

# A COMPARATIVE STUDY OF TEAR FILM PARAMETERS BEFORE AND AFTER SMALL INCISION CATARACT SURGERY AND PHACOEMULSIFICATION

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## ABSTRACT

### BACKGROUND

Cataract surgery is the commonest eye surgery performed. Sutureless cataract surgery is the preferred method today. A clinically significant proportion of cataract surgery patients experience some degree of dry eye symptoms after surgery. Dry eye is highly prevalent, yet largely underdiagnosed condition that can substantially affect quality of life.

The aim of the study is to compare changes in the tear film in patients undergoing small incision cataract surgery and phacoemulsification.

### MATERIALS AND METHODS

The study included a total of 407 patients randomly divided into two groups. Group A had 202 patients in whom phacoemulsification was performed and group B had 205 patients in whom small incision cataract surgery was performed. Detailed ocular examination and tear film tests were done as per the protocol on each group, which included Tearfilm Meniscus Height (TMH), Schirmer's 1 and 2 (S1T and S2T), Tear Film Breakup Time (TBUT) and Rose Bengal Score (RBS) to get the baseline values. Patients were followed up after one week, one month and three months postoperatively and a detailed questionnaire regarding dry eye was asked at each visit. Tear film tests were also performed.

### RESULTS

In individual groups (A and B), there was a significant difference seen between preoperative dry eye symptoms, Schirmer's 1 and 2, Rose Bengal score, tear film breakup time and tear film meniscus height from postoperative one week, one month and three months data. But, there was no significant difference noted between the two groups when compared to each other, except for tear meniscus height, which was significantly reduced from preoperative period ( $p=0.00$ ).

### CONCLUSION

We concluded that a trend toward baseline values was seen with time that is improvement of dry eye symptoms and tear film test values at consecutive followup in both groups. Nevertheless, the dry eye symptoms and tear film changes did not return to preoperative values in three months followup.

### KEYWORDS

Small Incision Cataract Surgery, Phacoemulsification, Tear Film Meniscus Height, Schirmer's 1 and 2, Tear Film Breakup Time and Rose Bengal Score.

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### BACKGROUND

Cataract surgery is the commonest surgery performed. Nearly, all intraocular surgeries can lead to some or the other complications and one of the most common complication is dry eyes because of tear film dysfunction. Cataract surgery can lead to dry eye even when dry eye symptoms and signs are absent or minimal preoperatively.<sup>1,2</sup> Also, the application of topical eye drops,

impaired corneal sensitivity and surgery-related inflammation are thought to contribute to postoperative tear film dysfunction.<sup>3</sup> Incidence of dry eye amongst ophthalmology outpatients in India was seen to be around 0.46% with a male:female ratio of 1:1.22.<sup>4</sup>

After cataract surgery, patients experience some degree of dry eye symptoms in the first month of surgery.<sup>5</sup> Cataract surgery either causes dry eye or exacerbates pre-existing dry eye.<sup>5</sup>

In this study, we compared changes in the tear film parameters after Small Incision Cataract Surgery (SICS) and phacoemulsification.

### MATERIALS AND METHODS

This prospective study was conducted in the Department of Ophthalmology, Christian Medical College, Ludhiana. The study included a total of 407 patients. They were randomly

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divided into two groups. Group A in whom phacoemulsification was performed and group B in whom SICS was performed. Group A had 202 patients and group B had 205 patients. Exclusion criteria were also set that included history of previous eye surgery, patients with dry eye disease, patients with history of glaucoma, uveitis or high myopia, patients with traumatic or subluxated cataract, any cataract surgery requiring suturing, patients who developed complications during surgery. Informed consent was taken from each patient. They were asked detailed history and also had to fill up a questionnaire.

Detailed ocular examination was done as per protocol. Tear film tests, which included Tear Film Meniscus Height (TMH), Schirmer’s 1 and 2 (S1T and S2T), Tear Film Breakup Time (TBUT) and Rose Bengal Score (RBS) were performed to get the baseline values. Each patient was followed up after one week, one month and three months postoperative. A detailed questionnaire regarding dry eye was asked again to each patient and answers to the questionnaire were graded as 0= none, 1= mild, 2= moderate, 3= severe, 4= very severe. Detailed ocular examination was done on each follow up. Tear film meniscus height, Schirmer’ 1 and 2, tear film breakup time were done on the first week, first month and third month. Rose Bengal score was done only on the first and third month.

**Statistical Analysis**

The data recorded as per protocol was entered in Microsoft excel and the relevant frequencies, ratios, parametrical and nonparametrical tests and Chi-square were calculated using Epi info version 6.

**RESULTS**

There were 227 patients who had undergone surgery in the right eye and 180 patients in the left eye. In group A, 115 patients got operated in the right eye accounting for 56.9% and 87 patients got operated in the left eye accounting for 43.1%. In group B, 112 got operated in the right eye accounting for 54.6 and 93 patients got operated in the left eye accounting for 45.4%. The difference was not statistically significant (p=0.641).

