

# The Effects of Kinesiotaping Applied onto Erector Spinae and Sacroiliac Joint on Lumbar Flexibility

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**Purpose:** The purpose of this study was to investigate the effects of kinesio taping on lumbar flexibility onto erector spinae and sacroiliac joint.

**Methods:** Sixty healthy adults (male = 36, female = 24) participated in this study and were randomly assigned to the experimental group that received kinesio taping onto erector spinae and sacroiliac joint (n = 30) or the control group that received X-letter placebo taping onto them (n = 30). Lumbar flexibility (flexion, extension, lateral flexion, and rotation) was measured using back range-of-motion instrument (BROM) II before and after taping.

**Results:** In the change of lumbar flexibility after taping in the experimental group, there were statistically significant difference in flexion, lateral flexion, and rotation ( $p < 0.05$ ), but there was no significant difference in extension. There was no significant difference in the change of lumbar flexibility after taping in the control group.

**Conclusion:** In conclusion, kinesio taping onto erector spinae and sacroiliac joint improved the joint function. Kinesio taping may reduce the muscle tension and facilitate the circulation of tissue fluid. In light of these results, it is thought that the application of kinesio taping had influence on an increase in lumbar flexibility. Therefore, kinesio taping will be able to be used as the method of the prevention of pain and the treatment in the lumbar region.

**Keywords:** Kinesio taping, Lumbar flexibility, Back range-of-motion instrument II

## INTRODUCTION

Low back pain (LBP), or lumbar pain, refers to a common pain syndrome in people, which appears between the second lumbar (L2) vertebra and the sacroiliac (SI) joint.<sup>1,2</sup> Such pain can lead to a vicious cycle of limited activities, reduced joint use, and secondary muscle weakening, which further leads to deterioration of physical function and productive activities.<sup>3-6</sup> Statistically, 80% of people experience LBP sometime during their lifetime and approximately 90% of the economically active population experience LBP.<sup>7</sup> Therefore, compared to other diseases, LBP is associated with significant medical, social, and economic losses at personal and national levels.<sup>8</sup>

The low back is the largest and least flexible joint in the body.<sup>9</sup> From a biomechanical perspective, lumbar flexibility allows bal-

anced adaptation of various forces, such as pressure, tension, and torque, but such a decrease in lumbar flexibility disturbs the balance between various forces and causes deformation, which leads to LBP.<sup>9</sup> Regardless of clinical cause, people with LBP have reduced muscle strength and endurance, reduced flexibility, and limited range of motion (ROM) at the waist and in the leg joints.<sup>10</sup> Flexibility refers to the ability to control accurate and smooth movement of the human mechanism involving joint movement under the dynamic or static state; contraction and extension of contractor and extensor muscles; elasticity, viscosity, and conductivity of muscles, and elasticity of ligaments.<sup>9</sup> Flexibility also plays a role in preventing muscle tears during sports activities by improving the quality of muscles when they are active.<sup>11</sup>

Accordingly, various methods have been presented to improve

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the quality of movements and to prevent pain and injury by increasing flexibility. One of the non-pharmacological methods among these is taping.<sup>12</sup> Taping involves the use of elastic or non-elastic tape that has not been treated with any drugs, and elastic tape, called kinesio taping, which is applied to the skin above the target muscle for normalization of the agonist muscle responsible for joint movement, thereby suppressing or promoting muscle tension.<sup>13</sup> Kinesio taping, when applied, can relax tensed muscles and improve the contractile force of weakened muscles, and thus, applying such taping on various parts of the body can immediately form balances in nearby muscles to show symptom improvement and provide peace of mind.<sup>14</sup> The taping application stimulates the fusimotor reflex from muscle spindles, which are the smallest unit of muscles. When the skin is stimulated from taping, the muscle directly below the skin is stimulated by the r-motor reflex and undergoes smooth and light physiological contraction.<sup>15</sup> Muscle contraction from the fusimotor reflex regulates muscle tension and maintains balance between muscles to allow proper physical balance.<sup>16</sup> Taping shows its therapeutic effects of reducing pain in agonist, synergist, and antagonist muscles by regulating the electric responses within the body and it is a method that can be used easily by anyone, even if the exact diagnosis is unknown.<sup>17</sup> Applying taping to patients who have sustained sports injuries may be effective for preventing re-injury, recovering joint ROM, and improving muscle strength.<sup>18</sup> It can also be effective in reducing pain and improving lumbar muscle strength and flexibility in middle-aged women with myogenic pain.<sup>12</sup>

