MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.36478/makrjms.2025.1.47.50

OPEN ACCESS

Key Words
Astigmatism, manual small incision and cataract surgery

Corresponding Author
Kiran Bhat,
Department of Ophthalmology, Kodagu Institute of Medical Sciences, Madikeri, Karnataka, India

Author Designation
[1]Assistant Professor
[2]Associate Professor

Received: 20 August 2024
Accepted: 05 December 2024
Published: 10 December 2024

Citation: M.J. Vikram and Kiran Bhat, 2025. Astigmatic Profile in Manual Small Incision Cataract Surgery. Res. J. Med. Sci., 19: 47-50, doi: 10.36478/makrjms.2025.1.47.50

Astigmatic Profile in Manual Small Incision Cataract Surgery

[1]M.J. Vikram and [2]Kiran Bhat
[1,2]Department of Ophthalmology, Kodagu Institute of Medical Sciences, Madikeri, Karnataka, India

ABSTRACT
Manual small incision cataract surgery is one of the most innovative and popular technique. The use of small cataract incision is thought to reduce surgically induced astigmatism resulting in more stable refraction. There are many factors responsible for surgically induced astigmatism such as the location and type of cataract incision, size, configuration of wound, suture material used, technique of wound closure etc. The present study is a prospective study on 100 patients who underwent suture less small incision cataract surgery. They were randomised into 3 groups. The group assignment was determined after surgery, based on chord length of external incision used into 6.0mm (Group A), 6.5 mm (Group B) and 7.0 (Group C). Keratometric values were recorded pre-operatively and post-operatively on day 1,1 week and 6 weeks using a standard calibrated Bausch and Lomb keratometer. In the present study we noticed a statistically significant reduction in the number of patients showing with-the-rule astigmatism. The number of patients showing against the rule astigmatism also increased from 51% preoperatively to 59% immediately post-operative and 72% after 6 weeks.

INTRODUCTION

Cataract surgery is one of the oldest and still the most challenging technique in anterior segment surgery. Newer techniques are being constantly evolved. The process of evolution has gained an impetus due to technological advancement. As a result, the greatest amount of functional vision of the patient is restored in the least amount of time. It has become an outdoor procedure due to advances in micro surgical techniques and suture materials[1]. However, post-operative visual results after cataract surgery, are sometimes disappointing due to surgically induced astigmatism. The post-operative corneal astigmatism still remains a problem to the surgeon and also to the patient because of delay in visual rehabilitation and limited visual outcome. Significant amounts of astigmatism can be visually disabling with reduction in visual acuity and symptoms as glare, monocular diplopia, asthenopia and distortion. Even when corrected with glasses, astigmatism may cause off axis blurring, eyestrain, glare and reduced visual field[2]. Surgical techniques are being continually modified and improved upon to reduce this post-operative astigmatism. Per-operative factors such as location, type of incision, size, configuration, suture material used and technique of closure have been seen to influence the amount of post-operative astigmatism[3]. This knowledge has led to the advent of small incision cataract surgery which returns to the patient, the greatest amount of functional vision in the least amount of time. This can be done using phacoemulsification or manually. Phacoemulsification involves high costs, sophisticated set up, high maintenance and a steep learning curve. Thus, manual small incision was designed to provide the benefits of phacoemulsification without the sophisticated set up required for the same[4].

MATERIALS AND METHODS

We conducted a prospective study on 100 patients who underwent suture less small incision cataract surgery. They were randomised into 3 groups. The group assignment was determined after surgery, based on chord length of external incision used into 6.0mm (Group A), 6.5 mm (Group B) and 7.0 (Group C).

Inclusion Criteria:

- Patients undergoing manual small incision cataract surgery.
- Patients within age group of 30-90 years.
- Patients with presenile/senile cataract.

Exclusion Criteria:

- Patients below 30 years of age.
- Patients above 90 years of age.
- Patients with ocular trauma, infection, inflammations, pterygium, congenital anomalies of eye.
- Patients with history of previous ocular surgeries (trabeculectomy, retinal detachment, surgery).
- Patients with any retinal pathologies, glaucoma, disease of posterior segment of eye.

