

## Evaluation of the Prevalence of Changes in Tear Film and Tear Secretion after Small Incisional Cataract Surgery: A Cross Sectional Study

Ashish Kumar<sup>1</sup>, Sharfuddin Ahmed<sup>2</sup><sup>1</sup>Senior Resident, Department of Ophthalmology, Vardhaman Institute of Medical Sciences, Pawapuri, Nalanda, Bihar<sup>2</sup>Associate Professor and Head of Department, Department of Ophthalmology, Vardhaman Institute of Medical Sciences, Pawapuri, Nalanda, Bihar

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Corresponding Author: Dr. Sharfuddin Ahmed

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### Abstract:

**Background:** Cataract is the major cause of blindness in the developing world. Aims of this study to clinically evaluate the prevalence of dry eyes after manual small incision cataract surgery based on signs and symptoms and, quantifying them using various test methods.

**Methods:** Follow up of 150 patients who had undergone SICS was done at regular interval starting at 1st week post-operative and continued up to 3rd months. Evaluation is done by performing Schirmer's test – I, TFBUT, Rose Bengal test followed by noting the symptoms which were relevant to the dry eyes. The observations were analyzed and graded according to the severity of dryness.

**Results:** Most of the patients had mild to moderate dry eye with male domination the female. Severe to very severe dry eyes was seen at 6th post-operative week, mild to moderate dryness of eyes was seen at 2nd & 3rd. weeks.

**Conclusion:** Dryness of eyes is usually seen after small incision cataract surgery and majority being mild to moderate dryness of eyes. Worsening or aggravation of dryness occurred in 6th week's post-operative interval. Post-operative management of cataract surgery should also include medication to deal with altered ocular surface tears film.

**Keywords:** Cataract, Dry eye, Small incision cataract surgery, Schirmer's test, Sclero corneal tunnel.

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### Introduction

In a developing countries like India, manual small incision cataract surgery is still the most efficient and economical means of treating patients with cataract. Even the base camp surgeries conducted under the National program for control of blindness are predominantly manual small incision cataract surgeries with sclerocorneal tunnel.

Improvement in the visual acuity after cataract surgery is accompanied by considerable gains in real life activities. [1] But they do have complication of altered tears film which can have a significant impacts on quality of vision and life. It impairs the ability of the patients to perform daily activities and can impact work productivity. [2] Dry eye is a multifactorial disease of the tears and the ocular surface, that results in symptoms of discomfort, visual disturbance, and tears film instability, with potential damage to the ocular surface. [5] Dry eye is due to the disturbance in lacrimal function unit, which comprises of the lacrimal gland, ocular surface, lid and the nerves connected to them. Damage to any component of the lacrimal function unit can desta-

bilize the tear film leading to ocular surface disease and visual disturbance. [8] Abnormalities of the tear film can be due to, aqueous tear deficiency, mucin deficiency, lipid abnormalities and lid abnormalities. Any irregularity in the ocular surface cause instability of the tear film leading to, quick breakup of the tear film before the next blink. [34] Patient who had dry eyes even before the cataract surgery have more aggravation of the symptoms than those who were normal. The incidence of dry eye after cataract surgery range from 33.8% to 66.2%. [3,4]

Patients of dry eye syndrome are more likely to have problems with their daily activities, including reading, driving, watching television and computer use. Studies have shown that dry patients are reported to have significant loss of productivity each year, with an average of only 208 working days. [6] Dry eye syndrome is still a serious visual problem related to the quality of life. After an uneventful cataract extraction with significant vision improvement, many patients still have complains and

are unsatisfied because of the dry eye symptoms. Any abnormality in the ocular tears film can have a significant impact on the quality of life by hampering their daily activities. The environmental exposure to wind, sunlight and high temperature predisposes to dry eyes, and cataract surgeries are known to aggravate the symptoms. [4] So, there is a need to clinically evaluate the all the patients for dry eye syndrome before cataract surgery so that necessary measures can be initiated to increase the patient's compliance.

