Study of Changes in Corneal Thickness and Corneal Endothelial Cell Density after Phacoemulsification Cataract Surgery

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ABSTRACT

BACKGROUND

Phacoemulsification is a common surgery for cataract. The endothelium comprises of hexagonal cells which in single layer is essential for maintaining the transparency of the cornea. We wanted to compare endothelial cell density (ECD), central corneal thickness (CCT), coefficient of variability, and hexagonality of endothelial cells before and after phacoemulsification surgery. we also wanted to evaluate the endothelial cell loss after phacoemulsification surgery.

METHODS

A rural hospital-based prospective observational study with 120 patients was conducted in a hospital based setting utilising the data of patient's eye by considering inclusion and exclusion criteria, before and after phacoemulsification surgery by using noncontact specular microscope.

RESULTS

The mean endothelial cell density significantly decreased postoperatively at day one, 4th week, 12th week. The mean central corneal thickness increased significantly at postoperative day one, then subsequently decreased at postoperative 4th week and 12th week (P value = 0.0001), but never reached the preoperative value. There was a significant change in coefficient of variation and hexagonality postoperatively (P value = 0.0001).

CONCLUSIONS

The primary result is the change in corneal endothelial cell density (cells per square millimetre of the corneal surface) which is decreased, and the central corneal thickness calculated in micro meter is increased. As endothelial cells do not replicate, to reimburse cell loss there are changes in coefficient of variation and hexagonality after phacoemulsification surgery.

KEY WORDS

Corneal Endothelial Cell Density, Central Corneal Thickness, Coefficient of Variation, Hexagonality, Phacoemulsification, Specular Microscope

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BACKGROUND

Visual impairment (VI) being a health problem is associated with augmented morbidity. In India approximately 62 million have visual impairment; in which 54 million persons are having low vision, and 8 million are blind.[1] The cause of both visual impairment and blindness is cataract, causing the blurring of normal lens which is transparent and crystalline in nature.[2]

On a large scale for eliminating avoidable blindness by the year 2020, World Health Organization (WHO) and the International Agency for the Prevention of Blindness (IAPB) in 1999 took a step towards VISION 2020 – The Right to Sight.[3] Patients having mild grade of cataracts are prescribed glasses though in long period, it is managed by surgery.[4]

The common surgery done for cataract is phacoemulsification surgery with the placement of a lens which is placed behind the iris.

The endothelium consists of a single layer of hexagonal cells which is vital for maintaining the transparency of the cornea. These cells do not replicate, and the loss is compensated by the migration, enlargement, and pleomorphism of the cells.[5]

The corneal dehydrated state is sustained by dynamic pumping action of Na+ / K+ - ATPase pump which drains excess fluid out of stroma through an active transport mechanism and barrier function. This guarantees its transparency.

There is a gradient across the corneal endothelium of bicarbonate ion. To maintain the pump activity, a minimal of 400 – 500 cells / mm^2 is necessary. Failure of functioning of pump causes corneal decompensation and diminution of vision.

Endothelium do not have the ability to regenerate which causes the endothelium to become gradually decrease in number of cells. After any intraocular surgery or any ocular disease, the cell loss becomes worsened.[6] During phacoemulsification surgery, ultrasonic energy is released which damages the cells and the cell junctions resulting in increased accumulation of fluid. Eventually loss of endothelial function can lead to corneal edema and decreased corneal transparency indicating pump function has been compromised.

The cells which are adjacent to them enlarge and migrate to maintain continuity or the cells, which is detected as increase in the coefficient of variation and reduction in the hexagonality of the endothelial cells.[7] Pirazzoli et al. found that in phacoemulsification 16.67 % endothelial cell loss occurs that was affected by various pre and intraoperative factors.[8]

Specular microscopy is a non-invasive technique that analyse the corneal layers under very high magnification. Modern specular microscope evaluate the size, shape and population of the endothelial cells.

There is a paucity of data from India on the effect of phacoemulsification on the corneal endothelium and central corneal thickness. Thus, the primary purpose of this study is to evaluate the postoperative changes in endothelial cell density and central corneal thickness (CCT) done by phacoemulsification technique.

METHODS

With due permission from scientific and ethical committee, patients with cataract presenting to the out-patient department of Acharya Vinobha Bhave Rural Hospital were selected for prospective observational study after taking the inclusion and exclusions criteria into consideration. Patients were counselled regarding the study and informed consents were obtained.

