

Dry Eye Disease : A Review Article

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Abstract— Dry Eye Disease is a common corneal condition characterized by symptoms of dry gritty sensation and excessive watering in the eyes. Early identification and individualized treatment plan is the key to manage the condition effectively. Artificial tear drops and ointments remain the first line option however, severe cases may require further interventions. This article illustrates the common clinical presentation, assessment and treatment options available globally.

Index Terms— Dry Eyes, Dry Eye Disease, Punctal occlusion, artificial tears, keratoconjunctivitis sicca

I. INTRODUCTION

Dry eye disease [DED] is one of the most common corneal conditions caused either by insufficient volume or inadequate function of tears leading to the tear film breaking easily. The condition is usually seen in elderly population and post-menopausal women. The tear film is known to be made up of 3 layers- the outermost lipid layer, then the aqueous and the lowermost mucous layer. The neuronal controlled blinking mechanism of the eyes allows the distribution of tear film evenly over the ocular and the corneal surface. There are 3 main features responsible for an effective coating of the film over the surface –a normal blinking reflex, interaction between the surface and the inner eyelids and lastly a normal corneal epithelium [1]. Classification of the condition along with the effect of environment on dry eyes, according to DEWS report 2007 is included in figure 1. It classifies dry eyes into aqueous –deficient type and evaporative type based on its cause [2].

This article is a brief illustration on how to assess and manage a patient with dry eye disease including the techniques for clinical assessment, differential diagnosis and treatment options for the condition.

II. SIGNS AND SYMPTOMS

Patients with dry eye disease usually complain of excessive watering and dry gritty sensation in the eyes which gets worse towards the end of the day. The visual acuity may sometimes be affected mostly in severe cases, leading to blurry vision. There may be stringy discharge present however, absence of emotional or reflex tearing is uncommon. Prolonged exposure to dry, cold, windy environment makes the condition worse.

The signs of the condition are briefly mentioned in the table below.

| Signs of dry eye disease [1] | |
|------------------------------|--|
| Eyelids | - Posterior seborrheic blepharitis |
| Conjunctiva | - Redness - Keratinization - Conjunctivochalasis |
| Tear film | - Lipid contaminated mucin debris that moves with every blink - Thin or absent marginal tear meniscus |
| Cornea | - Punctate epithelial erosions (keratopathy) _{SEP} - Corneal Filaments [mucus and shed epithelial cells] - Mucous plaques |

III. DRY EYE ASSESSMENT

Patient self-assessment using McMonnies’ questionnaire can be done in the waiting area. This questionnaire is a simple test which is well balanced with focused questions that helps the patients to think about when the symptoms started [3].

Following are the most commonly used tests in clinical practice to diagnose dry eyes. However, there is no definitive diagnostic test for evaporative type of dry eyes but the diagnosis of this is based on only clinical signs and symptoms the patient presents with. Following are the tests usually done in the clinics to help diagnose the condition.

I. Tear film stability tests

- Invasive tear stability assessment – [Tear Break Up time (TBUT)]

TBUT is seen to be abnormal in disorders with aqueous tear deficiency and insufficient meibomian gland function.

Fluorescein 2% is introduced into the lower fornix with or without anesthesia. Fluorescein strips with normal saline may also be used instead. After several blinks, the eye is visualized under broad beam cobalt blue light using a slit lamp under 10x magnification. Appearance of black spots or streak lines mean breaking of the tear film which if is under 10 seconds, denotes dry eyes [4].

- Non-invasive assessment is done using tearsopes like keratometer mire or HIRCAL grid or Lovridge grid or a portable device from a wok. They are a bit tedious but have an added advantage of being able to test the tear film stability over a rigid or a soft lens [4-6]. Bausch and Lomb keratometer is used to calculate Tear Thinning Time (TTT).

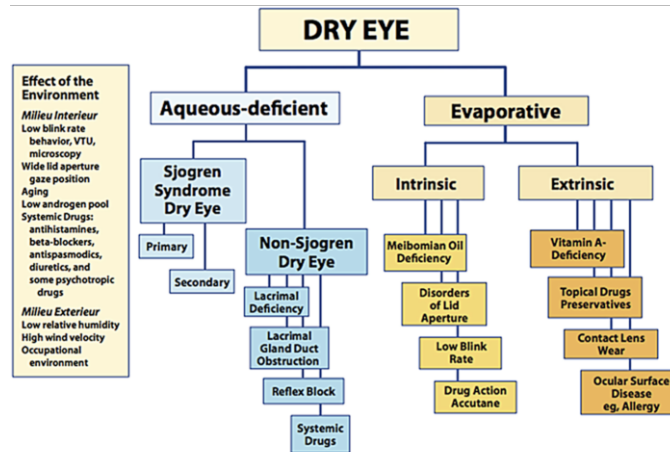


Figure 1 :Dry eye classification from the 2007 DEWS Report [2]

