



Dry eye disease after cataract surgery in a tertiary care hospital in western Uttar Pradesh

1) Dr. Ram Mohan Mishra, 2) Dr. Neelima Mehrotra, 3) Dr. Shipra Tripathi, 4) Dr. Gaurav Singh, 5) Dr. Aastha Agarwal, 6) Dr. Manu Priya

Date of Submission: 01-05-2023

Date of Acceptance: 10-05-2023

ABSTRACT

Objective: Post cataract surgery dry eye in the susceptible population can adversely impact visual outcome and overall patient comfort. There are varying reports on the incidence of post cataract surgery dry eye depending on patient population and surgical technique. This study aims to study the incidence of dry eye after cataract surgery

Material and Methods: This was a prospective, hospital-based, longitudinal study consisting of 100 patients, conducted in tertiary health care hospital over a period of 6 months, from October 2022 to April 2023, after obtaining ethical committee approval. Patients undergoing senile cataract were evaluated for dry eyes under schirmer's test, tear film break-up time test, and Ocular Surface Disease Index (OSDI), preoperatively and postoperatively on three follow up visits on one week and one month after surgery.

Results: Postoperatively, Schirmer's test values ranged from 12-35mm and 8-24mm at first and second follow-ups, respectively. Mean TBUT was 12.26 ± 2.45 and 9.19 ± 2.20 seconds, OSDI values ranged from 1-30 and 10-33 with mean 12.76 ± 5.87 and 26.83 ± 6.12 respectively at first and second follow-up. At first follow-up, 87.3% patients underwent phacoemulsification having grade 2 dry eye ($p < 0.001$), while 93.3% patients who underwent small-incision cataract surgery (SICS) had dry eye ($p < 0.001$). At second follow-up, grade 0 dry eye was observed in 90.1% patients who underwent phacoemulsification and 84.4% patients who underwent SICS ($p < 0.001$).

Conclusion: Dry eye incidence after cataract surgery was high, and was independent of demographic, and anthropometric profile, microscope exposure time, and type of surgical procedure. This dryness was temporary in nature, and showed declining trend, to achieve normalization by end of 1 month.

Keywords: Dry eye disease, cataract surgery, postoperative dry eyes, Schirmer's test, small-incision cataract surgery

I. INTRODUCTION

Cataract is one of commonest causes of visual-impairment in the world. According to World Health Organisation (WHO), cataract is leading cause of the blindness all over the world, responsible for 47.8% of blindness and accounting for 17.7 million blind people. In India, 80% of the blindness is due to cataract. Various modifiable risk-factors related with cataract are, diabetes, hypertension, UV exposure, body mass index (BMI), smoking, drug usage, and socio-economic factors; but advancing age is the single most important risk factor for cataract. In recent study, Vashist et al reported prevalence of 58.0% in Northern India and 53.0% in Southern India in older age group (>60years) with the nuclear cataract being commonest type of cataract in the both parts of country.

Dry eye disease (DED) is defined as "a disorder of the tear film due to reduced tear production or excessive tear evaporation, which causes damage to the inter-palpebral ocular surface and is associated with symptoms of ocular discomfort and/or visual symptoms". A more descriptive definition given by dry-eye workshop defines it as "a multifactorial disease of the tear film 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 osmolality of the tear film and inflammation of the ocular surface".

Symptoms of dry eye may vary from mild ocular discomfort to severe fatigue, which may affect daily activities and quality of life. Prevalence of dry-eye ranged from 4.30% to 75.0% in several studies. This large variation attributed to difference in the study population, and also lack of the standardized definition for diagnosis of dry-eye. There are very limited reports of the dry eye incidence in Asia, particularly those from the Southeast Asia. Previous research revealed that prevalence of dry-eye ranged from 21.0% to 73.5% using symptoms questionnaire.^{10.}

DED is more prevalent in the older adults. Older adults particularly vulnerable to the



inadequate tear production due to lacrimal gland dysfunction, the altered reflex secretion, the diminished corneal sensation, and/or inflammatory destruction of the lacrimal glands. Abnormalities in the eyelid positioning, the abnormal corneal sensation, and the decreased blink reflex are the significant contributors to the rapid tear-film break-up, and evaporation, and are increasingly seen in the older adults. Inflammation, and oxidative-stress, which upsurge in aging, might also play key role in the dry eye development in elderly. Notably, the older men, and women almost twice vulnerable to have the dry eyes than younger counterparts. Large epidemiological studies depicted that dry-eye prevalence increases in females and males every 5 years after 50 years of age, with higher prevalence in females compared to males.¹⁰

