

The 25th Annual

# Waltham/OSU Symposium

## Small Animal Ophthalmology

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### Diagnostic Examination of the Eye

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### Culture

#### *Indications*

1. Chronic, non responsive corneal ulcer
2. Acute, severe melting corneal ulcer
3. Purulent ocular discharge
4. Infectious blepharitis

The principles and techniques for obtaining a culture from the eye are the same as for elsewhere. A sterile swab, moistened in transport media, is used. The sample is taken in an aseptic manner specifically from the area of concern. In other words if the lesion is a corneal ulcer the swab is touched to the ulcer, and not placed into the conjunctival fornix. No topical anesthetic is used for this procedure as it will interfere with the growth of organisms. The sample is then labeled and submitted for aerobic and possibly fungal culture and sensitivity. It should be streaked onto nutrient agar as soon as possible.

### Schirmer Tear test

#### *Indications*

1. Assessment of normal tear production
2. Chronic mucoïd epiphora
3. Chronic pigmentary keratitis
4. Epiphora

The prepackaged, sterile strips are removed and the notched end is placed in the lower conjunctival fornix. Do not touch this end. The eye is held closed and the strip allowed to remain in place for exactly 1 minute. If convenient both eyes may be tested at the same time. The strip is then removed and using the standard measurement on the package the tear production is measured and recorded. Normal dogs should secrete 15 mm or more in one minute. Topical anesthetic is not used for this test as we are measuring the response of the eye to an irritant. This requires the ophthalmic branch of cranial nerve 5 as the afferent arm and the parasympathetic fibers in cranial nerve 7 as the efferent arm.

### Fluorescein sodium

Yellow water-soluble dibasic acid dye of the xanthine series. Gives an intense green fluorescent color in alkaline (above pH 5) solution. The normal precorneal tear film appears yellow-orange with fluorescein. The intact corneal epithelium resists penetration of water-soluble fluorescein and is not colored by it. Any break in the epithelium allows rapid penetration and appears bright green.

Fluorescein in solution is susceptible to bacterial contamination and multidose formulations are dispensed with a preservative. Fluorescein will stain soft contact or bandage lenses due to their high water content. Associated with severe local tissue damage if extravasated. Systemic administration associated with nausea, vomiting, hypotension, and

hypersensitivity reactions. Can administer orally and avoid side effects. With oral administration the best photographs are between 40-60 minutes after administration.

Administration of topical fluorescein prior to obtaining samples for FHV-1 immunofluorescent antibody assay will result in false positives. Irrigation of the conjunctival cul-de-sac does not eliminate false positives. This may have implications for other ocular IFA tests.

### **Indications**

Detection of epithelial defects

Evaluation of nasolacrimal system

Determination of tear breakup time - Topical fluorescein associated with a reduction in tear film stability, therefore tear film stability is likely greater than reported by the fluorescein method.

Seidel's test

Fluorescein angiography

Fluorophotometry - allows calculation of the permeability coefficient of the blood-aqueous barrier.

Fluorescein is a hydrophilic drug that binds to the corneal stroma, but not to the epithelium or to Decemet's membrane. It comes as a prepackaged, sterile strip. Fold the strip lengthwise to create a trough. Remove it from the package holding it by the green end. Place 2-3 drops of sterile eye wash on the strip and tilt the strip to allow stain to drip onto the eye. Do not touch the eye with the strip as this may result in an iatrogenic area of stain retention. Using the eye wash gently irrigate the excess stain from the eye onto a cotton ball and then examine the eye for stain uptake using a penlight. Visualization of the fluorescein uptake is improved by using a blue or Wood's light which excites the fluorescein molecules, making them glow green.

To evaluate the patency of the nasolacrimal duct all of the previous steps are performed, but the fluorescein is not rinsed from the eye. The stain should appear at the nares within 5 minutes. A positive test is definitive for a patent nasolacrimal duct, but does not prove that both puncta are patent. A negative test is only suggestive of a problem and indicates that the clinician should attempt to flush the duct.

### **Rose bengal**

An iodine derivative of fluorescein. Rose bengal stains dead or degenerated epithelial cells of the cornea and conjunctiva (including nuclei and cell walls) a red color. The mucus of the precorneal tear film is also stained. Cells will stain when they are not covered by mucin as is seen in deficiency of the precorneal tear film. The presence of mucin will block the staining of live or damaged cells. Can be associated with irritation. Rose bengal is not a vital dye, but is associated with a loss of cell vitality resulting in loss of cellular motility, cell detachment, and cell death. This effect is augmented by light exposure.

