

Research Article

Comparative study of dry eye after Phacoemulsification in senile cataract

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ABSTRACT

Background: Corneal surgery has been identified as one of the risk factors for the development of dry eye disease by decreasing corneal sensation and changing the contour of the ocular surface as a result of the inflammation caused by surgical trauma. Clear cornea phacoemulsification may also alter the ocular surface and disrupts normal tear function in eyes. The purpose of study to compare dry eye caused by phacoemulsification in different age groups in senile cataract patient with no pre-existing dry eye.

Methods: After taking informed consent 50 eyes of 50 patient of senile cataract with no preoperative dry eye had under gone 2.75 mm superior clear corneal phacoemulsification with IOL implantation. After ruling out pre-existing ocular disease, surgery, trauma and systemic diseases, Dry Eye evaluation by schirmer I test, FTBUT and lissamine conjunctival staining was done pre and postoperatively at 1st, 4th and 12th week.

Data was collected and analysed on IBM SPSS version 23 by paired T test.

Results: In all age group, SIT and FTBUT, conjunctival staining showed lowest values at 1st week ($p < 0.05$) and by 12th week values has come near to base line value ($p < 0.05$). Results showed only 38% of cases in 45-55 age group, 50% in 56-65 age group and all the cases showed dry eye in 66-75 age group at 12th week.

Conclusions: We have concluded that phacoemulsification surgery affects the tear film stability and the production of tears postoperatively and causes dry eye more in the older age group.

Keywords: Schirmer I test, Fluorescein tear break-up time, Lissamine staining

INTRODUCTION

Dry eye syndrome is a multifactorial disease characterized by dryness of the ocular surface due to tear deficiency and over evaporation.^{1,2} There are many causes and factors leading to dry eye, including aging, female gender, connective tissue diseases, diabetes mellitus, systemic hypertension, contact lens usage, drugs like antihistamines, anticholinergics, antidepressants, oral contraceptives and topical eye drops containing preservatives and ocular diseases like blepharitis, chronic

conjunctivitis, meibomitis and pterygium.³⁻⁵ Dry eye is the most frequent disorder in ophthalmology practice. The prevalence of which varies from 4% to 57%, thereby showing disparity worldwide.⁶⁻⁹ Corneal surgery has been identified as one of the risk factors for the development of dry eye disease by disruption of normal ocular homeostasis by decreasing corneal sensation and changing the contour of the ocular surface as a result of the inflammation caused by its surgical trauma.¹⁰⁻¹² Clear cornea phacoemulsification has become one of the safest, most successful, and most frequently performed

outpatient surgeries nowadays. As in with other corneal surgeries, it may alter the ocular surface and disrupt the normal tear function. Liu compared the tear break-up time and Schirmer tests of diabetic and non-diabetic patients before surgery at 1st day, 1st week, 1st month, 3rd months and on 6th months after clear cornea phacoemulsification. Data from this study showed reduction in tear secretion after phacoemulsification in diabetic patients.¹³

The purpose of present study is to determine the pattern of dry eye in patients undergoing cataract surgery by clear cornea phacoemulsification. We compared the results of various tear function tests, such as fluorescein tear break-up time (FTBUT), conjunctival lissamine staining and Schirmer test in different age groups of senile cataract with no preoperative dry eye and also determined the possible risk factors associated with it.

METHODS

This study was prospective, randomized, single centre, carried out in the department of ophthalmology of medical college at uttarakhand, India from October 2013 to September 2014 for a period of 1 year. 50 patients of senile cataract aged 45 to 75 years with no previous dry eye disease were included in this study after getting the approval of the Institutional Ethics Committee and a written informed consent was taken from them.

All patients under study had gone under detailed history, systemic and preliminary ocular examination. Patients with pre-existing dry eye, ocular pre-medications, ocular diseases and systemic diseases like diabetes, HTN, rheumatoid arthritis, previous ocular surgery, and trauma were excluded from the study.

Dry eye evaluation tests included Schirmer's-test 1 (S1T) (without anesthesia) and Tear film break-up time (TBUT) and lissamine green conjunctival staining. These tests were done pre-operatively and post operatively (under asepsis conditions) at 1st week, 4th weeks and on 12th weeks interval. Data was then graded, based on the guidelines of the 2007 Report of The International Dry Eye Workshop (DEWS).¹

The Schirmer's 1 test without anesthesia was done to assess the aqueous tear production (basic plus reflex secretion). Standardized Whatmann filter paper 5 x 35 mm was inserted over the lower lid margin, midway between the middle and outer third away from the cornea. This was kept in the lower conjunctival sac for 5 minutes with patient's eyes closed. Test results were reported as the length of the strip that was moistened measured in millimeters (mm). Value less than 10 mm was taken abnormal.

