RESEARCH PAPER

Prevalence and Severity of Dry Eye Disease Following Phacoemulsification Cataract Surgery

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ABSTRACT

The aim of our study is:

1. To determine the incidence of dry eye disease among patients undergoing phacoemulsification.
2. To study the severity pattern of dry eye disease among patients undergoing phacoemulsification.

Design: Prospective study

Materials and Methods: 200 uncomplicated cataract patients were selected for

study. Dry eye incidence and pattern were analyzed preoperatively and at days 1, 7, 30 and 90 after phacoemulsification using (1) Ocular Surface Disease Index (OSDI) questionnaire, (2) tear break up time (TBUT), (3) rose bengal staining, (4) Schirmer I test without anesthesia and (5) Schirmer 2 test with anesthesia. Data was evaluated and studied.

Results: The incidence of dry eye was 25%. The severity of dry eye was increased post-phacoemulsification and was measured by OSDI questionnaire and all four clinical tests.

Conclusion: It is important for ophthalmologists to assess the dry eye in pre-operative and postoperative period to ensure proper treatment , quality of vision and the quality of life of the patients.

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INTRODUCTION

Dry eye disease (keratoconjunctivitis sicca) is a disorder of tear film due to tear deficiency or excessive tear evaporation.[1] Dry eye syndrome (DES) is one of the most frequently encountered ocular morbidities. Twenty-five percent of patients who visit ophthalmology clinics report symptoms of dry eye, making it a growing public health problem. Studies reported the prevalence of dry eye to be varying from 5% to as high as 73.5%[2]. Another update from the international DEWS stated that the global prevalence of dry eye is about 17% while several other studies show a higher prevalence of approximately 30% in people of Asian descent.

Factors that are responsible for development of dry eye after cataract surgeries include

- Prolonged use of post-operative medications antibiotic-steroids eyedrops with preservatives.
- The surface irregularity which is caused at site of incision reduces tear film breakup time.
- Mucin production is reduced from the conjunctiva secondary to incision.
- Corneo-lacrimal gland loop is disrupted.
- Inflammatory mediators which are released after corneal incisions change the actions of the corneal nerves and reduce corneal sensitivity resulting in instability of tear fim.
- Prolonged exposure to light from operating microscope during procedure.[8].
- The cornea is vigourously irrigated and ocular surface is manipulated intraoperatively will effect the tear film stability and thereby decreasing goblet cell density and cause shortened break up time post-operatively
- Topical eyedrops which are administered before and after surgery may contain certain preservatives like Benzalkonium chloride may cause instable tear film and decrease mucin expressing cells causing dry eye after surgery

Phacoemulsification is commonly performed surgery worldwide, where a smaller incision is created and ultrasonic driven oscillating tips are used to emulsify or fragment crystalline lens. Few studies reported incidence of dry eye syndrome post-operatively in patients who underwent phacoemulsification. The purpose of this study is to identify the incidence of dry eye syndrome and to detect the pattern of dry eye after phacoemulsification .

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MATERIALS AND METHODS

- **STUDY SETTING**: This study was done in department of OPHTHALMOLOGY in APOLLO INSTITUTE OF MEDICAL SCIENCES AND REEARCH,CHITTOOR.
- **STUDY DESIGN**: Hospital based prospective study
- **STUDY PERIOD**: Study done over a period of 12 months
- **STUDY SAMPLE**: Patients who underwent phacoemulsification were included in the inclusion criteria and subjected for study.

INCLUSION CRITERIA:

1.Study material consisted of 200 cases, who are willing to undergo phacoemulsification.

2. Patients who gave consent for study

3.Patients who are coming for regular post-operative follow-ups

EXCLUSION CRITERIA:

OCULAR

Previously diagnosed with dry eye disease

History of pterygium excision

Previous eye surgery

History of eye trauma

History of ocular allergies

History of other neurotrophic disorders

Chronic inflammation of ocular surface

Lid abnormalities (i.e. trichiasis, Conjunctival scarring or lagophthalmos, ptosis)

Contact lens wearer

Systemic

Patients with diabetes and hypertension

Miscellaneous

Smokers

Patients who did not give consent for study

Pre-operative dry eye evaluation

1.Schirmer's Test-1

Without the use of topical anesthesia, schirmers -1 test was performed and wetting of schirmers strip values were noted

2.Schirmers Test 2

Topical anaesthetic Proparacaine was instilled into the conjunctiva and excess fluid was dried using filter paper , schirmers strip values were noted after 5min.

