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Comparing the Effect of Bobath Therapy and Motor Relearning Programme on Upper Limb Function in Patients with Cerebrovascular Accident: A Randomized Controlled Trial

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Abstract
Background: Upper limb dysfunction after cerebrovascular accident (CVA) restricts reaching, grasping, manipulation and independence in activities of daily living. Bobath Therapy emphasizes postural alignment, selective movement and sensory-motor facilitation, whereas the Motor Relearning Programme (MRP) emphasizes task analysis, repeated practice and transfer of learning. Methods: A prospective randomized controlled trial included 40 medically stable patients aged 50-75 years with first-ever unilateral CVA and upper limb motor deficit. Participants were allocated to Bobath Therapy (n=20) or MRP (n=20). Both groups received 12 supervised sessions over four weeks, approximately 60 minutes per session. Outcomes were Fugl-Meyer Assessment for Upper Limb (FMA-UL), Wolf Motor Function Test (WMFT), Modified Ashworth Scale (MAS) and Barthel Index. Paired t-tests assessed within-group change; independent t-tests, chi-square tests and one-way ANOVA were used as appropriate. Results: Both groups improved significantly after intervention. FMA-UL improvement was 16.96 ± 3.99 in the Bobath group and 14.22 ± 3.91 in the MRP group (p=0.035). WMFT improvement was 1.88 ± 0.32 versus 1.53 ± 0.43 (p=0.006), MAS reduction was 1.00 ± 0.33 versus 0.73 ± 0.37 (p=0.020), and Barthel Index improvement was 26.71 ± 5.54 versus 19.74 ± 5.79 (p<0.001). Conclusion: Both Bobath Therapy and MRP were effective for short-term upper limb rehabilitation after CVA, but Bobath Therapy produced greater improvement in motor control, functional performance, spasticity reduction and functional independence in this sample.

Keywords: Bobath Therapy; Motor Relearning Programme; cerebrovascular accident; stroke rehabilitation; upper limb; FMA-UL; WMFT; Modified Ashworth Scale

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1. Introduction

Stroke, or cerebrovascular accident, remains a major cause of death and long-term disability worldwide, and its rehabilitation burden continues to increase as survival improves. In India, stroke contributes substantially to mortality and disability-adjusted life years, with vascular risk factors and regional differences shaping the burden of disease. [1,2] Among stroke survivors, upper limb dysfunction is particularly disabling because the affected arm and hand are required for feeding, dressing, grooming, writing, carrying, reaching and manipulation. Recovery is often variable and incomplete, especially when voluntary control, sensation, coordination and dexterity are impaired. [3]

Contemporary stroke rehabilitation is grounded in neuroplasticity and motor learning. Repeated, meaningful and appropriately challenging activity can promote reorganization of motor networks and improve functional performance. Current rehabilitation recommendations therefore emphasize active, task-specific and patient-centered practice rather than passive treatment alone. [4,12] However, therapists still use different treatment frameworks to organize clinical reasoning, and the relative emphasis on movement quality versus task completion can influence the way upper limb practice is delivered.

The Bobath concept, also known as Neuro-Developmental Treatment, is widely used in neurological physiotherapy. Contemporary Bobath practice is described as an individualized clinical-reasoning approach that uses movement analysis, postural control, alignment, sensory-motor facilitation and therapist handling to enable more efficient active movement. [5,6] In upper limb rehabilitation, this may include preparation of the trunk and scapula, reduction of excessive effort or abnormal synergy, facilitation of selective movement, and progression into functional reaching and grasping. Evidence regarding its superiority has been heterogeneous, but the approach remains clinically relevant. [5,20]

The Motor Relearning Programme is a task-oriented approach derived from movement science and motor learning principles. It organizes treatment around analysis of a functional task, practice of missing components, practice of the whole task and transfer of learning to daily activity. [7,22] MRP places substantial responsibility on the patient to practice actively, recognize errors, use feedback and repeat meaningful tasks. Recent evidence supports task-oriented practice for post-stroke upper limb rehabilitation, including conventional and remotely delivered programmes. [7,10,11]

Direct comparison of Bobath Therapy and MRP is clinically important because each approach emphasizes a different but potentially complementary component of recovery. A recent comparative randomized trial reported significant improvement with both approaches and greater gains in FMA-UL and WMFT with Bobath Therapy.[8] At the same time, earlier comparative studies have reported differing results depending on stroke stage, intervention content and outcomes assessed.[17-19] The present study therefore compared Bobath Therapy and MRP under an equal treatment dose, focusing on upper limb motor impairment, functional task performance, spasticity and independence. The objective was to determine whether either approach produced greater short-term improvement in patients with CVA.

