Seasonal Variation in Dry Eye

Dry eye (DE) is a common disease whose symptoms of pain (described as discomfort, burning, and dryness) and blurry vision negatively impact quality of life. We previously demonstrated that approximately 1 in 6 United States veterans carried a diagnosis of DE and that environmental factors (air pollution coupled with weather conditions) affected the occurrence of DE. By integrating health care data from the National Veterans Administration (VA) database and environmental data from the National Climatic Data Center and the National Aeronautics and Space Administration, we found that air pollution and atmospheric pressure were the 2 most influential risk factors for DE. Building on this information, we subsequently used the same dataset to assess the occurrence of DE by season. This analysis was performed to formally quantify the clinical impression that DE has a seasonal pattern.

All patients seen in a VA eye clinic from July 5, 2006, to July 4, 2011, were included in this retrospective analysis. We defined DE...
cases as those who had an International Classification of Disease, 9th edition, code for DE (375.15) and used medication or underwent a procedure for the condition. The Miami VA Institutional Review Board approved this study, which was conducted in accordance with the principles of the Declaration of Helsinki.

During the study period, there were a total of 3.41 million visits to a VA eye clinic within the continental United States. In total, 17.4% of veterans (95% CI: 16.16% to 18.64%) were diagnosed with DE. Looking at the distribution of cases, a clear seasonal pattern is evident (Fig 1), with the greatest period prevalence of DE in winter and spring (18.7±0.98% and 18.5±4.16%, respectively) and least prevalence in summer (15.3±0.82%). Furthermore, there was a greater monthly variation in the occurrence of DE during the spring season compared with winter months, with a standard error of the mean of 4.16% in spring versus 0.98% in winter. The highest prevalence of DE occurred in April (20.9±0.14%). Interestingly, the year-round prevalence of DE in Miami was higher than the national average by approximately 3.2% ($P < 0.001$).

Our findings suggest that seasonality plays a role in DE. The observed seasonal pattern suggests that outdoor conditions, such as allergen exposure, explain approximately 3% of DE variability. Therefore, the remaining DE burden is likely owing to other factors, including indoor environment, demographics, and comorbid conditions. To further evaluate the link between allergens and seasons, we obtained information from www.pollen.com, which provides a monthly allergy index (based on pollen concentrations) for various locations throughout the United States. We selected 16 random zip codes, spread across the north, south, central, eastern and western United States and averaged allergy index information to estimate monthly pollen counts in the United States (not including Miami) and compared this with Miami estimates (zip code 33146; Fig 2, available at www.aaojournal.org). Our analysis clearly shows a strong seasonal pattern of DE and allergy index for both the United States and Miami. Specifically, 2 distinct DE clusters are visible (Fig 2A; available at www.aaojournal.org): one with low outdoor allergy indices in winter and one with high allergy indices in spring. We hypothesize that low indoor humidity during winter months (owing to heating in the absence of a humidifier) may be a potential factor underlying the increased winter prevalence of DE in the United States. Conversely, increased outdoor pollen concentrations in spring likely contribute to the elevated spring prevalence. Miami has 2 main seasons, dry and wet (Fig 2B; available at www.aaojournal.org). In winter and spring, we see relatively higher allergy indices, which correspond with the spring season in the rest of the United States. In a multivariable analysis considering meteorological conditions, season, and allergy index on DE prevalence, seasonality showed the strongest association with DE, with DE prevalence during peak seasons (winter—spring) being 3.7% higher in the United States and 5.2% higher in Miami, compared with summer—fall.

The overall greater frequency of DE in Miami may be explained by Miami’s humid, subtropical climate (where relative humidity and temperature are high year round). This can support the growth of allergens (such as pollens outdoors, and fungus and mold spores indoors). In a pilot study in Miami, we gave a mold test kit (Pro-Lab, Weston, FL) to 45 Masters of Public Health students to deploy indoor. Of these 45 kits, 27 (60%) tested positive for airborne mold spores in their homes, suggesting that indoor air pollution may play an important role in DE in climates such as Miami.