.3.Tear film break up time:

TBUT assessment done and readings were analyzed to assess the stability of pre-corneal tear film.

4. Rose Bengal stain:

Rose Bengal staining was performed by using sterile Rose Bengal paper strip, on the slit lamp using red free filter to see any corneal or conjunctival staining.

5. Ocular surface disease index

A structured symptom-based survey was conducted to identify patients with symptoms suggestive of dry eyes.

. HAVE YOU EXPERIENCED ANY OF THE FOLLOWING DURING THE LAST WEEK:

	All the time	Most of the time	Half of the time	Sometimes	Never
Eyes that are sensitive to light	4	3	2	1	0
Eyes that feel gritty	4	3	2	1	0
Painful or sore eyes	4	3	2	1	0
Blurred vision	4	3	2	1	0
Poor vision	4	3	2	1	0

Sub-total score-

WHETHER IRRITABILITY OF EYES LIMITED YOU IN PERFORMING ANY OF THE FOLLOWING DURING THE LAST WEEK

	All the time	Most of the time	Half of the time	Sometimes	Never
Reading	4	3	2	1	0
Driving at night	4	3	2	1	0
Working with a computer	4	3	2	1	0
Watching T.V	4	3	2	1	0

Sub-total score-

WHETHER YOUR EYES FELT UNCOMFORTABLE IN ANY OF THE FOLLOWING SITUATIONS DURING THE LAST WEEK

	All the time	Most of the time	Half of the time	Sometimes	Never
Windy conditions	4	3	2	1	0
Places or areas with low humidity	4	3	2	1	0
Areas that are air conditioned	4	3	2	1	0

Sub-total score =

OSDI = Sum of scores for all questions answered ×25

Total number of questions answered

Total score=

Post operative work-up

The above tests were performed on all patients and post-operative assessment of dry eye was done on day 1 ,7,30 and 90

Statistical analysis:

Data will be entered in MS-Excel and analyzed by using SPSS V25. Normality will be

checked by using the Kolmogorov smirnov test. Descriptive statistics will be represented with percentages, Mean with SD. Repeated ANOVA test will be applied based on the nature of the distribution. P<0.05 will be considered as statistically significant.

RESULTS AND ANALYSIS

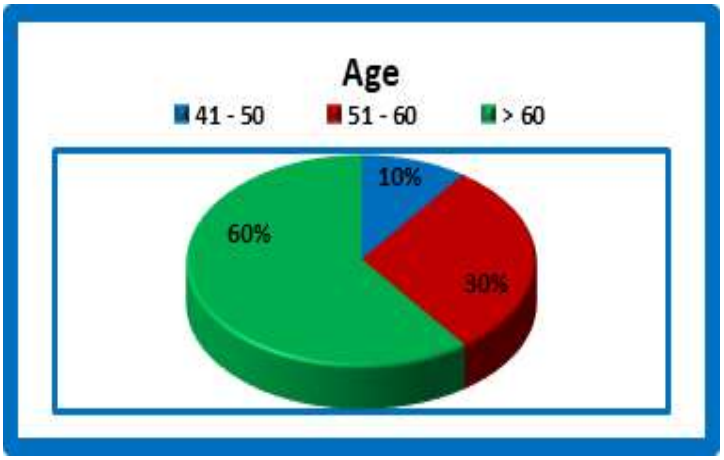
In the present hospital based prospective study, conducted over a period of 1year with a sample size of 200 patients attending Ophthalmology out-patient department, Apollo Institute of Medical Sciences and Research, Chittoor. All the surgeries were done by a single surgeon. The results of the study were

1. AGE DISTRIBUTION

Age of the patients included in the study ranged from 40 to 80 years. Tabulation for the age distribution as shown below

