

## Incidence and Pattern of Dry Eye after Phacoemulsification Surgery

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### ABSTRACT

**Background:** Dry eye is a multifactorial, heterogeneous disorder of the precorneal tear film because of tear deficiency or excessive tear evaporation. Many patients who have undergone cataract surgery have complained of dry eyes postoperatively. The aim of this study was to evaluate the incidence and severity pattern of dry eye after clear corneal phacoemulsification.

**Design:** Cohort Follow up study.

**Materials and Methods:** 140 uncomplicated cataract patients coming to Indira Gandhi Medical College and Hospital, Shimla were selected for study. Dry eye incidence and pattern were analyzed preoperatively and at days 1, 7, 30 and 60 after phacoemulsification using

**Results:** The incidence and severity of dry eye peaked at seven days post-phacoemulsification and was measured by OSDI questionnaire and all four clinical tests. Within 30 days and 2 months post-surgery, both the symptoms and signs showed rapid and gradual improvements respectively.

**Conclusion:** The incidence of dry eye after phacoemulsification was 11%. Symptoms and signs of dry eye occurred as early as seven days post-phacoemulsification and the severity pattern improved over time. We recommend that patients should be evaluated both before and after phacoemulsification to prevent further damage to the ocular surface and manage the patient effectively so that the patients have a good quality of life.

**Keywords:** Dry eye; Corneal; Phacoemulsification; Post-surgery

## INTRODUCTION

Cataract is a very important cause of blindness worldwide. Dry eye is a disorder of the tear film due to tear deficiency or excessive tear evaporation causing damage to the interpalpebral ocular surface and is associated with symptoms of ocular discomfort and irritation such as feeling dry, gritty or sandy, burning sensation, itching and watering or tearing.

Surgical interventions related to anterior segment have been associated to cause dry eye and aggravate the symptoms in pre-existing dry eye, like PRK, LASIK, Cataract surgery [1]. Cornea is innervated by long ciliary nerves of ophthalmic branch of Trigeminal nerve. For normal blinking and tearing reflexes, intact corneal innervation is necessary [2,4]. Damage of this circuit, causes dry eye. Phacoemulsification surgery causes denervation of cornea resulting in decreased blinking and

reduction in tear production thus leading to increased epithelial permeability, decreased epithelial metabolic activity and impaired epithelial wound healing [3].

Production of free radicals due to ultrasound energy, microscope light exposure time during surgery and pre and post-operative medications have also been implicated as the possible causes of dry eye after phaco surgery. Vigorous irrigation of the cornea intraoperatively and ocular surface manipulation deteriorate tear film stability and may reduce goblet cell density and thus cause shortened BUT postoperatively [4].

## AIM AND OBJECTIVES

To study the incidence and pattern of dry eye after phacoemulsification surgery in patients with no previous history of dry eyes at post-operative days 1, 7, 30 and 60.

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## MATERIALS AND METHODS

The study material consisted of 140 cases of uncomplicated cataract. Dry eye incidence and pattern was analysed at days 1,7,30 and 60 after phacoemulsification after applying inclusion and exclusion criteria. The following diagnostic tests of dry eye were carried out on all the patients.

### TBUT (Tear film break up time)

The test was performed by moistening a fluorescein strip with sterile no preserved saline and applying it to the inferior tarsal conjunctiva. The time lapse between the last blink and the appearance of the first randomly distributed dark discontinuity in the fluorescein-stained tear film is the tear break-up time. Break-up times less than 10 seconds are considered abnormal [5].

### Schirmer test-I

The schirmer test is performed by placing a narrow filter-paper strip (5 × 35 mm) in the inferior cul-de-sac. Aqueous tear production is measured by the length in millimeters that the strip wets during the test period, generally 5 minutes. Severity grading was done as follows; >15 mm/5 min (Normal) 10-15 mm/5 min, (Mild Dry Eye), 5-9 mm/5 min (Moderate Dry Eye), <5 mm/5 min (Severe Dry Eye) [6].

### Schirmer test-II

The schirmer test with anesthesia, also referred to as a basic secretion test is performed after 15 minutes of schirmer's test. After putting topical proparacaine drops, schirmer's strip was applied as for schirmer's test 1. Results noted down after 5 minutes. <6 mm/5 min was considered abnormal and >6 mm of wetting after 5 minutes was considered normal [7-9].