Moreover, gluteal taping applied on children with cerebral palsy was concluded to have a positive effect on their balance, as well as increasing trunk stability.<sup>19</sup> Moreover, taping is effective in preventing secondary damage by improving the functions of muscles and joints

that have been damaged,<sup>20</sup> while also contributing to increased lumbar flexibility and improved muscle strength in LBP patients.<sup>14</sup> However, studies are lacking on complex taping applied to two or more joints and/or muscles or examination of flexibility, focusing on the lumbar region, after taping. In the present study, complex kinesio taping was applied on the erector spinae (a powerful extensor muscle that is involved with spine extension, lateral flexion, and rotation, provides resistance against flexion, and promotes proper posture)<sup>21</sup> and the SI joint (the joint involved in weight transfer from the spine to pelvis, where LBP occurs first,<sup>22</sup> and mobility is severely limited) of healthy subjects without LBP for the purpose of investigating the effects of complex kinesio taping on lumbar flexibility. Since increased flexibility can contribute to preventing pain and injuries that may occur during physical activities, the findings of the present study may be used as basic data for such purposes.

## METHODS

### 1. Subjects

The subject population consisted of 60 staff members of “D” University hospital and physical therapy students of “D” University located in the city of Daegu, who had no previous history of LBP and gave prior consent to participate in the experiment. With respect to general characteristics of the experimental group, mean age was  $23.90 \pm 5.48$  years, mean height was  $170.70 \pm 8.19$  cm, and mean weight was  $64.90 \pm 12.54$  kg. In the control group, mean age was  $24.40 \pm 5.48$  years, mean height was  $168.23 \pm 7.35$  cm, and mean weight was  $60.93 \pm 11.25$  kg. There were no statistically significant differences in age, height, and weight between the two groups ( $p > 0.05$ , Table 1). To prevent prior knowledge affecting the study

**Table 1.** General Characteristics of subjects

(M±SD)

		Group				
		Experimental	Control	t	p	$\chi^2$
Age (year)		23.90±5.48	24.40±5.48	0.438	0.663	
Gender	Male	21 (70%)	15 (50%)			0.11 ns
	Female	9 (30%)	15 (50%)			
Height (cm)		170.70±8.19	168.23±7.35	-1.227	0.225	
Weight (kg)		64.90±12.54	60.93±11.25	-1.289	0.203	
Smoking	Smoker	7 (23%)	7 (23%)			1.00 ns
	Nonsmoker	23 (77%)	23 (77%)			
Total		30	30			

M±SD: mean±standard deviation, ns: not significant.

results, the subjects were blinded to the group they would belong to and they were told that the objective of the study was lumbar angle measurement. The subjects participated in the study after becoming fully aware of the precautions that should be taken during the experiment.

