Restorative approaches for attention and memory

- Different dimensions of attention and working memory are modulated by the behaviorally-context-dependent release of:
  - acetylcholine (focused attention/reward)
  - dopamine (reward, novelty)
  - norepinephrine (novelty)
  - Serotonin

Thiele and Bellgrove (2018)
Neuron Volume 97, Issue 4, p781–785

Roelfsema and Holtmaat, 2018
(Nature Reviews Neuroscience volume 19, pages 166–180)
doi:10.1038/nrn.2018.6

Evidenced-Based Outcome Research
(Tompkins, 2012)

- For treatment of attention, memory and other cognitive disorders – Practice Standards
  - External memory aids
  - Errorless learning
  - Spaced Retrieval
Balance Brain Stimulation
Chapman (2013)
• Active mental stimulation is required to improve or recover lost cognitive functions
• 80% rule (Merzenich & Jenkins)
  • Too low challenge creates boredom
  • Too high challenge creates frustration agitation
• Tasks need to be ratcheted up a notch to constantly achieve brain wiring

Strengthen Strategic Attention
Chapman (2013)
• Keep background stimulation as low as possible
• The brain has to work harder to process input while blocking out extraneous distractions
• The processing impaired/injured brain tires faster when there are extraneous stimuli
• Therapist can gradually add distractions during tasks to build tolerance

Figurative Language Tasks (Lundgen & Brownell, 2016)

Idiom Comprehension Worksheet (Lungren & Brownell, 2016) Steps 1&2
### Music Therapy as a Vicariative Approach to Enhancing Attention, Memory Skills and New Learning

Martha S. Burns, Ph.D.

#### Music and Rehabilitation of RHD

(Pfeiffer, C. F., & Sabe, L. R. (2015)

- **Sustained attention:**
  - Music perception task: The individual listens to 5-min of piano music in which the sounds of different musical instruments (xylophone, flute, triangle, violin, maracas, drums) are artificially imbedded.
  - The patient is given a frame drum and asked to beat once on it when he identifies the target sound (the drum), which appears 15 times in 5 min.
  - Scoring:
    - 0 correct beats 0 points, 1–3 correct beats 1 point,
    - 4–6 correct beats 2 points, 7–10 correct beats 3 points,
    - 11–14 correct beats 4 points, all correct 5 points

---

### Idiom Comprehension Worksheet (Lungren & Brownell, 2016) Step 3

**Meaning – Context:** combine to guess the true meaning

“What meaning connects with the context?”

---

### Screening of Music and Cognition

- Fifteen patients (9 female and 6 male) average 123 DPO
- Control group:
  - 30 healthy adults (19 female and 11 male), ages 48–72

*Figure 1.* Comparison of mean scores for the experimental and control groups.

---

### Music and Cognition

- Thirty-five patients (20 female and 15 male) average 123 DPO
- Control group:
  - 30 healthy adults (15 female and 15 male), ages 48–72

*Figure 2.* Comparison of mean scores for the experimental and control groups.

---

### Music and Cognition

- Twenty patients (13 female and 7 male) average 123 DPO
- Control group:
  - 30 healthy adults (15 female and 15 male), ages 48–72

*Figure 3.* Comparison of mean scores for the experimental and control groups.
Music and Rehabilitation of RHD (Pfeiffer, C. F., & Sabe, L. R. (2015) Continued

• **Selective Attention:**
  - Music performance task: The individual is invited to play along with the music therapist a 2/4 beat on a drum.
  - Once the beat is steady, the patient is required to keep playing independently at the same steady beat for 3 min without being distracted by the music therapist who starts improvising on his drum complex off-beat rhythms.
  - Scoring:
    - the individual does not initiate performance 0 points;
    - initiates performance but is unable to follow the beat 1 point;
    - plays along and keeps the beat steady independently 3 points;
    - keeps the beat steady in presence of distracting stimuli 5 points.

