

## ORIGINAL RESEARCH

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## EFFECTIVENESS OF A NEW BALANCE TRAINING PROGRAM ON ROCKER BOARD IN SITTING IN STROKE SUBJECTS A PILOT STUDY

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## ABSTRACT

**Background:** Stroke has been considered to be the most common cause of neurological disability with very high prevalence rate. The recovery of independence following stroke is a complex process requiring the reacquisition of many skills. Since controlling the body's position in space is essential part of functional skills, restoration of balance is a critical part of the recovery of ability after stroke. Most of the work done regarding balance training in stroke subjects has focused on task-oriented activities and training under varied sensory input and found them to be effective. Studies have also compared the effect of stable and unstable surfaces on balance in stroke subjects and found that balance training on unstable surfaces is more effective in improving static and dynamic balance. There has not been any study till date investigating the effectiveness of balance training program on rocker board which is specific for stroke subjects who have difficulty in standing. Since balance training on rocker board in sitting has proved to be effective in improving balance in subjects with spinal cord injury who have difficulty in standing, there is a need to find out if similar balance training program on rocker board in sitting is also effective for improving balance of stroke subjects.

**Method:** A Pilot study was performed on 10 stroke subjects selected through purposive sampling. Subjects were divided into two groups by randomization as control (CG) and experimental group (EG). EG received balance training on a rocker board along with conventional physiotherapy program. The CG received only conventional physiotherapy program.

**Results:** Post-intervention Berg balance scale score of EG and the CG was statistically significant ( $p < 0.05$ ) in both the groups as compared to pre-treatment depicted through Wilcoxon signed rank analysis within the groups. Greater improvement was observed in the EG compared to the CG post-treatment, analysed through Mann-Whitney U test with statistically significant results ( $p < 0.05$ ).

**Conclusion:** The new balance training program on rocker board in sitting is effective for improving balance of stroke subjects.

**Keywords:** Stroke, Somatosensory integration, Balance training, Rocker board, Reaching

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## Introduction

Stroke is the most common cause of neurological disability in the adult population. It is responsible for about a quarter of all deaths in the developed countries and account for much disability in the elderly. The WHO, defines Stroke as rapidly developing clinical sign of a focal disturbance of cerebral function of presumed vascular origin and of more than 24 hours duration, included within this definition are most cases of cerebral infarction, cerebral hemorrhage and subarachnoid hemorrhage but deliberately excluded are those cases in which recovery occurs within 24 hrs.<sup>1</sup>

In India, during the last decade the age adjusted prevalence rate of stroke was between 250-350/100,000. Hypertension was the most important risk factor.<sup>2</sup> Stroke is the leading cause of adult disability in India and the second leading cause of death worldwide. Stroke occurs more than a decade earlier among Indians affecting the productive period of life (40-60 years).<sup>3</sup>

The recovery of independence following stroke is a complex process requiring the reacquisition of many skills. Since controlling the body's position in space is essential part of functional skills, restoration of balance is a critical part of the recovery of ability after stroke.<sup>4</sup>

An important cause of balance impairment in patients with stroke hemiparesis is a deficit of the central integration of sensory inputs (somatosensory, visual and vestibular). In normal adult subjects, the visual, vestibular and somatosensory systems are all involved in balance control and make up the system of coordinates on which the body's postural control is based.<sup>5</sup> . The somatosensory system provides the CNS with position and motion information about the body with reference to supporting surfaces. Also somatosensory inputs throughout the body report information about the relationship of body segment to one another and hence maintaining balance<sup>6</sup>. Since stroke subjects often present with somatosensory deficits, the adaptation of regular exercises with the use of surface and vision manipulation to challenge balance could improve the process of somatosensory integration and have a positive effect on postural stability.<sup>7</sup>

Studies have shown that 6 weeks of wobble board exercise improves both static (eye closed) and dynamic balance of stroke survivors.<sup>8</sup> Another study comparing balancing exercises on unstable surface and stable surface concluded that exercises on an unstable surface was more effective for improving

balance of stroke patients in which Berg Balance Scale (BBS) score of both groups were increased after 6 weeks indicating improved balance ability.<sup>9</sup> A study done in spinal cord injury patients found that 4 weeks of balance training on a rocker board improved sitting balance as indicated by improved Modified Functional Reach Test score and swaying area.<sup>10</sup>

