CVI 101:
An Introduction to Cortical Visual Impairment

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Goals for Session

1. Explain the visual pathway from eyes to brain.
2. Identify the causes and risk factors of brain-based visual impairment.
3. Utilize key principles to create and support an appropriate visual environment.
4. Access services from a teacher of the visually impaired (TVI) and other available resources.
Vision:
A key component of learning

- One of two distance senses.
- Key motivator for activity.
- A synthesizer
- A communicative modality
- A provider of a sense of the “whole”

Almost 90% of what is learned in the first 3 years is through vision.
Influencing Factors

1. Disease
   - Medication
   - Posture

2. Quality of Functions in Peripheral Pathways

3. Visuo-Motor Functions
   - Head Control
   - Muscle Tone

4. Prevailing Reflexes

5. Visual Memory

6. Communication

7. Wakefulness

8. Visual Sphere
   - Visual Attention
   - Motivation
   - Experiences

9. Vision for Development
Top 3 Causes of B/VI

#1 Cortical Visual Impairment
  25%

#2 Retinopathy of Prematurity
  12%

#3 Optic Nerve Hypoplasia
  11%

(Hatton, et al., 2013; Babies Count)
Let’s discuss...
Cortical Visual Impairment

Is a “brain thing”..

- Sometimes also known as “cerebral visual impairment”
- Caused by damage to the posterior visual pathways and/or the occipital lobes of the brain
- Can range from mild visual impairment to total blindness
- 65% of children with CVI also have ocular impairment
- Can be temporary or permanent
- Is not an indicator of the child’s cognitive ability
- Is highly individual
What causes CVI?

- **Hypoxia ischemia**
  - PVL and IVH leading cause
  - Head injury (accidental or non-accidental) is the second cause of CVI. Shaken Baby Syndrome is the leading cause of head injury. (Good et. Al., 1994)
  - Near drowning
  - Shunt failure
  - Hydrocephalous
  - Stroke (pre-, peri-, and post natal)

- **Infectious diseases (TORCH)**

- **Seizures**

- **Central Nervous System disorders**

- **Metabolic disorders**

- **Global syndromes**
Discovering CVI

1. “Normal” eye exam
2. History of brain damage/neurologic issues
3. Visual inattentiveness or visual unresponsiveness not explained by an ocular impairment
4. Presence of some or all of the unique CVI behavioral characteristics

(Good et. al., 1994 & 2001, Jan et. al., 1994, Whiting et. al., and Roman 2001)
True or False

1. Black and white is best.
2. The vision of a child with CVI changes constantly.
3. Children with CVI must learn to use eye contact.
4. CVI is not a true visual impairment.
5. All children with CVI have cognitive deficits.
6. It's ok to skip the CVI Range Assessment.
7. Any motion or movement is bad.
8. Children with CVI are permanently blind.

www.wonderbaby.org/articles/top-8-misconceptions-about-cortical-visual-impairment-cvi
Alfie Video
Let’s discuss...
Visual Pathways in the Brain
Visual Pathways in the Brain

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Dorsal and Ventral Streams

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1. Complexity
   Object, array, motor/sensory, faces
2. Color
3. Movement
4. Latency
5. Visual Field
6. Light
7. Distance
8. Visual Reflexive Responses
9. Novelty
10. Visual Motor
The CVI Range

- Determines degree of impact of CVI represented along a continuum (Range 1)
- Describes each CVI characteristic individually to determine the type of intervention needed (strategies to adapt environment) (Range 2)
- Includes interviews with caregivers and other team member
- Includes observations and direct assessments by TVI
The CVI Range

- Phase 1: Building Visual Behavior
- Phase 2: Integrating Visual Behavior
- Phase 3: Refining the CVI Characteristics
Support Strategies

- Family centered
- Routine based
- Individualized
- Appropriate assessment by TVI
- Used by entire team

- Consistency
- Across environments
- Environment dependent
- Controlling complexities
  - Sensory
  - Environment
  - Expectations
Let’s discuss...
CASE STUDIES
Chris

- Cri du chat syndrome
- Severe microcephaly
  - “Microcephaly overriding the mechanics of his vision” – ophthalmologist
  - Not officially and specifically diagnosed with CVI through documentation
- Very farsighted with possible amblyopia in left eye
Chris’ CVI Range

- **Complexity**: Score: .25
  - Visually attended to a school bus on blackboard
  - Blackboard used to focus on a visual target

- **Color**: Score: .5
  - Yellow is preferred color
  - Red and yellow switches used for yes and no

- **Movement**: Score: .25
  - Visually oriented to person walking 6 feet away
  - Needed when attracting attention beyond 3 feet or to new object

- **Latency**: Score: .25
  - Latent response when presented two song choice objects
  - Allowed for ample amount of wait time when making choices