All data was collected by a single experienced ophthalmologist. The study period was of two years (September 2018 to September 2020).

The sample size was calculated using the following formula: Sample size formula with the desired error of margin-

$$n = \frac{Z^2_{\alpha/2} * P * (1 - P)}{d^2}$$

Where, zα / 2 – is the level of significance at 5 % i.e. 95 % confidence interval = 1.96

By assuming the non-response rate, the rate being 10 % i.e. 13, we evaluated 107 + 13 = minimum of 120 patients in the study. In this study, the sample size was of 120 patients.

Inclusion Criteria

- Patient's age: 45 - 80 years old.
- Senile cataract with nuclear sclerosis grade 2 according to Lens Opacities Classifaction System (LOCS) III classification.

Exclusion Criteria

- Patient not giving consent.
- H / o diabetes mellitus.
- H / o anti benign prostatic hyperplasia (BPH) medication.
- H / o trauma to the cornea.
- H / o uveitis.
- Complicated cataract.
- Traumatic cataract.
- Number of endothelial cells less than 2000 / mm^2.
- Ocular diseases like glaucoma, corneal dystrophy, other corneal diseases.
- Mature senile cataract / hyper mature senile cataract / grade 1, 3, 4 nuclear sclerosis.
- Patient with intraoperative complications during cataract surgery.
- Pseudo exfoliation syndrome.
- Patients with the non-dilating pupil.
- Patients with shallow anterior chamber.

A detailed history of the patient and general vital data was taken. A comprehensive ophthalmic examination was performed on all participants, including visual acuity checked with Snellen's visual acuity chart and pinhole improvement was noted.

Thorough anterior segment examination was performed using a slit lamp for an anterior segment like cornea, anterior chamber, iris, pupil, lens. Cataract was graded according to LOCS III grading classification. Preoperative specular

microscopy findings were noted. Patients underwent phacoemulsification technique.

Post-operative corneal thickness, endothelial cell density, endothelial cell loss, coefficient of variability, hexagonality was measured by noncontact specular microscope (Topcon SP - 3000P) microscope at a resolution of 640 x 480 pixels and compared with the preoperative findings on 3 occasions -

- A day after surgery.
- Towards the end of 4th week after surgery.
- At the end of 12th week after surgery.

Statistical Analysis

Statistical analysis was done by using descriptive and inferential statistics using Student's paired t test and software used in the analysis was SPSS 24.0 version and $P < 0.05$ is considered as the level of significance.

RESULTS

Parameters	No of Patients (120)	Percentage (100)	Mean ± SD
Age group (years)			61.64 ± 7.13 (45 - 77 years)
45 - 54 years	19	15.83	
55 - 64 years	46	38.33	
65 - 74 years	51	42.50	
≥ 75 years	4	3.33	
Gender			
Male	71	59.17	
Female	49	40.83	
Laterality			
Right eye	63	52.50	
Left eye	57	47.50	

Table 1. Age Distribution, Gender Distribution, Laterality Distribution of the Patients

Age

In the present study of 120 patients, the minimum age of patients was 45 years and the maximum age was 77 years. Maximum patients were seen in the age group of 65 - 74 years i.e. 51 patients. The mean age was 61.64 ± 7.13.

Gender

Out of the 120 patients in this study, 71 patients (59.17 %) were male and 49 patients (40.83 %) were female.

Laterality

Out of 120 patients, 63 patients (52.50 %) had a cataract in the right eye while 57 patients (47.50 %) had a cataract in the left eye.

Specular Microscopy	Mean	N	Std. Deviation	Std. Error Mean	Percentage
Preoperative	2771.16	120	62.43	5.69	-
Postoperative day 1	2552.56	120	73.28	6.69	7.89 %
4th Week	2456.90	120	70.58	6.44	11.34 %
12th Week	2416.66	120	70.74	6.45	12.79 %

Table 2. Comparison of Endothelial Cell Density (mm^2) at Postoperative Day 1, 4th Week and 12th Week with Baseline

According to this study, mean endothelial cell density preoperatively was 2771.16 ± 62.43, on 1st postoperative day it was reduced to 2552.56 ± 73.28, at end of 4th week was 2456.90 ± 70.58 and at end of 12th week was 2416.66 ± 70.74.

The P-value was 0.0001. By using Student paired t-test, endothelial cell density decreased significantly at day 1, 4th week and 12th week compared with baseline.