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2. Materials and Methods

2.1 Study design and participants

A prospective randomized controlled trial with two parallel intervention groups was conducted in a physiotherapy outpatient and neurological rehabilitation setting. Forty participants with CVA were recruited through purposive sampling after eligibility screening and were then allocated by simple random allocation to Bobath Therapy (n=20) or Motor Relearning Programme (n=20). The total study period was six months, while each participant completed a four-week intervention programme.

Eligible participants were 50-75 years of age, male or female, medically stable, had a first-ever unilateral CVA with upper limb motor deficit, were able to participate in approximately one hour of physiotherapy, and could understand simple verbal commands. Exclusion criteria were recurrent stroke, severe cognitive impairment, global aphasia preventing participation, severe neglect affecting safe training, other neurological disorders such as Parkinsonism or multiple sclerosis, severe upper limb orthopedic deformity or fixed contracture, unstable cardiac or respiratory conditions, and unwillingness to participate.

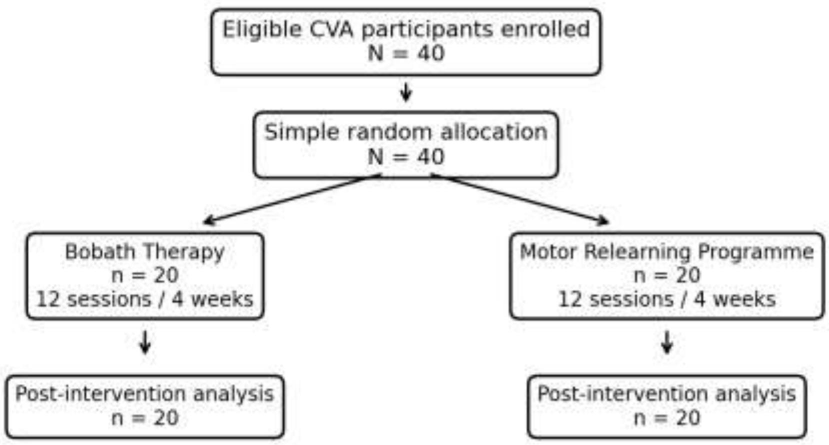

Figure 1. Participant allocation and four-week intervention schedule

2.2 Interventions

Both groups received 12 supervised physiotherapy sessions over four weeks; each session lasted approximately 60 minutes. Equal treatment duration and frequency were maintained so that between-group differences would primarily reflect therapeutic approach rather than treatment exposure. Standard materials included a treatment plinth, pillows, therapy ball, cones, cups, bottles, towels, sponge, small blocks, pegs, light weighted objects and everyday functional objects.

Bobath Therapy Group A: treatment emphasized postural alignment, trunk and scapular preparation, proximal stability, facilitation of selective upper limb movement, reduction of abnormal synergy and guided functional activity. Therapist handling through key points of control was used to help participants experience more efficient movement. Functional activities included reaching, grasping, releasing, placing objects and controlled weight-bearing through the affected upper limb.

Motor Relearning Programme Group B: Treatment followed the four-step motor relearning sequence of task analysis, practice of missing components, practice of the whole task and transfer of learning to daily activities. Participants practiced reaching for a cup, lifting and placing objects, opening containers, manipulating towels and using the affected hand in simple self-care tasks. Feedback and repetition were used to reinforce motor learning. Participants in both groups were also advised to use the affected upper limb safely during daily activity, with caregivers encouraged to support active participation without forcing painful movement.

Group A: Quadruped position focusing on weight improve bearing through the affected upper limb.

Group B: Lifting and placing objects to improve Upper limb function.

2.3 Outcome measures

The Fugl-Meyer Assessment for Upper Limb (FMA-UL) was used to quantify upper limb motor impairment and recovery pattern; it assesses voluntary movement, synergy and coordination and is widely used in post-stroke research.[15] The Wolf Motor Function Test (WMFT) was used to evaluate functional upper limb performance.[16] The Modified Ashworth Scale (MAS) assessed resistance to passive movement as a clinical measure related to spasticity.[14] The Barthel Index was included as a secondary measure of functional independence in activities of daily living.

