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# The impact of mental practice on stroke patients' postural balance

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ABSTRACT

*Introduction:* The most common problem in stroke patients is reduced balance and derangements of postural control that lead to increase the chance of falling and instability during walking. Since physical practice improves balance and postural control, it is assumed also that the application of mental practice would be useful in enhancing such balance. Mental practice is defined as the cognitive rehearsal of a physical skill in the absence of overt physical movements. Factors such as similar time between actual execution and mental performance of a task, the increase of regional cerebral blood flow and also the vegetative activation, all suggest that mental practice imitates physical performance of a task. Thus, the main purpose of this study was to investigate the effect of such mental practice on postural balance among stroke survivors.
*Method and materials:* This study was implemented as an experimental (interventional), case–control, double blind and randomized trial design. A total of 30 subjects (16 males and 14 females) with necessary arousal, attention and memory functions as their major components of mental practice, participated. Subjects' mean ages were $48.1 \pm 10.5$ years. They were divided randomly in two control and experimental groups. Timed Get up and Go (TUG) test was used to evaluate the balance of all participants. They were assessed before–after treatment and two weeks post-treatment as research's follow up. The two groups received the same method of occupational therapy services, but the experimental group in addition to aforementioned occupational therapy, was requested to participate in mental practice sessions.
*Results:* Mental practice had a significant effect on postural balance in stroke survivors ($P = < 0.001$).
*Conclusion:* Mental practice may improve postural balance in stroke patients and can be considered for them as a beneficial rehabilitative technique.



## 1. Introduction

Cerebrovascular accident (CVA) is identified as the sudden functional disruption in the central nervous system which is caused by the brain's vascular disease and lasts at least 24 h. CVA or its consequence, may lead into permanent problems within the central nervous system [1]. Reduced postural balance, postural control and functional mobility impairments are some of the most common problems in such patients [2]. More than 90% of stroke survivors suffer from the postural balance problem, which will lead to an increase in likelihood of falling and instability during mobility [3,4].

Functional mobility is defined as a time duration which is needed for the patient to walk a short distance and then sit down. Functional mobility is used as a measure to study the control of postural balance when the body moves from one place to another and is calculated by measuring the time needed for the complete performance of the activity. This is also valid for the prediction of the falling frequency [3,4].

Disorder in functional mobility is caused by changes in movement patterns, weakness, muscular paralysis, and lack of coordination [5]. All the mentioned problems lead to a decrease in self-confidence, reluctance in walking, depression, and decrease in participation in remedial programs [6,7]. The postural balance problems also caused a sense of insecurity while walking which prevents the patients in performing practices and remedial programs. Thereby patients may even refuse to participate in programs that they are capable to do [4,8].

Therefore, it is necessary to use the suitable remedial methods to improve the functional mobility of CVA patients [5].

One of the suggested methods to improve such functional mobility is mental practice [9]. This practice is the symbolic review of an activity, in mind without any executive motion. This is a simple, economical, and safe method and its performance is not tiresome and leads to an increase in patient's motivation and interest in performing the remedial programs at home [4,10]. This method can be used as an alternative movement therapy for the patients who have necessary arousal, attention and memory function [4]. Because ability for mental imaging is related to patients' arousal, attention and memory functions, they should have an adequate level of cognitive abilities to participate in these practices.

Mental practice has shown positive role in improving the performance and the serial movement skills in stroke and its role is emphasized on learning of new movement skills [11,12]. Furthermore, mental practice on movements of inferior limbs resulted in an

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increase of capability in lower limbs [13]. While many studies have examined the effects of motor imagery in post stroke patients [14–16], a few, if any has focused on lower limb or postural balance. Therefore, we aimed to study the impacts of mental practice on functional mobility in such patients. Considering these reports, this technique may improve control of postural balance, which can be considered as one of the most crucial problems in stroke survivors [3,4].

## 2. Materials and method

Thirty stroke patients (16 males and 14 females) in two settings; Rofaideh and Hazrat-e-Rasul hospitals; participated in a randomized experimental study. Participants were selected based on inclusion criteria such as: 1 — stroke diagnosis by neurologist, 2 — previous experience of CVA, 3 — under the age of 80 years old, 4 — scoring 22 and more in Mini Mental State Examination (MMSE) which has a cut-off point for dementia 22, while in depression status and personality disorders, scores are more than 22 [17]. Because one of the possible factors which should be considered in this present study population was depression, score of 22 and more in MMSE was considered as their cut-off point. 5 — Recognized as having functional movement and postural balance difficulties based on Timed Get up and Go test (more than 13/5 s) [18,19], 6 — absence of aphasia, hearing or visual problem, 7 — the average point received on two questionnaires including Vividness Motor Imagery (VMIQ) and Vividness Visual Imagery (VVIQ) which are used to evaluate the ability of mental imagination, was below the 3.5; 8 — and at least five months passed from incidence of stroke, and 9 — interested in participating in the study. Exclusion criteria were suffering from hemianopia, Wernike and global aphasia. Informed consents were obtained prior to experiment and contents were comprehended and signed by patients or their legal representative. Finally researchers aimed to implement the therapy in future for the control group, if results of intervention are positive.

