



# AOTA Evidence Briefs

## Stroke: Focused Questions

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

### SFQ #10

## What therapeutic interventions are effective in remediating perceptual impairments?

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**T**wo common perceptual impairments after stroke are apraxia (resulting from a left hemisphere stroke) and unilateral neglect (resulting from a right hemisphere stroke).

### Apraxia

#### Findings of Selected Studies

Although the studies included in this Evidence Brief were to be those published after the published review (Trombly & Ma, 2002), one intervention study (Van Heugten et al., 1998—Level III) that was included in the published review is included here because it very clearly delineates the intervention used (teaching patients strategies to compensate for the presence of **apraxia** (see *Glossary*). Van Heugten and colleagues hypothesized that, after participating in their treatment program, 33 patients with apraxia secondary to a left-hemisphere stroke would show **significant** (see *Glossary*) improvement in activities of daily living (ADL) but little or no change in the severity of the apraxia or in motor functioning. The patients were recruited from general hospitals, rehabilitation centers, and nursing homes and therefore were probably in the acute stage of recovery after stroke. They found a significant and strong **effect size** (see *Glossary*) ( $r = .76$ ) of the treatment on recovery of ADL skills, with a medium effect on motor functioning and severity of apraxia ( $r = .46$ ). The patients and the therapists both completed the ADL questionnaires and agreed on the level of recovery. However, without a **control group** (see *Glossary*), spontaneous recovery is a viable alternative explanation for the outcome.

The treatment program was based on information-processing theory, which sees each action as having three aspects: initiation, execution, and control (awareness of outcome and correction if necessary). The program consisted of applying a hierarchy of instructions, assistance, and feedback to the patients at the level at which they were performing and then withdrawing the support in reverse hierarchical order as the patients improved. The program is published in the appendix to the article.

In their review of the literature, van Heugten and colleagues (1998) also found no other study of treatment of apraxia. The only other study that one could consider is Poole (1998—Level II). However, her purpose was to show that patients could learn, not to test a treatment intervention. Using demonstration and verbal instruction, she taught 5 stroke patients with apraxia how to do the adapted one-handed shoe tie. The learning effect, measured 5 minutes after the patients were taught, was strong ( $r = .79$ ).

This review emphasizes the need for research on the effectiveness of occupational therapy interventions in restoring occupational performance in patients with apraxia following stroke.

### Clinical Application

Although the best evidence available is weak, these studies suggest that using structured procedures that enable patients to learn strategies to compensate for apraxia, while they are doing valued functional activities, is an effective treatment. Additionally, on the basis of observation of a man who had had such a massive stroke that his whole left

hemisphere was damaged, Rapcsak, Ochipa, Beeson, and Rubens (1993) suggested that patients with apraxia due to left-hemisphere damage perform best when handling actual objects in natural contexts for a natural (well-learned) performance. This probably enhances performance in less involved patients also.

## Unilateral Neglect

### Findings of Selected Studies

Five studies—Niemeier, Cifu, and Kishore (2001—Level II); Robertson, Nico, and Hood (1997—Level I); Samuel et al. (2000—Level IV); Lin, Cermak, Kinsbourne, and Trombly (1996—Level I); and Young, Collins, and Hren (1983—Level II) were selected for critical appraisal. Four tested the effects of motor cuing. Two were well-controlled randomized trials (Lin et al. and Robertson et al.) but carried out on a small number of subjects.

Lin et al. (1996) tested different levels of cuing on the ability to bisect a line in 13 patients with right-hemisphere stroke. All were still in the acute stage of recovery. The levels of cuing were as follows: (1) visual (find the cue digit at the left of a line); (2) motor (circle the cue digit with the finger); (3) visuomotor (circle the cue digit plus trace a line to the center from the cue digit) and (4) no cuing—the control condition. The patients participated in 21 trials per condition over 4 days. All the patients performed each of the 4 conditions in random order on different days. Line bisection significantly improved under all 3 cuing conditions, compared with the control condition. Digit circling plus tracing had the strongest effect ( $r = .95$ ), causing the scores to become normal.

Robertson et al. (1997) studied the short-term effects on unilateral neglect of giving 16 patients brief exposure (9 trials) to training in **proprioceptive** (see *Glossary*) feedback (picking up a rod at midpoint and seeing if it balances; if it does not, correcting the point of grasp until it does) versus simply gripping the rods at midpoint as if to pick up the rod, but not lifting it, or simply pointing to the midpoint. The rods were 50, 100, and 150 centimeters in length. The patients experienced the conditions in random order. After experimental treatment, the researchers administered four tests to the patients: the star cancellation subtest of the Behavioural Inattention Test by Wilson, Cockburn, and Halligan (1988); bisection of rods by pointing to the center of the various length rods; Line Bisection subtest of the Behavioural Inattention Test; and bisection of large lines, an adhoc test similar to the Line Bisection Subt, but the lines were 50 cm instead of 20 cm. The patients scored significantly better on the Star Cancellation Subtest and there was a strong effect ( $r = .74$ ). All patients continued to bisect rods and lines to the right of center, but they did so significantly less after training in proprioceptive feedback (the effect size was large— $r = .55$ ). There was no significant difference, however, in the patients' bisection of large lines or rods after treatment. The researchers could not explain this outcome. They concluded that the training in proprioceptive feedback took time to work (the rod and large-line tests were administered before the star and line tests). They believed that the training had improved the patients' awareness of neglect.

