How to Cite:
Nazm, N., Pisudde, P., Mukherjee, S., & Kadhane, A. (2022). Analysis of ocular surface and tear film abnormalities post cataract surgery- small incision cataract surgery V/S phacoemulsification. *International Journal of Health Sciences*, *6*(S6), 10368–10380. https://doi.org/10.53730/ijhs.v6nS6.12745

Analysis of ocular surface and tear film abnormalities post cataract surgery- small incision cataract surgery V/S phacoemulsification

Dr. Nazneen Nazm, MS (Oph), DNB (Oph), FICO, FAICO
Assistant Professor, Dept of Ophthalmology, ESI- PGIMSR, ESIC Medical College and Hospital, Joka
*Corresponding author email: nazneen.nazm@gmail.com

Dr. Pravin Pisudde
Associate Professor, Department of Community Medicine, ESIC Medical College Sanath Nagar Hyderabad

Dr. Sampurna Mukherjee MBBS, DO
Senior Resident, ESI- PGIMSR, ESIC Medical College and Hospital, Joka

Dr. Atul Kadhane MBBS, MS
Medical Director, Yash Netralaya and Child Hospital, Amravati

Abstract---Aim: To evaluate ocular surface and tear film abnormalities post cataract surgery- small incision cataract surgery (SICS) versus phacoemulsification. Material and methods: The present randomised control trial was conducted among 100 patients attending OPD diagnosed with cataract who underwent surgery; age group of more than 40 years were included in the study and randomly divided into 2 groups i.e. Group 1 (who underwent manual SICS) and Group 2 (who underwent Phacoemulsification). Postoperatively, the diagnosis of dry eyes was done by conducting tests viz. Ocular surface disease index questionnaire (OSDI), Schirmer's test-1, Tear Break up time (TBUT) and impression cytology (IC). Results: Post cataract surgery, mean Schirmer's value reduced more in group 1 as compared to group 2 at 1 week, 1 month and 3 month with statistically significant difference ($p<0.05$). Significant deterioration in OSDI was found in both group 1 as well as group 2 after 1 week, 1 month and 3 months of surgery with statistically significant difference ($p<0.05$). Conclusion: Incidence of dry eye was found to be higher in group that underwent small incision cataract surgery or SICS than phacoemulsification due to tear film instability.

International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2022.
Manuscript submitted: 9 May 2022, Manuscript revised: 18 July 2022, Accepted for publication: 27 August 2022

Keywords---cataract, dry eye disease, schirmer's test-I, tear film breakup time.

Introduction

Dry eye is a multifactorial ocular surface and tear illness that causes discomfort, visual disruption, and tear film instability, as well as the possibility for ocular surface injury. It is accompanied with an increase in the osmolarity of the tear film as well as ocular surface inflammation[1]. The International Dry Eye Workshop (DEWS) of The Tear Film and Ocular Surface Society (TFOS) in 2007 proposed the following definition of Dry Eye : "Dry eye is a multifactorial disease of the tears and ocular surface that results in symptoms of discomfort, visual disturbance, and tear 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"[2]. According to this definition, Dry Eye Disease (DED) was considered to be a disease of either tears or ocular surface, which could lead to visual disturbance. Also included in the definition was ocular surface inflammation and increased tear osmolarity. Between blinks, there are recurrent breakups into dry eye spots, exposing the cornea and conjunctival epithelium to evaporation.

Various population and hospital-based studies have variably reported the prevalence of dry eye disease from 5% to as high as 73.5%.[3] Dry eye illness is estimated to affect 7.4% to 33.7 percent of people[3,4]. An update from Dry Eye Disease Workshop (DEWS) stated the global prevalence of dry eye to be 17%.[4] The incidence and prevalence of dry eye disease (DED) after cataract surgery is grossly under-reported. The American Society of Cataract and Refractive Surgery (ASCRS) reported a DED prevalence of around 40% in patients who underwent cataract surgery. Prolonged use of antibiotic-steroid eye drops in the post-operative period, decreased tear film break-up time due to surface irregularity induced at the site of the incision, decreased mucin production from the conjunctiva secondary to incision placement, decreased corneal sensation due to surgical incision which disrupts the cornea-lacrimal gland loop leading to reduced tear secretion, poor tear film production, and stabilities are all factors that contribute to the development of dry eye after cataract surgery[5-7]. Although the symptoms of dry eye are only transient, they have an impact on the patient's quality of life (QoL).

