

Dry eye following phacoemulsification cataract surgery in patients attending a tertiary health care centre: A cross sectional study

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Abstract:

Background: Among the other risk factors for dry eye Corneal surgery has been identified as one of the major cause by decreasing corneal sensation and changing the contour of the ocular surface due to the inflammation caused by surgical trauma. Clear cornea phacoemulsification is thought to alter the ocular surface thereby disrupting normal tear physiology. The purpose of study was to study ocular status regarding dry eye following phacoemulsification in patients attending a tertiary healthcare centre.

Materials and Methods: After taking informed consent 320 patients having cataract who had under gone phacoemulsification with IOL implantation were included in our study. After ruling out pre-existing ocular disease, surgery, trauma and systemic diseases, Dry Eye evaluation by Schirmer test and Tear Film Break Up Time Test was done pre and postoperatively at 1st, 4th and 6th week. Data was collected and analysed.

Results: The result from our study showed that 39 out of 320 patients had dry eye making the prevalence of dry eye 12.18%. The values of Tear film Break up Time and Schirmer test showed normal values before operation (15.07 & 16.24) but significantly decreased on post operatively on 1st week (13.30 & 14.23) ($p < 0.00$, CI 95%) follow-up. The values showed improvement in 4th week (13.64 & 14.54) ($p < 0.00$, CI 95%) and 6th week follow-up (13.93 & 14.77) ($p < 0.00$, CI 95%) but were still significantly below preoperative value.

Conclusion: We have concluded that phacoemulsification surgery affects the tear film stability and the production of tears postoperatively and causes dry eye more in the older age group.

Key Word: Dry eye, Phacoemulsification, Tear film break-up Time and Schirmer test

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I. Introduction

Dry eye is a multifactorial disease of the ocular surface characterized by a loss of homeostasis of the tear film, and accompanied by ocular symptoms, in which tear film instability and hyperosmolarity, ocular surface inflammation and damage, and neurosensory abnormalities play etiological roles^[1]. Dry eye is the most frequent disorder in ophthalmology practice. The prevalence of which varies from 4% to 57%, showing disparity worldwide.^[2-5] The symptoms observed in dry eye syndrome include dryness, irritation, burning sensation, foreign body sensation, heaviness of the eyelids, redness, reflex lacrimation, ocular pain and fatigue. It may cause punctate keratitis, persistent epithelial defect, filamentary keratopathy, superior limbic keratoconjunctivitis and reduced visual acuity^[6-7] Our study has identified the pattern of dry eye in patients undergoing phacoemulsification in a tertiary care centre in northeast India. This information can lend additional support the current treatment guidelines following phacoemulsification, which will facilitate better patient care service

II. Material And Methods

This cross-sectional descriptive study conducted in the Department of Ophthalmology, Agartala Government Medical College and GB Pant Hospital, Agartala Tripura.

Study Design: cross-sectional study

Study Location: in the Department of Ophthalmology, Agartala Government Medical College and GB Pant Hospital

Study Duration: One and half years (October 2018 – May 2020)

Sample size: 320 patients.

Sample size calculation: The sample size was estimated on the basis of formula $n = \frac{Z_{\alpha/2}^2 \cdot p \cdot q}{L^2}$ where $Z_{\alpha/2}$ = value of normal deviate at the $\alpha\%$ level of significance (two sided), P = prevalence of dry eye in postoperative cases which was taken as 58% and L = margin of error at $\alpha\%$ level of significance Taking $\alpha = 0.05$ (5%) and $L = 10\%$ of prevalence. 10% drop outs were considered.

Subjects & selection method: We used the technique of Systematic random sampling. According to 2017 record 1000 phacoemulsification surgery were done. Therefore every third patient was enrolled for the study till the sample size was achieved

Inclusion criteria:

Patients who underwent phacoemulsification cataract surgery at Agartala Government Medical College and G.B Pant Hospital, who gave consent for the study.

