



TO EVALUATE THE INCIDENCE AND SEVERITY PATTERN OF DRY EYE AFTER PHACOEMULSIFICATION

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ABSTRACT

Purpose: To evaluate the incidence and severity pattern of dry eye after phacoemulsification. Setting- Department of Ophthalmology, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha (M.H.) **Methods And Material:** A total of 100 eyes of patients undergoing cataract extraction by phacoemulsification in Ophthalmology department were selected. A detailed study of tear film stability and severity of dry eye was assessed pre-operatively and post-operatively of each eye to assess the incidence and severity pattern of dry eye after phacoemulsification. **Results:** The **incidence of dry eye** on post-operative day 7 was found to be 57% by TBUT and severity pattern of dry eye peaks on the post-operative day -7 and gradually improves with time. It was also noted that maximum patients had mild degree of dry eye on 7th post-operative day. There was similarity found in severity pattern between the two clinical tests and the OSDI questionnaire. **Conclusion:** Cataract extraction by phacoemulsification can induce dry eye by decreasing the TBUT and Schirmers' I test values. The incidence of tear film instability was more than that of decreased Schirmer's I Test values. Dry eye symptoms developed immediately after phacoemulsification and the severity peaked on day 7. Both the symptoms and signs of dry eye were improved over time usually 30th post-operative day and 45th post-operative day.

KEYWORDS: OSDI questionnaire, TBUT and Schirmers' I.

INTRODUCTION

Cataract is considered the leading cause of blindness in the world. At the same time, cataract surgery is ever advancing, rewarding and a boon in the field of ophthalmology.^[1]

TYPES OF SURGERY

- Conventional ECCE.
- SICS.
- Phacoemulsification.

Major complaints of patients are redness, irritation, blurring of vision foreign body sensation after cataract surgery. Effects are worse in patients with ocular surface disorder and in the elderly population. Some patients need effective treatment as the symptoms may remain the same without treatment. Aggravation of signs of dry eye and symptoms post cataract surgery has been reported by few studies. Thus patients may remain partially satisfied even after a good Snellen visual acuity and a perfect cataract surgery.^[1]

Clear corneal phacoemulsification is now one of the safest & successful surgeries, but like other corneal surgeries, it may disrupt normal tear function by altering the ocular surface. Although, very studies have been reported in view of dry eye in this surgery.^[2]

International Dry Eye Workshop stated in view of dry eye that, "A multifactorial disease of the tears and ocular surface that results in symptoms of discomfort, visual disturbance, and tear film instability with potential damage to the ocular surface. It is accompanied by increased osmolarity of the tear film and inflammation of the ocular surface."^[3]

Normal corneal innervation can be disrupted due to severe impact on corneal sensation caused by ocular surface disorders and surgical procedures that involve the cornea. (Lawrenson, 1997)^[4], and this can result in impaired healing of epithelial wound.

Tear film instability and reduced corneal sensitivity may be caused by a change in the action of corneal nerves

which may be due to release of inflammatory mediators caused by incisions in the cornea.^[6]

Schirmer's test is used as the most common objective diagnostic test for dry eye.^[7] It is more acceptable diagnostic test as the cost of strips is less and is easy to apply.^[8]

Another widely used method is TBUT (tear break up time) with fluorescein for diagnosis of dry eye. More reliable test considered is TBUT than the Schirmer test, as it is minimally invasive and is repeatable.^[9] The OSDI (ocular surface disease index) is a questionnaire that is validated and reliable. It assesses a patient's subjective preferences with dry eye disease. The most commonly used questionnaire for dry eye is the OSDI. However, some limitations of OSDI are inevitable.^[10]

The present study was conducted with objective to determine the incidence of dry eye and to detect dry eye problem level in cataract surgery by phacoemulsification in a tertiary care hospital with the hypothesis that clear corneal phacoemulsification induces dry eye.

AIMS AND OBJECTIVES

AIMS

- To evaluate the incidence of dry eye post phacoemulsification.
- To evaluate severity pattern of dry eye post phacoemulsification.

OBJECTIVES

1. To assess severity of dry eye 7th day after clear corneal phacoemulsification.
2. To study tear film stability 7th day after clear corneal phacoemulsification.
3. To assess the improvement of symptoms and signs of dry eye on 30th post-operative day and 45th post-operative day.

MATERIAL AND METHODS

STUDY DESIGN

It is a rural hospital based, Prospective observational study.

STUDY SETTING

- All patients attending the OPD of Ophthalmology of A.V.B.R.H. hospital (Sawangi) who willingly consented to participate in the study and met the inclusion criteria were counselled regarding the study and the disease, were selected. Informed consents were taken from all subjects with the consent form approved by the Institutional Ethical Committee of College.

PERIOD OF STUDY

The study period was of 2 years (October 2016 to September 2018).

SAMPLE SIZE: 100 eyes of 100 patients were taken.

ETHICAL ISSUES

Study was approved from the Institutional Ethics Committee of the University (Ref. No. DMIMS(DU)/IEC/2016-17/5020) and was carried out in accordance with the declaration of Helsinki (Annexure-I).

MATERIAL AND METHODS

Inclusion criteria

1. Patients undergoing phacoemulsification cataract surgery without preoperative dry eye. 2. Age 30-80 years. 3. Uneventful cataract extraction.

Exclusion criteria

1. Previous history of dry eye. 2. Patients on drugs causing dry eye within 30 days before surgery, beta blockers, anti histamines, decongestants, antidepressants etc. 3. Autoimmune diseases. 4. Pre-existing ocular diseases other than cataract. 4. Hypertension. 5. Diabetes Mellitus. 6. Previous ocular surgeries. 7. Ocular trauma. 8. Ocular allergies. 9. Contact lens wearers. 10. History of other neurotrophic disorders. 11. Presence of punctal cautery or punctal plugs. 12. Smokers. 13. Fundus abnormalities (retinopathies, degenerations etc).

