Sudden Onset Diplopia: Should I Be Afraid?
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Case History – Diplopia
- Extremely important part of the examination
- What should you be asking about the diplopia?
  o Onset
  o Duration
  o Associated with injury
  o Associated with certain task (reading, driving, etc)
  o Intermittent vs. Constant
- Monocular Diplopia versus Binocular Diplopia
- Causes of Monocular Diplopia
  o Refractive
  o Corneal problems
  o Cataracts
  o Dry Eye
  o IOL decentration
  o Epiretinal Membrane
  o **Pinhole will often help with these conditions
- Binocular Diplopia
  o Vertical or Horizontal
  o Present in all gazes?
- Associated Physical Signs
  o Ptosis
  o Head tilt
  o Exophthalmos/proptosis
  o Don’t forget to look at your patient as a whole
- Neurological symptoms
- Medical History
  o History of trauma, other than ocular
  o Thyroid dysfunction
  o Vascular dysfunction
  o Neurologic dysfunction
  o Neurodegenerative condition
  o Stroke
- Ocular History
  o History of ocular injury
  o History of ocular surgery
  o History of dry eye
  o Last updated prescription
  o History of vision therapy
  o History of prism glasses

Ocular Alignment Assessment
- Cover Test
  o Fixation Target
    ▪ Distance: 20/30 single letter
    ▪ Near: 20/30 (or smaller) single letter
- Stress target clarity
- Unilateral versus Alternating
- Note laterality, frequency, direction of tropia
- Prism Neutralization
  - Measuring a Vertical Component
    - Cover Test
    - Maddox Rod
    - Modified Thorington
    - Borish Card
- Stereoacuity
  - No Global stereo means there is no bifoveal fixation
  - If a patient complains of diplopia and they have global stereo in your chair, you know it is intermittent

Comitancy Testing: Ocular Alignment in multiple gazes
  - Cover Test is most commonly how you will do this
  - Where is the patient symptomatic?
    - Distance
    - Near
  - Comitant versus Incomitant Deviation
    - Comitant Deviation:
      - Ocular alignment is the same in all positions of gaze
      - Not a muscle or nerve problem and is more likely longstanding
    - Incomitant Deviation:
      - Ocular alignment **IS NOT** the same in all positions of gaze
      - Typically caused paralytic or mechanical restrictive process and is more likely to be new onset
        - Worry about sinister origin
        - Note that a deviation that was once incomitant can eventually become comitant; sometimes this is referred to as **spread of comitancy**
    - Restrictive versus Non-Restrictive
      - Threshold
        - Lateral: 5 prism diopters
        - Vertical: 2 prism diopters
  - How can you test this?
    - Objective
      - Cover Test
      - Synoptophore
    - Subjective
      - Red Lens Test
      - Hess Lancaster
      - Maddox Rod/Modified Thorington
- Reminder: EOM Actions

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Primary Action</th>
<th>Secondary Action</th>
<th>Tertiary Action</th>
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</thead>
<tbody>
<tr>
<td>Lateral Rectus</td>
<td>Abduction</td>
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<td></td>
</tr>
<tr>
<td>Medial Rectus</td>
<td>Adduction</td>
<td></td>
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<tr>
<td>Superior Rectus</td>
<td>Elevation</td>
<td>Intorsion</td>
<td>Adduction</td>
</tr>
<tr>
<td>Inferior Rectus</td>
<td>Depression</td>
<td>Extorsion</td>
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<td>Superior Oblique</td>
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<td>Elevation</td>
<td>Abduction</td>
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</table>

- Diagnostic Action Fields

- Synoptophore/Troposcope/Major Amblyoscope
  - Unlikely to have in routine primary care practice
  - Easily find objective angle, subjective angle, and range of fusion
  - Lateral, Vertical, Cyclo components

- Red Lens Test
  - Ultimate goal: To determine in which diagnostic action field the white and red light are separated & which image is projected the furthest
  - Important to make sure patient does not turn their head during testing!
  - Record findings in all 9 positions of gaze
  - First place red lens in front of patient’s non-preferred eye (fixating with preferred!)
  - Hold transilluminator level with bridge of patient’s nose
  - Record what patient sees in all 9 positions, from EXAMINER point of view

Reminder: Methods of Comitancy testing

- Testing EOM:
  - Versions:
    - Binocular movements with the 2 eyes moving together and symmetrically in the same direction
  - Ductions:
    - Monocular eye movements consisting of adduction, abduction, elevation, and depression
  - What are you looking for?
    - Restrictions
    - Overactions
    - Underactions
    - A/V patterns

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- Incomitant deviation → determine the underacting muscle with the diagnostic action field drawing
  - “RED LENS LEADS” (diplopia test)
- Hess Lancaster
  - Likely won’t use in practice
  - Same principal as red lens test, but opposite findings
  - “Lancaster Lags” (projection test)
- Maddox Rod / Modified Thorington
  - Maddox Rod
    - Can use for lateral and vertical phorias/tropias
  - Modified Thorington
    - Utilizes Maddox rod and Modified Thorington target
      - Distance target
      - Near target
    - Target has numerical values in prism diopters
    - Vertical and Horizontal deviations
- Testing comitancy on a vertical deviation:
  - Parks 3 Step procedure
    - This procedure will help isolate the involved muscle in a vertical deviation
    - Can be done objectively or subjectively
    - 3 Steps:
      - Primary Gaze
      - Lateral Gaze (Left Gaze, Right Gaze)
      - Head Tilt (Left Tilt, Right Tilt)
  - How to prescribe for vertical
    - Wondering where to start?
      - Borish/Wesson Card (associated phoria)
      - Maddox Rod
      - Vergence ranges
        - (Base down to break – Base up to Break)/2 = correcting prism
          - (+) value → BD
          - (--) value → BU
        - Trial Frame!
        - Can’t get fusion with prism?? Check for torsion!
          - Double Maddox Rod
- Billing for sensory-motor (sensorimotor) exam
  - CPT Code 92060
  - Medical BV code
  - When can it be billed?
    - “Multiple measurements of ocular deviations with interpretation and report”
      - Multiple gazes
      - Same gaze with added lenses