The effect sizes of these 2 Level I studies, using a total of 29 participants, are too different to allow them to be combined to estimate an overall effect (Rosenthal, 1984). The conclusion that cuing that involves moving into neglected space to accomplish a goal, or treatment that uses movement responses to increase awareness of neglected space, improves unilateral neglect is truly tentative. Whether the effect transfers to functional tasks is not known. Large, definitive studies are needed to verify these findings and to delineate which patients benefit and which do not.

Niemeier et al. (2001) studied whether the Lighthouse Strategy, a motor–imagery treatment, improved skills for safe reentry into the community. In three 30-minute sessions, they taught their 19 participants, when attempting to do a functional task, to pretend to be a lighthouse beacon and move their head all the way from left to right so that their chin lined up first with one shoulder, then the other. The functional tasks involved were walking or using a wheelchair.

Compared with the control group, the treatment group showed significant improvement (and a large effect— $r = .70$ ) on route finding and on two items of the Functional Independence Measure (FIM™)—wheelchair ambulation and problem-solving. Whether these outcomes were due to practice of these tasks or to the strategy per se is still a question. Both groups improved significantly on all other measures, probably because of spontaneous recovery or concomitant therapy. The study was poorly controlled and reported.

Young et al. (1983), a study that was described in Ma and Trombly (2002), took a different approach. They tested training in cancellation, visual scanning, and block design versus routine occupational therapy versus routine occupa-

tional therapy plus training in cancellation and visual scanning. They assigned 27 patients to one of these 3 groups. The block design group improved significantly more than the other 2 groups in a letter cancellation test but not in a counting-faces test. This is not strong evidence to support such treatment.

In their Level IV study, Samuel et al. (2000) examined the effects of visuospatial–motor cuing on two very severely affected stroke patients who had failed to respond to scanning training. The patients were instructed to move their left arm or shoulder and pay attention to it (use it as a visual anchor) when attempting a task. The researchers used an *ABAB* single-case design in which the experimental condition (*B*) is alternated with the control condition (*A*) over time. In each phase, the patients' occupational therapists, physical therapists, and speech therapists applied the condition (*A* or *B*) during the patients' regular treatment for 45 minutes per therapist per day, 4 days a week, for 2 weeks. Both patients improved significantly on a line bisection test after treatment and maintained the gain at 1-month follow-up. Neither improved on a cancellation task (Bells Test). Both improved on the Catherine Bergego Scale of Neglect Behavior in ADL, whereas they had not improved on this test in the previous 3 months. The researchers did not test this improvement statistically, however.

### Findings of Review Articles

Diamond (2001) reviewed studies dated 1977 to 1999 on various rehabilitative interventions for visuospatial inattention and did not find strong evidence to support interventions such as eye patching, video feedback, training in visual imagery, pharmacological therapy with dopamine **agonists** (see *Glossary*). Interventions, the number of participants, and findings include the following:

- Visual scanning and visuoperceptual retraining ( $n = 78$ ): Immediate effects appear to be successful. The long-term impact on functional performance is unclear.
- Eye patching with and without transient visual stimulation or hemispatial sunglasses ( $n = 72$ ): Some immediate success occurred, but only for some patients.
- Video feedback, visual–motor imagery, and low ambient light ( $n = 41$ ): Some patients improved on the tests of neglect.
- Pharmacologic intervention (bromocriptine) ( $n = 3$ ): There was immediate improvement while the patients took the drug and worsening on withdrawal of the drug.
- **Vestibular** (see *Glossary*) ( $n = 10$ ) somatosensory stimulation by transcutaneous nerve stimulation (TENS) or vibration to the left side of the neck or to the left hand ( $n = 14$ ), or optokinetic stimulation (patient focuses on a moving light) ( $n = 33$ ): Vestibular and somatosensory stimulation had an immediate profound effect, but it was transient (lasting only 30 minutes). Optokinetic stimulation was less effective.

Diamond concludes that additional research is needed before researchers can declare which technique is most beneficial. I agree but stipulate that the research should be highly valid to provide high-level evidence.

### Clinical Application

Until there is more research, the best evidence available for treating unilateral neglect supports movement into neglected space and training in proprioceptive feedback.

### Glossary

**agonist**—a muscle that on contracting is automatically checked and controlled by the opposing simultaneous contraction of another muscle

**apraxia**—“loss or impairment of the ability to execute complex coordinated movements without impairment of the muscles or senses” (*Merriam-Webster's Collegiate Dictionary*, 10th ed., s.v.).

