

# A comparison of two approaches in the treatment of perceptual problems after stroke

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**Objective:** To compare the effectiveness of the transfer of training and functional approaches in improving perceptual and functional abilities after stroke.

**Design:** Patients identified as having perceptual problems were randomly allocated to either the transfer of training approach or the functional approach for perceptual treatment. On completion of six weeks of treatment, each patient was reassessed for perceptual and functional abilities.

**Subjects and setting:** Eighty inpatients on the Nottingham Stroke Unit.

**Interventions:** Perceptual treatment was given for 2.5 hours per week for six weeks.

**Main outcome measures:** Rivermead Perceptual Assessment Battery, Barthel ADL Index and Edmans ADL index.

**Results:** There was no significant difference between the treatment groups on patient characteristics or impairments. The results also showed no significant difference between the treatment groups before and after treatment on perceptual ability total scores, individual perceptual subtest scores, or functional ability total scores (Mann-Whitney  $U$  642.5-798.0,  $p > 0.05$ ). Wilcoxon matched pairs signed ranks tests showed a significant improvement in both groups after treatment on perceptual and functional abilities (perceptual  $z = 6.02$ ,  $p < 0.001$ , functional  $z = 6.72$ ,  $p < 0.001$ ).

**Conclusions:** These results indicated that the improvement in perceptual abilities was equivalent using either of the two approaches. This could be due to spontaneous recovery or the effects of the Stroke Unit.

## Introduction

Perceptual problems have been shown to be common following both right and left hemiplegic stroke.<sup>1-4</sup> These perceptual problems affect the patients' responses to rehabilitation and their ability to perform activities of daily living

(ADL),<sup>1,5-11</sup> suggesting that they should be treated if possible.

Two main approaches to the treatment of perceptual problems, which are suitable for use with adult brain-damaged patients, have been suggested by Zoltan and coworkers.<sup>12</sup> These are the transfer of training and functional approaches.

The basic assumption of the transfer of training approach is that practise on a particular perceptual task will affect a patient's performance on similar perceptual tasks, i.e. this approach is

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concerned with treating the cause of the perceptual problem. For example, a patient with difficulty dressing due to spatial relations problems, may practise a spatial task such as cube copying, in the hope that he or she improves functionally in areas involving spatial relations, such as dressing. The main disadvantage with the transfer of training approach is that patients may object to abstract perceptual training, finding it childish, degrading and/or irrelevant to their problems. Also it could also be seen as time consuming for therapists, as patients still have to do activities of daily living as well and it is not certain whether improvement in transfer of training activities will produce an improvement in functional abilities.

Several studies have investigated this approach with conflicting results. Some studies found positive results following the transfer of training approach,<sup>13-23</sup> whereas others did not.<sup>24-31</sup> Perceptual improvement appeared to be most effective after the treatment of left unilateral neglect following intensive early treatment, over a short period of time, using computer-based or arm activation treatment, with target outcome measures.

The functional approach is the repetitive practise of particular tasks, usually activities of daily living, in order to make the patient more independent. The emphasis is on treating the symptom rather than the cause of the problem. For example, a patient with spatial relations problems will have difficulty dressing. By practising dressing, the patient will learn to dress but will still have the underlying spatial relations problems. The main advantage of the functional approach is that it is more practical and more understandable to the patient than the transfer of training approach. However, it is only concerned with treating the symptom resulting from a perceptual problem and therefore the patient is still likely to have the perceptual problem.

Little research has been carried out to investigate the functional approach to treating perceptual problems other than that by Webster *et al.*<sup>32</sup> and Gouvier *et al.*<sup>33</sup>, who used wheelchair navigation as an outcome measure. However, this technique is not commonly used in the UK and therefore the relevance of these studies to the stroke population in the UK is reduced.

The main limitation of all the studies which investigated either treatment versus control

groups or single-case experimental designs was that they did not include both right and left hemiplegic stroke patients of all ages and that they were mainly concerned with the treatment of neglect/inattention following only one treatment approach. As a result, for the present study, it was decided to include left and right hemiplegic stroke patients of all ages with any perceptual problems, not just neglect/inattention, and to compare the transfer of training and functional approaches in the treatment of these perceptual problems after stroke. The study was designed to represent the treatment likely to be available in normal clinical practice in the UK. Further details about the strategies used in both treatment approaches are to be published in a later article.