Study Period: September 2023-September 2024.

Pre-operative Keratometric cylinder was recorded using a standard calibrated Bausch and Lomb Keratometer. The visual acuity, type of cataract and fundus, wherever possible were noted and recorded in the proforma. All patients were dilated with Tropicamide 0.8% and phenylephrine 5% eye drops, unless contraindicated. Surgery was performed under peribulbar anesthesia. A 3-step incision was made starting 1.5-2.0mm behind the limbus. First a partial thickness incision was made perpendicular to the sclera. The groove was then dissected forwards lamellarly along the contour of the globe, about 1.0 mm into the cornea using a cresent knife. The anterior chamber was entered using a keratome by “dimple-down” manoeuvre. The length of the incision was decided on table depending on the size and hardness of the nucleus.

RESULTS AND DISCUSSIONS

Table 1: Age Distribution of Study Group

Age Group (Years)	Males	Females	Total
30-39	0	1	1
40-49	3	1	4
50-59	25	18	43
60-69	19	14	33
70-79	9	6	15
80-89	3	1	4

For the purpose of study, patients were divided into Group A with incision length of 6.0 mm, Group B with 6.5 mm and Group C with 7.0 mm. Group A constituted 33% (33) of patients. 43% of these patients had against the rule astigmatism pre-operatively. In Group B there were 33% (33) of the patients. 45% of these had against the rule astigmatism pre operatively. Group C comprised of 34% of the patients and 59% of these patients had pre-operative against the rule astigmatism.

Table 2: Patient Demographics

	Group A (6.0 mm)	Group B (6.5 mm)	Group C (7.0 mm)
Number of patients	33	33	34
Pre-operative against the rule astigmatism	43	45	59

Table 3: Pre-Operative Astigmatism

	Group A	Group B	Group C
WTR	11	11	8
ATR	15	16	20
0	7	6	6

(Table 3) shows the number of patients with pre-operative astigmatism present in the three groups.

Table 4: Post-Operative Astigmatism

	Group A			Group B			Group C		
	WTR	ATR	0	WTR	ATR	0	WTR	ATR	0
Day 1	10	18	4	14	20	3	9	21	2
1 Week	9	22	2	11	24	0	10	22	0
6 Weeks	3	24	6	7	25	1	10	23	1

(Table 4) shows the post- operative astigmatism over a period of 6 weeks. The number of patients showing with the rule astigmatism declined from the pre-operative numbers in groups A and B and increased in group C. At the same time the number of patients showing against the rule astigmatism increased.

Table 5: Astigmatism in the Three Groups Pre-Operatively and After 6 Weeks

	Group A			Group B			Group C		
	WTR	ATR	0	WTR	ATR	0	WTR	ATR	0
Pre-operative	11	15	7	11	16	6	8	20	6
Percentage (%)	32.8	44.0	21.2	33.8	46.0	20.1	22.9	58.8	17.6
6 weeks	3	7.9	24	72.3	6	18.2	7	21.2	25
Percentage (%)	1	2.9	10	29.4	23	69.6	1	3.2	74.6

As seen in (Table 5), the number of patients showing with the rule astigmatism declined from the pre-operative numbers in groups A and B and increased in group C. At the same time the number of patients showing against the rule astigmatism increased. In group A, 32.8% of the patients showed with the rule astigmatism pre-operatively which declined to 7.9% after 6 weeks. At the same time the number of patients showing against the rule astigmatism increased from 44-72.3% after 6 weeks. In Group B, the number of patients showing with the rule astigmatism declined from 33.8% pre-operatively to 21.2% after 6 weeks. Number showing against the rule astigmatism increased from 46-74.6%. In Group C, the number of patients showing with the rule astigmatism increased from 22.9-29.4% after 6 weeks. This was however not significant. The number of patients showing against the rule astigmatism increased from 58.8-69.6% at 6 weeks.

