Reaching for the Stars: Practical Considerations in Occupational Therapy with Children Who Have Visual Impairments Including Those with Cortical Visual Impairment and Complex Learning Needs

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Kansas City, Missouri
Learning Outcomes

1. The participant will understand different diagnoses and etiology associated with visual impairment including the difference between cerebral visual impairment, cortical visual impairment and ocular visual impairments.

2. The participant will increase their knowledge of evaluations and considerations used with children who have visual impairments in occupational therapy and the role of other team members.

3. The participant will increase awareness of occupational therapy treatment goals and techniques used with children who have visual impairment including assistive technology apps, software and devices used with this population.
“Approximately 80% of learning occurs through vision.”

American Foundation for the Blind
Definition of Blindness

Legal blindness is defined as visual acuity no better than 20/200 in the better eye with the best correction. Legal blindness is also defined as a central visual field that is no greater than 20 degrees.
20/200

- 20 = distance a person with visual impairment would have to be to see something.
- 200 = Distance that person without visual impairment could be to see the same thing.

******insert picture of 20/200
20/200 vision
Definition of Low vision

Low vision is defined as a reduction in visual acuity no better than 20/70 but better than 20/200 in the better eye with the best correction.

Simulation*
“Students with low vision including those with multiple disabilities, are entitled to a comprehensive educational program that includes services from professionals in visual impairment. This should encompass a range of individualized techniques and services that enable a child to complete current and future tasks in the school, home, workplace, and community.”

- Position paper on Low Vision
Ocular v.s. Neurological

- Ocular conditions effect only the eye itself
- Retinal detachment, retinitis pigmentosa, etc.
- In very young children can effect development and impact all developmental areas.
- Albinism
- Retinitis Pigmentosous
- Amblyopia, Strabismus
Neurological Conditions

- Neurological conditions affect eye, nerves, brain and entire neurological system.
- Impacts development from birth, ie; Cerebral palsy,
- Optic Nerve Hypoplasia
- Septo-Optic Dysplasia
- Cortical/Cerebral Visual Impairment
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.

Eye Conditions

- Retina
- Fovea centralis
- Central retinal a.
- Optic disc (blind spot)
- Optic Nerve
- Central retinal v.
- Vitreous Body
- Posterior chamber
- Anterior chamber
- Cornea
- Pupil
- Iris
- Zonules
- Sclera
- Ciliary body
- Inferior rectus m.
Eye Conditions
- Retinopathy of Prematurity
- Optic Nerve Hypoplasia
- Albinism
- Optic Atrophy
- Leiber’s Syndrome
- CHARGE syndrome
- Cortical Visual Impairment
Retinopathy of Prematurity

- Newborn exposure to high levels of oxygen

- Proliferation of blood vessels occurs, development of scar tissue, bleeding, detachment of the retina. Results in blindness.

- Glaucoma, uveitis (swelling and irritation of the uvea, the middle layer of eye), cataract, and degenerative lesions of the eye may occur months to years after onset of the RLF stage.

- Strabismus and myopia

- About 80% of abnormal blood vessels heal completely in the first year of life. In other cases scars from incompletely healed ROP result in either mild or severe RLF. (retrolental fibroplasia)

- About 5% of retinal detachment results from formation of scar tissue and the resultant pulling loose of the retina from the normal position in the back of the eye.
• Coloboma of the eye,

• Heart defects,

• Atresia of the choanae, congenital disorder where the back of the nasal passage (choana) is blocked, usually by abnormal bony or soft tissue (membranous)

• Retardation of growth and development,

• Ear abnormalities and deafness- small or absent semicircular canals.

• Genetic disorder
Amblyopia

- Poor vision in an eye that has not developed normal sight (usually during early childhood). The condition is sometimes called “lazy eye.”

- Visual acuity is much better in one eye than the other.

- Amblyopia is common and affects two or three of every 100 people in the U.S.

