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Transfer of training effects in stroke patients with apraxia: An exploratory study

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ABSTRACT

The goal of the present study was to examine the transfer of the effects of cognitive strategy training for stroke patients with apraxia from trained to non-trained tasks. In strategy training, the occurrence of transfer is expected as the training programme is aimed, not at relearning specific tasks, but at teaching patients new ways to handle the problems resulting from the impairment. Exploratory analyses were conducted on data previously collected in a randomised controlled trial on the efficacy of the strategy training. A total of 113 left hemisphere stroke patients were randomly assigned to a strategy training group and a group receiving occupational therapy as usual. Assessment of apraxia, motor functioning and activities of daily living (ADL) took place at baseline, after an eight-week treatment period, and five months after baseline. The primary outcome measure consisted of standardised ADL observations of trained and non-trained tasks. The analyses showed that in both treatment groups, the scores on the ADL observations for non-trained tasks improved significantly after eight weeks of training as compared with the baseline score. Change scores of non-trained activities were larger in the strategy training group as compared with the usual treatment group.

By using previously collected data we are able to illustrate the potential transfer of treatment effects in a large sample of stroke patients. We found indications for the occurrence of transfer, although the study was not originally designed for the purpose of evaluating transfer. Therefore these results are worth exploring more profoundly. We will further investigate our preliminary conclusions in a new prospective study which is specifically designed to examine the transfer of training effects.

INTRODUCTION

A wide range of cognitive impairments can occur after stroke, one of which is apraxia. Apraxia is an impairment affecting the purposeful execution of learned and meaningful skills that cannot be explained by primary motor or sensory impairments, nor by deficits in motivation, memory or comprehension (De Renzi, 1989). Apraxia usually occurs following left hemisphere lesions (Basso et al., 1987a). Recently, the prevalence of apraxia has been investigated on the stroke unit of a rehabilitation centre in The Netherlands. In total 51.3% of the patients with a left hemisphere stroke were found to have apraxia, as opposed to 6.0% of the patients with a right hemisphere stroke. (Zwinkels, Geusgens, van de Sande, & van Heugten, 2004). It is agreed that apraxia can have a negative impact on the performance of activities of daily living (ADL), and that therefore the treatment of apraxia should be incorporated into the rehabilitation programme (Donkervoort, Dekker, Stehmann-Saris, & Deelman, 2001; Foundas et al., 1995; Goldenberg & Hagmann, 1998; Poizner et al., 1997; Saeki et al., 1995; van Heugten, 2001; van Heugten et al., 1998). Because of this growing awareness, patients in rehabilitation settings who suffer from apraxia are frequently referred to occupational therapists.

van Heugten et al. (1998) developed a standardised occupational therapy programme for left hemisphere stroke patients with apraxia, which is based on teaching patients strategies to compensate for the presence of apraxia. The aim of the therapy is to maximise the patients' independence by improving ADL functioning; little change is expected in the severity of the apraxia itself. This therapy programme has been evaluated in two studies, one non-controlled intervention study (van Heugten et al., 1998) and one experimental effect study (Donkervoort et al., 2001); both studies showed the success of the intervention.

In the experimental effect study, Donkervoort et al. (2001) investigated ADL functioning of left hemisphere stroke patients with apraxia. The experimental group received strategy training for apraxia, while the other interventions that are normally carried out by occupational therapists were conducted as usual, the control group received the usual occupational therapy only, including the usual training for apraxia. The study showed that after an eight-week treatment period, strategy training integrated into the usual occupational therapy was more effective in improving ADL functioning in left hemisphere stroke patients than usual occupational therapy only. At the end of the follow-up period, both groups were comparable in ADL functioning, suggesting strategy training had no long-term effects. However, significantly more patients in the usual treatment group were still receiving occupational therapy at follow-up. This finding suggests that patients in the usual treatment group needed more occupational therapy to obtain a corresponding level of improvement on ADL functioning than patients who received strategy training.

