



## AOTA Critically Appraised Topics and Papers Series Traumatic Brain Injury

*\*A product of the American Occupational Therapy Association's  
Evidence-Based Literature Review Project*

### CRITICALLY APPRAISED PAPER (CAP)

#### *Focused Question*

**What is the evidence that challenging demands to the brain, such as therapy, activity, or sensory stimulation reorganizes brain function beyond spontaneous recovery after traumatic brain injury (TBI)?**

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Page, S., & Levine, P. (2003). Forced use after TBI: Promoting plasticity and function through practice. *Brain Injury, 17*, 675–684.

#### **PROBLEM STATEMENT (JUSTIFICATION OF THE NEED FOR THE STUDY)**

- Skill is improved as a direct result of practice.
- Therapy time has decreased for patients in rehabilitation, which interferes with task-specific practice opportunities for neurologically impaired individuals.
- Rehabilitation for persons with traumatic brain injury (TBI) is usually delayed, missing the benefits of early intervention when spontaneous recovery is occurring.
- Because of economic constraints, therapy focuses on compensatory strategies rather than restitution of function.
- Application of operant conditioning overcomes learned nonuse in animal models and human models with brain injury.
- Short periods of concentrated, task-specific training induce brain reorganization and improvement of motor function.
- The original constraint-induced therapy (CIT) required 6 hours of therapy a day for 2 weeks plus restraint of the less-affected upper limb for 90% of awake time. Modified protocol requiring 30 minutes of structured functional practice plus restraint of only 5 hours per day has been found effective for persons with stroke.
- Therefore, an exploratory study of the effects of modified CIT for persons with TBI is warranted.

State the problem the authors are investigating in this study.

The problem is whether a modified program of constraint-induced therapy (mCIT) will be as effective in restoring function in the more affected arm of persons post-TBI as it was shown to be for persons poststroke.

## RESEARCH OBJECTIVE(S)

List study objectives.

To determine the efficacy of modified constraint-induced therapy to improve the function of the more involved upper extremity after traumatic brain injury.

Describe how the research objectives address the focused question.

This study examines evidence about the efficacy of the challenging demands of activity to improve function, and by implication based on brain reorganization literature, to reorganize brain function in patients no longer considered to be spontaneously recovering.

## DESIGN TYPE:

Multiple-baseline, pre-post, case series—one group. (This is *not* a multiple baseline experimental single case design.)

## Level of Evidence:

III

## Limitations (appropriateness of study design):

Was the study design type appropriate for the knowledge level about this topic? If no, explain.

Yes

No

✓ The level of knowledge about constraint-induced therapy for persons with brain damage warrants a randomized controlled trial of a larger sample.

## SAMPLE SELECTION

How were subjects selected to participate? Please describe.

All who volunteered and met criteria were selected. The number of subjects who volunteered and were screened was not reported.

## Inclusion Criteria

- Ability to actively extend at least 10 degrees at the 16 more affected metacarpophalangeal and interphalangeal joints and 20 degrees at the more affected wrist.
- TBI experienced between 1 and 6 years prior to study enrollment.
- Age between 18 and 50 years old.
- No excessive spasticity, or pain or joint restriction in the affected limb as measured by the Modified Ashworth Spasticity Scale and a 10-point visual analog pain scale.
- Total score > 75 on the Galveston Orientation Amnesia Test.
- Completely discharged from rehabilitation.
- Not participating in any experimental rehabilitation or drug study.

- No serious cognitive deficits that would preclude understanding and executing basic commands.
- Motor dysfunction of the affected upper extremity not caused by peripheral nerve damage.

**Exclusion Criteria**

NR

NR = Not reported.

Sample Selection Biases: If yes, explain.

Volunteers/Referrals

- Yes  Volunteers were recruited through advertisements placed in therapy clinics and given to physicians in four hospitals
- No

Attention

- Yes  Possibly; subjects knew they were participating in an experimental treatment with expectations of improvement. There was no control group or baseline period after enrollment into the study. Baseline period prior to enrollment into the study does not control for expectation or attention.
- No

Others (list and explain):

**SAMPLE CHARACTERISTICS**

N=3

- % Dropouts
- #/ (%) Male  #/ (%) Female
- Ethnicity
- Disease/disability diagnosis

Check appropriate group:

<20/study group	20–50/study group	51–100/study group	101–149/study group	150–200/study group
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Sample Characteristics Bias: If no, explain.

If there is more than one study group, was there a similarity between the groups?

Yes

No  N/A

Were the reasons for the dropouts reported?

Yes

No

NR

**INTERVENTION(S)**—Included are only those interventions relevant to answering the evidence-based question

*Add groups if necessary*

Group 1

Brief Description	Occupational therapy: 25 minutes of use of valued (patient-chosen) activities of daily living plus operant conditioning shaping techniques, followed by ~5 minutes of strengthening and/or compensatory techniques using the less affected upper extremity as needed, preceded by 30 minutes of physical therapy for dynamic stand/balance and ambulation.
Setting	Clinic and home
Who Delivered?	Occupational therapists
Frequency?	10 sessions of 30 minutes each, 3 times per week plus 5 hours of constraint of lesser-involved upper extremity to force use of the more affected during active usage time for 5 days/week
Duration?	10 weeks

Intervention Biases: Explain, if needed.

