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A CLINICAL STUDY OF DRY EYE DISEASE FOLLOWING CATARACT SURGERY IN A TERTIARY HOSPITAL OF ASSAM

Ophthalmology

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ABSTRACT

1) OBJECTIVE- a) To evaluate the symptoms and signs of dry eye disease following cataract surgery in a tertiary hospital of Assam b) To do clinical tests to confirm the presence of dry eye disease following cataract surgery c) To evaluate about the factors contributing to the severity dry eye disease after cataract surgery
2) MATERIALS & METHODS- A hospital based prospective study was conducted taking 200 patients in Assam Medical college and hospital in a duration of one year. The patients were divided into two groups, one undergoing SICS and another undergoing PHACOEMULSIFICATION
3) RESULTS:-In the study population including 200 patients, the most common age group were 56-70 years. There was female preponderance (F:M=52.5%:47.5%). The population was maximum (80%) from rural areas. 45 (22.5%) patients were smokers and 20(10%) patients gave the history of computer use. The symptoms and signs related to dry eye disease were maximum on the 7th post operative period. The highest incidence found in 40-55 years of age group with a female preponderance 53.3%. There was an occupational exposure which contributed to the dry eye disease. There was no significant difference between PHACO and SICS group. Out 45 patients, who were the smoker, 23 (51.1%) patients had the dry eye on 7th post-op day.

KEYWORDS

SICS(Small Incision Cataract Surgery), PHACO (phacoemulsification), DED(Dry Eye Disease)

INTRODUCTION

DRY EYE DISEASE: DEFINITION

1. ***DEWS DEFINITION (2007):*** Dry eye disease is a multifactorial disease of the tear film and ocular surface that results in symptoms of discomfort, visual disturbance, and tears 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. [1]
2. ***TFOS (TEAR FILM & OCULAR SURFACE SOCIETY) DEWS II REVISED DEFINITION(2017)***: Dry eye is a multi factorial 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.[2,3,4]

Dry eye disease (DED) is one of the most common ocular surface diseases in the world. Dry eye disease, representing an array of conditions, affects millions of people all over the world. The reported prevalence of dry eye in the literature is diverse ranging between 7.8% in one study from the western world [5] and 93.2% in one study from Asia.[6]

"Ocular surface" comprises of the tears, both in terms of the individual components at the site of production and as a film on the ocular surface. [2] The 2007 DEWS report recognized dry eye as a complex, multifactorial disease that cannot be characterized by a single process, sign or symptoms. In medical terms, multifactorial is described as having, or stemming from, a number of different interacting causes or influences, as is the cause in DED. [2]According to Mc Carty et al (1998), Bjerrum et al (1997) and Scein et al (1997), more than 6% of the population over the age of 40 suffers from dry eye, with the prevalence increasing to 15% of the population over the age of 65.[7,8,9]

The majority of dry eye symptoms are due to a chronic inflammation of the lacrimal functional unit resulting in a loss of tear film integrity and normal function. The underlying cause of tear film dysfunction is the alteration of tear aqueous, mucin, and lipid components.

Corneal innervations are an integral component of the lacrimal gland-ocular surface functional unit. In addition, neurotrophic factors released from corneal nerves are important in the normal physiology of corneal epithelial cells (Ku et al 2007).[10] The initial aetiology of DED that gives way to inflammation, which becomes the key mechanism of ocular surface injury. Inflammation is the cause and consequences of cell damage.

Dry eye can develop often after various types of ophthalmic surgeries. After cataract surgery, the incidence of dry eye increases dramatically. The lacrimal river line becomes narrow, and Tear Break-up Time (TBUT) and Schirmer's test I (ST I) decrease in 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 [11] and larger nerve fibers that run from the 9 o'clock to the 3 o'clock position and bifurcate to achieve a homogeneous distribution over the entire cornea. [12] So it is vulnerable to any damage within that region when giving incision for cataract surgery. Also, study reported that temporal corneal incisions given during Phacoemulsification can reduce the corneal sensitivity. [13] With corneal healing postoperatively, new neurite cells emerge and after 25 days, the neural growth factor is released to regenerate the subepithelial corneal axon. [14] Therefore dry eye symptoms appear immediately after surgery and improved thereafter.

