Keratoconjunctivitis sicca in canines – diagnostic methods and routine testing

Author : JAMES OLIVER

Categories : Vets

Date : March 17, 2008

JAMES OLIVER discusses how to spot signs of dry eye, confirm a diagnosis and treat the condition

KERATOCONJUNCTIVITIS sicca (KCS), also known as dry eye, is a common cause of ocular disease in dogs. The preocular tear film is typically described as being composed of three layers: aqueous, mucin and lipid.

The aqueous portion is the largest and is produced by the lacrimal and nictitans glands, which respectively contribute approximately two-thirds and one-third of this layer. The smaller mucin and lipid components are produced by the conjunctival goblet cells and by the meibomian glands respectively. KCS is typically characterised by deficiency of the aqueous component of the tear film, but the condition will be exacerbated by any mucin and/or lipid deficiencies.

Clinical signs

Aqueous deficiency causes conjunctivitis, ocular discomfort and keratitis. The corneal pathology is typically chronic and progressive, leading to opacification of the cornea. This can lead, in turn, to visual deficits or even total blindness. Acute KCS is sometimes seen and is associated with severe ocular pain and corneal ulceration.

The clinical signs of dry eye are summarised in Table 1 and some of these are demonstrated in the case in Figure 1.

Aetiology

There are many possible causes of KCS and these are presented in Table 2. The most common cause of canine KCS, however, is immune mediated. Evidence for this comes from histopathological findings of the lacrimal and nictitans glands of KCS cases and the response to treatment with immunomodulators, such as cyclosporine A (CsA)[3]. KCS is often a bilateral disease but may be unilateral, especially in examples of congenital, neurogenic and iatrogenic KCS.

Breeds

Although any breed (or crossbreed) may be affected by KCS, several breeds are disproportionately affected, suggesting a possible genetic predisposition. There have been several studies into which breeds are at greatest relative risk of developing KCS. Those breeds thought to be predisposed to the disease are the cavalier King Charles spaniel, English bulldog, Lhasa apso, shih tzu, West Highland white terrier and pug[2]. There may, however, be some geographical differences in those breeds most predisposed. A UK study of 44 of the most commonly affected breeds in a referral population of 229 cases reported the English cocker spaniel, cavalier King Charles spaniel, West Highland white terrier and shih tzu made up 58 per cent of the cases[4].

Diagnosis of aqueous tear deficiency

Diagnosis of KCS is usually made on the basis of clinical signs and reduced quantitative tear readings. In some cases, staining techniques, qualitative tear testing and even conjunctival biopsy and histopathology are useful in the diagnosis of KCS.

The most commonly used quantitative tear measurement is the Schirmer tear test (STT; Figure 2). STT I measures both reflex and basal tear production and is performed without prior application of topical anaesthetic. The correct method of performing the STT I is demonstrated in Figure 3. Important pitfalls include inadvertently touching the tear test strip at the notched end (the grease from the fingers may interfere with wetting of the strip) and placing it in the wrong position (it must in contact with the corneal surface). The STT I should be performed in all cases of canine conjunctival and corneal disease, unless it is contraindicated to do so. An example would be if there was a real risk of globe perforation, especially with a deep corneal ulcer. STT I readings should be interpreted in association with the clinical signs present in the individual, but the results are generally viewed as follows:

• Around 15mm/min amounts to normal production.

• A result of 11 to 14mm/min equals early or subclinical KCS.

• A result of six to 10mm/min amounts to mild/moderate KCS.

• A result of 5mm/min equates to severe KCS.

Some important pointers when interpreting STT I readings include the following:

• It is advisable to repeat STT measurements in cases of corneal ulceration. Ulceration is painful and, as such, the reflex tear production may be dramatically increased. This may result in a falsely elevated STT I reading. Perform the STT I in the other eye, even if it seems clinically normal. This may give clues to the likely real reading in the affected eye. In addition, consider performing STT II.

• Repeat STT I measurements in cases receiving topical therapy. Recently performed topical therapy may alter STT I readings. For example, atropine may reduce tear production and an application of artificial tears will increase STT I readings.

