



Dry eye Disease Following Manual Small Incision Cataract Surgery: A Study from Eastern India

KEYWORDS

Dry eye disease, manual small incision cataract surgery

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ABSTRACT **Background:** Dry eye is a multifactorial disease that affects the quality and quantity of tears that alter the ocular surface. It is characterized by various degree of discomfort, such as burning, stinging, grittiness, FB sensation, sensitivity to light and blurriness. It is often seen that these symptoms arise or get aggravated following cataract surgery. **Aim:** To find out if manual small incision cataract surgery (MSICS) causes dry eye post operatively. **Material and methods:** An institution based longitudinal comparative study was conducted to find out if manual small incision cataract surgery (MSICS) causes dry eye. 200 patients (400 eyes) were evaluated for dry eye pre and post-operatively. A detailed questionnaire was given and Mc Monnies Index was calculated from the given score. Schirmer test-I, tear break up time, tear meniscus height were tested for dry eye evaluation. Patients were followed up at 1 month, 3 months and 6 months. Statistical analysis was done using SPSS 19.0 and paired-t test. **Results:** Results showed that at 6 months follow up a statistically significant number of patients, especially in older age group developed dry eye symptoms post-operatively. It can be concluded that MSICS can lead to develop dry eye syndrome (DES) which is more in older age group and in female patients.

Introduction

Dry eye is a multifactorial disease that affects the quality and quantity of tears that alter the ocular surface. It is characterized by various degree of discomfort, such as burning, stinging, grittiness, FB sensation, sensitivity to light and blurriness. Lemp (1995) described it as a disorder of the tear film due to tear deficiency or excess tear evaporation which causes damage to the interpalpebral ocular surface, and is associated with symptoms of ocular discomfort¹. According to Mc Carty et al (1998), Bjerrum et al (1997) and Scein et al (1997), more than 6% of the population over the age of 40 suffers from dry eye, with the prevalence increasing to 15% of the population over the age of 65^{2,4}. Corneal innervations are an integral component of the lacrimal gland-ocular surface functional unit which co-ordinates basal and stimulated tear production, lid blinking, tear spreading and tear clearance. In addition neurotrophic factors released from corneal nerves are important in normal physiology of corneal epithelial cells (Ku et al 2007)⁵.

There are some evidences favoring dry eye after manual small incision cataract surgery (MSICS) as well as phacoemulsification & corneal refractive surgery. A study by Cho YK et al (2007) found that all dry eye test values were significantly worse after cataract surgery in non dry eye group⁶. Renuka Srinivasan (2008) in their study of dry eye after phacoemulsification found out similar results between phakic and pseudophakic eyes⁷. A study by Uday Devgan, also found an increased percentage of patients who developed dry eye following clear corneal cataract surgery⁸. Our study was conducted on patients who underwent MSICS and the symptoms of dry eye disease were evaluated with questionnaires and clinical examinations. The aim of our study was to find out if manual small incision cataract surgery (MSICS) causes dry eye post operatively.

Materials and methods

This was an institution based longitudinal comparative study which was conducted on patients who underwent MSICS in the department of Ophthalmology, CNMC&H, Kolkata during the period from March 2010 to April 2011. It was analyzed at one month, three months and 6 months intervals. 400 eyes of 200 patients (fellow phakic eyes of the patient served as controls) were studied. Patients (in age group 45-70 years) with no dry eye symptoms undergoing MSICS in CNMC&H were selected and in each case standard scleral incision was considered. All the surgeries in the selected cases were performed by 3 surgeons of our department who are expert in MSICS. The patients were selected by screening procedures at the OPD after subjective interview of symptoms by McMonnies questionnaires, slit lamp examination, Schimer I test (without anaesthetic), tear meniscus height, tear break-up time and fluorescein staining of the cornea and conjunctiva.

Following were the inclusion and exclusion criteria:

Inclusion Criteria:

- Patients undergoing MSICS without any symptoms of dry eye.
- Patient with age range 45-70 years.
- Normal lid anatomy & blinking function.

Exclusion Criteria:

- Patient with history or symptoms or diagnosed case of Dry Eye Syndrome (DES).
- Conjunctival & corneal pathology (scar, dystrophy etc.).
- H/O Contact lens wear, on antiglaucoma medicine.
- Systemic diseases (Sjogren syndrome, thyroid ophthalmology).
- H/O cataract or glaucoma surgery in other eye or previous glaucoma surgery in same eye.

