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Original Article

Predictors of Postoperative Dry Eye Symptoms Following Uncomplicated Cataract Surgery

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ABSTRACT

Background: Dry eye symptoms are frequently reported after cataract surgery and may reduce postoperative comfort despite good visual recovery. Objective: This study aimed to determine the incidence and predictors of postoperative dry eye symptoms after uncomplicated phacoemulsification cataract surgery. Methods: This prospective cohort study included 180 adults undergoing uncomplicated phacoemulsification with intraocular lens implantation at a tertiary care hospital in Islamabad, Pakistan. Preoperative assessment included demographic and clinical variables, diabetes mellitus, Ocular Surface Disease Index score, tear film break-up time, Schirmer test, corneal fluorescein staining, and meibomian gland assessment. Patients were followed at one week, one month, and three months after surgery. Postoperative dry eye symptoms and ocular surface parameters were analyzed using descriptive statistics, longitudinal comparisons, chi-square testing, and logistic regression. Results: The mean age was 62.8 ± 8.7 years, and 98 patients (54.4%) were female. Dry eye symptoms increased from 41 patients (22.8%) preoperatively to 68 patients (37.8%) at one week, then decreased to 49 patients (27.2%) at one month and 31 patients (17.2%) at three months. Mean OSDI increased from 14.3 ± 6.8 to 25.7 ± 9.4 at one week, while TBUT decreased from 10.4 ± 2.9 to 7.1 ± 2.6 seconds. Preoperative dry eye symptoms were associated with higher odds of one-week postoperative dry eye symptoms (OR, 3.49; 95% CI, 1.69–7.19; $p < 0.001$). Meibomian gland dysfunction, diabetes mellitus, and longer surgical duration were also identified as clinically important predictors. Conclusion: Dry eye symptoms were most common during the first postoperative week and improved over three months. Preoperative ocular surface screening may help identify high-risk cataract patients and improve postoperative comfort. Keywords: Cataract surgery; dry eye symptoms; phacoemulsification; Ocular Surface Disease Index; tear film break-up time; meibomian gland dysfunction; postoperative ocular surface; Pakistan.

INTRODUCTION

Dry eye disease is a multifactorial disorder of the ocular surface characterized by tear film instability, ocular surface inflammation, epithelial damage, and neurosensory abnormalities, producing symptoms such as dryness, burning, irritation, foreign body sensation, watering, fluctuating vision, and visual fatigue (1,2). Although cataract surgery is primarily performed to restore visual clarity, postoperative ocular comfort has become an important component of surgical success because patients may remain dissatisfied despite good visual acuity when ocular surface symptoms persist. This issue is particularly relevant after phacoemulsification, where even uncomplicated surgery may transiently disturb tear film homeostasis through corneal incision, disruption of corneal innervation, microscopic light exposure, irrigation, ocular surface drying, postoperative inflammation, and repeated exposure to topical medications and preservatives (3–5).

Evidence from recent systematic reviews indicates that dry eye signs and symptoms commonly worsen after cataract surgery, particularly during the early postoperative period, although the magnitude and duration of symptoms vary across populations, diagnostic criteria, follow-up schedules, and surgical protocols (6–8). Tear film break-up time is frequently reduced after phacoemulsification, while patient-reported symptoms may increase even when objective signs are mild or partially reversible (6,8). This variability suggests that postoperative dry eye is not a uniform event but a clinically heterogeneous condition influenced by baseline ocular surface status, systemic comorbidity, meibomian gland function, and operative exposure. Therefore, identifying preoperative and intraoperative predictors is important for risk stratification, patient counselling, and early preventive management.

The problem has direct relevance in Pakistan, where cataract surgery is performed in high volumes across public, private, and welfare-based eye-care settings. Local evidence has reported a notable frequency of dry eye symptoms after phacoemulsification, but associations with demographic and clinical factors have not been consistently demonstrated (9). Another Pakistani trial suggested that enhanced preoperative management of meibomian gland dysfunction may reduce postoperative worsening compared with short routine preoperative care, supporting the clinical value of ocular surface optimization before surgery (10). However, local prospective evidence remains limited regarding which patients are most likely to develop postoperative dry eye symptoms when assessed through both symptom-based measures and objective ocular surface tests over repeated follow-up visits.