Contamination

Yes

No

Co-intervention

Yes

No

Timing

Yes

No

Site

Yes

No

Use of different therapists to provide intervention

Yes

No

NR

The training of the occupational therapy in mCIT was not reported. Although the authors stated that the participants were to maintain an activity log for the part of the therapy done at home, the results of this were not reported, therefore, compliance to the home aspect of the program cannot be assured.

**MEASURES AND OUTCOMES**—Included are measures relevant to answering the focused question

Name of measure:

Action Research Arm test (ARA)

Outcome(s) measured (what was measured?):

Ability to grasp, pinch, grip, and carry out gross movement

Is the measure reliable (as reported in article)?

Yes

No

NR

Is the measure valid (as reported in article)?

Yes

No

NR

How frequently was the measure used for each group in the study?

Twice before the program began (elapsed time not reported) and once at the end of the 10-week program

Name of measure:

Motor Activity Log (MAL): 2 subtests—(1) amount of use (AOU), and (2) quality of movement scale (QOM)

Outcome(s) measured (what was measured?):

- Rating of amount of use of the more-affected extremity to accomplish 30 activities of daily living (ADL), using a 6-point rating scale for each activity.
- Rating of quality of use of the extremity during performance of ADL, using a 6-point scale for each activity.

Is the measure reliable (as reported in article)?

Yes

No

NR

Is the measure valid (as reported in article)?

Yes

No

NR

How frequently was the measure used for each group in the study?

Once before the program and once after the program.

Name of measure:

Wolf Motor Function Test (WMFT)

Outcome(s) measured (what was measured?):

Patient's ability to perform 19 simple limb movements and tasks with the more affected arm; 2 items measured strength and 17 measured time required to accomplish tasks.

Is the measure reliable (as reported in article)?

Yes

No

NR

Is the measure valid (as reported in article)?

Yes

No

NR

How frequently was the measure used for each group in the study?

Twice before the program began (elapsed time not reported) and once at the end of the 10-week program

### Measurement Biases

Were the evaluators blinded to treatment status? If no, explain.

Yes  Blinded as to whether the subject was pretreatment or posttreatment; also blinded to the purpose of the study.

No

Recall or memory bias? If yes, explain.

Yes  Possibly; the MAL required recall of the use of the extremity during the past week.

No

Others (list and explain):

The reliability and validity of two of the measures were not reported; these may not have been established.

Limitations (appropriateness of outcomes and measures) If no, explain.

Did the measures adequately measure the outcome(s)?

Yes

No

## RESULTS

List results of outcomes relevant to answering the focused question

Include statistical significance where appropriate ( $p < 0.05$ )

Include effect size if reported

- No statistical analysis was performed. All 3 subjects improved from 5.5 to 14 points on the ARA (a 19-item test with total possible score of 57). One scored 56. All 3 subjects improved more than 5 points in pinch, grip, and grasp.
- There was almost no change in all three subjects for the WMFT.
- All subjects improved more than 2 points on the AOU and QOM subtests of the MAL. Qualitative anecdotal reports attest to increased use of the affected extremity after the program as compared to before.

Was this study adequately powered (large enough to show a difference)? *If no, explain.*

Yes

No  Only three selected subjects participated. The researchers did not try to analyze the results statistically.

Were appropriate analytic methods used? *If no, explain.*

Yes

No  None used; raw scores reported.

Were statistics appropriately reported (in written or table format)? *If no, explain.*

Yes

No

## CONCLUSIONS

State the authors' conclusions that are applicable to answering the evidence-based question.

Data from the current study suggest that mCIT, which employs a more distributed practice schedule while still emphasizing repeated use, is effective in improving upper limb use and function following TBI. Repeated affected limb ADL practice is believed to be the critical variable of the program.

Were the conclusions appropriate for the study design (level of evidence)? *If no, explain.*

Yes

No

Were the conclusions appropriate for the statistical results? *If no, explain.*

Yes

No  There were only three highly-selected patients and the results were not tested statistically to determine whether the outcome could have been due to chance or not. The clinical significance of the changes in these patients was not described beyond a reference to “improved use.”

Were the conclusions appropriate given the study limitation and biases? *If no, explain.*

Yes

No  Limited sample, questionable reliability of two of the three outcome measures, unknown skill of the administering therapist(s), no information about home compliance (activity log), and no statistical analysis of the data limit the faith with which the authors’ conclusions can be accepted.

## IMPLICATIONS FOR OCCUPATIONAL THERAPY

This section provides guidance about clinical practice, program development, and other implications of the study findings as they relate to the focused question.

This is a study of good occupational therapy practice in which patient-chosen activities of daily living are intensively practiced both in the clinic, with the guidance of the therapist, and at home. The anecdotal results suggest improvement over a 10-week period. All three participants improved to some degree. The clinical significance of the improvements in these patients was not described. The duration of this program was 10 weeks, as compared to the 2-week duration of conventional CIT. Whether the amount of improvement was great enough to warrant the intensity of patient commitment and work investment cannot be determined from the report. Patients should be given the opportunity to decide whether they would like to engage in this therapy with the expectation of recovery of function tempered by the paucity of evidence.

This work is based on the evidence-based literature review completed by Catherine Trombly, ScD, OTR/L, FAOTA.

CAP Worksheet adapted from: Critical Review Form – Quantitative Studies ©Law, M., Stewart, D., Pollack, N., Letts, L., Bosch, J., & Westmorland, M., 1998, McMaster University. Used with permission.

For more information about the Evidence-Based Literature Review Project, contact the American Occupational Therapy Association, 301-652-6611, x 2052.



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