ORIGINAL RESEARCH

Evaluation of Dry Eye after Small Incision Cataract Surgery in Presenile Patients – A Clinical Study in a Tertiary Care Centre

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ABSTRACT
Dry eye is a significant concern following cataract surgery, impacting patients' ocular comfort and daily activities. This prospective study, conducted over a year(from 01/01/2023 to 31/12/23), focused on presenile patients (30-50 years) undergoing elective cataract surgeries. The aims were to identify factors contributing to postoperative dry eye and determine its incidence.

Various parameters, including incision size, topical eye drops, microscopic light exposure, and intraocular irrigation, were assessed. Results revealed a 60% incidence of dry eye after surgery. Larger incisions (7mm) and the use of preservative-containing eye drops correlated with higher dry eye percentages (40% and 80%, respectively). Prolonged microscopic light exposure (26-30 minutes) and vigorous intraocular irrigation (15 minutes) also contributed to increased dry eye cases (70% and 80%, respectively).

The study highlights the importance of minimizing surgical impact on the ocular surface. Counselling patients about potential postoperative dry eye symptoms and adopting strategies such as smaller incisions, preservative-free drops, and careful irrigation may enhance overall patient satisfaction and outcomes

INTRODUCTION

Dry eye as defined by the International Dry eye workshop is a multifactorial disease of the tears and ocular surfaces. It is a disorder of the tear film due to tear deficiency or excessive tear evaporation which causes damage to interpalpebral ocular surface and is associated with the symptoms of ocular discomfort. [1]Dry eye state is a form of non-infectious ocular surface disorder due to deficiency or absence of tear fluid. The ocular surface is defined as the entire sheet of epithelium which extends from the gray line back over the lid margin onto the back of the eyelids, into the inferior fornix up over the globe and onto the cornea. The ocular surfaces rub against each other with each blink. For smooth functioning, it is provided with lubricating fluid. The lubricating fluid is known as tears.[2]Normal tear film is a trilaminar structure comprising of superficial lipid layer, an Intermediate aqueous phase, and underlying mucous layer. Tears cleanse, lubricate, and nourish the surface of the eye, also provide physical and immune protection against infection. It forms smooth refractive surface for vision. Any change in the equilibrium of the three layered tear film can cause damage that may lead to disorders such as dry eye. Cataract operation is the most common ocular Surgery . It can cause ocular surface damage which can lead to dry eye disease. The Symptoms of dry eye are ocular discomfort, photophobia, sensation of dryness, foreign Body sensation such as grittiness and fatigue, burning, redness, blurred or fluctuating Vision, pain, headache, tired eyes, itching, stringy mucoid discharge, soreness, pseudoepiphora. It has been noticed that some patients during postoperative period present with dry eye symptoms. Dry eye disease can impair the ability of patients to perform daily activities which will affect the quality and mental health of the patient. Keeping these facts in mind, the present study is undertaken with the following aims and objectives

1. To find out various factors responsible for dry eye after cataract surgery in presenile patients.
2. To study incidence of dry eye after cataract surgery in presenile patients

MATERIALS AND METHODS

This prospective Study was conducted in Regional Institute of Ophthalmology, Gauhati Medical College &Hospital. A total of 100 patients aged between

30Years & 50 years of any gender, scheduled for elective cataract surgeries were included In this study, as these patients are categorized to presenile group. The Study was conducted over a period of one year from JANUARY 2023 to DECEMBER 2023. A detailed History and thorough Ocular examination including Tear breakup time(TBUT)Schirmer test (ST), Tear meniscal height(TMH) were done pre-operatively, post Operatively at 7 days, 30 days,90 days. All data was collected as per a predefined Proforma.

Inclusion criteria

1. Patients aged between 30 years and 50 years scheduled for elective cataract surgeries without dry eye symptoms.

Exclusion criteria were

1. Pre-existing dry eye
2. Pre-existing ocular disease like glaucoma
3. Uveitis
4. Disorders of the lid and nasolacrimal pathway
5. Ocular allergies
6. Pterygium
7. Blepharitis
8. Patients with chronic ocular medications
9. History of ocular trauma
10. Chemical injury
11. Burn
12. Sjogren's syndrome
13. Rheumatoid arthritis
14. Systemic lupus erythematosus
15. Diabetes mellitus

Before cataract surgery, Moxifloxacin eye drop was instilled 4 times daily for 2Days.2.5% phenylephrine And tropicamide drops were used to dilate pupil at 15Minutes interval For 1 hour before surgery. Post operatively combination of Moxifloxacin and Dexamethasone eye drop was used 1 drop 6 times daily for 2weeksand 1 drop4 times daily for another 4 weeks in the operated eye. Nepafenac eye dropswere also given for 6 weeks (1 drop 4 times daily)

This prospective study was approved by institutional Ethical committee and adheres to the declaration of Helsinki. Patients were verbally explained about the procedure and an informed consent was obtained from all patients who were enrolled in this Study.

