

## Effects of Therapeutic Ball Exercise and Hippotherapy for Balance Ability in Elderly

This study was conducted to evaluate the effect of the exercise on elderly balance ability by using hippotherapy and therapeutic ball exercise. 10 patients were assigned to the hippotherapy group and they got with 30 minutes of hippotherapy. Another 10 elderly were assigned to the therapeutic ball group and they got with 30 minutes of therapeutic ball exercise. All procedures were repeated 5 times a week for the total of four weeks. To investigate the participants balancing abilities, the Time "Up & Go"(TUG) and One Leg Stand Test(OLST) were evaluated. The results of study were significant differences between pre-test and post-test of TUG and OLST( $p < .05$ ), and there were no significant differences between hippotherapy and therapeutic ball exercise( $p > .05$ ). The conclusion showed that both the hippotherapy and the therapeutic ball exercises were effective on elderly balancing ability. Consequently, it would be better to practice therapeutic ball than hippotherapy for elderly exercise because the more economical and there is less restriction of space than the hippotherapy.

Key words: *Balance; Elderly; Hippotherapy; Therapeutic Ball Exercise*

Kwon Young Kang<sup>a</sup>, Ji Sung Kim<sup>b</sup>,  
Yoo Rim Choi<sup>c</sup>, Joon Hee Lee<sup>d</sup>,  
Joong San Wang<sup>e</sup>, Si Eun Park<sup>f</sup>,  
Hong Rae Kim<sup>g</sup>, Hee Joon Shin<sup>h</sup>

<sup>a</sup>Seonam University, Namwon; <sup>b</sup>Suwon Women's College, Suwon; <sup>c</sup>Daegu Science University, Daegu; <sup>d</sup>Sehan University, Yeongam; <sup>e</sup>Raphael Hospital, Suwon; <sup>f</sup>Sarang Hospital, Yongin; <sup>g</sup>Hyoja Hospital, Yongin; <sup>h</sup>Kyungwoon University, Gumi, Korea

Received : 29 April 2012

Accepted : 6 July 2012

### Address for correspondence

Hee Joon Shin, PT, Ph.D  
Department of Physical Therapy,  
Kyungwoon University, 55 Indeok-ri,  
Sandong-myeon, Gumi-si, Gyeongbuk,  
Korea  
Tel: 82-54-479-1373  
E-mail: Insshj@ikw.ac.kr

## INTRODUCTION

Fall accidents in old age are primarily caused by lowered balancing abilities including bone density, muscular strength, flexibility, power, and stability according to decreased amounts of exercise, accordingly having a very high risk(1). It was reported that programs designed to increase balance, flexibility, and response time improved the balance and perceptual exercise of the elderly and thus contributed to their stability(2) and that programs based on aerobic exercise, active strength exercise, long walk, posture adjustment, and repeating muscular coordination exercise increased balance and mobility and reduced and prevented falls(3, 4).

There have been many researches to help to increase balancing abilities, which have much influence on fall. Research efforts have recently been active to help the elderly reduce pain and increase stability, flexibility, and muscular strength through therapeutic ball exercise with positive effects on health, the muscles in the waist, pelvis, and trunk, and balance reported(5, 6). The elderly more and more

experience a fall accident with aging and desperately need efforts to prevent such an accident. With the increasing elderly population, it is further important to raise the quality of life in old age. Illness-based aging rather than simple aging is emerging as a social issue beyond the individual economic level. The number of proper exercise programs to help the elderly prevent a fall is low in reality. This study thus set out to investigate the effects of ball exercise and hippotherapy, which are both a regular and easily applicable exercise enough to induce interest and fun in the elderly and thus settle down as an elderly exercise program and consists of simple and easy movements, on the balancing abilities of the elderly.

## METHODS

### Subjects

The subjects include the male and female elderly aged 65 or older according to the Elderly Welfare Act and hospitalized in a nursing hospital in Gyeonggi

Province. Of them, 20 that fully understood the objectives of the study and voluntarily consented to participate in the study joined the study. They also passed the criteria of no problem with musculoskeletal system, capable of independent walking, no problem with vestibular sense and cognitive ability.

## Procedures

The 20 subjects were randomly appointed to the ball exercise group and hippotherapy group each consisting of ten. They listened to detailed explanations about each posture, watched demonstrations, and practice a few times before testing.

### Therapeutic ball exercise

As for warming up, they lightly walked on the treadmill for five minutes. As for the main exercise, they made light jumps on the ball, shifted their weight between the right and left foot, raised the right and left foot alternatively, sat against the ball and rose up, lied on the ball on the back and maintained the position, raised the right and left foot alternatively lying on the ball, and heaved the chest with the ball on the stomach for 20 minutes. As for cooling down, they did stretching for five minutes.

### Hippotherapy

Slim Rider model has a speed and courses from one to fifteenth level. Each course requirement 4 minutes and have a variety programs. The horseback simulation machine was covered with the leather pad and mounted on supports at the approximate height of an average horse. The elderly sat horseback simulation machine, as he would on a horse, with supervisor in place. While sitting the horseback simulation machine, the elderly keep the balance as the hippotherapy session. As for warming up, they walked on the treadmill for five minutes. As for the main exercise, they performed each of select only the five stages according to the prescribed course and speed for total 20 minutes with four minutes per stage in this study. As for cooling down, they did stretching for five minutes.

