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The Effect of Kinesiology Taping on Respiratory Muscle Strength

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Abstract. [Purpose] The aim of this study was to examine the effect of kinesiology taping applied to primary and accessory respiratory muscles on respiratory muscle strength.[Subjects] The subjects were 47 healthy university students (16 female, 31 male), who were all enrolled at the Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, The University of Marmara. [Methods] Participants were divided into two groups and diaphragmatic kinesiology taping was applied to the first group and kinesiology taping to the accessory respiratory muscles of the second group. Respiratory muscle strength was measured with Micro Mouth Pressure Measurement (MPM) before and after taping.[Results] The results show that kinesiology taping of the primary and accessory respiratory muscles caused no significant increase in respiratory strength. [Conclusion] The current findings on the effect of kinesiology taping on muscular strength do not fully support the results of other studies reported in the literature. These results suggest the need for more comprehensive studies of both acute and long-term effects of kinesiology taping on muscular strength of healthy individuals and patients.
Key words: Kinesiology taping, Respiratory muscle strength, Micro mouth pressure measurement

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INTRODUCTION

Kinesiology taping is a technique that was developed by Dr. Kenzo Kase in 1973[1)]. The tape material used in kinesiology taping is of epidermis thickness[2)] and weight[3)] and has a structure providing elasticity up to 55–60% of its normal size[4)]. It allows evaporation and can dry on the skin easily due to it being 100% cotton fiber material[1)] knitted with pinholes[2, 5)].

The structure of the tape and the application technique result in the therapeutic effects of kinesiology taping[6)]. These effects include improving circulation of the blood and lymph, decreasing pain, stimulating proprioception, stabilizing articulars and restoring muscle tone[3, 5, 6)].

The effect of kinesiology taping on muscular strength depends on the application technique. Taping from the insertion of muscle to its origin inhibits muscle function[7)], whereas taping from the muscle origin to insertion facilitates the muscle function[7, 8)]. The underlying mechanism of the taping is thought to be cutaneous stimulation of the sensorimotor and proprioceptive systems[9, 10)].

The diaphragm, which is a primary respiratory muscle, acts as a piston. It lowers pleural pressure and inflates the lungs by moving in the caudal direction with the ribs[11)]. The scalene and sternocleidomastoid muscles increase respiratory capacity by moving the sternum and rib cage in the cranial direction. While the sternocleidomastoid muscle is active as an accessory muscle only during forced inspiration, scalene muscles are always active as primary respiratory muscles[12–14)]. The internal and external oblique abdominal muscles are forced expiration muscles that help the exhalation of air by increasing the abdominal pressure during forced expiration[15)].

Respiratory muscles have striated muscle structure embryologically, morphologically and functionally and show fatigue after overwork. Some researchers claim that inhibitor signals are generated, reducing motor command when fatigue in the muscles continues and this leads to respiratory insufficiency[16)]. In a study of asthma patients, Turner et al. (2011) reported that the increase in respiratory muscle strength reduced the fatigue level of the respiratory muscles[17)].

Even though kinesiology taping is claimed to have the effect of increasing muscular strength, the results of the limited studies on this topic are contradictory. Therefore, our aim was to investigate the effect of kinesiology taping on primary inspiratory, accessory inspiratory and expiratory muscle strength.

SUBJECTS AND METHOD

Fifty university students at the Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, The University of Marmara took part in this study. Three

students were subsequently excluded due to respiratory diseases, so 47 individuals (16 female, 31 male) were evaluated. All participants were requested to sign consent forms approved by the Institute of Health Sciences, The University of Marmara. A personal information sheet was distributed to gather physical data. Table 1 shows the demographic characteristics of the participants.

This study examined the effect of the kinesiology taping muscle technique applied to the primary respiratory muscle and accessory respiratory muscles on maximum inspiratory and expiratory muscle strength. Measurements were made at the Exercise Laboratory of the Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, The University of Marmara. Pinotape® (PINO GmbH) was used as the tape and was applied by two physiotherapists, both certified in kinesiology taping. Maximum inspiratory and expiratory muscle strengths were evaluated with Micro MPM (by Micro Medical Limited) by measuring mouth pressure. The validity and reliability of the Micro MPM device was demonstrated by Zacharias et al.[18]. Participants were randomly divided into two groups. The kinesiology muscle taping technique was applied to the diaphragm of subjects in the first group. In the second group, the same taping technique was applied to the sternocleidomastoideus of the accessory respiratory muscles and to the rectus obliquus externus and internus, accessory expiratory muscles. Although the anterior and medius scalene muscles are primary respiratory muscles, they were evaluated in the second group, as they have a similar effect on respiration as the sternocleidomastoid muscle[19]. The first group (Group I) was divided into two subgroups, consisting of 13 (Group Ia) and 10 (Group Ib) participants. Maximum inspiratory and expiratory muscle strength were measured in the first subgroup (n= 13) and then the measurements were repeated after kinesiology taping. In the second subgroup, kinesiology taping was applied and muscular strengths were evaluated, then reevaluated after the taping had been removed. Twenty-four participants in total were evaluated in the second group (Group II). They were divided into 2 subgroups with equal numbers of participants. Maximum inspiratory and expiratory muscle strengths of the first subgroup (Group IIa) were measured with the MPM device and then, measurements were repeated after kinesiology taping. In the second subgroup (Group IIb), taping was applied and maximum respiratory muscle strengths were measured, then the measurements were repeated after the taping had been removed. The taping was applied with paper-off tension (approximately 25%) from the muscle origin to the insertion when the muscle was tense.

