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# EFFECTIVENESS OF THE COMBINED BOBATH CONCEPT AND MOTOR RELEARNING PROGRAM ON MOTOR RECOVERY AND SPASTICITY IN INDIVIDUALS WITH SUBACUTE STROKE: A PRE–POST INTERVENTIONAL STUDY

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*Stroke, Bobath Concept, Motor Relearning Program, Neurorehabilitation, Fugl–Meyer Assessment, Modified Ashworth Scale, Motor Recovery, Spasticity.*

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## Abstract

**Background**

Stroke remains one of the leading causes of long-term disability worldwide and is a major contributor to physical dependence and reduced quality of life. Survivors frequently experience impaired voluntary movement, abnormal muscle tone, postural instability, and difficulty performing functional activities. Physiotherapy plays a central role in restoring motor function through interventions that promote neuroplasticity and functional recovery. Among the numerous rehabilitation approaches available, the Bobath Concept focuses on facilitating normal movement patterns and inhibiting abnormal muscle tone, whereas the Motor Relearning Program emphasizes repetitive, task-oriented practice to restore functional movement. Although both approaches have demonstrated clinical benefits individually, evidence regarding their combined application in individuals with subacute stroke remains limited.

**Objective**

To determine the effectiveness of a combined Bobath Concept and Motor Relearning Program in improving motor recovery and reducing muscle spasticity among individuals with subacute stroke.

**Methods**

A pre–post interventional study was conducted among sixty individuals diagnosed with subacute stroke. Participants received a six-week rehabilitation programme incorporating Bobath-based facilitation techniques together with Motor Relearning Program exercises. Motor recovery was assessed using the Fugl–Meyer Score (FMS), while muscle spasticity was evaluated using the Modified Ashworth Scale (MAS). Pre- and post-intervention outcomes were analysed using the paired *t*-test.

**Results**

Following six weeks of intervention, the mean Fugl–Meyer Score increased significantly from **35.7 ± 6.4** to **44.4 ± 6.2** ($t$=31.1, $p$=0.0001). The mean Modified Ashworth Scale score decreased significantly from **2.4 ± 0.5** to **1.6 ± 0.4** ($t$=17.1, $p$=0.0001), indicating significant improvement in motor recovery and reduction in muscle spasticity.

**Conclusion**

The combined Bobath Concept and Motor Relearning Program significantly improved motor recovery while reducing muscle spasticity among individuals with subacute stroke. The findings support the integration of facilitation techniques and task-specific training as an effective rehabilitation strategy during the subacute stage of stroke recovery.

## Introduction

Stroke is a major global public health concern and remains one of the leading causes of mortality and long-term disability. It is characterised by the sudden onset of neurological deficits resulting from an interruption of cerebral blood flow caused either by vascular occlusion (ischaemic stroke) or rupture of cerebral blood vessels (haemorrhagic stroke). According to the World Health Organization, stroke affects millions of individuals every year and continues to place a substantial burden on healthcare systems, families, and society. Advances in emergency medical management have significantly improved survival rates; however, a large proportion of survivors continue to experience persistent neurological impairments requiring prolonged rehabilitation.

Motor impairment is the most common consequence of stroke, affecting nearly 80% of survivors during the acute stage. Weakness, abnormal muscle tone, impaired postural control, reduced balance, poor coordination, and loss of selective voluntary movement frequently limit independence in daily activities. Muscle spasticity develops in a considerable proportion of patients during the weeks following stroke and contributes to pain, joint stiffness, contractures, reduced range of motion, and difficulty performing functional tasks. These impairments ultimately reduce participation in social and occupational activities and negatively affect overall quality of life.

The subacute phase of stroke, generally extending from one week to six months after onset, represents a critical period for neurological recovery. During this stage, spontaneous biological recovery combines with activity-dependent neuroplasticity, allowing rehabilitation interventions to maximize functional improvement. Repetitive practice, intensive task-oriented exercises, and sensorimotor stimulation during this phase promote cortical reorganization and facilitate restoration of motor function. Consequently, evidence-based physiotherapy interventions implemented during the subacute stage have the potential to produce substantial improvements in functional outcomes.

The Bobath Concept, also known as Neurodevelopmental Treatment (NDT), is among the most widely used neurorehabilitation approaches worldwide. Developed by Berta and Karel Bobath, this concept focuses on analysing abnormal movement patterns and facilitating more efficient movement through therapeutic handling, postural alignment, weight shifting, and sensorimotor facilitation. Rather than prescribing stereotyped exercise programmes, the Bobath Concept emphasises individualised assessment and treatment based on each patient's movement dysfunction. By improving postural control, trunk stability, and movement quality, this approach aims to optimise functional performance and minimise compensatory movement strategies.

