AOTA Evidence Briefs
Stroke

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

S #12

Kinesthetic biofeedback is as beneficial as Brunnstrom's movement therapy in improving elbow range of motion in stroke clients

Greenberg, S., & Fowler, R. S., Jr. (1980). Kinesthetic biofeedback: A treatment modality for elbow range of motion in hemiplegia. *American Journal of Occupational Therapy, 34,* 738–743.

Level IC2c

Randomized controlled trial, less than 20 participants per condition or group, moderate internal validity, low external validity

Why research this topic?

Conventional treatment to improve stroke clients' performance often takes time, with an accompanying high cost. Researchers have looked to alternatives, and kinesthetic biofeedback, or relay of "information pertaining to actual movement of a body part" (p. 738), is a promising one.

What did the researchers do?

Greenberg and Fowler (1980), of the University of Washington (Seattle), studied the effects of kinesthetic biofeedback. That is, the researchers made the participants in the study aware of their movements through audio and visual feedback signals emitted by a goniometer (a device that measures angles) electronically adapted for the purpose.

There were 20 participants in the study: 13 men and 7 women, whose average age was 64.9 years. All met the following criteria: (1) a minimum age of 30 years; (2) a diagnosis of hemiplegia (total or partial paralysis of one side of the body) secondary to a stroke; (3) a lapse of at least 1 year since their stroke; and (4) a minimum discrepancy of 20 degrees between active and passive elbow extension (meaning at least 20 degrees difference in how much elbow straightening they could achieve on their own versus with help).

The participants were randomly assigned to receive either a kinesthetic biofeedback group or Brunnstrom's movement therapy group. Participants in the kinesthetic biofeedback group received visual feedback from a green light that was activated when they attained a specified amount of elbow extension. They also received audio feedback from a tone that increased in pitch as they increased their elbow extension. The participants in the Brunnstrom's movement therapy group were treated with techniques that involved "eliciting, reinforcing, or modifying reflex synergy movements using afferent stimuli and postural reflexes" (p. 739). Brunnstrom advocated redeveloping voluntary movement control by bringing the tonic reflex responses (which could be easily elicited in patients after stroke) under voluntary control. She did this by using resistance, stretch, and tactile stimulation; having patients "will" a movement (i.e., having them attend to a movement goal and try to accomplish it); and immediately requiring patients to use any obtained movement to accomplish a functional task (e.g., putting their arm through the sleeve of a shirt when they could extend their elbow). An occupational therapist delivered the treatments in 30-minute sessions twice a week for 4 weeks.

The outcome area of interest was *elbow range of motion* (as measured by a goniometer).

What did the researchers find?

The researchers found **no significant** (*see Glossary*) differences between the two groups. Both groups improved **significantly** *(see Glossary)*. A majority of participants in each group achieved an increase in active elbow extension following treatment; the average change was 11 degrees.

What do the findings mean?

For therapists and other providers, the findings suggest that kinesthetic biofeedback is as beneficial as Brunnstrom's movement therapy in improving elbow range of motion in stroke patients. The participants had experienced their strokes at least a year before the treatments, so spontaneous recovery is unlikely to account for the improvements in both groups. Therefore one looks to the treatments for a similarity that might account for the improvements. The similarity is that they focus attention on the movement.

What are the study's limitations?

The therapist may have known the study's hypothesis and unconsciously influenced the results.

Glossary

nonsignificant or no significance—A statistical term that refers to study findings that are likely to be due to chance differences between the groups rather than to other factors (like the treatment of interest). A nonsignificant result is not generalizable outside the study. Like significance, a nonsignificant result does not indicate the clinical effect. Often studies will show nonsignificant results, yet the treatment group's mean will be better than the control group's. This is usually referred to as a trend in the right direction. Because significance is closely determined by sample size, nonsignificant results would often become significant if the sample size were increased.

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.

■ 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).

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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.