- Strabismus (misaligned eyes) One eye may look straight ahead while one turns in, out, up or down. Signals are turned off by the brain to avoid double vision,
A rare disorder characterized by abnormal development of the optic disk, pituitary deficiencies, and often agenesis (absence) of the septum pellucidum.

Symptoms
Blindness in one or both eyes
Pupil dilation in response to light,
Nystagmus
Inward and outward deviation of the eyes,
Hypotonia (low muscle tone)
Hormonal problems.
Seizures
Jaundice may occur at birth.
Intellectual problems-normal intelligence, others have learning disabilities.
Albinism
A defect of melanin production that results in little or no color (pigment) in the skin, hair, and eyes.

Symptoms:
- Absence of color in the hair, skin, or iris of the eye
- Lighter than normal skin and hair
- Patchy, missing skin color
- Crossed eyes (strabismus)
- Light sensitivity (photophobia)
- Rapid eye movements (nystagmus)
- Low vision or functional blindness

Leiber’s Syndrome
Degenerative disease that results in a severe loss of vision. This disease is thought to be caused by abnormal development of photoreceptor cells in the retina or perhaps the extremely premature degeneration of the retinal cells.

Symptoms:

- Low vision or blindness that may get progressively worse
- Loss of visual field
- Increased nystagmus as vision worsens

Optic Nerve Atrophy

Optic Nerve Atrophy (ONA) is a permanent visual impairment caused by degeneration in the optic nerve, leading to degeneration of the optic disc and eventually atrophy.
Optic Nerve Atrophy (ONA) is a permanent visual impairment caused by damage to the optic nerve by disease, tumors etc.

Symptoms:
- Central vision is affected.
- Color vision deficits.
- Difficult for children with ONA to discriminate contrast, due to damage in the area of the eye responsible for detailed vision (macula).
- A wide range of acuity loss.
- Onset of ONA may be gradual or sudden depending on the cause.
- A general decrease of sensitivity in all visual fields.
- Additional neurologic problems, seizures, developmental delays or motor problems, and Cortical Visual Impairment (CVI). Difficult to determine which diagnosis is responsible for specific visual problems.

Optic Nerve Hypoplasia
Optic Nerve Hypoplasia (ONH) refers to the underdevelopment or failure of the optic nerve during its development.
Optic Nerve Hypoplasia (ONH) refers to the underdevelopment of the optic nerve during pregnancy.

Symptoms:

- Vision ranging from normal visual acuity to no light perception. The effect on the visual field may range from generalized loss of detailed vision in both central and peripheral fields to subtle peripheral field loss.
- Visual function does not deteriorate with time. Depth perception and nystagmus may be more severe if vision loss is great.
- Mild light sensitivity (photophobia) may occur.
- ONH is one of the three most common causes of visual impairment in children.
A prenatal or postnatal insult to the brain that causes damage to one or more defined areas or results in widespread brain damage. The most common cause of C/ CVI is lack of oxygen in the brain tissue, called hypoxia or asphyxia, due to insufficient blood flow, otherwise known as ischemia. Other common causes are accidental and non-accidental head injury, developmental brain defects, and infections during pregnancy or after birth.

Hyvärin, Appleby, Bernaise-Pierce, 2010
Typically, a child with CVI has a normal eye exam or has an eye condition that cannot account for the abnormal visual behavior.

It is one of the most frequent causes of visual impairment in children from developed countries.
• Normal or minimally abnormal eye exam (CVI may co-exist with optic nerve atrophy, hypoplasia or dysplasia and ROP.)

• Difficulty with visual novelty (The individual prefers to look at old objects, not new, and lacks visual curiosity.)

• Visually attends in near space only
• Difficulties with visual complexity/crowding (Individual performs best when one sensory input is presented at a time, when the surrounding environment lacks clutter, and the object being presented is simple.)