Another widely accepted rehabilitation approach is the Motor Relearning Program (MRP), introduced by Carr and Shepherd. Unlike impairment-focused therapies, the Motor Relearning Program emphasises the practice of meaningful functional activities through repetitive, task-specific training. The programme is based on principles of motor learning, encouraging patients to practise real-life tasks repeatedly while receiving appropriate feedback. This approach recognises that recovery of movement depends on active participation, problem-solving, and continuous practice rather than passive movement facilitation alone. Numerous studies have demonstrated that repetitive task-oriented practice enhances motor learning, promotes neuroplasticity, and improves functional independence following stroke.

Although both the Bobath Concept and the Motor Relearning Program have demonstrated favourable clinical outcomes independently, they address different aspects of stroke rehabilitation. The Bobath Concept primarily improves movement quality, postural alignment, and muscle tone regulation, whereas the Motor Relearning Program emphasises functional task performance and motor skill acquisition. Combining these approaches may provide complementary therapeutic benefits by integrating movement facilitation with repetitive functional practice. Such an integrated rehabilitation programme may enhance motor recovery more effectively than either approach alone by simultaneously targeting impairments and functional limitations.

Recent advances in neuroscience have further strengthened the rationale for combining these

rehabilitation approaches. Research has demonstrated that the adult brain retains the ability to reorganise itself following injury through neuroplastic mechanisms. Repetitive, meaningful movement practice stimulates synaptic reorganisation, strengthens surviving neural pathways, and facilitates recruitment of adjacent cortical areas. Rehabilitation strategies that combine sensory facilitation with intensive task-oriented practice are therefore considered particularly effective in promoting motor recovery after stroke.

Despite growing interest in evidence-based neurorehabilitation, relatively few clinical studies have investigated the effectiveness of combining the Bobath Concept and Motor Relearning Program within a single structured rehabilitation protocol. Most published studies have evaluated these interventions separately, making it difficult to determine whether an integrated approach provides additional clinical benefit. Furthermore, limited evidence is available from the Indian rehabilitation setting, where differences in patient demographics, healthcare resources, and rehabilitation delivery may influence treatment outcomes.

Therefore, the present study was undertaken to evaluate the effectiveness of a combined Bobath Concept and Motor Relearning Program in improving motor recovery and reducing muscle spasticity among individuals with subacute stroke. It was hypothesised that the integrated rehabilitation programme would produce significant improvements in Fugl–Meyer Scores while reducing Modified Ashworth Scale scores following six weeks of physiotherapy intervention. The findings of this study are expected to contribute to the growing evidence supporting comprehensive neurorehabilitation strategies and provide clinicians with practical guidance for optimising stroke rehabilitation programmes.

## MATERIALS AND METHODS

### Study Design

The present study was designed as a **pre–post interventional study** to evaluate the effectiveness of a combined Bobath Concept and Motor Relearning Program on motor recovery and muscle spasticity in individuals with subacute stroke. The study compared outcome measures before and after completion of a structured six-week rehabilitation programme.

### Study Setting

The study was conducted in the **Department of Physiotherapy, Pacific College of Physiotherapy, Pacific Medical University, Udaipur, Rajasthan, India**. Participants were recruited from the neurological physiotherapy outpatient and inpatient services after obtaining medical clearance from the treating physician.

### Study Duration

The study was conducted over a period of **six months**, including participant recruitment, baseline assessment, intervention, post-intervention assessment, data analysis, and interpretation of findings.

### Sample Size

A total of **60 participants** diagnosed with subacute stroke were included in the study using a convenient sampling technique. All participants completed the rehabilitation programme and were included in the final analysis.

### Participant Selection

#### Inclusion Criteria

Participants fulfilling all of the following criteria were included:

- Individuals diagnosed with first-ever ischemic or hemorrhagic stroke.
- Age between **41 and 70 years**.
- Stroke duration corresponding to the subacute stage.
- Presence of unilateral motor impairment.
- Mild to moderate muscle spasticity.
- Ability to understand and follow verbal instructions.
- Mini-Mental State Examination (MMSE) score indicating adequate cognition for participation.
- Medically stable and referred for physiotherapy rehabilitation.

#### Exclusion Criteria

Participants were excluded if they had:

- Recurrent stroke.
- Severe cognitive impairment or inability to follow instructions.
- Severe musculoskeletal disorders affecting

mobility.
- Other neurological disorders such as Parkinson's disease, multiple sclerosis, or traumatic brain injury.
- Unstable cardiovascular conditions contraindicating exercise.
- Severe visual or vestibular impairments interfering with rehabilitation.
- Refusal to participate in the study.

**Ethical Considerations**

Ethical approval was obtained from the Institutional Ethics Committee of Pacific Medical University before commencement of the study. The study was conducted according to the ethical principles of the Declaration of Helsinki. All participants were informed about the objectives, procedures, benefits, and possible risks of the study, and written informed consent was obtained before enrolment. Participant confidentiality was maintained throughout the research process.

