J Korean Soc Phys Med, 2015; 10(3): 73-79
http://dx.doi.org/10.13066/kspm.2015.10.3.73

Online ISSN: 2287-7215
Print ISSN: 1975-311X

Research Article

Open Access

Comparison of Walking in Elderly People and Adults Using a Walker Aid with a Pocket Attachment

Sung-won Kwag, OT, Ms · Eun-ji Shin, OT[2] · Jeong-uk Park, PT[1] · Hyo-lyun Roh, PT, PhD[2†]

Department of Occupational Therapy, Sung Duk College
[1]Graduate School of Kangwon National University
[2]Department of Physical Therapy, Kangwon University

Received: July 13, 2015 / Revised: July 13, 2015 / Accepted: August 12, 2015
ⓒ 2015 J Korean Soc Phys Med

| Abstract |

PURPOSE: This study aims to examine the impact of the location of a walker-aid pocket that is attached to the walker while walking.
METHODS: The research subjects included 10 male adults and 10 elderly people. The subjects used a two-wheeled walker for the walking analysis, and a firm velcro-type pocket that can be attached to the walker aid was used for weight loading. The size of the external loads was set at 2kg, which corresponds to approximately 2.5% of the mean body weight of the subjects. The pocket was attached to the left, center, and right sides of the walker aid. Stride length, stride, step width, and time were investigated according to the location change.
RESULTS: No statistical differences were observed in all the walking factors among the adults and elderly people regardless of the changes in the location of the walker pocket. In cases of no weight and the 2kg walker pocket, stride length and strides were longer for the adults, while the step width was greater and walking time was longer for the elderly people.
CONCLUSION: The weight of the walker pocket turn out to retard walking speed, although the location of the walker pocket is not affect walking with the walker-aid.

Key Words: External loads, Walker, Walking analysis

Ⅰ. INTRODUCTION

Walking is essential for maintaining daily life and enjoying happy senescence. However, as many as 30.7% of elderly people over 65 years of age develop walking impediments due to a reduction in their lower limb muscle strength following chronic disease or functional disabilities (Kang et al, 2010). When walking becomes difficult due to such limitations, a walking aid becomes necessary and a walker is one of the critical items for sustaining physical activities (Choi, 2007).

The aim of a walker is to support the balance of the body trunk or to assist in sit-to-stand movement, etc. It helps elderly people or the disabled who experience difficulties during walking by increasing their safety and enabling activity not only inside, but also outdoors (Jung et al, 2009).

†Corresponding Author: bustryagain@naver.com
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/3.0) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Compared to canes, walkers have a broader basal area and greater stability. Moreover, they make it easier to support the body with one leg in the stance phase during walking as well as reduce the load on the lower limbs during the swing phase, as they support lower limb stability and add the forces required to bend and lift the leg (Park et al, 2011). Thanks to these advantages, the use of walkers among elderly people with a reduced walking ability is ever growing, and their satisfaction with walkers is also increasing through daily life activity supports and diverse services (Choi et al, 2010).

Meanwhile, as a walker requires both of a user's hands to handle, a separate walker pocket becomes necessary that can contain personal belongings (Jung et al, 2009). The storage space is fabricated such that it does not hinder the operation of the walker and so that the walking aid does not flip even in case of maximum load (Jung et al, 2009). Despite these considerations, research on the impact that containing burdens such as personal belongings in the storage space can have on walking has been scarcely investigated to date. The majority of research on walking using walkers has focused on the effects of using a walking aid and hence research on the potential change in walking patterns according to the use of a walking aid is relatively insufficient (Yoon, 2007).

Therefore, this study compares the walking of normal adults and elderly people using a walker to which external loads are applied. The study attempts to provide information regarding the location of the walker pocket that is appropriate for safe walking when using walkers.

Ⅱ. Methods

1. Subjects

The research subjects for this study included 10 male adults enrolled in University K located in Kangwon-do, Korea and 10 elderly people who are living in City S in Kangwon-do, Korea. The inclusion criteria for the subjects were those without neurologic and orthopedic problems that can hinder walking, those without visual impairment, and right-handers (Kim et al, 2011). All the subjects received sufficient explanation about the objectives of this study before the experiment and submitted their consent for participation.

2. Methods

The physical properties of the research subjects in this study were first measured. Afterwards, the experiment on the adult males was performed at a lab in University K in Kangwon-do, Korea. The experiment on the elderly people was performed at a senior welfare center in Town D in City S. The elderly people were told to wear casual clothes for the measurement, while the college students wore comfortable sportswear. All the subjects only wore socks and no shoes. Before the experiment, the subjects performed sufficient stretching and a three-minute walking exercise with walker so that they could familiarize themselves with walking with the walker. The experiment began when the subjects could maintain natural walking. They started walking 30cm before the starting point of the walking analyzer and they were instructed to begin striding with the right foot.

