The Basics to an Ophthalmic Examination of the Anterior Segment: Procedure and Interpretation

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Abstract: Ideally, a complete ophthalmic examination consists of an external examination, followed by specific tests including the minimum ophthalmic database of Schirmer tear test, tonometry, and fluorescein staining, followed by ophthalmoscopy through a dilated pupil. A systematic approach is key to establish a consistent routine and to ensure proper interpretation of these diagnostic tests, as improper order or technique could alter results and impede accurate diagnosis of clinical diseases. The objective for this presentation is to identify and discuss major proponents of an ophthalmic examination, with a focus and emphasis on the anterior segment. The ophthalmic examination diagnostic tests and their interpretations will be discussed, as well as the clinical significance of their normal and abnormal findings.

Keywords: Ophthalmic exam, anterior segment

The Ophthalmic Exam

- It is important to have a systematic approach to the ophthalmic exam in order to be consistent and establish a routine.
- The minimum Ophthalmic Database are diagnostic tests that should be performed with every ophthalmic examination. This includes the Schirmer Tear Test (STT), Intraocular Pressure (IOP), and Fluorescein staining

    - Additional testing that can be performed depending on the case includes the tear break up time (TBUT), Tear osmolarity, and Rose Bengal staining.
- Instruments/Supplies necessary for a complete exam[1] include:
    - Focal light source such as a Finnoff transilluminator. A pen light will not provide enough focused light for the exam.
    - Direct Ophthalmoscope and indirect fundoscopic lens. I recommend a 2.2 Diopter lens
    - Schirmer tear test strips, Fluorescein strips,Tonometer (Tono-Pen, Tonovet)
    - Tropicamide (1%) for dilated examination, to be applied AFTER STT and IOP. This medication is contraindicated in cases of elevated intraocular pressures.
    - Proparacaine (0.5% topical anesthetic) as needed
    - Sterile eye wash
    - Magnifying loupes (ie Optivisor) for examination, also recommended for basic ophthalmic procedures or surgery
- The order of examination is important to have a complete and systematic approach.
    - A neuro-ophthalmic examination should be first to evaluate menace response, dazzle reflex, pupillary light response, palpebral reflex, ocular movement, and vestibulo-ocular reflex or “doll’s eye”.
    - Sequentially examine anterior segment with light source and magnification in dim light or preferably a dark room.
    - A Schirmer tear test should be performed before application of topical drugs

    - After a STT, the next diagnostic is tonometry with either a Tono-Pen or Tonovet. If the reading is normal or low, administer tropicamide for dilation. This medication takes 15-25 minutes to induce mydriasis and lasts up to 4-6 hours.
    - Culture/cytology (if indicated) should be performed prior to Fluorescein stain.
    - Fluorescein stain and Tear break up time
    - Dilated fundic examination- indirect ophthalmoscopy with a lens allows for an overview of the fundus, while the direct ophthalmoscope is better for evaluating lesions due to the higher degree of magnification.
- Evaluation of the cornea should be performed in a dark room utilizing direct illumination as well as retro-illumination to highlight lesions.
    - A general rule of thumb for corneal opacities is that: Red= vessels, Blue= edema, White= deposits (lipid or mineral), Brown= pigment, Yellow= cellular infiltrate, Gray= fibrosis
    - The location of the lesion in the cornea may provide information regarding the underlying cause, such as a nasal corneal ulcer due to a foreign body under the third eyelid.
- Schirmer Tear Test I (STT)
    - The STT is the first diagnostic test, as this should be done before applying any medications to the eye. It measures both basal and reflex tears; placement should be in the middle lower conjunctival fornix.[2]
    - This test is important in cases of corneal ulceration, as patients with KCS are predisposed to ulcers. This can help adjust the treatment plan for these patients,

such as withholding atropine and starting a lubricant until they are healed, then adding in a tear stimulant like Cyclosporine or Tacrolimus.

  - Canine normal STT values: 20 +/- 5 mm/min. This reading should be based on the line of wetting on the paper, which may not coincide with the dye on the strip.
  - If a corneal ulcer is present, there will be reflex tearing. Compare to the STT of the other eye, as immune mediated KCS is usually bilateral.
  - While dry eye in cats is rare, it can be associated with Herpes Virus. STT in the cat can be variable, especially with sympathetic overdrive, so a low value without clinical signs should be interpreted with caution. The findings should be paired with clinical signs and other tests to evaluate tear film, such as a tear break up time.[3]

- Intraocular Pressure
  - Normal IOP is 15-25 mmHg. Lower readings can be seen in older animals or cases of anterior uveitis (<10 mmHg). This test is important to perform any time you are working up a red eye, or if you plan on administering atropine or tropicamide, as these medications are contraindicated in glaucoma cases (>25 mmHg).
  - I usually take the a few readings and then use the lowest pressure reading. It is easy to artificially elevate a pressure, so restraint is key, like having a technician gently hold the mandible with one hand and behind the head at the level of the occipital protuberance with the other. When holding the eye open, place pressure on the periorbital rim to prevent pressure on the eye and without pulling the

eyelids laterally. There should be no tight collars or pressure around the neck, which can increase readings.