## 2. Experimental methods

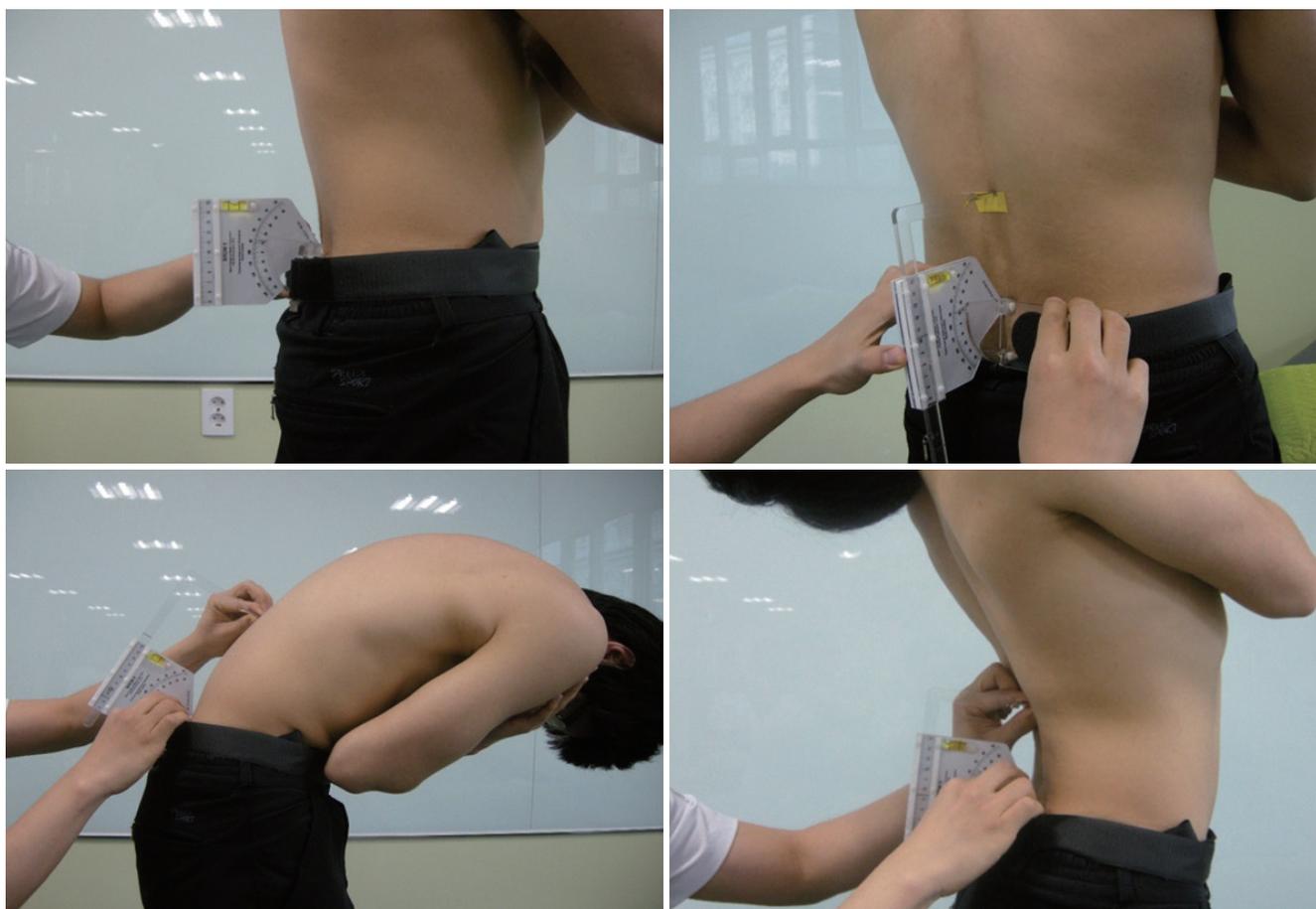
### 1) Measurements

Flexibility measurement: back range-of-motion instrument (BROM) II (Sammons Preston, Inc., USA). BROM II may be the most useful option when measuring the lumbar movement and dynamic planar motion of the lumbar spine without depending on the movement of the back and gluteal region.<sup>23</sup> The intra-examiner reliability (intraclass correlation coefficient, ICC) of BROM II was flexion (ICC 0.67), extension (ICC 0.78), left lateral flexion (ICC 0.91), right lateral flexion (ICC 0.95), left rotation (ICC 0.88), and right rotation (ICC 0.93),<sup>24</sup> while the inter-examiner reliability (ICC) was