Most of the work done regarding balance training in stroke subjects has focused on task-oriented activities and training under varied sensory input and found them to be effective. Studies have also compared the effect of stable and unstable surfaces on balance in stroke subjects and found that balance training on unstable surfaces is more effective in improving static and dynamic balance. There has not been any study till date to evaluate the effectiveness of balance training program on rocker board which is specific for stroke subjects who have difficulty in standing. Since balance training on rocker board in sitting has proved to be effective in improving balance in subjects with spinal cord injury who have difficulty in standing,<sup>10</sup> there is a need to find out if similar balance training program on rocker board in sitting is also effective for improving balance of stroke subjects. Objective of the study was to determine the effectiveness of a new balance training program on rocker board in sitting for improving balance of stroke subjects. Hypothesis of the study was; The new balance training program on rocker board in sitting is not effective for improving balance of stroke subjects.

## Methods

A pilot study was conducted among 10 stroke subjects who were enrolled from Padmashree physiotherapy clinic, Nagarbhavi and ESI hospital, rajaji nagar based on the inclusion and exclusion criteria. Informed consent was obtained from the subjects prior to study and proper assessment was done.

### Inclusion criteria:

- 40-60 years of age
- 3-6 months post stroke
- Motor Assessment Scale sitting score of 3
- Both males and females
- No visual deficits
- No sensory deficits

### Exclusion criteria:

- Any cognitive deficits
- Any other neurological deficits as multiple sclerosis, Parkinson's disease etc.
- Any musculoskeletal disorder like osteoarthritis, ligament injury etc.

- Patient undergoing any other balance training protocol simultaneously
- Non-cooperative patients

**Outcome measure:** Berg balance scale (BBS)

**Materials used:**

1. Rocker board
2. Measuring tape
3. Parallel bar

**Exercise protocol:**

The subjects were randomly divided into experimental group (EG) and a control group (CG). EG received balance training on an unstable surface (rocker board) along with conventional physiotherapy program. The CG received only conventional physiotherapy program. Exercise protocol used for the EG was modified from a study done by Kim JH et al (2010).<sup>10</sup> In this, first the subjects sat on a stable surface with their legs straight on the floor. For distance measurements, each subject was seated on a square piece of paper placed on a stable surface with the legs straight. The distance after reaching forward, towards the unaffected side and towards the affected side was separately measured. A bar was placed at 2 cm beyond the subjects' initial maximum reach point in each test. Then, a rocker board was placed on a stable surface. A square piece of paper was placed on the rocker board, and each subject had to sit in the center of the board with their legs straight ensuring that the board did not tilt. While sitting on the rocker board, each subject reached forward, towards the unaffected side and towards the affected side, while trying to reach the bar. Only when the subject could actually touch the bar, it was marked as "task completed". For forward reach, both hands were extended. Each task was performed in sets of 5, consisting of 20 repetitions, with a one minute break between each set. Training was performed one session per day, 5 sessions per week for 2 weeks.<sup>10</sup>

The conventional physiotherapy program for stroke included strengthening and stretching exercises for upper and lower limb. It was in the form of 1-3 sets of 10-15 repetitions in each session, 5 sessions per week for 2 weeks.

Before starting the intervention the subjects were assessed with BBS (Pre-measurement). After 2 weeks of completion of intervention, subjects were again assessed with BBS (Post-measurement) and the data was analyzed.

As this study involved human subjects, the ethical clearance was obtained from the ethical committee

of Padmashree Institute of Physiotherapy, Nagarbhavi, Bangalore as per the ethical guidelines for Biomedical Research on Human subjects, 2001 ICMR, New Delhi.



