

ORIGINAL ARTICLE

Changes in Tear Film and Ocular Surface after Phacoemulsification for Senile CataractADILA ANWAR¹, M. MUMTAZ CHAUDHRY², SAMRA AHMED³, QURAT UL AIN MALIK⁴, MISBAH NAEEM⁵, AMNA MANGRIO⁶¹Medical officer at Federal Government Poly Clinic Hospital Islamabad.²Head of Ophthalmology Department, F.G. Polyclinic (PGMI), Islamabad.³Medical Officer at Polyclinic Hospital Islamabad.⁴Medical officer at Polyclinic Hospital Islamabad.⁵KRL Hospital Islamabad.⁶Medical Officer at Polyclinic Hospital, Islamabad.Correspondence to: Dr. Adila Anwar, Email ID: adila.anwar@yahoo.com, Cell: 0331 5660803**ABSTRACT****Objective:** To determine the changes in “ocular surface” and “tear film” of patients who underwent phacoemulsification for senile cataract at Federal Government Polyclinic Hospital, Islamabad.**Methodology:** This study was conducted from 1-10-2022 to 31-12-2022. 66patients with senile cataract were selected for this study. After taking consent baseline features including age, gender, duration of cataract, was recorded were documented on the proforma. Preoperative and post-operative OSDI, TBUT, TMH and CFS at 1 and 4 weeks to assess changes in “ocular surface” and “tear film” were recorded. Data was analyzed by SPSS 21.**Results:** A total of 66eyes of 66 patients were made part of the study having a mean age of 65.32 ± 4.45 years. 77.3% of study participants were male while 22.7% were females. OSDI, TBUT, TMH and CFS were significantly effected (p-values of 0.000, 0.003, 0.000 and 0.000, respectively). No statistically significant difference was found in these parameters between male and female patients ($p > 0.05$). Overall frequency of patients who had OSDI ≥ 33 , TBUT ≤ 10 seconds and TMH ≤ 0.3 mm was 22% each while CFS was present in 19.7% of the patients.**Conclusion:** Phacoemulsification of senile cataract significantly effects the tear film and ocular surface, however, the change is a transient one.**Key Words:** Phacoemulsification, TBUT, Senile Cataract, CFS, OSDI.**INTRODUCTION**

Cataract, also called as opacification of the lens materials, is frequently treatable and nearly never incurable. It is widely acknowledged that this condition is the main cause of blindness^{1, 2}, and it is still a major issue for ophthalmological public health in both developing and industrialized nations^{3, 4}. Cataracts are the amongst frequent eye diseases, affecting 17.2% of the global population. There are several varieties of cataracts, the most frequent of which are “cortical”, “nuclear” and “posterior sub-capsular” cataracts⁵. Cataracts can be categorized by their density using a number of different systems, the most well-known of which is the “Lens Opacities Classification System III (LOCS III) system”^{6, 7}. Other such method that are available to classify cataracts include “Simple Pre-Operative Nuclear Classification Score (SPONCS)”⁸ and “Lens Opacities Classification System II (LOCS II) system”⁹.

Lens proteins found in lens fibers are frequently denatured and coagulated by various degenerative processes, leading to transparency loss and, eventually, cataract formation¹⁰. For this reason advancing age (especially age more than 70 years) is the most common cause of cataract, and is called “senile cataract”¹¹. As the healthcare facilities are becoming readily available to the general population and continuous advancement is happening in medical field, old age population is increasing for which burden of senile cataract is also increasing¹². Experienced surgeons can play a pivotal role in treating cataract which is the commonest cause of preventable blindness¹³. The only option to treat a cataract, regardless of its type or density, is to have the damaged lens surgically removed. For this treatment, the phacoemulsification approach is thought to be the most effective. This not only aids in the removal of opacified lens matter, but it also significantly improves the quality of life of those affected by the condition and leads to better visual outcomes^{14, 15}.

Like any surgical procedure, phacoemulsification surgery for extraction of senile cataract also carries a risk of developing complications. One such complication is changes in “ocular surface” and the “tear film” that can lead to development of dry eyes which has been reported as a potential complication of this surgery in older adults¹⁶. This study is, therefore, aimed to study the changes that can occur in the “ocular surface” and the “tear

film” after phacoemulsification surgery for the extraction of senile cataract.