2.4 Statistical analysis

Continuous variables were summarized as mean ± standard deviation and categorical variables as frequency and percentage. Paired t-tests were used for within-group pre- and post-intervention comparisons. Independent-samples t-tests were used for between-group comparisons of continuous variables. Chi-square tests were used for categorical variables. One-way ANOVA assessed FMA-UL improvement across categories of duration after CVA. Statistical significance was set at $p<0.05$.

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3. Results

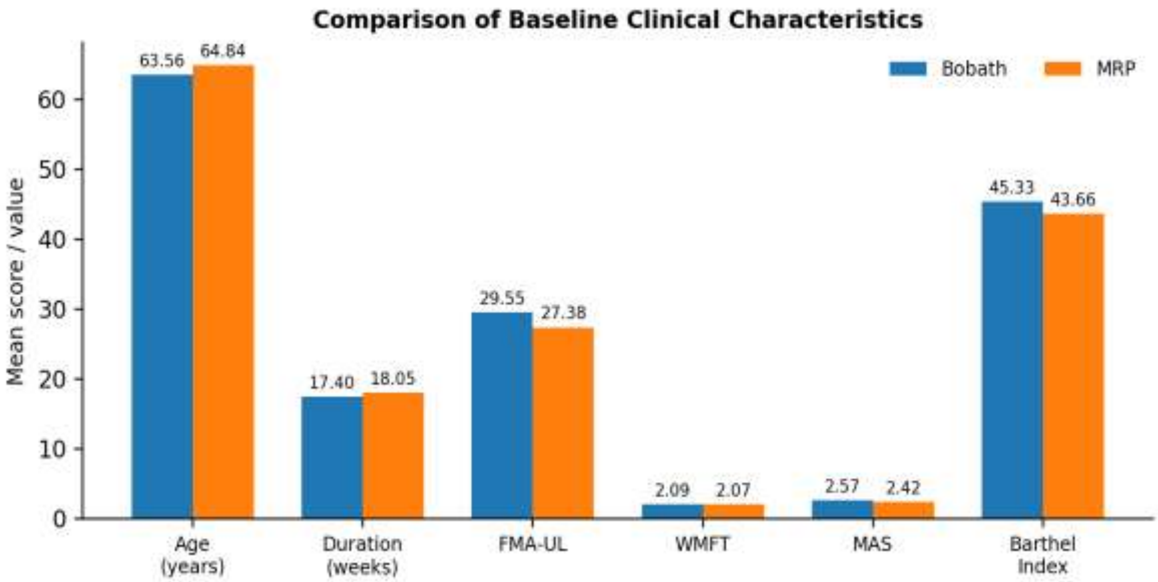
3.1 Baseline characteristics

The two groups were comparable at baseline. Mean age was 63.56 ± 6.94 years in the Bobath group and 64.84 ± 6.93 years in the MRP group (p=0.564). Duration since stroke was 17.40 ± 9.20 and 18.05 ± 9.85 weeks, respectively (p=0.828). Gender distribution, side of lesion and baseline FMA-UL, WMFT, MAS and Barthel Index scores also showed no statistically significant between-group differences.

Table 1. Baseline demographic and clinical characteristics

Characteristic	Bobath (n=20)	MRP (n=20)	p-value
Age, years	63.56 ± 6.94	64.84 ± 6.93	0.564
Duration since stroke, weeks	17.40 ± 9.20	18.05 ± 9.85	0.828
Male, n (%)	11 (55.0%)	12 (60.0%)	1.000
Right hemisphere lesion, n (%)	10 (50.0%)	9 (45.0%)	1.000
FMA-UL score	29.55 ± 5.53	27.38 ± 5.25	0.211
WMFT score	2.09 ± 0.38	2.07 ± 0.49	0.883
MAS score	2.57 ± 0.45	2.42 ± 0.49	0.327
Barthel Index	45.33 ± 6.66	43.66 ± 6.63	0.431

Values are mean ± SD unless otherwise stated. Continuous variables were compared by independent t-test; categorical variables by chi-square test.



