Effect of Rhythmic Movement Program to Improve Walking Ability for Elderly Patients with Stroke

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Abstract

Background/Objectives: This study is to find out the effect of the rhythmic movement exercise program applying the auditory stimuli, rhythm, which combined the aerobic and resistance exercise and flexibility exercise on walking ability of elderly stroke patient. **Methods/Statistical Analysis:** Subjects 22 selected people, a group of 11 people who conducted a simple therapeutic exercise (STE) and a group of 11 people who conducted rhythmic movement program (RMP) were allocated. The rhythmic movement program was conducted once a week for 60 minutes and for a total of 12 weeks. The basic mobility and ability to move were evaluated through Timed Up & Go (TUG) test and 10m walking test. Collected data were analyzed independent sample t-test analysis and corresponding sample t-test. Findings: First, Timed Up & Go (TUG) test of elderly stroke patients showed a statistically significant difference between two groups, and showed a larger decrease in rhythmic movement therapy group. Second, 10m walking test, which evaluates the gait speed, showed a significant difference between simple rhythmic movement therapy group and exercise therapy group, and both groups showed a significant decrease after exercise. \ The rhythmic movements can be applied to the exercise regimen and rehabilitation programs by providing resources to improve walking ability for patient's physical characteristics and abilities.

Keywords: Elderly Patients, Rhythmic Movement, Stoke, Timed Up & Go Test, Walking Ability, 10m Walking Test

1. Introduction

Stroke is currently the second largest cause of death in Korea¹. Typically, if the stroke occurs, 70-75% of patients have not been fully recovered from problems such as hemiplegia and sensory impairment, sensory impairment, gait disturbance, ADL limitations and emotional disturbances arise, depending on the extent of damage or disorder of the brain areas². In addition, patients suffer from the decline of social interacting cognitive impairment, depression, and the changes in bodily functions³. And dependence of the activity of production in daily activity and mood swings are accompanied because of the unexpected sudden crisis living in daily, so adverse changes in family and social relations occur⁴. Therefore, substantial rehabilitation program considering the quality of life of elderly patients with stroke is imperative as well as the simple survival of patients.

Especially hemiplegia causes 61-80% of the total weight to be concentrated on the non-paralyzed side⁵, so the staggering increase in the trunk⁶, decreased ability of balance, discord of movement in upper and lower body and loss of motor control capability are caused⁷, and eventually it lowers the walking ability. Decline in walking of patients with stroke has twice risk of falling because of the slow walking speed, small step length, and small number of stride⁸.

Walking of stroke patients results in asymmetry of the two sides in gait, due to weakness of the hip extensor in stance phase and damaged dorsal flexor in swing phase⁹. And due to the plantar flexion stiffness of the ankle and weakness of hip extensor, asymmetric walking pattern is generated¹⁰. Asymmetry of such non-paralyzed side and the paralyzed side significantly lowers the walking ability¹¹. If we observe asymmetric walking in terms of time

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factor, it occurs by the increases of the swing phase time in paraplegia side¹², and increase of standing phase time in non-paraplegia side⁹. In terms of spatial components, it causes paraplegia side to have stride reduction¹³, due to the reduction of the stride in paraplegia side and weakening of the dorsal flexor⁹. These space-time unbalance results in asymmetrical walking in stroke patients and degrades the walking ability^{12,14}.

Treadmill training¹⁵, aquatic exercise¹⁶, yoga¹⁷, stretching¹⁸ and ankle training with a brace², functional electrical stimulation¹⁹, auditory stimuli training²⁰ and various studies have been conducted to improve walking ability of stroke patients. Recently, various studies have been made with the hearing stimulus, and in practice, there are cases that it improved walking by applying auditory stimuli to patients with Parkinson's disease. Therefore, starting from the study which auditory stimuli are applied, it is expect to demonstrate the effect of each stimulation on walking ability of elderly stroke patients.