II. Tear production tests

- Shirmer’s test- This test makes the use of no41 Whatmann filter paper (5mm wide and 35 mm long). The Shirmer’s paper is folded about 5mm from one end and placed at the junction of lateral 1/3rd and the medial 2/3rd in the lower fornix without touching the cornea or the lashes. If the amount of wetting is less than 10mm without anesthesia or 6mm with anesthesia after 5 mins, it is suggestive of dry eyes. A repeated abnormal reading is a reliable criterion for diagnosing. A phenol cotton thread test may also be used to check for the wetting.
- Fluorescein clearance - 5µL of fluorescein is instilled on the ocular surface and residual dye is measured at set intervals on the shirmer’s strip. Delayed clearance is seen very commonly in this condition.
- Tear meniscus height and curvature (TMH)- this is not an absolute measurement for dry eyes. The normal TMH is 0.2-0.3mm. Dry eyes causes decrease in the TMH or sometimes may even be absent. Instillation of anesthesia increases the TMH by 26% due to lacrimal reflex [7].
- Tear film osmolarity measurement is a very accurate method of measuring tear production.
- Tear constituents may be analysed to look for any elevation or decrease in particular markers like matrix metalloproteinase-9 and lactoferrin.

III. Ocular surface disease

- Corneal staining- Dyes like fluorescein, Rose Bengal, Lissamine Green may be used to stain ocular surface to visualize punctate keratopathy, corneal filaments or plaques. The dyes cause stinging and irritation which may last upto a day. Hence the instillation needs to be immediately preceded by anesthesia and the excess needs to be washed with saline.
- Impression cytology may be used to calculate the number and hence determine the function of goblet cells in production of the mucous layer.

IV. TREATMENT

The treatment options for dry eyes has been categorized into levels based on severity of the condition. Artificial tears are usually first line options, examples of which include methycellulose, hypromellose, sodium hyaluronate etc. Selenium ointments can be used in the night time. Warm compresses and maintaining good lid hygiene can ease the discomfort. If the first line measures have failed, level two strategy should be adopted and so on. The treatment options under different levels have been enlisted in the table below.

| Treatment options for Dry Eyes [8] | | | |
|---|---|---|---|
| Level 1 | Level 2 | Level 3 | Level 4 |
| 1. Lifestyle modifications - emphasis on blinking during reading or working. For e.g. humidification. - caution that LASIK can cause increased dry eyes 2. Systemic medication | 1. Non preserved tears substitute- three to four times a day 2. Anti-inflammatory agents- topical steroids / Topical NSAIDS / Topical ciclosporin / oral omega fatty | 1. Serum eye drops- may be autologous or umbilical cord serum [10]. 2. Surgical permanent punctal occlusion 3. Contact lenses | 1. Systemic NSAIDS /steroids [anti-inflammatory agents] 2. Surgical options – 1) Eye lid surgery 2) Salivary gland autotransplantation |

| | | | |
|--|---|--|--|
| <p>review-if on any</p> <p>3. Artificial tears [preserved] during day time [methylcellulose, sodium hyaluronate etc.] + VitA-POS/selenium ointment in the night.</p> <p>4. Eyelid therapy – warm compresses, lid hygiene</p> | <p>acids [9].</p> <p>3. Tetracyclines</p> <p>4. Punctal plugs- collagen plugs/ silicone plugs</p> <p>5. Secretagogues- pilocarpine, rebamipide</p> <p>6. Moisture chamber spectacles and spectacle side shield. [SEP]</p> | | <p>3) Transplantation of mucous membrane or amniotic membrane over the cornea in cases of corneal complications.</p> |
|--|---|--|--|

Punctal occlusions

Moderate to severe keratoconjunctivitis sicca patients who have not responded to topical drops benefit the most with this procedure. The punctal plugs work by reducing the drainage of the tears and thus prolonging the effect of artificial tears. The plugs can be temporary, reversible or permanent and can be chosen according to the condition’s severity. The temporary punctal plugs dissolve over a few weeks by itself as they are made with collagen. The inferior canaliculi are occluded first and then reviewed. Both the inferior and the superior canaliculi can be occluded with plugs in severe cases of dry eyes. Avoidance of epiphora formation is of utmost importance following plugging. Reversible occlusion makes use of either long lasting collagen plugs or silicone plugs. Permanent occlusion should only be considered in severe cases of dry eyes and who have responded to temporary plugs without the formation of epiphora but still have had no relief. This procedure is done using thermal coagulation or sometimes laser. Recanalization is a possibility after the surgery and needs monitoring by regular follow ups.

Other treatment options

1. Oral cholinergic drugs can be used to ease sjogren’s syndrome in which patients usually present with dry eyes and dry mouth. However, it does have side effects such as blurring of vision.
2. Serum eye drops which are produced from umbilical cord blood serum is seen to repair the epithelial defects caused by the condition. However its making and storing had posed an absolute challenge in the practical world.
3. Botulinum toxin injections helps control the blepharospasm caused by extreme dry eyes. Moreover, the lid movement is limited when Bo-tox is injected into the medial canthus obstructing the drainage of the tears, thus helping the tears to stay on the ocular surface for a longer time [1].
4. Extensive surgeries such as submandibular gland

transplantation are available for severe cases of dry eyes. However, production of excessive levels of mucus in the tear film may cause temporary blurriness [1].

V. CONCLUSION

Dry eyes is a very common multi-factorial disease in the elderly with a complex patho-physiological process. Assessing clinical signs and symptoms under the slit lamp is of utmost importance in diagnosing the condition. The ultimate aim of the management plan is to ease the symptoms and also to repair the damaged ocular surface and tear film. A personalized and customized strategic plan is a key to complete resolution of dry eye disease.

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