• Consider the effect that any systemic medications or stress might have on tear production.

• If repeated STT I measurements are normal in the presence of clinical signs that are highly suspicious of KCS, then consider performing a tear film break-up time (TBUT). This is explained later.

• Fluctuations in STT values may occur from day to day. Therefore, if a low STT I reading is recorded in the absence of clinical signs, the test should be repeated on another day.

• Always use the same brand of tear test strip for repeat measurements in a given patient. Variation in absorbency has been reported in tear test strips manufactured by different companies[5].

Other tests for KCS

Occasionally, the STT II is of use in diagnosing KCS, especially in cases where reflex tear production is dramatically increased by the presence of a corneal ulcer. The STT II is performed as follows:

• Apply one drop of topical anaesthetic (such as 0.5 per cent proxymetacaine) to the ocular surface.

• Carefully and gently dry the conjunctival sac by, for example, using a sterile cotton-tipped swab.

• Apply the STT strip in the same way as for the STT I.

The normal STT II reading is approximately half of the STT I. Therefore, if a reading of 7mm/min or less is recorded, one should be suspicious of a diagnosis of KCS.

The phenol red thread test is an indirect measurement of tear production, is subject to less

variation than the STT and is better tolerated by patients. It involves the placement of a 75mm-long yellow thread, which has been impregnated with phenol, into the ventral conjunctival sac. The phenol turns red in alkaline conditions (such as the canine tear film) and the degree of wetting is measured in millimetres per 15 seconds. This test is not affected by topical anaesthesia, but is rarely used in the clinical setting.

The tear film break-up time (TBUT) is useful in cases of mucin and/or lipid deficiency of the preocular tear film. In these cases, STT readings may be normal. One drop of fluorescein is applied to the eye and the patient is allowed to blink. The eyelids are then held open and the clinician examines the tear film on the corneal surface using a light source with a cobalt blue filter in place. The time from the first blink to the presence of the first dry spot (which appears as a dark speck within the sea of green fluorescein) is recorded. The normal TBUT in the dog is reported as 20 seconds, plus or minus five seconds. This technique is still largely underused in the clinical setting.

Staining techniques are occasionally performed. Fluroescein is widely employed in the diagnosis of corneal ulceration, although Rose Bengal is less commonly used. There is dye uptake with Rose Bengal in the presence of devitalised cells and the absence of a mucin overlay. This stain, however, is quite an irritant to the ocular surface.

Secondary bacterial conjunctivitis is relatively common in cases of KCS and so the taking of samples for bacteriology culture and sensitivity may be useful in certain cases.

Conjunctival biopsy is not usually employed to diagnose KCS. However, histopathological examination of conjunctival samples taken from patients with chronic KCS has revealed a decreased number of goblet cells, which are responsible for producing the mucin component of the tear film.

Treatment

A full discussion on treatment of KCS is beyond the remit of this article. However, treatment options for KCS usually include the following:

• **Tear stimulants and immunomodulators.** CsA ointment is the treatment of choice for immunemediated KCS and works by both stimulating tear production and also acting as a local immunosuppressant. This drug should be applied twice daily and its maximum effect may take up to six weeks to occur.

• **Artificial tears.** Aqueous tear substitutes are not retained very well on the ocular surface and so a very high frequency of application is needed. Mucinometics such as Carbomer 980 are very useful for frequent applications during the day. Lipid-based treatments, such as petrolatum, are retained longer on the ocular surface but tend to cause blurring, so their use is best restricted to last thing at night.

• **Antibiotics.** Corneal ulcers and bacterial infections occur commonly in dogs with KCS and so antibiotics are often needed. Topical chloramphenicol and fusidic acid are appropriate firstline treatments while awaiting culture and sensitivity results.

• **Surgery.** A parotid duct transposition is usually only considered as a last resort (such as if medical management fails) and is not without complications. Even after surgery, lifelong management may still be needed to keep the face clean and treat any complications that can occasionally be caused by saliva being present in the eye instead of tears.

