

Efficacy of Trunk Regimes on Balance, Mobility, Physical Function, and Community Reintegration in Chronic Stroke: A Parallel-Group Randomized Trial

Suruliraj Karthikbabu, PT, PhD,* Mahabala Chakrapani, MD,†
Sailakshmi Ganesan, PT, PhD,‡ Ratnavalli Ellajosyula, MD, DM,§ and
John M. Solomon, PT, PhD||

Objective: The study objective was to examine the efficacy of plinth and Swiss ball-based trunk exercise regimes on balance, mobility, physical function, and community reintegration compared with standard physiotherapy in chronic stroke. **Subjects and Methods:** This observer-blinded parallel-group randomized trial was conducted in outpatient stroke units. People with chronic stroke aged between 30 and 75 years, first onset of unilateral cortical lesion, poor trunk performance, 10 m independent walking ability with or without walking aids, and absence of pusher syndrome were included. Trunk Impairment Scale 2.0, Brunel Balance Assessment, Tinetti scale, gait speed, Stroke Impact Scale-16, and Reintegration to Normal Living Index were the measures. Experimental interventions involved the practice of selective upper and lower trunk movements using either plinth or Swiss ball. Control group received standard physiotherapy. All the patients practiced 1 hour exercise session, 3 sessions a week over a duration of 6 weeks and followed up after 3 and 12 months. **Results:** Of 108 patients allocated into 3 groups, baseline characteristics were similar. Postintervention compared with control group, the plinth, and Swiss ball groups showed significant mean changes in the outcome measures: trunk impairment scale 2.0 (3.6;4.1 points), Brunel Balance Assessment (1-level), Tinetti scale (5;5.2 points), gait speed (.06;.08 m/s), Stroke Impact Scale-16 (8.7;7.2 points), and community reintegration (7.6;8.8 points). These improvements were retained during 3-12 months' follow-up. Statistical significant was set at $P < .05$. **Conclusion:** Plinth and Swiss ball-based trunk exercise regimes showed significant improvements in balance, mobility, physical function, and community reintegration in chronic stroke as against standard physiotherapy. **Key Words:** Trunk regime—stroke—balance—mobility—function—community reintegration. © 2018 National Stroke Association. Published by Elsevier Inc. All rights reserved.

From the *Department of Physiotherapy, School of Allied Health Sciences (SOAHS), Manipal University, Manipal Hospital, Bengaluru, India; †Department of Medicine, Kasturba Medical College, Manipal University, Mangalore, Karnataka, India; ‡Department of Physiotherapy, Spastics Society of Tamil Nadu, Chennai, Tamil Nadu, India; §Department of Neurology, Manipal Hospital, Bengaluru, India; and ||Department of Physiotherapy, SOAHS, Manipal University, Manipal, India.

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Address correspondence to Suruliraj Karthikbabu, PT, PhD, Department of Physiotherapy, School Of Allied Health Sciences, A Constituent College of Manipal University, Manipal Hospital, HAL Airport Road, 560017 Bangalore, India. Email: karthikbabu78@gmail.com.

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Introduction

Among the stroke survivors, 26%-35% experienced a serious fall between 6 months and 6 years post-stroke period because of balance dysfunction.¹ Motor deficit of lower extremity and trunk is believed to be one of the commonest impairments that attribute for balance dysfunction in people after stroke. Following stroke, trunk muscle performance is impaired bilaterally.^{2,3} Reduced activity of bilateral trunk muscles was observed by electromyography analysis in stroke.⁴ The major role of trunk muscles is to allow appropriate weight shifts and to control the movement of the trunk against the gravity. Trunk being the fundamental and largest part of the body, proximal trunk stability is essential for distal extremities movement, balance, and daily functioning. A cross-sectional study observed that trunk control is positively related to balance capacity, walking, and functional activities in patients with chronic stroke.⁵ Trunk control was recognized as an important early predictor of functional outcome after stroke.^{6,7}