The aim of a rehabilitation programme is to restore patients to their greatest potential and maximum independence, hopefully resulting in independent functioning, the return to their own home and participation in society. For patients to function as independently as possible at home, tasks which are taught in the rehabilitation setting should be transferred to the home setting. Moreover, therapists cannot possibly train all the difficulties and tasks a patient will encounter after rehabilitation discharge. Therefore, transfer of strategies from trained tasks to non-trained (related) tasks is very important in terms of the clinical success of a therapy programme. In strategy training, the occurrence of transfer is expected as the training programme is not aimed at relearning specific tasks, but at teaching patients new ways to handle the problems resulting from the impairment. In a recent review Cicerone points out that relatively few studies have tried to answer the transfer question by directly evaluating the transfer of treatment effects to everyday situations or behaviours. Several of these studies provide evidence to support the occurrence of transfer (Cicerone et al., 2000). Most of these studies, however, used relatively small sample sizes. In addition, they evaluated strategy training for cognitive functions other than apraxia.

In our opinion, answering the transfer question is very important in terms of the clinical success of an intervention. Further analyses of the data of the experimental effect study by Donkervoort et al. (2001) enable the exploration of transfer of the effects of strategies taught by means of the occupational therapy programme for left hemisphere stroke patients with apraxia. In the study by Donkervoort et al. (2001) the performance on four ADL tasks was measured during a period of 20 weeks in which three tasks may have been trained, whereas it was agreed that one of the four tasks would not be trained. For more detailed information on methods and results of this study, see Donkervoort et al. (2001).

The goal of the present study was to examine the possibility of the occurrence of transfer of a cognitive strategy training for stroke patients with apraxia.

METHODS

Patients

For 2.5 years, occupational therapists at 49 Dutch institutions (15 rehabilitation centres and 34 nursing homes) reported every consecutive patient with left hemisphere stroke referred for occupational therapy. Patients were eligible if they met the following inclusion criteria: (1) a left hemisphere stroke; (2) apraxia; and (3) admittance to an inpatient care unit. Exclusion criteria mainly concerned factors of medical history (see Donkervoort et al., 2001, for more detailed information on the exclusion criteria). The diagnosis of apraxia involved two steps. First, the patient's treating medical team made a clinical diagnosis. The patient was said to be apraxic if (1) the patient showed an inability (or restriction in the ability) to carry out purposeful tasks and (2) this inability was not the result of a primary motor or sensory impairment, or deficit of comprehension, memory or motivation. Second, before final inclusion in the study, patients were tested by a researcher for severity of apraxia (van Heugten et al., 1999a). Patients who showed no or minimal apraxic symptoms on the apraxia test (score above 87) were excluded from the study.

A total of 139 patients were selected for the study by the occupational therapists; 26 patients were excluded for various reasons: a score above 87 on the apraxia test (n = 11), withdrawal of consent (n = 4), discharge from the institute (n = 7), and poor condition of the patient (n = 4). After randomization of the remaining 113 patients, the strategy training group consisted of 56 patients and the usual treatment group consisted of 57 patients. Patients in the two intervention groups did not differ significantly with respect to the baseline characteristics, except for age (see Table 1); patients in the strategy training group were older. All patients and their families received verbal and written information about the study and gave verbal as well as written consent to participate.

[TABLE 1]

Study design

A randomised, single blind, controlled trial design was used to compare the effect of strategy training (integrated into usual occupational therapy) with the effect of usual occupational therapy only. Patients were followed over a period of five months. During the first eight weeks patients received treatment according to their randomisation. Baseline measurements were done immediately after inclusion. After the eight-week treatment period, a second measurement took place, and the final measurement was at follow-up five months after the first assessment. During each measurement, performance on four standardised ADL tasks was evaluated. The four tasks had the same level of difficulty on the classification of tasks on the Assessment of Motor and Process Skills (AMPS), in terms of both motor and process skill abilities needed to perform these tasks (Fisher, 1997). The four tasks were: (1) washing the face and upper body; (2) putting on a shirt or blouse; (3) preparing and eating a sandwich; and (4) preparing a cup of hot chocolate. The tasks were scored on four aspects: independence, initiation, execution, and control. It was agreed that task 4 (preparing a cup of hot chocolate) would never be trained, whereas no agreements were made concerning the training of tasks 1-3. The occupational therapists registered the content of the therapy sessions. With this information we were able to retrieve the actual trained and non-trained tasks for each participant.

