Original Research Article

Study of role of intraoperative keratoscopy in management of astigmatism in extracapsular cataract extraction [ECCE] with PCIOL

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Abstract

Aim: To evaluate and to obtain minimum degree of postoperative astigmatism in 20 cases of senile cataract using Singh's Keratoscope and finally compare the results with a control group .**Methods** A cross sectional analytical study was done on 40 patients operated for cataract**.**40 patients operated with Extracapsular Cataract Extraction [ECCE] and posterior chamber intraocular lens were equally divided into two groups. In Group A, intra-operative keratoscopy was done, using Singh's keratoscope, while in Group B this procedure was not done and served as comparison group. All possible parameters like type, length and site of cataract incision surgical technique, design of lens implant, suture material and suturing technique were similar in both the groups. **Results :** Final astigmatism noted at 12 weeks showed that in Group A it ranged from 0 to 2 Dioptres with a mean of 0.85 D and P value of less than 0.01 which is statistically highly significant while in Group B it ranged from 0.5 to 5 D with a mean of 2.275 D.**Conclusion** Singh's keratoscope is low cost instrument, easy to use, gives simple interpretation both on the table and can also be used postoperatively to follow the variation and monitor the conrneal curvature and wound healing in these cases. This method and instrument is an extremely useful in the prevention of high postoperative astigmatism, more so after intraocular lens implant surgery giving rapid visual rehabilitation and satisfaction both the patient and operating surgeon.

Keywords: Extracapsular Cataract Extraction [ECCE], Posterior Chamber Intraocular Lens [PCIOL], Intraoperative Keratoscopy, Singh's Keratoscope

Introduction

Cataract is a major cause of avoidable blindness and worldwide, an estimated 17 million are blind from this condition. In the absence of any preventive measures the only recource is surgery. In the field of cataract surgery, IOL implantation after extra capsular cataract extraction was a major breakthrough. However delayed rehabilitation was the major drawback with this procedure and it produced high induced astigmatism and ocular discomfort due to sutures. Invention of phacoemulsification by "Charles Kelmann" (1965) and learning the technique of self-sealing wound (1980) resolved the above mentioned problems associated with ECCE ,thus begun the era of suture-less small incision cataract surgery. Cataract surgeons were pre-occupied with finding ways & various methods and techniques to overcome the high incidence of operative and post-operative complications. Nowadays , that attention was directed towards quality of post-operative vision and soon it was realized that post-operative astigmatism was the main hurdle to be overcome, before good and early post - operative vision could be promised to the patient.Improvements in the surgical technique of cataract extraction further focused the attention on the cataract incision and its closure. Further, with the advent of A-scan biometry and extra capsular surgery, landing up with high post-operative astigmatism frustrates the efforts of an excellent surgery. Several factors responsible for surgically induced astigmatism have been identified , some of which are the position, length and shape of incision, method of suturing, number of sutures, sideways misalignment of section closure and the tightness of section closure. In addition to these, pre-operative astigmatism of the patient also plays an important role in the final visual outcome. Measuring astigmatism on the table can therefore be a very valid method for obtaining desired results. What is therefore required and worthwhile is an intra-operative method which simultaneously minimizes surgical astigmatism and is cheap, safe and gives quick results.Keeping this is mind, this work was undertaken and it is hoped that the study will provide useful information and throw more light in tracking the problem of control of post-operative astigmatism more effectively.Therefore keeping certain factors common viz. incision and type of suture used including technique of suturing, a clinical evaluation of postoperative astigmatism was done in Extra-capsular Cataract Extraction[ECCE] with PCIOL using Singh's Keratoscope. The results were compared with a comparison group of equal number of cases[1-3].

Materials and methods

In the present study, a series of 40 cases of different age & sex, admitted in the indoor wards of Department of Ophthalmology,Gandhi Medical College and Associated Hamidia Hospital,Bhopal during the year 1993-95 for cataract surgery were taken up. After routine registration,the cases were examined on the following lines:

History

Patients name, age, sex and address were noted. History of the patient was carefully recorded pertaining to the cause of cataract especially with regard to traumatic or complicated cataract. Any history of diseases like Diabetes or Hypertension

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was particularly noted and pre and postoperative management planned accordingly.