• **Auditory Processing**
  - Auditory Processing/Echoic Memory Music perception task: Five pairs of short melodies played on piano are compared and identified as same or different.
  - Each melody is between 4 and 6 s with a silent interval of 4 s preceding the second melody.
  - Melodic contour has been changed by modifying the final pitch of the second melody.
  - Those subjects unable to speak may point at cards on which the words “same” and “different” are written beneath an image of two identical and two different images (two circles for same, one circle and one star for different).
  - Scoring: 1 point for each correct answer.

• **Music perception task:**
  - same task as before, but this time the participant is asked to compare five groups of two rhythmic patterns
  - Scoring: 1 point for each correct answer.

• **Working Memory Music perception task:**
  - A 1-min recording including the sound of five different well-known musical instruments is presented three consecutive times.
  - The individual is asked to remember the order in which the different timbres are presented.
  - As visual support, a picture of each instrument is placed in random order on the desk.
  - After listening to the audio file, the individual is asked to place the cards in the opposite order in which the instruments were presented.
  - Scoring: 1 point for each correct answer.
Music and Rehabilitation of RHD (Pfeiffer, C. F., & Sabe, L. R. (2015) Continued

• Music performance task:
  • Imitation of simple rhythmic patterns on percussion instrument with the nonparetic arm.
  • Scoring: 1 point for each correct answer.

• Musical Memory
  • Music perception task: Five familiar tunes played without lyrics (e.g., happy birthday, a well-known South American lullaby) and pictures representing these are presented.
  • The pictures are placed on the desk in front of the patient, who is asked to point to the picture related to the song melody presented.
  • Scoring: 1 point for each correct answer.

Music and Rehabilitation of RHD (Pfeiffer, C. F., & Sabe, L. R. (2015) Continued

• Initiation and Response Inhibition
  • Music performance task: Three different motor responses are required in response to three different auditory cues:
    • Listening to one beat playing one beat.
    • Listening to two beats silence.
    • Listening to three beats playing three beats switching instrument.
  • A sequence of fifteen cues is presented (e.g., 1, 1, 2, 3, 2, 1, 3, 3) and the patient is required to respond making the correct response to each cue.
  • Scoring: distributed as in task 1.

Music and Rehabilitation of RHD (Pfeiffer, C. F., & Sabe, L. R. (2015) Continued

• New Learning
  • Music perception task: A novel piano tune is played three times at the beginning of the assessment.
  • The third item, two novel tunes are also.
  • The individual is asked to recognize the previously presented tune.
  • Scoring: The subject does not recall the tune 0 points. The subject recalls the tune 5 points.
Screening of Music and Cognition

Figure 2: Comparison of mean scores from baseline and follow-up for the Screening of Music and Cognition.

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Other Music Based Interventions

- DOI:10.1016/S1474-4422(17)30168-0

Music-based intervention
Refers to all experimental protocols that use music in various forms to study its therapeutic effects.

Music therapy
Music-based interventions delivered in a clinical setting by a credentialed music therapist that use various musical elements (e.g., singing, or creating, moving to, or listening to music).

Music medicine
Various types of music-based interventions delivered by health care professionals. The interventions have health-promoting goals, but often do not have the therapeutic relationship and reciprocal musical interaction that are characteristic of music therapy.

Rhythmic auditory stimulation
Neurological music therapy technique used in the rehabilitation of movements that are naturally rhythmic (e.g., gait). In rhythmic auditory stimulation, a series of auditory stimuli are presented at a fixed rhythm, and movements are synchronised (entrained) to the rhythm.

Music-supported therapy
Music-based intervention developed for motor rehabilitation of stroke. In music-supported therapy, gross and fine movements of the hemiparetic upper extremity are trained through playing musical instruments (e.g., drums, keyboard).

Interdisciplinary Therapeutic Application of Music

- Music may be used by:
  - PT for coordination activities
  - OT imitation of simple rhythmic patterns on percussion instrument with the paretic or nonparetic arm
  - Nursing – on the unit for mood enhancement and relaxation
  - SLP's for cognitive communicative intervention with attention and memory

Compensatory Strategy Training (Cicerone, et al 2011 review)

- Strategy training was aimed at teaching strategies adapted to different situations with memory requirements.
- Results indicated that frequency and intensity of memory training were critical in improving memory performance.
- A class III study[2] demonstrated increased knowledge of memory strategies and use of memory aids, reduced behaviors indicative of memory impairment, and improved performance on neuropsychologic assessment of memory following a 4-week structured, group format memory training program.

