Evaluation and Treatment of Patients with Executive Dysfunction Following Brain Injury

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Dedicated to All Better

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Learning Objectives

At the conclusion of the session, the learner will be able to:

- Identify formal and informal ways to evaluate executive dysfunction

- Identify treatment activities for patients with executive dysfunction

- Discuss compensatory strategies and recommendations to assist with returning to school

Executive Functions

- Integrative cognitive processes that determine goal-directed and purposeful behavior

- Refers to ability to plan, adjust to environmental stressors, change behavior and carry out multiple step simultaneously

- They allow for the orderly execution of daily life functions, which includes
    - setting realistic goals based on accurate self-appraisal
    - monitoring one's own behavior
    - evaluating performance in relation to these goals
    - problem solving and changing behavior to obtain the best solution.

Executive Dysfunction

Can result in problems with…

- Self- awareness
- Self-monitoring
- Attention
- Memory
- Learning
- Anticipating problems
- Planning
- Executing solutions
- Organization
- Concept formation

- Goal-directed behavior
- Strategic thinking
- Mental flexibility
- Generalization
- Reasoning
- Pragmatics
- Regulating emotions
- Behavioral issues
- Analyzing situations
- Inhibition

Executive Dysfunction

- May be present... EVEN if the patient shows good performance on highly structured speech and neuropsychological testing!
  - WHY???
  - Assessments are completed in the quiet and highly structured confines of clinic or office
  - There is a risk of missing the important dynamic interplay and unpredictability real life offers
  - CELF-5 and PTBI do not capture executive dysfunction
  - Obtaining a good history/parent report is crucial!

Areas of Executive Functioning

- Attention
  - Selective Attention
  - Sustained Attention
  - Alternating Attention
  - Divided Attention
- Memory
  - Long-term
  - Short-term
  - Working
  - Prospective

- Awareness
- Problem Solving
- Reasoning
- Planning
- Organization
- Self-Monitoring
- Self-Correction
- Mental Flexibility
- Metacognition

Areas of Executive Functioning

- A weakness in one area likely impacts function in another area
  - If awareness of strengths/weaknesses is absent, the ability to identify and implement strategies to compensate for those weak areas is impaired
  - If attention is impaired, memory is likely impaired
  - If memory is impaired, planning skills are likely impaired
  - If attention is impaired, organization is likely impaired
  - If mental flexibility is impaired, problem solving and reasoning skills are likely impaired

PT and OT Role

- Physical Therapy
  - Increasing cognitive load during exercise
  - Route-planning/navigation
  - Independence in following home exercise program
  - Verbalize multiple steps to complete care
  - Divided attention
- Occupational Therapy
  - Money management
  - Cooking
  - Laundry
  - Cleaning
  - Shopping
  - Time management

Evaluation of Executive Functions

Informal Evaluation

- **Case History**
  - School performance?
  - Study habits?
  - Daily routines?
  - Typical school day including level of assistance?
  - Attention to preferred and non-preferred activities?
  - Any changes in difficulties noted by family members?
- **Functional/Informal Evaluation**
  - Build in 1:1 time as well as **observation** in a dynamic setting
    - Attention
    - Problem solving/Mental flexibility
    - Deficit awareness
  - Verbal summarization of an activity or verbal description
  - Writing task for planning and organization
  - Reading and taking notes simultaneously or answering comprehension questions
  - Learning and carry-over for a novel multi-step activity
  - BADS-C, BADS

Formal Evaluation: S- FAVRES

- Functional Assessment of Verbal Reasoning and Executive Strategies for Students (S-FAVRES)

- Designed to evaluate aspects of complex comprehension, complex expression, social communication, verbal reasoning, problem solving, and executive functioning.

- Target Population (per test manual):
  - Ages 12-19
  - Rancho level of at least VI (Confused, Appropriate)
  - Reading comprehension functional for reading instructions AND 1-2 full pages of text at the 7th grade level
  - Sufficient written expression for 1-2 paragraphs
  - Adequate attention span (at least 30 minutes)

S- FAVRES

- Evaluation is made up of 4 tasks
    - Planning an Event (easiest task): Analyze several entertainment listings to determine and appropriate event when provided constraints of time, money, and appropriateness for the participant
    - Scheduling (most detailed, complex task): Analyze a to-do list that needs to be scheduled logically according to priorities (school and social engagements) and time constraints.
    - Making a Decision (moderately complex, mostly challenging due to length of text): Analyze a story, draw conclusions to make the most appropriate gift choice and provide support/rationale.
    - Building a Case (moderately complex, challenging for patients with limited exposure/experience): Analyze a scenario, prepare a written complaint based on the scenario, and outline appropriate solutions to solve the problems outlined.

