Nepal J Ophthalmol 2011; 3 (5): 19-22

■ ***Original article***

A comparative study of sclero-corneal and clear corneal tunnel incision in manual small-incision cataract surgery

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Abstract

Background: Cataract surgery techniques have improved a lot over the years from couching to the latest micro-incision cataract surgery.

Objectives: To compare the temporal sclero-corneal and clear corneal tunnel incisions in patients undergoing manual small-incision cataract surgery (SICS) with respect to the surgically-induced astigmatism.

Materials and methods: The present study included 60 patients who underwent manual SICS with posterior chamber intraocular lens implantation. Group A comprised of 30 patients, selected randomly, who underwent sutureless manual SICS through 6 mm curvilinear clear corneal tunnel incision made temporally and Group B comprised of 30 patients, selected randomly, who underwent sutureless manual SICS through 6 mm straight sclero-corneal tunnel made temporally. The patients were assessed at 1 week, 2 weeks, 1 month and 2 months post-operatively and visual acuity and keratometry findings were recorded. The amount of surgically induced astigmatism was calculated using Holladay's formula.

Statistics: Numerical data were compared between the two groups using unpaired Student's t-test. The p value of < 0.50 was considered significant.

Results: The mean induced astigmatism in Group A was 2.69 ± 0.84 D at 1 week, 2.31 ± 0.77 D at 2 weeks; 2.03 ± 0.82 D at 4 weeks and 1.98 ± 0.54 D at 8 weeks post-operatively. In group B, it was 1.85 ± 0.62 D, 1.56 ± 0.54 D, 1.35 ± 0.49 D and 1.34 ± 0.45 D at 1 week, 2 weeks, 4 weeks and 8 weeks postoperatively. Uncorrected visual acuity (UCVA) of 20/20 was seen in 20 % of patients in group A and in 40 % in group B at 8 weeks postoperatively.

Conclusion: Surgically-induced astigmatism is significantly higher in clear corneal manual SICS than in sclero-corneal. Our study confirmed the safety and improvement in visual acuity after small-incision cataract surgery using sclero-corneal tunnel incision.

Key words: astigmatism, sclero-corneal, clear corneal tunnel, extra-capsular cataract surgery, small incision cataract surgery

Introduction

Minimal post-operative astigmatism, rapid visual rehabilitation and the possible best uncorrected visual acuity (UCVA) are the aims of modern cataract surgery. Cataract surgery techniques have improved a lot over the years from couching to the latest micro-incision cataract surgical (MICS) technique, passing through phases of the intra-capsular and the conventional extra-capsular method (ECCE) of cataract extraction, manual small-incision cataract surgery (SICS) and phacoemulsification. Micro-incision cataract surgery (MICS) and even conventional phacoemulsification are still not being practiced very widely by the majority of surgeons in developing countries like ours because of expensive machines, costly maintenance and a difficult learning curve. Manual small incision cataract surgery has come as a boon to fill this yawning gap between high cost, high-tech phaco machines and conventional large-incision ECCE.

Surgically-induced astigmatism is the main obstacle to achievement of good uncorrected visual acuity

Received on: 12.05.2010 Accepted on: 10.11.2010
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(UCVA) after manual small-incision cataract surgery (SICS). In addition to pre-existing astigmatism, various parameters contribute to post-operative astigmatism such as size, width, depth, configuration, and location of the incision. The evolution and refinement of small-incision cataract surgery have almost done away with controversies regarding the width and shape of the incision (Steinert et al 1991, Oshika et al 1994) and the depth of the incision (Anders et al 1997); and it has been reported that the width and shape of the incision have little influence on the amount of astigmatism. On the other hand, Zanini et al (1997) found that the location, direction and size of incision have significant impact on surgical outcome (Kohnen, 1995).