Vicariative Functional Approaches

Encoding strategies

- **Visual Inspection**
  - Study the colors and/or the orientations of the objects
  - Study how the objects were physically arranged in relationship to each other

- **Verbal Elaboration**
  - SLP's
    - Repeat names aloud
    - Use the starting letter of the names, or associations
    - Construct a story that described what you physically want to remember
    - Construct interesting sentences
    - Construct sentences that contain names or objects to remember

  - OT and PT –
    - *verbal steps of actions*, “I tell myself, look to the left, then”
    - *guidelines for transitions*, “So, if we feel too away we go”
    - *steps, obstacles*
Let’s Practice

Now write down as many words as you can recall. You have one minute.

How Efficient is Your Brain?

- pill
- epic
- rose
- kind
- moose
- unlikely
- sip
- district
- direct
- soap
- weathervane
- statue
- mistake
- natural
- photo

Working Memory and Strategic Attention Tasks for PT’s

- Strategic Attention
  - During gait training (wheel chair ambulation, other motor task) practice, once safety and form are no longer primary issues:
    1. name grandchildren from oldest to youngest.
    2. recite the alphabet backwards
    3. count backwards from 100 by threes

- Working Memory
  - Have the patient recall items on a shopping list after presented prior to any exercise task, after the motor task is completed
  - Have the patient retell the important steps aloud of any motor task 15 minutes after the task is completed.

Memory Interventions discussed in the Cognitive Rehabilitation Manual and Reviewed by Cicerone et al. 2005, 2001

- Errorless learning and Spaced Retrieval
  - Focus - minimizing errors during delivery of instruction:
    - Errorless learning
    - Spaced retrieval
    - Most helpful for individuals with more severe cognitive impairments.
Errorless Learning compared to Conventional Instruction (Ehlhardt & Sohlberg, 2008)

<table>
<thead>
<tr>
<th>Systematic Instruction</th>
<th>Conventional Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited range of instructional targets</td>
<td>Broad range of instructional targets (calendar program plus)</td>
</tr>
<tr>
<td>Multiple training examples</td>
<td>Few training examples</td>
</tr>
<tr>
<td>Mastery emphasized</td>
<td>Mastery not emphasized</td>
</tr>
<tr>
<td>Exploration discouraged</td>
<td>Exploration encouraged</td>
</tr>
<tr>
<td>Step-by-step models; carefully faded support</td>
<td>Whole task model only</td>
</tr>
<tr>
<td>High rates of correct, distributed practice and review per target</td>
<td>Few practice opportunities per target</td>
</tr>
<tr>
<td>Immediate corrective feedback</td>
<td>Wait to give feedback</td>
</tr>
<tr>
<td>Training in different environments</td>
<td>Training in clinic setting only</td>
</tr>
</tbody>
</table>

Examples of Functional Goals

• Any ADL (grooming, dressing e.g.)
• Tells time
• Reads daily schedule
• Reads a calendar
• Reads appointments on calendar
• Uses personal phone list
• Scanning for road signs when passenger in a car
• Reads and complies with labels on cleaning products
• Reads/uses checklist to complete duties
• Follows directions on packaged food
• Reads/follows recipes
• Dials phone
• Reads grocery list
• Uses shopping lists

Higher Level Functional Tasks (continued)

• Grocery shopping on the internet
• Other shopping on the internet
  • Clothes, personal items, furniture, pharmacy
• Banking/money management
• Restaurant menus

Functional Activities for training visuospatial strategies

• Non-verbal tasks
  • Recognition of familiar faces
  • Gestalt perception
  • Construction
Distinctive feature description in simultagnosia

- Description to identify scene
- How many people?
- Sitting or standing?
- Direction they are facing?
- Are seated people children or adults?
- Is this a class, a lecture or a presentation?

Tone of voice, body posture, facial expression cues in pure word deafness

- What is this man saying?
- I'm furious, you know what movies I like!
- How would I know what movies you like?
- I don't care what you like.
- This is a great movie.