S- FAVRES

Pros

- Provides standardized data from typically developing adolescents and those with ABI (12-19)

- Comprehensive assessment of cognitive abilities

- Real life situations/scenarios

- Focused less on retrieval of facts, focusing more on "gist based processing", strategic learning and metacognitive skills

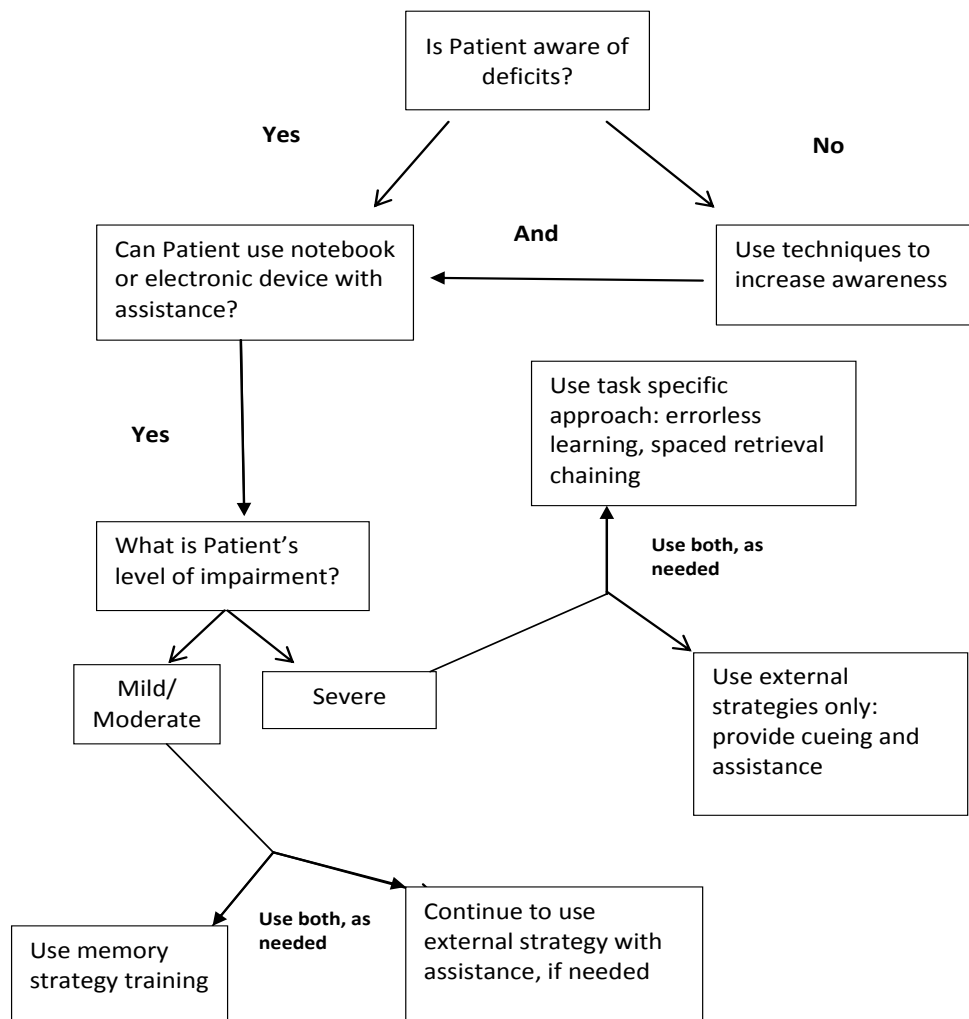- Standardized scores based on time—VERY helpful!

Cons

- It's a lengthy assessment. Depending on the child, can take anywhere between 45 minutes to 2 hours to complete.