Two tapings were applied to the diaphragm, from the abdomen and back. The taping on the diaphragm from the abdomen was applied when the participant was standing with his/her body in hyperextension and both arms extended at head level. The base point of the Pinotape® was applied on the xiphoid process without tension and the tails of the tape were applied towards the ribs with no tension. The taping was applied to the diaphragm from the back when the participant was standing with his/her body in flexion with arms crossed over the body. The projection of the xiphoid process on the back was determined as the base and the tails of the tape were applied towards the ribs without any tension [20].

Tapings of the accessory inspiratory muscles were applied in a sitting posture. Sternocleidomastoideus taping was applied when the neck of the participant was in lateral flexion to the opposite side to be taped and in rotation to the same side; and anterior and medius scalene tapings were applied when the neck of the participant was in the lateral flexion position to the opposite side to be taped. Tapings were repeated on the opposite side.

Taping was applied to accessory expiratory muscles in the supine position. While the participant was supporting one leg in the hip and knee flexion position on the bed, the other leg was extended from the bed and the hip was kept in the extension position. The obliquus externus muscle was taped on the side with hip-knee flexion and the obliquus internus muscle was taped on the side with hip extension [21]. Tapings were made on both sides.

Maximum inspiratory muscle strength was measured during forced inspiration following expiration and maximum expiratory muscle strength was measured during forced expiration following deep inspiration. The measurements were repeated 3 times and the highest value was recorded.

The SPSS program was used for statistical evaluation. Participants' age, height and body weight were compared using Student's *t*-test. The taping results of both groups were compared using the Wilcoxon Test. A value of $p<0.05$ was accepted as statistically significant.

RESULTS

A total of 47 subjects consisting of 16 females and 31 males participated in the present study. The mean age of the Diaphragmatic Kinesiology Taping group was 21.0± 1.4 years, the mean body weight was 66.1±10.4 kg and the mean height was 171.4±8.3 cm. In the Accessory Respiratory Muscle Kinesiology Taping group, the mean age was 21.0 ± 1.3 years, the mean body weight was 62.8±8.9 kg and the mean height was 170.7±8.5 cm. No statistically significant difference was found between the ages, height and body weights of the participants in the two groups ($p>0.05$, Table 1).

Nine (39.1%) participants in the Diaphragmatic Kinesiology Taping group were female and 14 (60.9%) were male; 7 (29.2%) participants in the Accessory Respiratory Muscle Kinesiology taping group were female and 17 (70.8%) were male. No statistically significant difference was found between two groups in terms of gender distribution ($p>0.05$, Table 2).

Inspiration muscular strength of the participants in the Diaphragmatic Kinesiology Taping Group Ia was 66.6±29.5 mmHg in the pre-taping test and 72.4±31.9 mmHg with taping ($p>0.05$, Table 3); inspiration muscular strength in Group Ib was 66.5±27.4 mmHg with taping and 70.8±28.1 mmHg without taping ($p>0.05$, Table 3). The average inspiration muscular strength among participants in the Accessory Respiratory Muscle Kinesiology Taping Group IIa was 63.5±27.1 mmHg at pre-taping and 60.0±19.8 mmHg with taping ($p>0.05$, Table 3); and the average inspiration muscular strength in Group IIb was 67.5±26.2 mmHg with

Table 1. Demographic parameters

Features	DKT (n=23)	ARKT (n=24)
Age (year)	21.0 ± 1.4	21.0 ± 1.3
Body Weight (kg)	66.1 ± 10.4	62.8 ± 8.9
Height (cm)	171.4 ± 8.3	170.7 ± 8.5

DKT: Diaphragmatic Kinesiology Taping. ARKT: Accessory Respiratory Muscle Kinesiology Taping. Value of Student's t-test, *p<0.05

Table 2. Gender distribution of participants

Gender	DKT (n=23)		ARKT (n=24)	
	n	%	n	%
Female	9	39.1	7	29.2
Male	14	60.9	17	70.8

