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To study incidence of dry eye disease after cataract surgery by phacoemulsification technique

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Abstract
Background: Cataract surgery is one of the most commonly performed ophthalmic procedures worldwide. Despite excellent visual outcomes, postoperative dry eye remains a frequent complication, affecting patient comfort and visual quality.
Aim: To evaluate the incidence, severity, and progression of dry eye following phacoemulsification cataract surgery using objective tests (Schirmer I test, Tear Break-Up Time, ocular surface staining) and subjective assessment (Ocular Surface Disease Index).
Methods: This prospective observational study included 99 patients undergoing uncomplicated phacoemulsification at a tertiary care center. Patients were evaluated preoperatively and postoperatively at 1 week, 4 weeks, and 12 weeks. Dry eye was assessed using Schirmer I test, TBUT, ocular surface staining (Oxford Schema), and OSDI scores. Demographic data, gender distribution, and rural/urban background were also recorded.
Results: The mean age of patients was 61.28 years, with 41.41% females and 58.59% males. A majority of patients (73.74%) belonged to rural areas. Schirmer I test showed a postoperative incidence of dry eye of 14.14% at 1 week, decreasing to 4.04% at 12 weeks. Mean TBUT values decreased from 15.71 s preoperatively to 11.16 s at 1 week, then improved to 13.72 s at 12 weeks. Abnormal ocular surface staining was seen in 45.45% of patients at 1 week and reduced to 9.09% by 12 weeks. OSDI scores were highest at 1 week (24.85), improved at 4 weeks (17.55), and stabilized by 12 weeks, reflecting gradual recovery.
Conclusion: Postoperative dry eye is common following cataract surgery but is mostly transient, with significant improvement within three months. Early recognition, patient counseling, and appropriate management can enhance postoperative comfort and visual outcomes.

Keywords: Cataract surgery, dry eye, schirmer I-test, tear break-up time, OSDI, ocular surface staining

Introduction
Dry Eye Disease (DED) is a common multifactorial disorder of the ocular surface characterized by symptoms such as foreign body sensation, burning, watering, visual fluctuations, and photophobia, all of which significantly affect visual function and postoperative satisfaction [1, 2]. According to the TFOS DEWS II definition, DED involves loss of tear film homeostasis accompanied by tear film instability, hyperosmolarity, ocular surface inflammation, and neurosensory abnormalities [3]. The Asia Dry Eye Society similarly defines dry eye as a multifactorial condition in which tear film instability results in symptoms and potential ocular surface damage [4].
DED is broadly classified into two major categories: Aqueous-Deficient Dry Eye (ADDE) and evaporative dry eye (EDE). Earlier classification systems, including the NEI/Industry Report, recognized these subtypes and emphasized intrinsic and extrinsic risk factors, and more recent TFOS DEWS I/II frameworks have refined these categories to improve diagnostic precision and treatment strategies [5].
Prevalence of dry eye varies widely, ranging from 5-50% globally, depending on diagnostic criteria and population studied [6]. In India, the prevalence has been reported as 29.25% using OSDI-based assessment [7]. Advancing age, female sex, preexistingmeibomian gland dysfunction (MGD), autoimmune disease, diabetes, prolonged screen exposure, and ocular surgeries are among the most consistent risk factors [3, 6, 8].
DED primarily results from tear film hyperosmolarity, caused either by reduced aqueous secretion (ADDE) or excessive evaporation (EDE). Hyperosmolarity induces epithelial stress, inflammation, goblet cell loss, and tear film instability, perpetuating a cycle of ocular surface damage. In EDE, meibomian gland obstruction reduces lipid secretion, accelerating tear evaporation, whereas ADDE may arise from lacrimal dysfunction, nerve impairment, systemic diseases, or medication use [9].

Phacoemulsification is the most widely used technique for cataract extraction. While visual rehabilitation is generally excellent, postoperative ocular surface disturbances including DED are frequently reported [8, 10].

Although many studies have assessed dry eye after phacoemulsification, reported incidence and duration of symptoms vary considerably. Some studies show rapid resolution of postoperative dry eye signs, whereas others describe persistent surface abnormalities for several months [2, 14]. Further, gaps persist regarding preoperative predictors and longitudinal changes in DED parameters following surgery.

