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OCCUPATIONAL THERAPY’S ROLE IN MANAGING FUNCTIONAL IMPLICATIONS OF VISUAL AND COGNITIVE IMPAIRMENTS

Lisa Rivera, MS, OTR/L

Vision

- Primary sensory system used to acquire information about the environment
- 80-90% of all learning occurs through the visual system
- Functions of Vision
  - Decision making
  - Social interactions
  - Motor control
  - Postural alignment
  - Participation in functional activities
Prevalence

- Overall prevalence of visual impairment early after stroke was estimated at 65%, ranging from 19% to 92%. Visual field loss reports ranged from 5.5% to 57%, ocular motility problems from 22% to 54%, visual inattention from 14% to 82%.
  (Hepworth, L., et al. 2016)

- Visual impairments were seen in 25% of post stroke survivors
  (Sand, K. M., et al. 2015)

Common Visual Impairments Following a Stroke

- Oculomotor Dysfunction
  - ROM
  - Pursuits
  - Saccades
- Visual Neglect
- Visual Field Deficit
  - Hemianopsia, quadrantanopia
- Binocular Dysfunction
  - Eye Alignment/Diplopia
  - Depth Perception
  - Convergence/Divergence
Oculomotor Dysfunction

- Poor scanning
- Poor ability fixate on a static or moving object
- Difficulty transitioning focus between objects
- Functional Deficits
  - Difficulty performing ADLs/IADLs
  - Reading
  - Functional Mobility
  - Driving

Oculomotor Assessment

- Pursuits/ROM
  - Hold a discreet target about 16” away from your patient
  - Move the target through the full ROM (use H, X, O patterns)
  - Perform monocularly and binocularly
  - Head should remain still
  - Observe for jumpiness, overshooting/undershooting, inability to dissociate eyes/head
  - Difficulty crossing midline
  - Identify specific quadrant i.e. nasal/temporal/superior/inferior
  - Assess without eyeglasses
Oculomotor Assessment

- Saccades
  - Direct patient to switch focus from one target to another (horizontal, vertical, diagonal)
  - Perform monocularly and binocularly
  - Head remains still
  - Observe for jumpiness, overshooting/undershooting, refixations, difficulty crossing midline, inability to dissociate eye movement from head movement

Clinical Pearls

- Use appropriate targets
  - White on black dot
  - Larger or brighter target
- Repeat tracking if attention is an issue
- Hold head still
Oculomotor Treatment

- Scanning sheets
- Thumb rotations
- Functional situations
  - Food tray/place setting
  - Identifying objects in drawers
  - Finding clothing
  - Newspaper articles/magazines
  - Shopping webpages
Clinical Pearls:
- Utilize head turns in remediation exercises
- Grade from simple backgrounds to busy backgrounds
- Incorporate higher level mobility

Binocular Dysfunction
- Disturbance in binocular vision
  - Double vision
  - Difficulty focusing (vergence/accommodation)
  - Decreased depth perception
- Functional Deficits
  - Difficulty performing ADLs/IADLs
  - Functional Mobility
  - Driving
Binocular Vision Assessment

- Convergence/Divergence - Moving target towards/away from nose
- Eye alignment
  - Note reflection of light source in pupils
  - Maddox Rod – assessment of “diopter” measurement
  - Cover/Uncover test: looking for tendency of an eye to rest opposite the direction of weakness
- Stereopsis – Depth perception test
  - Presence of 3D image

Cranial Nerve Palsies

<table>
<thead>
<tr>
<th>Nerve</th>
<th>Muscles</th>
<th>Function</th>
<th>Manifestations</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN III</td>
<td>Upper eyelid, all eye muscles except SO, LR</td>
<td>Eyelid closing</td>
<td>Ptosis</td>
</tr>
<tr>
<td>Oculomotor</td>
<td></td>
<td>Eye up-down and inward</td>
<td>Exotropia, Diplopia with near vision</td>
</tr>
<tr>
<td>CN IV</td>
<td>Superior oblique (SO)</td>
<td>Eye down and outwards</td>
<td>Hypertropia/-phoria</td>
</tr>
<tr>
<td>Trochlear</td>
<td></td>
<td></td>
<td>Vertical diplopia</td>
</tr>
<tr>
<td>CN VI</td>
<td>Lateral rectus (LR)</td>
<td>Eyeball outwards</td>
<td>Esotropia/-phoria</td>
</tr>
<tr>
<td>Abducens</td>
<td></td>
<td></td>
<td>Diplopia with far vision</td>
</tr>
</tbody>
</table>
Binocular Vision Patching Treatment

