Research Article

POSTURAL BALANCE AND BOBATH THERAPY IN STROKE REHABILITATION

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Abstract

Strokes have been rated among the commonest causes of morbidity and mortality throughout the world. Strokes occur due to interruption of blood flow to the brain because of obstruction or rupture of the blood vessels supplying blood to the brain, causing damage to the brain tissues. Bobath-Based Neurorehabilitation plays an important role in increasing upper extremity motor control and balance in stroke survivors. Bobath-Based Neurorehabilitation uses integration of trunk stabilization with upper extremities movement, thus giving patients an ability to perform tasks efficiently. Through the integration of coordination, weight shifts, balance reactions and repeated task performance, Bobath therapy is effective in increasing functional independence, reducing disability and participation in ADL. The current study stands out as being the first ever meta-analysis of Bobath therapy effects, making it a valuable addition to the literature. In contrast to previous systematic reviews which were mostly qualitative, the current meta-analysis has quantitative effect sizes for Bobath therapy.

Keywords: Postural, Balance, Bobath , Therapy, Stroke, Rehabilitation

1. Introduction

Neurological disorders refer to diseases or injuries of the nervous system, which affect more than 1 billion people worldwide. Neurorehabilitation is a key tool that can be used to decrease the burden of neurological disorders. However, despite being the most extensively applied method of neurological rehabilitation in the world, the effectiveness of the Bobath approach compared to other treatment options has been disputed. In particular, according to the findings of a systematic review carried out in 2009, out of 16 RCTs examined, Bobath therapy did not prove to be superior to other physical therapies with regard to upper and lower limbs sensorimotor control, dexterity, mobility, activities of daily living, cost-effectiveness, as well as balance. The conclusion made by the authors of the study is that the Bobath concept is not superior to other treatments of stroke. (Lennon S, 1996)

A stroke ranks among the most common causes of mortality and morbidity globally. It is characterized by the obstruction or bleeding of a brain vessel, causing brain tissue injury. Medical interventions in emergencies have led to better survival; yet, many people survive stroke with long-term neurological deficits that impact their physiological, psychological, and social health. This means that stroke rehabilitation has emerged as a critical area of health care, which strives to improve independence and quality of life.

Upper Limb Motor Impairment Following Stroke

Motor dysfunction in the upper limbs is among the most prevalent outcomes following stroke, with almost 70 to 80 percent of cases being affected at the acute stage of the condition. Movement impairments in the form of muscle weakness, stiffness, poor coordination, lack of dexterity, and faulty movement patterns interfere with the ability to carry out tasks like reaching, grasping, dressing, feeding, and writing. (Ploughman M et al., 2004)

Postural Balance and Functional Recovery

Good postural balance is important in ensuring that a person remains stable while sitting, standing, walking, and during other functional activities. Stroke patients normally experience problems with postural balance as a result of muscle weakness, sensory problems, and instability of the trunk. Poor postural balance is a contributory factor to fall risks

among stroke patients. It also hinders the ability of patients to participate in rehabilitation and community activities.

Bobath-Based Neurorehabilitation

Bobath Neurorehabilitation Approach, which is also referred to as Bobath Concept or NDT (Neurodevelopmental Treatment), is a physiotherapy approach that has been largely employed in treating various neurological conditions. The main aspects of this treatment include normalizing movement, correcting posture, improving trunk control, reducing muscle tone, and using of the affected upper limb functionally. This treatment involves use of handling techniques by the physiotherapist, sensory facilitation, and performing of task-oriented activities in order to induce neuroplasticity and normal motor control in the patient. (Howle JM, 2004)

Importance of Bobath Therapy in Stroke Rehabilitation

Neurorehabilitation using the Bobath Approach is highly effective in facilitating the development of upper extremity motor control and posture stability in people who have had a stroke. This approach is based on the coordination of trunk stability with upper extremity movement, which allows stroke survivors to carry out functional activities more successfully. The use of techniques such as movement coordination, weight shift, balance reactions, and task repetition leads to the improvement of functional independence and involvement in activities of daily living.(Raine S, 2006)