### Material and Methods

This descriptive cross-sectional study was conducted on 150 patients who had undergone small incision cataract surgery from, June 2017 to May 2018 at the department of ophthalmology, Vardhaman Institute of Medical Sciences, Pawapuri, Nalanda, Bihar. Informed Consent form from the patients was obtained. Sample size calculation in descriptive study

#### Formula used is: $n = z^2 \frac{p(1-p)}{d}$

Where  $n$  = sample size,  $z$  =  $z$  statistic for a level of confidence,  $p$  = estimated proportion of an attributed present in the population,  $d$  = level of precision.

Inclusion criteria consist of patient who had undergone uneventful manual small incision cataract surgery. Age of the patients included in the study ranges from 50 to 80 years. Any disorder of eyelids, past ocular surgeries, any other pre-existing ocular or systemic disease, any ocular or systemic medication, on radiation therapy and smokers were excluded from the study.

A case study proforma was prepared for each patient and the data was collected. Demographic information like name, age, sex and address of the patient were collected. The information on the date of the surgery, the post-operative duration and the eye which was operated on, were obtained. The symptoms which were relevant to the dry eyes were noted, wherever necessary the symptoms were elicited on further questioning. Slit lamp examination, marginal tears meniscus height, Rose Bengal (Modified Van Bijsterveld, schirmer's test-I and tear film break-up time were evaluated in this order. The data were collected from the patients who came for follow up, following manual small incision cataract surgeries.

ST-I was evaluated without corneal anesthesia by using a standardized schirmer's strip, with its dimensions, 5mm x 35mm. The patient was made to sit comfortably in a quiet room, and the strip was inserted into the lower temporal lid margin, after folding it at the notch and asking the patient to look straight. After 5 min, the strip was removed, and the length of the moistened area was recorded.

TBUT was assessed using a slit-lamp with a cobalt blue filter and sodium fluorescein. A fluorescein strip was applied in the lower palpebral conjunctiva, and the patient was asked to blink 5 times, after which he/she is asked to refrain from blinking. The appearance of black spots or lines indicates the onset of dry spots and the interval between the last blink and the first randomly distributed dry spot was taken as the TBUT. The average of three measurements was recorded and a value < 10 s was taken as abnormal. After 5 min, with the patient sitting on the same slit lamp, TMH was evaluated by adjusting the vertical length of slit beam on the tear meniscus at the center of the lower lid and the readings were noted from the slit lamp scale.

Rose Bengal staining test is performed by placing a moistened rose Bengal strip after instilling a drop of anesthesia. It is used to stain the devitalized ocular surface epithelial cells. Modified Van Bijsterveld grade the conjunctiva based on the density of the stain and the finding is then recorded on a scale. [33]

All the above tests were done on each patient and the data were graded, based on the guidelines of the 2007 Report of The International Dry Eye Workshop (DEWS). The grading was done as follows, based on the level of discomfort, severity and frequency: Grade 0: nil or no signs and symptoms, Grade 1: mild and or episodic; occurs under environmental stress, Grade 2: moderate, episodic or chronic, stress or no stress, Grade 3: severe frequent or constant without stress, Grade 4: severe: disabling and constant.

Preoperative medication like Flurbiprofen (1%) E/D qid, ofloxacin (0.3%) E/D qid were given one day before the cataract surgery. Mydriasis was achieved using eye drop 'tropicamide (0.8%) + phenylephrine hydrochloride (5%) eye drop 3times over an hour before the surgery.

All the patients underwent manual small incision cataract surgery under peribulbar block using 2% lidocaine for local anesthesia, ringer lactate as irrigating solution and hydroxyl propyl methyl cellulose as viscoelastic material. A 5.5-7.5mm superior incision 1.5 -2 mm behind the limbus and a three planar self-sealing sclera-corneal tunnel were made. Side port incision of 1 mm was made at 9 O'clock position. Capsulorrhexis, hydro dissection, and nucleus rotation were carried out sequentially. The posterior chamber intraocular lens is implanted and finally the side port and the wound is sealed.

All the patients received a standard postoperative regime consisting of topical steroid, antibiotic, and nonsteroidal anti-inflammatory drugs in tapering doses for 4 weeks. Post - operative assessment was

done at various intervals starting at 1st week, 3rd weeks, 6th weeks, 2 months, and 3 months.

