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Comparison of pre-incision and single-stepped clear corneal incision in phacoemulsification surgery

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Abstract. – AIM: To compare postoperative keratometric corneal refractive changes after phacoemulsification surgery between pre-incision and single stepped clear corneal incision techniques.

PATIENTS AND METHODS: This prospective clinical study included 40 eyes of 40 patients who underwent clear corneal cataract surgery. Twenty eyes were operated using pre-incision technique (Group A), and 20 eyes using single-stepped incision technique (Group B). Corneal refractive power was measured by keratometry before the surgery and one week, one month, and three months postoperatively. NCSS (Number Cruncher Statistical System), 2007&PASS (Power Analysis and Sample Size), and 2008 SS (Statistical Software, Utah, USA) was used for the statistical analysis.

RESULTS: The mean preoperative keratometric corneal power in the pre-incision group was 44.24±1.59 and 44.70±1.26 in the single stepped incision group. After three months postoperatively, it was 44.15±1.57 in the pre-incision group and 44.77±1.39 in the single stepped incision group. There was no significant difference in the keratometric corneal refractive changes between Group A and Group B, three months after surgery ($p > 0.05$).

CONCLUSIONS: Using pre-incision and single stepped clear corneal incision techniques in phacoemulsification surgery showed no difference on corneal refractive power changes. Pre-incision technique can be used for smoother corneal incision in cataract surgery especially for the beginners.

Key Words:
Cataract, Phacoemulsification, Astigmatism.

Introduction

Clear corneal cataract incisions are becoming more popular option for cataract extraction and intraocular lens (IOL) implantation throughout the world. The availability of foldable IOLs that can be inserted though small unsutured phacoemulsification incisions has created a trend away from scleral tunnel incisions to clear corneal incisions[1]. The approach through a clear corneal incision, as introduced by Fine et al[2], has demonstrated increased safety, decreased inflammation and pain, as well as reduced surgically induced astigmatism.

Clinical outcomes of cataract surgery are influenced by many factors, including the blade used to create the incision, the phacoemulsification apparatus, and the IOL used and mode of insertion, which together constitute a surgical system, the outcomes of which are restricted by the best performance of each component. Identifying surgical methods to provide the best postoperative visual acuity and the fastest restoration of visual function by reducing surgically induced astigmatism remain a challenge for cataract surgeons[3]. Several studies have investigated the induced astigmatism after various types of small incisions and various locations including superior, superonasal, superotemporal, and temporal[4,5]. On the other hand, proper wound site is very important for reducing surgically induced astigmatism and also reducing postoperative complaints as stinging. There are several options for correcting astigmatism at the time of cataract surgery. Phacoemulsification incision located on the steep corneal axis corrects small amounts of astigmatism. Peripheral corneal relaxing incisions, and toric intraocular lenses are used for more astigmatism.

The aim of this prospective study was to compare the postoperative keratometric corneal refractive changes after phacoemulsification surgery between pre-incision and single stepped clear corneal incision techniques.

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Patients and Methods

Study Design

The study was carried out in accordance with the tenets of the Declaration of Helsinki (1989) of the World Medical Association. All the patients were fully informed of the purpose and procedures of the study and written informed consent was obtained from all individuals.

This retrospective work included 40 eyes of 40 patients having phacoemulsification and implantation of foldable acrylic intraocular lens through an unsutured corneal incision by a single surgeon between April and October 2010. There were 18 women and 22 men, with an average age of 68.1 years (range = 49-87 years). Inclusion criteria were the absence of concurrent eye disease, no preexisting eye abnormality, and no history of eye surgery, eye trauma or systemic disease. All eyes had complete ophthalmological examination preoperatively and postoperatively at one week, one month and three months, including uncorrected visual acuity (UCVA), refraction, best corrected visual acuity (BCVA), slit-lamp biomicroscopy, funduscopy and tonometry. The mean BCVA before surgey and three month postoperatively was measured. Corneal refractive power was measured by keratometry readings.