### Dry eye questionnaire: Ocular Surface Disease Index score (OSDI)

The OSDI questionnaire has 12 items, with each question given a score ranging from 0 (none of the time) to 4 (all of the time). The final score was calculated by multiplying the sum of all the scores by 25 and then dividing the total by the number of questions answered. Scores range from 0 to 100 with 0-12 representing normal, 13-22 representing mild DED, 23-32 representing moderate DED, and ≥ 33 representing severe DED [8,9].

## OBSERVATIONS AND RESULTS

Out of total 140 patients, 5 patients (3.6%) had dry eyes on POD1, 11 patients (7.9%) on POD 7, 5 patients (3.6%) on POD 30 and 5 patients (3.6%) on POD60 had dry eyes on the basis of TBUT. Patients were classified according to the severity of dry eyes on the basis of ST1. On POD 7, 6 patients out of total 140 (4.3%) had mild dry eyes, 3 patients (2.1%) had moderate dry eyes and none had severe dry eyes. On POD 30, 3 patients (2.1%) had mild dry eyes, and no patients had signs of moderate

or severe dry eyes. On POD60, none of the patients had any dry eyes.

We classified the total number of patients with values <6 or >6 on ST2 at different intervals. On POD1, 2 patients (1.4%) had <6 values, on POD 7, 7 patients (5.0%) had values <6, on POD30, 1 patient out of all (0.7%) had <6 values on ST2.

In OSDI scoring, none of the patients had values >33 indicating severe dry eye at any follow, 2 patients classified for mild dryness and 2 classified for moderate dryness on POD 1. On POD 7, 5 patients (3.5%) had mild dry eyes and 5 also had moderate dry eyes (3.5%). On POD 30, 5 patients had score between 13-22 and 4 patients between 23-32. On POD 60, 4 patients had score between 13-22 and 1 patient had score between 23-32 (Figures 1-5).

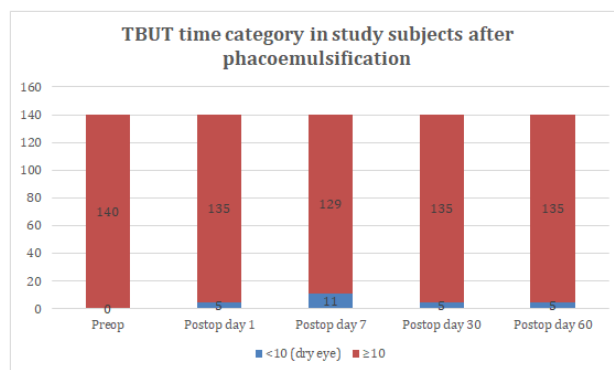


Figure 1: Incidence of dry eye on TBUT test.

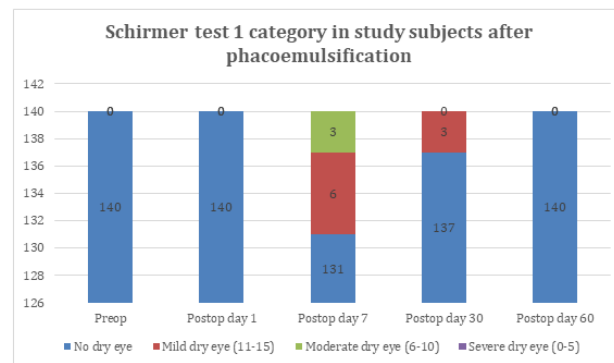


Figure 2: Incidence and severity of dry eye on ST1 test.

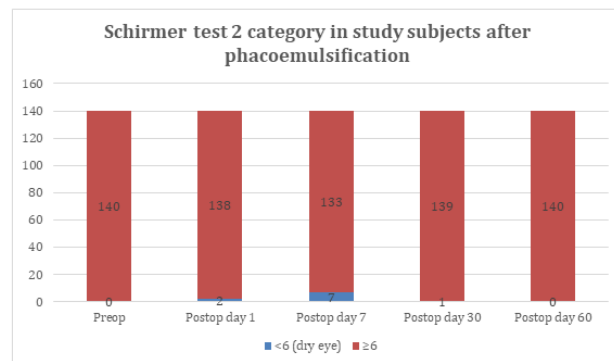


Figure 3: Incidence of dry eye on ST2 test.