Exclusion criteria:

1. Pre existing ocular disease like:
 - a. Complicated cataract
 - b. Glaucoma
 - c. Uveitis
 - d. Disorder of lids and nasolacrimal duct pathway
 - e. Ocular allergies
 - f. Disorder of the conjunctiva like pterygium
 - g. Disorder of sclera like scleritis, episcleritis
2. Previous ocular surgery
3. Any intra operative complications during this surgery
4. Insertion of Anterior chamber intraocular lens
5. Any anti-cholinergic medication, antihistaminic
6. Any ocular trauma or orbital trauma

Procedure methodology

Patients who underwent phacoemulsification cataract surgery at Agartala Government Medical College and GB Pant Hospital were subjected for this study. Informed consent was obtained after informing the study subjects the details of the procedure. After obtaining the informed consent from the subject, they were included in the study. A detailed history was taken, followed by Routine eye examination with slit lamp, systemic examination, systemic investigation like Blood Sugar (fasting and postprandial) and Electrocardiography was done. Among patients selected after fitting inclusion and exclusion criteria, lacrimal gland functions was assessed by **Tear film break-up Time and Schirmer test**. Tear film break-up Time was noted after instilling a drop of fluorescein and examining in a cobalt-blue light of a slit-lamp. Its normal values range from 15 to 35 seconds. Values less than 10 seconds implied an unstable tear film. Schirmer Test was performed with the help of a 5 × 35mm strip of Whatman-41 filter paper which was folded 5 mm from one end and was kept in the lower fornix at the junction of lateral one-third and medial two-thirds. The patient was asked to gently close his eyes for 5 minutes. After 5 minutes wetting of the filter paper strip from the bent end was measured. Normal values of Schirmer test is more than 15mm. Values of 5-10mm was suggestive of moderate to mild keratoconjunctivitis sicca and value less than 5mm of was considered severe keratoconjunctivitis sicca. Thus operational definition for a patient considered having Dry Eye were those having tear film breakup time values less than 10 seconds and or having Schirmer test values less than 10 mm on 1st week follow up.

Followup: Subjects were assessed prior to the surgery, and recalled for a complete ophthalmic and general physical examination after 1 week, 4 week and 6 weeks following surgery. At each visit the ophthalmological examination was done including best corrected visual acuity, tear film breakup time and Schirmer test.

Data Analysis: All data was recorded in the pro forma designed specifically for this study. On completion of the study, data was entered into Microsoft excel spreadsheet for analysis. Data was recorded, entered and analyzed with computer using SPSS version 15.0 and Epi-info-version-7. Descriptive statistics and other statistical tests like Chi square test; binary logistic regression analysis etc were used as per applicability. P value of less than 0.05 was considered as statistically significant.

Ethical Consideration: Informed written consent was obtained from each and every participant as per modified ICMR template, ensuring confidentiality while collecting and analyzing the data which was used for research purpose only. Application was placed before the Institutional Ethics Committee of Agartala Government Medical College for approval.

III. Result

320 patients were included in the study. 24 patients were less than 50 years, 104 between 50-60 years, 161 between 60 to 70 years, 24 were between 70 to 80 years and 17 above 70 years. There were 198 (62%) females and 122 (38%) males. All females had menopause.

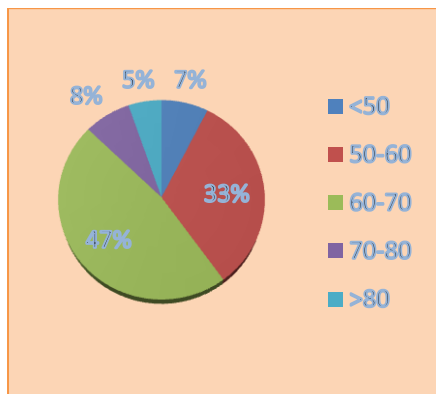


Figure 1. Pie chart showing age distribution. Tear Film Break Up Time

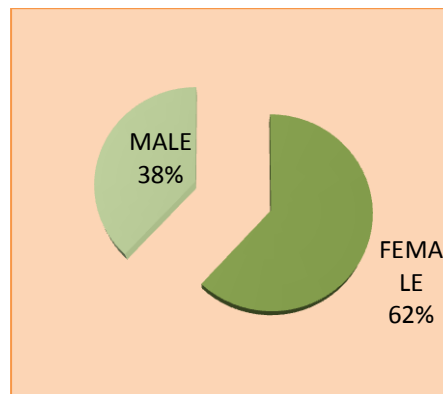


Figure 2: Pie chart showing sex distribution.