Table 1. Distribution of age

AGE	Total no of patients	%
41-50	20	10%
51-60	60	30%
>60	120	60%
Total	200	100%

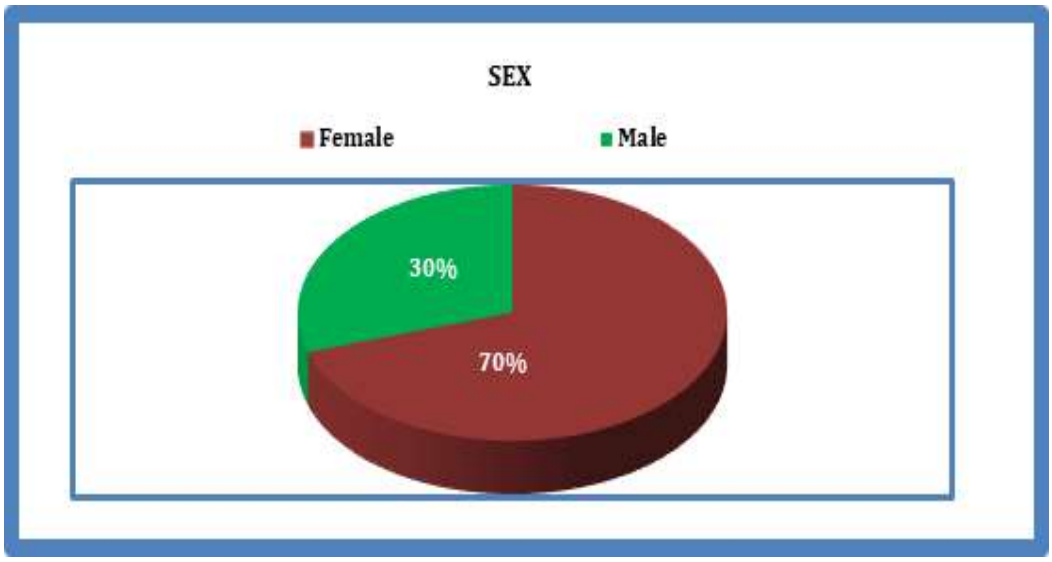


2. GENDER DISTRIBUTION

Gender distribution was shown as below

Table 2: Gender distribution

SEX	Frequency	%
Females	140	70%
Males	60	30%
Total	200	100%

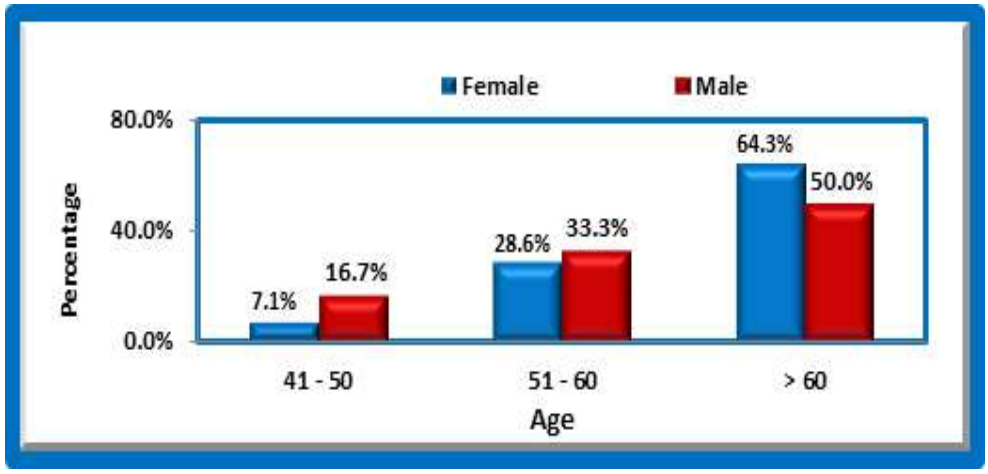


3. GENDER DISTRIBUTION IN DIFFERENT AGE GROUPS

Gender distribution in different age groups is shown as below

Table 3 : Gender distribution in different age groups

Age	Sex				Total	
	Female		Male			
	Count	%	Count	%	Count	%
41 - 50	10	7.1%	10	16.7%	20	10.0%
51 - 60	40	28.6%	20	33.3%	60	30.0%
> 60	90	64.3%	30	50.0%	120	60.0%
Total	140	100.0%	60	100.0%	200	100.0%