Small Incision Cataract Surgery (SICS) was invented in the United States and Israel and popularised in India, where it now accounts for the majority of procedures. SICS, like other limbal relaxing incisions, causes local injury by severing the circum-corneal network of nerve fibres, resulting in corneal hyposensitivity and a reduction in reflex secretion and wound healing. This, combined with prolonged intraoperative surgical time and exposure to the microscope, has the potential to exacerbate the symptoms[8]. Phacoemulsification is a contemporary cataract surgery in which the eye's internal lens is emulsified and aspirated from the eye using an ultrasonic handpiece. In their investigation, Khanal et al discovered that phacoemulsification causes a decrease in corneal sensitivity and tear physiology[9]. Incisional denervation of the corneal nerves, ultrasound-induced free radical production, microscope light exposure time

during surgery, and pre- and post-operative medicines have all been linked to dry eye after phacoemulsification[10].

The ocular surface disease index OSDI, Schirmer's tear test, and Tear break up time are the most commonly used tests for the diagnosis of dry eyes (TBUT).The OSDI is a subjective questionnaire which contains 12 items to assess dry eye symptoms and to assess the effect of these symptoms on functions related to vision in the patient's life over the past one week, whereas the TBUT and Schirmer's test -1 are objective dry eye tests. Lastly, Impression Cytology (IC) has been used for ocular surface assessment in various dry eye disorders such as keratoconjunctivitis sicca (KCS), ocular cicatricial pemphigoid (OCP) and Vitamin A deficiency. The aetiological diagnosis of various ocular surface disorders, documenting sequential changes in the conjunctival and corneal surface over time, monitoring treatment effects and staging conjunctival squamous metaplasia, and using impression cytology as an investigational tool for analysing ocular surface disease with immunostaining and DNA analysis are all applications of impression cytology[11]. Dry eyes is a known after effect of cataract surgery. This study has been designed to evaluate the association and comparison of ocular surface changes and tear film abnormalities (dry eyes) in patients undergoing cataract surgery i.e. Small Incision Cataract Surgery versus phacoemulsification technique of cataract surgery.

Materials and Methods

The present randomised control trial was conducted in Department of Ophthalmology from Jan 2021 to June 2022. Ethical approval was obtained from institutional research ethics committee before the start of study. A total of 100 patients attending OPD diagnosed with cataract who underwent surgery; age group of more than 40 years were included in the study and randomly divided into 2 groups i.e. Group 1 (included all cases who underwent SICS) and Group 2 (included all cases who underwent Phacoemulsification). All patients had similar cataract grading in both groups ie Nuclear grade 2/3 according to the Lens Opacities Classification System (LOCS III). Patients having pre-existing ocular surface disease, such as pre-existing dry eyes, patient with any other ocular disorder- pterygium, glaucoma, uveitis, disorders of the lids, disorders of nasolacrimal system, ocular allergies, contact lens wearers, previous ocular surgery, patients with systemic diseases- diabetes, hypertension, autoimmune disorders or on chronic medications and patients who did not give consent were excluded from the study. Patients who required cataract along with trabeculectomy for co-existing glaucoma were also excluded from the study. All the patients enrolled in the study were explained about the study and the procedures in the language understood by them.Prior written informed consent was taken from every patient.

Clinical assessment

All patients underwent a complete ophthalmic examination pre-operatively which included the following:

- Visual Acuity: Vision was recorded using Snellen's distance and near visual acuity chart
- Slit lamp examination: Thorough anterior segment examination including examination of lids, conjunctiva, cornea and anterior chamber was done. Cataract grading was done according to Lens Opacities Classification System LOCSIII
- Fundus Examination : Using 20D indirect ophthalmoscope dilated fundus examination was done both before and after cataract surgery

Diagnosis of Dry eye was done by conducting following tests:

Ocular surface disease index (OSDI)

The questions in the questionnaire were asked with reference to last one week recall period. OSDI subscale score can range from 0 to 100, with higher score indicating more problems and symptoms.

