Monocular vs Binocular Diplopia

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PARK NICOLLET PEDIATRIC AND ADULT STRABISMUS CLINIC
Monocular Diplopia

- Patient sees double vision with ONE eye open
- Second image appears as an OVERLAP or GHOST image
Monocular Diplopia

- How to test?
  - Cover test: cover each eye and ask the patient if they see single or double
  - Pinhole: monocular diplopia will likely resolve
Monocular Diplopia

Causes

- **Refractive**
  - High astigmatism

- **Tear Film Insufficiency**
  - Early tear break up time
  - Dry eye syndrome
  - Abnormalities in blink

- **Retinal Pathology**
  - Maculopathy due to fluid, hemorrhage, or fibrosis (epiretinal membranes are the most symptomatic)

- **Cornea abnormalities**
  - Keratoconus

- **Lens abnormalities**
  - Lens opacities
  - IOL decentrations where the edge of lens is within the visual axis
  - Change in refractive error (anisometropia)

- **s/p ocular surgery**
  - Refractive surgery can cause irregular astigmatism and ocular aberrations
  - Polycoria after iridectomy
Monocular Diplopia
Additional Testing

- **Refractive**
  - Pinhole, optical aberrations can be caused from irregular astigmatism
  - Refract with retinoscopy or over hard contact lens
  - Let patient dial in astigmatism axis

- **Tear Film Insufficiency**
  - Early tear film break up time or Schirmer test
  - Use artificial tear to see if symptoms resolve

- **Macular Pathology**
  - Fundus exam
  - OCT
  - Amsler Grid

- **Cornea abnormalities**
  - Slit lamp exam
  - Corneal topography instruments
Binocular Diplopia

- Patient sees double vision with BOTH eyes open

- Vertical and Horizontal Diplopia
Binocular Diplopia

- How to test?
  - Covering EITHER eye relieves the diplopia
Binocular Diplopia
Additional Testing

- Cover test in all gazes
- Motility
- Sensory testing
- Pupils
- Visual acuity
- Manifest refraction
- Fusional amplitudes

- Double maddox rod
- Eye lid position
- Abnormal head posture
- Orbicularis oculi strength and facial sensation
- Exophthalmometry
- Color vision
Visual Pathway

The cerebral cortex receives the encoded images of the contralateral visual fields of both eyes.

Never forget that the image on the retina is inverted.

Homonymous Diplopia
Uncrossed Diplopia

Example of a right 6th nerve palsy

- Right lateral rectus results in the right eye turning in
- Image falls on the retina nasal to the fovea
- Image is projected on the temporal field
Example right medial rectus palsy

- Paretic right medial rectus muscle results in the right eye going out
- The image falls on the temporal side of the fovea
- Image is projected to the nasal field
Causes for Binocular Diplopia

Acquired and Urgent

- You should NOT have more than one of the following neuro-ophthalmic symptoms at one time
  - Problem with the lid
  - Problem with the pupil
  - Problem with motility
Causes for Binocular Diplopia

**Acquired and Emergent**

1. **Aneurysm**  large, poorly reactive pupil suggesting 3rd nerve palsy (posterior communicating artery)

2. **Carotid dissection**  homer syndrome and 3rd nerve palsy

3. **Intracranial or meningeal based tumors**  multiple cranial nerve palsy

4. **Myasthenia gravis**  any pupil sparing motility disturbance, fatigue, variable, ptosis, respiratory failure

5. **Giant cell arteritis**  new onset headache, scalp tenderness, pain with chewing, diplopia
# Causes for Binocular Diplopia

## Acquired

<table>
<thead>
<tr>
<th>3rd nerve palsy</th>
<th>4th nerve palsy</th>
<th>6th nerve palsy</th>
<th>Restriction</th>
<th>Misc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microvascular ischemia (diabetes, HTN, high cholesterol)</td>
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<td>Orbital blow out fracture</td>
<td>Skew deviation (stroke, demyelinating)</td>
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<tr>
<td>Head trauma</td>
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<td>Orbital myositis</td>
<td>INO</td>
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<tr>
<td>Demyelination (Multiple Sclerosis)</td>
<td>Congenital that has broken down</td>
<td>Demyelination (Multiple Sclerosis)</td>
<td>Infiltration of the orbit by cancer</td>
<td></td>
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<tr>
<td>Compression (aneurysm, tumor, inflammation (sarcoidosis, vasculitis))</td>
<td></td>
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<td>Acquired Brown syndrome</td>
<td></td>
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<tr>
<td>Infection (meningitis)</td>
<td>Increased cranial pressure</td>
<td>Thyroid eye disease</td>
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Causes for Binocular Diplopia
Acquired s/p ocular surgery

- **Cataract**
  - Patient suppressed one eye due to poor vision and now the vision has improved so they are symptomatic of the eye misalignment
  - Aniseikonia from anisometropia can lead to disparate sized images from each eye
  - Trauma to extraocular muscles from peribulbar injections

- **Scleral buckling**
  - Expansion of hydrogel explant material can cause restrictive orbitopathy
  - Injury to muscle or scarring of Tenon’s capsule
Continued s/p ocular surgery

- Glaucoma
  - Baerveldt implants can result in bleb which can involve the extraocular muscles

- Refractive
  - Beware of prism in glasses prior to surgery
  - Accommodative esotropia and intermittent exotropia can be controlled by the prescription
  - Avoid mono-vision in someone with strabismus
Physiologic Diplopia

- All object points lying on the horopter curve stimulate corresponding retinal elements are seen singly. All points not lying on the horopter curve are imaged disparately. Points in panum’s area are seen stereoscopically (points are slightly disparate) and points outside panum’s space are seen double (points are disparate). The diplopia elicited by object points off the horopter is called physiologic diplopia. Physiologic diplopia can be demonstrated to anyone with normal binocular vision
Physiologic Diplopia

How to elicit physiologic diplopia

- Hold a pencil at reading distance in front of your head in its midplane and select an isolated object on the wall behind the pencil.

- Fixate the more distant object, and the pencil will be seen double.
  - When fixating a distant object, a nearer object is seen in crossed (heteronymous) diplopia. Figure B

- Fixate on the pencil, it will be seen singly, but the more distant object doubles.
  - When fixating on a near object, a distance object is seen uncrossed (homonymous) diplopia. Figure A
Causes for Binocular Diplopia

Longstanding

- Congenital strabismus
- Intermittent strabismus or phorias
Monocular and Binocular Diplopia

- You can have monocular and binocular at the same time
- Treat the monocular diplopia first
Triage help

**Diplopia**

- Persists with one eye cover
  - Ghost image

**Monocular**

Refer to optometrist or general ophthalmologist

**Diplopia**

Goes away if they cover one eye

**Binocular**

Refer to strabismus clinic (peds or neuro)