Therefore, the present study aims to evaluate the incidence and progression of dry eye disease after phacoemulsification cataract surgery over a three-month postoperative period, providing evidence that may help optimize patient care and improve surgical satisfaction.

Materials and Methods

Study Design

This research was conducted as a prospective observational study over a period of 1.5 years, including patient recruitment, follow-up assessments, and data analysis. The study was carried out in the Postgraduate Department of Ophthalmology, Government Medical College, Srinagar. Ethical clearance for the study was obtained from the Institutional Ethical Committee prior to the commencement of data collection.

Inclusion Criteria

Patients aged 18 years or older who had a confirmed diagnosis of cataract requiring phacoemulsification surgery were included. Only participants without prior signs or symptoms of dry eye disease and with the absence of corneal staining before surgery were enrolled. All participants were required to provide informed consent and agree to attend scheduled follow-up visits throughout the study duration.

Exclusion Criteria

Patients were excluded if they declined to provide informed consent or if they had any pre-existing ocular surface disorders, including blepharitis, conjunctivitis, uveitis, keratitis, glaucoma, pterygium, ocular allergies, or chronic lid margin disease. Eyelid abnormalities such as ptosis, dermatochalasis, entropion, ectropion, tumors, or congenital anomalies were excluded. Individuals with complicated cataracts associated with corneal compromise, those experiencing intraoperative complications such as capsular rupture, vitreous loss or corneal trauma, and patients undergoing combined procedures such as phacoemulsification with trabeculectomy were not included. A history of ocular surgery, trauma, or laser therapy within the preceding two months, as well as pre-operative or intraoperative lens subluxation, warranted exclusion. Patients with systemic conditions known to affect tear production, including diabetes mellitus, autoimmune diseases such as Sjögren's syndrome, rheumatoid arthritis and lupus, or connective tissue disorders, were excluded. Those taking systemic medications known to affect ocular surface health, including beta-blockers, antihistamines, antidepressants, and oral contraceptives, were also excluded.

Sample Size

The sample size was calculated using GPower 3.1.9.7 software. An effect size of 0.30, alpha error of 5%, and power of 90% were applied. The minimum required sample was 90 patients. After accounting for an anticipated 10% attrition rate, the final sample size was set at 99 participants.

Study Procedure

Pre-operative Evaluation

All participants underwent a detailed ophthalmic examination before surgery. Clinical history and demographic information, including age, sex, residence, occupation, and history of ocular trauma, previous surgeries, systemic disease, and medication use, were recorded.

Baseline ocular examination included uncorrected and best-corrected visual acuity assessment using a Snellen chart, and slit-lamp evaluation of the eyelids, conjunctiva, cornea, anterior chamber, iris, pupil, and lens. Fundus examination was carried out using direct and indirect ophthalmoscopy. Keratometry and axial length measurements were obtained for biometric analysis.

Dry eye diagnostic testing was performed pre-operatively. Fluorescein staining of the cornea and conjunctiva was conducted using sterile fluorescein paper strips moistened with non-preserved saline. Findings were examined under cobalt blue illumination and graded according to the Oxford Schema (Grades 0-5). A grade of 2 or higher was considered indicative of dry eye disease.

Schirmer's Test-I was performed using 5 × 35 mm Whatman filter paper strips without prior anesthesia. The strip was placed at the junction of the outer one-third and inner two-thirds of the lower eyelid. After five minutes, the strip was removed and the length of wetting was recorded. A value below 10 mm was regarded as abnormal.

Tear Film Break-Up Time was measured after fluorescein instillation. Patients were instructed to blink several times before holding the eyes open. The interval between the last blink and the appearance of the first dry spot was recorded. A TBUT value below 10 seconds was considered abnormal.

Subjective symptoms were evaluated using the Ocular Surface Disease Index (OSDI) questionnaire. Scores were calculated using the validated formula and interpreted as follows: 0-12 normal, 13-22 mild dry eye, 23-32 moderate dry eye, and 33-100 severe dry eye.