Score range	Inference
0-12	Normal
13-22	Mild
23-32	Moderate
33-100	Severe

Schirmer's Test -1(without topical anesthesia)

Tear secretion was measured by the Schirmer's test in the pre-operative phase and post operative eyes of the patients. To perform the Schirmer tear test, a standard Schirmer test strip was placed in the lower fornix at the junction of the lateral one third and medial two third, taking care not to touch the cornea. After 5 min, the strip was removed and the wetted length of the test strip was measured in millimeters to determine the Schirmer test value. A value of ≤ 10mm at 5 minutes was considered as dry eye.

Schirmer Strip Reading	Inference
0-4mm	Severe dry eye
5-9mm	Moderate dry eye
10-14mm	Mild dry eye
>15mm	Normal

Tear Break up time (TBUT)

To measure TBUT, a fluorescein sodium strip moistened with a drop of non-preserved saline solution was applied to the inferior palpebral conjunctiva in the cataractous and post operated eye of the patients. After removing the strip, the patient was asked to blink thrice and then look straightforward. The pre-corneal tear film was examined with a slit-lamp bio-microscope, and the time elapsed before initial breakup, rupture of the tear film, or formations of tiny dry spots were recorded. The TBUT was measured thrice, and the measurements were averaged.

Time Taken	Inference
<10 second	Unhealthy tear film
>10 second	Healthy tear film

Impression Cytology

Conjunctival impression cytology was performed before and after cataract surgery. The sample was collected from the temporal interpalpebral bulbar conjunctiva. After instillation of a single drop of proparacaine 0.5%, the cellulose acetate filter paper was gently applied over the temporal interpalpebral bulbar conjunctiva at a distance of 3mm from the limbus by a fine forceps. The filter paper was removed after several seconds. Following 95% of alcohol fixation for at least 10 minutes, the specimen was stained using the periodic acid-Schiff (PAS) and hematoxylin technique as described by Nelson. The cytologic changes were graded according to the Nelson's grading system as follows:

- **Grade 0:** Small and round epithelial cells with eosinophilic staining cytoplasm. Nucleo-cytoplasmic ratio 1:2, abundant, plump, oval goblet cells with intensely PAS-positive cytoplasm.
- **Grade 1:** Slightly larger and more polygonal epithelial cells with eosinophilic staining cytoplasm. Nucleo-cytoplasmic ratio 1:3. There is decrease in goblet cell number.
- **Grade 2:** Larger and polygonal, occasionally multinucleated epithelial cells with variably staining cytoplasm. Nucleo-cytoplasmic ratio 1:4 -1:5. Smaller and less intensely PAS-positive goblet cells with poorly defined cellular borders and marked decrease in number.
- **Grade 3:** Large and polygonal epithelial cells with basophilic staining cytoplasm. Small, pyknotic and in many cells completely absent nuclei with nucleo-cytoplasmic ratio greater than 1:6. Absence of goblet cells.

The findings of grades 2 and 3 on the slides from the interpalpebral conjunctiva suggest squamous metaplasia, which is an indicator of ocular surface inflammation, and hence supports the diagnosis of dry eye. Additionally the lymphocyte infiltration was recorded in samples.

Surgery: In Group 1 Manual small incision cataract surgery was performed using standard steps of surgery. Preoperatively antibiotic eyedrop (Moxifloxacin 0.5% eydrop) was started 4 times a day one day prior to surgery in both groups. Dilation of pupil was achieved by a combination of Tropicamide 0.8% and Phenylephrine 5%. The 5-6mm scleral tunnel was fashioned superiorly in all the cases along with a single side-port. A rigid Polymethyl methacrylate (PMMA) intraocular lens was implanted in the bag.

In Group 2, phacoemulsification was performed using standard steps via a 2.8mm main port and 2 sideport incisions. The microscope illumination was kept constant in both groups, and time taken to conclude the surgeries was noted. All surgeries were concluded uneventfully and by single surgeon only. Postoperatively an antibiotic-steroid (moxifloxacin- prednisolone) eye drop was started 8 times a