## Measurement

### Instruments

Used to measure the balancing abilities of the elderly in the study were the Gymnic Max 65cm Plus Ball(Gymnic, Italy) and Slim Rider(Shinwa Electronics, South Korea).

## Balancing Abilities

### Time "Up & Go" Test(TUG)

This test measures the time taken for the subject to rise from a 46cm chair with armrests, walk a distance of three meters, and return back to the chair. The test showed very close correlations with BBS and high validity for assessing balance, walking speed, and functional movements.

### One Leg Stand Test(OLST)

Designed by Stones and Kozma, this test can make quantitative measurement of posture balance at any position fast. The subject is asked to spread both arms, stare at front, and raise the right and left foot alternatively. The maximum value of the two measurements was adopted.

## Data Analysis

The study used SPSS Version 18.0 for Windows to process data statistically to investigate the effects of four weeks of balancing exercise with therapeutic ball exercise and hippotherapy on the balancing abilities of the elderly. Paired *t*-test was conducted to compare effects within each of the two groups before and after exercise. Independent *t*-test was performed to compare effects between the two groups. The significance level was set at  $\alpha = .05$  to test statistical significance.

## RESULTS

The study applied therapeutic ball exercise and hippotherapy to the elderly subjects and administered OLST and TUG to assess their balancing abilities. The findings were as follows:

### General Characteristics of the Subjects

The physical characteristics of the 20 subjects were as follows: as for the hippotherapy group, the mean age was 73.8, average height was 164.2cm, average weight was 66.2kg, and seven were male and three were female. As for the ball exercise group, the mean age was 76.3, average height was 163.7cm, average weight was 61.7kg, and six were male and four were female(Table 1).

**Table 1.** Characteristics of the subjects

	Hippotherapy group(n=10)		Ball exercise group(n=10)		p
Age(years)	73.88±7.54		76.33±8.10		.146
Weight(kg)	66.22±7.06		61.77±10.43		.357
Height(cm)	164.28±9.43		163.77±8.70		.873
Gender	Male	7	Male	6	
	Female	3	Female	4	

Mean±SD

**TUG Comparison between the Hippotherapy Group and the Ball Exercise Group before and after Exercise**

The hippotherapy group made a significant

decrease in TUG from 11.28 seconds to 8.36 seconds( $p<.05$ ), and so did the ball exercise group from 11.41 seconds to 9.32 seconds= $(p<.05)$ (Table 2). However, there were no significant differences between the two groups( $p>.05$ )(Table 3).

**Table 2.** TUG comparison before and after exercise

(Unit: sec)

	Before	After	t	p
Hippotherapy group(n=10)	11.28±1.54	8.36±1.29	20.761	.000*
Ball exercise group(n=10)	11.41±1.77	9.32±1.72	8.021	.000*

Mean±SD

\* $p<.05$

**Table 3.** TUG comparison between the groups

(Unit: sec)

	Hippotherapy group	Ball exercise group	t	p
Before	11.28±1.54	11.41±1.77	-.156	.878
After	8.36±1.29	9.32±1.72	-1.332	.202

Mean±SD

**OLST Comparison on the Right Foot between the Hippotherapy and Ball Exercise Group**

Both the hippotherapy and ball exercise group made a significant increase from 6.33 seconds to

9.48 seconds( $p<.05$ ) and from 6.80 seconds to 8.50 seconds( $p<.05$ ), respectively(Table 4). However, there were no significant differences between the groups( $p>.05$ )(Table 5).

**Table 4.** OLST comparison on the right foot before and after exercise

(Unit: sec)

	Before	After	t	p
Hippotherapy group(n=10)	6.33±1.07	9.48±1.46	-7.223	.000*
Ball exercise group(n=10)	6.80±1.44	8.50±1.41	-12.021	.000*

Mean±SD

\* $p<.05$

**Table 5.** OLST comparison on the right foot between the groups

(Unit: sec)

	Hippotherapy group	Ball exercise group	t	P
Before	6.33±1.07	6.80±1.44	-.778	.448
After	9.48±1.46	8.50±1.41	1.455	.165

Mean±SD

### OLST Comparison on the Left Foot between the Hippotherapy and Ball Exercise Group

Both the hippotherapy and ball exercise group made a significant increase from 5.71 seconds to 8.47

seconds( $p < .05$ ) and from 6.58 seconds to 8.70 seconds( $p < .05$ ), respectively(Table 6). However, there were no significant differences between the groups( $p > .05$ )(Table 7).