- Full patching
  - Occlusion of either eye depending on tolerance
  - Alternate the patch wearing schedule
- Partial patching
  - Use of tape to patch over lens of glasses
  - Occlude lens only enough to eliminate the double vision
  - Allows for more light to come in to the eye
Visual Field Dysfunction

- Ability to focus centrally and continue to see peripherally in all directions.
- VFD can often go undetected
- Most common VFD is homonymous hemianopsia
- Functional implications:
  - Bumping into things on one side
  - Disorganized/Poor search strategies
  - “Wall walker”
  - Portions of a page are missing
  - Decreased ability to read and write

Visual Field Assessment

- Confrontation testing
  - Ensure central fixation is maintained
  - 90-100 temporal; 60 nasal/inferior/superior
  - Note deficits in range of peripheral vision
- Perimetry tests
  - E.g. Campimeter
Visual Field Treatment

- Compensatory strategies:
  - Awareness training
  - Head turns
  - Page trailers

- “Remedial”
  - Scanning
  - NOAVISION

Visual Attention Dysfunction/Neglect

- Awareness of visual and physical space.
- Awareness and ability to process visual information in the central and peripheral fields
- Functional impairments:
  - Difficulty walking
  - Difficulty with basic ADLs
  - Difficulty driving
  - Difficulty in the community e.g. shopping
  - Difficulty with socialization
  - Difficulty reading
Visual Neglect Assessment

- Cancellation tests
- Clock Drawing
- Line Bisection
- Design copy
- Extinction tests during confrontation testing: wiggle fingers one at a time at end range randomly; incorporate wiggling both fingers at the same time; note consistently of extinction of one of the targets

Visual Neglect Treatment

- AWARENESS!!!
- Scanning activities with compensatory head turns, use of anchors
- Functional-scanning food trays/ bathroom
- Occlusion-partial or full patching

Eye patching can be effective for the treatment of visual neglect.  
Smania, K., et al. 2013
Comparison of VFD and Visual Neglect

**Visual Field Deficit**
- Abbreviated search pattern (organized)
- Re-checks work
- Takes time to complete work
- Responds to verbal cues

**Visual inattention**
- Disorganized search pattern
- Minimal or no re-check of work
- Quick task performance but incomplete
- Verbal cues don’t work

Connecting the Dots

- Implications for motor recovery
  - Sensory neglect has negative implications for motor recovery

- Implications for return to work
  - Driving
  - Functional mobility
  - Social
  - Missing details
Definition

Cognition

- interrelated processes including the abilities to perceive, assimilate, organize, and manipulate information to enable the person to process information, learn, generalize and produce a goal-directed action.
Domains of Cognition

- Primary Cognitive Abilities
  - Arousal
  - Orientation
  - Attention
  - Memory
  - Recognition/simple comprehension

- Higher Order Thinking
  - Problem solving
  - Abstraction
  - Insight/Awareness
  - Judgment
  - Executive Functions
    - Planning
    - Organization
    - Learning/adaptation

Common Cognitive Impairments Following Stroke

- Attention Impairment
- Memory Impairment
- Problem Solving Impairment
- Executive Function Impairment
- Awareness***
Prevalence

- In one UK study which occurred over 15 years, included over 1600 stroke survivors indicated that 18-24% had cognitive impairment at 3 month, 5 year, 10 year and 15 year (Douriri, A., et al, 2013).

- Another study in China including about 600 patients indicated that post-stroke cognitive impairment was prevalent in 48% of the subjects (Qu, Y., et al 2015).

Implications of Cognitive Impairment

- The presence of cognitive impairment following stroke has been associated with a 3-fold increase in risk for mortality. Mortality rates among stroke patients with dementia are 2 to 6 times greater than among stroke patients without dementia.

