The Effect of Kinesio Taping on Pain, Muscle Strength and Balance Control Ability by Age Group: A Literature Review

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**Purpose:** The purpose of this study is to objectively and systematically investigate the effect of Kinesio taping by organizing and analyzing the research results using effect size.

**Methods:** A total of 1,000 papers was searched, and 100 of them were selected the first time. Afterward, the effects of taping were analyzed and classified papers that studied balance, muscle strength, and pain, and finally 34 papers were selected. The effect size was calculated using the Effect Size Calculators (University of Colorado, USA) program. Statistical analysis was performed by using PASW Statistics software version 23.0 (IBM Co., Armonk, NY, USA). Descriptive statistics were used to obtain the effect size and confidence interval for each group.

**Results:** In a study related to balance control ability, the effect size was 1.519 in the young subjects group (20-39 years old), and the effect size in the elderly group (65 years or older) was 0.360. In a study related to muscle strength, the effect size was 0.469 in the group of young subjects and 0.250 in the middle-aged group (40-65 years old), and the effect size of the elderly group was 0.848. In the study related to pain control, the effect size was 0.469 in the young group, the effect size of the middle-aged group was 0.972, and the effect size of the elderly group was 1.040.

**Conclusion:** Kinesio taping differed in the degree of effect according to the age group of the subjects, but it was effective in balance control ability, muscle strength, and pain.

**Keywords:** Balance, Kinesio taping, Muscle strength, Pain control

**INTRODUCTION**

Recently, taping therapy among various intervention methods in the field of physical therapy has attracted attention. Taping therapy is the wrapping of tape around a joint, muscle, or ligament to prevent or treat an injury. Such taping therapy helps physical activity by relieving pain and balancing the body. Kinesio taping is effective in suppressing or promoting muscle tension by attaching it to the skin of the relevant muscle to normalize the action of the main muscle that moves the joint. Also, Kinesio taping is known as a safe treatment method due to its continuing effect and simple usage.

To summarize the mechanisms of Kinesio taping claimed in previous studies, taping assists joints, reducing the load on muscles or tendons, and pulling the skin to reduce pressure on blood vessels so that circulation is improved. And there was pain relief by the gate control theory.

Jeon reported that the application of taping affects muscle balance, and Yam et al. reported that the improvement of the muscle coordination function of taping has a positive effect in terms of muscle efficiency.

And in the thesis of Jeon, there was a significant difference in the amount of change in the total balance score after applying Kinesio taping. In addition, Lee stated that after taping was applied, there was a significant difference in both static and dynamic balance compared to before the experiment.

Another previous study, Lee et al. stated that there was a significant effect size in the ankle application and neck application.

In previous studies related to muscle strength, there have been many studies showing that when Kinesio taping is applied, muscle strength increases. When the taping was applied, it was said that there was an effect of increasing muscle strength in various subjects such as young adults, middle-aged and elderly people.
Taping is also frequently used in various diseases and subjects for pain control. It is mainly used for muscle damage, but it is applied to various subjects other than muscle damage.16-18

As above, the analysis of the results of the papers that studied the effects of taping according to balance control, muscle strength, and pain control showed that balance control, muscle strength, and pain control are all effective. However, there are still few studies on objective numerical analysis to determine how effective it is.

In addition, many studies on the difference in age-specific effects have not been conducted yet. An objective numerical analysis showing the age-specific effects of Kinesio taping and the extent of the effects is a key and essential part of evidence-based treatment. To this end, it is necessary to review and objective analysis of studies on the intervention of Kinesio taping.

Therefore, the purpose of this study is to objectively and systematically investigate the effect of Kinesio taping by organizing and analyzing the research results using effect size.

METHODS

1. Data collection

1) Data search database
This study searched journals registered by the Korea Research Foundation among the journals in the field of physical therapy in the academic subject classification. As a database for literature search, RISS (Research information sharing service), National Assembly Library, and Medical Research Information Center were used. The original texts of published papers were collected on the website of each journal.

2) Selected search word
Korean and English were used as search words, and the words 'kinesio taping', 'taping', and 'balance, muscle strength, pain' were used as the main search words.

2. Classification method

1) Selection criteria
In this study, studies that satisfy the following conditions were selected.
(1) Randomized controlled trial and non-randomized controlled trial
(2) Papers using Kinesio taping
(3) Research with objective results and numerical values
(4) Research related to muscle strength, balance control ability, and pain control

5) A study measuring the research results (muscle strength, balance control ability, pain control) related to at least one dependent variable

2) Exclusion criteria
Studies that have been duplicated, studies in which the original text cannot be verified, and studies in which appropriate research results are not provided were excluded.

