RETINOSCOPY LABORATORY

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Instrumentation:

1. Heine and Welch Allen retinoscopes
2. Luneau retinoscopy bars
3. Hiene practice eyes
4. 66cm and 50cm tape

Basic Steps in Retinoscopy:

1. Retinoscopy with lens bars or trial lenses will require you use one handed technique to hold the retinoscope handle in your palm and place your thumb on the sleeve to change MERIDIAN (direction of streak), and VERGENCE (converging, diverging, or parallel emitted light rays). You should practice using both your dominant and nondominant eye to perform retinoscopy. The lens bar is held in the opposite hand. The Luneau retinoscopy bars are color coded with the black bars being plus lenses and the red bars being minus lenses.

Dim the lights and turn the retinoscope on. Apply correct VERGENCE of the projected beam by moving the sleeve position DOWN (this is the correct position to project slightly divergent light rays with the Heine and Welch Allen retinoscopes; with Copeland style retinoscopes, the sleeve should be UP).

2. Rotate the MERIDIAN of the streak to a vertical position by rotating the sleeve.

3. With the tape, check your WORKING DISTANCE to ensure 66cm (50cm is more comfortable for some short armed individuals...remember there is slightly more distance error at 50cm and your working distance correction is 2 D rather than 1.5 D at 66cm).

4. Site through the peephole into the pupil (keep both eyes open!). Align the pupillary axis on the schematic eye to a comfortable alignment with your gaze, and align optically by superimposing the two Purkinje images on the surface of the eye lens. You may only see one Purkinje image in your schematic eye...if this is the case, align this in the center of the pupil.
5. Check the reflex by first aligning your streak to the 90 degree meridian. Place the scope on your brow and wiggle you head slightly to make small, deliberate sweeps across the pupil perpendicular to the streak axis (shake your head slightly as if you were disagreeing). Repeat the procedure with the streak in the 180 degree axis (shake your head as if you were agreeing).

**Exercises:**

A. **Evaluating the Reflexes:**

Set the schematic eye at -1.5 D and start at 10cm from the eye, streaking the horizontal and vertical meridians. You should see a very recognizable WITH motion (the streak moves in the same direction you are wiggling).

Slowly withdrawal towards 66cm....you should see the character of the WITH reflex changing...as you get closer to neutrality the reflex becomes FASTER, BRIGHTER, and the BROADER. Make sure you appreciate each of these.

At 66cm, you should see NEUTRALITY, where the entire pupil fills with light as you sweep the retinoscope, and no movement of the reflex is seen. Recall that neutrality is actually a zone, not a single point. It is best to judge the endpoint of neutrality nearer the WITH side.

Move beyond 66cm and you should see AGAINST motion (the streak appears to move opposite the direction you are wiggling, i.e. the streak appears first on the right hand side of the pupil if you are sweeping from left to right). Notice that against motion is more difficult to interpret.

B. **Use of the Retinoscopy Bar (or Trial Lenses)**

Set the eye at “0” or emmetropia. At 66cm, streak the meridians...you should see a recognizable WITH (why is this with if the eye is emmetropic?!).

Recall that a WITH motion “wants” PLUS lenses. Using the bar (or a SPHERICAL LENS from the trial lens set), and streak with the +0.5D lens in front of the pupil, close to the eye (keep the optical alignment correct by superimposing all the Purkinje images!). You should still see a WITH. Increase the plus lenses until you reach NEUTRALIZATION. Go beyond this point and try and identify AGAINST. Bracket on either side of your preliminary NEUTRALIZATION to confirm.

Note the lens power at this time. You should have reached NEUTRALIZATION at +1.5D. This is your GROSS refraction. Recall that you now have to subtract your working distance of 1.5D (@66cm) to calculate your NET refraction. This leaves you with “0” NET refraction.
C. **Low Hyperopia**

Set the eye at +2 D. Streak both meridians first without a lens...you should see a recognizable WITH. Add plus lenses until you reach NEUTRALIZATION. Bracket again. Check your GROSS refraction. Subtract your working distance to calculate NET refraction. Is it +2D?!

Now practice an ESTIMATING TECHNIQUE, which estimates GROSS hyperopia. Without a lens bar in place, streak both meridians @66cm to identify a WITH. Slowly change the VERGENCE by moving the sleeve up until the retinal reflex is the thinnest and crispest beam possible (ENHANCEMENT). Compare this with the width of the INTERCEPT, which is the beam outside of the pupil, or in the patient, on the face. With +3.5D GROSS hyperopia (schematic eye set on +2D), the retinal reflex should be about three-quarters the width of the intercept. Can you appreciate this? With higher degrees of gross hyperopia, e.g. +5D, the retinal reflex and intercept are identical widths at enhancement, both very narrow. With low gross hyperopia, e.g. <+1D, the retinal reflex will not enhance.

