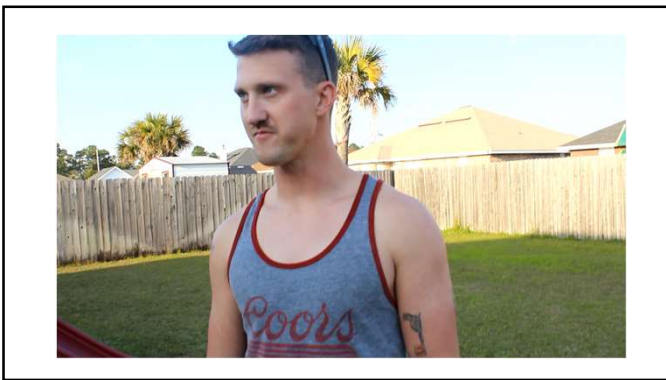




Extra-Ocular Muscles Testing

Lynn E. Lawrence, CPOT, ABOC, COA, OSC

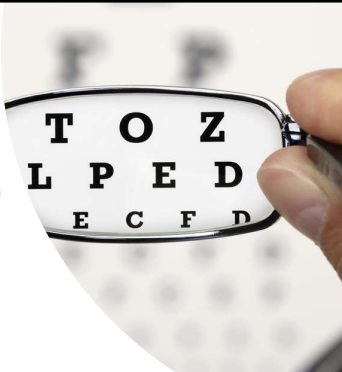
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2

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




3



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

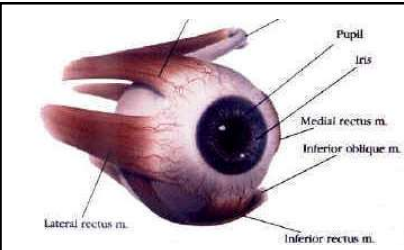
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Verify Visual Acuity

- Check visual acuity at near and distance
- With BCA
- While checking, keep your focus on the patient

5



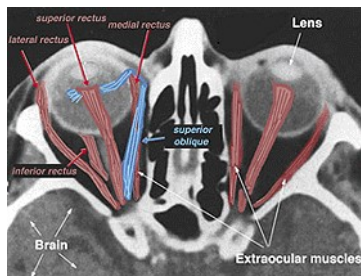
Anatomy and Physiology of the extraocular muscles

How many cranial nerves control these 6 muscles?

- The Extra-ocular Muscles
 - 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.)

6

Extra Ocular Muscles



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

7

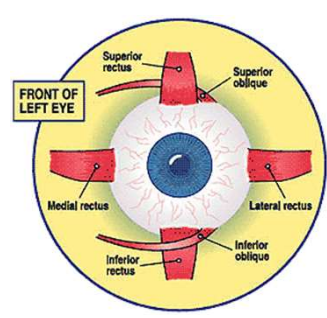
Extraocular Muscles

Medial Rectus
- Most powerful, adduction, CN III

Inferior Rectus
- Primary is depression, CN III

Lateral Rectus
- Abduction, CN VI

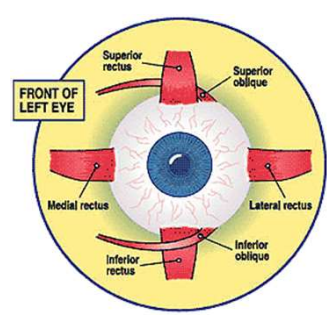
Superior Rectus
- Primary is elevation



8

Muscles and Function

- LR6...SO4...3
- Rectus
- Obliques
- Intorsion
- Extorsion
- Elevation
- Depression



9

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?


10

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?

11



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).

12

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)

13



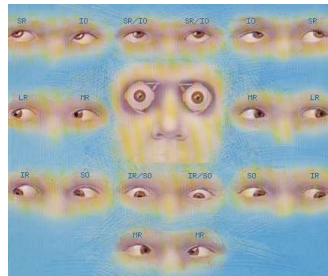
Terms

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

14

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?


15

Correction


- Depends on:
- Direction of movement
- Type of correction (plus or minus lenses)


A







B





C





16

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.




17

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.



18



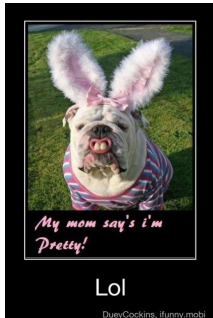
Vergences

- A “vergence” or “dis-conjugate” 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”)

19

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



20

Seriously?

You haven't schedule my InfantSEE Exam




To find out more about how InfantSEE program can protect your child's eyes contact your optometrist

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


21



Formula $LR_6(SO_4)_3$

That is, the lateral rectus (LR) is innervated by CN VI (**abducens**), the superior oblique (SO) is innervated by CN IV (**trochlear**), and the four remaining muscles (MR, SR, IR, and IO) are innervated by CN III (**oculomotor**).


22



Phoria

- The phoria, a measure of the relative position of the two eyes when dissociated
- Latent strabismus (not obvious)
- Is not noticed unless the eye is tested

23



Tropia
Manifested Strabismus (obvious)

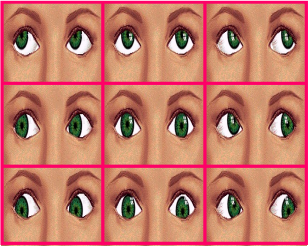
24

Muscle Function Overview


- Orthophoria
- Strabismus

- Eso (eye deviates inward)
- Exo (eye deviates outward)

- Concomitant vs non-commitmant




25



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

26



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.

27

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!

28

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!