**Figure 1:** Patient reaching forward



**Figure 2:** Patient reaching towards unaffected side



**Figure 3:** Patient reaching towards affected side

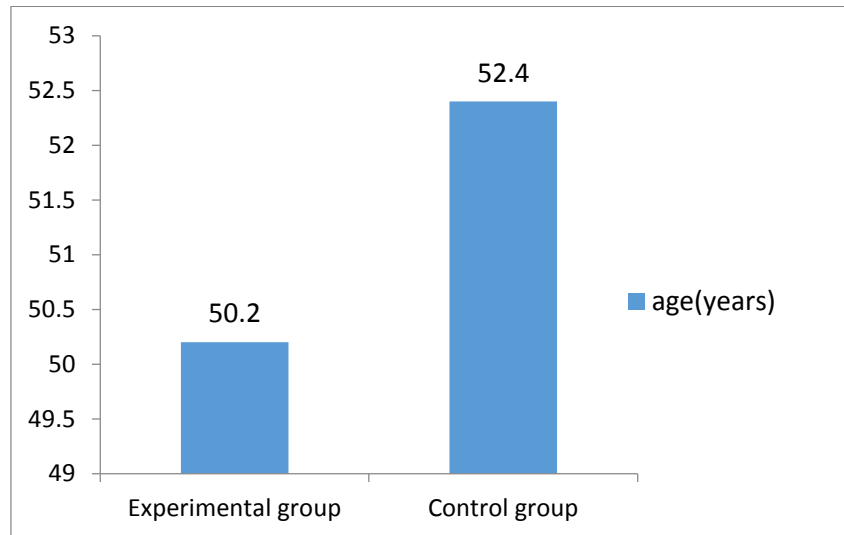
**Data analysis:**

Data analysis was performed using SPSS (version 17) for windows. Alpha value was set as 0.05. Wilcoxon's test was used to compare the improvement within the two groups. Mann-Whitney 'U' test was used to compare the improvement between the two groups.

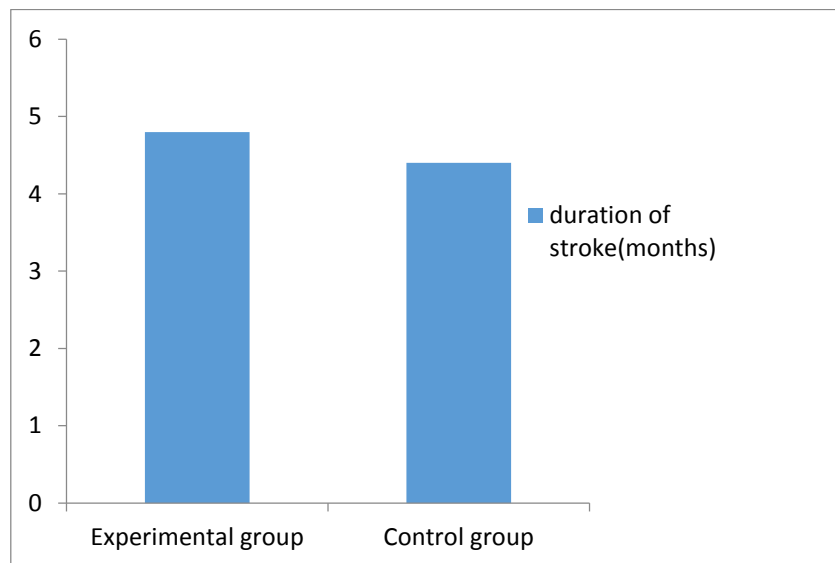
**Results:**

**Table 1:** Baseline variables

Group	Age(years)	Duration of stroke(months)
Experimental group	50.2	4.8
Control group	52.4	4.4



**Graph 1:** Mean age in experimental and control group.



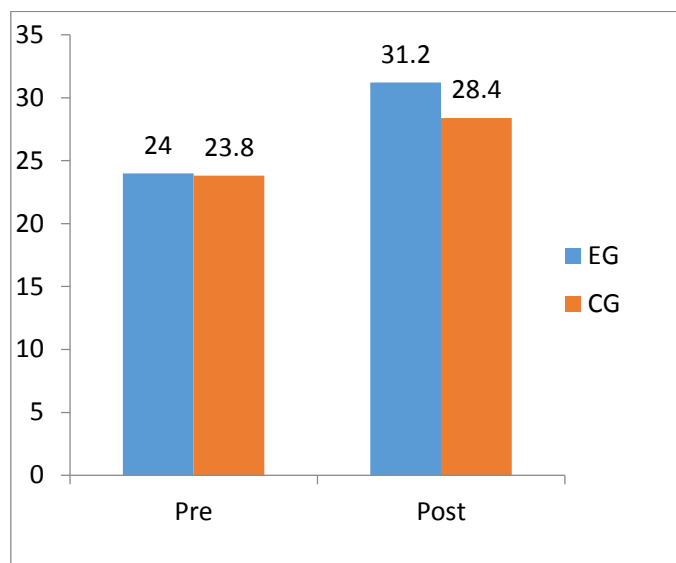
**Graph 2:** Mean duration of stroke in experimental and control group.