Rose bengal has been shown to have anti-viral activity against ocular herpes virus.

### **Indications**

Keratoconjunctivitis sicca

Herpes

Examination for corneal abrasions

### **Topical Anesthetics**

Prevent generation and conduction of nerve impulses by reducing sodium permeability, increasing electrical excitation threshold, slowing nerve impulse propagation and reducing the rise of action potential. Action is reversible with no evidence of structural damage. Rapid onset of action, 15-20 seconds with 15-20 minute duration. If greater anesthesia is desired for more painful procedures repeated instillation of several drops over several minutes will increase the effect. Topical anesthetics are esters of para-aminobenzoic acid. Local tissue pH effects anesthetic efficacy. Anesthetic exist in nonionized and ionized states with the former responsible for absorption and the later for anesthesia. The higher the pH the greater the ionization. In inflammation, the pH is lowered making the anesthetic more deionized and less available to penetrate tissue. The most common topical anesthetic is proparacaine 0.5%. It has less side effects and is better tolerated.

Prolonged use will diminish duration of anesthesia, retard wound healing (interfere with actin and myosin cytoskeleton) and result in keratitis and corneal epithelial erosions. In addition, a rare severe immediate hyperallergic corneal reaction can occur with epithelial keratitis and sloughing. Proparacaine is the third most common topical ocular agent causing contact dermatitis after neomycin and atropine.

Preinstillation of anesthetic will increase the effect of subsequently applied mydriatic/cycloplegics. Also will enhance the non uniform penetration of fluorescein into the epithelium.

Local anesthetics are used for periocular anesthesia. Inadvertent intraocular injection of lidocaine results in pupil dilation and a decrease in the b-wave of the electroretinogram.

## **Nasolacrimal Irrigation**

### *Indications*

1. Epiphora without an obvious etiology
2. Failure of passage of fluorescein stain
3. Mucopurulent ocular discharge

This procedure can be performed on a minimally restrained dog with only topical anesthesia and causes minimal discomfort. It usually requires sedation or general anesthesia in cats.

Topical anesthetic is applied. A 23 or 25 gauge nasolacrimal cannula is connected to a 3 cc syringe filled with eyewash. An assistant restrains the head and the clinician elevates and rolls the upper eyelid in the medial canthus to expose the superior punctum. Place your thumb or index finger on the plunger of the syringe so that you are ready to inject. Hold the syringe loosely such that no injury will result if the patient jerks its head. Gently insert the cannula in the punctum and without forcing it allow it to seat itself in the duct. Apply gentle pressure to the plunger and observe fluid emerging from the inferior punctum. Occlude the lower punctum, tip the nose down and continue to flush. The fluid should now appear at the nostril.

Do not use excessive force in the placement of the catheter or when flushing. If you cannot establish a patent duct and the epiphora is severe, consider medical therapy such as topical antibiotics or anti-inflammatories and repeat flushing or general anesthesia to further pursue the problem.

## **Cytology**

### *Indications*

1. To obtain a sample for Gram staining, especially important in horses
2. To characterize the type of inflammation ie. neutrophilic, lymphocytic, eosinophilic
3. To aid in the diagnosis of feline conjunctivitis including Chlamydia and Mycoplasma
4. To obtain a sample for fluorescent antibody testing

Cytology is a simple, fast, and inexpensive method for characterizing the type of inflammatory process and in many cases to obtain a diagnosis. Topical anesthetic is placed in the patients conjunctival sac. The globe is gently retracted and the lower eyelid retracted. This will expose the nictitans. A spatula, or other suitable instrument, is used to scrape the palpebral surface of the nictitans and the adjacent palpebral conjunctiva. While you don't want to damage the surface you must use enough force to exfoliate cells. These cells are then placed on a glass slide and streaked to form a monolayer. The slide can then be Gram-stained to characterize the type of bacteria, examined for cell type using Giemsa, Wright's, or Diff-Quik stains, or submitted for fluorescent antibody testing for Chlamydia or Herpes.