**Sampling Technique**

Participants meeting the eligibility criteria were recruited using **convenience sampling** until the required sample size of sixty participants was achieved.

**Intervention Protocol**

All participants underwent a **combined Bobath Concept and Motor Relearning Program** administered by a qualified physiotherapist.

Each participant received supervised treatment sessions over **six weeks**. Every treatment session lasted approximately **45–60 minutes**, with sessions conducted **five days per week**.

The rehabilitation programme consisted of two integrated components.

**Bobath Concept**

The Bobath component focused on improving postural control, facilitating normal movement patterns, and reducing abnormal muscle tone through therapist-guided handling techniques. Treatment included:

- Postural alignment training
- Trunk control exercises
- Weight-bearing activities
- Facilitation of selective voluntary movements
- Weight-shifting exercises
- Normalisation of muscle tone
- Functional reaching activities
- Sit-to-stand training
- Standing balance exercises
- Gait facilitation

Therapeutic handling techniques were individually modified according to each participant's motor impairments and functional abilities.

**Motor Relearning Program**

Following Bobath facilitation, participants performed task-specific Motor Relearning Program exercises designed to reinforce functional movement patterns through repetitive practice.

Exercises included:

- Bed mobility training
- Rolling activities
- Sit-to-stand practice
- Standing balance training
- Reaching activities
- Walking practice
- Stair climbing
- Transfer training
- Functional upper-limb activities
- Activities of daily living simulation

Participants received continuous verbal feedback and encouragement to promote motor learning and improve movement quality.

**Outcome Measures**

Outcome assessments were performed **before initiation of treatment** and repeated immediately after completion of the six-week intervention programme by the same physiotherapist.

**Primary Outcome Measure**

**Fugl–Meyer Score (FMS)**

Motor recovery was evaluated using the **Fugl–Meyer Assessment**, one of the most reliable and valid stroke-specific outcome measures. The assessment evaluates voluntary motor control, reflex activity, coordination, and movement synergy. Higher scores indicate better motor recovery.

**Secondary Outcome Measure**

**Modified Ashworth Scale (MAS)**

Muscle spasticity was evaluated using the Modified Ashworth Scale. The scale grades resistance encountered during passive movement of affected muscles, with lower scores indicating

reduced spasticity.

### Cognitive Screening

### Mini-Mental State Examination (MMSE)

Baseline cognitive function was assessed using the Mini-Mental State Examination to ensure that participants possessed adequate cognitive ability to understand instructions and actively participate in the rehabilitation programme. Participants demonstrated a mean MMSE score of **27.7 ± 2.5**, indicating satisfactory cognitive function for inclusion in the study.

### Data Collection Procedure

After obtaining informed consent, demographic information including age, gender, occupation, and area of residence was recorded. Baseline assessments of cognitive function, motor recovery, and muscle spasticity were completed before commencement of treatment.

Participants subsequently underwent the structured combined Bobath Concept and Motor Relearning Program for six weeks. At the end of the intervention period, all outcome measures were reassessed using the same standardized assessment procedures.

### Statistical Analysis

Collected data were entered into Microsoft Excel and analysed using the **Statistical Package for the Social Sciences (SPSS)** software.

Descriptive statistics including frequency, percentage, mean, and standard deviation were calculated for demographic variables and outcome measures.

The normality of the collected data was assessed prior to inferential analysis. Changes in motor recovery and muscle spasticity following intervention were analysed using the **paired Student's *t*-test**. Statistical significance was set at **$p < 0.05$**. Highly significant differences were reported at **$p = 0.0001$**.

## RESULTS

### Participant Characteristics

A total of **60 individuals with subacute stroke** completed the study. All participants successfully completed the six-week rehabilitation programme and were included in the final statistical analysis. The demographic characteristics of the study population are presented below.

### Age Distribution

The participants were equally distributed across three age groups. Twenty participants (33.3%) belonged to the 41–50 years age group, twenty (33.3%) were between 51–60 years, and the remaining twenty (33.3%) were between 61–70 years. This equal distribution ensured balanced representation of different age categories within the study population.