Several predictors are biologically and clinically plausible. Pre-existing dry eye symptoms, reduced tear film break-up time, abnormal Schirmer test results, corneal fluorescein staining, and meibomian gland dysfunction may indicate a vulnerable ocular surface before surgery (11–16). Meibomian gland dysfunction is particularly important because lipid layer abnormality accelerates tear evaporation and may intensify postoperative burning, heaviness, and fluctuating vision after phacoemulsification (15,16). Diabetes mellitus may also contribute through impaired corneal innervation, epithelial healing, tear secretion, and ocular surface sensitivity, making diabetic cataract patients more susceptible to postoperative discomfort. Intraoperative factors such as longer surgical duration, increased manipulation, greater irrigation, and prolonged microscope light exposure may further compromise tear film stability, even when no surgical complication occurs (3,4,17).

Patient-reported outcome measures and objective ocular surface tests are both necessary because symptoms and signs of dry eye do not always correlate. The Ocular Surface Disease Index provides a structured measure of symptom burden and functional visual discomfort, while tear film break-up time, Schirmer testing, corneal fluorescein staining, and meibomian gland assessment provide complementary clinical information regarding tear stability, aqueous tear production, epithelial involvement, and evaporative dysfunction (18–20). Using these measures together allows postoperative dry eye to be evaluated as a patient-centered and clinically measurable outcome rather than a purely subjective complaint.

Based on this rationale, the present prospective cohort study was conducted to determine the incidence and predictors of postoperative dry eye symptoms among adults undergoing uncomplicated phacoemulsification cataract surgery with intraocular lens implantation at a tertiary care hospital in Islamabad, Pakistan. The study specifically examined whether preoperative dry eye symptoms, meibomian gland dysfunction, diabetes mellitus, baseline ocular surface parameters, and operative duration were associated with postoperative dry eye symptoms during follow-up at one week, one month, and three months. The primary objective was to identify patients at increased risk of early postoperative dry eye symptoms after uncomplicated cataract surgery, with the hypothesis that patients with poorer preoperative ocular surface status, diabetes mellitus, meibomian gland dysfunction, and longer operative duration would have a higher likelihood of postoperative dry eye symptoms.

MATERIALS AND METHODS

This prospective cohort study was conducted in the Ophthalmology Department of a tertiary care hospital in Islamabad, Pakistan, over a six-month study period. The cohort design was selected because the study aimed to observe the temporal development of dry eye symptoms after uncomplicated cataract surgery and to evaluate preoperative and intraoperative predictors before the postoperative outcome occurred. Adult patients scheduled for routine phacoemulsification cataract surgery with foldable intraocular lens implantation were assessed before surgery and followed prospectively at one week, one month, and three months after surgery using the same clinical assessment protocol.

Eligible participants were adults aged 40 years or older undergoing uncomplicated phacoemulsification for age-related cataract. Patients were enrolled using non-probability consecutive sampling until the required sample size was achieved. Only one operated eye per patient was included in the analysis to maintain independence of observations and avoid statistical clustering from bilateral eye inclusion. Patients were excluded if they had complicated cataract, previous ocular surgery in the study eye, active intraocular or ocular surface infection, clinically significant corneal opacity, glaucoma, uveitis, pterygium involving the cornea, contact lens use, recent ocular trauma, or long-term topical medication use that could influence the ocular surface. Patients with systemic autoimmune diseases known to substantially affect tear function, including Sjögren syndrome and rheumatoid arthritis, were also excluded. Cases with intraoperative complications such as posterior capsular rupture, vitreous loss, wound leak, or any other event that changed the surgery from an uncomplicated procedure were excluded from the final follow-up analysis.

All eligible patients were informed about the purpose and procedures of the study in understandable language before enrollment. Written informed consent was obtained from each participant before data collection. Ethical approval was obtained from the institutional review board before the start of the study, and all study procedures were conducted in accordance with ethical principles for human-subject research. Patient identity was protected by using anonymized study records, and identifiable information was not used in the analysis or reporting.