Specular Microscopy	Mean	N	Std. Deviation	Std. Error Mean	Percentage
Preop	521.20	120	13.67	1.24	-
Day 1	537.44	120	8.91	0.81	3.16 %
4th week	525.77	120	10.74	0.98	0.87 %
12th week	523.68	120	11.30	1.03	0.47 %

Table 3. Comparison of Central Corneal Thickness (µm) at Post-Operative Day 1, 4th Week and 12th Week with Baseline

In this study, mean central corneal thickness preoperatively was 521.20 ± 13.67, on 1st postoperative day was 537.44 ± 8.91, at end of 4th week was 525.77 ± 10.74 and at end of 12th week was 523.68 ± 11.30.

The P-value was 0.000. By using Student paired t-test, the central corneal thickness increased significantly at postoperative day 1 as compared to baseline, then decreased at end of 4th week and 12th week but never came up to baseline.

Specular Microscopy	Mean	N	Std. Deviation	Std. Error Mean	%
Preop	33.42	120	3.05	0.27	-
Day 1	36.80	120	3.12	0.28	3.38 %
4th week	35.32	120	3.12	0.28	1.90 %
12th week	34.51	120	3.10	0.28	1.09 %

Table 4. Comparison of the Coefficient of Variation (CV) (%) at Postoperative Day 1, 4th Week and 12th Week with Baseline

According to this study, the mean of the coefficient of variation (CV) preoperatively was 33.42 ± 3.05, on 1st postoperative day was 36.80 ± 3.12, at end of 4th week was 35.32 ± 3.12 and at end of 12th week was 34.51 ± 3.10. The P-value was 0.0001. By using Student paired t-test, there was a significant increase in the coefficient of variation at day 1 postoperatively as compared to baseline, then decrease at end of 4th week and 12th week but never came up to baseline.

Specular Microscopy	Mean	N	Std. Deviation	Std. Error Mean	Percentage
Preop	59.49	120	4.14	0.37	-
Day 1	55.84	120	4.17	0.38	3.65 %
4th week	57.13	120	4.16	0.38	2.36 %
12th week	57.95	120	4.14	0.37	1.54 %

Table 5. Comparison of Hexagonality (HEX) (%) at Postoperative Day 1, 4th Week and 12th Week with Baseline.

According to this study, the mean of hexagonality (HEX) preoperatively was 59.49 ± 4.14, on 1st postoperative day was 55.84 ± 4.17, at end of 4th week was 57.13 ± 4.16 and at end of 12th week was 57.95 ± 4.14. The P-value was 0.0001. By using Student paired t-test, there was a significant decrease in hexagonality at day 1 postoperatively compared to baseline, then slightly increased at 4th week and 12th week but never came up to baseline.

Specular Microscopy	Mean	N	Std. Deviation	Std. Error Mean	Percentage
Day 1	218.60	120	60.86	5.55	7.89 %
4th week	314.26	120	58.01	1.67	11.34 %
12th week	354.50	120	58.48	0.86	12.79 %

Table 6. Comparison of Endothelial Cell Loss (ECL) at Postoperative Day 1, 4th Week and 12th Week with Baseline.

In this study, the mean endothelial cell loss (ECL) on 1st postoperative day was 218.60 ± 60.86 from the preoperative value, at the end of 4th week postoperatively the cell loss was 314.26 ± 58.01 and at the end of 12th week postoperatively, the cell loss was 354.50 ± 58.48.

The mean at the end of 4th week from last follow up (postoperative day 1) was 95.66 ± 18.31 and the endothelial cell loss at the end of 12th week from last follow up (at the end of 4th week postoperative) was 40.23 ± 9.48. The P-value was 0.0001. By using the Student paired t-test, there was a significant endothelial cell loss from postoperative day 1 to postoperative 12th week.