**Results**

The data from 150 patients were collected and assessed for the presence of dry eye. Comparison of the eye was done from one day (preoperative) followed by post-operative interval of first week,

third weeks, sixth weeks, two months and third months respectively. It was observed that 46% of patients were in 61-70 age groups, followed by 31.3% in 51-60 years, 20.7% in 71-80 years & 2% in 41-50 years.

Female constitute 51.3% and male 47.8% of the study group.

**Table 1: Findings on schirmer’s test-I**

Schirmer’s Test	Normal		Mild to Moderate		Severe		Very Severe		Pair	Z#	p
Before surgery (A)	117	78%	32	21.3%	1	0.7%	0	0%			
1 week (B)	107	71.3%	40	26.7%	3	2%	0	0%	A Vs B	3.46**	0.001
3 weeks (C)	103	68.7%	41	27.3%	5	3%	1	0.7%	A Vs C	4.08**	0.000
6 weeks (D)	82	54.7%	35	23.3%	22	14.7%	11	7.3%	A Vs D	7.16**	0.000
2 months (E)	93	62%	42	28%	15	10%	0	0%	A Vs E	5.86**	0.000
3 months(F)	91	60.7%	41	27.3%	18	12%	0	0%	A Vs F	6.41**	0.000

**\*\*Significant at 0.01 level; #Wilcoxon Signed Ranks Test**

Mild to moderate (28%) dry eye were seen at 2nd months after surgery, severe (14.7%) and very severe (7.3%) dry eye at 6th weeks. Severe dry eye were not seen at late post-operative period. In all the test periods significant increase in dryness of eyes were found as compared to pre-operative period.

**Table 2: Findings on TFBUT**

Tear Film break up time Value	Normal		Mild to Moderate		Severe	Very Severe	Pair	Z#	p
Before surgery (A)	103(68.7%)	47 (31.3%)	0	0					
1 week (B)	100 (66.7%)	50 (33.3%)	0	0			A Vs B	1.73	0.083
3 weeks (C)	92 (61.3%)	55 (36.7%)	2 (1.3%)	1 (0.7%)			A Vs C	3.64**	0.000
6 weeks (D)	74 (49.3%)	49 (32.7%)	8 (5.3%)	19 (12.7%)			A Vs D	6.71**	0.000
2 months (E)	85 (56.7%)	56 (37.3%)	8 (5.3%)	1 (0.7%)			A Vs E	5.11**	0.000
3 months (F)	84 (56%)	56 (37.3%)	8 (5.3%)	2 (1.3%)			A Vs F	5.23**	0.000

**\*\*Significant at 0.01 level; #Wilcoxon signed ranks test.**

Cases of severe dry eye (5.3%) were found at 6th weeks, 2nd & 3rd months, very severe dry eye at 6th week (12.7%) and mild to moderate at 2nd & 3rd months. In all the test periods except 1st week, significant increase in dryness of eyes was seen as compared to pre-operative eyes.

**Table 3: Findings on rose Bengal test (modified van bijsterveld)**

Rose Bengal Test	Normal	Abnormal	Pair	Z#	p
Before surgery (A)	97 (64.67%)	53 (35.33%)			
1 week (B)	93 (62%)	57 (38%)	A Vs B	1.73	0.083
3 weeks (C)	87 (58%)	63 (42%)	A Vs C	3.64**	0.000
6 weeks (D)	69 (46%)	81 (54%)	A Vs D	6.71**	0.000
2 months (E)	79 (52.67%)	71 (47.33%)	A Vs E	5.11**	0.000
3 months(F)	83(55.33%)	67 (44.67%)	A Vs F	5.23**	0.000

**\*\*Significant at 0.01 level; #Wilcoxon signed ranks**

Majority of the patients had dry eye (dry eye) at 6th weeks (54%) and few had dry eye at 1st week (38%).