## **Intraocular pressure determination**

### *Indications*

1. Any red or painful eye
2. Breeds that are predisposed to glaucoma
3. Predisposed breeds with a history of glaucoma in the opposite eye
4. Follow up in animals with medically controlled glaucoma

Determination of intraocular pressure (IOP) is indicated in all eyes with diffuse corneal edema, anisocoria, fixed and dilated pupils, episcleral congestion, blindness, buphthalmos and anterior uveitis. In addition, animals with medically or surgically controlled glaucoma require sequential determination of IOP to ensure adequate control and animals with unilateral primary glaucoma and breeds predisposed to primary glaucoma require monitoring of the IOP in the unaffected at risk eyes.

Determination of intraocular pressure requires an instrument that is fast, accurate, portable and user friendly. As clinicians we must feel we can rely on the accuracy of the test and make treatment decisions based on the results. In my

opinion, most of us do not feel this way about the Schiottz tonometer and consequentially, this instrument remains in its case in a drawer.

There are 2 specific ways to determine intraocular pressure: indentation tonometry and applanation tonometry.

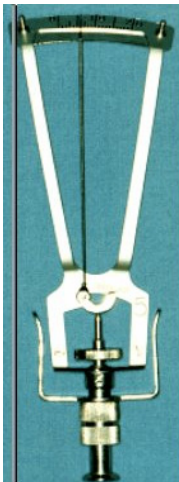
The indentation tonometer measures the amount of corneal indentation that occurs when a given weight is placed on the cornea. The result is inversely proportional to the intraocular pressure and the actual pressure must be obtained from a table of values. The Schiottz tonometer is an indentation tonometer. The Schiottz tonometer requires assembly, disassembly and cleaning in order to ensure its accuracy. The foot plate is large and the patient must be cooperative in order to place the foot plate on the cornea in a vertical position. If the animal is fractious or the eye painful then it is unlikely that accurate placement will be obtained and erroneous values will result. My clinical experience is that practices with a Schiottz tonometer either do not use it or do not believe the results obtained. In many instances, pressures obtained by this method are not confirmed on referral to a specialist. The result is that glaucoma is not diagnosed or monitored accurately and IOP determination is not performed at the frequency indicated by the breed or clinical signs.

Applanation tonometry determines IOP by evaluating the force require to applanate or flatten a given surface area of cornea. Typically in veterinary ophthalmology these are electronic or battery powered tonometers. They have been shown to be highly accurate across species and a wide range of IOP's. In recent years, the Tonopen® (Dan Scott & Associates 614-890-0370, 1-800-TONOPEN) has been evaluated and shown to be similar to other applanation tonometers in accuracy. It is light weight, portable, accurate, self calibrating and averages several readings and gives a % error to ensure accuracy. In addition, the small foot plate allows this tonometer to be used on painful eyes in less cooperative patients as only a small area of cornea is required to obtain a reading and the position of the patients head is not related to obtaining the reading. Finally, this is the only tonometer that is portable enough to allow routine IOP determination in the equine patient. Equine glaucoma in recent years has received attention and has increased in prevalence solely due to the availability of the Tonopen® and the increase in the number of equine eyes that are evaluated.

The ease of use, accuracy and comfort level this tonometer gives your practice will ensure its frequent use, increase your hospitals awareness of glaucoma, allow early and prompt referral of glaucoma patients to a specialist if indicated and subsequent referral of your glaucoma patients back to your hospital for monitoring following laser or other glaucoma surgery by a specialist. In addition, the Tonopen® will allow you to incorporate IOP determination as a routine part of the physical examination in those breeds predisposed to primary glaucoma.

### *Schiottz Tonometry*

The eye is first anesthetized with topical proparacaine. The tonometer is assembled, placing the shaft in the housing and attaching the 5.5 gm weight. The instrument is held vertically and the plunger should slide freely within the hollow sleeve. Using the metal calibration standard supplied the tonometer is tested for accuracy. When the instrument is placed on the standard it should read 0 on the scale. This means that the 5.5 gm weight does not indent the metal standard. An assistant gently elevates the patient's nose. The upper eyelid is elevated and the tonometer foot plate placed on the cornea. Keep the tonometer vertical and on the center of the cornea. The tonometer should rest on the eye and does not need to be pushed down. Read the scale. Three readings should be taken and averaged. A conversion chart is used to convert these scale readings to an approximation of the intraocular pressure matching the weight used with the reading obtained. Normal values for the dog are 15-27 mmHg with no more than 5 mmHg difference between eyes.



