Analysis of correlation between balance control ability, leg circumference and Muscle strength in young adults.

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균형 조절 능력에 대한 하지 근육 둘레와 ROM·근력의 상관관계 분석연구

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Abstract

Purpose: The purpose of this study was to analyze the correlation between balance control ability, leg circumference and Muscle strength in young adults.

Methods: The subjects of this study were 31 college students who were enrolled in S university in Chungcheongnam-do. We measured the dynamic balance and static balance through Biorescue. The muscular strength of the hip, knee, and ankle joints was measured.. Muscle strength was measured using a muscle contraction dynamometer. Pearson correlation analysis was used to test the relations between balance control ability and variables.

Results: Sway length were significantly correlated with knee and hip joint muscle strength ($P < 0.05$). Sway velocity were significantly correlated with ROM and proprioception in hip joints ($P < 0.05$). LOS were significantly correlated with muscle strength in hip joints ($P < 0.05$).

Conclusion: Balance control ability was correlated with muscle strength of knee and hip joints.

1. Introduction

In balancing, the muscles of the lower extremities have a lot of influence. The muscles of the lower extremities reduce the resistance to gravity transmitted to the upper body, such as weight support and shock absorption, compared to the upper limbs. It contributes to the role of maintaining equilibrium and plays an important role in maintaining the stability of the knee [1]. Among them, in order to provide stability for the body's balance control, the ability to control the ankle joint and the ankle joint plays an important role. In the case of a large range of fluctuations in the body, the ankle joint works, and in a small range, the ankle joint mainly works [2,3].

It is reported that in the operation of the ankle joint and the ankle joint, sufficient joint range of motion and muscular strength are required, and muscle strength is highly correlated with muscle quantity. Balance control and muscle strength decline with age [4,5], and loss of balance is associated with weakening of ankle muscle strength [6].

If we look at these previous studies, we can see that lower limb muscle strength is important for balance control ability. However, there hasn't been much research into which of these factors has a stronger correlation or what the quantitative correlation is.

Therefore, in this study, we wanted to analyze the correlation between lower limb muscle circumference and lower limb muscle strength for balance control.

2. Subjerct and methods

2.1 Subject

This study was performed with 31 (M / F, 15 / 16) college students attending S University in Chungcheongnam-do. The age

was 21.54 ± 0.99 years, height was 165.28 ± 7.69 cm and body weight was 60.04 ± 11.34㎏.

2.2 Study procedure

Prior to the experiment, subjects were trained on safety and equipment, and were prohibited from smoking the day before. During the exercise stress test, ratings of perceived exertion were checked, and subjects were monitored for any abnormalities in heart rate, blood pressure, ECG waveform, or RPE.

All the general public and obese people participating in the study were assigned to the obese group and the general group according to the BMI measurement. Obesity is based on BMI (Weight/Height + Height), and the average age is in the early to mid-20s, and the number of people with a result value of 25 kg/m2 or more according to world health standards is designated as obese. (World Health Organization, Asia-Pacific region and the Korean Society of Obesity standards BMI >25 kg/m2 or more) For more accurate experiments, the general public and obese people are tested under the same conditions. The experimenter sits in a chair while wearing the equipment, rests for 5 minutes, and measures systolic blood pressure, diastolic blood pressure, heart rate, mean arterial pressure, and pulse pressure. After the measurement, the experimenters proceeded with the treadmill exercise according to [table 2] up to 4 steps. Each stage lasts for 3 minutes, and the condition of the subjects is measured before and after exercise.

The study aimed to compare the cardiovascular changes between the two groups by analyzing the average changes in the measured values before and after exercise.

2.3 Statistical analysis

In this study, descriptive statistics were used to analyze the mean and standard deviation (SD) of each variable. SPSS was used for all statistical analyses. Means difference between the two independent means was used to compare the differences in cardiovascular changes between obese people and the general population, and the statistical significance level was set to α = 0.05

3. Results

There was no significant correlation between thigh and calf circumference and thigh muscle mass for balance control.(P>0.05)[Table 2].

