



AOTA Evidence Briefs

Stroke

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

S #14

Resisted and rapid exercises may improve finger straightening; unresisted, slow-extension exercises may target finger straightening

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.

Level IC2c

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

Why research this topic?

The inability of some stroke clients to straighten their fingers severely limits their performance of functional activities. To treat such clients, occupational therapists use activities that require finger extension (straightening) and avoid activities that require resisted finger flexion (bending). Therapists choose these activities, however, on the basis of untested assumptions and hypotheses.

What did the researchers do?

Trombly and Quintana (1983), of Boston University, examined the effects of five types of exercise on finger extension in stroke patients: (a) resisted grasp, (b) resisted extension, (c) unresisted grasp and release, (d) unresisted rapid extension, and (e) unresisted slow extension.

In the resisted-grasp condition, the participants grasped a 2.5-centimeter cylinder. In the resisted-extension condition, the participants attempted to straighten their fingers against the resistance of rubber bands placed around the outermost segments of their fingers and thumb. Unresisted grasp and release involved the participants first grasping, then releasing, a lightweight 6-centimeter cylinder. Unresisted rapid extension involved their quickly flicking Ping-Pong balls toward a target, and unresisted slow extension involved their slowly flicking Ping-Pong balls toward a target. An occupational therapist delivered the interventions in a laboratory setting.

The participants were 10 stroke patients (gender not reported) recruited from the outpatient population of Braintree Hospital in Braintree, Massachusetts. They averaged 53.1 years in age. To be eligible for participation, they had to have a diagnosis of stroke; be able to understand directions; be able to sit for 3 hours; be free of significant contractures, pain, and skin allergies in the affected extremity; and have experienced some return of hand function.¹

The participants were randomly assigned to four groups, with each group representing a certain order of exercises. Then all participants performed each of the exercises.

¹ Specifically, they had to have a return of function between Levels III and IV of Brunnstrom's classification. Level III means that a patient has a mass or hook grasp but no voluntary finger extension; Level IV means that a patient has semivoluntary finger extension in a small range of motion and lateral prehension with release by movement of the thumb.

The outcome areas of interest to the researchers were *activity of the extensor digitorum* (a muscle that straightens the fingers), *the flexor digitorum superficialis* (a muscle that bends the fingers at the proximal interphalangeal and metacarpophalangeal joints—those nearest and next-nearest to the palm), and *the flexor digitorum profundus* (a muscle that bends the fingers at the proximal interphalangeal, metacarpophalangeal, and distal interphalangeal joints—the latter the farthest from the palm), as measured electronically; and *total range of motion of finger extension*, adding together the degrees of movement of the metacarpophalangeal and proximal interphalangeal joints of the middle finger during opening from full flexion or bending.

What did the researchers find?

- During resisted extension the participants used the extensor digitorum at a **significantly** (*see Glossary*) higher percentage than they used the flexor profundus but not at a significantly higher percentage than they used the flexor superficialis.
- During rapid extension the participants used the extensor digitorum at a significantly higher percentage than they used the flexor superficialis but not at a significantly higher percentage than they used the flexor profundus.
- During slow extension the participants used the extensor digitorum at a significantly higher percentage than they used either flexor.
- During resisted grasp the participants used all three muscles at a high percentage, none significantly higher than the others.
- During unresisted grasp the participants used none of the three muscles at a higher percentage than the others. During release, however, they used the extensor digitorum at a significantly higher percentage than they used either flexor.

There were **no significant** (*see Glossary*) changes in range of motion of finger extension.

What do the findings mean?

For therapists and other providers, the findings suggest that therapists should choose exercises to suit their therapeutic purpose, as follows: resisted and rapid finger exercises if they seek output from all three extrinsic muscles of the fingers; unresisted, slow-extension exercises if they seek output from the extensor digitorum.

What are the study's limitations?

The therapist knew the study's hypothesis and may have unintentionally 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* (OTA, 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* (OTA, 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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