

# Dry Eye in Dogs: When Good Glands Go Bad

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## Common Causes of KCS

- Congenital conditions (eg, congenital lacrimal aplasia)<sup>13</sup>
- Infectious diseases (eg, canine distemper virus)<sup>14</sup>
- Metabolic conditions (eg, diabetes mellitus, hyperadrenocorticism, hypothyroidism)<sup>1,2</sup>
- Temporary or permanent drug toxicity (eg, from sulfasalazine, trimethoprim sulfa)<sup>15,16</sup>
- Temporary drug side effects (eg, from atropine, general anesthesia)<sup>17-19</sup>
- Trauma (eg, blunt trauma, radiation treatment)<sup>20</sup>

See also **Drugs in Brief**, page 38.

## Introduction

Dry eye, or keratoconjunctivitis sicca (KCS), is a common condition in dogs characterized by decreased tear production that most often results from idiopathic lacrimal gland inflammation with secondary glandular atrophy.<sup>1-3</sup> (See **Common Causes of KCS**.)

Neurogenic KCS is caused by loss of parasympathetic innervation to the lacrimal gland and is less common than immune-mediated KCS. Neurogenic KCS occurs secondary to chronic otitis, peripheral neuropathies, idiopathic disease, and primary neurologic disease.<sup>1,4</sup>



Photos courtesy of Shelby Reinstein, DVM, MS, DACVO

▲ **FIGURE 1** KCS, indicated by mucopurulent ocular discharge, conjunctival swelling and hyperemia, and corneal pigmentation in an 8-year-old English bulldog

Decreased tear production results in corneal and conjunctival cellular hypoxia, debris accumulation, and bacterial overgrowth, causing inflammation of the ocular surface. Clinical signs include conjunctival hyperemia, squinting, and thick, sticky discharge.<sup>1-3</sup> (See **Figure 1**, page 33, & **Clinical Signs of KCS**.)

## TAKE ACTION

- 1** Perform Schirmer tear testing in all dogs with ocular surface inflammation, discharge, or corneal opacification to rule out KCS.
- 2** Set client expectations early by preparing owners for regular follow-up ocular examinations and lifelong medication.
- 3** Implement routine KCS screening at wellness visits for at-risk breeds.

## Clinical Signs of KCS<sup>1,2,4</sup>

### ACUTE (see **Figure 3**)

- Marked pain
- Squinting
- Thick, sticky discharge
- Conjunctival hyperemia
- Corneal edema
- Corneal ulceration
- Dense corneal vascularization

### CHRONIC (see **Figure 1**, page 33)

- Minimal to mild squinting
- Thick, sticky discharge
- Wispy corneal vascularization
- Corneal fibrosis
- Corneal and conjunctival pigmentation

## Diagnosis

KCS should be suspected in all patients with clinical signs, especially in those with breed predisposition. (See **Breeds Predisposed to KCS**, page 36.) Any patient with ocular surface inflammation, discharge, or corneal opacification should undergo the Schirmer tear test (STT), which quantifies the aqueous component of the tear film. Perform the test by placing the tear strip in the ventral conjunctival fornix, approximately midway between the medial and lateral canthi. Take care not to handle the tear strip excessively because oils present on



▲ **FIGURE 2** STT results for a 10-year-old Chihuahua showing neurogenic KCS with abnormal results only in the left eye

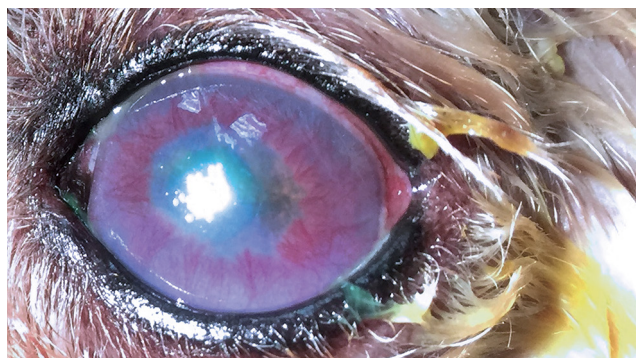
## TABLE 1 | STT Interpretation<sup>1</sup>

Measurement	Diagnosis
>15 mm wetting/minute	Normal
10-14 mm wetting/minute	Early KCS
5-10 mm wetting/minute	Moderate KCS
<5 mm wetting/minute	Severe KCS

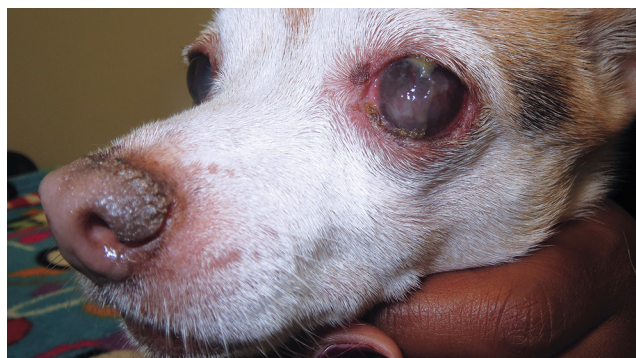
fingers may affect the absorption dynamics.<sup>1,5,6</sup> Leave the strip in place for 1 minute, remove it, and immediately record the measurement. (See **Figure 2** & **Table 1**.)