After enrollment of the subject to the study all subjects had undergone a thorough ophthalmic examination was done.

- All the surgeries were done by a single experienced surgeon. Schirmer's Test without anaesthesia and Tear break up time (TBUT) by Slit lamp examination and OSDI scoring was done before the surgery. The questionnaire was modified by omitting question no. 4 & 5, which assesses the evidence of poor and blurred vision, as the symptoms may be caused due to cataract alone or combined with symptoms that are induced by dry eye hence, it was difficult to differentiate it. Peribulbar block containing 5ml lignocaine (2%) with 1 in 2 lakh units of Adrenaline + 150 units hyaluronidase was given to the patients pre-operatively. Patient then underwent clear corneal phacoemulsification cataract surgery with supero-temporal incision. At the end of surgery cornea was hydrated in order to achieve wound apposition. The operated eye was covered for 1 day after surgery. Patients undergoing clear corneal phacoemulsification were instilled moxifloxacin eye drop and Flurbiprofen sodium 0.03% w/v eye drop 6 times before surgery. Procedure was performed by a single surgeon. Combination of Tropicamide (0.8%)-phenylephrine hydrochloride (5%) with Benzalkonium chloride preservative 0.01% w/v was used 4 times before surgery in order to dilate the pupil. Post-operatively, patients received Homatropine 2% eye drops twice daily for 15 days and eye drops (Moxifloxacin 0.3% + Dexamethasone 0.1%) 4 times per day which was then tapered over a duration of 1 month. The tests and scoring were done on 7th day post-operatively, 30th day post-operatively as well as 45th day. TBUT was used to

calculate the incidence of dry eye.^[3] Dry eye severity pattern after phacoemulsification was obtained from the average of Schirmer I test, TBUT, OSDI scores. Analysis of results was done using SPSS software.

GRADING OF DRY EYE

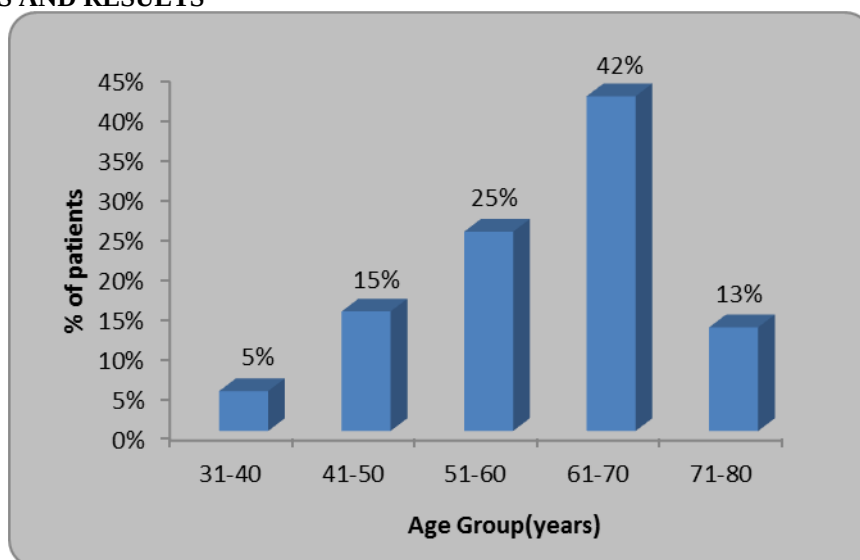
- BY TBUT^[57] : Values (in seconds) 10 or more than 10 was graded as normal, 6-10 as mild, 1-5 as moderate and 0 or immediate as severe.
- BY SCHIRMER'S -I TEST^[58]: Values (in mm) 10 or more than 10 was graded as normal, 6-10 as mild, 3-5 as moderate and 2 or less than 2 as severe.
- BY OSDI SCORING^[68]: scores between 0-12 was graded as normal, 13-22 as mild, 23-33 as moderate and 33-100 as severe.

Table no.1: Age wise distribution of patients who underwent phacoemulsification.

Age group	No. of patients	Percentage (%)
31-40	5	5
41-50	15	15
51-60	25	25
61-70	42	42
71-80	13	13
Total	100	100
Mean±SD	60.76 ± 10.18(Range:33-79 yrs)	

In the present study 100 patients were included; the youngest patient was of 33 years of age and the oldest was 77 years of age. The commonest age group was 61-70 years which comprised of 42 patients. The mean age was 60.76 ± 10.18years.

OBSERVATIONS AND RESULTS

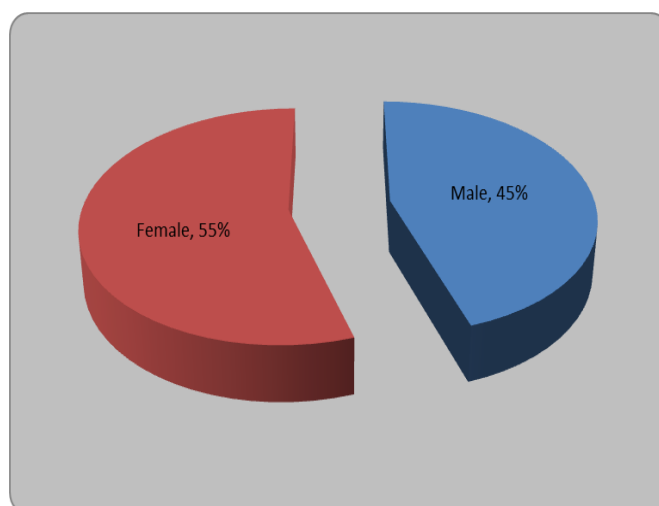


Graph no.1: Age wise distribution of patients who underwent phacoemulsification.

Table no.2: Gender wise distribution of patients who underwent phacoemulsification.

Gender	No of patients	Percentage(%)
Male	45	45
Female	55	55
Total	100	100

In the present study out of 100 patients; 45 patients were male and 55 patients were female, the male to female ratio was 1:1.2, hence female preponderance was seen.