- Despite being normed for 12, we have found the tasks are appropriate for an older population.

- Use caution when re-testing—are increased scores related to improvement or task familiarity?

Treatment for Executive Dysfunction

Decision Tree for Treatment Planning

Is Patient aware of deficits?

Yes ← → **No**

And

Can Patient use notebook or electronic device with assistance? ← Use techniques to increase awareness

Yes

What is Patient's level of impairment?

Use task specific approach: errorless learning, spaced retrieval chaining

Use both, as needed

Mild/Moderate → Severe

Use external strategies only: provide cueing and assistance

Use both, as needed

Use memory strategy training → Continue to use external strategy with assistance, if needed

Attention

- **Selective Attention**
  - Ability to attend to a target task in the presence of distractions

- **Sustained Attention**
  - Ability to attend to a target task for a period of time (even non-preferred tasks)

- **Alternating Attention**
  - Ability to switch between 2 tasks while maintaining accuracy

- **Divided Attention**
  - Ability to complete 2 tasks simultaneously while maintaining accuracy

Attention: Sample Goals

- Patient will sustain attention to a preferred/non-preferred or simple/moderate/complex task for __ minutes with __ cues/re-directions in a minimally distracting environment

- Patient will sustain attention to a preferred/non-preferred or simple/moderate/complex task for __ minutes with __ cues/re-directions in a dynamic environment

- Patient will alternate attention between 2 preferred/non-preferred or simple/moderate/complex task for __ minutes while maintaining __% accuracy

- Patient will divide attention between 2 preferred/non-preferred or simple/moderate/complex task for __ minutes while maintaining __% accuracy

Attention: Compensatory Strategies

- Setting a visual or auditory timer

- Using headphones to block excess noise

- Limiting distractions to work on task mastery

- Over time and (if able) being able to "tune out" auditory/visual distractions while still maintaining attention to task

- Rest breaks in between cognitively challenging tasks

- Presets or a "heads up" before discussing important information

- Frequent checks for comprehension and accuracy

- Dividing larger tasks into smaller chunks

Attention: Therapy Activities

Selective and Sustained Attention

- Maintain attention to pencil/paper task in a 1:1 setting
- Maintain attention to pencil/paper task with noise in background
- Maintain topic of conversation in 1:1 setting
- Maintain attention to pencil/paper task with noise in background
- Completing a cognitively demanding activity accurately while other conversation is ongoing in room
- Complete therapy activities without getting distracted in any dynamic environment
- Working toward maintaining attention to a single task for increasing periods of time while maintaining accuracy

Attention: Therapy Activities

Alternating Attention

- Cooking task involving consulting recipe
- Doing "homework" with periodic phone call or text interruptions
- Switching between phone and typing on the computer
- Construction task requiring switching between reading plans or instructions and assembly
- Addition or subtraction with frequent interruptions
- Navigation task involving walking and consulting a map
- Exercise program in gym involving use of multiple machines
- Completing a list of errands

Attention: Therapy Activities

Divided Attention

- Cooking task with 2 items requiring simultaneous monitoring
- Talking on the phone while doing chores/task
- Taking notes in real time
- Playing any game in a dynamic setting
- Having a conversation while simultaneously completing a task
- Teaching a person a familiar activity while at the same time completing it
- Having a responsibility in a game/activity while still actively participating in that game/activity
- Keeping up with score in a game/activity while also actively playing/participating

Memory

- **Long-Term Memory**
  - A system for permanently storing, managing, and retrieving information for later use
- **Short-Term Memory**
  - The capacity to hold, but not manipulate small amounts of information for a short period of time
- **Working Memory**
  - The capacity to hold and manipulate small amounts of information for a short period of time
- **Prospective Memory**
  - The ability to remember to do something at some point in the future

Memory: Sample Goals

- Patient will utilize (strategy) to recall __% details of activity/ event given ___ cues

- Patient will identify and utilize a compensatory strategy to complete an activity with __ accuracy given __ cues

- Patient will recall/summarize __ details of daily activity/ reading passage after a __ minute delay given __ cues

- Patient will recall __ pieces of novel information after a __ minute delay given ___ cues

- Patient will complete working memory tasks involving __ parts with __ accuracy given __ cues