Considering the fact that occurrence of dry-eye syndrome after cataract surgery could be reliant on number of factors such as type of surgery, intra-operative exposure and the energy used during the phacoemulsification, it's essential that proper risk valuation be done in both the phacoemulsification along with small-incision cataract surgery (SICS) procedures. Thus, the present study was carried out with an aim to assess the incidence of the dry eye syndrome, and its determinants among patients undergoing cataract surgery at a tertiary care center in North India.

II. MATERIAL AND METHODS

This hospital-based observational study was carried out in the Clinic of Ophthalmology of Shri Ram Murti Institute of Medical Sciences and Hospital, Bareilly, Uttar Pradesh India, a tertiary care center, over a period of 6 months. We initially enrolled 130 subjects with senile cataract and without pre-existing dry eye syndrome. Subjects undergone detailed history, and the ocular examination, and those having ocular conditions which can contribute to occurrence of the dry eye, like lid disorders (entropion, blepharitis, ectropion,), contact lens wear, the allergic conjunctivitis, any past-ocular surgeries, exposure keratitis, chronic conjunctivitis, Bell's palsy, and contact dermatitis; those with the systemic conditions such as thyroid-associated diseases, diabetes mellitus, hypertension, lupus, scleroderma, rheumatoid arthritis, vitamin A deficiency, Sjögren's syndrome, and other factors such as smoking; and those with the continuous long term use of the ocular, or the systemic medications (anti-histaminics, anti-depressants, decongestants, the beta blocker drugs, aspirin, and diuretics) were excluded from study. After excluding the subjects failed to meet inclusion, and exclusion criteria,

didn't give consent or were lost to the follow-up, remaining were 100 patients.

All subjects included in study with best corrected visual acuity was evaluated by the Snellen chart, and intra-ocular pressure by the Goldmann applanation tonometer. The detailed slit-lamp investigation was performed and fundus was inspected by the indirect ophthalmoscopy.

Schirmer's test, tear break-up time (TBUT) test, and Ocular Surface Disease Index (OSDI) were carried out for assessment of dry eye.

Schirmer's test performed to test the basal, and the reflex tear secretion using specialized Schirmer's strip made from Whatman filter paper number. 41 measuring 40.5mm, marked 0mm to 35mm. Depending on wetting of strip, results of the Schirmer's test graded as: >10mm, normal (grade-0); 5-10mm, mild (grade-1); 3-4mm, moderate (grade-2); 0-2mm, severe (grade-3).

TBUT was evaluated to test the tear film stability, and the meibomian gland disorder, and grading was done based upon time between last blink, and appearance of dry spot. TBUT <10s was abnormal, and graded as: >10s, normal (grade-0); 3.1 to 6s, moderate (grade-2); 6.1 to 10s, fair (grade-1); <3s, poor (grade-3).¹⁷

OSDI is 12-item assessment for the dry eye evaluated on scale of 0 - 100, with the higher scores representing the greater disability. Index demonstrates sensitivity, and the specificity in differentiating between normal subjects, and cases with dry-eye syndrome. Criteria used for grading was: 0-12 (normal); 13-22 (mild); 23-32 (moderate); and 33-100 (severe).

Risk-factors like shape of incision, pre-anesthetic medication, cataract surgery type (phacoemulsification or SICS), the microscope light exposure, the CDE manipulation of the ocular surface tissue and the intra- and post-operative medications taken into consideration. Of these factors, all the cases had same pre-anaesthetic medication, incision shape, intra-op and post-operative medications (combination of antibiotic, and steroid, non-steroidal anti-inflammatory, and intra-ocular pressure lowering topical eye drops from same pharmaceutical brands), and the operating surgeon.

Patients were followed-up one week and one month after surgery. Assessments of dry eye parameters repeated on both the occasions. The study was conducted after ethical approval by the institutional ethics committee in accordance with international agreements and the Declaration of Helsinki, and informed and written consent was taken from all the subjects included in the study.