The tear film break-up time assessment was done to assess the stability of the pre-corneal tear film i.e. the mucin component of the tear film. The interval in seconds

between the last blink and the appearance of the first fluorescein discontinuity spot at the center of the cornea was observed through a slit lamp with diffuse illumination and 10 x magnifications using cobalt blue light. Time was measured using a digital timer. Three consecutive FTBUTs were measured and the average was used for analysis of data. Break up time <10 sec was taken as abnormal.

To assess ocular surface, a lissamine green sterile paper strip (omni green) was utilized. The strip was moistened with 2 drops of normal saline, after waiting for 15 seconds was then applied to the lower palpebral conjunctiva. Using the Oxford scheme of grading staining, the six areas of the interpalpebral conjunctiva (three areas each of the temporal and nasal conjunctiva) were independently graded based on a six-point scale (0, 1, 2, 3, 4, 5) with 5 as the maximum grade for each area. Scores for each area was combined (maximum combined score of 30). All the tests were performed in the same sitting with a gap of 10 minutes. All the surgeries were performed under local anesthesia by a single surgeon. A 2.75 mm corneal incision was made superiorly at 11 o'clock position. Phacoemulsification with IOL implantation was performed with Laureate (linear phaco by Alcon) successfully with no untoward events. Topical antibiotic (Moxifloxacin 0.5%) four times a day for a week and topical steroid prednisolone acetate six times a day for a week was advised postoperatively. The steroid drop was then tapered over a period of 6 weeks. Total 50 eyes of 50 patient included in the study were divided in three groups according to their age. Out of 50 cases 28 were female and 22 were males. Statistics was done on IBM SPSS version 23 using paired t test.

RESULTS

A total of 50 eyes of 50 patients of age between 45-75 years were enrolled during the study period of 1 year. The mean age was 60.44 years. All were divided in three age groups n=13 in 45-55 years, n=26 in 56-65 years and n= 11 in 66-75 years as in Table 1. There were males (n=22) and females (n=28) as shown in Table 2.

Table 1: Distribution of cases according to their age group.

Age group (years)	Number of patients (n = 50)	Percentage (%)
45-55	13	26%
56-65	26	52%
66-75	11	22%

Table 2: Gender wise distribution of cases (n=50), 100%.

Gender	Number of patients(n)	Percentage
Male	22	44%
Female	28	56%

The preoperative and post-operative dry eye tests data analysed. Cases in all age group showed S1T lowest values at 1st week ($p < 0.05$). In 4th week values was still low ($p < 0.05$) and by 12th week values has come near to base line value ($p < 0.05$) as in Table 3-5.

TFBUT values also showed the same trend ($p < 0.05$) as in Table 3-5. Conjunctival staining scoring values were

maximum in the 1st week ($p < 0.05$) and come to near to baseline values by 12th week ($p > 0.05$) in 45-55 years and 56-65 years age group as shown in Table 3 and 4. But in 66-75 years age group, the values for conjunctival staining was significant by 12th week ($p < 0.05$) as in Table 5.

Table 3: Comparison of pre and post-operative dry eye tests values in age groups 45 – 55years (n=13).

Variables	Baseline	1 st week	4 th weeks	12 th weeks	p-value
Schirmer's-1 test (mm)	21.76± 5.71	13.76±4.22	16.38 ±5.72	19.0±3.76	<0.05
TFBUT (sec)	14.07±1.51	8.54±1.66	9.46±0.96	12.69±1.84	<0.05
Conjunctival staining (scoring)	2.15±0.80	7.84±1.46	3.46±2.02	2.87±1.38 p- >0.05	<0.05

Table 4: Comparison of pre and post-operative dry eye test values in age group 56 – 65years (n=26).

Variables	Baseline	1 st week	4 th weeks	12 th weeks	p-value
Schirmer's-1 test (mm)	18.84±5.94	11.30±5.12	13.34±5.19	15.26±3.90	<0.05
TFBUT(sec)	11.84±2.54	5.96±2.056	7.73±2.16	10.57±1.55	<0.05
Conjunctival staining (scoring)	2.42±0.70	8.92±1.92	4.23±1.55	2.42±0.70 p>0.05	<0.05

Table 5: Comparison of pre and Post- operative dry eye tests values in age group 66-75years (n=11).

