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### Dry eye following cataract surgery

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#### ABSTRACT

##### Aim

To Evaluate Dry Eye changes after small incision cataract surgery and Phacoemulsification.

##### Materials and Methods

This is a prospective study with 100 Uncomplicated Cataract patients between age group above 45-75years undergoing cataract surgery were taken for the study and dry eye changes were analyzed at 7,30 and 90 days after SICS and PHACOEMULSIFICATION including clear corneal incision and scleral incision by TBUT and Schirmers test.

##### Results

After 90 days postoperatively 12% of patients proved dry eye changes with reduced TBUT, 14% patients showed dry eye symptoms which were more marked in patients who underwent phacoemulsification.

##### Conclusion

3 months after cataract surgery (SICS and PHACOEMULSIFICATION) 14% of patients showed dry eye symptoms, 12% showed decrease in TBUT, 11% had lower value of schirmer1 and 8% had lower value of schirmer with anesthesia. Symptoms and signs of dry eye occurred as early as 7<sup>th</sup> post operative day after cataract surgery and the severity pattern improved over time. So evaluation of patients of both before and after cataract surgery either small incision cataract surgery or phacoemulsification should be done to prevent further damage to the ocular surface and able to manage the patients promptly and effectively so the patients will not have poor quality of life and vision due to dry eye syndrome.

**Keywords:** Dry eye, TBUT (tear break up time), Schirmer test, SICS (Small incision cataract surgery), Phacoemulsification.

#### INTRODUCTION

Dry eye is a multifactorial disease of the tears and ocular surface. [1] Ocular symptoms such as pain, irritation and poor vision can result from the dry eye. Severe dry eye affects patients ocular and general health, well being and quality of life. [1, 3] Since the dry eye syndrome is common worldwide

it can be caused by many things. Numerous epidemiological studies reported. [4-8] that aging, connective tissue disease, diabetes, use of antihistaminics and refractive surgery are risk factors for the development of dry eye. Worldwide, Cataract is the most common cause of diminishing of vision seen with aging. Modern cataract surgeries are considered very safe for the cornea

with a good visual outcome. Different surgical modalities like small incision cataract surgery and phacoemulsification with scleral or corneal incisions have varying effect on tear film stability which leads to disruption of corneal nerves [9, 10].

Few reports of dry eye syndrome have focused on patients who have undergone phacoemulsification and small incision cataract surgery and subsequently developed dry eye.

In current study, we use various measurements like TBUT and Schirmer test to assess the incidence of dry eye syndrome amongst patient who underwent small incision cataract surgery and phacoemulsification.

## **MATERIALS AND METHODS**

This prospective study was conducted at ophthalmology department, after approval by ethics committee. 100 eyes of 100 patients between the age group of 45-75 years presenting with age related senile cataract, scheduled for cataract extraction surgery were studied to evaluate post cataract surgery tear film changes and dry eye symptoms. The patients were divided into two groups, group A undergoing phacoemulsification (50patients) and Group B undergoing manual SICS (50patients). Group A patients were again subgroups, Group A1 underwent phacoemulsification with clear corneal incision and group A2 phacoemulsification with scleral incision.

### **Exclusion Criteria**

Patients with preexisting ocular disease like glaucoma and uveitis. Lid disorders (blepharitis, meibominitis, ectropion, entropion, lagophthalmous, trichiasis), preexisting dry eye disease or symptoms, previous ocular surgery, ocular allergies, pterygium, corneal opacities, signs of vitamin A deficiency.

Clinical examination included a comprehensive anterior segment evaluation including slit lamp biomicroscopy to rule out any preexisting ocular surface disorders,

Tear breakup time and schirmer test carried out preoperatively. Tear film stability was assessed using Fluroscein TBUT. The TBUT (1) measures the interval between the last complete blink and the first appearance of dry spot over cornea using cobalt blue filter and slitlamp biomicroscopy.

Three TBUT readings were taken and average was calculated .TBUT shorter than 10 seconds indicated the presence of dry eye. Schirmers test (1) with and without anesthesia was evaluated by inserting a schirmer paper strip in the lower fornix at the junction of middle and lateral third of the lower lid eye margin for 5 minutes. The wetness of the strip was measured after that cornea was anesthetized and same procedure was done. The wet area of 10mm or less was considered as dry eye. All cataract surgeries including small incision cataract surgeries, phacoemulsification with clear corneal and scleral incision were done under peribulbar block with lignocaine2% and bupivacaine.75%. In SICS and Phacoemulsification with scleral incision 6mm incision was placed superiorly. In Phacoemulsification with clear corneal incision 3.2 mm corneal incision was made at superotemporal location. Two 1mm size paracentesis were made 40 degree apart from main incision in phacoemulsification and only one paracentesis was made in manual SICS. Rigid PMMA PCIOL implanted in SICS and foldable acrylic IOL implanted in Phacoemulsification. Subconjunctival injection of antibiotic and steroid was given at the end of surgery. Only uncomplicated surgical cases were included in the study. Postoperatively all patients were put on antibiotic and steroid combination eye drops in tapering doses for 6 weeks. Clinical examination, dry eye symptom evaluation, schirmer test and TBUT were assessed at 7,30,45 and 90 days postoperatively.