• Non-purposeful gaze/light gazing behaviors

• Distinct color preference (Preferences are
- Distinct color preference (Preferences are predominantly red and yellow, but could be any color.)
- Visual field deficits (It is not so much the severity of the field loss, but where the field loss is located.)
- Visual latency (The individual's visual responses are slow, often delayed.)
Attraction to movement, especially rapid movements. Usually in peripheral fields

- Eccentric Viewing-to use peripheral

- Absent or atypical visual reflexive responses (The individual fails to blink at threatening motions.)

- Atypical visual motor behaviors
- Atypical visual motor behaviors (Look and touch occur as separate functions, e.g., child looks, turns head away from item, then reaches for it.)

- Inefficient, highly variable visual sense

Evaluations:

- Ophthalmology Exam-Diagnosis important to get services, especially in schools.
• Functional Vision Evaluation-TVIs with team determines functional use of vision. Near, middle, far vision, contrast, visual field, ocular motor control, complexity etc.

• Roman Scale of Cortical Visual Impairment-method to measure CVI and improvements

• Learning Media Assessment-Educational assessment that determines child’s primary learning mode.

• Expanded Core Curriculum-Used to determine areas to address in educational setting.

Opthamology Exam

• Acuity-preferential looking-infant, Lea symbols (apple, house, square, circle)-preschool
• Contrast sensitivity
• Visual Fields
- Contrast sensitivity
- Color perception
- Alignment
- Depth perception
- Pupillary responses
- Random dot Stereopsis-series of dots and 3d glasses for eye teaming.
- Ocular motility-how the eye muscles work to move the eye to locate and follow.
- Retinoscopy-shining light in eyes to see reflection on retina
- Visual fields
- Health of Eye including Retina

Evaluation
- Background Medical and Visual Information, Ophthalmology/ Optomotrist
- FVE, Learning Media Assessment, visual observation-TV1, other team members
- Motor/Positioning-UE/LE trunk, motor control/tone, fine/gross PT/OT
- Mobility-Orientation and Mobility, PT, OT
- Sensory Processing-OT, TVI
- Communication-gestural, verbal, receptive and expressive, AAC SP, OT, AT, TVI
- Cognitive skills/literacy mode-Learning Media Assessment-Teacher/TVI, OT
- Play/Learning Access-OT/AT/TVI
- Self Help-OT, Teacher, PT (mobility)

**EXPANDED CORE CURRICULUM FOR BLIND AND VISUALLY IMPAIRED CHILDREN AND YOUTH**
- compensatory or functional academic skills, including communication modes
- orientation and mobility
- social interaction skills
- independent living skills
- recreation and leisure skills
- career education
- use of assistive technology
- sensory efficiency skills
- self-determination
- May use assessment to determine IEP goals.

Considerations for Evaluation

Proper Physical Positioning-OT/PT Positioning is foundation for access and to assess visual skills.
Does child turn their head to one side or drop head down? Is muscle tone or weakness?

Is peripheral looking caused by CVI? - child will turn head when presented visual stimulus in front in central field and look out of corner of eyes. If look, look away it may be visual break.

Does Child have nystagmus?
- peripheral looking may be to reach a “null” point for nystagmus to “quiet” or slow to allow for looking.

Considerations for Evaluation

- Use of familiar and unfamiliar items
- Child's communication level and formal communication strategies (such as sign language, on object or picture system, and partner assisted...)
Communication strategies (such as sign language, an object or picture system, and partner-assisted scanning)

- Expectations for responding (verbal, pointing, eye gaze, vocalization, sign, gesture, and changes in biobehavioral states)

- Incorporation of wait time for responding. Children with VI often have increased processing time, especially with multiply needs such as autism, c.p. etc.

- Use of natural routines for observations

Functional Vision Evaluation-

- Background medical and functional history
• Sensory behaviors - do they need movement to process what they are seeing, tactile exploration or lack of etc.

• Appearance of the eyes - equal in size, cloudy etc.