Other factors contributing to the dry eye following Phacoemu lsification are exposure to microscopic light, vigorous intra operative irrigation of the tear film, elevation of inflammatory factors in the tear film due to ocular surface irritation, use of topical anaesthesia preoperatively, and topical eye drops administered postoperatively and it's preservatives.

EPIDEMIOLOGY

1. In preliminary findings from the Physicians' Health Study the age-standardized prevalence for clinically diagnosed dry eye was 2.3%, 1.9% for severe symptoms, and 3.5% for the prevalence of symptomatic dry eye in men 55 years and older.[15]
2. Reported prevalence of dry eye in the literature is diverse: ranging between7.8% in one study from western world [5] and 93.2% in one study from Asia. [6]
3. Asian studies on DED showed that the prevalence of dry eye is higher than that in western population and it is between 14.5% and 93.2%. [5,7]
4. The incidence of dry eye has recently been measured in the Beaver Dam Eye Study as varying from 10.7% in the age group 48-59 years to 17.9% in those over the age of 80. [16]

DRY EYE PROBLEM AND ITS ECONOMIC IMPACT ON SOCIETY

A prevalence of symptomatic dry eye in a population at a level of about 15% [9] in the U.S. population an estimated 4.3 million Americans aged 65 years or older who suffer from the dry eye condition. [9]

Female patients older than age 50 in the United States suffer from dry eye is estimated to be about 3.2 million. [5] It is a leading cause of patient visits to ophthalmologists and optometrists in the United States. It is perhaps surprising, therefore, that the condition is often under diagnosed and undertreated. [7] In the United States, approximately 7 to 10 million Americans use artificial tear preparations prescribed by doctors or as self-medication, and the market for these products is more

than $100 million per year. [17]

ROLE OF RISK FACTORS IN THE PREVALENCE OF DRY EYE

AGE:
Clinical experience suggests that dry eye is more common in older patients, perhaps because of a reduction in tear production and an increase in evaporation with age.

GENDER:
Clinical observations suggest that dry eye is more common in women, particularly after menopause. In the Melbourne study, [7] women were almost twice as likely to report severe symptoms of dry eye as men (OR-1.85), and in the Beaver Dam study, the age-adjusted prevalence of dry eye was 16.7% in women versus 11.4% in men.[16]

OTHER OCULAR CONDITION:
Dry eye is often associated with other ocular conditions. Ocular conditions that predispose patients to dry eye include MGD, blepharitis, ocular allergies, and pterygium. MGD is one of the most common disorders encountered in ophthalmic practice and can be a cause of dry eye as a result of changes in the lipid layer of the tear film leading to increased evaporation.

OPHTHALMIC SURGERY:
Several surgical procedures on the eye constitute risk factors for dry eye, including procedures for cataract surgery, refractive surgery, and graft - versus - host disease(GVHD). **Cataract Surgery:** Patients with pre existing dry eye disease who undergo cataract surgery are reported to have less favorable outcomes. A Chinese study [18] of tears before and after cataract surgery in patients who underwent PHACO indicates that patients with tear breakup times less than 10 seconds preoperatively have a significant risk of tear film instability postoperatively.

MATERIALS AND METHODS

AIMS AND OBJECTIVES

a) To evaluate the symptoms and signs of dry eye disease following cataract surgery in a tertiary hospital of Assam
b) To do clinical tests to confirm the presence of dry eye disease following cataract surgery
c) To evaluate about the factors contributing to the severity dry eye disease after cataract surgery.

TYPE OF STUDY:
Hospital based prospective study taking 200 patients in a tertiary hospital of Assam

PLACE OF STUDY:
Department of Ophthalmology, Assam Medical College and Hospital, Dibrugarh, Assam

DURATION OF STUDY: One year

PATIENTS POPULATION:
Patient attending the department of ophthalmology for cataract surgery were studied to evaluate post cataract surgery tear film changes and dry eye symptoms. A total of 200 patients were divided into 2 groups, GROUP A (150 patients) undergoing SICS and GROUP B (50 patients) undergoing PHACOEMULSIFICATION.

