Cortical Visual Impairment

The American Conference on Pediatric Cortical Visual Impairment brings together professionals in optometry, ophthalmology, occupational therapy and visual educational psychology to increase the understanding of the definition, diagnosis and management of cortical vision loss in children.

Drs. Dominick Maino, Joseph Maino, Kerri Pillen, Curt Baxsrom, Beth Ballinger, Nicole Hooper have all participated.

Pediatric Cortical Visual Impairment Society

Cortical Visual Impairment

Pediatric Cerebral Visual Impairment

History of CVI
- Brain injury 19th century with Phineas P. Gage

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Kran B, Mayer L. Vision Impairment and Brain Damage
Pediatric Cerebral Visual Impairment

- World War I, wounded veterans with brain injury
  - Displayed perceived motion in the “blind, non-seeing” visual field.
  - Ability to sense motion, lights, and colors
  - Conscious or subconscious.

- Statokinetic dissociation (in children)
  - Greater reduction in sensitivity to stationary visual stimuli relative to similar targets in motion
- Riddoch phenomenon (adults)
  - Ability to sense movement even though blind
  - “See” moving objects... but not stationary ones
- Blindsight
  - Ability to ‘sense’ objects in the way

- For those children who understand language stating what is being seen as the child reacts to it may enhance both visual and language development.
- Such children may rock to and fro. Whether this generates an image is difficult to know.
- Rarely, children with cerebral blindness who are mobile move slowly around obstacles. This phenomenon has been called travel vision (Blindsight).

- Reduced visual acuity identifying feature.
- Many children damage to white matter surrounding the ventricles (perventricular leukomalacia PVL)
- Cerebral Visual Impairment now used (especially in Europe)

- 1980’s adults with bilateral occipital cortex insult (cortical blindness)
  - Term applied to children.
  - Cortical visual impairment used in the 1980’s onward
  - Definition of CVI includes injury lateral geniculate nucleus/visual cortex

- Movement in the peripheral visual field may elicit a smile in the blind child with quadraplegia and profound intellectual disability.
- Children who are fed with a spoon may intermittently open their mouths to receive food when the spoon is moved in an arc from the peripheral visual fields, but not when it approaches the mouth from straight ahead.


- Many children with cerebral impairment due to white matter surrounding the ventricles (perventricular leukomalacia PVL)
Pediatric Cerebral Visual Impairment

Cerebral vs Cortical Visual Impairment

- Cerebral visual impairment: inclusive term
  - Reduced visual acuity
  - Oculomotor anomalies
  - Visual field loss
  - Vision information processing problems
  - Cognitive Visual Dysfunction (CVD)
    - Used to identify visual perceptual anomalies
    - Used to identify vision information processing problems

Pediatric Cerebral Visual Impairment

- Classification of CVI
  - Ocular visual impairment: Refractive state. Optics, Eye health
  - Cerebral visual impairment: Neuro-pathway problems, cortical problems, oculomotor dysfunction, vision information processing (dorsal and ventral streaming processing mechanisms)

Pediatric Cerebral Visual Impairment

The ventral stream (also known as the "what pathway") travels to the temporal lobe and is involved with object identification. The dorsal stream (or, "where pathway") terminates in the parietal lobe and process spatial locations.

Pediatric Cerebral Visual Impairment

- Delayed Visual Maturation (DVM)
  - DVM type I: Visually impaired infants: improved visual abilities by the age of 6 months, often without treatment.
  - DVM type II: attention problems, associated with neurological/learning abnormalities. Improvement takes longer.
  - DVM III: children have nystagmus, albinism. Vision improves later, can improve to low-normal levels.
  - DVM IV: associated with retinal, optic nerve, macular anomalies

Pediatric Cerebral Visual Impairment

Reduced visual acuity due to a "brain problem"

Determining Vision Function and Functional Vision in Children with Pediatric Cerebral Visual Impairment
Vision Function and Functional Vision Anomalies in PCV

Diagnostic Approaches & Strategies

1. Case History
2. Visual Acuity
3. Refractive Error
4. Vision Function Assessment
5. Ocular Health
6. Special Tools

Vision Function

Clarity of vision (visual acuity, contrast sensitivity, refractive error)
Oculomotor ability (pursuits and saccades; convergence and divergence)
Accommodation (focusing)
Depth perception (3D vision)

Vision Function and Functional Vision Anomalies in PCV

Vision Function

Eye health

Biomicroscopy
Tonometry
Dilated Fundus Evaluation
Special diagnostic tools
EOG (electrooculogram)
ERG (electroretinogram)
VER/VEP (visually evoked response visual evoked potential)

Functional Vision

Functionally induced disability that overlays pathologically induced disability
Uncorrected refractive error: Amblyopia
Constant Strabismus: Amblyopia
Oculomotor dysfunction, Binocular vision dysfunction, Accommodative dysfunction: Attention

Functional vision

Vision information processing (VIP)/Visual perceptual skills
laterality/directionality
visual motor integration
non-motor perceptual skills
auditory perceptual/processing

Vision Function

Clarity of vision
What is visual acuity?
What is contrast sensitivity?
What is refractive error?
**Vision Function**

**Clarity of vision**

**What is visual acuity?**

The ability to see a certain size object at a certain distance.