Surgical Procedure

All patients underwent standard phacoemulsification cataract surgery under topical or local anesthesia. Pre-operatively, topical moxifloxacin 0.5% was instilled for three days and the pupil was dilated using tropicamide 0.8% with phenylephrine 5%. The operative eye was cleaned with 5% povidone-iodine and draped aseptically. A corneal incision measuring 2.8-3.2 mm was made, followed by the introduction of a viscoelastic agent. Continuous curvilinear capsulorrhexis was performed, and hydrodissection facilitated nuclear rotation. The nucleus was emulsified and aspirated using an ultrasonic phacoemulsification probe. Cortical cleanup was performed, and a foldable intraocular lens was implanted in the capsular bag. The viscoelastic material was removed and the incision was hydrated to ensure self-sealing.

Postoperative Evaluation

Patients were followed at 1 week, 1 month, and 3 months after surgery. At each visit, Schirmer's Test-I, Tear Film

Break-Up Time, fluorescein staining, and OSDI scoring were repeated using the same methodology employed during the pre-operative assessment.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using descriptive and inferential statistical methods. Continuous variables were expressed as mean ± standard deviation, and categorical data were presented as percentages. Repeated Measures ANOVA was used to assess changes in Schirmer's Test-I values, TBUT, and OSDI scores across study intervals. A p-value of less than 0.05 was considered statistically significant.

Results: A total of 99 patients were included in the study. Among them, males accounted for 58.59 percent and females for 41.41 percent, indicating a slightly higher male representation. The age of participants ranged from 21 to 88 years, with the majority belonging to the middle-aged group (45-65 years). Rural residents made up nearly three-quarters of the study population, suggesting a predominantly rural sample [Table 1].

Table 1: Demographic Characteristics of the Study Participants

Variable	Category	Number of Cases	Percentage	Minimum	Maximum	Mean	SD
Gender	Female	41	41.41%	--	--	--	--
	Male	58	58.59%	--	--	--	--
Age Group	21-26 (Young)	3	3.03%	21	26	23.67	2.52
	45-65 (Middle-aged)	63	63.64%	40	65	54.81	7.34
	65-88 (Elderly)	33	33.33%	65	88	77.06	6.30
Residence	Rural	73	73.74%	--	--	--	--
	Urban	26	26.26%	--	--	--	--

Schirmer's Test values demonstrated significant postoperative fluctuations. Preoperatively, tear production was normal in all patients. A notable decline was observed at the first week, followed by gradual improvement over the first and third months. The significant p-value indicates that these changes were statistically meaningful [Table 2].

Table 2: Schirmer's Test (ST1)

Follow-up	Minimum ST1	Maximum ST1	Mean±SD	p-value
Preoperative	10	35	23.79 ±7.70	<0.001
1st Week	4	35	15.16±6.75	
1st Month	5	28	13.10 ±4.05	
3rd Month	5	33	21.89±7.45	

Tear film stability reduced markedly during the first postoperative week but showed significant recovery by the first month. By the third month, TBUT values nearly approached the preoperative levels. The overall differences across follow-ups were statistically significant [Table 3].

Table 3: Tear Break-Up Time (TBUT)

Follow-up	Minimum TBUT	Maximum TBUT	Mean	SD	p-value
Preoperative	10	28	15.71	3.60	<0.001
1st Week	6	32	11.16	3.96	
1st Month	3	23	14.06	5.02	
3rd Month	9	25	13.72	3.16	

Corneal staining increased significantly in the early postoperative period, reaching its peak during the first week. Subsequent follow-ups showed continuous improvement, with most patients exhibiting normal staining patterns by the third month. The mean staining score steadily reduced across follow-ups [Table 4].