This study has the purposes of finding out the effect of the rhythmic movement exercise program applying the auditory stimuli, rhythm, which combined the aerobic and resistance exercise and flexibility exercise on walking ability of elderly stroke patient. Rhythmic movement program, first, identifies the possible movement depending on the state of stroke elderly patients, and improves the elasticity of blood vessels by learning leveraging the movement using auditory rhythm, promotes the mobility and flexibility of joints and strengthens muscle and immunity of the body. Thus this program is physical rehabilitation on a whole body promoting their organization. Second, it is a rhythmic exercise program to increase the satisfaction of life through self-efficacy recovery by causing the interest to elderly stroke patients with reduced physical activity, habituating them to the rhythm movement without burdening the body, instead of difficult and tedious exercise and raising the mental confidence. Third, it is an integrated exercise program that can help patients to promote the positive role as family members and community members by inducing stroke patients with the lower selfesteem and cognitive functions into a expressive activity which is one of the rhythmic movement activities.

Rhythm and auditory stimuli used in rhythmic movement program influences the movement system by stimulating the sense of rhythm through certain auditory stimuli using music, and induces the activation of different areas of the brain by synchronizing the motor region and perceptual region in stable time²⁰. It improves the walking ability by making the stable gait²¹, and it has been reported that it improves the mental problems and quality of life as well as improving the movement and flexibility²². In this study, this researcher would like to confirm the effect of the rhythm movement program on the improvement of the walking ability of elderly patients with stroke, and do the clinical application to elderly patients with stroke through this.

2. Research Methods

2.1 Subject of Study

The subjects of this study selected 22 elderly patients of male and female who gained consents for participation from caregivers and themselves among the elderly patients with stroke attending the welfare center and day care center in Gangseogu and Mapogu, in Seoul being diagnosed with hemiplegia due to stroke. Subject selection criteria for this study is, first, a stroke duration over one year and less than two years, second, being incapable of walking independently at least five minutes walking, and third, patients with Korean Monumental State Examination (MMSE-K) score more than 21 points who can understand and follow the instructions of the researcher²³.

Targeting 22 selected people, a group of 11 people who conducted a simple therapeutic exercise (STE) and a group of 11 people who conducted rhythmic movement program (RMP) were allocated. General characteristics of the subjects are shown in Table 1.

	Affected	Age(yrs)	Height(cm)	Weight(kg)
	(n)	M±SD	M±SD	M±SD
STE	Left(5),	70.5±12.2	163.1±6.2	65.7±11.9
(n=11)	Right(6)			
RMP	Left(4),	67.0±10.8	165.9±7.2	66.4±9.4
(n=11)	Right(7)			

Table 1. General characteristics of subjects

2.2 Rhythmic Movement Program

Hong Dance Company developed the program in order to minimize the inconvenience of walking by conducting various walking in rhythm to improve walking ability, and the program was conducted once a week for 60 minutes and for a total of 12 weeks from 28th, August, 2015 to 20th, November, to find out the effect of devel-

Ball exercise for the stretching each body part and strengthening muscle

Rhythmic movements according to themes

Cooling down stretching for muscle relaxation and mind relaxation

Figure 1. Program Procedure.

oped program on test valve. Proceeding order of Program conducted over a total of 12 weeks is shown in Figure 1 program and the theme is shown in Table 2.

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Table 2.	Themes of rhythmi	c movement	program	per
class				

Num.	Theme	Num.	Theme
1	Rhythmic movements	7	Walking rhythmic
	with upper body		motion for
	movement		improving walking
			emotional vitality
2	Chair rhythmic	8	Rhythmic hin
2	movements improving	0	movements for
	the muscle and sense		flexibility of hip
	of balance in upper		extension
	and lower limbs		extension
3	Rhythmic movements	9	Rhythmic pelvic
	strengthening lower		movements for hip
	limbs		flexibility
4	Rhythmic movements	10	Rhythmic
	for improving the		movements for
	range of motion of the		improving the
	joint in lower limbs		walking ability
5	Rhythmic movements	11	Rhythmic
	for improving the		movements for
	energy of upper limbs		improving the
	muscle		walking ability
6	Hip rhythmic	12	Rhythmic
	movements for		movements for
	stimulation of hip		improving the
	extension		walking ability