**Table 4: Findings based on signs and symptoms (DEWS)**

Dry Eye Severity Grade	No Dry Eye	Mild Dry Eye	Moderate Dry Eye	Sever DryEye	Very Severe DryEye	Pair	Z#	p
Before (A)	54 (36%)	64(42.7%)	28 (18.7%)	4 (2.7%)	0 (0)			
1 week (B)	52(34.7%)	57 (38%)	33 (22%)	8 (5.3%)	0 (0)	A Vs B	3.44**	0.001
3 weeks (C)	43(28.7%)	60 (40%)	36 (24%)	9 (6%)	2 (1.3%)	A Vs C	5.46**	0.000
6 weeks (D)	31(20.7%)	40(26.7%)	44 (29.3%)	27 (18%)	8 (5.3%)	A Vs D	8.76**	0.000
2 months (E)	33 (22%)	47(31.3%)	44 (29.3%)	24 (16%)	2 (1.3%)	A Vs E	8.09**	0.000
3 months(F)	34(22.7%)	50(33.3%)	39 (26%)	26(17.3%)	1 (0.7%)	A Vs F	7.79**	0.000

**\*\*Significant at 0.01 level; #Wilcoxon signed ranks test**

Majority of patients had mild dry eye at 3rd week (40%), moderate dry eye (29.3%) at 6th weeks & 2nd months, severe dry eye at (18%) at 6th weeks and very severe dry eye (5.3%) at 6th weeks.

**Table 5: Number of patients having dry eye & non-dry eye**

Dry eye	No	Yes	Pair	Z#	p
Before surgery (A)	98 (65.3%)	52 (34.7%)			
1 week (B)	93 (62%)	57 (38%)	A Vs B	1.89**	0.059
3 weeks (C)	85 (56.7%)	65 (43.3%)	A Vs C	3.36**	0.001
6 weeks (D)	66 (44%)	84 (56%)	A Vs D	5.66**	0.000
2 months (E)	76 (50.7%)	74 (49.3%)	A Vs E	4.49**	0.000
3 months(F)	78 (52%)	72 (48%)	A Vs F	4.26**	0.000

**\*\*Significant at 0.01 level; #Wilcoxon signed ranks test**

Majority of dry eye were diagnosed at 6th weeks (56%) and minimal dry eye at 1st week (38%). [calculation was done by taking the number of patients having (46.8%) dryness of eye and non-dry eye (53.08%) at post-operative intervals The average percentages of 1st, 3rd, & 6th weeks and 2nd & 3rd months is then taken, and divided by 5].

**Table 6: Comparison of dry eye based on gender**

Dry eye		Male		Female		Chi-square test	p
		Count	Percent %	Count	Percent %		
Test Before surgery	No	43	58.9	55	71.4	2.6	0.107
	Yes	30	41.1	22	28.6		
1 week	No	43	58.9	50	64.9	0.58	0.447
	Yes	30	41.1	27	35.1		
3 week	No	39	53.4	46	59.7	0.61	0.435
	Yes	34	46.6	31	40.3		
6 week	No	31	42.5	35	45.5	0.14	0.712
	Yes	42	57.5	42	54.5		
2 month	No	37	50.7	39	50.6	0	0.997
	Yes	36	49.3	38	49.4		
3 month	No	37	50.7	41	53.2	0.1	0.754
	Yes	36	49.3	36	46.8		

In our study dry eye is seen in, 48.6% of male and 45.22% of female after the cataract surgery. At first week's post-operative, 41.0% of male and 35.1% of female had dry eye. And at sixth weeks post-operative, 57.5% of male and 54.5% of female had dry eye.

### Discussion

Dry eye is an ocular surface disorder, and it affects individuals worldwide. Dry eyes syndromes usually seen following cataract surgeries may be due to multiple factors and mechanisms. [7] Taking into consideration, the clinical methods used in my study on 150 patient's eye, it was seen that there was a significant increase of dry eyes in all post-operative intervals of 1st week, 3rd weeks, 6th weeks, 2nd month and 3rd months. But the results varies slightly in grading since ST-I assessed the aqueous tear production (lacrimal gland), TFBUT diagnosed the abnormal in aqueous tear deficiency and Meibomian gland disorder (lipid layer), and Rose Bengal test (modified van bijsterveld) detect the presence of dead and devitalized epithelial cells.

