

Keratoconjunctivitis Sicca or “Dry Eye”

By Sara Thomasy DVM, PhD, DACVO

Keratoconjunctivitis sicca (KCS) or dry eye is a commonly diagnosed condition in dogs. In the United States, it is estimated that 1% of dogs suffer from KCS which equates to more than 800,000 dogs. KCS occurs when there is inadequate production of the aqueous or watery portion of the tears by the lacrimal or tear-producing glands. Consequently, canine patients with KCS have thick, stringy mucous to pus-like discharge (**Figure 1**). They also suffer from severe ocular discomfort as a result of dryness and inflammation of the cornea (the outermost clear layer of the eye) and conjunctiva (pink tissues surrounding the eye). Patients with KCS are more likely to get corneal ulcers and secondary infections which results in further pain and potential blindness if the globe ruptures. With chronicity, extensive scarring, vessel infiltration and pigmentation of the cornea occurs which can also result in blindness.

How does KCS or dry eye occur? The most common cause in dogs is due to an attack of the tear-producing glands by the body's own inflammatory cells. KCS can also result from injury to the lacrimal glands or the nerves that supply them. Removal of a prolapsed gland of the third eyelid or “cherry eye” is another common cause for KCS. Drug-induced KCS can result with administration of sulfonamide antibiotics or a non-steroidal anti-inflammatory drug called etogesic. Systemic diseases including canine distemper and diabetes mellitus may also cause KCS. Rarely, puppies are born which absent or underdeveloped lacrimal glands which results in a severe form of dry eye.



Fig. 1. Severe keratoconjunctivitis sicca (KCS) in a West Highland White Terrier. Note the abundant discharge, dry ocular surface, conjunctival redness, corneal vessels and pigment present. KCS is a common cause of ocular discomfort and decreased vision in dogs.

The West Highland White Terrier is a commonly affected breed with immune-mediated KCS although any breed may develop it. Other commonly reported breeds include the English Bulldog, Lhasa Apso, and Shih Tzu. The observation that West Highland White Terriers are at greater than 5-fold risk of KCS in comparison to other breeds suggests that the disease may be inherited in West Highland White Terriers. Several studies have also documented that KCS is more common in female versus male West Highland White Terriers. In human patients, females are overrepresented with dry eye and several other immune-mediated diseases including rheumatoid arthritis. Female predispositions have been documented in other canine immune-mediated diseases including immune-mediated hemolytic anemia and chronic superficial keratitis (also known as pannus). At UC Davis, I am working with Dr. Danika Bannasch

and her laboratory to determine the genetics of KCS in West Highland White Terriers. However, more samples from KCS-affected and normal (over 7 years of age) West Highland White Terriers are needed. Please see the information at the end of the article on how to send samples. A Schirmer tear test (STT) is required for a diagnosis of KCS (along with appropriate clinical signs) or to confirm that tear production is appropriate in affected or normal West Highland White Terriers, respectively. Please refer to the information included at the end of the article regarding how to send samples.

How do we diagnose KCS in dogs?

Diagnostic tests routinely performed by veterinary ophthalmologists for KCS in canine patients include the Schirmer tear test to assess aqueous tear production and the application of fluorescein to determine corneal epithelial integrity. However, ophthalmologists treating human patients routinely perform a multitude of tests including the phenol red thread test to measure aqueous tear production, tear film break-up time to measure tear stability, application of vital dyes including lissamine green, fluorescein, and Rose Bengal to assess epithelial cell health and integrity, tear osmometry to measure tear osmolality, and meibometry to assess the amount of lipid in tears. In addition, advanced ophthalmic imaging including optical coherence tomography OCT and in vivo confocal microscopy are also used to diagnose and monitoring KCS in human patients (**Figure 2**). At University of California-Davis, we are fortunate to

(Continued on page 10)

have all these diagnostic modalities available to thoroughly characterize the tear film and ocular surface of West Highland White Terriers with and without KCS. By studying normal and KCS-affected dogs, we aim to better understand if all West Highland White Terriers are inherently at risk for dry eye or just a subset of the population.

Topical immunomodulatory drugs such as cyclosporine and tacrolimus have greatly improved the ability of veterinarians to treat KCS by preventing further immune-mediated destruction of the lacrimal glands. Tear-replacement therapies including lubricating gels, ointments or drops are also important in management of KCS especially since it can take several weeks for cyclosporine to be effective. It is important to realize that treatment of KCS, especially with immunomodulatory drugs, is lifelong. Unfortunately, some dogs do not respond well to treatment particularly when chronic damage to the lacrimal glands leaves little to no functioning tissue. It has been noted that West Highland White Terriers suffer from a particularly severe form of immune-mediated KCS which can be especially challenging to manage long-term. When routine medical therapy fails, then surgery is considered. One operation involves moving the duct of the parotid salivary gland up into the inner lower eyelid. This surgery uses saliva as a replacement for tears which increases the comfort of the patient. However, mineral deposits on the cornea and salivary overflow onto the skin underneath the

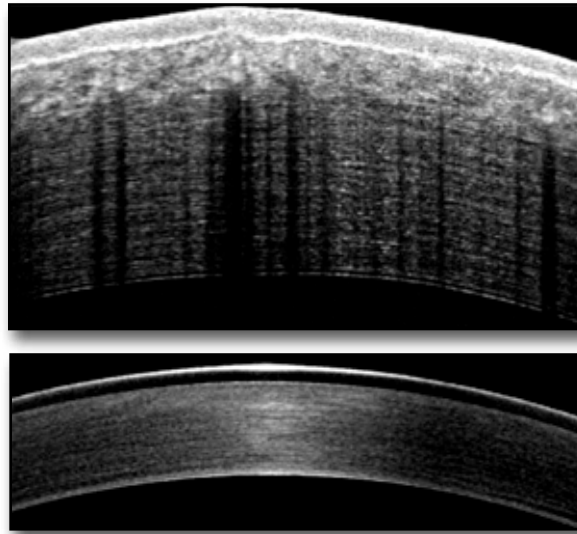


Fig. 2. Optical coherence topography of the cornea demonstrates a marked increase in corneal thickness and altered reflectivity in the outer portion of the cornea in a dog with keratoconjunctivitis sicca (upper) and the appropriate thickness and reflectivity of the cornea in a dog (lower).

eyes are common complications. As a last resort, some owners elect to have their dog's eyes removed rather than suffer with the pain and blindness caused by chronic, severe KCS.

To participate in the study:

Patients that meet the following criteria may be eligible:

1. West Highland White Terriers with KCS of any age (affected)
 - STT <10 mm/min in both eyes (ideally <5 mm/min in both eyes)
 - Clinical signs consistent with KCS
2. West Highland White Terriers >7 years of age (control)
 - STT >15 mm/min in both eyes
 - No ocular abnormalities

Please contact Dr. Sara Thomasy (smthomasy@ucdavis.edu or 530-7520-1770) if you are interested in sending blood samples or to participate with the diagnostics tests or imaging. If you are able to travel to UC Davis, we are currently looking for West Highland White Terriers with KCS to participate in this study. Participants must be available for appointments at UC Davis Veterinary Center, CA. The participants would receive a detailed eye examination and tests to assess the tear film at UC Davis VMTH. Some participants will be selected for non-invasive advanced ocular imaging as well. For further information, here is a link to the clinical trials website which also has detailed information regarding the study:

http://www.vetmed.ucdavis.edu/clinicaltrials/current_trials/by_service/ophthalmology.cfm

Thank you for your time and consideration. Please feel free to contact me with questions anytime.

About the author:

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