



AOTA Evidence Briefs

Stroke: Focused Questions

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

SFQ #5

Is brain reorganization limited to a certain time period after stroke?

No studies directly address this question. However, studies on constraint-induced therapy (CIT)¹ have shown that recovery of use of the affected upper extremity is possible for some patients if they are trained even many years after onset. Research also has shown that recovery as a result of CIT is accompanied by brain reorganization (Liepert, Bauder, Miltner, Taub, & Weiller, 2000—Level III; Liepert, Uhde, Gräf, Leidner, & Weiller, 2001—Level III).

Findings of Selected Studies

Recovery of motor function after stroke is accompanied by reorganization of **cortical maps** (see *Glossary*)². The various aspects of function recover at different rates. Therefore, knowing the timing of recovery of these aspects could be useful in deciding the emphasis of therapy.

According to Brosseau et al. (2001a), the many studies that have reported time of recovery of various abilities following stroke have lacked methodological sophistication. To rectify this, Brosseau and colleagues analyzed data from 421 stroke patients (214 women-201 men) admitted to a Canadian rehabilitation center from January 1987 through December 1992. The average time of admission was 45.5 days following stroke. The patients participated in a multidisciplinary rehabilitation program delivered by physicians, nurses, physical therapists, occupational therapists, psychologists, and speech pathologists. Biological, sociodemographic, and **psychosocial** (see *Glossary*) characteristics associated with recovery were used as **covariates** (see *Glossary*) in the analysis.

The researchers defined success, or recovery, as independence in the particular ability—that is, no need for help from another person to perform the ability. The multidisciplinary rehabilitation team scored the patients on the Uniform Assessment Outcome (UAO), which examines 7 abilities using a 5-point scale (0 = *independence*; 4 = *dependence*). Recovery time ranged from 18.7 to 32.4 days from admission to rehabilitation (64–78 days following stroke).

Standard deviations (SD) (see *Glossary*) were enormous. (see Table 1).

¹ See *Stroke Focus Question 11, Is Constraint-Induced Therapy Effective in Improving Behavioral Outcome After Stroke?*

² 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?*

Table 1. Time of Recovery of Abilities Following Admission to Rehabilitation

Ability Measured by the UAO	Average (\pm SD) Days to Independence from Date of Admission to Rehabilitation
Behavior	32.40 (\pm 37.46)
Cognition	30.45 (\pm 36.50)
Perception	31.83 (\pm 36.80)
Communication	22.43 (\pm 31.10)
Vision	18.70 (\pm 31.30)
Right upper-extremity motor use	25.32 (\pm 33.70)
Left upper-extremity motor use	26.60 (\pm 36.20)

Brosseau et al. (2001b) further analyzed the data to determine time of recovery of *life habits* following stroke. Life habits referred to bed mobility, transfer and ambulation, bathing, dressing, eating, homemaking activities (unspecified), sleep, and sphincter control. Average recovery times ranged from 5.51 to 57.60 days from admission to rehabilitation (51–103 days following stroke) (see Table 2). (Again, standard deviations were large.) Therefore, full independence in activities of daily living was achieved approximately 3 months following stroke in this sample. The time to achieve independence in eating seems inordinately long, but this could have included cutting food and spreading bread, which require use of both upper extremities.

Table 2. Time of Recovery of Life Habits Following Admission to Rehabilitation

Life Habit	Average (\pm SD) Days to Independence From Date of Admission to Rehabilitation
Bed mobility	25.11 (\pm 37.71)
Transfers and ambulation	40.01 (\pm 33.30)
Bathing	36.32 (\pm 32.72)
Dressing	34.57 (\pm 35.83)
Eating	43.56 (\pm 37.90)
Homemaking activities	57.60 (\pm 35.50)
Sleep	5.51 (\pm 17.56)
Sphincter control	11.60 (\pm 25.62)

These times indicate recovery with full rehabilitation services, not natural or untreated recovery.

