

Lessons Learned: The VA Experience with Cognitive-Communication Interventions for TBI

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Cognitive-communication rehabilitation is a system of therapeutic activities, based on brain- behavior relationships, directed to achieve functional change by:

- Re-establishing or reinforcing previously learned patterns of behavior
- Establishing new patterns of cognitive activity through compensatory cognitive mechanisms
- Establishing new patterns of activity through external compensatory mechanisms
- Enabling persons to adapt to their cognitive disability to improve overall functioning

Systematic Review of Relevant Literature

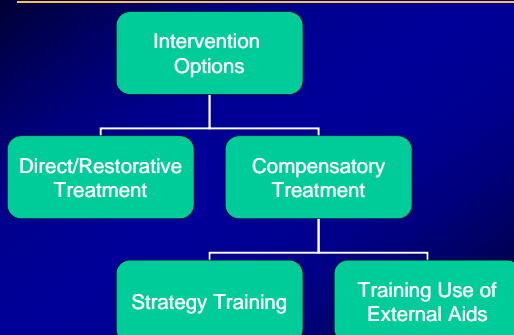
- 357 published reports of cognitive rehabilitation were fully evaluated and classified
 - 59 Class I studies
 - 54 Class II studies
 - 244 Class III studies

Cicerone, DCoE Consensus Conference, 2009

Classification and Recommendations

- Class I
 - RCTs
- Class II
 - Controlled observational studies
- Class III
 - Case Series
 - Single subject design
- Practice Standard
- Practice Guideline
- Practice Option

Cognitive-Communication Treatment Options



Remediation of Attention

Study Design	1997	2002	2007	Total
Class I	3	2	2	7
Class II	4	1	0	5
Class III	6	2	5	13

Remediation of Attention:

Treatment of attention during acute rehabilitation

- One Class I study (*Novack et al., 1996*)
- Two Class II studies
- No effect beyond spontaneous recovery &/or standard rehabilitation after TBI

Cognitive Rehabilitation during Acute Rehabilitation

Vanderploeg et al., 2008

- N = 360 moderate-severe TBI at 4 VAMC
- Mean 50 days post injury
- 66% MVA
- 13% LOC < 1 hour
- 51% PTA > 30 days
- most still in posttraumatic confusional state when protocol intervention began

Cognitive Rehabilitation during Acute Rehabilitation

Vanderploeg et al., 2008

- Cognitive vs. functional protocols embedded within acute rehabilitation
- Better FIM cognitive after cognitive tx arm
- Less severe memory complaints at 1 year
- No difference in functional outcomes at 1 year

Recommendations for Attention Training

Practice Guideline

There is insufficient evidence to distinguish the effects of specific attention training from spontaneous recovery or more general (cognitive) interventions, for persons with moderate-severe TBI, during acute period of recovery and rehabilitation

Remediation of Attention: Post-acute treatment of attention Attention Process Training

- 2 Class I studies
- 1 Class II studies
- 5 Class III studies

Remediation of Attention: Attention process training during post-acute rehabilitation

Sohlberg et al., 2000 (Class I)

- N = 14 (3 with LOC < 1 hour)
- Randomized crossover (Class I) design
- Attention Process Training (APT)
versus
- Brain injury education "placebo"

Remediation of Attention: Attention process training during post-acute rehabilitation

Sohlberg et al., 2000

- Greater self-reported improvement in attention & memory after APT
- Greater improvement on attention-executive (but not vigilance) tasks after APT.
- Psychosocial improvements greater after education and support

Remediation of Attention: Attention process training during post-acute rehabilitation

Tiersky et al., 2005 (Class I)

- N = 20 (19 LOC < 29 minutes)
- APT-II (with memory and problem solving component) and CBT vs. Waitlist control
- Improvement on NP measures of attention and memory, less anxiety and depression
- No improvement in community integration

Remediation of Working Attention: Post-acute Rehabilitation

Cicerone, 2002 (Class II)