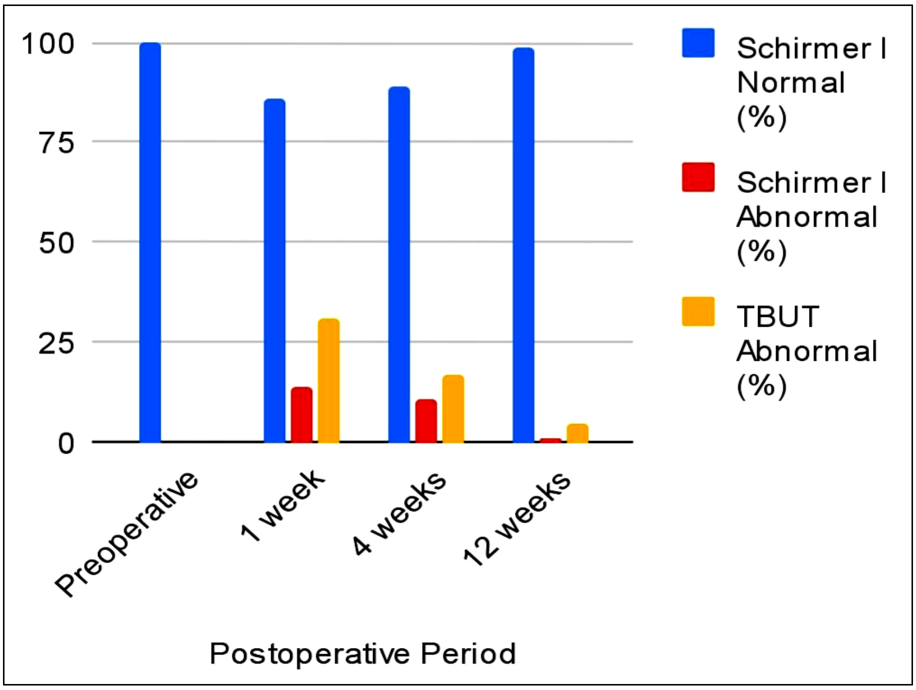
Table 4: Staining Pattern Scores

Follow-up	Minimum Score	Maximum Score	Mean	SD
Preoperative	0.00	1.00	0.48	0.50
1st Week	0.00	3.00	1.44	1.00
1st Month	0.00	3.00	1.03	0.95
3rd Month	0.00	3.00	0.60	0.79

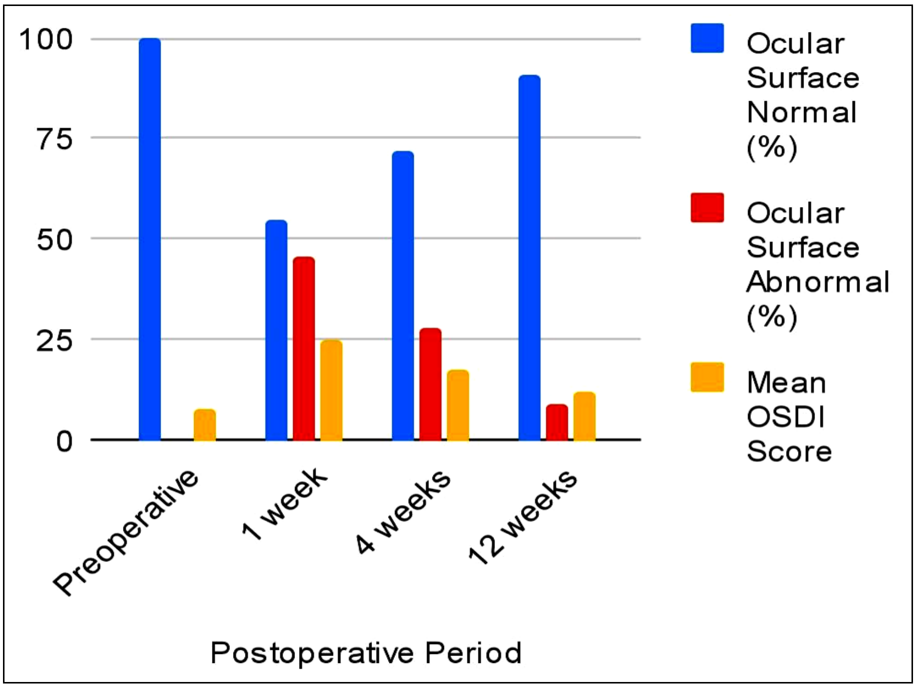
OSDI scores rose substantially during the first postoperative week, indicating increased subjective ocular discomfort. Progressive improvement was observed by the first and third months. The changes from baseline were statistically significant [Table 5].