Table 6: Percentage of Patients Showing Against the Rule Astigmatism

	Group A	Group B	Group C
Pre-operative	44.0	46.0	58.8
Post-operative (6 weeks)	72.3	74.6	69.6

The Chi-Square test was used to calculate p value. Overall we observed a reduction in the number of patients showing with the rule astigmatism over a period of 6 weeks. This decline was statistically significant. (p=0.006). The number of patients who were a stigmatically neutral also showed a statistically significant decrease. (p=0.04). An increase in the number of patients showing against the rule astigmatism was seen but this was not statistically significant (P=0.3). Thus, all the 3 groups had a larger number of patients showing against the rule astigmatism after 6 weeks. This number did not significantly differ between the 3 groups. This suggests that manual small incision cataract surgery by a 3-step scleral tunnel induced an against the rule astigmatism. The number of patients did not significantly differ in the 3 groups although an insignificant increase in the number of patients showing with the rule astigmatism was seen in Group C.

Table 7: Astigmatic Profile Over 6 Week Period

	WTR No. (%)	ATR No. (%)	None No. (%)
Pre-operative	30 (30)	51 (51)	19 (19)
Post-operative Day-1	33 (33)	59 (59)	9 (9)
1 week	30 (30)	68 (68)	2 (2)
6 weeks	20 (20)	72 (72)	8 (8)

The astigmatic profile over the 6 week period of follow up has been summarized in (table 7). The number of patients showing with the rule astigmatism showed a progressive decline over the period of study from 33% on the first post-operative day to 20% after 6 weeks. A progressive increase in the number of patients showing against the rule astigmatism was also seen at all follow up visits. 59%, 68% and 72% of the patients showed against the rule astigmatism on day 1, after 1 week and 6 weeks respectively. The number of patients showing the respective type of astigmatism stabilised by the sixth post-operative week. Thus, after sutureless, small incision cataract surgery, at all post-operative follow ups a larger number of patients showed against the rule astigmatism.

In the present study we noticed a statistically significant reduction in the number of patients showing with the rule astigmatism. The number of patients showing against the rule astigmatism also increased from 51% pre-operatively to 59% immediately post-operative and 72% after 6 weeks. This shows that manual small incision cataract surgery induced an against the rule astigmatic change as suggested by a decrease in the number of patients showing with the rule astigmatism and increase in those with against the rule astigmatism. A low mean surgically induced astigmatism was seen in all the 3 groups: 0.47D in Group A, 0.61D in Group B and 0.69D in Group C. Similar conclusions were drawn by Samuel Masket 5 who compared sutured and unsutured scleral pocket incisions. He noted that the group without suture closure demonstrated only against the rule astigmatic changes at any time after surgery. He noted a 0.08D shift on post-operative day 1 and progressive degradation of against the rule astigmatism thereafter to result in 0.45D shift from pre- surgical astigmatism. These observations were similar to our results. M.M. Lein and co-authors 6 have also concluded from their studies, that sutureless small incision cataract surgery

