



OCULAR SURFACE AND TEAR FILM CHANGES AFTER MANUAL SMALL INCISION CATARACT SURGERY

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ABSTRACT **BACKGROUND:** Manual small incision cataract surgery (MSICS) continues to be the mainstay of cataract surgeries in developing countries like India. Dry eye related symptoms like constant foreign body sensation, ocular surface discomfort, redness, watering are frequent phenomenon after cataract surgery. SICS may worsen lid margin anatomy, cause corneal denervation, cause reduction in number of Goblet cells and perpetuate tear film instabilities of a patient's eye after surgery. **OBJECTIVE:** To analyze changes in tear film indices after SICS **STUDY DESIGN:** This is a prospective observational study of 12 months duration from April 2020 to March 2021 done on 110 different patients undergoing cataract surgery 45-70 years age group by MSICS method. **METHODS:** 110 (48 male, 62 female) patients who underwent MSICS during the aforementioned period were selected for the study. Tear Meniscus Height (TMH), Schirmer's Test 1 (ST1), Tear Film Break Up Time (TBUT) evaluation was done 1 day preoperatively, 1 week, 1 month and 3 month post operatively and the values were noted. Collected data was analyzed by paired t test using MS EXCEL and SPSS V23. **RESULTS:** The mean age of the 110 patients was 60.21 years. The mean preoperative values of the tear film indices ST1, TBUT, TMH were found to be respectively 19.15 ± 8.59 mm, 16.70 ± 5.27 seconds, 0.39 ± .13 mm. 1 month and 3 month post operatively mean ST1 values were found to be 14.89 ± 6.15 and 14.40 ± 5.48 mm; mean TBUT values were 13.37 ± 4.76 and 12.93 ± 4.74 seconds; mean TMH was found to be 0.30 ± 0.10 and 0.29 ± 0.09. The progressive deterioration of tear film indices over our study period was found to be statistically significant. **CONCLUSION:** SICS causes significant deterioration of tear film indices and perpetuates ocular surface discomfort and dry eye disease post operatively. Operating surgeons must pay attention to dry eye signs, symptoms post operatively even in a well operated healthy eye to ensure optimal post-operative comfort for the patient.

KEYWORDS : Tear Meniscus Height, Schirmer's Test, Tear Film Break Up Time, MSICS

INTRODUCTION:

"Dry eye is a multifactorial 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"¹. It is characterized by various degrees of discomforts such as burning, stinging, grittiness, FB sensation, sensitivity to light and blurriness.

One of the most common reasons for ophthalmological consultation is dry eye. Its prevalence varies widely among 7.4%–33.7% according to different epidemiological surveys in different geographical conditions.²

Study conducted by Shilpy, Patel in 2019 found that the hospital-based prevalence of DED in western India is 34.26% and it was found to be more common in women.³

Another similar study done in northern India by Jeevan Singh Titiyal, et.al in 2018 concluded that "The prevalence of DED in North India is 32%, with the age group of 21–40 years affected most commonly."⁴

Dry eye related symptoms like constant foreign body sensations⁵, visual fatigue, ocular discomfort, redness, watering are frequent phenomenon after cataract surgery⁶. It has been reported in various publications that refractive surgeries like PRK, LASIK^{7,8} cause dry eye. Procedures causing corneal denervation tend to impair epithelial wound healing, cause impaired corneal permeability, decreases corneal metabolic activities and cause cyto-skeletal loss resulting in decreased cellular adhesion⁹. Intact corneal sensation, a responsible factor for tear secretion is impaired by cataract surgeries and leads to decreased tear production. Studies also suggest that cataract surgeries may also worsen lid margin and result in obstructive MGD and inflammation which may lead to dry eye following cataract surgery. Various studies suggest that dry eye can have impact on overall satisfaction with surgical and visual outcome and may influence the quality of life.

Other factors that are responsible for development of dry eye after cataract surgeries include prolong use of antibiotic-steroid eye drops leading to Goblet cell loss, decrease tear film break-up time due to surface irregularity at the site of the incision, decrease in mucin

production from the conjunctiva secondary to incision placement, diminished corneal sensation due to surgical incision which disrupts the cornea-lacrimal gland loop leading to reduced tear secretion, thinning of the lipid layer of tear film due to decreased meibomian gland function and expressibility, poor tear film production and stability due to surgically induced ocular inflammation and exposure to light from the operating microscope⁵. The symptoms of dry eye may be temporary but they affect the quality of life of the patient. Therefore, a proper counselling is necessary about the evanescent nature of the condition.