The incision used for cataract surgery has to serve three purposes: the ease of performance of surgery, minimum astigmatism induction, safety and reliability of the incision. Some surgeons use incisions posterior to the limbus, i.e. at sclera and others use them anterior to the limbus, i.e., clear corneal incisions while doing small-incision cataract surgery. The low-induced astigmatism, early recovery of corneal curvature and no direct damage to the cornea support and justify the use of small self-sealing sclero-corneal tunnel incision. Clear corneal incisions have advantages of a shorter tunnel length, an external entrance anterior to limbus, the abolition of the need of cautery, the choice of using topical anesthesia with minimal or no bleeding, less discomfort and faster recovery of the wound. Kohnen et al (1995) found that clear corneal incisions had a proven safety record with moderate incision size (5.5 mm) when used in phacoemulsification techniques for rigid PMMA lens implantation. Keeping this fact in view, the present randomized prospective study was carried out to compare and find merits and demerits of sclero-corneal incision and clear corneal incision over one another in patients who underwent manual small-incision cataract surgery.

Materials and methods

The present study was carried out in 60 patients with senile cataract undergoing manual small-incision cataract surgery (SICS). Patients with any intra-operative or post-operative complications were excluded from the study, and, in their place, during the course of the study further patients were similarly included so that the study finally consisted of 60 patients randomly selected. Only those patients who had senile cataract along with either no astigmatism or against-the-rule astigmatism pre-operatively were included in the study.

These patients were randomly divided into two groups of 30 patients each. Group A included 30 patients, who underwent manual SICS with 6.0 mm curvilinear clear corneal tunnel made temporally and Group B included those patients who underwent manual small incision cataract surgery with 6.0 mm straight sclero-corneal tunnel made temporally and Group B included those patients who underwent manual SICS with 6.0 mm straight sclero-corneal tunnel made temporally.

Preoperatively, all the patients were subjected to detailed history taking, general physical examination and local examination including slit lamp, tonometry, direct ophthalmoscopy and keratometry.

Keratometry was done by the same person using the same Bausch and Lomb keratometer (Optilasa S.L., Model 1, Ser 03125) preoperatively as well as postoperatively. The curvatural readings were measured in both the vertical and horizontal meridians.

All surgeries were performed by one experienced surgeon. Except for difference in incision type, the surgical method in each group was identical. All patients were given steroid and antibiotic eye drops which were gradually tapered. All patients were followed for 8 weeks. Uncorrected visual acuity (UCVA) and keratometry were measured at one week, two weeks, four weeks and 8 weeks postoperatively and refraction was done to record the best corrected visual acuity at 8 weeks.

Statistics

The amount of surgically-induced astigmatism was calculated using Holladay's formula I (Holladay, 1998). Numerical data were compared between the two groups using unpaired Student's t-test. The p value of < 0.50 was considered significant.

Results

The mean age of patients in Group A was 58.9 ± 6.4 years, while in group B was 59.57 ± 6.4 years. Table 1 shows the age distribution of patients.

Most of the patients in both the groups were either astigmatically neutral or had against-the-rule astigmatism pre-operatively. The mean pre-operative astigmatism was 0.79 ± 0.64 D and 0.68 ± 0.59 D in Group A and B respectively. Table 2 shows the distribution of patients according to pre operative astigmatism. The mean age, sex and preo-perative astigmatism were similar in the two groups ($p > 0.05$).

Table 1
Age distribution of the patients with cataract

Age range (years)	Group A No. of patients (%)	Group B No. of patients (%)	Total No. of patients (%)
45-54	9 (30%)	6 (20%)	15 (25%)
55-64	14 (46.67%)	16 (53.33%)	30 (50%)
65-75	7 (23.33%)	8 (26.67%)	15 (25%)
Total	30	30	60

Table 3
Induced keratometric astigmatism in Groups A and B at the end of 8 weeks (number of patients) Induced

Induced keratometric astigmatism	Group A No. of patients (%)	Group B No. of patients (%)
≤0.50D	0	0
0.51-1.0D	1 (3.33%)	13 (43.33%)
1.1-1.50D	8 (26.67%)	9 (30%)
1.51-2.0D	11 (36.67%)	6 (20%)
2.1-2.50	8 (26.67%)	2 (6.67%)
2.51-3.0	1 (3.33%)	0
3.1-3.5	1 (3.33%)	0

The mean post-operatively-induced astigmatism at 8 weeks was 1.98 ± 0.54 D in group A and 1.34 ± 0.45 D in group B. the distribution of patients according to induced keratometric astigmatism is shown in Table 3. Table 4 depicts the mean keratometric astigmatism at different time intervals. Thus, surgically-induced astigmatism was found to be significantly higher in the clear corneal group than in the sclero-corneal group ($p < 0.001$).

