

ANALYSIS OF POSTOPERATIVE CORNEAL ASTIGMATISM AFTER PHACOEMULSIFICATION THROUGH A CLEAR CORNEAL INCISION

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SUMMARY – The aim of the study was to analyze postoperative corneal astigmatism after phacoemulsification with intraocular lens implantation through a clear corneal incision. This prospective study included 22 eyes (10 right and 12 left eyes) having had phacoemulsification with implantation of a foldable intraocular lens through a clear corneal incision. A superotemporal incision was used in all right eyes, and superonasal incision in all left eyes. Astigmatism was measured by autorefractometer-keratometer preoperatively, and at 1 week, 1 month and 2 months postoperatively. The mean surgically induced corneal astigmatism was 0.23 D (diopter). The vertical component of astigmatism was statistically significantly lower postoperatively than preoperatively ($p=0.0404$). There was no significant difference in the horizontal component of astigmatism preoperatively and postoperatively ($p>0.05$). There was no statistically significant difference in surgically induced astigmatism between superotemporal incisions in the right eyes and superonasal incisions in the left eyes either ($p>0.05$). Oblique localization of clear corneal incision, superotemporal in the right eyes and superonasal in the left eyes, may ease manipulations during phacoemulsification for right-handed surgeon without significant difference in the surgically induced astigmatism.

Key words: *cataract surgery, clear corneal incision, surgically induced astigmatism*

Introduction

The aims of modern cataract surgery are rapid visual rehabilitation, the best possible uncorrected visual acuity, and minimal postoperative astigmatism¹. Surgically induced astigmatism (SIA) is still a common obstacle for achieving excellent uncorrected visual acuity². SIA is related to the incision length, incision location, incision architecture, and suture closure technique. Smaller incisions are associated with less surgically induced change in corneal contour. Peripheral incisions at sclera and limbus result in a less surgically induced change in corneal contour than those that involve cornea. Multiplanar incisions give the wound greater stability enabling self-sealing of the wound and thereby avoiding the need of sutures. Suturing the incision may result in ei-

ther steepening or flattening of one or more parts of the cornea³⁻⁶.

In this study, we analyzed postoperative corneal astigmatism after phacoemulsification with intraocular lens implantation through a clear corneal incision and evaluated the effect of small superotemporal and superonasal clear corneal incisions on postoperative corneal astigmatism.

Material and Methods

This prospective study included 22 eyes (10 right and 12 left eyes) of 22 patients with senile cataract. The patients included in the study had no history of previous ocular trauma, surgery or disease that could have affected corneal refraction. All operations were performed by the same surgeon. Topical anesthesia was achieved with tetracaine hydrochloride eye drops. In all right eyes the incision was located superotemporally, and in all left eyes superonasally. Three-step clear corneal

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tunnel incision was made with a 3.0-mm blade. The tunnel length was 1.75-2.0 mm. Phacoemulsification was performed with Universal II phacoemulsifier (Alcon). The incision was enlarged to 3.2 mm and a foldable intraocular lens was implanted in the capsular bag. All incisions were left sutureless. Patients were given dexamethasone-neomycin-polymyxin B eye drops *qid* and the ointment once a day, and the regimen was tapered over two months postoperatively. Corneal astigmatism was measured by a Speedy autorefractometer-keratometer preoperatively, and at 1 week, 1 month and 2 months postoperatively.

Results

The mean preoperative astigmatism was 0.72 ± 0.57 D (diopter). One week postoperatively, the mean astigmatism decreased to 0.49 ± 0.38 D. One month postoperatively it increased to 1.06 ± 0.83 D, and two months postoperatively it stabilized at 0.95 ± 0.77 D. There was a statistically significant difference between the mean preoperative astigmatism and the mean postoperative astigmatism at two months (Friedman test: $\chi^2=8.44$; $p=0.038$) (Fig. 1). The mean surgically induced corneal astigmatism was 0.23 D.

Decomposition of vectors showed that the vertical component of astigmatism was statistically significantly lower postoperatively than preoperatively (repeated measure ANOVA: $F=2.92$; $p=0.0404$) (Fig. 2). There was no statistically significant difference between the preoperative and postoperative horizontal component of astigmatism ($p>0.05$) (Fig. 3).