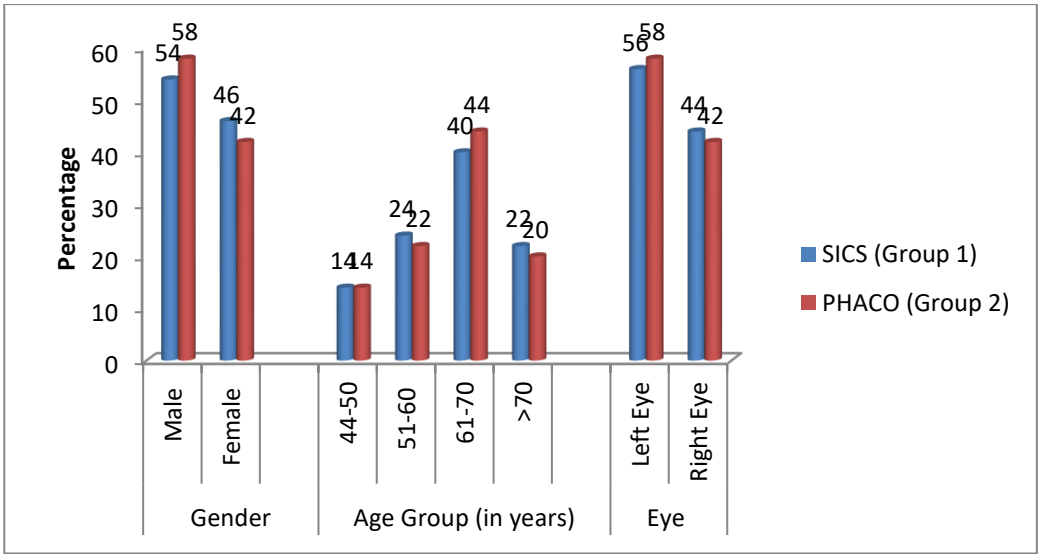
day, and tapered weekly in both the groups over 6 weeks. A dilating eyedrop was advised twice a day in the first postoperative week and then stopped. The clinical assessment of the subjects was done 1 day before surgery (preoperatively) and post operative at 1 week, 1 month and 3 months.

Statistical analysis

It was done using SPSS software version 24. Paired and unpaired t test was used to find out the significant difference.

Results

In our study, males were slightly more as compared to females in both the study groups. Maximum subjects were from the age group of 61-70 years (40% and 44% in group 1 and 2 respectively) followed by 51-60 years while minimum subjects were from the age of 44-50 years. Left and right eye involvement was found among 56%, 44% and 58%, 42% of the subjects in group 1 and 2 respectively. When baseline characteristics viz. gender, age and eye involvement was compared among group 1 and 2, it was found to be statistically insignificant as p>0.05 (graph 1).



Graph 1. Baseline characteristics of the study groups

All the patients in both the groups completed follow-up at 1 week and 1 month postoperative period. At baseline, mean Schirmer's test value was 21.74 and 22.26 in group 1 and 2 respectively. After the cataract surgery, mean Schirmer's value reduced more in group 1 as compared to group 2 at 1 week, 1 month and 3 month with statistically significant difference (p<0.05). Though both the groups showed improvement at 3 months, it never reached the baseline value. When mean Schirmer's value was compared between group 1 and 2, it was found to be statistically significant at 1 week and 1 month of surgery (p<0.05) , but it was not significant at 3 month (table 1).

Table 1
Schirmer's Test at different intervals among the study group

Surgery		Schirmer's Test				p value		
		Pre Operative	1 Week	1 Month	3 Month	Pre Op. vs 1 Week	PreOp vs 1 Month	Pre Op vs 3 Month
Group 1	Mean	21.74	15.18	17.10	19.16	<0.01*	0.002*	0.007*
	SD	4.754	4.188	4.320	4.613			
Group 2	Mean	22.26	18.10	19.76	20.56	0.004*	0.03*	0.044*
	SD	4.184	4.022	4.173	4.156			
t test		0.34	12.65	9.81	2.54			
p value		0.56	0.001*	0.002*	0.11			

*: statistically significant

At baseline, mean TBUT value in seconds was 12.36 and 12.52 in group 1 and 2 respectively. After the surgery, mean TBUT value reduced more in group 1 i.e. Manual SICS group as compared to group 2 phacoemulsification group) at 1 week, 1 month and 3 month with statistically significant difference ($p<0.05$). Though both the groups showed improvement at 3 months, but it never reached the baseline value. When mean TBUT value was compared between group 1 and 2, it was found to be statistically significant at 1 week and 1 month of surgery ($p<0.05$) , but it was not significant at 3 month (table 2).