A walker is a representative age-friendly products that prevents falling. A two-wheeled walker, which has two wheels at the front of the walker, is easy for movement and requires less muscle strength from users since it can be moved forward by lifting the two back legs and pushing (Jung et al, 2009). Hence, a two-wheel walker was used in this study referring to Jung et al (2009).

In general, the handle of walker should be located at the ulnar styloid when the user is in a standing position with relaxed arms and elbow joint flexion at 15~20 degrees. Here, the walker is supposed to meet the height of the greater trochanter of the femour (Lee, 2004). However, it was reported that having it meet one inch above the height of the greater trochanter of the femur is more efficient regarding walking speed, plantar prints on the paralyzed side, forward shifting of the body's center, and the contact area of the heel (Cha, 2009). In this study, femur height of the subjects was first measured and the handle height was located at one inch above it, with the elbow joint flexion angle set at 15–20 degrees, referring to Cha (2009).

In order to examine the impact of weight change on walking from diverse locations of the walker- aid pocket, the pocket was attached to the left, center, and right sides of the walker where the weight was altered in each case. A walker-aid pocket is a commercial-type fabric pocket made of firm textile and has a firmly attached velcro-type pocket that is currently available in market was selected. The size was 29.8cm x 27.3cm x 2.5cm and small pockets were attached that can contain personal belongings such as glasses, notes, medicine, and mobile phone (Fig. 1).

In this study, two cases were considered referring to McGibbon et al (1996): 2kg, which is the sum of the weight that is approximately 2.5% of the mean weight of the subjects and the pocket weight and another without the pocket.

Fig. 1. Pocket with walker

3. Analysis methods

In this study, the WalkWay MG-1000 (Animaco, Japan) walking analyzer was used to analyze the stride length, stride, step width, and time according to the weight change at the location of the walking aid pocket.

Data for each item from the walking analysis were processed using SPSS 20.0 for the statistical treatment of the data. Descriptive statistics were used for the general characteristics of the subjects. A one-way ANOVA was conducted to examine the difference among the two groups, depending on the location of the walker pocket. A paired sample t-test was performed to investigate the between-group differences according to the weight. The significance level was set to 0.05.

Ⅲ. RESULTS

1. General characteristics of the subjects

The general characteristics of the subjects were as follows. In the case of adults, the age, height, and weight was 20.44±1.06, 173.94±4.13cm, and 67.35±12.03kg, respectively. In the case of elderly people, the age, height, and weight was 75.67±4.27, 163.67±5.53cm, and 61.08±7.38kg, respectively.

2. Walking analysis according to the location of the walker pocket

Below summarizes the results of the analysis on the walking changes according to the location of the walker pocket. No statistical difference was observed in walking elements among the adults and elderly people according to the changes in the location of the walker pocket ($p>.05$). It is believed that the location of the walker pocket does not affect walking (Table 1). Therefore, the location of walker pocket of less than 2.5% of the body weight that seems it does not affect.

3. Comparison of walking between the adults and elderly people with the walker pocket located on the left

The walking of the adults and elderly people was

Table 1. Walking analysis according to the location of the walker pocket

		Normal adults			Elderly people		
	Pocket location	M±SD	F	p	M±SD	F	p
Stride	Lt	117.83±9.75	.02	.98	77.71±23.45	.04	.96
	Rt	118.73±10.21			75.13±18.21		
	Mid	118.28±9.83			76.42±19.83		
Step length	Lt	59.40±3.64	.16	.86	40.33±10.43	.04	.96
	Rt	60.38±4.30			38.91±12.70		
	Mid	59.89±3.79			39.54±11.06		
Step width	Lt	8.50±2.39	.11	.90	13.12±4.46	.05	.95
	Rt	7.93±3.33			13.68±4.22		
	Mid	8.22±2.46			13.12±4.46		
Time	Lt	0.94±0.25	.05	.95	1.99±0.67	.15	.86
	Rt	0.98±0.31			1.80±0.84		
	Mid	0.97±0.27			1.90±0.72		

Table 2. Comparison of walking between the adults and elderly people with the walker pocket located on the left

Weight		Stride length (cm)		Stride (cm)		Step width (cm)		Time (sec)	
		adults	elderly people	adults	elderly people	adults	elderly people	adults	elderly people
None	M±SD	118.63 ±9.46	81.33 ±15.68	58.90 ±4.25	41.45 ±7.85	7.39 ±1.98	10.81 ±4.83	1.48 ±0.34	2.95 ±0.77
	t	17.52**		16.86**		12.16**		4.47**	
2kg	M±SD	115.31 ±6.94	72.61 ±19.93	58.34 ±5.14	36.84 ±8.13	7.19 ±1.84	12.46 ±3.18	1.69 ±0.26	3.73 ±0.62
	t	13.19**		13.70**		8.52**		8.73**	

** $p<.01$

compared in the case where the walker pocket was located on the left side of the walker. A statistically significant difference was observed in the walking of the adults and elderly people both in cases of no weight and the 2kg walker pocket ($p<.01$). In cases of no weight and the 2kg walker pocket, the stride length and strides were longer for the adults, while the step width was greater and the walking time was longer for the elderly people (Table 2).

