Original Article
DOI: https://doi.org/10.70749/ijbr.v3i7.1900

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://ijbr.com.pk
ISSN: 2960-2793/ 2960-2807

# Occurrence of Dry Eye after Extra Capsular Cataract Extraction Vs Phacoemulsification

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## ARTICLE INFO

**Keywords:** Cataract, Dry eye, Extra-capsular cataract extractions (ECCE), Phacoemulsification.

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**Declaration**

**Authors' Contribution:** All authors equally contributed to the study and approved the final manuscript.

**Conflict of Interest:** No conflict of interest.

**Funding:** No funding received by the authors.

**Article History**

Received: 18-05-2025 Revised: 28-06-2025
Accepted: 06-07-2025 Published: 15-07-2025

## ABSTRACT

**Background and Aim:** Dry Eye syndrome is a recognized postoperative complication after cataract surgery, which can affect the visual comfort and recovery of patients. Both extra-capsular cataract extractions (ECCE) and phacoemulsification are standard surgical approaches for removing cataracts, but their comparative impact on tear film stability remains under investigation. To determine the frequency of the occurrence of dry eye after extra-capsular cataract extractions (ECCE) vs. phacoemulsification in patients undergoing cataract surgery. **Patients and Methods: Study Design:** Randomized controlled trial. **Study Setting:** The trial was conducted at Eye Unit III, Institute of Ophthalmology, Mayo Hospital Lahore, from November 01, 2024 to April 30, 2025. 60 cases of cataract (aged 40–70 years) with NS+2 and NS+3 cataracts were enrolled using non-probability purposive sampling. Patients equally divided into two groups: ECCE (n=30) and Phacoemulsification (n=30). Pre-existing dry eye, Meibomian gland dysfunction, prior ocular surgeries, or medication-related risk factors for dry eye excluded. Dry Eye was assessed using the Schirmer I Test (ST-I) and TEAR Breakup time (TBUT) and 1, 4, and 12 weeks later postoperative. The dry eye was defined as St-I <10 mm and TBUT <10 seconds on three consecutive readings. Data was analyzed using the SPSS V21, and the importance was determined at P <0.05. **Results:** The overall mean age was 58.7 ± 6.2 years. Out of 60 cases, 31 (51.7%) were male and 29 (48.3%) female. The frequency of dry eye occurrence was significantly higher in patients undergoing Extra-Capsular Cataract Extraction 60% (n=18) compared to those undergoing Phacoemulsification 26.7% (n=8) at 12 weeks postoperatively. The Schirmer I Test and Tear Break-Up Time values in both groups ECCE vs. Phacoemulsification were 8.2 ± 2.1 mm vs. 9.4 ± 1.8 mm and 7.5 ± 1.3 s vs. 8.6 ± 1.1 after 1 week, which increased to 9.5 ± 1.9 mm vs. 11.0 ± 1.5 mm and 8.1 ± 1.2 s vs. 9.5 ± 1.1 s, after 12 weeks respectively. These findings indicate that both values are consistently lower in the ECCE group across all time intervals, indicating poorer tear film stability and aqueous production. **Conclusion:** The frequency of dry eye occurrence was significantly higher in patients undergoing Extra-Capsular Cataract Extraction compared to those undergoing Phacoemulsification at 12 weeks postoperatively. Both Schirmer I Test and TBUT results indicated a statistically significant reduction in tear production and stability in the Extra-capsular group compared to the Phacoemulsification group.

## INTRODUCTION

Dry eye disease (DED) is a complex, multifactorial condition marked by a chronically unstable or insufficient tear film, leading to ocular discomfort and/or visual disturbances, accompanied by variable degrees of ocular surface epitheliopathy, inflammation and neurosensory abnormalities [1]. Although the exact pathogenesis of the dry eye is not yet fully understood, the situation is mainly associated with tears film instability and immunity-mediated inflammation. These disturbances can arise from abnormalities in the lipid layer, reduce aqueous tear production, mucin deficiency, or reduce irregularities of the eyelid surface [2]. The ocular surface functional unit—which includes the conjunctiva, cornea, accessory lacrimal glands, main lacrimal gland, Meibomian glands (responsible for producing the outer lipid layer of the tear film), and their neural connections plays a critical role in maintaining tear film homeostasis. Disruption in any component of this integrated system can lead to the development of dry eye disease [3, 4].

Intact corneal innervation is crucial for normal blinking and tearing reflexes, which are essential for preserving the integrity of the ocular surface. Sensory input to the cornea and the blink reflex transmitted via the nasociliary and supraorbital branches of the ophthalmic division of the trigeminal nerve, respectively, to the brainstem. A branch

of the facial nerve that activates the orbicularis oculi muscle mediates the corresponding efferent motor response. Additionally, secretomotor fibers of the facial nerve, via parasympathetic and sympathetic pathways, innervate the lacrimal gland and regulate tear production and secretion [5]. Disruption of these neural pathways can impair the regulation of both basal and reflex tear secretion, leading to tear film instability. This neural dysfunction is a key pathogenic mechanism contributing to postoperative dry eye in patients following ophthalmic surgeries [6, 7].

