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Bobath or Motor Relearning Programme? A comparison of two different approaches of physiotherapy in stroke rehabilitation: a randomized controlled study

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Objective: To examine whether two different physiotherapy regimes caused any differences in outcome in rehabilitation after acute stroke.
Design: A double-blind study of patients with acute first-ever stroke. Sixty-one patients were consecutively included, block randomized into two groups, and stratified according to gender and hemiplegic site. Group 1 (33 patients) and group 2 (28 patients) had physiotherapy according to Motor Relearning Programme (MRP) and Bobath, respectively. The supplemental treatment did not differ in the two groups.
Main outcome measures: The Motor Assessment Scale (MAS), the Sødring Motor Evaluation Scale (SMES), the Barthel ADL Index and the Nottingham Health Profile (NHP) were used. The following parameters were also registered: length of stay in the hospital, use of assistive devices for mobility, and the patient's accommodation after discharge from the hospital.
Results: Patients treated according to MRP stayed fewer days in hospital than those treated according to Bobath (mean 21 days versus 34 days, $p = 0.008$). Both groups improved in MAS and SMES, but the improvement in motor function was significantly better in the MRP group. The two groups improved in Barthel ADL Index without significant differences between the groups. However, women treated by MRP improved more in ADL than women treated by Bobath. There were no differences between the groups in the life quality test (NHP), use of assistive devices or accommodation after discharge from the hospital.
Conclusion: The present study indicates that physiotherapy treatment using the MRP is preferable to that using the Bobath programme in the acute rehabilitation of stroke patients.

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Introduction

Physiotherapy in the rehabilitation of stroke patients is represented by various approaches, e.g. Proprioceptive Neuromuscular Facilitation, Brunnstrøm, Bobath and the Motor Relearning Programme. There is a general opinion that physiotherapy improves the function of stroke patients but the benefits seem to be statistically small and limited.[1–3] There are, however, very few controlled studies on this subject and there is no documentation showing that one of the above-mentioned physiotherapy approaches gives better results than the others.[4] The aim of the present study was to compare the effects of two of these methods in early post-stroke treatment. The two approaches chosen were Bobath and Motor Relearning Programme. The Bobath concept represents a theoretical framework in a reflex-hierarchical theory, while Motor Relearning Programme is based in system theory, and is basically task oriented.[5] The patients in this study received strictly one of these two physiotherapy methods during early rehabilitation, while all other aspects of the treatment programmeme were kept alike for all patients. We wanted to determine whether changes in motor function, activities of daily living (ADL) and subjective assessment of life quality were different in the two groups. In addition, we also recorded the length of stay in hospital, the use of equipment for mobility and the home situation after stroke rehabilitation to see whether they were influenced by the two physiotherapy regimes. A power calculation was made in advance of the study, to calculate the appropriate sample size.

Materials and methods

One hundred and eighty-five stroke patients, according to WHO's criteria,[6] attended the hospital during the period October 1996 till August 1997. Of these, 61 patients were consecutively included in the study: 36 men and 25 women (Figure 1). Criteria for inclusion were first-ever stroke with hemiparesis verified clinically and by computerized tomography (CT). Exclusion criteria were more than one stroke incident, subarachnoid bleeding, tumours of the brain, other severe medical conditions in combination with stroke, or five or more points on each of the scores in the Motor Assessment Scale (MAS).

The patients were randomized into two groups and stratified according to gender and hemisphere site. Figure 2 shows the included patients randomized and stratified. Mean age of the patients was 78 years (range 49–95 years, SD 9), with no significant difference between the two groups. Marital status was also similar (15 patients married/cohabitants in the Bobath group versus 17 patients in the MRP group). The study was double blind, and the code was sealed until

