

Impaired Visual Performance in Patients with Dry Eye

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ABSTRACT Patients with dry eye disease (DED) often complain about poor vision, which is not easily quantifiable. This review assesses the current understanding of clinical evaluations of visual function in patients with DED. Several noninvasive techniques for the assessment of visual performance have been utilized in patients with DED, and these are critically reviewed in relation to the visual symptoms experienced by these patients. It is clear that none of the current techniques is ideal, and there is not one appropriate, simple, clinical test that can be used for assessing visual impairment in patients with DED. Evidence from a comprehensive literature search combined with clinical experience have been used to identify which tests are currently of most benefit and to highlight the future development of a more specific clinical test for visual impairment in the dry eye patient.

KEY WORDS contrast sensitivity, dry eye, functional visual acuity, vision tests, visual acuity, visual performance

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I. INTRODUCTION

Dry eye disease (DED), also known as keratoconjunctivitis sicca, is a disorder of the tear film and ocular surface. The tear film forms the first refracting surface of the eye, making it critical for visual performance. The definition of DED has evolved with improved understanding of the pathophysiology of the disease. The most recent definition, arising from the 2007 International Dry Eye WorkShop (DEWS), encapsulates both general and operational characteristics of the disorder: "Dry eye is a multifactorial disease of the tears and ocular surface that results in symptoms of discomfort, visual disturbance, and tear film instability with potential damage to the ocular surface. It is accompanied by increased osmolarity of the tear film and inflammation of the ocular surface."¹

There are two major etiological subtypes of dry eye: aqueous tear-deficient dry eye (ADDE), which comprises Sjogren syndrome dry eye and non-Sjogren syndrome dry eye, and evaporative dry eye (EDE), which can result from intrinsic factors such as meibomian lipid deficiency and low blink rate, or extrinsic factors such as ocular medications, environmental conditions (eg, low humidity), computer use, surface disorders, or contact lens wear. Dry eye in many patients results from a mixed etiology that incorporates aspects of both subtypes.^{2,3} A comprehensive review of the different classes and subclasses of DED was published following the 2007 DEWS report,¹ which included the major etiological causes of dry eye as shown in Figure 1.

Assessment of age-specific data from the largest reported epidemiological studies have given a prevalence range for DED of approximately 5% to over 30%.⁴ Contributing to the wide variation in reported prevalence figures are the lack of a single test that can accurately and reproducibly diagnose DED, the variability and tolerance of symptoms, the lack of correlation between tests, and the use of different diagnostic criteria.⁴ Risk factors for DED, grouped according to the level of supporting evidence, are summarized in Table 1. DED is a common problem with multiple causes.

II. SYMPTOMS ASSOCIATED WITH DED

DED is characterized by symptoms of ocular surface dryness and discomfort due to insufficient tear quantity

OUTLINE

- I. Introduction
- II. Symptoms associated with DED
- III. Functional visual problems of DED and the compensatory methods adopted by DED patients
 - A. Tasks of daily living
 - B. Compensatory techniques employed by patients to overcome visual problems in DED
- IV. Causes of poor visual performance in DED
- V. Specific tests of visual performance in DED
 - A. Visual acuity measurement
 - B. Contrast sensitivity measurement
 - C. Functional visual acuity (FVA) measurement
 - D. Measurement of higher-order aberrations (HOA)
 - E. Thin film interference techniques
 - F. Video keratographic measurements of the tear film of the cornea
 - G. Correlation between subjective and objective tests
- VI. Potential tests for detecting visual problems in DED
- VII. Conclusion

Abbreviations

ADDE	Aqueous tear-deficient dry eye
BCVA	Best corrected visual acuity
DED	Dry eye disease
DEWS	Dry Eye WorkShop
ECCE	Extracapsular cataract extraction
EDE	Evaporative dry eye
ETDRS	Early Treatment Diabetic Retinopathy Study
FVA	Functional visual acuity
HOA	Higher-order aberrations
HTLV	Human T cell lymphotropic virus-1
IVAD	Interblink interval visual acuity decay
LASIK	Laser-assisted in situ keratomileusis
MGD	Meibomian gland dysfunction
PEK	Punctate epithelial keratopathy
SSRI	Selective serotonin reuptake inhibitor
TFBUT	Tear film breakup time

or quality caused by low tear production and/or excessive tear evaporation.⁵ Common symptoms reported by patients include ocular discomfort, such as dry, scratchy, or burning sensations; pain and stinging; increased blinking; itching and redness; and blurred vision. Diurnal variations exist

in these symptoms, with most patients reporting greater symptomatology in the evening.^{6,7} Symptoms may be exacerbated by reduced and incomplete blinking combined with a decreased tear film breakup time (TFBUT) during normal visual tasks.⁸

