Dry Eye Syndrome – Diagnosis and Management

Dr. Jeffrey CF PONG

MBChB, MSc, PhD, FRCS(Ed(Ophth)), FRCS(Glas), FCOphHK, FHKAM(Ophth)
Eye Centre - Hong Kong Adventist Hospital

Introduction

Dry eye is a common eye disease. In the US, as many as 6% of the population over the age of 40 and more than 15% of the population over the age of 65 suffer from dry eye. According to a survey locally conducted, there is nearly 20% of the population with some dry eye symptoms. According to the National Eye Institute’s definition, dry eye is a disorder of the tear film due to tear deficiency or excessive tear evaporation which causes damage to the intraepalbebral ocular surface and is associated with symptoms of discomfort. The dry eye syndrome (keratoconjunctivitis sicca) can be divided into the non-Sjogren syndrome, Sjogren syndrome and meibomian gland diseases. Clinically, symptoms associated with dry eyes can include ocular burning, foreign body sensation, stinging sensation, pain, photophobia or blurred vision.

Clinical Types of Dry Eye

The precorneal tear film is an essential structure of the ocular surface. This tear film can be divided into the anterior lipid layer, the middle aqueous layer and the innermost mucin layer which is secreted by the meibomian glands, the lacrimal gland and the goblet cells of the conjunctival epithelium respectively. Its use is to lubricate the eye, maintain nutrients and oxygenation of the ocular structures, act as a part of the refractive surface and help to remove debris from the ocular surface. In terms of tear production, dry eyes can be divided into the tear deficiency type and evaporative type. Tear deficiency dry eyes can be further divided into the non-Sjogren syndrome and Sjogren syndrome, which is an autoimmune disease associated with lacrimal gland and salivary gland lymphocytic infiltration. Evaporative dry eyes can be divided into the meibomian gland disease (MGD), exposure-related dry eyes and mucin deficiencies such as the Steven-Johnson syndrome and ocular cicatrical pemphigoid.

Causes of Dry Eyes

The dry eye syndrome is associated with a long list of causes. Essentially, causes of dry eyes can be divided into primary and secondary ones. Dry eye diseases can be secondary to environmental, hormonal, physiological, contact lens wear and pathological causes. With pathological causes, both the tear deficiency type and evaporative type can lead to the dry eye syndrome. Systemic diseases such as diabetes, thyroid disease, rheumatoid arthritis, systemic lupus etc. can also lead to dry eyes. In addition, patients with previous eye surgeries or regular use of eye medications or systemic medications can predispose to dry eyes. Many systemic medications, such as antihistamines, antidepressants, beta-blockers and oral contraceptives can also be associated with dry eyes.

Diagnostic Criteria

In terms of diagnostic criteria, Ohashi reported that (1) Symptoms of dry eyes, (2) Schirmer tests (< 5 mm after 5 mins) and clearance test (< 8x) (3) Fluorescein stain and Rose Bengal staining (>3+) are qualified as clinical dry eyes. Other authors have devised other diagnostic criteria and there is so far no consensus. In many cases symptoms and signs do not correlate well with each other.

Essentially, to confirm the diagnosis of dry eyes, certain tests are necessary to be performed in the clinical setting. The tear film stability can be assessed with the fluorescein tear break-up time test (TBUT), measuring the interval in seconds between a complete blink and the first appearing dry spot or discontinuity in the precorneal film. Patients with TBUT less than 3 seconds are classified as clinical dry eyes. The tear meniscus is the tear pooling on the edge of the lower lid. If there is aqueous deficiency, the tear meniscus will appear to be thin and less than 1 mm in height. Another clinical method for assessing the severity of dry eye is the ocular surface dye staining. Fluorescein and Rose Bengal stain can both be used as diagnostic dyes for evaluating the staining. Fluorescein staining occurs when the epithelial barrier is disrupted, due to the loss of epithelial cells and serves as a good test for evaluation of dry eyes. Rose Bengal stains the devitalised epithelial cells of the conjunctiva and serves a similar purpose. However, Rose Bengal stain causes transient irritation after instillation and can be a problem for some patients. Patients with the dry eye syndrome can show signs of punctate epitheliopathy and even corneal abrasions.