Objectives Of The Study

1. To study on Importance of Bobath Therapy in Stroke Rehabilitation
2. To study on Upper Limb Motor Impairment Following Stroke

Research Method

Study design

The research conducted is a meta-analysis and systematic review that summarizes the use of Bobath-based therapy for stroke patients using qualitative and quantitative approaches. The systematic review has been done following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) criteria. The research has been pre-registered at the International Prospective Register of Systematic Reviews (PROSPERO) with reference number CRD42024620356.

Eligibility criteria

The criteria for eligibility were determined using the PICOSD model: Participants [P], Interventions [I], Comparison [C], Outcome [O], and Study Design [SD].

Inclusion Criteria

1) Participants The participants consisted of stroke patients

Intervention

The intervention was Bobath therapy or Bobath-based therapy, including all the subcategories falling under the Bobath Concept.

Comparison

The comparators used in the study were therapies involving task practice, Dynamic Neuromuscular Stabilization (DNS), regular exercise, Proprioceptive Neuromuscular Facilitation (PNF), traditional treatment, or Body Weight Supported Treadmill Training (BWSTT).

Outcome

The outcomes considered in the study involved scales indicating physical function, balance, and gait.

Study Design

The RCTs selected for the study were found in databases and peer-reviewed articles.

Exclusion criteria

Studies that did not contain subcategories associated with the Bobath Concept within RCTs, involved non-human

subjects, were not written in English, presented as conference abstracts, or were published prior to 2011 were considered for exclusion.

Literature-Search strategy

This review contains the articles found independently by two experienced researchers in conducting meta-analysis in November 2024. The search strategy entailed combining terms of P (Participants), I (Intervention), and SD (Study Design) and was based on Medical Subject Headings (MeSH). Keywords like (randomized controlled trial) AND (stroke patients) AND (bobath therapy OR bobath-based OR bobath concept OR neurodevelopment therapy) together with index terms were applied. The literature search was done in the following international electronic databases: Cochrane Central Register of Controlled Trials (CENTRAL), Cumulative Index of Nursing and Allied Health Literature (CINAHL), Excerpta Medica Database (Embase), Medical Literature Analysis and Retrieval System Online (MEDLINE), and Web of Science.

Selection of studies and data extraction

Studies obtained from the aforementioned electronic databases were transferred to Microsoft Excel (Microsoft, Redmond, Washington, USA) to exclude duplicate entries. Based on PRISMA, the titles and abstracts of the articles were screened, followed by review of the entire text of the articles for further analysis. Discrepancies that arose were resolved through consensus from reviewing the whole text of the articles.

Risk of bias assessment

Risk of Bias (RoB) for the selected RCTs was determined through the application of a validated RoB tool developed by the Cochrane Bias Methods Group that considers seven aspects of bias. The RoB assessment was carried out independently by two researchers who assessed each study as having a low (+), high (-) or unclear (?) risk of bias and any disagreement was discussed until a consensus was reached by examining the original articles.

Strategy for Data Synthesis Data synthesis was performed using RevMan 5.4 (The Cochrane Collaboration, England) statistical software package used for conducting systematic reviews. Meta-analysis was done where there were at least three studies providing comparable variables or quantified data from pre-interventional and post-interventional stages of measurement. Effect sizes were computed as standardized mean difference (SMD), and a random-effects model was used. Heterogeneity was estimated using I^2 statistic and Cochran's Chi-squared test, and the values above 75% and below 40% were taken to indicate high and low heterogeneity respectively). Publication bias was tested using RevMan 5.4-generated funnel plots).

