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**Original Research Article**

# The Effects of Dual-Task Training on Patient Outcomes of Institutionalized Elderly Having Chronic Stroke

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## Keywords
Geriatrics · Rehabilitation · Stroke

## Abstract
***Background/Aims:*** The purpose of our study was to investigate the effects of dual-task training on balance, mobility, functional independence, and fear of falling in geriatrics with chronic stroke. ***Methods:*** Fifty-three geriatrics diagnosed with stroke were included in our study. The elderly were divided into 2 groups, i.e., those walking with (intervention group, $n$ = 25) and those walking without (controls, $n$ = 28) dual-task training. ***Results:*** We found statistically significant improvements in all parameters between pre- and posttreatment in both groups ($p < 0.05$). ***Conclusion:*** Based on our findings, walking with dual-task training can be used in addition to conventional stroke rehabilitation aiming to improve balance and mobility.



## Introduction

The restoration of gait is one of the main concerns of stroke rehabilitation to increase the independence of patients in many daily living activities and to increase their participation in society [1, 2] but also to decrease risks of falls, especially for those having dementia or cognitive impairments [3]. The stroke patients with limited cognitive status and attention may have difficulty performing 1 activity or at least 2 activities at the same time [4]. In other

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**Table 1.** Physical characteristics of the patients

| | Control group ($n$ = 28) | Dual-task group ($n$ = 25) | Z | $p$ |
|---|---|---|---|---|
| Age, years | 71.21±4.92 (65–86) | 69.28±5.03 (65–85) | –1.783 | 0.075 |
| Gender, female/male | 9/19 | 5/20 | – | – |
| Height, cm | 166.78±7.92 (153–182) | 167.48±8.21 (155–182) | –0.277 | 0.782 |
| Body weight, kg | 75.07±11.65 (55–102) | 71.70±12.37 (50–106) | –0.990 | 0.322 |
| Body mass index | 27.00±1.51 (20.07–33.59) | 27.48±2.08 (17.48–37.56) | –1.265 | 0.206 |

Values are means ± standard deviations (minimum–maximum).

words, they may have difficulty focusing their attention on different tasks at the same time [5] due to misallocation of their attentional resources [1]. Since gait is an automated function requiring high-level cognitive function [6], dual-task walking is also considered as a standard measure to understand the relationship between cognitive ability and gait [7]. Thus, patients with stroke may need special attention while walking and performing another activity. For instance, Yang et al. [1] reported that elderly with chronic stroke had disturbed balance and slowed walking speed while performing a motor task, such as carrying a tray with glasses. They may also have an increased risk of falling if they focus their attention on another activity, such as traffic lights while crossing a road [5]. In this regard, decreased gait velocity and increased double support as a percentage of stride time were reported for elderly stroke patients if they talked while walking [8]. Thus, the interest of the researchers in the dual-task training approach as a neurophysiologic procedure, and as an additional procedure to the conventional rehabilitation of stroke to restore patients' balance and gait, is increasing extensively [2]. Thus, in general, the literature focuses on the assessment of dual-task performance of patients with stroke. To our knowledge, there is no study reporting the effects of dual-task training as a treatment modality on the clinical findings of patients with chronic stroke. Therefore, the purpose of this study was to investigate the effects of dual-task training on balance, mobility, functional independence, and fear of falling in geriatrics with chronic stroke.

## Methods

*Study Participants*

The 53 elderly (14 females and 39 males) with chronic stroke were selected according to the following inclusion criteria: being 65 years or older, having efficient cognitive function to be able to communicate (a Mini-Mental State Examination score of 23 points and above), walking independently 10 m (if necessary with a cane), and being able to stand on both feet for at least 90 s without assistance. The exclusion criteria were having a severe hearing loss and/or visual impairment, uncontrolled hypertension, and vertigo.

All participants were living independently in a government institution named Darulaceze. Their physical characteristics are given in Table 1. There were no statistical differences between the educational levels and the physical characteristics of the elderly in both groups. They were assigned randomly (according to their arrival) to 2 groups, i.e., those walking with dual-task training (intervention group, $n$ = 25) and those walking without dual-task training (controls, $n$ = 28). The intervention group included those who accepted the training with dual-task activities while walking (Table 2). Both groups had the same duration

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**Table 2.** Verbal cognitive tasks given while patients were walking with dual-task training

| | |
|---|---|
| Repeating numbers and letters | Give the patient a certain quantity of numbers and letters depending on the illness and let him/her repeat them from memory |
| Word spelling | Give the patient a word and let him/her spell the word given |
| Stroop test | Ask the patient to read color words printed in different colors, e.g. to read the word "yellow" in blue writing |
| Image description | Show the patient a picture and ask him/her to describe the picture in detail |
| Verbal communication | Give a letter of the alphabet to the patient and let him/her say words of a certain category, such as plant, animal, country, starting with that letter |
| Count the number | Ask the patient to count to 3 or from 3 backwards or forwards |
| Describing daily life activities | Ask the patient to describe something he/she has done on weekdays or on weekends and let him/her explain how to do it |