Measurements were conducted by an independent, blinded assessor. Treatment was individualised, as tasks relevant to the patient were trained. Relevant tasks were derived from the interests of the patient and the role the patient is going to fulfil in society. No arrangements were made on the tasks that would be trained by the occupational therapists, except for the agreement not to train one of the ADL tasks that would be observed by the assessor. Treatment of patients during the follow-up period was not prescribed in specific study guidelines, except for the agreement not to train the fourth ADL task. The study protocol was approved by the ethics committees of all participating institutions.

Scoring method in the present study

For the purpose of the present study, one overall mean score for tasks that had been trained was achieved, as well as one mean score for tasks that had not been trained. The mean scores ranged from totally dependent (score 0) to totally independent (score 3).

Interventions

The experimental treatment was standardised by means of a treatment protocol, developed in an earlier study (van Heugten et al., 1998). The occupational therapists in the strategy training group received additional training on how to use the protocol, consisting of a full-day course followed by several booster meetings. Differences between institutions with regard to the amount of treatment, the content of the usual occupational therapy and treatment outside the occupational therapy department were controlled for by the randomisation procedure.

Strategy training

Strategy training consisted of the standardised treatment programme for left hemisphere stroke patients with apraxia, developed by van Heugten and colleagues (1998), which is based on teaching patients strategies to compensate for the presence of apraxia. By means of this programme the patient is gradually taught more efficient strategies. The aim of the therapy is to maximise the patient's independence by improving ADL functioning. During a detailed diagnostic assessment of disability (standardised ADL observations), the specific problems of each individual patient are examined. These problems become the focus of attention during therapy; an intervention is chosen in correspondence with the observed problems. ADL tasks are conceptualised as being composed of three successive phases, according to the framework of information processing: the proper plan of action and the correct objects have to be selected (initiation and orientation), followed by adequate execution of the selected plan (execution), which has to be evaluated in terms of the result, and if necessary corrected (control and correction). Corresponding to these phases, the specific interventions focus on instructions, assistance and feedback, respectively. This diagnostic assessment is strictly used for clinical purposes and is therefore independent of the study.

Usual treatment

During the trial, usual occupational therapy concentrated on (sensory) motor, perceptual and cognitive deficits of the stroke patient and aimed at increasing independent functioning in ADL tasks. In general, the main focus of the therapy was on (sensory) motor impairments (e.g., muscle tone, reflexes, controlled movements, muscle strength, contractures) and disability due to these impairments. A variety of treatment methods have been mentioned in the literature and used in daily practice. Nowadays, strategy training is incorporated more in the usual occupational therapy.

MEASUREMENTS

ADL functioning

ADL functioning was measured in two ways:

ADL observations (van Heugten et al., 1999b)

These are a set of standardised observations, especially developed to assess disability in ADL functioning due to apraxia. The internal consistency and inter-observer reliability of this observation procedure have been found to be good (van Heugten et al., 1999, 2000b). The performance on four standardised tasks mentioned earlier was observed. The tasks were scored on four aspects: independence, initiation, execution, and control. Scores on the observations range from totally dependent (score 0) to totally independent (score 3).

Barthel ADL Index (Collin, Wade, Davies, & Horne, 1988; Wade & Collin, 1988)

The Barthel Index of tasks of daily living is a widely used, well-validated scale, which offers a simple and quick clinically relevant method to identify the most important physical disabilities. The score on the index ranges from 0 to 20 (Collin et al., 1988; Wade & Collin, 1988).