The objective of the study was to identify whether the transfer of training or functional approach to the treatment of perceptual problems gave a greater improvement in perceptual ability or functional ability. This was to be carried out by a randomized trial comparing the two treatment approaches.

## Method

Patients were selected from those admitted consecutively to the Nottingham Stroke Unit and the inclusion criteria for the study were as follows:

- 1) Patients had to be well enough to be assessed on the Rivermead Perceptual Assessment Battery<sup>8</sup> (RPAB). This included being able to see and hear; being able to understand the English language enough to complete the assessments and follow the instructions; being free of marked psychiatric problems that would affect their ability to complete the RPAB.
- 2) Patients had to have sufficient functional use of one hand to complete the RPAB and to carry out perceptual treatment activities, i.e. sufficient ability to pick up and move objects/cards with one hand.
- 3) Patients had to give consent to participate in the treatment. If patients were unable to give verbal consent, permission for them to enter the study was sought from their nearest relative. Consent to participation in this study

was then documented in the patients' medical notes.

It should be noted that during the study period, patients being admitted to the Stroke Unit had already been selected as being suitable for participation in an evaluation study that was being carried out.<sup>34</sup> For this evaluation study, all stroke patients who were medically stable, were able to transfer with a maximum of two nurses, had no discharge date planned, able to tolerate 30-minute treatment sessions, were able to do two out of four specified activities (able to eat, able to drink, able to wash their face and able to

toilet themselves) prior to the stroke were randomly allocated to either the Stroke Unit or to the control group (health care of the elderly and general medical wards). This means that all the patients on the Stroke Unit during the perceptual treatment study were also selected by these criteria.

The procedure of the study was as follows (see flow chart in Figure 1):

- 1) All patients admitted to the Stroke Unit were assessed on the Stroke Unit by the ward occupational therapist (OT) or the research OT, for perceptual ability using the full

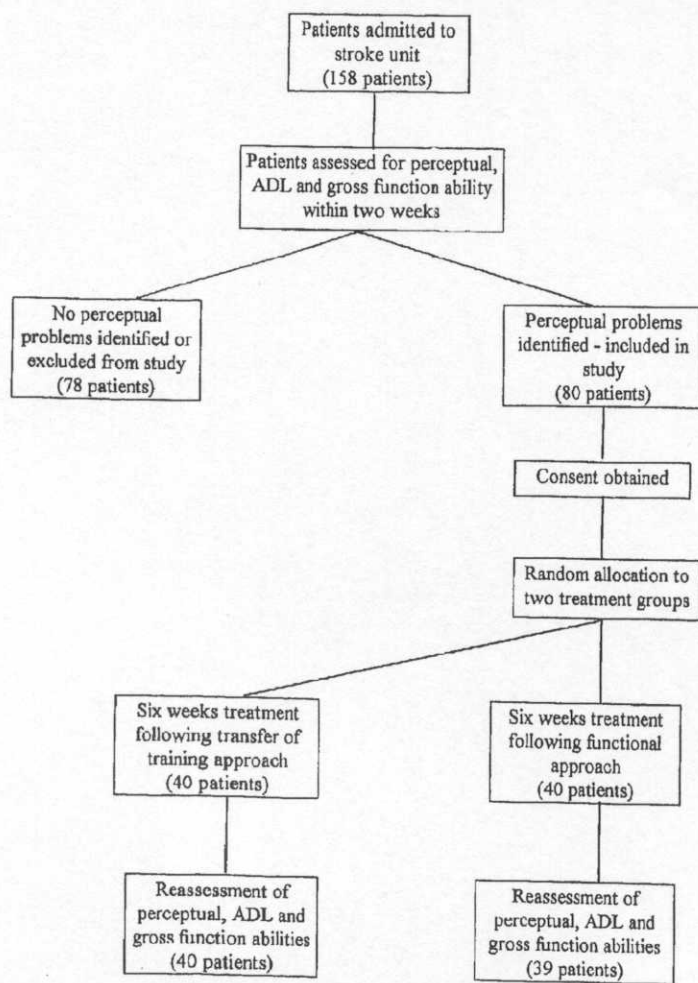


Figure 1 Procedure of the study.