INCLUSION CRITERIA:
1. Patients undergoing cataract surgery without presenting any symptoms of dry eye.
2. Patients with senile cataract

EXCLUSION CRITERIA:
1. Patients with age below 40 years.
2. Patient with diagnosed case of Dry Eye Syndrome (DES) or dry eye disease due to pre-existing ocular surface diseases.
3. H/O Contact lens wear or on topical anti-glaucoma medication.
4. Systemic diseases (Sjogren syndrome, Thyroid Ophtha lmopathy).
5. Previous cataract surgery in the fellow eye.
6. Traumatic and complicated cataract.

METHODOLOGY
Before surgery, all the patient were instilled 'Itrop plus' eye drops [Tropicamide (0.8%) + Phenylephrine hydrochloride (5%)]. Peribulbar block with 4 ml Lignocaine (2%) with 1:100000 adrenaline + 1 ml Bupivacaine (0.5%) was given. In SICS, sclerocorneal tunnel incision was made of about 5-6 mm either superior or supratemporal location.

On the other hand, the patients who underwent Phacoemulsification , a clear corneal incision of about 2.8-3.2 mm was made either supratemporal or temporally with two side ports of about 1mm size about 40 degrees apart from the main incision.

Postoperatively all patients in both the groups were put on combined antibiotic and steroids (Moxifloxacin+Dexamethasone) eyedrops on tapering doses for 6 weeks. Clinical examination, dry eye symptom evaluation, Tear break up time, ocular surface staining and Schirmer's test I were assessed at 7th, 30th and 90th day post-operatively. The dryness of the eyes was analyzed and graded according to the DEWS classification 2007. [1]

SLIT LAMP EXAMINATION

1. **ANTERIOR AND POSTERIOR LID MARGIN:** For signs of blepharitis, meibomian gland dysfunction.
2. **TEAR MENISCUS HEIGHT:** It is seen as a fluid meniscus along the upper edge of the lower lid margin under slit lamp magnification. The highest height of the lower tear meniscus was measured by comparing it with the 1 mm beam light of the slit lamp. A cut-point of <0.3mm was used for classifying an abnormal tear meniscus height.

SPECIAL CHEMICAL TESTS FOR TEAR FILM DYSFU NCTION

A) **SCHIRMER'S TEST I (WITHOUT ANAESTHESIA)**: It is intended to provide a measure of tear production per unit time (both basal and reflex tear secretion). No. 41 Whatman's filter paper of size5x35 is used. While a value of <10 mm is taken to be a case of dry eye suspect which need to be confirmed by another test.
B) **TEAR BREAK UP TIME (TBUT):** It is measured to detect tear film instability. It is the interval between a complete blink and the appearance of the first randomly distributed dry spot in the cornea. A TBUT of 10 seconds is recommended as the cut-off point for normal individuals.
C) **FLUORESCEIN STAIN:** A sterile, moist, dry impregnated fluorescein paper strip is gently placed in the lower fornix at the junction of medial 2/3rd and lateral 1/3rd.

Fluorescein staining of the cornea was graded from 0-3 depending upon the area of corneal surface stained:
0: No staining of corneal epithelial surface
1: Mild staining occupying <1/3 of corneal epithelial surface.
2: Moderate staining occupying <1/2 of corneal epithelial surface.
3: Severe staining of >1/2 of corneal epithelial surface.