Apraxia

The Apraxia Test is based on a test by De Renzi (De Renzi, 1989; van Heugten et al., 1999a). It consists of two subtests assessing the ability to use objects or pantomime the use of objects (aimed at ideational apraxia) and the ability to imitate gestures with the non-affected ipsilateral arm (aimed at ideomotor apraxia). The maximum score of the total test is 90, which indicates no signs of apraxic symptoms. The internal consistency, the validity and the inter-observer reliability of the test is good (van Heugten et al., 1999a; Zwinkels et al., 2004).

Motor functioning

The Functional Motor Test is a simplified version of the Action Research Arm Test (Lyle, 1981). The test measures the voluntary functional activity of the arm and hand of the affected contralateral side. It consists of four items in which the patient has to use a type of grip (pinch, grip or grasp) to pick up an object, move it forward and put it down again. The maximum score on the test is 12. The internal consistency is good (Donkervoort et al., 2001).

Additional measures

The SAN test, a standardised test assessing verbal comprehension was used to monitor the patients' understanding of the Dutch language (Deelman, Liebrand, Koning-Haanstra, & van de Burg, 1987). Occupational therapists completed a questionnaire (at baseline) on the demographic and clinical stroke-related data and a questionnaire (at post-treatment and follow-up assessment) concerning the treatment patients received during the study, such as the amount and content of occupational therapy and other therapies received.

STATISTICAL ANALYSES

Comparability

Comparability of the treatment groups was assessed in four ways. First, between-group differences in functional impairments were investigated by comparing differences between the intervention groups in motor functioning, apraxia and verbal comprehension. Second, between-group differences in the amount (sessions and hours) of occupational therapy in the eight-week treatment period were investigated. Third, we used chi-square tests to see whether the proportion of trained tasks and non-trained tasks was comparable within the groups. Fourth, to see whether the scores on trained and non-trained tasks were comparable, we investigated between-group and within-group differences for ADL functioning at baseline, using independent samples *t*-tests and paired samples *t*-tests, respectively.

Transfer of training

To assess the occurrence of transfer, first we graphically displayed the course of the ADL functioning over time. Second, the visible differences were tested. In order to evaluate outcome, change scores were calculated by subtracting baseline scores from post-treatment and follow-up scores, respectively. Change scores of trained and the non-trained tasks were compared between and within the two treatment groups, by independent samples *t*-tests and paired samples *t*-tests, respectively. On the basis of the results of the between-group comparison, an adjusted analysis (ANCOVA) was conducted for the change scores of non-trained tasks. In this analysis we controlled for improvement in motor functioning and apraxia by including these variables as covariates. As the intervention groups differed with respect to age, this variable was also included as a covariate. The course of the ADL functioning was examined by a general linear model for repeated measures. In adjusted analyses, we controlled for age and for improvement in motor functioning and apraxia. Main effects were further investigated by contrasts testing.

In all analyses, the level of significance was set at .05. Analyses were carried out using SPSS 11.0 for Windows. One-tailed tests were used in analyses where the results of the experimental group were compared with the control group, as we expected the experimental group to outperform the control group. Two-tailed tests were used in the analyses where trained tasks were compared with non-trained tasks, as we did not have an assumption on the direction of these differences in advance. There was a substantial number of missing values in all analyses. This was caused by the fact that in a relatively large number of participants none of the four tasks that were observed had been trained during the research period (i.e., Tables 3 and 4).

[TABLE 3]

[TABLE 4]

RESULTS

Comparability

At baseline, no between-group differences in functional impairments were found (see Table 1). Also, the amount (sessions and hours) of occupational therapy that patients received during the eight-week treatment period did not differ significantly between the two intervention groups (sessions: t = -1.06, df = 96; hours:t = -1.63, df = 97). Patients in the experimental group had on average 25 (SD = 9.8) sessions, resulting in 15 (SD = 7.7) hours of occupational therapy. The control group had on average 27 (SD = 15.6) sessions, resulting in 19 (SD = 15.0) hours of occupational therapy. For all four tasks, the proportion of training and not training was equal in both treatment groups (see Table 2), indicating that in the experimental group each task was trained in as many patients as in the control group.

