Effectiveness of Kinesio Taping on Pulmonary Function and Respiratory Muscle Performance in Healthy Adult Males

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Purpose: This study aimed to evaluate the immediate effects of Kinesio taping on pulmonary function and respiratory pressure in healthy adult men. **Methods:** This study involved 30 healthy men, who were randomly assigned to a control group with no taping (n = 10), an intercostal taping group (n = 10), and a diaphragm taping group (n = 10). Pulmonary function was assessed by measuring the forced expiratory volume (FEV), FEV in 1 s (FEV_1), maximum inspiratory pressure (MIP), and maximum expiratory pressure (MEP). **Results:** No significant differences were found in the FEV and FEV_1 across or within the groups. However, significant improvements were observed in the MIP and MEP within the intercostal taping group and between this group and the other groups. **Conclusion:** The results of this study indicate that Kinesio taping does not induce significant changes in the overall pulmonary function. However, it significantly enhances the MIP and MEP. These findings propose that intercostal Kinesio taping is a viable therapeutic intervention for patients with diminished inspiratory and expiratory pressures.

Key words: Diaphragm, Intercostalis, Spirometer, Kinesio taping

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1. Introduction

The mortality rate due to respiratory diseases increased from 3.9% in 1991 to 6.5% in 2001. This increase can be attributed to factors such as the inhalation of ashes from industrial accidents and the deterioration of the atmospheric environment resulting from industrialization and urbanization (Korea National Statistical Office, 2002). Furthermore, deaths due to chronic lower airway diseases, such as chronic bronchitis, emphysema, bronchial asthma, and bronchiectasis, constitute 58.1% of all respiratory disease-related deaths and continue to show a steady increase (Jackson, 2000).

Respiratory muscles play a crucial role in the inhalation and exhalation of air into the lungs. When these muscles deteriorate, they cause pulmonary function insufficiency. Reduced lung capacity and respiratory myopathy symptoms limit daily physical activities and lower quality of life due to physical weakness and muscle atrophy (Chin et al., 2008). Chronic obstructive pulmonary disease (COPD) is one of the most common chronic lung diseases, characterized by airflow limitation or obstruction. The prevalence and mortality rate of COPD are increasing in modern society (Lee et al., 2008). Fatigue of the inspiratory respiratory muscles significantly contributes to acute respiratory failure, which is a severe issue for COPD patients (Rochester, 1980). Compared to healthy individuals, COPD patients have weaker inspiratory respiratory muscles (Jones et al., 1971).

Parker et al. (2005) conducted research on changes in inspiratory respiratory muscles, pulmonary function, and dyspnea in COPD patients. Over two months, they monitored 20 subjects with moderate or severe COPD before and after treatment. The results showed that respiratory obstruction and dilatation were more severe during deterioration, and dyspnea recovery was associated with improvement in these parameters.

Research has demonstrated that respiratory rehabilitation programs, which include integrated breathing retraining,

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upper extremity muscle training, and inspiratory muscle training, are effective for COPD patients. Participants in these programs experienced alleviated dyspnea and increased exercise tolerance (Kim, 2001). Kisner and Colby (2017) emphasized that respiratory training and chest mobility training, such as respiratory muscle training, glossopharyngeal breathing, and lip pursed breathing, are essential components of chest physical therapy. These methods should be tailored to the clinical condition of the patient and may include drug therapy, positioning, and complementary respiratory taping.

Taping therapy involves attaching unmedicated adhesive tape to muscles to normalize muscle function, reduce muscle spasms, and improve blood, tissue, and lymphatic circulation. This method helps restore normal muscle function, enhance proprioception, and balance muscles that are not in congruence with their surroundings, thereby reducing pain and stabilizing muscles and joints (Kase, Wallis, & Kase, 2013). Kinesio taping promotes respiratory muscle activation, reduces abnormal muscle tension, and consequently increases muscle strength. Ora et al. (2013) reported increased respiratory ventilator efficiency in healthy individuals during heavy lifting with Kinesio taping on the chest.

Macgregor et al. (2005) identified the relationship between cutaneous afferent stimulation and motor unit firing. Daitx et al. (2018) investigated the effectiveness of Kinesio taping on thorax expansion and lung capacity in COPD patients. The study found significant improvements in lung capacity measures such as FVC, FEV, FEV/FVC, and PEFR, although no significant changes were observed in the FEV/FVC ratio. Daitx et al. (2018) stated that research on the effectiveness of Kinesio taping in COPD patients, particularly those with chronic respiratory disease, is limited. For these patients, Kinesio taping reduces the work of respiration and increases respiratory efficiency.