**Table 1. Age Distribution of Participants (n = 60)**

| Age Group (Years) | Number of Participants | Percentage (%) |
|---|---|---|
| 41–50 | 20 | 33.3 |
| 51–60 | 20 | 33.3 |
| 61–70 | 20 | 33.3 |
| **Total** | **60** | **100** |

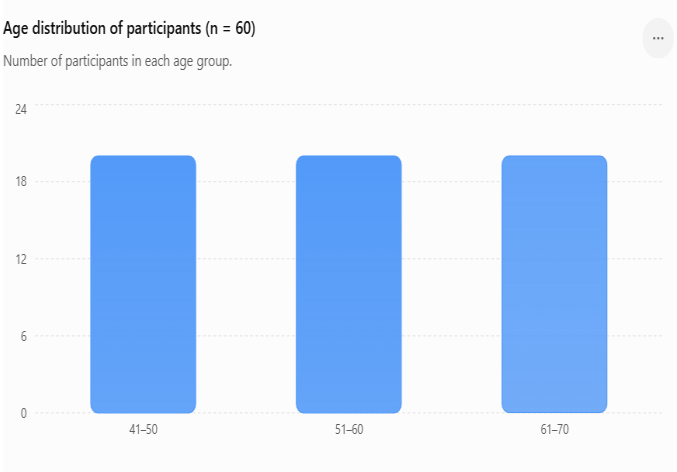



**Figure 1. Age Distribution**
Age distribution of participants (n = 60)
Number of participants in each age group.

### Gender Distribution

Among the 60 participants, **31 (51.6%) were males**, while **29 (48.4%) were females**, indicating a nearly equal gender distribution with a slight predominance of male participants.

**Table 2. Gender Distribution of Participants (n = 60)**

| Gender | Number of Participants | Percentage (%) |
|---|---|---|
| Male | 31 | 51.6 |
| Female | 29 | 48.4 |

| Gender | Number of Participants | Percentage (%) |
|---|---|---|
| **Total** | **60** | **100** |

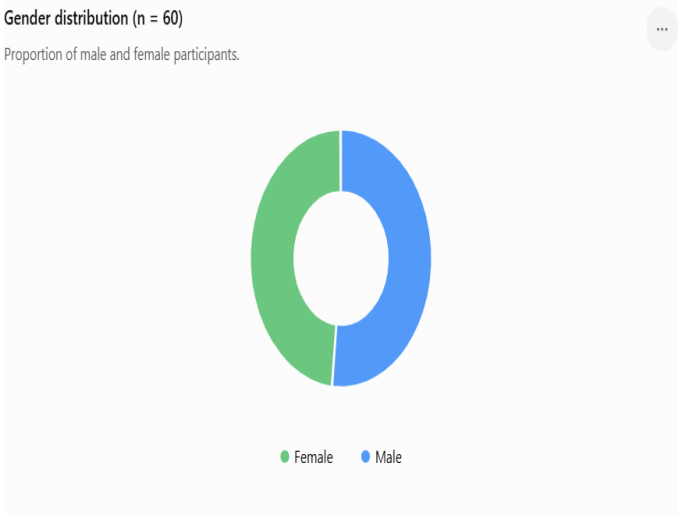



**Figure 2. Gender Distribution**
**Gender distribution (n = 60)**
**Proportion of male and female participants.**
**Female Male**

**Occupational Distribution**

Housewives represented the largest occupational category (**36.6%**). Participants employed in jobs accounted for **15%**, while businessmen, retired individuals, and participants classified as others each represented **13.3%**. Farmers constituted **5%**, and unemployed participants accounted for **3.3%** of the study population.

**Table 3. Occupational Distribution of Participants (n = 60)**

| Occupation | Number | Percentage (%) |
|---|---|---|
| Housewife | 22 | 36.6 |
| Businessman | 8 | 13.3 |
| Unemployed | 2 | 3.3 |
| Retired | 8 | 13.3 |
| Farmer | 3 | 5.0 |
| Job | 9 | 15.0 |
| Others | 8 | 13.3 |
| **Total** | **60** | **100** |

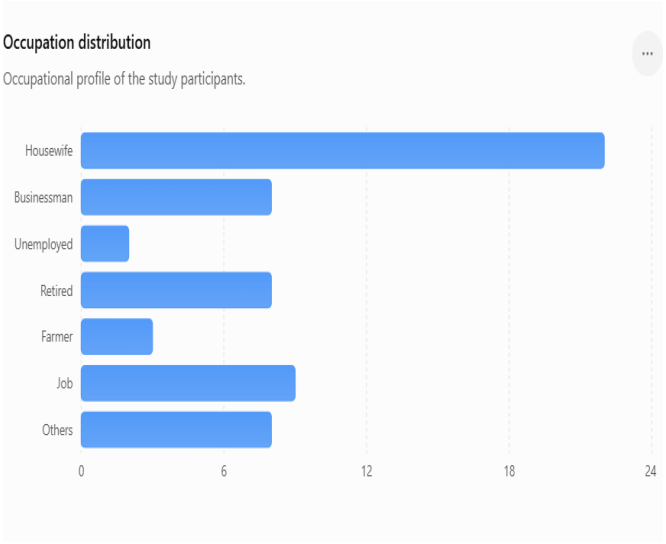



**Figure 3. Occupation Distribution**
Occupation distribution
Occupational profile of the study participants

**Area-wise Distribution**

Equal numbers of participants were recruited from urban and rural areas, with **30 participants (50%)** belonging to each category. This reflects balanced geographical representation within the study sample.

