

Review Article

The Impact of Dry Eye Disease on Cataract Surgery: A Brief Review

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Abstract

Cataract surgery is one of the most commonly performed eye surgeries worldwide, while dry eye disease (DED) is a multifactorial ocular surface disorder characterized by the loss of tear film homeostasis, accompanied by symptoms such as dryness, foreign body sensation, and inflammation. Although both conditions are more prevalent in older individuals, numerous reports confirm an increase in dry eye symptoms following cataract surgery. Additionally, tear film disorders can significantly affect preoperative biometric measurements. In such cases, cataract surgery outcomes may be compromised, and patient dissatisfaction due to the discomforting symptoms of DED may increase. This mini-review provides a brief overview of the key aspects of dry eye disease in patients undergoing cataract surgery.

Keywords: Cataract; Surgery; Dry Eye; Review.

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Introduction

Cataract surgery is one of the most common ophthalmic procedures ^{1, 2}. In recent years, this surgery has become more predictable and precise. Advances in femtosecond laser surgery and intraocular lenses (IOL) have led to increased accuracy in cataract surgery, transforming it into a refractive procedure ³. However, coexisting conditions such as dry eye disease (DED) may have negative consequences ⁴.

The association between dry eye disease and cataracts is not unusual, as both conditions are age-related. Furthermore, cataract surgery itself can contribute to post-surgical dry eye ⁵. Studies indicate that approximately 10 % to 30 % of patients experience an increase in dry eye symptoms following cataract surgery ^{6, 7}. Factors contributing to this condition include the loss of goblet cells, laser light toxicity, toxicity from preservatives in medications, and exacerbation of meibomian gland dysfunction ⁷.

Recent studies have shown significant increases in inflammatory secretions, lymphangiogenesis, and neovascularization after cataract surgery ⁸. Moreover, some research suggests that surgical techniques such as small incision cataract surgery (SICS) and extracapsular cataract extraction (ECCE) are more likely to cause inflammation and dry eye compared to phacoemulsification ⁹. Intraoperative factors that may exacerbate dry eye include light toxicity, repeated irrigation of the ocular surface, local anesthesia, and antibiotic medications ¹⁰.

Therefore, given that cataract surgery can induce dry eye even in clinically normal eyes, it is expected to worsen pre-existing dry eye conditions. This mini-review provides a brief overview of the key aspects of dry eye disease in patients undergoing cataract surgery.

Is DED More Prevalent After Cataract Surgery?

Dry eye disease is a multifactorial condition caused by dysfunction in the glands responsible for tear production and the ocular surface. This disease leads to discomfort, visual disturbances, instability of the tear film, and potential damage to the ocular surface. The primary cause of this condition is an increase in tear film osmolarity and subacute inflammation of the ocular surface ¹¹.

Studies report that between 5 % and 50 % of individuals worldwide suffer from dry eye disease, with a higher prevalence among the elderly ¹². The prevalence of this condition varies based on geographical location and diagnostic criteria. With modernization and increased life expectancy, the incidence of dry eye disease has been rising ¹².

The prevalence of post-cataract surgery dry eye remains uncertain, with conflicting study results. In a prospective study on 100 patients, Dasgupta and Gupta reported that all patients experienced post-surgical impairments in tear break-up time (TBUT), Schirmer's test, and dry eye symptoms three months after surgery ¹³. In contrast, a longitudinal study by Choi et al., ¹⁴ reported that after three months, approximately 27 % of patients experienced dry eye symptoms, with increased ocular surface disease index (OSDI) scores, reduced TBUT, and increased corneal fluorescein staining. Other studies have reported varying prevalence rates of post-cataract surgery dry eye. For example, Ishrat et al., ¹⁵ reported a prevalence of about 9 %, while Miyake and Yokoi ¹⁶ recorded a prevalence of 31 % in their patients. The duration of post-surgical dry eye symptoms also varies. Iglesias et al., ¹⁷ reported that 32 % of patients still experienced dry eye symptoms six months after surgery. Conversely, a retrospective studies by

Cetinkaya et al.,¹⁸ and a prospective studies by Kohli et al.,¹⁹ indicated that dry eye symptoms improved within three months post-surgery. Recent studies suggest that post-surgical dry eye is more prevalent in women, individuals with autoimmune diseases, anterior segment disorders, and those using medications such as antidepressants, anti-reflux drugs, antihistamines, and sleep aids²⁰. Additionally, factors such as light toxicity, excessive ocular surface irrigation, local anesthetics, and preservatives in eye drops have been identified as risk factors for exacerbating dry eye after phacoemulsification²⁰.

Managing Cataract Surgery-Associated DED

Preoperative considerations

Early diagnosis and treatment of DED before cataract surgery are crucial. The American academy of ophthalmology (AAO) recommends an external examination of the eyelids, eyelashes, and lacrimal system, along with an assessment for dry eye disease, particularly in elderly patients, before undergoing cataract surgery²¹.

