

# A study of effect of manual small incision cataract surgery (MSICS) on corneal thickness in early postoperative period

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## Abstract

**Purpose:** To measure corneal thickness at four sites preoperatively and in early postoperative period after Manual small incision cataract surgery (MSICS) with goal of evaluating the functional integrity of corneal endothelium after MSICS. **Materials and Methods:** This was a hospital based prospective interventional study without control conducted at S.M.S Hospital, Jaipur. Sample consisted of seventy five eyes of 75 patients of senile cataract aged between group of 45 yrs to 75 yrs. All patients underwent Manual small incision cataract surgery. The measurement of corneal thickness was done using ultrasonic pachymeter (Ophthasonic A/P III) at four corneal sites from centre to periphery of cornea. The measurements were done preoperatively as well as on 1<sup>st</sup>, 7<sup>th</sup> and 21<sup>st</sup> postoperative days. The measurements at all four corneal points automatically get taken simultaneously. Three observations were made for each thickness site (preoperatively and at follow ups) and their mean was recorded as the thickness reading in the study. **Results:** Out of the seventy five patients included in the study, 42 (56%) were males and 33 (44%) were females. Preoperatively, mean central corneal thickness was 517±31.64 micron. Postoperatively, it was 595.35 ± 33.48 micron on 1<sup>st</sup> day; 552.79±31.97 micron on 7<sup>th</sup> day and 524± 31.66 micron on 21<sup>st</sup> day and this change was found to be statistically significant (P<0.01). The paracentral; midperipheral and peripheral corneal thickness values also showed similar trend as compared to baseline values which was also statistically significant (P<0.01). **Conclusion:** This study suggests that there is transient increase in corneal thickness in immediate postoperative period following MSICS suggesting endothelial cell stress and damage. The thickness values start approximating the baseline preoperative values by 21<sup>st</sup> day suggesting that corneal endothelial damage is not permanent and endothelial cells tend to regain their pump function.


**Keywords:** Manual small incision cataract surgery, corneal endothelium, pachymetry, corneal thickness.

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## INTRODUCTION

A huge backlog of cataract blindness exists in developing and under developed countries. There are 39 million people reported blind worldwide. Age related cataract is

responsible for 51% of world blindness. Quality visual restoration can be achieved by both phacoemulsification and manual small incision cataract surgery (MSICS). MSICS when compared with phacoemulsification is relatively easy to learn and is inexpensive and hence is better suited for mass cataract surgery in third world countries. Cataract surgery is known to change corneal endothelial cell density. This, in turn, affects endothelial pump function. A compromised endothelial function can result in stromal edema and a poor visual rehabilitation after cataract surgery. MSICS, being associated with manipulation of nucleus in anterior chamber, is more prone to corneal endothelial damage. Besides the direct evaluation of corneal endothelium by specular microscopy, an indirect assessment of functional integrity of corneal endothelium is possible with pachymetry.

Gogate *et al*<sup>3</sup> (2010) concluded that there was no clinically or statistically significant difference in endothelial cell count and visual acuity between phacoemulsification and MSICS. George R *et al*<sup>4</sup> (2005) has also reported that there is no significant difference in endothelial cell loss in MSICS and phacoemulsification. Goldenberg D *et al*<sup>5</sup> (2013) has reported that modified MSICS (using a/c maintainer) offers a viable enhancement of MSICS with mild and transient impact on corneal endothelial cell density and corneal pachymetry. Our study primarily aims to assess the metabolic stress on endothelial cells following MSICS in early postoperative period by measuring corneal thickness at four sites using ultrasonic pachymeter.

**MATERIAL AND METHODS**

This was a hospital based prospective interventional study without control conducted at S.M.S Hospital, Jaipur. Sample consisted of seventy five eyes of 75 patients of senile cataract aged between group of 45 yrs to 75 yrs who refused for phacoemulsification surgery due to their own reasons and came during the study period. Patients with traumatic cataract, subluxated lens, glaucoma, uveitis, corneal opacity or any significant posterior segment pathology were excluded from the study. Informed written consent was taken from all participants. All patients underwent detailed history; general and ocular examination to satisfy the inclusion and exclusion criteria and were operated Manual small incision cataract surgery by the same surgeon to eliminate subjective variation. The measurement of corneal thickness was done using ultrasonic pachymeter (Ophthasonic A/P III) at four corneal sites from centre to periphery of cornea after prior instillation of anaesthetic drops. The measurements were done preoperatively as well as on 1<sup>st</sup>; 7<sup>th</sup> and 21<sup>st</sup> postoperative days by the same investigator to eliminate observer’s bias. With patient being asked to fixate with other eye on the target in primary position of gaze, the probe was applied perpendicular to cornea; due care was taken not to indent cornea. The microprocessor present in Ophthasonic A/P III pachymeter automatically disregards any reading in which there is improper

alignment of probe tip and cornea. When the probe is correctly aligned, the amplitude of signal from backside of cornea is at the same level as the signal from frontside; the microprocessor uses this signal as good criteria to take reading. The measurements at all four corneal points automatically get taken simultaneously. Three observations were made for each thickness site (preoperatively and at follow ups) and their mean was recorded as the thickness reading in the study.