METHODOLOGY:

This is a prospective observational study done on 110 patients undergoing MSICS 45-70 year's age group from April 2020 to March 2021 in a tertiary center of West Bengal.

Exclusion criteria include patients with adnexal, conjunctival & corneal pathology (scar dystrophy etc.), punctal occlusion, patient on antiglaucoma medicine, systemic diseases (Sjogren syndrome, thyroid ophthalmology), contact lens wearer, patients having previous glaucoma surgery in other eye or previous glaucoma surgery in selected eye for MSICS in this study. An informed consent was taken from all the patients. Ethical clearance was obtained from the institute Ethics committee before starting the study.

Thorough ophthalmic examination and history taking is done to rule out any of these conditions before enrolling the patients for the study. Visual acuity was noted using Snellen's chart. Fundus examination was done by direct ophthalmoscope, slit lamp bio microscopy with 90 Dioptre lens and indirect ophthalmoscope with 20 Dioptre lens.

Tear film assessment is done by Tear Film Breakup Time (TBUT), Schirmer's Test 1 (ST1) and Tear Meniscus Height (TMH). Assessments is done on 1 day before surgery, 1 week post-operatively, 1 month post-operatively and 3 month post-operatively. Manual SICS with poly methyl methacrylate (PMMA) posterior chamber intraocular lens (PCIOL) implantation is performed with a scleral tunnel incision of 6–8 mm and a side port of 1 mm. The patients who underwent an uneventful and uncomplicated surgery only are included in the study. All the patients are operated by same surgeon. The total duration of microscope light exposure as well as time taken to complete the surgery is noted. Moxifloxacin (0.5%) and eye drop four

times a day is started one day prior to the surgery. Pupillary dilatation is achieved using a combination of phenylephrine (5%) and tropicamide (0.8%) eye drop before the surgery. Postoperatively moxifloxacin and dexamethasone eye drop is continued eight times a day for one week and then tapered every week over six weeks.

All the collected data are analyzed using standard statistical tool including MS EXCEL, SPSS V23.

RESULTS:

A total of 110 patients were included in this study. All of them underwent SICS by the same surgeon. Out of them 62 patients were female i.e 56.4%, and 48 patients were male i.e 43.6%.

The mean age was 60.21±6.75 years. Prior to operation 21 patients i.e 19.1% had low ST1 value (<10mm after 5min), suggestive of dry eye. 17 patients i.e 15.45% had TBUT<10 seconds. Also 17 patients had TMH <0.3 mm preoperatively. The mean preoperative values of the tear film indices ST1, TBUT, TMH were found to be respectively 19.15 ± 8.59 mm, 16.70 ± 5.27 seconds, 0.39 ± .13 mm. Mean microscopic light exposure time was 22.9 ± 8.59 minutes. 1 week post SICS the mean ST1 value reduced by 3.75 mm to 15.40 ± 5.98 mm, mean TBUT decreased by 2.93 seconds to 13.7 ± 4.61 seconds and the mean TMH decreased by 0.07mm to 0.32 ± 0.11 mm. These changes from preoperative finding were found to be statistically significant (p < 0.01). 1 month and 3 month post operatively mean ST1 values were found to be 14.89 ± 6.15 and 14.40 ± 5.48 mm; mean TBUT values were 13.37 ± 4.76 and 12.93 ± 4.74 seconds; mean TMH was found to be 0.30 ± 0.10 and 0.29 ± 0.09. The progressive deterioration of tear film indices over our study period was found to be statistically significant. At the end of our study period 27 patients had ST1 <10mm which was a 28% increase from pre-operative assessment, 29 had TBUT<10 seconds and 33 had TMH <0.03 mm. The comparison of the tear film indices prior to surgery and 3 months post-surgery is plotted in Table 1.

Table 1: Comparison of pre and post-operative tear film indices

	MEAN	SD	T-TEST P VALUE
ST1 PRE-OP	19.15 mm	8.59	<0.01
ST1 12 WEEK POST-OP	14.40 mm	5.48	
TBUT PRE-OP	16.70 seconds	5.27	<0.01
TBUT 12 WEEK POST-OP	12.93 seconds	4.74	
TMH PRE-OP	0.39 mm	0.13	<0.01
TMH 12 WEEK POST-OP	0.29 mm	0.09	

In figure 1 to figure 3 the number of patients having lower than critical value of the three tear film indices after 12 week of surgery is compared against the number of the patients having the same pre-operatively according to age group. In figure 4 to figure 6 the number of patients having abnormal value of the three tear film indices after 12 week of surgery is compared against the number of the patients having the same pre-operatively according to gender.