We have considered the discomfort, severity and the frequency of the symptoms, the tear film break up time and the schirmer's test 1 score from the classification and the final grading was done by adding the scores of the three mentioned test in the below mentioned table:-

dry eye severity level	1	2	3	4 (must have signs and symptoms)
discomfort, severity and frequency	mild and episodic, occurs under environmental stress	Moderate episodic or chronic, stress or no stress	Severe frequent or constant without stress	Severs and/or disabling and constant
tear film break-up time (in seconds)	variable	≤ 10	≤5	immediate
schirmer's test-I (in mm)	variable	≤10	≤5	≤2

FINAL GRADING OF DED

Severity	scoring
Mild	<3
Moderate	3-4
Severe	>4

RESULTS:

Table1: Baseline characteristic of 200 study population

Characteristic		Number	Percentage
Age group	**40-55**	**80**	**40%**
	56-70	**97**	**48.5%**
	>70	**23**	**11.5%**
Sex	**Male**	**95**	**47.5%**
	Female	**105**	**52.5%**
Residential status	**Urban**	**40**	**20%**
	Rural	**160**	**80%**
Operated eye	**Right**	**114**	**57%**
	Left	**86**	**43%**
Smoking	**Smoker**	**45**	**22.5%**
	Non smoker	**155**	**77.5%**
Computer use	**Yes**	**20**	**10%**
	No	**180**	**90%**
Environmental exposure	**Yes**	**95**	**47.5%**
	No	**105**	**52.5%**
Occupational exposure	**Yes**	**30**	**15%**
	No	**170**	**85%**

In the present study, cases were mostly found in the age group of 56-70 years (48.5%) followed by 40-55 years (40%) and above 70 years (11.5%). In this study, 105(52.5%) patients were female and 95(47.5%) patients were male .The sex ratio in the study population was **F: M=1.10:1.** The maximum number patients were hailing from rural area (80%) followed by urban population (20%). 22.5% of patients were smoker and 10% of patients gave the history of computer use. Environmental factors like wind, high temperature and sunlight and occupational factors like air conditioned room, computer use, radiation exposure etc were looked for. 47.5% of patients had environmental and 15% of patients had occupational exposure.

Figure 1:Type of surgery in study population

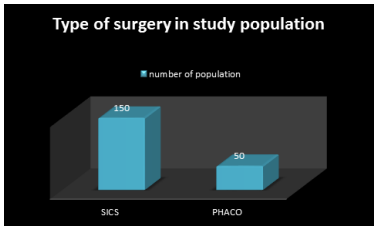
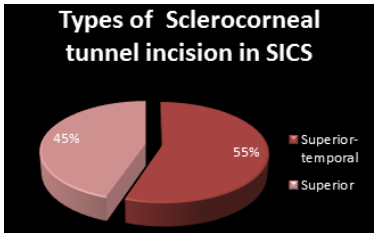
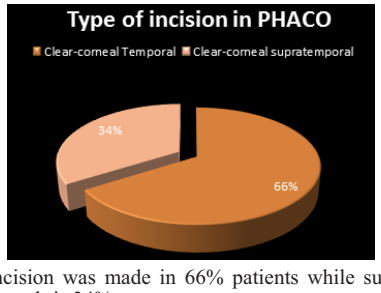


Figure2: Types of Sclerocorneal tunnel incision in SICS



Supratemporal incision was made in 55% patients and superior incision was made in 45% patients.

Figure3: Type of incision in PHACO



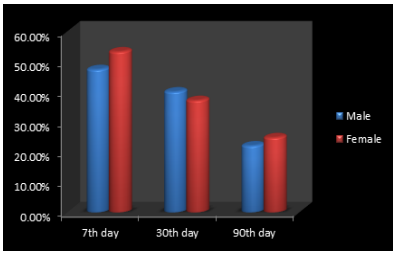
Temporal incision was made in 66% patients while supratemporal incision was made in 34%.

Table 2: No of eyes having dry eye on post-operative period

Type of dry eye	7th day	30th day	90th day
Mild	**54(27%)**	**35(17.5%)**	**29(14.5%)**
Moderate	**27(13%)**	**23(11.5%)**	**13(6.5%)**
Severe	**20(10%)**	**19(9.5%)**	**6(3%)**
TOTAL	**101(50.5%)**	**77(38.5%)**	**48(24%)**

In this study, on the 7th post-operative day, the total number of eyes presenting with signs & symptoms of dry eye was **101(50.5%)**. On 7th day, 54(27%) patients had mild DED, 27(13.5%) had moderate DED and 20(10%) had severe DED. On 30th and 90th day the percentage of DED decreased to 38.5% and24% respectively. In 30th post-op day, the mild, moderate and severe DED was 17.5%, 11.5% and 9.5% respectively. On the 90th post-op day, the mild, moderate and severe DED was 14.5%, 6.5%, and 3% respectively.