- N = 8 MTBI
- “Working memory” intervention aimed at allocation of resources and managing rate of information
- Improvement on working memory tasks and symptoms, but no direct effect on processing speed

Remediation of Working Attention: Post-acute Rehabilitation

Serino et al., 2007 ; Westerberg et al., 2007

- Some evidence of benefits from automated / computer-based practice on working memory tasks
- Benefits on ‘executive’ tasks but not vigilance or processing speed
- Improved self-appraisal of cognitive failures
- *Compensation vs. neuroplasticity ?*

Recommendations for Attention Training

Practice Standard

Remediation of attention through strategy training (which includes varied modalities, task complexity, & response demands) is recommended for persons with TBI during the post-acute period of rehabilitation.

Attention Process Training

(Based on Sohlberg, 2009)

- APT Exercises
- Frequency/Dosage based on client needs
- Measurement
 - Therapy exercises: time, accuracy, level of effort (move up in the hierarchy)
 - Nontrained impairment based measures: Paced Auditory Serial Addition Task (Test of Everyday Attention)
 - Impact/Generalization: Conversation recall; Attention Questionnaire

Case 1

Background

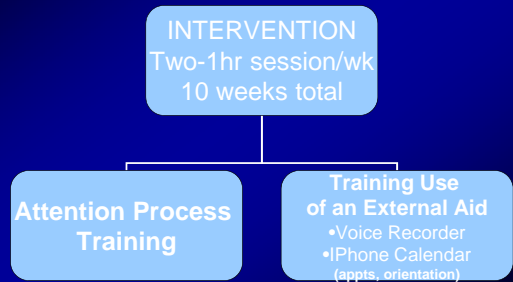
- 24 year old male
- 5 year in army as helicopter mechanic
- Two head injuries:
 - Sports injury accident in camp with brief LOC
 - Blow on the head when engine column from helicopter dropped again brief LOC
- Was fired from Public Safety job due to difficulty learning and remembering procedures
- Working night shift at department store cleaning floors and stocking shelves

Neuropsychological Evaluation

- Headache; neck pain
- Postconcussive disorder
 - decreased working memory
 - Periodic disorientation

Sohlberg, 2009

Case 1: Intervention Focus



Clinic Report

GOALS

LTG 1: Pt. will improve his working memory ability in order to increase his recall of conversations and his ability to hold on to instructions or information given at work.

STG 1.1: Pt. will complete Level I of the Attention Process Training program w/20% improvement in task times, accuracy & level of effort ratings.

STG 1.2 Pt. will track the general content and provide min of 2 supporting details from at least two conversations during the week and 1 exchange from therapy for two consecutive weeks.

OUTCOME

Re-administration of the PASAT showed an improved performance of 1 SD. Scores now appear in the mildly impaired range

Pt. progressed from zero recall of any conversations, even with prompts, to recalling 2 conversations with a moderate amount of detail (3 details per conversation), without prompts for three consecutive weeks.

Metacognitive Strategy Training

- Involve teaching the client behaviors or sequences of behavior that influence the learning process
- Strategies provide alternative ways of learning
- It is critical to understand what strategies are important to use under what conditions. (e.g., learning familiar vs. unfamiliar information; distracting vs. boring conditions)

Critical Steps when Training Strategy Use

- **Identify goal:** What will change and how will you measure it?
- **Identify strategies:** What best matches client and circumstance?
- **Create action steps:** Cue cards, recording, other prompts? How will person initiate strategy use?
- **Practice:** Make a plan for practicing and implementing
- **Self monitor:** How will person evaluate strategy use AND strategy effect?
- **Modify the steps**
- **Continue or revise**
- **Self monitor**