2.3 Measurement

The basic mobility and ability to move were evaluated through Timed Up & Go (TUG) test, and the average value was used after repeated measurements of three times with a way of measuring the time to sit in a chair with back walking 3m away sitting on a chair with armrests, using a stopwatch. In this test, inner reliability in is r = .99, and inter atomic reliability tool to 0.98, thus it is a reliable tool24.

Recently, it is applied to patient with stroke. Parkinson's disease and arthritis diseases²⁵, the measurement value of most healthy adult is less than 10 seconds, and those of the frail elderly or disabled people is 11-20 seconds. More than 20 seconds indicates a functional sports injury, ad more than 30 seconds indicates the dependent basic movement skill, so one can't move outside alone.

10m walking test which evaluates the walking speed of a patient with a neurological impairment used the average value after repeated measurements of three times by creating a walking path in total 16m, and measuring the time in second (sec) units to walk 10m, except both 3m considering acceleration and deceleration with a physical therapist to keep looking from behind for the safety. The test is measurement method with high reliability (R $= .89 - 1.00)^{26,27}$.

2.4 Data Analysis

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Collected data were analyzed using Windows SPSS Ver. 21.0 program. Significance level was set for p<.05. First, an independent sample t-test was conducted to review whether the experiment group and the control group were homogenous. Second, to identify the effects on walking ability, a corresponding sample t-test was conducted between pre-test and post-test.

3. Results

3.1 Verification of the Homogeneity of Groups

As a result of conducting the independent sample t-verification to verify the homogeneity of the simple therapy exercise group (STE) and the rhythmic movement program group (RMP) prior to study, two groups were found to be homogeneous groups.

Table 3. The effects of STE or RMP on basic movement and movement skills

Variable	Group	Pre-test	<i>t</i> (p)	Post	<i>t</i> (p)	Variance	F(D)
		M(SD)		M(SD)		Pre-Post	F(P)
Time Up &	STE	26.27(1.67)	.248(.807)	24.72(2.24)	2.892(.009)	1.545	F 012(006)
Go(sec)	RMP	26.09(1.75)		21.45(3.01)		4.636	5.012(.006)

*p<.05, **p<.01, ***p<.001

3.2 The Effects of STE or RMP on Basic Movement and Movement Skills

Table 3 and Figure 2 shows in Timed Up & Go test (sec), the simple therapy exercise group (STE) was reduced to 26.27 from 24.72, so 1.5 seconds was decreased, the rhythmic movement program group (RMP) was reduced to 26.09 from 21.45, so 4.6 seconds was decreased. Thus, two groups were enhanced and showed a statistically significant difference (p<.01).



Figure 2. The effects of STE or RMP on basic movement and movement skills.

3.3 The Effects of STE or RMP on Walking Speed

Table 4 and Figure 3 shows in 10m walking test (sec), the simple therapy exercise group (STE) was reduced to 20.09 from 18.72, so 1.3 seconds was decreased, and the rhythmic movement program group (RMP) was reduced to 20.18 from 16.27, so 3.9 seconds was decrease. Thus, two groups were enhanced and showed a statistically significant difference (p<.05).



Figure 3. The effects of STE or RMP on walking ability after participation.

4. Conclusions

Walking is the most basic natural movement of the human action that is performed unconsciously in order to move the body. The walking motion looks simple, but it is a complex operation that is moved by coordination and operating in harmony with the more than 100 skeletal muscles in upper and lower limb acting as the various segments. So walking is not a simple day-to-day operations, but accounts for a large proportion of the health care and exercise, and it is the important movement researched across a variety of target from childhood to old age and disabled in their whole life.