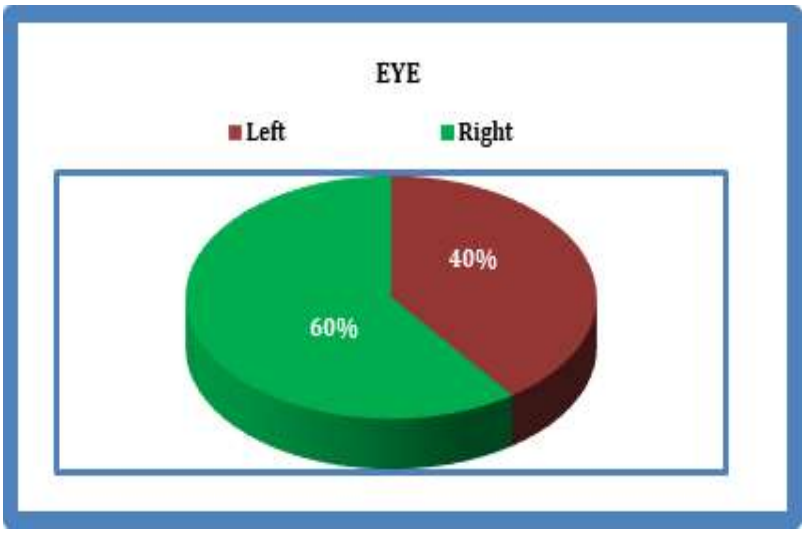


4. EYE

Distribution of eye during this study

Table 4: Distribution of eye

EYE	FREQUENCY	%
LEFT	80	40%
RIGHT	120	60%
TOTAL	200	100%

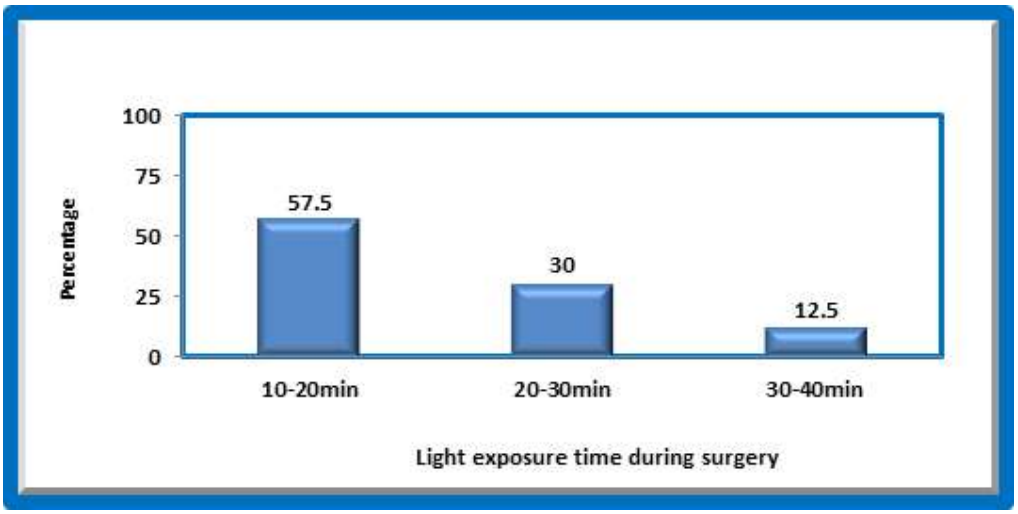


5. LIGHT EXPOSURE FROM OPERATING MICROSCOPE

Light exposure from operating microscope weretabulated as below

Table 5: Light exposure time from operating microscope during surgery

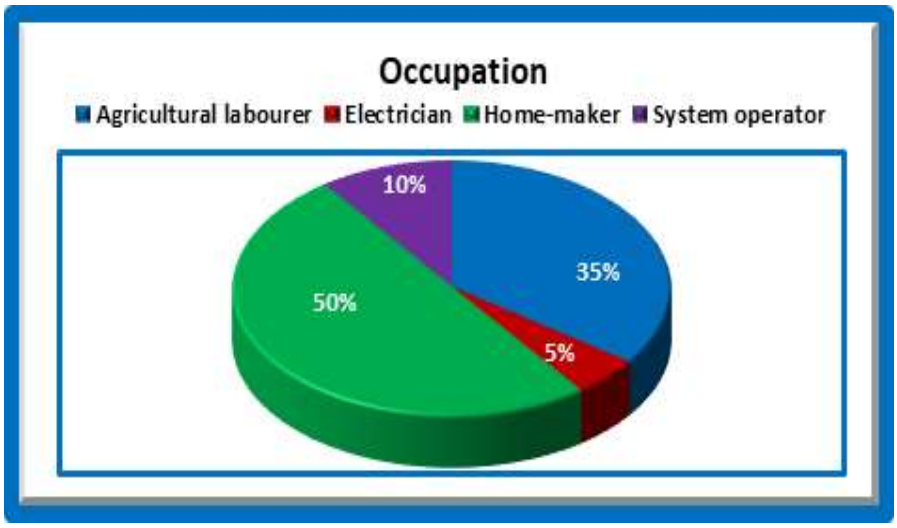
Light exposure time	Frequency	%
10-20min	115	57.5%
20-30min	60	30.0%