The chronic use of eye drops after cataract surgeries as also seen in other studies can lead to

toxic changes in the cornea and the conjunctiva due to the presence of preservatives. [7,35,36] Li et al., in their study demonstrates that, even 3 months following cataract surgery, goblet cells were reduced in lower bulbar conjunctiva along with changes of squamous metaplasia, these findings suggests that misuse of eye drops may be one of the major pathogenic factors in dry eye. [27] So the necessity of using preservative free eye drop and question of reducing the duration of eye drop post cataract surgery can also be discussed without compromising on the safety parameters. While on the other hand the role of eye drops in postoperative dry eye has not been confirmed in other studies (Khanal et al., 2008); [32] (Ram et al., (2002). [30]

In our study male (48.6%) had more dry eye compare to female(45.22%) postoperatively, but the finding was clinically insignificant with p value 0.669. While Some of the other study done by Jayshree MP have reported a higher prevalence of dry eyes in females than in males. [37,4,9]

In this study we make use of multiple parameters like ST-1, TFBUT, Rose Bengal test and subjective variable like DEW-2007 to analyze the magnitude of dry eye after small incision cataract surgery.

Aggravation of dry eye symptoms and signs (DEWS-2007), with altered ST – I and TFBUT was seen after small incision cataract surgery. Similar study conducted by srinivasan R et al., have also found that TFBUT was reduced in pseudophakic eyes after cataract surgery, which indicates tear film instability. [12] Dry eye usually seen after cataract surgery could be due to irregularity in the ocular surface at the site of incision or from the decreased mucin secretion by the conjunctival goblet cells. Good intra operative wound construction and opposition of the wound including the conjunctival flap with minimum distortion of ocular surface might help us in dealing with the problem to dry eye to some extent.

Our study, also found that dry eyes were more prevalent in 6th weeks which were significant, with a p value of 0.000, which is almost similar to the study done by K.C. Venogupal et al. [38] Whereas study by Liu Z et al., found that TFBUT and ST – I scores were significantly reduced on the early post-operative in day and return to normal at the 4th weeks. [13]

In our study no medication or treatment for dry eyes were given either pre-operatively and post-operatively. But Calvin W Roberts et al, [14] showed that the administration of cyclosporine ophthalmic emulsion 0.05% two times daily for one month prior to the cataract surgery and one month following the surgery could reduce the problem of dry eyes after cataract surgery. Various studies have estimated the prevalence of DES to be between 5% and 34% of the population. [16,17] While Studies conducted in Thailand, shows that the incidence of dry eye in hospital based population was 34%. [18]

The difficulties which are usually encounter while assessing dry eye is the lack of a specific guidelines or a gold standard test. [21] As a result various diagnostic tools with different sensitivities and specificities are used to assess the dry eye syndrome thus, resulting in variable observations by different authors.

The sclera-corneal incision wound can damage the corneal nerve, which may decreased corneal sensation and finally leads to dry eye syndrome. [8,39] Study conducted by K.C. Venogupal et al., had shown that dry eye was more on superior incision than on temporal incision. But theoretically the symptoms of dry eye should be more severe on temporal incision than on superior incision due to more damage on long ciliary nerve which is predominantly at the 9 o' clock and the 3 o'clock positions. [38]

According to ESCRS after cataract surgery the prevalence of dry eye disease symptoms increases with patients complaining of foreign body sensation, ocular fatigue and dry eye redness. Cataract surgeries also aggravate the symptoms of dry eye with, a decrease in tear film meniscus,

altered Schirmer test scores and TFBUT. Based on Various studies the prevalence of DES is found to be between 5% - 34% of the population. [26] One of the major risk factor for developing DES or exacerbating pre-existing DES is an ocular procedure, most commonly being cataract. [28] In our study it is seen that all the dry eye test values were significantly worse after cataract surgery in the group who were normal preoperatively. [27]

Vigorous irrigation and manipulation of the ocular surface during the surgery may reduce the goblet cell density and results in altered TFBUT post-operatively. [31] Minimal insult to the eye by gently handling the ocular surface tissue and causing less ocular distortion may decrease the post-operative complications related to dry eye. Studies with longer period of follow-up will be required to assess the time taken for the ocular surface and the tear film to recover.

### Conclusion

It can be concluded that cataract surgery induces dry eye symptoms even in patients who were normal prior to surgery. So, it is very important to evaluate all the patients for signs of ocular surface disorder before and after the cataract surgery. Cataract Patients must be informed about the possible increase in dry eye symptoms after the surgery, and artificial tears may be prescribed in the postoperative period so that the patient will have a better quality of life and vision. Future research should focus on means to achieve better patient's satisfaction after cataract surgery.

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