Table 5: Ocular Surface Disease Index (OSDI)

Follow-up	Minimum OSDI	Maximum OSDI	Mean	p-value
Preoperative	1	11	8.57±2.37	<0.001
1st Week	1	33	24.85±10.00	
1st Month	1	36	17.55±10.30	
3rd Month	1	30	12.01±8.56	



Bar graph 1: Postoperative Schimer I Test and TBUT over Time



Bar graph 2: Postoperative Ocular Surface Staining and OSDI Scores

Discussion

The tear film-cornea interface is the primary refractive surface of the eye, and any disruption can compromise visual quality. Cataract surgery, particularly phacoemulsification, has been associated with postoperative dry eye disease (DED), a common and challenging complication [15]. In this prospective study of 99 patients, we observed that middle-aged and elderly individuals constituted the majority, with a mean age of 61.28 years, consistent with previous reports [16, 17].

A higher proportion of males (58.59%) were affected, aligning with prior studies that reported male predominance in postoperative dry eye incidence [15, 16]. Most patients (73.74%) were from rural backgrounds, which may reflect differences in healthcare access, awareness, or environmental exposures such as ultraviolet light and dust, similar to findings in earlier studies [18].

The prevalence of DED following cataract surgery was notable in the early postoperative period. Schirmer I (ST1) testing revealed abnormal results in 14.14% of patients at 1 week, which decreased to 4.04% by the 12th week. Tear film break-up time (TBUT) demonstrated a higher early incidence of DED (31.31%) that significantly improved by 12 weeks, indicating recovery of tear film stability [19, 20]. These results are consistent with previous studies showing transient postoperative tear film instability and gradual improvement over time [21, 22].

The initial reduction in ST1 and TBUT values may be attributed to corneal nerve disruption caused by surgical incisions, which impairs the corneal-lacrimal gland reflex arc and reduces tear secretion [23]. Neurogenic inflammation, ocular surface irritation, and the use of topical medications and preservatives may further contribute to early postoperative dry eye [24, 25]. Recovery of corneal innervation over time likely explains the observed improvement in tear function, as corneal nerve regeneration begins approximately 25 days postoperatively [26, 27].

Ocular surface staining also showed significant early postoperative abnormalities, with 45.45% of patients affected at 1 week and 28.28% at 1 month, gradually improving by the third month [28, 29]. Similarly, Ocular Surface Disease Index (OSDI) scores increased significantly in the first postoperative week, reflecting patient-reported symptoms, and improved progressively by 12 weeks, although some residual symptoms persisted [18, 19, 21].

Overall, the findings of this study confirm that dry eye after cataract surgery is common, predominantly transient, and shows gradual improvement over the first three months. These results are in agreement with previous literature, which reported similar trends in ST1, TBUT, staining patterns, and OSDI scores [15-27]. Awareness of this complication and early management can improve patient satisfaction and postoperative visual outcomes.

Conclusion

Postoperative dry eye is a common and transient complication following cataract surgery, particularly in the early weeks after phacoemulsification. In this study, the incidence of dry eye was highest during the first postoperative week, as evidenced by Schirmer I test, tear break-up time, ocular surface staining, and Ocular Surface Disease Index scores. Tear film parameters and patient-reported symptoms generally improved over the first three months, indicating recovery of ocular surface function and corneal nerve regeneration.

Older age, male gender, and rural background were common characteristics in this patient cohort, though these factors did not significantly influence the severity of dry eye symptoms. The study highlights the importance of early recognition and management of postoperative dry eye to improve patient comfort and visual outcomes. Proper counseling and timely intervention can help mitigate the transient visual discomfort associated with postoperative ocular surface changes.