flexion (ICC 0.74), extension (ICC 0.55), left lateral flexion (ICC 0.78), right lateral flexion (ICC 0.79), left rotation (ICC 0.64), and right rotation (ICC 0.60).<sup>23</sup> In BROM II, the angles of flexion and extension are set up by 1°, while those of rotation and lateral flexion are 2°. For reliability of the measurements, two examiners conducted repeated measurements, taking three repeated measurements from each subject. We set to the middle value except the maximum and minimum values. The mean value was changed to the purity of the measured value, and the repeated measurement was chosen as the intermediate value regardless of the order to remove the limitations on the adaptability and non-adaptability of the measurement.

#### (1) Flexion and extension angle measurements

For flexion angles: when the apex of the protractor that served as the reference point contacted the first sacral (S1) vertebra, a Velcro strap was used to immobilize it. During this time, markers were used to mark the body for re-measurements. While standing up-



**Figure 1.** Flexion and extension examination by BROM (back range-of-motion instrument) II.

right with the legs shoulder-width apart, the subject put both arms on their chest and slowly bent their torso forward along the measurement tool immobilized on the first position as much as possible without pain.

The angle where the final point of flexion was reached was measured and recorded. This angle subtracted by the first angle represented the flexion value. The angles were measured in units of 1°. The extension angle was measured using the same method, as the body was slowly bent backwards (Figure 1).

### (2) Rotation angle measurements

A rotary protractor was used like a horizontal compass to measure the movement from magnetic force. The subject sat facing westward and wore a belt with a magnet attached, where the magnet was positioned about 4 cm below the S1 vertebra. Subsequently, the examiner used his thumb to immobilize the protractor on the T12 vertebra of the subject while wrapping the fingers around the thorax. Rota-

tion was measured as the subject sat with their arms crossed on their chest and slowly rotated the torso as much as possible without pain. The angles were measured in units of 2° (Figure 2).

### (3) Lateral flexion angle measurements

Lateral flexion angles were measured using a vertical compass type protractor. The examiner used his or her thumb to immobilize the protractor on the same T12 vertebra used for the rotation angle measurement while wrapping the fingers around the thorax of the subject. While standing upright with the legs shoulder-width apart, the subject put both arms straight down and slowly bent the torso sideways as much as possible without pain. The angles were measured in units of 2° (Figure 2).

### 2) Intervention

The subjects were randomly assigned to either the experimental group (taping applied to the erector spinae and SI joint) or the control



Figure 2. Rotation and lateral flexion examination by BROM (back range-of-motion instrument) II.

group (taping applied in an X-shape), followed by the first evaluation. After the initial evaluation, taping of the erector spinae and SI joint was applied on the experimental group, and after 15 min of rest, the second evaluation was performed. After applying the X-shaped taping on the control group, the second evaluation was performed after 15 min of rest. Kinesio taping (MyO tape 5 cm, Myo-Coland, Korea) was used for taping, with taping applied to the erector spinae and SI joint of the experimental group. For taping of the erector spinae in the experimental group, tape was applied to both sides of the spine from the sacrum to the area directly below the scapula. Here, the erector spinae were fully extended by having the subject slowly bend the torso forward as much as possible without pain with the sacral region immobilized. The tape was then applied, without pulling to stretch it, along the erector spinae, appearing on both sides of the spine down to the area below the scapula. For taping of the SI joint, the same 5 cm tape was applied, without pulling to stretch it, from below the posterior SI spine to the bottom of the posterior SI spine on the opposite side while the subject stood comfortably. Meanwhile, sham taping was applied on the control group for placebo effect. Sham taping was applied so that the tape would be readily visible to the subject so that the subject would feel that taping had been applied.<sup>25</sup> With the subject standing comfortably, the taping was applied around the T12 vertebra using tape with a width of 5 cm and a length of 20 cm crossing each other to form an X-shape (Figure 3).