Tear Film Break Up time preoperatively was seen to be normal with average value of 15.07(SD 3.54). On postoperative 1st week follow-up the value reduced to an average of 13.30 (SD 4.10); on postoperative 4th week follow-up the value improved a little bit to an average of 13.64 (SD 3.86) but still less than preoperative values and on postoperative 6th week follow-up the value further improved to an average of 13.93 (SD 4.10) but still less than the preoperative value. All data was statistically found to be significant with p value <0.000 in confidence interval of 95%. Preoperatively all patients had test values above 10. On post operative 1st week follow-up 39 patients (12.18%); on post operative 4th week follow-up out of these some improved and number of patients with values less than 10 were 29 (9.06%). On Postoperative 6th week follow-up patients having values less than 10 further reduced to 16 (5%). All data was found to be statistically significant with p value <0.001 in confidence interval of 95%.

	Preoperative	Post Op week 1	Post Op Week 4	Post Op Week 6
Mean	15.07	13.30	13.64	13.93
Standard Deviation	3.54	4.10	3.86	3.73
Standard Error of mean	0.19	0.23	0.26	0.20
P value (CI 95%, <0.05)		.00	.00	.00

Table 1: Mean values on different days

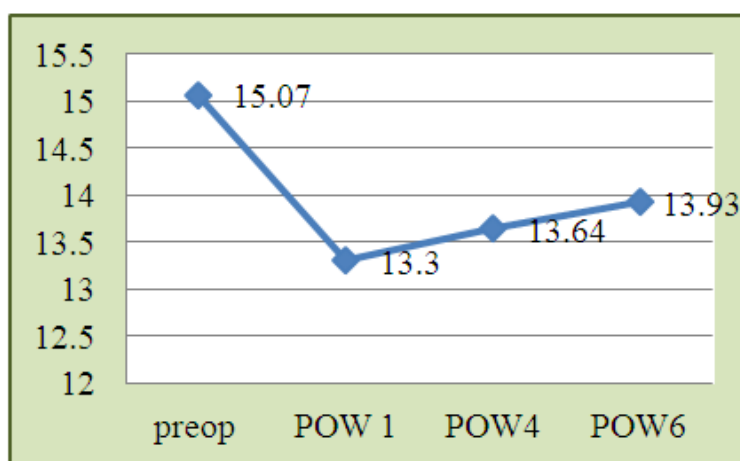


Figure 3: Line diagram showing mean values of tear film break up time test on different days.

No. of Patient	Pre Operative	Post Op week 1	Post Op week 4	Post Op week 6
<5	0	3	0	0
5 TO 9	0	36	29	16
10 TO 14	134	144	150	154
15 TO 19	150	122	125	134
20 TO 24	36	16	16	16
>25	0	0	0	0
Total	320	320	320	320

P value compared to before Phaco(95% CI)		<0.001	<0.001	<0.001
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Table 2 showing tear film break up time values and number patients on different days of visit with corresponding values of Tear film Break Up Time test

