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The relationship of trunk control with balance, upper extremity and lower extremity functions in stroke patients

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Abstract

The center of the body is the trunk. For distal extremity movements, balance, and functional tasks, proximal trunk control is crucial. The aim of the study is to examine the relationship of trunk control with balance, upper extremity and lower extremity functions in stroke patients. Thirty-six stroke patients were included in this cross-sectional descriptive study. Trunk control was assessed using the Trunk Impairment Scale (TIS), Berg Balance Scale (BBS) was used for balance evaluation, Fugl-Meyer Lower Extremity Scale (FML) was used for lower extremity function evaluation, Fugl-Meyer Upper Extremity Scale (FMU) was used for upper extremity function evaluation. The mean age of the included stroke patients was 62±11 years. There was a moderate negative correlation between TIS and BBS (r=-0.610, p<0.01). A moderate negative correlation was found between TIS and FML (r=-0.520, p=0.001). A low negative correlation was found between TIS and FMU (r=-0.372, p=0.025). Trunk control affects balance, lower extremity and upper extremity function. In the treatment of stroke patients, exercise approaches for trunk control should be added to rehabilitation programs in addition to basic neurophysiological approaches.

Keywords: Stroke, trunk control, balance, function

Introduction

After heart disease and cancer, stroke is the third most common cause of death in developed nations. In terms of causing death and impairment in adults, it tops all neurological illnesses [1].

About one-third of people with strokes have physical impairment that is permanent. The patient and his family are negatively impacted by the situation in terms of their economic, social, psychological, and overall quality of lives [2]. Due to issues like activity constraints and participation restrictions brought on by problems with body functioning, stroke is one of the main causes of long-term impairment in adults [3]. At this point, rehabilitation in stroke patients has an important place in ensuring the social participation of the patient and minimizing the disorders.

According to a review of the literature, effective postural control reveals the best functional effects. because the body's central point is the trunk. For distal extremity movements, balance, and functional tasks, proximal trunk control is crucial. It offers trunk control, upright body posture, static and dynamic posture, and selected trunk movements [4].

Trunk function impairments are frequent in stroke patients. In previous studies on the trunk muscles' muscle weakness and delayed activation, major errors in the sense of the trunk's location, inadequate center of pressure control when seated, poor trunk performance, and trunk asymmetry during walking were all reported. Trunk function has been demonstrated to be a useful predictor of balance, walking ability, and activities of daily living (ADL) outcomes in stroke patients and is related

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with these abilities [5].

Trunk control means more than just sitting balance. A strong trunk control provides the organization of postural and corrective reactions, stability needed to create extremity motions, rotation, an adequate gait pattern, proximal stabilization to support distal movement, and construction of the connection between the shoulder and pelvis. The trunk, which makes up 60% of our body mass, is necessary for controlling the force created in our body and for optimum movement in the extremities. The holistic system that includes the lower extremities, pelvis, trunk and upper extremities is called the kinetic chain. The creation, collection and transfer of the force required for extremity movements from the lower extremity to the upper extremity are made possible by this system. Thus, during functional activities, these segments, which are independent of one another from proximal to distal, cooperate and interact in a certain way [6].

Examining the impact of trunk control on balance, upper extremity, and lower extremity functions in stroke patients is the study's main objective.

Material and Methods

Population and sample of the research

This cross-sectional descriptive study included 36 volunteer sub acute and chronic stroke (hemorrhagic and ischemic) patients living in Gaziantep, who were followed in the physiotherapy and rehabilitation department of two hospitals. These two hospitals were selected from Gaziantep by using random sampling method.

According to TIS mean scores of Haruyama et al.'s studies, the sample of the study was determined as 32 with alpha 0.05 and 80% power [5]. In post-hoc power analysis, the power of the study was calculated to be 99% with the correlation coefficient of TIS and BBS.

Inclusion criteria; He was 55-85 years old, had an ischemic stroke at least 6 months ago, was at stage 2 according to brunstroma, had a mini-mental test score above 22, could stand independently for 3-4 seconds, and had no orthopedic problems. Fourteen of individuals with neurological and orthopedic problems that may affect walking other than stroke, those who had a history of cardiovascular and rheumatological diseases that prevent their daily activities, with lesions or fractures in the lower extremities, lower extremity spasticity 4 according to the Modified Ashworth Scale (MAS), aphasia and communication disorders were not included.

The Clinical Research Ethics Committee of SANKO University approved the study ethical permission (2019/03:07).

Data collection instruments

Demographic information (age, height, weight, gender) and disease information (duration of disease) of the included individuals were recorded. For trunk control Trunk Impairment Scale (TIS) [6] for balance Berg Balance Scale (BBS) [7], for lower extremity function Fugl-Meyer Lower Extremity Scale (FML) [8], for upper-extremity function Fugl-Meyer Upper Extremity Scale (FMU) [8] were used.

TIS: The Trunk Impairment Scale is divided into three sections: static sitting balance (three items), dynamic sitting balance (ten items), and coordination (four items). The highest possible score is 7, 10, and 6 points, respectively. TIS's overall rating ranges from 0 to 23. Good trunk control is indicated by high scores [6]. TIS validity and reliability research in Turkey was also carried out [9]. Cronbach alpha coefficients for internal consistency ranged from 0.65 to 0.89.

BBS: Berg Balance Scale evaluates balance and postural control [7]. The 14-item scale assesses the capacity to keep the balance while carrying out functional tasks. The scores for each item range from 0 to 4. The balance is regarded as good if the total score is 56 or higher. Cronbach alpha coefficients for internal consistency ranged from 0.92-0.98.