30-40min	25	12.5%



5. OCCUPATION OF PATIENTS

Table 6 : Occupation of patients

	Frequency	%
Agricultural labourers	70	35
House-wives	100	50
System operators	20	10
Electrician	10	5
Total	200	100

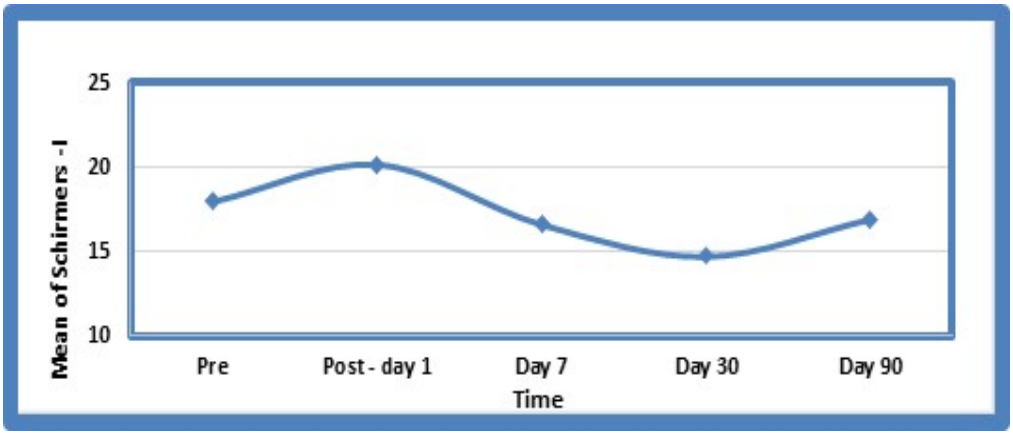


6. SCHIRMERS TEST 1

pattern of post-operative dry eye detected by Schirmers test 1 done without topical anesthesia

Table 7: Schirmers test 1 results

Time	Schirmers-I		P-value
	Mean	SD	
Pre	17.95	4.94	0.000*
Post - day 1	20.15	5.53	
Day 7	16.60	4.01	
Day 30	14.70	3.73	
Day 90	16.90	4.33	

