

Reduction in Corneal Diameter Following Cataract Surgery: A Comparison between Those Who Underwent Small Incision Cataract Surgery and Phacoemulsification at a Tertiary Care Hospital in South India

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Abstract

Introduction: The prevalence of blindness in the country has progressively come down over the last three decades due to a dramatic increase in the number of cataract surgeries performed. However, surgically induced astigmatism (SIA) is one of the complications of cataract surgery and can cause residual vision problems to those undergoing the procedure. Those undergoing manual small incision cataract surgery (MSICS) are considered as more at risk for developing astigmatism than patients undergoing phacoemulsification (PE).

Materials and Methods: Patients diagnosed to have age-related cataract and undergoing surgical intervention through MSICS or PE at Pushpagiri Medical College Hospital were included in the study. Visual acuity and corneal diameters were assessed before and 30 days after the surgical intervention.

Results: A total of 61 participants were included in the study, 33 of them underwent MSICS and 28 had a PE procedure. The mean change in K1 corneal diameter was significantly lower in the case of MSICS than PE ($P = 0.035$) while the mean change in K2 diameter was comparable between the groups ($P = 0.452$). The changes in K1 corneal diameter was not affected by other factors like age, sex, or presence of comorbidities. In addition, the changes in K2 corneal diameter were not affected by any factors such as the type of surgery, age, sex, or presence of comorbidity.

Conclusion: The study has shown that there is a significant change in corneal diameter in those patients undergoing surgical management of cataract. These changes in corneal diameter may be responsible for the rising incidence of SIA, and it is important to document these measurements. We need bigger studies with large sample sizes to establish the causal association between changes in corneal diameter and SIA.

Key words: Aphakia, Cataract extraction, Cornea/abnormalities, Microsurgery/methods, Phacoemulsification/methods, Postcataract/pathology

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INTRODUCTION

Cataract is the most common cause of blindness in India, with almost 75% of a total load of blindness due to this condition. The prevalence of blindness in the country has progressively come down over the last three decades due to a dramatic increase in the number of cataract

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surgeries performed. However, even then, the absolute number of blind persons in the country has increased, due to an increase in the proportion of people above the age of 50 years.¹ The Indian government is a signatory to the World Health Organization convention by the name Vision 2020, which aims to reduce the prevalence of avoidable blindness by as much as 95% by the year 2020. The National Programme for Control of Blindness (NPCB), which was launched as a centrally sponsored scheme in 1976, had an ambitious target to reduce the prevalence of blindness to <0.3% by 2000, but the data from various community surveys have shown that it has failed miserably.² Certain studies have shown that the prevalence of blindness (vision of <6/60 in the better eye) is as high as 1.84% and the total number of blind in the country may be 18 million. Furthermore, these studies show that more than 60% of the blindness is due to treatable causes such as cataract and refractive errors.³ Subsequently, the NPCB has revamped itself to counter the challenge of blindness in the country. The program which used to be cataract-centric has now expanded to include refractive errors, glaucoma, diabetic retinopathy, ocular trauma, etc. The government has built more than 300 eye surgery suites and has trained over 2000 ophthalmic surgeons through the program. Ophthalmic units and dedicated eye wards have been established at district and sub-district levels. Now, more than 95% of the cataract surgeries involve intraocular lens (IOL) implantation, up from <10% in 1995.⁴

The IOL revolution has transformed the surgical management of cataract, through improvements in visual acuity following surgery and reduced complication rates. Extracapsular cataract extraction (ECCE) followed by posterior chamber IOL insertion was the most popular method for a long period. However, the advent of technological innovations such as foldable intraocular lens and phacoemulsification (PE) equipment decreased the popularity of ECCE.⁵ Techniques like PE and Manual Small Incision Cataract Surgery (MSICS) are the most popular among the different cataract surgery methods. Certain studies have shown that both these techniques are comparable in terms of improvement in visual acuity and incidence of complications and that there is a cost advantage for MSICS over PE.⁶ However, a systematic review done by the Cochrane collaboration shows that the short term uncorrected visual acuity is better in patients who undergo PE. There was no concrete evidence on long-term visual acuity and the differences in complications were not significant between the procedures. The review goes on to recommend MSICS for centers with high volumes as a priority, due to better cost-effectiveness offered by the procedure over PE.⁷