**Figure 1.** Schiottz indentation tonometer



**Figure 2.** Tonopen applanation tonometer

## ***Applanation Tonometry***

This is a more expensive, but more accurate method of intraocular pressure determination in the dog and cat. It is also the only method for use in the horse. The most commonly used applanation tonometer in veterinary ophthalmology today is the Tonopen®. Despite its initial increased cost, it will likely result in increased income and better patient care. This is a result of the increased use it receives due to the ease of use and the increased reliability of the results obtained. I would encourage every practice to own a Tonopen®.

## **Biomicroscopy**

### ***Indications***

1. Examination of the anterior segment of the eye:

Adnexa, Conjunctiva, Cornea, Aqueous, Iris, Lens, Anterior Vitreous

There are several excellent hand-held biomicroscopes or slit lamps available:

Kowa SL-2 - 5 to 20 X zoom magnification; slit widths form 0 to 10 mm

Kowa SL-5 - 10 and 20 X magnification; slit widths of 0.1, 0.2, and 0.8 mm

Kowa SL-14 - rechargeable battery; 10 and 16 X magnification

Zeiss HSO-10 - 10 X magnification

Heine - 1-800-367-4872; [www.heine.com](http://www.heine.com)

Eidolon



**Figure 3.** Handheld biomicroscope. Heine USA



**Figure 4.** Eidolon handheld biomicroscope



**Figure 5.** Haag-Streit handheld biomicroscope

The features of a slit lamp are:

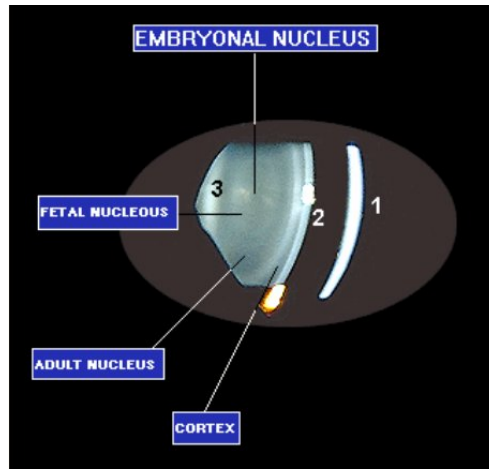
Magnification - generally 5-20X with hand-held types

Slit beam of light - variable, obtain an optical section of the eye

Variable image brightness

Depth of field

Stereopsis



**Figure 6.** Anterior segment of the eye as seen through a biomicroscope

## Indirect Ophthalmoscopy

### Indications

1. Examination of the ocular fundus, especially in small animals.

### Advantages - compared with direct ophthalmoscopy

1. Both hands are free to manipulate the patients head
2. Greater ability to visualize through translucent ocular media
3. Low magnification and larger field of view give a better survey of the entire fundus
4. Stereopsis gives a better appreciation of raised/depressed lesions
5. Easier to examine the peripheral retina
6. Examiner is farther from the patient and less prone to harm

This technique can be performed using a hand-held lens and a bright focal light source, or for those with a stronger interest in ophthalmology an indirect headset is essential to provide stereopsis.

While this technique initially requires more practice to become proficient, once mastered it is a much more useful procedure to screen the fundus of the small animal patient. It is also less expensive to obtain the needed equipment which consists of a penlight and a 20 diopter lens. Indirect ophthalmoscopy provides the examiner with an inverted, reversed image that is magnified 2-5 X. This image, while of a lower magnification than with direct ophthalmoscopy, has a much larger field of view and is better for routine screening of the eye.

The patient's pupils should be dilated with 1- drops of tropicamide (Mydracyl®). This will take 10-15 minutes for complete dilation and will last 8-12 hours in the dog. The examiner begins at arms length from the patient. An assistant is required to restrain the patient and to hold the eyelids open. Darken the exam room. With a focal light source such as a penlight or your direct ophthalmoscope held at arms length from the patient, the tapetal reflection is obtained. Holding the lens in your opposite hand place the lens 1-2 inches in front of the patient's eye, in the path of your light. The fundus should appear as a virtual image in front of the lens. It is important to look at the image which is in front of the lens and not at the lens or the eye. To view other areas of the fundus you must move yourself, the light source, and the lens while keeping all of these in alignment. Remember that the image is inverted so you must move in the opposite direction to the image. If the image is lost, move the lens out of the light beam and start again. Practice, practice, practice.

Various lenses are used in indirect ophthalmology and they provide varying magnification and field of view. The less the magnification, the greater the field of view.