- Cognitive impairment is associated with decreased ADL and IADL function and patients may require longer-term, ongoing rehabilitation (Salter, K., et al. 2013)
Choosing the Best Assessment

- Determine method of testing
  - Global vs. Domain Specific
  - Pen and paper vs. Functional
  - Static vs. dynamic
  - Top down vs. bottom up
  - Participation vs. Performance

Cognitive Screens

- Mini-mental Status Examination
- Cognistat
- (D)LOTCA
- Kettle Test
- Functional Evaluation—Any functional activity can use turned into a cognitive assessment
Outcome Questionnaires

- Canadian Occupational Performance Measurement (COPM)
- Functional Activities Questionnaire (FAQ)
- Daily Living Questionnaire (DLQ)
- Stroke

Cognitive Behavioral Approach

- Based on humanistic/existential psychology
- Behavioral control through internalization of cognitive processes via
  - Changing of thoughts believed to result in or cause specific behaviors
  - Developing knowledge base for problem solving
- Different from behavioral approaches – goal is to change behaviors thru reinforcements
Cognitive Behavioral Approach

- Evaluation and Intervention:
  - Perceptions, thoughts, attitudes, and beliefs that shape behaviors
- Outcome:
  - Increased self-knowledge (awareness) and
  - Heightened sense of self-efficacy.

Dynamic Interaction Model

- Developed by Joan Toglia in the early 1990s Departs from “static” impairment specific models.
- Combines cognitive psychology (e.g., information processing models) and rehabilitation sciences (i.e., remediation, compensation, adaptation)
- A.k.a., “Multi-contextual approach”
- Defines cognition as
  - “ongoing product of the dynamic interaction between the individual, task (occupation), and the environment.”
Dynamic Interaction Model

- Function-Dysfunction continuum
  - contextual in nature
  - adequate/competent cognitive function –
  - impaired performance – mismatch between the person, task, and environment

- THERAPIST’S ROLES
  - Detective – careful observation and analysis of performance in context
  - Collaborator
  - Mediator – must know/understand “zone of proximal development”

Comparison with Traditional Models

- Dynamic Interactional
  - Focuses not on the specific areas of cognition but on dynamic processing
  - Cognition consists of multiple interrelated processes
  - Restorative rehab approach in context: client has the capacity to learn

- Traditional Models
  - Deficit focus with cognition broken into sub-components
  - Sub-skills are hierarchically arranged with primary skills addressed first
  - Intervention involves repetition and practice of sub-skill components that are usually non-contextual in nature
Clinical Pearls: Intervention Process

- Determine approach
  - Impairment based strategies
  - Functional approach
  - Cognitive behavioral approach
  - Multi-contextual approach
  - Compensatory strategies

Clinical Pearls: Intervention Process

- Strategies to increase generalization/transfer of learning to different contexts
  - Near (simple context)
  - Intermediate
  - Far (multi-/complex context)
- Break down the task via grading or segmentation
  - Number of steps/rules
  - Task details, objects used
  - Familiar to novel task
Clinical Pearls: Intervention Process

- Internal vs. External Cueing
- Internal = changing the person
- External = changing the task and/or the environment
- Examples:
  - Memory:
    - Internal: Mental rehearsal (small bits of info), chunking, mnemonics
    - External: Pill organizers, calendars, post it notes

Attention Impairment

- Sustained attention – difficulty maintaining attention during performance over time
- Selective attention – difficulty attending to task while ignoring extraneous stimuli
- Divided attention – difficulty responding to more than 1 task at a time
- Alternating attention – difficulty being flexible shifting of attention
- Functional implications:
  - Difficulty filling out forms, looking up transportation schedules, finding a specific item from a shelf
  - Lose focus while reading or watching TV
  - Difficulty cooking several dishes or talking to someone while taking notes
Attention Impairment Assessment

- Screening: Observation and timing of attention in task
- Assessments:
  - MMSE
  - CAM (Cognitive Assessment of Minnesota)
  - Trail-Making
  - TEA (Test of Everyday Attention)

Attention Impairment Treatment

- Selective attention:
  - scanning sheets, donning a shirt, meal prep, item localization on a grocery shelf
- Sustained attention:
  - Trail Making, time estimation, playing a card game, cleaning the refrigerator, performing morning routine
- Shifting attention:
  - Writing bills, performing morning routine, interrupt client while working – ask to resume, comparing prices online
- Divided Attention:
  - Talking while walking, exercises and monitoring repetitions, making pasta and sauce
Attention Impairment Treatment