All selected cases Underwent ICS procedure by a single surgeon with sufficient Experience in cataract surgery. The surgeries were performed under peribulbar anaesthesia. A foldable acrylic hydrophobic PCIOL was implanted in the capsular bag of each patient. The lens from the same company with same design was used in each case.

CLINICAL DATA COLLECTION AND ANALYSIS

History: A complete general and ophthalmic history was elicited. It was followed by aThorough ocular and systemic examination.

SLIT LAMP EXAMINATION

1. **Lower tear meniscus height (TMH):**

It is seen as a fluid meniscus the upper edge of the lower lid margin under slit lampMagnification. The highest height of he lower tear meniscus was measured by comparing it with the 1 mm beam light of the slit lamp. Value <0.3mm is consideredas an abnormal tear meniscus height.

2. **Tear meniscus floaters:**

These were seen as bits of debris being carried along in the lower and upper tearmenisci. They are composed o dead epithelial cells and small fibrils of lipidcontaminated mucus.

3. **Conjuctival Xerosis:** Appear as loss of smoothness of conjunctiva near the limbus
4. **Cornea:**

A. Cornealxerosis:

Appear as loss of lustre or shiny appearance of the corneal surface B. Mucous strands:

These were strings of lipid contaminated mucin that have been tolled up and pushedInto the conjunctival cul– de-sac by shearing action of the lid

C. Filaments:Filaments were seen as discreet, elongated, translucent strands, usually < 2mm lengththat hang from the surface of the cornea and which is painful on movement.

Tear film break up time:

It was done to measure tear film stability. It is the interval between a complete blinkand appearance of the first randomly distributed dry spot on the cornea .

The test is performed with the patient seated at the slit lamp and all fans in the roomswitched off. The tear film is stained with fluorescein and the patient is asked to blinka few times to allow tear film homeostasis. The eye observed through the oculars ofSlit lamp usingDiffuse illumination with cobalt blue filter. The patient is asked toblink once and then keep the eye open normally till instructed to blink again. After ablink, the fluoresceinstained tear film spread evenly across the corneal surface resulting in a yellow -green appearance, The time taken for the appearance of first darkspot noted. TheTest is repeated and average of the three values is noted as the tearTBUT.

TBUT>10 s considered as normal.

5- 10 s moderate dry eye,

< 5 s severeDry eye.

Schirmer's Test

Schirmer s test evaluates aqueous tear production. It is helpful in the assessment of patients with signs and symptoms of dry eye. To perform a Schirmer's test a special(no. 41 Whitman) filter paper is used which is 5 mm wide and 35 mm long . Patient wasmade to Sit comfortably. Each filter paper was folded 5mm from one end. Usually there is a notch in the filter paper 5 mm from one end, which indicates the point to be Folded. Folded tip was inserted into the lower lid: at the junction of the middle andouter thirds of the lower lid. The test lasted for 5 minutes, and the length of wettedpaper was directly read off the scale on the

paper itself. Schirmer's value >15 mm is considered normal, 9-14 mm -mild dry eye 4-8mm- moderate dry eye <4 mm-severe dry eye.

RESULTS AND OBSERVATIONS

The case selection, documentation were done as per materials and methodologies ofthe study. Total duration of the study was one year (from January 2023 to December 2023)the study was conducted on 100 patients aged between 30 years and 50 years of both sexes, who were scheduled for elective cataract surgeries

Table :1S howing incision size and percentage of dry eye cases after 90 days follow up.

