Understanding Neuro-Based Vision Deficits: Assessment and Treatment

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Objectives

1. Identify basic structures of the eye and visual pathway
2. Understand how visual deficits impact functional performance
3. Identify role of therapy in vision management
4. Demonstrate basic functional vision treatment techniques
Vision and Functional Performance

● Goal = adaptation to the environment
● Primary sensory function used to acquire information
● Impacts all areas of function
  ○ Self-care
  ○ Postural control, balance, mobility
  ○ Coordination and quality of movement
  ○ Social interaction

http://discoveryeye.org/optic-nerve-visual-link-brain/
Eye Anatomy Review

- **Cardinal directions of gaze**
- **Cranial nerve function**
  - CN III: Oculomotor
  - CN IV: trochlear
  - CN VI: abducens

Eye Anatomy Review

1. Light enters eye through pupil and passes through cornea and lens to focus on retina
2. Retina contains light receptors (rods, cones) which process the image
3. Information is transmitted to the CNS via the optic nerve

http://www.apppsychology.com/Book/Biological/vision.htm
Visual Pathway

Transmitting visual information from retina to cortical areas of brain

1. Optic nerve
2. Optic chiasm
3. Geniculocalcarine tracts
4. Occipital lobe
Hierarchy of Visual Perception

- Foundation visual skills
  - Visual acuity
  - Visual Field
  - Oculomotor control

http://www.visibilities.com/
Role of Therapy

- Observe impairments
- Refer to neuro-ophthalmology
- Determine effects on performance
- Identify appropriate interventions

Know your scope of practice!
Interventions

Types:
- Remedial
- Compensatory
- Education

General Recommendations:
- Interdisciplinary
- Individualized
- Sensorimotor integration
Common Visual Impairments

Visual impairments and visual functional deficits.

<table>
<thead>
<tr>
<th>Visual Impairment</th>
<th>Prevalence (%)</th>
<th>Visual Functional Deficits [1,8,16–19,22]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accommodative Deficits</td>
<td>31–41</td>
<td>Difficulty with reading and writing tasks, diplopia, blurred vision</td>
</tr>
<tr>
<td>Vergence Deficits</td>
<td>40–56</td>
<td>Difficulty with reading and writing tasks, diplopia, blurred vision</td>
</tr>
<tr>
<td>Strabismus</td>
<td>26–32</td>
<td>Deficits of binocularity, depth perception, and eye movements; potential visual field deficits; double vision; and balance deficits</td>
</tr>
<tr>
<td>Pursuit/Saccade Deficits</td>
<td>29</td>
<td>Difficulty with reading and writing tasks, diplopia, blurred vision</td>
</tr>
<tr>
<td>Diplopia</td>
<td>19</td>
<td>Blurred vision, balance deficits, nausea, reading deficits, visual motor deficits</td>
</tr>
<tr>
<td>Cranial Nerve Palsy</td>
<td>7</td>
<td>Limited eye movements, diplopia, eyelid droop, abnormal pupil (glare issues), balance deficits, nausea, reading deficits</td>
</tr>
<tr>
<td>Fixation Deficits</td>
<td>9–13</td>
<td>Difficulty with reading and writing tasks, diplopia, blurred vision</td>
</tr>
<tr>
<td>Visual Field Deficits</td>
<td>46 (39 TBI, 67 CVA)</td>
<td>Difficulty with reading and writing tasks, ADL and IADL deficits, mobility deficit</td>
</tr>
<tr>
<td>Visual Acuity Deficits</td>
<td>21</td>
<td>Difficulty with reading and writing tasks, difficulty with mobility and navigation, ADL and IADL deficits</td>
</tr>
<tr>
<td>Contrast Sensitivity Glare</td>
<td>82</td>
<td>Blurred vision, mobility deficits, ADL and IADL deficits (difficulty recognizing objects and faces)</td>
</tr>
</tbody>
</table>
Basic Visual Assessment

1. General Appearance
2. Pupillary Size and Response
3. Accommodation
4. Near/ Distant Acuity
5. Visual Field
6. Oculomotor Function
Pupillary Response

- Assessment: appearance, response to light, response to accommodation
- Normal: round, equal, centered within iris, ~3mm
- Abnormal: constricted, dilated, asymmetrical, sluggish

Possible Indications
- Light sensitivity
- Blurry vision
- CN palsy
- Blindness

Interventions
- Lighting
- Transitions between environments

http://www.allaboutvision.com/conditions/anisocoria.htm
Visual Acuity

- Assessment: Snellen fraction
- Clinical Observations
- Possible Indications
  - Corneal scarring
  - Hemorrhage
  - Accommodation impairment
  - Retinal detachment
  - Optic nerve damage
- Interventions
  - Lighting
  - Magnification
  - Contrast

http://www.visionaware.org/info/your-eye-condition/eye-health/low-vision/low-vision-terms-and-descriptions/1235
Visual Field Deficits

- Assessment: confrontation
- Clinical Observations
- Interventions
  - Scanning
  - Dynavision
  - Anchors
  - Items in intact field vs. impaired field
  - Increase awareness of field loss

Oculomotor Function

- Assessment: corneal reflection, pursuits, convergence
- Clinical Observations
- Possible Indications
  - Strabismus
  - Convergence insufficiency
- Interventions
  - Saccades: hart chart, phone number copy, pegboard design copy
  - Tracking/pursuits: flashlight tag, wii
  - Scanning
  - Dynavision
  - Null point
Diplopia

- Assessment: cover/uncover, alternate cover
- Cranial Nerve Palsy
- Taping vs. Patching
Visual Attention

- Assessment: letter cancellation, design copy
- Clinical Observations
- Interventions
  - Scanning and organized scanning strategies
  - Dynavision
  - Environmental modifications

http://tactustherapy.com/what-is-left-neglect/
Determining Field Cut vs. Hemi-inattention

**Visual Field Deficit**
- Search pattern is abbreviated toward blind field
- Client attempts to direct search toward blind side
- Search pattern is organized and generally efficient
- Client rescans to check accuracy of performance
- Time spent on task is appropriate to level of difficulty

**Hemi-inattention**
- Search pattern is asymmetrical; initiated/confined to the right side
- Client makes no attempt to direct search toward left side
- Search pattern is random, and generally inefficient
- Client does not rescan to check accuracy of performance
- Client completes task quickly; level of effort applied is not consistent with difficulty of task
Scanning Activities

Central:
- Locating/gathering ADL items
- Card matching
- Where’s waldo/ I Spy
- Word search
- Large puzzles
- Connect 4

Environmental:
- Ball/balloon toss
- Scavenger hunt
- Kitchen mobility
- Grocery store (simulated or real)
Acquired Monocular Vision

- Use contrast as a guide
- Increase head movements
- Eye-hand coordination activities

Figure 2. Partial occlusion on glasses.

http://optometrytimes.modernmedicine.com/optometrytimes/content/tags/acquired-brain-injuries/treating-patients-brain-injuries
References

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