The patients were randomly assigned to Group A or B for either the phacoemulsification through pre-incision or phacoemulsification through single-stepped clear corneal incision. In group A, there were 7 women and 13 men, with an average age of 65.3 years, 10 right 10 left eyes operated. Clear corneal pre-incision was made with the side edge of 2.8 mm knife parallel to the limbus (Figure 1). After this pre-incision, clear corneal incision was performed in the middle and entered to the anterior chamber (Figure 2). In group B, there were 11 women and 9 men, with an average age of 67.9 years, 10 right 10 left eyes operated. single-stepped clear corneal incision was performed with 2.8 mm knife (Figure 3). All operations were performed under topical anesthesia consisting of a single drop of proparacaine 0.5% (Alcaine; Alcon Laboratories Inc., Fort Worth, TX, USA) was administered 3 times at intervals of 5 minutes prior to surgery and all patients underwent standard periorbital disinfection using 10% povidone iodine (PVI) scrub on the eyelids and surrounding skin. After the patient had been transferred into the operating room, the conjunctival sac was vigorously irrigated with 10 mL of 1% povidone iodine solution. Next, the brow, upper and lower eyelids, eyelashes, and the adjacent forehead, nose, cheeks, and temporal orbital area were again scrubbed with 10% PVI just prior to surgery. All groups the surgeon sat in the superior

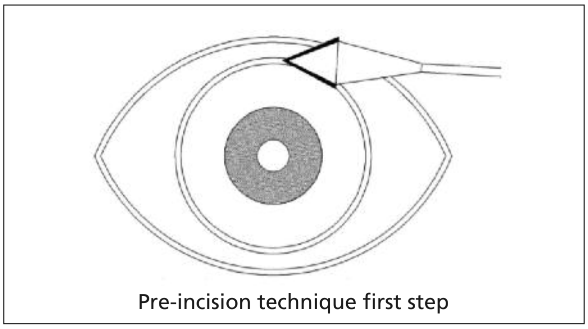

Figure 1. Clear corneal pre-incision with the side edge of 2.8 mm knife parallel to the limbus.

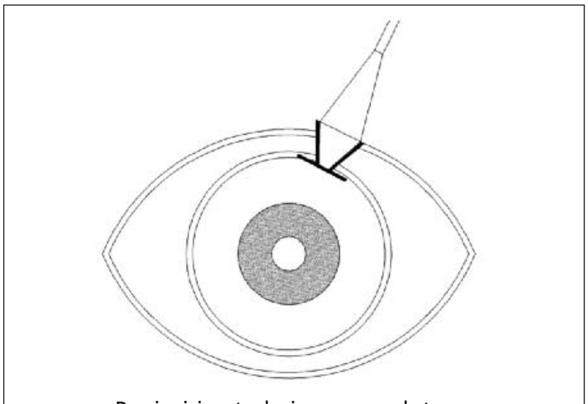

Figure 2. After the pre-incision clear corneal incision was made in the middle and entered to the anterior chamber.

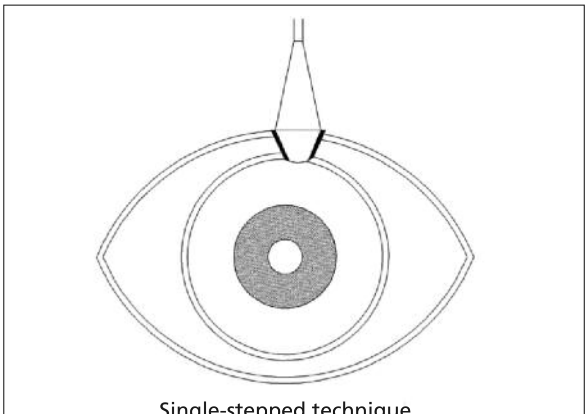

Figure 3. Single-stepped clear corneal incision was made with 2.8 mm knife.

Table I. Mean keratometry readings.

	Group A pre-incision	Group B single-stepped	p^a
Preoperative	44.24 ± 1.59	44.70 ± 1.26	0.322
Week 1	44.03 ± 1.54	44.67 ± 1.32	0.164
Month 1	44.03 ± 1.54	44.81 ± 1.52	0.119
Month 3	44.15 ± 1.57	44.77 ± 1.39	0.196
p^c	0.042*	0.885	p^b

[a]Student *t* test; [b]Mann Whitney U test; [c]Repeated Measures Anova test; *$p < 0.05$.

position. The right eye always received a superonasal incision and the left eye a superotemporal incision. After the injection of viscoelastic material, capsulorexis was performed, followed by hidrodissection, phacoemulsification using stop and chop technique. Cortex removal was completed and acrylic intraocular lens was inserted using an injector system. In any case, it was necessary to widen the original incision. After irrigation of the anterior chamber, the eye was formed using balanced salt solution and any leakage from the incisions was controlled using stromal hydration. The eye was bandaged after the operation. Postoperative topical therapy included0.3% tobramycin and 0.1% dexamethasone eye drops(Tobradex; Alcon Laboratories) 4 times per day and 0.3%tobramycin and 0.1% dexamethasone eye ointment (Tobradex;Alcon Laboratories Inc.) every night for 1 month. All patients were followed up at 1 day, 1 week, 1 month, and 3 months after surgery.