3) Research selection process
Researches were searched for each database using the search word and search strategy set in this study, and 1,000 papers published from 2005 to 2020 were searched. Among them, 100 papers that meet the purpose of this study were selected for the first time. Afterward, the effects of taping were analyzed and classified papers that studied balance, muscle strength, and pain, and finally 33 papers were selected (Figure 1).

3. Analysis method

1) Quantitative analysis of research results
The studies used in this study were studies in which taping was applied to the experimental group to compare the effect with the control group, and the effect size of each study was derived as Cohen's D as a quantitative result.19

The effect of taping was analyzed by classifying the subjects into 3 groups [young subjects (20-39 years old), middle-aged (40-60 years old), and elderly (65 years old or older)] by age group of the subjects of each study.

The effect size was calculated using the Effect Size Calculators (University of Colorado, USA) program.

2) Statistical analysis
Statistical analysis was performed by using PASW Statistics software version 23.0 (IBM Co., Armonk, NY, USA). Descriptive statistics were used to obtain the effect size and confidence interval for each group.

Figure 1. Summary of the Study Selection Process.
For each dependent variable, the mean effect size (d) and 95% confidence interval (95% confidence interval, 95% CI) were presented. The effect size was interpreted as follows. First, a 95% confidence interval of the average effect size was presented, and significance was confirmed through whether 0 was included or not. Second, in the standardized mean difference, according to the effect size analysis criteria, if the effect size is less than or equal to 0.2, it is interpreted as a small effect size; if it is 0.5, it is interpreted as a medium effect size, and if it is greater than or equal to 0.8, it is interpreted as a large effect size.

RESULTS

1. General characteristics of the selected study
All of the studies included in this study were Kinesio taping intervention studies, and a total of 34 studies included in the literature review were analyzed. The publication year was 24 (70.59%) from 2005 to 2016 and 10 (29.41%) from 2017 to 2020. Of these, 9 studies (26.47%) were a dissertation for a diploma (Table 1).

There was a total of 10 studies related to the ability to control balance. Among them, 8 studies were in the younger group (20-39 years old) and 2 studies in the elderly group (65 years or older). There are many studies of young subjects and the elderly, and there are no middle-aged people (40-60 years old).

Studies related to muscle strength were 10 studies in the younger group (20-39 years old), 1 study in the middle-aged (40-60 years old), and 1 study in the elderly (65 years and older).

There were 3 studies related to pain control in the younger group (20-39 years old), 6 studies in the middle-aged (40-60 years old), and 3 studies in the elderly (65 years or older). The most frequent studies were in middle-aged people (40-60 years old) (Table 2).

2. Effect of Kinesio taping on balance control ability
There was a total of 10 studies related to the ability to control balance. In eight studies of the young subject group (20-39 years old), the effect size was 1.519, which had a large effect size. In the elderly group (65 years or older) studies, the effect size was 0.360, which had a small effect size. In both age group studies, the 95% confidence interval did not contain 0, indicating that it had a significant effect (Table 3).

3. Effect of Kinesio taping on muscle strength
There was a total of 11 studies related to muscle strength. In 10 studies of young subjects (ages 20-39), the effect size was 0.469, which had a moderate effect size. In the middle-aged group study (40-65 years old), the effect size was 0.250, which had a small effect size. In the elderly group study (65 years or older), the effect size was 0.848, which had a large effect size.

In all age group studies, the 95% confidence interval did not contain 0, indicating that it had a significant effect (Table 4).

4. Effect of Kinesio Taping on Pain Control
There was a total of 12 studies related to pain control. In the study of young subjects (ages 20-39), there was an effect size of 0.468 moderate. In the middle-aged study (40-65 years old), the effect size was 0.972, which had a large effect size. In the elderly group study (65 years or older), the effect size was 1.040, which had a large effect size. In all age group studies, the 95% confidence interval did not contain 0, indicating that it had a significant effect (Table 5).

DISCUSSION

All the studies included in this study were Kinesio taping intervention studies, and a total of 33 studies included in the literature review were analyzed. When Kinesio taping was applied, we searched the papers to find out how much the difference between balance control, muscle strength, and pain before and after was effective. To search for papers related to Kinesio taping, I searched Kinesio Taping at the sites of Reese, the National Assembly Library, and the Medical Research Information Center. Then, 100 papers were found and subdivided into papers comparing balance, muscle strength, and pain. The effect size was then analyzed using Cohen's D.

There was a total of 10 studies related to the ability to control balance. In eight studies of young subjects (ages 20-39), the effect size was 1.519, which had a large effect size. In the elderly group study (65 years or older), the effect size was 0.360, which had a small effect size.