III. STATISTICAL ANALYSIS

Microsoft Excel was used in creating the database and producing graphs, while the data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 23 for Windows. Mean and standard deviation (\pm SD) were used to describe quantitative data meeting normal distribution. Continuous two independent groups were compared by parametric independent Student's t test/fisher test was used. Discrete (categorical) groups were compared by chi-square (χ^2) test was used. p values less than 0.05 ($p < 0.05$) was considered statistically significant.

IV. OBSERVATION/RESULTS

Of 100 cases evaluated, largest age group was 61-70 years (36.0%), followed by 51-60 years (32.0%), <50 years (24.0%), and >70 years (8.0%). Mean age studied patients was 58.79 \pm 10.13 years predominantly males (n=62, 62.0%). The male to

female ratio was 31:19. Using body mass index (BMI) criteria, 91 patients (91.0%) were of normal weight (18.5-25.0 kg/m²) and other 9 (9.0%) fell in overweight category (25.1-30 kg/m²). There were no patients evaluated were underweight (<18.5 kg/m²), or obese (>30 kg/m²). On the basis of symptoms, the majority of the cases were having Watering (57.0%) followed by photophobia (52.0%), burning sensation (47.0%), itching (43.0%), eye pain (41.0%) and redness of eyes (37.0%).

The incidence of dry eye was 87.3% and 16.3% in the phacoemulsification group at 1 week and 1 month, compared to 93.3% and 28.9% in the SICS group at the corresponding time points. Although incidence of dry eye was higher after SICS than phacoemulsification at both time points, the differences were not significant statistically ($p > 0.05$)

Figure 1: Distribution of cases on the basis of symptoms

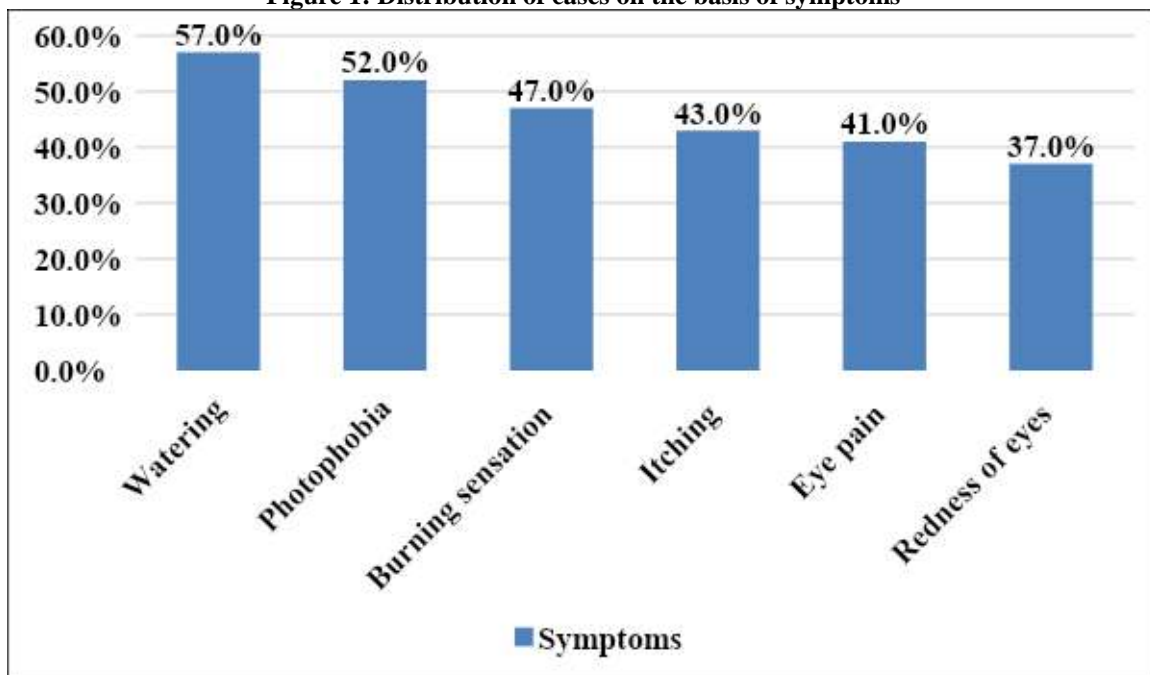


Table 1: Clinical assessment (for dry eye-related tests) preoperatively and at postoperative 1 week and 1 month