In 2015, the American society of cataract and refractive surgery (ASCRS) provided guidelines for preoperative evaluation of dry eye in surgical patients²¹. These recommendations include scheduling a preoperative visit at least 14 days before surgery, performing non-invasive refractive measurements such as keratometry and optical biometry, and using the SPEED2 questionnaire to identify symptoms²¹. Additionally, evaluating tear osmolality and matrix metalloproteinase 9 (MMP9) levels are advised. If abnormalities are detected, further non-invasive testing for anterior segment disorders is recommended²¹.

Intraoperative considerations

Patients with dry eye disease require special intraoperative care during cataract surgery. Topical anesthesia is preferable, and deep injections should be avoided as they may exacerbate ocular surface issues³. Since eyelid positioning may be abnormal in elderly patients, peribulbar anesthesia is recommended. To prevent complications, excessive irrigation and any additional trauma to the ocular surface should be avoided²⁰.

Phacoemulsification is the preferred surgical technique for patients with dry eye. Surgical considerations include making incisions in the thicker part of the cornea, using smaller incisions, shortening surgery time, and minimizing phacoemulsification parameters²². Furthermore, preservative-free antibiotics are recommended for these patients²³.

Postoperative considerations

Postoperative management of dry eye disease is essential to prevent adverse effects on ocular tissues. Dry eye symptoms such as meibomian gland dysfunction, short TBUT, and high OSDI scores may persist for months¹⁷. However, patients experiencing prolonged symptoms should be identified and treated promptly. Studies have demonstrated that preservative-free eye drops are superior to those containing preservatives in managing postoperative dry eye²⁴. Additionally, long-term use of topical anti-inflammatory medications has been shown to effectively reduce symptoms after surgery²⁵.

Several treatments for dry eye, including lubricants, warm compress therapy, omega-3 supplements, intense pulsed light (IPL) therapy, cyclosporine, and mucin stimulators, have shown positive results²⁶. Due to the importance of treating this condition, newer

therapies such as biologic treatments and pharmaceutical interventions like Lifitegrast (Xiidra) are also being used and have demonstrated promising outcomes ^{27,28}.

The Effect of Dry Eye Disease on Biometry Results

Before undergoing cataract surgery, the first step is performing biometry. Given its critical role in determining the type of intraocular lens (IOL) and vision correction, biometry is particularly important for multifocal and toric lenses. Optical biometry is specifically recommended for these lens types ²⁹.

Regarding the impact of the ocular surface on imaging quality, dry eye disease appears to introduce errors in optical devices, affecting measurements such as astigmatism, keratometry, and topography ³⁰. Studies have shown that keratometry stability decreases in dry eye conditions, and standard keratometry and axial length measurements are inversely correlated with tear break-up time (TBUT) ^{31,32}. Additionally, one study reported that lens power measurements in dry eye patients significantly differed from those in the normal group, with a maximum discrepancy of up to 5.5 diopters ³². These findings indicate that inadequate preoperative management of ocular surface dryness can significantly impact surgical outcomes.

However, some studies have also suggested that the use of eye drops can significantly reduce the repeatability of biometry tests ³³. To minimize errors in suspected cases, it is recommended to repeat biometry measurements over several days.

Discussion

Dry eye disease is one of the most common

ocular conditions and can either be exacerbated or induced by cataract surgery ²⁰. This condition has a significant impact on patients' quality of life ³⁴. If preoperative screening is available, subclinical dry eye symptoms can be identified in asymptomatic patients ³⁵. Many specialists face the challenge of discrepancies between clinical test results and the actual disease condition ³⁵. In patients with dry eye disease, biometry also requires special considerations ³.

During cataract surgery, using peribulbar anesthesia, carefully planning the incision location and size, reducing surgical duration, and using preservative-free medications can help minimize the incidence of postoperative dry eye ³. Additionally, preservative-free lubricants and topical or systemic immunosuppressants play a crucial role in alleviating symptoms ³⁶. Implementing these measures to protect the ocular surface is both reasonable and necessary.

Overall, performing cataract surgery in dry eye patients remains a challenge ³⁶. However, proper patient selection, preoperative management, and adherence to intraoperative precautions can lead to more favorable outcomes ³⁷.

Future research should focus on developing more precise diagnostic tools to detect subclinical dry eye disease before cataract surgery. Advancements in artificial intelligence and imaging technologies could enhance preoperative assessments. Additionally, novel therapeutic approaches, such as biologic treatments and nanomedicine, may offer more effective management of post-surgical dry eye.

Conclusion

DED is a common issue in cataract surgery patients, potentially affecting surgical

outcomes and patient satisfaction. Proper preoperative assessment, careful intraoperative management, and targeted postoperative care can help mitigate these effects. Continued research is essential to improve strategies for managing DED in cataract surgery patients and enhancing overall surgical outcomes.

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Footnotes and Financial Disclosures

Conflict of interest:

The authors have no conflict of interest with the subject matter of the present manuscript.