**Table 6.** OLST comparison on the left foot before and after exercise

(Unit: sec)

	Before	After	t	P
Hippotherapy group(n=10)	5.71±1.97	8.47±1.63	-6.496	.000*
Ball exercise group(n=10)	6.58±2.02	8.70±1.75	-12.220	.000*

Mean±SD

\* $p < .05$ **Table 7.** OLST comparison on the left foot between the groups

(Unit: sec)

	Hippotherapy group	Ball exercise group	t	P
Before	5.71±1.97	6.58±2.02	-.933	.365
After	8.47±1.63	8.70±1.75	-.278	.785

Mean±SD

## DISCUSSION

Fall accidents in old age are primarily caused by lowered balancing abilities including bone density, muscular strength, flexibility, power, and stability according to decreased amounts of exercise, accordingly having a very high risk(1). Considering that they are also one of the main causes to lower the quality of life in old age, it is very critical to improve the balancing abilities of the elderly to prevent falls and increase their quality of life(7).

Of previous studies on training to enhance the balancing abilities of the elderly, Suter et al. reported that therapeutic ball exercise applied to patients turned out to be helpful for facilitating the stability and balancing reaction of the spine and doing posture adjustment training(8). In the study, the ball

exercise group reduced TUG time by 2.1 seconds and increased OLST time by 1.7 seconds, which findings support the increased balancing abilities of the elderly subjects. McGibbon found that hippotherapy could increase the task performance skills by regulating the trunk movements and even the balancing abilities by regulating sensory information and reported that children who had difficulty with walking were able to improve in exercise functions and walk more easily after hippotherapy(9). Fleck reported that hippotherapy could generate the same effects as walking exercise since the pelvis exercise the rider has on the horseback is very similar to that while walking(10). Kang and Song reported that indoor horse riding simulations stimulated interest in children with cerebral palsy and were worth considering as a therapeutic method to enhance functions(11). According to the results, the hippotherapy

group reduced TUG time by 2.9 seconds and increased OLST time by 3.1 times, which matches the results of previous studies. Such regular exercise to maintain a posture can have effects on the physical abilities of the elderly. Even low-intensity exercise that takes the physical conditions of the elderly into account can fully improve their balancing abilities. In the study, both ball exercise and hippotherapy led to the improved muscular strength and the effects of vestibular and visual stimuli on sensory functions. Both the groups had great interest in therapeutic methods and recorded a high participation level in exercise, which seems to have had contributed to their improved balancing abilities. They all showed significant differences in balancing tests, which raises the possibility of application to home programs. Future studies need to search for various methods for ball exercise and take an initiative in spreading hippotherapy through programs of various stages.

## CONCLUSION

This study investigated the effects of therapeutic balls and indoor horse riding machines on the balancing abilities of 20 senior citizens and led to the following results:

Both the ball exercise and hippotherapy group made a significant increase in TUG and OLST ( $p < .05$ ) with no significant differences between them ( $p > .05$ ).

Both ball exercise and hippotherapy seem to be proper exercise programs to improve the balancing abilities of the elderly and effective exercise programs for the elderly by utilizing space to a high degree and stimulating interest in the elderly. In addition, they are also worth considering as home programs to prevent fall accidents for the elderly.

## REFERENCES

1. Tideiksaar R. Falling in Old Age: Prevention and management. 2 Ed, *The Gerontologist* 1997; 37(6): 83-87.
2. Buchner DM, de Lateur BJ. The importance of skeletal muscle strength to physical function in older adults. *Annals of Behavioral Medicine* 1991; 13: 91-98.
3. Means KM, Rodell DE, O'Sullivan PS, Cranford LA. Rehabilitation of elderly fallers: pilot study of a low to moderate intensity exercise program. *Archives of physical medicine and rehabilitation* 1996; 77: 1030-1036.
4. Roberts B. Effects of walking on balance among elders. *Nursing research* 1989; 38: 180-183.
5. Rasmussen-Barr E, Nilsson-Wikmar L, Arvidsson I. Stabilizing training compared with manual treatment in sub-acute and chronic Low-back pain. *Manual therapy* 2003; 8: 4.
6. Carpes FP, Reinehr FB, Mota CB. Effects of a program for trunk strength and stability on pain, low back and pelvis kinematics, and body balance. *Journal of body work and movement therapies* 2008; 12: 22-30.
7. Harada N, Chiu V, Damron-Rodriguez J, Fowler E, Siu A & Reuden DB. Screening for balance and mobility impairment in elderly individuals living in residential care facilities. *Physical Therapy* 1995; 75(6): 462-469.
8. Suteral J, Zaiff C, Nelson AJ, Rothman J. The effect of a therapeutic ball on the quadriceps and lumbar paraspinals during a forward reaching task. *JOSPT* 1998; 27(1): 82.
9. McGibbon NH. Effect of an Equine-Movement Therapy Program on Gait, Energy Expenditure, and motor Function in Children with spastic cerebral Palsy: A Pilot Study. *Developmental medicine and child neurology* 1998; 40(11): 754-762.
10. Fleck CA. Hippotherapy; mechanics & human walking and horseback riding. In: Teichmann Engel BT, editor. *Rehabilitation with the aid of horse: A collection of studies*. Durango, Co; Barbara Engel Therapy Services 1997; 140.
11. Kang GY, Song BH. The Effects of Horse Riding Simulations on the Gross Motor Functions of Children with Cerebral Palsy. *Journal of Korean Contents Association* 2010; 10: 1-5.