(a)Fundus examination was done in all the cases under full mydriasis where - ever possible and the details if visible were noted specially with regard to configuration of optic disc to rule out astigmatism.

(b)Slit lamp examination was done under full mydriasis

(c)Preoperative Keratometry & A scan biometry were done.

Routine preoperative preparation and premedication for Extracapsular Cataract Extraction[ECCE] with PCIOL implantation was done.

Mannitol 20%,350 c.c. was given intravenously in all the patients half hour prior to surgery. Pupil was maximally dilated using Tropicamide 1% Phenyl-ephrine 5% eye drops with 1% Indomethacin drops for sustained dilatation of pupil.

Local anaesthesia and akinesia All operations were done under local anesthesia. Surface anesthesia was obtained with 4% Xylocaine drops.

Operative procedure: Standard operative technique was done in all the cases, except that in half the cases intra-operative Singh's keratoscopy was done prior to tying of final sutures. It was repeated after tying the suture and suture adjustment was then done accordingly so that a clear circular ring reflex was obtained on the table in this group .

Intraoperative keratoscopy : After completion of suturing air was injected into the anterior chamber to form it. Superior rectus suture was loosened and pressure of the lids was also excluded. The modified Singh's Keratoscope was used and its reflex on the cornea was noted. The different types of reflexes which were seen were as follows :

A perfect circle - Minimum Astigmatism.

Oval reflex- Axis of oval indicates flatter meridian.

Round reflex with a Small flat segment -Indicates an area of tight suture.Final suture strength or tightness was adjusted, so that at the end of surgery a clear circular reflex was obtained in all the cases of Group A. This procedure was not done in the other comparison group cases i.e. Group B. Rest of the surgical steps were similar to the Group A[4,5].

Postoperative care: Routine postoperative care including daily dressing was done. A standard postoperative regimen included antibiotic for 5 days: Acetazolamide 250 mg. twice a day for 3 days and supportive treatment were given. On first postoperative d,ay local steroid + antibiotic drops were started .(Steroid + Antibiotic was kept same in all the cases because of effect of steroids on healing of wound and thus on postoperative astigmatism).

Follow up of patients: Postoperative keratoscopy was done on 1st and 4th postoperative day. Patients were called for follow-up at 4th and 6th postoperative week. Keratometry and keratoscopy was done on each visit in cases of Group A. Keratoscopy was not done in cases of Group B. Refraction was done at 12th week postoperatively in both the Groups and final number of glasses was prescribed and noted. Results were evaluated in relation to postoperative astigmatism in both the group of cases seperately and analysed, whether use of keratoscopy intraoperatively altered the final postoperative astigmatism and visual results

Observation chart

Table 1:Preoperative visual acuity–Group A & B

S.No.	Visual Acuity	Group A		Group B	
		No. of Cases	Percentage	No. of Cases	Percentage
1	Projection/Perception of Light/finger counting 1 metre.	03	15	08	40
2	1 / 60 - 5 / 60	04	20	06	30
3	6 / 60 - 6 / 36 P	06	30	04	20
4	6 / 36 - 6 / 24 P	07	35	02	10
	Total	20	100	20	100

Table 2:Keratoscopic Findings - 1st & 4th Postop Day -Grp A

S.No.	Type of Keratosopic Reflex	1st Postop day		4th Post op day	
		No. of Eyes	Percentage	No. of Eyes	Percentage
1	Circular	14	70	12	60
2	Circular with one small flat segment	02	10	01	05
3	Horizontally oval	02	10	06	30
4	Vertically oval	01	05	00	00
5	Oblique	01	05	01	05
	Total	20	100	20	100

Table shows the keratoscopic findings on 1st & 4th postoperative day in Group A.

Table 3: Preoperative Keratometer Difference (K_2 - K_1) In Group A And B (Signifying Preoperative Astigmatism

S.No.	K_2 - K_1	Variable		(K_2 - K_1)	
		Group A		Group B	
		No. of Eyes	Percentage	No. of Eyes	Percentage
1	Zero	04	20	04	20
2	0.25 - 1.0 D	11	55	07	35
3	1.25 - 2.25 D	04	20	08	40
4	2.5 - 3.5 D	01	05	01	05
	Total	20	100	20	100

Table shows the preoperative keratometric difference in Group A and B simultaneously.