DKT: Diaphragmatic Kinesiology Taping. ARKT: Accessory Respiratory Muscle Kinesiology Taping. Chi-square test, *p<0.05

Table 3. Comparison of with and without taping inspiration and expiration muscular strengths

Groups	Inspiration	
	First measurement (mmHg)	Second measurement (mmHg)
DKT -Group Ia	66.6 ± 29.5	72.4 ± 31.9
DKT -Group Ib	66.5 ± 27.4	70.8 ± 28.1
ARKT -Group IIa	63.5 ± 27.1	60.0 ± 19.8
ARKT -Group IIb	67.5 ± 26.2	67.4 ± 24.5
	Expiration	
	First measurement (mmHg)	Second measurement (mmHg)
DKT -Group Ia	79.6 ± 36.4	84.0 ± 34.0
DKT -Group Ib	75.9 ± 32.0	79.8 ± 38.2
ARKT -Group IIa	73.9 ± 21.2	71.4 ± 22.6
ARKT -Group IIb	77.6 ± 22.8	87.4 ± 29.0

DKT: Diaphragmatic Kinesiology Taping. ARKT: Accessory Respiratory Muscle Kinesiology Taping. Wilcoxon signed rank test, *p<0.05 (for with and without taping measurement values)

taping and 67.4±24.5 mmHg without taping (p>0.05, Table 3). When the inspiratory muscle strengths were compared, no statistical significant difference was found in terms of inspiratory muscle strengths between with and without taping (p>0.05, Table 3).

Expiratory muscle strength of participants in the Diaphragmatic Kinesiology Taping Group Ia was 79.6±36.4 mmHg at pre-taping and 84.0±34.0 mmHg with taping (p>0.05, Table 3); the expiratory muscle strength measured in Group Ib was 75.9±32.0 mmHg with taping and 79.8±38.2 mmHg without taping (p>0.05, Table 3). The average expiratory muscle strength among participants in the Accessory Respiratory Muscle Kinesiology Taping Group IIa was 73.9±21.2 mmHg at pre-taping and 71.4±22.6 mmHg with taping (p>0.05, Table 3); and the average expiratory muscle strength measured in Group IIb was 77.6±22.8 mmHg with taping and 87.4±29.0 mmHg without taping (p>0.05, Table 3). When the expiratory muscle strengths of participants were compared, no statistically significant difference was found in terms of expiratory muscle strengths between with and without taping (p>0.05, Table 3).

DISCUSSION

The study examined the effect of kinesiology taping applied to primary and accessory respiratory muscles of healthy individuals on maximum respiratory muscle strength. The results indicate that kinesiology taping applied to primary and accessory respiratory muscles has no significant effect on maximum respiratory muscle strength. This result is in partial agreement with previous findings in the literature. In a study of physical education and sports department students, Tieh-Cheng Fu et al. (2008) found that kinesiology taping did not affect the muscular strength of healthy individuals[9]. Similarly, another study of baseball players examined the acute effect of kinesiology taping on the lower trapezius muscle strength and reported no significant increase[22]. The literature includes other studies showing that kinesiology taping had no effect on muscular strength[23–25].

A number of studies have evaluated the acute effect of kinesiology taping. Kenzo Kase claimed that the effect of kinesiology taping lasts for 3–4 days[4]. Therefore, it is possible that an increase in muscle activation following kinesiology taping will emerge in long-term applications and the results of acute evaluation might be misleading. This view is consistent with the results of Slupik et al. (2007)[10] who reported an increase in vastus medialis muscle strength after taping that reached its peak level within 24 hours and lasted for a further 48 hours following removal of the tape.

Studies of the effect of kinesiology taping on muscular

strength in the literature have included healthy individuals. Kenzo Kase stated that kinesiology taping balanced muscle activation by reducing increased muscle tone and increasing reduced muscle tone[20, 26]. We suggest that kinesiology taping applied to healthy muscles, as in our study, may have no acute effect on muscle activation, as claimed by Kase. The results of our study and other studies[9, 22–25, 27] support this view. Additionally, in another study by Murray et al. (2000), kinesiology taping applied after ACL repair was found to increase muscular strength. This result was attributed to the restoration process after injury. The result of that study therefore supports our view[28].

The results of studies examining the effect of kinesiology taping on muscular strength are inconsistent with each other. Our study, once again, shows that more comprehensive research is required in this field. Comparative studies of healthy subjects and patients may facilitate reaching consensus on this issue. Similarly, we suggest that research on the acute and long-term effects of kinesiology taping is required for better understanding of this topic.

We did not evaluate the effect of kinesiology taping on spirometric and volumetric measurements and this is a limitation of this study. However, there are few studies of the efficiency of kinesiology taping on respiratory muscles in healthy individuals and the present study therefore contributes to the literature and may inform future studies.

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