Graph no.2: Gender wise distribution of patients who underwent phacoemulsification.

Table no.3: Table showing TBUT values of patients before and after phacoemulsification.

Age group	No. of patients	TBUT(seconds)			
		Pre-op day	Post-operative		
			Day 7	Day 30	Day 45
31-40	5	13.60±1.17	11.64±0.59	11.22±2.35	12.92±0.72
41-50	15	14.38±0.91	11.58±1.08	11.92±1.77	13.36±0.95
51-60	25	13.49±0.79	9.64±2.27	11.24±2.12	12.10±1.47
61-70	42	13.51±1.14	9.08±2.58	10.75±2.57	11.55±1.77
71-80	13	11.96±0.49	6.49±1.21	10.51±2.17	9.59±0.43
Total	100	13.44±1.15	9.39±2.55	11.05±2.29	11.77±1.76
F-value		11.84	11	0.91	13.31
p-value		0.0001,S	0.0001,S	0.45,NS	0.0001,S

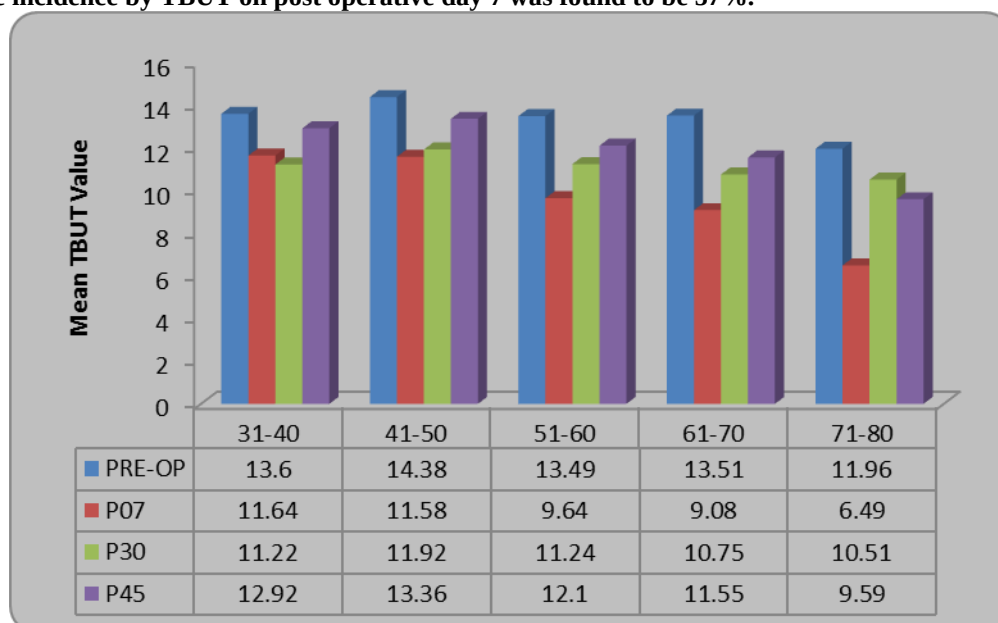
In the present study, out of 100 patients; the mean pre-operative TBUT value was 13.44±1.15 seconds. The mean value on 7th, 30th and 45th post operative day was 9.39±2.55, 11.05±2.29 and 11.77±1.76 seconds respectively.

The lowest pre-operative TBUT recorded was 11.96±0.49seconds in the age group of 71-80years with the post-operatively values on 7th, 30th and 45th being

6.49±1.21, 10.51±2.17 and 9.59±0.43 seconds respectively.

The highest pre-operative TBUT recorded was 14.38±0.91seconds in the age group of 41-50years with the post-operatively values on 7th, 30th and 45th being 11.58±1.08, 11.92±1.77 and 13.36±0.95 seconds respectively.

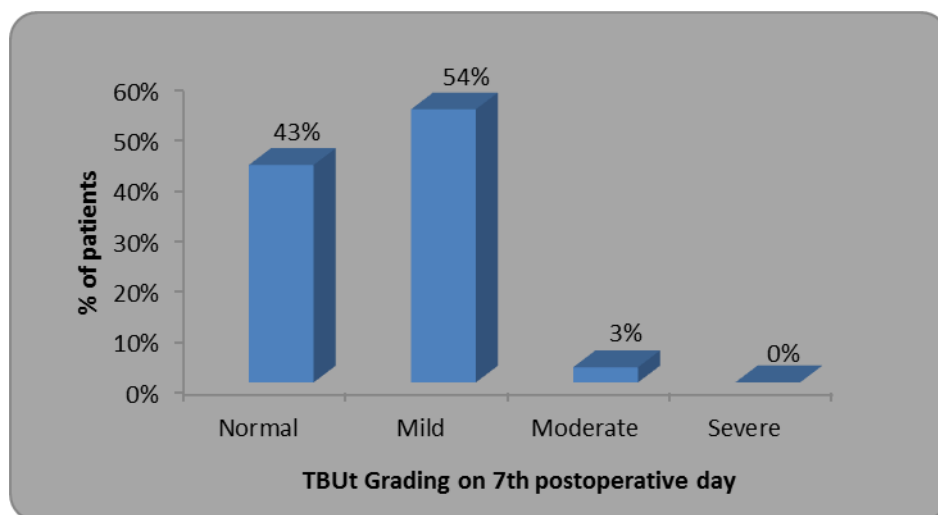
The dry eye incidence by TBUT on post operative day 7 was found to be 57%.

**Graph no.3: Graph showing TBUT values of patients before and after phacoemulsification.****Table No. 04: Table showing grading of dry eye according to TBUT in 7th post operative day.**

Grading	No. of patients	% of patients (n=100)	Incidence Of Dry Eye
Normal (>10secs)	43	43%	57%
Mild (6-10secs)	54	54%	
Moderate (1-5 secs)	03	03%	
Severe (0 secs/immediate)	00	00%	

In the present study of 100 patients, 43 patients had normal TBUT values on the 7th post operative day while 54 patients had mild grade of dry eye and only 3 patients had moderate grade of dry eye. No patients in the present

study had severe grade of dry eye. The table also shows the dry incidence in the present study which is to be calculated according to TBUT on 7th post operative day, and is found to be 57%.