The importance of early diagnosis in cases of KCS cannot be overemphasised. As mentioned before, cases that are not diagnosed early or managed appropriately can progress to total blindness. In addition, it has been shown that dogs that are first diagnosed with KCS when they only have STT I values of zero to 1mm/min only have approximately a 50 per cent chance of responding to CsA with increased tear production, whereas if their tear production is 2mm/min or greater, they have a greater than 80 per cent chance of improved lacrimation[3]. This is because the effect of the immunomodulators requires the presence of some functional secretory tissue.

So, in which cases should we be performing an STT? With such a strong breed predisposition, some might argue that we should routinely be testing the usual suspects on a regular basis – even in the absence of clinical signs. There are, however, reasons both for and against this practice. Some dogs will have low STT I readings in the absence of clinically apparent disease. These may represent transient or borderline cases of KCS and should be closely monitored with follow-up examinations, including subsequent STT I measurements. However, these cases only represent a relatively small percentage of overall cases and, as outlined above, STT I readings can fluctuate dramatically from day to day.

Final pointers

With that in mind, the following pointers may be helpful.

• Perform an STT I measurement on *all* cases of conjunctivitis or corneal ulceration in *both* eyes. So, every eye that is red, uncomfortable or that has a discharge should receive a STT 1 test.

• If you are suspicious of KCS but obtain a normal STT I reading, you should repeat the test on another day.

• Consider the ancillary tests for KCS detailed previously if you are consistently getting normal STT I readings in the presence of suspicious clinical signs.

• Once a diagnosis of KCS is achieved, monitor the response to treatment at regular intervals – initially every two to three months. Changes may need to be made to the medication on the basis of clinical signs or diagnostic tests.

• Consider routine testing of predisposed breeds – for instance, at booster vaccinations and check ups. Monitor for any trend towards a decrease in tear production year on year.

• Finally, if you are unsure about a case, don’t be afraid to seek specialist advice as some cases of dry eye can be very complicated.

References

- 1. Carter R and Colitz C M H (2002). The causes, diagnosis, and treatment of canine keratoconjunctivitis sicca, *Veterinary Medicine* **97**: 683-694.
- 2. Helper L. C (1996). The tear film in the dog. Causes and treatment of canine keratoconjunctivitis sicca, *Animal Eye Research* **15**: 5-11.
- 3. Kaswan R L and Salisbury M A (1990). A new perspective on canine keratoconjunctivitis sicca. Treatment with ophthalmic cyclosporine, *Veterinary Clinics of North American Small Animal Practice* **20**: 583-613.
- 4. Sanchez R F, Innocent G, Mould J and Billson F M (2007). Canine keratoconjunctivitis sicca: disease trends in a review of 229 cases, *Journal of Small Animal Practice* **48**: 211-217.
- 5. van der Woerdt A and Adamcak A (2000). Comparison of absorptive capacities of original and modified Schirmer tear test strips in dogs, *Journal of the American Veterinary Medical Association* **216**: 1,576-1,577.