Table 4: Postoperative Keratometer Difference (K_2 - K_1) On 4th Week In Group A and B (Signifying Postoperative Astigmatism)

S.No.	K_2 - K_1	Variable (K_2 - K_1)			
		Group A		Group B	
		No. of Eyes	Percentage	No. of Eyes	Percentage
1	Zero	02	10	02	10
2	0.25 - 1.0 D	08	40	03	15
3	1.25 - 2.25 D	05	25	05	25
4	2.5 - 3.5 D	02	10	04	20
5	3.75 - 4.75 D	02	10	04	20
6	5 D or more	01	05	02	10
	Total	20	100	20	100

Table shows the postoperative keratometric difference in Group A and B simultaneously at the end of 4th postoperative week.

Table 5: Postoperative Keratometer Difference (K_2 - K_1) On 8th Week In Group A & B (Post Operative Astigmatism)

S.No.	K_2 - K_1	Variable(K_2 - K_1)			
		Group A		Group B	
		No. of Eyes	Percentage	No. of Eyes	Percentage
1	Zero	03	15	00	00
2	0.25 - 1.0 D	11	55	05	25
3	1.25 - 2.25 D	06	30	08	40
4	2.5 - 3.5 D	00	00	04	20
5	3.75 - 4.75 D	00	00	03	15
	Total	20	100	20	100

Table shows the postoperative keratometric difference in Group A and B simultaneously at the end of 8th postoperative week.

Table 6:Final Astigmatic Correction At 12th Week -Group A & B

S.No.	Astigmatism	GROUP A- with keratoscopy		GROUP B without keratoscopy	
		No. of Cases	Percentage	No. of Cases	Percentage
1	00 - 0.5 D	07	35	00	00
2	0.75 - 1.25 D	08	40	02	10
3	1.5 - 2.0 D	03	15	07	35
4	2.25 - 2.75	02	10	04	20
5	3.0 - 3.5 D	00	00	05	25
6	3.75 - 4.25 D	00	00	02	10
7	4.5 D and above	00	00	00	00
	Total	20	100	20	100

Table shows the final postoperative astigmatic correction at end of 12 weeks in cases of Group A i.e. with keratoscopy & Group B i.e.without keratoscopy.In group B maximum number of patients 7 (35%) show a final astigmatism of 1.5 to 2.0 D. 5 patients (25%) had final astigmatism of 3.0 to 3.5 D while 4 patients (20%) had astigmatism of 2.25 to 2.75 D. patients (10%) showed final astigmatism of 0.75 to 1.25 while another 2 had final astigmatism of 3.75 to 4.25 D. In group A,7 patients(35%) showed astigmatism of 0-0.5 D & 8 patients(40%) showed astigmatism of 0.75-1.25 D

Table 7: Final Postoperative Visual Acuity -Group A & B

		Group A		Group B	
S.No.	Visual Acuity	No. of Cases	Percentage	No. of Cases	Percentage
1	6 / 24 - 6 / 18 P	00	00	04	20
2	6 / 18 - 6 / 9 P	04	20	10	50
3	6 / 9 - 6 / 6	16	80	06	30
	Total	20	100	20	100

Table shows the final postoperative visual acuity in cases of Group A & B

Table 8: Complications Affecting Final Astigmatism In Group A & B

S.No.	Complications	No. of Cases	Group in which complication occured	Percentage from total cases
1	Wound Gap	01	B	2.5
2	Loosening of Suture	01	A	2.5
3	Iridocylitis with Mild decentring of lens	02	B	5.0
4	Iris tuck	01	A	2.5

Table 9:Range & Mean Of Final Astigmatism Group A & B

S. No.	Group	Range	Mean	Difference
1	A	0 to -2 D	-0.85 D	-1.425 D
2	B	-0.5 to -5 D	-2.27 D	

Results

Maximum number of eyes (70%) in this group, had a circular corneal keratoscopic reflex signifying that the change in corneal curvature from surgery to 1st postoperative day was not significantly altered. Maximum number of eyes i.e. 60% still showed a circular corneal keratoscopic reflex even on 4th day signifying that the change in corneal curvature on 4th postoperative day was also not significantly altered. However