Lens	Magnification- dog	Magnification- horse
30 D	2.0 X	0.3 X
20 D	4.0 X	0.8 X

14 D

8.0 X

2.0 X



**Figure 7.** Binocular indirect ophthalmoscope. Heine USA **Figure 8.** Spectacle indirect ophthalmoscope. Heine USA

## Direct ophthalmoscopy

### Indications

1. Examination of the ocular fundus, especially in large animals.
2. Detailed examination of specific areas such as the optic nerve and blood vessels with higher magnification.
3. In addition, the direct ophthalmoscope handle has additional attachments such as the Finoff transilluminator for ophthalmology and otoscopic attachments.

Several types are available:

- Welch-Allyn
- Propper
- Keeler



**Figure 9.** Direct ophthalmoscope. Heine USA

This is the technique of choice for examination of the ocular fundus in large animal patients and is used to achieve greater magnification of the fundus in small animals. It provides an upright image of the fundus and associated structures and magnifies the image 15 X. Magnification is less with hyperopia and aphakia and greater with myopia. Although a useful procedure in small animals, the field of view is small, there is no stereopsis and therefore this is a difficult technique to use for general screening of the eye. Also, with opacities of the transmitting media it is difficult to visualize the fundus as compared with indirect ophthalmoscopy.

The ophthalmoscope is turned on and the rheostat is used to adjust the light intensity to suit the examiner. The diopter wheel is turned to select the 0 diopter setting. This is the setting to view the fundus for most people and animals. Use your right eye to examine the patients right eye and visa versa. Darken the exam room. Place the ophthalmoscope to your eye and from a distance of 25 cm obtain the tapetal reflection. Move toward the eye and as you do so observe for any interference with the tapetal reflection indicating an opacity of the transmitting media, the cornea, aqueous, lens, and vitreous. When you are 2-3 cm from the patient's cornea you should see the retina, optic nerve, retinal vessels, and tapetum in clear focus. Find a blood vessel and follow it to the optic nerve. In the horse find the tapetum, move ventrally to the tapetal non-tapetal junction, then move horizontally to find the optic nerve. Evaluate the optic nerve and blood vessels then scan the fundus for abnormalities of color, clarity, size, and shape. Use the diopter wheel to focus in and out to evaluate raised and depressed lesions. The red numbers are negative or deeper and the black are positive or more superficial.

## Ocular Ultrasound

### Indications

1. Opacity of the transmitting media
2. Prior to cataract surgery
3. Evaluation of intraocular mass lesions.
4. Assess intraocular damage following trauma
5. Evaluation of orbital disease.



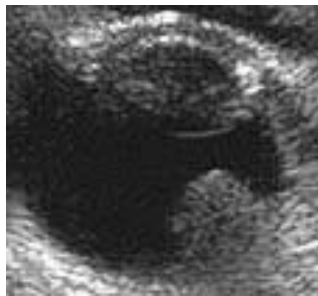
Ultrasonography is a non-invasive, safe procedure that allows evaluation of the intraocular and retrobulbar tissue without sedation or general anesthesia. Ocular ultrasound is an addition to, not a replacement for, routine ophthalmic examination.

Ocular ultrasonography is indicated whenever opacity of the transmitting media of the eye (cornea, aqueous humor, lens, vitreous humor) prevents a complete ophthalmic examination. Ultrasound aids in evaluation of intraocular mass lesions, differentiation between solid and cystic structures, evaluating the extent of damage following ocular trauma, examination for a foreign body, axial length determination and examination of retrobulbar orbital structures.

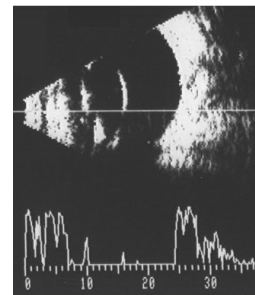
The most common clinical indications for ocular ultrasound are to evaluate for the presence of a retinal detachment in eyes with a cataract, to assess posterior segment damage and examine for the presence of a foreign body following trauma, or to evaluate intraocular structures in eyes with severe corneal opacification. In addition, orbital evaluation can be performed in instances of exophthalmos or orbital trauma.

New ultrasound technologies, including three-dimensional imaging, tissue characterization, and very high frequency (50 MHz) ultrasound biomicroscopy, have become available recently.