[TABLE 2]

The analysis showed no significant between-group difference on ADL observations score of trained and non-trained tasks (trained tasks: t = -0.03, df = 68; non-trained tasks: t = -0.747, df = 92). However, within the total group as well as within the two individual treatment groups, patients scored lower on non-trained tasks as compared with their score on trained tasks [total group: t = 5.07, df = 66, p = .000; strategy training group: t = 3.85, df = 33, p = 001; usual treatment group: t = 3.26, df = 32, p = 003].

Transfer of training

The course of ADL functioning over time is displayed in Figure 1. At week 8, the two individual treatment groups scored lower on the non-trained tasks than on the trained tasks [strategy training group: t = 2.74, p = 01; usual treatment group: t = 3.09, p = .004]. The same was true for test scores at week 20 [strategy training group: t = 2.88, p = 008; usual treatment group: t = 2.42, p = 023].

[FIGURE 1]

The score on ADL observations of trained tasks appeared to improve significantly over time for the group as a whole, $F(2, 52)$ = 6.15, p = .004, and for the strategy training group alone, $F(2, 26)$ = 4.25, p = .025. The score on the trained tasks in the usual treatment group did not change over time, $F(2, 24)$ = 1.90. The significant main effects were caused by the differences in scores at week 8 as compared with week 0, [total group: $F(1, 53)$ = 10.41, p = .002; strategy training group: $F(1, 27)$ = 8.06, p = .009].

The score on ADL observations of non-trained tasks also appeared to improve significantly over time for the group as a whole, $F(2, 76) = 16.71$, $p = .00$, and for the two individual treatment groups [strategy training group: $F(2, 34) = 11.38$, $p = 0.00$; usual treatment group: $F(2, 31) = 6.40$, $p = .05$]. The significant main effects were caused by the differences in scores at week 8 as compared with week 0 [total group: $F(1, 68) = 31.29$, $p = 000$; strategy training group: $F(1, 35) = 23.41$, $p = 000$; usual treatment group: $F(1, 32) = 9.16$, $p = 005$]. When type of treatment was included in the model as a between subjects factor and after controlling for age and for improvement in motor functioning and apraxia, we found a significant main effect of time of measurement, $F(2, 63) = 3.44$, $p = .038$. This effect was caused by the difference in scores at week 8 as compared with week 0, contrasts analysis: $F(1, 64) = 5.24$, $p = .025$.

DISCUSSION

The aim of the present study was to explore whether there are indications for the occurrence of transfer of the strategies taught by means of the occupational therapy programme for left hemisphere stroke patients with apraxia. Because both treatment groups improved significantly on non-trained tasks, transfer seemed to have occurred in the strategy training group as well as the usual treatment group. Moreover, Figure 1 shows that the improvements on trained and non-trained tasks in both treatment groups follow identical patterns. This suggests transfer effects from trained to non-trained tasks in both forms of treatment. However, we have reasons to believe that more transfer occurred in the strategy training group as compared with the usual treatment group. Change scores for non-trained tasks turned out to be larger in the strategy training group than in the usual treatment group. These findings cannot be explained by differences between the treatment groups. Patients in the two intervention groups did not differ significantly with respect to the baseline characteristics, except for age. Patients in the strategy training group were older. In the analyses, we controlled for this difference. The amount (sessions and hours) of occupational therapy that patients received during the first eight weeks of the study did not differ significantly between the two intervention groups.

To answer the research question we used data that was previously collected by Donkervoort et al. (2001). In their study ADL tasks were compared between the two treatment groups. The strategy training group showed significantly more improvement on ADL tasks than did the usual treatment group. The mean scores on the tasks however were not split into trained and non-trained tasks. In the new analyses that were carried out in the present study, we did split the ADL tasks into trained and non-trained tasks. In these analyses the improvement on trained tasks turned out to be the same in both groups. However, the strategy training group did improve more on non-trained tasks than the usual treatment group. This finding suggests that the difference between the improvements of the two treatment groups found by Donkervoort et al. (2001), was not caused by a difference in trained tasks, but by the fact that the strategy training did transfer to other (non-trained) tasks, while the usual treatment transferred less than the strategy training.