number of cases showing horizontally oval reflex increased to 6 i.e. 30% possibly signifying that tension of know at the end of incision had some role to play in this change in corneal curvature in this group of patients.In Group A maximum eyes (11) i.e. 55% had a postoperative astigmatism ranging between 0.25 to 1.0 D. In Group B maximum number of cases belong to a group having postoperative astigmatism ranging from 1.25 to 2.25 which was seen in 8 eyes i.e. 40%. Final astigmatism noted at 12 weeks showed that in Group A it ranged from 0 to 2 Dioptres with a mean of 0.85 D and P value of less than 0.01 which is statistically highly significant while in Group B it ranged from 0.5 to 5 D with a mean of 2.275 D. Maximum number of patients in group A i.e. 16 (80%) had a final visual acuity of 6 /9 to 6 /6 while only a patients (20%) had final visual acuity of 6/ 18 to 6/ 9 P Visual acuity of maximum numbers of patients in group B ranged from 6/ 18 to 6 / 9. This was seen in 10 eyes i.e. 50% of the total in this group. 6 patients (30%) had final visual acuity of 6 / 9 to 6 / 6 while 4 patients (20%) had vision of 6 / 24 to 6 / 18 P[6-9]

Statistical analysis: Data was compiled using MS excel 2007 and analysis was done with the help of Epi-Info 7 software. Frequency and percentage were calculated & statistical test (Chi Square) was applied wherever applicable; $p<0.05$ was taken as statistically significant.

Discussion

With the advent of intraocular lens, rapid return of good vision without spectacles is possible if minimum astigmatism has been induced by the surgeon. Many authors have reported attempts to minimize postoperative astigmatism by using various modifications in the technique of incision, suture material and methods of suturing. Certain surgical instruments like operating keratometers have also been described to minimize unwanted postoperative astigmatism. However the cost, complexity and difficulty in using their systems have prevented universal acceptance.In the present study, 40 cases operated with planned Extracapsular Cataract Extraction [ECCE] with posterior chamber lens implantation were evaluated in relation to postoperative astigmatism. For this evaluation, these 40 cases were equally divided into 2 groups viz. Group A and Group B. In Group A of cases intraoperative Singh's Keratoscopy was done prior to the final wound closure while in Group B this added procedure was not done. Postoperative out of 40 patients only 8 presented with no preoperative astigmatism while 18 eyes had a preoperative astigmatism ranging between 0.25-1 D. Rest of the eyes i.e. 14 eyes had a preoperative astigmatism of more than 1.25 D. Alpins NA et al worked on new method of analyzing vectors for changes in astigmatism. This method of astigmatism analysis recognizes the need to define an astigmatism goal, thus allowing the surgeon to obtain precise, separate measures of the magnitude and the angle of surgical error. From this, the surgeon can evaluate what surgery may be required to achieve the initial preoperative goal. An index that measures surgical success is adjusted for the level of preoperative astigmatism. The resulting data allow statistical comparison of multiple surgeries and techniques. This method also assists in resolving the case when spectacle and corneal astigmatism do not coincide.Among the most recent of the studies Giannaccare G et al studied automated digital analysis of intraoperative keratoscopy and its correlation with postoperative astigmatism after big-bubble deep anterior lamellar keratoplasty. Data from 121 patients were included. The mean value of R*was 0.93 ± 0.04 (range 0.76–0.99). R showed a significant correlation with PA at V3 ($R = -0.42$, $P < 0.01$). The ROC curve had an AUC of 0.69 (95% CI 0.59–0.79). A cutoff value of $R = 0.93$ had a sensitivity of 70.3% and specificity of 61.0% for identifying patients with PA < 3D at V3. This new digital analysis of keratoscope rings allows to identify with reasonably good diagnostic accuracy patients with low values of post-DALK astigmatism correctable with spectacles.Similar study like us was done by Loh J. who explored importance of performing corneal topography before cataract surgery. O'BRART DP also did preoperative considerations of corneal topography. In another study Day AC et al assessed the prevalence and severity of preoperative and postoperative astigmatism in patients with cataract in the UK. They did a retrospective cohort study. A power vector analysis compared changes in the astigmatic 2-dimensional vector (J_0, J_{45}) before and after surgery, for the subgroup of eyes with both preoperative and postoperative astigmatism measurements. Visual acuity was also assessed preoperatively and postoperatively. The available refraction data indicate that this burden is not reduced after surgery with implantation of standard monofocal IOLs. Measures should be taken to improve visual outcomes of patients with astigmatic cataract by simultaneously correcting astigmatism during cataract surgery.Some of the studies in contrast studied astigmatism after cataract surgery. Study by Oshika T et al studied regular and irregular astigmatism after superior versus temporal scleral incision cataract surgery. Study by Nichamin LD et al was on astigmatism management for modern phaco surgery. Their objective was to evaluate the effect of superior and temporal scleral incisions on regular and irregular astigmatism in small incision cataract surgery. Prospective, randomized, comparative clinical trial.Surgically-induced regular astigmatism calculated with vector analysis method, irregular astigmatism obtained by Fourier analysis of video keratography data, and uncorrected and corrected visual acuity.In small scleral incision cataract surgery, superior and temporal approaches are comparable in terms of visual rehabilitation and induction of regular and irregular astigmatism.Wishart MS et al did their study on corneal astigmatism following cataract extraction. The changes in corneal curvature in the first six months after cataract extraction were studied by performing sequential keratometry on a group of 57 patients. A high degree of with-the-rule astigmatism was evident in all patients two weeks postoperatively, but thereafter the character of the astigmatism produced by 8/0 virgin silk and 10/0 monofilament closure was quite different: in the 8/0 virgin silk group there was an early and pronounced shift in the axis of astigmatism to against-the-rule, whereas in the 10/0 monofilament group there was little further change in the astigmatism unless the sutures were removed. It was concluded that wound compression and wound gape were factors responsible for these changes .An important study was performed by Masket S. et al to determine whether alternative suturing techniques of a standard wound play a significant role in the immediate and long-term postoperative course of corneal astigmatism. Two groups of patients had phacoemulsification and posterior chamber lens implantation through a scleral pocket incision closed with a continuous suture. In one group, the sutures were apposed to the posterior edge of the scleral incision; in the second group, deep suture placement designed to incorporate the internal layer of the scleral pocket was used. The deep suture group demonstrated significantly reduced transient iatrogenic astigmatism but the eventual healed astigmatic results were similar for the two groups. The deep suture group developed no filtration blebs; these did occur in three of 50 cases sutured with the appositional technique.Chang SW et al studied influence of ocular features and incision width on surgically induced astigmatism after cataract surgery. They inferred that reducing limbal incision width and considering patient age, the meridian and magnitude of corneal astigmatism, anterior chamber depth, axial length, and intraocular pressure, and adjusting the flattening component of SIA input for toric intraocular lens power calculation could potentially improve the astigmatism control in refractive lens surgery[10]

