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GLAUCOMA AND OCULAR SURFACE DISEASE: UNDERSTANDING VISUAL QUALITY RELATED TO DRY EYE

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Since 2007, the Tear Film and Ocular Surface Society Dry Eye Workshop (TFOS DEWS) has invested extensive time, effort, and resources into creating a universal, evidence-based definition of dry eye disease (DED). Grounded on the collective understanding of DED, a contemporary classification system established consistent diagnostic pathways to improve patient outcomes through recommended treatment protocols. What we've learned is that DED is a multifactorial, complex disease in which, in addition to a detailed clinical evaluation, the examination through multiple, noncontact tests also gives us critical information for an accurate diagnosis.

WHY GLAUCOMA PATIENTS HAVE DRY EYE DISEASE

One of the main correlating factors connecting glaucoma patients and DED is age. Another factor is the IOP-lowering drops prescribed as part of a treatment regimen. Many prescription eye drops contain the preservative benzalkonium chloride (BAK), which has been discovered to cause cell damage on the ocular surface.[1] Studies have shown that 59% of patients using eye drops with BAK reported DED symptoms in at least one eye, and 27% of those patients reported severe symptoms. Schirmer testing determined that 61% of patients had a decrease in tear production in at least one eye, and 35% of those patients had severe tear deficiency. Tear breakup time (TBUT) showed abnormal tear quality in 78% of patients, and in 65% of those patients a severe deterioration in tear quality was found in at least one eye.[2]

As glaucoma specialists, our goal is to lower IOP, reduce the number of drops, and increase quality of life. When we consider treatment strategies for chronic disease, we often inadvertently underestimate the long-term collateral effects that may occur with the current standard of care. With this understanding, we can conclude that DED has been greatly underestimated. DED and glaucoma coexist, and their prevalence is clearly linked to both age and the collateral effects of eye drops being prescribed as the first line of treatment for glaucoma.[3] In order to successfully treat glaucoma patients, we must first address DED through proper examination, diagnosis, and treatment. Taking these extra measures will increase our ability to effectively treat both disease conditions and target a better quality of life outcome. If DED is not diagnosed and treated, we are ultimately sabotaging our glaucoma treatment strategies and our surgical results for alteration of the conjunctiva and cornea.

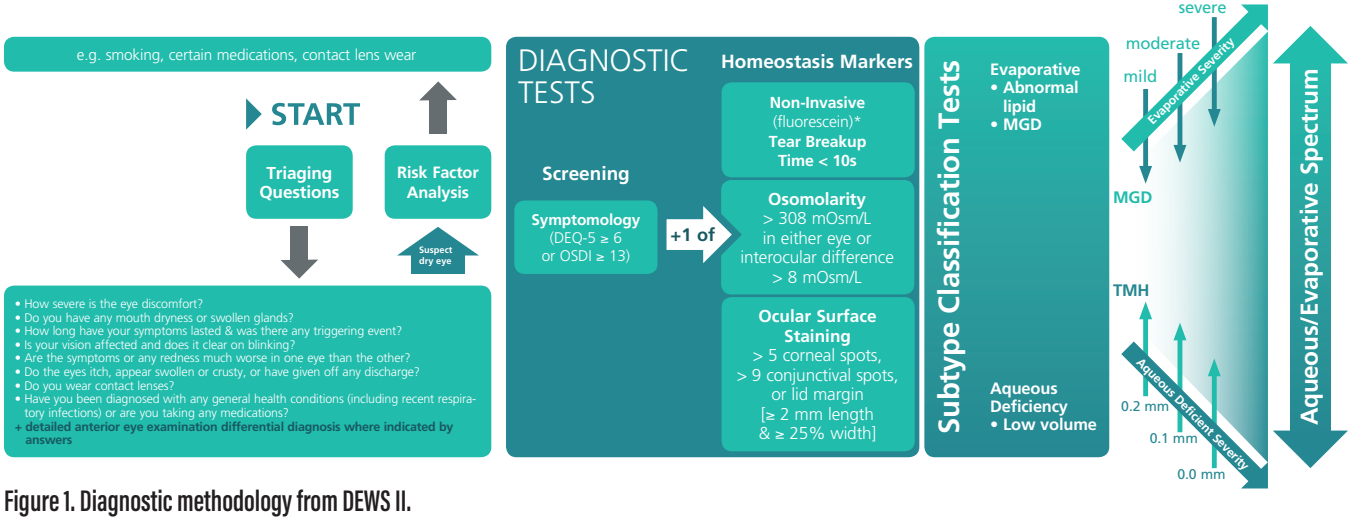

Figure 1. Diagnostic methodology from DEWS II.