Graph. No. 04: Graph showing grading of dry eye according to TBUT in 7th post operative day.

Table no.05: Table showing ST-1 values of patients before and after phacoemulsification.

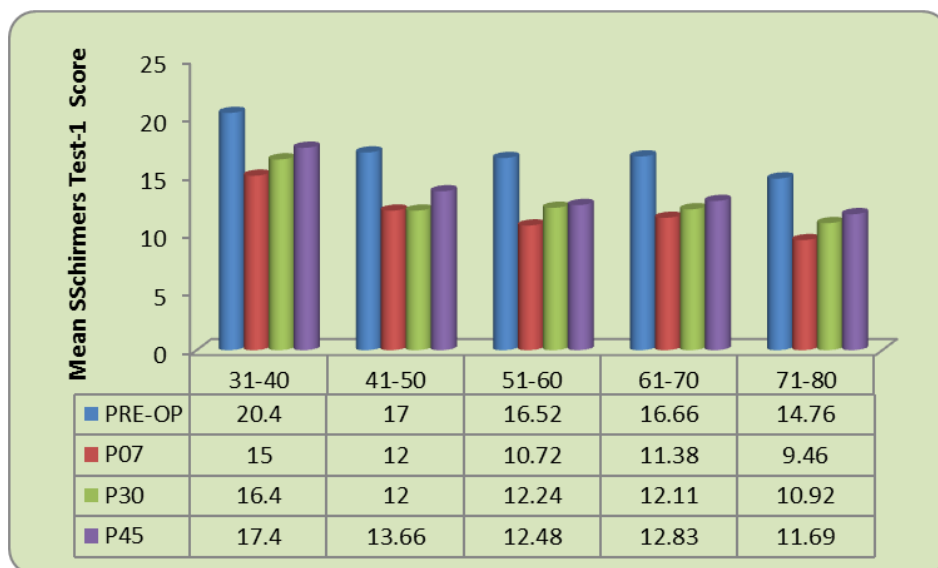
Age group	No. of patients	SCHIRMERS TEST-1			
		Pre-op day	Pre-operative		
			Day 07	Day 30	Day 45
31-40	5	20.40±1.14	15±1.41	16.40±1.14	17.40±1.51
41-50	15	17±2.20	12±2.85	12±3.72	13.66±2.31
51-60	25	16.52±1.91	10.72±2.97	12.24±2.55	12.48±3.26
61-70	42	16.66±1.99	11.38±2.92	12.11±2.92	12.83±2.26
71-80	13	14.76±1.09	9.46±1.39	10.92±1.55	11.69±1.65
Total	100	16.62±2.14	11.24±2.90	12.19±2.92	12.95±2.69
F-value		0.62	8.29	4.28	3.56
p-value		0.64,NS	0.0001,S	0.003,S	0.009,S

In the present study, out of 100 patients; the mean pre-operative ST-I value was 16.62±2.14 mm. The mean values on 7th, 30th and 45th post operative day were 11.24±2.90, 12.19±2.92 and 12.95±2.69mm respectively.

The lowest pre-operative ST-I value recorded was 14.76±1.09 mm in the age group of 71-80years with the

post-operatively values on 7th, 30th and 45th being 9.46±1.39, 10.92±1.55 and 11.69±1.65 mm respectively.

The highest pre-operative ST-I value recorded was 20.40±1.14 mm in the age group of 31-40years with the post-operatively values on 7th, 30th and 45th being 15±1.41, 16.40 ±1.14 and 17.40±1.51 mm respectively.



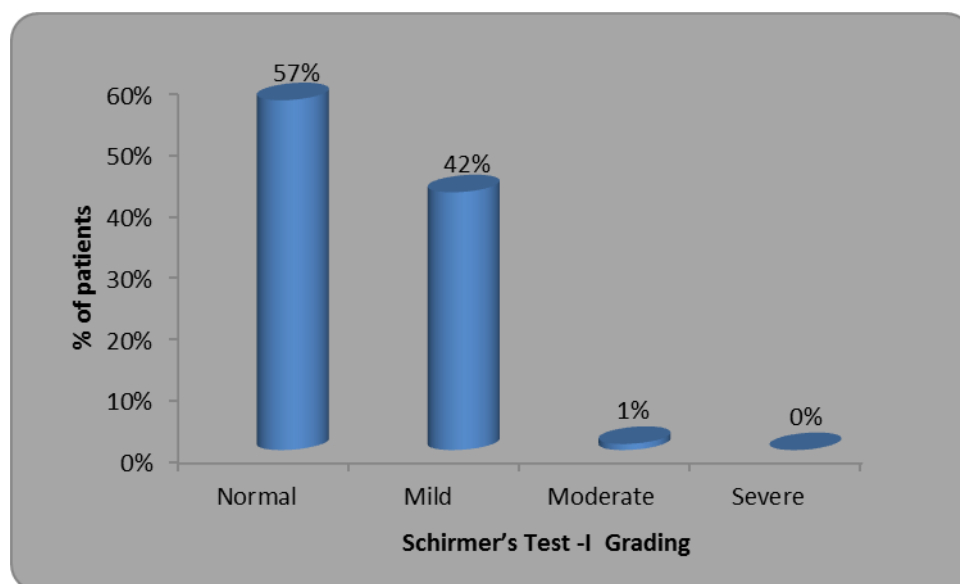
Graph no.05 ST-1 values of patients before and after phacoemulsification.

Table No.06: Table showing grading of dry eye according to ST-I in 7th post operative day.

