Dry Eye After Phacoemulsification

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Background: Dry eye is a multifactorial, heterogeneous disorder of the preocular tear film because of tear deficiency or excessive tear evaporation which causes symptoms of ocular discomfort. Many patients who have undergone cataract surgery have complained of dry eye and symptoms of irritation postoperatively. The aim of this study was to evaluate the incidence and severity pattern of dry eye after phacoemulsification.

Design: Prospective study.

Materials & Methods: 100 uncomplicated cataract patients coming to Guru Gobind Singh Medical College and Hospital, Faridkot were selected for study. Dry eye incidence and pattern were analyzed preoperatively and at days 1, 7, 30 and 90 after phacoemulsification using (1) Ocular Surface Disease Index (OSDI) questionnaire, (2) tear break up time (TBUT), (3) rose bengal staining, (4) Schirmer I test without anesthesia and (5) Schirmer 2 test with anesthesia. Data was evaluated by student T test.

Results: Seven days after phacoemulsification, the incidence of dry eye was 11%. The severity of dry eye peaked seven days post-phacoemulsification and was measured by OSDI questionnaire and all four clinical tests. Within 30 days and 3 months post-surgery, both the symptoms and signs showed rapid and gradual improvements respectively.

Conclusions: The incidence of dry eye after phacoemulsification was 11%. Symptoms and signs of dry eye occurred as early as seven days post-phacoemulsification and the severity pattern improved over time. We recommend that ophthalmologists should evaluate patients both before and after phacoemulsification to prevent further damage to the ocular surface and manage the patient promptly and effectively so that the patient does not have a poor quality of life and vision due to dry eye syndrome.

Introduction

Dry eye (keratoconjunctivitis sicca) is a disorder of the tear film due to tear deficiency or excessive tear evaporation causing damage to the interpalpebral ocular surface and is associated with symptoms of ocular discomfort and irritation such as feeling dry, gritty or sandy, burning sensation, itching and watering or tearing.1 The overall prevalence of dry eye among Indian patients based upon Ocular Surface Disease Index was found to be 29.25% in a study done to estimate the prevalence of dry eye among Indian patients. Because of its high prevalence, dry eye syndrome is considered a significant public health issue.2

Tear secretion may be decreased by any process that damages the lacrimal gland or its excretory ducts. The most common cause is autoimmune disease, less common causes include cicatrical ocular surface conditions. Tear secretion may also be decreased by any condition that decreases corneal sensation, including common entities such as Herpes Zoster, long term contact lens wear and surgeries that involve corneal incisions like cataract extraction or those that ablates corneal nerves like laser in situ keratomileusis (LASIK).3

Many patients, who have undergone cataract surgery, the most common procedure performed in ophthalmic units, have complained of dry eye and symptoms of irritation postoperatively. Complications such as dry eye syndrome can occur after an extracapsular cataract extraction because a large incision is created in the eye during the procedure that sometimes damages the cornea. Phacoemulsification is also commonly performed worldwide, a smaller incision is created and ultrasonic-driven oscillating tips are used to emulsify or fragment the crystalline lens. Few reports of dry eye syndrome have focused on patients who had undergone phacoemulsification and subsequently developed dry eye.4

Aims & Objectives

The aim of our study was:
1. To estimate the incidence of dry eye disease among cataract patients undergoing phacoemulsification.
2. To evaluate severity pattern of dry eye disease among cataract patients undergoing phacoemulsification.

Material & Methods

The study material consisted of 100 cases of uncomplicated cataract. Dry eye incidence and pattern was analyzed at days 1,7,30 and 90 after phacoemulsification after applying inclusion and exclusion criteria.

Any patients with conditions like acute ocular infections, extensive corneal or conjunctival pathology, presence of foreign body or trichiasis, exposure keratitis or history of use of topical lubricants for the last 6 months, previous ophthalmic surgical or laser procedures, any systemic diseases, intake of systemic medication that would interfere with tear film parameters were excluded from our study. The patients who were previously diagnosed of having dry eye were excluded from our study.
The Ocular Surface Disease Index (OSDI) is a valid and reliable score for measuring dry eye disease severity (normal, mild to moderate and severe). The OSDI is assessed on a scale of 0 to 100, with higher scores representing greater disability. The index demonstrates sensitivity and specificity in distinguishing normal subjects and patients with dry eye. The OSDI is a valid and reliable instrument for measuring dry eye disease (normal, mild to moderate and severe).