Table 2
TBUT at different intervals among the study group

Surgery		TBUT				p value		
		Pre Operative	1 Week	1 Month	3 Month	Pre Op. vs 1 Week	PreOp vs 1 Month	Pre Op vs 3 Month
Group 1	Mean	12.36	8.08	9.52	10.64	<0.01*	<0.01*	0.005*
	SD	1.306	1.536	1.129	1.55			
Group 2	Mean	12.52	9.80	10.54	11.24	<0.01*	0.009*	0.041*
	SD	1.488	1.525	1.501	1.83			
t test		0.33	31.56	14.74	2.43			
p value		0.57	<0.01*	<0.01*	0.18			

*: statistically significant

After the surgery, mean OSDI value increased more in group 1 as compared to group 2 at 1 week and 1 month. Post-operatively at three months, mean OSDI value was approximately same in both group 1 as well as group 2. Significant deterioration in OSDI was found in both group 1 as well as group 2 after 1 week, 1 month and 3 months of surgery with statistically significant difference ($p<0.05$). Though both the groups showed improvement at 3 months, but it never reached the baseline value. When mean OSDI value was compared between group 1 and 2, it was found to be statistically significant at 1 week and 1 month of surgery ($p<0.05$) , but it was not significant at 3 month (table 3).

Table 3
OSDI at different intervals among the study group

Surgery		OSDI				p value		
		Pre Operative	1 Week	1 Month	3 Month	Pre Op. vs 1 Week	PreOp vs 1 Month	Pre Op vs 3 Month
Group 1	Mean	10.92	24.58	20.10	16.52	<0.01*	<0.01*	<0.01*
	SD	3.306	3.468	2.643	2.100			
Group 2	Mean	11.12	23.00	19.82	16.44	<0.01*	<0.01*	<0.01*
	SD	4.124	3.550	2.153	2.055			
t test		0.07	3.09	2.96	1.09			
p value		0.79	0.042*	0.047*	0.78			

*: statistically significant

Post-operatively three month, mean Impression Cytology value was approximately same in both group 1 as well as group 2. Increase in Impression cytology value was found in both group 1 as well as group 2 after 1 week, 1 month and 3 months of surgery with statistically significant difference ($p<0.05$). When mean Impression Cytology value was compared between group 1 and 2 after 1 week, 1 month and 3 month of surgery, it was found to be statistically significant ($p<0.05$) as shown in table 4.

Table 4
Impression Cytology at different intervals among the study group

Surgery		Impression Cytology				p value		
		Pre Operative	1 Week	1 Month	3 Month	Pre Op. vs 1 Week	PreOp vs 1 Month	Pre Op vs 3 Month
Group 1	Mean	0.14	2.36	1.90	1.60	<0.01*	<0.01*	<0.01*
	SD	0.351	0.898	0.763	0.670			
Group 2	Mean	0.12	2.00	1.46	1.26	<0.01*	<0.01*	<0.01*
	SD	0.328	0.756	0.706	0.664			
t test		0.09	4.70	8.96	6.49			
p value		0.77	0.03*	0.003*	0.012*			

*: statistically significant

Discussion

Dry eye syndrome is a multifactorial pre-corneal tear film condition that causes ocular pain, visual disturbances, and tear film instability, as well as potential ocular surface injury[1]. Cataract surgery can induce dry eye or worsen a pre-existing dry eye condition by a variety of mechanisms. Prolonged use of antibiotic-steroid eye drops, decreased tear film break-up time due to surface irregularity at the site of the incision, decreased mucin production from the conjunctiva secondary to incision placement, decreased corneal sensation due to surgical incision which disrupts the cornea-lacrimal gland loop leading to reduced tear secretion, poor tear film production, and instabilities are all factors that

contribute to the development of dry eye after cataract surgery[7]. Although the symptoms of dry eye are only transient, they have an impact on the patient's quality of life. As a result, thorough counselling about the ephemeral nature of the illness is required[11]. In our study, males were slightly more as compared to females in both the study groups. Maximum subjects were from the age group of 61-70 years (40% and 44% in group 1 and 2 respectively) followed by 51-60 years while minimum subjects were from the age of 44-50 years. Left and right eye involvement was found among 56%, 44% and 58%, 42% of the subjects in group 1 and 2 respectively. Saba Ishrat et al[12] in their study too found that baseline characteristics were comparable among the study groups. In a study by Pragati Garg et al[13], the largest age group was 61-70 years (n=43, 35.83%), followed by those aged 51-60 years. The male to female ratio was1.55:1.