■ Change the Task and the environment
  - Increase or decreased salient visual cues in the environment
  - Reduce the amount of information presented at one time
  - Present one task or step at a time
  - Limit or reduce clutter in the environment
  - Pre-select relevant objects needed for task

Attention Impairment Treatment

■ Change the person
  - Internal strategies:
    ■ talk out loud, pace and adjust speed, attend to details, ignore irrelevant information, look over before responding, keep goal of task in mind, maintain consistency in task
  - External Strategies:
    ■ highlight, list, circle or underline relevant information; use finger as a guide, stimuli reduction (teach person to cover or remove part of the information)
Memory Impairment

- Inability to draw upon past experiences and learn new information
- Immediate/ Working Memory Impairment
- Short term memory Impairment:
  - 1 minute to 1 hour
- Important to identify the phases of memory
  - Acquisition: learning or encoding
  - Storage: holding of information
  - Retrieval: recognition and recall

Memory Impairment

- Functional Implications:
  - Difficulty keeping track of instructions
  - Difficulty remembering a conversation which took place an hour before
  - Difficulty remembering dates of special events, birthdays, etc.
  - Difficulty relating personal experience to the events
  - Difficulty remembering “the how to”
  - Difficulty remembering appointments, payment of bills
Memory Impairment Assessment

- Screening: Observation
- Interview
- Assessments:
  - Mini-MSE
  - Hopkins Verbal Learning Test
  - Contextual Memory Test

Memory Impairment Treatment

- External Strategies
  - *External adaptations, devices and strategies:*
    - Timers/alarms, pill box organizers, calendars, post-its, reminder cards, checklists, appointment books, smart phone applications/features
  - *Keeping Track of Objects*
    - Object and key locator devices, talking key chains, consistent location, key holder, bright key chain
Memory Impairment Treatment

- Internal Strategies:
  - Mental rehearsal (small bits of info, focusing)
  - Chunking or semantic clustering
  - Mnemonics
  - Mental Imagery and Maps (visual)
  - Rhymes
  - Anticipation
  - Verbal elaboration
  - Name-face associations

Problem Solving Impairment

- Inability to generate a solution to a problem or obstacle
  - Identification of the problem
  - Generation of solutions
  - Solution implementation
  - Evaluation of the outcomes
Problem Solving Assessment

- Screening: Observe task requiring problem solving/error detection,
- Interview
- Assessment Tools:
  - CAM
  - TCA
  - Robnett
  - Busy Day

Problem Solving Impairment Treatment

- Reading material
  - Newspapers, magazines, brochures, paragraphs, coupons, spreadsheets, telephone book, bills
- Forms to fill out
  - Credit card, subscription to magazine, bank deposit slips, order forms to catalogues, applications, paragraph with errors
- Computer skills
  - Online bill pay, ordering off of websites, google searches
- Directions
  - Directions to a grocery store, office, maps, household items
Executive Function Impairment

- **Initiation:**
  - Ability to engage spontaneously in activities
  - Assess behaviors: appear passive, apathetic, unmotivated, require prompts to participate

- **Planning and Organization:**
  - Ability to anticipate what needs to be done and carry out those steps in an orderly fashion
  - Assess behaviors: underestimates time required for a task, fails to plan ahead, over-focuses on details, omits steps in a task, proceeds by trial and error.

Executive Function Impairment

- **Self-monitoring or Error Detection**
  - Ability to realistically evaluate performance on a certain task
  - Behaviors: May not notice incorrect actions; impulsive; may not monitor own behavior

- **Self-regulation or Error Correction**
  - Ability to recognize an error and generate a solution to correct it
  - Behaviors: Concrete and rigid in approach; fails to persist to complete a task; may fail to generate alternative solutions to problems (mental flexibility)
Executive Function Impairment

- Functional Implications:
  - Difficulty coordinating morning routine (e.g., Getting bathed, dressed, groomed, fed)
  - Difficulty performing a new routine or deviations in routine
  - Difficulty gathering, consolidating, or sorting of information
  - Concrete thinking