- Patient will complete tasks involving prospective memory involving __ parts with __ accuracy given __ cues

Memory: Compensatory Strategies

External Memory Strategies

- Memory Notebook/ Journal/Agenda to record details of activities completed
- "To Do" lists
- Calendars
- Smart phones
- Apps
- Cueing devices (Clocks, Timers, Alarms)

Internal Memory Strategies

- Visualization
- Association
- Grouping/semantic clustering
- Repetition
- Storytelling
- Mneumonics
- Spaced Retrieval
- Chaining
  - Forward
  - Backward

Memory: Therapy Activities

Working Memory

- Any new learning uses working memory

- Any game/activity that involves multiple steps and/or mentally manipulating information

  - Basic examples: Mentally alphabetizing a list of words, performing basic mental math calculations, remembering and carrying over 1 rule in game/activity

  - Advanced examples: Calculating tax/tips/discount, Recalling 5 items to purchase at the store without a list, remembering and carrying over multiple steps in a game/activity

Prospective Memory

- Any task that involves remembering to do something at some point in the future

  - Examples: Assignment due dates, chores to be done on a certain day, reminding therapist of something at the end of the session

Planning/Organization

Generally refers to the ability to generate steps, sequences, materials required, and necessary information to execute a task or behavior.

- **Planning**
  - Refers to the ability to create a "roadmap" to reach a goal or complete a task.
  - It also involves being able to make decisions about what is important to focus on and what isn't

- **Organization**
  - Refers to the ability to arrange or place things into a system in an orderly fashion

Planning/Organization: Sample Goals

- Patient will utilize <u>(external strategy)</u> to organize information with __% accuracy given __ cues

- Patient will summarize __ steps to complete a functional task with __% accuracy given __ cues

- Patient will sequence __ steps to complete a functional task with __% accuracy given __ cues

- Patient will use a graphic organizer to plan for multi-paragraph writing task given __ cues

- Patient will generate a __ paragraph passage demonstrating appropriate organization and fluidity with __% accuracy given __ cues

- Patient will sort and categorize items with __% accuracy given __ cues

Planning/Organization: Compensatory Strategies

- Routine consistency
- Using agenda/planner
- Using calendar
- Using timers
- Labels
- Written checklists/To-Do Lists
- Category grouping
- Extra time for task completion
- Break larger tasks into smaller chunks
- Goal, Plan, Do, Review

For Reading Tasks:

- Highlighting important information
- Note-taking
- To-Do Lists

For Writing Tasks:

- Graphic organizer
- Paragraph organization

Planning/Organization: Therapy Activities

- Planner/agenda organization

- Plan a birthday party (or anything)

- Sort and categorize grocery list

- Graphic organizer for writing task

- Paragraph organization within writing tasks

- List steps to complete a project for school

- Sequencing activities

- Fill out weekly calendar of events

- Route-planning/navigation

Problem Solving

The process of generating solutions to difficult or complex issues

- What is the problem?

- What are possible solutions?

- How do I choose one?

- How do I implement it?

- Did it work?

- If not, what next?

Problem Solving: Sample Goals

- Patient will identify a problem given a scenario with __% accuracy with __ cues

- Patient will identify possible solutions to solve problem with __% accuracy given __ cues

- Patient will execute logical solution to solve a problem with __% accuracy given __ cues

- Patient will identify alternative solution to solve functional problems with __% accuracy given __ cues

- Patient will complete structured tasks involving problem solving in 1:1 setting with __% accuracy given __ cues

- Patient will complete functional tasks involving problem solving in a dynamic setting with __% accuracy given __ cues

Problem Solving: Compensatory Strategies

- Extra time

- Careful attention

- Self talk

- Predict-Perform

- Identify main goal/problem to be solved

- Distinguishing between relevant and irrelevant details

- Visual cues

- Brainstorm alternate solutions

- Pros and cons

- How to choose best possible solution

- Mental flexibility

- Troubleshooting

Problem Solving: Visual Cues

Problem Solving: Therapy Activities

- Structured
  - Deductive reasoning worksheets
  - Puzzles/Riddles/Complex games
  - Sudoku/Math
- Non-structured
  - Hypothetical situations
  - Functional tasks involving problem solving in dynamic setting
  - Planning ahead for alternate solutions in dynamic situation
- "Time-Pressure Management"

