



INCREASED ENDOTHELIAL CELL SUSCEPTIBILITY TO DAMAGE IN OLDER INDIVIDUALS POST PHACOEMULSIFICATION.

Ophthalmology

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ABSTRACT

Purpose: To evaluate the effect of phacoemulsification energy on endothelial cells in different age groups **Methods:** The study is a comparative observational study that enrolled 390 individuals and observed the effect of phacoemulsification on endothelial cells on different age groups when the parameters causing endothelial damage were comparable. The follow up for the patients was on day 1, month 1 and month 3. **Results:** The study enrolled 390 patients, with a mean age of 61.78 ± 10.92 years. Post phacoemulsification surgery the percentage endothelial cell loss was 9.6 %, 9.66%, 9.74% and 11.3% from baseline, hexagonality decreased by 18.15%, 18.25%, 18.79% and 19.27% and coefficient of variation increased by 11%, 11.01%, 11.54% and 11.99% (at 3months) in 40 to 49, 50 to 59, 60 to 69 and 70 to 79 years age group respectively (when the mean cataract grades and phacoemulsification energy was comparable for every group). This trend of greater endothelial cell loss in older patients was also seen when the anterior chamber depth and phacoemulsification was made comparable. **Conclusion:** The study throws light on the increased susceptibility of endothelial cells to damage in older individuals in a manner not researched before and needs to be researched further to find the possible cause. **Summary:** The study throws light on the increased susceptibility of endothelial cells in older individuals to damage causing stimulus and concludes that there is greater endothelial cell loss in older age group/ lower endothelial cell group for the same amount of damaging energy as compared to younger age group.

KEYWORDS

endothelial cell loss, phacoemulsification, cataract surgery, hexagonality, coefficient of variation, anterior chamber depth.

INTRODUCTION

Endothelial cell loss post cataract surgery is a well know and an extensively documented phenomenon.^[1] The research work on this topic has mainly focused on various intraoperative parameters and techniques that cause endothelial loss. But the effect of age on endothelial loss post cataract surgery has not been focused upon. And our study focuses on this topic and tries to understand and evaluate logically the outcome.

MATERIAL AND METHODS

The study was a single center, comparative, prospective and observational study which included 390 patients undergoing phacoemulsification cataract surgery. The study was done under the tenets of declaration of Helsinki.

The study was carried out on patients having senile cataract. The patients after enrollment were evaluated for cataract surgery. The endothelial cell count (ECC), hexagonality, coefficient of variation and anterior chamber depths (ACD) for each patient were also recorded. Patients having previous ocular surgery, recent ocular infection, glaucoma, intraoperative complications (such as posterior capsular rupture, nucleus drop) and those who were not able to come for follow up were excluded from the study.

All the patients were operated by a single surgeon. During surgery the phacoemulsification energy used was recorded. Post-surgery the patients were followed up on day 1, month 1, and month 3. On all follow ups the following parameters were noted for the study: endothelial cell count, coefficient of variation and hexagonality.

RESULTS

The study enrolled a total of 390 patients. They had a mean age of 61.78 ± 10.92 years. The patients were divided into four age groups (table 1).

Table 1: Age Wise Distribution Of Patients And Parameters Recorded (m: Mean Values)

Age group Interval	Total patients	Grade of cataract (M)	Endothelial cell Count (M)	Hexagonality (M)	Coefficient of variation (M)	Total energy (M)
40 to 49	96	1.49	3027.75	64.09	30.97	247.36
50 to 59	100	1.75	2889.83	62.45	33.96	244.85

60 to 69	94	1.54	2688.11	59.74	35.65	249.25
70 to 79	100	1.68	2396.56	57.25	38.27	241.99

It was seen that when the means of the cataract grades and the total phacoemulsification energy were similar for all four groups (table 1): There was an endothelial cell loss of 9.6 %, 9.66%, 9.74% and 11.3% from baseline (at 3 months) in 40 to 49, 50 to 59, 60 to 69 and 70 to 79 years age group respectively (table 2, figure 1).

