

Comparison of the Immediate Effects of Kinesio Taping on the Dynamic Balance of Stable Ankle and Functional Ankle Instability among Young Adults in Their Twenties: a preliminary study

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Abstract

Purpose : Kinesio taping applied to the ankle varies, and if the overall ankle is taped as much as possible, several effects, including balance, can be expected, but clinically the cost reduction for intervention is very important. Therefore, this study attempted to find out the optimal way to the effect and cost of kinesio taping on ankle dynamic balance.

Methods : The subject of this study was 24 university students in their 20s (male: 13, female: 11), who received sufficient explanation of the purpose and method of the study. The Cumberland ankle instability tool (CAIT) questionnaire was used for the degree of ankle instability of the study subjects. If the subject's CAIT score was 28 points or more, it was classified as a stable ankle, and if the score was 24 points or less, it was classified as functional ankle instability (FAI). In this study, Biodex Balance System[®] measurement equipment was used to calculate the dynamic balance of study participants. The application of kinesio taping was performed by one physical therapist to attach in the same way, and a method of wrapping the ankle joint was applied in the eight-shaped bandage.

Results : The results are as follows in before and after taping of the stable ankle and FAI group. There was no significant difference in the overall, anterior-posterior, and medial-lateral stability index. The comparison is as follows between groups for the differences (post-pre value) in before and after the application of kinesio taping. There were no significant differences between groups in all the overall, anterior-posterior, and medial-lateral stability index.

Conclusion : In this study, no significant difference in kinesio taping was found in the dynamic balance of stable ankle and FAI (overall, anterior-posterior, and medial-lateral). It is necessary to continue to study ways to find the maximum effect while minimally attaching them to the application method of ankle kinesio taping.

Key Words : ankle joint, ankle sprain, dynamic balance, functional ankle instability, kinesio taping

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I. Introduction

Ankle sprains are one of the most common musculoskeletal injuries that occur during sports activities (Doherty et al., 2014). After experiencing such an ankle sprain, many often feel residual symptoms, and various interventions are being attempted to solve the problem (Lazarou et al., 2018). The problem is that after the ankle sprains, about 40 % develop into a state known as chronic ankle instability (Miklovic et al., 2018). As a result, the subjects feel an ankle instability called functional ankle instability (FAI), and experience repeated ankle sprains.

Various methods have been attempted to improve FAI. For example, joint mobilization techniques were used to improve the range of motion and balance for ankle joint and self-questionnaire (Cruz-Díaz et al., 2015). The other common way is to improve a sense of balance, and the intervention showed a good result in postural control (McKeon et al., 2009). One way to improve the balance is to attach kinesio taping to the injured joint. For example, in previous studies, kinesio taping was applied to improve the ankle balance for dancers (Tekin et al., 2018).

The therapeutic kinesio ankle taping is controversial about its effectiveness in static and dynamic balance. For example, previous studies have shown that the taping improves proprioception and muscle function and improves circulation of blood and lymph nodes (Feuerbach et al., 1994; Halseth et al., 2004). On the other hand, recent studies reported that the effect of kinesio taping on ankle balance may not be as we expected (Kim & Gang, 2020; Nunes et al., 2015; Park & Kim, 2021; Raymond et al.,

2012). In addition, even kinesio taping applied to the ankle varies, and if the overall ankle is taped as much as possible, several effects, including balance, can be expected, but clinically the cost reduction for intervention is very important. Therefore, this study attempted to find out the optimal way to the effect and cost of kinesio taping on ankle dynamic balance.

II. Methods

1. Participants

The subject of this study was 24 university students in their 20s (male; 13, female; 11), who received sufficient explanation of the purpose and method of the study. This study was conducted by the informed consent of the subjects. The Cumberland ankle instability tool (CAIT) questionnaire was used for the degree of ankle instability of the study subjects. If the subject's CAIT score was 28 points or more, it was classified as a stable ankle, and if the score was 24 points or less, it was classified as FAI (Kim & Yoo, 2020). Subjects excluded from the CAIT questionnaire were 25 to 27, and college students who had orthopedic or neurological problems in their legs or specific exercise programs that could affect their ankles, or who could not walk their daily lives without tools. Finally, stable ankle and FAI were divided into 12 subjects each. Table 1 shows the general characteristics and CAIT questionnaire scores of each group.