Result And Discussion

Literature search and characteristics of the included studies

In total, 63 studies were retrieved from various international online databases. After screening and removing 11 duplicates from Excel, the titles and abstracts of the studies were scrutinized, resulting in the exclusion of 10 studies. The full-text assessment led to the exclusion of 36 studies because of the following reasons: nine studies did not have any data; six were different interventions; 18 had improper study designs; two had improper comparison; and one was excluded because the participants did not fulfill the participant criteria. In total, six RCTs were included in the synthesis process (Figure 1).

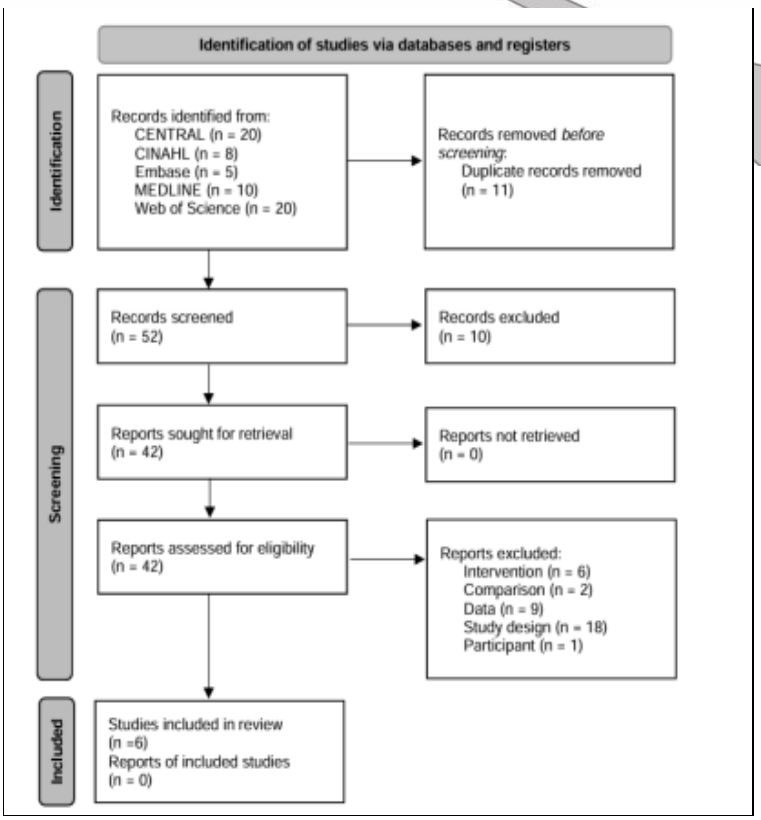

Figure 1. PRISMA diagram

Methodological Quality Assessment

The quality appraisal of the methodology of the included six RCTs revealed complete agreement among the researchers. The results of RoB assessment in seven domains are provided below. Random sequence generation (+: 6), allocation concealment (+: 3, ?: 3), blinding of participants and personnel (-: 6), blinding of outcome assessment (+: 4, ?: 2), incomplete outcome data (+: 6), selective reporting (+: 6), and other bias (-: 2, ?: 4) (Figure 2).