### 3) Analysis

An independent t-test was performed to analyze the general characteristics of the subjects (height and weight), while  $\chi^2$  test was used to

test the personal characteristics (gender, smoking status) of the subjects.

Paired t-tests were performed to investigate the differences between pre- and post-experimental flexibility within the experimental and control groups. Meanwhile, an independent t-test was performed to investigate the differences in pre- and post-experimental flexibility between the experimental and control groups. Lastly, multiple regression analysis was performed to check whether statistically significant variables were controlled. SPSS WIN version 18.0 was the program used for statistical data analyses and all statistical analyses were performed with a significance level set to 5%.

## RESULTS

### 1. Inter-group comparison of flexibility through taping

The results from testing the flexibility in the experimental and control groups after applying the taping methods showed statistically significant differences in flexion ( $p < 0.01$ ), right lateral flexion ( $p < 0.05$ ), left lateral flexion ( $p < 0.05$ ), and rotation ( $p < 0.01$ ), but not in extension (Table 2).

### 2. Intra-group comparison of flexibility through taping

#### 1) Comparison between pre- and post-taping (X-shape) within the control group

The results from comparison between pre- and post-taping for placebo effect within the control group showed no statistically significant differences in flexion, extension, right lateral flexion, left lateral flexion, right rotation, and left rotation ( $p > 0.05$ ) (Table 3).



**Figure 3.** Application of experimental group and control group. Experimental group: kinesio taping on erector spinae and sacroiliac joint. Control group: X-taping on lumbar region

**2) Comparison between pre- and post-taping within the experimental group**

The results from comparison between pre- and post-taping on the erector spinae and SI joint within the experimental group showed statistically significant differences in flexion, right lateral flexion, left lateral flexion, and rotation, but not in extension ( $p < 0.01$ )(Table 4).

**3. Multiple regression analysis on the factors that affect the amount of difference**

The results from multiple regression analysis with the amount of change between pre- and post-experimental values of variables used for flexibility measurements were as shown in Table 5. If other general and clinical variables, besides taping, had influences on the amount of change, the effect of taping was tested using differences in the experimental and control groups after controlling the influ-

**Table 2.** Inter-group comparison of flexibility through taping

		Control	Experimental	T	p
Flexion	pre	27.57±4.24	32.57±4.08	-4.653	<0.01*
	post	27.67±4.13	26.83±4.62	0.736	0.465
Extension	pre	11.80±3.49	11.43±3.26	0.421	0.657
	post	11.90±3.57	11.20±3.29	0.789	0.434
Rt.side lateral flexion	pre	29.43±5.79	32.33±3.93	-2.270	0.027*
	post	29.40±5.80	27.47±4.45	1.447	0.153
Lt.side lateral flexion	pre	30.10±5.18	33.10±3.63	-2.597	0.012*
	post	30.13±5.27	28.17±3.39	1.718	0.091
Rt.side rotation	pre	29.60±5.72	35.30±5.90	-3.802	<0.01*
	post	29.53±5.57	29.80±6.33	-0.173	0.863
Lt.side rotation	pre	30.17±6.47	37.03±4.04	-4.931	<0.01*
	post	30.53±6.81	31.57±5.71	-0.637	0.527

M±SD: mean±standard deviation.  
\* $p < 0.05$ .

**Table 3.** Comparison between pre-and post-taping (X-shape) within the control group (M±SD)

	Pre-test	Post-test	t	p
Flexion	27.67±4.13	27.57±4.24	1.140	0.264
Extension	11.90±3.57	11.80±3.49	0.828	0.415
Rt.side lateral flexion	29.40±5.80	29.43±5.79	-2.273	0.787
Lt.side lateral flexion	30.13±5.27	30.10±5.18	0.328	0.725
Rt.side rotation	29.53±5.57	29.60±5.72	-0.441	0.662
Lt.side rotation	30.53±6.81	30.17±6.47	1.056	0.300

M±SD: mean±standard deviation.

