



CLINICAL EVALUATION OF EARLY CORNEAL CHANGES AFTER PHACOEMULSIFICATION

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ABSTRACT

A prospective observational study was carried out at GCS Medical College, Hospital and Research Centre on 100 patients undergoing uneventful cataract surgery with IOL of either eye via phacoemulsification and were on regular follow-ups carried out by single surgeon to prevent inter observer variation.

Pre-op and post-op central BCVA using Snellen's chart, central corneal thickness using ultrasound pachymetry and corneal endothelial cell density (ECD), percentage hexagonality (%HEX) and coefficient of variation (CV) using non-contact specular microscope on 1 day, 1 week, 1 month, 3 months and 6 months after surgery. Results were analyzed using SPSS.

CCT showed highest value on first postoperative day and progressively decreased attaining almost near preoperative value by the 6th month post op with higher values in diabetics than non-diabetics. Endothelial cell density by specular microscopy decreased significantly at end of 1st postoperative week, after which it increased gradually but significant deficit in was noted at the end of 6 months. The minimum value of %hexagonality was attained at the end of 1st postoperative month and increased to completely attain preoperative levels at the end of 6th month with higher variation in diabetics. The CV attained maximum peak at 1st postoperative day and it gradually decreased till 6 months after which preoperative values were attained with higher values in diabetics. The endothelial damage is higher in diabetics than non-diabetics due to various biochemical mechanisms and these patients are more susceptible to develop low visual acuity. Thus, advances in surgical technique, the implementation of newer surgical technologies such as torsional ultrasound, femtosecond assisted cataract surgery, dispersive viscoelastic devices & control of systemic illnesses like diabetes may prevent endothelial cell loss after cataract surgery.

KEYWORDS : Cornea, Phacoemulsification, CCT, ECD

INTRODUCTION

Phacoemulsification with intraocular lens implantation (IOL) has become the predominant cataract treatment and is preferred over ECCE and SICS because of faster recovery, shorter procedure and fewer complications.^[1,2] It is associated with loss of corneal endothelial cells.^[3] In childhood, the endothelium consists of ~4000 cells/mm², which is reduced to 2500 cells/mm² by eighth decade.^[4] Phacoemulsification can lead to significant loss of endothelial cells and increase in corneal thickness, resulting in prolonged corneal edema^[5-7].

Corneal endothelial cells are arranged in a single layer and have a regular structure maintaining transparency. They do not regenerate and in severe cases, edema and opacity can occur leading to vision loss.^[8] It can also be affected by IOL implantation^[8-10] and skills of the surgeon.^[11] These factors coupled with DM indicate a great risk of keratocyst pitheliopathy^[12,13] and development of bullous keratopathy.^[14] Accelerated losses of have been reported even 10 years after surgery.^[15]

All surgical procedures that involve entry into anterior chamber damage endothelial cells. The adjacent cells enlarge and slide over to maintain continuity, that changes endothelial cell density (ECD). Central corneal thickness (CCT) is an indicator of physiological condition of cornea. Endothelial morphological changes can alter the cornea's ability to function.

Corneal abnormalities, are commonly found in patients after cataract surgery due to diabetic state and procedure itself.^[16] Hence this study is aimed to evaluate the early effect of phacoemulsification on the state of corneal endothelium.

MATERIALS AND METHODS

A prospective observational study was carried out on 100 patients undergoing uneventful cataract surgery via Phacoemulsification and were on regular follow-ups.

Pre-op CCT was measured using ultrasound pachymetry and specular microscopy. Corneal endothelial cell density (ECD), percentage hexagonality (%HEX) and coefficient of variation (CV) was measured using non-contact specular microscope.

Corneal curvature was measured by Bausch and Lomb keratometer & biometry was calculated by A-scan machine, which included KH, KV, ACD, AL for IOL power calculation.

Post-op day parameters were calculated and followed up 1 day, 1 week,

1 month, 3 months and 6 months after surgery. The collected data was edited and coded in MS-Excel and analyzed using IBM SPSS version 26.

RESULTS

A total of 100 patients were included in our study out of which 45% males and the age distribution was 84% patients above 50 years of age.

Out of them 45% patients had unilateral cataract while 48% patients were getting their right eye operated at time of study. 18% patients had only Diabetes Mellitus, 13% had only Hypertension while 15% had both. 51% had no systemic illnesses and 3% had other disorders. So, in our study 33% had diabetes as compared to 67% who didn't.

The mean preoperative KH was 44.37±1.73D, KV was 43.91±1.92D and axial Length was 23.09±1.02mm while anterior chamber depth was 3.01±0.31mm. The mean IOL power was +21.00D.

Table 1: mean corneal parameters seen at all the visits

CORNEAL PARAMETERS	PREOP	1 DAY	1 WEEK	1 MONTH	3 MONTHS	6 MONTHS
CCT(Ascan)						
Mean±SD	508±31.9	534.8±35.02	513.7±31.4	511.9±33.4	511.49±32.9	512.9±35.93
Min	408	463	457	455	447	419
Max	599	615	591	606	584	586
CCT(specular)						
Mean±SD	486±58.9	521.9±45.1	495.3±40.5	489.2±37.7	495.9±38.43	493.06±3.33
Min	50	425	408	418	421	429
Max	594	4997	585	592	575	576
ECD						
Mean±SD	2722.7 ± 199.55	2668.63 ± 241.31	2636.36 ± 187.69	2664 ± 163.54	2679.96 ± 197.92	2662.96 ± 195.04
Min	2132	1193	1698	2262	2278	2188
Max	3145	3247	3040	3077	3205	3058
%HEX						
Mean±SD	47.98 ± 5.7	45.85 ± 7.4	45.63 ± 6.7	44.80 ± 7.0	46.48 ± 6.3	48.10 ± 6.0
Min	7	8	9	4	7	4
Max	36	24	31	30	34	35
Max	66	64	62	64	63	65
CV						

Mean±SD	30.17±3.7	33.79±12	33.35±12	32.13±5.5	30.73±3.8	29.59±3.5
SD	1	68	36	2	5	5
Min	24	22	23	24	22	23
Max	43	110	124	54	43	38

CCT measured by ultrasonic pachymetry as well as by specular microscopy showed highest value on 1st post-op day and progressively decreases; attaining pre-op value by 6th month. The difference was statistically significant at 1st day and 1st week while at other days was not.