MATERIAL AND METHODS

This study was conducted at ophthalmology unit of “Federal Government Polyclinic Hospital, Islamabad” from 1/10/2022 to 31/12/2023, having study design of “descriptive cross sectional study”, after obtaining approval from the ethical review board (ERB) of the aforementioned institution. Sample size of 66was calculated using WHO sample size calculator by assuming confidence level of 95%, absolute precision 10%, and anticipated population proportion 22%¹⁷ using following formula:

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

Patients who fulfilled all the criterion of having an age between 55-75 years, either male or female gender with “senile cataract” were made part of the study. Patients were selected using “non-probability consecutive sampling technique”. Patients who had history of chemical trauma/burn, who had cicatrizing ocular surface and those with previous history of dry eye disease were all excluded from the study. After that, patients received predesigned consent forms, which they had to sign and verbally assent to in order to participate in the study. Before this procedure, patients were informed of the study's objectives, procedures, and prospective benefits. All study participants' baseline demographic information, such as age, gender, duration of cataract, was recorded. To assess the changes in “ocular surface” and “tear film” following parameters were used in all the study participants.

1. “Ocular Surface Disease Index (OSDI)”: It is a twelve question index (Figure 1) that has a score ranging from 0 to 100. OSDI score was ≥ 33 was considered significant.

OCULAR SURFACE DISEASE INDEX (OSDI)

Q. No.	QUESTION	4 All the time	3 Most of the time	2 Half of the time	1 Some of the time	0 Never
1	Eyes that are sensitive to light?					
2	Eyes that feel gritty?					
3	Painful or sore eyes?					
4	Blurred vision?					
5	Poor vision?					
6	Reading?					
7	Driving at night?					
8	Working with a computer or bank machines (ATM)?					
9	Watching TV?					
10	Windy conditions?					
11	Places or areas with low humidity (very dry)?					
12	Areas that are air conditioned?					

Total Score: ____/100

Figure 1: "Ocular Surface Disease Index (OSDI)"

2. "Tear film breakup time (TBUT)": A fluorescein strip was applied to the bulbar conjunctiva's lower region for this test, and it was moistened with "hydroxypropymethylcellulose." The patient was then told to sit for an eye examination under a slit lamp while blinking normally for a few seconds. The time between the appearance of the "first dark spot" and the last blink was recorded, and it was used for visualization and analysis. TBUT of 10 seconds or less was considered significant.

3. "Tear Meniscus Height (TMH)": The central TMH of the lower lid was examined with a reticule at an 8x magnification on the slit-lamp. The average of three consecutive measurements was recorded. TMH of 0.3mm or less was considered significant.

4. "Corneal Fluorescein Staining (CFS)": In this test, a fluorescein strip was put to the lower portion of the bulbar conjunctiva and wetted with a drop of "hydroxypropymethylcellulose," after which the patient was requested to sit in front of a slit lamp for evaluation of the eyes while blinking regularly many times. A "cobalt blue filter" was employed to see the "superficial punctate staining of the cornea". Presence of CFS was considered significant.

All these parameters were assessed and documented pre-operatively, at 1 week and at 4 weeks post-operatively. SPSS 26 was used to analyze the data. The mean with standard deviation and the median were used to depict quantitative data (IQR). Percentage and frequency were used to express qualitative data. The Chi square test (for qualitative variables) and the unpaired t-test (for quantitative variables) were used, with $p \leq 0.05$ being significant.

RESULTS

We enrolled a total sum of 66 patients in our study, 77.3% (51) of which were males while 22.7% (15) were females. Mean age of the study participants was 65.32 ± 4.45 years and median age was 66 years. Mean duration of cataract was 12.62 ± 12.00 months. Pre-operative parameters used for assessing "ocular surface" and "tear film" to define "dry eye disease" are demonstrated below in the following table 1:

Table 1: Pre-operative Parameters

Sr. No.	Characteristics	Value
1	OSDI	7.62 ± 1.31
2	TBUT	14.22 ± 3.08 seconds
3	TMH	0.36 ± 0.29 mm
4	CFS	0%

All these parameters were also assessed at week 1 and 4 and their values are tabulated below in table 2:

Table 2: Post-operative Parameters

Parameter	Week 1	Week 4
OSDI	27.11 ± 17.66	24.41 ± 14.78
TBUT (seconds)	11.76 ± 4.01	12.32 ± 4.01
TMH (mm)	0.33 ± 0.05	0.33 ± 0.04
CFS present (%)	36.4%	19.7%