29

Accommodative Esotropia

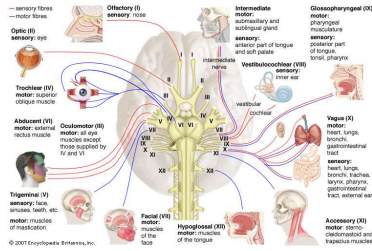
- The optical system of the eye cannot sustain it's balanced enough to keep both eyes aligned and so the dominate takes over
- Story about the twins

30

Cranial Nerves LR6SO4

Muscles

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

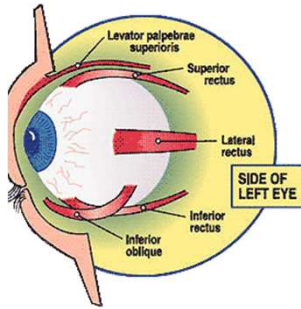


Name the 3 chambers of the internal eye?

31

Muscle Balance Testing

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



32

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)

33

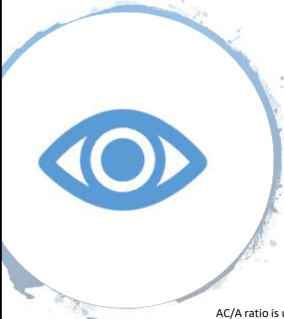


Extraocular Muscles

- **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?

34




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

35




When To Perform Ocular Motility Testing

- All new patients
- Children every year
- Any complaints of diplopia
- Any trauma... MVA
- All diabetic patients every year
- Patients with MS or any neurological disorder

36

Ocular Motility

- Muscle-H Test
- Ocular Motility
 - Patient instructions
 - Appropriate target
 - Proper illumination
 - Proper distance
 - Accurate recording
 - **Proper level with pt**



What does the Muscle H test check for?

37

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?

38

Cover Test #1

- In the alternating cover test the two eyes are alternately covered with an occluder or "cover paddle" while the patient looks at a target which he can see clearly. The test is done while the patient fixates a distant target and again when he fixates a near target. When the occluder covers an eye, it is dissociated from its fellow and moves to its phoria position. When the occluder is removed, the eye resumes fixation.



Which is the dominate eye?
What happens when you cover the dominate eye?

39

Cover Test


- Assess heterophoria and heterotropia
- Two separate tests - unilateral and alternate
- Tests are performed at **distance and near**
- Unilateral test is performed first
- Magnitude, frequency, amplitude, and direction of deviation

An orthophoric patient would have what type of eye deviation?

40

Cover Test Position

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



What is the difference between a tropia and phoria?

41

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?

42

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 _____ ?

43

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?

44

Worth 4 Dot - Suppression Test

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

45




Stereopsis

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

What type of glasses are used for this test?

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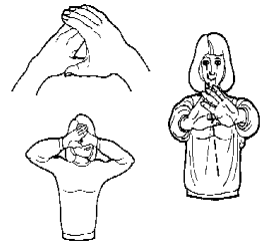
Trauma Testing

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

47

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?

48

Don't forget the basics!

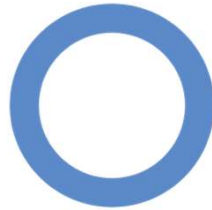
- Real story... of pt that came in complaining of OD eye turn...Hx of strabismus sx OD, pain OD, and diplopia at near
- Causes of muscle imbalances can be related to disease or trauma



49

Other causes:

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



This is the international symbol for diabetes

50



51

Prescriptions: Light Rays

- Rays move from left to right
- **Converging Rays**
- **Diverging Rays**

Light always deviates toward the _____ of a prism?

52

Prisms

- Light deviates toward the base of a prism
- The image deviates toward the apex

53

Lenses: Convex & Concave

- **Plus lenses** –prisms stacked base to base
- **Minus lenses** – prisms stacked apex to apex

54



Prisms in spectacles
(optic lesson required)

- When a patient is esotropic the doctor would give _____ prism
- When a patient is exotropic the doctor would give _____ prism

55

Ocular Nerves and Muscle Innervation

2 nd Optic Nerve	3 rd Oculomotor	4 th Trochlear	5 th Trigeminal	6 th Abducens	7 th facial
Retina	Medial Rectus	Superior Oblique	Cornea	Lateral Rectus	Lids
Macula	Superior Rectus		Upper and lower eyelids	One muscle is innervated by this nerve	Levator Palpebrae
Optic Nerve	Inferior Rectus		Conjunctiva		Orbicularis Oculi
	Inferior Oblique				
	Pupils constriction/ Accommodation		Cheek and tip of nose...		
	Levator muscle		Larger nerve		

Eyelids have nerve innovations from cranial nerves 3, 5, 7

56

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

57

Review Questions

When testing extra ocular muscles with the H-test, how is it record when there no movement is 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

58

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

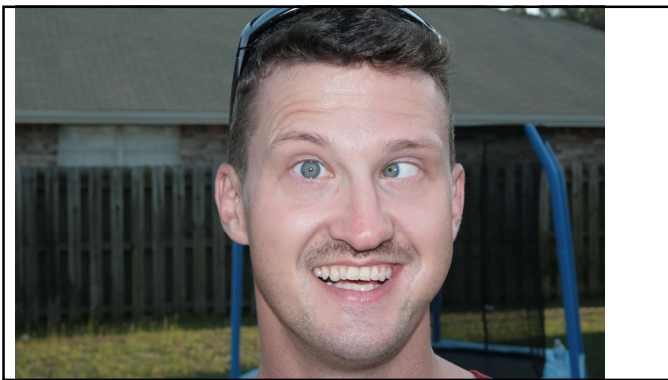
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60



61



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Review

- Brief Ocular Muscle Anatomy Review
- Extra Ocular Muscle and Nerve Innervations
- Terms Associated with EOM's
- Testing Associated with EOMs
- 10 Question Review Test

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