Graph 1. Comparison of baseline clinical characteristics between Bobath and MRP groups

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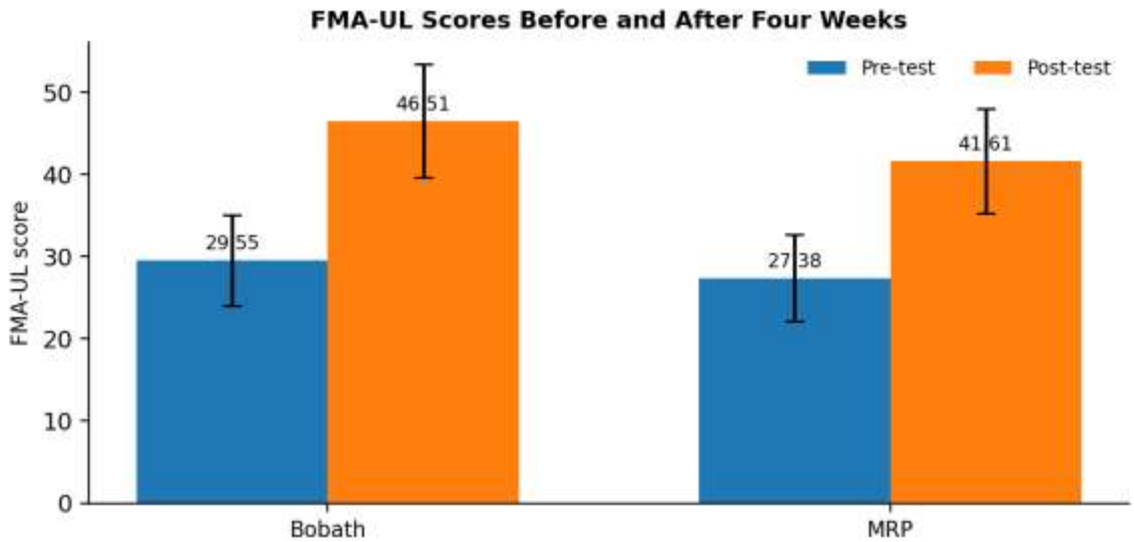
3.2 Primary outcome: FMA-UL

Both groups demonstrated marked improvement in FMA-UL over four weeks. The Bobath group increased from 29.55 ± 5.53 to 46.51 ± 6.88, a mean improvement of 16.96 ± 3.99 (paired t=-19.01, p<0.001). The MRP group increased from 27.38 ± 5.25 to 41.61 ± 6.36, a mean improvement of 14.22 ± 3.91 (paired t=-16.28, p<0.001). The between-group comparison of improvement favored Bobath Therapy (t=2.19, p=0.035).

Table 2. Within-group change in upper limb outcomes after four weeks

Outcome	Group	Pre-test mean ± SD	Post-test mean ± SD	Mean change ± SD	Paired t	p-value
FMA-UL	Bobath	29.55 ± 5.53	46.51 ± 6.88	16.96 ± 3.99	-19.01	<0.001
FMA-UL	MRP	27.38 ± 5.25	41.61 ± 6.36	14.22 ± 3.91	-16.28	<0.001
WMFT	Bobath	2.09 ± 0.38	3.97 ± 0.50	1.88 ± 0.32	-26.25	<0.001
WMFT	MRP	2.07 ± 0.49	3.60 ± 0.70	1.53 ± 0.43	-16.00	<0.001
MAS	Bobath	2.57 ± 0.45	1.57 ± 0.56	1.00 ± 0.33 reduction	13.43	<0.001
MAS	MRP	2.42 ± 0.49	1.69 ± 0.66	0.73 ± 0.37 reduction	8.92	<0.001



Graph 2. FMA-UL pre- and post-intervention scores in Bobath and MRP groups.