The strength of our study is that it included information from a large patient population covering the entire continental United States. However, as with all retrospective reports, our study has limitations which need to be considered. This study relied on International Classification of Disease, 9th edition, coding to define DE and as such we cannot further subtype DE by severity or clinical characteristics (aqueous vs evaporative). Furthermore, it is possible that patients with DE but without a documented diagnosis were excluded from the case group. Also, it is likely that patients with other ocular surface pathologies such as allergic conjunctivitis were lumped in with our DE cases. Although a prospective study that included an ocular examination and tear film measurement would have been optimal, it would not have been feasible considering the number and distribution of patients in this study. It is also important to consider that our population of United States veterans seeking eye care services may not be generalizable to other populations. Regarding our analysis, it was limited by the aggregated nature of the data sets for DE, allergy indices, and meteorological conditions. Further investigation is needed to assess the time—space lag effects of environmental factors, including exposure to pollen and mold spores, on the prevalence of DE, as studied for other disease such as chronic obstructive pulmonary disease.4

In conclusion, our study supports the general clinical impression that DE has a seasonal pattern and suggests that different mechanisms may underlie DE in winter versus spring months. This distinction is important, because the treatment approach to DE may differ based on whether allergy is a component of disease. Furthermore, environmental manipulations are, in general, more cost effective than medical ones. Understanding which indoor and outdoor environmental conditions, across different seasons, most closely align with DE can open up new treatment algorithms that include environmental manipulation (e.g., air filters, humidifiers indoors, and use of goggles for outdoor environment).

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Speculum versus Bimanual Lid Retraction during Intravitreal Injection

With increased utilization of intravitreal injections, patient comfort and safety issues are receiving greater attention. Tailor et al identified speculum use as one of the more unpleasant elements of the injection procedure from a patient perspective. A metal lid speculum may generate discomfort during insertion and removal or cause irritation from prolonged corneal exposure. Recently, Fineman et al described a bimanual lid retraction technique as an alternative (Fig 1). The purpose of our study was to compare patients’ injection experience when using a metal lid speculum versus bimanual retraction.

Wills Eye Hospital Institutional Review Board approval was obtained for this single-center, prospective, randomized, crossover study. Procedures adhered to the tenets of the Declaration of Helsinki and research was conducted in accordance with regulations set forth by the Health Insurance Portability and Accountability Act. Patients receiving bilateral same-day intravitreal antivascular endothelial growth factor injections for neovascular age-related macular degeneration, diabetic macular edema, or retinal vein occlusion-associated macular edema were eligible. Individuals with a history of corneal epithelial basement membrane dystrophy or those with a previously documented hypersensitivity to ophthalmic 5% povidone-iodine solution (Betadine; Alcon Labs, Fort Worth, TX) were excluded. Preinjection preparation was standardized: 1 drop of proparacaine 0.5% (Allergan, Inc, Irvine, CA) followed by 1 drop of 5% povidone-iodine (Alcon Labs). This series was repeated 1 minute later followed by the injection.

The first eye undergoing treatment was randomized to eyelid retraction by bimanual technique or a sterilized metal lid speculum. Once the initial injection was completed, the fellow eye immediately underwent the alternative means of lid retraction. All other elements of the injection procedure were identical for both eyes. After both injections were performed, patients completed a 5-question pain survey, scoring each step (anesthetic and povidone-iodine drops, eyelid retraction, needle penetration, and overall pain) for each eye individually, using a 0 to 10 visual analog pain scale (from 0 [no pain] to 10 [worst pain]). They were then contacted by telephone 2 hours later for a follow-up assessment.

Thirty-six patients (72 eyes) were enrolled (21 females and 15 males), with a mean age of 79.7 years (standard deviation, 9.8; median, 80; range, 50–94). Two patients were treatment naïve, and the remaining 34 had previous bilateral same-day injections (all had prior experience with both forms of eyelid retraction, but not concurrently). The first eye injected had bimanual retraction in 14 cases (38.9%) and a metal speculum in 22 (61.1%).

Patients’ subjective scores for both injection procedures are outlined in Table 1 and Figure 2 (available at www.aaojournal.org/). The only step eliciting a significant scoring divergence after injection was the eyelid retraction technique. The average pain score for the speculum eye was 2.81 versus 0.74 for the

Figure 1. Bimanual assisted eyelid retraction for an intravitreal injection. The assistant’s fingers are positioned several millimeters away from the lid margin, causing the eyelids to become everted, which directs the lashes away from the field of injection. Care is taken by the assistant to avoid applying any direct pressure to the globe.