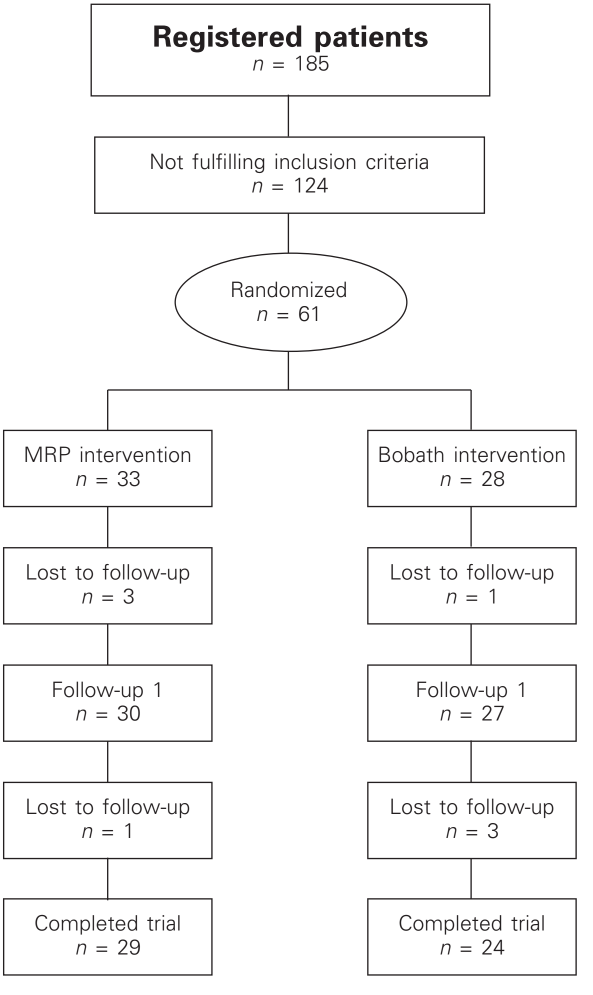

Figure 1 Flow diagram showing the patients participating in the study and drop-outs.

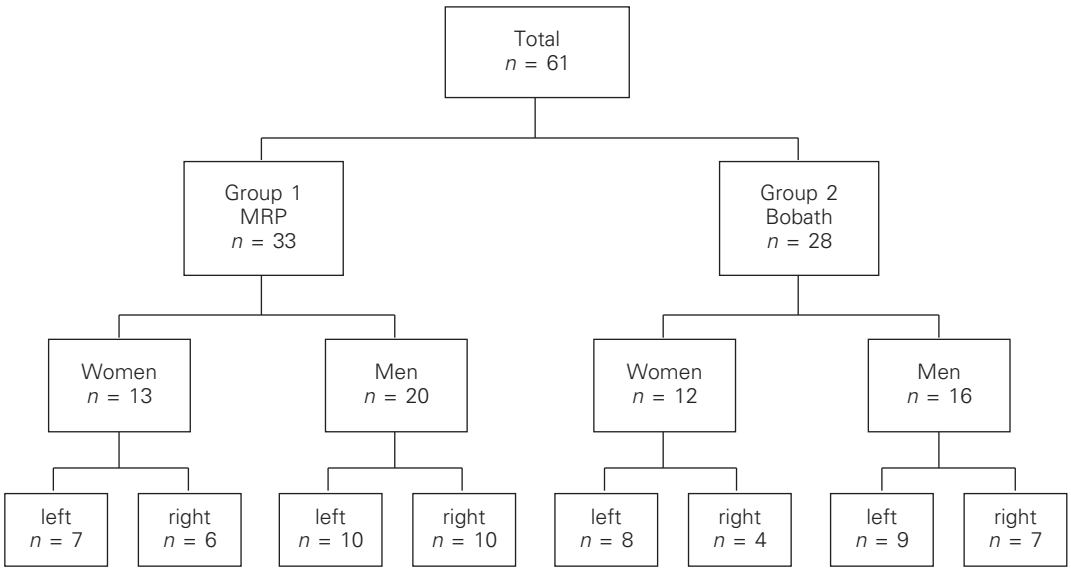

Figure 2 Patients included in the study and randomized into two groups, stratified according to gender and hemisphere lesion.

the last test was performed at three months follow-up. Information concerning the physiotherapy used was known only by the therapists who treated the patients and the secretary of the ward, who was in charge of the randomization.

The two physiotherapy programmes were standardized as follows; a manual describing the main philosophy behind the two physiotherapy methods was produced according to background literature.[7,8] Workshops were organized with stroke patients not included in the study, and physiotherapists, in order to coordinate treatment according to the Bobath and MRP manuals. These treatments were discussed among the physiotherapists and the project leader in order to coordinate and as far as possible identify treatment variables in a 'Bobath respectively MRP manner' and as described in the manuals true to the background literature. This procedure was continued throughout the project period, in order to keep the methods up to date. The patients included in the study were given physiotherapy five days weekly with a minimum of 40 minutes duration as long as they were hospitalized.[1] Besides physiotherapy the patients received the same comprehensive, multidisciplinary treatment for stroke patients from doctors, nurses, occupational therapists and speech therapists according to recommendations for stroke units in Norway.[9] After discharge, the patients received physiotherapy in their homes, at rehabilitation centres in the community or in private outpatient departments. The aim was that every patient should continue the same type of physiotherapy that he or she had received during the hospital stay. Thus, individual treatment programmes and instructions were sent from the physiotherapist in the hospital to the patient's physiotherapist outside the hospital. All physiotherapists involved were invited to meetings in the hospital where the purpose of the study, design and methods were presented and discussed. There were also several informal meetings between the project leader and the local physiotherapists as a follow-up of these meetings. Some patients, however, did not receive any follow-up physiotherapy. These patients were considered independent in daily life activities and had minor physical problems at discharge. Patients with major physical problems who were totally dependent on personal care in their daily life activities after several weeks in hospital were transferred to nursing homes, and because of staff shortages few of these patients had further physiotherapy.

