

Effect of Cataract Surgery (Phaco and Manual Small Incision Cataract Surgery) on the Corneal Endothelium

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ABSTRACT

Objective: This study will investigate the relationship between phacoemulsification (active removal of cataracts) and manual tiny incision (passive removal of cataracts) on the corneal endothelial cell count.

Study Design: Prospective Comparative study

Place and Duration of Study: This study was conducted at the Department of Ophthalmology, Chandka Medical College & Shaheed Mohtarma Benazir Bhutto Medical University Larkana, from 1st August 2020 to 30th April 2021.

Materials and Methods: The researchers investigated the effect of phacoemulsification, SICS, and cataract surgery on 100 patients who underwent this procedure using manual small incision cataract surgery (SICS). In order to investigate the correlation between nuclear cataracts and senile cortical cataracts, participants age 30 to 70 years were enrolled. Approximately 70% of the surgeries done by a single surgeon were collected for the study. The data were analyzed in SPSS version 21.0

Results: Phacoemulsification was utilised on a total of 100 patients. In the case of the SICS method, 50 patients received phacoemulsification and 50 patients did not. Lower endothelial count loss was detected with manual SICS, with 22 eyes showing a count loss of between 100-500 cells, and an increase of over 1500 cells was found in 8 eyes (4 eyes). was shown to be at 18% of endothelial cell loss with fewer than 100 endothelial cells lost (9 eyes). When looking at the data in phacoemulsification, it was revealed that the endothelial cell count loss of under 100 cells was highest at 46% (23 eyes), and greater than 1500 cells was undetected in this study.

Conclusion: In this study, endothelial cell count loss after phacoemulsification surgery was found to be smaller than SICS. After phacoemulsification surgery was found to be superior to manual SICS because it prevented the endothelial cells from receiving extensive injury, which helped to ensure that patients immediately post-surgery would have a good BCVA, as opposed to a lesser-than-desired BCVA experienced by patients who received manual SICS.

Key Words: Corneal Endothelium, Manual Small Incision Cataract Surgery, Phacoemulsification

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INTRODUCTION

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The cornea is a transparent, avascular outermost layer of the eye which has further six layers namely the epithelium, Bowman's membrane, stroma, pre-Desmet's layer, Descemet's membrane, and the endothelium¹.

Small-incision cataract surgery (SICS) is one of the cataract surgical techniques commonly used in developing countries². It is a low-cost, small-incision form of extra capsular cataract extraction (ECCE)².

Finally, we expect that this corneal endothelial study aids us in choosing the most optimal extraction approach for cataractous lens in order to provide good postoperative vision rehabilitation as discussed by our pioneer. 75% of the refractive power of the eye is provided by the cornea, yet to obtain clear vision, a highly transparent cornea is required. The corneal endothelium is a single layer of cells lining the inner surface of the cornea and is responsible for the normal, continuous function of the cornea. The endothelial cell

density in the typical cornea at birth is high.⁷ Cell counts range from 1500 cells per millimetre to 3500 cells per mm.⁷ To better understand the effects of phacoemulsification cataract surgery and manual small incision cataract surgery on the corneal endothelial cell count, we performed this research. Phacoemulsification outcomes play a critical role in our understanding of how phacoemulsification surgery affects the morphology and central corneal thickness of habitual corneal endothelial cells.

MATERIALS AND METHODS

The researchers carried out a prospective study of 100 patients who had cataract surgery done by SICS and phacoemulsification in Larkana, the city of Larkana, from August 1st, 2020 to April 30th, 2021. The research work done on surgeries performed by a single surgeon is taken as the study. Inclusion criteria include senile cortical cataract and nuclear cataract, which must occur in adults between the ages of 30 and 70. Any pre-existing corneal disease, any complicated cataracts, cataracts with glaucoma, posterior segment lesions, or systemic illness, and insufficiently consistent follow-up are all part of the exclusion criteria. Preoperative evaluation includes a detailed history and routine medical tests, such as measurement of the corrected distance visual acuity (BCVA) using a Snellen chart or an E-chart recording tension with a Schiottz tonometer assessing the patency of the duct, an A-scan, and calculation of IOL power using the SRK II formula.

