

# Immediate Effect of Balance Training on Unstable support surface and Self Elongation Exercise of Gastrocnemius muscle on static and Dynamic Balance

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균형 훈련 시 다리 각도 변화불안정한 지지면에서의 균형훈련과 장딴지근의 자가신장 운동이 정적 균형에 미치는 즉각적 효과

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## Abstract

The purpose of this study is to study the acute and chronic effects of balance training on unstable support surfaces and the effects of self-stretch movement of the gastrointestinal tract on static balance. One group was subjected to balance training, the other group was subjected to self-stretching exercise of Gastrocnemius with balance training, and static balance were measured before and after intervention. Static balance increased significantly in both groups( $p<0.5$ ). Static balance increased significantly in WDI and ST in the group with balance training and self-stretching exercise of Gastrocnemius( $p<0.5$ ). As a result of this study, it was found that both balance training on the unstable support surface and self-stretching exercise of Gastrocnemius were effective in improving static balance.

## 1. Introduction

Balance refers to the process of continuously maintaining posture stability by maintaining the center of gravity Within the base plane with the ability to adapt to the base plane with both feet or one foot. The ability to maintain balance is the most fundamental essential factor for humans to go daily or perform purposeful activities [1]. Balance is divided into static and dynamic balance, which refers to the ability to stand motionless on a fixed support surface, and dynamic balance refers to the ability to maintain balance when moving on a support surface, when there is external stimuli, or when moving on its own [2]. Recently, therapeutic approaches that change environmental conditions such as unstable support surfaces requiring posture control have been applied in various diseases such as sports injury patients and the elderly falling [3].

## 2. Methods

### 2.1 participants

40 healthy adults in their 20s were chosen as the subjects of this study through interviews. Sufficient explanation and training on the research procedures and methods were provided before the experiment. All subjects agreed to participate in the study voluntarily.

### 2.2. Balance training on unstable support

On an air cushion, 20 times of squats and lunges were performed as a set. A diameter of 33cm TOGU was used for the unstable supporting surface. On the unstable supporting surface, 20 times of squats and lunges were performed as a set. They were also asked to be careful of the knee crossing the tip of the toes and to keep the waist neutral while raising the head slightly to maintain 15 degrees in front. [Fig. 1].

### 2.3. Experiment procedures



[Fig. 1] 3D motion analyzer

2.3.1 Measuring Static Balance(TETRAX)

Balance ability was measured using TETRAX (Tetrax, Tetra-ataxiometric posturography, and Israel). The subjects were asked to position the toes and heels of both feet on each platform (A-B-C-D) for 32 seconds while standing up to measure their static balance ability[Fig. 1].

2.4. Data analysis

This study conducted all statistical analysis using SPSS 20.0. The normality test was performed using the Kolmogorov-Smirnov test, and the data were normally distribution, so a parametric test method was used. A paired t-test was used to test the significance of static and dynamic balance before and after intervention according to each intervention method, and an independent t-test was used to compare the values of differences before and after intervention between the two groups. The statistical significance level was set at .05.

3. Results

This study measured and compared the static and dynamic balance before and after balance training on the unstable support surface and Gastrocnemius Self-stretching.

A Paired t-test was conducted to compare the differences before and after intervention within the group. In the balanced training group on the unstable support surface, both static and dynamic balance increased significantly(p<.05). Both static and dynamic balance increased more significantly in the group with balance training on unstable support surfaces and Gastrocnemius Self-stretching indicating significant differences (p<.05)[Table 1].

		Intervention								
		Balance training Group				Balance training+ Self-stretching Group				
		Pre	Post	t	p	Pre	Post	t	p	
Dynamic Balance (%)		99.19 ±4.48	104.41 ±15.55	-1.81	.011	105.06 ±11.21	112.80 ±22.72	.33	.781	
	NO	7.59 ±2.53	6.68 ±2.17	1.69	0.02	5.39 ±2.97	5.68 ±3.60	-.44	.002	
Static Balance (points)	W D I	NC	6.43 ±2.36	6.42 ±2.38	.033	.023	5.76 ±2.74	5.69 ±2.91	.12	.002
		PO	7.13 ±2.67	7.03 ±5.63	.085	.58	5.55 ±2.96	5.28 ±3.90	-.98	.006
		PC	6.77	6.75	.042	.000	5.16	4.99	.32	.001

		±3.41	±2.40		±2.23	±3.02		
ST	NO	17.37 ±2.99	17.29 ±2.88	-0.8	.067	15.86 ±4.72	15.26 ±3.33	.57 .116
	NC	20.02 ±5.41	20.20 ±4.58	-0.10	.021	19.01 ±7.26	18.91 ±4.92	.06 .016
	PO	19.64 ±4.62	20.20 ±4.62	-0.6	.002	21.01 ±6.03	20.91 ±4.51	-1.1 .000
	PC	27.29 ±5.31	27.29 ±5.85	0.61	.001	28.17 ±7.59	27.06 ±7.32	.65 .032

[Table 1] Comparison of Balance training on unstable support surface and self elongation exercise of gastrocnemius on static balance

4. Discussion and Conclusion

Conducting balance training on an unstable support surface showed significant improvement in both dynamic balance and static balance, consistent with previous studies showing that balance training on an unstable support surface is effective for normal adults in their 20s [5]. Compared to on a stable support surface, balance training on an unstable support surface is more effective in improving the sense of proprioception during weight movement training and is effective in enhancing weakened muscles and balancing exercise feedback by activating balance training and strategies of regulating the exercise of around the ankle [4]. Thus, a significant improvement in dynamic balance and static balance was shown immediately after conducting balance training on an unstable support surface in this study, as well. This was consistent with the results of previous studies that balance training on unstable support was effective in improving joint mobility range [5, 6].

According to the result, it is believed that conducting balance training on an unstable support surface showed a significant improvement in static balance and dynamic balance like it showed an improvement in Gastrocnemius Self-stretching. Additionally, appropriate ankle and calf muscle strength are required to maintain balance by fixing the posture straight and positioning the center of gravity (COG) within the base of support (BOS) [7]. In this study, as it showed an improvement in dynamic and static balance through balance training by doing squat and lunge exercise using TOGU, which is an unstable support surface, it is believed that there is also an effect from this.

The intervention time alone can be expected to produce relatively good results for the mixed group of self-extension exercise of the gastrocnemius. Therefore, in future studies, it will be necessary to increase the reliability of the study by setting the same conditions for the intervention application of all groups.

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