Previous research indicated significant differences when diaphragm and intercostal muscles were taped. Therefore, The purpose of this study is to investigate the effects of kinesio taping on pulmonary function and inspiratory and expiratory pressures when applied to the intercostal muscles and diaphragm muscles.

2. Materials and Methods

2.1. Participants

The participants of this research were 30 healthy, non-smoking male students from S University located in Chungcheongnamdo Province. Detailed explanations of the purpose and methodology of the research were provided to all participants prior to the study. None of the participants had a medical history of neck or rib injuries/surgeries. All participants who provided consent participated in the research. Individuals with chronic heart or respiratory diseases, mental or cognitive disorders, scoliosis, and smokers were excluded from the study. This research was approved by Sunmoon University's IRB (Institutional Review Board) (SM-202203-002-2).

All participants submitted written consent forms after the purpose and methodology of the research were explained to them. Prior to the beginning of the research, participants' height and weight were measured using an autonomic BMI measuring stadiometer (BSM 370, Korea, 2011). General characteristics of the participants are presented in Table 1.

Table 1. General Characteristics of participants (N=30)

Age (years)	22.48±2.20
Height (cm)	175.22±4.70
Weight (kg)	73.07±11.69

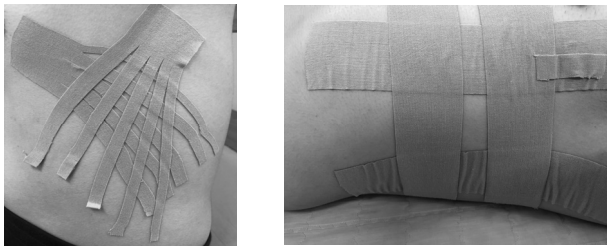
*Mean ± standard deviation

2.2. Measurement Equipment

Spirometer(Pony FX, Cosmed, Italy) and Kinesio taping (Nitto Denko Corporation, Osaka, Japan) were used for measurements. These devices were employed to measure the participants' respiratory function. The Spirometer is designed to measure lung volume or lung ventilation and is used to identify FVC, FEV_1, MIP, and MEP.

2.3. Application of Kinesio Taping

The Kinesio taping technique from Osaka, Japan was utilized. For the diaphragm, the anterior and posterior axillary lines were located, and the tape was applied horizontally while the participant lay supine with arms lifted 180°. For fixation, Kinesio taping was applied vertically.



(a) diaphragm taping (B) intercostal taping

Figure 1. Application of Kinesio taping

For the intercostal muscle, the participant sat on a stool with hands on their head, and the cut tape was applied in five lines from the subcostal part—diagonally from the pectoral muscle on one side and from the latissimusi muscle on the other side. 20% tension was used at the tail end (figure 1). In the control group, kinesio taping was not applied.

2.4. Measure Procedures

This study measured FVC, FEV_1, MIP, and MEP values to assess lung capacity and ventilation using a spirometer. All participants sat with a gumshield in place. Upon the 'begin' signal, participants breathed regularly 3 to 4 times and then inhaled deeply, followed by a maximum inhalation for 6 seconds. For accuracy, each participant conducted 1 to 2 practice trials before actual measurements. The average value was derived from four separate measurements of FVC, FEV_1, MIP, and MEP, with a one-minute break between each measurement.

2.5. Experiment Procedures

The experiment procedures were as follows: all 30 male participants conducted the measurements. Prior to the experiment, each group measured respiratory function using the Spirometer to check FVC, FEV_1, MIP, and MEP values. All measurements were conducted once, and for accuracy, the average value was derived from 3 to 4 measurements. To prevent symptoms such as dyspnea, participants were given a one-minute break and additional breaks between