**What is contrast sensitivity?**

Contrast sensitivity measures the ability to see details at low contrast levels. Visual information at low contrast levels is particularly important:

1. **in communication**, since the faint shadows on our faces carry the visual information related to facial expressions.

2. **in orientation and mobility**, where we need to see such critical low-contrast forms as the curb, faint shadows, and stairs when walking down. In traffic, the demanding situations are at low contrast levels, for example, seeing in dusk, rain, fog, snow fall, and at night.

3. **in every day tasks**, where there are numerous visual tasks at low contrast, like cutting an onion on a light colored surface, pouring coffee into a dark mug, checking the quality of ironing, etc.

4. **in near vision tasks** like reading and writing, if the information is at low contrast as in poor quality copies or in a fancy, barely readable invitation, etc.

Vision Function and Functional Vision Anomalies in PCV

Tests of Visual Acuity and Contrast

Used with permission
Pursuits, Saccades, Convergence

Retinoscopy

Vision Function and Functional Vision Anomalies in PCV

Retinoscopy

Bell (Apell)

Target (Wolf Wand) directly in front of the retinoscope
Patient fixates the target
Move the ball toward the patient slowly and smoothly
The distance of the target from the patient is recorded for a change in motion or other changes of interest
Expect to see a change from “with” to “against” on the way in at 35 - 42 cm. (14 - 17 inches) and a change from “against” to with at 37.5 - 45 cm. (15 - 18 inches).

Pediatric Cerebral Visual Impairment

Therapeutic Strategies for the Treatment of Pediatric Cerebral Visual Impairment

- Treatment begins with the basics.
  - Vision function
  - Refractive correction
  - Spectacles therapeutic
  - Eye health
Pediatric Cerebral Visual Impairment

- Treatment with spectacle/lenses
  - multi-focal prescription/bifocal
  - prism
  - occlusion

- Vision Therapy
  - Oculomotor/hand-eye/accommodation & fusion
  - Biocular
  - Binocular
  - Integration

- Vision Therapy
  - Integration/Stabilization
  - Visual stimulation
  - Vision information processing
  - Vestibular/Vision

- http://www.wonderbaby.org/articles/cvi-educational-tools

Perceptual Learning vs Vision Therapy
What follows is supplemental information to the presentation, resources and references that are not necessarily a part of this presentation, but which I thought you would like to have for your own information.

How Do Environmental Factors, Medications and Non-Visual Handicaps Affect the Evaluation and Treatment of Pediatric Cerebral Visual Impairment?

For individuals with disability...

- **Medications**: Prescribed many more medications
- Higher affinity for adverse effects due to environmental/systemic factors
- **Seldom complain** of symptoms related to their disability, systemic anomalies, or medication side effects

- **Alternative and complementary medical therapies**
  - Traditional allopathic approaches

- **Mental illnesses in children**
  - Pediatric Bipolar disorder
  - Pediatric depression
Pediatric Cerebral Visual Impairment

- Major environmental hazard: **People**
- do not know how to respond
- make assumptions
- true for lay individuals, teacher, health care professionals

Medication Side Effects

Antidepressants

- Abdominal pain/constipation
- Abnormal dreams/thinking
- Blurred vision
- Increased risk of disturbances
- Anxiety
- Photophobia

Anticonvulsants

- Memory problems/amnesia
- Sedation
- Insomnia
- Bronchitis
- Fluid retention
- Blurred vision
- Dimming of vision
- Diplopia
- Involuntary eye movements
- Dry eye

Anti-Parkisons

- Abnormal dreams/insomnia
- Memory problems/amnesia
- Increased muscle tone/weakness
- Involuntary movements
- Hallucinations
- Vision
- Blurred vision
- Mydriasis
- Decreased accommodation

Tranquilizers

- Breast development in men
- Breathing problems
- Insomnia
- Tardive dyskinesia
- Risk of narrow angle GLC
- Cycloplegia/Mydriasis
- Decreased vision
- Capsular cataract
- Anemia
- Seizures
- Blood disorders
- Unusual excitement
- Decreased accommodation
- Nystagmus
- Diplopia
- Mydriasis
**PCVI: References**


**References**


**Pediatric Cerebral Visual Impairment**

**Resources**

- Facebook [http://www.facebook.com/Thinkingoutsidethelightbox](http://www.facebook.com/Thinkingoutsidethelightbox)
- Infant Visual Stimulation Video [https://www.youtube.com/watch?v=Iey5PqwUnDw](https://www.youtube.com/watch?v=Iey5PqwUnDw)
- COVD [http://www.COVD.org](http://www.COVD.org)
- OEPF [http://www.OEPF.org](http://www.OEPF.org)