Variables	Baseline	1 st week	4 th weeks	12 th weeks	p-value
Schirmer's-1 test (mm)	16.81±4.42	10.18±3.86	11.72±3.90	13.91±4.76	<0.05
TFBUT(sec)	10.91±1.13	6.00±1.67	7.09±1.64	7.72±1.73	<0.05
Conjunctival staining (scoring)	3.82±0.98	8.64±1.03	6.64±1.28	5.45±1.21 p<0.05	<0.05

Table 6 showed only 38% of cases in 45-55 years age group, 50% in 56-65 years age group had dry eye by the end of 12th week and all the cases showed dry eye in 66-75 years age group at 12th week.

Table 6: Age wise distribution of percentage of cases of dry eye at 12 weeks.

Age group (years)	Total number of cases (n=50)	Percentage of dry eye
45-55	13	38%(n=5)
56-65	26	50%(n=13)
66-75	11	100%(n=11)

On comparing the S1T in different age groups, Figure 1 showed better recovery in younger age groups (45-55 years and 56-65 years) in post-operative follow ups than in older age group (66-75 years) and by 12th week they were approaching the baseline value.

TBUT test values in post-operative follow ups in different age group showed similar trend as was in S1T values as in Figure 2. Younger age groups (45-55 and 56-65years) showed recovery and oldest age

group (66-75 years) was not improving at 12th weeks in Figure 2.

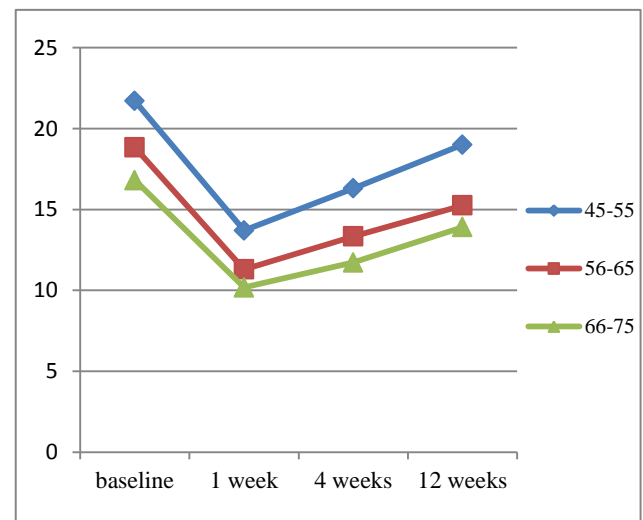


Figure 1: Comparative of post-operative Schirmer-1 test (mm) in different age groups.

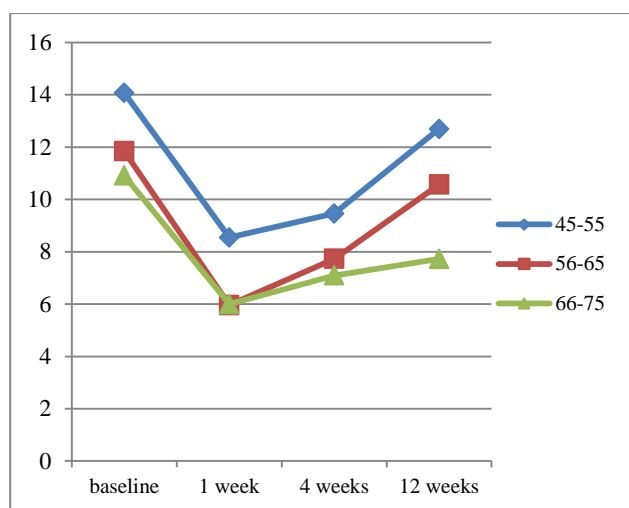


Figure 2: Comparative of post-operative TBUT tests (sec) in different age groups.

DISCUSSION

In our present study all age groups showed FTBUT and Schirmer test values and Lissamine conjunctival staining in post-operative period lowest at 1st week which gradually improved at 4th week ($p < 0.05$) and came near to baseline by 12th week which are similar to other studies.