## **RESULTS**

Data from the 100 eyes of 100 patients including 47 males and 53 females were studied for dry eye changes over a period of 18 months between age group of 45-75 years.

**Table 1:** No. and Percentage of patients showing decreased TBUT and Schirmer test values and onset of dry eye symptoms in total 100 patients

**Patients showing decreased values and onset of dry eye symptoms.**

	<b>7 Day</b>	<b>30 Day</b>	<b>90 Day</b>
Tbut	33(33%)	21(21%)	12(12%)
Schirmer 1	15(15%)	13(13%)	8(8%)
Schirmer with Anesthesia	20(20%)	16(16%)	11(11%)

These results show that 33% patients showed decrease TBUT on 7<sup>th</sup> postoperative day reducing to 21% on 30<sup>th</sup> postoperative day and 12% on 90<sup>th</sup> postoperative day with 8% showing reduced schirmer 1 and 11% schirmer with anesthesia and 14% patients having symptoms of dry eye. Early changes can be due to structural and reflex changes

caused by cataract surgery which reducing successively on further postoperative day suggesting recovery. Among the patients TBUT showed mean decrease of 2.33 seconds, schirmer 1 showed mean decrease of 2.625mm and schirmer with anesthesia showed mean decrease of 1.72mm at the end of 3 months.

**Table 2:** No. and Percentage of patients showing Decreased TBUT and Schirmer test values and onset of dry eye symptoms in group A

**Patients showing decreased values and onset of dry eye symptoms**

	<b>7 Day</b>	<b>30 Day</b>	<b>90 Day</b>
Tbut	25(50%)	15(30%)	8(16%)
Schirmer 1	10(20%)	9(18%)	5(10%)
Schirmer with Anesthesia	13(26%)	11(22%)	7(14%)
Dry eye symptoms present	NIL	13(26%)	10(20%)

This table shows that at 7<sup>th</sup> postoperative day 50% patients had shorter TBUT ,20% had lower schirmer 1 and 26% had lower reading of schirmer

with anesthesia improving to 16% of lower TBUT, 10% with lower schirmer 1 and 14% with lower schirmer with anesthesia on 90<sup>th</sup> postoperative day.

**Table 3:** No. and percentage of patients showing decreased TBUT and schirmer test values and onset of dry eye symptoms in Group B

**Patients showing decreased values and onset of dry eye symptoms**

	<b>7 Day</b>	<b>30 Day</b>	<b>90 Day</b>
Tbut	8(16%)	6(12%)	4(8%)
Schirmer 1	5(10%)	4(8%)	3(6%)
Schirmer with Anesthesia	7(14%)	5(10%)	4(8%)
Dry eye symptoms	NIL	2(4%)	4(8%)

This table shows that at 7<sup>th</sup> postoperative day 8% patients had shorter TBUT,5% had lower schirmer1 and & 7% had lower reading of schirmer

with anesthesia improving to 4% had lower TBUT,3% had lower schirmer 1 and 4% with lower schirmer with anesthesia on 90<sup>th</sup> postoperative day.

**Table 4:** Percentage of patients showing dry eye change in different study parameters in different groups at 90<sup>th</sup> postoperative dayPercentage of Patients showing dry eye change in deferent study Parameters in different groups at 90<sup>th</sup> post operative day

	A1	A2	B
Tbut	20%	12%	8%
Schirmer 1	12%	8%	6%
Schirmer test with Anesthesia	16%	12%	8%
Dry eye symptoms Present	28%	12%	8%

This table shows that incidence of dry eye changes is much higher in group A1 as compared to other groups. The incidence of dry eye changes was significantly high in A1 group (28%) which is more than twice of that seen in other groups. Patients with shorter TBUT had the next highest proportion, values being 20%, 12% and 8% in group A1, A2 and group B respectively.

## DISCUSSION

Dry eye is a multifactorial disease of tears and ocular surface that can be result from aqueous deficiency or be evaporative in nature. Longterm population based studies have shown the incidence rates of dry eye among the population between ages 43 and 86 years at 5 and 10 years follow up to be 13.3% and 21.6% respectively. [4, 5] Dry eye can develop after various types of ophthalmic surgeries such as photorefractive keratectomy and laser assisted in situ keratomileusis. The incidence of dry eye, assessed by corneal fluorescein staining 1 week post operatively for either nasal or superior hinge LASIK were 47.06% and 52.44% respectively [6]. In addition after LASIK, dry eye can persist for up to 6 months or more with an incidence of 20%. [7] Many previous studies have compared the preoperative and postoperative changes in dry eye symptoms and/ or dry eye test values that worsened significantly after cataract surgery. [9, 11, 12, 14]

In present study evaluation of dry eye changes after different types of cataract surgeries like SICS and Phacoemulsification with comparison of dry eye in SICS and Phacoemulsification with scleral

incision. A difficulty in assessing dry eye is that there is no gold standard test. [1]

As a result various diagnostic tools with different sensitivities and specificities are used to diagnose dry eye. In current study, we have done TBUT and Schirmers test 1 and schirmer with anesthesia because it can easily detect and ocular surface inflammation. Cataract surgery can affect or interrupt the neurogenic response of the ocular surface and decrease tear secretion.