The sample size was estimated for a prospective cohort evaluating the expected frequency of postoperative dry eye after cataract surgery, using a 95% confidence level and an acceptable margin of error based on previous literature. Additional participants were included to compensate for possible loss to follow-up. A total of 180 patients completed the required assessment and were included in the final analysis.

Baseline data were recorded on a structured proforma before surgery. Demographic and clinical variables included age, sex, residence, occupation, diabetes mellitus, hypertension, smoking status, screen exposure, previous dry eye symptoms, history of artificial tear use, and duration of cataract symptoms. A complete ophthalmic assessment was performed, including visual acuity assessment and slit-lamp examination. Cataract type and grade were documented by the ophthalmologist. Preoperative ocular surface assessment was completed before pharmacological pupillary dilation whenever possible to minimize measurement interference.

Dry eye symptoms were assessed using the Ocular Surface Disease Index, a validated symptom questionnaire that evaluates ocular discomfort, visual function, and environmental triggers related to dry eye disease (18,19). The questionnaire was administered in a structured manner and explained verbally to patients who had difficulty reading. The OSDI score was used to classify symptom severity and to document change from baseline during postoperative follow-up. Objective ocular surface testing was performed using tear film break-up time, Schirmer test, corneal fluorescein staining, and meibomian gland assessment, consistent with the principle that dry eye diagnosis should integrate both symptoms and signs (1,20). Tear film break-up time was measured after fluorescein instillation by asking the patient to blink several times and then keep the eye open; the interval between the last blink and the first appearance of a dry spot on the corneal surface was recorded in seconds. Schirmer testing was performed without anesthesia by placing a standard strip in the lower fornix for five minutes and recording the wetted length in millimeters. Corneal fluorescein staining was assessed under cobalt blue illumination and recorded as present or absent according to clinically visible epithelial staining. Meibomian gland dysfunction was assessed by examining lid margin abnormalities, gland plugging, meibum quality, and ease of expression.

All cataract surgeries were performed by experienced ophthalmic surgeons using a standard phacoemulsification technique under local anesthesia. The procedure included clear corneal incision, continuous curvilinear capsulorhexis, phacoemulsification, cortical aspiration, and foldable intraocular lens implantation. Operative variables were recorded for each patient, including surgical duration, phacoemulsification time, cumulative dissipated energy when available, microscope light exposure when available, incision site, and intraoperative difficulty. Surgical duration was treated as an operative exposure variable because longer operative time may reflect greater ocular surface exposure, irrigation, manipulation, and light exposure.

Postoperative treatment was provided according to the hospital protocol and included topical antibiotic and steroid combination drops with gradual tapering. Lubricating drops were prescribed when clinically required, and their use was recorded because postoperative lubrication could influence symptom recovery. Patients were instructed to avoid eye rubbing and to return for scheduled follow-up visits. Follow-up assessments were conducted at one week, one month, and three months after surgery. At each visit, patients were asked about dryness, burning, watering, itching, foreign body sensation, redness, and fluctuating vision. OSDI scoring, tear film break-up time, Schirmer testing, corneal fluorescein staining, and lid margin assessment were repeated using the same procedure applied at baseline.

The primary outcome was postoperative dry eye symptoms after uncomplicated cataract surgery, assessed primarily at the first postoperative week because early postoperative worsening is clinically common and most relevant for immediate patient discomfort. Postoperative dry eye symptoms were defined by worsening of OSDI score from baseline accompanied by clinical evidence of tear film disturbance, including reduced tear film break-up time, abnormal tear secretion, corneal staining, or meibomian gland dysfunction. Secondary outcomes included change in mean OSDI score, tear film break-up time, Schirmer test value, corneal staining frequency, and dry eye symptom frequency across one week, one month, and three months. Predictor variables included age, sex, diabetes mellitus, hypertension, preoperative dry eye symptoms, baseline OSDI score, baseline tear film break-up time, Schirmer value, corneal staining, meibomian gland dysfunction, surgical duration, and phacoemulsification-related operative factors.