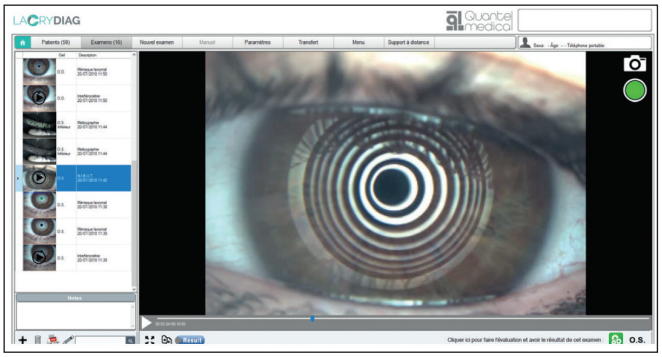

Figure 2. NIBUT exam.

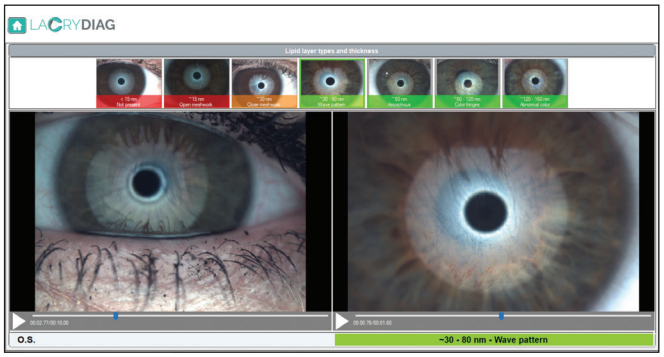

Figure 3. Interferometry.

DIAGNOSTIC METHODOLOGY FOR DRY EYE DISEASE OF GLAUCOMA PATIENTS

The ocular surface is the barrier between the eye and the outside world, and it provides immunological, physiological, and anatomical protection. Given its vital role in sustaining quality eye health, it is imperative that patients receive proper examinations prior to treatment for glaucoma. There are many tests dedicated to examining the ocular surface, however no single test is sufficient on its own, and many produce results that are inaccurate due to the contact nature of the exam.

The TFOS DEWS II committee[4] has concluded that noncontact exams are the preferred method for providing a differential diagnosis of DED, identifying its subclassification, and labelling its severity. The methodology of diagnosing DED starts by eliminating the conditions that can mimic DED. This is conducted via a list of triage questions recommended by the TFOS DEWS II. The next step is the evaluation of the DED symptoms by using a questionnaire (DEQ-5 or OSDI) created by the TFOS DEWS II committee.

A risk factor analysis should be the next step if DED is suspected. With the information from the test and risk factor analysis, a series of diagnostic examinations identifying specific homeostasis markers will help determine the subtype classification of the DED—evaporative, aqueous deficient or, the most frequent, mixed type—and determine the severity of the classification. This is the starting point for deciding proper DED treatment pathways (Figure 1).

In today's market, some devices examine the ocular surface and determine the severity level of DED. The LacryDiag (Quantel Medical) is an ocular surface analyzer that can perform all TFOS DEWS II-recommended noncontact exams for a complete and accurate DED diagnosis. CE-marked and FDA-approved, the LacryDiag conducts the four essential noncontact exams, while offering analysis of the ocular surface's three tear film layers. Noninvasive tear breakup time (NIBUT) performs a tear film stability diagnosis on the cornea and the quality of the tear and the mucin layer (Figure 2). This exam confirms whether there is DED. Once diagnosed, it's time to conduct different exams to subclassify the DED. To evaluate the evaporative form of DED, interferometry (Figure 3) performs a diagnosis of the lipid layer, and meibography offers a diagnosis of the meibomian glands with automatic quantification of loss (Figure 4). To evaluate the aqueous deficient form of DED, the tear meniscus height provides a diagnosis of the aqueous layer (Figure 5). What gives the LacryDiag a significant clinical value is the ability to conduct these four critical exams in under 4 minutes.

NIBUT

In a study comparing NIBUT against the standard TBUT, the noncontact method was found to provide a more accurate diagnosis of the cornea's tear film stability.[5] The TBUT method's use of fluorescein eye drops dilutes the natural tears, modifying its physical properties and results. TFOS DEWS II now recommends the use of dye-free imaging, which is achieved through the noncontact method.

INTERFEROMETRY

Interferometry tests offer qualitative and quantitative analyses of the lipid layer. The noncontact exam provides a quick determination of

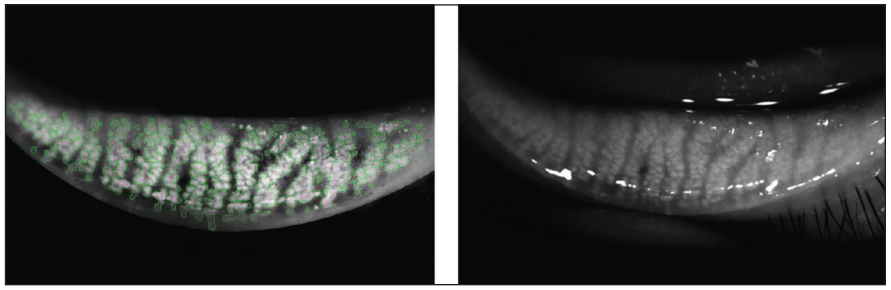

Figure 4. Meibography (lower eyelid).