Grading	No. of patients	% of patients (n=100)
Normal (>10mm)	57	57%
Mild (6-10mm)	42	42%
Moderate (3-5 mm)	01	01%
Severe (<2mm)	00	00%

In the present study of 100 patients, 57 patients had normal ST-I values on the 7th post operative day while 42 patients had mild grade of dry eye and only 01 patient

had moderate grade of dry eye. no patients in the present study had severe grade of dry eye.

**Graph No.06: Graph showing grading of dry eye according to ST-I in 7th post operative day.****Table no.07: Table showing OSDI Scores of patients before and after phacoemulsification.**

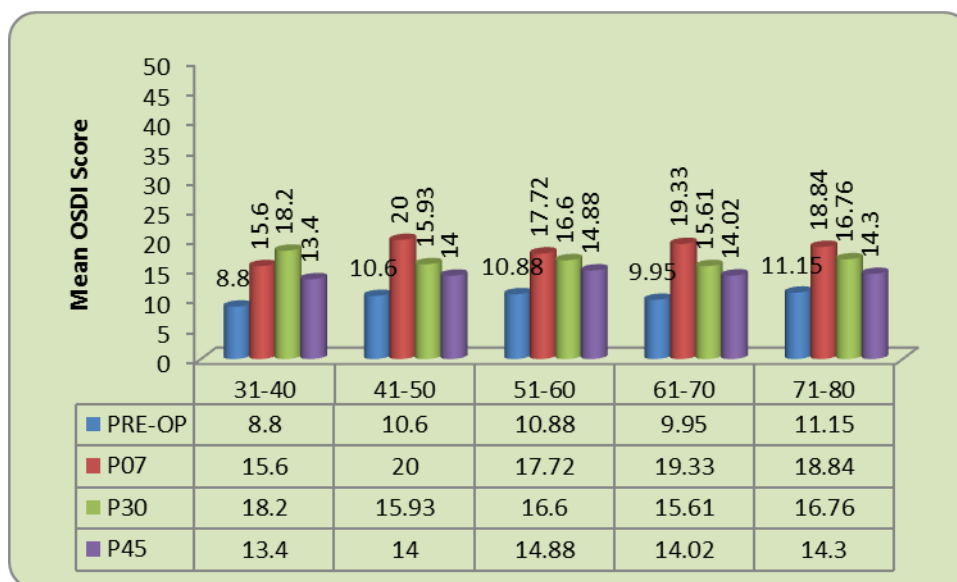
Age group	No. of patients	OSDI SCORE			
		Pre-op day	Post-operative		
			Day 07	Day 30	Day 45
31-40	5	8.80±1.30	15.60±5.89	18.20±5.26	13.40±1.34
41-50	15	10.60±2.58	20±8.33	15.93±5.48	14±2.20
51-60	25	10.88±2.24	17.72±5.82	16.60±3.45	14.88±2.31
61-70	42	9.95±2.51	19.33±6.05	15.61±3.26	14.02±1.96
71-80	13	11.15±1.40	18.84±4.93	16.76±4.74	14.30±2.21
Total	100	10.38±2.33	18.78±6.22	16.19±3.98	14.24±2.10
F-value		1.64	0.72	0.67	0.93
p-value		0.17,NS	0.57,NS	0.61,NS	0.44,NS

In the present study, out of 100 patients; the mean pre-operative OSDI score was 10.38±2.33. The mean score on 7th, 30th and 45th post operative day were 18.78±6.22, 16.19±3.98 and 14.24±2.10 respectively.

The lowest pre-operative OSDI score recorded was 8.80±1.30 in the age group of 31-40years with the post-

operatively scores on 7th, 30th and 45th being 15.60±5.89, 18.20±5.26 and 13.40±1.34 respectively.

The highest pre-operative score recorded was 11.15±1.40 in the age group of 71-80years with the post-operatively values on 7th, 30th and 45th being 18.84±4.93, 16.76±4.74 and 14.30±2.21 respectively.



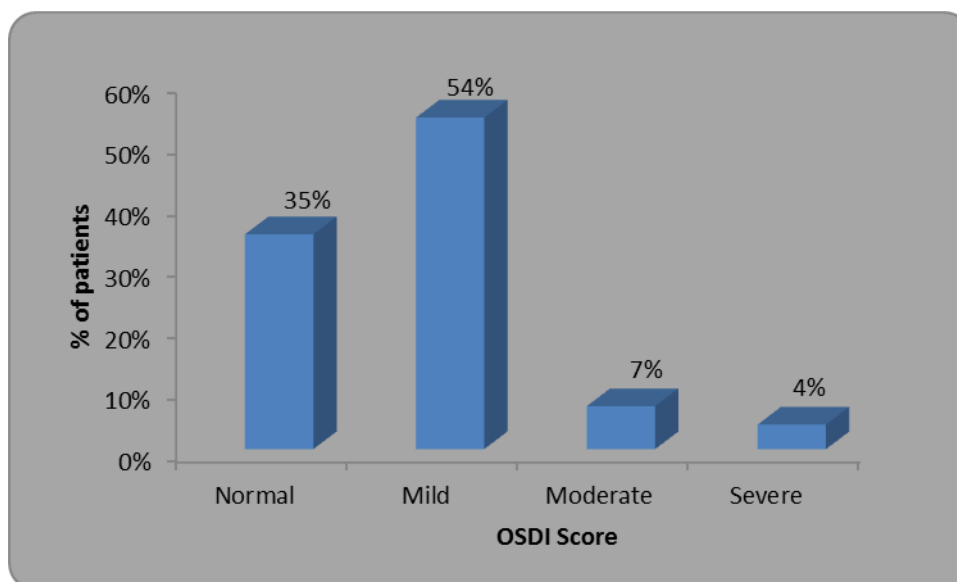
Graph no.07: Graph showing OSDI Score values of patient before and after phacoemulsification.

Table no.08: Table showing grading of dry eye according to OSDI Scoring on 7th post operative day.