Figure 4: No of cases having dry eye in relation to gender



In the study population, the more number of dry eyes was found on 7th post-operative day in female population **(53.3%)** in contrast to male population **(47.4%).** On 30th post-operative day it was more in males (40%) than females (37.14%) and on 90th post-operative day the percentage decreased in both males (22.1%) and females (24.8%).

Table 3: No of dry eyes in the different age group in post operative period

Age group	7th day	30th day	90th day
40-55	43(53.8%)	32(40%)	19(23.8%)
56-70	47(48.45%)	38(39.2%)	25(25.8%)
>70	11(47.8%)	7(30.4%)	4(17.4%)
TOTAL	101	77	48

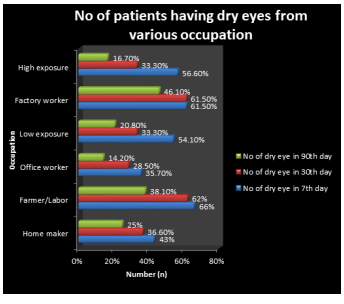
In the study population, we found that **40-55** year age group had maximum number (53.8%) of dry eye cases in 7th day. On 30th and 90th day 40-55 and 56-70 year age group had almost equal percentage of dry eye.

Table 4:Association of signs and symptoms in prevalence of dry eye

Signs & symptoms	No of patients		
	7th day	**30th day**	**90th day**
Symptoms	95(47.5%)	71(35.5%)	46(23%)
Schirmer's test 1 (≤10)	34(17%)	38(19%)	17(8.5%)
Abnormal TBUT(≤10)	45(22.5%)	38(19%)	18(9%)
Fluorescein staining	41(20.5%)	28(14%)	14(7%)

association of dry eye with symptoms and clinical signs. The signs and symptoms of dry eye were maximum in the 7th post-operative day. Gradually it declined in the 30th and 90th post-operative day.

Figure 5: No of patients having dry eyes from various occupation



SICS and PHACO group. We found that the p-value was not significant in SICS group (p>0.001) as well as in PHACO group (p>0.001) in relation to incision location.

From the above graph, we can conclude that **farmer/labour and factory workers** had higher prevalence showing **66%** and **61.5%** on 7th post-operative day. On 30th day, higher prevalence was present in the **farmer/labour (62%) and factory worker group (61.5%)** followed by home maker (36.6%), high exposure (33.3%), low exposure (33.3%) and office worker. On 90th day, factory worker had more prevalence (46.1%).

Figure 6: No of dry eye cases in SICS

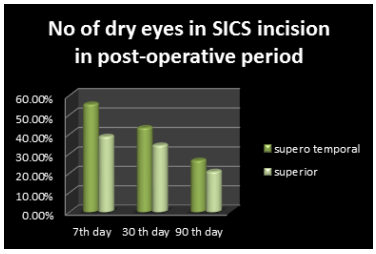


Figure 7: No of dry eye cases in PHACO

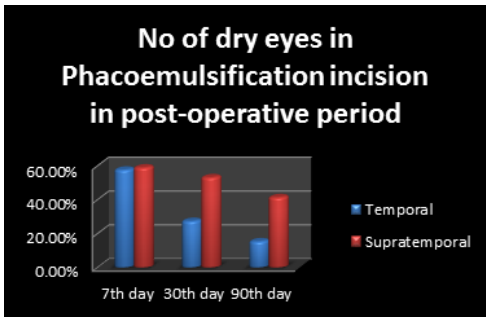


Table 5: Presence of dry eye depending upon the incision location

To see the significance between the incision location and relation of dry eye, we calculated p-value in