RPAB and for ADL ability using the Barthel ADL Index<sup>35</sup> using the scoring by Collin *et al.*<sup>36</sup> and Edmans ADL Index,<sup>37</sup> within two weeks of admission to the Stroke Unit. This was completed by nonrandomized allocation of patients to the ward OT and research OT. Previous inter-rater reliability studies had shown good inter-rater reliability between these two raters. The ward physiotherapist assessed all patients on the Rivermead Motor Assessment (RMA) – Gross Function scale,<sup>38</sup> on admission to the Stroke Unit.

- 2) Perceptual problems were identified on the basis of having a score which was two standard deviations or more below the mean on four or more subtests of the RPAB. If perceptual problems were identified, an explanation was given to the patient about what these problems were and how they might affect the patient in everyday life. An explanation of the study was given and consent obtained.
- 3) When consent had been obtained, patients were then randomly allocated to either the transfer of training or functional approach for perceptual treatment. Envelopes had been prepared prior to the start of the study by the research OT with numbers taken from random number tables. Odd numbers signified that patients would follow the transfer of training approach and even numbers signified that patients would follow the functional approach. This was continued until there were 40 patients in each group.
- 4) Perceptual treatment was given for two and a half hours per week for six weeks, in addition to their general OT treatment. The perceptual treatment was given by a combination of the research OT and ward OT. The amount of treatment time was chosen as this was thought to be a realistic amount achievable in normal clinical practice.
- 5) Details for each patient of every attendance for any OT treatment were recorded in an OT register by the ward OT. The amount of time spent on each treatment was also recorded in this register, in terms of number of half hour units.
- 6) At the end of the six weeks treatment, the

patients were reassessed on the RPAB, Barthel ADL Index and Edmans ADL Index by an assessor who was blind to the treatment approach given, i.e. an independent assessor. For practical reasons, to complete the ADL indices, the independent assessor discussed the patients' functional ability with the primary nurses. Separately, the ward OT also completed the Barthel ADL Index and Edmans ADL from her own assessment of the patients' functional ability. The patients were also reassessed on the RMA Gross Function scale by the physiotherapist.

However, the ability to complete the RPAB and to respond to treatment, may be influenced by factors other than perceptual ability. Therefore to identify these problems and to investigate their effect, the results of the other assessments used by the physiotherapists, speech and language therapist and psychologist were then collated by the research OT. The assessments were chosen as those already being routinely carried out by the Stroke Unit staff of each discipline, most of which had evidence of validity and reliability. These assessments included clinical assessment by the speech and language therapist of auditory comprehension, expressive language, articulatory dyspraxia, reading comprehension and dysarthria; sensory assessment by the physiotherapist using the Nottingham Sensory Assessment<sup>39</sup>; cognitive assessment by the psychologist of premorbid IQ level using the Shortened National Adult Reading Test<sup>40,41</sup> memory using the Wechsler Memory Scale – Revised,<sup>42</sup> reasoning using Word Fluency from the Multilingual Aphasia Examination<sup>43</sup> and Cognitive Estimates,<sup>44</sup> limb dyspraxia using the apraxia test by Kertesz and Ferro<sup>45</sup> and anxiety and depression using the Hospital Anxiety and Depression Scale.<sup>46</sup>

## Results

The patients were identified from those admitted to the Nottingham Stroke Unit between May 1992 and July 1994, excluding February and March 1994, when the ward OT was on sick leave. During this time 158 patients were admitted. There were 80 suitable patients for the study.

Seventy eight patients were excluded for the following reasons: 63 had no perceptual problems, nine were transferred back to medical, surgical or health care of the elderly wards before assessment and random allocation, one did not have a stroke, one had a marked psychiatric overlay, three did not understand English and one died. The selection of suitable patients took 25 months to complete.

