

## **Cognitive Rehabilitation Efficacy in people with attention/working memory and/or executive function impairments**

*Does cognitive rehabilitation improve executive function in people who have suffered from traumatic brain injuries?*

### **Critical Appraisal Form-Quantitative Study**

#### **Article Citation:**

Serino A, Ciaramelli E, Santantonio AD, Malagu S, Servadei F, Ladavas E. A pilot study for rehabilitation of central executive deficits after traumatic brain injury. *Brain Inj.* 2007; 21(1):11– 19.

#### **Study Level of Evidence, What Type of Study?**

Level I:  RCT

Level II:  Cohort trial  Case-control trial  Non-randomized control trial

Level III:  Case-control  no pre-post test

Level IV:  Single case study  Case series  No comparison group

Level V:  Descriptive study  Narrative review  Expert opinion

**Purpose of Study: Is purpose clear?** X yes  no

#### **Describe researchers question/purpose:**

The researcher's' purpose was to investigate the efficacy of a rehabilitation program that focused on working memory training targeting the central executive system in improving working memory and other cognitive functions in participants with a traumatic brain injury.

#### **METHODS**

Were there any biases or ethical concerns in the study design? Yes, there could be bias and issues with the internal validity of the study because the way that some of the data was collected was through subjective scales and questionnaires, which can cause measurement bias. There was statistical regression bias because it is likely that when the participants repeat the same tests a second time their score will improve after two interventions.it's own. There is selection bias because this is not representative of a typical TBI population and has very specific criteria.

#### **POPULATION**

**Who was the sample, how many subjects?**

9 TBI Patients

#### **Inclusion Criteria:**

- Severe working memory impairment (percentile  $\leq 5$ ) on neuropsychological assessment
- 6-months status post (s/p) TBI event

**Exclusion Criteria:**

- Co-morbidities that include neurological diseases, MS, dementia, or Alzheimer's
- Emotional or psychiatric disturbance, or communication problems

**What was the intervention? Frequency, setting?**

The study took place within the researcher's computer lab. The intervention was based on Working Memory Training which consisted of repeated administration of the Paced Auditory Serial Addition Test (PASAT) & two experimental task derived from the PASAT (ex-month's task & words task). The WMT was preceded by general stimulation training (GST; control training), where participants performed simple decision tasks, requiring low executive demands, and progressively familiarize with the testing setting. The interventions were administered four sessions a week, over a period of four weeks.

**How measured?**

The results were measured using a neuropsychological profile to evaluate upon admission and after general stimulation training(GTS). A new neuropsychological profile and psychosocial assessment was conducted at the end of the working memory training(WMT). The effects of the results for functional performance were measured using ANOVA.

**Relevant outcomes to OT? How measured?**

Reaction time	Testbatterie zur Aufmerksamkeitsprüfung (TAP) Alertness subtest
Sustained attention	TAP Optimal Vigilance subtest
Divided attention	TAP Divided Attention subtest
Working memory	TAP Working Memory subtest
Long-term memory	Buschke-Fuld Test
Executive function	The Tower of London Letter Fluency
Everyday functioning	Rivermead Head injury Follow-Up Questionnaire (RHFUQ) Patient Competency rating Scale (PCRS)

**Were the tests valid? Explain**

There were several tests in this study. These are standardized tests that have established validity in assessing specific neurocognitive functions of stated intent.

**Were the tests reliable? Explain**

These tests are widely used standardized tests that have been established for reliability. training programs and CES.

**RESULTS, CONCLUSIONS, CLINICAL IMPLICATIONS:**

**What were the findings? Was there: Statistically significant change?**

Statistical significance achieved: working memory ( $p < 0.05$ ), divided attention ( $p < 0.05$ ), long-term memory ( $p < 0.05$ ), and both tests of executive functions (Tower of London  $p < 0.005$ ; Letter of Fluency  $p < 0.05$ ), and everyday functioning self-questionnaires RHFUQ ( $p < 0.001$ ), and PCRS ( $p < 0.05$ ) change in pre-post Working Memory Training.

**Clinically significant change? Explain:**

Clinical significance was shown in the everyday functioning of participants as indicated in their responses on self-questionnaires.

**What did the author conclude?**

The participants improved on divided attention, executive functions, long term memory, and daily living. They did not improve on speed processing or sustained attention, so there was efficacy and specificity of the WMT in improving cognitive functions dependent on the central executive system.

The authors also noted possible causal relationships that could have impacted the study outcomes. The performance improvement observed after the WMT is unlikely to be due to general cognitive stimulation, practice effects, or to any possible role played by psychological and relational factors, since these factors were not effective during the control training. The same reasoning applies to other plausible effects having an effect on the results, such as motivation for being involved in a research study. Moreover, the overall results of the study are in line with previous research on training programs targeting the CES. For example, in previous training program studies (Cicerone; McDowel et al.) found similar results showing executive functioning processes are linked to one another.

**My Brief Summary:**

**What I see as study strengths:** The study's strengths include a creative way to solve multiple cognitive problems through the use of one therapy. All of the findings were positive in that there was significant improvement in working memory, long-term memory, and executive functions. The results of the study can be generalized among patients who sufferer from a cluster of TBI symptoms depending on the CES functioning. However, the results of the study may be not be applicable to patients who suffer from a different variety of impairments.

**What I see as limitations:** A limitation of the study acknowledged was the small sample size which affects the generalizability of the study. Further research should be conducted with a larger sample of TBI patients, to allow confirmation or extension of the findings. This can also help determine if certain factors among TBI patients such as individual, clinical, or demographic characteristics play a role in who may or may not benefit from this intervention. In addition future fMRI investigations would help verify whether the intervention helped contribute to improving functional connectivity.

**How is the study's findings relevant to OT?**

The studies findings are relevant to occupational therapy because occupational therapists will be working with clients of this population and it is important to see how the problem areas related to the central executive system can be improved upon. Additionally, the study outcome is relevant to OT in that we require these cognitive skills to perform daily occupational roles. Finally, the findings are relevant because the study had a specific aim to focus on only the areas in the central executive system. This way of having a focused approach is important for occupational therapists to consider when creating intervention plans and their specificity to the client's needs.

**How do I intend to use these results?**

The results of this study can be used to provide practitioners with supporting evidence that Working Memory Training can be an effective form of cognitive rehabilitation for improving impairments in executive functioning, selective attention, working memory, and long term memory in patients suffering from TBI.