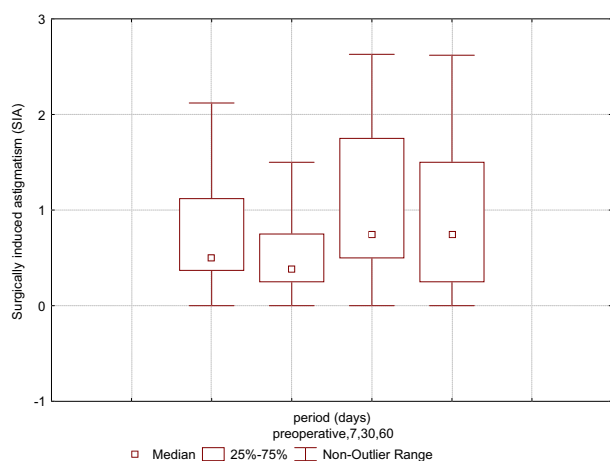


Fig. 1. Surgically induced astigmatism (diopter) on postoperative days 7, 30 and 60.

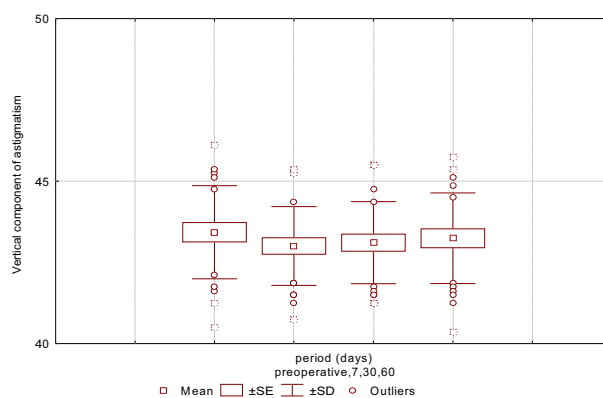


Fig. 2. Values of the vertical component of astigmatism (diopter) preoperatively and on postoperative days 7, 30 and 60.

We found no statistically significant difference in SIA between superotemporal incisions in the right eyes and superonasal incisions in the left eyes either (Mann Whitney test: $p>0.05$) (Table 1).

Discussion and Conclusion

Clear corneal incisions (CCI) have been widely reported to produce minimal SIA^{1,4,5,7,8}. To avoid an effect on corneal refraction, the appropriate size of corneal incision for self-sealing is 3.0-3.5 mm in width and 1.7-2.0 mm in length^{6,9,10}. In our study, all operations were performed by the same surgeon who is right-handed. The size of CCI in width after enlarging for intraocular lens implantation was 3.2 mm. CCI can be placed at superior, oblique (superotemporal and superonasal) or temporal locations. Different studies confirmed that a small

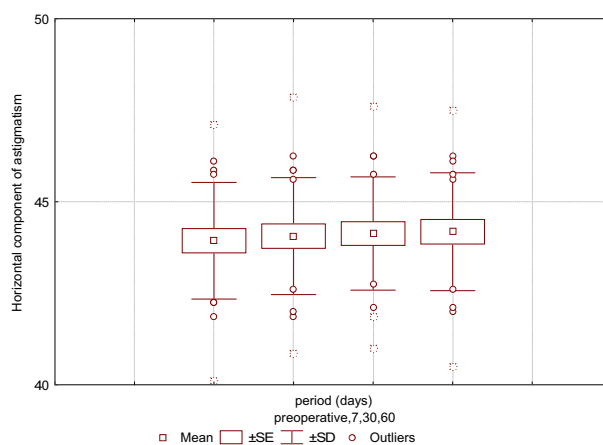


Fig. 3. Values of the horizontal component of astigmatism (diopter) preoperatively and on postoperative days 7, 30 and 60.

Table 1. Values of astigmatism during the observation period

Observation period	Astigmatism (mean \pm SD)		
	superotemporal	superonasal	Z; p*
Preoperative	0.67 \pm 0.60	0.77 \pm 0.56	0.56; 0.576
Postoperative day 7	0.47 \pm 0.44	0.51 \pm 0.32	0.93; 0.352
Postoperative day 30	0.88 \pm 0.75	1.30 \pm 0.91	1.30; 0.192
Postoperative day 60	0.87 \pm 0.77	1.06 \pm 0.79	0.53; 0.598

*Mann Whitney test

superior CCI induced greater postoperative astigmatism than a small temporal^{4,11} or a small oblique CCI¹², and that a small oblique CCI induced greater postoperative astigmatism than a small temporal CCI¹. In our patients, CCI in the right eyes was located superotemporally, and in the left eyes superonasally. We found no statistically significant difference in SIA between the superotemporal and superonasal incisions. It is consistent with the results reported by Rainer *et al.*¹ and Ermi^o *et al.*¹³. The vertical component of astigmatism was statistically significantly lower postoperatively than preoperatively, which was probably the result of corneal relaxation due to the operative incision. There was no significant difference in the horizontal component of astigmatism preoperatively and postoperatively. In conclusion, oblique localization of CCI, superotemporal in the right eyes and superonasal in the left eyes, may ease manipulations during phacoemulsification for right-handed surgeon without significant difference in SIA.