No patients withdrew from the study but one patient (in the functional approach group) died before completing his six weeks of perceptual treatment.

The biographical characteristics and impairments of the patients in each treatment group are shown in Table 1.

Comparison of these characteristics between the two treatment groups showed no significant

**Table 1** Biographical characteristics and impairments of patients in each treatment group

	Transfer of training approach ( <i>n</i> = 40)		Functional approach ( <i>n</i> = 40)
Age in years			
Mean	69.75		67.85
Standard deviation	9.10		11.38
Range	47-84		26-86
	<i>t</i> = 0.82	NS	CI (-2.69, 6.49)
Sex			
Male	18		22
Female	22		18
		chi-squared = 0.45	NS
Side of stroke			
Left	24		21
Right	16		19
		chi-squared = 0.20	NS
Days post stroke			
Mean	37.68		31.15
Standard deviation	16.60		10.13
Range	16-84		14-56
	<i>t</i> = 2.12	<i>p</i> < 0.05	CI (0.38, 12.67)
Carer			
With	25		26
Without	15		14
		chi-squared = 0.00	NS
IQ			
Above average	3		2
Average	37		38
Below average	0		0
		chi-squared = 0.00	NS
Handedness			
Left	1		2
Right	39		38
		chi-squared = 0.00	NS
Hand used for RPAB			
Dominant	25		21
Non dominant	15		19
		chi-squared = 0.81	NS
Dysphasia			
Present	12		14
Absent	28		26
		chi-squared = 0.06	NS

Table 1 continued

	Transfer of training approach ( <i>n</i> = 40)		Functional approach ( <i>n</i> = 40)	
Dysarthria				
Present	9		6	
Absent	31		34	
		chi-squared = 0.33	NS	
Articulatory dyspraxia				
Present	6		5	
Absent	34		35	
		chi-squared = 0.00	NS	
Reasoning problems				
Present	25		23	
Absent	7		11	
		chi-squared = 0.46	NS	
Memory problems				
Present	32		31	
Absent	4		6	
		chi-squared = 0.09	NS	
Depression				
Present	8		13	
Absent	24		21	
		chi-squared = 0.79	NS	
Anxiety				
Present	14		9	
Absent	18		25	
		chi-squared = 1.47	NS	
Limb dyspraxia				
Present	3		6	
Absent	33		31	
		chi-squared = 0.45	NS	
Sensory problems				
Present	28		27	
Absent	9		7	
		chi-squared = 0.01	NS	

NS, not significant ( $p > 0.05$ ); CI, confidence interval.

Some patients were unable to be assessed for reasoning, memory, depression, anxiety, limb dyspraxia or sensory problems due to speech and language difficulties, i.e. dysphasia, dysarthria or articulatory dyspraxia.

difference using a *t*-test on age ( $t = 0.82, p > 0.05$ ), using chi-squared tests on sex, side of stroke, handedness, presence of a carer, IQ level, presence of dysphasia, dysarthria, articulatory dyspraxia, reasoning problems, memory problems, depression, anxiety, limb dyspraxia, sensory problems (chi-squared = 0.00–1.47,  $p > 0.05$ ).

There was a significant difference between groups using *t*-tests on time post stroke to entry to the study ( $t = 2.12, p < 0.05$ ) with the transfer of training group patients being slightly longer post stroke than the functional group.

#### Length of stay and amount of OT received

Details of the length of stay on the stroke unit, number of OT attendances and amount of OT treatment received (in terms of number of half hour treatment units) in each treatment group are shown in Table 2. Comparison of these details showed no significant difference using a *t*-test on length of stay ( $t = -0.80, p > 0.05$ ), or using Mann-Whitney *U*-tests on OT attendances ( $U = 597.5, p > 0.05$ ) and OT treatment time ( $U = 723.0, p > 0.05$ ).