Case 2

Background

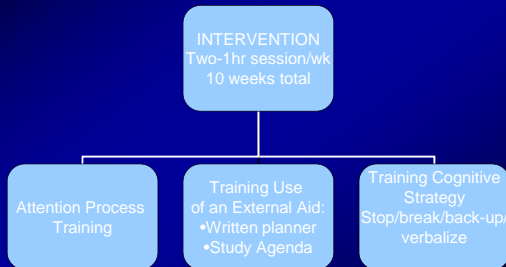
- 37 year old male
- Did not complete college and entered the military
- 18 month tour in US army in Iraq as a member of an armored tank crew which exposed him to a number of combat experiences
- Received a large blast in an IED explosion 3 years prior
- Has been attempting to complete university courses for biology degree with mostly C grades

Neuropsychological Evaluation

- PTSD
- Headache
- Superior Intelligence (93rd & 99th %ile on VIQ and PIQ),
- Cognitive Impairments
 - Decreased working memory & processing speed
 - ADHD—"inattentive type w/impulsivity"

Sohlberg, 2009

Case 2: Intervention Focus



Cognitive Strategy to Improve Study Skills

- Create Time-Ordered Study Agenda
- Follow Agenda
 1. If "blank out" starting to occur
 2. Get up from table and take break
 3. Return to table and find last place where material is familiar and easily recalled
 4. Review familiar material
 5. Read aloud the material or concepts that follow
 6. Repeat 3 & 4 until it clicks.

Activity: Frequency of Use – Daily Planner	Date	# of times break/back- up strategy used	% study sessions w/blank out	Comments
	11/6	1	50%	Forgot planner
	11/11	2	50%	"I know it'll help but forget to do it"
	11/18	3	40%	"Talking out loud when I found my place worked"
	11/25	10+	35%	"I think I'm now seeing how much study time I was wasting"

External Cueing Strategy for Distractibility

- Lose goal focus after a period of time
 - Leave tasks unfinished
- Set countdown timer at or just beyond attention span
 - Provides timely reminder to maintain task



Remediation of Memory

Study Design	1997	2002	2007	Total
Class I	4	3	2	9
Class II	4	2	1	7
Class III	34	8	10	52

Remediation of Memory Deficits

- 4 Class I studies
- Effectiveness of compensatory strategy training and 'mnemonic techniques' *versus*
- 'Pseudotreatment' (memory drills, computer games) and/or psychosocial support or alternative intervention

Remediation of Memory Deficits

Ryan & Ruff, 1988

- Treatment group memory strategies
 - external mnemonic strategies
 - encoding strategies
 - personalized emotional techniques
 - rehearsal
 - computer-assisted practice
 - group memory education & practice

Remediation of Memory Deficits

Ryan & Ruff, 1988

- No difference between treatments on primary analysis
- Benefits of compensatory memory strategies apparent only for participants with *mild memory impairment*

Remediation of Memory Deficits

Berg, et al., 1991

- Significant effects on objective memory measures only with strategy training
- Differences between conditions most apparent at 4 month follow-up – suggesting need for continued strategy use

Remediation of Memory Deficits In Severe Brain Injury

Schmitter-Edgecombe & Fahy, 1995

- 8 TBI subjects with *mild memory deficit*
- Significant reductions in self-reported *everyday memory failures* following individualized training in use of a memory notebook

Remediation of Memory Deficits

Kachel et al., 2002

- 22 patients (stroke or TBI) with *mild memory impairments* (severe impairments excluded)
- Visual imagery training produced significant benefits on recall of verbal material
- Improvements occurred in parallel to relative's ratings of improved memory functioning
- Benefits maintained at 3-month follow-up

Recommendations for Memory Remediation

- 8 Class I studies with 231 subjects support compensatory memory strategy training for persons with *mild memory impairments* due to TBI
- Class II and III studies support effects of compensatory strategy training for *mild memory deficits* but not for persons with severe memory deficits

Recommendations for Memory Remediation

Practice Standard

Compensatory memory strategy training is recommended for persons with *mild memory impairments* due to TBI

Remediation of Memory Deficits

- *Wilson et al., 2001, 2005* (Class I) supported by Class II and Class III studies
- External compensations superior to memory "retraining" for persons with severe memory difficulties
- Use of memory notebooks may require extensive, structured training with ongoing external support
- Need to consider ease of use, patient preferences