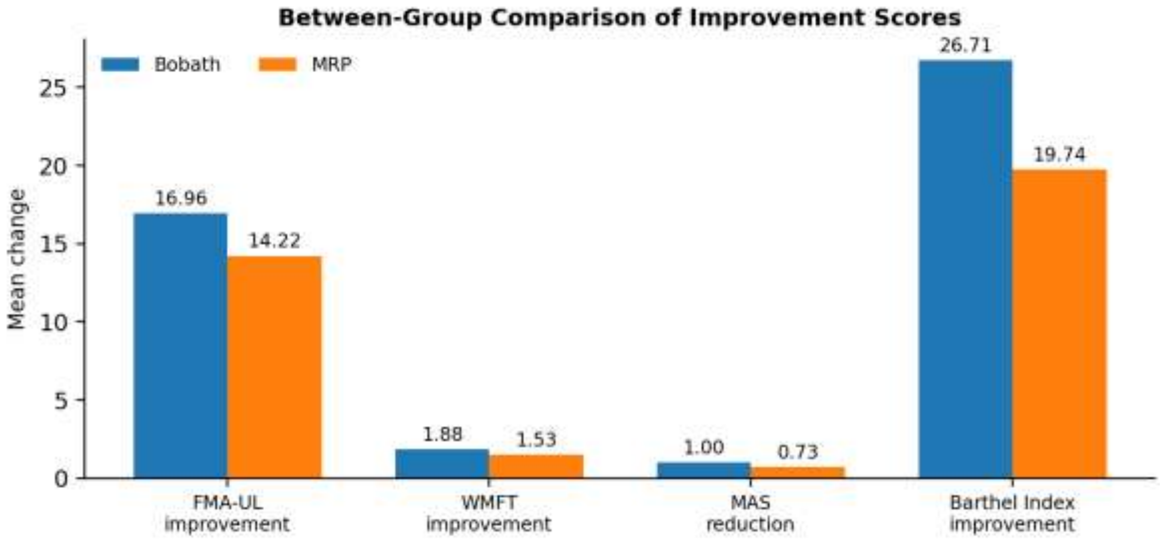
3.3 Secondary outcomes and between-group improvement

WMFT scores improved significantly in both groups, with a larger mean gain in the Bobath group (1.88 ± 0.32 vs 1.53 ± 0.43; p=0.006). MAS scores decreased significantly within both groups, and the reduction was greater with Bobath Therapy (1.00 ± 0.33 vs 0.73 ± 0.37;

p=0.020). Functional independence also favored Bobath Therapy: Barthel Index improvement was 26.71 ± 5.54 compared with 19.74 ± 5.79 in the MRP group (p<0.001).

Table 3. Between-group comparison of improvement scores

Improvement variable	Bobath group	MRP group	t value	p-value
FMA-UL improvement	16.96 ± 3.99	14.22 ± 3.91	2.19	0.035
WMFT improvement	1.88 ± 0.32	1.53 ± 0.43	2.89	0.006
MAS reduction	1.00 ± 0.33	0.73 ± 0.37	2.44	0.020
Barthel Index improvement	26.71 ± 5.54	19.74 ± 5.79	3.89	<0.001



Graph 3. Between-group comparison of mean improvement scores.

Categorical FMA-UL recovery showed a clinically favorable pattern for Bobath Therapy: 65.0% of participants achieved high recovery (≥16-point improvement) compared with 35.0% in the MRP group. The categorical difference did not reach conventional statistical significance (χ^2=5.33, p=0.070). FMA-UL improvement also did not differ significantly across duration-after-CVA categories of 4-12 weeks, 13-24 weeks and 25-52 weeks (ANOVA F=0.82, p=0.447). These findings suggest that the treatment effect observed in this sample was not explained solely by time since CVA.

4. Discussion

The present randomized controlled trial found that both Bobath Therapy and the Motor Relearning Programme produced statistically significant short-term improvement in upper limb outcomes after CVA. FMA-UL, WMFT and functional independence improved in both groups, while MAS scores decreased. The principal comparative finding was that Bobath Therapy produced greater improvement than MRP across FMA-UL, WMFT, MAS reduction and Barthel Index change. Because the treatment dose was kept equal, the observed difference is consistent with a stronger short-term effect of the Bobath-focused intervention in this sample. The FMA-UL result is important because this measure reflects impairment-level motor recovery rather than simple task completion. A larger FMA-UL gain can indicate better selective voluntary control and reduced dependence on abnormal synergy. Contemporary descriptions of Bobath emphasize individualized movement analysis, postural control, sensory-motor facilitation and therapist-patient interaction rather than passive handling alone.[5,6] These elements may be particularly relevant when poor trunk or scapular organization restricts efficient reaching and hand use. The present findings are also consistent with the 2025 comparative trial reported by Rashid et al., in which both groups improved but Bobath produced greater FMA-UL and WMFT gains.[8]

The WMFT findings provide activity-level support for the motor impairment results. Functional upper limb performance improved significantly in both groups, with greater improvement after Bobath Therapy. This suggests that improvements in alignment, selective control and movement quality were translated into task performance rather than remaining isolated impairment changes. The use of both FMA-UL and WMFT strengthens interpretation because the two instruments represent complementary dimensions of post-stroke recovery.[15,16]

The MRP group nevertheless demonstrated meaningful gains, supporting task-specific motor relearning as an effective rehabilitation strategy. MRP emphasizes active problem-solving, repeated practice, feedback and transfer to daily tasks.[7,22] Recent randomized and task-oriented rehabilitation studies also support the value of structured repetition for upper limb recovery.[10,11] The improvement observed with MRP therefore should not be interpreted as treatment failure; rather, it indicates that active task practice is beneficial but may be enhanced when movement quality and proximal control are adequately prepared.