**Table 2** Comparison of treatment groups on length of stay and amount of occupational therapy (OT) received

	Transfer of training approach ( <i>n</i> = 40)			Functional approach ( <i>n</i> = 40)
<b>Length of stay (weeks)</b>				
Mean	9.20			9.27
Standard deviation	4.12			4.23
Range	2.8-18.4			1.8-23.0
	<i>t</i> = -0.08	NS	CI (-1.93, 1.78)	
<b>OT attendances</b>				
Median	17.00			23.00
Interquartile range	10.25-25.75			17.00-28.00
Range	0-47			3-52
	<i>U</i> = 597.5	NS	CI (-10.00, 0.00)	
<b>OT treatment time (half hour units)</b>				
Median	34.50			40.50
Interquartile range	20.00-56.00			29.00-52.75
Range	0-91			5-96
	<i>U</i> = 723.0	NS	CI (-14.00, 7.00)	

NS, = not significant ( $p > 0.05$ ); *U*, Mann-Whitney *U*; CI, confidence interval.

### Comparison of treatment groups on outcome measures

Mann-Whitney *U*-tests were used to determine the probability of a difference occurring by chance between the transfer of training and functional groups on initial and final RPAB total scores, Barthel ADL Index and Edmans ADL

Index total scores, and RMA gross function scores. The results are shown in Table 3.

These showed no significant difference between groups on initial or final RPAB total scores, Barthel ADL Index or Edmans ADL Index total scores, or gross function scores.

If a patient scored two standard deviations or

**Table 3** Comparison of treatment groups on perceptual total scores, functional total scores and gross function total scores

	Transfer of training approach ( <i>n</i> = 40)			Functional approach ( <i>n</i> = 40)
<b>RPAB</b>				
<b>Initial total score</b>				
Median	100.50			99.90
Interquartile range	52.95-124.73			76.35-124.68
Range	17.70-170.70			0.00-189.90
	<i>U</i> = 798.0	NS	CI (-19.80, 18.79)	
<b>Final total score</b>				
Median	126.30			120.70
Interquartile range	69.55-151.88			87.20-144.28
Range	15.70-190.40			0.00-199.60
	<i>U</i> = 786.0	NS	CI (-22.99, 21.71)	
<b>Barthel ADL</b>				
<b>Initial total score</b>				
Median	9.00			9.00
Interquartile range	7.00-10.00			7.00-10.00
Range	2-18			1-19
	<i>U</i> = 768.0	NS	CI (-1.00, 2.00)	

Table 3 continued

	Transfer of training approach ( <i>n</i> = 40)	Functional approach ( <i>n</i> = 40)
<b>Final total score (nurses)</b>		
Median	11.50	13.00
Interquartile range	9.00-15.00	10.25-17.00
Range	6-20	0-20
	<i>U</i> = 691.0   NS   CI (-3.00, 1.00)	
<b>Final total score (OT)</b>		
Median	12.00	13.00
Interquartile range	10.00-15.75	11.00-17.00
Range	3-20	0-20
	<i>U</i> = 674.5   NS   CI (-3.00, 1.00)	
<b>Edmans ADL</b>		
<b>Initial total score</b>		
Median	28.50	29.00
Interquartile range	22.25-35.00	22.00-33.75
Range	8-57	11-62
	<i>U</i> = 776.5   NS   CI (-4.00, 5.00)	
<b>Final total score (nurses)</b>		
Median	36.50	42.00
Interquartile range	28.25-48.75	35.25-57.50
Range	12-74	0-78
	<i>U</i> = 670.0   NS   CI (-12.00, 3.00)	
<b>Final total score (OT)</b>		
Median	39.50	47.00
Interquartile range	34.00-53.25	37.00-58.00
Range	12-76	0-77
	<i>U</i> = 646.5   NS   CI (-12.00, 2.00)	
<b>RMA Gross Function</b>		
<b>Initial total score</b>		
Median	1.00	1.00
Interquartile range	1.00-2.00	1.00-3.00
Range	0-13	0-13
	<i>U</i> = 787.5   NS   CI (0.00, 1.00)	
<b>Final total score</b>		
Median	3.00	5.00
Interquartile range	1.25-6.00	2.00-7.50
Range	1-13	0-13
	<i>U</i> = 723.0   NS   CI (-2.00, 1.00)	

RPAB, Rivermead Perceptual Assessment Battery; RMA, Rivermead Motor Assessment; *U*, Mann-Whitney *U* test; NS, not significant ( $p > 0.05$ ); CI, confidence interval.

more below the mean of the normal sample in the RPAB manual on individual RPAB subtests, a criterion score of 1 was given for that subtest.