• Ocular Reflexes - blink, doll’s eye, nasopalpbral

• Visual Abilities - tracking, scanning, gaze shift, following, depth perception, accommodation, saccades, binocular

•

FVE

• Visual Acuities - near, middle and far space

• Visual Field - confrontation test, kinetic two person test
Color Perception

OcularMotility


Literacy-print, braille, size of picture identification etc.

Positioning-head tilt or turn, head back or down to use particular field, peripheral or eccentric looking
Roman Scale of Cortical Visual Impairment

by Christine Roman Lansky, Ph.D.

• Phase I: CVI Range Level 0 to 3 (inconsistent visual attention on objects)
• Attention on objects
  • Need single color or personally preferred color objects.
  • Shiny objects.
  • Objects with movement.
  • Familiar objects.
  • Objects presented in a simple background.
  • Look and touch completed as separate event.

• Phase II: CVI Range Level 4 to 7 (some functional use of vision)
  • Use child’s favorite color and add one or two more colors.
- Child should begin to tolerate more complex visual patterns.
- Put reflective strips on objects. Outline objects.
- Reduction in light gazing by individual.
- May regard faces when voice does not compete.

Phase III: CVI Range Level 7 1/2 to 10 (using vision to perform most activities)
- Beginning to demonstrate a visually guided reach.
- Problems continue with complex visual setting.
Problems continue with complex visual setting:

- Difficulty with images/words on paper.
- Problems with objects over 10-15 feet from the child.
- May enjoy seeing self in mirror.
- No color preference.
- Attends to 2 dimensional images against a complex background.

Developmental Evaluations/Occupational Performance Measures

- Oregon Project for Visually Impaired Children-criterion referenced test. Fine/gross motor, compensatory/positioning, visual skills.
- Standard Evaluations are not made for Children with Visual Impairments. Be sure assessments allow for modifications if child can’t see items ie; tactile input.

- Visual Perceptual Tests- VMI, TVPS, MFVPT: Need to be sure that child is seeing all test items and doesn’t miss items due to visual field or visual processing.

Orientation and Mobility

- Sensory awareness

- Spatial concepts
- Spatial concepts
- Searching skills: locating items and places efficiently
- Independent movement
- Sighted guide: using another person to aid in travel
- Protective Techniques
- Cane Skills:

OT’s Role with V.I.
- Goals/treatment based on Occupational Performance
- Improving tolerance for tactile input and developing tactile discrimination.
- Overall Sensory Processing
- Self help/play goals.
- UE strength, dexterity, bilateral use
- Fine Motor/handwriting
- Functional Academic Skills
- Assistive Technology training

Positioning/Vision Modifications

Look at vision with head looking straight forward without tilt.

- With head flexed forward - Is it weakness or are they trying to get closer to visual stimulus? Bring screen or object closer

Are they turning away more or closing their eyes?
- Perhaps visual input is too stimulating or too cluttered. Put black InvisiBoard behind or simplify what you are presenting.

Try supporting the head and provide same visual input. Do you get longer central looking? If so, it may be head control not vision.

Make visual input simpler and less cluttered. Do they look more centrally for a longer period. If so, it may be visual complexity.

If they look away or squint eyes maybe the screen is too bright. Try going to adjustments in control panel and decreasing brightness.

Do they look at visual stimulus longer? If so, it may be light sensitivity or glare.

General Considerations for CVI

- Use of familiar and unfamiliar items
- Use color preference, contrast, simplify pictures.
Use color preferences, contrast, simplify pictures
- Pair objects with picture icons (consider Roman level)
- Use of natural routines for observations
- Incorporation of increased wait time for responding
- Use movement to gain visual attention
- Use lighted toys in darkened room or backlit items, e.g., lightbox, iPad, computer screen

Treatment Considerations: CVI
- Simplify-start with lighted toy/wand in darkened room, one object/one color, black or simple color background
• Use color that they are attracted to increase visual skills ie; red or yellow.
• Increase visual localization and fixation time.
• Use movement or auditory cue to attract vision.

