Diagnosis and Treatment of Dry Eye Syndrome

- Ophthalmologists at the Penn Dry Eye & Ocular Surface Center are applying recent advances in diagnostic technology to diagnose the primary causes of keratoconjunctivitis sicca (or dry eye syndrome) in order to optimize treatment for the condition.

The symptoms of dry eye syndrome (DES) include blurred vision, scratchiness, irritation, redness and tiredness of the eyes. Traditionally, the condition has been thought of as a deficiency of tears at the ocular surface. Recent investigations have shown, however, that DES is much more complex than previously thought and that it might more accurately be described as “tear film dysfunction syndrome.”

Tear film dysfunction can be broken down into two basic etiologic classifications: insufficient tear production or increased evaporation of tears from the eye surface. The tear film is made up of lipid, mucin and aqueous components. Individuals with dry eye syndrome can be deficient in any of these basic factors.

- Lipid tear deficiency is most commonly caused by blepharitis or meibomian (oil producing) gland dysfunction. This leads to abnormally increased evaporation of the tears from the surface of the eye.
- Mucin deficiency can be caused by conditions such as vitamin A deficiency, chemical injury, and Stevens-Johnson syndrome. Mucin is produced by goblet cells, and promotes even distribution of the aqueous tears over the surface of the eye.
- Aqueous tear deficiency is associated with insufficient tear production. Congenital causes include conditions such as Riley-Day syndrome or familial dysautonomia. Acquired causes of aqueous tear deficiency include contact lens wear, increasing age, hormonal changes, medications, and Sjogren’s Syndrome and other autoimmune diseases.

DES is often misdiagnosed, and accurate assessment of the underlying causes of a patient’s ocular surface disease is critical. Misdiagnosis and the resulting delay in appropriate treatment can permit the continuation of destructive disease processes and may lead to eventual permanent scarring of the ocular surface.

Diagnosis

The Penn Dry Eye & Ocular Surface Center has developed a multidisciplinary approach to identify the cause of a patient’s tear film dysfunction or ocular surface disease. Ophthalmologists collaborate with specialists in other departments to provide care for any medical problems or conditions that may be contributing to the patient’s eye problems. In the office, specially-trained ophthalmologists perform thorough evaluations of the ocular surface. These assessments may include analysis of the tear film for specific proteins, cytokines and osmolarity. Schirmer testing is used to measure tear production, while optical coherence tomography (OCT) allows quantification of tear meniscus height. Special stains and impression cytology are used to evaluate the cornea and conjunctiva. Keratoagraphs utilizing trans-illumination and infrared light capture detailed images of the meibomian glands in the upper and lower eyelid and lid margin. The oil or lipid layer is also measured with sophisticated surface interferometers.

Treatment Options

Management of tear film dysfunction and ocular surface disease at the Penn Dry Eye & Ocular Surface Center is tailored to the individual patient and has the objective of promoting the health of the ocular surface. Lifestyle changes, artificial tears and topical eye ointments may help patients with mild DES. Patients with moderate to severe DES may benefit from medical treatment with immunomodulators, anti-inflammatory agents, omega-3 fatty acid supplements, autologous serum, mucolytic agents or surgical interventions such as punctal occlusion, cautery or various lid surgeries.

The specialists at the Penn Dry Eye & Ocular Surface Center also perform amniotic membrane transplantation, artificial cornea transplants (keratoprosthesis surgery) and other advanced ocular reconstructive surgeries. Therapeutic options for eyelid diseases include intense pulsed light (IPL) therapy (Fig. 2), Lipidow, Blephex, lid debridement and meibomian gland probing (Fig. 3, back page).

Patients may also be fitted for specialized contact lenses including various types of scleral lenses. In addition, supplemental treatments including drops, gels, ointments, vitamins, lid scrubs, warming and cooling gel packs, goggles, specialized sunglasses, etc. are offered on site for patients to purchase.
Tear film dysfunction and other ocular surface diseases are treated at the Penn Dry Eye & Ocular Surface Center by specially trained ophthalmologists who have a particular interest in caring for patients with dry eye and other types of ocular surface disease. The Center involves collaboration with specialists in cornea and external disease, oculoplastics, contact lens, rheumatology, dermatology and endocrinology.

**Faculty Team**

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**Access**

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**Research at the Dry Eye & Ocular Surface Center**

**Dry Eye Assessment and Management Study (DREAM)**

The objective of the DREAM study is to evaluate the effectiveness and safety of supplementation with omega-3 fatty acids in relieving the symptoms of moderate to severe dry eye disease. The study is designed to test the hypothesis that omega-3 supplementation is an effective treatment for dry eye disease (DED). Please see http://1.usa.gov/13NclH for additional information.

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**Evaluation of Efficacy of 20 µg/ml rhNGF New Formulation (With Anti-oxidant) in Patients With Stage 2 and 3 Neurotrophic Keratitis**

The primary objective of this study is to evaluate the efficacy of 20 µg/ml 6 times a day of recombinant nerve-growth factor (rhNGF) eye drop solution containing anti-oxidant compared to vehicle (formulation containing anti-oxidant) given 6 times a day. The evaluation of efficacy is intended as complete healing of stage 2 (persistent epithelial defect) and 3 (corneal ulcer) neurotrophic keratitis (NK) as measured by the central reading center using corneal fluorescein staining; assessing the duration of complete healing; improvement in visual acuity and improvement in corneal sensitivity. Please see http://1.usa.gov/1B43Bq5 for additional information.

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