The numbers of patients in each group scoring below their expected levels (criterion levels) on individual RPAB subtests on the initial and final assessment are shown in Table 4.

The investigation of individual RPAB subtests, comparing the two groups on the initial assessment and then comparing the two groups on the

final assessments showed that the transfer of training group and functional group had a similar pattern of test scores. In both groups, right/left copying shapes, right/left copying words and cube copying were the most difficult tasks. Mann-Whitney *U*-tests were calculated, showing there was no significant difference between groups on any of the initial RPAB subtests, with *U*-values ranging from 666.5 to 795.0 or between groups on any of the final RPAB subtests, with

U-values ranging from 642.5 to 791.5. Details are shown in Table 5.

#### Comparison of individual RPAB subtests between initial and final assessments for each treatment group

The investigation of individual subtests of the RPAB, comparing the initial and final assess-

ments for the transfer of training group and then the functional group, again showed that both groups had a similar pattern of test scores. In both groups, right/left copying shapes, right/left copying words and cube copying were the most difficult tasks. To compare the difference between initial and final assessments for each group, Wilcoxon matched pairs signed ranks tests

**Table 4** Number of patients scoring below their expected levels on Rivermead Perceptual Assessment Battery (RPAB) subtests

RPAB subtest	Transfer of training approach (n = 40)		Functional approach (n = 40)	
	Initial assessment	Final assessment	Initial assessment	Final assessment
Picture matching	12	9	13	5
Object matching	10	3	11	1
Colour matching	18	10	19	16
Size recognition	8	3	8	5
Series	16	9	18	7
Animal halves	9	6	8	4
Missing article	16	14	16	10
Figure ground	19	10	17	11
Sequencing pictures	24	13	21	19
Body image	28	19	26	16
R/L copying shapes	39	33	40	34
R/L copying words	39	35	38	38
3D copying	32	27	32	28
Cube copying	39	35	39	39
Cancellation	35	29	33	30
Self-identification	32	23	29	29

**Table 5** Comparison of treatment groups on individual Rivermead Perceptual Assessment Battery (RPAB) subtests on both initial and final assessments

RPAB subtest	Initial assessment (n = 80)		Final assessment (n = 80)	
	U	p	U	p
Picture matching	756.5	NS	731.0	NS
Object matching	770.5	NS	761.0	NS
Colour matching	754.0	NS	682.5	NS
Size recognition	780.5	NS	757.5	NS
Series	765.0	NS	742.5	NS
Animal halves	777.0	NS	759.5	NS
Missing article	781.0	NS	727.0	NS
Figure ground	687.0	NS	735.0	NS
Sequencing pictures	776.5	NS	670.0	NS
Body image	666.5	NS	714.5	NS
R/L copying shapes	795.0	NS	791.5	NS
R/L copying words	793.0	NS	753.5	NS
3D copying	753.5	NS	748.5	NS
Cube copying	780.5	NS	778.0	NS
Cancellation	790.0	NS	786.5	NS
Self-identification	781.5	NS	642.5	NS

U, Mann-Whitney U test; NS, not significant ( $p > 0.05$ ).

were calculated between the individual RPAB subtest scores on initial and final assessments for each treatment group. Details are shown in Table 6.

The transfer of training group showed a significant improvement ( $z = 2.01-3.33$ ,  $p < 0.05-0.001$ ) between initial and final assessments on all except five subtests (picture matching, series, animal halves, missing article and 3D copying) ( $z = 0.79-1.85$ ,  $p > 0.05$ ).

The functional group showed a significant improvement ( $z = 1.99-3.71$ ,  $p < 0.05-0.001$ ) between initial and final assessments on all except seven subtests (colour matching, size recognition, animal halves, missing article, sequencing pictures, 3D copying and self-identification) ( $z = 1.11-1.86$ ,  $p > 0.05$ ).