VR for Treatment of Neglect (Ogourtsova, 2015)

- In terms of the intervention studies, it is apparent that research is still limited in that area. The current review shows that, overall, there is a lack of high-quality research studies to produce conclusions with strong evidence. Therefore, the results of the intervention trials are to be interpreted with caution.
Prism Adaptation for Neglect

• In prism adaptation, a sensorimotor approach that induces procedural learning, the patient wears prism glasses or goggles that shift the left visual field to the right.
• One study reported gains that lasted out to 6 months postonset.
• As noted by Arene and Hillis, patients with right cerebellar damage may not be good candidates for this treatment.


• There is some evidence suggesting that PA can improve daily functioning, particularly as measured by reading/writing and ADL direct tests.
• Among the 26 articles, a total of 32 measurements showed significant PA effects (one measurement from a study of excellent quality, 17 from studies of good quality, 10 from studies of fair quality, four from studies of poor quality).
• Whereas non-significant effects were found in 15 measurements (two from a study of excellent quality, three from studies of good quality, eight from studies of fair quality, two from studies of poor quality).
FIGURE 4 | Drawings of daisy and virtual supermarket map from memory.
Example of drawings made by each neglect patient before and after prism adaptation. Glize et al. 2017

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Treatment of other Cognitive-Communication

• Treatment of emotional perception deficits
• Group treatment
• Treatment of Theory of Mind
• Treatment of social communication deficits and use of family for collaborative communication intervention
• Treatment of executive functions

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Treatment of Emotion Perception Deficits (Cognitive Rehabilitation Manual ACRM 2012)

• Goal – patient will independently name the emotions represented in pictures of people
1. Patient will identify emotion of people based on photographic stimuli with a choice of six text options
2. Patient will identify common emotions associated with specific facial expressions
3. Patient will independently identify emotion in people without text options

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Treatment of Theory of Mind

Martha S. Burns, Ph.D.
Classic Approach

TOM training, Lundgen & Brownell, 2011

- Thought bubbles provide a completely explicit, visual means to support strategies for thinking about mental states.
- Thought bubbles provide the opportunity to observe the similarities and differences between two people’s thoughts,
- that IS, false beliefs, which provide a basis for predicting and understanding behavior.

Examples of Thought Bubbles

Other approaches

- Favorites Differences with S.O., child, sibling:
  - FOODS
  - COLORS
  - VACATION SPOTS
  - TV PROGRAMS
- At a higher level - Political Cartoons – discuss both sides (may be less emotionally charged than political opinion pieces)
Social Participation Changes after RHD
(Hewetson, Cornwell & Shum (2017)

(1) social participation change as reported by people with RH stroke;
(2) compares social participation change across two groups based on the presence or absence of CCD following RH stroke; and
(3) compares self and proxy reports of changes in participation.

Most participants (94.4%, n = 34) reported change in at least one of the SPRS-2 domains. The presence of CCD had an impact on social participation as measured on the SPRS-2, which was significantly different to what was reported by participants without a communication impairment post-RH stroke ($p = 0.02$.)

Family Members as Collaborative Communication Partners (Ylvisaker, et al 1998)

Collaboration is a multifaceted concept with five key elements, including:
- having collaborative intent
- when approaching the interaction, providing cognitive and emotional support for the person with
- approaching the interaction using a positive questioning style and, finally,
- considering turn taking as a collaborative process
Dynamic Coaching (Miller & Rollnick, 2012)

Requires the cooperation of the client or patient so a key component is motivational interviewing (Miller & Rollnick, 2012), a process that helps individual’s make constructive changes. In motivational interviewing, the clinician follows five principles:

1. Understands the individual’s perspective with empathy and non-judgmental listening
2. Explores discrepancies between the individual’s current behavior and life goals and objectives
3. Once the individual recognizes the discrepancy, the individual (not the clinician) can think about and present reasons for change
4. Problem solving – the clinician encourages the individual to problem solve possible solutions
5. Encourages self-efficacy – the clinician supports the individual’s capacity to change

Group Treatment — suggested topics (Cognitive Rehabilitation Manual ACRM 2012)