Variables	Preoperative	Post operative 1 week	Post operative 1 month
Schirmer's test (mm)	28.1 \pm 4.61 (15-35)	24.93 \pm 5.69 (12-35)	13.32 \pm 3.24 (8-24)
TBUT (seconds)	12.89 \pm 1.68 (10-18)	12.26 \pm 2.11 (8-18)	9.19 \pm 2.18 (5-16)
Ocular Surface Disease Index (OSDI)	7.23 \pm 2.74 (1-12)	12.76 \pm 5.87 (1-30)	26.83 \pm 6.12 (10-33)



Table 2: Comparison of the dry eye prevalence at post-operative 1 week, and 1 month between the phacoemulsification, and the SICS groups

Surgical technique	No. of cases (n=100)	Dry Eye	
		1 week	1 Month
Phacoemulsification	55 (55.0%)	49 (87.3%)	9 (16.3%)
small incision cataract surgery (SICS)	45 (45.0%)	42 (93.3%)	13 (28.9%)
p-value		0.461	0.145

Table 3: Comparison of the Ocular Surface Disease Index grade preoperatively and at postoperative 1 week and 1 month

Surgical technique		OSDI (Normal)	OSDI (Mild)	OSDI (Moderate)	p-value
Overall (n=100)	Preop	120 (100.0)	0 (0.0)	0 (0.0)	-
	Postop 1 week	8 (8.0)	3 (3.0)	89 (89.0)	<0.001
	Postop 1 month	89 (89.0)	9 (9.0)	2 (2.0)	<0.001
Phacoemulsification (n=55)	Preop	55 (100.0)	0 (0.0)	0 (0.0)	-
	Postop 1 week	5 (9.1)	2 (3.6)	48 (87.3)	<0.001
	Postop 1 month	50 (90.1)	4 (7.3)	1 (1.8)	<0.001
Small Incision cataract Surgery (n=45)	Preop	45 (100.0)	0 (0.0)	0 (0.0)	-
	Postop 1 week	2 (4.4)	1 (2.2)	42 (93.3)	<0.001
	Postop 1 month	38 (84.4)	6 (13.3)	1 (2.2)	<0.001

Table 4: Association of microscope exposure time with dry eye at 1 week and 1 month after cataract surgery

Time	N	1 week	1 Month	
Overall (n=100)	10-15 min	53	47 (88.7)	10 (18.9)
	16-20 min	28	27 (96.4)	8 (28.6)
	21-25 min	8	7 (87.5)	2 (25.0)
	26-30 min	11	10 (90.9)	2 (18.2)
p-value		0.687	0.766	
Phacoemulsification (n=55)	10-15 min	44	41 (93.2)	7 (15.9)
	16-20 min	9	8 (88.9)	2 (22.2)
	21-25 min	2	0 (0.0)	0 (0.0)
	26-30 min	-	<0.001	0.731
p-value				
Small Incision cataract Surgery (n=45)	10-15 min	10	10 (100.0)	4 (40.0)
	16-20 min	20	19 (95.0)	6 (30.0)
	21-25 min	9	8 (88.9)	2 (22.2)
	26-30 min	6	5 (83.3)	1 (16.7)
p-value		0.561	0.742	

V. DISCUSSION

Dry eye-related symptoms are very commonly complained by patients undergoing the cataract surgery, during the immediate postoperative follow-up period. In this study, we assessed DED after the cataract surgery in tertiary care hospital in western Uttar Pradesh.

Mean age in our study was 58.79±10.13 years predominantly males (n=62, 62.0%) which was comparable to findings of Patil M et al who reported mean age in their studied cases as 61.77±11.01 years which was also comparable to the study done by Jayshree MP et al in which mean age was 58.18±8.62 years. According to



Garg P et al¹⁴ mean age of cases was 59.25±9.77 years, and most were males (60.8%) with male to female ratio 1.55:1. In contrast to the previous studies where majority cases were females. This was probably because of estrogen changes associated with the menopause that results in the higher risk of the age related cataract in females than males. The higher incidence could be related to borderline or subclinical dysfunction of tear film in higher age group which is further compromised following cataract surgery. Higher incidence of the dry eyes and its association with advancing age has been reported in Beaver dam eye study.

