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Prevalence of ocular surface dysfunction in patients presenting for cataract surgery evaluation

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Purpose: To report the prevalence of ocular surface dysfunction in patients presenting for cataract surgery evaluation.

Setting: Duke University Eye Center and Weill Cornell Ophthalmology, single-physician practices.

Design: Prospective case series.

Methods: Consecutive patients presenting for cataract surgery evaluation were identified. Patient information including demographics, medical history, slitlamp findings, tear osmolarity, and tear matrix metalloproteinase-9 (MMP-9) levels were recorded. Patients were considered to have ocular surface dysfunction if any of the following outcomes were present: visually significant abnormal corneal surface examination, positive MMP-9 test, or abnormal osmolarity values (>307 mOsm/L or >7 mOsm/L intereye difference). Patient symptoms were recorded using the ocular surface disease index (OSDI) or Symptom Assessment iN Dry Eye questionnaires.

Results: There were 120 patients (69% women), mean age 69.5 years ± 8.4 (SD). Abnormal osmolarity was found in 68 patients (56.7%), and abnormal MMP-9 in 76 patients (63.3%). Clinical findings showed that 47 patients (39.2%) had positive corneal staining on presentation, 9 patients (7.5%) had epithelial basement membrane dystrophy, and 2 patients (1.6%) had Salzmann nodules. Questionnaire data showed 54 (54.0%) of 100 patients reported symptoms suggestive of ocular surface dysfunction. In the asymptomatic group of 46 patients, 39 (85%) had at least 1 abnormal tear test (osmolarity or MMP-9) and 22 (48%) had both tests abnormal. Overall, 96 (80%) of 120 patients had at least 1 abnormal tear test result suggestive of ocular surface dysfunction and 48 patients (40%) had 2 abnormal results.

Conclusions: Objective ocular surface dysfunction findings were common among patients presenting for cataract surgery, yet many presented undiagnosed. Clinicians should be aware of this high prevalence and consider screening with tear testing before surgery.

Ocular surface dysfunction includes a spectrum of diseases that impair the ocular surface leading to a constellation of clinical signs and patient symptoms. Dry-eye disease is likely the most common subtype of ocular surface dysfunction; however, many others can be present along with dry-eye disease or masqueraded as dry-eye disease. These include blepharitis, epithelial basement dystrophy, Salzmann nodular degeneration, allergic conjunctivitis, conjunctivochalasis, floppy eyelid syndrome, and others. The prevalence of dry-eye disease varies in the literature but has been reported to be as high as 35% in some populations.[1–4]

Cataract surgery is one of the most common procedures performed in the United States with a growing annual incidence.[5] The typical age of patients having cataract surgery is over 50 years. Dry-eye disease and meibomian gland dysfunction are very common diseases, and prevalence significantly increases with age.[6] In the setting of preoperative cataract surgery planning, dry-eye disease and meibomian gland dysfunction can impair critical refractive

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measures such as keratometry values worsening surgical outcomes.[7] In addition, ocular surface dysfunction has been reported to increase after cataract surgery.[8–12] One study found that up to 62% of patients presenting for cataract surgery had a tear breakup time (TBUT) of less than 5 seconds, and 76% had corneal staining.[13] Another study showed worsening of corneal fluorescein staining patterns for up to 3 months after cataract surgery. In addition, TBUT was found to be significantly reduced postoperatively compared with presurgery baseline for up to 1 month after cataract surgery.[14] Dry-eye disease has also been found to increase postoperatively, especially in patients having femtosecond laser–assisted cataract surgery compared with manual phacoemulsification.[9] The altered tear film caused by dry-eye disease can impair important aspects of visual quality and function, which might further affect the patient's perceived surgical outcome.[15–18]

It is well known that there is a poor association between the signs and symptoms of ocular surface dysfunction, making it difficult to accurately diagnose.[19,20] Common tools used to diagnose ocular surface dysfunction, and specifically dry-eye disease, in addition to slitlamp evaluation include traditional tests (fluorescein staining, TBUT, Schirmer test) and validated questionnaires (eg, ocular surface disease index [OSDI] and Symptom Assessment iN Dry Eye [SANDE]). Some traditional tests such as invasive TBUT and Schirmer test have been shown to have a low sensitivity and specificity[21] and can be subject to error in interpretation; however, newer point-of-care diagnostics such as tear osmolarity and matrix metalloprotease-9 (MMP-9) testing have been shown to have a high sensitivity and specificity in diagnosing ocular surface dysfunction.[22–26]

Given that ocular surface dysfunction has been shown to have an adverse impact on visual function and can worsen after surgery, it is critical to identify and address any tear film and ocular surface abnormalities before cataract surgery. Little has been reported about the prevalence of tear film and ocular surface abnormalities using modern diagnostic tests preoperatively in patients having cataract surgery. The purpose of this study is to report the prevalence of visually significant ocular surface dysfunction as evidenced by either an abnormal tear-film paramenter (elevated MMP-9 or abnormal osmolarity), or corneal surface slitlamp evaluation findings in patients presenting for cataract surgery assessment.