Surgically induced astigmatism (SIA) is one of the complications of cataract surgery and can cause residual vision problems to those undergoing the procedure. Those undergoing MSICS is considered as more at risk for developing astigmatism than patients undergoing PE.⁸ Studies have indicated that corneal diameter can be a factor which can predict the incidence of astigmatism in patients who undergo cataract surgery. It was shown that those patients with a higher white to white corneal diameter was less at risk of developing corneal astigmatism as compared to patients with lesser diameter.⁹ Shorter axial length, shallow anterior chamber, lower intraocular pressure and advancing age, has been shown as risk factors for SIA, in those undergoing cataract surgeries.¹⁰ Even though SIA is a problem with significant morbidity, the literature available on the problem and its possible risk factors are very few. In this study, we aim to study the changes in corneal diameter, which is considered as a risk factor for astigmatism, among patients undergoing cataract surgery using PE or MSICS techniques.

MATERIALS AND METHODS

The study was conducted at the Department of Ophthalmology of Pushpagiri Medical Hospital, Tiruvalla, Kerala, India. The study was planned during the period August to September 2015, and the data collection was done during October to December 2015.

Patients diagnosed to have age-related cataract and undergoing surgical intervention at Pushpagiri Medical College Hospital were included in the study. The patients having congenital or pediatric cataract and those with secondary cataracts due to any cause were excluded from the study. Those patients who were not willing for a 30 days follow-up after surgical intervention were also excluded. Written informed consent was obtained from the participants 1 day before the surgery.

The demographic and clinical characteristics of the participants like age, sex, and presence of comorbidity were found out before the surgery. Prior to the surgical intervention, the visual acuity of the participants was tested using a Snellen's chart, by the ophthalmic surgeon concerned. The Vertical and Horizontal corneal diameters were found out using a standardized keratometer (Model: KMS 6, manufactured by Appasamy Associates, Chennai, India).

All the patients underwent PE or MSICS. The methods were decided after taking into account the choice and financial status of the patient, and also clinical considerations. The investigators had no role in influencing the patient

regarding the choice of surgical technique, or in deciding the course of clinical management of the problem. The surgical interventions were performed by ophthalmic surgeons with considerable experience in performing these procedures. Both the surgical procedures were performed on an in-patient basis, even though some centers prefer to perform PE as a day care procedure. The participants were followed up on an out-patient basis, looking for any complications because of the surgical procedure. Visual acuity and corneal diameters were found out at the end of 1 month of follow-up.

The data collection was done using a structured questionnaire and was digitized using Epi-Data, which is a free data entry software for epidemiological studies. The data were analyzed using Epi-Info 7.0; a free statistical package brought out by Centres for Disease Control, USA.

RESULTS

A total of 61 participants were included in the study, 33 of them underwent MSICS and 28 had a PE procedure. A majority of the participants were above 60 years of age, and more than 60% were females. 52% of those undergoing surgery had diabetes mellitus, and 40.9% was on treatment for hypertension. More than 60% of the participants were having immature cataracts, and the rest had mature cataracts. None of the participants were in the stage of hypermaturity. The baseline clinical and demographic correlates were comparable between the participants undergoing MSICS and PE (Table 1).

The mean K1 diameter fell from 44.50 to 44.01 in case of patients undergoing MSICS, and from 44.59 to 43.48 in

patients undergoing PE. The mean K2 diameter was also reduced after the participants underwent cataract surgery, from 44.81 to 44.28 in the case of MSICS and from 44.27 to 44.01 in PE. The mean change in K1 diameter was significantly lower in the case of MSICS than PE ($P = 0.035$) while the mean change in K2 diameter was comparable between the groups ($P = 0.452$) (Table 2).

The data were further analyzed to look for possible factors which will affect the changes in corneal diameter. The mean reduction in K1 corneal diameter was significantly affected by the choice of surgery, with those undergoing PE having a larger reduction in diameter ($P = 0.035$). The changes in K1 corneal diameter was not affected by other factors like age, sex or presence of comorbidities. Furthermore, the changes in K2 corneal diameter were not affected by any factors such as type of surgery, age, sex, or presence of comorbidity (Tables 3 and 4).