Table 2
Distribution of pre-operative keratometric astigmatism

Group	Against-the-rule astigmatism	With-the-rule astigmatism	No astigmatism
A No. of patients (%)	24 (80%)	0 (0.0%)	6 (20%)
B No. of patients (%)	25(83.33%)	0 (0.0%)	5(16.66%)

Table 4
Mean keratometric astigmatism at different points of time in Group A and Group B

Postoperative Weeks	Group A No. of patients (%)	Group B No. of patients (%)
Preoperative	0.79±0.64	0.68±0.59
Postoperative 1 week	2.69±0.84D	1.85±0.62D
Postoperative 2 week	2.31±0.77D	1.56±0.54D
Postoperative 4 weeks	2.03±0.82D	1.35±0.49D
Postoperative 8 weeks	1.98±0.54D	1.34±0.45D

Table 5
Uncorrected visual acuity at 8 weeks

Uncorrected Visual Acuity (UCVA)	Group A No. of patients (%)	Group B No. of patients (%)
20/50p-20/50	3 (10.00%)	0
20/40p-20/40	9(30.00%)	5 (16.67%)
20/30p-20/30	12 (40%)	13 (43.33%)
20/20p-20/20	6(20%)	12 (40.0%)

Uncorrected visual acuity (UCA) of 20/20p - 20/20 was seen in 20 % of patients in Group A and 40 % patients in Group B at 8 weeks postoperatively (Table 5). Also, a maximum number of patients in group A had cylinder correction between >1.0 - 1.5 D whereas the majority of patients in group B had cylinder correction between >0.5- 1.0 D. Thus, the power of the post-operative cylinder prescribed was significantly more in Group A than in Group B (Table 6). Thus, the patients in Group B had better uncorrected visual acuity than those in Group A.

Table 6
Post-operative cylinder prescription

Cylinder (Diopters)	Group A No. of patients (%)	Group B No. of patients (%)
Plano	4 (13.33%)	8 (26.67%)
<u><</u>0.50	2 (6.67%)	7 (23.33%)
>0.50 – 1.00	6 (20%)	9 (30%)
>1.00 – 1.50	8 (26.67%)	4 (13.33%)
>1.50 – 2.00	7 (23.33%)	2 (6.67%)
>2.00	3 (10%)	0

Discussion

Locating the incision as posterior as possible from the limbus maximizes the distance to the optical centre of the cornea and results in lesser astigmatism. In the clear corneal incision, since the incision is more anterior, there is an increased chance of induced astigmatism. Our results based on Holladay's method of analysis of keratometric data corroborate this fact. Our study showed a significantly higher amount of surgically-induced astigmatism with sutureless 6.0 mm clear corneal tunnel incision than with 6.0 mm sclero-corneal tunnel incision at all post-operative follow ups (Table 4). The temporal incision is also beneficial because against-the-rule astigmatism is more common in the cataract age group, causing a reduction of astigmatism on average by flattening the horizontal corneal axis.

The low-induced astigmatism, early recovery of corneal curvature and no direct damage to the cornea support and justify the use of small self sealing scleral tunnel incision during cataract surgery. Clear corneal incisions have advantages of a shorter tunnel length, an external entrance anterior to limbus, the abolition of the need of cautery, the choice of using topical anesthesia with minimal or no bleeding, less discomfort and faster recovery of the wound.

The present study indicates that the visual outcome after manual SICS is excellent. However, UCVA was definitely better in sclero-corneal incision group than clear corneal group. This ensures satisfactory and rapid rehabilitation of patients who

have undergone manual small incision cataract surgery (SICS) through sclero-corneal tunnel incision. Due to high induced astigmatism in clear corneal incision group the postoperative cylinder prescription was significantly higher and consecutively the patients in clear corneal group were not satisfied.

Conclusion

The sclero-corneal incision induces a significantly lower amount of induced astigmatism and gives a definitely better visual function. However, we suggest a long-term comparative study with a larger number of subjects and a longer follow- up before recommending clear corneal incision cataract surgery even for mass surgeries.

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Source of support: nil. Conflict of interest: none