**Table 3.** Differences between the groups after the treatment program

| Outcomes | Dual-task group | | | Control group | | | Differences between the groups | | |
|---|---|---|---|---|---|---|---|---|---|
| | pretreatment | posttreatment | $p^1$ | pretreatment | posttreatment | $p^1$ | Δdual-task | Δcontrol | $p^2$ |
| Balance | 42.8±10.0 | 46.4±10.0 | 0.001* | 41.5±10.4 | 43.1±9.1 | 0.025* | 3.6±3.2 | 1.5±3.9 | 0.020* |
| Mobility | 11.5±3.0 | 13.2±2.5 | 0.001* | 8.3±3.2 | 9.0±3.3 | 0.029* | 1.7±1.4 | 0.7±1.5 | 0.027* |
| Functional independence | 105.4±23.5 | 107.8±25.2 | 0.015* | 101.2±15.6 | 104.4±14.3 | 0.045* | 1.6±3.6 | 3.2±7.6 | 0.710 |
| Fear of falling | 35.6±15.8 | 34.4±15.8 | 0.030* | 45.1±10.5 | 44.3±10.6 | 0.036* | –1.2±2.3 | –0.4±1.6 | 0.225 |

$p^1$, Wilcoxon test. $p^2$, Mann-Whitney U test. * $p < 0.05$.

of walking sessions, i.e., 5 days a week for 30 min each, and had undergone the same conventional rehabilitation programs (range of motion, strengthening, mat, and mobility exercises) with neurodevelopmental therapy (Bobath therapy) for 45 min 5 days a week. Their functional balance (Berg Balance Scale) [9], mobility (Rivermead Mobility Index) [10], functional independence (Functional Independence Measure) [11], and falls efficacy (Falls Efficacy Scale) [12] were assessed before and after the totally 8 weeks of the treatment program.

*Statistical Analysis*

All statistical analyses were performed using SPSS Statistics, version 15, software (IBM Corporation, USA). $p < 0.05$ was considered statistically significant. The demographic characteristics (age, height, and body mass index), postural balance, mobility levels, and fear of falling of the cases were expressed as means ± standard deviations (minimum–maximum).

A Kolmogorov-Smirnov test was used to determine the distribution of the data. Since the groups were not evenly distributed, the data obtained from patients before and after treatment were assessed by the Wilcoxon signed-rank test. Additionally, the analysis of differences between the 2 groups was assessed by the Mann-Whitney U test.

## Results

We found significant improvements in the outcomes of balance and mobility of the elderly in both groups ($p < 0.05$). However, the difference was significant in favor of the dual-task group ($p < 0.05$) (Table 3). Although the elderly in both groups had increased functional independence and decreased fear of falling ($p < 0.05$) after the treatment program, there was no significant difference between the groups.

We have found a positive correlation between balance and educational level of the elderly in the dual-task group ($r = –0.409$, $p = 0.043$) ($p < 0.05$). According to simple linear regression analyses, education had an effect of 15% on balance in the dual-task group ($R = 0.389$, $p < 0.05$).

## Discussion

We found that balance was improved after the training sessions in the elderly with chronic stroke in both groups. However, the group which had dual-task training while walking showed a significantly better performance in balance than the group which only had a conventional rehabilitation program with neuromuscular therapy. This was also similar in their functional mobility activities. Supporting these outcomes, An et al. [13] reported that the motor and cognitive dual-task gait training was more effective in improving the balance of chronic stroke patients than if both trainings were performed conventionally as separate modalities. Kim et al. [14] also observed improved cognitive and walking abilities of patients with chronic stroke after dual-task training. However, Choi et al. [15] found that dual-task training was as effective as conventional balance training in improving balance and cognition in poststroke patients in a subacute phase. Although we have studied elderly with chronic stroke, we suggest including walking with dual-task training as a modality as early as possible in the rehabilitation program of stroke cases.

We have found a positive correlation between balance and educational level of the elderly in the dual-task group. Although this was a weak (15%) effect according to the linear regression analyses, we consider it as important. Thus, elderly with chronic stroke may derive more benefit from dual-task training for their balance performance if they are well educated.

Based on our findings, we conclude that walking with dual-task training is complementary to conventional stroke rehabilitation aiming at improving balance and mobility. However, for the best practice in physiotherapy and rehabilitation, the educational level of the elderly may be considered while planning the dual-task program.

## Statement of Ethics

This study was approved by the Yeditepe University Ethics Committee for Clinical Research (Protocol No. 37068608-6100-15-1233).

## Disclosure Statement

The authors acknowledge that there are no conflicts of interest pertaining to this article.

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