Preoperatively, mean Schirmer's value was 21.74 and 22.26 in patients who underwent SICS (group 1) and Phacoemulsification surgery (group 2) respectively. After the surgery, mean Schirmer's value reduced more in group 1 as compared to group 2 at 1 week, 1 month and 3 months of surgery with statistically significant difference ($p<0.05$). Though both the groups showed improvement, it never reached the baseline value. When mean Schirmer's value was compared between group 1 and 2, it was found to be statistically significant at 1 week and 1 month of surgery ($p<0.05$). ST-1 readings improved at 1 and 3 months postoperatively, although they remained lower than the baseline, according to Oh et al[14]. Other investigations have found that phacoemulsification reduces postoperative Schirmer Test-1 scores. Similarly, Saba Ishrat et al[12] found that the ST-1 performed similarly well in both groups after one week: 19.1 ± 0.89 mm in the SICS group and 20.7 ± 0.81 mm in the phacoemulsification group. When compared to the preoperative finding, all patients' ST-1 scores decreased throughout the early postoperative period at one week. In a similar study, Saurabh Shrivastava et al[15] discovered a significant difference in preoperative Schirmer's test values compared to day 7 and day 21 postoperative values ($P \leq 0.05$) in groups A and B. At Day 90 postoperatively, on the other hand, these values were comparable to preoperative values, with no significant difference ($P>0.05$).

Preoperatively, mean TBUT value was 12.36 and 12.52 in patients who underwent SICS (group 1) and Phacoemulsification surgery (group 2) respectively. After the surgery, mean TBUT value reduced more in group 1 as compared to group 2 at 1 week , 1 month and 3 months of surgery with statistically significant difference ($p<0.05$). Though both the groups showed improvement, but it never reached the baseline value. When mean TBUT value was compared between group 1 and 2, it was found to be statistically significant at 1 week and 1 month of surgery (<0.05). Cho and Kim[16] found that following cataract surgery, dry eye symptoms and diagnostic test findings worsened compared to preoperative measurements. They came to the conclusion that TBUT and the corneal epithelium's barrier function are impaired in the early postoperative period following cataract surgery, which is compatible with the findings of the current investigation. In their investigation, Saba Ishrat et al[12] discovered significant changes in TBUT levels at 1 week, 1 month, and 3 months postoperatively. The SICS group had a mean TBUT of 10.0 ± 0.55 sec, whereas the phacoemulsification group had a mean TBUT of 13.9 ± 0.70 sec ($p \leq 0.001$). These findings are comparable to the findings in our study.

When compared to preoperative data, there was a significant decrease in TBUT values in the early postoperative period at one week, with a greater reduction in TBUT in the SICS group. At the one-month follow-up, the difference in TBUT values still persisted.

Garg et al[13] studied the determinants and risk factors for dry eye after cataract surgery and found that a greater incidence of dry eye in SICS group (92.9% at 1 week and 26.8% at 1 month) compared to phacoemulsification group (89.1% and 15.6% at 1 week and 1 month respectively) at both 1 week and 1 month postoperatively. However the difference was not statistically significant. Similarly, the OSDI grade pre- and postoperatively, and within the two groups was also compared. At postoperative 1 week, 89.1% of the phacoemulsification group had grade 2 dry eye ($p<0.001$) compared to 92.9% in the SICS group ($p<0.001$). At 1-month follow-up, 92.2% of the phacoemulsification group had grade 0 and the other 7.8% had grade 1 dry eye. None of the patients had grade 3 dry eye at 1 month and the results were statistically significant ($p<0.001$). Of the 56 patients who underwent SICS, 82.1% had grade 0, 16.1% had grade 1, and only 1.8% had grade 2 dry eye at postoperative 1 month ($p<0.001$)