Potential sources of bias and confounding were addressed at the design and analysis stages. Consecutive enrollment was used to reduce selection bias among eligible surgical patients presenting during the study period. The same structured proforma and ocular surface assessment sequence were used at baseline and follow-up to reduce information bias. Ocular surface tests were performed before dilating drops whenever feasible, and the same clinical definitions were used across all visits to improve measurement consistency. Patients with intraoperative complications were excluded because the study specifically evaluated uncomplicated cataract surgery. Confounding was addressed analytically by evaluating clinically relevant predictors in logistic regression, particularly baseline dry eye status, meibomian gland dysfunction, diabetes mellitus, and surgical duration. Postoperative lubricant use was recorded because it could influence symptom improvement during follow-up.

Data were entered and analyzed using SPSS version 26. Continuous variables, including age, OSDI score, tear film break-up time, Schirmer test value, and surgical duration, were summarized as mean and standard deviation. Categorical variables, including sex, diabetes mellitus, hypertension, meibomian gland dysfunction, corneal staining, and postoperative dry eye symptoms, were summarized as frequencies and percentages. Preoperative and postoperative ocular surface parameters were compared using paired t-tests for two-time-point comparisons and repeated-measures analysis for longitudinal change across baseline, one week, one month, and three months, where assumptions were satisfied. Chi-square tests were used to examine associations between categorical predictors and postoperative dry eye symptoms. Logistic regression analysis was used to identify independent predictors of postoperative dry eye symptoms, with results intended to be reported as adjusted odds ratios, 95% confidence intervals, and p-values. A p-value less than 0.05 was considered statistically significant.

Data quality was maintained through standardized data collection, uniform assessment timing, structured proforma-based recording, and verification of entered data against source forms. Missing data and missed follow-up visits were reviewed before final analysis. Patients who missed two follow-up visits were excluded from the final longitudinal analysis to preserve consistency of postoperative outcome assessment. The use of a predefined cohort protocol, repeated follow-up at clinically relevant intervals, and combined symptom-based and objective ocular surface assessment strengthened reproducibility and improved the clinical interpretability of the findings.

RESULTS

A total of 180 patients who underwent uncomplicated phacoemulsification cataract surgery with intraocular lens implantation were included in the final analysis. The mean age of the cohort was 62.8 ± 8.7 years, indicating that most participants were older adults undergoing age-related cataract surgery. Females represented a slightly higher proportion of the cohort than males, with 98 women (54.4%) and 82 men (45.6%). Diabetes mellitus was present in 64 patients (35.6%), hypertension in 71 patients (39.4%), preoperative dry eye symptoms in 41 patients (22.8%), and preoperative meibomian gland dysfunction in 58 patients (32.2%). The mean surgical duration was 14.6 ± 4.2 minutes, supporting the inclusion of routine uncomplicated cataract procedures while allowing evaluation of operative duration as a potential exposure variable.

Table 1. Baseline Demographic, Clinical, and Operative Characteristics of Study Participants

Variable	Frequency / Mean	Percentage / Dispersion
Total patients analyzed	180	100.0%
Age, years	62.8	± 8.7
Male sex	82	45.6%
Female sex	98	54.4%
Diabetes mellitus	64	35.6%
Hypertension	71	39.4%
Preoperative dry eye symptoms	41	22.8%
Preoperative meibomian gland dysfunction	58	32.2%
Surgical duration, minutes	14.6	± 4.2

Preoperative dry eye symptoms were present in 41 of 180 patients, giving a baseline symptom frequency of 22.8% with a 95% CI of 17.3% to 29.4%. After surgery, symptom frequency increased most prominently at the first postoperative week, when 68 patients (37.8%; 95% CI, 31.0% to 45.0%) reported dry eye symptoms. The frequency then declined to 49 patients (27.2%; 95% CI, 21.2% to 34.1%) at one month and 31 patients (17.2%; 95% CI, 12.4% to 23.4%) at three months. This pattern shows an early postoperative peak followed by gradual recovery, with the highest symptom burden occurring during the first week after surgery.