**Table 4. Area-wise Distribution of Participants (n = 60)**

| Area | Number | Percentage (%) |
|---|---|---|
| Urban | 30 | 50 |
| Rural | 30 | 50 |
| **Total** | **60** | **100** |

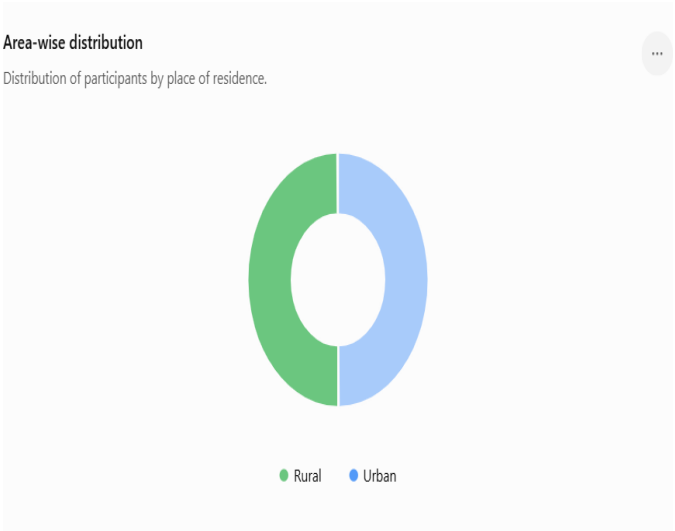



**Figure 4. Area-wise Distribution**

Area-wise distribution
Distribution of participants by place of residence.

**Baseline Cognitive Function**

The baseline Mini-Mental State Examination (MMSE) score was **27.7 ± 2.5**, with scores ranging from **24 to 32**. These findings indicate that participants had adequate cognitive function to understand instructions and actively participate in the rehabilitation programme.

**Table 5. Baseline MMSE Scores (n = 60)**

| Variable | Mean ± SD | Minimum | Maximum |
|---|---|---|---|
| MMSE Score | 27.7 ± 2.5 | 24 | 32 |

**Effect of Intervention on Motor Recovery**

Motor recovery was assessed using the **Fugl–Meyer Score (FMS)** before and after the six-week rehabilitation programme.

The mean pre-intervention FMS was **35.7 ± 6.4**, which increased to **44.4 ± 6.2** following treatment. This improvement represents a substantial enhancement in motor performance after completion of the combined Bobath Concept and Motor Relearning Program.

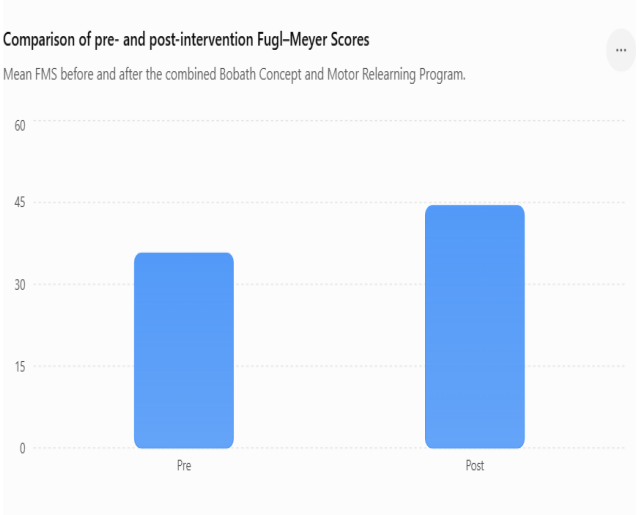



**Figure 5. Fugl–Meyer Score (Pre vs Post)**
Comparison of pre- and post-intervention Fugl–Meyer Scores
Mean FMS before and after the combined Bobath Concept and Motor Relearning Program.

**Table 6. Pre- and Post-intervention Fugl–Meyer Scores (n = 60)**

| Assessment | Mean ± SD |
|---|---|
| Pre-intervention | 35.7 ± 6.4 |
| Post-intervention | 44.4 ± 6.2 |

To determine whether the observed improvement was statistically significant, a paired *t*-test was performed.

The analysis demonstrated a highly significant increase in Fugl–Meyer Scores following intervention (**t = 31.1, p = 0.0001**), confirming that the combined rehabilitation programme significantly improved motor recovery among individuals with subacute stroke.