In all the patients undergoing cataract surgery, the mean dry eye symptom preoperatively was 1.58. The mean dry eye symptom at 1 week was 2.34 (p=0.00) and at 1 month it was 2.05 (p=0.00). At 3 months, it was 1.89 (p=0.00). The symptoms of dry eye reduced in the subsequent one month and two months postoperatively, but was nevertheless statistically significant as compared to the preoperative values as shown in table 1.

Study Visits	Dry Eye Symptoms (Mean±S.D.)	p value
Preoperative	1.58±0.728	
1 week	2.34±0.992	0.000
1 month	2.05±0.953	0.000
3 months	1.89±0.971	0.000

**Table 1**

The comparison of dry eye symptom between group A and B was as follows- The mean dry eye symptom preoperatively in group A was 1.60 and in group B was 1.56 (p=0.529). At 1 week postoperatively, it was 2.39 in group A and 2.30 in group B (p=0.397). At 1 month postoperatively, it was 2.07 in group A and 2.02 in group B (p=0.609). At 3 months postoperatively, it was 1.90 in group A and 1.89 in group B (p=0.946). There was no statistical significance between the two groups.

Among the total patients undergoing cataract surgery, the mean Schirmer 1 test preoperatively was 15.45 mm. At 1 week, it was 19.29 (p<0.00), and at 1 month, it was 16.65 mm (p<0.00). At 3 months, it was 16.12 mm (p=0.001). This was statistically significant. This is shown in table 2.

Study Visits	S1T (mm)(Mean±S.D.)	p value
Preoperative	15.45±7.707	
1 week	19.28±7.637	0.000
1 month	16.65±7.751	0.000
3 months	16.12±7.782	0.014

**Table 2**

The comparison of Schirmer’s 1 between group A and B was as follows-The mean Schirmer’s 1 test preoperatively in group A was 15.9 mm and group B was 14.92 (p=0.160). At 1 week postoperatively, it was 19.34 mm in group A and 19.24 in group B (p=0.898). At 1 month postoperatively, it was 16.42 mm in group A and 16.89 mm in group B(p=0.541). At 3 months postoperatively, it was 15.86 mm in group A and 16.37 in group B (p=0.506). There was no statistical significance in between the patients undergoing phacoemulsification and SICS.

In all the patients undergoing cataract surgery, the mean Schirmer 2 test preoperatively was 12.40 mm. At 1 week, it was 16.56mm (p=0.00) and at 1 month, it was 13.42 mm (p=0.00). At 3 months, it was 12.91 mm. This was statistically significant as shown in table 3.

Study Visits	S2T (mm) (Mean±S.D.)	p value
Preoperative	12.40±6.718	
1 week	16.56±6.865	0.000
1 month	13.42±6.740	0.000
3 months	12.91±6.573	0.006

**Table 3**

The comparison of Schirmer’s 2 between group A and B was as follows-The mean Schirmer’s 2 test preoperatively in group A was 12.71 mm and group B was 12.09 (p=0.352). At 1 week postoperatively, it was 16.53 mm in group A and 16.59 in group B (p=0.935). At 1 month postoperatively, it was 13.31 mm in group A and 16.52 mm in group B (p=0.754). At 3 months postoperatively, it was 12.89 mm in group A and 12.94 in group B (p=0.932). There was no statistical significance in between the two groups. However, the mean values were more in the SICS

group as compared to the phacoemulsification group at 1 week, 1 month and 3 months postoperatively.

The Rose Bengal score was used to quantify the degree of staining. A score of 4 or more was considered significant. The mean Rose Bengal score preoperatively was 1.30. The Rose Bengal score continued to rise over the period of 1 month in patients undergoing cataract surgery (p=0.00). At 3 months, it was lower than the first month postoperatively, but remained significantly higher than the preoperative value (p=0.00) as shown in table 4.

Study Visits	RBS (Mean±S.D.)	p value
Preoperative	1.30±0.687	
1 month	1.80±1.085	0.000
3 months	1.60±0.990	0.000

**Table 4**

The mean Rose Bengal score preoperatively in group A was 1.13 and in group B was 1.29 (p=0.724). At 1 month postoperatively, it was 1.83 in group A and 1.76 in group B (p=0.512). At 3 months postoperatively, it was 1.62 in group A and 1.58 in group B (p=0.624). There was no statistical significance in between the two groups. However, the mean values were more in SICS group as compared to the phacoemulsification group at 1 month and 3 months postoperatively.

The mean TBUT in both the groups combined was 9.92 seconds preoperatively. At 1 week postoperatively, it was 10.18 seconds (p=0.00). At 1 month postoperatively, it was 10.25 (p=0.00) and at 3 months postoperatively, it was 10.07 seconds (p=0.112) as shown in table 5.

Study Visits	TBUT (Seconds) (Mean±S.D.)	p value
Preoperative	9.92±3.297	
1 week	10.18±3.410	0.000
1 month	10.25±3.399	0.000
3 months	10.07±3.283	0.112

**Table 5**

The comparison of TBUT between group A and B was as follows- The mean TBUT preoperatively in group A was 9.97 seconds and in group B was 9.88 seconds (p=0.801). At 1 week postoperatively, it was 10.21 seconds in group A and 10.15 seconds in group B (p=0.867). At 1 month postoperatively, it was 10.31 seconds in group A and 10.19 seconds in group B (p=0.708). At 3 months postoperatively, it was 15.86 in group A and 16.37 in group B (p=0.723). There was no statistical significant difference between the two groups.