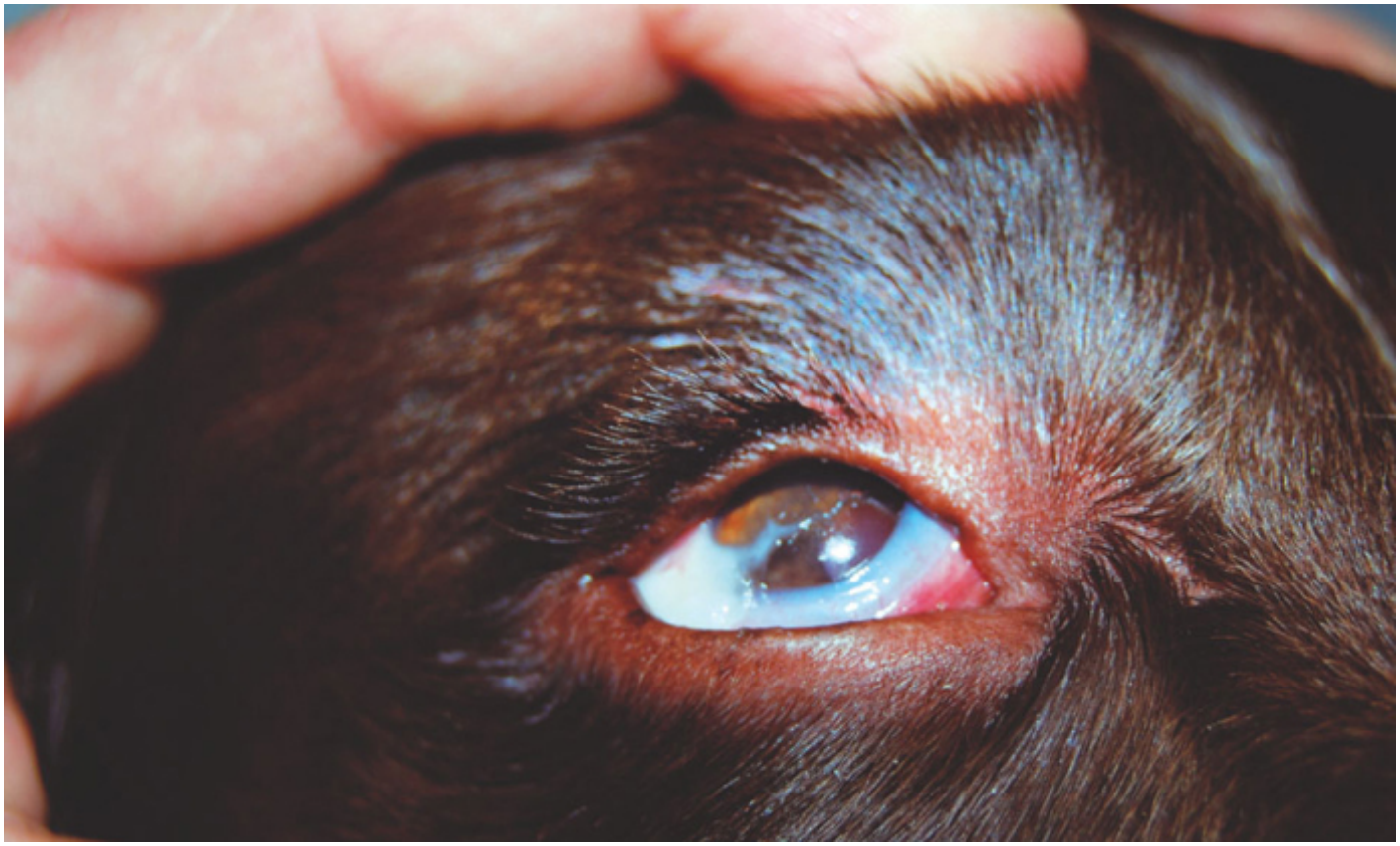

Figure 1. Right eye of a nine-year-old English springer spaniel with KCS. Note the sticky grey/ white discharge and lacklustre appearance of the cornea. This dog had a STT 1 reading of 0mm/minute and was exhibiting pain, blepharospasm, photophobia, enophthalmos, third eyelid protrusion and a miotic pupil (apparently due to a reflex uveitis). The dog had a history of chronic right ear disease and a dry ipsilateral nostril. A neurogenic cause of the KCS was suspected.