We found out where the patient’s score falls on the graph. The vertical axis shows number of questions answered and horizontal axis shows sum of scores for all questions answered. We modified the questionnaire by omitting...
items 4 and 5, which assess the presence of blurred and poor vision, because it is difficult to differentiate the change of these symptoms caused by cataract surgery alone or combined with visual symptoms due to cataract surgery induced dry eye conditions. The OSDI scores range from 0 to 100. Scores from 0 to 25 are considered normal; scores exceeding 25 indicate the presence of dry eye symptoms.

**Ethical consideration**
- Clearance from institute ethics committee was obtained.
- An informed consent was obtained from the patient prior to recruitment. The study did not involve any invasive procedure. All therapeutic decisions were taken by the treating physician and no interference was done. Confidentiality of patient was maintained and the patient or his/her relative had the right to opt out of the study at any given point of time.
- Statistical analysis was done by calculating mean and p-value obtained by independent t-test and ANOVA test.

**Results**
The present study included 100 cases of cataract requiring cataract surgery, who presented to Guru Gobind Singh Medical College and Hospital, Faridkot. They were selected at random for phacoemulsification technique with posterior chamber IOL implantation. A thorough preoperative examination was done. Occurrence of dry eye in those patients was assessed post operatively at day 1, day 7, day 30 and day 90, with the help of various objective and subjective tests.

The following observations were made:
On preoperative examination, the mean of Schirmer I test was 26.72 with standard error of 0.516. On day 1, the mean value was 23.78 with standard error of 0.734. On day 7, the mean value was 23.07 with standard error of 0.855. On day 30, the mean was 25.11 with standard error of 0.848. On day 90, the mean was 25.46 with standard error of 0.720. This pattern of mean scores depict that dry eye scores peaked on day 7 which gradually improved over day 30 and returning to near preoperative values by day 90 as shown in Figure 1.

On preoperative examination, the mean of Schirmer II scores was 18.91 with standard error of 0.482. On day 1, the mean was 16.88 with standard error of 0.664. On day 7, the mean was 15.44 and standard error was 0.597. On day 30, the mean was 16.37 with standard error of 0.595. On day 90, the mean of Schirmer II score was 16.98 with standard error of 0.555. According to pattern of Schirmer 2 scores, dry eye patients peaked at day 7 and scores gradually improved over follow up as shown in Figure 2.

On preoperative examination, the mean of Tear Film Break Up Time scores was 13.32 with standard error of 0.160. On day 1, the mean was 12.06 with standard error of 0.244. On day 7, the mean was 10.85 and standard error was 0.302. On
day 30, the mean was 11.41 with standard error of 0.280. On day 90, the mean of tear film break up scores was 11.89 with standard error of 0.245. According to the pattern of tear film break up scores, dry eye patients peaked at day 7 and the scores gradually improved over follow up days as shown in Figure 3.

On preoperative examination, the mean of Ocular Surface Disease Index scores was 13.13 with standard error of 0.41. On day 1, the mean was 13.13 with standard error of 0.41. On day 7, the mean was 26.90 and standard error was 2.07. On day 30, the mean was 23.44 with standard error of 1.96. On day 90, the mean of OSDI score was 19.22 with standard error of 1.86. According to pattern of Ocular Surface Disease Index scores, dry eye patients peaked at day 7 and scores remained nearly the same on follow up as shown in Figure 4.

On preoperative examination, the mean value of Rose Bengal staining scores was 0.38 with standard error of 0.06. On day 1, the mean was 0.74 with standard error of 0.155. On day 7, the mean was 0.98 and standard error was 0.218. On day 30, the mean was 0.83 with standard error of 0.183. On day 90, the mean value of Rose Bengal staining scores was 0.69 with standard error of 0.141. According to pattern of Rose Bengal staining, dry eye patients on day 7 had confluent staining with more number of patients having higher scores and on follow up days, the staining scores of patients decreased as shown in Figure 5.