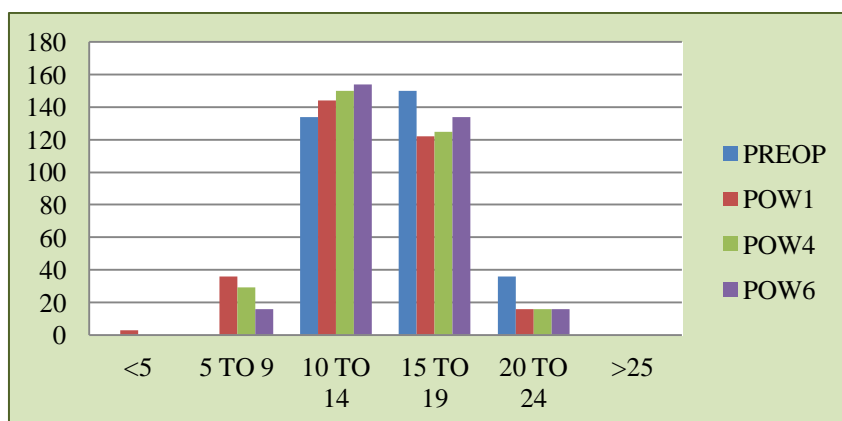


Figure 4: Bar graph showing number of patients on different days of visit (on y axis) with corresponding values of Tear film Break Up Time test (on x axis)(POW: Post Operative Week).

Schirmer Test

Schirmer test preoperatively was seen to be normal with average value of 16.24(SD 4.49). On postoperative 1st week follow-up the value reduced to an average of 14.23 (SD 4.46); on postoperative 4th week follow-up the value improved a little bit to an average of 14.54 (SD 4.29) but still less than preoperative values and on postoperative 6th week follow-up the value further improved to an average of 14.77 (SD 4.022) but still less than the preoperative value. All data was statistically found to be significant with p value <0.000 in confidence interval of 95%.Preoperatively all patients had test values above 10. On post operative 1st week follow-up 35 patients (10.09%); on post operative 4th week follow-up out of these some improved and number of patients with values less than 10 were 26 (8.12%). On Postoperative 6th week follow-up patients having values less than 10 further reduced to 20 (6.25%). All data was found to be statistically significant with p value <0.001 in confidence interval of 95%.

	Pre operative	Post Op week 1	Post Op Week 4	Post Op Week 6
Mean	16.24	14.23	14.54	14.77
Standard Deviation	4.492	4.465	4.295	4.022
Standard Error of mean	0.251	0.250	0.240	0.225
P value (CI 95%,<0.05)		.00	.00	.00

Table 3: Mean values on different days

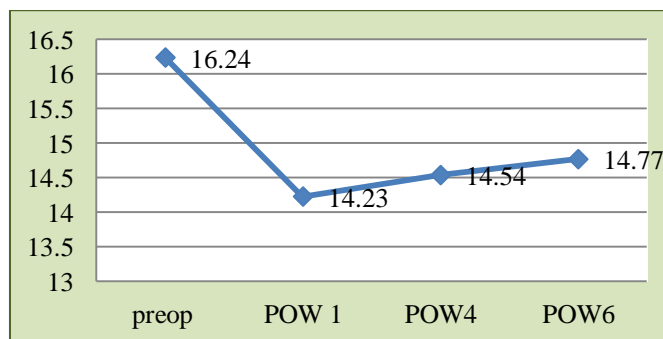


Figure 5: Line diagram showing mean values of Schirmer test on different days.

No. of Patient values	Pre Operative	Post Op week 1	Post Op week 4	Post Op week 6
<5	0	3	0	0
5 TO 9	0	32	26	20
10 TO 14	112	128	134	142
15 TO 19	125	115	120	127

20 TO 24	70	42	37	38
>25	13	0	3	3
Total	320	320	320	320
P value compared to before Phaco (95% CI)		<0.000	<0.000	<0.000

Table 4 showing number of patients on different days of visit (on y axis) with corresponding values of Schirmer test