In previous studies, Jeon reported that the application of taping affects muscle balance, and Yam et al. reported that the improvement of muscle coordination function by taping has a positive effect on the aspect of muscle efficiency. In addition, in the paper of Choi and Lee, it was found that there was a significant difference in the amount of change in the total balance score after application of Kinesio taping than before application of Kinesio taping.

In addition, Lee reported that there was a significant difference between the static balance and the dynamic balance after the taping was applied when compared to before the experiment. And Lee reported that
### Table 1. General subject characteristics

| Author (yr)       | Participants                  | Intervention Place                           | Comparison Place | Measuring method                        | Outcome variables            |
|-------------------|-------------------------------|---------------------------------------------|------------------|----------------------------------------|------------------------------|
| Jun (2015)        | N = 17                         | Ankle Jt                                    | None             | Balance system                         | Balance ability              |
| Lee (2009)        | N = 10                         | Ankle Jt                                    | None             | GAITRite system                        | Walking ability              |
| Park (2005)       | N = 14                         | Ankle Jt, Neck                              | Spiral taping    | Biodex Balance System                  | Balance ability              |
| Lee et al. (2010) | N = 20                         | None                                        | Balance system   | GAITRite system                        | Walking ability              |
| Lee et al. (2008) | N = 23                         | None                                        | None             | Biodex Balance System                  | Balance ability              |
| Lee (2008)        | N = 15                         | Ankle Jt                                    | None             | Biodex pro system3                     | Muscle strength              |
| Lee (2017)        | N = 31                         | Kneel Jt                                    | None             | Visual Analog Scale (VAS)              | Pain                         |
| Kwon et al. (2020)| N = 15                         | Ankle Jt                                    | Dynamic taping   | Wii Balance Board, Functional reach test, Star excursion balance test | Balance ability              |
| Joo et al. (2019) | N = 15                         | Ankle Jt                                    | None             | Visual Analog Scale (VAS)              | Pain                         |
| Park (2005)       | N = 15                         | Kneel Jt                                    | None             | Biodex system III                      | Muscle strength              |
| Kim et al. (2009)| N = 10                         | Ankle Jt                                    | Strength exercise| Dynamic Balance System                 | Balance ability              |
| Oh & Lee (2019)   | N = 20                         | Ankle Jt                                    | None             | Visual Analog Scale (VAS)              | Pain                         |
| Park et al. (2010)| N = 15                         | Erector spine muscle, lumbar bar            | None             | Visual Analog Scale (VAS)              | Muscle activation            |
| Kim (2015)        | N = 32                         | Six taping methods related with trapezius   | None             | Algometer, Visual Analog Scale (VAS)   | Pain                         |
| Kang (2011)       | N = 20                         | Compression stocking                        | Visual Analog Scale (VAS) | Pain                                    |                              |
| Kim (2017)        | N = 15                         | Trunk muscles                               | None             | TKK-5402                               | Muscle strength              |
| Seo et al. (2012) | N = 10                         | Medial epicondyle                           | None             | Visual Analog Scale (VAS)              | Pain                         |
| Cho et al. (2012) | N = 10                         | Ankle Jt                                    | None             | MatScan                                | Balance ability              |
| Lee (2016)        | N = 25                         | Trunk muscle                                | None             | Wii Balance Board                      | Balance ability              |
| Yu & Lee (2018)   | N = 13                         | Ankle Jt                                    | Static stretching, Ultrasound | Space Balance 3D            | Balance ability              |
| Kim (2013)        | N = 7                          | Ankle Jt                                    | None             | CSMI medical solution                  | Muscle strength              |
| Yeo et al. (2008) | N = 33                         | Wrist Jt                                    | Wrist support    | dynamometer                            | Muscle strength              |
| Yang & Lee (2006) | N = 25                         | Shoulder Jt                                 | None             | Visual Analog Scale (VAS)              | Pain                         |
| Suk et al. (2013) | N = 10                         | Trunk muscles, Hamstring muscle             | Pilates           | TAKE PHYSICAL FITNESS TEST             | Muscle strength              |
| Lee et al. (2006) | N = 20                         | Elbow Jt                                    | Elbow band, Sports taping, McConnel taping | Hand Dynamometer          | Muscle strength              |
| Lee et al. (2010) | N = 16                         | Wrist Jt                                    | None             | Baseline Pneumatic Squeeze Dynamometer | Muscle strength              |
| Lee & Jung (2005) | N = 10                         | Trunk spinous process                       | None             | Pressure Algometer                     | Pain                         |
| Kim & Yoon (2019) | N = 15                         | Shoulder Jt                                 | Himo training, Training group/ control group | Biodex system3 (dynamometer) | Muscle strength              |
| Lee (2005)        | N = 7                          | Knee Jt                                     | None             | Visual Analog Scale (VAS)              | Pain                         |
| Jung (2011)       | N = 10                         | Shoulder Jt                                 | None             | Back-D (Japan)                         | Muscle strength              |
| Lee & Kwon (2011) | N = 40                         | Erector spine muscle                        | None             | Cybex                                  | Muscle strength              |
| Jeon (2015)       | N = 20                         | Shoulder Jt, Knee Jt                        | None             | Visual Analog Scale (VAS)              | Pain                         |
| Lee et al. (2000) | N = 20                         | Shoulder Jt                                 | None             | Visual Analog Scale (VAS)              | Pain                         |
| Choi (2018)       | N = 12                         | Quadriceps femoris muscle                   | None             | O’Connor formula (1RM)                 | Muscle strength              |