Once KCS is confirmed by STT results, thoroughly evaluate the patient's ocular and systemic health to rule out underlying conditions such as hypothyroidism. A detailed eye examination, including fluorescein staining, should also be performed.

Neurogenic KCS most often occurs unilaterally, with ipsilateral nasal crusting a common supportive clinical finding.<sup>4</sup> (See **Figure 4**.)



▲ **FIGURE 3** This case of acute KCS in a 6-year-old Cavalier King Charles spaniel is indicated by the diffusely edematous and densely vascularized cornea and the lack of normal corneal reflection. The eye has been stained with fluorescein and rinsed to remove discharge and debris.



▲ **FIGURE 4** This case of neurogenic KCS in a 10-year-old Chihuahua is indicated by severe mucopurulent discharge, conjunctival hyperemia, corneal pigmentation, vascularization, and fibrosis in the left eye, whereas the right eye is normal. Note the ipsilateral nasal planum crusting, a common finding in the neurogenic form of KCS.

## Treatment

KCS is managed medically, often with a combination of agents. (See **Table 2**, page 36.) Refractory cases may require alternative treatments, such as parotid duct transposition or eyelid surgery, by an ophthalmologist. Treatment regimens require periodic adjustments based on serial eye examinations and STT measurements. Lifelong treatment is usually necessary.<sup>1</sup>

### Tear Stimulants

Immunomodulating agents (eg, cyclosporine, tacrolimus), which reduce glandular inflammation and improve tear secretion, are most commonly used to treat KCS. Cyclosporine and tacrolimus are used q8-12h initially; 30 to 45 days are required for full response. In dogs that respond well to initial therapy and achieve STT values >20 mm wetting/minute, treatment may be decreased to q24h or q12h for long-term maintenance. Tear-stimulant therapy is usually lifelong.<sup>1,7-11</sup> (See **Goals of Tear Stimulant Therapy**, page 37.)

### Cholinergic Agents

Cholinergic agents are used to treat neurogenic KCS. Pilocarpine can be administered either topically (ie, as a 0.125% or 0.5% drop) or orally (ie, by adding a commercially available 1% or 2% ophthalmic solution to the patient's food). Topical administration is often quite irritating. Oral administration is effective but may cause systemic side effects with inappropriate doses. Given the markedly narrow safety margin, the dose should be adjusted slowly and the client advised to monitor the patient closely for side effects.<sup>1,4,12</sup>

### Tear Replacements

Many commercial tear replacement products are available to treat tear deficiencies. Veterinarian preference, product availability and cost, and the patient's specific needs determine treatment choice. These medications play a crucial role in KCS management and should be combined with tear-stimulant therapy.

## TABLE 2 | Common Medications for Treating KCS

Purpose	Available Products
Tear stimulants	Immunomodulating agents <ul style="list-style-type: none"> <li>• Cyclosporine (ointment or drops)</li> <li>• Tacrolimus (ointment or drops)</li> </ul> Cholinergic agents <ul style="list-style-type: none"> <li>• Pilocarpine (topical or oral)</li> </ul>
Tear replacements*	Optixcare, Optixcare Plus i-drop Vet Gel GenTeal Severe Relief Gel
Antibiotics	Neomycin – Polymyxin B – Bacitracin ointment Neomycin – Polymyxin B – Gramicidin drops Tobramycin Gentamicin Ciprofloxacin Ofloxacin
Anti-inflammatories	Neomycin – Polymyxin B – Bacitracin + Hydrocortisone Neomycin – Polymyxin B – Dexamethasone ointment or drops Gentocin sulfate + Betamethasone

\*Author's preferences

### Breeds Predisposed to KCS

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

### Antibiotics & Anti-Inflammatories

Secondary bacterial conjunctivitis is common in dogs with KCS because of reduced ocular debris removal and surface inflammation. Broad-spectrum topical antibiotics should be administered in the early stages of treatment, usually q6-8h.<sup>1</sup> As tear levels improve and ocular surface inflammation subsides, administration frequency can be decreased and treatment eventually stopped.

