



2 Simple Tests for Assessing Ophthalmic Health

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Schirmer tear testing and fluorescein staining of the cornea provide important information about a patient's ophthalmic health. (See [Schirmer Tear Test & Fluorescein Stain](#), page 22.) The Schirmer tear test (STT) measures basal tear production and reflex tear response and is often used to diagnose keratoconjunctivitis sicca (KCS).¹ Basal tears are normal tears produced daily to lubricate and nourish the ocular surfaces.²

The STT is performed by inserting an absorbent paper test strip between the lower eyelid and cornea and measuring the length of strip that absorbs moisture in 1 minute. The result is then compared with established normal values.

Fluorescein is a water-soluble stain applied to the cornea to detect corneal ulcers. The stain appears orange in high concentration, such as on the commercial strip, but green when diluted with saline. The stain does not penetrate the intact corneal epithelium but adheres to the hydrophilic stroma when a break in the epithelium occurs.

See also [Drugs in Brief](#), page 38.

Schirmer Tear Test & Fluorescein Stain

The Schirmer tear test measures basal tear production and reflex tear response and is often used to diagnose keratoconjunctivitis sicca.

INDICATIONS

- Any patient that presents with an ocular problem
- Most importantly, patients with
 - Blepharospasm
 - Diabetes mellitus
 - Facial nerve paralysis
 - Hyperadrenocorticism
 - Hyperemia
 - Hypothyroidism
 - Mucoïd discharge
 - Prolapsed gland of the third eyelid

Fluorescein is a water-soluble stain applied to the cornea to detect corneal ulcers.

INDICATIONS

- Red and/or painful eyes, including those with suspected keratoconjunctivitis sicca
- Patients being treated with topical steroids

I ndications for Testing

Ophthalmology practices may routinely include Schirmer tear testing in all new patient examinations, but in general practice, testing typically is performed only in patients with signs of ophthalmic disease, including mucoïd or crusty discharge, dull corneal surfaces, and prolapsed third eyelid glands.³

Canine breeds predisposed to KCS (eg, bulldogs, Lhasa apsos, West Highland white terriers, cocker spaniels) should undergo Schirmer tear testing at every wellness visit.^{3,4} KCS occurs less commonly in cats,⁵ so feline patients are not tested routinely. Diagnosing KCS in cats can be difficult because they have sympathetic control over their lacrimal glands and an accurate STT measurement cannot be obtained.⁶ Patients receiving treatment with sulfonamides should also undergo Schirmer tear testing before and during treatment because sulfonamides have been shown to be cytotoxic to lacrimal gland tissue.^{4,7} Twenty-five percent of dogs treated with sulfonamides develop KCS.⁸ Anticholinergic drugs used systemically and topically are also known to transiently decrease tear production.⁹

TAKE ACTION

When used appropriately, Schirmer tear testing and fluorescein staining are simple, effective tools for diagnosing ophthalmic disorders.

- 1 Take care not to handle the end of the Schirmer tear test strip because oils from the skin can alter the results.
- 2 Touch only the conjunctiva when applying fluorescein stain to the eye to avoid damaging the cornea.
- 3 Ophthalmology practices include testing in all new patient examinations, but general practices should test patients based on history and clinical signs.

In addition to identifying abnormal lacrimation, Schirmer tear testing helps diagnose other ophthalmic conditions. Epiphora, an increase in tear production, is a sign of ocular discomfort. If the STT reading is excessive (ie, >30 mm wetting/minute), causes of ocular discomfort (eg, entropion, ectopic cilia, distichiasis, corneal ulcers) should be explored. Epiphora can also result from a conformational abnormality such as the absence or abnormally small opening of nasolacrimal puncta or medial entropion occluding the nasolacrimal puncta.¹⁰

Proper Patient Restraint

Proper patient restraint helps ensure successful Schirmer tear testing and fluorescein staining. Most patients respond best to minimal restraint. When restraining a dog, place one hand behind the head and one hand under the chin. (See **Figure 1**.) With cats, place 2 thumbs behind the ears and the index fingers under the jaw. (See **Figure 2**.)