Presence of dry eye depending upon the incision location											
Surgery	Incision		7th day			30th day			90th day		
			Present	Absent	p-value	Present	Absent	p-value	Present	Absent	p-value
SICS	ST	83	46	37	0.0428	36	47	0.259	22	61	0.423
	S	67	26	41		23	44		14	53	
PHACO	T	33	19	14	0.932	9	24	0.0732	5	28	0.0412
	ST	17	10	7		9	8		7	10	

Table 6:No of dry eye disease in smokers

Smoker (N=45)	No of Dry eye disease		
	7th day	23	51.1%
	30th day	20	44.4%
	90th day	12	26.7%

In the study, maximum cases of dry eye were observed on 7th post operative day.

DISCUSSION

1) In our study, the mean age is 58.80 years which includes patients with senile cataract. Findings of the present study can be comparable to **Dodia K et al** (2013), **Sahu P. K.et al** (2015) and **Jayshree MP et al**(2017).[19,20,21]
2) In our study we found the maximum number of dry eye cases (50.5%) in the 1st week follow up. Gayathri Mohan et al (58.8%) observed aggravation of dry eye after cataract surgery worsening at three weeks postoperative period. [22] In our study at 1 month post-op period, the total number of patients presenting with signs & symptoms of dry eye was 38.5%.
3) In our study, female had an increase prevalence of DED. Our study correlates with the study done by Abhinav K et al (2018) and **Jayshree MP et al** (2017). The study done by **Gayathri Mohan et al** stated that females were more affected than males in their study done on comparative evaluation of dry eye before and after manual small incision cataract surgery. [22]
4) In this study prevalence of dry eye was more in the population with outdoor activities like the farmer, labor, field worker. **Gupta et al.** found the increased prevalence of dry eye in males which were engaged in outdoor work. [23] They also stated that males from the rural background are more exposed to sunlight, high temperature, excessive wind.
5) The study was done by **Khurana et al**. stated that outdoor air quality and temperature also affect tear film stability. Exposure to sun, dust, and wind exacerbate or precipitate DED. [24]
6) In our study, we found that 7.6% of asymptomatic patients had the dry eye.
7) In our study at 3rd month follow up we found that both SICS and PHACO group has the equal percentage of dry eye (24%). **Kavitha et al.** found that after manual small incision cataract surgeries with corneoscleral tunnel incisions, 66.2% of the patients had dry eyes, which was relatively high.[25]
8) In our study, we could not find any significant difference in the surgical procedure in relation to the dry eye. The p-value was not significant in any of the post-operative period. Also, we did not find any significant difference in SICS as well as in PHACO group in relation to incision location.
9) In this study 51.1% of smoker had dry eye. **Klein et al.** found the prevalence of dry eye was 60% among the smokers. [26]

CONCLUSION

Each form of dry eye (tear deficient form or evaporative form) has certain global features in common, including a set of characteristic symptoms, ocular surface damage, reduced tear film stability and tear hyperosmolarity. Increasingly an inflammatory component has become apparent, which contributes not only to symptoms but also to the disease process itself. For the patient, symptoms are the most important aspect of the disorder, whereas dry eye diagnosis depends additionally on the recognition of tear film instability and ocular surface damage. Tear film instability appears to be a component of all forms of dry eye disease, and tear hyperosmolarity is a key mechanism for ocular surface damage.

In this study, the diagnosis of dry eye was based on discomfort, frequency, and severity of symptoms, TBUT and Schirmer's test I and then graded by adding the score taken from them.

The etiology of the dry eyes following cataract surgery may be due to any of these mechanisms [27]

1) The frequent use of eye drops after cataract surgery
2) The tear film instability in the operated eyes can result either from a surface irregularity at the site of the incision
3) The exposure to light from the operating microscope
4) The decreased corneal sensation disrupts the cornea lacrimal gland loop, resulting in reduced tear secretion.

Hence, a little early detection of changes in the tear film status after cataract surgery and starting appropriate treatment results in better postoperative results with regard to quality of life of the patient.

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Conflict of interest- Nil

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