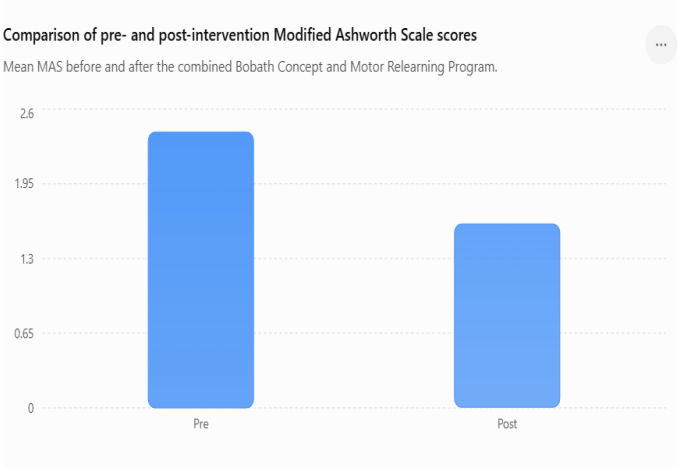



**Figure 6. Modified Ashworth Scale (Pre vs Post)**
Comparison of pre- and post-intervention Modified Ashworth Scale scores
Mean MAS before and after the combined Bobath Concept and Motor Relearning Program.

**Table 7. Comparison of Pre- and Post-intervention Fugl–Meyer Scores**

| Assessment | Mean ± SD | *t*-value | *p*-value |
|---|---|---|---|
| Pre-intervention | 35.7 ± 6.4 | | |
| Post-intervention | 44.4 ± 6.2 | **31.1** | **0.0001*** |

*Statistically significant ($p < 0.05$)

**Effect of Intervention on Muscle Spasticity**

Muscle spasticity was evaluated using the **Modified Ashworth Scale (MAS)**.

The mean pre-treatment MAS score was **2.4 ± 0.5**, which decreased to **1.6 ± 0.4** following six weeks of intervention, indicating a reduction in muscle spasticity.

**Table 8. Pre- and Post-intervention Modified Ashworth Scale Scores (n = 60)**

| Assessment | Mean ± SD |
|---|---|
| Pre-intervention | 2.4 ± 0.5 |
| Post-intervention | 1.6 ± 0.4 |

Statistical analysis using the paired *t*-test demonstrated that the reduction in MAS score was highly significant (**t = 17.1, p = 0.0001**). These findings indicate that the intervention effectively reduced muscle spasticity in participants with subacute stroke.

**Table 9. Comparison of Pre- and Post-intervention Modified Ashworth Scale Scores**

| Assessment | Mean ± SD | *t*-value | *p*-value |
|---|---|---|---|
| Pre-intervention | 2.4 ± 0.5 | | |
| Post-intervention | 1.6 ± 0.4 | **17.1** | **0.0001*** |

*Statistically significant ($p < 0.05$)

**Summary of Findings**

The present study demonstrated statistically significant improvements in both primary outcome measures following six weeks of the combined Bobath Concept and Motor Relearning Program. Motor recovery improved significantly, with the Fugl–Meyer Score increasing from **35.7 ± 6.4** to **44.4 ± 6.2** ($t = 31.1$, $p = 0.0001$). Simultaneously, muscle spasticity was significantly reduced, with Modified Ashworth Scale scores decreasing from **2.4 ± 0.5** to **1.6 ± 0.4** ($t = 17.1$, $p = 0.0001$). These findings support the effectiveness of the combined rehabilitation programme in enhancing motor function while reducing spasticity in individuals with subacute stroke.

## DISCUSSION

The present study evaluated the effectiveness of a combined **Bobath Concept and Motor Relearning Program (MRP)** in improving motor recovery and reducing muscle spasticity among individuals with subacute stroke. Following six weeks of rehabilitation, statistically significant improvements were observed in both primary outcome measures. The mean Fugl–Meyer Score increased from **35.7 ± 6.4** to **44.4 ± 6.2**, while the Modified Ashworth Scale score decreased from **2.4 ± 0.5** to **1.6 ± 0.4**. These findings demonstrate that the combined rehabilitation approach was effective in enhancing voluntary motor control while simultaneously reducing spasticity in individuals with subacute stroke.

Stroke rehabilitation is based on the principle that the central nervous system possesses the capacity for neuroplasticity. During the subacute stage, repetitive, task-specific practice and sensory input stimulate cortical reorganization, promote synaptic strengthening, and facilitate recovery of motor function. The present intervention combined the movement facilitation principles of the Bobath Concept with the functional, repetitive practice emphasized in the Motor Relearning Program. This combination allowed participants to improve movement quality while simultaneously practising meaningful functional tasks, thereby addressing both impairment and activity limitations.

The significant improvement in Fugl–Meyer Scores observed in the present study indicates enhanced voluntary motor control after completion of the intervention. The Fugl–Meyer Assessment is one of the most widely accepted stroke-specific measures of motor recovery and is highly sensitive to changes occurring during neurological rehabilitation. The improvement recorded in this study suggests that integrating facilitation techniques with repetitive task-oriented training enhances motor relearning and functional motor performance.