**Table 4.** Comparison between pre-and post-taping within the experimental group (M±SD)

	Pre-test	Post-test	t	p
Flexion	26.83±4.62	32.57±4.08	-11.302	<0.01*
Extension	11.20±3.29	11.43±3.26	-1.882	0.07
Rt.side lateral flexion	27.47±4.45	32.33±3.93	-10.962	<0.01*
Lt.side lateral flexion	28.17±3.39	33.10±3.63	-13.636	<0.01*
Rt.side rotation	29.80±6.33	35.30±5.90	-15.363	<0.01*
Lt.side rotation	31.57±5.71	37.03±4.04	-10.934	<0.01*

M±SD: mean±standard deviation.  
\* $p < 0.05$ .

**Table 5.** Multiple regression analysis on the factors that affect the amount of difference

(n=60)

Group	Flexion	Rt.side lateral flexion	Lt.side lateral flexion	Rt.side rotation	Lt.side rotation
	Standardized Coefficients				
Group	0.800**	0.807**	0.875**	0.888**	0.782**
Age	-0.121	-0.013	0.048	0.057	0.020
Sex	-0.089	-0.129	-0.006	-0.110	-0.048
Height	0.102	-0.251	-0.085	-0.266*	0.008
Weight	-0.070	0.092	0.040	0.081	-0.054
Smoking	-0.048	0.029	-0.009	-0.022	-0.094
F	21.273**	18.684**	27.319**	35.506**	14.512**
Adj R <sup>2</sup>	0.637	0.642	0.728	0.778	0.579

\* $p < 0.05$ , \*\* $p < 0.01$ .

ences of such variables. Therefore, in the statistical fit regression model, the group referred to the differences in the changed values between the experimental and control groups. The regression models with the amount of change in flexion, right lateral flexion, left lateral flexion, right rotation, and left rotation as the dependent variables were found to be statistically fit. When flexion, right lateral flexion, left lateral flexion, and left rotation were used as dependent variables, only group status was a significant variable ( $p < 0.01$ ). When right rotation was used as the dependent variable, group status and height were significant variables ( $p < 0.05$ ). The amount of change observed in right rotation (difference between pre- and post-intervention measurements) was greater in the experimental group than in the control group even when the influence of difference in height was controlled. On the other hand, age, gender, weight, and smoking status were variables that showed no statistical significance in all regression models.

## DISCUSSION

The present study applied kinesio taping on the erector spinae and SI joint of healthy subjects for the objective of investigating the effects of such taping on lumbar flexibility, meaning flexion, extension, lateral flexion, and rotation that are components of lumbar movement. Flexibility is one of the key elements in basic physical fitness, and is included as a part of basic physical fitness because a lack of flexibility is associated with risk of injury during physical activities and can lead to clinical disadvantages.<sup>9</sup> Lack of flexibility in the waist or the hamstring muscles can cause LBP.<sup>26</sup>

Weakening of the soft tissues in the lumbar region due to lack of exercise can lead to muscle motor impairment, and resulting excessive weight bearing on the nearby joints can cause LBP.<sup>27</sup> The treatment goal for LBP is to eliminate the problem and prevent recurrence by using different combinations of exercise, drug therapy, physical therapy, conservative treatment, and surgical treatment.<sup>12</sup> Interest in lumbar taping has been increasing since lumbar taping offers the advantages of short application time and no discomfort during the application period to allow activities of daily living.<sup>28</sup> Elastic taping is referred to as kinesio taping, which was developed in 1985 by a Japanese doctor named Arikawa for the purpose of patient treatment. It is viewed differently than sports taping, as applying tape to areas of the body with impairment can promote recov-