induced an against the rule astigmatism. Larger number of patients showed an induced astigmatism of ≤1.0D in both studies irrespective of an induced with or against the rule astigmatism. A statistical correlation cannot be established between the studies due to a large difference in number of cases in both studies. Analysing the amount of induced astigmatism, the results of the present study reaffirm that small incision cataract surgery gives rise to a lower amount of astigmatism post-operatively. Maximum number of patients in the study showed a cylinder of ≤1.5D at any time post-operatively. This was true for all the 3 groups with no significant difference at any time after surgery. The number of patients with cylinder ≤1.5D progressively increased over the 6 week period, with a larger variability in group B. However this variability cannot be considered significant because of a relatively small sample size and requires further study and evaluation. Similar results were seen by Steinert[5-7] and M.M. Leen and co-authors. The results of a similar study by Martha M. Leen have been compared with the present study. A progressive increase in the number of patients with cylinder <1.5D is seen in both. Brint[7] also found less astigmatism with small incision technique than the conventional incision technique at 1 and 6 weeks post-operatively. They studied incision lengths of 4 and 6.5mm. All patients showed low levels of mean induced astigmatism although variability in induced astigmatism was greater for the 6.5mm incision patients than for 4.0mm incisions. In the present study, a mean surgically induced astigmatism of 0.47D was seen in the 6.0mm group, 0.61D in the 6.5mm group and 0.69D in the 7.0mm group. Also, low mean astigmatism were seen on all follow up visits. A mean astigmatism of 0.97D in the 7.0mm group, 1.03D in the 6.5mm group and 0.80D was seen in the 6.0mm group on the first post-operative day. These are comparable with the study by Wollensak and co-authors[8]. In our study we noted a relative stabilization of cylinder by the sixth post-operative week. This is especially true of the smaller cylinders of ≤1.0D. The present study affirms the suggestions of Brint and co-authors and Steinert[7] and co-authors that small scleral tunnel incisions a ford a rapid and stable optical result, providing early visual recovery to the cataract patients. Studies by Van Horenbeck[9], O.R. Men apace and co-authors[10] show a low induced astigmatism, faster visual recovery and more stable refraction after small incision cataract surgery. Since, during the period of cylinder change, refractions is too unstable to permit prescription of glasses, an early stabilization of cylinder with manual small incision cataract surgery enables early prescription of glasses with faster visual rehabilitation.

CONCLUSION

A mean surgically induced astigmatism of 0.47D was seen with 6.0mm incisions, 0.61D with 6.5mm and 0.69D with 7.0mm incisions, after 6 weeks. The difference in the surgically induced astigmatism between incision length of 6-7mm where scleral tunnel was constructed by a 3-step method was not significant. A low mean astigmatism was seen in all the 3 groups, which stabilized by the sixth post-operative week. Thus a faster visual rehabilitation can be achieved by early prescription of spectacles. However, long term evaluation of decay in astigmatism is required.

REFERENCES

1. Duke, E.S., 1996. System of Ophthalmology. Disease of lens and vitreous, Glaucoma and hypotony. Henry Kimpton., 11: 248-263.
2. Pallin, S.L., 1991. Chevron sutureless closure: A preliminary report. J. Cataract Refractive Surg., 17: 706-733.
3. Girard, L.J., J. Rodriguez and M.L. Mailman, 1984. Reducing Surgically Induced Astigmatism by Using a Scleral Tunnel. Am. J. Ophthalmol., 97: 450-456
4. Colvard, D.M., R.P. Kratz, T.R. Mazzocco and B. Davidson, 1980. Clinical evaluation of the Terry surgical keratometer. Am. Intra-Ocular Implant Soc. J., 6: 249-251.
5. Masket, S., 1993. One year postoperative astigmatic comparison of sutured and unsutured 4.0 mm scleral pocket incisions. J. Cataract Refractive Surg., 19: 453-456.
6. Leen, M.M., C.C. Ho and M. Yanoff., 1993. Association between surgically induced astigmatism and cataract incision size in the early post operative period. Ophthalmic Surg., 24: 586-592.
7. Steinert, R.F., S.F. Brint, S.M. White and I.H. Fine., 1991. Astigmatism after small incision cataract surgery. A prospective randomized, multicenter comparison, 4 and 6.5mm incisions. Ophthalmology., 98: 423-424.
8. Pham, D.T., J. Wollensak and S. Drosch., 1995. ECCE with self-sealing cataract incision. Technique and results. Ophthalmology., 92: 256-260.
9. Horenbeck, A.G.V. and V.R. Jan., 1991. Bull Soc. Belge Ophthalmo., 242: 8-10.
10. Menapace, R., U. Radax, M. Amon and P. Papanos., 1994. No-stitch, small incision cataract surgery with flexible intraocular lens implantation. J Cataract Refract Surgery., 20: 534-542.