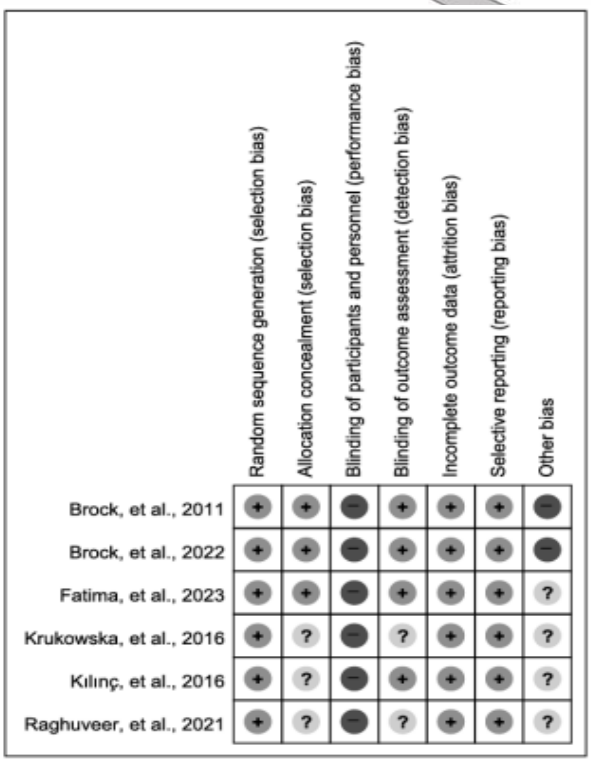

Figure 2. Risk of bias summary.

Bobath Therapy for Stroke Rehabilitation

The six randomized controlled trials analyzed in this systematic review included 246 stroke patients altogether. The intervention groups included Bobath therapy and Bobath therapy approach, both being subsets of the Bobath approach. The length of the treatment period was 2–12 weeks. The outcome measures included assessment scales for balance, gait, and physical function (Table 1).

Table 1. Characteristics of Included Studies

Study (Author, Year)	Sample Size	Therapeutic Intensity	Outcome Measures
Brock et al. (2011)	EG = 12CG = 14	Total duration: 2 weeks. Experimental group (EG) received 1-hour Bobath-based therapy + task practice, 3 sessions/week. Control group (CG) received 1-hour task practice only, 3 sessions/week.	Balance: Berg Balance Scale (BBS)Gait: Gait Velocity
Brock et al. (2022)	EG = 29CG = 24	Total duration: 2 weeks. EG received 1-hour Bobath-based therapy, 3 sessions/week. CG received 1-hour conventional therapy, 3 sessions/week.	Physical Function: Stroke Rehabilitation Assessment of Movement (STREAM)
Fatima et al. (2023)	EG = 23CG = 23	Total duration: 12 weeks. EG received 45-minute Neurodevelopmental Treatment (NDT), 3 sessions/week. CG received 45-minute Body Weight Supported Treadmill Training (BWSTT), 3 sessions/week.	Balance: Berg Balance Scale (BBS)Gait: Functional Gait Assessment (FGA)
Kılınç et al. (2016)	EG = 10CG = 9	Total duration: 12 weeks. EG received 1-hour Bobath-based trunk exercises, 3 sessions/week. CG received 1-hour conventional exercises (stretching,	Balance: Berg Balance Scale (BBS)Gait: 10-Meter Walk Test (10MWT)Physical Function: STREAM

		strengthening, mat activities, and range of motion).	
Krukowska et al. (2016)	EG = 36CG = 36	Total duration: 6 weeks. EG received daily 1-hour NDT-Bobath therapy for 35 sessions. CG received daily 1-hour Proprioceptive Neuromuscular Facilitation (PNF) therapy for the same duration.	Balance: Center of Pressure (COP)
Raghuveer et al. (2021)	EG = 15CG = 15	Total duration: 6 weeks. EG received daily 1-hour Neurodevelopmental Treatment (NDT). CG received daily 1-hour Dynamic Neuromuscular Stabilization (DNS).	Balance: Trunk Impairment Scale (TIS)Gait: 10-Meter Walk Test (10MWT)Physical Function: Modified Rankin Scale (MRS)

Abbreviations: EG = Experimental Group; CG = Control Group; BBS = Berg Balance Scale; STREAM = Stroke Rehabilitation Assessment of Movement; NDT = Neurodevelopmental Treatment; BWSTT = Body Weight Supported Treadmill Training; FGA = Functional Gait Assessment; 10MWT = 10-Meter Walk Test; PNF = Proprioceptive Neuromuscular Facilitation; COP = Center of Pressure; DNS = Dynamic Neuromuscular Stabilization; TIS = Trunk Impairment Scale; MRS = Modified Rankin Scale.