Statistical Analysis

Preoperative and postoperative keratometric corneal refractive changes between Group A and Group B were analyzed by using ANOVA. $p < 0.05$ was considered statistically significant.

Results

Comparison of the mean keratomety readings between two goups is shown in Table I. No significanct difference was found in the intra-group comparison of keratometric corneal refractive power before surgery, at one week, one month, and three months postoperatively ($p = 0.05$). In Group A, corneal refractive power change was significant after one week and one month postoperatively ($p < 0.05$) whereas it was not significant after three months ($p > 0.05$). In Group B, corneal refractive power change was not significant before and after surgery ($p > 0.05$). No significant difference was found in the mean keratometric corneal refractive power change between Group A and Group B, three months after surgery ($p > 0.05$).

The mean UCVA before surgery and postoperative 3th month. There were no significant differences between groups preoperatively. The mean UCVA was higher in Group A at 3th month, but the difference was not significant ($p > 0.05$). The mean BCVA before surgery and postoperative 3th month. The differences in BCVA between groups were not statistically significant (Table II) ($p > 0.05$).

The incision site in ten eyes operated superonasally and in ten eyes operated superotemporally were assesed. in each groups. The corneal refractive power changes between the incision sites after three months postoperatively were compared and there was no significant difference in two groups (Tables III and IV) ($p > 0.05$).

Discussion

The aim of all surgical proceduresis reduced astigmatism and better visual function, but inci-

Table II. The mean BCVA before surgey and three month postoperatively.

Examination Mean BCVA ± SD	Group A pre-incision	Group B single-stepped
Preoperative	0.36 ± 0.33	0.27 ± 0.23
Month 3	0.74 ± 0.21	0.85 ± 0.17

BCVA best corrected visual acuity *$p > 0.05$.

Table III. Mean keratometry readings according to incision sites in Group A.

Group A	Superonasal	Superotemporal	p^a
Preoperative	43.85 ± 1.63	44.63 ± 1.53	0.281
Week 1	43.72 ± 1.66	44.33 ± 1.43	0.388
Month 1	43.52 ± 1.63	44.53 ± 1.34	0.146
Months 3	43.68 ± 1.69	44.62 ± 1.36	0.189
p^c	0.031*	0.583	p^b

[a]Student *t* test; [b]Mann Whitney U test; [c]Repeated Measures Anova test; *$p < 0.05$.

sional astigmatism is usually inevitable. Astigmatism outcomes can be in a wide range if the incision is made in the same location regardless of preoperative values. Clear corneal incision phacoemulsification surgery is an astigmatic keratotomy operation, the incision site and the configuration of incision is very important for corneal astigmatism[6]. Incisional astigmatism may be caused by various factors such as incision size and surgical approach[7]. There are several clear corneal incision techniques to provide the best postoperative visual acuity and the fastest restoration of visual function by reducing surgically induced astigmatism.

Single plane incisions, as first described by Fine[8], used a 3.0 mm diamond knife. Williamson[9] was the first to use a shallow 300-400 m grooved clear corneal incision. Langerman[10], later, described the single hinge incision, in which the initial groove measured 90% of the depth of the cornea anterior to the edge of the conjunctiva. Kershner[11] used the temporal incision by starting with a nearly full-thickness T-cut through which he then made his corneal tunnel incision. In the pre-incision technique we made the incision with the side edge of 2.8 mm knife parallel to the limbus. After this pre-incision, clear corneal incision was made in the middle and entered to the anterior chamber.

Masket and Tennen[12] reported that astigmatic stabilization of 3.0 mm temporal clear corneal cataract incisions was occured at 2 weeks of the surgery. Barequet et al[13] reported that induced astigmatism was evident at 6th week and persisted to 12 months postoperatively. In our study, astigmatic stabilization was stable after the 4th week postoperatively.

