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AN INVESTIGATION OF ACUTE EFFECT OF KINESIO TAPING ON SINGLE LEG BALANCE IN TAEKWONDO ATHLETES: A RANDOMIZED CONTROLLED TRIAL

ORIGINAL ARTICLE

ABSTRACT

Purpose: Balance has a vital role in taekwondo athletes for injury prevention and athletic performance. Many strategies are being investigated to improve balance. The Kinesio Tape (KT) application is one of these methods. The study aimed to investigate the acute effect of the KT application to the hip abductor muscle on the single-leg balance in elite taekwondo athletes.

Methods: The 53 elite taekwondo athletes with no ankle or lower extremity problems (27 males and 26 females) participated in the study. Athletes were randomly assigned to either the study group (n=28) or the control group (n=25) after the first balance evaluation. Single leg balance was assessed with using a power plate device under different conditions: (1) without taping (for all athletes); (2) the 48 hours after application with the KT for the study group; (3) the 48 hours after the first balance evaluation without KT for the control group. KT was applied to the hip abductor muscle by facilitation technique to the study group. The second measurement of balance was made 48 hours after the KT application.

Results: There was no statistically significant difference between the groups in terms of the total score, anteroposterior (A-P) score and mediolateral (M-L) scores between the first and second balance tests (p>0.05). No statistically significant differences were found in total score, A-P score, and M-L scores of the first and the second balance tests of both KT and control groups (p>0.05).

Conclusion: It was determined that KT application to hip abductor muscles did not affect single leg balance in healthy elite taekwondo athletes.

Key Words: Athletic Tape; Hip Joint; Postural Balance; Sports.

TAEKWONDO SPORCULARINDA KİNEZYO BANTLAMANIN TEK BACAK DENGESİNE AKUT ETKİSİNİN İNCELENMESİ: RANDOMİZE KONTROLLÜ ÇALIŞMA

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Denge, taekwondo sporcularının sportif performansında ve yaralanmalardan korunmasında önemli role sahiptir. Dengeyi geliştirmek için çeşitli stratejiler araştırılmaktadır. Kinezyo Bantlama (KB) uygulaması da bu yöntemlerden biridir. Çalışmanın amacı; kalça abdüktor kasına yapılacak KB uygulamasının, elit taekwondo sporcularında tek bacak üzerinde denge becerisine akut etkisini incelemekti.

Yöntem: Çalışmaya ayak bileği ya da alt ekstremite problemi olmayan 53 (27 erkek ve 26 kadın) elit taekwondo sporcusu dâhil edildi. Sporcular ilk denge değerlendirmesinden sonra randomize olarak çalışma grubu (n=28) ve kontrol grubu (n=25) olmak üzere iki gruba ayrıldı. Tek bacak üzerinde denge ölçümü bir kuvvet platformu ile farklı durumlarda değerlendirildi: (1) Bantlama yapılmadan (tüm sporculara), (2) Çalışma grubunda bant uygulamasından 48 saat sonra, bant ile birlikte, (3) Kontrol grubunda ilk değerlendirmeden 48 saat sonra bant olmadan. KB uygulaması kalça abduktor kasına fasilitasyon tekniği ile yapıldı. İkinci denge değerlendirmesi, KB uygulamasından 48 saat sonra yapıldı.

Sonuçlar: Çalışma ve kontrol grubunun gruplar arası ilk ve ikinci denge testleri arasında total skor, anteroposterior (A-P) skor ve mediolateral (M-L) skorlarda istatistiksel olarak anlamlı farklılık olmadığı tespit edildi (p>0,05). Hem çalışma hem de kontrol grubunun grup içi ilk ve ikinci denge testinin total skor, A-P skor ve M-L skorlarında istatistiksel olarak anlamlı farklılık olmadığı bulundu (p>0,05).

Tartışma: Çalışmanın sonuçlarına bakıldığında, kalça abduktor kasına yapılan KB uygulamasının sağlıklı elit taekwondo sporcularında dengeye etkisi bulunmadığı tespit edildi.

Anahtar Kelimeler: Atletik Bantlama; Kalça Eklemi; Postüral Denge; Spor.

INTRODUCTION

Ability to adapt to the changing center of gravity during the movements of the human body is called balance (1). Visual, vestibular, and proprioceptive stimuli are transmitted to the central nervous system. The commands, generated by processing the received input, are transmitted to the musculoskeletal system. As a result of these process, balance skill comprises (2). It is known that increased proprioceptive stimuli improve balance (3). In addition, the effect of skeletal muscles on balance, such as strength, fatigue, endurance, is known (4). The critical muscle groups that contribute to balance are ankle and hip muscles (5). Various studies support the effect of hip abductor muscles on balance (6,7).