**Statistical Analysis**

Linear variables were summarized as mean and standard deviation and were analyzed by using repeated measure anova and paired ‘t’ test. Normal and categorical variables were summarized as proportion (%). ‘P’ value less than 0.05 was taken as significant. SPPP 22-0 version software was used for all statistical calculations and analysis.

**RESULTS**

Out of the seventy five patients included in the study, 42 (56%) were males and 33 (44%) were females. Majority of patients were of 55yrs to 75yrs age. Preoperatively, mean central corneal thickness was 517±31.64 micron. Postoperatively, it was 595.35 ± 33.48 micron on 1<sup>st</sup> day; 552.79± 31.97 micron on 7<sup>th</sup> day and 524± 31.66 micron on 21<sup>st</sup> day and this change was found to be statistically significant (P<0.01). Preoperatively, mean paracentral corneal thickness was 550.04±38.81 micron. Postoperatively, it was 632.33 ±34.75 micron on 1<sup>st</sup> day; 594.71±36.68 micron on 7<sup>th</sup> day and 559.75 ± 40.79 micron on 21<sup>st</sup> day and this change was found to be statistically significant (P<0.01). Preoperatively, midperipheral corneal thickness was 590.68 ± 44.93 micron. Postoperatively, it was 673.21 ± 39.05 micron on 1<sup>st</sup> day; 634.60 ± 38.15 on 7<sup>th</sup> day and 599.87 ± 44.89 micron on 21<sup>st</sup> day and this change was found to be statistically significant (P<0.01). Preoperatively, peripheral corneal thickness was 626.21 ± 51.14 micron. Postoperatively, it was 720.39 ± 51.73 micron on 1<sup>st</sup> day; 678.60 ± 43.71 micron on 7<sup>th</sup> day and 636.21 ± 49.53 micron on 21<sup>st</sup> day and this change was found to be statistically significant (P<0.01).

**Table 1: Age and Sex wise distribution of the patient**

Age group (in years)	Sex				Total	
	Male		Female			
	No.	%	No.	%	No.	%
46-55	6	8.00	7	9.33	13	17.33
56-65	18	24.00	17	22.67	35	46.67
66-75	18	24.00	7	9.33	25	33.33
76-85	0	0.00	2	2.67	2	2.67
<b>Total</b>	<b>42</b>	<b>56.00</b>	<b>33</b>	<b>44.00</b>	<b>75</b>	<b>100.00</b>

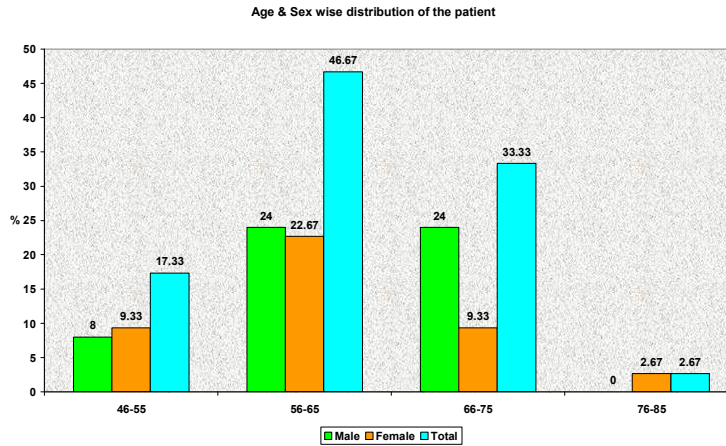


Figure 1

Table 2: Mean  $\pm$  SD of corneal thickness at different sites of cornea on pre-operative and post-operative evaluation