In our study, basis of symptoms, the majority of the cases were having Watering (57.0%) followed by photophobia (52.0%), burning sensation (47.0%), itching (43.0%), eye pain (41.0%) and redness of eyes (37.0%). None previous studies depicted any evaluation of pre-operative symptoms. These symptoms recorded, and analysed using OSDI grading, that showed them within normal limits of the grading severity of dry eye pre-operatively. This was verified, as all cases had the dry eye parameters (Schirmer's test, TBUT and OSDI) within the normal range when the examinations were conducted.

In present study 55.0% cases were in phacoemulsification surgical technique of which 49 (87.3%) were having dry eye at one week which was reduced to 69 (16.3%) at 1 month whereas 45.0% were in SICS of which 42 (93.3%) were having dry eye at one week which was reduced to 13 (28.9%) at 1 month. For purposes of present study, we acknowledged OSDI assessed dry eye as representing the dry eye. Thus, prevalence of the dry eye was 91.0% in present study. Reported prevalence of the dry eye considerably varies in various studies, which may be dependent on different determinants along with methods of assessing dry eye. Our findings were in accordance with **Garg P et al**¹⁴ who reported that both phacoemulsification, and the SICS methods taken to evaluate impact of the type of surgery on dry eye incidence. Phacoemulsification accounted for 53.3% and SICS 46.7% operations in their study. Cataract surgery performed using phacoemulsification procedure in 53.3% patients while 46.7% undergone SICS. Incidence of the dry eye was 89.10% and 15.60% in phacoemulsification at 1 week, and 1 month, than 92.90%, and 26.80% in SICS at corresponding time points. Though incidence was higher in SICS than phacoemulsification at both the time points, differences weren't significant ($p > 0.05$) with OSDI prevalence 91.7%. **Saif MYS et al, Sinha M et al**

and **Rizvi Y et al** have included SICS, and phacoemulsification subjects. **Patil M et al**²⁰ reported that out of 100 patients included, 69.0% had dry eye at 1 or more follow-up visits. Among these, 13.0% developed mild, 33.0% had moderate, and 23.0% were having severe dry eyes, according to OSDI scoring. Our finding is concordance with many previously done studies by **Venugopal KC et al** and **Jayshree MP et al**²¹ who assessed dry eye following the MSICS, which showed high incidence.

When comparing the OSDI grade in patients according to the cataract surgery methods, all patients who underwent phacoemulsification and who underwent SICS had normal dry eye pre-operatively. At post-operative 1 week, 87.3% phacoemulsification group had grade moderate dry eye ($p < 0.001$), and 93.3% SICS group had moderate dry eye ($p < 0.001$). At 1-month follow-up, 90.1% phacoemulsification group had normal and other 7.3% had mild dry eye and 1.8% patients had severe dry eye at 1 month, and results were significant statistically ($p < 0.001$). Of 45 patients underwent SICS, 84.4% had normal, 13.3% had mild, and only 2.2% had moderate dry eye at post-operative 1 month, and results were significant statistically ($p < 0.001$). **Kasetsuwan N et al** conducted a study that followed-up cases at days 0, 7, 30, and 90 days and reported that severity of the dry eye peaked at post-operative 7 days. **Venugopal KC et al**²⁹ on other hand, assessed data for cases from post-operative weeks 2 through 6 in 58.8% of study population, and from 6 weeks to 2 years in remaining 41.20% of their patients. **Dodia K et al** assessed dry eye incidence at post-operative day 1, 7 and 45 days and reported peak incidence at day one. Interestingly, most studies didn't conduct any pre-operative evaluation for dry eye and henceforth it was difficult to evaluate whether dry eye incidence depicted in study was continuation of the pre-existing dry eye syndrome, or was response to the cataract surgery

On overall evaluation among cases undergoing SICS, the microscope exposure time didn't show significant association with prevalence of dry eye at post-operative 1 week or 1 month. However, in phacoemulsification group, the exposure time > 15 min was found significantly associated with increased risk of the dry eye at 1 week ($p < 0.001$). This was similar with the observations from **Sahu PK et al**²³, **Rizvi Y et al**²⁸ and **Sengupta S and Banerji S** who also detected insignificant difference between phacoemulsification, and SICS, comparable to our findings. **Yu Y et al** also depicted that surgery type didn't have impact on the dry eye incidence.



