The Eye Exam: Achieving Success by Mastering Ocular Anatomy, Physiology, and Diagnostic Techniques

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Abstract

Stop being afraid of eye cases! The key to successful management of ophthalmic disease is a strong foundation in "the basics." As such, this lecture will promote a thorough understanding of ocular anatomy and physiology of the canine and feline eye through a clinically relevant review of these topics. This information will then be used to guide a systematic approach to the ophthalmic examination and associated diagnostic tests, which will enable the clinician to make accurate diagnoses and initiate appropriate therapy in their patients.

1. PUPILLARY LIGHT REFLEX (PLR)
    a. **Direct Reflex:** Shine light directly into the eye and observe the pupil for rate and degree of constriction.
    b. **Indirect Reflex:** Shine light directly into one eye and observe the other pupil for rate and degree of constriction.
        i. The "swinging light test" can be used to get a rough idea of the indirect reflex. Shine the light in the first eye until complete pupillary constriction has occurred, and then quickly direct the light at the other eye and note the pupil size of this second eye.
    c. Anatomy of PLR and visual pathway:
        i. Optic nerve (CNII) - from eye to optic chiasm
        ii. Optic chiasm - area where optic nerves join behind the eye. The more medial fibers cross, the more lateral fibers don't cross.
        iii. Optic tracts - nerve fibers from the optic chiasm to the lateral geniculate body
        iv. Optic radiations - nerve fibers from the lateral geniculate body to the visual cortex located at the back of the occipital lobe for visual pathway
        v. Impulse causing pupillary light reflex separates from the visual pathway adjacent to the lateral geniculate body. The pupillomotor fibers leave the lateral geniculate body and travel into the midbrain. Most cross back over between the pretectal nucleus and the parasympathetic nucleus of the oculomotor (3rd cranial) nerve, travel back to the eye via the oculomotor nerve, and into the eye via the ciliary nerves that enter the eye adjacent to the optic nerve.
            1. **Since the pupillomotor fibers split from the visual fibers prior to the optic radiations, the visual cortex has NO effect on the PLR. Hence, a dog with a brain tumor in the visual cortex might be blind but would have normal PLRs.**

2. SCHIRMER TEAR TEST (STT)
    a. Used to diagnose an AQUEOUS tear deficiency, in combination with clinical signs consistent with keratoconjunctivitis (hence KCS – keratoconjunctivitis sicca).
        i. Normal = 15 mm/min and over
        ii. Gray zone = 10-15 mm/min suspicious of hyposecretion, **if clinical signs are also present.**
        iii. Abnormal = Below 5 mm/min is diagnostic for hyposecretion, **if clinical signs are also present.**
    b. **Perform the test before applying eyewash, anesthetic, etc., to the eye.** If you forget, dry the eye carefully with a cotton ball, wait at least five minutes, and conduct the test.

i. **Performing a STT after topical anesthetics have been administered will lower the result by ~50% (Schirmer I).** Be sure to gently blot/absorb all topical anesthetic and pooled tears from the lower conjunctival cul-de-sac prior to starting the test.

c. Bend the end of tear test strip by 90° (**while still in the protective packaging**) and hook the bend end over the lower lid. Do not touch the tip of the strip with your fingers as the oils and secretions from your hand may influence the results. Time for 1 minute. Remove immediately and measure length of moistened portion.

3. FLUORESCEIN STAIN
    a. Tear Film Breakup Time – used to assess tear film *quality* (i.e., lipid and mucoid components).
        i. Place stain on eye, blink for the dog, and then hold the eyelids open while watching the tear film. The stain should start to clump/splotch. If it does in less than 20 seconds, lipid/mucin quality or quantity is abnormal. A general splotchiness to the ocular surface can be noted following fluorescein staining as well with severe abnormalities.
    b. Jones Test – used to assess nasolacrimal patency from the puncta to the nasolacrimal orifice.
        i. Place a large amount of stain on the eye and watch for it to come out of the nose. Watch closely – dogs can lick it up, or it can escape further back from the tip of the nose. Some animals, even some dogs, have oral exiting of the nasolacrimal duct – this is particularly true for brachycephalics, who often have such tortuous ducts that the Jones Test is not reliable.
        ii. If positive, the duct is patent. However, a negative test does NOT confirm a blockage/stenosis.
    c. Corneal Ulcer Test
        i. If there is a break in epithelium, fluorescein stain will penetrate and stain the stroma. Only the stroma binds fluorescein! Be sure to rinse well to remove any pooled stain, especially if the corneal surface is irregular. You cannot "rinse off" positive corneal staining.
        ii. Can help determine the stage of ulcer healing based on epithelial characteristics, depth, and the type of ulceration.
        iii. Strips are better than solutions. Solution may become contaminated with *Pseudomonas* and other bacteria.
    d. Seidel Test – used to assess for aqueous humor leakage from a corneal rupture/penetration site.
        i. Place a large amount of stain directly over and below the suspected leak site. Do not allow the animal to blink, and, while holding the lids open, watch the site with a cobalt blue light. A positive test, or leak, is indicated by streaming of the stain away from the site due to outflowing aqueous humor.

4. NASOLACRIMAL FLUSH – a diagnostic and therapeutic technique.
    a. Used to diagnose a nasolacrimal blockage when Jones Test is negative or inconclusive
    b. Used to isolate the location of the blockage if located within either one of the canaliculi vs. the nasolacrimal duct or sac.
    c. Used to treat a blockage by flushing out debris acting as a nidus of infection and/or inflammation
    d. Canulate either the dorsal or ventral puncta while holding off at the canaliculus, thus flushing out each canaliculus. Then hold off the opposite canaliculi to flush down the duct to the nose.

5. TONOMETRY - used to measure intraocular pressure for diagnosis of uveitis and glaucoma.
    a. Two types:
        i. Applanation tonometers measure intraocular pressure, or tension, by detecting the

pressure necessary to flatten a small area of cornea. Tono-Pen is an applanation tonometer.

1. Advantages
    a. Simple in operation
    b. Less expensive
2. Disadvantages
    a. Risky when a deep corneal ulcer is present.

ii. Rebound tonometers measure intraocular pressure by detecting the "rebound" of the probe as it gently touches the cornea. TONOVET is a rebound tonometer.

1. Advantages
    a. More accurate to detect glaucoma and monitor effect of treatment compared to actual intraocular pressure.
    b. Does not require topical anesthesia.
2. Disadvantages
    a. Less reliable with high intraocular pressures and confounding corneal abnormalities (severe edema, anterior lens luxation, etc.)
    b. Must be held horizontally

b. Avoid neck restraint and muzzles, and open the eye from the FACE/ORBIT, NOT THE EYELIDS! IOP can artificially be elevated to extreme amounts.
c. A normal reading in dogs is 10-20 mmHg. Low readings are suspect for uveitis, high readings are suspect for glaucoma. Older dolichocephalic dogs can have lower pressures as orbital fat is lost with age. Stressed or exuberant dogs that require force to open eyes will often have artificially elevated IOPs. Keep in mind the impact of anterior uveitis – a high-normal pressure (e.g., 18-20 mmHg) in the face of active uveitis is concerning for the development of glaucoma!