Taekwondo is known as a sport branch that requires high balance skills due to its nature (8). It is assumed that loss of balance causes sports injuries and decreases in athletic performance (1,9). Various methods are being studied to improve balance. Kinesio tape (KT) application has been one of the popular methods in recent years. This material is designed to mimic human skin. It is similar in thickness to the epidermis and could stretch by 140% compared to normal length (10). The literature about KT is contradictory. Some of the studies claim that KT improves balance by neuromuscular control and proprioceptive feedback factors (11-13). However, some other studies do not agree with this claim (11-13,14-18).

The authors suggested that KT may have provided cutaneous stimulation to the skin. Therefore, it may stimulate the afferent receptors of the skin, thus affecting muscle activity and causing an increase in proprioception through increased stimulation to cutaneous mechanoreceptors (15,19). This underlies our hypotheses, stating that the application of KT to the hip abductor muscle by facilitation technique may affect proprioception and hip abductor muscle activity, thus the single-leg balance. The popularity of the application of KT during the sports rehabilitation process and sports competitions, and the need for empirical evidence on the effect of KT and its potential effect on balance were compelling reasons to perform this experiment. This study aimed to determine whether the application of KT to the hip abductor muscle, affected single leg balance in elite taekwondo athletes.

METHODS

Participants

Eighty-two elite taekwondo athletes that in the national team camp at between June and December 2018 in Athletic Training and Research Center were invited to the study. Athletes were given detailed information about the study, and verbal and written informed consent was obtained from those who wanted to participate in the study and/or their representatives. Athletes were questioned about the illness and injury story, and a sports physician performed physical examinations. Athletes with previous musculoskeletal injuries, those with lower limb malalignment (femoral anteversion, genu varum, ankle hyper-pronation) and joint limitation during physical examination and athletes whose sports experience is less than three years, who is doing less than two hours and five days a week sport-specific training were excluded from the study. As a result of the evaluations, 65 (33 males, 32 females) athletes meeting the inclusion criteria were included in the study. Athletes were randomly assigned two groups as a study group and control group. Randomization was provided with the flip a coin method. Randomization was performed after the first balance assessment. Twenty-eight members of the study group (14 males, 14 females) and twenty-five members of the control group (13 males, 12 females) completed the study (Figure 1). Ethics committee approval for this study was obtained from the Ankara Yıldırım Beyazıt University Ethics Committee (Approval Date: 18.05.2018 and Approval Number: 18.05.2018/145/05).

Study Procedure

Each athlete participated in two balance testing sessions on separate days. The tests were performed at the same time in the morning (after two hours from the breakfast), at the same center, by the same clinicians, and by giving the same directions for each athlete. There was a 48 hours difference between the tests to avoid the learning effect (20). Athletes in the study group were taped

with KT after the first balance test. The second balance test was done 48 hours after the KT application. Both balance test of the control group and the first balance test of the study group were taken without taping. The second balance test of the study group was taken with taping.

Kinesio Tape Application

The athletes in the study group were taped with KT on the abductor muscles of the non-dominant (support legs) lower limbs. This application was done with Kinesio Tex® Tape (Kinesio Holding Corporation, Albuquerque, NM, USA). The tape is waterproof, flexible, and sticky. The width of the tape is 5 cm, and the thickness is 0.5 mm. The KT was applied on gluteus medius muscle of the non-dominant leg from the direction of trochanter major to posterior, medial and anterior spinal iliac crista at 75% of its maximal length-tension, in order to provide a muscle facilitation effect. Taping was applied while the athlete was side-lying (21). Three pieces of tape were applied on the athletes from just below the greater trochanter directly upwards to the iliac crest with the leg in neutral position, and anteriorly on the anterior superior iliac spine with the leg in extension position, upwards and posteriorly towards the posterior third of the iliac crest with the leg in flexion position (22).

Balance Evaluation

The power plate (Kistler® brand Body Sway Module, Kistler, Switzerland) was used to perform balance tests. This device consists of a moving circular platform and pivot support located in the center under this platform. The platform that measures the center of gravity changes was connected to a computer. The changes are recorded in millimeters (mm) according to their distance from the starting point. The changes are calculated as total, anteroposterior (A-P), and mediolateral (M-L) changes. The lower value of the changes; in other words, the lower value in millimeters, indicates that the balance is better.

A protocol was created in the Body Sway module for single-leg balance analysis of the athletes. The measurements were made with bare feet. The athletes were asked to stand on the non-dominant leg for 30 seconds in a position that hip and knee of dominant leg flexed 90 degrees. Athletes put their hands on their waist and looked forward during all tests. The first measure was accepted as a trial. The means of the next three measures were used for statistical analysis (23).

