



## DIFFERENCES IN TEAR SECRETION BEFORE AND AFTER PHACOEMULSIFICATION SURGERY USING SCHIRMER I TESTS

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### ABSTRACT

**Background:** Cataract is a serious problem in the world because it is the biggest cause of blindness in the world. Cataract healing can only be done with operative measures, one of them is phacoemulsification. The phacoemulsification technique is the latest operative technique for cataract healing but both conventional techniques or phacoemulsification techniques can cause a decrease in tear secretion after cataract surgery. The reduction in tear secretion can be evaluated using the Schirmer I test. In this study an analysis of differences in tear secretion before and after phacoemulsification surgery. **Aims:** Knowing, comparing, and analyzing the differences in tear secretion before and after phacoemulsification surgery using the Schirmer I test. **Methods:** 22 cataract eyes consisting of 15 patients who will undergo phacoemulsification surgery were collected by consecutive sampling at the Sultan Agung Eye Center, Sultan Agung Hospital, Semarang from August to September 2019, examined using the Schirmer I test. After the data was collected, data analyzed with Wilcoxon rank test. **Results:** A total of 15 cataract patients consisting of 10 female patients and 5 male patients with a total of 22 eye samples. The average tear secretion before and after phacoemulsification surgery was  $12.77 \pm 2.74$  mm and  $11.00 \pm 1.95$  mm. Data were tested with the Wilcoxon rank test,  $p = 0,000$  ( $p < 0.05$ ) which showed a difference in average tear secretion before and after phacoemulsification. **Conclusion:** There are differences in tear secretion before and after phacoemulsification surgery.

**Keywords:** Phacoemulsification, Schirmer I. Test

### INTRODUCING

A lacrimation functional unit consisting of the lacrimal glands, eyelids, and innervation of the lacrimal gland has an important function in the secretion of tear components for the maintenance of a stable, protective and supportive tear layer that is essential for the optimal functioning of the optic system of the eye. Abnormalities of any or all structures of the functional unit of the lacrimation can interfere with the maintenance process of the eyeball surface.

Cataract is a degenerative disease that causes the most blindness in the world and its cure can only be done through operative actions<sup>1,2</sup>. Ophthalmic operations involving the cornea such as cataract surgery and refractive surgery can cause a decrease in the lacrimation reflex due to damage to the corneal nerve<sup>3</sup>.

The lacrimation reflex that is important for the protection of the eyeball surface occurs due to stimulation of the eyeball surface. Damage to the corneal nerve fibers after cataract surgery can reduce nerve sensitivity thereby causing a decrease in reflex

lacrimation. Impaired tear secretion will cause dry eye syndrome which is a multifactorial disease of tears and the surface of the eyeball<sup>4</sup>. It is often complained by patients that there are symptoms of dry eyes after cataract surgery.

In the phacoemulsification surgical procedure, the cornea incision causes the sensory nerve to be cut off and gives negative feedback to the sympathetic and parasympathetic nerves acting on the lacrimal gland resulting in decreased tear secretion<sup>5</sup>. Tear secretion can be evaluated semi quantitatively using the Schirmer I test with a normal value of 10 mm - 30 mm. If the results of the Schirmer I test are less than 10 mm, there is a reduction in tear secretion<sup>6</sup>.

### METHOD

This study was an observational analytic study with a cross sectional study design. This research was conducted at Sultan Agung Eye Center, RSI Sultan Agung, Semarang in August - September 2019.

Subjects were cataract patients treated at Sultan Agung Eye Center, RSI Sultan Agung, Semarang by fulfilling the criteria of age 50-60 years,



research subjects who had a history of external eye abnormalities, DM sufferers, had a history of cataract surgery or previous refraction were not included in research.

Schirmer test strips were used in this study. The examiner held the tip of the Schirmer test strip in a hook-like conformation to the lower eyelid of the outside one-third of the conjunctival sac of each subject without anesthesia. Subjects closed their eyelids during the test. After 5 minutes, the examiner removes the strips and measures the length of strip wetted by tears. Without anesthesia, wetting of less than 10 mm of a Schirmer strip indicates dry eyes.

Based on the calculation of the sample size needed for this study were 22 cataracts. The independent variable of this study was phacoemulsification surgery. The dependent variable of the study was tear secretion, which was obtained from the evaluation results using the Schirmer I test. Hypothesis testing for differences in tear secretion before and after phacoemulsification surgery using the Saphiro-Wilk test with results  $p < 0.05$ , because it does not meet the requirements to use an independent t-test, statistical analysis was performed using the Wilcoxon rank test. The p value is considered significant if the p value  $< 0.05$ .

The data was then analysed by computer software, SPSS in 24.0 version. The ethical clearance for this research was derived from Ethical Commission (No.253/EC/KEPK/FK-UNDIP/VI/2019) of Health Research of Medical Faculty of Diponegoro University Semarang and Bioethics Commission (No.447/VII/2019/Komisi Bioetik) of Health Research of Medical Faculty of Islam Sultan University Semarang

## RESULTS

This research has been conducted on cataract patients at Sultan Agung Eye Center, RSI Sultan Agung, Semarang who have met the inclusion and exclusion criteria. The method of selecting samples is consecutive sampling. This research was conducted in 22 eyes.