In our study, significant deterioration was found in both group 1 as well as group 2 after 1 week, one month and 3 months of surgery with statistically significant difference ($p<0.05$). When mean OSDI value was compared between group 1 and 2 after 1 week and 1 month of surgery, it was found to be statistically significant ($p<0.05$). According to Saba Ishrat et al[12], at 1 week, 1 month and 3 months postoperative visits, OSDI score kept on decreasing and the symptoms of dry eye showed a trend toward improvement. At baseline, mean Impression Cytology was 0.14 and 0.12 in patients who underwent SICS (group 1) and Phacoemulsification surgery (group 2) respectively. After the operation, mean Impression Cytology increased more in group 1 as compared to group 2 at 1 week and 1 month. Post-operatively three month, mean Impression Cytology value was approximately same in both group 1 as well as group 2. Significant deterioration was found in both group 1 as well as group 2 after 1 week, one month and 3 months of surgery with statistically significant difference($p<0.05$). When mean Impression Cytology value was compared between group 1 and 2 after 1 week, 1 month and 3 month of surgery, it was found to be statistically significant ($p< 0.05$). Ngamjit Kasetsuwan et al[17] in their study reported similar results.

Corneal sensory nerve injury caused by the incision is one of the iatrogenic causes of dry eyes after cataract surgery. Corneal denervation can cause decreased blinking and less tear discharge. Denervation of a larger portion of the cornea occurs in SICS with a large corneoscleral tunnel incision, which is linked with prolonged foreign body sensation with mucus and debris accumulating within the groove. In phacoemulsification cataract surgery, on the other hand, the incision is substantially smaller. As a result, the chances of corneal denervation are less. As a result, we found that individuals who had SICS had a higher prevalence and severity of dry eyes than those who had phacoemulsification surgery. Other investigations have found that the size of the incision is associated with the severity and duration of dry eye[12-16]. It is thought that phacoemulsification incisions at 3 and 9 o'clock on the cornea's densely innervated horizontal portions cause less tear secretion and neurotropic

keratopathy. Transection of corneal nerves is said to interfere with epithelial integrity, causes impaired epithelial wound healing, reduced corneal sensitivity, and ultimately reduced tear production[18]. This, coupled with inflammatory response, leads to development of dry eye. Other authors have also found decreased corneal sensitivity and tear production after cataract surgery. Most studies have concluded that the dry induced by cataract surgery is transient, and usually recovers by 3-6 months[19-21]. There are some limitations of this study as with any study. Firstly, the corneal sensitivity was not assessed. Secondly, a comparison between postoperative dry eye and visual acuity was not done in this study.

Conclusion

Incidence of dry eye is higher and severity greater after SICS than phacoemulsification technique of cataract surgery due to greater tear film instability induced by the former technique. Various etiological factors have been implicated in causation of dry eye. Cataract surgery is one of the factors predisposing to dry eye. Dry eye can occur following cataract surgery. Eyes with post operative dry eye may also have lesser visual recovery compared to those who do not develop significant dryness. In light of the high incidence of dry eye following cataract surgery, our study suggests the use of an appropriate lubricating agent be prescribed for atleast 3 months after cataract surgery in order to avoid dry eye-related complications following surgery and provide symptomatic relief to patients. Further studies with longer duration of follow-up targeted to assess time taken to attain normal status are recommended. Moreover, long-term residual dry eye following cataract surgery also needs to be investigated.

Financial support: Nil
Conflict of interest: The authors declare that there is no conflict of interest.

References

1. Cetinkaya S., Mestan E., Acir N.O., Cetinkaya Y.F., Dadaci Z., Yener H.I. The course of dry eye after phacoemulsification surgery. *BMC Ophthalmol.* 2015;68:1–5
2. Cho YK, Kim MS. Dry eye after cataract surgery and associated intraoperative risk factors. Korean J Ophthalmol 2009;23:65–73.
3. Cho YK, Kim MS. Dry eye after cataract surgery and associated intraoperative risk factors. Korean J Ophthalmol 2009;23:65–73.
4. Darmadi, N. M., Edi, D. G. S., Kawan, I. M., Semariyani, A. A. M., & Sudiarta, I. W. (2018). The changes in protein content, moisture content, and organoleptic pindang of auxis thazard due to re-boiling stored in cold temperatures. International Journal of Life Sciences, 2(3), 75–85. https://doi.org/10.29332/ijls.v2n3.210
5. Dieckow J. 6th International Conference on the Tear Film & Ocular Surface: Basic science and clinical relevance (Florence, Italy, September 2010) *Ocul Surf.* 2011;9:3–12.Lin PY, Tsai SY, Cheng CY, et al.