In the age group of up to 50 years, out of fourteen, two patients developed dry eye and twelve patients had no dry eye. In the age group of 50 to 60 years, out of twenty nine, three patients developed dry eye and twenty six patients had no dry eye. In the age group of 60 to 70 years, out of thirty eight, three patients developed dry eye and thirty five patients had no dry eye. In the age group of 70 to 80 years, out of seventeen, three patients developed dry eye and fourteen patients had no dry eye. In the age group of 80 to 90 years, none of the patients developed dry eye. Chi square value was 1.556 and p value was 0.817. Therefore, no association was found between age of the patient and occurrence of dry eye as shown in Figure 6.
Out of thirty eight female patients, five patients developed dry eye and thirty three patients had no dry eye. Out of sixty two male patients, six patients developed dry eye and fifty six patients had no dry eye. Chi square value was 0.292 and p value was 0.409. Hence, no association was found between sex of the patient and development of dry eye. Development of dry eye was equally common in both the sex as shown in Figure 7.

Discussion

Dry eye can develop often after various types of ophthalmic surgeries such as photorefractive keratectomy and laser-assisted in situ keratomileusis (LASIK). After LASIK, dry eye can persist for up to 6 months or more with an incidence of 20%. Cataract operations have substantially increased from 16 lakh in 1992-93 to 59.1 lakh in 2009-10 according to the annual report 2010-11 of National Programme for Control of Blindness. Various factors might affect the ocular surface environment after cataract surgery. Most important is corneal desensitization. Superficial punctate keratitis, recurrent filamentary keratitis, secondary infections including conjunctivitis, infective keratitis, persistent or recurrent epithelial defects, stromal keratolysis and corneal ulceration have been reported in dry eye patients after cataract surgery notably conventional extracapsular cataract extraction (ECCE) by Ram et al in 2002. The present study was done on 100 patients attending the outpatient department with cataract and were scheduled for cataract operation using Phacoemulsification technique. All the tests performed preoperatively and postoperatively showed incidence of dry eye to be 11%. Dry eye symptoms peaked at day 7 in our study. Another explanation for the dry eye pattern observed in the current study was the recovery process of the corneal nerves. The cornea is one of the most highly innervated organs, with about 44 corneal nerve bundles entering the cornea around the limbus centripetally and larger nerve fibers that run from the 9 o’clock to the 3 o’clock position and bifurcate to achieve a homogenous distribution over the entire cornea. Therefore, it is vulnerable to any damage within that region. Temporal corneal incisions created during phacoemulsification can reduce the corneal sensitivity in the surgical area and other areas far from the incision site. The damage to the corneal nerves may expand when longer phacoemulsification time is needed to break up a dense cataract. Neurogenic inflammation also can develop after corneal incisions. Inflammatory mediators can change the action of the corneal nerves and reduce corneal sensitivity. With corneal healing postoperatively, new neurite cells emerge and after 25 days, neural growth factor is released to regenerate the subepithelial corneal axon. Thus, the recovery of the corneal nerves may explain why dry eye was seen early after surgery and improved thereafter as was observed in various tests which showed a trend towards improvement in all test scores over 90 days.

In addition to transection of the corneal nerves and damage to the corneal epithelial cells, exposure to microscopic light, vigorous intra operative irrigation of the tear film, elevation of inflammatory factors in the tear film due to ocular surface irritation, use of topical anesthesia intra-operatively and topical eye drops administered postoperatively and its preservatives can cause dry eye after phacoemulsification. Benzalkonium chloride, one of the most commonly used preservatives in topical eye drops can induce tear film instability and decrease the number of mucin-expressing cells. Excessive instillation and incorrect use of preserved eye drops are important factors that contribute to the development of dry eye after phacoemulsification and corneal toxicity. Other factors associated with dry eye are older age, female gender, diabetes and systemic hypertension. However, in the current study, dry eye was not associated with those factors. This may have been due to the small sample size in the study. Although mild to moderate dry eye may not interfere with vision, decrease of vision can occur in severe cases.

Conclusion

The study clearly showed that cataract surgery can cause or aggravate dry eye. However, before surgery, preoperative assessment of all patients should be done properly, patients must be informed about the possible aggravation of dry eye symptoms and artificial tears should be prescribed for attenuating corneal damage and dry eye symptoms.

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