AOTA Evidence Briefs
Stroke

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

S #18

Finger exercises may enhance stroke clients' grasp and release

Trombly, C. A., Thayer-Nason, L., Bliss, G., Girard, C. A., Lyrist, L. A., & Brexa-Hooson, A. (1986). The effectiveness of therapy in improving finger extension in stroke patients. *American Journal of Occupational Therapy, 40*, 612–617.

Level IIC2b

Nonrandomized comparison of two or more groups or treatments in a quasi-experiment without randomization to group, condition, or sequence; less than 20 participants per condition or group; moderate internal validity; moderate external validity

Why research this topic?

Humans must be able to extend, or straighten, their fingers in order to perform the grasping and release functions of their hands. In stroke clients this ability is slow to redevelop. To improve finger extension, therapists most frequently use sensory stimulation and reflex enhancement, but there are problems with these methods. Earlier research by Trombly and Quintana (1983) showed that three types of exercises elicited high levels of activity in the muscle that extends the fingers. Trombly and colleagues (1986), variously of Boston University and New England Rehabilitation Hospital (Woburn, Massachusetts), tested whether the three types of exercise would improve finger extension.

What did the researchers do?

The researchers designed a study involving four conditions: ballistic extension, resisted extension, resisted grasp, and a control condition. In ballistic extension the participants in the study flicked a Ping-Pong ball at a paper cup. In resisted extension they straightened their fingers against the resistance of as many rubber bands as possible. In resisted grasp they grasped either a dynamometer (an instrument that measures force) with its handles set 2.5 centimeters apart or a Hand Helper Exercise Aid loaded with the maximum number of elastics that the participants could squeeze. In the control condition, the participants engaged in any activity for 10 minutes that did not involve their affected hand. In the three treatment groups, the participants performed the exercise 10 times every day to a maximum of 20 treatments (days) or until they were discharged. An occupational therapist delivered the treatments in a clinic.

The participants were 20 stroke patients (9 men and 11 women, average 66 years) consecutively admitted to the New England Rehabilitation Hospital after September 1, 1982. They were included if they (a) could grasp a 2.5-centimeter cylinder, (b) could understand directions, (c) were free of pain in the affected arm, (d) were willing to participate, (e) were medically cleared for participation by their physicians, and (f) were expected to stay in the hospital for several weeks. They were randomly assigned to one of the four conditions described in the preceding paragraph, except two patients who could grasp but not actively release were assigned to the grasp task.

The researchers were interested in three outcome areas, all involving **sensorimotor** (*see Glossary*) performance: *active range of motion of finger extension; tapping* (ability to reverse the direction of finger movement rapidly, a proxy measure for spasticity, or heightened muscle tone accompanied by exaggerated tendon reflexes); and *grasp/release* (as indicated by the number of successful grasps and releases of various-sized cylinders).

What did the researchers find?

There was **no significant** (*see Glossary*) difference among the groups in the ability to grasp and release or in active finger extension. This finding may be due to the small sample size.

Over the course of treatment, the ballistic- and resisted-extension groups improved **significantly** *(see Glossary)* more than the resisted-grasp and control groups in their ability to reverse movement rapidly (indicating decreased spasticity). There were no significant differences among the groups when effects were measured before and after each daily treatment. **Effect sizes** (*see Glossary*) were in the moderate range for the ballistic- and resisted-extension groups, in the small range for the resisted-grasp group.

The researchers noted that there was an imbalance in participants' assignment to conditions. Significantly more patients assigned to the ballistic- and resisted-extension conditions were at a higher level of recovery of motor control.

What do the findings mean?

For therapists and other providers, the findings suggest the use of ballistic and resisted extension to reduce spasticity, especially in clients with better recovery of motor control. The outcome indicates that therapy aimed at increasing muscle activity may have too low a cost-benefit ratio to be justified.

What are the study's limitations?

First, the process used to select the participants may have influenced the results; as noted earlier, there was an imbalance in participants' assignment to conditions. Second, the researchers' expectations may have influenced the results.

Reference

Trombly, C. A., & Quintana, L. A. (1983). The effects of exercise on finger extension of CVA (cerebrovascular accident) patients. *American Journal of Occupational Therapy, 37,* 195–202.

Glossary

effect size (Cohen's *r*)—An effect size is a measure of clinical significance. It provides information about the magnitude of effect of the treatment. Although related to significance, it is not as influenced by the size of the sample. Therefore, it is possible to have an outcome on which the treatment had a large effect (i.e., the treatment group improved a lot more than the control group) and still have a non-significant result. If the results have a large effect but no significance, this means that this effect may be sample specific and not generalizable outside the study. There are many different types of effect sizes. What is reported here is Cohen's r. Cohen's r can be interpreted in a manner similar to a Pearson's correlation coefficient:

Effect size *r*	Size of the effect
<0.99	Negligible
0.10–0.29	Small
0.30–0.49	Medium
>0.50	Large

Cohen, J. (1977). *Statistical Power Analysis for Behavioral Sciences*. New York: Academic Press.

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.

sensorimotor—"of, relating to, or functioning in both sensory and motor aspects of bodily activity" (*Merriam Webster's Collegiate Dictionary,* 10th ed., p. 1066)

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.

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