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Dry Eye and Ocular Surface Disease

Dry eye disease: A review of diagnostic approaches and treatments

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Abstract

Dry eye (DE) is a common ocular disease that results in eye discomfort, visual disturbance and substantially affects the quality of life. It has a multifactorial etiology involving tear film instability, increased osmolarity of the tear film and inflammation of the ocular surface with potential damage to the ocular surface. This review discusses the classification, diagnostic approaches and treatments of DE.

Keywords: Dry eye, Ocular surface disease, Visual disturbance, Diagnostic approaches

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Introduction

Dry eye (DE) 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, accompanied by increased osmolarity of the tear film and inflammation of the ocular surface.[1] Estimated prevalence ranges from about 5% to over 35% in different age groups.[2] Despite its high prevalence, DE is frequently under-recognized. Owing to its negative influence on patients' visual function and quality of life, DE represents a big burden in public healthcare. Therefore, attempts to find better diagnostic approaches and appropriate treatment for DE are worthy of consideration. This review discusses the classification, diagnostic approaches and treatments of DE.

Classification

The major classes of DE, as identified by the International Dry Eye Workshop (DEWS) report are aqueous deficient dry eye (ADDE) and evaporative dry eye (EDE).[1] Although both ADDE and EDE present with similar signs of reduced stability and increased tear film osmolarity, ADDE chiefly refers to a failure of lacrimal secretion and EDE is due to excessive water loss from the exposed ocular surface in the presence of normal lacrimal secretory function. It is also important to recognize that ADDE and EDE may coexist. The main etiopathogenic classification is illustrated in Fig. 1.

Diagnostic assessment

Although literature provides an extensive discussion on the role and appropriateness of currently used tests to diagnose DE, there is no gold standard test or even a panel of tests or well-established cutoff values for the available tests.[3] The suggested sequence of DE diagnostic tests is: history and examination followed by a symptom questionnaire; tear break-up time and ocular surface fluorescein staining; Schirmer test; lid and meibomian morphology and meibomian expression.[2] In Delphi panel, the most frequently cited tests were slit-lamp examination and fluorescein staining (100%)

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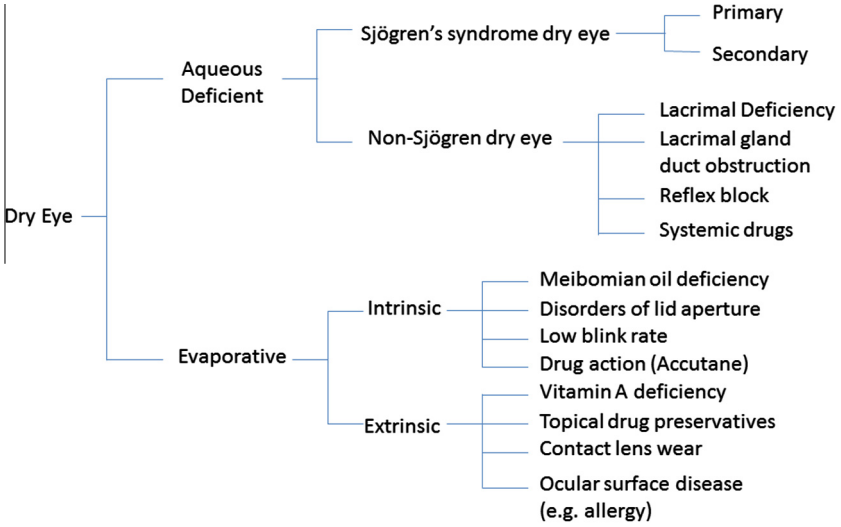

Figure 1. Etiopathogenic classification (modified from 2007 DWES report).[1]

followed by tear breakup time and medical history (both 94%).[3] An ideal diagnostic method should be preferably noninvasive, objective, specific, reproducible and sustainable in terms of cost and time. At present, none of the current tests for DE diagnosis altogether meet these features.

Subjective evaluation

The symptoms and history of DE patients vary widely; therefore, validated questionnaires have been developed to ensure consistency in recording symptomatic information. A comparative listing of DE questionnaires is available in the report of the Epidemiology Subcommittee of the International DEWS 2007.[2] Previously it was believed that DE can be diagnosed largely on the basis of symptoms; however, recent studies have questioned this opinion as there is often a lack of correlation between the severity of the symptoms and signs of DE.[4] This lack of consistency between signs and symptoms presents a problem not only in the diagnosis of the disease, but also in assessment of severity and in the evaluation of the clinical efficacy of treatments.

Objective evaluation

A scientific roundtable on dry eye ranked tear break up time (93%), corneal staining (85%), tear film assessment (76%), conjunctival staining (74%), and the Schirmer test (54%) as the most commonly used diagnostic tests for initial assessment of dry eye.[5] Apart from these traditional clinical tests, we will discuss more about the less invasive evaluations based on the recently developed technologies related to tear hyperosmolarity, tear film instability and inflammation.

Tear osmolarity

An increase in tear osmolarity is common to all types of DE. It is suggested that osmolarity values greater than 308 mOsms/l are a sensitive indicator of mild DE and values greater than 312 mOsms/l are indicative of moderate to severe DE (sensitivity 73%; specificity 92%).[6] The difference in the tear osmolarity values among normal, mild, moderate or severe dry eye patients is so small that precision is critical. Tear film osmolarity can be measured in three ways: freezing point depression (FPD), (considered to be the gold standard);[7] vapor pressure[8] and electrical conductivity or impedance.[9] Since the electrical impedance of tear samples requires a small sample size (0.05 μl) and short test duration (30 s), it is considered more suitable for clinical use.[10] The TearLab system (TearLab Inc., San Diego, CA, USA) uses this method to determine tear osmolarity. While recent studies have demonstrated the correlation between increased osmolarity and DE disease severity, it is also observed that ''tear osmolarity cannot be used as the sole indicator of dry eye disease''.[11]

Assessment of tear stability

The measurement of tear film stability is fundamental to the diagnosis of dry eye.[12] A variety of methods are available to assess different aspects of the tear film and provide insights into its ''stability''. Tear break-up time (TBUT), introduced by Norn,[13] remains the most frequently used diagnostic test to determine tear film instability.[14] Generally, the noninvasive tear break-up time (NIBUT) involves the observation of an illuminated grid pattern reflected from the anterior tear surface. NIBUT can be measured by corneal topography, interferometry, aberrometry, functional visual acuity assessment, and confocal microscopy. A regular image of the reflected target indicates a stable tear film. The time (in seconds) from the last blink to the appearance of the first discontinuity or break in the reflected image is recorded.

Tear film particle assessment

Non-invasive tear film particle assessment technique to measure tear film's upward spread and stability can potentially be used for the precise and objective evaluation of tear film.[12,15] Tear film particle velocity is measured as an assessment of tear hydrodynamics by tracking the movement of reflective particles in the tear film. Digital images of the central region of the ocular surface are collected for 10 s to visualize the naturally seen particles in the tear film following a

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