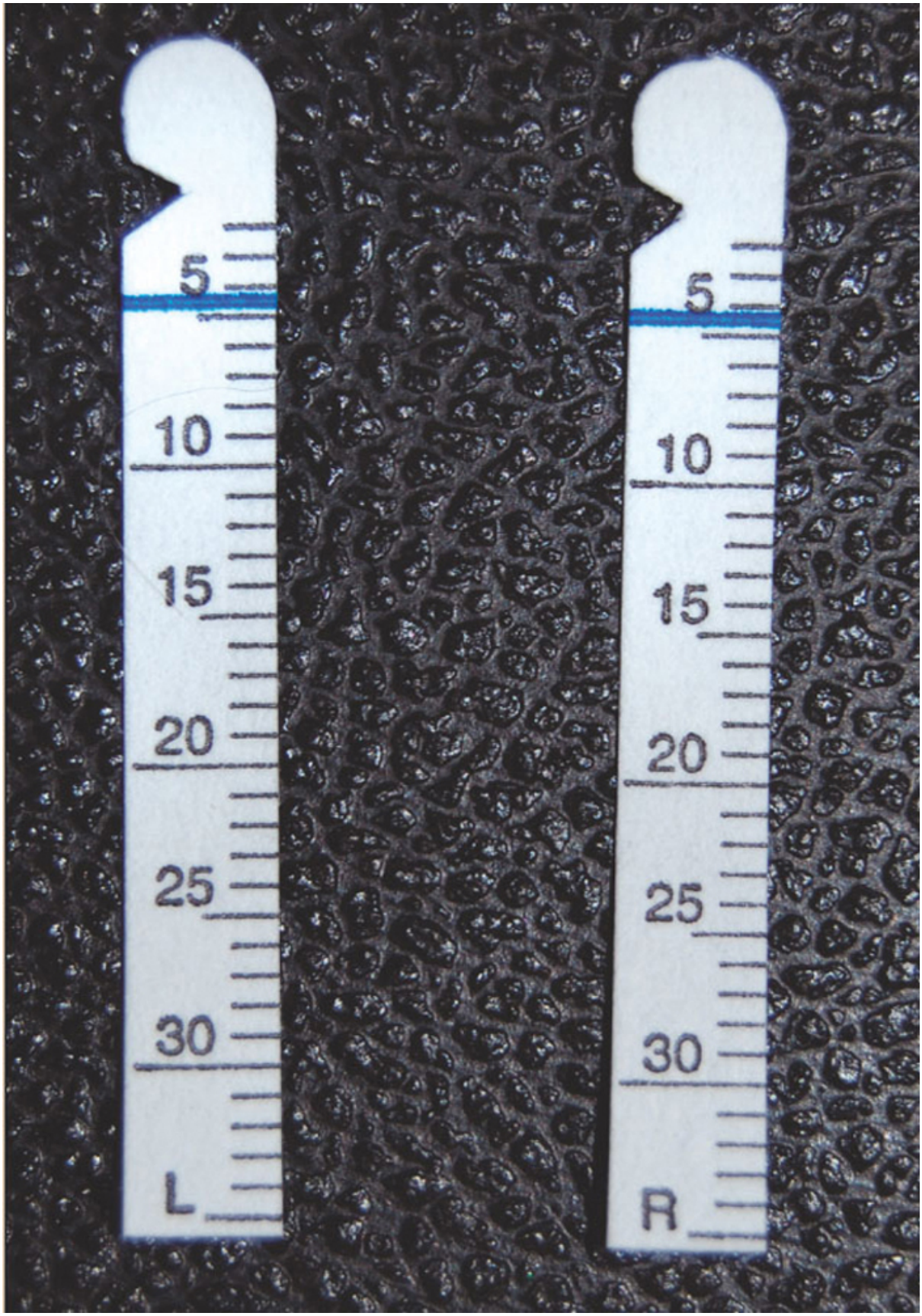
5
10
15
20
25
30
L
5
10
15
20
25
30
R

Figure 2. Commercially available Schirmer tear test strips. The type of strip illustrated above is impregnated with blue dye to facilitate easier reading of the measurements.