PATIENTS AND METHODS

Consecutive patients presenting for cataract surgery evaluation were included in the study. Patients were recruited from 2 physician's practices (P.K.G., C.E.S.) at the Duke University Eye Center and Weill Cornell Medicine, respectively. Institutional Review Board approval was obtained at both institutions; all research was conducted in accordance with this approval, was U.S. Health Insurance Portability and Accountability Act compliant, and adhered to the tenets of the Declaration of Helsinki. Inclusion criteria included age 18 years or older and presentation to the ophthalmology clinic for cataract surgery evaluation. Patients who had ophthalmic surgery in the last 3 months or those who were receiving either topical or systemic corticosteroids were excluded from the study. The following parameters were recorded from the clinical record: demographic and clinical information including sex, age, medical and surgical history, slitlamp evaluation findings of the corneal surface, OSDI, or SANDE questionnaire score, tear osmolarity, and tear MMP-9 test results.

The SANDE questionnaire consists of 2 questions and a visual analog scale to quantify ocular discomfort or irritation. The first question asks: "How often do your eyes feel dry and/or irritated?" The second question asks: "How severe do you feel your symptoms of dryness and/or irritation are?" For each question, the patient is presented with a 100 mm horizontal line and asked to rate each question. Multiplying scores from the frequency question and the severity question, and then obtaining its square root yields the final SANDE score.[26] For the purpose of disease stratification, the SANDE scores were graded as "normal" if less than 20, mild dry-eye disease if 20 to 39, moderate dry-eye disease if 40 to 59, and severe dry-eye disease if the score was more than 59.

The OSDI questionnaire is a validated questionnaire composed of 3 subscales: vision-related function, ocular symptoms, and environmental triggers.[25,27] The questionnaire is 1 page and patients have the option to abstain from answering certain questions in the ocular symptom and environmental trigger subsections. Each subscore is summated and then the index score is calculated by multiplying the total score by 25 and dividing by the number of questions answered. The OSDI is assessed on a scale of 0 to 100. Scores of 0 to 12 are considered normal; abnormal scores range from mild dry-eye disease,[13–22] moderate dry-eye disease,[23–32] or severe dry-eye disease (33 to 100).[28]

Tear osmolarity was measured using the Tearlab Osmolarity System (Tearlab Corp.).[29] The test was performed before the instillation of eyedrops or other testing. Patients were unable to have osmolarity testing if they had used artificial tears within 2 hours before testing. The system was calibrated as per manufacturer's instructions.[29] Osmolarity samples were collected from the tear meniscus near the lateral canthus from both eyes. An osmolarity value of more than 307 mOsm/L in either eye or an intereye difference of more than 7 mOsm/L was considered to be indicative of abnormal osmolarity.[A]

The presence of elevated MMP-9 levels on the ocular surface was measured using Inflammadry (Rapid Pathogen Screening, Inc.). The test was administered before the instillation of eyedrops. Testing was conducted in accordance with provided manufacturer instructions; the sampling strip was placed on the palpebral conjunctiva and dabbed in multiple locations until saturated. This test is considered positive if the concentration of MMP-9 measured in the assay is higher than 40 ng/mL. A positive/abnormal test was defined as the appearance of a red indicator line adjacent to the blue control line, read and interpreted at least 10 minutes after completion of the sample collection.[30]

Patients were considered to have signs of visually significant ocular surface dysfunction if any of the following were present: positive MMP-9 test, osmolarity values above 307 mOsm/L or an intereye difference greater than 7 mOsm/L, and/or presence of corneal surface examination findings indicative of visually significant ocular surface dysfunction (eg, punctate epithelial erosions, epithelial basement membrane dystrophy, Salzmann nodules, pterygium). The number of patients with at least 1 positive test suggestive of ocular surface dysfunction was determined and the prevalence of ocular surface dysfunction in the study population presenting for cataract surgery evaluation was calculated by summing the patients who had had at least 1 abnormal objective test for ocular surface dysfunction (ie, abnormal osmolarity or MMP-9 or corneal surface examination findings) divided by the total number of patients in the study. Symptoms of ocular surface dysfunction in this population were assessed using the questionnaire results. The OSDI scores higher than 12 and SANDE score higher than 19 were considered abnormal results suggestive of ocular surface dysfunction. Descriptive statistics were computed