

경사로에서 전방보행과 후방보행의 운동학적인 효과 비교

Therapeutic efficacy of walk backward and forward on a slope in normal adults

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ABSTRACT

This study aimed to examine the therapeutic effects of backward walking. The subjects were randomly assigned to an experimental group of 16 subjects and a control group of 17 subjects. All subjects walked barefoot for twenty minutes on the treadmill (HM50EX, Daeho, Korea) for five times per week for total four weeks. The average gait velocities of subjects were 3 km/h on a slope of 10%. The experimental group walked back and the control group walked forward. The experimental group showed significant increments in variable of medial-lateral, anterior-posterior, step length, velocity compared to the pre-intervention results. In addition, the control group showed significant increments in the anterior-posterior, velocity compared to the pre-intervention results. Significant differences in the post-training gains in variable of anterior-posterior, step length, velocity were observed between the experimental group and the control group. There were positive effects of backward walking on their gait and balance ability after intervention.

I. Introduction

According to the previous studies which made comparisons between forward and backward walking, the backward walking was reported to stimulate muscles in the lower limbs more than the forward walking⁴). In addition, it can contribute to improving the gait ability as it increases the strength of the knee joints and muscle activities of the quadriceps. Recently, such effects are being manifested through the application of various approaches such as walking exercises on treadmill and flatland, backward walking exercise and robot-assisted walking exercise for stroke patients with hemiplegia to improve their gait and balance ability¹). Moreover, a variety of studies on forward walking have been conducted to improve gait and balance ability. However, little research has been carried out to find the therapeutic effects of backward walking. Therefore, the present study aims to examine the effects of forward and backward walking on the gait and balance ability.

2. Subject and method

Subjects walked for one minute to determine their natural gait velocity before the experiment, and all

subjects walked barefoot for twenty minutes on the treadmill (HM50EX, Daeho, Korea) for five times per week for total four weeks. The average gait velocities of subjects were 3 km/h on a slope of 10%. The experimental group walked back and the control group walked forward.

After the intervention, balance measuring equipment (Good Balance, Metitur, Finland) was used to quantitatively measure balance ability.

A pedometer (Gait Rite, K634-DB, Epson Inc, America) was used to collect data for temporospatial gait characteristics such as velocity, step length, stride length, single support, double support and cadence of the experimental group and the control group.

Data analysis was performed using SPSS version 20.0 (SPSS Inc., Chicago, IL, USA). Comparisons of variables before and after training within each group were made using paired sample t-tests. Comparisons of pre- and post-test differences in variables between the experimental and control groups were performed using the independent t-test.

3. Results

Significant differences in the post-training gains in variable of Anterior-posterior, step length, velocity were observed between the experimental group and the

control group ($p < 0.05$) (Table 1).

Table 1. Comparison of change in characteristics of the experimental and control group with values presented as mean (standard deviation)

	EG (n=15)		CG (n=15)	
	Pre-test	Post-test	Pre-test	Post-test
Balance				
Medial-lateral (mm/s)	147.0(41.6)	138.1(38.6)*	142.1(36.4)	138.8(35.2)
Anterior-posterior or (mm/s) ^a	188.2(39.1)	180.5(36.2)*	183.4(37.2)	179.6(43.6)*
Gait				
Step length ^{a,b} (cm)	55.4(6.4)	59.9(7.3)*	55.2(5.2)	57.1(6.7)
Velocity (m/s) ^a	84.6(4.3)	94.5(5.2)*	78.3(4.2)	82.3(3.2)*
Double support (%)	16.9(9.4)	20.3(8.1)	17.5(7.2)	19.8(8.7)
Cadence (steps/min)	101.4(13.2)	108.4(12.4)	81.6(11.2)	84.5(15.2)

EG, experimental group; CG, control group

^a Significant difference in gains between two groups, $p < 0.05$

4. Discussion

The present study was performed to investigate the effects of forward and backward walking on the gait and balance ability of healthy people. According to the research findings, there were positive effects of backward walking on their gait and balance ability after intervention. The previous studies reported that backward walking reduced the step length and improved the gait speed, and indicated that it was an effective way to increase the endurance of the lower limbs 2).

The findings of the present study are in line with the previous research findings. According to the comparison between forward and backward walking in another study, backward walking stimulates the muscles in the lower limbs and causes much higher energy consumption in the lower limbs with the combination of knee flexion and hip extension 3).

As for the mechanism of walking, backward walking has a small impact on the kneecaps and patella femoral joints as the metatarsal joints first come in contact with the surface. However, forward walking has a relatively big impact on the ankles and knee joints since walking is only possible with flexion of the knees or legs because the ankles hardly move. Although backward walking is not practiced in day-to-day life, it is effective in stimulating muscles of the knee joints and quadriceps group in a more balanced way.

■ 참고 문헌 ■

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