Effects of body awareness therapy on balance

The meta-analysis of six studies measuring the impact of Bobath therapy on balance included a total of 193 subjects (96 in the experimental group and 97 in the control group) (see Figure 3). The pooled SMD was 0.59 (95% CI: 0.04 to 1.15) and showed a moderate positive impact of Bobath therapy on balance when compared to control interventions. The value of I^2 was 69%, which means that there is moderate to high heterogeneity between the included studies. The significance level for the effect was statistically significant (p = 0.04). Among the balance measurements included, COP had been converted through multiplication by -1 to ensure the same directionality as the rest of the outcome measures.

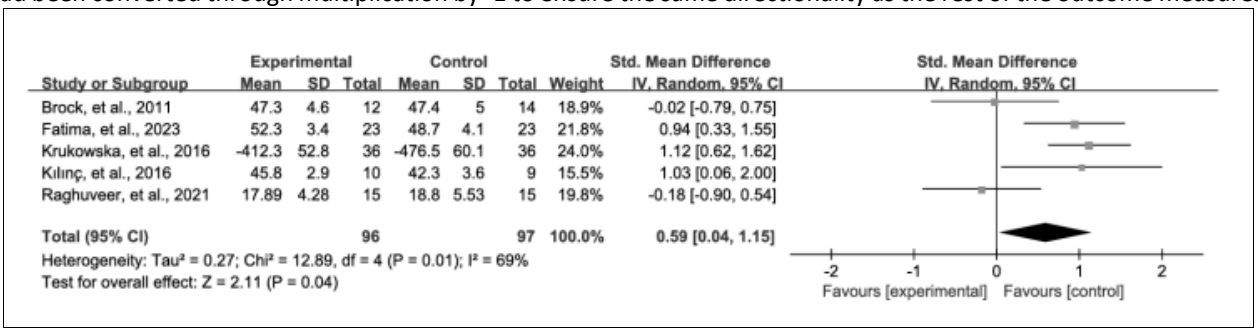

Figure 3. Forest plot on balance

Effects of body awareness therapy on gait performance

In the meta-analysis of four studies investigating the impact of Bobath therapy on gait performance, a total number of 121 participants were analyzed (60 participants in the experimental group and 61 participants in the control group) (Figure 4). SMD was equal to 0.56 (95% CI: 0.02 to 1.11), which means that there is a moderately positive impact of Bobath therapy on gait performance as compared to control intervention. The I^2 statistic was 52%, which means that the variation between the studies included in the analysis is moderate. The total effect is statistically significant (p = 0.04).

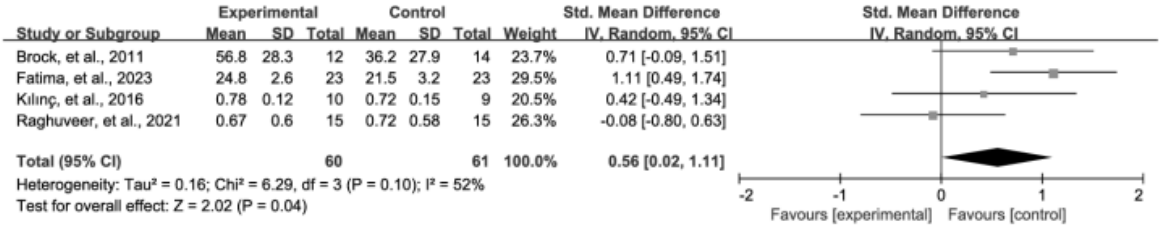

Figure 4. Forest plot on gait performance

Effects of body awareness therapy on physical function

In the meta-analysis of the impact of Bobath therapy on physical function in stroke patients, a total number of 102 subjects were enrolled into the study group (54 in the experimental group and 48 in the control group) (Figure 5). The SMD calculated was 0.52 (95%CI: 0.00 to 1.04). This suggests that there is a small to moderate effect of the intervention in physical function in the patients with stroke compared to the control interventions. I^2 was 36%, which indicates that there is low to moderate variability among the included studies. The overall effect was statistically insignificant at p-value of 0.05. With respect to the physical function measurements, the MRS measure was converted to -1 to make it in line with the other measurements such as STREAM where high values suggest better outcomes.