The mean tear film meniscus height in both the groups combined was 0.739 mm preoperatively. At 1 week postoperatively, it was 0.963 (p=0.00). At 1 month, it was 0.817 mm (p=0.00). At 3 months postoperatively, it was 0.779 mm (p=0.006). There was a statistically significant reduction in the tear film meniscus height postoperatively. This is shown in table 6.

Study Visits	TFMH (mm) (Mean±S.D.)	p value
Preoperative	0.739±0.293	
1 week	0.963±0.249	0.000
1 month	0.817±0.710	0.000
3 months	0.779±0.277	0.006

**Table 6**

The comparison of mean tear film meniscus height between group A and B was as follows- Preoperatively, in group A, it was 0.786 mm, and in group B, it was 0.692 mm (p=0.001). At 1 week postoperatively, it was 0.996 mm in group A and 0.931 mm in group B (p=0.009). At 1 month postoperatively, it was 0.844 mm in group A and 0.790 in group B (p=0.045). At 3 months postoperatively, it was 0.807 mm in group A and 0.752 mm in group B (p=0.047). There was a statistically significant difference inbetween the two groups. However, there was significant improvement postoperatively in both the groups, but the difference remained statistically significant throughout the duration of our study period. The difference could be because there was a statistically significant difference in between the two groups from the preoperative period.

### DISCUSSION

Dry eye in normal subjects can often develop after various types of ocular surgeries such as cataract surgery,<sup>6</sup> photorefractive keratectomy<sup>7</sup> and laser-assisted in situ keratomileusis.<sup>8</sup> The aim of this study was to compare tear film parameters in SICS and phacoemulsification.

According to our study, there was a significant level of discomfort felt by the patients 1 week postoperatively. The symptoms had reduced in the subsequent one and three months in the postoperative period, but remained significantly high as compared to the preoperative values. There was a statistically significant difference in the preoperative and postoperative levels of tear production as evidenced by Schirmer's 1 and 2, but when comparing the tear production between group A and B, we inferred that there was no statistical significance in the production of tears pre and postoperatively inbetween patients undergoing phacoemulsification and SICS. According to Srinivasan R et al, Schirmer's 1 and 2 values in pseudophakic eyes and phakic eyes when compared the difference between the two groups was not significant statistically with a p value of 0.19.<sup>9</sup>

The mean Rose Bengal scores continued to rise over the period of 1 month in patients undergoing sutureless cataract surgery (p=0.00). At 3 months, it was lower than first month postoperatively, but remained significantly higher than the preoperative value (p=0.00). Srinivasan R et al in their cross-sectional study of 150 patients who underwent phacoemulsification more than 3 months back found that none of the eyes showed significant Rose Bengal staining.<sup>9</sup>

In our study, the mean TBUT in both the groups combined was 9.92 seconds preoperatively. There was a significant alteration in the TBUT postoperatively as

compared with the preoperative values in individual groups, but when compared between patients undergoing phacoemulsification and SICS, there was no statistical significance between the two groups. According to Cho YK et al and Liu Z et al, cataract surgery causes significant alteration in the tear film breakup time.<sup>10,11</sup> Srinivasan R et al inferred that TBUT in the pseudophakic eyes ranged from 4 to 20 seconds while that in the phakic eyes ranged from 6 to 20 seconds. The difference between the two groups was statistically significant with a p value of 0.03.<sup>9</sup>

We found that the mean tear film meniscus height in both the groups combined was 0.739 mm preoperatively. At 1 week, 1 month and 3 months postoperatively values were statistically significant ( $p=0.00$ ). According to study conducted by Cho YK et al, there was a significant aggravation in TMH at 3 days, 10 days, 1 month and 2 months postoperatively compared with the preoperative values.<sup>10</sup> Liu Z et al in their study found that at 1 day and 2 days postoperatively, the TMH increased significantly. Height of the meniscus at 14 days returned to their preoperative value ( $p=1.00$ ).<sup>11</sup> In our study, the comparison of mean TMH between group A and B postoperatively showed a statistical significance between the two groups. However, there was a significant improvement postoperatively in both the groups, but the difference was still statistically significant between the two groups during the entire duration of the study.

### CONCLUSION

Based on the present study, we concluded that there are significant changes in the tear film parameters after sutureless cataract surgery, which include both phacoemulsification and small incision cataract surgery and all parameters showed statistically significant increase in values postoperatively.

But, there was no statistically significant difference in the dry eye symptomatology and tear film changes between patients undergoing phacoemulsification and small incision cataract surgery excepting for the data obtained in the tear film meniscus height of the two groups.

However, a trend towards baseline values was seen with time. Nevertheless, the dry eye symptoms and tear film changes did not return to the preoperative values in three months follow up in our study.

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