DISCUSSION

Age

The mean age in this study was 61.64 ± 7.13. Maximum patients were seen in the age group of 65 - 74 years i.e. 51 patients (Table 1). This was similar to a study conducted by Bamdad et al. where the mean age was 62.1 ± 12.2.[9] Similarly, in a study conducted by Sahu et al. the mean age was 64 years.[10]

Gender

In our study, male preponderance (71 males) is seen over females (49 females) (Table 1). In a study conducted by Bamdad et al. on 85 patients, males were 42 and females were 43.[9]

Endothelial Cell Density

Preoperative

Preoperative mean endothelial cell density in our study was 2771.16 ± 62.43 (Table 2). In a study done by Bamdad et al. the mean preoperative endothelial cell density was 2791.15 ± 99.86.[9] The study conducted by Sahu et al. showed a mean preoperative endothelial cell density of 60 non-diabetic patients to be 2672.72 ± 259.84.[10] Wu et al. conducted a study where mean preoperative endothelial cell density was 2743.10 ± 58.03, which was similar to our study.[11] Similarly, the mean preoperative endothelial cell density calculated by Siddique et al. of 60 patients was 2745.35 ± 395.27. Wang et al. in his study of 60 non-diabetic patients found that the mean endothelial cell density calculated on a preoperative day was 2726.5 ± 157.3.[12] Maggon et al. found out the mean endothelial cell density preoperatively as 2584.88 ± 305.95.[13] Li in 2016, done a study of 190 non-diabetic patients and found mean preoperative endothelial cell density to be 2867.53 ± 277.51.[14] Indra Dandaliya et al. in their study concluded that the preoperative mean endothelial cell density was 2393.93 + 251.92.[15] As per the study of Simova et al. preoperative mean endothelial cell density was 2398 (1025 - 2965 cells / mm^2).[16]

Postoperative Day One

On postoperative day one, our mean endothelial cell density was reduced to 2552.56 ± 73.28, which was significant as the P-value was 0.0001 (Table 2). Siddique et al. found that the mean endothelial cell density at postoperative day one of 60 patients was 2585.07 ± 355.65. Similarly, Wu et al. in their study concluded that the mean endothelial cell density of non-diabetic patients on postoperative day one was reduced to 2680.3 ± 61.3 and was significant.[11] These were correlating to our study. However, Bamdad et al. found that mean endothelial cell density on postoperative day one was reduced to 2472.87 ± 472.14 and this result was significant.[9] This greater reduction of endothelial cells is probably due to higher surgery time and the inclusion of diabetic patients in their study.

At the End of Postoperative 4th Week

Endothelial cell density mean at the end of 4th week in our study was 2456.90 ± 70.58, which was found to be significant having a P-value of 0.0001 (Table 2). Wu et al. found that the mean endothelial cell density at the end of the 4th week was 2586.4 ± 91.2, was statistically significant.[11] Wang et al. calculated mean endothelial cell density at the end of 4th week around 2568.8 ± 83.9.[12] These findings were similar to our findings. However, Dandaliya et al. found mean endothelial cell density at 4th week around 2145.08 ± 279.76, which was dissimilar from our study probably because they considered grade 3 cataract also.[15]

At the End of Postoperative 12th Week

The mean endothelial cell density at the end of 12th week postoperatively in our study was 2416.66 ± 70.74, which was significant with a P-value of 0.0001 (Table 2). Wu et al. found that mean endothelial cell density at postoperative 12th week was 2569.3 ± 79.5.[11] Li, calculated mean cell density at 12th week postoperatively around 2463.17 ± 268.5.[14] These findings were similar to our studies.

Central Corneal Thickness

Preoperative

The preoperative mean in our study was 521.20 ± 13.67 (Table 3). According to a study conducted by Bamdad et al. on 85 patients, the mean preoperative central corneal thickness was 530.47 ± 2.60[9] and this was similar to our study. Budiman et al. calculated mean preoperative central corneal thickness as 511.9 ± 31.5.[17] According to Wang et al. the mean preoperative central corneal thickness of non- diabetics patients was 540 ± 16.97.[12] Maggon et al. found the mean preoperative central corneal thickness as 513.54 ± 19.77.[13] Hugod et al. in 2011, observed that mean preoperative central corneal thickness was 530 ± 31.8.[18] Morikubo et al. found that the mean preoperative central corneal thickness was 541.9 ± 33.3.[19] Zhao et al. calculated mean preoperative central corneal thickness as 542.62 ± 43.11.[20] These findings were also comparable to our findings.