Compensatory Memory Training

Internal Strategy Internal Control <small>e.g. Berg et al.; Kaschel, Ownsworth, Huilhebrandt, Dou</small>	Internal Strategy External Control <small>e.g. Acker</small>
External Strategy Internal Control <small>e.g., Schmitter-Edgecomb</small>	External Strategy External Control <small>e.g., Wilson</small>

Recommendations for Memory Remediation

Practice Guideline

- Interventions to promote external compensations and specific skill learning recommended for persons with moderate to severe memory deficits after TBI or stroke
- Direct application to functional activities, not memory abilities, *per se*

Assistive Technology for Cognition (ATC)

- Subclass of AT designed to increase, maintain, or compensate for cognitive impairments
 - Focus on real-life, functional task performance
 - Technology oriented (simple to complex)
- a.k.a "cognitive orthoses," "cognitive prosthetics," or "memory aids"

(Kirsch et al., 2004; LoPresti et al., 2004; Scherer et al., 2005)



Implementing ATC (Sohlberg, 2007, 2009)

1. Become familiar with the *range* of ATC tools
2. Conduct individualized needs assessment
3. Train use of device
4. Measure effectiveness

Range of Assistive Tools

Low-Tech ↔ High-Tech

Multi-Functional ↔ Task Specific

Specialized ↔ Commercial

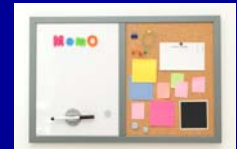
Paper and Pencil Systems

- Low Tech; multi-functional; commercial
- Most commonly used in practice (Evans et al., 2003)
- Examples:
 - Calendars/planners
 - Memory notebook/binder
 - Post-It notes



Home Organizer Systems

- Low-Tech; multi & single Function; commercial
- Examples:
 - Scheduling/bulletin board
 - Alarms & timers
 - Mail sorter
 - Key hook
 - File organizer
 - Pillbox
 - Boxes, baskets, bins...



Data Watches

- Mid-tech; multi-function; commercial
- Most effective when provide signal and content (LoPresti et al., 2004)
- Examples:
 - Timex™ data watch (\$50-90)
 - Fossil Wrist Palm (\$250)
 - Casio Databank watches (\$20-60)

Voice Recorders

- Mid-tech; single function; commercial
- May or may not include: alarm function; multiple folders; clock
- Examples:
 - Keychain recorder (\$10-15)
 - Digital voice recorders (\$30-150)

Pagers

- Mid-tech; task specific; commercial
- Strongest evidence to support ATC
(Wilson et al., 2001)
- Limited to alphanumeric information
- Requires telecommunications subscription
- Price range (\$40-200)



Cell Phones

- Mid-tech; multi-function; commercial
- Requires telecommunications subscription
- Uses:
 - Phone calls
 - Address book
 - Calendar functions
 - Clock, alarm, reminders
 - Instant messaging (text, multimedia)
 - GPS
 - Camera



Handheld Organizers/PDA

- High-tech; multi-function; commercial
- PDA, Palm, Pocket computer, Handheld
- Uses:
 - Calendar, To-Do lists, notes, reminders/alarms
 - Document organization and editing
 - Internet (email, Web)
 - Camera/GPS
 - Phone (smart phone)

4 Step Process

1. Become familiar with the *range* of ATC tools
2. Conduct individualized needs assessment
3. Train use of device
4. Measure effectiveness

Assessment Model

- Assistive Technology Outcomes Measure (ATOM)
 - Matching Person to Technology - consider:
 - Person
 - Environment
 - Technology
 - Outcomes - measure:
 - Clinical use, comfort, & satisfaction
 - Functional impact / QOL
 - Cost & time

(Scherer, 2002, 2004)