Grading	No. of patients	% of patients(n=100)
Normal (0-12)	35	35%
Mild (13-22)	54	54%
Moderate (23-32 mm)	07	07%
Severe (33-100)	04	04%

In the present study of 100 patients, 35 patients had normal OSDI Score on the 7th post operative day while 54 patients had mild grade of dry eye, 07 patients had

moderate grade of dry eye and only 4 patients had severe grade of dry eye.



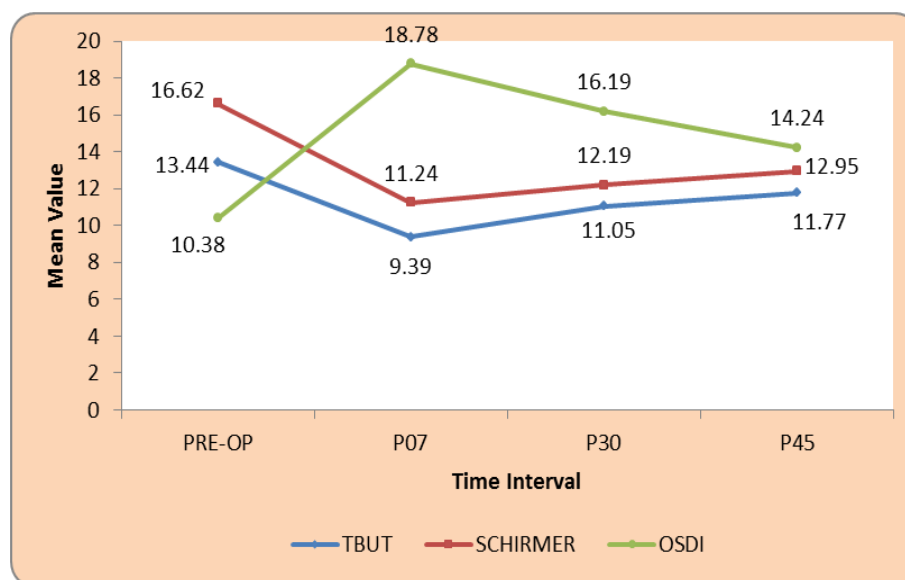
Graph no.08: Graph Showing grading of dry eye according to OSDI Scoring on 7th post-operative day.

Table no.09 Table showing mean values of TBUT, ST-I and OSDI Score in patients (n=100) before and after phacoemulsification.

STUDY	Pre-op day	Post-operative		
		Day 07	Day 30	Day 45
TBUT	13.44±1.15	9.39±2.55	11.05±2.29	11.77±1.76
p-value	-	22.26 p=0.0001,S	10.02 P=0.0001,S	14.37 P=0.0001,S
ST-I	16.62±2.14	11.24±2.90	12.19±2.92	12.95±2.69
p-value	-	29.22 P=0.0001,S	24.24 P=0.0001,S	24.07 P=0.0001,S
OSDI	10.38±2.33	18.78±6.22	16.19±3.98	14.24±2.10
p-value	-	15.88 P=0.0001,S	15.31 P=0.0001,S	15.78 P=0.0001,S

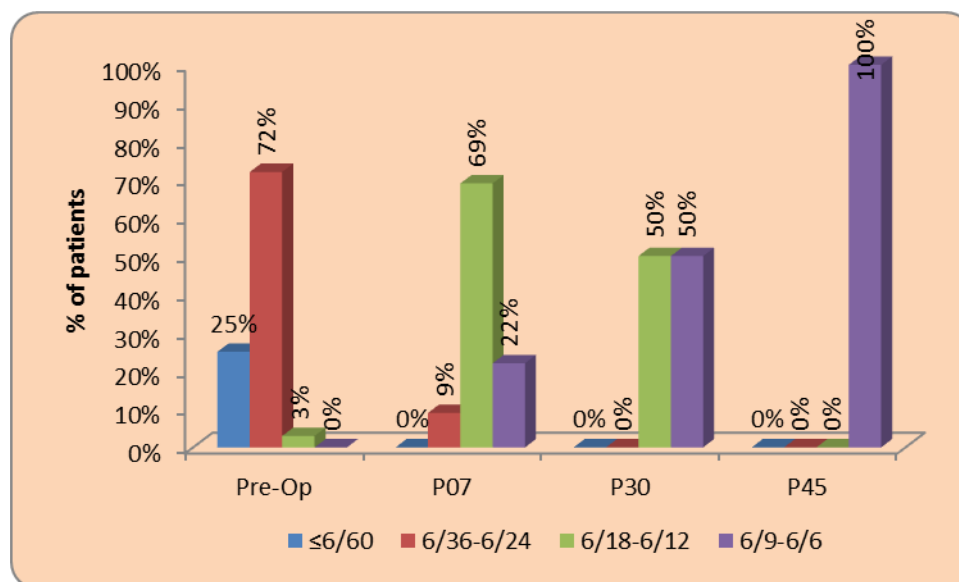
In the present study, out of 100 patients, the TBUT, ST-I and OSDI Scoring was done and the Table no.09 correlates all the mean values of the three tests in the pre-operative day and post-operative days 7th, 30th and 45th. The p-values were found to be statistically significant in TBUT between the pre-operative period and post-operative 7th, 30th and 45th day in all the three tests i.e. TBUT, ST-I and OSDI Scoring. This signifies that all the pre-operative values were within normal range in respect to the particular tests and there was significant fall in the

values of TBUT, ST-I and worsening of OSDI Score in the post-operative day 7 i.e. the dry eye after phacoemulsification was found to be at the peak level on 7th day post-operative and further the dry eye status may improve on post-operative 30th and 45th days. It also signifies that the preoperative values are not attained by the 45th day after surgery. Hence, according to the above mentioned values and observations it can be concluded that the severity pattern of dry eye peaks on the post-operative day 7 and gradually decreases with time.

**Graph no.09:** Graph showing mean values of TBUT, ST-1 and OSDI score in patients (N=100) before and after phacoemulsification.**Table no.10:** Table showing visual acuity on Snellen's chart in patients before and after phacoemulsification.