ery from impairment and recuperation of motor functions to allow normal physical activities.<sup>29</sup> However, it is also being used in recent times on athletes for improvement of motor functions and prevention of sports injuries.<sup>30</sup> Accordingly, the present study used BROM II to investigate whether applying complex kinesio taping on the erector spinae and SI joint has an effect on lumbar flexibility. The study results indicated that the experimental group with tape on the erector spinae and SI joint showed statistically significant differences in flexion, right lateral flexion, left lateral flexion, right rotation, and left rotation, as compared to the control group that had sham taping applied for placebo effect ( $p < 0.05$ ). However, there was no statistically significant difference in extension ( $p > 0.05$ ). During flexion and extension, the muscle contraction is different. In the case of flexion, rotation and lateral flexion, it provides stability against eccentric contraction for taped muscles, thereby increasing the range of flexibility. In the case of extension, the abdominal eccentric contraction is mainly performed. Kinesio taping should be performed on the abdomen to increase the stability and flexibility of the extension. We did not apply taping to the abdomen because it was an experiment to see the effect when kinesio taping was applied to erector spinae and sacroiliac joints. Therefore, although the erector spinae effective to eccentric contraction on flexion, rotation and lateral flexion, but it was considered that kinesio taping was not influencing in the abdomen. And also it can be seen that the action of the erector spinae perform the eccentric contractions of flexion, rotation, and lateral flexion. With respect to differences between pre- and post-taping within the control group, there were no significant differences in all items tested ( $p > 0.05$ ).

Meanwhile, differences between pre- and post-taping within the experimental group were statistically significant in flexion, right lateral flexion, left lateral flexion, right rotation, and left rotation ( $p < 0.05$ ), but not extension. When the tape was applied, significant differences in flexion, lateral flexion, and rotation were found, as compared to when tape was not applied, although no such difference was found in extension. Thus, it was determined that flexibility increased in all aspects, except extension flexibility. These findings were consistent with results from various previous studies that reported increased joint ROM from 5 weeks of kinesio taping on 17 frozen shoulder patients,<sup>31</sup> increased joint ROM from applying taping on 50 LBP patients who did not require surgery,<sup>32</sup> and increased flexibility in 30 male students when kinesio taping was applied as

compared to that when this was not applied when compared by changes in athletic ability according to taping application format.<sup>33</sup> Just as in the present study, all these studies showed increases in lumbar flexibility, except extension ROM.

Improved flexibility from such taping is believed to be the result of skin stimulation activation and continued increases in motor unit recruitment,<sup>15</sup> while the reason behind the increased flexibility may also be inferred, through other studies reported that stimulation from taping relaxed tension in the muscles and stability was provided to the injured muscle through contact, which enabled greater ROM and facilitated blood, lymph, and tissue fluid circulation<sup>34</sup> to improve joint function.<sup>12</sup>

Based on the findings in the present study, it is determined that applying appropriate complex taping on the erector spinae and SI joint may be suggested as an intervention method for improving lumbar flexibility with respect to flexion, left and right lateral flexion, and left and right rotation, although it had no effect on extension ROM.

Go<sup>34</sup> reported that kinesio taping treatment does not show any differences based on gender or age, whereas Jang<sup>35</sup> reported that kinesio taping acts together with athletic experience, physical conditions, gender, intellectual ability, and psychological factors. Jung<sup>36</sup> reported that differences in flexibility appeared according to changes in age among men and women. However, the present study randomly selected its subjects, and thus, they were not categorized according to age, physical conditions, gender, intellectual ability, and psychological factors. Therefore, it is believed that future studies should categorize the subjects by their age, physical conditions, intellectual ability, and psychological factors with all subjects being the same gender. Moreover, the subjects in the present study were students and office workers from a single region, and thus, generalization would be difficult. The long-term effects were not proven since additional exercise programs for increased flexibility were not applied. Therefore, additional future studies that take these factors into consideration are needed.

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