Treatment Considerations:

Improve visual efficiency with residual vision. Improve access to the environment, information and the curriculum.

○ Enlargement/magnification of materials
○ Lighting
- Lighting
- Low vision evaluation by Optomotrist for magnifiers, glasses and other visual aids. OT can train in use of these devices.
- Instruction in use of other sensory systems to compensate for visual loss ie; tactile, auditory, proprioceptive.
- Strengthening and dexterity for use of devices ie; Perkins Brailler, Mountbatten Learning System.
- Auditory feedback-talking books, beeper balls,
- Scanning and search pattern techniques.

Low Vision Treatment Ideas

- Little Room-hang objects, tactile and visually stimulating materials for independent exploration with infants/toddlers.
- Upright stand with materials and lights for older multiple visual and tactile learners
Upright stand with materials and lights for older multiply involved students.

- High contrast, dark lined paper, fine tip marker or dark lined mechanical pencil for preschool or elementary school age.
- Enlargement for fonts/pictures.
- Positioning of materials in most effective visual field.
- Tactile graphics for pictures, maps etc, textures, object symbols.

Braille v.s. Print

- If child’s condition is progressive Braille instruction is necessary.
- If child’s low vision requires magnification.
If child’s low vision requires magnification greater than 72 pt. font, Braille should be taught.

If child demonstrates visual fatigue after a short time, consider Braille.

Braille literacy is important all the time i.e.; Braille games and classroom materials/labels

Assistive Technology-ECC

- Assistive Technology to maximize functional performance for self help, learning, recreation, future vocational goals etc.
- Adaptive Keyboards
- Accessibility Options on computer
• Accessibility Options on computer
• Mountbatten Learning System-
• Perkins Brailler
• Smart Brailler
• Refreshable Braille Displays
• Braille Notetakers

SETT Framework
Student, Environment, Task and Tools.
Joy Zabala, 2007

STUDENT
• What does the individual need to be able to do?
• What are the individual’s special needs as related to the task?
• What are the individual’s current abilities?
• What are the functional areas of concern?

Sensory Considerations
1. Can they handle multisensory input? Do they need only one input mode ie; visual, auditory, tactile, movement?

2. Do they do better when you are not talking, but just looking at visual input?
-May not be able to play music or sound on computer or ipad during visual activities.
- If hearing and visually impaired may need tactile adaptations or louder auditory output.

3. Do they need tactile input/braille. What are their tactile skills like?

4. What is their biobehavioral state? (Alertness level)
   Maybe need to provide graded sensory input, ie; movement, deep pressure, louder voice to increase alertness level.

   Do they need alerting activities or movement to increase interaction or alertness?

5. Do they need movement for alerting prior to visual activities?

Environment

- What are the structural and physical arrangements of the environment?

- What supports are available to both student and staff?
Tasks

- What naturally occurring activities take place in the environment?
- What is everyone else doing?
- What activities support the student's curricular goals?
- What are the critical elements of the activities?
- How might the activities be modified to accommodate the student's special needs?
- How might technology support the student's active participation in those activities?

Tools

- What no tech, low tech, and high tech options should be considered when developing a system for a student with these needs and abilities doing these tasks in these environments?
- What strategies might be used to invite increased student performance?
- How might these tools be tried out with the student in the customary environments in which they will be used?

SETT example

<table>
<thead>
<tr>
<th>Student</th>
<th>Environment</th>
<th>Task</th>
<th>Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literacy</td>
<td>classroom</td>
<td>Read book, answer questions</td>
<td>iPad, bluetooth interface, switches.app</td>
</tr>
<tr>
<td>Centers/cooking</td>
<td>classroom</td>
<td>Add/mix ingredients</td>
<td>mixer, power link, switch, measuring cups</td>
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</tbody>
</table>

**Visual Considerations**

What are the expectations for responding?

Do they have good eye gaze control? Can they visually scan across screen and localize to a specific target.

