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EFFECT OF RESPIRATORY MUSCLE'S KINESIOLOGY TAPING ON PHYSICAL FITNESS PARAMETERS IN MALE UNIVERSITY STUDENTS: DOUBLE-BLIND CROSS-OVER STUDY

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ABSTRACT

The aim of this study was to investigate the effects of diaphragmatic kinesiology taping on physical fitness parameters in university students. Twenty male university students participated in this study voluntarily. Muscle facilitation technique was applied on back and abdominal region coinciding diaphragm muscle. For sham application, same tape material was applied without a special stretch or technique. International Physical Activity Questionnaire Short Form (IPAQ-SF), 2 km walking test, prone plank, side plank, Sorenson test and Standing stork test were used for evaluation. After the first evaluation, we waited 72 hours for the second application. Firstly, 10 participants had tape application and the other half had sham taping. In the second session, we changed the application. In the taping and placebo applications, a significant relationship was found between prone endurance test values before and after application ($p<0.05$). In the kinesio tape and placebo applications, a significant relationship was found in 2 km walk performance compared to untaped condition evaluation before and after the application ($p <0.05$). In the before-after evaluations within the group, a significant difference was found in the kinesio tape and placebo applications in the 2-kilometer walking test, but there was no statistically significant difference in the comparisons between the kinesio tape and placebo applications.

Keywords: Athletic tape, diaphragm, physical fitness

ERKEK ÜNİVERSİTE ÖĞRENCİLERİNDE SOLUNUM KASI KİNEZYOLOJİK BANTLAMASININ FİZİKSEL UYGUNLUK PARAMETRELERİNE ETKİSİ: ÇİFT KÖR ÇAPRAZ TASARIMLI ÇALIŞMA

ÖZET

Bu çalışmanın amacı, üniversite öğrencilerinde diyafragmatik kinesiyolojik bantlamanın fiziksel uygunluk parametreleri üzerine etkilerini araştırmaktır. Bu çalışmaya 20 erkek üniversite öğrencisi alındı. Diyafragma için sırt ve karın bölgesine kinezyobandın kas fasilitasyon tekniği kullanıldı. Plasebo uygulama için aynı bant materyali, diyafragma kasına herhangi bir özel gerim ve teknik olmaksızın sadece yapıştırıldı. Değerlendirme için; Uluslararası Fiziksel Aktivite Anketi Kısa Formu (IPAQ-SF), 2 km yürüme testi, prone plank, side plank, Sorenson test ve Standing stork test kullanıldı. İlk ölçümlerde 10 katılımcıya kinesio tape, 10 katılımcıya plasebo bantlama uygulandı. İlk değerlendirme bittiğinde kinesio tape hemen çıkarıldı ve 72 saat dinlenme süresi verildi. İkinci ölçümde uygulama değiştirildi. Kinesio tape ve plasebo uygulamalarında prone endurans değerlendirmesinde uygulama öncesi ve sonrası arasında anlamlı bir farklılık bulundu ($p<0,05$). Kinesio tape ve plasebo grubunda 2 km yürüme testi değerlendirmesinde uygulama öncesi ve sonrası arasında anlamlı bir farklılık bulundu ($p<0,05$). Grup içi önce-sonra değerlendirmelerinde 2 kilometre yürüme testinde kinesio tape ve plasebo uygulamalarında anlamlı fark bulundu ancak kinesio tape ve plasebo uygulamaları arasındaki karşılaştırmalarda istatistiksel olarak anlamlı fark görülmedi.

Anahtar Kelimeler: Atletik bant, diyafram, fiziksel uygunluk

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INTRODUCTION

Kinesio Tape (KT) is a tape material developed by Dr. Kenzo Kase in 1973. Kinesio tape is epidermis thick and has a structure that provides flexibility up to 55-60% of its normal size. As it is 100% cotton fiber material, it allows sweating and can be easily dried on the skin (Zübeyir et al., 2012). Depending on the structure of the skin and the surrounding conditions, the KT can stay in the application region (Kase, 2003). KT has many beneficial effects such as correction, relaxation of the fascia, support of the ligament, muscle and tendon, correction of the movement and increase of lymph circulation (Huang et al., 2011).

Physical fitness is the body's ability to perform its functions efficiently and effectively. Physical fitness is analyzed as two main topics as health-related and performance-related physical fitness parameters. Physical fitness parameters related to health are cardiorespiratory fitness, muscular endurance, strength, flexibility, body composition and the essential skills required for success in athletic competitions and sports events are defined as performance-related parameters (Caspersen et al., 1985).

The primary respiratory muscle, the diaphragm, reduces pleural pressure and by moving in the caudal direction with the ribs, expands the lungs (Zübeyir et al., 2012). The diaphragm muscle takes over 75% of the inspiratory capacity. Increasing the functionality of the diaphragm muscle can help increase pulmonary ventilation and provide significant improvement in pulmonary function test scores (Arslan et al., 2018).