Postoperative Day One

We calculated the mean central corneal thickness on postoperative day one as 537.44 ± 8.91. There was an increment of 3.16 % thickness as compared to the

preoperative value (Table 3) Various studies were conducted. These are as follows -

Sl. No.	Name	Mean Central Corneal Thickness on Postoperative Day One (Increase in Percentage as Compared to Preoperative Value)	Similar to Our Study	Dis-similar to Our Study
1.	Morikubo et al.	563.25 ± 33 (3.94 %)	-	-
2.	Maggon et al.	525.42 ± 20.09 (2.14 %)	-	-
3.	Dandaliya et al.	543.46 ± 47.64 (8.19 %)	-	-

Table 7. Mean Central Corneal Thickness on Postoperative Day One

Dandaliya et al.[15] study was different from our study possibly because they have considered cataract till nuclear sclerosis grade 3 of LOCS III classification, and more dense cataract needs more energy which causes more endothelial cell loss thus, resulting in more corneal edema postoperatively, hence, there is further increase in central corneal thickness.

At the End of 4th Week Postoperatively

We reported mean central corneal thickness as 525.77 ± 10.74. The central corneal thickness was increased by 0.87 % as compared to the preoperative value and was decreased as compared to postoperative day one value (Table 3). Various other studies had results similar to those our study. Maggon et al.[13] found that mean CCT on postoperative 4th week was 515.78 ± 19.9 (0.04 %) and similarly Morikubo et al.[19] found that mean CCT on postoperative 4th week was 542.1 ± 33, (0.04 %). These both were similar to our study.

At the End of Postoperative 12th Week

We calculated postoperative 12th week mean central corneal thickness as 523.68 ± 11.30, an increase of 0.47 % in thickness as compared to the preoperative value (Table 3). Hugod et al.[18] found the mean CCT on postoperative 12th week as 529 ± 34.3, an increment of 0.13 % and Wang et al.[12] found the mean CCT on postoperative 12th week as 547.7 ± 9.8, an increment of 0.87 %. These findings were similar to our study.

Coefficient of Variation

Preoperative

In our study, the mean coefficient of variation preoperatively was 33.42 ± 3.05 (Table 4). According to Sahu et al.[10] Budiman et al.[17] Li et al.[14] Dandaliya et al.[15] Morikubo et al.[19] Zhao et al.[20] mean coefficient of variation preoperatively was 34.55 ± 4.59, 37.1 ± 5.8, 36.42 ± 6.14, 36.17 ± 3.99, 30.6 ± 6.6, 34.23 ± 5.57 respectively. These studies were correlating with our studies.

Postoperative Day One

We calculated the mean coefficient of variation at postoperative day one as 36.80 ± 3.12, an increment of 3.38 % from the preoperative value (Table 4). According to Li et al. the mean coefficient of variation at postoperative day one of the non-diabetic patients was 38.94 ± 5.97, (increase of 2.52 %).[14] Similarly, Morikubo et al.[19] studies were found to be similar to our study. However Yang et al. studies and calculated the mean coefficient of variation at postoperative day one of the non-diabetic patients as 56.2 ± 6.67, which was about a 16 % increase from preoperative value.[21] This was dissimilar from our study. This is probably because they have considered age limit till 84 years.

At the End of Postoperative 4th Week

We calculated the mean coefficient of variation at the end of the postoperative 4th week as 35.32 ± 3.12, which is a 1.9 % increase from preoperative value (Table 4). According to Zhao et al. the mean coefficient of variation on the postoperative 4th week of non-diabetic patients was 37.62 ± 5.78, which was 3.39 % increase from preoperative value.[20] Similarly, Budiman et al. assessed changes in coefficient of variation on follow up of 4th week postoperatively and found that there was an increase in the coefficient of variation, 38.1 ± 7.5 (1 % increase).[17] These studies were comparable with our studies. But Yang et al. found an increment of 11.2 % from the preoperative value (51.4 ± 1.69), which deferred from our study.[21]

At the End of Postoperative 12th Week

We calculated the mean coefficient of variation at the end of postoperative 12th week and result was 34.51 ± 3.10, 1.09 % increase as compared to preoperative findings. (Table 4) According to Zhao et al.[20] the mean coefficient of variation at the end of the postoperative 12th week of non-diabetic patients was 36.73 ± 6.83 (2.56 % increase). This increase in percentage was somewhat similar to our study. There was a difference in results when our study at postoperative 12th week was compared to Yang et al.[21] In their study, they calculated the mean coefficient of variation at 12th week as 49 ± 2.78, which was 8.8 % increase from their preoperative value. This is probably because they have considered the age limit till 84 years.