This study and research project was approved by "University of Social Welfare and Rehabilitation ethical committee". All participants were provided with the information sheet and ensured that their participation in the research is voluntary and they are able to withdraw from the study in every stage of the process. Following their consent data were collected in the participant's convenient time and day. All people with stroke who provided consent to the study were included in the study. Subjects were blinded to the purpose of the study and assessors were blinded to group assignment.

There were four tools for collecting data. A questionnaire was used within which data on age, sex, and post-stroke duration were collected. Folstein's Mini-Mental State Examination (MMSE) with 6 subscales for orientation, registration, attention, calculation, recall, and language and praxis tests were used to estimate the severity of cognitive impairment and to classify patients as having a clinical level of cognitive impairment. Because one of the factors which should be considered in this research was depression, score 22 and higher in MMSE was considered as the cut-off point to identify clinically low levels of cognitive impairment. While there was no any measure of stroke severity, other measures such as MMSE, VMIQ and VVIQ demonstrate subjects' abilities to participate in study.

Timed Get up and Go test was used to evaluate the functional mobility and postural balance [20,21].

Four different stages of the test were performed as follows: one week before the examination (baseline assessment), just before the beginning of the remedy (pre-treatment assessment) to evaluate the spontaneous recovery by time, immediately after the remedy (post-treatment assessment), and two weeks after the remedy (follow-up assessment) to evaluate the remaining and permanent effects of intervention. In this test, the patient is sitting on an adjustable handled chair, while his/her hands are resting on the handles, in a comfortable position. Chair is situated 3 m away from a wall. The patient is asked to get up after hearing the command "go" toward the wall, approach it and then return back to sit on the chair. The time is recorded using a chronometer. Remedy term lasted three days in a week for five weeks.

Participants in experiment group practiced mentally for 15 min and then received current therapy for 30 min, all together for 45 min. Participants in control group continued their current therapy for 45 min including muscle stretching, positioning, facilitating normal patterns of movement, facilitatory and inhibitory techniques, reflex inhibitory patterns, facilitating higher level reflexes and muscle tone normalization. Mental practice took 15 min in which the first 5 min was allotted to relaxation practices and the remaining 10 min was allotted to mental practice. In mental practice, the participant was lying supine in a bed with closed eyes, imagined himself on an adaptable armchair, and imagined how to stand up and go. Then he imagined by visualizing himself as first perspective that he stands up and approaches a wall which is 3 m far away, turns in without stop and comes back to the armchair and sits on it. The patient imagined this activity again next time but with more speed and care. The imagination time was recorded by chronometer. While it is difficult to confirm that the patient is imagining and engaged, their verbal agreement and confirmation, accompanied with outcome measures are only determinant of whether they are engaged or not. Therefore, they were asked during this process daily to verify their engagement.

Data concerning times recorded in each stage to perform the test were analyzed using the SPSS software version 11.5. Descriptive statistics were used for quantitative and qualitative data, and to evaluate normal distribution of data statistical test of Kolmogorov–Smirnov was used. Equality of variables between the two groups was compared pre intervention using independent t-test for quantitative and chi-square tests for qualitative variables. Statistical variance analysis for repeated measures (repeated measure ANOVA) was used to study the changes in test scores in each group during consequent assessments and then the mean scores of each test during sequential testing were compared in each group separately using paired t-test and between the two groups using independent t-test.

## 3. Findings

A total of 30 stroke patients (16 males and 14 females) with mean age of 48.1 (±10.5) years participated in this study (Table 1). Analyzing data showed that there was normal distribution of the variables in two groups. Comparing the equality of data distribution between the two groups (Table 2) showed that studied data in two groups are similar, hence data are distributed similarly between two groups.

Repeated measurement during four stages for variables Berg functional balance test (Table 3) and Timed Get up and Go (Table 4)

**Table 1**
Characteristics of the groups. Descriptive statistics and K–S results for assessing normality of variable distribution in the two groups.

| Variable | Mean | Std. dev. | Min–max | Probability |
|---|---|---|---|---|
| Age (year) | 48.1 | 10.43 | 32–73 | 0.747 |
| Time since stroke occurrence (M) | 19.3 | 7.55 | 8–40 | 0.915 |
| VVIQ (first time) | 2.4 | 0.457 | 2–3.1 | 0.324 |
| VVIQ (second time) | 2.3 | 0.42 | 2–3 | 0.111 |
| VMIQ (first time) | 2.4 | 0.42 | 2–3 | 0.73 |
| VMIQ (second time) | 2.3 | 0.39 | 3–3 | 0.634 |
| TUG (first time) (S) | 21.3 | 2.3 | 17.3–26.1 | 0.734 |
| TUG (second time) (S) | 21.1 | 2.40 | 17.10–26 | 0.678 |
| TUG (third time) (S) | 16.4 | 2.82 | 12.30–23.20 | 0.978 |
| TUG (fourth time) (S) | 16.6 | 2.48 | 12.40–22.70 | 0.439 |
| BBT (first time) | 39.6 | 2.61 | 35–45 | 0.269 |
| BBT (second time) | 39.6 | 2.56 | 35–44 | 0.616 |
| BBT (third time) | 39.6 | 2.56 | 35–44 | 0.614 |
| BBT (fourth time) | 45.3 | 3.72 | 39–52 | 0.907 |