The patients were tested three times: (1) three days after admission to the hospital, (2) two weeks thereafter, and (3) three months post stroke. The tests were conducted by the project leader who had no information about which group the patient belonged to. The tests used were Motor Assessment Scale (MAS) (all times),[10–12] Sødring Motor Evaluation Scale (SMES), (all times),[13–15] Barthel ADL Index[16–18] (first and third time) and Nottingham Health Profile (NHP) (only third time).[19–21] All tests are tested for reliability and validity.

MAS is a test of motor function. MAS registers eight functional activities: turning in bed, sitting, standing up, walking, balance in sitting, activities of the upper arm, the wrist and the hand. Each item is scaled from 0 to 6. Hence scores range between 0 and 48 (normal function). MAS is supposed to test on a disability level according to the WHO criteria.[6]

SMES is a test of motor function after stroke. The main difference between SMES and MAS is that SMES only assesses the unassisted performance of the patient. The scoring reflects a combination of the quality and the quantity of the movements. At the lower score levels, the ratings reflect whether or not the movement can be carried out (against or not against gravity), whereas at the higher score levels the degree of motor control (the qualitative aspect) is emphasized. The instrument has 32 items which distribute on three subscales, measuring leg function (SMES 1), arm function (SMES 2) and functions concerning trunk, balance and gait (SMES 3). The arm and leg subscores should be considered as measures of impairment, whereas the trunk/balance/gait subscores are close to disability.

Barthel ADL Index is a test of primary activities of daily living (P-ADL). The index was developed to monitor functional independence before and after treatment, and to indicate the amount of nursing care needed. The index includes 10 activities of daily life: feeding, transferring from wheelchair to bed and back, personal hygiene, getting on and off toilet, bathing, walking on level surface/propelling wheelchair, ascending and descending stairs, dressing, controlling bowels, controlling bladder. The items are weighted differently. The scores reflect the amount of time and assistance required by a client. A score of 0 (complete dependence), 5, 10 or 15 is assigned to each level, for a total score of 100 (normal function).

NHP is a life quality test which is structured as a questionnaire with yes or no answers and divided into two parts. The questionnaire is designed to measure social and personal consequences of disability. NHP 1 contains 38 yes/no statements on energy, pain, emotional reactions, sleep, social isolation, and physical mobility. NHP 2 contains seven yes/no statements on problems concerning paid employment, housework, family life, sex life, social life, hobbies and holidays. The ratings on each component are weighted to give a score from 0 to 100; higher scores indicate greater problems.

In addition, the length of stay in hospital, the use of assistive devices for mobility and the destination after discharge were registered.

The results were analysed in a SPSS programme with Student's *t*-test for evaluation of group differences. Group differences between test 1 and test 2 were also tested by comparing test 2 minus test 1 differences. ANOVA for repeated measurements, with Bonferroni correction was used to assess changes in motor and ADL function from test 1 to test 3 between the groups. Differences between results in groups of men and women, length of stay in the hospital, destination after discharge, use of assistive devices and NHP were tested using the Mann–Whitney nonparametric test.

The study was acknowledged by the Regional Committee of Medical Research Ethics of Norway, and all patients participated voluntarily, signing a written agreement after being informed orally and in written form about the intentions of the study.

Results

There were a few drop-outs during the study mainly due to death or because patients moved to another community (Figure 1). There were no significant differences in MAS, SMES or Barthel ADL Index between the two groups in the acute stage (Tables 1–3). Both groups improved in MAS and SMES from the first to the third test. However, the MRP group improved more than

Table 1 MAS scores (mean and range) at the three tests

	Test 1 Mean/median	Test 2 Mean/median	Test 3 Mean/median	Test 1 versus test 2, *p*-value Student´s *t*-test	Test 1 versus test 3, *p*-value Student's *t*-test
Group 1 – MRP	24/29	32/40	37/42	0.0001	0.0001
Range	0–41	3–47	7–48		
SD	14	15	12		
Group 2 – Bobath	19/20	23/25	33/39	0.0001	0.0001
Range	0–42	0–46	2–48		
SD	15	16	15		
Group 1/group 2, *p*-value Student´s *t*-test	0.44	0.05	0.31		
Group1/group 2, Repeated measurements[a]		$p = 0.016$			