	Visual Acuity	≤6/60	6/36-6/24	6/18-6/12	6/9-6/6
Pre-operative day		25	72	3	0
Post-operative day	Day 07	0	9	69	22
	Day 30	0	0	50	50
	Day 45	0	0	0	100

The table no 10 summarizes all the values of BCVA in the pre-operative and post-operative day 7, 30, 45 respectively.



Graph no.10: Graph showing visual acuity in patients before and after phacoemulsification.

DISCUSSION

Dry eye, which is a multifactorial disease of the ocular surface and tears which can be evaporative in nature and can be a result of aqueous deficiency. The incidence rates of dry eye in population based long term studies have shown to be 13.3% and 21.6% in a follow up duration of 5 and 10 years respectively. As there is no gold standard test for the assessment of dry eye, a group of diagnostic tests with different sensitivities and specificities and some questionnaires can help in diagnosis of dry eye for further implication of the treatment strategy. The reason why OSDI Score was used because OSDI Score assesses the effects, natural history and severity of dry eye reliably. Tear film stability can easily be detected by TBUT. The neurogenic response of the ocular surface can be interrupted due to phacoemulsification and lead to decreased tear secretion.

The present study included assessment of tear film stability and tear secretion in patients who underwent cataract extraction by phacoemulsification pre and post operatively. Tear film stability was assessed by TBUT while the severity of dry eye was measured using ST-I and OSDI Scoring. TBUT on the 7th post-operative day was assessed after phacoemulsification in view of incidence of dry eye. Severity pattern was obtained from the average of OSDI scores, tear break-up time TBUT & ST-I.

• AGE

Mean age was 60.76 ± 10.18 years in the present study.

Sahu et al^[49] (2015) study showed mean age of 60.85±6.92 years (n= 100) in their subjects

Singh et al^[58] (2015) study showed mean age of 64.6 ± 7.1 years (n= 65) in their subjects.

Park et al^[69] (2016) study showed mean age of 64.18 ± 6.02 years (n=34) in their subjects.

J S Kim et al^[50] (2016) study showed mean age of 65.0 ± 13.8 years (n=43) in their subjects.

Charu jain et al^[61] (2018) study showed mean age of 58.8 ± 6.92 years (n=60) in their subjects.

Mean age was found to be similar in above mentioned studies as in the present study.

• SEX

In the present study female preponderance was seen.

M:F ratio was 1:1.22(n= 100 subjects).

M:F ratio in a study done by **Kasetsuwan et al^[55] (2013)** was 1:1.96 (n=92), while in the study by **Kamal dodia et al^[10] (2013)** it was 1:1.26 (n=272), by **Sahu et al^[49] (2015)** it was 1:1.43 (n=100), by **Das gupta et al^[59] (2016)** it was 1:1.12 (n=100), by **Xue et al^[70] (2018)** it was 1:1.14 (n=101) which was congruous to the present study conducted.

In a study by **Charu jain et al^[61] (2018)** M:F was **1:0.76 (n=60)** where male preponderance was seen, which was not congruous to the present study. Which may be due to less number of patients enrolled in the study.

TEAR BREAK UP TIME

TBUT Preoperatively

The mean TBUT on the pre-operative day in the present study was 13.44 ± 1.15 seconds which was similar to the studies conducted by **Kasetsuwan et al^[55] (2013)**, **Peter mark et al^[71] (2013)**, **Yusuf et al^[60] (2014)**, **Yuli park et al^[69] (2016)** and **Munish et al^[72] (2018)** in which the mean pre-op TBUT value was 12.15 seconds, 14.01 ± 0.56 seconds, 12.21 ± 2.96 seconds, 13.5 ± 2.5 seconds and 13.32 seconds respectively.

The studies conducted by **Kamal Dodia et al^[10] (2013)** and **Dasgupta et al^[59] (2016)** the mean pre-op TBUT value was 11.69 ± 3.60 seconds and 11.46 ± 1.72

seconds respectively. The values were marginally similar to the present study.

TBUT POST-OPERATIVE DAY 7

The mean TBUT value on the post-operative day 7 in the present study was 9.39 ± 2.55 seconds, which was similar to the studies conducted by Xi LIU et al^[73] (2008), Yusuf et al^[60] (2014) and Munish et al^[72] (2018) in which the mean TBUT value on 7th post-operative day was 10.2 ± 0.8 seconds, 10.96 ± 3.02 seconds and 10.85 seconds respectively.

In the studies conducted by Mohana et al^[1] (2014) and Das gupta et al^[59] (2016) the mean TBUT value on 7th post-operative day was 7.53 ± 1.89 seconds and 7.88 ± 1.89 seconds which was marginally similar to the present study.

INCIDENCE OF DRY EYE: According to the present study, the incidence of dry eye by TBUT was found to be 57% which was similar to the study conducted by Kasetsuwan et al (2013) in which the incidence by TBUT was 68.4% (52.9–83.9).

TBUT- POST-OPERATIVE DAY 30

The mean TBUT value on the post -operative day 30 in the present study was 11.05 ± 2.29 seconds.

In Sahu et al^[49] (2015) study it was 9.66 ± 3.06 seconds. In Das gupta et al^[59] (2016) study it was 9.66 ± 1.37 seconds.

In Munish et al^[72] (2018) study it was 11.41 seconds. All the above three studies were congruous with the present study.

TBUT-POST-OPERATIVE DAY 45

The mean TBUT value on the post -operative day 45 in the present study was 11.5 ± 1.76 seconds.

In a study conducted by Gayathri et al^[74] (2017) the mean TBUT value on 45TH post-operative day was 8.12 ± 3.45 seconds which was similar to the present study.

GRADING OF DRY EYE BY TBUT

In the present study, out of 100 patients, 54 patients (54%) had mild degree of dry eye and only 03 patients (03%) had moderated dry eye while none of the patients had severe dry eye according to TBUT.