Another important clinical test is the Schirmer test. It is a useful and robust test for measuring aqueous tear production. It is also easy to be performed in a simple clinical setting but it can be subjected to errors. Essentially, filter paper strips called Schirmer strips are placed on the lower lid inside the tarsal conjunctiva area. The patient is then allowed to blink as normally and the tear strip is reassessed according to the degree...
Pathogenesis of Dry Eyes

Studies have been performed in looking at the proteomic profiles of the ocular surface. Protein analysis comparing dry eyes and normal eyes found decreases in lactoferrin and Epidermal growth factor in the dry eye syndrome using enzyme-linked immunosorbant assay (ELISA). A protein found in acinar cells of the lacrimal gland, AQP-5 was shown to have increased in the Sjogren type of dry eye syndrome, indicating a component of mucin in tear has found a lower level in dry eye patients compared to controls, indicating a change in quantity and quality of glycoproteins in the tear in dry eye diseases.28 The change in tear protein profile in the dry eye syndrome, especially the Sjogren disease, has shed some light on the mechanism of the dry eye syndrome.

Management of Dry Eye Diseases

Management of dry eye diseases depends on the causes and severity of the dry eye syndrome. Essentially, artificial tear used to replenish the deficient aqueous layer of the tear film, and to dilute the cytokines necessary to substantiate the disease. Artificial tear comes in different viscosities and can be divided into preserved or non-preserved forms. If the tear deficiency is severe, then more viscous forms such as eye gel or even ointment can be used to maintain a better and longer ocular protection. Since dry eye diseases, such as the Sjogren syndrome is associated with inflammation of the episclera, sclera and even vitreoretinal involvements. It is important to be thorough in the examination to look for any correlated diseases.
drugs such as cyclosporine-A drops (Restasis) may be necessary. Studies have demonstrated an improvement of symptoms and signs of the dry eye syndrome, together with improvement of T cell infiltration in conjunctiva and cytokines level in the tear with the use of cyclosporine-A drops.\(^4\)\(^,\)\(^15\)

In very severe dry eye cases, frequent topical lubricants may not suffice. Studies have looked into the use of autologous serum as topical eye drops for severe dry eyes and clinical improvement was evident with prolonged treatment of 4-6 weeks. Its additional growth factors compared to artificial tear are cited as important components necessary for epithelial healing. Autologous serum can be produced from a designated period of centrifuging venous blood and diluting it with balanced salt solution to around 20%.\(^16\)

Bandage contact lens is sometimes useful in dry eyes to prevent and minimise the extent of exposure keratopathy. Severe dry eye diseases with corneal complications may warrant surgical intervention such as punctal occlusion. Lacrimal puncta can be plugged either temporarily with collagen plugs which are absorbable, or for a longer period with non-absorbable plugs which needs to be removed if problems arise. Permanent punctal occlusion can also be performed using local anaesthetics to permanently save the tear from draining through the tear ducts and canaliculi. For patients with dry eyes secondary to connective tissue diseases, it is important to work with medical physicians to optimise treatment for their systemic diseases. In very severe dry eye diseases secondary to ocular surface diseases such as chemical injury, Steven-Johnson syndrome or ocular cicatricial pemphigoid, amniotic membrane transplantation, tarsorrhaphy, keratoplasty, limbal stem cells transplantation or even other ocular prosthesis is necessary to restore vision.\(^17\)

Accupuncture has been recently cited as a treatment option in the dry eye syndrome. Meta-analyses of studies have revealed clinical improvements in fluorescein staining, tear break up time and Schirmer tests after acupuncture. It is yet to see if the alternative medical practice does have a role in this common disease.\(^18\)

Conclusions

The dry eye syndrome consists of a wide spectrum of diseases with different causes. Useful clinical tests include Schirmer tests, fluorescein dye tests and the tear break up time for the assessment of severity of the syndrome. More advanced tests such as tear interferometry, functional Vision test and other tear proteomics studies can be used to distinguish clinical dry eyes and their severity at the experimental level. Treatment depends on an accurate diagnosis and the severity of the dry eyes. Treatments that can replenish deficient tear include artificial tears, gel and ointment in mild to moderate dry eyes. In severe dry eyes, surgical approaches such as punctal occlusion can be used to save the tear. Other treatments such as topical steroids, topical immuno-modulating drugs, topical antibiotics, bandage contact lens, autologous serum and amniotic membrane can be useful in very severe cases. Certain conjunctival and lid surgeries can also be performed to treat specific causes. Clinicians should be aware of the extent of the dry eye symptoms and do not overlook lightly. A thorough history taking and investigation is necessary to identify the cause of the dry eyes.

References