

# Comparison of the keratometric corneal astigmatic power after phacoemulcification: clear temporal corneal Incision versus superior scleral tunnel Incision

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**Abstract Objective:** This is prospective randomized control trial to compare the mean keratometric corneal astigmatism diopter power (not surgical induced astigmatism) among pre-op and one month, three-month post-op phacoemulcification of either a clear temporal corneal incision versus a superior scleral tunnel Incision. Using only keratometric astigmatic power reading to evaluate the difference between the two cataract surgery incisions.

**Methods:** 120 patients (134 eyes) underwent phacoemulcification were randomly assigned to two groups: Group A, the clear temporal corneal incision group and Group B, the superior scleral tunnel incision group. SPSS11.5 Software was used for statistical analysis to compare the post-surgical changes of cornea astigmatism on keratometry.

**Results:** The changes of corneal astigmatic diopter in Group A and B after 3 months post-op from keratometric reading were  $1.04 \pm 0.76$  and  $0.94 \pm 0.27$  respectively ( $p=0.084 > 0.05$ ) which showed no statistic significance difference.

**Conclusion:** The incision either through temporal clear cornea or superior scleral tunnel in phacoemulcification show no statistic difference in astigmatism change on keratometry 3 month post –op.

**Key words:** phacoemulcification, cataract extraction, astigmatism, keratometry, clear corneal incision, superior scleral tunnel incision, and foldable intraocular lens

## Introduction:

Along with the availability of the foldable intraocular lens, the incision in the phacoemulcification cataract extraction has developed from sclera incision

to the clear corneal incision. At present time, cataract surgeries by phacoemulcification through clear corneal incision have become the principal method for cataract surgery because of its bloodless and fast approach. The post-op SIA (surgical induced astigmatism) has always been a concern to most of surgeons. It has always been assumed that scleral incision would minimize the post-op astigmatism. There were numerous studies about SIA. Masker has advocated scleral pocket with suture under tonometric and keratometric control to reduce SIA.<sup>1</sup> Altan-Yaycioglu indicated in his study that temporal and superotemporal incisions result only small astigmatic changes.<sup>2</sup> Conversely, the superior, superonasal and nasal incision induced more astigmatism.<sup>2</sup> In the review of Amesbury showed that in phacoemulcification, the incision placed on the steep corneal axis can correct small amount of astigmatism depend upon the location of the axis.<sup>5</sup> The peripheral corneal relaxing incision corrected greater amount of astigmatism. The toric intraocular lenses are also safe and effective for treating more than 1 diopter of astigmatism.<sup>3</sup> We know the temporal clear corneal incision is efficient and bloodless whereas the superior scleral incision is less efficient and bloody. This study aims to find out that the temporal clear corneal incision will not create more SIA than superior scleral incision in three month using keratometry. Many studies on surgical Induced cornea astigmatism using vector analysis of complicated Holladay-Cravy-Koch formula.<sup>4</sup> Since this study was focused solely on the comparison the mean keratometric reading pre-op and post- op in clear temporal versus superior scleral incision, the Holladay-Cravy-Koch formula regarding specific SIA was not used . Furthermore, the statistics study of ANOVA need to pass the F-test for homogeneity purpose, the method of pre-op and post-op measurement should be the same.

A total of 120 (134 eyes) patients were included in this study from July 2006 to January 2007 at the Ophthalmology Center, Beijing Tongren Hospital. The keratometric astigmatic diopter before and after surgery of the two groups were recorded and inputted into SPSS for statistic analysis.

## 1. Materials and Methods

### 1.1 General data

120 patients of 134 eyes had cataract surgery at the Ophthalmology Center, Beijing Tongren Hospital from July 2006 to January 2007, 50 male and 70 female patients. Age varied between 25 to 70 years old. There were 120 eyes suffered from senile cataract and 14 eyes had complicated cataract.