Statistical Analysis

The SPSS 23.0 (Statistical Package for Social Sciences Inc. Chicago, IL, USA) for Mac (Free Trial) was used for statistical analysis of the data. The sample size was calculated using an open-source web-based program. The effect size was estimated to be 0.10. Considering a power of 0.80 and α level of 0.05, a minimum of 25 athletes would be required for each group in the study. The distribution of the data was tested with the Kolmogorov-Smirnov Test. The study and control groups' results were assessed using the Paired t-test. The first and the second tests of the control and study groups were compared with each other using Student t-test for parametric data and Mann Whitney-U test for nonparametric data. Descriptive level of significance was set at $p<0.05$.

RESULTS

The age, height, weight, and body mass index values, and sports experience of the athletes in the study group and the control group are shown in Table 1. There were no significant differences in

Table 1: Age and Physical Characteristics of the Athletes.

Parameters	Study Group (n=28) Mean±SD	Control Group (n=25) Mean±SD	p
Age (years)	18.57±2.69	17.88±2.77	0.180§
Height (cm)	174.01±8.27	174.08±11.40	0.498§
Body Weight (kg)	63.01±12.77	63.94±16.25	0.408§
Body Mass Index (kg/m²)	20.62±2.79	20.79±3.25	0.839§
Sports Experience (years)	8.68±2.43	7.96±2.95	0.255ϕ

§Student t Test, ϕMann Whitney-U test.

Table 2: Single Leg Balance Test Results between the Groups.

Parameters	Study Group (n=28) Mean±SD	Control Group (n=25) Mean±SD	p[§]
First Test Total (mm)	1265.65±324.25	1230.56±285.84	0.677
First Test A-P (mm)	780.61±219.96	741.88±196.43	0.501
First Test M-L (mm)	852.85±203.25	840.14±188.28	0.814
Second Test Total (mm)	1226.21±246.26	1259.29±287.95	0.657
Second Test A-P (mm)	747.08±166.89	773.79±195.25	0.597
Second Test M-L (mm)	828.14±173.69	856.65±192.78	0.576

[§]Student t-Test. A-P: Antero-Posterior, M-L: Medio-Lateral.

age, height, weight, and body mass index values, and sports experience between the two groups (p>0.05) (Table 1).

The first and second balance test results of the study and the control groups are shown in Table 2. No significant differences were found in the first and the second test balance values between the study and the control groups (p>0.05). The difference between the first and the second balance tests within the groups are shown in Table 3. It was determined that there was no significant difference within the groups (p>0.05).

DISCUSSION

In this study, it was determined that the application of KT to the hip abductor muscle did not affect the single-leg balance of elite taekwondo athletes.

There are various studies to date regarding this topic. In a study with healthy subjects, KT application was performed to the ankle muscles of the subjects. There was no significant difference in single-leg balance tests performed before and after application (24). Nichols et al. applied KT to the ankle and found that KT does not affect the star excursion balance test (SBET) (25). In a study in which KT was applied to the hip flexors, it was determined that the single-leg balance was not affected by this application (26). In another study, Nunes et al. applied ankle plantar flexor muscle KT application, and they did not find any difference at SBET before and after KT application (17).

Furthermore, in two studies which participants were applied KT on their ankle muscles, it was determined that this application does not affect single-leg balance (14,15). In a study investigating the effect of standard athletic tape and KT on balance, it was shown that the balance results of standard athletic tape group were worse than the control group, and KT had no effect on balance (27). These studies were found to be consistent with the results of our study. The present study differs from others due to it was conducted with elite athletes, and KT was applied to the hip abductor muscle.

It is known that balance is related to muscle strength (4). The manufacturers of KT claim that this application increases muscle strength (10). Csapo and Alegre's meta-analysis showed that KT application did not affect muscle strength (28). It is

Table 3: Difference between the First and Second Tests in the Groups.

Parameter	First Test Mean±SD	Second Test Mean±SD	p[§]
Study Group (n=28)			
Total (mm)	1265.65±324.25	1226.21±246.26	0.487
Anteroposterior (mm)	780.61±219.96	747.08±166.89	0.321
Mediolateral (mm)	852.85±203.25	828.14±173.69	0.545
Control Group (n=25)			
Total (mm)	1230.56±285.84	1259.29±287.95	0.601
Anteroposterior (mm)	741.88±196.43	773.79±195.25	0.419
Mediolateral (mm)	840.14±188.28	856.65±192.78	0.679

[§]Paired t-Test.