- **Visual Field**: Score: .25
  - Immediately looked at iPad on right side
  - Presented visual targets in right field
Chris’ Strategies

- **Light**: Score: .5
  - Distracted by light from outside and fixated on 2-D materials on lighted surface.
  - Light used when combining vision with motor activities or introduced new concept

- **Distance**: Score: .25
  - Visually localized phone when presented 4 feet away
  - Presented non-lighted visual targets within 3 feet of Chris

- **Novelty**: Score: .5
  - Visually oriented to new image of milk after several minutes
  - Used pictures of familiar objects

- **Visual Reflexive Response**: Score: .5
  - Blinked to touch at bridge of nose and did not blink when finger was brought near face without touch

- **Visual Motor**: Score: .25
  - Looked at lightbox when reaching and later looked away when reaching for toy while standing
Photograph of a familiar object next to the real object
Red and yellow switches positioned on Chris’ right side
Two objects presented on blackboard for choice making
Light highlighting toys during play
Let’s discuss...
Kaitlyn

- 24 week preemie, weighed 1 lb 8 oz
- NICU stay (4 months)
  - ROP (4 laser surgeries to control)
  - Grade III IVH with shunt
- MRI shows no cerebellum and enlarged 4th ventricle
- EEG was abnormal in left hemisphere but no seizure activity
- Visual diagnosis of ROP and CVI
- 1 year 3 mo to 2 years during assessment period.
# Kaitlyn’s CVI Range

<table>
<thead>
<tr>
<th></th>
<th>1st</th>
<th>Increase</th>
<th>2nd (3 mo later)</th>
<th>Increase</th>
<th>3rd (3 mo later)</th>
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<tbody>
<tr>
<td>1. Color</td>
<td>.25</td>
<td>+</td>
<td>.50</td>
<td></td>
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<tr>
<td>2. Movement</td>
<td>.25</td>
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<tr>
<td>3. Latency</td>
<td>0</td>
<td>+</td>
<td>.25</td>
<td>+</td>
<td>.50</td>
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<tr>
<td>4. Visual Fields</td>
<td>.25</td>
<td>+</td>
<td>.50</td>
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<tr>
<td>5. Complexity</td>
<td>.25</td>
<td>+</td>
<td>.50</td>
<td>+</td>
<td>.75</td>
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<td>6. Light Gazing</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
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<tr>
<td>7. Distance Viewing</td>
<td>0</td>
<td>+</td>
<td>.50</td>
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<td>.50</td>
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<tr>
<td>8. Visual Reflexive Responses</td>
<td>.50</td>
<td></td>
<td>.50</td>
<td></td>
<td>.50</td>
</tr>
<tr>
<td>9. Visual Novelty</td>
<td>.25</td>
<td>+</td>
<td>.50</td>
<td></td>
<td>.50</td>
</tr>
<tr>
<td>10. Visual Motor</td>
<td>0</td>
<td>+</td>
<td>.25</td>
<td>+</td>
<td>.50</td>
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<tr>
<td>Totals:</td>
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<td></td>
<td>5</td>
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<td>5.75</td>
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Intervention Strategies Used with Kaitlyn

- Positioning
  - Side lying
  - Supported seating
  - Window or light source behind her
  - Visual targets in middle and right, then moved to all and left
- Blackboard made of Velcro display fabric
- Black elastic string with Velcro
- One toy presented at a time, then 2, then 3, as tolerated
- Familiar toys at first, then novel toys added as tolerated
- Toys with only one or two colors, red and yellow. Moved to new colors as moved to novel items
- Toys with movement properties like shiny
- Toy bar for environmental consistency
- Frequent rest breaks (watched for hiccups)
- Low levels of environmental noise
- Worked on other skills, like head and trunk control
Blackboard with 1 toy on elastic string in side lying.
One toy on toy bar with black background in supported seating.
Three familiar toys on toy bar with no black background.
New toy, different color but similar characteristic of shiny, on toy bar presented alone on preferred side.
New toy on left side, familiar toy on right. Visual delay of approximately 2 minutes to locate favorite toy in unfavorable field.
Switch activated lights on black background in dim room. Added visual motor/cause & effect component.
Let’s discuss...
Website Resources

www.wsdsonline.org
www.cvi.aphtech.org
www.littlebearsees.org
www.wonderbaby.org
www.strategytosee.com
www.perkinselearning.org/cvi
www.cviteacher.wordpress.com
www.cviscotland.org
Books:

1. *Little Bear Sees* by Aubri Tallent, Andrei Tallent and Fredy Bush

2. *Cortical Visual Impairment: An Approach to Assessment and Intervention, 2nd edition* by Dr. Christine Roman

3. *Cortical Visual Impairment: Advanced* by Dr. Christine Roman

4. *Vision and the Brain*, Dr. Amanda Lueck and Dr. Gordon Dutton