The surgical trauma due to cataract surgery causes up regulation of the inflammatory mediators (e.g. production of prostaglandins, inflammatory cytokines, proteolytic enzymes, leukotrienes and oxygen free radicals) which may increase inflammation, affect corneal sensitivity, and have contribution in tear film instability [8]. Incisional site surface irregularity or goblet cell destruction may lead to tear film instability. Post-Surgery dry eye may be due to use of preservative containing drugs, which may lead to increase evaporation [9]. Large incisions made during extracapsular cataract extraction (ECCE) can occasionally damage corneal nerves, potentially leading to dry eye syndrome. In contrast, phacoemulsification involves a much smaller incision and utilizes ultrasonic-driven oscillating tips to emulsify or fragment the crystalline lens. Despite the minimally invasive nature of phacoemulsification, cases of postoperative dry eye have also been reported [10]. Epidemiological studies have identified several risk factors for the development of dry eye syndrome, including aging, connective tissue disorders, a history of allergies, diabetes, the use of antihistamines, and previous refractive surgery. In this study, we aim to compare the incidence of dry eye among patients who have undergone ECCE versus phacoemulsification, taking into account the specific climatic and surgical conditions of our population [11–13].

## METHODOLOGY

### Study Design and Setting

This randomized controlled trial investigated 60 cataract to compare the frequency of dry eye occurrence in patients undergoing Extra-capsular Cataract Extraction (ECCE) versus Phacoemulsification at Eye Unit III, Institute of Ophthalmology, Mayo Hospital, Lahore, from November 01, 2024 to April 30, 2025. 60 patients (30 in each group: ECCE and Phacoemulsification) were enrolled using non-probability purposive sampling. Patients aged 40–70 years, of either gender, and diagnosed with NS+2 or NS+3 nuclear sclerosis cataracts enrolled. Pre-existing dry eye syndrome, diagnosed Meibomian gland dysfunction, history of prior ocular surgeries or trauma-related cataracts, current use of long-term topical ocular medications, Use of systemic medications associated with dry eye (e.g., antihistamines, antidepressants, contraceptives, decongestants, isotretinoin, gabapentin, sildenafil citrate, anticholinergics), autoimmune disorders, and patients with complicated cataract surgeries excluded.

### Data Collection Procedure

Formal approval for the study obtained from the Institutional Review Board (IRB) of King Edward Medical University/Mayo Hospital, Lahore. Detailed patient information recorded, including a thorough history and a comprehensive ophthalmic examination using a slit lamp and a +90D VOLK lens after pharmacologic pupil dilation with tropicamide 0.8% and phenylephrine 2.5%. Schirmer's test and tear break-up time (TBUT) performed preoperatively to exclude patients with pre-existing dry eye disease. All surgeries conducted under topical anesthesia. Patients randomly assigned to undergo either extracapsular cataract extraction (ECCE) or phacoemulsification. Intraoperatively, the ocular surface maintained using intermittent saline irrigation and ophthalmic viscoelastic devices. Postoperatively, patients were prescribed topical antibiotics (moxifloxacin) and corticosteroids (dexamethasone) in a tapered regimen, along with lubricating eye drops for a duration of six weeks. Objective evaluation of dry eye was conducted using Schirmer I test (ST-I) and TBUT measurements, performed one day prior to surgery and subsequently at 1, 4, and 12 weeks postoperatively. Data analysis done in SPSS v21 with a p-value of <0.05 considered statistically significant.

## RESULTS

The overall mean age of patients was 58.7 ± 6.2 years. Of the total patients, there were 31 (51.7%) male and 29 (48.3%) female. The frequency of dry eye occurrence was significantly higher in patients undergoing Extra-capsular Cataract Extraction 60% (n=18) compared to those undergoing Phacoemulsification 26.7% (n=8) at 12 weeks postoperatively. The Schirmer I Test and Tear Break-Up Time values in both groups ECCE vs. Phacoemulsification were 8.2 ± 2.1 mm vs. 9.4 ± 1.8 mm and 7.5 ± 1.3 s vs. 8.6 ± 1.1 after 1 week, which increased to 9.5 ± 1.9 mm vs. 11.0 ± 1.5 mm and 8.1 ± 1.2 s vs. 9.5 ± 1.1 s, after 12 weeks respectively. These findings indicate that both values are consistently lower in the ECCE group across all time intervals, indicating poorer tear film stability and aqueous production. Table 1 depicts the demographic data of patients. Comparison of frequency of Dry Eye Occurrence after Cataract Surgery presented in Table 2. Occurrence of Dry Eye and Test Parameters shown in Table 3.

