Vision and Retinal Problems in Horses

Equine Ophthalmology Service
University of Florida
Equine Vision: Just what do they see?
Anatomy of the eye

- IRIS
- PUPIL
- FLATTENED ‘OVAL’ PUPIL
- ‘GRANULAE IRIDICA’
Anatomy of the eye

‘GRANULAE IRIDICA’
Anatomy of the eye

Cornea
Anatomy of the eye

Iris

Acts as shutter to control light entering the eye
Anatomy of the eye

- **Lens**: Changes shape to focus light onto back of the eye.

Limited focusing ability in horse
Anatomy of the eye

Receptors stimulated by light: create electrical signals

Retina
Anatomy of the eye

Gather electrical signals from retina and carry them to the brain. HENCE VISION
Equine Vision: What do they see?
What does evolution require them to see?
Equine Vision: What do they see?

They need to have…….

• Wide panoramic vision
• Good vision in low light
• Detect motion
Equine Vision: What do they see?

They need to have……..

• Wide panoramic vision
• Good vision in low light
• Detect motion
• ‘Acuity’ (Sharpness) not that important
• Binocular vision not that important
• Color not that important
Wide Panoramic Vision
- Visual Field

Remember:

- Flattened ‘oval’ pupil
Wide Panoramic Vision
- Visual Field

Remember:

- Flattened ‘oval’ pupil
- Eyes on side of head
Visual Field

Binocular vision 65°

60°

170°

120°

Blind spots
Visual Field

Human field of vision
Visual Field

Horse field of vision

Human field of vision
Visual Acuity
- Sharpness of Vision

If you can see an object clearly from 50 feet away, a horse would need to be 20 feet away to see the object in the same detail.
Detection of Motion

Horse is highly adapted to detect motion on edge of visual fields
Equine Color Vision
Equine Color Vision

Colors appear ‘washed out’
Can we test a horse’s vision?

- If it is completely blind….Yes
Can we test a horse’s vision?

- If it is completely blind….Yes
- Because it walks into things!
Can we test a horse’s vision?

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- Otherwise….Not objectively!
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OBSTACLE COURSES ??
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‘MENACE’ TESTING

If horse reacts: *ie.* a positive test

Tells us the horse has, at a minimum, 20/20000 vision

Which is vision 100x worse than what, in man, is legally blind!
Can we test a horse’s vision?

- If it is completely blind….Yes
- Because it walks into things!
- Otherwise….Not objectively!

‘MENACE TESTING

If horse doesn’t react: *i.e.* a negative test

Tells us the horse probably couldn’t care less!!
Can we test a horse’s vision?

- If it is completely blind…Yes
- Because it walks into things!
- Otherwise….Not objectively!
- Horses with severe and extensive eye disease show no apparent difficulty in “seeing”!
- This is one of life’s mysteries…..
Can we test a horse’s vision?
Can we test a horse’s vision?
The most we can say is...

- That from examining the eye...
This eye has an abnormality or disease which is damaging eye function…and therefore

A visual deficit is present in this horse

- Either: This is a major problem, and is likely to affect behaviour and safety of horse and rider
- Or: This is a minor problem and is, on balance of probability, of no consequence

But there are often ‘in betweens’.
Ophthalmoscopy

- The direct ophthalmoscope:
  - lateral magnification: 7.9X
  - axial magnification: 84X

- Indirect ophthalmoscopy:
  - 5.5 D lens: 3.86X lateral and 20.1X axial
  - 14 D lens: 1.18X lateral and 1.86X axial
  - 20 D lens: 0.79X and 0.84X lateral and axial respectively.

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- Visual impairment in dim light with generally normal vision in daylight
- Behavioral uneasiness at night
- Normal retinal appearance!!
- Defect in neural transmission related to reduced expression of the *TRPM1* gene.
  - (Transient Receptor Potential Melatansin1)
CSNB

- ERG: large negative scotopic a-wave with decreased scotopic b-wave amplitude
- Normal histology suggesting a neurotransmission problem in the middle retina
- The true incidence of this disease in Appaloosas is not known but may approach 25%
- No treatment
- Do not breed
Normal ERG a- and b-waves

CSNB: all a-wave
Retinal images
Normal

Excess myelin (AM)
Tapetal thinning
Retinal Dysplasia
Chorioretinitis
“bullet hole” chorioretinitis: not related to ERU
Matthews Scotland
- Matthews Scotland
Chorioretinitis in Scotland (Matthews)
Italy: blindness
Horizontal band of depigmentation
Hyphema and retinal hemorrhages.
Found in foals in many eyes.
Retinal Detachments

- Exudative and traction RD are found in the horse.
- Total RD: free-floating, opaque veils overlying the optic disc.
  - Tapetal hyperreflectivity
- Primary in RMH.
- Secondary to ERU, head trauma, perforating globe wounds, and tumors
- No treatment
Some exudative RD can reattach and leave retinal folds
Proliferative Optic Neuropathy

- PON is in older horses
- a slowly enlarging white mass protruding from the optic disc into the vitreous
- incidental, no effect on vision
- histology: “schwannoma“
- Protrusion of axonal contents
- no therapy.
Ischemic Optic Neuropathy

- ION is due to ligation of the internal carotid, external carotid and greater palatine arteries for treatment of epistaxis caused by guttural pouch mycosis.
  - Maxillary artery only should be occluded
- Can result in sudden, irreversible blindness to the eye on the surgically operated side.
- Optic disc congestion and NFL involvement are prominent.
Chorioretinitis/Optic Nerve Atrophy
Traumatic Optic Neuropathy

- Trauma to the occipital region causes the globes to move anteriorly.
- The strong optic nerve attachments at the chiasm result in stretching of the optic nerves.
Dilated pupils

RD

Optic nerve atrophy
The Lamina Cribrosa

Exposure of the lamina indicates demyelination
Optic neuritis: hemorrhage and edema from head trauma
Equine Motor Neuron Disease

- Ceroid lipofuscin in RPE
- Mosaic of yellow/dark
- Vitamin E deficient
  - <1.799 microg/ml
- Visual deficits at times
- Therapy does not resolve these lesions
Choroidal nevi

Retinal colobomas (AM)
Choroidal coloboma (AM)

RPE colobomas (AM)