



# Immediate Effects of Elastic Taping on Ankle on Balance in the Elderly

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## Abstract

**Purpose:** The purpose of this study is to observe the immediate effects of elastic taping and isometric exercises on balance ability in the elderly. **Research design, data and methodology:** 15 elderlies were participated in this study and randomly assigned into two group. The intervention group was applied elastic taping on ankle joint while the control group performed isometric ankle exercise in three sets for 30 seconds per set. Anterior-posterior and medial-lateral postural sway speed were measured after the experiment. To compare the change in balance ability between groups after the experiment, independent t-test was used. To investigate the change in balance ability between pre- and post-experiment within the groups, paired t-test was used. **Results:** A significant difference in medial-lateral postural sway speed was found after elastic taping application only in the intervention group ( $p>0.05$ ). However, there was no significant difference between the groups. **Conclusions:** In conclusion, this finding supported that elastic taping would be helpful to support ankle stability and increase balance ability for the elderly as well as performance for sports athlete that was demonstrated in previous studies. Further studies will be necessary to confirm the long-term effects of elastic taping application on motor control and the risk of falling.

**Keywords :** Balance, Elastic Taping, Exercise, Motor control, Stability

**JEL Classification Codes :** I10, I30, I31

## 1. Introduction

Balance is the process of continuously maintaining postural stability, and the ability to maintain balance is one of the fundamental elements of human's performance of purposeful motor actions in daily life (Wang, Jiang, & Huang, 2018). At the same time, various factors in daily life such as musculoskeletal injury or nervous system damage

by injury, disease, and even aging would reduce the ability to balance (Sturnieks, St George, & Lord, 2008).

Actually, postural perturbation, is a normal phenomenon in which the center of gravity of the body is maintained within the support surface during many daily activities like walking or other any purposeful activities (Anderson & Behm, 2005). However, once the stability of postural balance decreases to an abnormal state, it causes a fall (Corbeil, Simoneau, Rancourt, Tremblay, & Teasdale,

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2001). Whereas, as the stability of balance increases by exercise, or rehabilitation, it prevents injuries by accident.

Among various anatomical structures that are responsible for balance, ankle joints are important for postural balance, which are vulnerable to be damaged in daily life such as during sports, and leisure activities, and repeated ankle injury increases the probability of chronic ankle instability (Ha, Han, & Sung, 2018). Especially, in aging process, motor control of ankle joint is the most vulnerable structure or the body due to musculoskeletal and neurological degeneration (Cuevas-Trisan, 2019). In addition to maintaining balance during walking, the ankle regulates the interaction between the feet and the ground, which is essential for walking and postural balance, and a reduced stability and range of motion in the ankle joint results in hip and body's excessive movements to compensate for balance (MacKinnon, & Winter, 1993).

Representative intervention methods introduced so far for ankle stability were rehabilitation training methods through neurophysiology-based evidence and elastic taping has been frequently used as an assistance tool for maximizing the neurophysiological effects during training (Kaminski, & Hartsell, 2002). However, reports of clinical outcomes due to the neurophysiological effects by elastic taping are still insufficient especially for the elderly. In addition, it is also necessary to demonstrate the effect of the independent application of elastic taping on balance (Morris, Jones, Ryan, & Ryan, 2013).

Therefore, this study aimed to observe the effects of independent application of elastic tapping on balance ability for the elderly by comparing with control group.

## 2. Literature Review

### 2.1. Elastic band in rehabilitation

The basic purpose of taping is to support and protect joints to perform the optimal functional movement, and various studies have reported that external support to ankle joint by taping could increase joint stability through ligament support, hyperactivity inhibition, joint alignment correction, proprioceptive sensory improvement, and pain relieve (Hewetson, Austin, Gwynn-Brett, & Marshall, 2009).

## 3. Methodology

### 3.1. Participants

15 participants in their 60s were enrolled in this study. The inclusion criteria were those who did not suffer ankle

injury or experience a fall within the last 6 months. Before the experiment, the experimental procedure was explained to all participants, and they consented to participate. The detailed demographics are shown in Table 1.

**Table 1:** Participant demographics

n=15	Control (n=7)	Intervention (n=8)
Sex (male/female)	4/3	4/4
Age (years)	61.32 ± 2.23	63.25 ± 3.72
Height (cm)	155.24 ± 1.62	157.51 ± 2.78
Weight (kg)	59.56 ± 3.12	60.22 ± 2.42
Skeletal muscle mass (kg)	20.42 ± 2.52	19.93 ± 1.12
Body fat mass (%)	35.12 ± 1.53	35.28 ± 3.27
BMI (kg/m <sup>2</sup> )	26.16 ± 3.24	25.92 ± 2.23

### 3.2. Experimental Procedure

After selecting 15 participants, they were randomly assigned into a control group and an intervention group. All participants measured their balance ability using Good Balance (Metitur, Finland) before the experiment. Afterwards, the control group performed general stabilization exercises for the ankle stability by isometric contraction in three sets for 30 seconds with dorsiflexion and plantar flexion movements of the ankle, and the intervention group applied elastic taping to ankle joint according to a method, introduced by a previous study (Hewetson et al., 2009). Next, post measurements were performed after the experiment.

Specifically, the taping attachment method began to attach the center of the elastic tape with a width of 5cm and a length of 70cm from the center of the metatarsal arch, and wrapped the ankle bone. In addition, with the ankle bent, the center of the tape 5cm wide and 35cm long was attached to the Achilles tendon and attached to the front part of the ankle joint.

