Basic Ocular Motility

There are six extra ocular muscles on each eye. All muscles except the inferior oblique’s functional origin is at the annulus of Zinn. The inferior oblique originate at the infero-nasal orbital rim margin, goes back into the orbit, under the globe, and the inferior and lateral rectus then attaches.

Extraocular Muscle Actions

Extraocular Muscle Insertions

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Length</th>
<th>Limbus to Plane</th>
<th>Insertion angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR</td>
<td>41mm</td>
<td>5.5mm</td>
<td>0 degrees</td>
</tr>
<tr>
<td>LR</td>
<td>40.5mm</td>
<td>7.0mm</td>
<td>0 degrees</td>
</tr>
<tr>
<td>SR</td>
<td>42mm</td>
<td>7.7mm</td>
<td>23 degrees</td>
</tr>
<tr>
<td>IR</td>
<td>40mm</td>
<td>6.5mm</td>
<td>23 degrees</td>
</tr>
<tr>
<td>SO</td>
<td>59.0mm</td>
<td>13.8mm</td>
<td>54 degrees</td>
</tr>
<tr>
<td>IO</td>
<td>37mm</td>
<td>17mm</td>
<td>51 degrees</td>
</tr>
</tbody>
</table>

Strabismus

Tropia-a constant eye turn without any ability to control it with fusion. The patient with a tropia has either constant diplopia or suppression if developed early in life.
**Horizontal deviations**
- Esodeviations
- Congenital ET
- Accommodative ET
- 6th CN palsy
- Duane’s Syndrome-Type 1
- Consecutive ET
- Cyclic ET
- Divergence paralysis
- Pseudo ET

**Horizontal Deviations**
- Exodeviations
- Convergence Insufficiency
- Congenital XT
- MR palsy/3rd CN palsy
- Duane’s Syndrome-Type 2
- Sensory XT
- Consecutive XT
- Cranial Facial Anomalies
- Convergence Paralysis-Trauma
- Internuclear Ophthalmoplegia(INO)-MS
- Pseudo XT

**Vertical Deviations**
- Hyperdeviations
- Isolated CN palsy-SO palsy most common(4th)
- DVD
- Pseudo HT
- True Hypodeviations
- Brown’s syndrome
- Double Elevator Palsy
- Blowout Fracture
- Grave’s/TED

**Pseudostrabismus**
- All babies have uncoordinated eyes until they are 6 months of age.
- The Hirschberg test determines the position of corneal light reflexes on the corneas in relation to one another

**Paralytic Strabismus**
- Strabismus caused by any cranial nerve palsy.
- Most common horizontal-6th vertical 4th
- Characterized by their incomitance
- Will have a primary and secondary deviation
- Primary deviation is amount of strabismus measured with normal eye fixating
- Secondary deviation is amount with paralytic eye fixating. It is always larger than primary eye, so document which eye fixating in measurements
- Because of Hering’s Law, when paralytic eye fixating more additional innervation goes to the normal eye. The healthy eye “overacts”
Amblyopic Detection

- Amblyopia is defined as decreased vision in one eye that cannot be attributed to a specific organic problem and cannot be improved with corrective lenses.
- There are over ten causes of amblyopia. Most are treatable before the age of 9.
- Most people believe if it is not treated by the age of 8 or nine, the vision will not recover.

Evaluation Assessment Methods

- Cover/ uncover
- Only done to detect tropias

Cross Cover/Alternate Cover Test

- Test used to measure phorias
- The patient must fixate on an accommodative target (20/40 or smaller) and continue to accommodate on it
- As you cover the eyes, you watch the eye under the cover as it is moved to the other eye
- Do not allow the cover to be removed as binocularity should never take place
- Prism is added to the deviation in the direction to neutralize the movement of each eye as seen on the cross covering

Hirschberg Measurements

- Objective method of measuring tropias on a very young or blind patient
- Hirschberg measures the relative position of the light reflexes in each eye. If the reflexes are symmetrical or slightly nasal in each eye, there is no eye turn
  - If asymmetrical tropia may exist
  - Where the displacement is determines the direction the eye is deviated
- An INward turning eye will have an OUTward displaced light reflex
- 1mm of displacement=7degrees=about 15PD

Krimsky Measurements

- Krimsky measurements use prisms to move the light reflex back to the approximate position of the other eye
- Base out to correct and Esotropia, etc.
Diagnostic Positions of Gaze

- The nine positions to which both eyes are moved as the head remains forward

Stereopsis/Fusion

- There are Three Grades of Fusion
  - 1 superimpositioning of dissimilar objects
  - 2 motor fusion-fine tuning movements to maintain sensory fusion-amplitude measurements
  - 3 stereopsis-blending of two similar images into one, resulting in depth perception

Near Point of Convergence and Accommodative Convergence

- NPC

- Accommodative Convergence-convergence is exerted as the eye accommodates.

Duction - movement of one eye

Version - movement of both eyes on one direction

Vergences - eyes moving in opposite directions to maintain fusion-convergence and divergence

Abduction: eye moves out
Adduction: eye moves in
Dextroversion: both eyes move to the right
Levoversion: both eyes move to the left
Convergence: both eyes move in
Divergence: both eyes move out
Risley Prism

- In the phoropter or hand held
- Prisms mounted front to back and rotated in opposite directions
- Allow gradual increase continuous change in prism

Maddox Rod

- A dissociating test used to detect and measure a phoria or tropia
  - A group of red cylinders lined up side by side
  - When a light is shown through the Maddox rod, it appears as a line perpendicular to the orientation of the cylinders

Using the Maddox rod

- To test for a horizontal deviation, have the patient hold the Maddox rod with the cylinders horizontal
- Shine a pen light or muscle light in a dimly-lit room
- The eye without the Maddox rod will see a point light
- The eye with the Maddox rod will see a red vertical line
  - If the red line goes through the white dot of light, there is no deviation

Maddox rod for horizontal deviations (con’t)

- Place Maddox rod over right eye
  - Patient perceives red line to the right of the white dot, indicates ESO deviation (uncrossed)
  - Patient perceives red line to the left of white dot, indicates EXO deviation (crossed)
- Place the Maddox rod over the left eye
  - Patient perceives red line to the left of the white dot, indicates ESO deviation (uncrossed)
  - Patient perceives red line to the right of the white dot, indicates EXO deviation (crossed)

Maddox rod for vertical deviations

- Have the patient hold the Maddox rod vertical
- Shine a pen light or muscle light in a dimly-lit room
- The eye without the Maddox rod will see a point light
- The eye with the Maddox rod will see a red horizontal line
  - If the red line goes through the white dot of light, there is no deviation

Maddox rod for vertical deviations (con’t)

- Place Maddox rod over right eye
  - Patient perceives red line below the white dot, indicates right hyper deviation
  - Patient perceives red line above the white dot, indicates right hypo (or left hyper) deviation
- Place the Maddox rod over the left eye
  - Patient perceives red line below the white dot, indicates left hyper deviation
  - Patient perceives red line above the white dot, indicates left hypo (or right hyper) deviation
Thank you