Needs Assessment: Person

- Team-driven assessment of personal factors:
 - Physical needs (gross + fine motor, speech)
 - Sensory needs (vision, hearing)
 - Cognitive needs (insight, attention, memory, executive functions)
 - Cultural values and expectations
 - Perceptions of technology benefits
 - Pre-injury familiarity with technology
 - Motivation to...
 - Improve in daily tasks
 - Use assistive devices
 - Psychosocial state

Needs Assessment: Environment

- Type of Supports
 - What is already in place?
 - Are natural supports in place?
 - Who is available for technical support?
 - How often is support needed?
- What is device needed for?
 - How often do opportunities to use device occur?
 - When will they use it and what will trigger them to use the device?
- Physical Environment
 - Distractions
 - Lighting

Needs Assessment: Device

- Cognitive Demands:
 - Memory load
 - Number of steps
 - Complexity of decision trees
- Physical Demands:
 - Access (button, stylus, touch screen)
 - Size, complexity, sensitivity
- Sensory/Language Demands:
 - Symbols (text, pictures, both)
 - Size and layout

4 Step Process

1. Become familiar with *range* of ATC tools
2. Conduct individualized needs assessment
3. Train use of device
4. Measure effectiveness

Systematic Training Makes a Difference

Components:

- Task analysis (step-by-step instructions; chain together)
- Prevent errors during initial learning (model - cue - consistent feedback)
- Review regularly to reinforce & solidify learning (during session & subsequent sessions)
- Encourage high numbers of correct repetitions to master skill
- Encourage active learner engagement

(Brush & Camp, 1998; Evans et al., 2000; Sohlberg et al., 2005; Wilson et al., 2001)

4 Step Process

1. Become familiar with *range* of ATC tools
2. Conduct individualized needs assessment
3. Train use of device
4. Measure effectiveness

Measuring Therapy Outcomes

- Can the client use the device?
 - Therapy observational data
- What is the impact of using the device?
 - Client and care provider interview
- Get the client into real-life contexts as soon as possible
- Program for long-term maintenance
 - Support, motivation, cost/benefits

Durham VAMC Experience with Memory Aids

- Lead SLP – Dr. Carol Smith-Hammond
- mTBI Evaluation protocol: Mental Health and Speech Pathology Services
 - 1.5 to 2.0 hours in duration
 - Neurobehavioral Symptom Inventory (NSI) (Cicerone, 1995)
 - Questionnaire about post-deployment changes in daily activities
- 192 veterans referred following positive results on the mandatory TBI screening

Frequency of Cognitive Problems Reported on NSI

- Forgetfulness 96%
 - Decision Making 85%
 - Organization 93%
 - Concentration 97%
- Level of severity ranging from 0=no problem to 4=very severe

Questionnaire (Pre and Post Treatment)

- Changes and difficulties with
 - Basic and higher level activities of daily living
 - Family and parenting
 - Job performance
 - Community involvement, including vocational pursuits
 - Relationships
- 0-10 Visual Analog Scale
 - 0 = no problem; 10 = severe problem

Treatment

- Issue memory device
- Provide training to use device
- Compensatory strategies to improve
 - Attention/Concentration
 - Memory skills
- Individual and group treatment sessions

Outcomes: Medical Care (mean of veteran responses)

Remember to:	Before	After
Take Medications	6.9	3.8
Keep Appointments	6.2	3.9

(0= no problem 10= severe problem)

Outcomes: Job Issues (mean of veteran responses)

	Before	After
Complete Homework	6.1	3.6
Find Phone/Address	6.2	4.0
Attempt complex projects	7.4	4.2
Pay attention	6.1	4.7
Finish projects	4.4	3.7

(0= no problem 10= severe problem)

Outcomes: Household Issues

(mean of veteran responses)

	Before	After
Grocery Store	7.4	4.9
To Do list	6.9	4.0
Feed animal	3.8	0.82
Finish projects	6.0	3.9
Cooking (not burning)	3.8	2.6

(0= no problem 10= severe problem)

Outcomes: Relationship Issues

(mean of veteran responses)