The mean CCT values at each visit were higher in diabetics than non-diabetics and though the peak CCT is achieved at 1st post op day.

The ECD decreased significantly at all visits and minimum value was attained at end of 1st postoperative week. After that, the cell density began increasing gradually.

The difference in the % of hexagonal cells before and after surgery was statistically significant on all follow up visits except at the end of 6th month. The minimum value was attained at the end of 1st month after which the % increased to attain preoperative levels at 6th month.

The variation in mean % hexagonality values are seen more in diabetics (statistically significant at 1st post op day and end of 1st post op month; pre op values are achieved in both samples (better in non diabetics).

CV increased after surgery to attain maximum peak at 1st postoperative day and gradually decreased till 6 months. CV values are found higher in diabetics which has a higher peak but the pre op values are almost attained in both groups and is statistically significant at the end of 6th month.

The mean postoperative KH obtained was 44.16±1.46, KV was 43.95±1.74 while the anterior chamber depth was 3.72±2.02. The difference were not statistically significant.

72% patients attained 6/6 vision at the end of 1st postoperative period which was statistically significant.

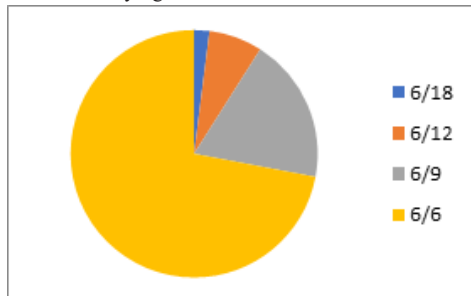


Figure 1: Post Operative Best Corrected Visual Acuity In All Patients

The proportion of patients achieving 6/6 vision is more in non-diabetics (76%) as compared to diabetics (66%).

DISCUSSION

Phacoemulsification aims for preservation of eye anatomy. Cornea contributes to two thirds of the refractive power of eye and its regular arrangement is of utmost importance to preserve transparency.

There was no statistical significant difference amongst the ECD between males and females which is comparable with George et al.^[17] and Maggon et al.^[18]. Also, there was no difference with age, either eye, diabetics with duration <5 years versus those with >5 years. It was similar to study by Syed Abdullah Mazhar et al.^[19]

Corneal endothelium is more vulnerable in diabetic patients with delayed repair after surgery and greater EC loss. He X et al.^[22] showed that degree of diabetic control, based on HbA1c >7, did not yield a significant difference in percentage of EC loss. Most of our patients had a good glycemic control and were admitted only after fitness.

There was no statistical significant association between EC loss and phacoemulsification parameters which is similar to T Walkow et al.^[25] However Maadane A et al.,^[26] reported a significant correlation between the energy used and count.

Jong-Soo Lee et al.^[27] reported significant decrease in ECD and CV significantly increased for high-risk PDR patients. This is not correlating with our study however we had very less patients with retinopathy.

CCT showed highest value on 1st day and progressively decreased. Difference was statistically significant at 1st day and 1st week while at other days it was not which is coinciding with Yizhen Tang et al.^[29]. While Hossam T Al-Sharkawy et al.(2015)^[28] found out that it was significant in diabetics only. Shahram Bamdad et al.^[30] and Dr. Fereshteh Kargar Bafrani et al.^[31] found out increased CCT at 3-months. However, Hugod M, et al.^[20] showed that there was no significant change in CCT.

The difference in ECD at 1st day, 1st week and 3rd month is significant in diabetics as seen by Hugod M, et al.^[20], Khan A, et al.^[21], He X et al.^[22], Pramod Kumar Sahu et al.^[24], Yizhen Tanget al.^[29], Shahram Bamdad et al.^[30] and RuiMing Yanget al.^[32] while it is significant in non-diabetics at 1st week, 1st month, 3rd month and 6th month.

Our findings in change of CV after surgery are similar to that of Hossam T Al-Sharkawy et al.^[28] and Pramod Kumar Sahu et al.^[24] The postoperative KH and KV values in our study were comparable with study by Hugod M, et al. (2011)^[20].

CONCLUSION

We have seen that endothelium does undergo cell loss after phacoemulsification while the damage is higher in diabetics than non-diabetics due to various biochemical mechanisms. For prevention, pre-operative screening of cornea is very important. Also, ample viscoelastic should also be used as a part of routine procedure.

Pre-operative control of systemic illness is also essential as it a predisposing factor for endothelial decompensation and corneal edema; apart from other complications. Use of oral and iv hyperosmotic agents can also be done to shrink vitreous volume so that the iris lens diaphragm falls back and provides intracameral space for manipulation.

Thus, advances in surgical technique, the implementation of newer surgical technologies such as torsional ultrasound, femtosecond assisted cataract surgery, better dispersive viscoelastic devices and control of systemic illnesses like diabetes may prevent endothelial cell loss after cataract surgery.

LIMITATIONS

- The sample size was small as many patients whose initial few visits data was collected dropped out and hence were not included.
- Long term follow up (more than 6 months) was not done.

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