Table 2. Comparison of spirometry parameter in among the groups

		Diaphragm[a]	Intercostalis[b]	Control[c]	F	p	post-hoc
FVC(liter)	Pre	5.70±0.40	5.71±0.83	5.36±0.52	0.96	0.39	
	Post	5.97±0.63	5.63±0.82	5.29±0.52	1.78	0.19	
	Difference	0.27±0.29	0.08±0.07	0.09±0.05	2.88	0.07	a,b,c
	t	-2.32	2.18	2.55			
	p	0.06	0.07	0.03			
FEV_1(liter)	Pre	4.31±0.46	3.67±1.39	4.54±0.48	2.22	0.13	
	Post	4.77±0.51	4.20±0.75	4.21±0.62	1.73	0.20	
	Difference	0.46±0.6	0.81±0.94	0.33±0.39	1.14	0.33	a,b,c
	t	-2.02	-1.21	2.22			
	p	0.09	0.27	0.06			
MIP (cmH_2O)	Pre	65.00±28.20	99.13±39.92	72.20±28.76	2.24	0.13	
	Post	70.14±18.90	129.71±56.51	76.50±24.18	6.17	0.00	
	Difference	13.42±9.72	31.28±20.34	8.50±6.60	6.81	0.00	b>a,c
	t	-0.82	-0.40	-1.34			
	p	0.44	0.70	0.21			
MEP (cmH_2O)	Pre	94.42±40.35	23.85±35.49	89.90±29.42	2.17	0.13	
	Post	96.71±26.10	136.28±44.09	92.90±27.43	4.38	0.02	
	Difference	15.14±11.52	37.14±23.50	5.40±4.90	10.19	0.00	b>a,c
	t	-0.31	-4.18	-1.39			
	p	0.77	0.01*	0.20			

* p<.05, Values are presented as mean ± SD, FVC : Forced vital capacity(%), FEV_1 : Forced expiratory volume in 1 second(%), MIP : maximum inspiratory pressure(cmH_2O), MEP : maximum expiratory pressure(cmH_2O)

measurements.

2.6. Data Analysis

SPSS/PC ver.26.0 for Windows (SPSS INC, Chicago, IL) was used for data analysis. Data on participants' general characteristics, respiratory function, and diaphragm movement were analyzed. One-way ANOVA was used to compare groups, with results explained using means and standard deviations. Paired t-tests were conducted to compare pre- and post-intervention data on respiratory function and diaphragm movement. Statistical significance was set at α=.05, and post hoc verification was performed using the Bonferroni correction.

3. Results

The results of this study showed no significant differences in FVC and FEV_1 values before and after the intervention, nor in the changes within the groups($p>.05$) However, significant differences were found in the changes of MIP and MEP values($p<.05$). Post-hoc analysis revealed that the intercostal group showed significant improvements compared to the diaphragm and control groups($p<.05$). There were no significant differences within the groups($p>.05$). Conversely, for MEP, significant differences were observed only in the intercostal group($p<.05$).

4. Discussion

This study aimed to evaluate the effectiveness of Kinesio taping on respiratory function by comparing forced vital capacity (FVC), forced expiratory volume in 1 second (FEV_1), maximum inspiratory pressure (MIP), and maximum expiratory pressure (MEP) before and after the intervention in diaphragm, intercostalis, and control groups. The findings provide insightful observations into the impact of Kinesio taping on these parameters. The results for FVC and FEV_1 indicated no significant differences between the diaphragm, intercostalis, and control groups, both before and after the intervention. This suggests that Kinesio taping did not significantly influence these lung volume measures in healthy individuals. For MIP and MEP, significant post-intervention differences were observed among the groups, with the intercostalis group showing the most notable improvements. Specifically, the intercostalis group demonstrated significant enhancements in both MIP and MEP compared to the diaphragm and control groups. This suggests that Kinesio taping might enhance respiratory muscle strength, particularly when applied to the intercostal muscles. The significant improvement in the intercostalis group can be linked to the role of intercostal muscles in respiratory mechanics, which are crucial for chest expansion and overall lung function (McKenzie et al., 1994). The findings also support the notion that Kinesio taping might have more pronounced effects when used in conjunction with other therapeutic interventions, such as lung rehabilitation programs. This is consistent with previous studies indicating that combined approaches yield better outcomes for respiratory function enhancement (Barthels & Das, 2020). Several limitations need to be acknowledged. The small sample size limits the generalizability of the results, and the short duration of the study may not fully capture the potential long-term benefits of Kinesio taping. Additionally, the study participants were healthy young males, which restricts the applicability of the findings to other populations, such as older adults or individuals with respiratory conditions. In conclusion, while Kinesio taping did not significantly affect lung volumes (FVC and FEV_1), it showed potential benefits in improving respiratory muscle strength (MIP and MEP), particularly when applied to the intercostal muscles. Future research should involve larger, more diverse populations and longer follow-up periods to further elucidate the potential benefits of Kinesio taping in respiratory function enhancement.

5. Conclusion

The findings of this study indicate that although kinesio taping did not result in significant changes in overall pulmonary function, there was a notable increase in maximal inspiratory pressure (MIP) and maximal expiratory pressure (MEP) when applied to the intercostal region. Consequently, it is recommended that kinesio taping be considered as a therapeutic intervention for enhancing

inspiratory and expiratory pressures in patients with respiratory muscle weakness

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