**Table 1**

Demographic Details (N=60)

| Characteristics | | ECCE Group (n=30) | Phaco Group (n=30) | Total (n=60) |
|---|---|---|---|---|
| Age (mean ± SD) | | 59.2 ± 6.4 yrs | 58.1 ± 5.9 yrs | 58.7 ± 6.2 yrs |
| Gender | Male | 16 (53.3%) | 15 (50.0%) | 31 (51.7%) |
| | Female | 14 (46.7%) | 15 (50.0%) | 29 (48.3%) |

**Table 2**

*Frequency of Dry Eye Occurrence after Cataract Surgery (N=60)*

| Group | Total Patients (n) | Patients with Dry Eye (n) | Percentage (%) |
|---|---|---|---|
| Extra-capsular Cataract Extraction | 30 | 18 | 60% |
| Phacoemulsification | 30 | 8 | 26.7% |

**Table 3**
*Occurrence of Dry Eye and Test Parameters*

| Time After Surgery | Parameter | ECCE Group (n=30) (Mean ± SD) | Phaco Group (n=30) (Mean ± SD) | *p*-value | Significant? |
|---|---|---|---|---|---|
| 1 week | ST-I (mm) | 8.2 ± 2.1 | 9.4 ± 1.8 | 0.038 | Yes |
| | TBUT (s) | 7.5 ± 1.3 | 8.6 ± 1.1 | 0.021 | Yes |
| 4 weeks | ST-I (mm) | 9.0 ± 2.0 | 10.2 ± 1.7 | 0.030 | Yes |
| | TBUT (s) | 7.9 ± 1.4 | 9.0 ± 1.2 | 0.016 | Yes |
| 12 weeks | ST-I (mm) | 9.5 ± 1.9 | 11.0 ± 1.5 | 0.012 | Yes |
| | TBUT (s) | 8.1 ± 1.2 | 9.5 ± 1.1 | 0.008 | Yes |

## DISCUSSION

The present study mainly focused on to evaluate postoperative events of the dry eye and tear film festival after two commonly performed cataract surgery techniques: Extra-capsular Cataract Extraction (ECCE) and Phacoemulsification. The findings highlight a significantly higher frequency of dry eye symptoms among patients who underwent ECCE, suggesting a greater impact of this surgical approach on tear film stability and ocular surface health. Earlier studies reported that in experience hands, cataract surgery usually considered safe and free from complications. Nevertheless, some postoperative issues, such as dry eyes, documented in literature [14, 15].

The mean age of investigated cases was 58.7 ± 6.2 years, which usually reflects the typical demographic affected by cataract. The male-to-female ratio relatively balanced, which aligns with the general epidemiological trends of cataract phenomena. Importantly, no significant gender differences observed in the prevalence of dry eyes, it shows that instead of gender-based physical differences, surgical techniques played a more important role in affecting the dynamics of postoperative tears. Although our results did not indicate any significant impact of the gender on the occurrence of dry eye disease (DED), but an earlier study reported DED-related discomfort among female patients [16].

A major observation in this study was quite a much higher phenomenon of dry eye symptoms in the ECCE group (60%) compared to the Phacoemulsification group (26.7%) at 12 weeks postoperatively. This supports previous literature suggesting that larger incisions and increased surgical manipulation in ECCE can result in greater ocular surface trauma and inflammation, thereby impairing tear film function. Phacoemulsification, being minimally invasive with smaller incisions, appears to preserve ocular surface integrity better and consequently results in a lower incidence of dry eye symptoms. Earlier study reported 22.2% prevalence of dry eye symptoms in Phacoemulsification group [17].

The Schirmer I Test and Tear Break-Up Time (TBUT) values offer quantitative insights into aqueous tear production and tear film stability, respectively. At 1 week postoperatively, both tests yielded lower values in the ECCE group (8.2 ± 2.1 mm for Schirmer and 7.5 ± 1.3 s for TBUT) compared to the Phacoemulsification group (9.4 ± 1.8 mm and 8.6 ± 1.1 s). Although both parameters improved by 12 weeks, they remained consistently lower in the ECCE group (9.5 ± 1.9 mm and 8.1 ± 1.2 s) than in the Phacoemulsification group (11.0 ± 1.5 mm and 9.5 ± 1.1 s). These findings reinforce the hypothesis that the extent of surgical invasiveness correlates with the degree of disruption to the ocular surface and tear-producing glands. Similar findings reported in earlier literatures [18, 19].

Constant inequality in tear parameters between two groups suggests that ECCE tear can lead to longer or possibly irreversible changes in the dynamics of the film. The initial postoperative period, especially the first week, showed more clear differences, which attributed to acute inflammation, conjunctival manipulation and corneal nerve damage. Over time, the gradual recovery of these parameters indicates partial treatment and adaptation of the ocular surface, but not the same extent in ECCE patients who were in those who underwent Phacoemulsification [20].

This study has important clinical implications. Given the high probability of dry eyes after ECCE, physicians should consider preoperational screening for tear film abnormalities and provide proper immunity or medical intervention. Patient education and potential requirement of artificial tears or anti -inflammatory drugs about the expected postoperative symptoms is also necessary, especially for those or those who are accompanied by already existing ocular surface disorders [21, 22].

## CONCLUSION

This study shows that ECCE is associated with a high phenomenon and more severity of dry eye symptoms compared to Phacoemulsification in a high phenomenon and early postoperative period. The consistently lower Schirmer I and TBUT values in the ECCE group underscore the importance of surgical technique in preserving tear film integrity. These findings advocate for the preference of Phacoemulsification over ECCE when feasible and highlight the need for vigilant postoperative ocular surface management to enhance patient comfort and surgical outcomes.

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