	Before	After
Remember what people tell me	6.7	4.0
Family comments on my memory	6.7	4.6

(0= no problem 10= severe problem)

Remediation of Executive Function

Study Design	1997	2002	2007	Total
Class I	1	2	3	6
Class II	2	0	2	4
Class III	11	7	9	27

Remediation of Deficits in Executive Functioning

- 3 RCTs of Problem Solving Treatment
- Significant benefits of problem solving strategies on neuropsychological measures of planning ability and ratings of dysexecutive behavior

Remediation of Deficits in Executive Functioning

Rath et al, 2003

- N = 60 (45% LOC < 5 minutes)
- Group treatment based on problem solving skills and problem orientation (emotional regulation)
- Selective benefits on
 - executive functioning (WCST perseveration)
 - self appraised problem solving & emotional regulation
 - observer ratings of interpersonal problem solving

Recommendations for Remediation of Executive Dysfunction

Practice Guideline

Training of formal problem solving strategies and their application to functional situations is recommended for persons with stroke or TBI during the post-acute period of rehabilitation

Remediation of Deficits in Executive Functioning

- Class I studies of attention, neglect and memory have incorporated self-instructional training as a component of interventions
- Class II and Class III studies suggest that training of self-management strategies (e.g., self-instruction, self-monitoring) can improve deficits in executive functioning, including reduction of problem behaviors in everyday situations

Remediation of Deficits in Executive Functioning

Cheng & Man, 2006; Goverover et al, 2007

- Awareness interventions applied to functional IADL tasks
 - Prediction of performance
 - Planning and verbal self-regulation
 - Strategy generation and selection
 - Feedback / Self-evaluation
- vs. Conventional rehabilitation

Remediation of Deficits in Executive Functioning

Cheng & Man, 2006 (Class I)

- Improved awareness with no differences on functional tasks
- Goverover et al, 2007 (Class I)*
- Improved task performance with no differences on awareness measures

Recommendations for Remediation of Executive Dysfunction

Practice Guideline

Cognitive remediation to promote internalization of self-regulation strategies (self-instruction, self-monitoring, emotional regulation) may be considered for treatment of deficits after TBI

Approaches to Treatment of Executive Dysfunction

- Acknowledging and/or generating goals to manage activities and behaviors
- Self-monitoring and self-recording performance
- Making strategy decisions based on performance-goal comparisons in which individuals adjusted or modified a plan based on self-assessment and/or external feedback

Remediation of Language

Study Design	1997	2002	2007	Total
Class I	8	4	2	14
Class II	7	1	3	11
Class III	26	35	33	94

Remediation of Communication Deficits after TBI

Dahlberg et al., 2007 (Class I)

- Social Communication Skills Training after TBI vs. Deferred Treatment
 - Pragmatic language skills
 - Social behaviors
 - Cognitive abilities

Remediation of Communication Deficits after TBI

Dahlberg et al., 2007 (Class I)

- Significant benefits apparent on
 - 7 of 10 aspects of Functional Communication (blind objective ratings)
 - Social Communication Skills (self-report)
- Gains maintained at 6 month follow-up
- Improved life satisfaction at 6 month follow-up

Recommendations for Cognitive-Linguistic Remediation

Practice Standard

Specific interventions for functional communication deficits, including pragmatic conversational skills, are recommended for persons with TBI

Approaches to Remediation of Social Communication

- Address affective-behavioral impairments that result in socially disruptive behaviors or social avoidance
- Establish common understanding of target behaviors and establish a rating system
- Observe and rate behaviors in movies other persons, and then in self
- Use of videotaped feedback
- Individual vs. group treatment
- Training of family and friends

General Principles of Cognitive Rehabilitation

- Understand the cognitive profile
 - What are the types of impairments in the domains of memory, attention & executive functions
- Think about outcome measurement
 - What will change as a result of my therapy (long term goal)
- Think about dosage/intensity
 - How will I achieve sufficient drill and/or strategy practice?

Thank you

Questions?

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