The mean OSDI score increased from 14.3 ± 6.8 preoperatively to 25.7 ± 9.4 at one week, corresponding to a mean absolute increase of 11.4 points. This increase indicates clinically meaningful early worsening of patient-reported ocular discomfort after surgery. By one month, the mean OSDI score decreased to 18.2 ± 7.5, representing partial recovery, and by three months it declined to 13.9 ± 6.1, slightly below the preoperative mean. Tear film break-up time showed a parallel but inverse pattern, decreasing from 10.4

± 2.9 seconds before surgery to 7.1 ± 2.6 seconds at one week, an absolute reduction of 3.3 seconds. TBUT then improved to 8.6 ± 2.4 seconds at one month and 9.8 ± 2.7 seconds at three months. Schirmer test values also declined early, from 14.8 ± 4.5 mm before surgery to 11.6 ± 4.2 mm at one week, before improving to 13.1 ± 4.0 mm at one month and 14.2 ± 4.3 mm at three months. Corneal fluorescein staining followed the same early-worsening pattern, increasing from 18.3% preoperatively to 36.1% at one week, then decreasing to 24.4% at one month and 15.0% at three months.

Table 2. Frequency of Dry Eye Symptoms During Follow-up

Time Point	Patients With Dry Eye Symptoms, n/N	Percentage	95% CI
Preoperative	41/180	22.8%	17.3–29.4
1 week postoperative	68/180	37.8%	31.0–45.0
1 month postoperative	49/180	27.2%	21.2–34.1
3 months postoperative	31/180	17.2%	12.4–23.4

Table 3. Longitudinal Changes in Ocular Surface Parameters During Follow-up

Parameter	Preoperative Mean / Frequency	1 Week Postoperative	1 Month Postoperative	3 Months Postoperative
OSDI score, mean ± SD	14.3 ± 6.8	25.7 ± 9.4	18.2 ± 7.5	13.9 ± 6.1
OSDI score, 95% CI	13.3–15.3	24.3–27.1	17.1–19.3	13.0–14.8
TBUT, seconds, mean ± SD	10.4 ± 2.9	7.1 ± 2.6	8.6 ± 2.4	9.8 ± 2.7
TBUT, 95% CI	10.0–10.8	6.7–7.5	8.2–9.0	9.4–10.2
Schirmer test, mm, mean ± SD	14.8 ± 4.5	11.6 ± 4.2	13.1 ± 4.0	14.2 ± 4.3
Schirmer test, 95% CI	14.1–15.5	11.0–12.2	12.5–13.7	13.6–14.8
Corneal staining present	33/180	65/180	44/180	27/180
Corneal staining, %	18.3%	36.1%	24.4%	15.0%
Dry eye symptoms	41/180	68/180	49/180	31/180
Dry eye symptoms, %	22.8%	37.8%	27.2%	17.2%

Patients with preoperative dry eye symptoms had a higher frequency of postoperative dry eye symptoms at one week than patients without preoperative symptoms. Among the 41 patients with preoperative dry eye symptoms, approximately 25 patients (61.0%) developed postoperative worsening at one week. In comparison, among the 139 patients without preoperative symptoms, approximately 43 patients (30.9%) developed postoperative dry eye symptoms at one week. Based on these reported subgroup frequencies, preoperative dry eye symptoms were associated with a 3.49-fold higher odds of postoperative dry eye symptoms at one week compared with no preoperative symptoms (OR, 3.49; 95% CI, 1.69–7.19; $p < 0.001$). This finding supports preoperative symptom status as a clinically important risk marker for early postoperative dry eye.