Topical anesthesia of the cornea (proparacaine 0.5%, Alcaine®, Alcon Laboratories) and manual restraint is usually all that is required for ultrasonographic ophthalmic examination in most small animal patients. Sterile ultrasound coupling gel or K-Y jelly is placed on the transducer tip or on the corneal surface. Cellulose-based coupling gels should be avoided as they may cause corneal irritation. The transducer is placed directly on the cornea or the scan may be performed through closed eyelids or an offset device. Performing the examination through the eyelids or an offset device will facilitate examination of the anterior portions of the globe while direct corneal contact provides a superior image of the posterior segment and orbit. When imaging through eyelids or an offset device, it may be necessary to increase the gain setting and significant reverberation artifact may occur from air in the offset or trapped under the hair. The globe is imaged in both the horizontal and vertical planes through the visual axis. Oblique positioning of the probe should also be used for a complete examination. A temporal approach has also been described placing the probe caudal to the orbital ligament and directing it ventrally to evaluate the retrobulbar structures. This technique allows superior visualization of the optic nerve, extraocular muscles and orbital fissure. At the completion of the study the coupling gel should be irrigated from the eye and conjunctiva using sterile eyewash.



**Figure 10.** B-mode ultrasound. A large choroidal melanoma is present extending into the vitreous. The lens is cataractous



**Figure 11.** B-mode ultrasound above left with A-mode (right) of a normal canine globe. The cornea is to the left.

In general, ultrasonographic images are described as hyperechoic, hypoechoic, and anechoic. There are 4 major ocular acoustic echoes within a normal eye: anterior cornea, anterior lens capsule, posterior lens capsule, and the retina/choroid/sclera (Figure 1). When ultrasound energy travels across these interfaces energy will be reflected back to the transducer in the form of an echo and will be seen as an echodensity. The iris, corpora nigra, ciliary body, optic nerve, orbital fat, muscles, and other orbital structures may generate additional echodensities. The optic nerve head/lamina cribrosa appears as a hyperechoic structure with the optic nerve itself seen as a hypoechoic structure extending posteriorly from the optic nerve head. The orbital muscle cone appears as an echodensity extending posteriorly from the equatorial region of the globe and converging towards the orbital apex. The anterior and posterior chambers, lens cortex and nucleus, and vitreous chamber are normally anechoic.

### Other Ocular Imaging Techniques

There are many varied imaging modalities that can be applied in ophthalmology to assess the architectural structure of the globe, adnexa, orbit and visual system. Traditional imaging modalities include radiography and ultrasound, but as access to sophisticated equipment becomes more commonplace, CT scan and MRI are becoming routine procedures in the



assessment of clinical patients. In addition, newer imaging modalities are allowing access to in vivo ultrastructure and multidimensional views of the globe allowing a better understanding and earlier diagnosis of ocular disease.

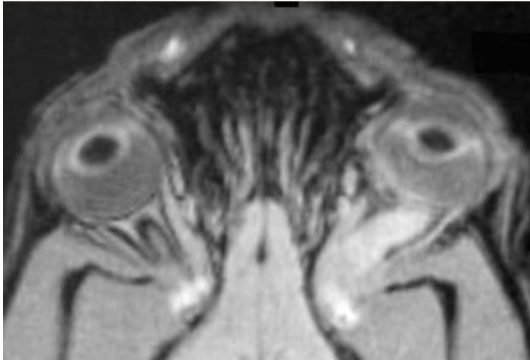
The clinician must remember that ocular imaging is an addition to, not a replacement for, routine ophthalmic and physical examination.

Routine Imaging Modalities	New Imaging Modalities
Radiographs	Ultrasound Biomicroscopy
Plain	Color Doppler Ultrasound
Contrast Studies	Confocal Microscopy
Ultrasonography	Confocal Scanning Laser Ophthalmoscopy
Magnetic Resonance Imaging	Nerve Fiber Analyzer
Computed Tomography Scan	Optical Coherence Tomography
Flourescein Angiography	
Fundus Photography	

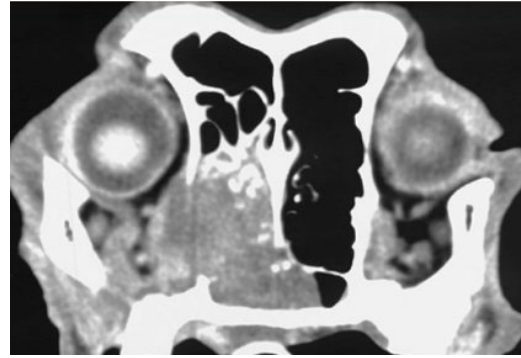
The decision on the imaging modality of choice depends on several factors. Availability and cost are often the two most important factors since access to many of these tests are limited and many require sophisticated and expensive equipment and diagnostic expertise in the interpretation of results.