References

1. RAINER G, MENAPACE R, VASS C. Corneal shape changes after temporal and superolateral 3.0 mm clear corneal incisions. *J Cataract Refract Surg* 1999;25:1121-6.
2. BAREQUET IS, YU E, VITALE S, CASSARD S, AZAR DT, WALTER JS. Astigmatism outcomes of horizontal temporal *versus* nasal clear corneal incision cataract surgery. *J Cataract Refract Surg* 2004;30(Suppl 2):418-23.
3. YANOFF M, DUKER JS. *Ophthalmology*. 2nd ed. St. Louis: Mosby Inc., 2004.
4. İMİEK A, YAAR T, DEMİROK A. Effect of superior and temporal clear corneal incisions on astigmatism after phacoemulsification. *J Cataract Refract Surg* 1998;24:515-8.
5. ROMAN SJ, AUCLIN FX, CHONG-SIT DA, ULLERN MM. Surgically induced astigmatism with superior and temporal incisions in cases of with-the-rule preoperative astigmatism. *J Cataract Refract Surg* 1998;24:1636-41.
6. FINE IH. *Clear corneal lens surgery*. 1st ed. New Jersey: SLACK Inc., 1999.
7. GILLS JP, SANDERS DR. Use of small incisions to control induced astigmatism and inflammation following cataract surgery. *J Cataract Refract Surg* 1991;17:740-4.
8. LYHNE N, KROGSAGER J, CORYDON L, KJELDGAARD M. One year follow-up of astigmatism after 4.0 mm temporal clear corneal incisions and superior scleral incisions. *J Cataract Refract Surg* 2000;26:83-7.
9. ERNEST PH, LAVERY KT, KIESSLING LA. Relative strength of scleral corneal and clear corneal incisions constructed in cadaver eyes. *J Cataract Refract Surg* 1994;20:626-9.
10. ERNEST PH, FENZL R, LAVERY KT, SENSOLI A. Relative stability of clear corneal incisions in a cadaver eye model. *J Cataract Refract Surg* 1995;21:39-42.
11. MENDIVIL A. Comparative study of astigmatism through superior and lateral small incisions. *Eur J Ophthalmol* 1996;6:389-92.
12. JOO C-K, HAN H-K, KIM J-H. Computer assisted videokeratography to measure changes in astigmatism induced by sutureless cataract surgery. *J Cataract Refract Surg* 1997;23:555-61.
13. ERMI SS, İNAN ÜÜ, ÖZTÜRK F. Surgically induced astigmatism after superotemporal and superonasal clear corneal incisions in phacoemulsification. *J Cataract Refract Surg* 2004;30:1316-9.



Sažetak

ANALIZA POSLIJEOPERACIJSKOG KORNEALNOG ASTIGMATIZMA NAKON FAKOEMULZIFIKACIJE KROZ ČISTI KORNEALNI REZ

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Cilj studije bio je analizirati poslijeoperacijski kornealni astigmatizam nakon fakoemulzifikacije i implantacije intraokularne leće kroz čisti kornealni rez. U ovu prospektivnu studiju bila su uključena 22 oka (10 desnih i 12 lijevih očiju) kod kojih je učinjena fakoemulzifikacija i implantacija savitljive intraokularne leće kroz čisti kornealni rez. Operacije desnih očiju rađene su kroz superotemporalni rez, a operacije lijevih očiju kroz superonazalni rez. Astigmatizam je mjereno autorefraktometrom-keratometrom prijeoperacijski, te 1 tjedan, 1 mjesec i 2 mjeseca poslijeoperacijski. Srednja vrijednost kirurški induciranog kornealnog astigmatizma iznosila je 0,23 D (dioptrije). Vrijednosti vertikalne komponente astigmatizma bile su statistički značajno niže poslijeoperacijski u odnosu na prijeoperacijske vrijednosti ($p=0,0404$). Vrijednosti horizontalne komponente astigmatizma nisu se statistički značajno razlikovale prijeoperacijski i poslijeoperacijski ($p>0,05$). Također nismo našli statistički značajnu razliku između vrijednosti kirurški induciranog astigmatizma nakon superotemporalne incizije u desnim očima i superonazalne incizije u lijevim očima ($p>0,05$). Zaključeno je kako kosa lokalizacija čistog kornealnog reza, superotemporalno u desnim očima i superonazalno u lijevim očima, može olakšati rad i manipulacije tijekom fakoemulzifikacije kirurgu dešnjaku bez značajne razlike u veličini kirurški induciranog astigmatizma.

Ključne riječi: *kirurgija katarakte, čisti kornealni rez, kirurški inducirani astigmatizam*