These findings are consistent with the work of **Carr and Shepherd**, who proposed that recovery following stroke depends largely on repetitive practice of meaningful functional activities rather than passive movement alone. Their Motor Relearning Program encourages patients to actively solve movement problems and repeatedly practise functional tasks, thereby facilitating motor learning and cortical reorganization. The present findings support these principles, as participants demonstrated marked improvements in motor performance after repeated functional training.

The results are also supported by **Veerbeek et al.**, whose systematic review concluded that intensive physiotherapy interventions involving repetitive task practice significantly improve motor recovery following stroke. Their review highlighted that higher treatment intensity and increased task-specific repetitions are associated with superior functional outcomes. The improvement in motor

recovery observed in the present study is consistent with these conclusions and further supports the use of intensive, evidence-based rehabilitation programmes.

Similarly, **Rensink et al.** reported that task-oriented rehabilitation significantly improves mobility, balance, and activities of daily living in individuals recovering from stroke. Their systematic review demonstrated that rehabilitation programmes emphasizing meaningful functional practice consistently produce better clinical outcomes than conventional exercise programmes alone. The present study extends these findings by demonstrating that combining task-oriented training with Bobath facilitation techniques may provide additional clinical benefits.

Reduction in muscle spasticity represented another important finding of the present investigation. The Modified Ashworth Scale score decreased significantly following six weeks of intervention, indicating improvement in muscle tone regulation. Spasticity frequently develops during the subacute phase of stroke because of altered descending inhibitory control, resulting in increased resistance to passive movement and impaired functional performance. The reduction in spasticity observed in the present study may be explained by repeated weight-bearing activities, postural alignment, controlled movement practice, and normalization of movement patterns incorporated within the Bobath Concept.

Therapeutic handling techniques employed during Bobath treatment facilitate normal muscle activation while inhibiting abnormal synergistic movement patterns. When these facilitation techniques are immediately followed by repetitive functional task practice through the Motor Relearning Program, patients are able to reinforce newly acquired movement patterns during purposeful activities. This sequential combination may explain the simultaneous improvements in both motor recovery and muscle tone observed in the present study.

The findings are further supported by **Ada et al.**, who demonstrated that strengthening and active rehabilitation interventions improve motor performance without increasing spasticity. Their work challenged the traditional belief that intensive exercise aggravates abnormal muscle tone and instead showed that appropriately prescribed functional exercise enhances recovery. The reduction in Modified Ashworth Scale scores observed in the present study agrees with these conclusions.

An important strength of the present intervention is that it addressed multiple components of stroke rehabilitation simultaneously. While the Bobath Concept focused on improving postural control, trunk stability, weight transfer, and movement quality, the Motor Relearning Program emphasized repetitive functional activities such as sit-to-stand transfers, gait training, reaching tasks, and balance exercises. This comprehensive rehabilitation strategy likely contributed to the significant improvements observed across the outcome measures.

Despite these encouraging findings, certain limitations should be acknowledged. The study employed a pre–post interventional design without a control group, making it difficult to determine whether the observed improvements were greater than those achieved through conventional rehabilitation or spontaneous neurological recovery. Furthermore, the study was conducted at a single centre with a sample of sixty participants, which may limit the generalizability of the findings. Long-term follow-up was also not performed; therefore, the durability of treatment effects remains uncertain.

Overall, the present study demonstrates that combining the Bobath Concept with the Motor Relearning Program is an effective rehabilitation strategy for individuals with subacute stroke. Significant improvements in motor recovery together with reductions in muscle spasticity suggest that integrating movement facilitation with repetitive task-oriented training may optimize neurological recovery during the period of greatest neuroplastic potential. These findings support the incorporation of combined neurorehabilitation approaches into routine physiotherapy practice for subacute stroke management.

## STRENGTHS OF THE STUDY

The present study possesses several strengths that enhance its clinical relevance and scientific value. First, it investigated the combined effectiveness of the Bobath Concept and the Motor Relearning Program, an approach that has received comparatively limited attention in the existing

literature. By integrating movement facilitation with repetitive task-oriented training, the study addressed both impairment-level deficits and functional motor performance in individuals with subacute stroke.

Second, standardized and widely accepted clinical outcome measures, namely the **Fugl–Meyer Score (FMS)** and the **Modified Ashworth Scale (MAS)**, were used to evaluate treatment outcomes. These assessment tools have established validity and reliability for measuring motor recovery and spasticity in stroke rehabilitation, thereby improving the credibility of the findings.

Third, all participants completed the intervention programme, resulting in complete follow-up and eliminating attrition bias. The six-week structured rehabilitation programme was delivered consistently under physiotherapy supervision, ensuring uniformity of treatment across all participants.