The largest improvements on trained and non-trained tasks in both treatment groups took place in the first eight weeks of the study. This was to be expected, as most of the treatment was given in this period of the study.

At baseline, after eight weeks of training and at follow up (five months after the start of the training), both treatment groups performed more poorly on non-trained tasks than on trained tasks. These differences at the post-treatment and follow up measurements may be explained by the effect of the therapies. However, these differences may also be caused by the differences between trained and non-trained tasks at baseline within both treatment groups. A possible explanation for the difference at baseline might be that the non-trained tasks are more difficult to perform than the trained tasks, although this does not seem very plausible as the four tasks have the same level of difficulty on the classification of tasks on the Assessment of Motor and Process Skills (AMPS), in terms of both the motor and process skill abilities needed to perform these tasks (Fisher, 1997). An alternative explanation might be that the trained tasks were more automated than the non-trained tasks. Unfortunately, this could not be examined in the present study. Another explanation might be that the training of some basic, trained, ADL tasks had already been initiated in the hospital phase, which precedes the start of the rehabilitation process.

Previous research into transfer of apraxia training

Transfer of the therapeutic effects of apraxia training from trained to non-trained tasks has been assessed in two studies by a German research group (Goldenberg & Hagmann, 1998; Goldenberg, Daumuller, & Hagmann, 2001). In both studies, no indications of transfer were found as the therapeutic results turned out to be restricted to the trained activities. However, these results were based on relatively small sample sizes ($N = 15$ and $N = 6$, respectively) compared to our study (control group $N = 57$; experimental group $N = 56$). In the first study, therapy consisted of errorless completion of the whole task, combined with training of details (Goldenberg & Hagmann, 1998). The first part of this therapy is task specific, the second part might be seen as strategy training, as in training of details, patients are taught to infer the function of a object from its structure. However, this strategy is aimed at handling only one of the problems in ADL functioning that can occur in patients with apraxia, namely problems in object use. Another problem that is often observed in apraxia patients concerns the lack of a proper plan of action, including, for example, the order in which specific actions have to be conducted. In apraxia, the two problems described above can occur separately or both at the same time. When a patient lacks an action plan, he or she cannot be expected to perform a non-trained activity properly on the basis of what he or she has learned about inferring function from structure. In our training programme a strategy is selected matching the specific problems that are observed. In the second study, effects of direct training of an activity were compared to effects of exploration training, aimed at teaching patients to infer function from structure (Goldenberg et al., 2001). The direct training of an activity is very task specific, no general strategies are taught and therefore transfer is not expected to occur, as was confirmed by the study. At the same time, no transfer was found after exploration training, which can be described as a strategy training.

However, exploration training turned out to have no effect on the trained tasks as well. Clearly, a training that does not have an effect on trained tasks cannot be expected to transfer to non-trained tasks.

Spontaneous recovery versus training effects

In the present study, spontaneous recovery of both apraxia and ADL functioning is important to consider. Over the years, there has been some discussion about the occurrence of spontaneous recovery of apraxia. It is sometimes believed that apraxia recovers spontaneously (Basso et al.,1987b). However, other studies have shown apraxia to be persistent (Donkervoort, 2001; Poeck, 1985), a viewpoint further confirmed by the data of Donkervoort et al. (2001) in which apraxia was observed to be enduring. Spontaneous recovery of ADL functions in patients with apraxia has not been investigated as thoroughly as the recovery of apraxia itself. There is, to our knowledge, only one study that looked into this matter. In this study spontaneous recovery of ADL functions did not occur (Goldenberg & Hagmann, 1998). In addition, in the study of Donkervoort et al. (2001), the time post-stroke was more than three months on average, which exceeds the acute phase of recovery. Moreover, spontaneous recovery was controlled for by the successful randomisation of the strategy training group and the usual treatment group, although it is important to consider spontaneous recovery in the within-group analyses we carried out.