Some recent studies have shown that application of Kinesio Tape increases musculoskeletal function (Tsai et al., 2009; Cho et al., 2015; Kelle et al., 2016). Depending on the technique, muscle activation can be both improved and inhibited (Huang et al., 2011). The underlying mechanism is explained by the stimulation of the sensory motor and proprioceptive systems (Arslan et al., 2018).

There are some studies in the literature investigating the effects of KT on respiratory muscles (Zübeyir et al., 2012; Arslan et al. 2018; Ökmen and Ökmen, 2019; Roopa Desai, 2018).

METHODS

Participant Selection

Twenty male students from Gümüşhane University aged between 18 and 22 participated in the study voluntarily.

Inclusion criteria;

- No injury or surgical operation involving the musculoskeletal system in the past six months,

- Having a medium level of physical activity according to the International Physical Activity Questionnaire Short Form (IPAQ-SF) (Öztürk, 2005).

Exclusion criteria;

- A contraindication for Kinesio Tape (allergy, hyperesthesia, etc.)
- To evaluate the allergic reaction, a 5X5 cm-sized kinesio tape was applied to the forearm flexor face of the participant and checked for a while.
- Participants who did not want to continue being in this study.

Kinesiology Tape Application

Kinesio tape® was applied to the anterior and posterior subcostal surfaces for the diaphragm application to the individuals participating in the study. For the diaphragm, the muscle facilitation technique of the Kinesio Tex Gold® (Kinesio USA, Albuquerque, NM) was used on the back and abdomen. In abdominal taping, the person stands and the trunk is in extended position. The person is asked to raise their hands above their head and make expiration. Taping was started under the xiphoid process and the ends of the tape were glued to the ribs. In back taping, the person stands and the trunk is flexed. Taping was started at the level of the 12th thoracic vertebra and the ends of the tape were glued to the subcostal region (Anandkumar et al., 2014; Arslan et al., 2018). The same Kinesio tape material for placebo application was adhered only to the diaphragm muscle without any special tension and technique.

For the homogeneous distribution of learning and band effect, kinesio taping was applied to 10 participants and placebo taping was applied to 10 participants in the first session. When the first session was over, the kinesio tape was immediately removed and a 72-hour rest period was given. Within the cross-over design, applications were displaced in the second application and the same evaluations were repeated.

Evaluations

Demographic information, body mass index and physical activity level (IPAQ) were determined before starting the study. For physical fitness levels of the participants; aerobic endurance (2 km walking test), muscular endurance (prone plank, side plank, Sorenson test) and balance (Standing stork test) tests were evaluated before and after taping.

All evaluations were made by an experienced physiotherapist while kinesio tape was done by another physiotherapist. Because of the double-blind study, the volunteers who participated in the study and the physiotherapist who made the evaluations did not know which individuals were applied the placebo.

First, a trial was made and the participant was taught the test, then the test was done and the result was recorded.

2 km Walk Test: The area of the test was determined. The participant was asked to walk this distance briskly and his duration was recorded (Oja et al., 1991).

Prone Plank Test: It is used to measure the endurance of core muscles. The participant lies in prone position. The participant is asked to rise on his elbows and toes, and keep the body on a straight line. The total time is recorded. The time is stopped when the participant drops or raises his body (Carneiro et al, 2016).

Side Plank Test: This test evaluates the endurance of the lateral trunk flexor muscles. The participant is asked to lie on the elbow with the legs in full extension, lift the trunk and maintain his position, with the lower limbs, hip and back aligned. The total time is recorded. When the participant drops his hips, the duration is stopped. Measurements are repeated on both sides, right and left (Tong et al., 2014).

Sorenson test: The participant's body lies prone above the anterior superior iliac spine (ASIS) level hanging from the table. Thighs and legs are stabilized using tapes. Then he places his hands on the shoulders crosswise and is asked to lift his body at the same level as the table. The participant is asked to hold this position as long as possible and the total time is recorded (Mohamed, 2017).

Standing Stork Test: This test evaluates the strength of the leg, pelvic and trunk muscles as well as dynamic balance. The participant stands with hands on his waist. He is asked to bend one leg and keep the other knee medial. He is then asked to stand up to his fingertip and stand without losing his balance. The total time is recorded. The time is stopped if the participant takes his hand from the waist, the non-tested foot is cut off from the other knee, and the tested side is in contact with the heel (Mohamed, 2017; Selvaganapathy, 2017).

Research Ethics Approval

The study was approved by the Scientific Research and Publication Ethics Committee of Gümüşhane University (2018/10 numbered 20.12.2018) and permission was obtained from the institution where the research was conducted. Participants were informed about the research before the application and their permission was obtained. This study was conducted in accordance with the Helsinki Declaration Principles.

Statistical Analysis

The data obtained in the study were analyzed using the statistical package program (SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.). Mean, standard deviation, median, lowest, highest, frequency and ratio values were used in the descriptive

statistics of the data. One Sample Kolmogorov Smirnov test was applied for the analysis of normality. Wilcoxon test was used in the analysis of dependent data, and Mann-Whitney U test was used in the analysis of non-dependent data. The findings were evaluated within the 95% confidence interval and 5% significance level.