Finally, the study focused on the subacute phase of stroke, a period during which neuroplasticity is highly responsive to rehabilitation interventions. Consequently, the findings provide clinically relevant evidence supporting early physiotherapy intervention to maximize motor recovery and reduce muscle spasticity.

## CLINICAL IMPLICATIONS

The findings of the present study have important implications for neurological physiotherapy practice. The significant improvements observed in motor recovery and reduction in muscle spasticity suggest that integrating the Bobath Concept with the Motor Relearning Program can be considered an effective rehabilitation strategy for individuals with subacute stroke.

The combined intervention enables physiotherapists to address both movement quality and functional performance simultaneously. Bobath-based facilitation techniques assist in improving postural control, trunk stability, and selective voluntary movement, while task-oriented exercises based on the Motor Relearning Program reinforce functional motor patterns through repetitive practice. This integrated approach may facilitate faster recovery of functional abilities and improve patient participation during rehabilitation.

The intervention requires minimal specialised equipment and can be implemented in hospitals, rehabilitation centres, outpatient departments, and community-based rehabilitation settings. Therefore, it represents a practical and cost-effective approach that can be incorporated into routine neurological physiotherapy practice, particularly in resource-limited healthcare settings.

## LIMITATIONS

Although the present study demonstrated significant improvements following intervention, several limitations should be considered while interpreting the findings.

- The study employed a **pre–post interventional design** without a control group, limiting direct comparison with other rehabilitation approaches.
- Participants were recruited using **convenience sampling**, which may introduce selection bias.
- The study was conducted at a **single institution**, thereby limiting the generalizability of the findings to other healthcare settings and populations.
- The intervention period was limited to **six weeks**, and no long-term follow-up was performed to evaluate the sustainability of treatment effects.
- Only motor recovery and muscle spasticity were assessed. Other important outcomes such as balance, gait performance, quality of life, and participation in community activities were not evaluated.

## FUTURE RECOMMENDATIONS

Future studies should employ randomized controlled trial designs with larger sample sizes to compare the combined Bobath Concept and Motor Relearning Program with individual treatment approaches and other evidence-based neurorehabilitation techniques. Multicentre studies involving participants from different geographical regions would improve the external validity of future findings.

Long-term follow-up assessments are recommended to determine whether improvements in motor recovery and spasticity are maintained after completion of supervised rehabilitation. Future research should also evaluate additional outcome measures including gait speed, balance, functional independence, upper-limb dexterity, quality of life, and community participation.

The incorporation of objective assessment tools such as three-dimensional motion analysis,

wearable movement sensors, and electromyography may further improve understanding of the biomechanical and neuromuscular changes associated with combined rehabilitation programmes.

## CONCLUSION

The present study demonstrated that a six-week programme combining the Bobath Concept and the Motor Relearning Program produced significant improvements in motor recovery and reductions in muscle spasticity among individuals with subacute stroke. The mean Fugl–Meyer Score increased significantly from 35.7 ± 6.4 to 44.4 ± 6.2, while the Modified Ashworth Scale score decreased from 2.4 ± 0.5 to 1.6 ± 0.4 following intervention, indicating enhanced voluntary motor function and reduced spasticity.

The findings support the concept that combining movement facilitation techniques with repetitive task-specific training promotes motor relearning and functional recovery during the subacute phase of stroke rehabilitation. This integrated approach addresses both impairment-level deficits and activity limitations, making it a valuable strategy for contemporary neurological physiotherapy practice.

Although further randomized controlled trials with larger sample sizes and longer follow-up periods are required to establish comparative effectiveness, the results of the present study provide encouraging evidence that the combined Bobath Concept and Motor Relearning Program can improve rehabilitation outcomes and should be considered as part of comprehensive stroke rehabilitation programmes.

## ACKNOWLEDGEMENTS

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## ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee of Pacific Medical University, Udaipur, Rajasthan, India, before commencement of the research. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki for research involving human participants.

## INFORMED CONSENT

Written informed consent was obtained from all participants before enrolment. Each participant received a detailed explanation of the study objectives, procedures, potential benefits, and possible risks. Confidentiality of participant information was maintained throughout the study.

## DATA AVAILABILITY STATEMENT

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request.

## ABBREVIATIONS

| Abbreviation | Full Form |
|---|---|
| ADL | Activities of Daily Living |
| CNS | Central Nervous System |
| FMS | Fugl–Meyer Score |
| MAS | Modified Ashworth Scale |
| MMSE | Mini-Mental State Examination |
| MRP | Motor Relearning Program |
| NDT | Neurodevelopmental Treatment |
| ROM | Range of Motion |
| SD | Standard Deviation |
| SPSS | Statistical Package for the Social Sciences |
| WHO | World Health Organization |

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