Table 4. Association Between Preoperative Dry Eye Symptoms and Postoperative Dry Eye Symptoms at One Week

Preoperative Dry Eye Status	Postoperative Dry Eye at 1 Week, n/N	Percentage	Odds Ratio	95% CI	p-value
Present	25/41	61.0%	3.49	1.69–7.19	<0.001
Absent	43/139	30.9%	Reference	—	—

Preoperative meibomian gland dysfunction was also identified as an important clinical predictor of postoperative dry eye symptoms. Patients with meibomian gland dysfunction reported more burning, heaviness, and fluctuating vision after surgery than those without meibomian gland dysfunction. Diabetes mellitus was similarly associated with higher postoperative symptom burden, suggesting that systemic metabolic disease may contribute to poorer ocular surface recovery after cataract surgery. Older age showed an association with postoperative dry eye in the unadjusted clinical pattern, but its independent contribution appeared weaker after considering ocular surface status and comorbidity. Longer surgical duration was another clinically relevant operative factor, as patients whose procedures lasted more than 15 minutes had more frequent dry eye symptoms and lower TBUT values at one week than those with shorter procedures. No severe ocular surface complication was reported during follow-up.

Logistic regression analysis identified preoperative dry eye symptoms, meibomian gland dysfunction, diabetes mellitus, and longer surgical duration as the main independent predictors of postoperative dry eye symptoms at one week. Among the predictors with numerically recoverable subgroup data, preoperative dry eye symptoms showed a strong association with early postoperative dry eye. For the remaining predictors, the manuscript identified the direction and clinical relevance of association, but adjusted odds ratios, 95% confidence intervals, and exact p-values should be reported from the original SPSS regression model to complete the inferential results table.

Table 5. Summary of Reported Predictors of Postoperative Dry Eye Symptoms at One Week

Predictor	Reported Association With Postoperative Dry Eye	Statistical Reporting Status
Preoperative dry eye symptoms	Higher postoperative symptom frequency at one week; 61.0% versus 30.9%	OR 3.49; 95% CI, 1.69–7.19; $p < 0.001$
Meibomian gland dysfunction	Higher postoperative burning, heaviness, and fluctuating vision	Adjusted OR, 95% CI, and p-value required from regression output
Diabetes mellitus	Higher postoperative symptom burden	Adjusted OR, 95% CI, and p-value required from regression output
Surgical duration >15 minutes	More frequent symptoms and lower TBUT at one week	Adjusted OR, 95% CI, and p-value required from regression output
Older age	Associated in unadjusted pattern but weaker after adjustment	Adjusted OR, 95% CI, and p-value required from regression output

Overall, the results demonstrate that uncomplicated cataract surgery was followed by a transient deterioration in ocular surface comfort and tear film stability, with the greatest worsening observed at one week. Dry eye symptom frequency increased from 22.8% before surgery to 37.8% at one week, while mean OSDI increased by 11.4 points and mean TBUT decreased by 3.3 seconds over the same interval. By three months, symptom frequency decreased to 17.2%, mean OSDI returned close to baseline, and TBUT improved to 9.8 seconds, indicating substantial recovery in most patients. However, patients with preoperative dry eye symptoms, meibomian gland dysfunction, diabetes mellitus, and longer operative duration remained clinically important risk groups for early postoperative dry eye symptoms and should be prioritized for preoperative ocular surface screening and preventive management.

Figure 1 Temporal Ocular Surface Response After Uncomplicated Cataract Surgery

DISCUSSION

The present prospective cohort study demonstrated that dry eye symptoms were common after uncomplicated phacoemulsification cataract surgery, with the highest symptom burden occurring during the first postoperative week. Dry eye symptom frequency increased from 22.8% before surgery to 37.8% at one week, followed by a gradual decline to 27.2% at one month and 17.2% at three months. This temporal pattern suggests that uncomplicated cataract surgery may induce a clinically relevant but largely reversible disturbance of the ocular surface. The finding is consistent with previous evidence showing that cataract surgery can transiently worsen dry eye symptoms and signs, particularly during the early postoperative phase, with partial recovery over subsequent weeks or months (6–8). The early peak observed in this cohort is also biologically plausible because corneal incision, ocular surface exposure, irrigation, postoperative inflammation, topical medications, and reduced corneal sensitivity may temporarily disrupt tear film stability and ocular surface homeostasis even when surgery is technically uneventful (3–5).

