

Cortical Vision Impairment (CVI)

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An increasing number of children with cortical vision impairment are entering the educational system. These children pose many difficulties in identifying their educational and visual needs and in planning for their programs. There is a difference between children who have true cortical vision impairment and those children who have reduced visual functioning due to more widespread, global damage. In the literature, this global damage is often referred to as cerebral blindness. The prevalence of children with CVI is significant as it is one of the major causes of visual handicap in children in developed countries (Good1994). However, it is far too easy to label all children who have chronic developmental disability as being cortical vision impaired or blind.

Vision is a complex process involving intact anterior visual pathways (eyes, optic nerves, and chiasm) and preserved geniculostriate pathways (the pathways the optic nerves take through the brain to the back of the brain, the occipital lobe), including the lateral geniculate body (located approx. mid brain), optic radiations (approx. mid. Brain) and the primary visual cortex (area 17, 18, 21). Cortical Visual Impairment is reduced vision that is associated with normal or minimal ocular abnormalities, lesions involving the visual cortex, widespread neurological disease and frequently visual field and visual perceptual abnormalities. Any disease that affects the areas corresponding to the geniculated and extrageniculated pathways can cause CVI. The disease or accidents that cause CVI can also damage other areas of the brain or the visual pathways. Consequently, the majority of children with CVI may have additional disabilities. Causes of CVI include:

- Anoxia, hypoxia, ischaemia, asphyxia-lack or insufficiency of oxygen. (The visual cortex can only survive for approximately 4 minutes without oxygen.)
- Cerebral haemorrhage/cortical thrombosis
- Dysgenesis-malformation of the brain during prenatal development
- Trauma-car accidents, shaken baby syndrome
- Near miss Sudden Infant Death Syndrome.
- Severe central nervous system infections-meningitis, encephalitis
- Shunt malfunction in children with hydrocephalus.

Recovery of vision depends on many factors, however the vast majority of children show some degree of improvement however they remain vision impaired.

A number of clinical tests can be used to determine CVI. These include Electroretinogram (ERG), Electroretinogram (EOG), Visual Evoked Response (VER), Visual Evoked Potential (VEPM), Electroencephalogram (EEG), Computer Tomography (CT Scan), Magnetic Resonance Imaging (MRI), Positron Emission Tomography. The Ophthalmological, clinical assessment includes history, assessment of eye movement and head, fixation to light, optokinetic nystagmus, response to a threatening gesture, blink reaction to a bright light, pupil reaction, ophthalmoscopy.

Evaluation and assessment of visual function is often more relevant than attempts at acuity measurements. Functional assessment has an emphasis in two areas, the first being visual responses and the second being observed response to the environment. This assessment includes mobility, responses to light, color, threat, chequerboard patterns, zig zag patterns, responses to people and stylised faces, exploring when is the child most alert and examining preferred sensory modality for learning.

Children with CVI have unique, characteristic features these include:

- Children do not look “blind”
- Expressionless faces
- Eye movement smooth, slow but aimless
- Visual self-stimulation is rare.
- Visually inattentive
- Tends to look away from people and events
- Diminished visual communication
- Normally reacting pupils
- Blink reflexes eg blind to a threat
- No optical/sensory nystagmus present
- Additional neurological impairment always present.

Children with CVI also have distinct visual characteristics. These include:

- Visual abilities fluctuates
- Peripheral vision appears to be more functional
- Attends to moving objects-children tend to “see” better when travelling in a car.
- Sees better in familiar environment
- Lacks visual curiosity/inattention
- Spontaneously use reduced vision for short periods of time only
- Tires easily during visual learning
- May move head from side to side when looking
- Turns head when reaching
- Visual fields restrictions may be apparent.
- Some children respond selectively to visual stimuli
- Color can be important
- Some children engage in light gazing while some a light sensitive (1:4 are photophobic)

Children with CVI display perceptual characteristics that are unique to this group. These include:

- Appears unable to recognise stationary objects
- May not recognize faces
- Needs wide spaces between objects and visual stimuli
- Focuses on only one toy among several
- Reach is often inaccurate
- Identifies colour more easily than objects or shapes
- Familiarity of environment or object can aid recognition
- Little generalization
- Difficulty seeing objects of pictures places close together-“crowding effect”
- Uses hand searching movements when locating objects
- Supplements vision with touch
- Appears to hear better, when eyes are closed
- Many children with CVI are not capable of filtering out sensory information.
- Rarely bump into objects during travel-often have good mobility
- Balance also appears better when eyes are closed.

Given these characteristic features of this population of children their educational intervention requires specific intervention. Natalie Barraga believes “that a child’s visual skill can never be greater than his/her cognitive ability.” Keeping this in mind, these children present particular challenges to educator and they require more research.

Management of children with CVI requires careful consideration. The literature suggests that the use of a functional curriculum embedded in routines appears to work best with CVI children. One of the most significant educational considerations is the construction of a “user friendly” environment when working with these children. The term sensory filtering is used to create a quiet, stimuli restricted environment. Control needs to be placed on the type, intensity and duration of sensory input. Sensory bombardment may cause the child with CVI to shut down to block out an overload of input. Children with CVI require the following considerations when implementing their program:

- Well-lit area for working, indirect light source
- Work in familiar area of setting
- Provide optimum positioning of the child-head upright and in the midline
- Position of stimuli is critical
 - Distance:* up to 3 months child sees no further than approx. 75cm from himself, bigger objects 150 cm.
 - Field:* offer stimuli in every part of normal field, determine best area, then expand field of visual attention.
 - Background:* simple stimuli against neutral but contrasting background
- Short periods of structured activities, frequent rest breaks may be required
- Repetition is helpful, use real, familiar objects
- Present objects in dominant field
- Allow time to obtain a response.
- Color is significant, preference for yellow, red and orange stimuli
- Requires verbal and tactile cueing
- Visual responses may need confirmation from tactile sense
- Maximise the use of moving objects, this may enhance visual performance
- Minimize crowding
 - Adopting a shortened focal length-hold stimuli close to child.
 - Use tilt board to place work close and cut out background information
 - Widely separate objects/pictures
 - Point to objects/ pictures cue with verbal and auditory prompts.

Some of the literature suggests that it is essential to present visual information before introducing additional sensory information. It is also suggested that an object be presented first for tactual exploration and then identify the visual characteristics. It is also suggested that there is little evidence that vision training is effective with children with CVI but the use of routine coupled with a functional curriculum that maximizes environmental consideration is the most effective way to teach these children. The constant ambiguity within the literature makes it very difficult for educators to have confidence in the strategies they employ when working with these children.