The findings of the present study was found to be contrasting with the findings of the study done by Charu et al in the year 2018 where out of 60 patients, only 35% patients had mild dry eye, 15% patients had moderate dry eye according to TBUT. The difference in the findings may be due to small sample size ($n = 60$) in the study done by charu et al.

SCHIRMER'S TEST I

ST-I PREOPERATIVELY

The mean ST-I value on the pre-operative day in the present study was 16.62 ± 2.14 , which was similar to the studies conducted by Y K Cho et al^[52] (2009), Peter

Mark et al^[71] (2013), Sahu et al^[49] (2015) and Yuli Park et al^[69] (2016) in which the mean pre-op ST-I value was 17.74 ± 6.43 , 18.78 ± 1.17 , 18.78 ± 1.17 and 17.4 ± 5.9 respectively.

ST-I POST OPERATIVE DAY 7

The mean ST-I value on the post-operative day 7 in the present study was 11.24 ± 2.90 .

In Xi LIU et al^[73] (2001) study it was 14.45 ± 0.8 .

In Ratna et al^[54] (2008) study it was 13.47 ± 4.29 .

In Peter Mark et al^[71] (2013) study it was 14.02 ± 1.52 .

In Das Gupta et al^[59] (2016) study it was 11.96 ± 1.93 .

All the above mentioned four studies were congruous with the present study

ST-I POST OPERATIVE DAY 30:

The mean ST-I value on the post-operative day 30 in the present study was 12.19 ± 2.94 , which was similar to the studies conducted by Xi LIU et al^[73] (2001), Y K Cho et al^[52] (2009), Peter Mark et al^[71] (2013), Yusuf et al^[60] (2014), Das Gupta et al^[59] (2016) and Maierhaba et al^[66] (2018) in which the mean post-op day 30 ST-I value was 13.3 ± 0.8 , 13.08 ± 4.52 , 14.91 ± 1.48 , 14.86 ± 1.66 , 10.38 ± 1.57 and 11.6 ± 6.7 respectively

ST-I POST OPERATIVE DAY 45

The mean ST-I value on the post-operative day 45 in the present study was 12.95 ± 2.69 In a study conducted by Gayathri et al^[74] (2001) the mean post-op day 45 ST-I value was 11.07 ± 7.35 .

There was only one study found to be comparable to the values of Schirmers –I test on 45th post operative day and the results found were matchable to the present study.

GRADING OF DRY EYE BY SCHIRMER'S-I TEST

In the present study, out of 100 patients, 42 patients (42%) had mild degree of dry eye and only 01 patient (01%) had moderate dry eye while none of the patients had severe dry eye according to schirmer's- I test.

The findings of the present study was found to be contrasting with the findings of the study done by Charu et al^[61] in the year 2018 where out of 60 patients, only 8.33% patients had mild dry eye, 5% patients had moderate dry eye and 11.6% patients had severe dry eye according to schirmer's - I test. The difference in the findings may be due to small sample size ($n = 60$) in the study done by Charu et al.^[60]

OCULAR SURFACE DISEASE INDEX SCORING.

OSDI SCORE- PREOPERATIVELY

The mean OSDI Score on the pre-operative day in the present study was 10.38 ± 2.33 which was markedly similar with the studies conducted by Kasetsuwan et al^[55] (2013), Maierhaba et al^[66] (2018), Xue et al^[70] (2018) in which the mean values were 12.57, 8.8 ± 10.0 and 12.5 respectively.

OSDI SCORE- POST-OPERATIVE DAY 7

The mean OSDI Score on the post-operative day 7 in the present study was 18.78 ± 6.22 which was found to be similar with the study conducted by Peter Mark et al^[71] (2013) in which the mean post-op day 7 OSDI Score was 13.1 ± 1.61 .

OSDI SCORE- POST-OPERATIVE DAY 30

The mean OSDI Score on the post-operative day 30 in our present study was 16.19 ± 3.98 which was found similar to the studies conducted by Kasetsuwan et al^[55] (2013), Maierhaba et al^[66] (2018) which had the mean post-op day 30 OSDI Score 17.34 & 16.0 ± 14.7 respectively.

While in a study conducted by Peter Mark et al^[71] (2013) had the mean post-op day 30, OSDI Score 11.86 ± 1.77 which was found contrasting to the present study.

OSDI SCORE- POST-OPERATIVE DAY 45

The mean OSDI Score on the post-operative day 45 in the present study was 14.24 ± 2.10 .

In a study conducted by Gayathri et al^[74] (2017) the mean post-op day 45 OSDI Score was 22.52 ± 16.15 which was similar with the present study.

GRADING OF DRY EYE BY OSDI SCORE

In the present study, out of 100 patients, 54 patients (54%) had mild degree of dry eye, 07 patients (7%) had moderated dry eye while only 04 patients (4%) had severe dry eye according to OSDI Scoring.

CONCLUSION

Cataract extraction by phacoemulsification can induce dry eye by decreasing the TBUT and Schirmers' I test values. The incidence of tear film instability was more than that of decreased Schirmer's I Test values. Phacoemulsification also produces symptoms like discomfort and irritation which further affects the patients' quality of life post surgery as well as visual outcome in the early post operative period. Hence, it was found that the incidence of dry eye on post operative day 7 was 57% by TBUT and severity pattern of dry eye peaks on the post operative day 7 and gradually improves with time. It was also noted that maximum patients had mild degree of dry eye on 7th post operative day.

LIMITATIONS OF THE STUDY

Small sample size, Schirmers test I without anaesthesia measures both reflex and basal secretion and so only basal tear secretion of the patient was not known, Short follow-up period.

RECOMMENDATIONS

On the pre-operative period, patients should be assessed for tear film stability and tear film secretion. Preservative free lubricant eye drops should be added in the immediate post-operative period. Topical medication used in the pre-operative periods should be preservative free. Patients with pre-operative dry eye should be

counseled regarding further development of dry eye and should be made aware of the signs and symptoms.

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