https://doi.org/10.18857/jkpt.2021.33.3.142
The effect was proved by showing the results of a study showing the significance of balance and gait. Another previous study, Lee et al.\textsuperscript{11} reported that there was an effect size in the ankle application and neck application. From the results of these previous studies and comprehensive analysis, it was found that Kinesio taping has an effect on balance.

There was a total of 12 studies related to muscle strength. In 10 studies of young subjects (ages 20-39), the effect size was 0.469, which had a moderate effect size. In the middle-aged study (40-65 years old), the effect size was 0.250, which had a small effect size. In the elderly group study (65 years or older), the effect size was 0.848, which had a large effect size. As for previous studies that investigated the effect of taping on muscle strength, Lee\textsuperscript{21} reported that the group who took taping treatment during lower extremity exercise showed a significant difference in the comparison of muscle strength reduction after exercise than the group without taping.

As for previous studies that investigated the effect of taping on muscle strength, Lee\textsuperscript{21} reported that the group who took taping treatment during lower extremity exercise showed a significant difference in the comparison of muscle strength reduction after exercise than the group without taping.

In another previous study, Suk et al.\textsuperscript{22} reported that there was a slight increase in lumbar muscle strength. And in the study of de Jesus et al.\textsuperscript{23}, there was a significant difference when comparing muscle strength according to the treatment period. In addition, Park et al.\textsuperscript{24} reported that there were significant differences in muscle strength between groups.

In conclusion, Kinesio taping was effective in controlling balance, muscle strength, and pain. The effect of Kinesio taping on balance control was most effective in young adults, and it was also effective in helping the elderly.

### Table 2. Classification by variable and age

| Variable                | Age  | Percent | N  |
|-------------------------|------|---------|----|
| Balance control ability | 20-39| 80      | 8  |
|                        | 40-65| 0       | 0  |
|                        | Over 65| 20     | 2  |
| Total                  |      | 100     | 10 |
| Strength               | 20-39| 90.9    | 10 |
|                        | 40-65| 8.3     | 1  |
|                        | Over 65| 8.3    | 1  |
| Total                  |      | 100     | 12 |
| Pain control           | 20-39| 25      | 3  |
|                        | 40-65| 50      | 6  |
|                        | Over 65| 25     | 3  |
| Total                  |      | 100     | 12 |

### Table 4. Analysis of effect size on the strength of Kinesio taping

| Variable                | Age  | ES  | 95% CI          | Cohen’s d | Lower | Upper |
|-------------------------|------|-----|-----------------|-----------|-------|-------|
| Strength                | 20-39| 0.469| 0.292 - 0.645   | 0.469     | 0.292 | 0.645 |
|                        | 40-65| 0.250| - -             | 0.250     | -     | -     |
|                        | Over 65| 0.848| - -             | 0.848     | -     | -     |

### Table 3. Analysis of effect size on the balance control ability of Kinesio taping

| Variable                | Age  | ES  | 95% CI          | Cohen’s d | Lower | Upper |
|-------------------------|------|-----|-----------------|-----------|-------|-------|
| Balance control ability | 20-39| 1.519| 0.290 - 2.956   | 1.519     | 0.290 | 2.956 |
|                        | 40-65| -    | -               | -         | -     | -     |
|                        | Over 65| 0.360| 0.226 - 0.494   | 0.360     | 0.226 | 0.494 |

### Table 5. Analysis of effect size on the pain control of Kinesio taping

| Variable                | Age  | ES  | 95% CI          | Cohen’s d | Lower | Upper |
|-------------------------|------|-----|-----------------|-----------|-------|-------|
| Pain control            | 20-39| 0.468| 0.096 - 0.840   | 0.468     | 0.096 | 0.840 |
|                        | 40-65| 0.972| 0.388 - 1.550   | 0.972     | 0.388 | 1.550 |
|                        | Over 65| 1.040| 0.212 - 1.872   | 1.040     | 0.212 | 1.872 |

ES: effect size, CI: confidence interval.
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