• Orientation and review – “tell your story”
• Key communication skills – greetings, complimenting, turn-taking, asking questions, interest in communication partner
• Conversation starters, topic selection
• Keeping conversations going
• Social boundaries
• Video-taping and video review
• Community outings

Prioritization after Chapman (2013)

• Teach client/patient with executive function problems to prioritize tasks
  • Avoid trying to do two things at once (multitasking is very difficult after brain injury)
• Teach patient/client to identify top two tasks from to-do lists
  • The brain becomes quickly overwhelmed with long to-do lists
Vocational and Educational Re-entry

- Importance of Dynamic Coaching to Enlist full cooperation of higher level patients

Executive Function Goals

- Volition
  - Motivational capacity
  - diminish cues for task/conversational initiation
  - Set conversational goals in role playing
  - Speech – Conversational topics

- Capacity for self-awareness
  - PT - Physical status
  - OT - environmental and situational context
  - Speech - social awareness

Executive Function Goals for Purposive Action

- PT – Adaptation/generalization of motor skills to new environments
- OT – Shifting tasks and response paradigms
- Speech - Verbalized intentions followed by actions

Integrated Reasoning

Chapman (2013)

Start with higher-order processing

SLPs
- Rehearse or write down big ideas
  - Strategic Memory and Reasoning Training (SMART)
  - Transfer to higher levels of functionality

Vas et al (2011)
- Rehearse with possible relevance to rehabilitation strategies
  - Irimia, A. (2012) et al; also, table of cortical regions affected in TBI

PT and OT’s (Burns added): – strategic motor planning (cognitive control of action)
  - Caeyenberghs et al (2012)
Executive Function Goals – Effective Performance

• PT – measure reaction time, speed of execution, mastery
• OT – use timers to increase task completion
• decreasing rigidity
• Speech – increase processing speed and working memory on tasks such as concentration; holding to a script
• Outcome measures should include:
  • Self-direction
  • Self-regulation

Other Executive Function Considerations

• Planning - Develop goals that focus on planning prior to:
  • reading of any item
  • How is a newspaper organized? How to easily get to the sports page? Where are the advice columns? How to get through a TV guide?
  • Motor tasks – How many steps? How far away is the toilet?
  • ADL – Shopping lists for recipes.

Executive Function (cont.)

• Organization
  • Most important for organization of space
  • Up/down; left/right
  • Edgeness and bookness
  • Using filing systems to store credit card receipts, bills
  • Attaching TV guides to the TV, using a clip to enable the patient to find today’s listings
  • Highlighting important names and addresses in listings

Time Pressure Management (TPM)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>Example Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1: Planning</td>
<td>Plan the task ahead of time</td>
<td>Prepare materials, prioritize tasks</td>
</tr>
<tr>
<td>Stage 2: Organizing</td>
<td>Organize the environment</td>
<td>Use filing systems, labels</td>
</tr>
<tr>
<td>Stage 3: Executing the Task</td>
<td>Execute the task efficiently</td>
<td>Follow a checklist, use time management tools</td>
</tr>
<tr>
<td>Stage 4: Monitoring</td>
<td>Monitor progress and adjust</td>
<td>Keep track of time, note any changes</td>
</tr>
</tbody>
</table>

TREATMENT

- Behavioral interventions
- Pharmacological therapies
- Family therapy
- Occupational therapy
- Cognitive-behavioral therapy
Metacognitive Strategy Instruction (MSI) For TBI applicable to RHD

- Incorporates external organizers and prompts, such as charts, notebooks, checklists, and cue cards
- Also includes time pressure management (eg, planning ahead, adjusting environment when possible, practicing a few times) and strategic thinking training (eg, clinician models problem-solving strategies, explaining decisions).

And we KNOW - Adequate sleep is also essential

- Dromerick et al., 2009; Gao et al., 2010). In the subchronic and chronic post-stroke recovery phases, sleep is assumed to promote use-dependent neuroplasticity and improve learning and stroke recovery (Siengsukon et al., 2015).
Other Excellent Resources:

- Especially a listing and discussion of Evidence Based Approaches

Q and A

Selected References

References (continued)


References (continued)