6. Garg P, Gupta A, Nishi Tandon PR. Dry eye disease after cataract surgery: study of its determinants and risk factors. Turk J Ophthalmol. 2020;50(3):133.
7. Ishrat S, Nema N, Chandravanshi SC. Incidence and pattern of dry eye after cataract surgery. Saudi J Ophthalmol. 2019;33(1):34-40.
8. Kasetsuwan N, Satitpitakul V, Changul T, Jariyakosol S. Incidence and pattern of dry eye after cataract surgery. PloS one. 2013;8(11):e78657.
9. Khanal S, Tomlinson A, Esakowitz L, Bhatt P, Jones D, Nabili S, et al. Changes in corneal sensitivity and tear physiology after phacoemulsification. Ophthalmic Physiol Opt 2008;28:127-34
10. Khanal S., Tomlinson A., Esakowitz L. Changes in corneal sensitivity and tear physiology after phacoemulsification. *Ophthalmic Physiol Opt.* 2008;28:127–134.
11. Li XM, Hu L, Hu J, Wang W. Investigation of dry eye disease and analysis of the pathogenic factors in patients after cataract surgery. Cornea 2007;26(9 Suppl 1):S16–20.
12. Oh T, Jung Y, Chang D, Kim J, Kim H. Changes in the tear film and ocular surface after cataract surgery. Jpn J Ophthalmol 2012;56:113–8.
13. Roberts C.W., Elie E.R. Dry eye symptoms following cataract surgery. *Insight.* 2007;32:14–21
14. Sahu PK, Das GK, Malik A, Biakthangi L. Dry Eye Following Phacoemulsification Surgery and its Relation to Associated Intraoperative Risk Factors. Middle East Afr J Ophthalmol. 2015;22(4):472-477.
15. Setiawan, Y., Kristhy, M. E., Arafah, R., & Kristalina, K. (2022). Law and globalization: The emergence of global regulatory governance and its impact on Indonesia's legal and economic development post-COVID-19 pandemic. International Journal of Health Sciences, 6(2), 898–906. https://doi.org/10.53730/ijhs.v6n2.8760
16. Shrivastava S, Dudhat B, Ramakrishnan R, Gore V. Tear film changes after cataract surgery: manual small-incision cataract surgery versus phacoemulsification. Delta J Ophthalmol. 2018;19(3):170.
17. Small Incision Cataract Surgery (SICS) vs. Phacoemulsification (Phaco)- A Review 2012. National Cataract Coalition(NCC)African Vision Research Institute(AVRI).
18. Suryasa, I. W., Rodríguez-Gámez, M., & Koldoris, T. (2021). Get vaccinated when it is your turn and follow the local guidelines. *International Journal of Health Sciences*, *5*(3), x-xv. https://doi.org/10.53730/ijhs.v5n3.2938
19. Sutu C, Fukuoka H, Afshari NA. Mechanisms and management of dry eye in cataract surgery patients. Curr Opin Ophthalmol 2016;27:24–30.
20. Sutu C, Fukuoka H, Afshari NA. Mechanisms and management of dry eye in cataract surgery patients. *Curr Opin Ophthalmol.* 2016; 27:24–30
21. The definition and classification of dry eye disease: report of the definition and classification subcommittee of the international dry eye workshop (2007). Ocul Surf. 2007;5:75–92. [PubMed]
22. The epidemiology of dry eye disease: Report of the Epidemiology Subcommittee of the International Dry Eye WorkShop (2007) *Ocul Surf.* 2007;5:93–107
23. Willcox MDP, Argüeso P, Georgiev G, Holopainen J, Laurie G, Millar T, et al.TFOS DEWS II Tear film report.OculSurf2017;15:438-510

24. Yao K, Bao Y, Ye J, et al. Efficacy of 1% carboxymethylcellulose sodium for treating dry eye after phacoemulsification results from a multicenter, open-label, randomized, controlled study. BMC Ophthalmol 2015;15:28.