### 3.3. Outcome Measurements

The change in the balance ability was observed by measuring the change in the postural sway level in a comfortable standing position. Participants were instructed to stand on the force plate in the most natural and comfortable posture while maintaining the distance between both heels by 5 to 6 cm for 30 seconds and fixing the gaze on the cross mark on the front wall. Two outcome measurements were observed; 1) mean X speed indicated that medial-lateral sway speed during 30 seconds in the standing position and 2) mean Y speed indicated that anterior-posterior sway speed at the same duration.

### 3.4. Statistical analysis

After homogeneity test of the general characteristics of the participants using Shapiro-wilk test of SPSS (Version 19, USA), the comparison between the two groups was performed by independent t-test. Paired t-test was performed to compare between pre- and post-experiment in each group. All statistical levels were set to P=0.05.

## 4. Results

### 4.1. Changes in balance ability of each group

In the intervention group, mean X Speed showed a significant change ( $p > 0.05$ ) from  $1379.56 \pm 390.57$  mm/s to  $1227 \pm 305.19$  mm/s after elastic taping application, and mean Y Speed was decreased, but there was no significant difference (Table 2). In the control group, whereas, both mean X Speed and mean Y Speed were not significant changed after exercise application (Table 3). There were no significant differences in both mean X Speed and Y Speed between the groups.

**Table 2:** The changes in balance ability after elastic taping application

Variables (mm/s)	Intervention		P-value
	Pre	Post	
Mean X speed	1379.56±390.57	1227±305.19	0.022*
Mean Y speed	890.94±321.61	874.02±283.46	0.305

Note: \* P<0.05

**Table 3:** The changes in balance ability after exercise application

Variables	Control		P-value
	Pre	Post	
Mean X speed	2067.16±1793.13	1110.6±1565.77	0.091
Mean Y speed	901.09±3223.96	823.38±2602.65	0.144

Note: \* P<0.05

## 5. Discussion

The ability to maintain balance is one of the essential physical functions in their daily lives to perform purposeful activities, and when the stability of balance decreases to abnormal state, it causes falls (Sturnieks et al., 2008; Cuevas-Trisan, 2019). According to a number of studies to date, taping has been reported to be effective in reducing weight load and reducing pain by supporting and protecting

joints to perform the best functional movements (Al-Shareef, Omar, & Ibrahim, 2016; Lu, Li, Chen, & Guo, 2018). In this study, the clinical effect of independent application of taping for the elderly was observed by comparing the effect of taping in the intervention group and general rehabilitation exercise in the control group on balance ability.

As a result, there was no significant difference in effect between the intervention group and the control group, but a significant reduction in the medial-lateral sway speed during 30 seconds in the standing position after taping application was found only within the intervention group. That is, these results indicated that elastic taping would be effective to reduce the body sway immediately after application. Many previous studies have reported various clinical effects of elastic taping consistent with the results of this study. In particular, most of studies reported taping application and effectiveness related to sports injury. Representatively, Choi, Kim, Kim, Nam, and Kim (2008) reported that both muscle strength and posture control ability were improved after applying elastic taping on the ankle in tennis players. In addition, Leanderson, Ekstam, and Salomonsson (1996) reported that the application of taping to the ankles of soccer players showed an effect of reduction in postural sway. These results that taping would be more helpful to sports injury of athletes who mainly performed lateral motion in a competition.

Based on previous demonstrations of taping effects, in this study, elastic taping was applied to the elderly with relatively low balance ability compared to young adults. Generally, in the case of the elderly, since the musculoskeletal and nervous system deteriorate due to aging, and a significant decrease in balance ability with increase in the risk of falling is remarkable (Konrad, Girardi, & Helfert, 1999), many rehabilitation methods to assist this symptom have been introduced. As expected, this study demonstrated that elastic taping would immediately enhance balance ability of the elderly.

In the absence of proprioceptive information from joint receptors located in ligaments around the ankle joint or joint sac, the body posture becomes more difficult to balance, which can lead to problems related to functional instability and re-injury of the ankle joint (Freeman, Dean, & Hanham, 1965). Therefore, the reason why taping attached to the ankle increases the balance ability of the elderly would be that taping promotes the mechanical receptor of the fascia around the ankle. Therefore, long-term taping application and effect on the risk of falling will be necessary to be additionally examined in future studies.

In addition, until now, reports on the taping effect on patients with neurological damage such as spinal cord injury and stroke are relatively insufficient. Regarding ankle exercises performed by the control group in this study, Karatas, Çetin, Bayramoglu, and Dilek (2004) reported that

strengthening the flexor and extensor muscles of the ankle with isometric exercise increased muscle strength and dynamic balance, and based on this, taping application will be expected to have a positive effect on the balance ability of the hemiplegic patients. Therefore, future studies are needed to expand the scope of taping application and demonstrate its clinical effects. Although the result of this study might be meaningful to expand the scope of taping application, there were limitations in generalization of study results because of the small sample size.

## 6. Conclusions

In this study, it was confirmed that independent application of elastic taping was effective immediately on body's medial-lateral postural sway. Therefore, this finding supported that elastic taping would be helpful to support ankle stability and increase balance ability for the elderly as well as performance for sports athlete. Plus, further studies will be necessary to confirm the long-term effects of elastic taping application on motor control and the risk of falling for elderly or patients with various neuromuscular damage.

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