Table 1. General characteristics of the subjects

	SA	FAI
Gender (male/female)	8/4	5/7
Age (years)	23.3±1.9 ^a	21.2±1.4
Height (cm)	170.0±9.7	165.7±7.1
Weight (kg)	61.7±15.7	60.9±7.7
CAIT (scores)	29.0±.9	20.8±2.6

^aMean±Standard deviation, SA; stable ankle, FAI; functional ankle instability

2. Measurement of dynamic balance

In this study, Biodex Balance System[®] (BBS, Biodex Medical Systems, Shirley, NY, USA) measurement equipment was used to calculate the dynamic balance of study participants. The dynamic balance was measured for 30 seconds after allowing the gaze to face the center as much as possible while standing on one foot on the platform while looking at the point on the monitor located in front. The average value was calculated by performing a total of three measurements, and each set was set to have a break of 10 seconds. The calculated results included overall, anterior-posterior, and a medial-lateral stability index. Overall stability means the total range of movement of the ankle; anterior-posterior stability indicates the range of motion on the sagittal plane, and medial-lateral stability shows the range of motion on the frontal plane. This stability index means that the lower the value, the better the dynamic balance.

In this study, dynamic balance was measured by dividing it into before (first assessment) and after the taping application (second assessment). The two measurement methods of balance are the same, and no intervention has been applied. The only difference between measurements is the non-taping and the attachment. The dynamic balance

was assessed by the first and second measurements at intervals of approximately four weeks in order for subjects to avoid errors in outcome values due to adaptation of experimental equipment in BBS (Jeong et al., 2017).

3. Kinesio taping

The width of the kinesio taping (Kinesiology 3ns tape, TS, corporation, Republic of Korea) was 5cm. The application of kinesio taping was performed by one physical therapist to attach in the same way, and a method of wrapping the ankle joint was applied in the eight-shaped bandage (Kim & Gang, 2020). The order of attachment of the ankle kinesio taping started 1) from the bottom of the calcaneus bone, 2) cover the upper-front of the talus bone, 3) cover the Achilles tendon toward the inside of the ankle, 4) cover the outside of the ankle and again the talus bone, 5) attach to the inside of the ankle 6) attached bottom of the calcaneus bone (Fig 1). The muscles of the attachment area were stretched as long as possible during the process of the tape. For example, when attaching the top side of the foot, subjects moved toward plantar flexion of the ankle, and when bandaging the back of the foot (achilles tendon), it was attached with dorsiflexion.



Fig 1. Kinesio taping for an ankle joint

4. Statistical analysis

The data analysis of this study was conducted using the statistical program SPSS version 25 (Statistical Package for the Social Sciences; IBM Co., Armonk, NY, USA). Frequency analysis and descriptive statistics (average, standard deviation) were conducted to evaluate the general characteristics of all subjects. The data of this study were assessed by a normality test. As a result, the data was calculated through a nonparametric test. Wilcoxon signed-ranks test was conducted to find out the differences before and after the intervention within the group and to find out the differences (post-pre values) of each group were first calculated, between the groups, and then the results were analyzed using the Mann-Whitney U test. The significance level was set to $\alpha = .05$ with a two-tailed statistical test.

III. Results

The comparison results in before and after kinesio taping of the stable ankle group are as follows. No significant difference was found in the overall, anterior-posterior, and medial-lateral stability index ($p > .05$). The results are as follows in before and after taping of the FAI group. There was no significant difference in the overall, anterior-posterior, and medial-lateral stability index ($p > .05$)(Table 2).

The comparison is as follows between groups for the differences (post-pre value) in before and after the application of kinesio taping. There were no significant differences between groups in all the overall, anterior-posterior, and medial-lateral stability index ($p > .05$)(Table 3).