The Schirmer Tear Test

Perform the STT before instilling any medication in the



Photos courtesy of Pamela K. Kirby, RVT

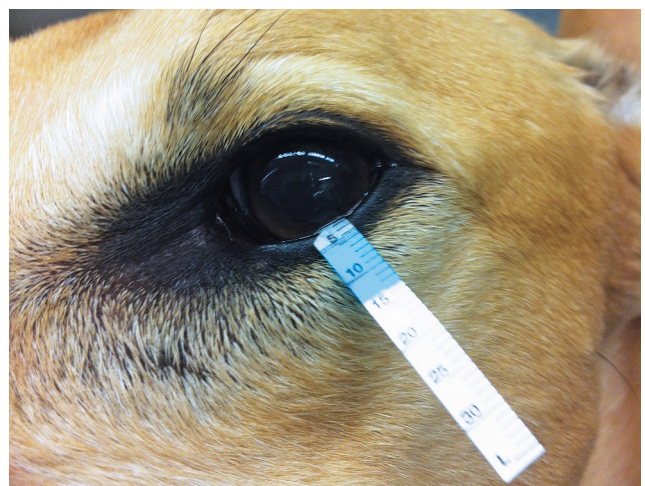
▲ **FIGURE 1** Proper restraint of a dog for Schirmer tear testing and fluorescein staining



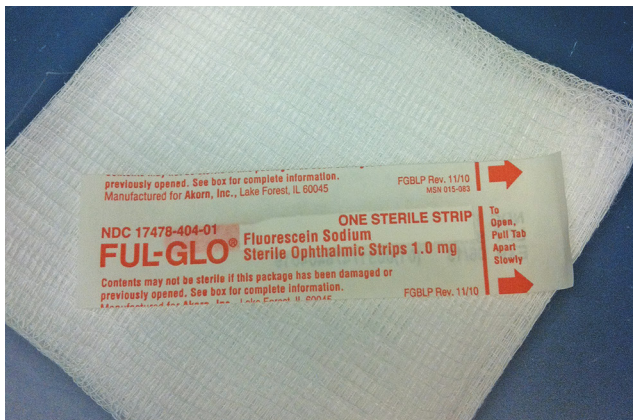
▲ **FIGURE 2** Proper restraint of a cat for Schirmer tear testing and fluorescein staining



▲ **FIGURE 3** Sterile Schirmer tear test strips with left and right labeled for convenient reference



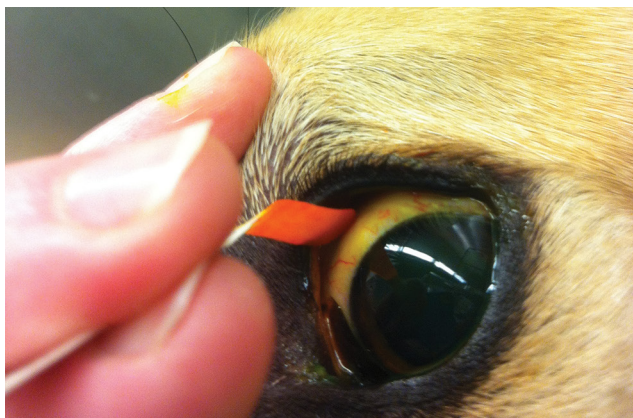
▲ **FIGURE 4** Correct placement of a Schirmer tear test strip in a canine patient's eye



▲ **FIGURE 5** Sterile fluorescein test strips



▲ **FIGURE 6** Fluorescein test strip moistened with sterile ophthalmic solution, which changes color after contact with the strip



▲ **FIGURE 7** Proper application of fluorescein dye to a canine patient's eye



▲ **FIGURE 8** Break in the epithelial surface, indicated by the area of bright green after fluorescein dye application

eye. Clients should be advised to stop giving their pet any ophthalmic medications at least 2 hours before tear measurement.¹¹ Any thick mucus present on the cornea or in the conjunctival sac should be gently removed with a cotton ball or gauze square to prevent the mucus from interfering with the test.