Metacognition

- "Thinking about thinking"
- Represents a person's awareness of his or her thinking, ability to self-monitor and adapt to changes in the environment or task demand
- Involves self-regulation that involves
  - Setting goals
  - Comparing performance to goal
  - Making decision to change behavior or select an alternative approach
  - Executing change in behavior

Metacognition: Sample Goals

- Patient will identify errors made with __% accuracy given __ cues

- Patient will double check work for errors with __% accuracy given __ cues

- Patient will monitor performance within a task with preset and maintain __% accuracy given __ cues

- Patient will identify and implement an appropriate compensatory strategy to complete an activity with __% accuracy given __ cues

Metacognition: Compensatory Strategies

- Extra time

- Careful attention

- Talking through a plan (internally or with someone else)

- Double checking work

- Identifying errors

- Correcting errors

- Setting goals

- Re-evaluating those set goals based on performance

- Knowing when to ask for assistance

- Self-talk

Metacognition: Therapy Activities

- Predicting future performance on any complex task

- Evaluating performance on said complex task

- Review a task and identify errors

- Correct errors

- Identifying strategies to be implemented

- Implementing strategies for any complex task with or without assistance

- Modification of strategies based on performance or in the event of unexpected change

CHOA Speech Therapy Activities

- Grocery shopping
- Cooking
- Planning anything/packing for a trip
- Paragraph writing- organization
- Training the use of external memory aides (i.e., memory notebook, notes, journal, iPhone/technology) based on patient's cognitive deficits and what systems patient has access to/can use
- Mental math in context of activities (working memory, attention)
- Training compensatory strategies within tasks (i.e., use of imagery or mneumonics, note taking, etc).
- Changing the rules of game to work on impulse control, working memory, attention.
- Add time pressure to tasks to work on processing efficiency and increase cognitive demands

- Route finding using maps, signs, asking for directions
- Playing challenging cognitive games (Sequence, Guess Who)
- Follow therapy schedule or activity/class schedule including planning what to bring and where to be
- Organize Memory Aid or planner including functional sections/tabs
- Six Parts Subtest of BADS (used as a therapy activity)
- Zoo Map subtest of BADS (used as a therapy activity)
- "Plan-Do-Review" with each task.
- Work on patient metacognition and self evaluation (how long will it take, what accuracy? Then evaluate at end).
- Functional multiple step routines. Pick based on patient's interests (if low-getting ready in morning, if high-planning a b-day party).

Home Program

Resource: http://www.smartbutscatteredkids.com

Suggestions for Parents:

- Agenda/Planner
- Calendars
- Smart phones
- Apps
- Cueing devices (Clocks, Timers, Alarms)
- Room cleaning scheme
- System for organizing backpack
- System for organizing desk
- System for organizing school work (ie: "Homework Hub")
- System for organizing items needed/used on a daily basis (ie: "Everything has a Home")
- "To Do" lists

School Recommendations

- **Recommendations for Attention:**
  - Increased time to complete all activities
  - Presets to changes in familiar routines
  - Preferential seating away from auditory and visual distractions
  - Rest breaks for cognitive fatigue
  - Small group instruction for novel, complex information.

- **Recommendations for Memory:**
  - Increased time for recalling information
  - Visual cues/reminders
  - Consistent and familiar routines to promote carryover and independence
  - Presets for when predictable information is going to change
  - Reduced amounts of novel, complex, lengthy, information presented at a given time.

School Recommendations

- **Recommendations for Executive Functioning & Reasoning:**
  - Increased time
  - Set up and demonstration of novel activities
  - Visual cues to assist with sequencing of multiple steps
  - Familiar and consistent routines
  - Assistance in identifying alternative solutions to solve novel problems
  - Rest breaks following cognitively demanding activities.

- **Other Considerations when making recommendations:**
  - Any academic supports prior to injury
  - Medications and any effect they would have on performance
  - Course load
  - Physical abilities with regard to fatigue and any upper extremity involvement that would affect their participation

Example of School Recommendations

- IEP/school plan to meet educational needs

- Use of the neuropsychology evaluation in addition to this report to create the most appropriate school plan

- In addition to the recommendations below, *** will benefit from the following accommodations in an academic setting: Increased time to complete activities, external memory aids, shortened assignments without sacrificing quality, assistance organizing multiple pieces of information, assistance following multiple step directions to complete functional tasks, information broken down into smaller pieces, visual supports for complex auditory information, presets for important auditory information, positive peer groups, supervision in all activities, multiple choice testing, preferential seating away from background noise and visual stimuli.