In the correlation of lower limb muscle strength to balance control, sway length and knee extension (r = -0.32) had a significant negative correlation (P <0.05) with eyes open, and sway length and knee extension (r = -0.30) had a significant negative correlation with closed eyes. (P<0.05)

The stability limit (LOS) was significantly positively correlated with hip extension (r = 0.45) and knee extension (r = 0.31). (P<0.05) [Table 3].

[Table 1] The General subject characteristics

Variable	N=31
Age(year)	21.54±0.99a
Height(㎝)	165.28±7.69
Weight(㎏)	60.04±11.34

Mean±SDa

[Table 2] Correlation among thigh and calf circumference, thigh muscle mass and balance ability

	thigh circumference(cm)	calf circumference(cm)	thigh muscle mass(cm)
	52.35±4.52a	35.40±3.39	43.38±3.70
Sway length EO	0.11	0.04	0.09
Sway length EC	0.11	0.04	0.08
Sway velocity EO	-0.23	-0.12	0.11
Sway velocity EC	-0.25	-0.16	0.08
LOS	0.03	-0.24	-0.04

Mean±SDa

[Table 3] Correlation between lower extremity muscle strength and balance ability

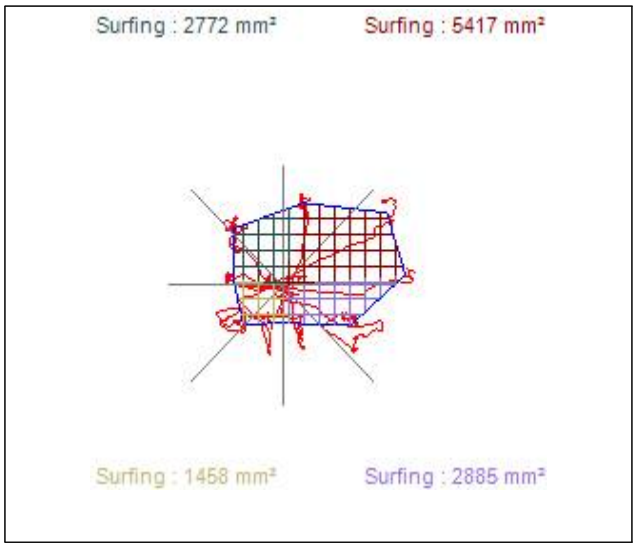
	MHF (lbs)	MHE (lbs)	MHAB (lbs)	MHAD (lbs)	MHEX (lbs)	MHINT (lbs)	MKF	MKE	MADF	MAPF
	25.13± 6.63a	15.98± 6.20	26.08± 7.03	13.35± 4.70	15.40± 5.23	12.44± 4.34	26.40± 6.85	23.58± 5.49	22.12± 5.35	21.87± 4.94
Sway length EO (cm)	-0.13	-0.16	-0.09	-0.23	-0.15	-0.20	-0.22	-0.32*	0.06	-0.26
Sway length EC (cm)	-0.11	-0.14	-0.07	-0.21	-0.14	-0.17	-0.18	-0.30*	0.08	-0.24
Sway velocity EO (cm/s)	0.13	0.07	0.11	-0.05	0.23	0.02	-0.16	-0.08	0.11	-0.01
Sway velocity EC (cm/s)	0.09	-0.00	0.04	-0.11	0.19	-0.04	-0.19	-0.15	0.07	-0.08
LOS (mm2)	0.10	0.45**	-0.11	0.26	0.08	0.24	-0.10	0.31*	-0.27	0.01

Mean±SDa,*p<.05,**p<.01, EO = eye open, EC = eye close, LOS = Limit of stability, MHF = mmt of hip flexion, MHE = mmt of hip extension, MHAB = mmt of hip abduction, MHAD = mmt of hip adduction, MHEX = mmt of hip external rotation, MHINT = mmt of hip internal rotation, MKF = mmt of knee flexion, MKE = mmt of knee extension, MADF = mmt of ankle dorsiflexion, MAFF = mmt of ankle plantar flexion.

4. Conclusion

In conclusion, sway length was strongly related to the muscle strength of the knee joint disarms, and the stability limit (LOS) was strongly related to the disparity of the muscle strength.

Balance training in young adults may be effective if treatment focuses on the knee and hip joints in terms of muscle strength, based on the results of this study.



[Fig. 1] The Result of balance control ability

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