Extra-Ocular Muscles

Lynn E. Lawrence, CPOT, ABOC
Overview

- Brief Ocular Muscle Anatomy Review
- Extra Ocular Muscle and Nerve Innervation
- Terms Associated with EOM’s
- Testing Associated with EOMs
- 10 Question Review Test
Case History is very important!

- Age/onset
- Is the eye turn constant or intermittent
- Is it the same eye or does it alternate
- Does it affect near or distant or both
- Fam hx/trauma/causes
- Birth hx/past hx
- General and past health
Verify Visual Acuity

- Check visual acuity at near and distance
- With BCA
- While checking, keep your focus on the patient
Anatomy and Physiology of the extraocular muscles

- The Extra-ocular Muscles (EOM)
  - Organized into an umbrella-like bundle among the orbital fat, orbital blood vessels and nerves
  - Six muscles associated with eye movements
    - Superior rectus (S.R.)
    - Inferior rectus (I.R.)
    - Medial rectus (M.R.)
    - Lateral rectus (L.R.)
    - Superior oblique (S.O.)
    - Inferior oblique (I.O.)

How many cranial nerves control these 6 muscles?
Extra Ocular Muscles

What is the name of the point where the muscles come together?
Extraocular Muscles

- **Medial Rectus**
  - Most powerful, adduction, CN III
- **Inferior Rectus**
  - Primary is depression, CN III
- **Lateral Rectus**
  - Abduction, CN VI
- **Superior Rectus**
  - Primary is elevation

Which muscle closes the eye lid and is innervated by cranial #7?
An obvious upward/superior deviation of the eye is called?
Extraocular Muscles

- **Superior Oblique (SO)** - has 3 functions; intorsion, depression and abduction; innervated by the 4th (trochlear) cranial nerve

- **Inferior Oblique (IO)** - 3 functions; extorsion, elevation, and abduction; innervated by the 3rd (oculomotor) cranial nerve

Proper alignment and muscle balance of the eyes is called?
Extraocular Muscles

- **Medial Rectus (MR)** - moves the eye inward from the straight-ahead position (adduction); innervated by the 3rd (Oculomotor) cranial nerve

- **Lateral Rectus (LR)** - moves the outward (abduction) from the straight-ahead position; innervated by the 6th (Abducens) cranial nerve

- **Inferior Rectus (IR)** - 3 functions; depression, extorsion, and adduction; innervated by the 3rd (Oculomotor) cranial nerve

A definite and obvious turning of the eye is called?
Muscle Innervation

- The primary muscle that moves an eye in a given direction is known as the “agonist.” A muscle in the same eye that moves the eye in the same direction as the agonist is known as a “synergist,” while the muscle in the same eye that moves the eye in the opposite direction of the agonist is the “antagonist.” According to “Sherrington’s Law,” increased innervation to any agonist muscle is accompanied by a corresponding decrease in innervation to its antagonist muscle(s).
6 Versional Positions of Gaze

- dextroversion (looking right)
- levoversion (looking left)
- supraversion or sursumversion (looking up)
- infraversion or deorsumversion (looking down)
- dextrocycloversion (rotation to the right)
- levocycloversion (rotation to the left)

This is an info only slide
Terms

- Steropsis...two eyes / one image
- Yoked muscles
- Strabismus (Heterotropia)
- Eccentric Fixation
- Diplopia (double vision)
- Concomitant (non-paralytic)
- Non-concomitant (paralytic)
- Simultaneous Innervation
- Third Nerve Palsy
Ocular Motility

- **Version** - a conjugate movement of the 2 eyes. Both eyes remain parallel during the movement.

- **Vergence** - A disjunctive movement of the 2 eyes
  - Convergence
  - Near triad of accommodation, pupil constriction, and convergence
  - Divergence

A constant tendency for the eyes to turn from the norm is called?
Ductions (one eye movement)

- When considering each eye separately, any movement is called a “duction.” Describing movement around a vertical axis, “abduction” is a horizontal movement away from the nose caused by a contraction of the LR muscle with an equal relaxation of the MR muscle. Conversely, “adduction” is a horizontal movement toward the nose caused by a contraction of the MR muscle with an equal relaxation of the LR muscle.
Versions (two eyes moving)