Comparison of pre-operative and post-operative parameters at the end of study period was analyzed by using paired t-test and chi-square test and the results are tabulated below in table 3:

Table 3: Comparison of Pre- vs Post-operative Values of Parameters

Parameter	Pre-op	Week 1 post-op	Week 4 post-op	p-value
OSDI	7.62 ± 1.31	27.11 ± 17.66	24.41 ± 14.78	0.000
TBUT (seconds)	14.22 ± 3.08	11.76 ± 4.01	12.32 ± 4.01	0.003
TMH (mm)	0.36 ± 0.29	0.33 ± 0.05	0.33 ± 0.04	0.000
CFS present (%)	0%	36.4%	19.7%	0.000

Comparison of these parameters by gender is tabulated below in table 4:

Table 4: Comparison of Pre- vs Post-operative Values of Parameters by Gender

Parameter	Male	Female	p-value
OSDI			
- Pre-op	7.71 ± 1.39	7.33 ± 0.98	0.337
- Week 1 post-op	27.29 ± 17.64	26.46 ± 18.33	0.875
- Week 4 post-op	25.21 ± 14.90	21.66 ± 14.51	0.418
TBUT			
- Pre-op	14.33 ± 3.15	13.87 ± 2.89	0.610
- Week 1 post-op	11.49 ± 4.15	12.67 ± 3.39	0.321
- Week 4 post-op	12.06 ± 3.91	13.20 ± 4.36	0.336
TMH			
- Pre-op	0.36 ± 0.03	0.36 ± 0.02	0.543
- Week 1 post-op	0.32 ± 0.06	0.33 ± 0.05	0.509
- Week 4 post-op	0.32 ± 0.04	0.33 ± 0.03	0.451
CFS			
- Pre-op	0%	0%	1
- Week 1 post-op	35.29%	40%	0.739
- Week 4 post-op	21.56%	13.33%	0.481

At the end of 4 weeks follow up we found that overall frequency of patients who had $OSDI \geq 33$, $TBUT \leq 10$ seconds and $TMH \leq 0.3$ mm was 22% each while CFS was present in 19.7% of the patients.

DISCUSSION

Cataract surgery by phacoemulsification is one of the commonest surgical procedure that is performed in the field of ophthalmology. It has been found associated with many complications including corneal edema¹⁸, increased intraocular pressure that may lead to glaucoma¹⁹, incomplete recovery of visual acuity¹⁹, intraocular lens drop²⁰ and dry eye disease²¹. "Dry eye disease" occurs secondary to changes in the "ocular surface" and the "tear film" that are induced by the cataract surgery by phacoemulsification. We conducted this study to quantify these changes and to determine whether there is a significant effect on the parameters that are used to measure this effect. We used OSDI, TBUT, TMH and CFS as parameters of measuring the changes in "ocular surface" and "tear film". We found that after phacoemulsification surgery for senile cataract, all the parameters of dry eye disease were significantly effected [p-values of 0.000, 0.003, 0.000 and 0.000, respectively]. We also found that based on the tests overall frequency of dry eyes ranged from 19.7% - 22%. There was no statistically significant difference between the genders in terms of any of these parameters.

These findings were consistent with the results of a study conducted by Rahim *et al.*²¹ in which it was reported that overall frequency of "dry eye disease" was 29.2%. Similar results were observed in a study conducted by Hamad *et al.*¹⁶ who reported that

“dry eye disease” after cataract surgery occurred in 22% of the patients with significant fall in TBUT post-operatively ($p < 0.001$). Findings of Ragab *et al.*²² were also consistent with our results. In another study conducted by Kohli *et al.*¹⁷ similar findings were reported with significant changes observed in OSDI, TBUT, TMH and CFS after phacoemulsification of senile cataract.

CONCLUSION

Following phacoemulsification for senile cataracts, there is a worsening of the parameters associated with 'dry eye disease.' Patients need to be carefully counselled about the evanescent nature of the disease in order to prevent patients from dropping out of follow-up care and to achieve better visual outcomes.

Limitations: Our study had the limitations of only including patients from one institution, having a short follow-up period and a small sample size.

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Conflict of Interest: We declare that there was no conflict of interest.

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