Hexagonality

Preoperative

In our study, the mean preoperative hexagonality was 59.49 ± 4.14. (Table 5). According to Sahu et al. and Budiman et al. the mean preoperative hexagonality was 53.08 ± 7.07 and 52.1 ± 10.6 respectively.[10,17] A study conducted by Wu et al. the mean preoperative hexagonality was 58.41 ± 13.27.[11] Morikubo et al. calculated the mean preoperative hexagonality as 58.8 ± 10.4.[19] These two studies were found to be similar to our study. Zhao et al. Yang et al. calculated the mean preoperative hexagonality as 55.88 ± 7.37 and 55.30 ± 3.68 respectively.[20,21]

Postoperative Day One

We reported a decrease in mean hexagonality on postoperative day one and this was found to be 55.84 ± 4.17 which was roughly 3.65 % decrease (Table 5) Morikubo et al.[19] Wu et al.[11] also found that there was a decrease in mean hexagonality and their findings were 56.7 ± 10.4 (2.1 %) and 54.24 ± 13.28 (4.17 %) respectively, was comparable to our findings on postoperative day one. There was a difference in a study conducted by Yang et al. from our findings, as they reported a decrease in hexagonality by 7.3 %[21] and we reported a decrease of 3.65 %. This difference in decrease might be because they have considered age up to 84 years in non-diabetic patients.

At the End of Postoperative 4th Week

In our study, we calculated the mean hexagonality at the end of postoperative 4th week as 57.13 ± 4.16, that is around 2.36

% decrease from the preoperative value. (Table 5). Budiman et al.[17] Morikubo et al.[19] also reported mean hexagonality at the end of postoperative 4th week had decreased as compared to preoperative value [50.1 ± 14.5 (2 %) and 57.2 ± 10.4 (1.6 %) respectively]. Their findings were found to be similar to our findings though Yang et al. study was different from our study, 48.6 ± 8.58 (6.7 %).[21]

At the End of Postoperative 12th week

Our mean hexagonality at the end of postoperative 12th week was 57.95 ± 4.14, 1.54 % decrease in hexagonality from the preoperative value (Table 5). According to the study conducted by Sahu et al. Wu et al. the mean hexagonality calculated at 12th week after phacoemulsification surgery was 47.85 ± 6.79 (5.23 % decrease), 56.91 ± 15.28 (1.5 % decrease) than preoperative value respectively.[10,11] They were similar to our results.

Endothelial Cell Loss

Postoperative Day One

According to this study, the mean endothelial cell loss was 218.60 ± 60.86 cells (7.89 %) (Table 6). According to Siddique et al. the mean endothelial cell loss on postoperative day one was 160.28 ± 39.62, that is 5.84 %. This was similar to our study. Li et al. reported the mean endothelial cell loss as 53.89, that is 1.88 %.[22] This was different from our findings.

At the End of 4th Week after Cataract Surgery

We reported the mean endothelial cell loss at the end of postoperative 4th week as 314.26 ± 58.01 (11.34 %) (Table 6). According to Dandaliya et al. the mean loss of endothelial cells at postoperative 4th week was 248.85+156.63 (10.39 %).[15]

At the End of Postoperative 12th Week

We calculated the mean endothelial cell loss at the end of postoperative 12th week as 354 ± 58.48 (12.79 %) (Table 6) Dandaliya et al. calculated the mean endothelial cell loss at postoperative 12th week as 255.53 + 155.03 (10.67 %).[15] This was similar to our study.

CONCLUSIONS

Cataract extraction done by phacoemulsification surgery causes an alteration in endothelial cell density by reducing endothelial cell density postoperatively which was significant. The endothelial cell density is reduced after surgery and continues to get reduced until 3rd month postoperatively. However, the reduction of cells is greater in 1st postoperative day. Central corneal thickness increases significantly on postoperative day 1. This is followed by a gradual decrease of central corneal thickness but never returning to the preoperative value which was also significant.

Corneal endothelial cells don't have the capacity to multiply and form new endothelial cells. To cover up the cell loss due to surgical trauma, the endothelial cells shape their morphology in terms of shape and size. After phacoemulsification surgery, there is an increment in the coefficient of variation of cells which is maximum in the early postoperative period. Gradually there is a decrease in the coefficient of variation as compared to postoperative day 1, but the preoperative value is never reached. This change is statistically significant.

After phacoemulsification cataract surgery there is a decrease in the percentage of hexagonality of endothelial cells which occurs maximally in the 1st postoperative day. Then it gradually approaches the preoperative value but never reaches the baseline value. This change was statistically significant.

Data sharing statement provided by the authors is available with the full text of this article at jemds.com.
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