All cases were followed up for a period of 6 months to assess whether dry eye develops following cataract operation. Cases who were irregular in follow up were excluded from the study.

Analysis: The data was entered into an excel spreadsheet and analyzed using statistical software SPSS 19.0. The p value (significance level) was set at 5%. Data interpretation was done by paired t test.

Observations and Results

The study was conducted on 200 patients who MSICS in CNMC& H, during the period from March 2010 to April 2011. The patients were followed till 6 months and assessed for the development of dry eye, on the basis of Schirmer's test (ST1), tear meniscus height (TMH) and tear break up time (TBUT). The results of the study and analysis are given below. The test value results were not significantly deteriorated after 1 month postoperatively but it started deterioration gradually thereafter.

The mean values of ST1 of operated eyes at 1month & 3 months were 16.54 ± 5.23 & 14.54 ± 4.53 mm respectively. (Pre-op mean value was 17.13 ± 4.65 mm)

The mean values of TBUT of operated eyes at 1month & 3 months were 13.94 ± 3.6 & 12.53 ± 3.2 seconds respectively. (Pre-op mean value was 14.74 ± 3.016 seconds). The mean values of TMH of operated eyes at 1month & 3 months were 0.35 ± 0.07 & 0.31 ± 0.064 mm respectively. (Pre-op mean value was 0.35 ± 0.06 mm). The Schirmer's test I values at 6 months follow up is shown in table 1. The graphical representation of ST-I values at 6 months follow up is shown in Figure 1.

Table 1: Schirmer test 1 values after 6 months follow up

Out of 200 patients 108 (54%) patients had normal values of ST1 (>10mm). 82 patients (41%) were under borderline group (10-5mm) whereas 10 patients (5%) came with abnormal values (<5mm). So from this study we found 46% (41+5) patients had dry eye whereas 54% did not have ($p < .001$), and which was found to be statistically significant.

(All 200 patients had values >10mm preoperatively.)

Table 2: Tear Breakup Time at 6 months following MSICS.

Before operation all the 200 patients had TBUT values ≥ 10 seconds. After operation 63% patients (126 patients) retained the normal values whereas 37% patients (74 patients) showed values < 10sec. in 6 months followup period ($p < .001$) as shown in table 2 and figure 2.

(All 200 patients had TBUT values ≥ 10 sec. preoperatively.)

Table 3: Tear meniscus height after 6 months followup.

All selected 200 patients had TMH ≥ 0.3 mm but after MSICS 56 patients (28% of all patients) showed values < 0.3mm (Pre-op 0.35 ± 0.06 , post op 0.31 ± 0.10 mm, $p < .001$). 144 patients (72% of all patients) were in normal range ≥ 0.3 mm as shown in table 3 and figure 3.

(All patients had values ≥ 0.3 mm preoperatively.)

Table 4: Symptoms wise distribution (McMonnies score) postoperatively

After 6 months followup 118 (59%) patients had score of >14.5 but 82 (41%) patients still showed a score of < 14.5 as shown in table 4 and figure 4

The comparison of dry eye indices was done preoperatively and postoperatively at 6 months, which included ST-I, TMH and TBUT. All of the indices deteriorated in the post-operative period to statistically significant values, as shown in table 5.

Table 5: Comparison of pre and post op dry eye indices

Discussion

The epidemiological studies have reported that more than 6% of the population over the age of 40 suffers from dry eye, with the prevalence increasing to 15% of the population over the age of 65. Most corneal surgical procedures disrupt the normal organization of corneal innervations. Denervation of cornea results in increase corneal sensitivity threshold causing reduction in tear flow, decrease in blinking frequency, impaired wound healing and longer re-epithelialization period, increased epithelial permeability and decreased epithelial metabolic activity. Jordan and Baum in 1980 reported a reduction in tear flow in anesthetized cornea⁹. Beurman and Schimmelpfennig observed a decrease in blinking frequency in eyes with denervated cornea¹⁰. Cataract surgery results in alteration of tear physiology resulting in decreased lacrimal production.