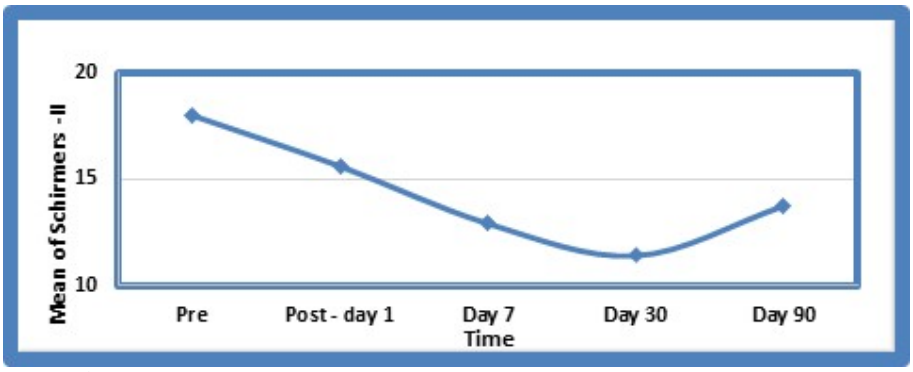


7. SCHIRMERS TEST 2 RESULTS

pattern of post-operative dry eye detected by Schirmers test 2 done with topical anesthesia

Table 8: Schirmers test 2 results

Time	Schirmers-II		P-value
	Mean	SD	
Pre	17.95	4.95	0.000*
Post - day 1	15.60	4.45	
Day 7	12.95	4.39	
Day 30	11.45	3.99	
Day 90	13.75	4.48	

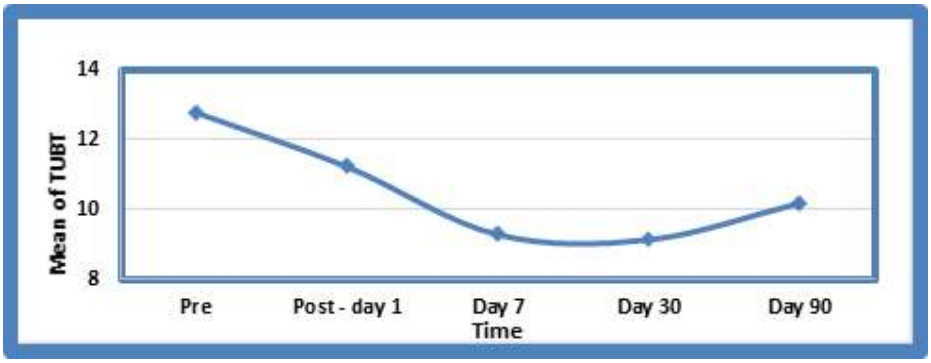


8. TEAR FILM BREAK UP TIME

Pattern of dry eye detected by tear film break up time

Table 9 : Tear film break up time results

Time	TUBT		P-value
	Mean	SD	
Pre	12.80	3.192	0.000*
Post - day 1	11.25	2.543	
Day 7	9.30	1.775	
Day 30	9.15	1.662	
Day 90	10.20	1.578	