Donschik et al reported the baseline symptomatology of 544 patients with DED entering a Phase 3 trial.⁹ Patients suffered from a variety of symptoms with no one symptom predominating. The symptoms most often reported from daily diaries include foreign-body sensation (29%), photophobia (27%), itching (21%), and burning/pain (11%). Other studies have shown that there is little correlation between the severity or type of symptoms experienced and the clinical manifestations of the disease.¹⁰

Patients' subjective visual complaints are typically assessed with patient-reported outcomes (PRO) questionnaires. Table 2

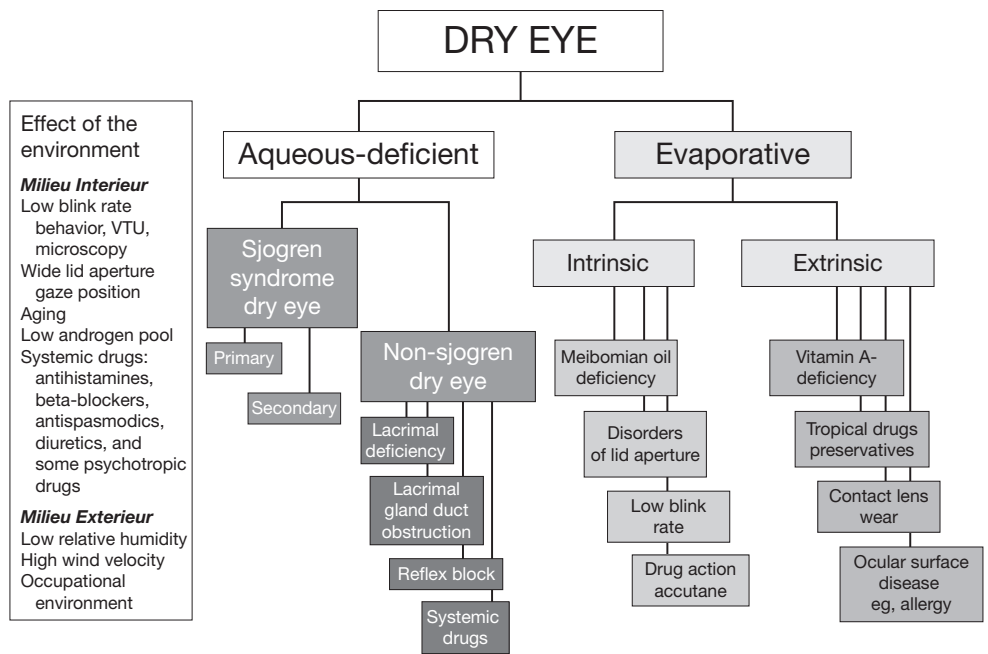


Figure 1. Major etiological causes of dry eye.

The left hand box illustrates the influence of environment on the risk of an individual to develop dry eye. The term “environment” is used broadly, to include bodily states habitually experienced by an individual, whether it reflects their “milieu interieur” or is the result of exposure to external conditions which represent the “milieu exterieur.” This background may influence the onset and type of dry eye disease in an individual, which may be aqueous-deficient or evaporative in nature.

Aqueous-deficient dry eye has two major groupings, Sjogren syndrome dry eye and non-Sjogren syndrome dry eye.

Evaporative dry eye may be intrinsic, where the regulation of evaporative loss from the tear film is directly affected, eg, by meibomian lipid deficiency, poor lid congruity and lid dynamics, low blink rate, and the effects of drug action, such as that of systemic retinoids. Extrinsic evaporative dry eye embraces those etiologies that increase evaporation by their pathological effects on the ocular surface. Causes include vitamin A deficiency, the action of toxic topical agents such as preservatives, contact lens wear, and a range of ocular surface diseases, including allergic eye disease. (Reprinted from The definition and classification of dry eye disease: report of the Definition and Classification Subcommittee of the International Dry Eye WorkShop [2007]¹ with permission.)

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