Table 2: Endothelial Cell Loss Percentage From Baseline

Age group interval	day 1	month 1	month 3
40 to 49	8.28	9.41	9.6
50 to 59	8.31	9.49	9.66
60 to 69	8.4	9.54	9.74
70 to 79	10	11.11	11.3

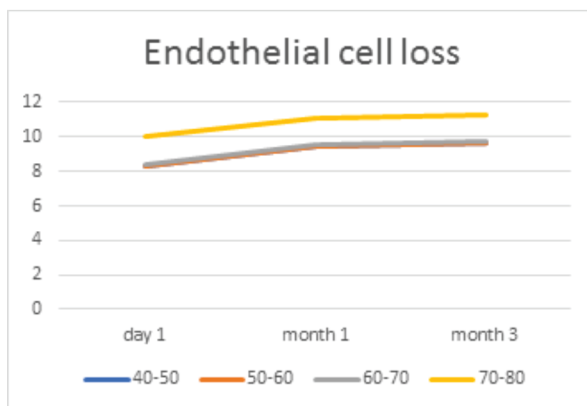


Figure 1: Percentage Endothelial Cell Loss Postoperatively

The hexagonality decreased by 18.15%, 18.25%, 18.79% and 19.27% from baseline (at 3 months) in 40 to 49, 50 to 59, 60 to 69 and 70 to 79 years age group respectively (table 3, figure 2).

Table 3: Percentage Decrease In Hexagonality Form Baseline

Age group interval	day 1	month 1	month 3
40 to 49	7.09	16.45	18.15

50 to 59	7.36	16.57	18.25
60 to 69	7.82	17.11	18.79
70 to 79	8.79	17.59	19.27

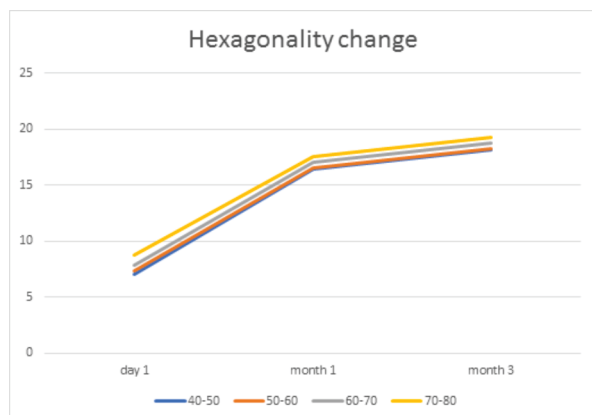


Figure 2: Percentage Hexagonality Decrease Post-operatively

And the coefficient of variation increased by 11%, 11.01%, 11.54% and 11.99% from baseline (at 3 months) in 40 to 49, 50 to 59, 60 to 69 and 70 to 79 years age group respectively (table 4, figure 3).

Table 4: Percentage Increase In Coefficient Of Variation Form Baseline

Age group interval	day 1	month 1	month 3
40 to 49	8.11	10.68	11
50 to 59	8.21	10.94	11.01
60 to 69	8.47	11.12	11.54
70 to 79	9.84	11.55	11.99

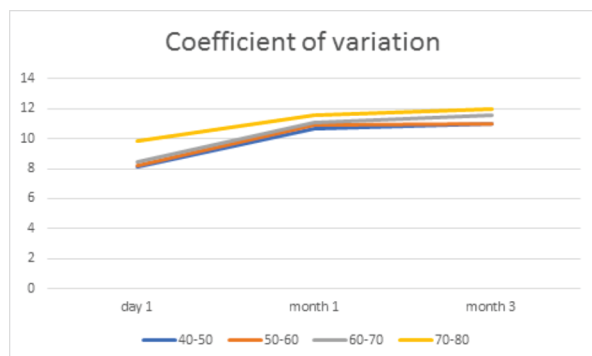


Figure 3: Percentage Increase In Coefficient Of Variation

When the anterior chamber depth and the phacoemulsification energy were kept comparable then:

The percentage cell loss in ACD between 1.5 to 2.5 mm was 12.62% vs 13.74%, in ACD between 2.5 to 3.5 was 9.52% vs 9.77% and in ACD between 3.5 to 4.5 was 7.25% vs 7.81% for 40-49 years group and 70-79 years age group respectively (Table 5).