FML: It has components that assess reflex actions, coordination, and hip, knee, and ankle joint movements. In this evaluation, a 34 is the maximum possible score. Cronbach alpha coefficients for internal consistency was 0.935.

FMU: It has parts for assessing shoulder, elbow, forearm, wrist, and hand joint movements, coordination, and reflex actions. With this test, a score of 66 is the maximum possible. Cronbach alpha coefficients for internal consistency ranged from 0.90 and 0.88.

Statistical analysis

"SPSS for Windows 25.0" package version was used for statistical analysis. The conformity of the data to the normal distribution was tested with the Shapiro Wilk Test. As descriptive statistics, mean±standard deviation was given for numerical variables, and number and % values were given for categorical variables. The relationship between Trunk Control, Berg Balance Test, Fugl Meyer Tests was evaluated with Spearman Correlation Analysis. The level of the relationship between the variables is weak if the correlation coefficient is between 0-0.29; moderate if it is between 0.30-0.64; strong if it is between 0.65-0.84; It was also considered very strong if it was between 0.85-1.

Results

The mean age of the included individuals was 62±11 years. Eighteen (50%) of the 36 included stroke patients were male and 18 (50%) were female. While eleven of the patients had a hemorrhagic stroke, twenty five had an ischemic stroke. (Table 1). All socio-demographic characteristics and clinic features of the participants were given in Table 1.

When the correlation between TIS and other scales is examined, there were a moderate negative correlation between TIS with BBS, FML nad FMU (Table 2).

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Table 1. Socio-demographic characteristics and clinic features of the participants

Variables		n (%)	Mean±SS	Median (Min-Max)
Gender	Male	18 (50)	-	-
	Female	18 (50)	-	-
Age (years)		-	62±11	52 (28-82)
Height (cm)		-	167.8±7.31	169 (150-180)
Weight (kg)		-	79.2±13.2	72.5 (60-114)
Smoking	No	23 (63.8)	-	-
	Yes	13 (36.1)	-	
Alcohol	No	33 (91.6)	-	-
	Yes	3 (0.8)	-	-
Dominant side	Right	32 (88.8)	-	-
	Left	4 (11.1)	-	-
Affected side	Right	14 (33.8)	-	-
	Left	22 (61.1)	-	-
Stroke type	Hemorrhagic	11 (30.5)	-	-
	Ischemic	25 (69.4)	-	-
Disease duration	0-6 month	20 (55.6)	-	-
	6-12 month	8 (22.2)	-	-
	12-24 month	6 (16.7)	-	-
	Over 24 month	2 (5.6)	-	-
Trunk Impairment Scale		-	14.3±5.7	7 (5-23)
Berg Balance Scale		-	30.8±14.8	40.5 (5-52)
Fugl-Meyer Lower Extremity Scale		-	17.02±6.85	13.0 (2-27)
Fugl-Meyer Upper Extremity Scale		-	38.2±18.7	25.5 (1-64)

Table 2. Correlation between TIS and BBS, FML, FMU

Variables		BBS	FML	FMU
TIS	r	-0.610	-0.520	-0.372
	p	0.000*	0.001*	0.025*

*p<0.05, Spearman Correlation Analysis, TIS: Trunk Impairment Scale, BBS: Berg Balance Scale, FML: Fugl-Meyer Lower Extremity Motor Rating Scale, FMU: Fugl-Meyer Upper Extremity Motor Rating Scale

Discussion

In our study to investigate the effects of trunk control on balance and upper and lower extremity functions in stroke patients, we found that balance and lower and upper extremity functions increased with increasing trunk control.

Loss of trunk control is very common in patients who have had a stroke as a result of a cerebrovascular accident and is one of the factors affecting recovery. The trunk, which provides dynamic stabilization for different parts of the body, is our body part that maintains its contact with the support surface in standing and sitting positions. The center of the body is the trunk. The smoother the proximal trunk control, the more successfully distal extremity movements, balance and functional movements are performed. Abnormalities in other body parts are reduced with proper trunk support [10].

In our study, trunk control was evaluated with trunk disorder scale. Balance was assessed with the Berg Balance Scale, which is considered the gold standard. In a study, balance was evaluated with the Tinetti balance test in patients with chronic stroke, and it was stated that balance increased with trunk control [11].In another study, it was stated that there was a strong relationship between balance assessed by the biodex balance system and trunk control [12]. The trunk impairment scale, which is a powerful test in predicting the functional abilities of stroke patients, is an important clinical test that can be used to determine the prognosis of patients [13]. At the same time, it was found in our study that trunk control increases balance skills, which are important for activities of daily living. We believe that including trunk control in stroke rehabilitation will increase the success of rehabilitation.

The Karaca et al. studied the relation between trunk control and extremities functions in a study they carried out [14]. According to the study in which limb functions were assessed using STREAM, trunk control was more closely associated to daily living activities, balance, and limb functions.

Studies have shown that upper extremity functions as well as lower extremity are directly related to trunk control [15,16].

Upper extremity function was assessed using FMU in a study that investigated at how trunk control and upper extremities interact. The results showed that trunk control and upper extremity function were related. In parallel with the literature, in our study, it was found that lower and upper extremity functions increased as trunk control increased.

Conclusion

Since the trunk is the main dynamic stabilizer of the body, it is very important to gain trunk control in hemiplegia patients. The effect of the trunk muscles, which are active during sitting and standing, causes hemiplegic patients to experience activity limitations [2]. Based on all these findings, evaluating trunk control from the early stages of rehabilitation and including trunk training will be effective in increasing the success of treatment.

Limitation of our study is that the duration of illness of stroke patients was not evenly distributed.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
The Clinical Research Ethics Committee of SANKO University approved the study ethical permission (2019/03:07).

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