[a]Corresponds to group and testing session interaction, i.e time between tests 1 and 2 (2 weeks) and time between tests 2 and 3 (3 months).

the Bobath group both in MAS and SMES part 2, while SMES parts 1 and 3 showed the same improvement in the two groups (Tables 1 and 2). This finding was statistically significant both by using Student's *t*-test between absolute values and with repeated measurements; also when comparing differences between tests. When comparing test 2 minus test 1 differences a tendency towards difference was found in MAS ($p = 0.06$) and SMES part 2 ($p = 0.078$), but no difference was found between test 2 and 3 when using this method. Both groups showed significant improvement in Barthel ADL Index from the acute stage to three months follow-up (Table 3). No significant difference was recorded between the two groups in total score. There was, however, a significant difference in favour of the MRP group in the part scores concerning bladder and bowel function, and also in independence in toilet situations at three months (Table 3). The same significant differences in Barthel subscores were also found when comparing test 3 minus test 1 differences.

The length of stay in the hospital was significantly shorter in the MRP group compared with the Bobath group (21 versus 34 days, $p = 0.008$). Fifty-two per cent of the patients in the MRP-group were discharged to their homes, versus 46% of the Bobath group (NS). Wheelchairs were used by 36% in the Bobath group versus 24% in the MRP group (NS). NHP 1 tested three months post stroke showed no significant differences between the two groups (Table 4). There was, however, a significant difference between men and women in both groups, indicating better subjective life quality in men (Table 4). NHP 2 showed median value 52 (range 14–69) in group 1 and median value 58 (range 21–67) in group 2 (NS).

Discussion

The number of patients included in this study can be considered representative of the acute stroke population in the area of Asker and Bærum. It was a time-consuming process to enrol patients who fulfilled the inclusion criteria: first-time ever-stroke and no complicating other diseases, especially since a large group of patients admitted during this time had suffered from a previous stroke. A sample of 61 patients must, in this perspective, be considered to be relatively large and sufficient to draw conclusions, especially since a power calculation made in advance of the study indicated a minimum of 55 patients. The average age of the patients in this study was relatively high, at 78 years. However, this high average age

was relatively representative of the mean age of all patients with acute stroke who were admitted to the same hospital during 1997 ($n = 359$), namely 74 years.

The main findings in the present study were that patients treated with physiotherapy according to MRP had a shorter stay in hospital and improved more in motor function than patients treated according to the Bobath concept. In addition, the results indicated that women treated with MRP improved more in ADL than women treated with Bobath. Thus, this study indicates that physiotherapy treatment according to MRP is preferable to Bobath in the rehabilitation of stroke patients. The Bobath group was slightly more dependent at entry, a finding that could explain a poorer outcome in this group. However, the statistical analysis showed no statistical

Table 2 SMES score (mean, median, range and standard deviation) at the three tests. Sumscores in SMES parts 1, 2 and 3 are given

	Test 1 Mean/median	Test 2 Mean/median	Test 3 Mean/median	Test 1 versus test 2, *p*-value Student's *t*-test	Test 1 versus test 3, *p*-value Student's *t*-test
SMES part 1 sumscore					
Group 1 – MRP	12/13	15/16	17/20	0.0001	0.0001
Range	4–20	4–25	5–25		
SD	5	6	5		
Group 2 – Bobath	11/12	14/16	16/19	0.0001	0.003
Range	4–20	4–20	4–20		
SD	5	6	6		
Group 1 versus group 2, *p*-value	0.52	0.43	0.42		
Repeated measurements[a]		$p = 0.21$			
SMES part 2 sumscore					
Group 1 – MRP	47/51	58/65	65/76	0.0001	0.001
Range	16–77	16–80	16–80		
SD	19	23	21		
Group 2 – Bobath	39/35	48/51	58/65	0.0001	0.003
Range	16–86	16–80	18–80		
SD	23	24	23		
Group 1 versus group 2, *p*-values Student`s *t*-test	0.16	0.08	0.27		
Repeated measurements[a]		$p = 0.018$			
SMES part 3 sumscore					
Group 1 – MRP	20/19	32/37	41/44	0.0001	0.0001
Range	3–53	3–60	3–60		
SD	16	20	18		
Group 2 – Bobath	18/15	30/32	39/48	0.0001	0.0001
Range	0–60	0–60	0–60		
SD	18	21	21		
Group 1 versus group 2, *p*-values Student`s *t*-test	0.65	0.64	0.79		
Repeated measurements[a]		$p = 0.51$			

[a]Corresponds to group and testing interaction, i.e. time between tests 1 and 2 (2 weeks) and time between tests 2 and 3 (3 months).