D. **Low Myopia.**

Set the eye at -3D. Streak both meridians. Notice the AGAINST motion is hard to interpret. You can CONFIRM against motion simply by changing the VERGENCE of your retinoscope, moving the sleeve up. This same AGAINST motion should now be WITH.

Move your sleeve back down and observe the AGAINST motion again. Because against motion “wants” MINUS lenses, use your minus lens bar. Streak with progressively higher minus lenses, and GO BEYOND NEUTRALIZATION, until you see a recognizable WITH motion (always neutralize from the WITH side). Bracket back to NEUTRALIZATION. Your GROSS refraction should be -1.5D. Subtract your working distance of 1.5D...note that this means ADDING MINUS LENS here, to calculate your NET refraction of -3D.

Now practice an ESTIMATING TECHNIQUE to estimate NET myopia. With no lens bar in place, streak @66cm. Slowly move in towards the eye, streaking as you go, and with the sleeve remaining down, until you see a recognizable WITH. Move back until you reach NEUTRALIZATION. Check your distance from the eye. With -3 D of NET myopia, your distance should be 33cm. -2D NEUTRALIZES @ 50cm, -4D @ 25cm, -5D@20cm, and -10@10cm.

E. **Astigmatic Errors**

Recall that with astigmatism, the two meridians are of different power and will therefore neutralize with different lenses.
In veterinary ophthalmology refraction is usually and most conveniently performed by neutralizing with spheres only (a lens bar has only spherical lens). This is simply performed by streaking and neutralizing one meridian, noting the gross refraction, and then streaking and neutralizing the other meridian with the appropriate lens (in an astigmatic eye the power of these two lenses will be different!).

One can also neutralize an astigmatic eye with a sphero-cylindrical method, using spherical lens in one meridian and (the same) spherical lens and cylinder lens in the other meridian. In this fashion, both meridians can be neutralized with the same combination of lenses. The details of this method are beyond the scope of the laboratory, but make for fascinating reading!

You can simulate an astigmatism in your schematic eye by placing a phantom cylinder lens in your schematic eye lens frame. A phantom lens applies an opposite power to the schematic eye (i.e. a -1 D phantom lens simulates a +1D refractive error). A cylinder lens applies power in the corneal meridian perpendicular to its axis.

Remember, however, that with the retinoscopy streak at 90 degrees, you are testing the 180 degree or horizontal corneal meridian (the corneal meridian you are sweeping across). As such a plus cylinder placed at 90 degrees will apply power to the 180 degree corneal meridian and cause the vertical retinoscopy streak to neutralize at a higher plus lens. Don’t worry too much if you don’t understand this concept, it’s difficult to grasp, and a little like a double negative. See Corby’s Handbook if you want to understand it better.

**Simple hyperopic astigmatism**

Set the schematic eye at “0”. Place a minus phantom cylinder lens at 90 degrees in your schematic eye. This simulates a plus (hyperopic) astigmatism in the 180 degree corneal meridian.

Set your retinoscopy streak to horizontal (streak at 180) first and determine neutralization with your lens bar. This should be at +1.5D. Rotate your streak to 90 degrees and with the +1.5D lens, note that you still see with motion. Add plus lens in this meridian until you reach neutralization. This require a higher plus lens corresponding to the power of your phantom cylinder lens power!

**Oblique astigmatism (major meridians off 90 and 180 degrees)**

Usually, the axis of the meridians in an astigmatic eye will be at or near 90 and 180 degrees. When the axis is not at 90 and 180 degrees, the retinal reflex and the intercept will not line up...simply rotate the sleeve and change the meridian to
line these two up and estimate and record this AXIS. The remaining axis (other principle meridian) will generally still be perpendicular to this one.

Rotate the phantom cylinder lens to 45 degrees. Set your retinoscopy streak at 90 degrees. Note that this has caused the RETINAL REFLEX and the INTERCEPT to not be aligned. Change the MERIDIAN on your retinoscope to align these two. This should be at approximately 45 degrees! Neutralize this meridian, note the gross refraction, and then rotate your streak 90 degrees to neutralize the opposite meridian.

F. Refract your partner

Practice your retinoscopy technique on your laboratory partner. This is generally best done with both of you sitting down. Cycloplegia to relax accommodation is generally unnecessary in adults, and in fact, retinoscopic reflexes are easiest to interpret in an undilated pupil, as mydriasis creates odd reflexes from spherical aberrations and irregular reflexes.

Have your partner maintain distance fixation by siting their left eye over your left ear, trying not to accommodate. Remember optical alignment! If your partner wears spectacles, refract them with and without these in place. Line the Purkinje images on the spectacle to confirm optical alignment.

G. Refract your next canine patient.

Practice your retinoscopy technique on your next canine patient. If the pupil is dilated, concentrate on the retinoscopic reflex from the center of the pupil. Irregular reflexes may appear as swirls or a “scissors motion” Optical alignment is again critical and more difficult to maintain in the moving patient! Notice the difference in the reflex from the tapetum as opposed to the “red reflex” of a human.