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

**effect size** (Cohen's  $r$ )—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 (e.g., the treatment group improved a lot more than the control group) and still have a nonsignificant 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:

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

Note: Cohen, J. (1977). *Statistical power analysis for behavioral sciences*. New York: Academic Press.

**proprioceptive**—capable of receiving stimuli originating in the muscle, tendons, and other internal tissues

**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.

**vestibular**—relating to balance.

## References

### Articles Ranked by Level of Evidence

Lin, K-C., Cermak, S. A., Kinsbourne, M., & Trombly, C. A. (1996). Effects of left-sided movements on line bisection in unilateral neglect. *Journal of the International Neuropsychological Society*, *2*, 404–411.

**Level IC1b:** Randomized controlled trial, less than 20 participants per condition, high internal validity, moderate external validity.

Robertson, I. H., Nico, D., & Hood, B. M. (1997). Believing what you feel: Using proprioceptive feedback to reduce unilateral neglect. *Neuropsychology*, *11*, 53–58.

**Level IC1b:** Randomized controlled trial, less than 20 participants per condition, high internal validity, moderate external validity.

Young, G. C., Collins, D., & Hren, M. (1983). Effect of pairing scanning training with block design training in the remediation of perceptual problems in left hemiplegics. *Journal of Clinical Neuropsychology*, *5*, 201–212.

**Level IIC2b:** Nonrandomized controlled trial—two groups, less than 20 participants per condition, moderate internal validity, moderate external validity].

Poole, J. L. (1998). Effect of apraxia on the ability to learn one-handed shoe tying. *Occupational Therapy Journal of Research*, *18*, 99–104.

**Level IIC2c:** Nonrandomized controlled trial—two groups, less than 20 participants per condition, moderate internal validity, low external validity].

Niemeier, J. P., Cifu, D. X., & Kishore, R. (2001). The Lighthouse Strategy: Improving the functional status of patients with unilateral neglect after stroke and brain injury using a visual imagery intervention. *Topics in Stroke Rehabilitation*, *8*, 10–18.

**Level IIC3c:** Nonrandomized controlled trial—two groups, less than 20 participants per condition, low internal validity, low external validity.

Van Heugten, C. M., Dekker, J., Deelman, B. G., van Dijk, A. J., Stehmann-Saris, J. C., & Kinebanian, A. (1998). Outcome of strategy training in stroke patients with apraxia: A phase II study. *Clinical Rehabilitation, 12*, 294–303.

**Level IIIB3b:** Nonrandomized controlled trial—one group (one treatment) pretest and posttest, 20 or more participants per condition, low internal validity, moderate external validity

Samuel, C., Louis-Dreyfus, A., Kaschel, R., Makiela, E., Troubat, M., Anselmi, N., et al. (2000). Rehabilitation of very severe unilateral neglect by visuo-spatio-motor cuing: Two single case studies. *Neuropsychological Rehabilitation, 10*, 385–399.

**Level IVC3c:** Single-subject design, less than 20 participants per condition, low internal validity, low external validity.

### Articles for Focused Questions (not ranked)

Diamond, P. T. (2001). Review: Rehabilitative management of post-stroke visuospatial inattention. *Disability and Rehabilitation, 23*, 407–412.

Ma, H-I., & Trombly, C. A. (2002). A synthesis of the effects of occupational therapy for persons with stroke, Part II: Remediation of impairments. *American Journal of Occupational Therapy, 56*, 260–274.

Rapcsak, S. Z., Ochipa, C., Beeson, P. M., & Rubens, A. B. (1993). Praxis and the right hemisphere. *Brain and Cognition, 23*, 181–202.

Rosenthal, R. (1984). *Meta-analytic procedures for social research*. Beverly Hills, CA: Sage.

Trombly, C. A., & Ma, H-I (2002). A synthesis of the effects of occupational therapy for persons with stroke, Part I: Restoration of roles, tasks, and activities. *American Journal of Occupational Therapy, 56*, 250–259.

Wilson, B. A., Cockburn, J., & Halligan, P. (1988). *Behavioral Inattention Test*. Flempton, England: Thames Valley Trust.

### Further Reading

Grossi, D., Clise, G., Correr, C., & Trojano, L. (1996). Selective drawing disorders after right subcortical stroke: A neuropsychological premorbid and follow-up case study. *Italian Journal of Neurological Sciences, 17*, 241–248.

Harvey, M., & Milner, A. D. (1999). Residual perceptual distortion in “recovered” hemispatial neglect. *Neuropsychologia, 37*, 745–750.

Olk, B., & Harvey, M. (2002). Effects of visible and invisible cueing on line bisection and landmark performance in hemispatial neglect. *Neuropsychologia, 40*, 282–290.

Vuilleumier, P., & Sagiv, N. (2001). Two eyes make a pair: Facial organization and perceptual learning reduce visual extinction. *Neuropsychologia, 39*, 1144–1149.

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