FACTOR	ICISION SIZE IN mm											
	5.5 mm			6mm			6.5 mm			7 mm		
	Post op 7th day	Posto p 30th day	Posto p 90thday	Posto p 7th day	Posto p 30th day	Posto p 90thday	Posto p 7th day	Posto p 30th day	Posto p 90thday	Posto p7th day	Posto p 30th day	Pos t op 90th day
TBUT(s)	8	10	10	8	11	13	6	8	10	4	5	5
ST (mm)	14	18	15	14	16	15	9	12	15	7	9	12
TMH (mm)	0.20	0.26	0.22	0.18	0.20	0.22	0.16	0.18	0.20	0.13	0.18	0.2 0
No.of patients with dry eye cases	27	13	1	12	4	1	9	5	1	9	7	3
Percentage of dry eye	10%			14%			20%			40%		

Table shows that the highest number of dry eye cases in 7 mm incision- 40%, Followed by 6.5mm -20% , 6 mm- 14%, 5.5 mm- 10%

Table: 2 Microscopic Light Exposure And Dry Eye Test Values

FACTOR	MICROSCOPIC LIGHT EXPOSURE											
TIME	10-15 minutes			16-20 minutes			21-25 minutes			26-30 minutes		
POST OP DAYS	Post op 7thday	Post op 30thday	Post op 90thday	Post op 7thday	Post op 30thday	Post op 90thday	Post op7thday	Post op 30thday	Post op 90thday	Post op 7thday	Post op 30thday	Post op 90thday
TBUT(s)	10	16	12	10	12	10	8	11	12	5	7	8
ST (mm)	12	16	10	10	14	10	9	14	16	4	6	8
TMH (mm)	0.26	0.28	0.28	0.24	0.28	0.28	0.17	0.28	0.34	0.14	0.22	0.34
NUMBER OF PATIENTS WITH DRY EYE	38	15	1	18	8	1	6	4	2	6	5	3
PERCENTAGE OF PATIENTS WITH DRY EYE	10%			45%			50%			70%		

Table shows microscopic light exposure and percentage of dry eye cases. Those whoHad exposed to longer period of light showed more percentage of dry eye cases. 26-30

Table: 3 Intraocular Irrigation And Dry Eye Cases

FACTOR	INTRA OCULAR IRRIGATION								
Total time irrigation done	5 minutes			10 minutes			15 minutes		
POST OP DAYS	Post op 7thday	Post op 30thday	Post op 90thday	Post op 7thday	Post op 30thday	Post op 90thday	Post op 7thday	Post op 30thday	Postop 90thday
TBUT(s)	8	9	9	8	9	8	5	8	9
ST(mm)	7	8	9	8	8	9	6	8	9
TMH(mm)	0.24	0.28	0.29	0.13	0.14	0.23	0.12	0.16	0.20

NUMBER OF PATIENTS WITH DRY EYE	36	15	6	12	6	3	14	9	7
PERCENTAGE OF PATIENTS WITH DRY EYE	4%			50%			80%		

Table shows vigorous intraocular irrigation can cause dry eye. 15 minutes irrigation Showed 80 % cases of dry eye after 90 days of follow up, 10 minutes showed 50 % of Cases, 5 minutes irrigation showed 4 %o cases of dry eye.

Table: 4 Usage Of Topical Eye Drops And Percentage Of Dry Eye Cases

FACTOR	**TOPICAL EYE DROPS USED WITHPRESEVATIVES**			**TOPICAL EYE DROPS PRESEVATIVESFREE**		
POST OP DAYS	**Post op 7thday**	**Post op 30thday**	**Post op 90thday**	**Post op 7thday**	**post op 30thday**	**Post op 90thDay**
TBUT (s)	5	7	9	9	9	9
ST (mm)	6	8	9	9	9	8
TMH(mm)	0.13	0.16	0.18	0.20	0.24	0.28
NUMBER OF PATIENTS WITH DRY EYE	52	37	30	18	8	1
PERCENTAGE OF PATIENTS WITH DRY EYE	80%			15%		

Table shows those patients who used topical eye drops with preservatives developeddry eye disease. Dry eye cases were found to be quite high in patients who usedpreservatives containing topical eye drops -80 %.Patients who used preservative free Topical drops showed less cases 15% .

TOTAL INCIDENCE

Table: 5 Total Incidence of dry eye cases after cataract surgery in presenilepatients in 60% .