Correspondence
- Types of Correspondence
  - Normal Correspondence: stimulation of the two foveas gives rise to the same cortical visual direction
    - Subjective angle = objective angle
**Anomalous Correspondence**: phenomenon or anomaly of binocular vision in which stimulation of the two foveas does NOT give rise to the same cortical visual direction
- Fovea of one eye is functioning directionally with an extrafoveal area of the other eye
- Subjective angle ≠ objective angle

**Angles used in determining correspondence**
- **Objective angle of deviation (H)**
  - Angle by which the visual axis of the deviating eye fails to intersect the object of regard
  - Manifest in strabismus, latent in phoria
- **Subjective angle of deviation (S)**
  - Angle at which patient perceives fusion
- **Angle of Anomaly (A)**
  - Difference between objective and subjective angles
  - \[ A = H - S \]
- **Threshold**: more than 5 prism diopters is considered significant difference

**3 types of anomalous correspondence**:
- **Harmonious**
  - Subjective angle = 0 (straight ahead)
  - Patient will give fusion response in primary gaze despite presence of strabismus
- **Unharmonious**
  - Patient perceives fusion at an angle which is less than the angle of deviation, but is not straight ahead
  - Objective angle > Subjective angle > 0
- **Paradoxical**
  - Surgical under or over correction
  - PAC I – angle of anomaly > objective
  - PAC II – subjective angle > objective

**How to measure**
- **Subjective Angle**
  - Red Lens Test
  - Maddox Rod
  - Bagolini lenses
  - Hess Lancaster
  - Synoptophore
- **Objective Angle**
  - Bagolini lenses
  - Cover Test
  - Synoptophore

**What does it mean?**
- **Generally**, normal correspondence tells you it is not long standing versus having anomalous correspondence which is generally seen in long standing conditions
- Therefore, it’s good to have objective measurement of the angle of deviation as well as subjective input from the patient to confirm their subjective angle where the image is fused

**Neurologic Signs**
- **Pupils**
  - Parasympathetic Pupillary fibers travel along the 3rd nerve on the outer portion of the nerve
- If you see a 3rd nerve palsy with mydriatic pupil, be thinking of compressive lesion (tumor, aneurysm)
  - IMAGING WARRANTED

  - Horner’s Syndrome
    - Sympathetic denervation
    - Can be a result of trauma
    - Triad
      - Ptosis
      - Miosis
      - Anhydrosis

- Cranial Nerve Testing

<table>
<thead>
<tr>
<th>Cranial Nerve</th>
<th>How to Test</th>
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<tbody>
<tr>
<td>I (Olfactory)</td>
<td>Sense of smell from each nostril</td>
</tr>
<tr>
<td>II (Optic)</td>
<td>Visual acuity, fundoscopy</td>
</tr>
<tr>
<td>III (Oculomotor)</td>
<td>EOM, pupils</td>
</tr>
<tr>
<td>IV (Trochlear)</td>
<td>EOM</td>
</tr>
<tr>
<td>V (Trigeminal)</td>
<td>Light touch and pinprick for each division (V1 – Forehead, V2 – cheek, V3 – lower lip)</td>
</tr>
<tr>
<td>VI (Abducens)</td>
<td>EOM</td>
</tr>
<tr>
<td>VII (Facial)</td>
<td>Facial symmetry – close eyes tightly, smile, show teeth, whistle</td>
</tr>
<tr>
<td>VIII (Auditory)</td>
<td>Hearing with whispered speech or rubbing fingers together in each ear</td>
</tr>
<tr>
<td>IX (Glossopharyngeal)</td>
<td>Position of uvula when say “ahh”</td>
</tr>
<tr>
<td>X (Vagus)</td>
<td>Gag reflex, hoarseness</td>
</tr>
<tr>
<td>XI (Spinal Accessory)</td>
<td>Turn head with resistance and shrug shoulders</td>
</tr>
<tr>
<td>XII (Hypoglossal)</td>
<td>Stick out tongue looking for deviation to one side</td>
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</tbody>
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- Concern about cranial nerve nuclei close to ocular cranial nerves
- Can help localize where lesion is
  - Ex: CN VII close to CN VI and CN VIII nuclei
- Worried about multiple cranial nerve palsies

- Ptosis (with diplopia)
  - Unilateral ptosis
    - 3rd nerve involvement
    - Possible Horner’s
  - Bilateral ptosis
    - Myasthenia Gravis
    - Thyroid dysfunction

- When to image?
  - Cranial nerve palsy with no history of vascular disease, trauma
  - Especially CN III with pupillary involvement
  - Any neurological associations
  - Multiple cranial nerve impairment
  - When all else fails, if you’re unsure it is always better to refer for imaging.