## 1.2 Methods and Grouping

The pre-op keratometry was done and astigmatism were recorded for all the sample patients. They were then randomly assigned to Group A or B for either the phacoemulcification through temporal clear corneal incision or the phacoemulcification through superior scleral tunnel incision with intraocular lens implant (one surgeon). It was not possible to blind the participants, staff and the surgeon due to the nature of the intervention. However, the study personnel who verified and recorded the outcomes of keratometric astigmatism (same keratometry) was blind to the group allocation (randomly allocated). Both groups were followed and data collected in the same way. In Group A (the temporal clear corneal incision group of 70 eyes), under the topical anesthesia, the anterior chamber was entered through temporal clear cornea about 0.5 mm from the limbus with a 3.2 mm keratome. In Group B (the superior scleral tunnel incision group of 64 eyes), the scleral tunnel incision was made 2 mm behind the posterior limbus superiorly which extended 2 mm into clear cornea, anterior chamber was entered with a 3.2 mm keratome. Neither group A nor group B need stitch to close the wound. The keratometric mean astigmatism in the two groups before surgery was similar ( $0.89 \pm 0.42 / 0.91 \pm 0.38$ ). All 120 patients were able to be followed in 3 months.

## 1.3 Statistic

The comparison of the keratometric astigmatic diopter between Group A and Group B before surgery, post-op 1 month and post-op 3 months was conducted using ANOVA.

## 2. Results

Inter-group and intra-group comparison of mean keratometric corneal astigmatic diopter between Group A and Group B before and after surgery

Group	mean keratometric corneal		Astigmatic diopter
	Before surgery	1 month post-op	3 months post-op
A	0.89±0.42	1.56±0.94	1.04±0.76
B	0.91±0.38	1.09±1.03	0.94±0.27

### Comparison of mean between the two groups

No significance was found in the intra-group comparison of astigmatic diopter before surgery ( $p=0.45 >0.05$ ). This was the test for homogeneity of variance to assess whether ANOVA was valid. Since the p-value was not significant ( $p=0.45 >0.05$ ), this ANOVA was valid. There was a statistically difference (at 5% level) that the mean keratometric cornea astigmatic diopter in Group A was higher than that in Group B ( $p=0.039 <0.05$ ) one month after surgery. However, there was No statistically significant difference was found when compared the mean keratometric cornea astigmatic diopter between Group A and Group B, 3 months after surgery ( $p=0.084 >0.05$ ).

The mean keratometric astigmatic diopter of Group A increased 1 month after surgery but recovered to the pre-surgical level 3 months after surgery. There was no statistically difference when compared the mean keratometric corneal astigmatic diopter between post-surgical 1 month and post-surgical 3 months in Group B. The superior scleral incision showed statistically stable mean astigmatism post-op one month to three month.

### 3. Discussion

The clear temporal corneal incision did show statistically significant changes of more keratometric astigmatism 1 month after phacoemulcification compare to superior scleral incision. However, there was no statistically significant change after three month. It is possible that a small incision on the cornea may takes up to three month to be refractive stable. In addition, the attempt of correcting astigmatism such as wound incision or limbal relaxation incision (LRI) through temporal cornea approach may get minimum effectiveness after three month. According to Holladay's study, the least SIRC (surgical induced refractive change) happened between 60 to 365 days post-op.<sup>4</sup>

Further study beyond 365 days in the same comparison may be necessary. This study just intends to do the comparison between the two incisions using

keratometry as a measurement as previous similar published studies.<sup>6</sup> Therefore; the axis and vector analysis was not account for during the study.

#### 4. Conclusion

Clear temporal corneal incision in phacoemulcification will not increase more keratometric corneal astigmatism than superior scleral incision after three month of operation.

#### References:

1. Masket S. Keratorefractive aspects of the scleral pocket incision and closure method for cataract surgery. *Current Opinion Ophthalmology*, 2009 Jan; 20 (1): 19-24
2. Altan-Yaycioglu R, Akova YA, Akca S, Gur S, Oktem C. Effect on astigmatism of the location of clear corneal incision in phacoemulcification of cataract. *J Refract Surg*. 2007 May; 23(5):515-8.
3. Amesbury EC, Miller KM, Correction of astigmatism at the time of cataract surgery. *J Cataract Refract Surg*, 1989 Jan; 15 (1): 70-7
4. Holladay JT, Cravy TV, Koch DD. calculating the surgically induced refractive change following ocular surgery. *J Cataract Refract Surg*. 1992; 18: 429-43.
5. Altan-Yaycioglu R, Pelit A, Evyapan O, Akova YA. Phacoemulcification using clear cornea incision in steepest meridian *Arq Bras Oftalmol*. 2007 Mar-Apr; 70(2):225-8. Portuguese.
6. Olsen T., Dam-Johansen M., Bek.T.Hjorstdal J.: Corneal versus scleral tunnel incision in cataract surgery. *JCRS* 1997; 23:337-341

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