Basic Strabismus

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Do You Feel this Way when you hear about Strabismus???

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  - Provided images of her patients and input on their use
- Kenneth Kayne, COT
  - My first instructor, who "lit the flame"
- All my patients and colleagues – they keep us honest by “helping us learn” from our mistakes!

Triage/History: Onset
- WHEN did your symptoms FIRST start?
- Tell me about the first time it happened.
  - Let the patient tell you...
- How long did the symptoms last?
- Could you make it go away?
- How often does this happen?
- Is there any pattern?
- Any Family History? Systemic History? Medications? Developmental History?

Triage/History: describe images
- monocular vs binocular
  - (“I have double vision in my right eye.”)
  - (Does it go away with either eye covered??)
- placement of the images…...direction
- description of the images….quality

Triage/History: Associated Systemic Disease
- Grave’s Disease
- Diabetes
- Myasthenia Gravis
- Multiple Sclerosis
- Parkinson’s
- others?
- Recent viral infection?
Triage/History: Associated Symptoms

- **NEW** ptosis
- **NEW** anisocoria
  - pupils unequal...old pictures sometimes help
- Pain
- Numbness/tingling in extremities
- Balance problems/dizziness
- Fatigue

Triage/History: Medications

- What medications are you taking? Is there anything new?
- some medications may affect accommodation
- some medications may reduce control of a pre-existing phoria

Look at the patient: facial asymmetry

Look at the patient: how do glasses sit on the face?

This patient has 8 ∆ base out in each lens. Is vertical prism is induced?

Look at the patient: Media opacities

Look at the patient: Head position
Head Tilting: IV N Palsy

Retinal Correspondence
- Nasal retina corresponds to temporal field
- Superior retina = inferior field
- Temporal retina = nasal field
- Inferior retina = superior field

Ocular Motility

Anatomy
- CN III innervates SR, IR, MR, IO and levator palpebrae superioris
- CN IV innervates SO – be aware of Trochlear damage if trauma
- CN VI innervates LR

Ocular Anatomy: Muscles

Right Eye

Superior Rectus
Superior Oblique
Lateral Rectus
Medial Rectus
Inferior Rectus
Inferior Oblique

Ocular Motility

Anatomy
- Insertion: “where they stick to eye”
  - Four rectus muscles insert in an anterior direction near the corneal limbus
  - “Spiral of Tillaux”
  - SO inserts posteriorly after passing through trochlea at sup-nas orbit
  - IO inserts posteriorly very near macula

Ocular Motility

Anatomy
- Origin: “where they start”
  - All but IO start at back of orbit near optic foramen
  - IO starts on mid-anterior medial orbital wall – only one of the 6 that does NOT start at back of orbit
Ocular Motility - Terminology

- **Duction**
  - action of one muscle
- **Versions**
  - two muscles, same direction
- **Vergences**
  - two muscles, opposite direction
- Agonist, antagonist, synergist
- Recession, Resection (surgical terms)

Sherrington’s Law

- Also known as Law of Synergistic and Antagonistic Muscles (“One Eye” Law)

To move to the right, you contract your RLR “agonist” a certain amount and you relax the “antagonistic” muscle (RMR) an equal amount to achieve smooth movements of the same amount.

Hering’s Law

- Also called the Law of Yoke Muscles
  - Also known as “Two Eye Law”

Fixing eye determines how much your “agonist” muscle contracts, then an equal amount is given to your “synergist” muscle in the other eye.

- R gaze would have RLR and LMR working equally.

Yoke Muscles

- Pairs of muscles (1 ea. Eye) that work together to move eyes in desired version
- “Yoked together”

Like RMR and LLR to move your eyes to your left!
Hering’s Law (Yoke)

Hering’s Law (motor correspondence)

the law of eyes working in pairs

Motility

- Cover testing
  - Cover-uncover test
  - Alternate cover test
  - Using Prisms to measure ("neutralize") deviations of the eyes

Cover-Uncover test

- One eye covered and then uncovered
- You look at the UNCOVERED eye
- Watch for movement of this eye (NOT the one you are covering and uncovering)
- For detection of TROPIAS – each eye is separately done

Alternation

- Seems like each eye has the tropia!
- Example – R eye covered, left moves in to fixate, then left eye covered and R moves in to fixate
- Cover is not moved over the nose – move it under when going from R-L and L-R

Alternate cover test

- Movement of the cover across the nose from one eye and then back to first
  - Also known as “cross-cover” test
- Detects PHORIAS when TROPIAS not present.
- Ex – cover-uncover shows no movement when looking at uncovered eye. Now you look at the eye under the cover as you go across the nose to the other eye