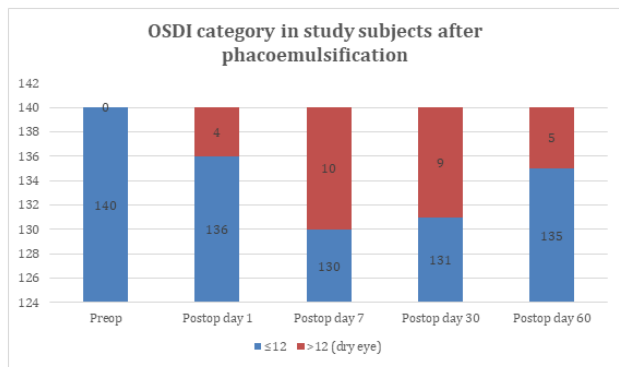


Figure 4: incidence and severity of dry eye on OSDI scoring.

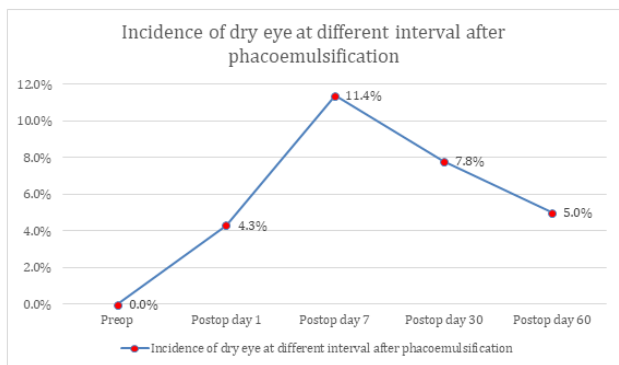


Figure 5: Incidence of dry eye after phacoemulsification surgery.

## DISCUSSION

Dry eye is often recognized as in DEWS 1 a disturbance of the Lacrimal Functional Unit (LFU), an integrated system comprising the lacrimal glands, ocular surface (cornea, conjunctiva and meibomian glands) and lids, and the sensory and motor nerves that connect them.

TBUT values were lowest at post op day 7 as compared to pre op although the values improved at next follow-ups but the changes were significant at all-time intervals up to months  $p < 0.001$  consistent to most studies. Cetinkya et al., included TBUT, ST 1 and OSDI in their study reported that in comparison with preoperative value, the 1st day, 1st week and 1st month values were significantly lower ( $P < 0.001$ ,  $P < 0.001$ ,  $P < 0.001$ ), however 3rd month, 6th month, 1st year and 2nd year values were not significantly different from preoperative value. Cho and Kim [12] observed the aggravation of dry eye symptoms and diagnostic test results after cataract surgery as compared to preoperative measurements. They concluded that TBUT and the barrier function of the corneal epithelium get affected in the early postoperative period after cataract surgery which is consistent with the present study. Apart from ST1 values change trend with decrease in post-operative period with lowest values on POD 7 and improving thereafter, we also noticed increased ST 1 values in 49 patients out of total 140 in POD 1. The reason for increased ST1 values in immediate post-operative time could be due to increase reflex as any surgical procedure leads to release in inflammatory mediators in immediate post-operative time. Khanal et al. also reported same unanticipated finding in immediate post-operative period which returned to preoperative

values at 90 days, the reason for this was not provided. None of the participated study group had ST1 value  $< 5$  i.e., severe dryness on any follow up period. All the tests performed preoperatively and postoperatively showed incidence of dry eye to be 11%. Dry eye symptoms peaked at day 7 in our study. The cornea is one of the most highly innervated organs, with about 44 corneal nerve bundles entering the cornea around the limbus centripetally 15 and larger nerve fibers that run from the 9 o'clock to the 3 o'clock position and bifurcate to achieve a homogenous distribution over the entire cornea. Therefore, it is vulnerable to any damage within that region. Temporal corneal incisions created during phacoemulsification can reduce the corneal sensitivity in the surgical area and other areas far from the incision site.

## CONCLUSION

Cataract surgery is indeed capable of inducing dry eye symptoms and signs. Therefore, prior to surgery, patients must be informed about the possible increase in dry eye symptoms, and if indicated, artificial tears may be prescribed in the postoperative period. Future research should focus on realistic modifications to the phacoemulsification procedure to achieve a safer approach in patients with ocular surface disorders. When dry eye is diagnosed pre operatively, surgeon should add topical preservative free lubricating drops and in exceptional circumstances topical cyclosporine drops. One should use Ophthalmic Viscosurgical Devices (OVDs) on corneal surface during phacoemulsification cataract surgery to reduce the trauma induced by surgery and BSS irrigating solution flushing.

## ACKNOWLEDGMENT

None

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