Table 5: Percentage Cell Loss In Different Age Groups When Acd And Phacoemulsification Energy Are Comparable. (acd: Anterior Chamber Depth, Ecc: Endothelial Cell Count)

Age group	pre op ECC	ECC at 3 months	Percentage loss
Group A: ACD (between 1.5 to 2.5 mm)			
40-49	3065.43	2678.57	12.62
70-79	2378.21	2051.44	13.74
Group B: ACD (between 2.5 to 3.5 mm)			
40-49	2859.96	2587.69	9.52
70-79	2499.73	2255.5	9.77
Group C: ACD (between 3.5 to 4.5 mm)			
40-49	2891.93	2682.26	7.25
70-79	2398.65	2211.31	7.81

DISCUSSION

Our study factored in the major causes that influenced endothelial cell loss. Where normally in studies that are available, analysis has been

done for endothelial loss when parameters such as grades of cataracts and phacoemulsification are variable. But in our study, we took it a step further. We answered what happens to endothelial cell count when for surgery is done in similar grades of cataract and similar phacoemulsification energy in different groups? Something which no other study has answered (according to the knowledge of the author).

The results in are study are interesting. As in our study we divided the patients into different age groups. And for each age group the means of grades of cataract and the total phacoemulsification energy were similar to the other group.

Firstly, at the end of our study we noted findings as observed in other studies that is, we in our study observed that the mean pre-operative endothelial count and hexagonality decreased and the coefficient of variation increased as the age increased (Table 1).^[2]

Then, in our study post-operatively we noted something interesting. There was endothelial cell loss post-operatively in all the age groups but as the age of the patients increased the percentage of endothelial cell loss also increased (This was observed when the mean of cataract grades and phacoemulsification energy were comparable in all age groups). This finding points to the fact that older age group or the lower endothelial cell group were more susceptible to damage even though the energy causing the damage in all groups was similar. The cause of the finding could not be ascertained whether the greater endothelial loss was due to age related factors or the lower endothelial cell count in older age group that in some way may have affected endothelial cell health or a combination of both. As after much research there was no study which reported such a finding (as far as the knowledge of the author is concerned).

Then came the argument where some studies have observed that as the age increases the ACD decreases and hence the greater endothelial cell loss.^[3] Now to check if ACD was a confounding factor that was the only reason causing endothelial cell loss we in our study selected two ends of the age spectrum (40-49 and 70-79 years). Then we compared these two groups at different ACD intervals (evaluating from shallower to deeper ACD, table 5). What we observed was that when the ACD and the phacoemulsification power were comparable endothelial cell loss still showed a similar trend as observed before. The endothelial cell loss was more percentage wise in the older group than the younger age group (however small the percentage be). It also needs to be noted that when evaluating for this we choose a subset of patients that had similar ACD and similar phacoemulsification energy which naturally led to a decrease in sample size for the same and hence can justify the smaller difference between the two groups (the difference in percentage may be greater if the sample size would have been greater). But what was certain was a visible percentage difference in our study.

To make our case stronger we would like to highlight the fact that endothelial cells in older individuals respond much slowly and to a lesser extent to growth factors which has been observed in other studies.^[4,5] This makes us believe that in older individuals the endothelial cells are less responsive to reparative factors/protective factors that causes more endothelial cell loss in older patients compared to younger individuals when a damaging stimulus is presented to either groups. But as concrete evidence is lacking further studies are needed for evaluating the same.

The drawbacks of the study were that the study could have incorporated a larger sample size and it didn't evaluate results in patients above the age of 79 years.

CONCLUSION

The study throws light on the increased susceptibility of endothelial cells in older individuals to damage causing stimulus and concludes that there is greater endothelial cell loss in older age group/ lower endothelial cell group for the same amount of damaging energy as compared to younger age group.

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Conflict Of Interest: None

Financial Disclosures: None

REFERENCES

1. Walkow T, Anders N, Klebe S. Endothelial cell loss after phacoemulsification: relation to preoperative and intraoperative parameters. J Cataract Refract Surg. 2000 May;26(5):727-32.

2. Islam QU, Saeed MK, Mehboob MA. Age related changes in corneal morphological characteristics of healthy Pakistani eyes. *Saudi J Ophthalmol.* 2017 Apr-Jun;31(2):86-90.
3. Hwang HB, Lyu B, Yim HB, Lee NY. Endothelial Cell Loss after Phacoemulsification according to Different Anterior Chamber Depths. *J Ophthalmol.* 2015;2015:210716.
4. Tadashi Senoo, Nancy C. Joyce; Cell Cycle Kinetics in Corneal Endothelium from Old and Young Donors. *Invest. Ophthalmol. Vis. Sci.* 2000;41(3):660-667.
5. Cheng Zhu, Nancy C. Joyce; Proliferative Response of Corneal Endothelial Cells from Young and Older Donors. *Invest. Ophthalmol. Vis. Sci.* 2004;45(6):1743-1751.