Total no, of cases undergone cataract surgery	**Total dry eye cases**	**Incidence%**
100	60	60

DISCUSSION

In this prospective study it was observed that dry eye symptoms due to ocular surface damages may occur after surgery of presenile cataract [3] When cataract develops before the age of 50 it is defined as Presenile cataract. "Cataract surgery can induce dry eyein patients with healthy ocular surface prior to surgery. Affected patients may experience foreign body sensation, grittiness, burning sensation and watery eyes postoperatively .Dry eye test values were affected in early postoperative days but a decrease in test values were found in further postoperative follow up.In the present study we made a detailed assessment of various risk factors that canpotentially cause dry eye disease after cataract surgery in presenile patients.We evaluated the effect of sclero-corneal tunnel incision, usage of preservative containing eye drops, microscopic light exposure and repeated irrigation and drying intra operatively.

1. INCISIONAL CORNEAL NERVE DAMAGE

Cornea is one of the most sensitive tissues of the body, as it is densely innervated with sensory nerve fibres via ophthalmic division of trigeminal nerve by way of 70-80 longciliary nerves. The corneal nerves are important in the self regulation of tears sincethey provide the sensation in the feedback loop that signals tear production. When we block or decrease the function of these nerves ,we can significantly limit the eye's ability to create a proper tear film ,which can lead to decreased vision and symptomatic patients. The Surgical procedure that cause corneal denervation can cause epithelial injury and hind rance in wound healing , epithelial permeability is also increased .This willIn turn affects metabolic activity of corneal epithelium and cause structural damage. Corneal sensation is function of the long ciliary nerves of the ophthalmic division of Fifth cranial nerve that is Trigeminal nerve.

In this study it was observed that as the size of corneo -scleral tunnel increases bigger part of the cornea gets denervated and neural regeneration is also prolonged which in turn leads persistent foreign body sensation and other symptoms of dry eye disease. This study showed similar results with other studies where size of the incision correlates with occurrence and duration of dry eye.

Yang et al observed aggravation of dry eye symptoms in their study. They conducted Their study on 70 eyes of 35 patient .They noted no difference in dry eye test

values Based on incision location but test values can get affected with increase in depth of incision. [4]A Study conducted by Lyne showed complete loss of corneal sensitivity m patients Who had undergone cataract surgery, only 2 of 9 patients recovered after 2 years of follow up.[5] Similar result were Observed in another study by John. On 60 patients.

Kim et al. conducted similar study in which they assessed all parameters at 1 week, 1Month and 3 months after surgery and observed decreased corneal sensitivity post Operatively .[6]

2. APPLICATION OF TOPICAL EYE DROPS

As a part of routine treatment regime topical eye drops including antibiotic drops, nonsteroidal eye drops, steroidal eye drops were prescribed to the patients after cataract surgery. Topical eye drops usually contain preservatives. Preservatives are used to decrease contamination to provide anti microbial activity, to prevent secondary mycotic, amoebal, bacterial ocular infections, and prolong the half-life of the drug by preventing biodegradation and maintaining drug potency. Some of the examples are Benzalkoniumchloride(BAC),chlorobutanol, methylparaben, sodiumperborate, stabilized thimerosal. The most commonly used preservative in ocular preparations is Benzalkonium chloride.[7] In this study it was observed that those patients who used topical eye drops with preservatives developed dry eye diseases, Percentage of dry eye disease postoperatively after 90 days follow up was high among them. Toxicity of preservatives may cause ocular surface damage and exacerbate dry eye symptoms. Similar study conducted by Jee et al, on 80 patients also noted same findings.[8]Xue- Min et al, also noted occurrence of dry eye after cataract surgery postoperatively. As total of 50 eyes of 37 patients were examined in their study. Manyauthors have raised the possibility of toxicity of preservatives added in topicaleye drops on ocular ssurface[9'10'11]Benzalkonium chloride (BAK)exacerbate dry eye symptoms ,interfere with the integrity of the external lipid layer of the pre-corneal tear Film, reduction of tear film break up time BAK toxicity is dose dependent.BAK at low concentration can cause cell arrest byapoptosis and high concentration can cause necrosis. Various in vivo vitro studies hasbeen proved toxicity of BAK on corneal and conjunctival epithelial cellsexperimentally. [12]

3. PHOTOTOXICITY

Phototoxicity caused by prolonged microscopic light exposure can be one of thepossible factors causing dry eye post operatively. In the present study it was foundthat patients who had prolonged exposure to microscopic light intraoperativelydeveloped dry eye disease.

Similar study: Yang et al. Observed same findings of our study. They noticedWorsening of dry eye test values post operatively.