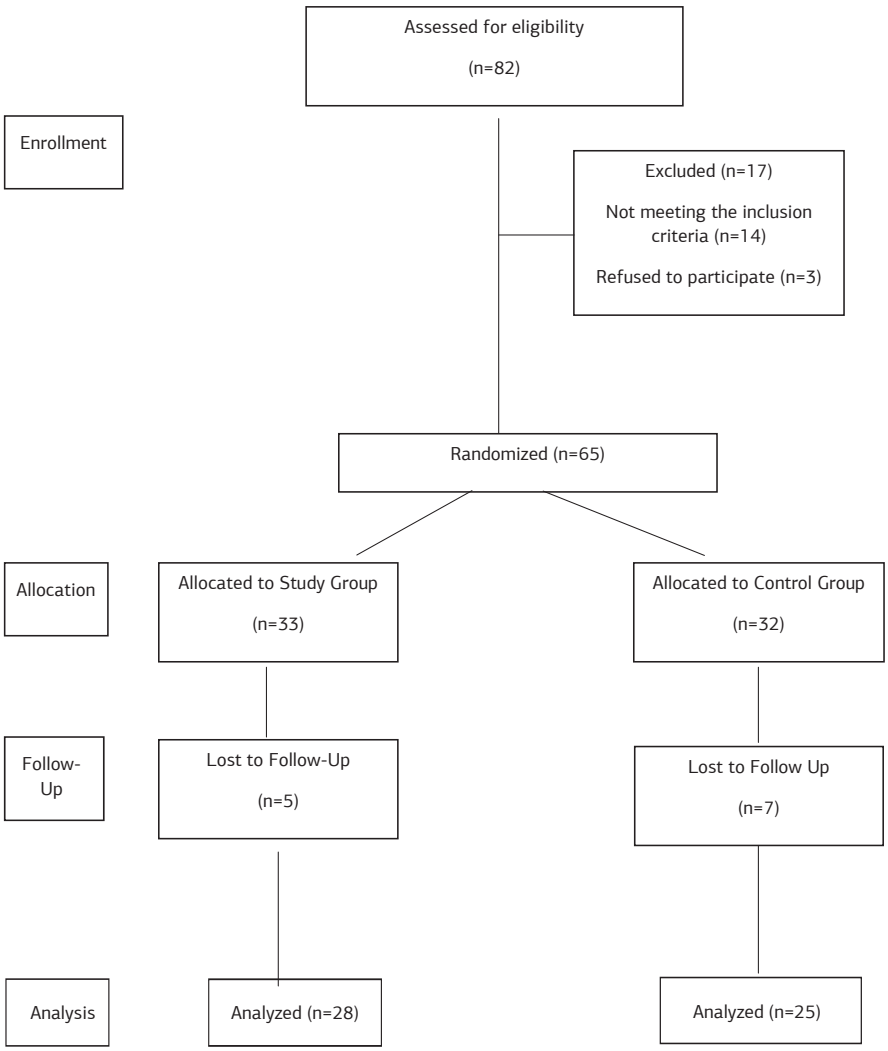

Figure 1. Flow Chart of the Study.

stated that one of the possible effects of KT is to increase neuromuscular stimulation (10). However, in one study, it was shown that KT application by inhibition and facilitation method did not cause any change in electromyographic activity (29). This result supports that KT does not affect balance. Therefore, it is compatible with the current study.

Contrary to our study, there are various studies in the literature that claim that KT improves balance and proprioception. In a study of Nakajima and Baldrige with 52 healthy sedentary subjects, it was determined that KT application to the ankle muscle had a positive effect of balancing in female subjects, but there was no significant difference in male subjects (13). The present study was conducted with healthy individuals, but the difference in outcome was probably due to the presence of elite athletes instead of sedentary individuals. In the study conducted by Sawkins et al., the real and placebo taping did not affect the balance skill of the subjects, but the self-confidence of the subjects during physical activity was increased (30). This study highlights the possible placebo effect of KT.

In our study, the presence of subjects in both genders, but the gender-free evaluation of results could be regarded as a limitation of the study. Other possible limitations are that the hip abductor muscles were taped with only one method and

that no placebo group exists. It would be useful to evaluate the effects of different taping methods and placebo applications.

In conclusion, the application of KT on the hip abductor muscle did not affect the single-leg balance of elite taekwondo athletes. The results of the study reveal the necessity of new studies in order to investigate the effectiveness of the KT application, which is frequently used in practice, on balance.

Sources of Support: None.

Conflict of Interest: None.

Ethical Approval: This study was approved by the Ethics Committee of Ankara Yıldırım Beyazıt University Non-Interventional Research Ethics Committee (Approval Date: 18.05.2018 and Approval Number: 145/05).

Informed Consent: A written informed consent was obtained from all study participants.

Peer-Review: Externally peer-reviewed.

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