DISCUSSION

A vast majority of the patients undergoing surgery for cataract was aged above 60 years, and this reflects

Table 1: Baseline clinical and demographic correlates

Characteristic	MSICS (n=33) (%)	Phacoemulsification (n=28) (%)
Age		
Up to 59	5 (15.2)	1 (3.6)
60 and above	28 (84.8)	27 (96.4)
Sex		
Male	10 (30.3)	14 (50)
Female	23 (69.7)	14 (50)
Diabetes		
Yes	14 (42.4)	18 (64.3)
No	19 (57.6)	10 (35.7)
Hypertension		
Yes	10 (30.3)	15 (53.6)
No	23 (69.7)	13 (46.4)
Stage of cataract		
Immature	20 (60.6)	17 (60.7)
Mature	13 (39.4)	11 (39.3)
Hypermature	0	0

MSICS: Manual small incision cataract surgery

Table 2: Changes in corneal diameter following cataract surgery

Corneal diameter	Mean (SD)	
	MSICS (n=33)	PE (n=28)
Pre-op K1	44.50 (1.55)	44.59 (1.39)
Pre-op K2	44.81 (1.58)	44.27 (1.53)
Post-op K1	44.01 (1.62)	43.48 (1.38)
Post-op K2	44.28 (1.69)	44.01 (1.52)
Change in K1	0.500 (1.14)	1.109 (1.03)
Change in K2	0.529 (1.47)	0.267 (1.16)

SD: Standard deviation, MSICS: Manual small incision cataract surgery, PE: Phacoemulsification

Table 3: Factors affecting changes in corneal diameter (K1)

Characteristic	Mean (SD) change in corneal diameter	P value
Type of surgery		
MSICS	0.500 (1.14)	0.035 [#]
PE	1.109 (1.03)	
Age		
Up to 59	0.358 (0.65)	0.342
60 and above	0.825 (1.16)	
Sex		
Male	1.021 (0.79)	0.183
Female	0.623 (1.29)	
Diabetes		
Yes	0.768 (1.26)	0.939
No	0.791 (0.99)	
Hypertension		
Yes	0.748 (1.27)	0.858
No	0.801 (1.04)	

[#]Statistically significant, SD: Standard deviation, MSICS: Manual small incision cataract surgery, PE: Phacoemulsification

Table 4: Factors affecting changes in corneal diameter (K2)

Characteristic	Mean (SD) change in corneal diameter	P value
Type of surgery		
MSICS	0.528 (1.47)	0.452
PE	0.267 (1.16)	
Age		
Up to 59	0.475 (1.42)	0.342
60 and above	0.401 (1.33)	
Sex		
Male	0.108 (1.17)	0.183
Female	0.604 (1.41)	
Diabetes		
Yes	0.507 (1.42)	0.939
No	0.300 (1.24)	
Hypertension		
Yes	0.346 (1.39)	0.858
No	0.452 (1.31)	

SD: Standard deviation, MSICS: Manual small incision cataract surgery, PE: Phacoemulsification

the nature of the problem whereby the prevalence of age-related cataract goes up exponentially with age.¹¹ The very high prevalence of diabetes mellitus and hypertension among the study participants concurs with the statistics available from other parts of Kerala which shows that the state is fast becoming the capital of metabolic diseases in the country.¹² Furthermore, it is important to note that majority of the participants were undergoing surgery for the problem at a relatively early stage (immature), and this may be due to the advancement of medical facilities in the state of Kerala. The state of Kerala has been at the forefront of medical revolution in India, with easily accessible and decentralized facilities available at government subsidized rates and this has massively improved the health coverage in case of common problems like cataract.¹³