Some authors have studied dry eye disease after cataract surgery using similar parameters like us. Li et al in 2007, in their study used STI, TBUT, corneal fluorescein staining, impression cytology, Ocular Surface Disease Index (OSDI) and National Eye Institute's Visual Function Questionnaire (NEI-VFQ25)¹¹. Gharaee et al in 2009 used basic tear secretion time, TMH, TBUT and STI to detect tear film effects following Phacoemulsification surgery¹². Liu et al in 2008 used TBUT, STI and corneal fluorescein staining to evaluate changes in tear film after Phacoemulsification in diabetic patients¹³. Cho et al in 2009 investigated dry eye symptoms after cataract surgery using TBUT, STI, TMH and subjective dry eye symptoms⁶. Ram et al in 2002 used STI and TBUT to detect outcomes of Phacoemulsification in dry eye patients¹⁴. Sitompul et al in 2008 assessed tear film quantity and quality after SICS and Phacoemulsification using Cochet Bonnet esthesiometer, TMH, TBUT, STI and OSDI¹⁵.

Patient questionnaire can yield important information used to diagnose dry eye and determine the severity of dry eye symptoms. A well designed questionnaire can be validated for reproducibility and should consist of relevant questions that elicit responsive answers.

While performing the Schirmer test, both the basal and reflex tearing was measured by Schirmer test.

In the present study 59% of patients developed dry eye symptoms postoperatively. Li et al in 2007 also found out that ocular discomfort increased in the postoperative period, more so at 1 month, which was calculated at 14.66 ± 12.40 according to OSDI¹¹. Cho et al in 2009, figured out that in both dry eye and non dry eye groups, there were significant aggravations in dry eye symptoms at 2 months post operative period⁶. Liu et al in 2008 found out that both diabetic and non diabetic patients had more severe dry eye symptoms after Phacoemulsification at 1 week post operative period. Symptoms returned to preoperative values by 6 months postoperatively in non diabetic patients but remained elevated in diabetic patients. They characterized dry eye symptoms by burning sensation, stinging, redness, foreign body sensation, photophobia and blurred vision¹³.

In our study 41% of patients had ST-I in borderline group and abnormal values in 5% of patients. TBUT < 10 sec in 37% of patients and TMH is < 0.3 mm in 28% patients. We also found out that STI, TBUT and TMH values gradually decreased in the post operative period, more so at 3 months. Preoperatively STI was 17.13±4.65mm which came down to 14.54±4.53mm at 3 months follow up. Likewise TBUT was 14.74±3.016sec preoperatively and it decreased to 12.53±3.2sec at 3 months follow up. TMH values also showed a gradual decrease in the post operative period from preoperative values.

Li et al in 2007 also found significant decrease in the STI and TBUT values at 3 months postoperatively after phacoemulsification¹¹. Gharaee et al in 2009 also found out a gradual decrease in the TMH values from preoperative 1.5mm to 1mm at 3 months following phacoemulsification. In our study, average TBUT was 12 seconds preoperatively which decreased to 9 seconds postoperatively. STI values showed an increase of 15.88mm at 3 months postoperatively from 14mm preoperative value¹².

There are studies in which dry eye symptoms were compared postoperatively after SICS and Phacoemulsification. One such study was performed by Sitompul et al, who evaluated the dry eye test values in the early postoperative period following Phacoemulsification and SICS. They found out that there was gradual decrease in the TBUT values at 1 week postoperatively which came to preoperative values at 2 weeks follow up after SICS. Schirmers test values increased at day 1 postoperatively which came back to preoperative values at 2 weeks postoperatively after SICS, but none were statistically significant. On comparing the two surgical groups, they did not find any significant difference in TMH values in the follow up visits in the two surgical groups¹⁵.

Conclusion

After analysis of the results it was found that after 6 months follow up there were a significant amount of patients who were showing dry eye symptoms which was also evidenced by Schirmer test I (46% below 10mm reading), tear break up time (37% below 10sec), tear meniscus height (28% below 0.3mm). This was statistically significant. There were a significant percentage of patients showing dry eye symptoms following MSICS. Before operation, patients who were selected did not show any dry eye symptoms and none of the 3 diagnostic tests were below borderline level but after MSICS at 6 months follow up there was significant alteration in the test values. Therefore from this study, it can be concluded that manual small incision cataract surgery can lead to develop dry eye syndrome (DES).

Table 1: Schirmer test 1 values after 6 months followup.

Schirmer test 1	No.of patient	Percentage
Normal(>10mm)	108 (M-49,F-59)	54%
Borderline(10-5mm)	82 (M-33,F-49)	41%
Abnormal(<5mm)	10 (M-4,F-6)	5%
Total	200	100%

Table 2: Tear Breakup Time at 6 months following MSICS.