The STT package contains 2 sterile strips. (See **Figure 3**, page 23.) Before opening the package, bend the strip approximately 90° at the notch near the rounded end. Open the package at the opposite end to avoid touching the rounded tips and contaminating the strips with oil from the skin.² Test each eye separately. Insert the bent, rounded tip of the strip between the lower eyelid and

cornea approximately one-half to two-thirds of the eyelid length away from the medial canthus. (See **Figure 4**, page 23.) The strip should not sit between the third eyelid and lower lid. If the patient will not remain still, gently hold the eyelids closed. The strip should be left in place for 1 minute, removed, and read immediately using the scale on the strip. The line at which the moisture stops wicking is the result—moisture may or may not correspond to the blue dye on the strip.

A normal value for dogs is ≥ 15 mm wetting/minute.¹⁰ A 10 to 15 mm wetting/minute result in dogs is considered borderline and treatment should be instituted if the patient is showing clinical signs of KCS. If the patient is

not showing any clinical signs, the tear values should be rechecked at the next visit. Results <10 mm wetting/minute in dogs should be considered indicative of KCS and treatment instituted.¹⁰

Fluorescein Staining

Always use sterile fluorescein strips (see **Figure 5**) or single-use sterile vials of fluorescein dye to stain the cornea because multi-use vials are easily contaminated. Moisten a sterile strip with sterile ophthalmic solution (see **Figure 6**) and touch the strip to the conjunctiva (see **Figure 7**), or allow the dye to drip from the strip onto the corneal surface. If using single-use vials, allow 1 or 2 drops of the solution to flow over the cornea and into the lower conjunctival fornix.¹² To prevent the strip from creating microabrasions on the corneal surface, do not allow the strip to directly touch the cornea. Allow the patient to blink, or gently close and open the eyelids to ensure the cornea is completely covered with the stain and then gently irrigate the eye with sterile ophthalmic solution.

A break in the epithelial surface appears bright green. (See **Figure 8**.) Using an ultraviolet or cobalt blue light enhances stain-uptake visualization. Roughened areas of the cornea may appear as a light green haze, indicating corneal scarring from previous injuries, including abrasions caused by STT strips. Light green hazing can also indicate stain is beginning to leak under the loose edges of the epithelium of an indolent ulcer. If a green stain is donut- or halo-shaped with no stain uptake in the center of the circle, a descemetocele should be suspected. Fluorescein stain does not adhere to the lipid-rich Descemet's membrane.^{13,14}

Conclusion

Schirmer tear testing and fluorescein staining are effective tools for diagnosing ophthalmic disorders in veterinary patients. Patients with a predisposition for KCS should be monitored annually using the STT. Both

tests require minimal patient restraint. Prepackaged test strips make performing the tests convenient in specialty and general practices. ■

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PAMELA K. KIRBY, RVT, has been an ophthalmology nurse at Purdue University College of Veterinary Medicine for 15 years. She is a member of NAVTA, the Veterinary Ophthalmic Technician Society (VOTS), and the newly approved Academy of Veterinary Ophthalmic Technicians (AVOT). Pam has served as an unseated board member, secretary, and vice president of VOTS during the last 10 years. She currently serves as secretary of the AVOT organizing committee. Pam teaches veterinary students ophthalmology and veterinary nursing students the technical skills needed to perform a proper ophthalmic examination. Her clinical interests include equine ophthalmology, advanced imaging of the eye globe and orbit, and ophthalmic surgery.

FUN FACT: Pam is a crazy sports mom and avid NASCAR and Colts fan. She once made her kids stand in line with her for hours to get Dale Earnhardt Jr's autograph.