AOTA Evidence Briefs

Stroke: Focused Questions

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

SFQ #6

What intensity of training is required for brain reorganization to occur?

No studies directly address this question. If recovery of function is assumed to be an indication of brain reorganization,[1] then studies that test the effects of different intensities of therapy on recovery are pertinent.

Findings of Review Articles

In a synthesis of research on the benefits of intensity of therapy, Kwakkel, Wagenaar, Koelman, Lankhorst, and Koetsier (1997) reviewed 9 controlled studies of 1,051 participants, published from 1966 to 1995. They found a small but **significant** (see *Glossary*) effect of intensity on improvement of activities of daily living and neuromuscular outcomes in stroke patients. The intensive rehabilitation group received approximately 92 minutes of occupational therapy or physical therapy daily, the **control group** (see *Glossary*) approximately 42 minutes.

Although they reviewed only randomized trials, the studies were flawed by major **confounding factors** (see *Glossary*): insufficient contrast in the amount of rehabilitation received by the experimental and control groups; a lack of **blinding** (see *Glossary*) of group assignment) for assessment and statistical analysis; the heterogeneity of patient characteristics; and therapy of different intensities being offered at different clinics within the same study.

Findings of Selected Studies

Two more recent studies examined the effects of intensity of physical therapy on recovery of motor function. Because no studies that examined the intensity of occupational therapy were retrieved, these are the best evidence available. Until occupational therapy research is done, it seems acceptable for occupational therapists to use them in making decisions for stroke patients. Occupational therapy and physical therapy work similarly in terms of organization of service (frequency, duration, and setting of treatment). Also, they work somewhat similarly in terms of treatment to remediate motor **impairments** (see *Glossary*). That is, they apply the same principles differently, according to each profession's philosophy.

In a randomized controlled trial, Kwakkel, Wagenaar, Twisk, Lankhorst, and Koetsier (1999—Level I) examined the effects of 30 minutes of daily arm or leg training versus 30 minutes of arm and leg immobilization, both for 20 weeks and both in addition to 45 minutes a day of arm and leg training and ADL training. The researchers randomly assigned 101 patients who had experienced a stroke in the middle cerebral artery to one of three intensity groups: training of the paretic arm, training of the paretic leg, or immobilization of the paretic arm and leg (the control condition).

At 20 weeks, the leg-training group had significantly higher scores on the Barthel Index, functional ambulation category, and the Action Research Arm Test than the control group. Also, the arm-training group had significantly higher scores on the Action Research Arm Test than the control group. There were **no significant** (see *Glossary*) differences between the arm- and leg-training groups. At 26 weeks (the 6-week follow-up), scores on the Action Research

[1] *See Stroke Focus Question 1, What Occurs in the Brain During Recovery After Stroke (So-called Spontaneous Recovery)? and, Stroke Focus Question 2, What Is The Evidence That Challenging Demands (Therapy, Activity, or Sensory Stimulation) on the Brain Reorganize Brain Function After Stroke, Beyond Spontaneous Recovery?*

Arm Test for both the arm- and the leg-training group were significantly higher than those for the control group. Increased intensity of rehabilitation (630 + 50 hours of therapy) resulted in greater function than immobilization (630 hours of therapy). The improvement seemed to be confined to the types of tasks practiced in therapy.

The second study was also a randomized controlled trial, but major "attrition" (loss of participants) may have compromised the outcome. Lincoln, Parry, and Vass (1999—Level I) randomly assigned 282 patients who had experienced a stroke in various locations to one of three groups: regular physical therapy (RPT), qualified physical therapy (QPT), and assistant physical therapy (APT). The RPT group received the usual therapy used in England, which is based on Bobath's Neurodevelopmental Therapy (NDT), for 30–45 minutes per day, 5 days a week, for 5 weeks. The QPT group received, in addition to RPT, 2 hours per week of similar treatment from a senior, research physical therapist, for 5 weeks. The APT group received, in addition to RPT, 2 hours per week of exercises and functional training from a physical therapy assistant under the supervision of the research physical therapist, for 5 weeks. All groups improved during treatment. There were no significant differences among them. However, attrition in the QPT and APT groups was approximately 50%, reducing the samples to fewer participants than required to detect small differences if they existed.