Spasticity reduction was observed in both groups, with a larger mean reduction in MAS after Bobath Therapy. MAS is a practical clinical measure but represents only one aspect of post-stroke motor dysfunction.[14] A patient may demonstrate improved active control despite persistent tone, or reduced tone without meaningful voluntary recovery. For this reason, the concurrent changes in FMA-UL and WMFT are clinically relevant. The stronger combined improvement with Bobath may reflect the interaction of tone management, postural preparation and active selective movement rather than an isolated antispastic effect.

The Barthel Index findings indicate that upper limb rehabilitation was associated with broader functional independence. Although the Barthel Index is not an upper-limb-specific measure, feeding, grooming, dressing and toileting depend substantially on arm and hand use. The greater improvement observed in the Bobath group therefore supports functional carryover. Broader evidence on occupational and stroke rehabilitation similarly indicates that structured therapy can improve activity-level outcomes and independence.[13,21]

The categorical recovery analysis showed more participants with high FMA-UL improvement in the Bobath group, although the chi-square result was not statistically significant. With only 40 participants, the study may have been underpowered for categorical subgroup comparisons. Likewise, duration after CVA was not significantly associated with FMA-UL improvement in the ANOVA analysis. Recovery after stroke is multifactorial and may also be influenced by baseline severity, sensory deficits, cognition, motivation, lesion characteristics, family support and opportunities for practice. [3,4]

From a clinical perspective, the findings support an integrated rather than dogmatic use of named approaches. A patient with poor postural alignment, abnormal synergy or inadequate scapular control may benefit from Bobath-based preparation and facilitation before high-volume task practice. Once more efficient movement is available, MRP principles can increase repetition, problem-solving and transfer into daily activity. Current guidelines emphasize individualized, active and goal-oriented rehabilitation, which is compatible with combining clinically appropriate components rather than relying on one framework in isolation. [4,12,24,25]

4.1 Strengths and limitations

Strengths of the study include random allocation after recruitment, equal group sizes, comparable baseline characteristics, an equal treatment dose, and the use of multiple validated outcome measures spanning impairment, activity, spasticity and functional independence. The analysis included both within-group and between-group testing and examined whether duration after CVA influenced recovery.

The principal limitations are the modest sample size, the four-week intervention period and the absence of long-term follow-up. The study was conducted in a single rehabilitation setting, which limits generalizability. Assessor blinding was not documented, and the intervention protocols were therapist-dependent, so treatment fidelity may have varied. The study focused on upper limb outcomes and did not evaluate gait, balance, quality of life, real-world arm use or neurophysiological mechanisms. These limitations should be considered when interpreting the superiority observed in the present sample.

4.2 Clinical implications and future research

Bobath Therapy may be particularly useful when selective motor control, postural alignment, proximal stability and abnormal movement patterns are major barriers to upper limb use. MRP remains valuable for patients able to engage in repeated functional task practice and may be used to consolidate gains and improve transfer. Future studies should compare Bobath, MRP and an integrated Bobath-MRP programme in larger multicentre samples, use blinded outcome assessment, include longer follow-up, and add measures such as the Action Research Arm Test, Motor Activity Log, quality of life, patient satisfaction and kinematic analysis.

5. Conclusion

Both Bobath Therapy and the Motor Relearning Programme were effective in improving upper limb function after cerebrovascular accident during a four-week rehabilitation programme. Bobath Therapy produced greater short-term gains in FMA-UL, WMFT, reduction in MAS and Barthel Index improvement in this sample. MRP also produced clinically meaningful improvement through active, task-specific practice. The findings support patient-centered use of both approaches, with Bobath principles potentially used to optimize movement quality and MRP principles used to reinforce task practice and functional carryover.

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