Gait, the important human movement, has a hemiplegic gait disturbance to patients with stroke due to hemiparalysis². It is a important task to grasp the walking speed decreased and asymmetry of gait of patients with stroke on a first level in gait training interventions. Because walking speed increased also emphasizes the asymmetrical weight bearing in non-paralyzed, lower limbs side and movement skill, the functional role of exercise in lower limbs must be emphasized²⁸. Therefore, this study was to investigate the effect of the rhythmic movement exercise program applying the auditory stimuli, rhythm, which combined the aerobic and resistance exercise and flexibility exercise on walking ability of elderly patient patients with stroke.

To solve the purpose of this study, subjects 22 selected people, a group of 11 people who conducted a simple therapeutic exercise (STE) and a group of 11 people who conducted rhythmic movement program (RMP) were allocated. In order to lessen the inconvenience of walking of the elderly, the rhythmic program consists of various walking in rhythm to improve walking ability, and the program was conducted once a week for 60 minutes and for a total of 12 weeks. The basic mobility and ability to move were evaluated through Timed Up & Go (TUG) test and 10m walking test.

The study results are as follows. In the Timed Up & Go (TUG) test of elderly stroke patients showed a statistically significant difference between two groups, and showed a larger decrease in rhythmic movement therapy group.

Table 4.	The effects	of STE or	RMP on	walking speed
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Variable	Group	Pre-test	t(p)	Post	t(p)	Variance	F(P)
		M(SD)		M(SD)		Pre-Post	
10m walking(sec)	STE	20.09(2.34)	090	18.72(1.90)	2.739*	1.363	3.523*
_	RMP	20.18(2.40)		16.27(2.28)		3.909	

p*<.05, *p*<.01, ****p*<.001

This is consistent with the findings that exercise therapy reduced the TUG of stroke patients in the study such as Bouisset^{29's} research results. Also it is consistent with the claims of Winter³⁰ that improving the movement of the upper body is needed, as well as the movement of the lower body for the balance and stability.

In addition, the walking speed is used to measure the ability to walk independently which enables functions in daily activity and functional recovery level²⁸. In 10m walking test, which evaluates the gait speed, showed a significant difference between simple rhythmic movement therapy group and exercise therapy group, and both groups showed a significant decrease after exercise. This is a result which shows that it is more effective in improving walking ability in elderly stroke patients than the simple rhythmic movement exercise therapy program. Rhythmic movement programs extend the range of the joint in lower limbs, consciously force the weight transfer in all directions and conduct the movement for the balance and flexibility to address the left and right unbalance due to hemi paralysis, and by these, it is consistent with the study of Bouisset²⁹ that decreased walking speed is due to the basic balance difference between left and right, before and after. On the other hand, partial correspondence is shown with³¹'s research results in the sports field that the despite short duration and lesser frequency of exercise program, exercise was effective and enhanced improvement in physical parameters and lowered total cholesterol and low density lipoprotein. ³²Support our result with findings that aquarobics built up balance and nimbleness because there were many movements to increase them by keeping one leg afloat, or jump and turns, and also improved muscle strength around knees, ankles and joints.

Thus the rhythmic movement program for improving walking ability of elderly patients with strike, first, minimizes the daily life movement restrictions due to physical deterioration through various movements in upper and lower limbs for the strengthening of the body, and enhances the muscle strength and range of motion and cardiovascular function. Second, it is not boring, because it is rhythmic movement performed in exciting music, and it will play an important role in slowing down the pace of aging and preventing geriatric illness by positive communication, psychological intimidation eliminated and emotional stability caused among the participants by exercising together in groups. Third, it is expected to provide catalytic role in healthy and active daily life and improve the quality of life by saving the social and economic costs. Finally, the rhythmic movements can be applied to the exercise regimen and rehabilitation programs, and it is expected to be used in rehabilitation programs by providing resources to improve walking ability for patient's physical characteristics and abilities.

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