Executive Function Assessment

- Executive Function Performance Test
  - Top down approach
  - Identifies what the person can do
- Multiple Errands Test
Executive Function Impairment Treatment

- External strategies:
  - checklists, timers, alarms,
  - highlight important info, use outline
  - Use of smartphone apps
    - EverNote

- Internal strategies:
  - verbalize or visualize steps and obstacles before performing task
  - set time limits before initiation of task
  - brainstorm, self questioning, talk out loud

Executive Function Impairment Treatment

- Fading checklist:
  - check each step as it is completed
  - list each step and then reduce the number of steps grade visual cues

- Planning:
  - To-do and to get lists to complete an activity of choice
  - e.g., Planning a party, Going on vacation
    - Obtaining information (e.g., ticket cost, schedules)
    - Reading maps and planning a route
    - Setting a budget
Awareness Impairment

- Intellectual Awareness: the ability to recognize that a particular function is impaired
- Emergent Awareness: the ability to recognize a problem when it is actually happening.
- Anticipatory Awareness: ability to predict a problem is likely to occur as the result of a deficit.

Awareness Impairment Assessment

- CMT
- Interview
- Awareness Questionnaire
Awareness Impairment Assessment

- Intellectual awareness:
  - “Have you notice a change in_____?”
  - “What is your level of_____ now vs. prior to injury.”
- Emergent awareness:
  - “How difficult is this_____ task?”
  - “Which part of the task, you had most difficulties with?”
- Anticipatory awareness:
  - “If I ask you do more_____ tasks, how much do you think will you be able to accomplish?”

Awareness Treatment

- Self evaluation or rating self before and after a task
- Feedback from therapists, families, other team members
- Video or audio taping
- Awareness screening form
- Self check of work against an answer key
- **You may often deal with denial** and need to use these strategies over and over.
Treatment Efficacy

- Computerized activities appears to assist with improvements in attention.
- Compensatory strategies work well with memory impairments.  
  Salter, K., et al. 2013
- More research is needed!

Clinical Pearls

- Consider using a self-assessment questionnaire like the Stroke Impact Scale (SIS)
  - Assessment of strength, hand function, ADL/IADL, mobility, communication, emotion, memory and thinking, and participation.
Clinical Pearls: Hierarchy of Cueing

- **Level One:**
  - Minimal, non-verbal or verbal type of cue (reflective pause, raising an eyebrow, slow cadence of speech, tone of voice)

- **Level Two:**
  - Indirect hint that does not tell the patient what to do or how to do it (action cue)

- **Level Three:**
  - Utilize a direct question or hint to prompt the patient which will allow them to do some processing

Clinical Pearls: Hierarchy of Cueing

- **Level Four:**
  - Tell the patient exactly what to do

- **Level Five:**
  - Show and tell the patient what to do; you may even need to provide a tactile cue for initiation
    - E.g. point to or demonstrate the task while telling them what to do
Examples of Hierarchy of Cueing

1. “Hmmm?” with a questioning look
2. “Wow! That was quick.”
3. “Did you find everything your were looking for?”
4. “You’ve made many mistakes, try using your finger as a guide.”
5. “You’ve made many mistakes, let me show you how it is done.
6. Provide hand over hand assistance and give verbal instructions at the same time.

Connect the Dots

- Motor Recovery
  - Difficulty initiating HEP
  - Difficulty attending/remembering to incorporate UE into functional activities
  - Difficulty problem solving motor plans to improve movement patterns
    - Utilize clear written instructions
    - Family involvement may be crucial
    - Assist with daily planning to “schedule in” UE work
Connecting the Dots

■ Return to Work
  - Prone to social errors
  - Inability to formulate, plan, and execute a process
    ■ May need more structure, initial support, or guidance.
  - Difficulty returning phone calls
    ■ write down the who, what, when
  - Difficulty following up on tasks
  - Difficulty with written instructions
  - Difficulty attending to the entire work environment,
  - Difficulty multi-tasking

Key Points

■ Stroke Survivors with visual and cognitive impairments are at greater risk for:
  - Social isolation
  - Depression
  - Falls
  - Decreased Quality of Life
  - Mortality
On the Horizon

- Medications to enhance cognitive functioning
- rTMS/tDCS
- Music Listening