## Characteristics of Research Subjects

**Table 1.** Characteristics of research subjects

Patient Characteristics	Frequency	Percentage
Gender		
- Men	5	33.3%
- Women	10	66.7%

The study sample was obtained from 15 patients, and numbered 22 eyes. In this study cataract patients were dominated by women as many as 10 people (66.7%), while men as many as 5 people (33.3%).

## Descriptive Data Measurement of Tear Secretion Using Schirmer I Test

**Table 2.** Descriptive data measuring tear secretion using the Schirmer I test

Tear Secretion	N	Mean $\pm$ SD	Median	Min	Max
Before	22	12.7 $\pm$ 2.74	12.00	9	19
After	22	11.0 $\pm$ 1.95	10.00	9	15
Delta Change	22	1.77 $\pm$ 1.60	1.00	0	6

Based on table 2, the Parametric Paired t-test, showed a Tear secretion before phacoemulsification surgery: an average and standard deviation of  $12.77 \pm 2.74$  mm were obtained with the highest and lowest values being 19 and 9; whereas after phacoemulsification surgery: the average and standard deviation of  $11.00 \pm 1.95$  mm with the highest and lowest values are 15 and 9. In this study we found delta changes in tear secretion of  $1.77 \pm 1.60$  mm.

## Comparison of Tear Secretion Measurement Using Schirmer I Test

**Table 3.** Comparison of tear secretion measurements using the Schirmer I test

	N	Mean Rank	Sum of Ranks	p-value
Post pre				
Negative Ranks	18 <sup>a</sup>	9.50		
Positive Ranks	0 <sup>b</sup>	0.00		
Ties	4 <sup>c</sup>			0.000
Total	22			

Note: a: post <pre, b: post> pre, c: post = pre



The results obtained 18 samples experienced a decrease in tear secretion, 4 samples did not experience a decrease in tear secretion, and there were no samples that experienced an increase in tear secretion. Test with Wilcoxon rank test obtained  $p = 0,000$  ( $p < 0.05$ ), which shows there are differences in tear secretion before and after phacoemulsification surgery.

## DISCUSSION

The study was conducted in 22 eyes out of 15 people with 5 men while the number of women was 10. This is also consistent with research conducted by Saba, et al. concerning the effects of dry eye after cataract surgery in which the study sample was dominated by women as many as 61 samples from 96 samples and research conducted by Madeleine that there was an increased risk of cataracts in women who had experienced menopause<sup>7,8</sup>.

During cataract surgery, the surgical procedure can cause inflammation and release of inflammatory mediators such as oxygen-free radicals, proteolytic enzymes, and cyclooxygenase. In the ocular surface. Thus, the ocular surface is damaged, resulting in decreased density of goblet cells. Cataract surgery itself can aggravate dry eye. The patients diagnosed with dry eye before the surgery had abnormalities of ocular structure and function

An incision of 2 mm in phacoemulsification surgery is the most minimal incision when compared with other cataract surgery techniques but the phacoemulsification surgery technique still gives the impression of dry eye in patients after phacoemulsification surgery<sup>9</sup>. The same incision size is also present in the refractive difference by the Small Incision Lenticule Extraction (SMILE) method and according to research conducted by Zeren et al. there is a change in tear secretion after refractive surgery with the SMILE method. This is caused by the severing of the nasociliary longus nerve fibers which are the last branch of the ophthalmic nerve, cranial nerves V. The decrease in sensitivity causes negative feedback to the motor nerve components, sympathetic and parasympathetic, which act on the lacrimal gland causing a decrease in tear secretion and cause complaints of tears dry eye in patients after cataract surgery<sup>10,11</sup>.

This is relevant to research conducted by Retnaniadi, et al. that there is a decrease in tear secretion after surgery either by the EKEK technique or the SICS technique in cataract patients due to damage to the corneal nerve fibers. Khanal et al. also reported that deterioration in corneal sensitivity and tear physiology was seen immediately after phacoemulsification. Corneal sensitivity didn't return to preoperative levels until 3 months postoperatively<sup>12,13</sup>.

Measurements were made using the Schirmer I test and significant results were obtained with an average tear secretion before phacoemulsification surgery of  $12.77 \pm 2.74$  mm, while the average tear secretion after phacoemulsification surgery was  $11.00 \pm 1.95$  mm and obtained a difference in tear secretion of  $1.77 \pm 1.60$  mm. A decrease in tear secretion after cataract surgery also occurred in a study conducted at Hindu Rao Hospital using measurements of Tear Meniscus Height (TMH), Tear Breakup Time (TBUT)<sup>9</sup>.

## CONCLUSION

Phacoemulsification surgery technique is the latest cataract surgery technique in the field of ophthalmology which has experienced many developments when compared to other cataract surgery techniques. In contrast to other conventional techniques, phacoemulsification technique uses a very minimal incision, of 2 mm. Although this technique has a smaller incision size than other conventional techniques, there is still a decrease in tear secretion due to damage to nerve fibers in the cornea.

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