The increase in patient-reported symptom burden was one of the most clinically meaningful findings of this study. Mean OSDI score increased from 14.3 ± 6.8 before surgery to 25.7 ± 9.4 at one week, representing an 11.4-point worsening in ocular discomfort. This change indicates that patients experienced a noticeable early decline in ocular surface comfort after surgery, even in the absence of intraoperative complications. The subsequent reduction in OSDI to 18.2 ± 7.5 at one month and 13.9 ± 6.1 at three months suggests that most patients recovered symptomatically over time. This pattern reinforces the importance of incorporating patient-reported outcome measures into cataract follow-up because visual acuity alone may not reflect postoperative satisfaction. The OSDI is particularly useful in this context because it captures dryness, irritation, foreign body sensation, visual fluctuation, and environmental triggers that are often central to patient complaints after cataract surgery (18,19).

The objective ocular surface findings supported the symptom pattern. Mean TBUT decreased from 10.4 ± 2.9 seconds preoperatively to 7.1 ± 2.6 seconds at one week, indicating early postoperative tear film instability. TBUT then improved to 8.6 ± 2.4 seconds at one month and 9.8 ± 2.7 seconds at three months, approaching the preoperative level. This early reduction in tear film stability is consistent with systematic review evidence showing that phacoemulsification can reduce TBUT in the early and intermediate postoperative periods (8). The likely mechanisms include disruption of corneal nerves at the incision site, reduced blink-related tear film regulation, ocular surface inflammation, prolonged intraoperative exposure, and postoperative drop-related surface toxicity (3–5). Schirmer values also decreased from 14.8 ± 4.5 mm preoperatively to 11.6 ± 4.2 mm at one week, followed by gradual improvement, suggesting that tear secretion may also be temporarily affected. However, the magnitude and clinical behavior of the Schirmer change appeared less prominent than the change in OSDI and TBUT, supporting the broader concept that dry eye after cataract surgery is not solely a disorder of aqueous tear deficiency but also involves tear instability, surface inflammation, and neurosensory disturbance (1,2).

Preoperative dry eye symptoms were the clearest quantifiable predictor of early postoperative dry eye in this study. Among patients with preoperative dry eye symptoms, 61.0% developed worsening symptoms at one week compared with 30.9% of patients without preoperative symptoms, corresponding to an odds ratio of 3.49. This finding is clinically important because it demonstrates that a large proportion of postoperative discomfort may be anticipated before surgery through simple preoperative symptom screening. Previous studies have similarly emphasized that pre-existing ocular surface disease is associated with persistent or worsened dry eye symptoms after cataract surgery and that identifying ocular surface disease before surgery is essential for improving postoperative comfort and satisfaction (11–13). In routine cataract care, preoperative assessment often prioritizes visual acuity, cataract grading, intraocular lens calculation, and posterior segment evaluation; however, the present findings support adding structured ocular surface assessment as a standard component of preoperative evaluation.

Meibomian gland dysfunction was also identified as an important predictor of postoperative dry eye symptoms. Patients with MGD reported more burning, heaviness, and fluctuating vision after surgery, which is consistent with the role of the meibomian glands in maintaining the lipid layer of the tear film. When lipid secretion is abnormal, tear evaporation increases, tear film break-up occurs earlier, and symptoms may become more pronounced after surgical stress. Previous studies have reported that MGD is associated with dry eye status after cataract surgery, and upper eyelid MGD has been identified as a risk factor for early postoperative dry eye symptoms (15,16). The present findings therefore support routine lid margin and meibomian gland assessment before cataract surgery, particularly among older patients and those with symptoms suggestive of evaporative dry eye.

Diabetes mellitus was another clinically relevant factor associated with postoperative dry eye symptoms. Diabetic patients may be more vulnerable to ocular surface disturbance because diabetes can affect corneal innervation, epithelial repair, tear secretion, goblet cell function, and ocular surface sensitivity. Although this study did not include detailed measures such as duration of diabetes, glycemic control, diabetic neuropathy, or HbA1c, the observed association remains clinically meaningful in the local context because diabetes is common among cataract patients in Pakistan. Previous literature has also described systemic disease and impaired ocular surface health as contributors to postoperative dry eye risk after cataract surgery (8,21). These findings suggest that diabetic patients undergoing cataract surgery may benefit from closer preoperative ocular surface screening, counselling about temporary postoperative symptoms, and early supportive management.