Special surgical procedures: Before surgery, the use of tropicamide and 10% phenylephrine was done one hour before surgery, to promote adequate pupil dilation. It was employed in all instances of circumilbar anaesthesia. Digital compression was used to achieve anisometropia. A No.11 blade was used to cut a 1 mm wide linear incision that was positioned about 2 mm from the limbus. A fornix-based conjunctival flap was utilised in creating a 5.5 mm (phaco) or 6 mm (manual SICS) long sclera incision. A 1.5 mm-thick crescent blade was embedded into a clear cornea, forming a tunnel. To enter AC, they started out with a 3.2 mm keratome, and later expanded the size.⁸ The following types of cataract surgery were used in manual small incision cataract surgery: 1)can opener capsulotomy, 2)continuous curvilinear capsulorhexis, and 3) 26G needle cystectomy. The nucleus was withdrawn with Vectis irrigating device after hydrodissection and hydraulic expression. Everything was done using viscous substances such as viscoelasticity enhancers. Simcoe cannula was used to aspirate the cortex. A 6 mm PMMA single-piece IOL was inserted into the capsular bag, and it was centred correctly. This established the anterior chamber and allowed the incision to close itself. During the surgery, a small (0.5mL) dose of dexamethasone was injected in the conjunctival sac, along with repositioning of the

conjunctiva to the wound. After introduction into AC via a 3.2 mm keratome phaco probe, a lens entry procedure known as phacoemulsification was then used to reach the lens tissue. The soft cataracts were treated with phaco aspiration and in the other type of cataracts, the nucleus was emulsified with the divide and conquer technique. As the wound self-sealed, the AC had been formed. A injection of 0.5mL of dexamethasone 4 mg was performed through the conjunctiva.⁹ They received topical steroids, antibiotic drops, and 1% cyclopentolate eye drops after the operation.¹⁰ Patients were examined with a microscope that is able to visualise specular particles on the fourth postoperative day.¹¹ The V/A is ready to be recorded. The corneal endothelial count was taken. Using a specially prepared form, the findings were recorded and various variables were measured.

RESULTS

Table No.1: Frequency of Different Phaco Parameters (n = 100)

Phaco	Power %	Vacuum (mm/H)	Flow rate (cc/mt)
Trenching	70-80	50	10-20
Quadrant emulsification	50-60	200	25-30
Colour of Nucleus			
Grade	Colour of Nucleus	Number of Eyes	Percentage
Grade I	White or green and yellow	22i	22i
Grade II	Yellow	44	44
Grade III	Amber	22	22
Grade IV	Brown	0	0
MC	White	12	12
Age Group Vs. % of Cataract			
Grade of Nucleus	Number of Eyes	Percentage	
I	2	4	
II	18	36	
III	20	40	
Mature cataract	10	20	
Endothelial Cell Count			
<100	23	46	
100-500	15	30	
500-1000	7	14	
>1000	5	10	
BCVA on Fourth Postoperative Day			
6/6	20	40	
6/9	16	32	
6/12	9	18	
6/18	5	10	

In the 20 eyes (40%) in which grade III cataracts were found, they were the most common. One of the commonest problems among the preoperative patients was rupture of the posterior capsule and premature entry, with frequency of 4% and 6%, respectively. As the rating of nuclear sclerosis grew, the incidence of complications rose. In cases where endothelial cell count loss of between 100-500 cells occurred, 44% of the eyes showed a loss of between 100-500 cells, and in those with counts loss >1500 cells, 8% of the eyes had a loss of this amount (4 eyes). Decrease in the number of endothelial cells was reported to be 18% (9 eyes). Half of the 60 people who participated in the study had a corrected visual acuity of 6/96/18.

Nuclear sclerosis (Grade 2) was the most commonly performed cataract surgery in phacoemulsification surgery, with an incidence of 52 percent (26 eyes). Rupture of the posterior capsule is found to be the most prevalent complication, occurring in 10% of cases. Eighty-three percent of those who developed nuclear sclerosis had a loss of <100 endothelial cells, while the remaining 17% had a loss of >1500 endothelial cells. 72% of the participants saw that the cell density before and after phaco was significantly different, as shown by a p-value of <0.018 (5 percent level).