In addition, realizing that recovery is influenced by numerous biological, sociodemographic, and psychosocial characteristics, Brosseau et al. (2001a) sought to determine those that were associated with the recovery of each of the 7 abilities. Some of the biological characteristics were associated with recovery time, but none of the psychosocial and sociodemographic characteristics were. This finding tentatively suggests that recovery time reflects brain reorganization as manifested through biological abilities.

This information is useful, but limited, because of the characteristics of the sample studied by the researchers. It represented patients in rehabilitation centers, only 10% of the stroke population in Canada. Also, the health care system of Canada is different from that in the United States in several respects, one of which is length of stay in rehabilitation. For example, in this study, the average length of stay was 8 weeks, which is several weeks longer than what is currently permitted by third-party payers in the United States. The effect a particular health care system has on recovery is not known. Furthermore, there were large variations in recovery times. This provides a reminder that

each person recovers individually because of his or her unique anatomy and the particular location of the **lesion** (see *Glossary*). Therapists must therefore use this information in addition to, not in place of, professional judgment. Study is needed of the timing relationship between recovery of functional performance and brain reorganization on greater numbers of cases that are more representative of the stroke population of the United States.

Clinical Application

The timing of recovery of various abilities and life habits can serve as a tentative guideline when making estimates of recovery for patients, with the caution that each person recovers at his or her own unpredictable pace. Hope may be instilled by noting to patients that there is evidence of people making motor recovery of the affected upper extremity months or years after the stroke when engaged in intensive task specific training such as constraint-induced therapy (CIT).

Glossary

cortical maps—diagrams of the cortex, determined by computer-assisted radiological examination or electrical stimulation, that designate the particular parts of the cortex responsible for movement of particular body parts.

covariates—variable that may predict the dependent variable regardless of intervention. It should be statistically removed from the analysis using an analysis of covariance. For example, height and weight covary to some extent, that is, as one increases, so does the other. If one were doing a study of effects of a certain diet on childhood obesity, it would not be enough to test the difference in weight from beginning to end of a diet. It would be necessary to factor out the change in height of the child over the same period. We would say that height was a covariate.

lesion—“an abnormal change in structure of an organ or part due to injury or disease” (*Merriam-Webster Medical Dictionary*, s.v.).

standard deviations (SD)—one measure of the dispersion or variability of scores around the mean value in a distribution (Rosenthal & Rosnow, 1991). Large standard deviations (high variability) indicate that the scores of each individual (or each trial in a multiple trial design) are very different from the average score; small standard deviations (low variability) indicate that the scores tend to cluster around the average score.

psychosocial—“involving both psychological and social aspects” (*Merriam Webster’s Collegiate Dictionary*, 10th ed., s.v.).

References

Articles Ranked for Level of Evidence

Liepert, J., Bauder, H., Miltner, W. H. R., Taub, E., & Weiller, C. (2000). Treatment-induced cortical reorganization after stroke in humans. *Stroke*, *31*, 1210–1216.

Level IIIc2c: Nonrandomized controlled trial—one group (one treatment) pretest and posttest, less than 20 participants per condition, moderate internal validity, low external validity.

Liepert, J., Uhde, I., Gräf, S., Leidner, O., & Weiller, C. (2001). Motor cortex plasticity during forced-use therapy in stroke patients: A preliminary study. *Journal of Neurology*, *248*, 315–321.

Level IIIc2c: Nonrandomized controlled trial—one group (one treatment) pretest and posttest, less than 20 participants per group, moderate internal validity, low external validity.

Articles for Focused Questions (not ranked)

Brosseau, L. Sanraranarayanan, R., Fourn, L., Coutu-Walkulczyk, G., Tremblay, L. E., Pham, M., et al. (2001a). Recovery time of independent poststroke abilities, Part I. *Topics in Stroke Rehabilitation*, 8(1), 60–71.

Brosseau, L. Sanraranarayanan, R., Fourn, L., Coutu-Walkulczyk, G., Tremblay, L. E., Pham, M., et al. (2001b). Recovery time of independent poststroke life habits, Part II. *Topics in Stroke Rehabilitation*, 8(2), 46–55.

Rosenthal, R., & Rosnow, R. L. (1991). *Essentials of behavioral research: Methods and data analysis* (2nd ed). New York: McGraw-Hill.

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