**Table 2:** Pre-post difference within the groups for BBS score

Group	Pre	Post	p-value
Experimental group	24±1	31.2±1.303	<0.05
Control group	23.8±0.836	28.4±0.953	<0.05

In the experimental group, the pre BBS score improved from 24 with sd of 1 to post BBS score of 31.2 with sd of 1.303 which was statistically significant(p value<0.05). In the control group, the

pre BBS score improved from 23.8 with sd of 0.836 to post BBS score of 28.4 with sd of 0.953 which was statistically significant(p value< 0.05).



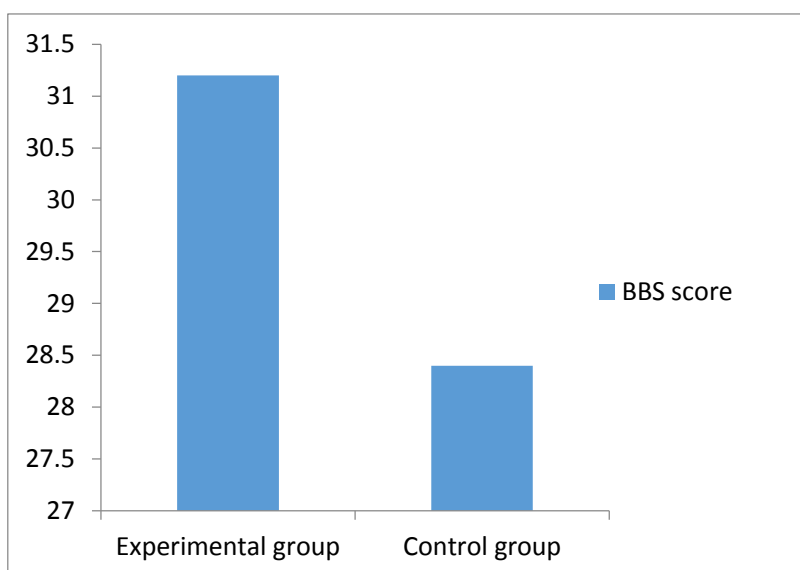
**Graph 3:** Pre post difference within the groups

**Table 3:** Difference between the groups

S.N.	Variable	Experimental group	Control group	p-value
1	BBS	31.2±1.303	28.4±0.953	<0.05

In the experimental group, the post BBS score was 31.2 with sd of 1.303 and in the control group, the

post BBS score was 28.4 with sd of 0.953 which was statistically significant (p value< 0.05).



**Graph 4:** Difference between the groups

**Discussion:**

The main objective of the current study was to check the effectiveness of a new balance training program on rocker board in sitting for improving balance of stroke subjects.

Data analysis revealed that the post BBS score of EG and the CG was statistically significant (p < 0.05) and the improvement was more in the EG compared to

the CG. Kim JH et al(2010) suggested that the improvement is believed to occur mainly due to the development of a compensatory posture strategy and neural plasticity.<sup>10</sup> Bjerkefors et al (2007) suggested that the balance ability improved after training on an unstable surface because the training might increase neuro-transfer through the descending corticospinal pathway to the trunk muscles.<sup>11</sup> Shumway Cook and Wollacott suggested

that an unstable surface increases the external swing which more effectively encourages postural orientation by forcing faster modifications of the sensory system and motor system and also it assists in the postural strategy of self- postural control.<sup>12</sup> Granacher U et al(2007) suggested that balancing exercises on an unstable surface sensitize the muscle spindle through gamma motor neurons, thereby improving motor output which influences the stability of joints.<sup>13</sup>

This study had many limitations. Since this was a pilot study, a complete study needs to be conducted with a larger sample size to have a discrete information of these findings. Further studies should check the long term effects of this balance training protocol. Also follow up study needs to be done to check the long standing effects of the training program. Further studies should check the effectiveness of this balance training protocol in other neurological disorders with balance impairment. This new balance training program can be used as a treatment protocol to improve balance in sub-acute stroke patients who have difficulty in standing.

### **Conclusion:**

The new balance training program on rocker board in sitting is effective for improving balance of stroke subjects.

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