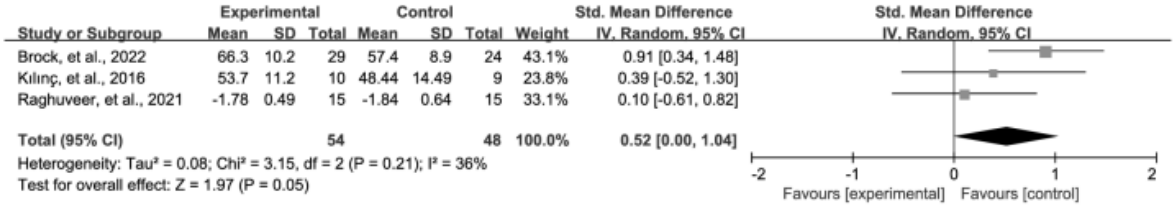

Figure 5. Forest plot on physical function

Publication Bias

Six articles were synthesized for the systematic review and meta-analysis in accordance with the eligibility criteria. Based on Cochrane Reviews, publication bias assessment is not suggested where fewer than 10 studies have been analyzed. Thus, publication bias assessment has not been conducted in this review.

Discussion

The results synthesized in the present review show that Bobath therapy showed moderate effect sizes on balance and gait performance, and small to moderate effect sizes on physical function. In particular, the pooled results revealed that the SMD was 0.59 (95% CI: 0.04 – 1.15) for balance, 0.56 (95% CI: 0.02-1.11) for gait performance, and 0.52 (95% CI: 0.00-1.04) for physical function. This means that Bobath therapy produces notable improvements compared to conventional therapy and other methods of rehabilitation. However, the heterogeneity (I^2) was moderate to high, 69% for balance and 52% for gait performance. Thus, it is possible to assume that the results could be interpreted with consideration of differences in study design and protocol. The results obtained in the course of the current study coincide with mechanistic evidence obtained in the previous studies concerning Bobath therapy. It is important to note that the neurodevelopmental method of Bobath therapy implies normalizing abnormal postures and movements and improving balance control and movement efficiency. These processes are exemplified by the inclusion of evaluation instruments like STREAM and MRS into the study. While STREAM is a tool for evaluating movement and functional independence generally, MRS allows one to examine specific aspects of physical function. Differences in these instruments allow to understand better the complexity of analyzing research results related to physical functions. This study can be called a pioneering meta-analysis, which quantitatively evaluates the effects of Bobath therapy and makes an important addition to the literature. In contrast to earlier systematic reviews, which were based mainly on qualitative evaluations, this study provides quantitative effect sizes, which helps to understand better the clinical efficacy of Bobath therapy. There are some limitations, however, that need to be mentioned. First, a small number of studies involved in this study (less than 10, as recommended by Cochrane) did not allow to assess publication bias. Second, heterogeneity resulted from different study designs and comparator interventions. To overcome these weaknesses, the future research may involve meta-regression analysis in order to identify the reasons of heterogeneity and get more insights about the effect of the therapy on the improvement of balance, gait and physical performance of patients with stroke. In terms of clinical application, the results of this study show that the Bobath therapy is one of the most efficient approaches in the treatment of such patients. Nevertheless, the future research should pay attention to high-quality randomized controlled trials with the use of standardized measures and protocols.

Conclusion

In summary, the results of the current meta-analysis show that there is enough evidence of the moderate effect of Bobath therapy on improving the balance, gait, and physical functioning of stroke patients. The current study addresses some gaps in the literature by pointing out the clinical importance of the use of Bobath therapy as a treatment modality in rehabilitation of stroke patients. However, the presence of heterogeneity and the variability of the methodology in

the selected studies calls for more research.

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