How many objects or pictures icons can they handle and what size?

Is the screen too cluttered or are the icons appropriately spaced?
Is the screen cluttered or are the icons appropriately sized to utilize vision or access?

- Do they need a grid or can they visually localize and attend to a scene?

Do you see a look-look away pattern with increased icons or scenes?

Do they need high contrast and do they listen to auditory output?

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Computer software

- Senswitcher-free download with high contrast patterns, pictures etc. Can change colors of background and picture.
- Switch it-patterns, pictures, scenes, opposites.
- Baby Giggles-high contrast, sound output software.
- Teach me to Talk-high contrast photos naming pictures, stories, puzzles.
- Teach me to talk-high contrast photos naming pictures, stories, puzzles.
- Judy lynn software-Look and Listen, Visual skills, animated toys, etc.
- Digital lightbox images-APH-black and white and color.
- Screen readers/magnifiers-Zoomtext, Izoom, Pixwriter-reading and writing, Intellitalk-voice output word processing.
- Websites-Priorywoods school, helpkizlearn, starfall.com, bookshare.com
- Computer accessibility-voice output and input, onscreen keyboard with large print, contrast, white on black and screen magnification, touch screens.

Ipad Applications

CVI apps

- Tap n See Zoo
- Big Bang Patterns
- Big Bang Pictures
- Big Bang Pictures
- Bubbles
- EPlay
- Infant Stimulation

Ipad Applications

Ocular Motor Skills
- Tap n See Zoo
- Visual Skills
- Sequential Vision
- Visual Scanning
- Low Vision
- MagLight
- Abilipad

Ipad Applications

Visual Impaired/Blindness
- Read2go-Bookshare: text to speech/braille
- Visual Brailler
Blindness/Deaf Blind Techniques

- Tactile/kinesthetic techniques-hand under hand exploration, not hand over hand.
- Search pattern techniques
- Tactile graphics, tactile symbols, textures, tactile discrimination
textures, tactile discrimination
• Braille, refreshable braille displays,
• Auditory feedback-talking books, beeper balls, environmental sounds, text to speech.

Basic Principles for Preparing Tactile

• Make the tactile graphic as clear as possible.

• Know the important facts to be kept in mind when creating the graphic.

• Determine if the original shapes and textures are necessary to convey the concept, or can simple geometric shapes or braille signs be used to illustrate the concept.

• Omit unnecessary parts of the diagram

• Keep in mind the knowledge level, skill base, and age level of the reader.

• Keep focus and directionality if necessary.
• Keep forms and lines to scale if measurement is required.
• Keep it simple
• Edit/proofread the graphic with your fingers, not your eyes, before showing it to a student.

Source: American Foundation for the Blind Braille Literacy Mentors in Training: The Next Generation - Teaching Special Codes: Nemeth, CBC, and Tactile Graphics - Workshop in Fremont, California (August 7-9, 1997) and Atlanta, Georgia (September 11-13, 1997). Diane Spence and Susan A. Osterhaus

Ways to make Tactile Graphics

• Puff paint to outline picture
• wicki stix
• Real objects glued to paper
• Textured paper cut out to form on paper
• Thermoform machine
- Thermoform machine
- Picture in a Flash PIAF
- Quicktac with Braille Embosser
- 3D printing

**Low Vision Aides/mobility devices**

- Magnification devices - magnifiers, Electronic magnifiers, monocular
- CCTV - portable camera, distance viewing
- Trekker Breeze - GPS
- AMD - cane, long cane, different tips
Case Studies?

Questions?
Resources

1. American Printing House for the Blind (APH)-quota funds/registry
2. Deaf/blind registry in Kansas and Missouri-funding for equipment
3. National Library Service for the Blind
4. Bookshare-free books in auditory format.
6. Independent Living Aids, Inc.
7. Noir Medical Technologies
9. Texas School for the Blind and Visually Impaired.
10. Enabling Devices
11. Freedom Scientific
12. Humanware