Table No.2: Frequency of Preoperative Complications (n = 100)

Preoperative Complications	Number of Eyes	Percentage
P.C.R.	2i	4i
Premature entry	3i	6i
Difficulty in delivering nucleus	2i	4i
Vitreous disturbance	5i	10i
Increased irritation	3i	6i
Increased phaco time	3i	6i

DISCUSSION

In order to keep the cornea clear and dehydrated, the corneal endothelium is essential. When it comes to cataract surgery, some endothelial cell loss is unavoidable, although the amount depends on the surgical approach.¹³⁻¹⁵ For diagnostic reasons, two key characteristics in the functional assessment of cornea are the thickness of the central cornea and the density of corneal endothelial cells. To compensate for lost cells, corneal endothelial cells use cell enlargement and cell spread to increase their size. This causes an overall drop in endothelial cell density, which may affect the cells' ability to perform their activities.^{15,16}

There were 100 patients included in this study. One hundred and six of them were women, while the other forty-four were men. Between 30 and 70 years old was the average age of the patients that came to the clinic. A

total of 52.18 years of patient experience were gathered to calculate the mean age. Using a S/L examination of the nucleus colour, the clinical hardness of the lens was determined.

50 individuals who had manual SICS had a self-sealing and suture less superior scleral incision and a superotemporal defect. When phaco surgery was performed on 50 patients, only 17 of those individuals had a superotemporal incision.¹⁷

Phaco Surgery: This operation was performed on 50 people. In total, there were 40 people, with 20 of them being men and 30 of them being women. People in the study ranged in age from thirty to seventy years old. In general, people were between the ages of 52 and 53. Two of the nuclear graders had fully developed cataracts, ranging in age from grades I-III.

Cataracts of grade II were the most common, with 26 of the eyes examined having this condition (52 percent). In all cases, the incision was linear and CCC was performed.

PC rupture, which occurred in 10% of patients, was the most common intraoperative complication. We counted the endothelial cells in all of the eyes with noncontact specular microscopy, and the average number of cells was 30. Endothelial cell count is shown in Table 5 for your convenience.

Researchers believe the endothelial cell loss of 500-1000 or more was caused by problems such as PCR, longer phaco times, and more fluids in the AC (prolonged irrigation).¹⁰

Nearly half (46 percent) of patients who underwent phaco surgery had an endothelial loss of 100 cells or more.

Patients who underwent phaco surgery in the immediate post-operative period (4th POD) had 6/6-6/9 vision in 36 of 50 eyes (72%), and the 'p-value for BCVA was not statistically significant.

MSICS (Multi-State Information and Communications Systems (manual small incision cataract surgery) This operation was performed on 50 people. In total, there were 42 individuals, with 22 being men and 28 being women. The patients' ages ranged from 35 to 70 years in this clinic. Among the participants, 55.58 years of age was found to be common. This group's nuclear classification ranged from I to III, with 10 people having MC.

Grade III cataract was the most common, with incisions and capsulorhexis extending continuously in 20 of the eyes (40 percent).¹⁸

In all eyes, an average of 30 endothelial cells were counted using non-contact specular microscopy.

In 23 (46%) of the eyes that underwent manual SICS tunnel surgery, an endothelial cell loss of 100-500 was discovered.¹⁹

Nine eyes (8 percent) had a cell loss of more than 1500 after non-phaco cataract surgery, while this incidence was very low after phaco surgery and the 'p-value was

statistically significant at the 1 percent level (p-value 0.001). Patients with reduced vision of 6/24-6/60 had a 40% recovery rate of improved vision of 6/6 and 6/9 after a few weeks following surgery. When looked at on a 1% scale, the p-value for BCVA was significant.

CONCLUSION

This study indicated that the loss of endothelial cells was less with phaco surgery than with manual SICS. An endothelial cell loss associated with phaco surgery was discovered in this study to be most often the result of intraoperative difficulties, such as post capsular rupture with vitreous disturbance, higher irrigation in the anterior chamber, and longer total phaco duration in a few patients.²⁰ The cornea's optical property can be preserved by protecting the endothelium and using good technique during the entire procedure, from incision to IOL implantation. Using phaco surgery instead of manual SICS resulted in less damage to the endothelial cells and, as a result, a higher BCVA immediately after the surgery, allowing patients to see more clearly sooner.

Author's Contribution:

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