The area of anatomic interest is also a factor. Imaging of the anterior and posterior aspect of the globe require the ability to view soft tissue with high resolution while having a different requirement for depth of axial resolution. While B-scan ultrasound can image the entire globe and orbital contents, ultrasound biomicroscopy and confocal microscopy have limited axial resolution allowing imaging of the anterior most aspect of the globe. Imaging of the adnexa and orbit vary depending on whether the soft tissue or bony structures are of interest. In general, radiographs and CT scans are preferred for evaluation of the bony orbit and nasal and sinus cavities while MRI and ultrasound are superior for the globe and orbital soft tissue and MRI for central nervous system evaluation. Evaluation of the nasolacrimal apparatus and vascular anatomy can be performed using contrast radiographs and techniques such as dacryocystorhinography. Fundus photography is used to document retinal vascular and optic nerve head changes for future comparison. When combined with the technique of fundus photography, flourescein angiography allows visualization of retinal arterial and venous blood flow and optic nerve and choroidal blood flow. Areas of delayed filling, nonperfusion, leakage and blocked fluorescence are evaluated.

Selection of an orbital imaging technique requires a thorough understanding of pertinent anatomy applied to relevant clinical history and detailed ophthalmic examination. The clinical findings should direct the clinician to the imaging study that provides maximum information and narrows diagnostic considerations for the individual patient.



**Figure 12.** MRI demonstrating enlargement of the optic nerve



**Figure 13.** CT scan of a dog with progressive exophthalmos. A soft tissue mass with bone production and destruction is evident in the left orbit/nasal cavity. Chondrosarcoma was confirmed on histopathology.

## Gonioscopy

### Indications

1. Examination of the iridocorneal angle for assessment of:
  - Glaucoma patient
  - Prior to cataract surgery
  - Examination of the angle for neoplasia, foreign body, etc.

There are several gonioscopy lenses available, the one I prefer is the Franklin gonio lens. The cornea is anesthetized, one drop of a viscous methylcellulose solution (ie. Goniosol®) is placed in the gonioscopy lens and the lens placed on the cornea. Ensure all air bubbles are extruded from between the lens and the cornea. Use a biomicroscope, direct ophthalmoscope, otoscope or other such device to examine the iridocorneal angle through the lens. In addition, evaluate the anterior iris face and the ciliary processes in some animals. Examine the iridocorneal angle:

- open, narrow, closed?
- foreign body?
- tumor extension?
- invasion of the anterior chamber by extraocular process?

## Electroretinogram

### Indications

- Quantitative and Qualitative assessment of photopic (cone) and scotopic (rod) retinal function.
- Prior to cataract surgery
- Sudden onset blindness such as a SARD's suspect
- Evaluation for Progressive Retinal Atrophy

This is a referral-only procedure. It is used to assess the function of the retina in much the same way that an electrocardiogram is used to assess the function of the heart. Using this technique the rod and cone function can be separated. An electroretinogram is the only definitive method to obtain a diagnosis of SARDS in the acute stage of the disease. An electroretinogram is mandatory in patients with mature cataracts that are surgical candidates.

## Ophthalmic photography

### Indications

1. Documentation for publication.
2. Monitor lesion for progression.
3. Consultation with colleagues.

### Fundus Photography

There are several hand-held fundus cameras available. The examiner can control the focus (diopters) and the flash intensity, but not the aperture. It is essential to become familiar with the required flash intensities for various lesions and locations of the eye as well as the correct ASA required for various types of photography. In general, 25 or 50 ASA is

indicated for high resolution fundus photography while 50-200 ASA can be used for external photography. Tapetal photographs require low flash settings (1 or 2) especially hyper-reflective lesions and cat tapetum while non-tapetal fundus and external photos require higher flash settings (4-6). In addition, filters are available to excite flourescein for photographing corneal ulcers or performing flourescein angiography.

Types of fundus cameras:

Kowa RC-2 - older type, still works very well

Kowa Genesis camera - new model. Very user friendly, expensive, higher maintenance requirements.

### ***Exernal Photography***

A 1:1 Macro-type lens is required for high quality photography of the eye with photos of a size adequate to visualize lesions. A ring-type flash or a flash that can be adjusted to shoot across the top of the lens is best.

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