Present study specified that there was high dry eye incidence after the cataract surgery. This might be because of corneal nerve transection, that results in the impaired epithelial wound healing, decreased in epithelial metabolic activity, increased permeability and loss of the cytoskeletal structures causing decreased corneal sensitivity along with reduction in the tear production, as reported by **Sutu C et al.** Elevation of the inflammatory response causing recruitment of macrophages, and neutrophils, and production of the free radicals, the proteolytic enzymes, and cyclooxygenase also considered key factor in the dry eye development. Topical anaesthetics, and pre- and post-operative preservative containing eye drops may also contribute to inflammatory reaction.

Limitations of the study:

- Smaller sample size
- The last follow-up visit was at one month. A longer follow-up period of 3 months would have added more insight into behaviour of postoperative dry eyes.
- Further, adding impression cytology, which is a more sensitive and specific test, would have increased the validity of our findings

VI. CONCLUSION

A significant proportion of patients experiencing cataract surgery go on to develop dry eye symptoms due to a variety of factors, either induced by the surgery itself or due to concurrent postoperative medications. The encouraging observation is that dry eye symptoms become lesser over time and in many patients, it's probably just a transient discomfort following cataract surgery. Incidence of dry eyes is higher and more severe after SICS than after phacoemulsification surgery. We therefore recommend that artificial tear substitutes could be prescribed in the immediate postoperative period to lessen the symptoms of dry eyes and also to reassure the patients that the discomforting symptoms of dry eyes will improve with the passage of time.

REFERENCES:

- [1]. Rao GN, Khanna R, Payal A. The global burden of cataract. *Curr Opin Ophthalmol* 2011;22:4-9.
- [2]. Liu YC, Wilkins M, Kim T, Malyugin B, Mehta JS. Cataracts. *Lancet* 2017;390:600-12
- [3]. Dandona L, Dandona R, Srinivas M, Giridhar P, Vilas K, Prasad MN, et al. Blindness in the Indian state of Andhra Pradesh. *Invest Ophthalmol Vis Sci* 2001;42:908-16
- [4]. Singh S, Pardhan S, Kulothungan V, Swaminathan G, Ravichandran JS, Ganesan S, et al. The prevalence and risk factors for cataract in rural and urban India. *Indian J Ophthalmol* 2019;67:477-83.
- [5]. Vashist P, Talwar B, Gogoi M, Maraini G, Camparini M, Ravindran RD, et al. Prevalence of cataract in an older population in India: The India study of age-related eye disease. *Ophthalmology* 2011;118:272-8
- [6]. Lemp MA. Report of the National Eye Institute/Industry workshop on Clinical Trials in Dry Eyes. *CLAO J*. 1995;21:221-232.
- [7]. International Dry Eye Workshop Subcommittee. The definition and classification of dry eye disease: report of the definition and classification subcommittee of the International Dry Eye Workshop (2007) *Ocul Surf*. 2007;5:75-92.
- [8]. Tong L, Waduthantri S, Wong TY, et al. Impact of symptomatic dryeye on vision related daily activities: the Singapore Malay Eye Study. *Eye (Lond)*.2010;24(9):1486-1491.
- [9]. Schaumberg DA, Dana R, Buring JE, Sullivan DA. Prevalence of dryeye disease among US men: estimates from the physicians'healthstudies. *Arch Ophthalmol*.2009;127(6):763-768.
- [10]. Nina Asrini Noor1Tri Rahayu1,2Tjahjono D Gondhowiardjo. Prevalence of Dry Eye and its Subtypes in an Elderly Population with Cataracts in Indonesia. *Clinical Ophthalmology* 2020;14 2143-2150
- [11]. Viso E, Rodriguez-Ares MT, Gude F. Prevalence of and associated factors for dry eye in a Spanish adult population (the Salnes Eye Study). *Ophthalmic Epidemiol*.2009;16(1):15-21.
- [12]. Stapleton F, Alves M, Bunya VY, et al. TFOS DEWS II epidemiology report. *Ocul Surf*.2017;15(3):334-365.
- [13]. Sharma A, Hindman HB. Aging: a predisposition to dry eyes. *J Ophthalmol*.2014;2014:781683.
- [14]. Garg P, Gupta A, Tandon N, Raj P. Dry Eye Disease after Cataract Surgery: Study of its Determinants and Risk Factors. *Turk J Ophthalmol*. 2020 Jun 27;50(3):133-142.