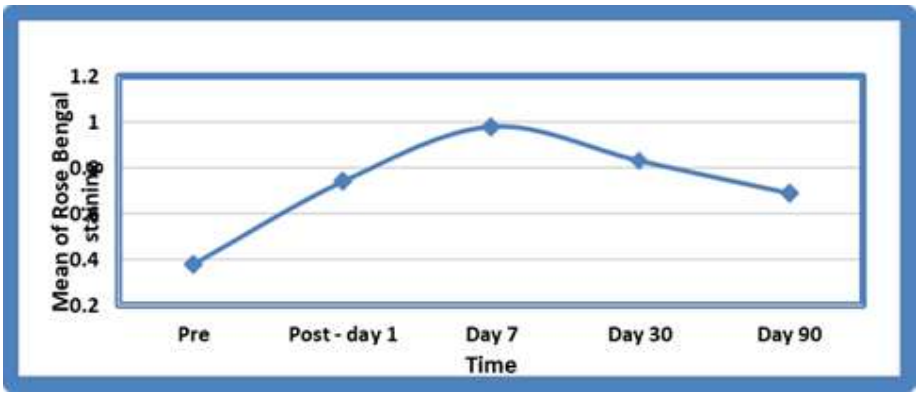


9. ROSE BENGAL STAINING

Pattern of post-operative dry eye detected by Rose Bengal Stain as follows

Table 10: Rose Bengal staining pattern

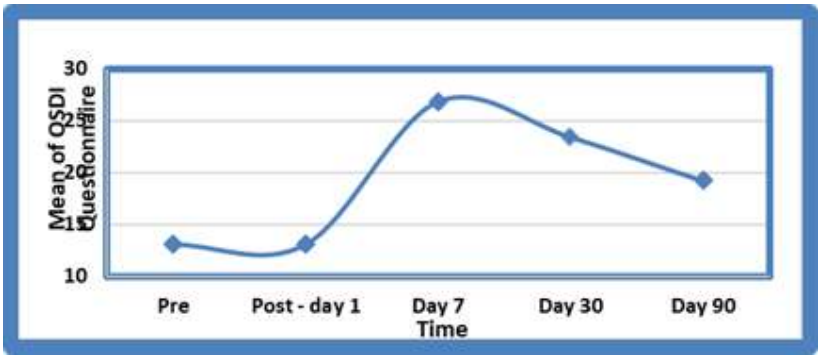
Time	Rose Bengal staining		P-value
	Mean	SD	
Pre	0.38	0.06	0.000*
Post - day 1	0.74	0.155	
Day 7	0.98	0.218	
Day 30	0.83	0.183	
Day 90	0.69	0.141	



10. OSDI QUESTIONNAIRE

Table 11: OSDI questionnaire

Time	OSDI Questionnaire		P-value
	Mean	SD	
Pre	13.13	0.41	0.000*
Post - day 1	13.13	0.41	
Day 7	26.90	2.07	
Day 30	23.44	1.96	
Day 90	19.22	1.86	

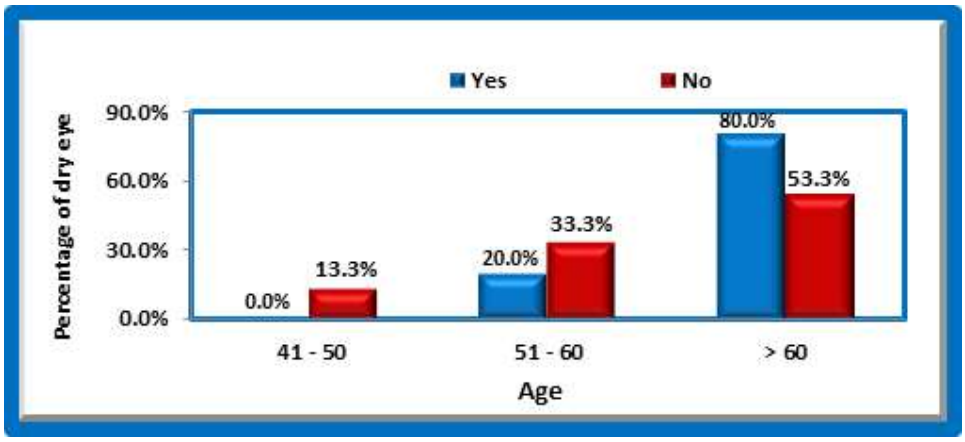


11.ASSOCIATION OF AGE AND DRY EYE

Association of age and dry eye

Table 12: Association of age and dry eye

Age	Dry eye			
	Yes		No	
	Count	%	Count	%
41 – 50	0	0.0%	20	13.3%
51 – 60	10	20.0%	50	33.3%
> 60	40	80.0%	80	53.3%
Total	50	100.0%	150	100.0%
P-value = 0.069				

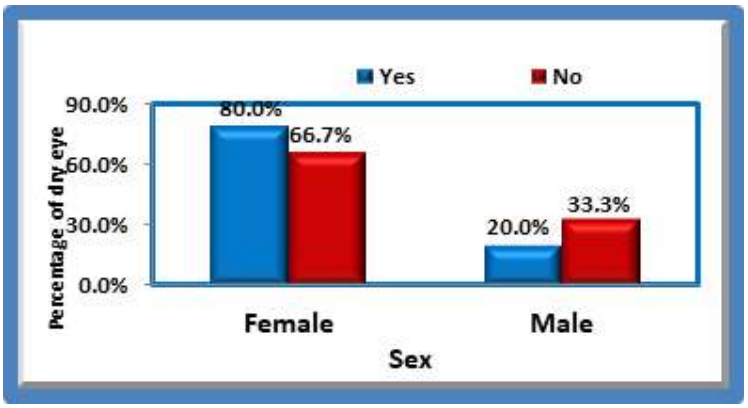


12. ASSOCIATION OF SEX AND DRY EYE

The association between sex and dry eye shows the following

Table 13 : Association between sex and dry eye

Sex	Dry eye			
	Yes		No	
	Count	%	Count	%
Female	40	80.0%	100	66.7%
Male	10	20.0%	50	33.3%
Total	50	100.0%	150	100.0%
P-value = 0.201				