- School based evaluation and treatment as indicated

Case Study: "Michael"

Case Example: "Michael"

- **Hx:** 14 Y male admitted s/p pedestrian versus semi 1/14/16. Patient was reportedly walking home alone from school after sports practice and struck by a part of the vehicle (not hit head-on).

- **Injury complex:** TBI, proximal humeral fracture and right scapular fracture

- **Neuroimaging:** Diffuse Axonal Injury (DAI) throughout the right and left cerebrum and cerebellum, smear subdural hematoma, subtle parenchymal contusions within the bilateral inferior frontal lobes and right anterior temporal lobe, temporal bone fx

- **Procedures:** OR with orthopedics 1/15/16. Brain injury treated non-operatively

Case Example: "Michael"

Background Information:

- Right handed
- 10th grade student
- Advanced classes
- Enjoys track and baseball
- Extremely supportive parents
- No premorbid concerns—however, upon admission to DRP, family endorsed that patient's thinking was highly literal/lacked mental flexibility. Highly sensitive to sound.

Case Example: "Michael"

Hospital course:

- Date of injury: 1/14/16
- Admitted to CIRU: 1/27/16
- CIRU LOS: 34 days
- Discharged to Day Rehab Program: 3/1/16
- Admitted to Day Rehab Program: 3/3/16
- Day Rehab LOS: 30
- Discharged from Day Rehab Program: 4/29/16
  - Recommendations: IEP, outpatient for all disciplines

Case Example: "Michael"

Admission to CIRU	Discharge from CIRU
Inconsistent ability to attend to visual and auditory stimuli	Able to focus and attend, though demonstrates poor topic maintenance and difficulty alternating between tasks
Long-term memory intact, impaired short-term recall	Able to recall most details of daily events with external memory aids and cues
Non-verbal	Communicates verbally at the conversation level, occasional word-finding impairments
Follows some basic commands and answers basic yes/no questions via thumbs up/thumbs down, slow processing efficiency	Answers open-ended questions appropriately, follows multi-step commands consistently, Slow processing efficiency
Impaired functional problem solving	Able to demonstrate functional problem solving but difficulty solving more complex problems
Unaware of deficits	Emerging executive functioning skills

Case Example: "Michael"

Admission to Day Rehab	Discharge from Day Rehab
Highly distractible in quiet 1:1 settings. Heightened sensitivity to sound.	Very impulsive in responses, requiring constant cues to slow down and review work.
Long-term memory intact, impaired short-term recall and working memory skills	Used visual aids, reminders and repetition to improve functional recall.
Verbalizing basic wants, needs, and thoughts however is verbose and tangential.	Emerging insight into higher level deficits. Improved word finding for higher level tasks.
Follows some basic commands and answers questions with increased time. Significant processing delays. Performance improved with visual supports.	Basic comprehension intact. Struggles with complex, novel, lengthy information. Processing speeds still impaired, especially with distraction.
Impaired functional problem solving. Very concrete/literal. Unable to complete abstract or inferential reasoning tasks.	See slide for FAVRES results.
Able to verbalize deficits but unable to understand the implication they have on daily functioning.	Emerging insight. Can implement strategies when suggested by therapist, but unable to implement anything indepdnently.

Case Example: "Michael"

PTBI was completed on admission to Day Rehab:

- **Constrained Skills**
    - Orientation   38 (High)
    - Following Directions   15 (High)
    - Naming   12.5 (High)
- **Unconstrained Skills**
    - Word Fluency   24 (Low)
    - What Goes Together   87 (High)
    - Digit Span   82.5 (High)
    - Story Retelling- Immediate   25 (Very Low)
    - Yes/ No/ Maybe   29 (High)
    - Picture Recall   31 (Low)
    - Story Retelling- Delayed   12.5 (Very Low)

Case Example: "Michael"

The **CELF-5** was completed upon admission to Day Rehab:

Subtest	Scaled Score	Percentile
Word Classes	9	37
Understanding Spoken Paragraphs	8	25
Sentence Assembly	4	2
Semantic Relationships	9	37

Case Example: "Michael"

FAVRES-S Results:

	Task 1		Task 2		Task 3		Task 4	
	Raw Score	SS	Raw Score	SS	Raw Score	SS	Raw Score	SS
Time	3	119	19	95	8	101	10	109
Accuracy	5	105	4	89	5	104	5	105
Rationale	5	105	5	110	3	69	2	28
Reasoning Subskills	26	110	26	98	24	96	18	81

Case Example: "Michael"

FAVRES-S Results:

Subtest	Raw Score	Standard Score
Time	40	104
Accuracy	19	101
Rationale	15	70
Reasoning Subskills	94	94

Case Example: "Michael"

Speech Therapy POC for Executive Dysfunction:

- Awareness of deficits and errors
- Maintaining on-task behavior
- Goal-setting
- Planning ahead
- Self-instruction
- Self-evaluate
- More complex problem solving
- Mental flexibility

Case Example: "Michael"

Back-to-School Speech Therapy Recommendations:

1. Neuropsychology testing

2. Development of school plan (IEP or 504) to meet his educational needs

3. Recommend the following accommodations in an academic setting:

   – Increased time to complete activities

   – external memory aids

   – shortened assignments without sacrificing quality

   – assistance organizing multiple pieces of information

   – assistance following multiple step directions to complete functional tasks

   – information broken down into smaller pieces

   – visual supports for complex auditory information

   – presets for important auditory information

   – positive peer groups

   – supervision in all activities

   – multiple choice testing

   – preferential seating away from background noise and visual stimuli

Case Example: "Michael"

Outpatient Speech Recommendations:

– 2x per week to address language and cognitive impairments

Recommended Outpatient goals:

– Patient will: summarize written or verbal information to peer/therapist with appropriate organization and content, 80% accuracy, min cues.

– Patient will: verbally describe the meaning of moderately complex figurative language phrases, 80% accuracy, minimal cues.

– Patient will: use strategies to self-monitor behaviors and progress to complete a cognitive activity with 80% accuracy, minimal cues.

– Patient will: complete alternating and divided attention tasks with 80% accuracy, minimal cues.

Questions???

References

- Cicerone, K.D., Dahlberg, M.A., Malec, J.F., Langenbahn, D.M., Felicetti, T., Kneipp, S., Ellmo, W., Kalmar, K., Giacino, J.T., Harley, J.P., Laatsch, L., Morse, P.A., &Cantanese, J. (2005) Evidence-based cognitive rehabilitation: updated review of the literature from 1998 to 2002. *Archives of Physical Medicine and Rehabilitation*,85, 2239-2249.

- Cicerone, K. & Giacino, J. (1992) Remediation of executive function deficits after traumatic brain injury. *NeuroRehabilitation,* 2 12-22.

- Crossan, B., Barco, P.P., Velozo, C.A., Bolesta, M., Cooper, P.V., Werts, D., & Broebeck, T.C. (1998) Awareness and compensation in postacute head injury rehabilitation. *Journal of Head Trauma Rehabilitation.* 4, 46-54.

- Dawson, Peg & Guare, Richard. (2010) *Executive skills in children and adolescents, second edition: a practical guide to assessment and intervention*. New York, NY: The Guilford Press.

- Evans, J.J., Wilson, B.A., Schuri, U., Andrade, J., Baddeley, A., Bruna, O., et al.. (2000) A comparison of errorless and trial-and-error learning methods for teaching individuals with acquired memory deficits. *Neuropsychological Rehabilitation,* 10, 67-101.

- Haskins, Edmund C. , et all.. (2012-2014) *Cognitive rehabilitation manual: translating evidence-based recommendations into practice.* Reston, VA: ACRM Publishing.

- Sohlberg, McKay Moore & Turkstra, Lyn S. (2011). *Optimizing cognitive rehabilitation: effective instructional methods.* New York, NY: The Guilford Press

- Toglia, J. & Kirk, U. (2000) Understanding awareness deficits following brain injury. *NeuroRehabiltation,* 15, 57-70.