Topical anti-inflammatories or anti-inflammatory and antibiotic combinations are useful in reducing ocular surface inflammation, improving comfort, and diminishing corneal opacities and vascularization.<sup>1</sup>

### Conclusion

KCS is a common ocular condition in dogs that occurs more frequently in predisposed breeds and should always be suspected in patients with ocular irritation signs. Diagnosis is made with the STT. A thorough eye examination helps identify concurrent corneal disease (eg, ulceration). KCS is initially treated with multiple medications that improve tear secretion, provide surface lubrication, and reduce bacterial overgrowth and surface inflammation. Medications can be adjusted as tear production improves; however, therapy with tear stimulants is almost always lifelong. ■

### References

1. Giuliano E. Diseases and surgery of the canine lacrimal secretory system. In: Gelatt KN, Gilger BC, Kern TJ, eds. *Veterinary Ophthalmology*. 5th ed. Ames, IA: John Wiley & Sons, Inc; 2013:912-944.
2. Sansom J, Barnett KC. Keratoconjunctivitis sicca in the dog: a review of two hundred cases. *J Small Anim Pract*. 1985;26(3):121-131.
3. Kaswan RL, Martin CL, Chapman WL Jr. Keratoconjunctivitis sicca: histopathologic study of nictitating membrane and lacrimal glands from 28 dogs. *Am J Vet Res*. 1984;45(1):112-118.
4. Matheis FL, Walser-Reinhardt L, Spiess, BM. Canine neurogenic keratoconjunctivitis sicca: 11 cases (2006-2010). *Vet Ophthalmol*. 2012;15(4):288-290.
5. Williams DL. Analysis of tear uptake by the Schirmer tear test strip in the canine eye. *Vet Ophthalmol*. 2005;8(5):325-330.
6. Hartley C, Williams DL, Adams VJ. Effect of age, gender, weight, and time of day on tear production in normal dogs. *Vet Ophthalmol*. 2006;9(1):53-57.
7. Kaswan RL, Salisbury MA. A new perspective on canine keratoconjunctivitis sicca. Treatment with ophthalmic cyclosporine. *Vet Clin North Am Small Anim Pract*. 1990;20(3):583-613.
8. Olivero DK, Davidson MG, English RV, Nasisse MP, Jamieson VE, Gerig TM. Clinical evaluation of 1% cyclosporine for topical treatment of keratoconjunctivitis sicca in dogs. *J Am Vet Med Assoc*. 1991;199(8):1039-1042.
9. Morgan RV, Abrams KL. Topical administration of cyclosporine for treatment of keratoconjunctivitis sicca in dogs. *J Am Vet Med Assoc*. 1991;199(8):1043-1046.
10. Berdoulay A, English RV, Nadelstein B. Effect of topical 0.02% tacrolimus

## Goals of Tear Stimulant Therapy<sup>1,8-11</sup>

- Decrease or eliminate ocular discharge
- Eliminate squinting
- Reduce redness
- Reduce corneal vascularization
- Reduce corneal pigmentation

aqueous suspension on tear production in dogs with keratoconjunctivitis sicca. *Vet Ophthalmol.* 2005;8(4):225-232.

11. Hendrix DV, Adkins EA, Ward DA, Stuffle J, Skorobohach B. An investigation comparing the efficacy of topical ocular application of tacrolimus and cyclosporine in dogs. *Vet Med Inter.* 2011;2011:487592. doi:10.4061/2011/487592
12. Smith EM, Buyukmihci NC, Farver TB. Effect of topical pilocarpine treatment on tear production in dogs. *J Am Vet Med Assoc.* 1994;205(9):1286-1289.
13. Westermeyer HD, Ward DA, Abrams K. Breed predisposition to congenital alacrima in dogs. *Vet Ophthalmol.* 2009;12(1):1-5.
14. Martin CL, Kaswan R. Distemper-associated keratoconjunctivitis sicca. *J Am Anim Hosp Assoc.* 1985;21(3):355-359.
15. Klauss G, Giuliano EA, Moore CP, et al. Keratoconjunctivitis sicca associated with administration of etodolac in dogs: 211 cases (1992-2002). *J Am Vet Med Assoc.* 2007;230(4):541-547.
16. Trepanier LA, Danhoff R, Toll J, Watrous D. Clinical findings in 40 dogs with hypersensitivity associated with administration of potentiated sulfonamides. *J Vet Intern Med.* 2003;17(5):647-652.
17. Herring IP, Pickett JP, Champagne ES, Marini M. Evaluation of aqueous tear production in dogs following general anesthesia. *J Am Anim Hosp Assoc.* 2000;36(5):427-430.
18. Dodam JR, Branson KR, Martin DD. Effects of intramuscular sedative and opioid combinations on tear production in dogs. *Vet Ophthalmol.* 1998;1(1):57-59.
19. Sanchez RF, Mellor D, Mould J. Effects of medetomidine and medetomidine-butorphanol combination on Schirmer tear test 1 readings in dogs. *Vet Ophthalmol.* 2006;9(1):33-37.
20. Spugnini EP, Thrall DE, Price GS, Sharp NJ, Munana K, Page RL. Primary irradiation of canine intracranial masses. *Vet Radiol Ultrasound.* 2000;41(4):377-380.



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**FUN FACT:** Shelby and her husband are amateur wine enthusiasts. After learning the basics in Napa Valley, they continue to enjoy food pairings and tastings at local wineries in Bucks County, Pennsylvania.

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