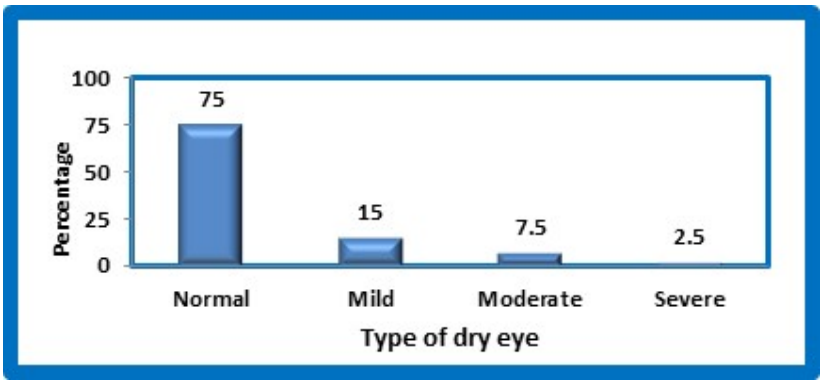


13. SEVERITY OF DRY EYE

Depending upon the test results ,dry eye is categorized into normal,mild,moderate and severe

Table 14: Severity of dry eye

Type of dry eye	Frequency	Percent
Normal	150	75.0
Mild	30	15.0
Moderate	15	7.5
Severe	5	2.5
Total	200	100.0



DISCUSSION

Various factors might affect the ocular surface environment after cataract surgery. Most important is corneal desensitization, superficial punctate keratitis, recurrent filamentary keratitis, secondary infections including conjunctivitis, infective keratitis, persistent or recurrent epithelial defects, stromal keratolysis and corneal ulceration have been reported in dry eye patients after cataract surgery.

The cornea is one of the most highly innervated organs, with about 44 corneal nerve bundles entering the cornea around the limbus centripetally[4] 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.[5]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.[6] The damage to the corneal nerves may expand when longer phacoemulsification time is needed to break up a dense cataract[6] .Neurogenic inflammation also can develop after corneal incisions. Inflammatory mediators can change the action of the corneal nerves and reduce corneal sensitivity.[7] With corneal healing postoperatively, new neurite cells emerge and after 25 days, neural growth factor is released to regenerate the subepithelial corneal axon.[7] Thus, the recovery of the corneal nerves may explain why dry eye was seen early after surgery and improved thereafter as was observed in various tests which showed a trend towards improvement in all test scores over 90 days. In addition to transection of the corneal nerves and damage to the corneal epithelial cells, exposure to microscopic light, vigorous intra operative irrigation of the tear film, elevation of inflammatory factorsi n the tear film due to ocular surface irritation, use of topical anesthesia intra-operatively and topical eye drops administered postoperatively and its preservatives can cause dry eye after phacoemulsification.[8,9] Benzalkonium chloride, one of the most commonly used preservatives in topical eye drops can induce tear film instability and decrease the number of mucin-expressing cells.[10] Excessive instillation and incorrect use of preserved eye drops are important factors that contribute to the development of dry eye after phacoemulsification and corneal toxicity. Other factors associated with dry eye are older age, female gender, diabetes and systemic hypertension. However, in the current study, dry eye was not associated with those factors. This may have been due to the small sample size in the study. Although mild to moderate dry eye may not interfere with vision, decrease of vision can occur in severe cases.

CONCLUSION

It is important for ophthalmologists to assess the dry eye in preoperative and postoperative period to ensure proper treatment , quality of vision and the quality of life of the patients.

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