Like other studies, we also have reported that dry eye can develop after cataract surgery [15-18]. Li-et al [15] reported high percentage of patients who developed dry eye symptoms after phacoemulsification, lower tear meniscus height, decreased TBUT scores, decreased schirmer 1 test and serious squamous metaplasia detected on impression cytology. Liu et al [16] also reported significant worsening of tear film pattern, height of tear meniscus, and scores detected by TBUT, schirmer 1 test and corneal fluorescein staining after phacoemulsification. Study conducted by Kavitha et al to evaluate dry eye after small incision cataract surgery reported 66.2% patients had dry eyes. Among them 53.32% had mild grade, 26.6% had moderate grade and 20% had severe grade dry eyes. In one case series, 10 patients [13] eyes presented with keratopathy including epithelial keratopathy, central epithelial ulcer, and central stromal ulcer after cataract surgery [17] In contrast Ram et al [18] reported no differences in dry eye between before and after phacoemulsification in 23 patients when the TBUT and schirmer 1 test with anesthesia were performed. The reason for the discrepancy may be due to its small sample size. Our study is comparable with study

conducted by Li et al in may 2004, observed reduced schirmer 1 in 19.3%, TBUT in 19.3% and dry eye symptoms in 11.11%, in present study it was 18%, 30% and 26% respectively on 30<sup>th</sup> post operative day. Out of patients showing decrease TBUT and shorter schirmer 1 test values, 66.7% were females. The observation could not be explained but might be coincidental finding. Out of 50 patients undergone phacoemulsification 10 had temporally placed incision showed 80%, 70%, 40% dry eye changes at 1 week, 1 month and 3 month post operatively. The observation could be explained by the fact that temporally placed incision cause more damage to corneal innervations as the large nerves of long ciliary nerve trunk enter the limbus predominantly at 9-o'clock and 3-o'clock position. Other observation in current study was the recovery process of the corneal nerves. Since the cornea is one of the most highly innervated organs, with about 44 corneal nerve bundles entering the cornea around the limbus centripetally [19] and larger nerve fibers that run from the 9 o'clock to the 3 o'clock position and bifurcate to achieve homogenous distribution over the entire cornea, [20] It is vulnerable to any damage within that region. Temporal corneal incisions created during phacoemulsification can reduce the corneal sensitivity in the surgical area and other areas far from the incision site. The damage to the corneal nerves may expand when longer phacoemulsification time is needed to break up a dense cataract. Neurogenic inflammation also can develop after corneal incisions. Inflammatory mediators can change the action of the corneal nerves and reduce corneal sensitivity. Disruption of the normal corneal innervation or lacrimal functional unit feedback can reduce the tear flow and blink rate and cause instability of the tear hyperosmolarity and tear film [1]. With corneal healing postoperatively, new neurite cells emerge and after 25 days, neural growth factor is released to regenerate the subepithelial corneal axon. Thus, the recovery of the corneal nerves may explain why the dry eye was seen early after surgery and improved thereafter. Even though, in theory, neurogenic

inflammation may effect by feedback loop contralateral eye, we did check the other eye as in general as screening and did not find any significant dryness developed after surgery. In addition to transection of the corneal nerves and damage to the corneal epithelial cells, exposure to microscopic light, vigorous intraoperative irrigation of the tear film, elevation of inflammatory factors in the tear film due to ocular surface irritation, use of topical eye drops administered postoperatively and its preservatives can cause dry eye after phacoemulsification and SICS [11,12,15,17] Vigorous irrigation of the tear film and manipulation of the ocular surface intraoperative may reduce the goblet cell density and result in shortened TBUT postoperatively. [15] We believe that the use of light filters, decreased exposure time, appropriate irrigation and gentle handling of the ocular surface tissue may decrease the postoperative. As there may be spontaneous appearance of dry eye, further study should be conducted to compare postoperative patients with subjects without operation who serve as control. Although mild to moderate dry eye may not interfere with vision, decrease of vision can occur in severe cases. As a result, preoperative assessment should be done properly, Hardten suggested using the ocular surface stress test, which takes about 30 to 60 minutes to perform and can be done after routine ocular examinations such as the slit-lamp examination and pupil dilatation. If an abnormal ocular surface is detected, the patients are at high risk of developing dry eye postoperatively. Other clinical tests such as the TBUT and fluorescein staining can be done to screen dry eye. If dry eye is detected preoperatively artificial tears and cyclosporine eye drops can be prescribed post operatively. We concluded that dry eye symptoms can develop immediately after cataract surgery. Severity can be on peak on day 7. Both symptoms and signs of dry eye can improve overtime. However, it is important that ophthalmologist assess dry eye before and after Cataract surgery to ensure proper treatment, quality of vision and quality of life for their patients.

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