Sites of cornea	Mean $\pm$ SD (in Micron)				'p' Value*
	Pre-op	1st Day	7th Day	21st Day	
Central	517.15 $\pm$ 31.64	595.35 $\pm$ 33.48	552.79 $\pm$ 31.97	524.72 $\pm$ 31.66	<0.001
Paracentral	550.04 $\pm$ 38.81	632.33 $\pm$ 34.75	594.71 $\pm$ 36.68	559.75 $\pm$ 40.79	<0.001
Mid Peripheral	590.68 $\pm$ 44.93	673.21 $\pm$ 39.05	634.60 $\pm$ 38.15	599.87 $\pm$ 44.89	<0.001
Peripheral	626.26 $\pm$ 51.14	720.39 $\pm$ 51.73	678.60 $\pm$ 43.71	636.21 $\pm$ 49.53	<0.001

\*Repeated Measures ANOVA

Table 3: Pairwise comparison of pre-operative corneal thickness at different sites of cornea with post-operative follow-ups

Sites of cornea	Baseline	Follow-ups	'p' Value*
Central	Pre-op	1st Day	<0.001
		7th Day	<0.001
		21st Day	<0.001
		1st Day	<0.001
Paracentral	Pre-op	7th Day	<0.001
		21st Day	<0.001
		1st Day	<0.001
		21st Day	<0.001
Mid Peripheral	Pre-op	7th Day	<0.001
		21st Day	0.031
		1st Day	<0.001
		21st Day	<0.001
Peripheral	Pre-op	7th Day	<0.001
		21st Day	<0.001
		1st Day	<0.001
		21st Day	<0.001

\*Paired t-test

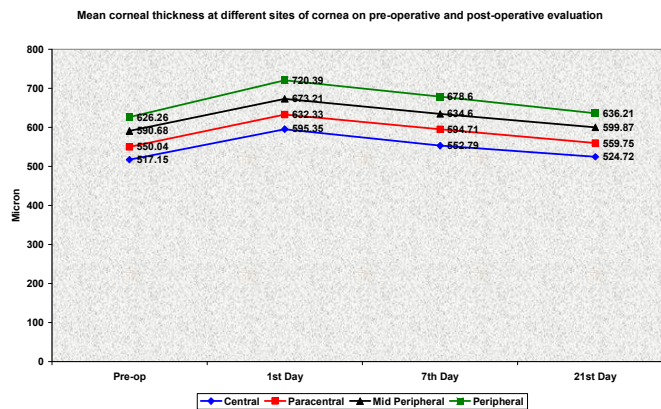


Figure 2

## DISCUSSION

In the present study, the mean central corneal thickness preoperatively was  $517.15 \pm 31.64$  micron. This is in correlation with study done by Mathew PT *et al* where central corneal thickness was  $503 \pm 27$  micron. In present study, ultrasonic pachymeter (Ophthasonic A/P III) was used for measuring corneal thickness. Patel S *et al*<sup>7</sup> noted that optical pachymetry tends to overestimate corneal thickness whereas ultrasonic pachymetry tends to underestimate corneal thickness. The mean % increase in central corneal thickness in our study was  $15.12 \pm 5.81$  % on 1<sup>st</sup> day;  $6.89 \pm 1.04$  % on 7<sup>th</sup> day and  $1.46 \pm .63$  % on 21<sup>st</sup> day. In present study, the postoperative 21<sup>st</sup> corneal thickness value started approximating the preoperative value. Deturgescence of corneal stroma is controlled by pump action of endothelial layer and can be monitored by measurement of corneal thickness (Pachymetry). Ventura A *et al*<sup>11</sup> (2001) concluded that as long as the measured density of central corneal thickness does not fall below the physiological threshold, a moderate decrease in this parameter does not compromise the pumping activity of layer as a whole. Our findings are similar to those of Mathew PT *et al*<sup>7</sup> and Bolz *et al*<sup>2</sup> and we agree with them that pachymetric changes after MSICS are reversible.

## CONCLUSION

This study suggests that there is transient increase in corneal thickness in immediate postoperative period following MSICS suggesting endothelial cell stress and damage. The thickness values start approximating the baseline preoperative values by 21<sup>st</sup> day suggesting that corneal endothelial damage is not permanent and endothelial cells tend to regain their pump function. Manual small incision cataract surgery is a safe procedure and its low cost nature can be confidently utilized for eradication of cataract blindness in developing and underdeveloped countries where affordability and accessibility to phacoemulsification is not always possible.

## LIMITATIONS

1. Controls were not taken in the study as it would have been unethical to randomize the patients for phacoemulsification and manual small incision

cataract surgery against their opted surgical technique.

2. Selection bias may be present in sample population as all patients were from tertiary care govt. hospital and had predefined mindset for small incision cataract surgery.

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