Methodological issues

To evaluate transfer of training, we used the ADL observations. An earlier study with this instrument reported the possibility of an instrumental ceiling effect for the ADL observations (van Heugten et al., 2000a). However, the difference in change scores we found cannot be explained by a possible ceiling effect of the ADL observations, as the baseline score on the non-trained tasks was equal in the two treatment groups. Therefore the usual treatment group should have been able to improve as much as the strategy training group.

In the present study, we used data that were collected for the purpose of evaluating the efficacy of the strategy training. The study was not originally designed to investigate the occurrence of transfer of the training. Therefore there are some methodological shortcomings in the dataset.

In all participants, the same four tasks were observed and evaluated several times during the research period. As indicated above, it had been agreed that one of the tasks would never be trained, whereas no agreements were made concerning the training of the other three tasks. Because the therapists registered the tasks they trained, we were able to compute a mean score for tasks that had been trained, as well as a mean score for tasks that had not been trained. For each participant there was at least one task that had not been trained, because of the agreement not to train this task. Because there were no agreements made concerning the other tasks, the mean scores for trained and non-trained tasks consisted of different numbers of scores, ranging from 0-4 for trained tasks and 1-4 for non-trained tasks. This raises two potential problems in the study. First, inequality of variances can occur.

However, in our study the variances appeared not to differentiate significantly between the groups; this was checked with Levene's test for equality of variances. Second, because no agreements were made on the tasks that would be trained, in a relatively large number of participants in both groups, none of the four tasks that were observed had been trained during the research period. This resulted in a substantial number of missing values in the analyses of the mean scores of the trained tasks (15 missing cases in the strategy training group and 14 in the usual treatment group).

FINAL CONCLUSIONS AND FUTURE RESEARCH

In strategy training, the occurrence of transfer is expected as the training is aimed at teaching patients general ways to handle the problems resulting from an impairment. However, to our knowledge, there are relatively few studies that have directly examined the transfer of treatment effects to everyday situations or behaviours in a large sample of patients. Despite the issues raised above, the present study does show that there are indications for the occurrence of transfer of the strategies taught by means of the occupational therapy programme for left hemisphere stroke patients with apraxia. However, more insight into transfer is necessary to be able to draw firmer conclusions. We are now conducting a prospective study that is specifically aimed at examining the occurrence of transfer of the training results in apraxia patients. In this new study trained and non-trained tasks will be observed in each participant thus eliminating the problem of the substantial number of missing values.

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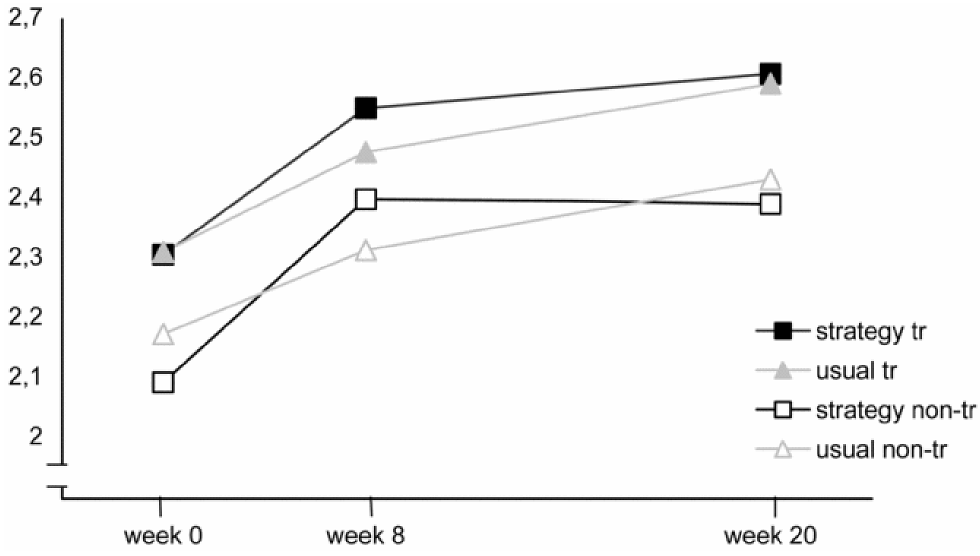
Figures