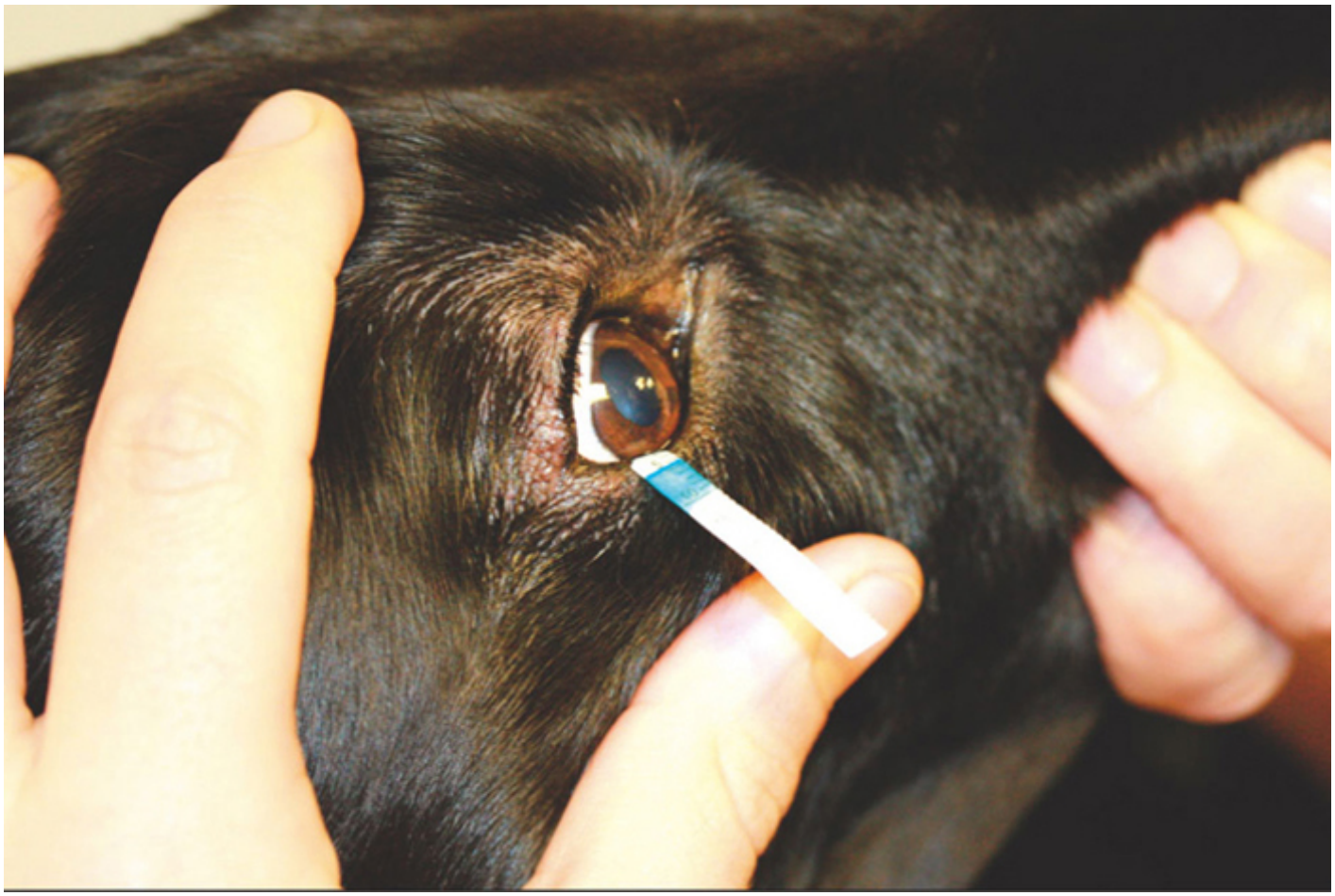

Figure 3. The correct placement of a Schirmer tear test strip. The strip should be placed in the lower eyelid, lateral to the third eyelid, and be in contact with the corneal surface.

Discomfort/ pain	Photophobia, blepharospasm, head shyness, reflex uveitis (miosis)
Conjunctival disease	Hyperaemia, chemosis, ulceration, thickening. – Secondary bacterial infection
Corneal disease	Lacklustre appearance, inflammation, ulceration, oedema, neovascularisation, pigmentation, xerosis
Discharge	Typically grey/white and tenacious. Yellow/green if secondary infection
Extraocular signs	Ear disease, dry nostrils, facial paralysis may be present in neurogenic cases

TABLE 1. Common clinical signs associated with KCS

TABLE 2. Causes of KCS in the dog

- English cocker spaniel
- Cavalier King Charles spaniel
- West Highland white terrier
- Shih tzu
- Lhasa apso
- English bulldog
- Pug

TABLE 3. Breeds predisposed to KCS[2,3]