- When considering the eyes’ working together, a “version” or “conjugate” movement involves simultaneous movement of both eyes in the same direction. Agonist muscles in both eyes which work together to move the eyes in the same direction are said to be “yoked” together.
According to “Herring’s Law,” yoked muscles receive equal and simultaneous innervation. There are six principle versional movements:
Vergences

- A “vergence” or “disconjugate” movement involves simultaneous movement of both eyes in opposite directions. There are two principle vergence movements:
  - convergence (looking nasally or inward—“crossed-eyes”)
  - divergence (looking temporally or outward—“wall-eyes”)

ROLLING DOWN THE STREET EATING CHEERIOS SIPPING MY BOX OF JUICE

WITH MY MIND ON MY MOMMY AND MY MOMMY ON MY MIND
Amplitude of Accommodations

- Amplitude of refraction is higher the younger you are and lower the older you are

- Basically, how much power your ocular system has to focus
Accommodative Esotropia

- When your focusing ability does not reach the stimulus level to align the eye you will need glasses to keep the eyes aligned

- Story of the 6 year old girl
That is, the lateral rectus (LR) is innervated by C.N. 6, the superior oblique (SO) is innervated by C.N. 4, and the four remaining muscles (MR, SR, IR, and IO) are innervated by C.N. 3.
Muscle Function Overview

- Orthophoria
- Strabismus
- Eso (eye deviates inward)
- Exo (eye deviates outward)
- Concomitant vs non-commitment
Orthophoria

- The normal condition of balance between the muscles of the eyes that permits the lines of sight to meet at an object
- Check at distant and near
- Aids in stereopsis
Strabismus

- **Strabismus**: A condition in which the visual axes of the eyes are not parallel and the eyes appear to be looking in different directions. The danger with strabismus is that the brain cones may come to rely more on one eye than the other and that part of the brain circuitry connected to the less-favored eye fails to develop properly, leading to amblyopia (blindness) in that eye.

Call the condition and win a prize!
Eso

- Esophoria
- Esotropia

**Symptoms**
- Decreased vision
- Misaligned eyes
- More commonly associated with diplopia

Note the direction of movement when testing

Call the condition and win a prize!
Exo

- In divergent strabismus, or exotropia, the visual axes diverge

Symptoms
- Decreased vision
- Misaligned eyes
- Sensitivity to light

Note the direction of movement when testing

Call the condition and win a prize!
Cranial Nerves LR6SO4

Muscles
- Lateral rectus muscles #6 ...abducens nerve
- Superior Oblique #4 ...trochlear nerve
- All other muscles are controlled by #3 ... oculomotor nerve

Name the 3 chambers of the internal eye?
Muscle Balance Testing

- Cover Test (distant/near)
  - Cover/uncover
  - Alternating cover
- Krimsky’s Test
  - Using prisms for alignment
- Hirschberg Test
  - Location of corneal reflex

Which test checks for direction when using the cover test?
Extraocular Muscles

- Medial Rectus
  - Toward the nose (adduction)
- Lateral Rectus
  - Away from the nose (abduction)
- Superior Rectus
  - Up; towards the nose (elevation)
- Inferior Rectus
  - Down; away from the nose (depression)

How many extra ocular muscles are there?
Extraocular Muscles

- **Superior Oblique**
  - Rotates the top of the eye toward the nose; moves eye down

- **Inferior Oblique**
  - Rotates the top of the eye away from the nose; moves eye up

Where is the insertion points for these muscles?
Near Point of Accommodation

- Ability of the eyes to focus at near
- Binocular measurement
- Amplitude of accommodation
  - Binocular or monocular measurement
  - Distance measured in cm

AC/A ratio is usually _______ in elderly patients
Ocular Motility

- Muscle-H Test
- Ocular Motility
  - Patient instructions
  - Appropriate target
  - Proper illumination
  - Proper distance
  - Accurate recording

What does the Muscle H test check for?
Extra-Ocular Muscle Testing

• **Versions**
  - conjugate movements of the eyes together

• **Vergence**
  - disjunctive movements of the eyes

• **Pursuits**
  - Movement of the eyes while following a moving target

• **Saccades**
  - Jumping movements from one target to another

An exotropic patient’s eye would deviate in what direction?
Cover Test

- Assess heterophoria and heterotropia
- Two separate tests - unilateral and alternate
- Tests are performed at distance and near
- Unilateral test is performed first

