



# AOTA Evidence Briefs

## Brain Injury

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

### BI #14

## Casts may be more effective than traditional techniques in reversing contractures

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Hill, J. (1994). The effects of casting on upper-extremity motor disorders after brain injury. *American Journal of Occupational Therapy*, 48, 219–224.

#### Level: IIB2b

Nonrandomized controlled trial, 2 groups, less than 20 participants per condition, moderate internal validity, moderate external validity

### Why research this topic?

The literature contains single-case-study reports on, and general references to, the effects of a series of plaster casts on **spasticity** (*see Glossary*) and **contractures** (*see Glossary*) in the upper extremities of patients with traumatic brain injury, but there are no reports of experimental studies. The researcher hypothesized that persons with traumatic brain injury would show greater improvement after 1 month in casts than after 1 month of traditional treatment.

### What did the researcher do?

The researcher at the Rehabilitation Institute of Chicago compared the effects of casts and traditional treatment techniques. She recruited 15 participants from persons admitted to the institute over 2 1/2 years. Thirteen were men and 2 were women. They ranged in age from 9 to 48 years. The researcher randomly assigned them to one of two groups. Group 1, which consisted of 8 participants (average age 24.9 years), received treatment with casts for 1 month and then traditional therapy for 1 month. Group 2, which consisted of 7 participants (average age 32.1 years), received the same treatments in reverse order.

The cast treatment involved successive applications of plaster casts to participants' elbows and/or wrists, with each application lasting 5 to 7 days and each successive application adjusted for gains. Traditional therapy consisted of **passive** (*see Glossary*) and **active range of motion** (*see Glossary*), prolonged stretching, splinting, neurophysiological treatment (e.g., neurodevelopmental treatment and proprioceptive neuromuscular facilitation, both of which are movement reeducation techniques), and relaxation techniques.

The researcher was interested in **range of motion** (*see Glossary*) (as measured by a **goniometer** [*see Glossary*]), **spasticity** (*see Glossary*) (as measured by a goniometer and clinical observations of participants as they executed rapid alternating motions); and functional use of the extremity as indicated by observations of participants' performance in a variety of functional tasks (e.g., feeding themselves with a spoon, turning a faucet on and off, tying a shoelace).

### What did the researcher find?

On the measure of range of motion, the researcher found no **significant** (*see Glossary*) differences between the two groups. On average, the participants in both groups made significantly greater gains in range of motion during their month in casts than during their month in traditional therapy.

On the spasticity measure, Group 1 participants showed significantly greater improvement on one measure (the joint angle at which a stretch reflex was elicited—a clinical indicator of the severity of spasticity) after the cast phase (which they had first) than after the traditional treatment. Further, all 8 participants exhibited fewer clinical manifestations of spasticity after casting. Five regressed during traditional therapy but still showed improvement over their baseline scores. Group 2 participants did not show a significant difference in response to either treatment.

On the measure of functional use, members of both groups showed more improvement after casts than after traditional treatment. The differences did not quite reach the level of significance, however.

### **What do the findings mean?**

■ For *therapists and other providers*, the findings suggest that casts are more effective than traditional techniques in reversing contractures in the upper extremities of clients with traumatic brain injury, but not in reducing such clients' spasticity. Casts appear to be more effective in reducing spasticity in some clients, whereas traditional techniques may be equally effective in others.

The improvements derived from casts did not translate into significantly greater improvement in functional use of the extremity, though.

■ The findings suggest some directions for research: replication of this pilot effort with a larger sample, using functional tasks specific to the patients as measures; and a study to identify the kinds of patients for whom casts are more effective.

### **What are the study's limitations?**

The researchers' method of selecting study participants was not systematic. A convenience sample was used. Also, the validity of the clinical measures that the researchers used was not confirmed. These flaws in the study's design lower confidence that the results can be attributed to the intervention.

The study provides useful information. However, it has limited generalizability for the population of persons with traumatic brain injury across settings because the participants did not represent all age ranges and all types of upper-extremity **hypertonicity** (*see Glossary*) associated with brain injury.

## **Glossary**

**active range of motion**—arc of motion through which the joint passes when moved by muscles acting on the joint (moving on one's own)

**contracture**—"permanent shortening (as of muscle, tendon, or scar tissue) producing deformity or distortion" (*Merriam-Webster's Medical Dictionary*)

**goniometer**—instrument that measures angles

**hypertonicity**—excessive tone or tension

**passive range of motion**—arc of motion through which the joint passes when moved by an outside force

**range of motion**—arc of motion through which a joint passes

**significance (or significant)**—A statistical term, this refers to the probability that the results obtained in the study are not due to chance, but to some other factor (such as the treatment of interest). A significant result is one that is likely to be generalizable to populations outside the study.

Significance should not be confused with clinical effect. A study can be statistically significant without having a very large clinical effect on the sample. For example, a study that examines the effect of a treatment on a client's ability to walk, may report that the participants in the treatment group were able to walk significantly longer distances than the control. However, if you read the study you may find that the treatment group was able to walk, on average, six feet, while the control group was able to walk, on average, five feet. While the outcome may be statistically significant, a clinician may not feel that a one foot increase will make his or her client functional.

**spasticity**—"muscular hypertonicity [excessive tone] with increased tendon reflexes" (*Merriam-Webster's Medical Dictionary*)

■ Terminology used in this document is based on two systems of classification current at the time the evidence-based literature reviews were completed: *Uniform Terminology for Occupational Therapy Practice—Third Edition* (AOTA, 1994) and *International Classification of Functioning, Disability and Health (ICIDH-2)* (World Health Organization [WHO], 1999). More recently, the *Uniform Terminology* document was replaced by *Occupational Therapy Practice Framework: Domain and Process* (AOTA, 2002), and modifications to *ICIDH-2* were finalized in the *International Classification of Functioning, Disability and Health* (WHO, 2001).

This work is based on the evidence-based literature review completed by Beatriz C. Abreu, PhD, OTR, FAOTA, and colleagues.

For more information about the Evidence-Based Literature Review Project, contact the Practice Department at the American Occupational Therapy Association, 301-652-6611, x 2040.



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