Tear film stability was significantly compromised in present study as supported by low FTBUT values. This finding could not be attributed to clear cornea phacoemulsification alone. The low FTBUT values were likely to be the result of the use of topical eye drops with preservatives, exposure to light of microscope, frequent irrigation of cornea as they could cause toxicity to the cornea and conjunctiva. These preservatives acted like detergents that caused break down of the tear lipid layer resulting in low FTBUT. A study by Pisella and colleagues who compared the ocular symptoms (foreign body sensation, tearing, burning sensation, and itching) of patients on preservative and preservative-free glaucoma medications showed a significant decrease in symptoms with the use of preservative-free medication and a reversal of symptoms after the medication with preservative was removed.¹⁴ In our study, the FTBUT gradually improved at 1st month after the surgery which could be due to the decreased frequency of topical medications at around this time and returned to near normal levels at 12th week (medication stopped) after surgery.

The observed decrease in Schirmer test values after the surgery was similar to findings from previous studies that reported significantly worse dry eye test values after phacoemulsification.¹⁵ Proposed mechanisms for decrease in tear production after clear cornea phacoemulsification included, the corneal incisions caused certain corneal irregularities that might produce tear film disruptions and decrease in corneal sensation secondary to severing of the

corneal nerves that disrupted the feedback loop of the cornea and lacrimal gland.

The use of topical anesthesia, topical eye drops containing preservatives like benzalkonium chloride administered preoperatively and postoperatively may cause tear film instability and decrease the number of mucin expressing cells and lead to dry eye postoperatively.^{16,17}

The gradual recovery of the tear production could be compared to what happens in LASIK surgery. After LASIK, it was seen that corneal nerves decreased by as much as 90% in the flap and sub-basal areas especially during the first week after surgery.

Corneal sensitivity improved 3-6 months after LASIK and corneal nerves reached 50% of its original preoperative count.^{18,19} The disruption in corneal sensitivity due to the incisions in clear cornea phacoemulsification, although small, could lead to decrease in tear production similar to that found in LASIK. The sub-basal nerve encounters the cornea from the limbal side, mainly from the temporal and nasal quadrants, and then divides toward the central area. Corneal incision at the temporal area may cut the base of corneal nerves and widening the incision may worsen the reduction in corneal sensitivity.^{20,21} The theory that reduces in corneal sensitivity affects tear production supports the feedback mechanism that exists between the cornea and the lacrimal gland. In present study, the gradual recovery of the Schirmer values over time was postulated to be due to the recovery of the sensitivity, thus enhancing the feedback neural loop of the cornea and lacrimal gland. Although the baseline values were still not reached at 3 months after surgery. A study reported that deterioration in corneal sensitivity and tear physiology that was seen immediately after phacoemulsification did not return to preoperative levels until 3 months, whereas the tear functions recovered within 1 month postoperatively.²²

Kasetsuwan et al reported that signs and symptoms of dry eye occurred as early as 7 days post-phacoemulsification and the severity pattern improved over time.²³ In our study also, the dry eye test values returned near to preoperative values after 12 weeks of surgery.

In the present study, only 38% in 45-55 years age group and 50% in 56-65 years age group at 12 weeks had dry eye whereas 66-75 years age group showed the same course except at 12 weeks and the tests values were below the baseline in all cases and had dry eye. To our knowledge, such results have not been reported in other studies. The disparity in recovery in different age groups may be because of more nuclear sclerosis in older age group, more Phaco-time and more exposure to microscopic-light.^{14,24}

Oh et al, reported that the decrease in goblet cell density, which was correlated with operation time, had not recovered even at 3 months after cataract surgery. Therefore, the microscopic ocular surface damage during cataract surgery seems to be one of the many pathogenic factors that causes ocular discomfort and dry eye syndrome after cataract surgery.²⁴ Han et al, reported that Meibomian gland function may be altered without accompanying structural changes after cataract surgery.²⁵

Movahedan et al, reported that maintaining a healthy ocular surface is essential for achieving the best visual outcome in cataract patients.²⁶

CONCLUSION

We have concluded from our study that phacoemulsification surgery affects the tear film stability and the production of tears postoperatively. It causes dry eye in all age groups, but was more in the older age group and stayed for a longer time. May be the use of torsional Phaco-technique would be better than linear for higher grades of nuclear sclerosis among old patients take less Phaco time.²⁷ Further studies are required to compare effect of these techniques in older age groups on dry eye postoperatively.

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