Table 2. Comparison of dynamic balance before and after applying kinesio taping in each group (unit: °)

	Stability Index	Before	After	Z	p
	Overall	2.39±1.31 ^a	2.29±1.38	-.459	.646
SA (n=12)	Anterior-posterior	1.13±.77	.99±.64	-1.253	.210
	Medial-lateral	1.85±1.06	1.82±1.12	-.205	.838
	Overall	2.04±.42	2.10±.38	-.079	.937
FAI (n=12)	Anterior-posterior	.85±.25	.90±.19	-.845	.398
	Medial-lateral	1.73±.36	1.70±.34	-.403	.687

^aMean±Standard deviation, SA; stable ankle, FAI; functional ankle instability

Table 3. Comparison of the difference (post-pre values) before and after dynamic balance between the stable ankle and the FAI group (unit: °)

Stability Index	SA (n=12)	FAI (n=12)	U	p
Overall	-.10±.93 ^a	.06±.37	62	.562
Anterior-posterior	-.14±.34	.05±.18	49	.179
Medial-lateral	-.03±.88	-.03±.32	70	.907

^aMean±Standard deviation, SA; stable ankle, FAI; functional ankle instability

IV. Discussion

In this study, no difference was found in the dynamic balance (overall, anterior-posterior, medial-lateral stability) index in before and after taping in the subjects of stable ankle and FAI. The results of this study are different from those initially expected by the authors. We would like to interpret it as follows. First, it is estimated that the subjects who participated in this experiment were college students with living their daily without major problems, and although they had felt FAI, there was no serious problem with ankle stability. This is supported by the fact that the CAIT score was from 17 to 24 in this study of FAI subjects. Therefore, kinesio taping was applied to the ankle, but it did not significantly affect the dynamic balance, so there would have been no crucial difference in the results before and after. Second, it may be because the method was different to attach the taping to the ankle. For example, the methods of taping were varied in each of the preceding studies (Bicici et al., 2012; Botsis et al., 2019; Fereydownnia et al., 2019; Sarvestan et al., 2020), and the results may be different. Of course, if physiotherapists attach the taping to all areas (muscles, joints) to an ankle, the results may differ significantly, but the clinical value may be decreased. This is because it is very important for hospitals and clinics to use the minimum cost to produce the maximum effect.

After applying kinesio taping, there was no significant difference when comparing the dynamic balance (overall, anterior-posterior, and medial-lateral) of the stable ankle and FAI groups. This result is also contrary to the effect of kinesio taping, which was positively described in previous studies (Barelds et al., 2018; Doherty et al., 2017; Fraser et al., 2016). For example, in a previous study, when kinesio tape was applied, the score was 9.16 (from 34.27 to 37.41) % improvement in the Berg balance test (Saltan et al., 2019). The authors explain the results of this study as follows. First, kinesio taping may not be effective in

dynamic balance of the ankle. According to the results of a previous study, when kinesio taping is applied to FAI, it may not be as effective in static and dynamic balance as expected (Kim & Gang, 2020). Another latest meta-analysis also stated that functional performance was ineffective regardless of the population (Nunes et al., 2021). This study also requires further research, but it may show similar results. Second, there may be a difference in the degree of ankle instability of the study participants compared to previous studies. For example, in the study of Vuurberg et al. (2018), it can be inferred that people with FAI had a much lower sense of balance than in this study with a CAIT score of 12.35. For this reason, the different results would have been shown. If research is conducted through more subjects in the future, more accurate results will be known.

The limitations of this study are as follows. First, this study was a preliminary study, and the number of subjects were small. Of course, it is true that the prolonged COVID-19 has made it more difficult to recruit subjects than before, but now that the relaxed quarantine guidelines have begun. Authors think more accurate information will be obtained through more subjects and various age groups. Second, ankle instability was not sufficiently subdivided. The CAIT average score of FAI in this study is 20.8, but if the lower score is divided, more accurate results could be produced. For example, if the CAIT score is divided into 0-9, 10-19, and 20~24 points to analyze the kinesio taping effect, the results of application to the ankle can be analyzed in more detail.

V. Conclusion

In this study, no significant difference in kinesio taping was found in the dynamic balance of stable ankle and FAI (overall, anterior-posterior, and medial-lateral). However, as a preliminary study, this study provided a foothold for

further research in the future. In addition, it is necessary to continue to study ways to find the maximum effect while minimally attaching them to the application method of ankle kinesio taping.

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