RESULTS

Table 1. Descriptive statistics

Age (years) (Mean ±SD.)	Physical Activity Level (IPAQ Score*) (Mean ±SD.)	Body Mass Index (kg/m$^{2)}$ (Mean ±SD.)	Smoking Level (piece-day) (Mean ±SD.)
19.10±1.150	1565.92±1178.49	22.25±3	9.95±8.637

* International Physical Activity Questionnaire Short Form, SD: Standard Deviation

Descriptive data of 20 individuals taken within the Double-Blind Cross-Over Study were shown in Table 1.

Table 2. Results of in-condition difference analysis (Wilcoxon Signed Rank Test)

	Placebo Application				Kinesio Tape Application			
	Negative Ranks	Positive Ranks	Z	p	Negative Ranks	Positive Ranks	Z	p
Balance (Right)	60	93	-0.782[c]	0.434	120	70	-1.007[b]	0.314
Balance (Left)	82.50	70.5	-0.285[b]	0.776	72	64	-0.207[b]	0.836
Prone Endurance test	181	29	-2.838[b]	0.005	161.5	28,5	-2.677[b]	0.007
Side Endurance Test (Right)	114	76	-0.765[b]	0.444	106	104	-0.037[b]	0.970
Side Endurance Test (Left)	80	109	-0.584[c]	0.559	97	93	-0.081[b]	0.936
Sorenson Test	145	65	-1.494[b]	0.135	125	85	-0.747[b]	0.455
2 km. walking test	168.5	41.5	-2.371[b]	0.018	172	38	-2.501[b]	0.012

a. After taping < Before taping b. After taping > Before taping c. After taping= Before taping

In the taping and placebo applications, there was no significant difference between right and left foot balance assessment before and after taping ($p>0.05$).

In the taping and placebo applications, a significant relationship was found between before and after application in the evaluation of prone endurance ($p<0.05$). In the taping and placebo applications, prone endurance values were lower after taping.

There was no significant relationship between pre and post-administration in the evaluation of Sorenson, right and left side endurance tests of the taping and placebo applications ($p>0.05$).

In the taping and placebo applications, a significant relationship was found between before and after taping in the 2 km walking test evaluation ($p<0.05$). After the taping in both conditions, the 2 km walking test was completed in a shorter time. Statistics within the condition are shown in Table 2.

Table 3. Differences between conditions (Mann- Whitney U Test)

	Before Taping		After Taping	
	Z	**p**	**Z**	**p**
Balance (Right)	-0.958	0.338	-0.082	0.935
Balance (Left)	-0.653	0.514	-0.463	0.644
Prone Endurance test	-0.325	0.745	-0.176	0.860
Side Endurance Test (Right)	-0.312	0.755	-0.325	0.745
Side Endurance Test (Left)	-1.070	0.285	-0.447	0.655
Sorenson Test	-0.541	0.588	-0.785	0.433
2 km. walking test	-0.541	0.588	-0.975	0.330

In this study, no significant differences were detected between the conditions in the right-left balance, prone endurance, right-left side endurance, Sorenson and 2 km walking tests before and after the application ($p>0.05$). Statistical data between conditions are shown in Table 3.

DISCUSSION

In this study, the instant effect of the kinesio tape applied to the diaphragm muscle on the physical fitness parameters was investigated.

Stimulating effects of kinesio tape on muscle performance have been investigated in previous studies and there are conflicting publications on its effectiveness (Csapo and Alegre, 2015; Mostaghim et al., 2016; dos Santos Glória et al., 2017).

In our study, we aimed to increase the activation of the diaphragm muscle with kinesio tape, as well as to investigate its effect on parameters of physical fitness. There is very limited research in the literature regarding the effectiveness of kinesio tape applied to the diaphragm muscle (Zübeyir et al., 2012; Roopa Desai, 2018; Ökmen and Ökmen, 2019) . In our study in which the instantaneous effect of cross over and kinesio tape on the same cases were investigated, no difference was found between taping and placebo taping applications. However, there was a deterioration in prone endurance test results between both kinesio tape and placebo before and after application. This may be because the tension created by the tape prevents it from maintaining the test position. We think that the tension created by the tape application in the abdominal region prevents the activation of the posterior pelvic tilt and deep muscle together with the abdominal draw-in maneuver and in this case, it makes it difficult to maintain spinal stabilization.

In addition, a significant difference was found in 2 km walking test results in kinesio tape and placebo applications. Kinesio taping is known to provide proprioceptive input (Cho et al., 2015; Seo et al., 2016; Torres et al., 2016; Arslan et al.. 2018). Even if the technique is

neglected, the application of placebo and kinesio tape may have positively affected performance, as it provides proprioceptive input to the diaphragm muscle.

CONCLUSION

In our study, we compared the effectiveness of kinesio taping applied to the diaphragm with the placebo method of kinesio taping. In the before-after evaluations within the condition, a significant difference was found in the kinesio tape and placebo condition in the 2-kilometer walking test, but there was no statistically significant difference in the comparisons between the kinesio tape and placebo condition. In order to determine the effectiveness of kinesio tape on respiratory muscles, more investigations with more participants are needed in the future.

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