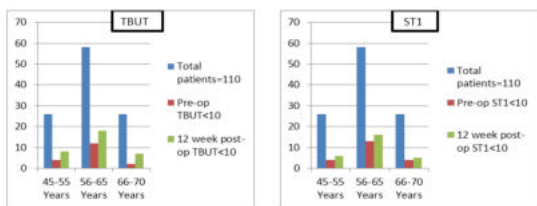


Figure 1: Age wise distribution of patients TBUT <10 sec
Figure 2: Age wise distribution of patients having having ST1 <10 mm

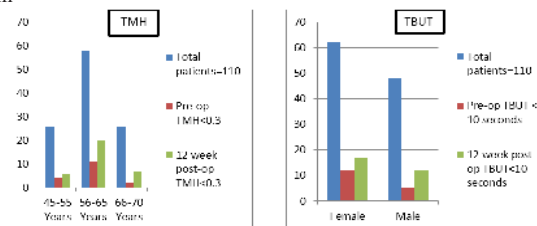


Figure 3: Age wise distribution of patients having TMH<0.3mm

Figure 4: Gender wise distribution of TBUT<10 seconds

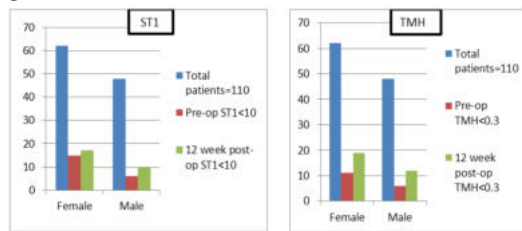


Figure 5: Gender wise distribution of patients having ST1<10 mm

Figure 6: Gender wise distribution of patients having TMH<0.3mm

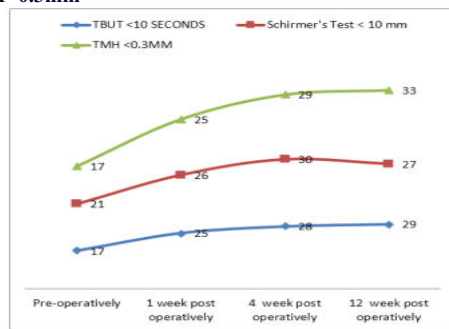


Figure 7: Comparison of number of patients having lower than critical value of tear film indices over the period of observation.

DISCUSSION:

The occurrence of dry eye and tear film related complications after cataract surgery is greatly understudied. Dry eye post cataract surgery is a common complication of the surgery with its prevalence ranging from 9.8%-34%¹⁰. Exact etiology of post-operative tear film disturbance is yet to be understood clearly. Recent studies have shown significant association between MGD with post cataract surgery dry eye¹¹. Moreover, corneal denervation after cataract surgery also plays a role in disturbing ocular surface homeostasis¹². As we still don't have a single gold standard test or index for diagnosing dry eye multiple methods with different sensitivity and specificity has to be used for assessing tear film abnormalities. In various studies it is found that the degree of progressive worsening of dry eye indices is more significant in SICS than in Phaco-emulsification. This can be attributed to the broader length of the incision in SICS leading to more corneal innervation^{6,13,14}. Ram et al, in 23 patients found deterioration in Schirmer's score and TBUT values after cataract surgery⁶. Rajashekarreddy et al, found significant increase in dry eye symptoms with OSDI scoring and TBUT test after cataract surgery in a study of 123 patients including 87 SICS and 36 phaco-emulsification¹⁵. Pallamreddy et al in a study of 100 patients found decreased TMH in 24% of the eyes and decreased TBUT in 8% of the eyes¹⁶. Cho Y K et al, established significant aggravation of dry eye and deterioration of tear film indices in already diagnosed dry eye patients after cataract surgery⁵.

In our study the pre-operative incidence of dry eye with both TBUT and TMH was found to be 15.5% which increased to 26.4% with TBUT and to 30% with TMH assessment after 3 month of surgery. However with Schirmer's test the pre-operative prevalence was found to be 19.1% and post-operative to be 24.5%. The deterioration of tear film values both after 1 week, 4 week and 12 week from the pre-operative values were found to be statistically significant. All three indices showed peak deterioration at 12 week after surgery.

CONCLUSION:

SICS causes significant deterioration of tear film indices and perpetuates ocular surface discomfort and dry eye disease post operatively. One of the main reasons of patient dissatisfaction even after an uneventful cataract surgery with good visual acuity after surgery is ocular surface discomfort, foreign body sensation due to tear film abnormalities.