Cover Testing: measure near and distance
**Prisms**
- AIM the APEX towards the deviation
  - Eso (inwards eye) would need Base OUT to neutralize
  - Exo (outwards eye) needs Base IN
- PLACE the BASE in the direction the eye is moving
  - Ex.: You saw right eye move from OUT to IN (moving inwards) – now you place the prism base IN

**Eso, Exo, Hyper**
- In ESO deviations, the eye seems to move out (from where it **was**)
- EXO deviations will have the eye moving inwards (it **was** out, now it has to move in to fixate)
- HYPER deviations show the eyes moving upwards and downwards (usually with the upper lid at the same time)
  - Named after the “higher” eye

**Types of deviations**
- **Eso**
  - E, ET, E(T)
- **Exo**
  - X, XT, X(T)
- Vertical
  - HT, H(T), HOT, HO(T)
- **Dissociated**

**Amblyopia**
- “Lazy eye”
- Can be caused by muscle problem or refractive problem (anisometropic) – or even lid or corneal problems!
- If one eye stays blurred too long the body compensates by ignoring its impulses, and rotating it away to minimize “confusion”

**Measurement Techniques**
- By Corneal Light Reflex
  - **Hirschberg** estimating the angle of deviation by the degrees of decentration
  - **Krimsky** using a prism to center the corneal light reflex

**Estimating deviations**
- Hirschberg method – estimates using the position of a light reflex on the cornea – normal cornea 12 mm, so each mm away from center equals 15° P.D. (or ~7°)
  - ½ cornea = 6 mm
  - 6 X 15 = 90
- **Krimsky** method -uses prism to move the light reflexes on the cornea into equal positions on each eye
Cover Testing for **horizontal** diplopia:

- gaze positions to measure:
  + both side gazes
  + up and down ("A" or "V" patterns)
  + distance and near
  + with +3.00/-2.00 (especially XT)
  + fusional amplitudes

Accommodation: make sure to control it

- Non-accommodative target
- Accommodative Target

Accommodation: take advantage

- Accommodative Esotropia
- High AC/A ratio (measure with +3.00)
- Exotropia (measure with -2.00 at distance, +3.00 at near)

Cover Testing for **vertical** diplopia (watch lid movement)

- sides – Right and Left
- up and down
- tilts
- double Maddox Rod
- fusional amplitudes

Double Maddox Rod

Cover Testing: Vertical deviations
Intermittent Tropias

- Seem like they aren’t always there – they aren’t!
- Fusion only breaking down some of the time, so patients will sometimes be aware “something not right”
- Can be intermittent and alternating!

Fixing vs. Non-fixing Eye

- “Better” eye is usually fixating (preferred by the patient in “normal situations” “Primary deviation”
  - Parents will say it’s usually one eye (pictures may help)
  - When the “worse” eye fixates, the defect will GROW larger because it takes more “innervation” to make it move “Secondary deviation”
- In alternating defects, fixation shifts from one eye to the other easily – both eyes are being used, so amblyopia does NOT appear.

Paralytic Strabismus

- Implies nerve is involved
- Usually noticed by patient at onset – suddenly diplopia
- Pupils and lids are involved if CN III
  - Ex – R III palsy might show inability to move OD in, up, or down (limited). Also may have R ptosis from levator, and R miosis (from poor dilator function)
- Website to show:

Example: Acute VI N palsy

Example: III N palsy

Example: Grave’s and Myasthenia

Lid Fatigue

Watch RIGHT Upper Lid (our left) position in extended upgaze → fatigue
Pseudostrabismus

- Looks like an esotropia because the epicanthal folds are large or prominent
- Cover tests will show no movement, meaning pt. is orthophoric.

3-step test for vertical diplopia

1) map out the muscles
2) identify the direction of the deviation in **primary gaze**
3) identify the direction where the deviation is greatest in **side gaze**
4) identify the direction where the deviation is greatest in **head tilts**

**Weak muscle**
3 step test: let’s do one

Primary gaze
Right gaze
Left gaze

Right tilt
Left tilt
Note: Prism tilts with patient’s head

Other factors / “need to know”
- Stereo tests
- Six diagnostic positions of gaze (Not same as nine “cardinal” positions)
- Maddox Rod
- NPC/NPA
- Fusion, Simultaneous Macular Perception
- Diplopia (monocular vs. binocular)
- Risley / Rotary prism

Sensory Testing
- Worth 4-dot
- Stereo
- Color

Any questions????

- Thanks!

- My email addresses (if there are questions):
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