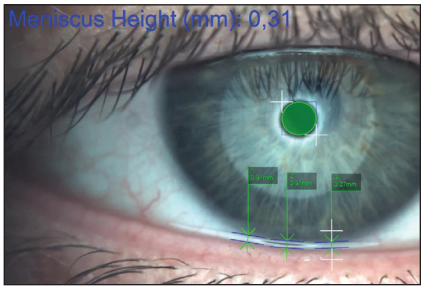

Figure 5. Tear meniscus height exam.

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the lipid layer quality and provides an evaluation of lipid layer thickness based on a grading scale.

MEIBOGRAPHY

Infrared meibography is used to clearly visualize the meibomian gland condition and dysfunction through high-quality images of the ducts. This test offers a qualitative analysis of both the upper and lower lids, giving an automatic detection of meibomian glands and an automatic calculation of the percentage of loss. Meibomian gland dysfunction is the most common abnormality of DED.[6]

TEAR MENISCUS HEIGHT

This test provides a quantitative analysis of the aqueous layer by measuring the tear meniscus height in millimeters. Additionally, measurement of the meniscus curvature and cross-sectional area provide further quantitative information. Schirmer testing uses a measuring technique with blotted paper, which can cause reflex tearing and potentially distort the test. TFOS DEWS II recommends a noncontact imaging method offering a quantitative analysis of the aqueous layer or tear meniscus, which is properly achieved in the tear meniscus height exam.

Additional exams offered by the LacryDiag include corneal staining with fluorescein, assessment of demodex on the eyelashes, blepharitis (Figure 6), and bulbar redness. The device also features several international grading scales used to assess the severity of various disease and treatment results.

SLT AS A GLAUCOMA PRIMARY THERAPY

When you consider the potential damage to the ocular surface from prescribed topical prostaglandin analogues, beta blockers, carbonic anhydrase inhibitors, or alpha agonists—especially the treatment with several drops with preservatives—having a different line of approach for treating mild to moderate primary open-angle glaucoma is necessary. The most important therapeutic goal in glaucoma is to lower and control the patient's IOP while not relying on the patient to control it. Compliance is a critical problem with glaucoma patients, and the more medications they are prescribed, the less likely they are to satisfy the application requirements. Selective laser trabeculoplasty (SLT) provides 100% compliance because there are no postoperative responsibilities required from the patient except punctual attendance at their regular check-ups. The goal is to reduce or eliminate the need for topical medications, which can cause long-term ocular surface damage and DED. And, since there is no scarring to the trabecular meshwork, SLT can be repeated and/or used before or after many other surgical interventions, such as MIGS.

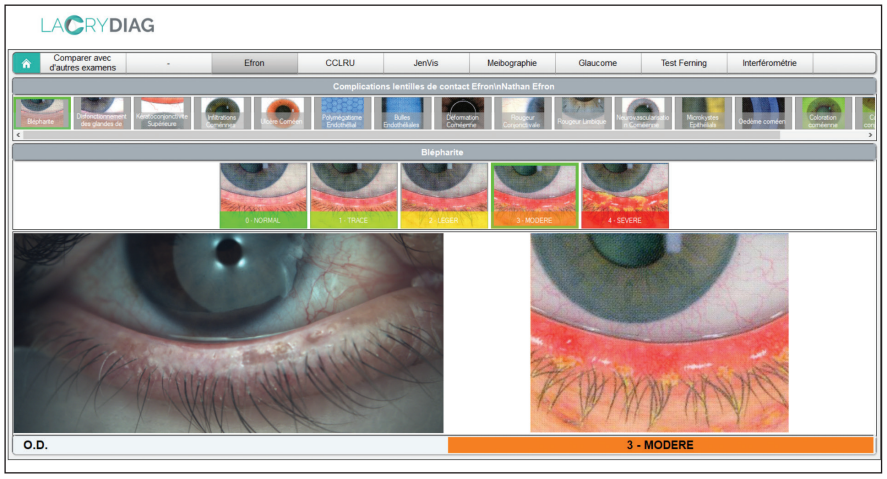

Figure 6. Blepharitis severity grading scale.

CONCLUSION

DED is a multifactorial, complex disease that requires examination through multiple test points for sufficient diagnosis. With glaucoma patients in the mild to moderate phase, the main goal is to avoid as many topical drugs as possible. Consider SLT as a strong starting point, especially since it is currently accepted as a first-line treatment. Diagnosing and treating DED should be the first action to take when creating a glaucoma treatment plan, and continued testing is recommended during clinical or postop follow-up visits. For our patients, our goals are to increase quality of life, sustain IOP reduction, and reduce or eliminate the need for prescription eye drops.

The LacryDiag offers a complete DED diagnosis through multiple, noncontact tests in less than 5 minutes, making this a valuable device to have in a clinical setting and establishing a strong vantage point for treating patients diagnosed with DED and glaucoma. ■

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