Tables

TABLE 1
Comparability of the intervention groups with respect to demographic and clinical characteristics ($n = 113$)

	Strategy training ($n = 56$)	*Usual treatment* ($n = 57$)
Gender, *n* (%)		
Male	29/56 (52)	35/57 (61)
Female	27/56 (48)	22/57 (39)
Age at stroke, mean (SD)*	67.6 (11.7)	63.3 (11.6)
Education, *n* (%)		
Low	19/56 (34)	25/57 (44)
Middle	17/56 (30)	12/57 (21)
High	8/56 (14)	5/57 (9)
Unknown	12/56 (21)	15/57 (26)
Right handedness, *n* (%)	50/56 (89)	54/57 (95)
Type of stroke, *n* (%)		
Haemorrhage	12/56 (21)	4/57 (7)
Infarction	41/56 (73)	48/57 (84)
Otherwise/unknown	3/56 (5)	5/57 (9)
Time since stroke in days, mean (SD)	100.2 (63.3)	102.9 (70.7)
Test results		
Apraxia, mean (SD)	57.3 (21.2)	62.0 (17.9)
Functional Motricity Test, mean (SD)	6.5 (3.9)	5.3 (3.5)
Barthel Index, mean (SD)	10.7 (4.9)	11.2 (5.0)
Verbal Comprehension	32.9 (8.7)	32.6 (6.6)

*Difference between intervention groups, 2-tailed significance $p < .05$.

TABLE 2
Percentage of cases in which the specific task was trained during the course of the study

	Strategy training ($n = 50$)	*Usual treatment* ($n = 49$)	*Chi-square*	*p-value*
Washing face and upper body	50.0	53.1	0.09	.761
Putting on shirt/blouse	44.0	57.1	1.71	.191
Preparing and eating sandwich	42.0	38.8	0.11	.744
Preparing hot chocolate	2.0*	0.0	0.99	.320

*Preparing a cup of hot chocolate was mistakenly trained in one participant.

groups, patients scored lower on non-trained tasks as compared with their score on trained tasks [total group: $t = 5.07$, $df = 66$, $p = .000$; strategy training group: $t = 3.85$, $df = 33$, $p = 001$; usual treatment group: $t = 3.26$, $df = 32$, $p = 003$].

TABLE 3
Between-group difference in change scores of ADL observations of trained and non-trained tasks: Strategy training vs. usual treatment

	Strategy training group			*Usual treatment group*				
	n	*mean*	*(SD)*	*n*	*mean*	*(SD)*	*t*	*p-value*
Non-trained week 8–week 0	41	0.307	(0.45)	40	0.143	(0.37)	1.78	.04
Non-trained week 20–week 0	38	0.271	(0.54)	36	0.241	(0.48)	0.25	.40
Trained week 8–week 0	32	0.208	(0.53)	29	0.108	(0.46)	0.79	.22
Trained week 20–week 8	30	0.242	(0.54)	27	0.218	(0.53)	0.17	.43

TABLE 4
Within-group difference in change scores of ADL observations: Trained vs. non-trained tasks

		Mean score ADL observations			
	n	*trained (SD)*	*non-trained*	*t*	*p*
Strategy training week 8–week 0	30	0.201 (0.54)	0.344 (0.47)	−1.21	.23
Strategy training week 20–week 0	27	0.221 (0.55)	0.361 (0.59)	−1.18	.25
Usual treatment week 8–week 0	28	0.112 (0.46)	0.153 (0.41)	−0.45	.65
Usual treatment week 20–week 0	25	0.195 (0.41)	0.260 (0.51)	−0.52	.61

was caused by the difference in scores at week 8 as compared with week 0, contrasts analysis: $F(1, 64) = 5.24$, $p = .025$.