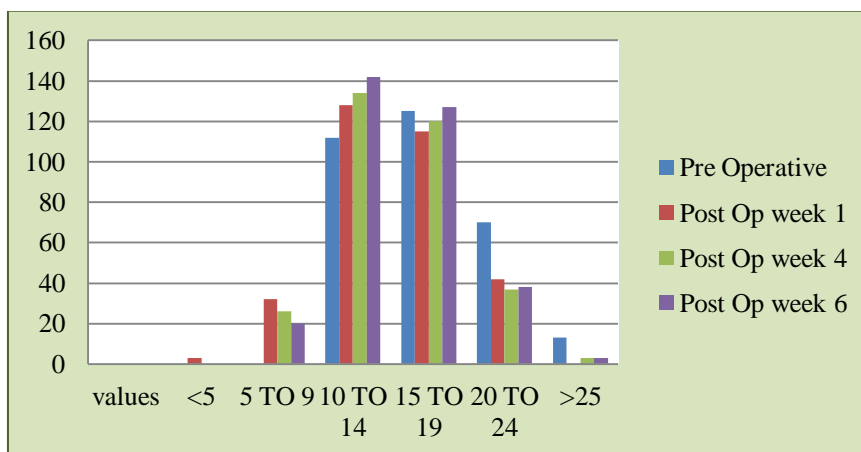


Figure 6: Bar graph showing number of patients on different days of visit (on y axis) with corresponding values of Schirmer test (on x axis)(POW: Post Operative Week).

Proportion of dry eye:

Out of 320 patients who underwent Phacoemulsification 39 (12.18%) patients had Tear Film Break Up time values less than 10 and or Schirmer Test value less than 10 indicating Dry eye disease.

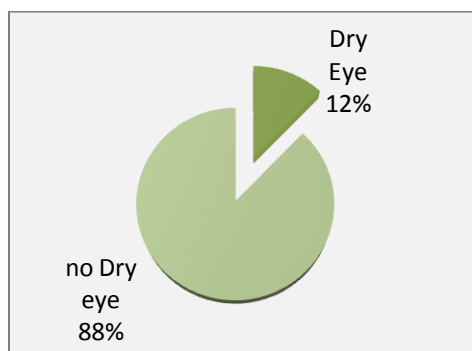


Figure 7: pie chart showing percentage of dry eye and non dry eyes.

Age Wise Distribution

We observed maximum patients were in age group of 60 to 70 years (151). Out of 24 patients in age group of <50 years 2 (8.33%) developed dry eye .Out of 104 patients in age group of 50 to 60 years 12 (11.53%) developed dry eye. Out of 151 patients in age group of 60 to 70 years 19(12.58%) developed dry eye. Out of 24 patients in age group of 70 to 80 years 3 (12.5%) developed dry eye and out of 17 patients in age group of >80 years 3 (17.64%) developed dry eye. We observed that maximum percentage of dry eye was increasing with increase in age, from 8.33% in <50 years to 14.63% in above 70 years , 6 out of 41 patients (14.63%) had dry eye.

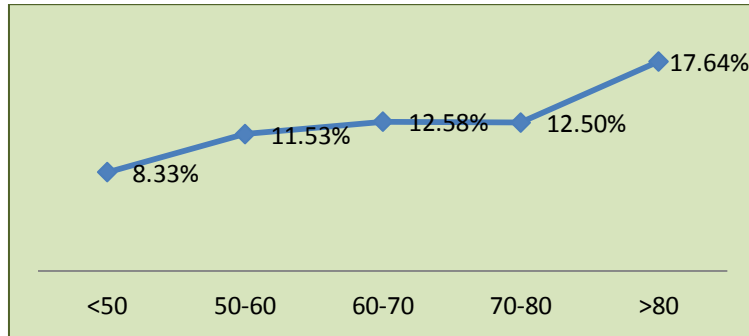


Figure 8: line diagram showing percentage dry eyes in different age groups.

Sex difference

There were 198 female patients out of which 23 (13.13%) developed dry eye and 175 remained normal. 122 male patients participated in our study out of which 13 developed dry eyes.