Many studies[14-17] have demonstrated that temporal incisions induce the least amount of astigmatism. In this study we sought to determine whether nasal incisions lead to the same favorable astigmatic outcomes as temporal incisions but three months after the surgery we found no significant difference between these techniques[18].

We compared the keratometric refractive changes between the pre-incision technique and the single stepped incision technique. Three months after the surgery we found no significant difference between these techniques. The pre-incision technique can provide proper wound site to reduce surgically induced astigmatism with early onset after surgery. The mean UCVA was better in group A there was no stastically significant difference in the mean UCVA and BCVA between groups at 3th month.

Clear corneal incisions, by nature of their architecture and location, have some complications. If one incidentally incises the conjunctiva at the time of the clear corneal incision, chemotic ballooning of the conjunctiva may ocur and may compromise visualization of anterior structures[19,20]. Early entry into the anterior chamber may result in an incision of insufficient length to be self-sealing. In addition, incisions that are too

Table IV. Mean keratometry readings according to incision sites in Group B.

Group B	Superonasal	Superotemporal	p^a
Preoperative	45.25 ± 1.42	44.15 ± 0.82	0.281
Week 1	45.10 ± 1.47	44.25 ± 1.06	0.388
Month 1	45.20 ± 1.50	44.41 ± 1.52	0.146
Month 3	45.25 ± 1.41	44.41 ± 1.28	0.189
p^c	0.820	0.537	p^b

[a]Student *t* test; [b]Mann Whitney U test; [c]Repeated Measures Anova test; *$p < 0.05$.

short or improperly constructed can result in an increased tendency for iris prolapse[21,22]. On the other hand, a late entry may result in a corneal tunnel so long that the phaco tip creates striae in the cornea and compromises visualization of the anterior chamber[23]. No intraoperative or postoperative complications were identified in our study.

Prophylactic techniques to decrease the risk of bacterial endophthalmitis related to cataract surgery are commonly used, but the evidence justifying their use is unclear. Bacterial endophthalmitis prophylaxis in cataract surgery, current literature most strongly supports the use of preoperative povidone-iodine antisepsis[24]. We use preoperative PVI, postoperative topical therapy for prophylactic therapy. No bacterial endophthalmitis related to cataract surgery were identified in our study.

Preincision 2.8 mm incision is made with the side edge of the blade slit technique facilitates operation and controlled the most important steps allows to create the corneal tunnel. The main advantage of this technique is the incision parallel to the limbus incision is also made more controlled extended when prompted (Figure 4).

Conclusions

The pre-incision technique can provide controlled entry to the anterior chamber, reduces complications and can be used for smoother corneal incisions in cataract surgery especially for the beginners. Further larger and longer-term studies of the influence of different incision technique surgically induced astigmatism might prove helpful in predicting and improving the visual performance after phacoemulsification.

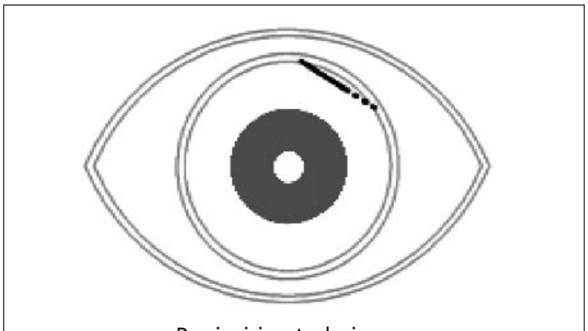

Figure 4. Extension of the incision made with precision technique Single-step technique, the incision may not be always parallel to the limbus, particularly beginners, in which case the incision prompted extended to obtain an irregular cut (Figure 5).

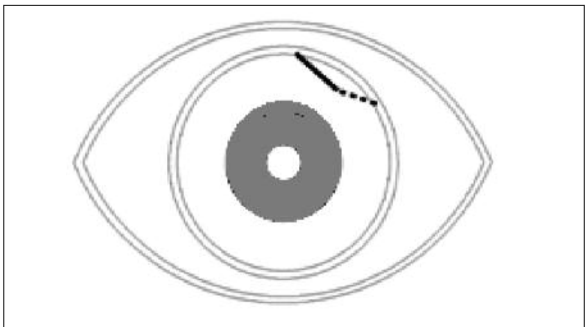

Figure 5. Extension of the incision made with single-step technique.

Conflict of Interest

The Authors declare that they have no conflict of interests.

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