4. Comparison of walking between the adults and elderly people with the walker pocket located at the center

The walking of the adults and elderly people was compared in the case where the walker pocket was located at the center of the walker. A statistically significant difference was observed in the walking of the adults and elderly people both in cases of no weight and the 2kg walker pocket ($p<.01$). In cases of no weight and the 2kg walker pocket, the stride length and strides were longer for the adults, while the step width was greater and the walking time was longer for the elderly people (Table 3).

5. Comparison of walking between the adults and elderly people with the walker pocket located on the right

The walking of the adults and elderly people was

Table 3. Comparison of walking between the adults and elderly people with the walker pocket located at the center

Weight		Stride length (cm)		Stride (cm)		Step width (cm)		Time (sec)	
		Adults	Elderly people	Adults	Elderly people	Adults	Elderly people	Adults	Elderly people
None	M±SD	118.28 ±9.83	82.49 ±16.01	58.03 ±4.94	41.26 ±7.38	7.85 ±2.14	11.65 ±4.47	1.47 ±0.39	2.91 ±0.69
	t	19.33**		19.62**		9.97**		5.20**	
2kg	M±SD	115.7 8±9.11	71.98 ±18.66	57.89 ±4.56	38.37 ±8.10	8.25 ±1.80	13.22 ±3.12	1.60 ±0.36	3.99 ±0.77
	t	15.27**		16.88**		10.96**		6.31**	

** p<.01

Table 4. Comparison of walking between the adults and elderly people with the walker pocket located on the right

Weight		Stride length		Stride		Step width		Time	
		Adults	Elderly people	Adults	Elderly people	Adults	Elderly people	Aadults	Elderly people
None	M±SD	118.63 ±9.46	81.33 ±15.68	58.90 ±4.25	41.45 ±7.85	7.39 ±1.98	10.81 ±4.83	1.48 ±0.34	2.95 ±0.77
	t	18.87**		19.29**		8.94**		5.10**	
2kg	M±SD	115.31 ±6.94	72.61 ±19.93	57.74 ±3.28	36.84 ±8.13	7.19 ±1.84	12.46 ±3.18	1.69 ±0.26	3.73 ±0.62
	t	14.85**		15.50**		8.85**		7.70**	

** p<.01

compared in the case where the walker pocket was located on the right side of the walker. A statistically significant difference was observed in the walking of the adults and elderly people both in cases of no weight and the 2kg walker pocket (p<.01). In cases of no weight and the 2kg walker pocket, the stride length and stride were longer for the adults, while the step width was greater and the walking time was longer for the elderly people (Table 4).

Ⅳ. DISCUSSION

In today's aging society, universal design, which anyone can easily use regardless of age, physical and mental ability, or use environment, is receiving an increasing amount of attention. At the same time, demands for age-friendly welfare tools for the elderly people are continuously growing (Choi et al, 2010). In this situation, diverse designs and functions are being applied to walking aid tools for the purpose of the enhancing daily life activity of elderly people. Moreover, diverse types of walkers are being used such as the one with a basket or a pocket attachment for personal belongings or the one with a chair function so that the user can sit and rest when feeling fatigue (Chang et al, 2012).

In this study, stride length, stride, step width, and walking time according to the location of the walker pocket differed between the adults and elderly people, where the stride length and strides of the elderly people were shorter than those of the adults. The step width of the elderly people was broader than that of the adults, while the walking time was longer for the former. These results can be attributed to the physical changes accompanying aging, such as reduced muscle strength. In general, changes in walking due to aging appear between 60 and 70 years of age. Park (2005) reported that elderly people develop properties such as slower walking, stooped posture, and easily lost balance, which can result in collapse. Moreover, they show decreased mental activity, memory, and space perception sensations due to nervous system deterioration. Even though walking rhythm is not severely affected by aging, elderly people move a shorter distance with the same number of steps. This essentially decreases their stride length and stride, which consequently elongates their walking time. Walking under these conditions will naturally result in more stable walking, as both feet can touch the ground for longer periods of time, requiring less time for one foot to support the ground (Cromwell et al, 2001). In the case of step width, Hwang (2005) reported that elderly people have a narrower step width than adults in normal walking. However, a walker was used during walking and weight was loaded in the pocket in this study. This weight loading caused a broader basal area, a lower center of gravity, and posture where the center line is located at the center of the basal area. It is conjectured that step width increased and walking base also increased in order to enhance stability during walking.