An orthophoric patient would have what type of eye deviation?
Cover Test

- **Cover Test**
  - Pt instructions
  - Eye level position
  - Proper fixation
  - Procedures for cover/uncover
  - Recording accuracy

What is the difference between a tropia and phoria?
Unilateral Cover Test

• Determines heterophoria or heterotropia
  • Heterophoria=tendency
  • Heterotropia=constant

• Determines frequency (constant or intermittent)

• Unilateral or alternating

An alternating cover test determines what?
Alternating Cover Test

- Determines the direction and magnitude of the tropia or phoria
  - Eso-in
  - Exo-out
  - Hyper-up
  - Hypo-down

A left eye that deviates upward is classified as _______?
Fusion/Suppression

- **Fusion**
  - Blending of 2 images, one from each eye

- **Suppression**
  - Subconscious inhibition of an eye’s retinal image
    - Associated with strabismus

What is the highest degree of fusion called?
Worth 4 Dot - Suppression Test

- Looks like a flashlight
- Has 4 dots
  - 2 dots
  - 3 dots
  - 4 dots
  - 5 dots (diplopia)
- Anaglyphic Glasses
Stereopsis

- Highest degree of depth perception
- Purpose of test
- Types of stereo tests
  - Titmus stereo fly
  - Randot
  - Reindeer

What type of glasses are used for this test?
Trauma Testing

- Blunt force trauma
- Blowout fractures
- Sports injuries
- Complaints of diplopia
- Orbital bleeding
Eye Dominance

- Eye preference
- Eye used for monocular viewing or sighting
- Reasons for recording
  - Monovision CTL

The rotation of the eye around an anteroposterior axis, such as fixation is called?
Don’t forget the basics!

- Real story... of pt that came in complaining of OD eye turn...Hx of strabismus sx OD, pain OD, and diplopia at near

- Causes of muscle imbalances can be related to disease or trauma
Other causes:

- Vasulopathic: Diabetes, hypertension, atherosclerosis, trauma, idiopathic
- Increased intracranial pressure, giant cell arteritis, cavernous sinus mass, sarcoidosis, lumber puncture, stroke

This is the international symbol for diabetes
Prescriptions: Light Rays

- Rays move from left to right
- Converging Rays
  - The focal point forms a real image
- Diverging Rays
  - The focal point forms a virtual image

Light always deviates toward the ______ of a prism?
Prisms

- Light deviates toward the base of a prism
- The image deviates toward the apex
Lenses: Convex & Concave

- Plus lenses – prisms stacked base to base

- Minus lenses – prisms stacked apex to apex

The _____ theory state that light moves as waves like those in water?
Prescriptions: Light Rays

- **Rays move from left to right**
- **Converging Rays**
  - The focal point forms a **real** image
- **Diverging Rays**
  - The focal point forms a **virtual** image

Light always deviates toward the _____ of a prism?
Prisms in spectacles

- When a patient is esotropic the doctor would give ______ prism

- When a patient is exotropmic the doctor would give ______ prism
Review Questions

- Which test is used to check six cardinal position of gaze for motility?
  - A. Muscle H
  - B. APD
  - C. Amsler Grid
  - D. Tropia

- The test that uses the corneal reflexes to identify eye alignment is called:
  - A. Amsler Grid Test
  - B. Hirschberg Test
  - C. Pupillary Reflex Test
  - D. Eye Alignment Pupil Test
Review Questions

- When testing extra ocular muscles with the H-test, how is it recorded when there is no movement indicated at near or distance?
  - A. Emmetropia at near and distance
  - B. Ammetropia at near and distance
  - C. Orthophoria at near and distance
  - D. Orthotropia at near and distance

- What is the highest degree of fusion called:
  - A. Super Fusion
  - B. Suppression
  - C. Bionotrope
  - D. Stereopsis
Review Questions

Which term means uncorrectable vision?
- A. Emmetropia
- B. Ammetropia
- C. Amblyopia
- D. Suppression

Which term means a disjunctive movement of both eyes?
- A. Vergence
- B. Versions
- C. Fusion
- D. Stereopsis
Review

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Thank you

Martralyn@msn.com