Operating surgeons must pay attention to dry eye signs, symptoms post operatively even in a well operated otherwise healthy eye to ensure optimal post-operative comfort to the patient. So, pre-operative tear film assessment and counselling of patients regarding post-operative worsening of dry eye symptoms is becoming a necessity.

REFERENCES:

- 1) Craig JP, et al., TFOS DEWS II Report Executive Summary, The Ocular Surface (2017), <http://dx.doi.org/10.1016/j.jtos.2017.08.003>
- 2) Alshamrani AA, Almousa AS, Almulhim AA, et al. Prevalence and Risk Factors of Dry Eye Symptoms in a Saudi Arabian Population. *Middle East Afr J Ophthalmol.* 2017;24(2):67-73. doi:10.4103/meajo.MEAJO_281_16
- 3) Shilpy, Neha & Patel, Dhaval. (2019). Prevalence of Dry Eye Disease in Western India. *International Journal of Contemporary Medical Research [IJCMR]*. 6. 10.21276/ijcmr.2019.6.7.37.
- 4) Titiyal JS, Falera RC, Kaur M, Sharma V, Sharma N. Prevalence and risk factors of dry eye disease in North India: Ocular surface disease index-based cross-sectional hospital study. *Indian J Ophthalmol.* 2018;66(2):207-211. doi:10.4103/ijo.IJO_698_17
- 5) Cho YK, Kim MS. Dry eye after cataract surgery and associated intraoperative risk factors. *Korean J Ophthalmol.* 2009;23(2):65-73. doi:10.3341/kjo.2009.23.2.65
- 6) Ram J, Gupta A, Brar G, Kaushik S, Gupta A. Outcomes of phacoemulsification in patients with dry eye. *J Cataract Refract Surg.* 2002;28(8):1386-1389. doi:10.1016/s0886-3350(02)01387-1
- 7) Ang RT, Dartt DA, Tsubota K. Dry eye after refractive surgery. *Curr Opin Ophthalmol.* 2001;12(4):318-322. doi:10.1097/00055735-200108000-00013
- 8) Belmonte C. Eye dryness sensations after refractive surgery: impaired tear secretion or "phantom" cornea?. *J Refract Surg.* 2007;23(6):598-602.
- 9) Kohlhaas M. Corneal sensation after cataract and refractive surgery. *J Cataract Refract Surg.* 1998;24(10):1399-1409. doi:10.1016/s0886-3350(98)80237-x
- 10) Mencucci R, Vignapiano R, Rubino P, et al. Iatrogenic Dry Eye Disease: Dealing with the Conundrum of Post-Cataract Discomfort. A.P.I.C.A.S.S.O. Board Narrative Review. *Ophthalmol Ther.* 2021;10(2):211-223. doi:10.1007/s40123-021-00332-7
- 11) Cochener B, Cassan A, Omiel L. Prevalence of meibomian gland dysfunction at the time of cataract surgery. *J Cataract Refract Surg.* 2018;44(2):144-148. doi:10.1016/j.jcrs.2017.10.050
- 12) Bron AJ, de Paiva CS, Chauhan SK, et al. TFOS DEWS II pathophysiology report [published correction appears in *Ocul Surf.* 2019 Oct;17(4):842]. *Ocul Surf.* 2017;15(3):438-510. doi:10.1016/j.jtos.2017.05.011
- 13) Sitompul R, Sancoyo GS, Hutauruk JA, Gondhowiardjo TD. Sensitivity change in cornea and tear layer due to incision difference on cataract surgery with either manual small-incision cataract surgery or phacoemulsification. *Cornea.* 2008;27 Suppl 1:S13-S18. doi:10.1097/ICO.0b013e31817f29d8
- 14) Chang-Ling T, Vannas A, Holden BA, O'Leary DJ. Incision depth affects the recovery of corneal sensitivity and neural regeneration in the cat. *Invest Ophthalmol Vis Sci.* 1990;31(8):1533-1541.
- 15) Badam Rajashekar Reddy, Jasmitha & Manchegowda, Pradeep & Belamgi, Varsha. (2020). Evaluation of Dry Eye Disease Post-Cataract Surgery using Symptom Questionnaire and Tear Film Tests. *International Journal of Current Research and Review.* 12. 19-24. 10.31782/IJCRR.2020.12134.
- 16) Lakshmi, Pallamreddy. (2018). Changes in the Tear film after Manual Small Incision Cataract Surgery – A Prospective Study. *Delhi Journal of Ophthalmology.* 29. 10.7869/djo.392.