In this study, a difference was also observed between the adults and elderly people in the case where weight was loaded on the walker pocket. In general, using a walker can increase the efficiency of walking, as it disperses body weight to the aids during walking, which reduces the weight loaded on the muscles and joints of the lower limbs (Kim and Kim, 2008). However, energy consumption increased and the stride length and strides decreased to reduce the walking speed due to an increase in the external loads, despite the difference in the walker pocket’s location (Ting et al, 2014). When an external load is applied, the body responds to maintain balance. Here, the intensity and way of reacting differ according to the direction or location of the weight loading where posture control can be more efficient when the weight loading is closer to the center of the body. This kind of control contributes to physical fatigue reduction and efficient movement. Despite these diverse merits, external loads have a greater impact on elderly people’s walking and posture, due to a considerable decrease in their body function, sense, exercise ability, etc. (Chang et al, 2012). Moreover, hindrance can occur due to inappropriate handling of walkers, and walking aids can even flip in cases of excessive loading, inappropriate handling, or unstable location (Jung et al, 2009). Because of these negative impacts, stability when using a walker cannot be perfect. Such potential for additional injuries or falls can be a serious risk factor for walker user (Pauserk et al, 2011). Therefore, diverse studies are required to prevent falling by reducing these risk factors, and to ensure the safe walking and efficient daily living of elderly people. In-depth research on the application of appropriate external loads and the location should be continued.

Ⅴ. CONCLUSION

This study examined the impact of a walker pocket’s location on walking. In terms of all of the walking factors among the adults and elderly people observed in this study, no difference was observed according to the changes in the location and weight of the walker pocket. In cases of no weight and the 2kg walker pocket, the stride length and stride turned out to be longer for the adults, while the step width was greater and the time was longer for the elderly people.

To sum up, the weight of the walker pocket slowed down the walking speed, although the location of the walker pocket did not affect individuals’ walking with a walking aid.

References

Chang JS, Choi JH, Lee MY, et al. Gait analysis of healthy adults with external loads on trunk. Journal of the

Korean Society of Physical Medicine. 2012;7(1): 69-75.

Cha YJ. The effect of cane height on foot pressure of affected side in adult hemiplegia. Master's Degree. Daegu university. 2009.

Choi DS. A study on the usability of the walking aids-focus on physically disabled elderlies. Bulletin Korean Society of Basic Design & Art. 2007;8(1):623-9.

Choi HJ, Kwon CY, Kang SJ, et al. Analysis of COM change during manual walker gait for power walker walking control. Journal of the Korean Society for Precision Engineering spring congress. 2010;(5):1423-4.

Cromwell RL., Newton RA, Forrest G. Head stability in older adults during walking with and without visual input. Journal of Vestibular Research. 2001;11(2):105-14.

Hwang GC. A Practical Design of the Efficient Walking Aids. Master's Degree. Hongik University. 2005.

Jung KT, Shin DJ, Chun KJ, et al. Anthropometric analysis and usability evaluation of four-wheeled walker. Jounal of Ergonomics Society of Korea. 2009;28 (2):17-26.

Kang CK, Sung SC, Lee MG. Effects of two kinds of combined exercise training on daily living fitness in elderly farmers. Korean Journal of Sport Science. 2010; 21(2):1152-64.

Kim BK, Kim TH. The change of lower-limb muscle activity according to gait speed when normal and assistive gait of older. Journal of Korea Academy of Orthopedic Manual Physical Therapy. 2008;14(2):60-7.

Kim JS, Kim K, Jun DH. The effect of changes in young women`s static balance after performing walking task with different carrying bag positions. Journal of the Korean Society of Physical Medicine. 2011;6(1):51-8.

Lee YR. Effect of the height of walker on muscle activity in elbow extensor and energy expenditure index during ambulation with salker. Master's Degree. Hanseo University. 2004.

McGibbon CA, Kerbs DE, Mann RW. Pressures exerted on acetabular cartilage in-vivo while using a cane and carrying loads in one hand. Gait and Posture. 1996;4(2):188-9.

Park YH, Kim YK, Song WK, et al. The effect of using the walker on the kinematics and muscle activation pattern during gait and sit-to-stance in normal elderly. Korea HIC conference 2011. 2011(1):293-95.

Park JH. The variability of lower extremity's segment between the elderly and young during walking. Master's Degree. Korea National Sport University. 2005.

Yoon SH. Biomechanical analysis of the elderly gait with a walking assistive device. Korean Journal of Sport Biomechanics. 2007;17(2):1-9.

Ting W, Jean-Pierre M, Guillaume S, et al. Walking analysis of young and elderly people by using an intelligent walker ANG. Robotics and Autonomous Systems. 2014; In Press.