Conflict of interest: Nil

Funding: Nil

References

1. Sidaraite A, Mikalauskiene L, Grzybowski A, Zemaitiene R. Evaluation of ocular surface after cataract surgery: a prospective study. J Clin Med. 2022;11(15):456.
2. Zamora MG, Caballero EF, Maldonado MJ. Short-term changes in ocular surface after phacoemulsification. Eur J Ophthalmol. 2020;30(6):1301-1307.
3. Craig JP, Nichols KK, Akpek EK, *et al*. TFOS DEWS II Definition and Classification Report. Ocul Surf. 2017;15(3):276-283.
4. Tsubota K, Yokoi N, Shimazaki J, *et al*. Asia Dry Eye Society consensus: definition and diagnosis. Ocul Surf. 2017;15(1):65-76.
5. International Dry Eye WorkShop. Report of the Definition and Classification Subcommittee. Ocul Surf. 2007;5(2):75-92.
6. Gayton JL. Etiology, prevalence and treatment of dry eye disease. Clin Ophthalmol. 2009;3:405-412.
7. Gupta N, Prasad I, Jain R, D'Souza P. Prevalence of dry eye among Indian patients. Ann Trop Med Parasitol. 2010;104(3):247-255.
8. Sahu PK, Das GK, Malik A, Biakthangi L. Dry eye following phacoemulsification and its risk factors. Middle East Afr J Ophthalmol. 2015;22(4):472-477.
9. Hyon JY, Kim HM, Lee D, *et al*. Korean guidelines for diagnosis and management of dry eye. Korean J Ophthalmol. 2014;28(3):197-206.
10. Naderi K, Gormley J, O'Brart D. Cataract surgery and dry eye disease: a review. Eur J Ophthalmol. 2020;30(5):840-855.
11. Garg P, Gupta A, Tandon N, Raj P. Dry eye disease after cataract surgery: determinants and risk factors. Turk J Ophthalmol. 2020;50(3):133-142.
12. Gayton JL. Treatment of dry eye disease. Clin Ophthalmol. 2009;3:405-412.
13. Hamed MA, Aldghaimy AH, Mohamed NS, Amer AA. Incidence of post-phacoemulsification dry eye. Clin Ophthalmol. 2022;16:705-713.
14. Kasetsuwan N, Satitpitakul V, Changul T, Jariyakosol S. Incidence and pattern of dry eye after cataract surgery. PLoS One. 2013;8(11):e78657.
15. Bhattacharjee S, Ram A, Ferdows SKS, *et al*. Evaluation of dry eye symptoms after phacoemulsification. J Evid Based Med Healthc. 2018;5(8):659-662.
16. Khadke A, Khan MA, Moulick PS, Gupta S, Shankar S. A clinical study to evaluate incidence of dry eye following cataract surgery. Indian J Clin Exp Ophthalmol. 2018;4(2):213-216.
17. Bista B, Bista PR, Gupta S, Byanju R, Khadka S, Mishra S. Comparative study of dry eye indices following cataract surgery. Nepal J Ophthalmol. 2021;13(25):104-111.
18. Garg P, Arora S, Jain AK. Prevalence and management of post-cataract surgery dry eye in rural population. Indian J Ophthalmol. 2022;70(2):556-562.
19. Cetinkaya S, *et al*. Tear film break-up time changes after cataract surgery. Clin Ophthalmol. 2015;9:123-129.
20. Kasetsuwan N, *et al*. Incidence and pattern of dry eye after cataract surgery. J Med Assoc Thai. 2013;96(4):468-475.
21. Sahu PK, *et al*. Evaluation of tear film parameters after phacoemulsification. Int J Ophthalmol. 2015;8(6):1127-1132.
22. G P, KC, PN, AS. Prevalence of dry eye in post-cataract surgery patients in a tertiary care hospital, Pondicherry. Int J Acad Med Pharm. 2023;5(3):839-842.
23. Müller LJ, Marfurt CF, Kruse F, Tervo TM. Corneal nerves: structure, contents and function. Exp Eye Res. 2003;76:521-542.
24. Li XM, Hu L, Hu J, Wang W. Investigation of dry eye disease and analysis of pathologic factors in patients after cataract surgery. Cornea. 2007;26(Suppl 1):S16-S20.
25. Liu Z, Luo L, Zhang Z, Cheng B, Zheng D, *et al*. Tear

film changes after phacoemulsification. Zhonghua Yan Ke Za Zhi. 2002;38:274-277.
26. Ram J, Gupta A, Brar GS, Kaushik S, Gupta A. Outcomes of phacoemulsification in patients with dry eye. J Cataract Refract Surg. 2002;28:1386-1389.
27. Belmonte C, Acosta MC, Gallar J. Neural basis of sensation in intact and injured corneas. Exp Eye Res. 2004;78:513-525.
28. Gahanoliya K, Maanju S, Kumar A, Kumar K. Effect on determinants of dry eye after phacoemulsification. Indian J Clin Exp Ophthalmol. 2022;8(4):496-499.

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