Trunk exercise regimes involve the selective upper and lower trunk movements in supine and sitting positions using either a stable support or an unstable support. Additional trunk exercises training to standard physiotherapy was beneficial in improving trunk performance in early-stage stroke⁸⁻¹⁰ and also resulted in carry-over effect on functional standing balance, mobility, and walking.⁹ Lateral weight shifts toward the most affected side¹¹ and selective movements of lower trunk¹² are the primary target in stroke rehabilitation, and inclusion of an unstable support in trunk training could be a possible option to achieve this. Swiss ball or physio ball, a dynamic treatment instrument, is believed to enhance the coactivity of trunk muscles as the movement of a ball below the patient demands more muscular activity to maintain the desired posture.¹³ Jung et al¹⁴ proposed weight shift training regime in sitting using unstable support such as balance pad and balance cushion, and they showed improvement in trunk reposition accuracy, trunk performance, and balance capacity in chronic stroke. Also, trunk exercises practiced using physio ball or unstable support demonstrated an improvement in the thickness of trunk muscles, trunk control, and dynamic balance ability than similar exercises performed on a stable support surface in chronic stroke.^{15,16} The major limitations of previously published trunk regimes are that less number of patients participated in these trials, studies lacked control group, and no follow-ups were conducted.

Although the trunk performance influences the balance, walking ability, and daily functioning, no randomized trials with large sample were conducted till date to examine the effects of such training regimes in chronic stroke. The primary objective of the current study was to examine the effects of plinth and Swiss ball-based trunk exercise

regimes to standard physiotherapy on trunk control, that is, dynamic sitting balance and coordination, balance capacity, mobility, physical function, and community reintegration in people with chronic stroke. The secondary objective was to compare the trunk regimes with each other in chronic stroke.

Methods

This observer-blinded parallel-group randomized trial obtained its approval from ethics and research committees of Manipal University and registered in the clinical trial registry of India (CTRI/2017/02/007760). People with minimum of 6 months post-stroke duration were contacted through purposive sampling method. The tester explained the purpose of the study to the stroke volunteers and requested them to provide their consent to participate in the trial. The participants who consented were then screened for study inclusion and exclusion criteria. The study inclusion criteria were as follows: people with unilateral supratentorial stroke lesion aged between 30 and 75 years; first onset of ischemic or hemorrhagic stroke; ability to comprehend and to follow verbal instructions; Brunnstrom recovery stage beyond 3 for lower extremity; patients with poor trunk performance (Trunk Impairment Scale score < 21); and independent walking ability to cross 10 m distance with or without a mobility aid. The study exclusion criteria were as follows: patients with multiple stroke; pusher syndrome; neurologic disorders other than stroke that could potentially affect balance and ambulation; and those who cannot tolerate treatment positions and exercise intensity because of diagnosed musculoskeletal dysfunction of lower extremity or trunk. The included participants were then randomly assigned to receive any of the 3 interventions by block randomization. The process of allocation was concealed in sealed envelopes numbered in sequences.

Outcome Measures

Trunk Impairment Scale 2.0 is a valid and reliable ordinal scale to measure trunk control, that is, dynamic sitting balance and trunk coordination. It evaluates the selective movements of lateral flexion and rotation of trunk initiated from the upper and lower parts of the trunk.^{17,18} Functional balance and mobility were assessed using Brunel Balance Assessment and Tinetti scale, respectively. Brunel Balance Assessment was found to be a reliable and valid measure of balance issues post stroke.^{19,20} The Tinetti scale, a valid and reliable tool, is a measure of balance and gait abilities in patients with stroke.²¹ Gait speed was calculated using 10 m walk test, a valid and reliable tool to measure mobility in stroke.²² Stroke Impact Scale-16, an ordinal scale with good reliability and validity, was used to assess physical functioning. It is a sensitive

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