One hour and a half daily of occupational therapy and physical therapy was found in the Kwakkel, et al. (1997) review to improve ADL and neuromuscular outcomes by stroke patients. The Kwakkel, et al. (1999) study found that, for a homogenous sample of participants, 50 hours of extra therapy over 20 weeks (approximately 30 minutes per day extra or 1 1/4 hours total per day) was beneficial for recovery of the functions practiced in therapy. However, in the Lincoln et al. (1999) study for a heterogeneous sample of participants and a major confounding factor of attrition, 10 hours of extra therapy over 5 weeks (24 minutes extra per day or 54 to 65 minutes total per day) was insufficient to improve recovery. Carefully controlled studies are required to determine the ideal intensity of occupational therapy for recovery of function and documentation of brain reorganization. Also required is identification of the patients for whom greater hours of therapy is best practice.

Clinical Application

A tentative argument can be made for the benefits of scheduling the intensity of occupational therapy and physical therapy combined to at least 1 1/4 or 1+ hours per day for people who had a stroke.

Glossary

blinded/blinding—the practice of keeping members of the research study unaware of which group a participant is assigned to (treatment or control) in the study. *Single blinding* usually refers to keeping study participants unaware of whether they are receiving the experimental or the sham treatment. *Double blinding* usually refers to keeping the participants and those who are administering the treatment unaware of who is receiving the experimental and who is receiving the sham treatments. In some cases, where it is impossible to blind those administering treatment, the individuals who are administering the outcome measures can be blinded to group status.

Studies in which blinding does not occur can have significant biases. When the participants know that they are receiving the experimental treatment, they often get better because they think they ought to (this is often referred to as the "placebo effect"). When researchers know that a participant is receiving the experimental treatment, they often subconsciously favor those participants when evaluating them on outcome measures. For instance, when timing a participant in the treatment group, researchers may unknowingly stop the watch a little faster or slower so the treatment participant seems to do better.

confounding factors—one that could plausibly be an explanation for the outcome of the study rather than the independent variable.

control group—a group that received special attention similar to that which the treatment group received but did not receive the treatment.

impairments—"abnormalities of body structure and appearance and with organ or system function, resulting from any cause" (*International Classification of Impairments, Disabilities, and Handicaps*, 1980, p. 14).

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 (e.g., 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; 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, 6 feet, while the control group was able to walk, on average, 5 feet. While the outcome may be statistically significant, a clinician may not feel that a 1-foot increase will make his or her client functional.

References

Articles Ranked for Level of Evidence

Kwakkel, G., Wagenaar, R. C., Twisk, J. W. R., Lankhorst, G. J., & Koetsier, J. C. (1999). Intensity of arm and leg training after primary middle-cerebral-artery stroke: A randomized trial. *Lancet*, *354*, 189–194.
Level IB1b: Randomized controlled trial, 20 or more participants per condition, high internal validity, moderate external validity.

Lincoln, N. B., Parry, R. H., & Vass, C. D. (1999). Randomized controlled trial to evaluate increased intensity of physical therapy treatment of arm function after stroke. *Stroke*, *30*, 573–579.
Level IA2b: Randomized controlled trial, 50 or more participants per condition, moderate internal validity, moderate external validity.

Articles for Focused Questions (not ranked)

Kwakkel, G., Wagenaar, R. C., Koelman, T. W., Lankhorst, G. J., & Koetsier, J. C. (1997). Effects of intensity of rehabilitation after stroke: A research synthesis. *Stroke*, *28*, 1550–1556.

Further Reading

Alexander, H., Bugge, C., & Hagen, S. (2001). What is the association between the different components of stroke rehabilitation and health outcomes? *Clinical Rehabilitation*, *15*, 207–215.

Langhorne, P. (2002). Intensity of rehabilitation: Some answers and more questions? *Journal of Neurology, Neurosurgery, and Psychiatry*, *72*, 430–431.

Langhorne, P., Wagenaar, R., & Partridge, C. (1996). Physiotherapy after stroke: More is better? *Physiotherapy Research International*, *1*(2), 75–88.

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