The Chi square Statistics was 0.2287, the p value was 0.631 and was not significant at $p < 0.05$

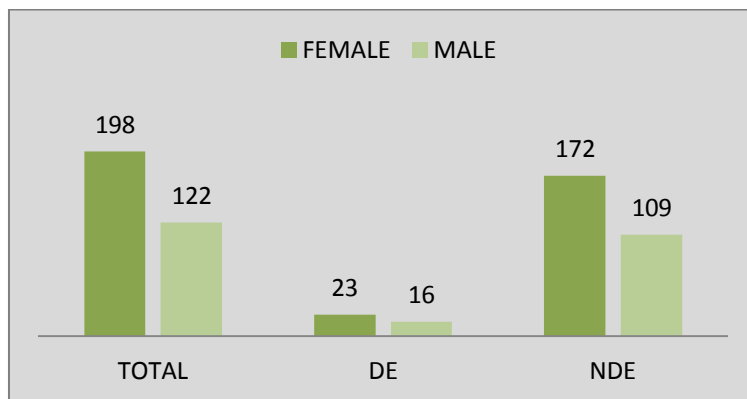


Figure 9: Bar graph showing number of patients on y axis and whether they developed dry eye (DE) or remained non Dry eye (NDE) on x axis.

Comparison between diabetic and non diabetic patients

there were 52 diabetic patients out of which 8 (15.38%) developed dry eye and 44 remained normal. 268 non diabetic patients participated in our study out of which 31 developed dry eyes.

The Chi square Statistics was 0.593, the p value was 0.441 and was not significant at $p < 0.05$

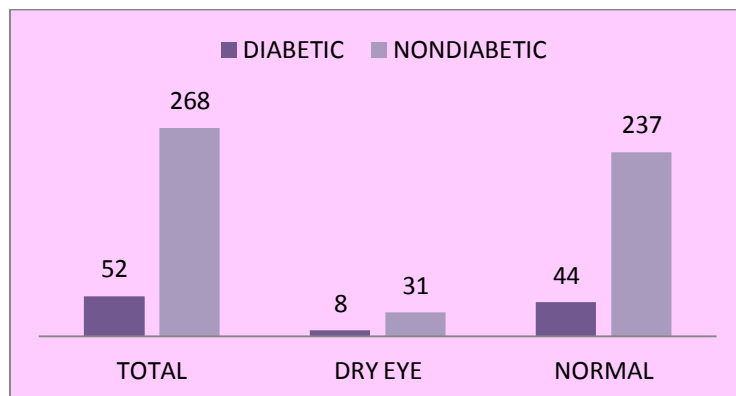


Figure 10: Bar graph showing number of patients on y axis and whether they developed dry eye (DE) or remained non Dry eye (NDE) on x axis

Comparison between Smoker and Non Smoker

In our study there were 61 smoker patients out of which 9 (14.75%) developed dry eye and 52 remained normal. 259 non smoker patients participated in our study out of which 30 (11.58%) developed dry eyes.

The Chi square Statistics was 0.463, the p value was 0.495 and was not significant at $p < 0.05$

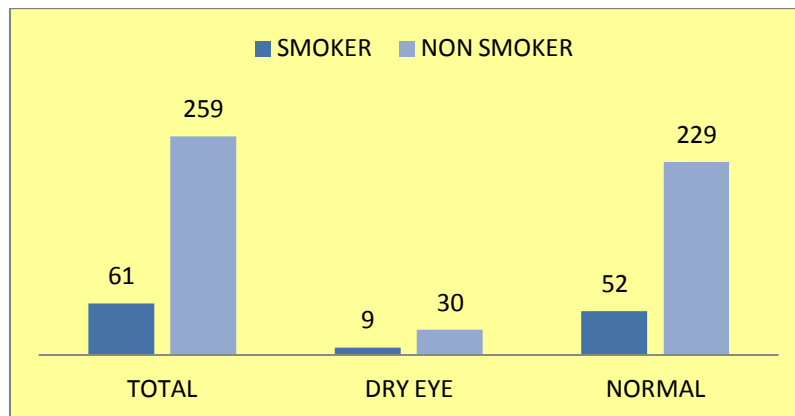


Figure 11: Bar graph showing number of patients on y axis and whether they developed dry eye (DE) or remained non Dry eye (NDE) on x axis.