In a time when SIA has been recognized as a major complication of cataract surgery, the study of corneal diameter is important. Multiple studies have showed an association between SIA and corneal diameter, and these studies go on to recommend routine measurement of corneal diameters before the patient undergoes surgical management of cataract.⁹ In our study, it was found that the reduction in corneal diameter K1 was significantly lower in case of patients undergoing MSICS, when compared to the patients who had PE. This result contradicts studies done previously, which shows that patients undergoing MSICS are more at risk for developing SIA, though we are unsure of the exact correlation between changes in corneal diameter and incidence of astigmatism.⁸ Many review articles also suggest that the incidence of SIA is significantly lower in case of PE, when compared to patients undergoing MSICS.¹⁴ Therefore, the contradictory result in our study

may have been due to the fact that the sample size of the study was low, and that MSICS is performed in our center by more experienced ophthalmic surgeons with considerable operating experience.

CONCLUSION

The study has shown that there is a significant change in corneal diameter in those patients undergoing surgical management of cataract. These changes in corneal diameter may be responsible for the rising incidence of SIA, and it is important to document these measurements. A large study with a longer follow-up period is warranted, to find out the association between changes in corneal diameter and visual acuity. Furthermore, we need bigger studies with large sample sizes to establish the causal association between corneal diameter and SIA.

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REFERENCES

- Murthy G, Gupta SK, John N, Vashist P. Current status of cataract blindness and Vision 2020: The right to sight initiative in India. *Indian J Ophthalmol* 2008;56:489-94.
- Dandona L, Dandona R, John RK. Estimation of blindness in India from 2000 through 2020: Implications for the blindness control policy. *Natl Med J India* 2001;14:327-34.
- Dandona L, Dandona R, Srinivas M, Giridhar P, Vilas K, Prasad MN, et al. Blindness in the Indian state of Andhra Pradesh. *Invest Ophthalmol Vis Sci* 2001;42:908-16.
- Verma R, Khanna P, Prinja S, Rajput M, Arora V. The national programme for control of blindness in India. *Australas Med J* 2011;4:1-3.
- Minassian DC, Rosen P, Dart JK, Reidy A, Desai P, Sidhu M, et al. Extracapsular cataract extraction compared with small incision surgery by phacoemulsification: A randomised trial. *Br J Ophthalmol* 2001;85:822-9.
- Gogate P, Optom JJ, Deshpande S, Naidoo K. Meta-analysis to compare the safety and efficacy of manual small incision cataract surgery and phacoemulsification. *Middle East Afr J Ophthalmol* 2015;22:362-9.
- Riaz Y, de Silva SR, Evans JR. Manual small incision cataract surgery (MSICS) with posterior chamber intraocular lens versus phacoemulsification with posterior chamber intraocular lens for age-related cataract. *Cochrane Database Syst Rev* 2013;10:CD008813.
- Haldipurkar SS, Shikari HT, Gokhale V. Wound construction in manual small incision cataract surgery. *Indian J Ophthalmol* 2009;57:9-13.
- Theodoulidou S, Asproudis I, Kalogeropoulos C, Athanasiadis A, Aspiotis M. Corneal diameter as a factor influencing corneal astigmatism after cataract surgery. *Cornea* 2016;35:132-6.
- Chang SW, Su TY, Chen YL. Influence of ocular features and incision width on surgically induced astigmatism after cataract surgery. *J Refract Surg* 2015;31:82-8.
- Vashist P, Talwar B, Gogoi M, Maraini G, Camparini M, Ravindran RD, et al. Prevalence of cataract in an older population in India: The India study of age-related eye disease. *Ophthalmology* 2011;118:272-8.e1-2.
- Raman Kutty V, Joseph A, Soman CR. High prevalence of Type 2 diabetes

Ipe, *et al.*: Reduction in Corneal Diameter following MSICS and Phacoemulsification

- in an urban settlement in Kerala, India. *Ethn Health* 1999;4:231-9.
13. Sasikumar S, Naved M, Saikumar SJ. Cataract surgical coverage in Kolenchery, Kerala, India. *Community Eye Health* 1998;11:7.
 14. Gogate P, Optom JJ, Deshpande S, Naidoo K. Meta-analysis to compare the safety and efficacy of manual small incision cataract surgery and phacoemulsification. *Middle East Afr J Ophthalmol* 2015;22:362-9.

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