#### Comparison of perceptual and functional total scores between initial and final assessments

The perceptual and functional total scores were compared between initial and final assessments for all patients ( $n = 80$ ). Wilcoxon matched pairs signed ranks tests were calculated between initial and final assessments for RPAB, Barthel ADL Index (as assessed by nurses and OTs),

Edmans ADL Index (as assessed by nurses and OTs) and RMA gross function total scores. The RPAB total scores showed a highly significant improvement over time ( $z = 6.02$ ,  $p < 0.001$ ) as did the Barthel ADL Index total scores (nurses,  $z = 6.72$ ,  $p < 0.001$ , OT,  $z = 7.20$ ,  $p < 0.001$ ), Edmans ADL Index (nurses,  $z = 7.01$ ,  $p < 0.001$ , OT,  $z = 7.65$ ,  $p < 0.001$ ) and RMA gross function ( $z = 6.62$ ,  $p < 0.001$ ).

#### Comparison of changes in perceptual ability between treatment groups

Although these results showed a highly significant change over time, some patients' perceptual ability improved and some deteriorated or remained at the initial level.

The number of patients whose criterion total score (i.e. the number of RPAB subtests in which the patient scored below their expected level) improved or did not improve over the six weeks was investigated.

This showed that 27 transfer of training group patients and 25 functional group patients (65%) improved, whilst 13 transfer of training group patients and 15 functional group patients (35%) did not improve. There was no significant differ-

**Table 6** Comparison of individual Rivermead Perceptual Assessment Battery (RPAB) subtests between initial and final assessments for each treatment group

RPAB subtest	Transfer of training group ( $n = 40$ )		Functional group ( $n = 40$ )	
	$z$	$p$	$z$	$p$
Picture matching	1.53	NS	2.34	*
Object matching	2.01	*	2.80	**
Colour matching	2.85	**	1.75	NS
Size recognition	2.20	*	1.86	NS
Series	1.85	NS	2.70	**
Animal halves	0.80	NS	1.11	NS
Missing article	0.79	NS	1.85	NS
Figure ground	3.30	**	1.99	*
Sequencing pictures	3.33	***	1.20	NS
Body image	3.32	***	2.65	**
R/L copying shapes	3.02	**	3.71	***
R/L copying words	3.24	**	3.65	***
3D copying	1.23	NS	1.66	NS
Cube copying	2.60	**	2.39	*
Cancellation	2.21	*	2.44	*
Self-identification	2.28	*	1.33	NS

$z$ , Wilcoxon matched pairs signed ranks test; NS, not significant ( $p > 0.05$ ).

\*  $p < 0.05$ .

\*\*  $p < 0.01$ .

\*\*\*  $p < 0.001$ .

**Table 7** Relationship between perceptual and functional total scores for treatment groups ( $n = 80$ )

	Spearman rank correlation coefficient	p-value
<b>Initial assessment</b>		
RPAB total score with Barthel ADL total score	0.43	***
RPAB total score with Edmans ADL total score	0.51	***
<b>Final assessment</b>		
RPAB total score with Barthel ADL total score - nurses	0.35	***
RPAB total score with Barthel ADL total score - OT	0.42	***
RPAB total score with Edmans ADL total score - nurses	0.42	***
RPAB total score with Edmans ADL total score - OT	0.51	***

RPAB, Rivermead Perceptual Assessment Battery.

\*\*\*  $p < 0.001$ .

once between treatment groups in the proportion that improved or did not improve (chi-squared = 0.22,  $p > 0.05$ ). Details concerning the differences between the improvers and the nonimprovers are to be published in a later paper.

#### Relationship between perceptual total and functional total scores

It is important to the rehabilitation of stroke patients to know whether the presence of perceptual problems has any effect on functional performance. Therefore, to identify the relationship between perceptual and functional abilities, Spearman rank correlation coefficients were calculated between the RPAB total scores and the Barthel ADL Index and Edmans ADL Index total scores on initial and final assessments for all patients ( $n = 80$ ).

These indicated a highly significant relationship between perceptual and ADL abilities on both initial and final assessments. Details are shown in Table 7.