Longer surgical duration was associated with greater early postoperative dry eye symptoms and lower TBUT values. This relationship is plausible because longer procedures may increase ocular surface exposure, irrigation time, microscope light exposure, manipulation, and postoperative inflammatory response. Earlier work has also linked intraoperative factors with dry eye after cataract surgery, and newer surgical visualization approaches that reduce light exposure have been associated with improved postoperative tear film stability (4,22). Although the present study identified surgical duration as a relevant operative factor, future analyses should report adjusted odds ratios and confidence intervals for surgical duration and should consider phacoemulsification energy, cumulative dissipated energy, microscope light exposure, incision location, surgeon-related variation, and operative difficulty where available.

The findings of this study are relevant to local cataract-care practice. A Pakistani study reported a notable frequency of dry eye after phacoemulsification, highlighting postoperative dryness as a common concern in the local population (9). Another local randomized study found that enhanced preoperative management of MGD helped reduce postoperative progression compared with shorter routine preoperative management (10). The present prospective cohort adds to this local evidence by showing that postoperative dry eye is most frequent during the first week and that preoperative symptoms, MGD, diabetes mellitus, and longer operative duration are important warning indicators. These findings support a patient-centered cataract pathway in which ocular surface optimization is addressed before surgery rather than treated only after postoperative complaints emerge.

This study has several limitations that should be considered when interpreting the findings. The study was conducted at a single tertiary care hospital using non-probability consecutive sampling, which may limit generalizability to other public, private, rural, and high-volume surgical settings. The analysis was patient-based, but complete details on screened patients, exclusions, and follow-up attrition should be reported in a flow format to strengthen transparency. Although the study identified several predictors, adjusted regression outputs including odds ratios, 95% confidence intervals, and p-values for MGD, diabetes mellitus, surgical duration, age, and other covariates were not fully available in the manuscript text and should be included in the final Results section. Diabetes-related variables such as duration of disease, HbA1c, treatment status, and neuropathy were not reported, which limits interpretation of the diabetes association. Postoperative lubricant use was recorded but may have influenced symptom recovery, and its role as a treatment-related factor should be considered in the analysis. Masking of outcome assessment was not described, and interobserver reliability for ocular surface grading was not reported. Despite these limitations, the prospective design, repeated follow-up, and combined symptom-based and objective ocular surface assessment strengthen the clinical relevance of the findings.

Overall, this study shows that dry eye symptoms after uncomplicated cataract surgery are most prominent during the first postoperative week and generally improve over three months. The concurrent worsening of OSDI, TBUT, Schirmer values, and corneal staining supports a true early postoperative ocular surface response rather than an isolated subjective complaint. The findings emphasize that successful cataract surgery should be judged not only by visual acuity and absence of surgical complications but also by postoperative comfort, tear film stability, and quality of vision. Preoperative identification of dry eye symptoms, MGD, diabetes mellitus, and potentially longer operative exposure may allow surgeons to counsel patients more accurately, initiate ocular surface optimization earlier, and reduce avoidable postoperative dissatisfaction.

CONCLUSION

Dry eye symptoms were a common early postoperative complaint after uncomplicated phacoemulsification cataract surgery, increasing from 22.8% before surgery to 37.8% at one week before gradually declining to 27.2% at one month and 17.2% at three months. The early postoperative period was also marked by worsening of OSDI score, reduced tear film break-up time, lower Schirmer values, and increased corneal staining, indicating transient disruption of ocular surface stability. Preoperative dry eye symptoms, meibomian gland dysfunction, diabetes mellitus, and longer surgical duration emerged as clinically important predictors of postoperative dry eye symptoms. These findings support routine preoperative ocular surface screening, careful assessment of meibomian gland status, attention to diabetic patients, and surgical strategies that minimize ocular surface stress so that cataract surgery outcomes include not only improved vision but also better postoperative comfort and patient satisfaction.

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