Oh et al. In his study on 48 eyes Demonstrated longer the microscopic light exposure higher the chances of developing Dry eye diseases. He observed decrease in goblet cell density which had not recovered At three months after surgery.[13]Excessive light exposure can cause possible damage to the ocular surface and tear film Stability. Hyung et al.demonstrated this in his study on 30 rabbits[15]. Light exposed Group showed decreased aqueous production, decreased conjunctival goblet cell Density, squamous metaplasia of conjunctival epithelial cells, ultrastructural cellular Damage to corneal and conjunctival tissues. Ipek et al. conducted in vitro study on porcine fibroblast and documented fibroblastic cell damage and delayed wound healing on prolonged light exposure.[16]Otherauthors also reported microscopic exposure as a contributory factor for dry eye after cataract surgery[14].

4. REPEATED INTRA-OCULAR DRYING AND IRRIGATION

Repeated irrigation and drying is done intra operatively during cataract surgery in order to maintain optical clarity. In our study it has been noticed patients who had undergone vigorous irrigation for a prolonged time developed dry eye symptoms postoperatively. Vigorous irrigation and drying can cause ocular surface trauma by damaging conjunctival and corneal epithelial cells ,also reduces goblet cell density.Our study was in accordance with similar study by Moon et al. He observed aggravated dry eye parameters during early post operative period.[17]Saurabh et al. also concluded that one of the factors contributing dry eye is Repeated irrigation and drying their study on 100 patients. Dry eye assessment had done preoperatively, at 7th day, 21st day and 90th day post operatively and they observed dry eye test values was affected till three months after surgery.[18]

INCIDENCE OF DRY EYEIN PRESENILE CATARCT PATIENTS AFTER CATARCAT SURGERY

In the present study the incidence of dry eye disease after cataract surgery in presenile patients was found to be 60%.

Venugopal et al.in their study documented 62.2%%of the patients had dry eyes after cataract surgery. They conducted their study on 68 patients and they concluded after small incision cataract surgery majority of the patients were developed dry eye disease. Jayashree et al.also observed same findings in their study on 81 patients. Cho and kim also reported aggravation of dry eye symptoms in their study during follow up period after cataract surgery. A total of 98 eyes were included in the study. Similar studies by various authors have been observed dry eye disease after cataractsurgery.[19'20'21'22'23]Many previous studies had been conducted on dry eye disease after cataract surgery in senile cataract patients. But our study was done on presenile cataract patients. Not much studies

has done on presenile age group.But the risk factors for developing dry eye after surgery in both the presenile and senile age group were found to be same. Not much studies has done on presenile age group.

SUMMARY

Present study was a prospective study conducted in Regional institute of ophthalmology, GMCH over a period of one year (from January 2023 December 2023). The study was conducted on 100 patients aged between 30 years and 50 years of both sexes, who were scheduled for elective cataract surgeries. Our main aim was to find out factors responsible for dry eye after cataract surgery in presenile patients and also to find incidence of dry eye after cataract surgery in presenile patients.

Patients were subjected to a detailed history taking and thorough ocular examination under slit lamp biomicroscope. Then a series of objective dry eye test was conducted Tear meniscus height, Tear break up time, Schirmer test, history taking ,ocular examination and dry tests were done preoperatively, post operatively at 7 days, 30days, 90 days.

The results were documented in a presented proforma and analysed at the end of the study.

1. Incidence of dry eye after cataract surgery in presenile patients was found to be 60 %.
2. Highest percentage of dry eye was observed in patients who had incision size of 7mm- 40%.
3. Patients who used topical eye drops containing preservatives developed dry eye disease. Dry eye cases were 80% in them.
4. Those who had exposed to microscope light for a longer time (26-30 minutes)Showed 70 % of dry eye cases.
5. Vigorous irrigation and drying can also cause dry eye,15 minutes irrigation showed80% of dry eye cases at 90 days of follow up.

CONCLUSION

Cataract surgery is capable of causing dry eye disease and affecting dry eye test Values. Factors responsible are sclerocorneal incision, microscopic light exposure Repeated irrigation, topical eye drops containing preservatives. Even after successful Cataract surgery patients may be dissatisfied due to dry eye symptoms. Therefore, Proper counselling should be done before surgery about the possible occurrence of Dry eye symptoms after surgery. By decreasing incision size of tunnel, minimizing microscopic light exposure and vigorous irrigation, using preservative free drops can Decrease dry eye symptoms post operatively.

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