Table 3 Barthel ADL Index score (mean and range) in the acute phase (test 1), and at three months follow-up (test 3)

	Test 1 Mean/median	Test 3 Mean/median	Test 1 versus test 3, *p*-value/Student's *t*-test	
Group 1 – MRP	56/60	83/95	0.0001	
Range	0–100	5–100		
SD	28	25		
Group 2 – Bobath	46/55	72/88	0.0001	
Range	0–100	0–100		
SD	36	34		
Group 1 versus group 2, *p*-value	0.32	0.20		
Repeated measurements *p*-values	Total scores 0.19	Bowel 0.01[a]	Bladder 0.004[a]	Toilet 0.02[a]

[a]Corresponds to group and testing interaction tests 1–3 (3.5 months).

Table 4 NHP 1 mean values (SD) and levels of significances between the groups and according to gender

	Group 1 (n = 29)	SD	Group 2 (n = 24)	SD	*p*-value	Women n = 23	SD	Men (n = 30)	SD	*p*-value
Energy	19	(33)	15	(30)	0.6	26	(39)	10	(23)	0.1
Sleep	26	(25)	30	(35)	0.7	42	(30)	17	(25)	0.001
Emotions	18	(23)	17	(19)	0.9	25	(23)	11	(17)	0.01
Mobility	37	(34)	44	(36)	0.5	58	(30)	26	(31)	0.0006
Pain	12	(19)	17	(27)	0.4	20	(27)	10	(19)	0.1
Social life	21	(24)	22	(23)	0.9	32	(22)	14	(21)	0.0007
Total	22	(18)	24	(21)	0.7	33	(21)	15	(17)	0.0003

difference between the groups in motor function tests MAS, SMES or Barthel ADL Index at arrival.

Patients in both groups showed significant improvement in both MAS and SMES, as expected during rehabilitation after stroke.[2,22] The difference between the two groups in favour of the MRP group, however, indicates that different physiotherapy approaches have an impact on the results of the early rehabilitation of stroke patients (Tables 2 and 3). The difference in motor function between the two groups seemed to even out between the second and third tests. The explanation may be that the treatment regime after the hospital stay were more or less similar in both groups, as most patients were discharged to their homes and tried to perform 'normal activities' during this period of time. An alternative hypothesis could be that the MRP is not more effective, but simply that it is effective more rapidly, than the Bobath. Under this hypothesis, the treatment regime would not influence the final status of the patient, but may modify the time-course of recovery. This would be in accordance with the shorter hospitalization duration found with the MRP.

Clinical messages

- This study indicates that physiotherapy with task-oriented strategies, represented by the Motor Relearning Programme (MRP), is preferable to physiotherapy with facilitation/inhibition strategies, such as the Bobath programme, in the rehabilitation of acute stroke patients of a significant age.
- The study verifies that patients who suffer from first-time-ever stroke improve significantly in motor function and activities of daily living during a comprehensive rehabilitation programme, including regular physiotherapy.

The improvement according to the Barthel ADL Index showed a small tendency in favour of the MRP group, with improved function from the first to the third test in both groups, but with a difference when bladder and bowel function were considered (Table 4). In the first test no differences between the two groups were found in any of the part scores. When repeated measurements were performed there was a significant difference in bowel, bladder and independence in the toilet situation in favour of the MRP group. A reasonable explanation for these differences could be the difference in physiotherapy approach. The patients in the MRP group were mobilized earlier on in the rehabilitation and kept active to a greater extent than patients in the Bobath group. We have speculated that this active approach using MRP may also have influenced the muscles of the pelvic floor and stimulated the sphincter function in a positive way, similar to the physiotherapy approach in spinal cord injuries.[23, 24]

The NHP profile did not reveal any differences between the two groups (Table 4). Both groups experienced reduced quality of life, as measured by the NHP test.[25, 26] Male patients scored better than female patients in NHP. A similar gender difference in subjective assessment of life quality has also been noted in other studies.[27] However, no connection between life quality and physiotherapy treatment was found in the present study, or in other studies.

In conclusion, this study indicates that physiotherapy with task-oriented strategies, represented by MRP, is preferable to physiotherapy with facilitation/inhibition strategies, such as the Bobath programme, in the rehabilitation of acute stroke patients. This is the first study including stroke patients of a significant age that presents significant results in favour of a particular physiotherapy regime, and should give inspiration to further, similar controlled clinical studies within physiotherapy.

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