- [15]. Kasetsuwan N, Satitpitakul V, Changul T, Jariyakosol S. Incidence and pattern of dry eye after cataract surgery. *PLoS One*. 2013;8:e78657.
- [16]. Uchino Y, Uchino M, Yokoi N, Dogru M, Kawashima M, Komuro A, Sonomura Y, Kato H, Argüeso P, Kinoshita S, Tsubota K. Impact of Cigarette Smoking on Tear Function and Correlation between Conjunctival Goblet Cells and Tear MUC5AC Concentration in Office Workers. *Scientific Reports*. 2016;6:27699.
- [17]. No authors listed. Methodologies to diagnose and monitor dry eye disease: report of the Diagnostic Methodology Subcommittee of the International Dry Eye WorkShop (2007) *Ocul Surf*. 2007;5:108–152.
- [18]. Schiffman RM, Christianson MD, Jacobsen G, Hirsch JD, Reis BL. Reliability and validity of the Ocular Surface Disease Index. *Arch Ophthalmol*. 2000;118:615-621
- [19]. Patil M, Sugantharaj V, Hegde S. A prospective clinical study of the incidence of dry eye disease, following manual small incision cataract surgery, in a suburban population of South India. *TNOA J Ophthalmic Sci Res* 2020;58:69-73
- [20]. Jayshree MP, Shivkumar H, Monalisha P, Mallikarjun S. A prospective study of dry eye after manual small incision cataract surgery in rural population of Bagalkot. *J Clin Res Ophthalmol* 2017;4:25-9
- [21]. Li XM, Hu L, Hu J, Wang W. Investigation of dry eye disease and analysis of the pathogenic factors in patients after cataract surgery. *Cornea*. 2007;26(9 Suppl 1):S16-20
- [22]. Sahu PK, Das GK, Malik A, Biakthangi L. Dry Eye Following Phacoemulsification Surgery and its Relation to Associated Intraoperative Risk Factors. *Middle East African Journal of Ophthalmology*. 2015;22:472- 477
- [23]. Wimalasundera S. Is gender a risk factor for cataract? *Galle Med J*. 2008;13:44-47
- [24]. Moss SE, Klein R, Klein BE. Incidence of dry eye in an older population. *Arch Ophthalmol* 2004;122:369-73.
- [25]. Saif MYS, Saif ATS, Abd El-Khalek MO, Mahran W. Dry Eye Changes after Phacoemulsification and Manual Small Incision Cataract Surgery (MSICS). *Int J Ophthalmol Eye Res*. 2016;4:184-191
- [26]. Sinha M, Sinha A, Chowdhury B. Comparative Evaluation of Dry Eye Following Cataract Surgery: A Study from North India. *IOSR Journal of Dental and Medical Sciences*. 2014;13:13-18.
- [27]. Rizvi Y, Singh S, Dokania A. Comparative assessment of tear function and ocular surface following cataract surgery employing manual SICS and phacoemulsification techniques. *Indian Journal of Basic and Applied Medical Research*. 2014;4:544-553.
- [28]. Venugopal KC, Krishnaraj PA, Chandan N. Evaluation of dryness of eyes after manual small incision cataract surgery with corneoscleral tunnel incision. *J Clin Diagn Res* 2012;6:1029-33.
- [29]. Kasetsuwan N, Satitpitakul V, Changul T, Jariyakosol S. Incidence and pattern of dry eye after cataract surgery. *PLoS One*. 2013;8:e78657
- [30]. Dodia K, Bapat S, Chudasama RK. Dry eye risk factors after phacoemulsification cataract surgery at a secondary care hospital. *Int J Health Allied Sci*. 2013;2:242-245
- [31]. Sengupta S, Banerji S. Prevalence of dry eye diseases in a rural and urban population in West Bengal and the role of air pollution. *IOSR Journal of Environmental Science, Toxicology and Food Technology*. 2014;8:45-50.
- [32]. Yu Y, Hua H, Wu M, Yu Y, Yu W, Lai K, Yao K. Evaluation of dry eye after femtosecond laser-assisted cataract surgery. *J Cataract Refract Surg*. 2015;41:2614-2623
- [33]. Sutu C, Fukuoka H, Afshari NA. Mechanisms and management of dry eye in cataract surgery patients. *Curr Opin Ophthalmol*. 2016;27:24-30