#### Discussion

The results from this study showed that there was no significant difference between the transfer of training approach and functional approach in the effectiveness of treating perceptual problems following stroke or the generalization of this treatment to everyday activities. These results therefore support the findings of the studies previously mentioned<sup>24,25,27,30</sup> which found that the transfer of training approach did not improve

perceptual ability any more than conventional therapy.

As previously mentioned, it has been shown that perceptual problems affect the patients' response to rehabilitation. This current study also showed a highly significant correlation between perceptual and functional abilities, which although correlation does not imply cause, suggests that maybe it is not possible to treat one without affecting the other, i.e. treatment of perceptual problems may affect functional ability and treatment of functional difficulties may affect perceptual ability.

The choice of strategies used in treatment may have been a reason for this lack of difference between the two treatment approaches. The basic strategies used in treatment were similar for both groups. This included strategies such as

#### Clinical messages

- No significant difference was found in the amount of improvement in perceptual ability after six weeks treatment following either the transfer of training or functional approach.
- Patients following either approach improved in both perceptual and functional abilities.
- Perceptual improvement may be due to the treatment strategies used, spontaneous recovery or the effects of being on a stroke unit.

progressing from simple to complex tasks; staging components of each task; the choice of instructions, cues or prompts; and the use of demonstration, imitation, gesture, repetition, reinforcement, mental stimulation and a systematic method. It may be that the choice of the strategies used in treatment has more effect than the approaches to treatment. In other words, it may be more important to decide how treatment is to be given rather than what treatment is to be given.

Another reason could be either that there is no difference between the two approaches or that there were insufficient subjects in each group to show a difference. Maybe a difference would have been found between treatment approaches if larger numbers of patients had been included.

The significant improvement in perceptual scores achieved by patients in either treatment group may have been because the treatments were effective in treating these problems. It could also have been due to differences in scoring by the different assessors, i.e. between the ward OT, research OT and independent assessor. However, inter-rater reliability studies on the scoring between the ward OT and research OT, and between the ward OT and independent assessor, prior to the start of the study showed there was good inter-rater reliability on all subtests of the RPAB. Inter-rater differences in scoring were therefore not responsible for the apparent improvement in scores.

Another aspect that may have affected the assessment of patients is that the RPAB may not be sufficiently sensitive to detect minor changes in ability and thus to identify differences between the improvements in the two treatment groups. This should not be the case as the test-retest reliability in the original RPAB studies as described in the RPAB manual,<sup>8</sup> was high.

Another factor that may affect the assessment of patients and the apparent improvement over the six weeks is spontaneous recovery. Motor and functional recovery is generally considered to be greatest during the first three months after a stroke. However, it is uncertain whether spontaneous recovery affects perceptual ability in the same way. The current study showed that patients achieved a significant improvement in both perceptual and functional abilities over the

six weeks. These patients ranged from 14 to 84 days post stroke, i.e. 2-12 weeks, suggesting that they may be at a stage to achieve maximum spontaneous recovery.

The apparent improvement that patients made in perceptual ability in the current study may have been due to other treatments or general multidisciplinary treatment. A major limitation of this study was that it was carried out on a specialist stroke unit. On the Nottingham Stroke Unit, staff of all disciplines and grades had previously been taught what perceptual problems were, how to recognize them and how to adapt their treatment and care of these patients according to the perceptual problems identified. Consequently, the Nottingham Stroke Unit staff of all disciplines and grades had a heightened awareness of perceptual problems and their treatment, resulting in staff adapting their treatment accordingly.

This intensive multidisciplinary treatment received by patients whilst on the Stroke Unit made it more difficult to show the effectiveness of only one aspect of a patients' treatment. In hindsight, it may have been better to carry out this study on a different ward where staff had less knowledge of perceptual problems or when the patients were outpatients and therefore receiving less rehabilitation.

Ethical approval had been given to carry out this study to compare the two treatment approaches. However, prior to this study, perceptual treatment was normally offered to patients on this Stroke Unit. It was therefore considered unethical to withdraw this treatment to permit a control group to be studied. The monitoring of a control group would have provided information for comparison with the treatment groups.

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