Anuradha TR et al did a comparative study on post operative astigmatism. This study was done to evaluate the post operative astigmatism by keratometry in 100 cases of cataract surgery by the two surgical techniques, to find out which surgery produced less post operative astigmatism. This study also analyzed if the use of smaller

incision in SICS group produced less post operative astigmatism and to find out the shape of incision which produced lesser post operative astigmatism. It was found in this study that the SICS with PCIOL, produced less degree of post operative astigmatism and in the same group, use of smaller incision and using frown incision produced lesser post operative astigmatism. It was also found that placing the incision on the steeper meridian, reduces the preexisting astigmatism. Longer incision, curvilinear to limbus and suturing produces greater post operative astigmatism and a drift towards ATR/Oblique astigmatism as in ECCE. Small, posteriorly placed incision produces less post operative astigmatism. Frown shaped incision in SICS produces less post operative astigmatism. It is inferred and concluded that SICS using frown incision could be the preferred mode of cataract surgery resulting in minimal post operative astigmatism[11]

Conclusion

Singh's keratoscopy is low cost instrument, easy to use, gives simple interpretation both on the table and can be used also postoperatively to follow the variation and monitor the conrneal curvature and wound healing in these cases. This method and instrument is an extremely useful device in the prevention of high postoperative astigmatism more so after intraocular lens implant surgery giving rapid visual rehabilitation and satisfaction both the patient and operating surgeon.

What this study add to existing knowledge

Singh's keratoscope is low cost instrument, easy to use, gives simple interpretation both on the table and can be used also postoperatively to follow the variation and monitor the corneal curvature and wound healing in these cases.

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