TBUT	No.of patient	Percentage
≥10 sec.	126(M-59,F-67)	63%
<10 sec.	74(M-35,F-39)	37%

Table 3: Tear meniscus height at 6months followup.

TMH	No.of patient	Percentage
≥0.3mm	144 (M-51, F-93)	72%
<0.3mm	56 (M-26,F-30)	28%

Table 4: Symptoms wise distribution (McMonnies score)

McMonnies score	No.of patient	Percentage
>14.5	118(M-55,F-63)	59%
<14.5	82(M-39,F-43)	41%

Table 5: Comparison of pre and post op dry eye indices

	Mean	SD	t value	p value
ST1 RE Pre	17.13	4.75	10.012	< .001
ST1 RE Post	13.05	5.25		
ST1 LE Pre	17.13	4.52	6.79	< .001
ST1 LE Post	14.37	4.51		
TMH RE Pre	0.355	0.063	5.91	< .001
TMH RE Post	0.310	0.103		
TMH LE Pre	0.350	0.0615	1.597	=0.112
TMH LE Post	0.347	0.0750		
TBUT RE Pre	14.94	0.016	8.078	< .001
TBUT RE Post	12.32	4.272		
TBUT LE Pre	14.52	2.742	2.702	<.007
TBUT LE Post	13.83	3.441		

References:

- Lemp, M.A. (1995) Report of the National Eye Institute Industry work shop on clinical trials in dry eyes. *CLAO Journal*; 21: 221-232.
- Mc Carty ,C.A., Bansal, A.K., Livingstone, M., Stanoslavsky, Y.L., Taylor, H.R. (1998) The epidemiology of dry eye in Melbourne, Australia. *Ophthalmology*; 105: 1114-1119
- Bjerrum, K.B. (1997) Keratoconjunctivitis sicca and primary Sjogren's syndrome in a Danish population aged 30-60 yrs. *Acta Ophthalmol Scand* ; 75: 281-286
- Scein, O.D., Munoz, B., Tielsch, J.M., Banden, Roche, K., West, S. (1997) Prevalence of dry eye among the elderly. *American Journal of Ophthalmology* ; 124: 723-28
- Ku, H., LYKHS, C. (2007) Corneal sensation and tear film stability after cataract surgery with temporal clear corneal incision. *J Korean Ophthalmol Soc* ; 2004 9450:2000-6
- Cho, Y.K., Kim, M.S. (2009) Dry Eye After Cataract Surgery and Associated Intraoperative Risk Factors. *Korean J Ophthalmol June*; 23(2): 65-73.
- Srinivasan, R., Agarwal, V., Suchismitha, T., Kavitha, S. (2008) Dry eye after Phacoemulsification. *AIOC Proceedings*.
- Devgan, U. (2005) Dry-eye syndrome after cataract surgery. *Review Ophthalmol Oct*; 12(10): 65.
- Jordan, A., Baum, J. (1980) Basic tear flow: does it exist? *Ophthalmology* ; 87: 920-930.
- Beuerman, R.W., Schirmelpfennig, B. (1980) Sensory denervation of the rabbit cornea affects epithelial properties. *Exp Neurol Jul*; 69 (1): 196-201.
- Li, X.M., Hu, L., Hu J, Wang, W. (2007) Investigation of Dry Eye Disease and Analysis of the Pathogenic Factors in Patients after Cataract Surgery. *Cornea*; 26(Suppl. 1): S16-S20.
- Gharaee, H., Mousavi, M.N., Daneshvar, R., Hosseini, M., Sazande, S. (2009) Effect of clear corneal incision location on tear film following phacoemulsification surgery. *Iranian Journal of Ophthalmology*; 21(3): 29-34.
- Liu, Xi, Yang-shun, Gu, Ye-sheng, Xu. (2008) Changes of tear film and tear secretion after phacoemulsification in diabetic patients. *J Zhejiang Univ Sci B. April*; 9(4): 324-328.

14. Ram ,J., Gupta, A., Brar, G.S., Kaushik ,S., Gupta ,A. (2002)Outcomes of phacoemulsification in patients with dry eye. J Cataract Refract Surg March; 28: 1386-1389.
15. Sitompul, R., Sancoyo, G,S,, Hutaaruk, J.A., Gondhowiardjo, T.D. (2008) Sensitivity Change in Cornea and Tear layer due to Incision Difference on Cataract Surgery with Either Manual Small-Incision Cataract Surgery or Phacoemulsification. Cornea. Sep; 27(Suppl. 1): S13-S18.