical induced astigmatism in group I was 0.25-2.09 D with 0.00-0.5 D in 10 (20%) patients, 0.50-1.00 D in 19 (38%), 1-1.5 D in 10 (20%), 1.5-2.0 D in 10 (20%) and >2 D in 1 (2%) (Table 4).

In group II range of surgically induced astigmatism was 0.00-2.923 D with 0.00-0.5 D in 17 (34%), 0.5-1.00 D in 15 (30%), 1-1.5 D in 6 (12%), 1.5-2.0 D in 7 (14%) and >2 D in 5 (10%) (Table 4).

The mean difference in surgical induced astigmatism in two groups was 0.06 D, which was statistically insignificant (P>0.625).

DISCUSSION

With advancement in technique and technology, cataract surgery has become a procedure with fewer complications and more predictable visual outcomes. As a result the expectations of patients undergoing cataract surgery are not much below the patients undergoing refractive surgery.

The ultimate limiting factors in optimum post-operative visual function, is often the amount of post-operative astigmatism. Nevertheless, post-operative astigmatism remain one of the most unpredictable and difficult aspect of the modern cataract surgery.

Surgically induced astigmatism (SIA) is related to the type, length and location of the incision and to the source of closure techniques[8,9].

With the widespread use of phacoemulsification, new surgical techniques to reduce the amount of astigmatism and facilitate visual recovery have been developed. Self-sealing, small-incision surgery using a foldable intraocular lens has become popular, and the incidence of complications has significantly decreased[10,11].

Foldable intraocular lenses and innovations in insertion forceps and injector delivery systems have enabled the use of unenlarged phacoemulsification incisions.

The results showing SIA after phacoemulsification in our study are almost similar to many other studies in similar setup. Studies dealing with incision size indicated that the incision should be measured after IOL implantation[12]. Kohnen and Coauthors[12] reported that cataract incisions enlarged by approximately 11.0% with use of injectors for IOL insertion.

In a study conducted by Mamalis[13] showed that forceps inserted IOLs create larger change in wound diameter than lens inserted with an injector. As in our study wound size with forceps delivery system was slightly larger than with injector delivery system (0.516mm).

Knowing the proper size of a wound before implantation of a foldable IOL is important in preventing corneal damage by uncontrolled wound extension[14]. In our study although the 3.2 mm keratome was used but wound was slightly enlarged in forceps delivery system so that uncontrolled wound extension would not occur. Radner and Coauthors[15] and Radner et al[16] found that IOL implantation through an incision that is too small intensifies corneal damage with tearing of stromal lamellae.

Kohnen et al[12] evaluated the astigmatism changes in incision of different sizes; 3.5 mm and 4.00 mm (foldable lenses) and 5.00 mm (small optic PMMA lenses). During the first post-operative week, the mean astigmatism was found to be (0.86 D) in 3.5 mm incision group, 0.93 D in 4.00 mm group and 1.6 D in 5 mm incision group.

No difference in postoperative vector astigmatism was found at any postoperative examination in a study by Pfleger et al[17] who compared a 4.5 mm scleral incision group with a 3.5 mm scleral incision group. These studies showed that the difference in incision size in comparison group has to be 2 mm or more to be statistically significant. In our study the mean difference in wound size between two groups was less than 2 mm (0.516 mm) which was statistically insignificant (P>0.05).

Pfleger et al[18] also studied small incision (3.2 mm) cataract surgery with foldable IOL implants. The mean keratometric cylinder in their patients was 0.79 D. Subsequent post-operative values recorded at one week, four weeks and 12 weeks were 0.84 D, 0.81 D and 0.74 D respectively.

In a study conducted by Rainer et al[2] showed an SIA of 0.78 D after 1 week, 0.18 D after 1 month, and 0.89 D after 3 month in supero-lateral clear corneal incision.

Yao et al[19] conducted a study and stated that surgery was performed through a 3.2mm incision. The mean post-operative astigmatism was 0.89+/-0.83 D at the one week and+0.73+/-0.76 D at one month.

In our study the surgically induced astigmatism 0.999±0.53 in group I and 1.06±0.75 in group II was slightly higher than all these studies which were mentioned above. This could be probably due to that we have taken the kerotometery readings by manual keratometer (Javel-Schiotz), which measures the central corneal power, and if these were measured with video keratoscopy the results could be more accurate.

Table 1: Distribution of age in both groups

Age (Years)	Group I (n=50)	Group II (n=50)
40-50	9 (18.0)	9 (18.0)
51-60	19 (38.0)	21 (42.0)
61-70	19 (38.0)	9 (18.0)
71-80	2 (4.0)	10 (20.0)
>80	1 (2.0)	1 (2.0)

Table 2: Wound size in both groups

Wound Size	Group I (n=50)	Group II (n=50)
3.1-3.2	37 (74.0)	
3.4-3.5	13 (26.)	13 (26.0)
3.6-3.7		14 (28.0)
3.8-4.0		23 (46.0)

Table 3: Mean values in group 1 and 2

	Group I Meas +SD	Group II Meas +SD	P Value
K1	0.545±0.538	0.615±0.587	P>0.05
Angle K1	135.0±54.79	119.10±53.24	P>0.05
K3	0.86±0.58	0.785±0.670	P>0.05
Angle K3	109.80±42.86	84.70±50.43	P>0.01
K2	0.998±0.532	1.06±0.757	P>0.05
Angle K2	94.44	78.59	

K_1 = Pre-operative astigmatism in Diopters
K_3 = Post-operative astigmatism in Diopters
K_2 = Surgically induced astigmatism in Diopters
SD = Standard deviation

Table 4: Surgically induced astigmatism in groups 1 and 2

	Group I (n=50)	Group II (n=50)
0.00-0.5 D	10 (20)	17 (34)
0.5-1.00 D	19 (38)	15 (30)
1-1.5 D	10 (20)	6 (12)
1.5-2 D	10 (20)	7 (14)
>2 D	1 (2)	5 (10)
Range	0.25-2.09	0.00-2.923

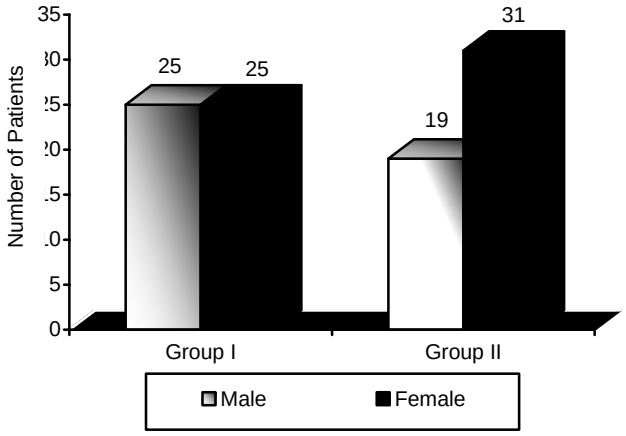

Fig. 1: Distribution of patients according to sex

In our study, we did not encounter any serious complication as mentioned by Hashmani et al[20] in his first series and Hussain et al[4] have mentioned previously. Only one case in group I developed post-operative endophthalmitis, which was excluded from this study.

The data summarized here demonstrated that although there was a small difference in wound size in both group but surgically induced astigmatism was not significant in both groups.

CONCLUSION

Delivery of intraocular lens with injector and forceps was safe and equally acceptable statistically with statically insignificant difference in surgically induced astigmatism.

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