- Applanation vs rebound tonometry
    - Tono-Pen- The Tono-Pen works by flattening the cornea (applanation), takes multiple readings, and then displays the average. The good thing about the Tono-Pen is that it is better option for use in diseased corneas and works in any position. In order to use the Tono-pen, proparacaine must be applied for topical anesthesia. The readings used should be with the 95% error shown on the screen. If more than one reading is taken, the lowest reading should be used, rather than averaging readings.
    - TonoVet- The TonoVet utilizes “rebound” tonometry. The portable hand-held unit is about 1/4" away from the cornea. The small probe hits the cornea and then averages 6 measurements; the probe needs to be parallel to the ground in order to work. No topical anesthesia is required and there are different settings for species- dogs, horses, and pocket pets.
- Cytology and Culture: Cytology can be used to evaluate corneal ulcers and conjunctival lesions, such as conjunctivitis in cats which is usually infectious in nature. Culture, both aerobic and fungal, are recommended for corneal ulcerations. These samples can be obtained using a Kimura spatula, handle end of a #15 scalpel blade, or cytobrush. Prior to obtaining a sample, proparacaine should be applied. Since fluorescein can be bacteriostatic, these tests should be performed before staining.
    - When obtaining a sample, resting your hand on the face/nose will make your hand move with the patient’s head and prevent iatrogenic damage to the eye.

- Fluorescein Stain uses include staining for corneal ulcers, the tear break up time, the Jones test for nasolacrimal system patency and the Seidel test to evaluate for aqueous humor leakage
    - For corneal ulcers, fluorescein adheres to the corneal stroma but not descemet's membrane, so descemetoceles do not take up stain.
    - Cobalt blue light enhances stain uptake- make sure your direct ophthalmoscope has this light, rather than the red-free green light
    - The other option for a cobalt blue light is the Eidolon BLUMINATOR®, an Illuminator lens that gives 7.5x magnification and can be ordered with a cobalt blue light or white light.
- Tear Break Up Time (TBUT) is used to evaluate the tear film quality. To perform this test, apply fluorescein stain to the eye, allow the animal to blink its eyelids, then examine with a cobalt blue light for areas of drying, which appear as dark spots.
    - Normal TBUT is 20 +/- 5 seconds
    - Can have a normal STT but a low (<10 seconds) TBUT, which indicates a qualitative tear film abnormality.
        - This could be due to a decreased lipid component, decreased mucus component, or exposure
- Dogs with low TBUT and clinical signs of mucoid discharge or corneal pigmentation would benefit from treatment with a tear stimulant like cyclosporine or tacrolimus. The Jones Test is used to evaluate patency of the nasolacrimal system
    - Apply fluorescein to the eye, it should be seen coming out of the nose within 5 minutes

    - This test is helpful in cases of epiphora or tear staining, where you suspect the nasolacrimal duct to be blocked. It can help determine if the duct needs to be flushed or if it is patent.
    - Stain can drain caudally into the nasopharyngeal region, so a negative Jones test does not always mean there is an obstruction
- The Seidel test is used to evaluate deep corneal ulcers, lacerations, or descemetoceles for perforation
    - Apply fluorescein to the eye, if the lesion is actively leaking there will be a trail of aqueous through the fluorescein
- Rose Bengal Stain is used to identify devitalized epithelial cells
    - Apply the Rose Bengal and then evaluate with a white light
    - Positive in cases with Herpetic epithelial ulcers or keratoconjunctivitis sicca
    - Recommended for every feline case
- Tear Osmolarity can be measured with the I-PEN® Osmolarity System (OcuSOFT) or the TearLab™ Osmolarity System
    - Osmolarity readings lower than 325.5 mOsm/L indicate dry eye disease.[4]
    - This is a newer device that can be used to measure the osmolarity (concentration of dissolved salts in solution) of tears in normal and dry eye disease patients. This is a quick and simple method for determining tear osmolarity by measuring the tear soaked palpebral conjunctiva.
- In conclusion, the sequence of examination should be consistent and include a STT, Tonometry, and Fluorescein as part of a complete exam.
- There are other tests available, such as tear break up time, Rose Bengal, Tear Osmolarity.

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