IV. Discussion

Corneal surgery has been identified as one of the risk factors for the development of dry eye disease. Dry eye can develop or deteriorate after cataract surgery if not treated in time.^[8] In this study we enrolled three twenty patients coming to eye OPD of GBP Hospital with diagnosis of cataract who fulfilled our inclusion criteria. Along with other relevant necessary investigation tear film evaluation was done by Tear Film Break Up time and Schirmer Test. The same tests were repeated when patient came for first week, fourth week and sixth week follow-up.

The result from our study showed that 39 out of 320 patients had dry eye making the prevalence of dry eye 12.18%. Our result is consistent with a study conducted by Dhawan et al. who studied 100 eyes undergoing cataract surgery and observed dry eye in 11% patients^[9]. Kasetuwan N evaluated the incidence of dry eye after phacoemulsification 9.8%.^[10] Ishrat S et al. calculated and observed the incidence and pattern of dry eye 22.2% in patients who had Phacoemulsification.^[11]

In our study values of Tear film Break up Time and Schirmer test showed normal values before operation (15.07 & 16.24) but significantly decreased on post operatively on 1st week (13.30 & 14.23) ($p < 0.00$, CI 95%) follow-up. The values showed improvement in 4th week (13.64 & 14.54) ($p < 0.00$, CI 95%) and 6th week follow-up (13.93 & 14.77) ($p < 0.00$, CI 95%) but were still significantly below preoperative value. Liu z. conducted a study involving 68 patients with age-related cataract (79 eyes) who underwent phacoemulsification. He showed that at 1 day and 2 days postoperatively, the mean tear break-up time reduced greatly, the mean Schirmer test value, ($P < 0.001$ for day 1, $P < 0.005$ for day 2). Schirmer Test value at 7 days postoperatively ($P = 0.831$) 14 days returned to their preoperative values ($P = 1.000$). The tear break-up time, corneal fluorescein staining scores and the grades of tear film pattern all recovered at 30 days postoperatively ($P > 0.05$). At 30 days postoperatively, 19.3% of patients showed shorter tear break-up time and less Schirmer test value than that of preoperative day.^[12] The finding in this study coincides with our study.

In our study we included patients of different age group, with maximum number of patients in age group of 60 to 70 years, mean age 62 years. We observed that maximum percentage of dry eye was increasing with increase in age, from 8.33% in <50 years to 14.63% in above 70 years.

Large epidemiological studies from the Women's Health Study and Physician's Health noted that dry eye prevalence increases in women and men every five years after the age of 50. Dhawan M et al. conducted a study and showed the prevalence of dry eye after phacoemulsification increased with increasing age.^[13] In our study 13.13% female and 10.75% male developed dry eyes. The Chi square Statistics was 0.2287, the p value was 0.631 and was not significant at $p < 0.05$. Similar observation was made in study conducted by Dhawan M et al. in which 13.75% female and 9.6% male patients developed dry eye^[13] Out of 52 diabetic patients in our study 8 (15.38%) Kamel S et al. observed in their study that Schirmer test and tear film BUT values were lower among the uncontrolled diabetic patients.^[14] Diabetic patients undergoing cataract surgery are prone to DES. Ocular symptoms and tear film stability are transiently worsened in diabetic patients and are restored more slowly than those in non-diabetic patients. Khalil MH et al. observed Schirmer 2 test values were significantly lower in smokers 13.91 ± 6.81 mm compared with nonsmokers 16.58 ± 7.41 mm ($P = 0.017$).^[15] Our study showed Dry eye was seen more in smokers, 9 (14.75%) as compared to nonsmokers 30 (11.58%).

V. Conclusion

Dry eyes develop in patients undergoing cataract surgery with phacoemulsification. It can be considered as a complication of cataract surgery and should be considered as a reason for ocular discomfort postoperatively. Dry eye is maximum during postoperative first week and shows improvement over time. Therefore we can supplement with tear substitutes in initial few weeks after cataract surgery. Dry eye increases with age and more in older age groups. Females are affected more as compared to male. Diabetes and Smoking can be considered as risk factors for development of dry eye after cataract surgery. All these facts should be considered while managing cataract patients with phacoemulsification. Necessary preoperative counseling and post operative treatment should be given to at risk group.

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